

UTILITY PATENT APPLICATION TRANSMITTAL (Only for new nonprovisional applications under 37 CFR 1.53(b))	Attorney Docket No.	16223-Pending
	First Inventor	Chester O.D. Thompson
	Title	KEY BLANK IDENTIFICATION SYSTEM...
	Express Mail Label No.	EFS

APPLICATION ELEMENTS See MPEP chapter 600 concerning utility patent application contents.	ADDRESS TO: Commissioner for Patents P.O. Box 1450 Alexandria VA 22313-1450

1. ☐ Fee Transmittal Form (e.g., PTO/SB/17) 2. ☒ Applicant claims small entity status. See 37 CFR 1.27. 3. ☒ Specification [Total Pages <u>22</u>] Both the claims and abstract must start on a new page (For information on the preferred arrangement, see MPEP 608.01(a)) 4. ☒ Drawing(s) (35 U.S.C. 113) [Total Sheets <u>12</u>] 5. Oath or Declaration [Total Sheets _____] a. ☐ Newly executed (original or copy) b. ☒ A copy from a prior application (37 CFR 1.63(d)) (for continuation/divisional with Box 18 completed) i. ☐ DELETION OF INVENTOR(S) Signed statement attached deleting inventor(s) name in the prior application, see 37 CFR 1.63(d)(2) and 1.33(b). 6. ☒ Application Data Sheet. See 37 CFR 1.76 7. ☐ CD-ROM or CD-R in duplicate, large table or Computer Program (Appendix) ☐ Landscape Table on CD 8. Nucleotide and/or Amino Acid Sequence Submission (if applicable, items a. – c. are required) a. ☐ Computer Readable Form (CRF) b. Specification Sequence Listing on: i. ☐ CD-ROM or CD-R (2 copies); or ii. ☐ Paper c. ☐ Statements verifying identity of above copies	ACCOMPANYING APPLICATION PARTS 9. ☐ Assignment Papers (cover sheet & document(s)) Name of Assignee _____ 10. ☐ 37 CFR 3.73(b) Statement ☐ Power of Attorney (when there is an assignee) 11. ☐ English Translation Document (if applicable) 12. ☐ Information Disclosure Statement (PTO/SB/08 or PTO-1449) ☐ Copies of citations attached 13. ☐ Preliminary Amendment 14. ☐ Return Receipt Postcard (MPEP 503) (Should be specifically itemized) 15. ☐ Certified Copy of Priority Document(s) (if foreign priority is claimed) 16. ☐ Nonpublication Request under 35 U.S.C. 122(b)(2)(B)(i). Applicant must attach form PTO/SB/35 or equivalent. 17. ☐ Other: _____

18. If a CONTINUING APPLICATION, check appropriate box, and supply the requisite information below and in the first sentence of the specification following the title, or in an Application Data Sheet under 37 CFR 1.76:

☒ Continuation	☐ Divisional	☐ Continuation-in-part (CIP)	of prior application No.: <u>12/772,709</u>

Prior application information: Examiner Nicholas J. Plonis Art Unit: 3733

19. CORRESPONDENCE ADDRESS

☒ The address associated with Customer Number:	33772	OR	☐ Correspondence address below
Name			
Address			
City	State	Zip Code	
Country	Telephone	Email	

Signature	/Charles F. Gray/	Date	January 23, 2014
Name (Print/Type)	Charles F. Gray	Registration No. (Attorney/Agent)	67012

This collection of information is required by 37 CFR 1.53(b). The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

Privacy Act Statement

The **Privacy Act of 1974 (P.L. 93-579)** requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (*i.e.*, GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	16223-Pending
		Application Number	
Title of Invention	KEY BLANK IDENTIFICATION SYSTEM WITH GROOVE SCANNING		
The application data sheet is part of the provisional or nonprovisional application for which it is being submitted. The following form contains the bibliographic data arranged in a format specified by the United States Patent and Trademark Office as outlined in 37 CFR 1.76. This document may be completed electronically and submitted to the Office in electronic format using the Electronic Filing System (EFS) or the document may be printed and included in a paper filed application.			

Secrecy Order 37 CFR 5.2

☐ Portions or all of the application associated with this Application Data Sheet may fall under a Secrecy Order pursuant to 37 CFR 5.2 (Paper filers only. Applications that fall under Secrecy Order may not be filed electronically.)

Inventor Information:

Inventor 1					Remove	
Legal Name						
Prefix	Given Name	Middle Name	Family Name	Suffix		
	Chester	O.D.	Thompson			
Residence Information (Select One) ☒ US Residency ☐ Non US Residency ☐ Active US Military Service						
City	Painesville	State/Province	OH	Country of Residence i	US	
Mailing Address of Inventor:						
Address 1		7377 Amanda Place				
Address 2						
City	Painesville	State/Province	OH			
Postal Code	44077	Country i	US			
Inventor 2					Remove	
Legal Name						
Prefix	Given Name	Middle Name	Family Name	Suffix		
	William	R.	Mutch			
Residence Information (Select One) ☒ US Residency ☐ Non US Residency ☐ Active US Military Service						
City	North Ridgeville	State/Province	OH	Country of Residence i	US	
Mailing Address of Inventor:						
Address 1		35284 Nikki Avenue				
Address 2						
City	North Ridgeville	State/Province	OH			
Postal Code	44039	Country i	US			
All Inventors Must Be Listed - Additional Inventor Information blocks may be generated within this form by selecting the Add button.					Add	

Correspondence Information:

Enter either Customer Number or complete the Correspondence Information section below.
For further information see 37 CFR 1.33(a).

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	16223-Pending
		Application Number	
Title of Invention	KEY BLANK IDENTIFICATION SYSTEM WITH GROOVE SCANNING		

☐ An Address is being provided for the correspondence information of this application.			
Customer Number	33772		
Email Address	ip@mcdonaldhopkins.com	Add Email	Remove Email

Application Information:

Title of the Invention	KEY BLANK IDENTIFICATION SYSTEM WITH GROOVE SCANNING		
Attorney Docket Number	16223-Pending	Small Entity Status Claimed	☒
Application Type	Nonprovisional		
Subject Matter	Utility		
Total Number of Drawing Sheets (if any)	12	Suggested Figure for Publication (if any)	1

Filing By Reference :

Only complete this section when filing an application by reference under 35 U.S.C. 111(c) and 37 CFR 1.57(a). Do not complete this section if application papers including a specification and any drawings are being filed. Any domestic benefit or foreign priority information must be provided in the appropriate section(s) below (i.e., "Domestic Benefit/National Stage Information" and "Foreign Priority Information").

For the purposes of a filing date under 37 CFR 1.53(b), the description and any drawings of the present application are replaced by this reference to the previously filed application, subject to conditions and requirements of 37 CFR 1.57(a).

Application number of the previously filed application	Filing date (YYYY-MM-DD)	Intellectual Property Authority or Country

Publication Information:

☐ Request Early Publication (Fee required at time of Request 37 CFR 1.219)
☐ Request Not to Publish. I hereby request that the attached application not be published under 35 U.S.C. 122(b) and certify that the invention disclosed in the attached application has not and will not be the subject of an application filed in another country, or under a multilateral international agreement, that requires publication at eighteen months after filing.

Representative Information:

Representative information should be provided for all practitioners having a power of attorney in the application. Providing this information in the Application Data Sheet does not constitute a power of attorney in the application (see 37 CFR 1.32). Either enter Customer Number or complete the Representative Name section below. If both sections are completed the customer Number will be used for the Representative Information during processing.			
Please Select One:	☒ Customer Number	☐ US Patent Practitioner	☐ Limited Recognition (37 CFR 11.9)
Customer Number	33772		

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	16223-Pending
		Application Number	
Title of Invention	KEY BLANK IDENTIFICATION SYSTEM WITH GROOVE SCANNING		

Domestic Benefit/National Stage Information:

This section allows for the applicant to either claim benefit under 35 U.S.C. 119(e), 120, 121, or 365(c) or indicate National Stage entry from a PCT application. Providing this information in the application data sheet constitutes the specific reference required by 35 U.S.C. 119(e) or 120, and 37 CFR 1.78.

When referring to the current application, please leave the application number blank.

Prior Application Status	Pending	Remove	
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)
	Continuation of	12772709	2010-05-03
Prior Application Status	Expired	Remove	
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)
	Claims benefit of provisional	61215152	2009-05-01
Prior Application Status	Expired	Remove	
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)
	Claims benefit of provisional	61275654	2009-09-01
Additional Domestic Benefit/National Stage Data may be generated within this form by selecting the Add button.			Add

Foreign Priority Information:

This section allows for the applicant to claim priority to a foreign application. Providing this information in the application data sheet constitutes the claim for priority as required by 35 U.S.C. 119(b) and 37 CFR 1.55(d). When priority is claimed to a foreign application that is eligible for retrieval under the priority document exchange program (PDX) ⁱ the information will be used by the Office to automatically attempt retrieval pursuant to 37 CFR 1.55(h)(1) and (2). Under the PDX program, applicant bears the ultimate responsibility for ensuring that a copy of the foreign application is received by the Office from the participating foreign intellectual property office, or a certified copy of the foreign priority application is filed, within the time period specified in 37 CFR 1.55(g)(1).

Remove			
Application Number	Country ⁱ	Filing Date (YYYY-MM-DD)	Access Code ^j (if applicable)
Additional Foreign Priority Data may be generated within this form by selecting the Add button.			Add

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	16223-Pending
		Application Number	
Title of Invention	KEY BLANK IDENTIFICATION SYSTEM WITH GROOVE SCANNING		

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications

This application (1) claims priority to or the benefit of an application filed before March 16, 2013 and (2) also contains, or contained at any time, a claim to a claimed invention that has an effective filing date on or after March 16, 2013. ☐ NOTE: By providing this statement under 37 CFR 1.55 or 1.78, this application, with a filing date on or after March 16, 2013, will be examined under the first inventor to file provisions of the AIA.

Authorization to Permit Access:

☐ Authorization to Permit Access to the Instant Application by the Participating Offices If checked, the undersigned hereby grants the USPTO authority to provide the European Patent Office (EPO), the Japan Patent Office (JPO), the Korean Intellectual Property Office (KIPO), the World Intellectual Property Office (WIPO), and any other intellectual property offices in which a foreign application claiming priority to the instant patent application is filed access to the instant patent application. See 37 CFR 1.14(c) and (h). This box should not be checked if the applicant does not wish the EPO, JPO, KIPO, WIPO, or other intellectual property office in which a foreign application claiming priority to the instant patent application is filed to have access to the instant patent application. In accordance with 37 CFR 1.14(h)(3), access will be provided to a copy of the instant patent application with respect to: 1) the instant patent application-as-filed; 2) any foreign application to which the instant patent application claims priority under 35 U.S.C. 119(a)-(d) if a copy of the foreign application that satisfies the certified copy requirement of 37 CFR 1.55 has been filed in the instant patent application; and 3) any U.S. application-as-filed from which benefit is sought in the instant patent application. In accordance with 37 CFR 1.14(c), access may be provided to information concerning the date of filing this Authorization.

Applicant Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	16223-Pending
		Application Number	
Title of Invention	KEY BLANK IDENTIFICATION SYSTEM WITH GROOVE SCANNING		

Applicant 1				Remove
If the applicant is the inventor (or the remaining joint inventor or inventors under 37 CFR 1.45), this section should not be completed. The information to be provided in this section is the name and address of the legal representative who is the applicant under 37 CFR 1.43; or the name and address of the assignee, person to whom the inventor is under an obligation to assign the invention, or person who otherwise shows sufficient proprietary interest in the matter who is the applicant under 37 CFR 1.46. If the applicant is an applicant under 37 CFR 1.46 (assignee, person to whom the inventor is obligated to assign, or person who otherwise shows sufficient proprietary interest) together with one or more joint inventors, then the joint inventor or inventors who are also the applicant should be identified in this section.				
Clear				
☒ Assignee		☐ Legal Representative under 35 U.S.C. 117		☐ Joint Inventor
☐ Person to whom the inventor is obligated to assign.		☐ Person who shows sufficient proprietary interest		
If applicant is the legal representative, indicate the authority to file the patent application, the inventor is:				
Name of the Deceased or Legally Incapacitated Inventor :				
If the Applicant is an Organization check here. ☒				
Organization Name	HY-KO PRODUCTS COMPANY			
Mailing Address Information:				
Address 1	60 MEADOW LANE			
Address 2				
City	NORTHFIELD	State/Province	OH	
Country ⁱ	US	Postal Code	44067	
Phone Number	216-348-5400	Fax Number	216-348-5474	
Email Address	ip@mcdonaldhopkins.com			
Additional Applicant Data may be generated within this form by selecting the Add button. Add				

Assignee Information including Non-Applicant Assignee Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.	
Assignee 1	
Complete this section if assignee information, including non-applicant assignee information, is desired to be included on the patent application publication. An assignee-applicant identified in the "Applicant Information" section will appear on the patent application publication as an applicant. For an assignee-applicant, complete this section only if identification as an assignee is also desired on the patent application publication.	
Remove	
If the Assignee or Non-Applicant Assignee is an Organization check here. ☐	

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	16223-Pending
		Application Number	
Title of Invention	KEY BLANK IDENTIFICATION SYSTEM WITH GROOVE SCANNING		

Prefix	Given Name	Middle Name	Family Name	Suffix

Mailing Address Information For Assignee including Non-Applicant Assignee:

Address 1			
Address 2			
City		State/Province	
Country i		Postal Code	
Phone Number		Fax Number	
Email Address			

Additional Assignee or Non-Applicant Assignee Data may be generated within this form by selecting the Add button.

Add

Signature:

Remove

NOTE: This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4 for signature requirements and certifications

Signature	/Charles F. Gray/		Date (YYYY-MM-DD)	2014-01-23
First Name	CHARLES F.	Last Name	GRAY	Registration Number
				67012

Additional Signature may be generated within this form by selecting the Add button.

Add

This collection of information is required by 37 CFR 1.76. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 23 minutes to complete, including gathering, preparing, and submitting the completed application data sheet form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these records.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

PATENT APPLICATION

Inventor: Chester O.D. Thompson
William R. Mutch

Docket No.: 16223-PENDING

KEY BLANK IDENTIFICATION SYSTEM WITH GROOVE SCANNING

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application is a continuation of U.S. Application No. 12/772,709 filed on May 3, 2010 entitled “KEY BLANK IDENTIFICATION SYSTEM WITH GROOVE SCANNING,” which claims the benefit of priority of U.S. Provisional Patent Application Ser. No. 61/215,152 filed on May 1, 2009, and U.S. Provisional Patent Application Ser. No. 61/275,654 filed on September 1, 2009, each of which are hereby incorporated by reference in their entirety.

FIELD OF ART

[0002] This invention relates generally to the field of systems for identifying objects and, more particularly to systems for utilizing electronic means for identifying key blanks that are compatible with an unknown key.

BACKGROUND OF THE INVENTION

[0003] The art of key replication is well known. Commonly, a key intended for duplication (the master key) is copied on to an appropriately identified key blank utilizing any number of different systems known in the art. The process of identifying an appropriate key blank to use when making copies of a key can be a difficult, tedious and time consuming affair. It is important that each master key be copied onto the proper key blank so as to prevent numerous adverse consequences caused by reproducing a master key onto an inappropriate

key blank. However, choosing the correct key blank can be difficult even for experts in the field.

[0004] There are hundreds, if not thousands, of key blanks, and many blanks are not readily distinguished from others. Identifying the correct key blank for use in duplication involves selecting a blank from hundreds or even thousands of possibilities, where differences between key blanks may be very subtle. These hard-to-notice subtleties significantly increase the level of difficulty for all operators of such key replication systems, both inexperienced trainees and experts alike.

[0005] Once a key blank is chosen, it goes through a cutting process. The typical cutting process simply traces the profile of the master key onto the key blank, such that the key blank will exactly match (within the error limits and accuracy of the tracing machine) the original master key. Normally, a mechanically linked cutting wheel actually cuts into the key blank while it mimics the movement of the tracer as the tracer moves longitudinally along the profile of the master key. If the incorrect key blank is provided during this process, the key blank being formed into the duplicate key may not possess the correct longitudinal length, thereby causing a failure. When this type of failure occurs, the entire process of selecting a key blank for replication and then mechanically cutting the key must begin again. Worse still, if the blank has the proper length but does not possess the appropriate thickness, contour, groove or other traits, the failure may not be discovered until the key is actually inserted into the lock.

[0006] Businesses that offer key cutting services are often times not staffed by experienced locksmiths. Instead, employees are usually trained to “eyeball” what is thought to be the correct blank and then cut a duplicate key. Such informal and imprecise key blank identification invariably increases the rate of failures for the duplication process. These failures often occur at the expense of the industry and to the extreme dismay of the key

holder. Therefore, the industry would welcome an easy-to-use key blank identification system that increases the accuracy and efficiency of key replication.

[0007] Not surprisingly, numerous attempts have been made to improve identification systems and/or key replication systems. Many of these improvements include imaging systems designed to determine the proper key blank based on physical parameters of the key to be copied, such as length, shape, and groove characteristics.

[0008] While many of these systems provide useful improvements for determining a proper key blank, they still suffer from various deficiencies. Specifically, many of these systems compare scanned data from a master key to be copied with data from known key blanks in order to determine if the master key matches the key blank. However, in some instances the scanned key parameters and the key blank data are insufficient to determine a matching key blank. In such cases, additional information about the master key and the key blank would be useful in narrowing the field of prospective key blanks. Accordingly, an improved system and method for determining a key blank is needed.

SUMMARY

[0009] A key identification system is provided. The key identification system comprises an imaging system to capture an image of a master key, and a logic to analyze the image. The imaging system may be configured to capture an image of a groove in the key from an angle between perpendicular and parallel to the blade of said master key. The logic analyzes the captured image to compare characteristics of the groove with groove characteristics of known key blanks.

[0010] The key identification system may account for the orientation or positioning of the master key with respect to the imaging system or key holder to determine groove characteristics of the master key. For example, the logic may analyze a contour of the groove

and determine groove characteristics of the master key based on the contour and the orientation and positioning of the master key.

DESCRIPTION OF THE DRAWINGS

[0011] Objects and advantages together with the operation of the invention may be better understood by reference to the following detailed description taken in connection with the following illustrations, wherein:

[0012] FIG. 1 illustrates a master key;

[0013] FIG. 2a illustrates a first example configuration of a key ID system;

[0014] FIG. 2b illustrates a second example configuration of a key ID system;

[0015] FIG. 3 illustrates an example silhouette of a key tip;

[0016] FIG. 4 illustrates an example configuration of a key ID system with reflectors;

[0017] FIG. 5 illustrates an example scanned image of a master key blade silhouette;

[0018] FIG. 6 illustrates an example projection of a tip outline onto the image of a tip;

[0019] FIG. 7 illustrates an example calculated data set of tip groove contours;

[0020] FIG. 8 illustrates an example matching comparison between master key tip contour data and stored key blank data; and

[0021] FIG. 9 illustrates an example unmatched comparison between master key tip contour data and stored key blank data.

[0022] FIG. 10 illustrates the coordinate references for the outline camera image.

[0023] FIG. 11 illustrates the coordinate references for the outline camera image including the outline vanishing point.

[0024] FIG. 12 illustrates the coordinate references for the groove camera image including the groove vanishing point relating to the y-axis projection.

[0025] FIG. 13 illustrates the coordinate references for the groove camera image including the groove vanishing point relating to the x-axis projection.

[0026] FIG. 14 illustrates an angular coordinate system for a master key.

DETAILED DESCRIPTION OF THE INVENTION

[0027] Reference will now be made in detail to exemplary embodiments of the present invention, examples of which are illustrated in the accompanying drawings. It is to be understood that other embodiments may be utilized and structural and functional changes may be made without departing from the respective scope of the present invention.

[0028] A system and method for identifying a key blank are provided. The system (“key ID system”) analyzes a master key to be duplicated, such as a house key, car key or other key, and determines the appropriate key blank to be used in duplicating the master key. The system and method described herein may be used independently to determine a proper key blank, or may be used in conjunction with other systems to narrow the field of prospective key blanks. Moreover, it will be understood that existing key identification systems may be modified or retrofitted to implement some or all features described herein.

[0029] The key ID system may scan a master key to determine traits and characteristics of the master key. Based on these characteristics, the key ID system may then determine the proper key blank to be used to duplicate the master key. The key ID system may include any means known in the art for determining the traits and characteristics of the master key geometry. For example, the key ID system may include an imaging system, such as a camera, laser, or any other imaging system known in the art. The imaging system may scan the master key to determine characteristics of the master key, specifically characteristics that may be

unique to a specific key blank. While the key ID system is described herein as including an imaging system, it will be appreciated that other known methods or devices, such as electrical or mechanical sensors, may be used in place of or in conjunction with the imaging system to determine the traits and characteristics of the master key geometry.

[0030] With reference to FIG. 1, a master key 10 is depicted. The master key 10 may include standard key features such as a head 16 connected to a blade 18 and a groove 11. The groove 11 may comprise a channel, opening, geometric shape, or other indentation formed in the blade 18. A master key 10 may include a single groove 11 on one side of the blade 18, a single groove 11 on each side of the blade 18, multiple grooves 11 on either side of the blade 18, or any other configuration of grooves 11 with respect to the blade 18. Further, it will be appreciated, that the master key 10 may be any key and is not limited to keys having a head 16, blade 18 or groove 11.

[0031] The key ID system may include a key holder to hold the master key. The key holder may be any device capable of holding or supporting a master key. For example, as shown in FIGS. 2a and 2b, the key holder 13 may comprise a lower support 15 and an upper door 12 to close onto the key. The key holder may alternatively comprise a clamp, gripper, platform, suspension, or any other device configured to hold the master key 10.

[0032] In an embodiment, the key ID system includes a camera system. The camera system includes one or more cameras configured to record images, such as digital images, of the master key. The camera system may further include other components to assist in recording images of the master key, such as lights and mirrors. The lights may be positioned to enhance the clarity and quality of the image recorded by the camera. The mirrors may be positioned to allow a camera in a first position to record an image of the key from a second position. The mirrors may further allow a single camera to record multiple images of the master key from

different angles, thereby increasing the amount of information related to the master key recorded by a single camera.

[0033] The key ID system may include a logic to analyze images captured by the imaging system. As used herein, the term “logic” includes but is not limited to a software, a firmware, an executable program, a hardware or hard-wired circuit, or combinations thereof. For example, based on a desired application or needs, a logic may include a software controlled microprocessor, discrete logic like an application specific integrated circuit (ASIC), an analog circuit, a digital circuit, a programmed logic device, a memory device containing instructions, or the like. Logic may include one or more gates, combinations of gates, or other circuit components. Logic may also be fully embodied as software. Where multiple logical logics are described, it may be possible to incorporate the multiple logical logics into one physical logic. Similarly, where a single logical logic is described, it may be possible to distribute that single logical logic between multiple physical logics.

[0034] The logic may be configured to determine a correlation or likelihood of a match between a known key blank and the master key. For example, the logic may include a database to store key related information (“key data”). The key data may include characteristics of known key blanks, such as length, shape, biting information, size, shape and location of key grooves, and other geometric and physical characteristics of known key blanks. The database may be integral with the logic, in communication with the logic, or remotely accessible to the logic. The database may associate key data with specific key blanks or with types or groups of key blanks. For example, the database may associate key data with specific key manufacturers or different types of keys such as house keys or car keys. The key ID system may access the database to compare scanned characteristics of the master key with the stored key data in the database. Key blanks that do not have characteristics consistent with those of the master key may be then ruled out as possible

matches for the key blank. The key ID system may scan the master key 10 one or more angles and compare the scanned data with stored key data.

[0035] The key ID system may scan a master key 10 to determine information related to the groove 11. Keys and key blanks commonly include a groove 11 or grooves 11 in the blade 18 of the key. Characteristics of the grooves 11 may be unique to a given key blank or group of key blanks. For example, the size, location, angle, and other geometric parameters of a given groove may be unique to a key blank or blanks. Further, the location of a groove 11 on a first side of the key blade (“top groove”) may be unique with respect to the location of a groove 11 on the second side of a key blade (“bottom groove”).

[0036] The key ID system may analyze various aspects of the groove 11 of a master key 10. For example, the imaging system may capture an image of the groove 11 from a position perpendicular to the key blade 18, as illustrated by the overhead camera 20 in FIG. 2a. This camera angle provides a top view of the blade 18 and allows the overhead camera to scan the length of the groove 11. The imaging system may also capture an image of the groove 11 from the end of the tip 14 at an angle parallel to the blade 18. This angle provides a view of the groove 11 cross-section. However, neither overhead scanning of the groove 11 nor parallel scanning of the groove 11 provide sufficient contrast between the groove 11 and the rest of the key 10 to effectively determine certain parameters of the groove 11.

[0037] In many keys, a groove 11 extends from the shoulder 16 through the tip 14 of the key 10. Therefore, the shape and contours of the tip geometry reflect characteristics of the groove 11. Accordingly, unique characteristics of a master key may be determined by scanning the tip 14 from an angle designed to capture the top groove or bottom groove characteristics. This may be best accomplished by scanning the tip 14 at an angle other than perpendicular or parallel to the blade 18. For example, as shown in FIG. 2a, the key ID system may include a camera 22 facing the tip 14, and positioned at an angle slightly above

parallel to the blade. In an embodiment, the camera is positioned facing the tip of the key 10, between 5 and 15 degrees from parallel to the blade of the key 10. This positioning allows the camera 22 to capture the contours of the tip 14 formed by the bottom groove 11. Alternatively, it will be appreciated that the camera may be positioned similarly underneath the key to capture the contours of the tip 14 formed by the top groove 11. As illustrated in FIG. 3, the camera 22 may capture a silhouette of the bottom groove. This silhouette may be unique to a key blank or group of key blanks, thereby narrowing the field of prospective key blanks.

[0038] It will be appreciated that configurations other than the camera configuration shown in FIG. 2a may be used to capture the tip-groove geometry. For example, the key ID system may include only a groove camera 22 without any overhead camera 20. Further, the key ID system may include a plurality of mirrors to allow a single camera at a remote position to capture multiple angles of the master key, including angles of the tip 14. In an embodiment, as shown in FIG. 4, a first mirror 30 may be positioned to provide a top view of the tip 14 from behind the key 10. A mirror may be similarly positioned below and behind the key 10 to capture an image of the bottom groove 11. This view allows the camera to capture the contours of the tip 14 formed by the top groove 11. A second mirror 32 may also be positioned to provide a top view of the tip 14 from in front of the key 10. This view allows the camera to capture the contours of the tip 14 formed by the bottom groove 11. It will be appreciated that the key ID system may include any number of cameras, mirrors, and other imaging devices to capture the desired views of the contours of the tip 14.

[0039] In an embodiment, the key ID system scans the master key 10 to capture the silhouette of the blade 18, as shown in FIG. 5. This silhouette is used to determine the outline shape of the tip 14 in order to isolate groove geometry from the tip geometry. The key ID

system may also scan the tip 14 from an angled position to capture the contours of the tip 14 formed by the groove 11.

[0040] As shown in FIG. 6, a trigonometric projection of the tip 14 may be used to identify the portion of the tip contour that is due to the groove shape. Specifically, contour data related to contours of the groove 11 may be determined by calculating a set of scalar variables based on image information and machine constants. As described herein, points in the image taken by the overhead camera 20 are mapped to their corresponding points from the image taken from the groove camera 22.

[0041] The contour image may be compiled from data obtained by the overhead or outline camera 20. Once the outline or contour data has been generated, the outline image is rescanned to generate a set of data points, as shown in FIGS. 7-9. For example, data points may be generated every .005 inches along the tip of the key. The data point interval of the rescanned or resampled image may be adjusted based on the required accuracy for groove identification and the optical characteristics of the outline and groove cameras. For example, the data point interval may be 0.002 in order to obtain a better defined sample.

[0042] The groove contour may be compared to contours of known key blanks stored in the database to determine a matching key blank. Tolerance and/or correlation values may be set to determine if the comparison yields a match. FIG. 8 illustrates a comparison between a scanned key tip contour and stored key data of a known key blank. The statistical correlation value between the data sets is approximately .985, indicating a match between the master key and compared key blank. FIG. 9 illustrates another comparison between a scanned key tip contour and stored key data of a known key blank. The statistical correlation value between the data sets here is approximately .879, indicating that the master key and compared key blank do not match.

[0043] Referring to FIG. 2a, the plane of the overhead camera 20 image intersects the groove camera 22 image at the lower edge of the door opening 12. The overhead camera 20 observes the profile of the key 10 while the groove camera 22 is focused on the tip of the key 10. With reference to FIGS. 10-13, the line at which these two images intersect, referred to as the door axis 52, is a primary axis for purposes of determining contour data. The primary reference or origin point of the door axis is located at the center of the door 12. The plane of the door also passes through this intersection and is by definition perpendicular to the overhead camera 20 image plane.

[0044] A silhouette image of the key 10 may be captured by the groove camera 22. To capture the silhouette image, the key ID system may utilize elements such as a light source 24 and a diffuse reflector element 26, as shown in FIGS. 2a and 2b. The light source 24 may be shielded with a light shield 28 to illuminate the reflector element 26 while avoiding the tip of the key 10. In an embodiment, the directional light from the light source 24 is angled to direct the light substantially on the diffuse reflector element 26, but not on the tip of the key 10.

[0045] The light source 24 may be any light source known in the art. For example, the light source 24 may be a series of discrete LED lights substantially oriented in a row. It will be appreciated, however, that the light source 24 may be any lights arranged in any configuration. The diffuse reflector element 26 may be affixed to the interior surface of the door, such that when the light from the light source 24 strikes the diffuse reflector element 26, the diffuse reflector element 26 provides a backlit area. In other words, this arrangement provides a backlit area behind the key 10 with respect to the groove camera 22 while minimizing the amount of light that is directed toward the key 10. Thus, the groove camera 22 may view the key 10 tip as a substantially dark or black feature, similar to that shown in Fig. 3. It will be appreciated, however, that the key ID system may include any additional lights, such as backlights, positioned throughout the system.

[0046] With reference to Fig. 2b, an alternative configuration for the key ID system is shown. The groove camera 22 may be mounted in a vertical camera box 23. The vertical camera box 23 mounts the groove camera 22 at the bottom directed upward toward a mirror 25 mounted at the other end of the vertical camera box 23. The mirror 25 is directed toward the key 10 tip, such that the angle of incidence is nominally about 15 degrees. However, it will be appreciated that the angle of incidence upon the key 10 of the image may be any angle, preferably between approximately 5 degrees and approximately 45 degrees.

[0047] The key 10 is not constrained to a particular orientation or position when held within the key holder 13. With reference to FIG. 14, the key may be tilted or yawed in a plane perpendicular to the orientation of the outline camera 20; tipped up or down relative to the plane defined perpendicular to the door opening 12; and rotated around the axis of the key blank it self (rolled) or combinations of any of the preceding as well as variations caused by the overall length of the key blade 10 that would position the tip of the key at various focus positions relative to the groove camera 22. Thus it is necessary to correct for the optical distortions and transform the images obtained from the two different cameras to obtain an effective image of the tip 14.

[0048] The concept of a vanishing point is used to handle the foreshortening of the key 10 when viewed by the groove camera 22. The effects of this foreshortening vary greatly as the end of the key 10 is tipped up or down slightly by the clamping action of the door 12. The distance from the door to the vanishing point may be substantially affected by this tipping action.

[0049] To compensate for the angle between the groove camera 22 and the key 10, the distance from the tip of the key to the door axis is readily determined for both the overhead camera 20 image and groove camera 22 image. The ratio of these distances (hereinafter “GrooveLR”) is dependent both on the angle between the groove camera 22 angle and the

key tipping angle. The actual values of these angles may be ignored because only the ratio is required for the calculations to compensate for the key location.

[0050] In an embodiment, a groove image vanishing point may be determined by multiplying the distance to the outline image vanishing point by the ratio $GrooveLR$. The outline image vanishing point may first be empirically determined. For example, previous test indicate a sample outline image vanishing point to be 20 inches from the origin of the door axis. The outline image vanishing point depends on the configuration of the key ID system and the characteristics of the cameras. Vanishing points may be assumed to be on the door centerline axis. However, in other embodiments vanishing points may be offset from the door centerline axis with additional compensation.

[0051] FIGS. 10-13 illustrate a crop box 50 used for limiting the image of the key 10. An example of an outline crop box 50 is shown in FIG. 5, where the outline crop box 50 defines the outer periphery of the image. The outline crop box functions to limit the image that is actually processed by the system, even though the actual image captured by the camera is larger than the outline crop box 50. The outline vanishing point is far to the left of the outline crop box 50 along its X axis shown as point 52. The groove vanishing point is above the groove crop box 60, shown in FIG. 6, along its Y axis at point 62. The groove crop box 60, serves a similar function to the outline crop box 50, namely it reduces the overall image processed by the system to a subset of the actual image captured, in this case by the groove camera 22. This outline image vanishing point distance is combined with $vOutX$ to calculate the x axis distance from the vanishing point to the starting point. While a specific method determining the vanishing points and associated distances is described, it will be appreciated that other methods may be used.

[0052] FIG. 10 shows the position of the starting location relative to the door axis and the Outline Camera image. $vOutX$ and $vOutY$ are the x and y coordinates of a point at the tip of a

key image that is to be mapped to the groove image. These points correspond to the set of data points that define the tip of the key. The units of the outline camera 20 are in pixels. Thus a series of vOutX and vOutY points are created to define the tip of the key.

[0053] FIG. 11 shows the starting point translation to distances from the outline view vanishing point. This distance is multiplied by GrooveLR to yield the outline VPy shown on Fig. 11 and referred to as GVPY (groove image vanishing point distance).

[0054] FIG. 12 shows the construction of the projected tip point y axis coordinate. This projection is made on the Groove Camera image plane. The y axis projection is simply the difference between GVPY and GrooveVP.

[0055] The x axis projection calculation uses the GVPY to GrooveVP ratio as shown in FIG. 13. The Groove Door X distance may be determined from the outline image. The Groove Door X distance may be scaled by the GVPY to GrooveVP ratio and added to the Groove Crop Box Center distance to find gsx which is the x axis coordinate. A trim value may be added to enable small physical offsets to be adjusted during machine calibration.

[0056] Once each point on the outline camera 20 image has been mapped to the groove camera 22 image, the groove contour data may be determined. FIG. 6 shows a typical groove image with two rows of points drawn at its tip. The row that is touching the tip may be calculated using the method described here. The lower row may be extrapolated from the same data points.

[0057] The groove contour is found by measuring the distance from a point that is eight pixels below the mapped point to the actual white to black edge in the groove image. Giving the edge detection software the extra pixels allows it to readily find a transition and allows for small errors if the mapped points are slightly above the actual transition. The set of these distances forms the groove contour.

[0058] Various tip shapes and bittings near the tip of the key may affect the image of the grooves as seen by the groove camera 22. Therefore, it may be helpful to manipulate the groove data in an attempt to compute how the grooves would appear if the key blade was cut off square. To accommodate this manipulation, a scan of the outline data (from the outline camera 20 image) along the tip of the key may be performed with respect to a series of lines that are parallel with the axis of the key. This yields a series of measurements that determine the distance from the edges of the tip of the key to some arbitrary squarely cut edge. These measurements may then be translated to the groove camera 22 image using a process described below. These translated key tip points 62 in the groove image 60 represent the tip of the key as if there were no grooves in the key. Differences between these points and the observed edge of the tip of the key in the groove image 60 represent the actual shape of the grooves as if the key blade was cut off square.

[0059] The final task of blank identification is to match the measured contour with the stored characteristics. The type of key 10 may be used to help match the contour with the appropriate data set. For symmetrical double sided keys the direction of the key insertion into the key identification system is irrelevant because the grooves and other features are symmetrical so a single characteristic reference image is stored for those symmetric keys. For most single sided keys, both sides of the key (referred to as left and right) are distinctive. In those cases, the characteristic reference images for each key include a left and right view. When performing comparisons, right cuts are only matched to data for single cut blanks and only right cut data for those blanks. The data is also aligned so the key reference sides (e.g. in the case of a single sided key, the flat of the blank) are near each other. Often cut key data has many fewer data points so it is assumed data points opposite the reference side is where the metal (and data) have been removed. Double cut keys are matched based on the centerlines.

[0060] A series of comparisons may performed between the characteristic reference image that is stored in the database and the actual captured image to compensate for small registration errors. The comparison may be performed via a 2-D correlation analysis described in greater detail below. Specifically, the data may be moved a few data points in each direction. These points may then be compared and analyzed with the best result being chosen as the correct data point.

[0061] Small errors in image registration and performing the transpositions between the images can cause the contour data to be sloped up or down. This is called “roll” and is similar to an airplane roll where the wings are not level. Some level of roll is presumed to be dependent on unique machine set up details. To compensate for this roll, each key ID system may have a roll constant that is used to adjust its measured values. This insures that biases are not a factor when compared to stored data sets that were generated on other machines.

[0062] There also may be roll based on individual key scans. A second roll test may be used to insure the best possible match after the machine roll has been accounted for, and the best horizontal sliding position has been determined. Each comparison is done for as many as 40 different roll values to determine the best match. These calculations assure the comparison is done as accurately as possible. In other embodiments, larger numbers of roll values may be used to handle greater variation in the image captured by the groove camera 22.

[0063] Mathematical correlation may also be as the basis of contour comparison. The correlation may be done based on a standard formula. However, if a data point in the newly collected data or stored data is potentially in error it may be excluded from the correlation calculation. The actual data may have values larger than one as we begin the scan for groove edge data 8 pixels below the first expected transition point. Alternatively, different pixel offsets may be used based on the likelihood of erroneous data. If this data is set to -1 that point is excluded from the calculation. Some stored data is manually set to -1 to compensate

for scan errors and to de-emphasize some features of the contours. Errors in edge detection can cause -1 values in the newly scanned data.

[0064] Other methods may be employed to compare the tip image to the reference contours. One method is to fit the contour inside an envelope based on the stored contours. Other techniques taking advantage of various basis functions are also suitable for performing the comparisons between the characteristic reference images and the captured image in order to obtain a match as well.

[0065] A secondary test may be added to the standard correlation calculation. Some key blanks have the same overall pattern of grooves, but the groove depths are exaggerated on some blanks more than others. Since correlation may be insensitive to scale, these blanks may be found to match even where there are large differences in actual groove depths. A second factor based on the standard deviation of the two contour data sets is used to aid in this differentiation. The factor is calculated by taking the difference between the two standard deviations and dividing it by the sum of the two values. This value is then subtracted from the correlation coefficient and a secondary test is performed. The resulting correlation results are used to provide an estimate as to which type of key is inserted into the key ID system. In an embodiment, the correlation results are used in conjunction with the key outline characterization to further narrow and reduce the type of key identified.

[0066] Both the standard correlation value and the adjusted correlation value are unitless and non-scaled numbers between 0 and 1. In order to provide more meaning to the values, each is rescaled to a scoring system of 0 to 100% where 0 is considered to be an impossible match and 100 is a perfect match. In an embodiment, standard correlations of 0.60 to 1.0 are rescaled to a score of 0 to 100% and adjusted correlations of 0.50 to 1.0 are rescaled to a score of 0 to 100%. Any correlations of less than the 0.60 and/or 0.50, respectively, are

considered to be impossible matches. The total groove scanning score or correlation score may be a weighted average of these two individual scores.

[0067] The key ID system as described may be used in conjunction with other known key identification systems. For example, the key ID system may be used in conjunction with user interface identification systems, such as the object identification system disclosed in U.S. Publication No. 2004/0095380 and the key duplication system disclosed in U.S. Publication No. 2007/0224008, each of which are hereby incorporated by reference in their entirety.

[0068] The invention has been described above and, obviously, modifications and alternations will occur to others upon a reading and understanding of this specification. The claims as follows are intended to include all modifications and alterations insofar as they come within the scope of the claims or the equivalent thereof.

CLAIMS

What is claimed is:

1. A key identification system comprising:

an imaging system including a camera configured to capture an image of the tip of a master key, wherein said image includes a contour;

a logic configured to analyze said captured image to determine characteristics of said contour and compare said characteristics with characteristics of known key blanks to determine the likelihood of a match between said master key and a known key blank; and

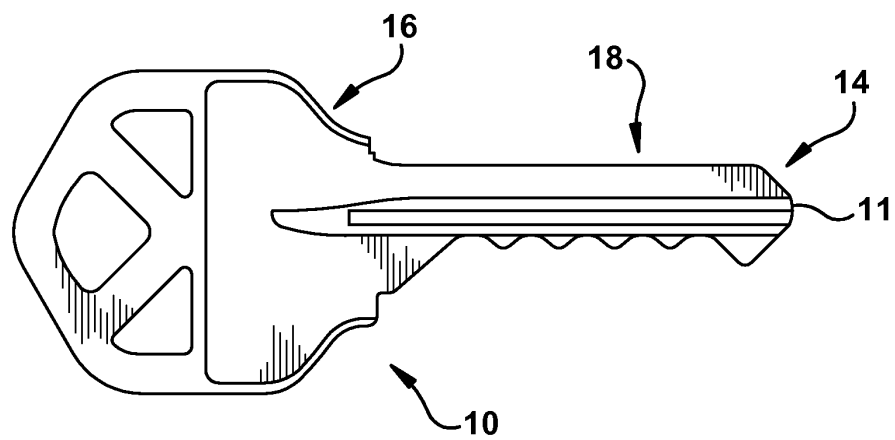
one or more mirrors positioned to allow said camera to capture two or more views of the master key.
2. The key identification system of claim 1, wherein said logic includes a database containing data related to characteristics of grooves of known key blanks.
3. The key identification system of claim 1, wherein said imaging system includes a reflecting device.
4. The key identification system of claim 1, wherein said imaging system includes a light.
5. The key identification system of claim 4, wherein said light is directed toward said reflecting device.
6. The key identification system of claim 5, wherein said light includes a shield to direct light away from said master key.
7. The key identification system of claim 1, wherein said captured image is a digital image.
8. The key identification system of claim 1, wherein said captured image comprises a silhouette of said tip of said master key.

9. The key identification system of claim 1, wherein said logic accounts for rolling of said master key with respect to said imaging system to determine characteristics of said contour.
10. The key identification system of claim 1, wherein said logic accounts for tilting of said master key with respect to said imaging system to determine characteristics of said contour.
11. The key identification system of claim 1, wherein said logic accounts for tipping of said master key with respect to said imaging system to determine characteristics of said contour.
12. The key identification system of claim 1 wherein said captured image comprises a silhouette of the blade of said master key.
13. The key identification system of claim 1, wherein said characteristics of said contour are determined based on image data from at least said two or more views of said master key.
14. The key identification system of claim 13, wherein said logic calculates the geometry of the contour as seen from a view of the tip parallel to the blade based on data from at least said two or more views of said master key.
15. The key identification system of claim 13, wherein said logic calculates the geometry of the contour as though the tip were squarely cut based on data from at least said two or more views of said master key.
16. The key identification system of claim 1 further comprising a key holder configured to hold said master key.
17. The key identification system of claim 16, wherein said key holder includes a lower support.
18. The key identification system of claim 16, wherein said key holder includes an upper door.

19. The key identification system of claim 16, wherein said key holder includes a clamp.
20. The key identification system of claim 1, wherein one of said views of said master key includes a view from above the master key blade of a groove in the bottom of said blade.
21. The key identification system of claim 1, wherein one of said views of said master key includes a view from an angle between perpendicular and parallel to the blade of said master key and not including perpendicular or parallel to the blade of said master key.
22. The key identification system of claim 1, wherein the captured image of said tip includes a contour of a groove in said master key.
23. The key identification system of claim 1, wherein the logic is configured to shift data related to said characteristics of said contour to compare with said known key blank characteristics.
24. The key identification system of claim 1, wherein said logic includes a tolerance range for each characteristic of said master key to determine whether a master key passes or fails to match a known key blank.

ABSTRACT

A key identification system is provided. The key identification system comprises an imaging system to capture an image of a master key, and a logic to analyze the captured image. The imaging system may be capture an image of a groove in the master key from an angle between perpendicular and parallel to the blade of said master key. The logic analyzes the captured image to compare characteristics of the groove with groove characteristics of known key blanks to determine the likelihood of a match between the master key and a known key blank. The key identification system may further compensate for displacement or orientation of the master key with respect to the imaging system when analyzing characteristics of the groove.

**FIG. 1**

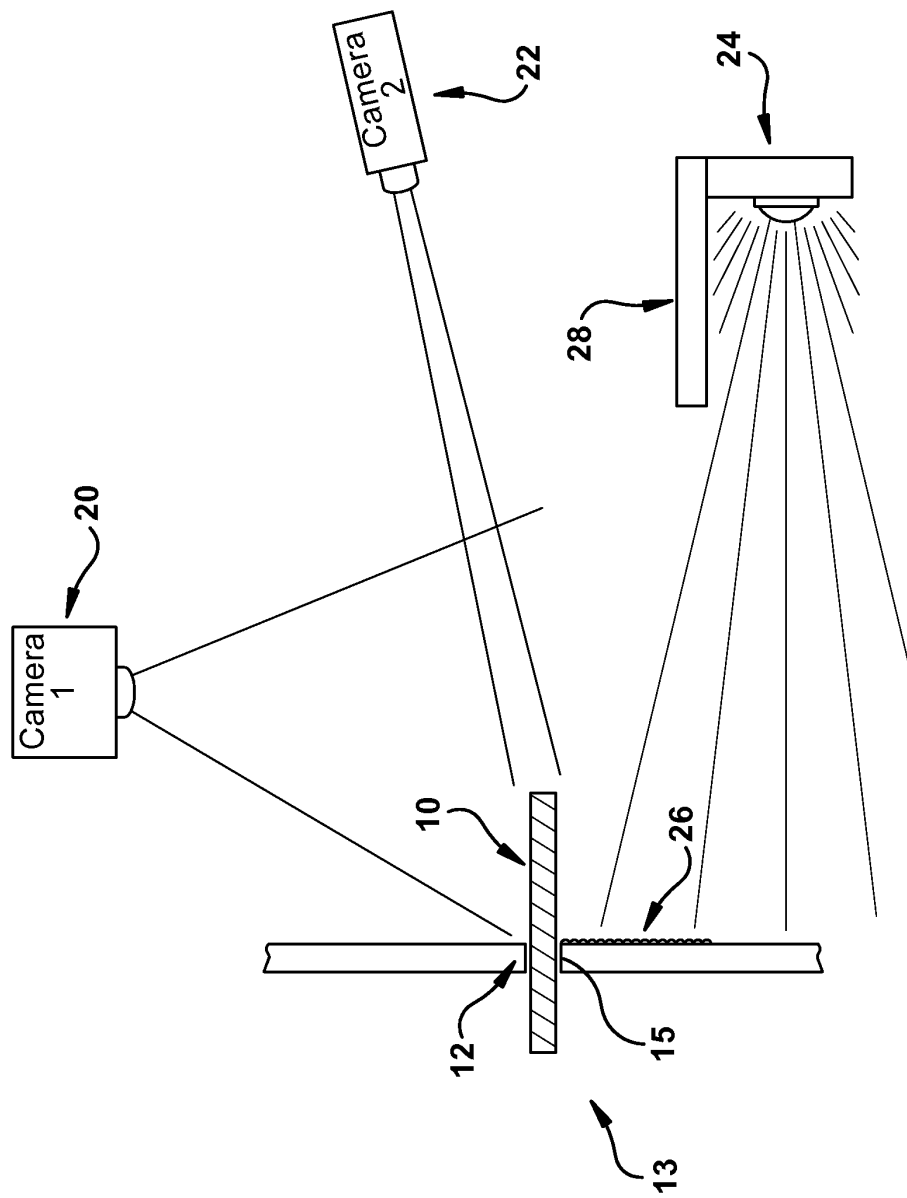


FIG. 2a

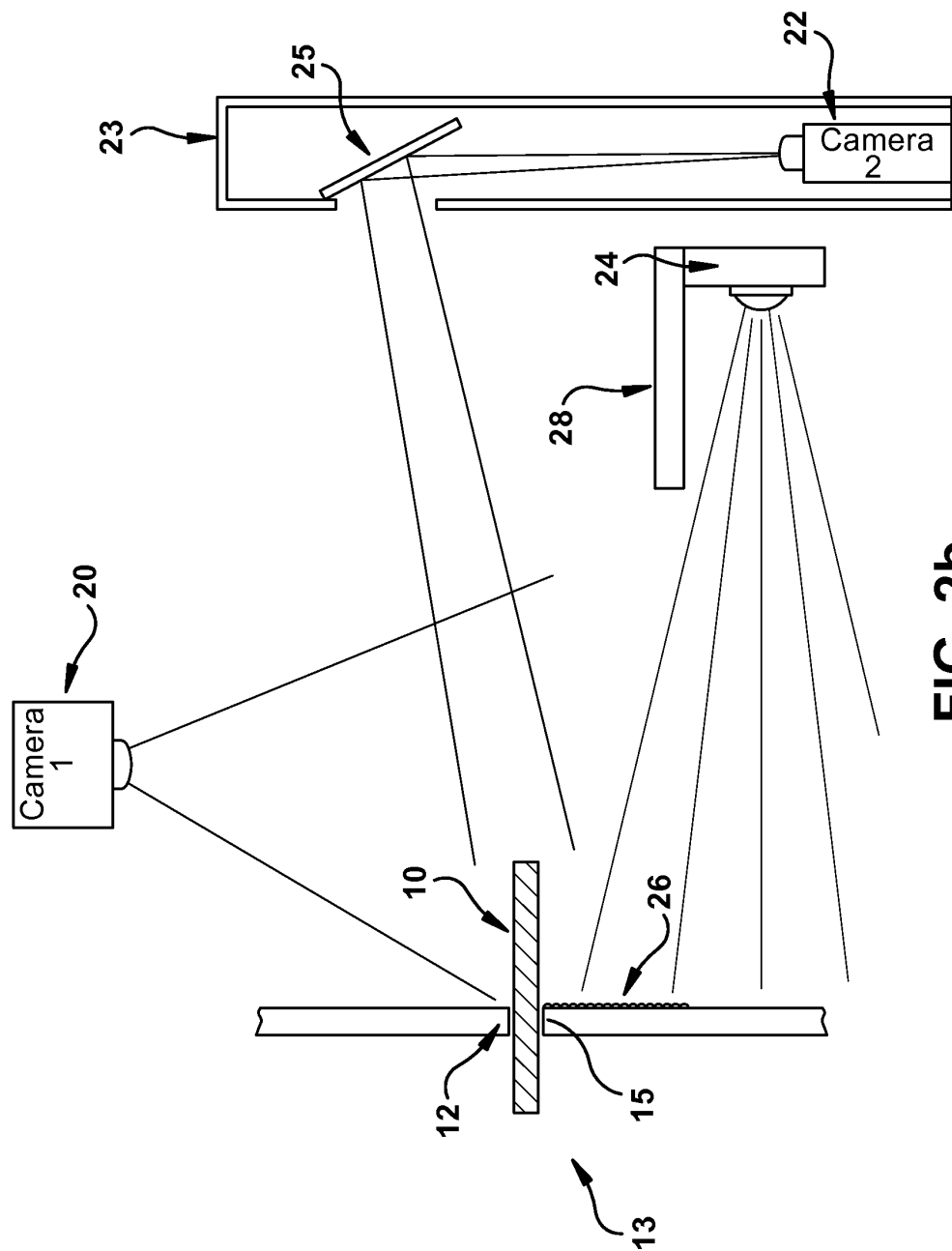


FIG. 2b

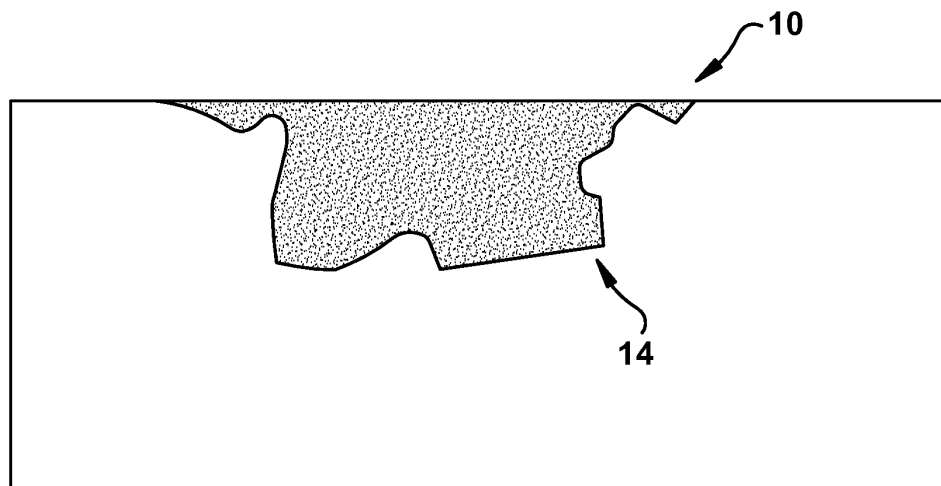
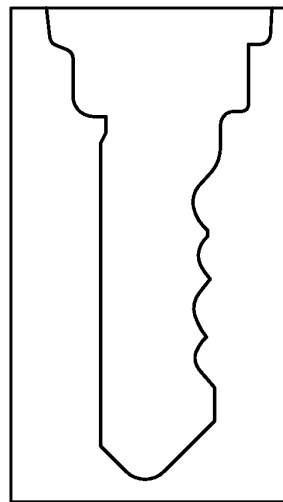
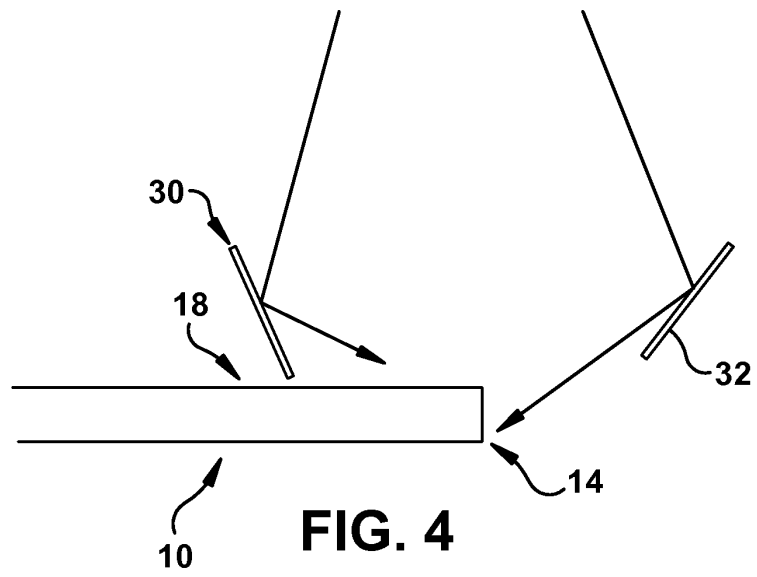


FIG. 3



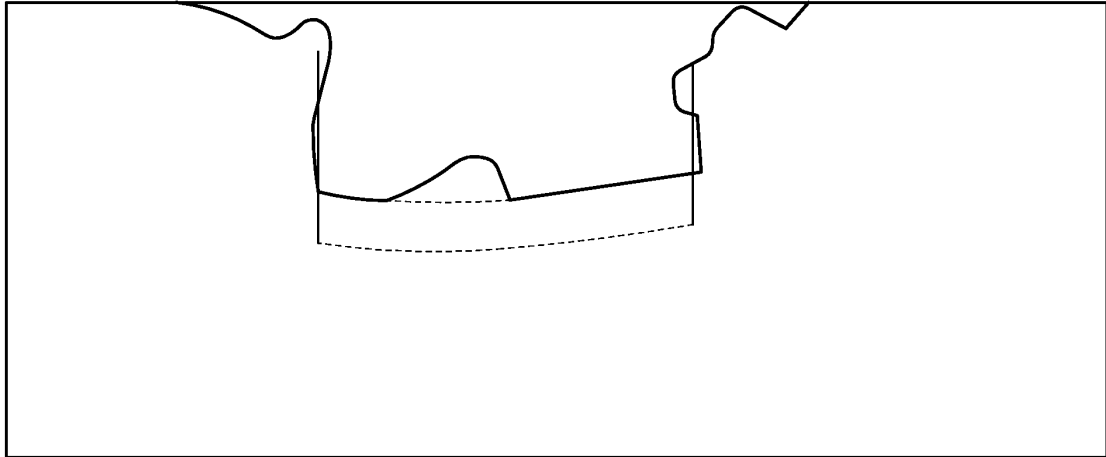


FIG. 6

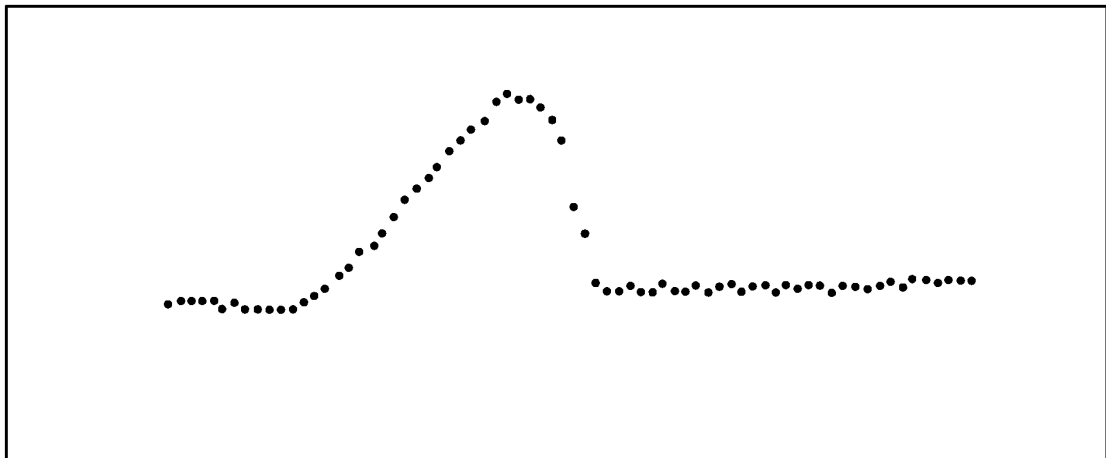


FIG. 7

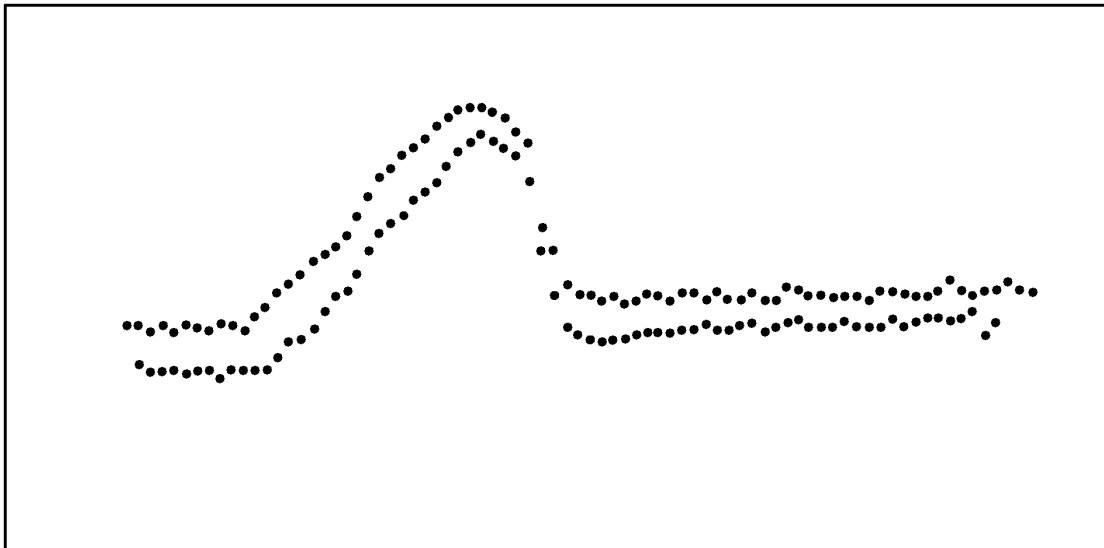


FIG. 8

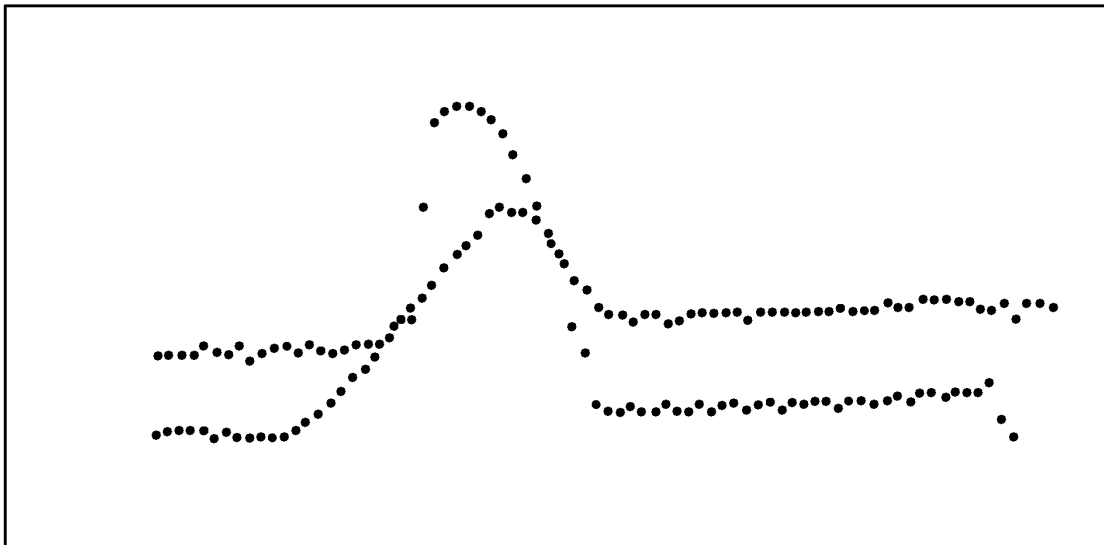


FIG. 9

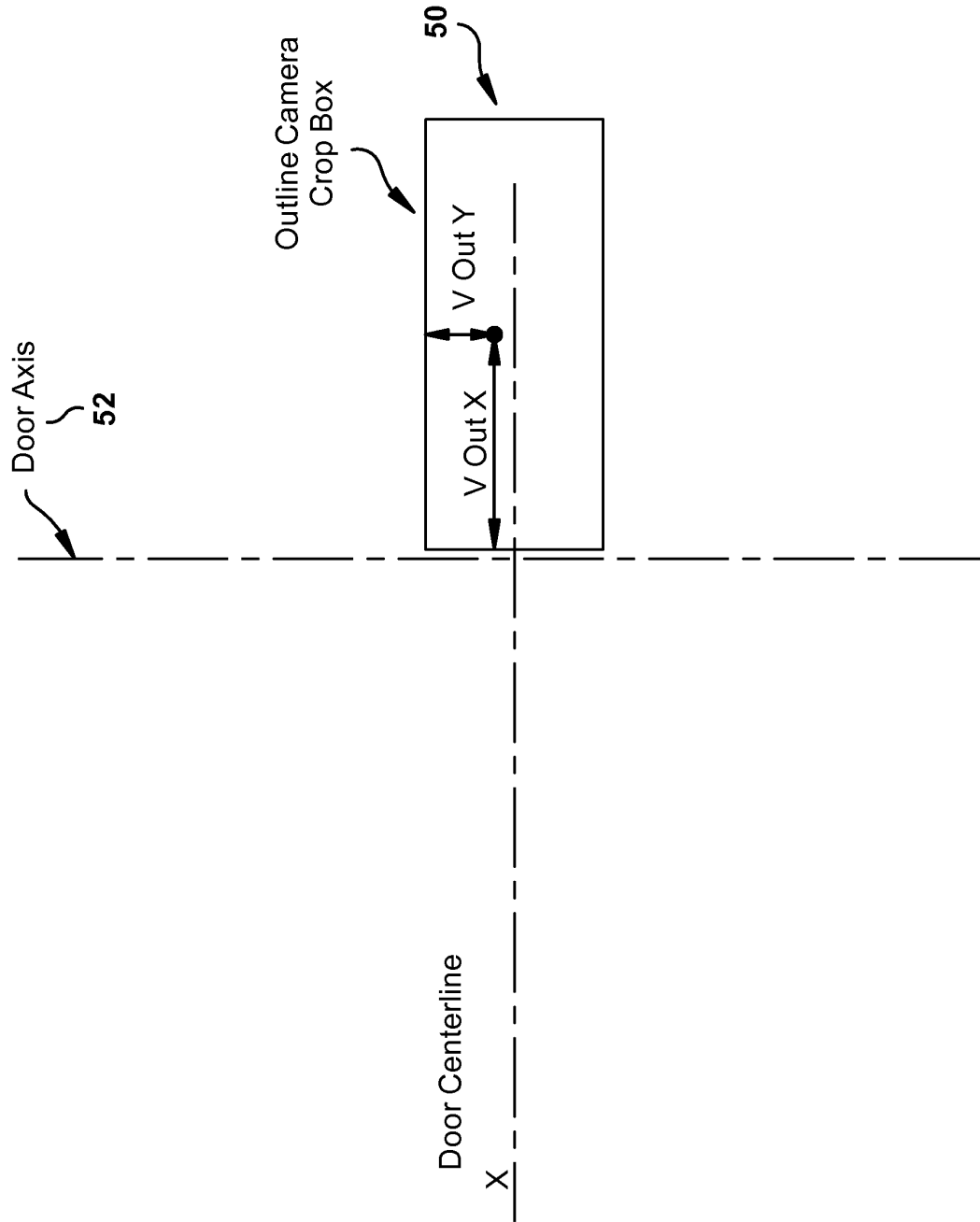


FIG. 10

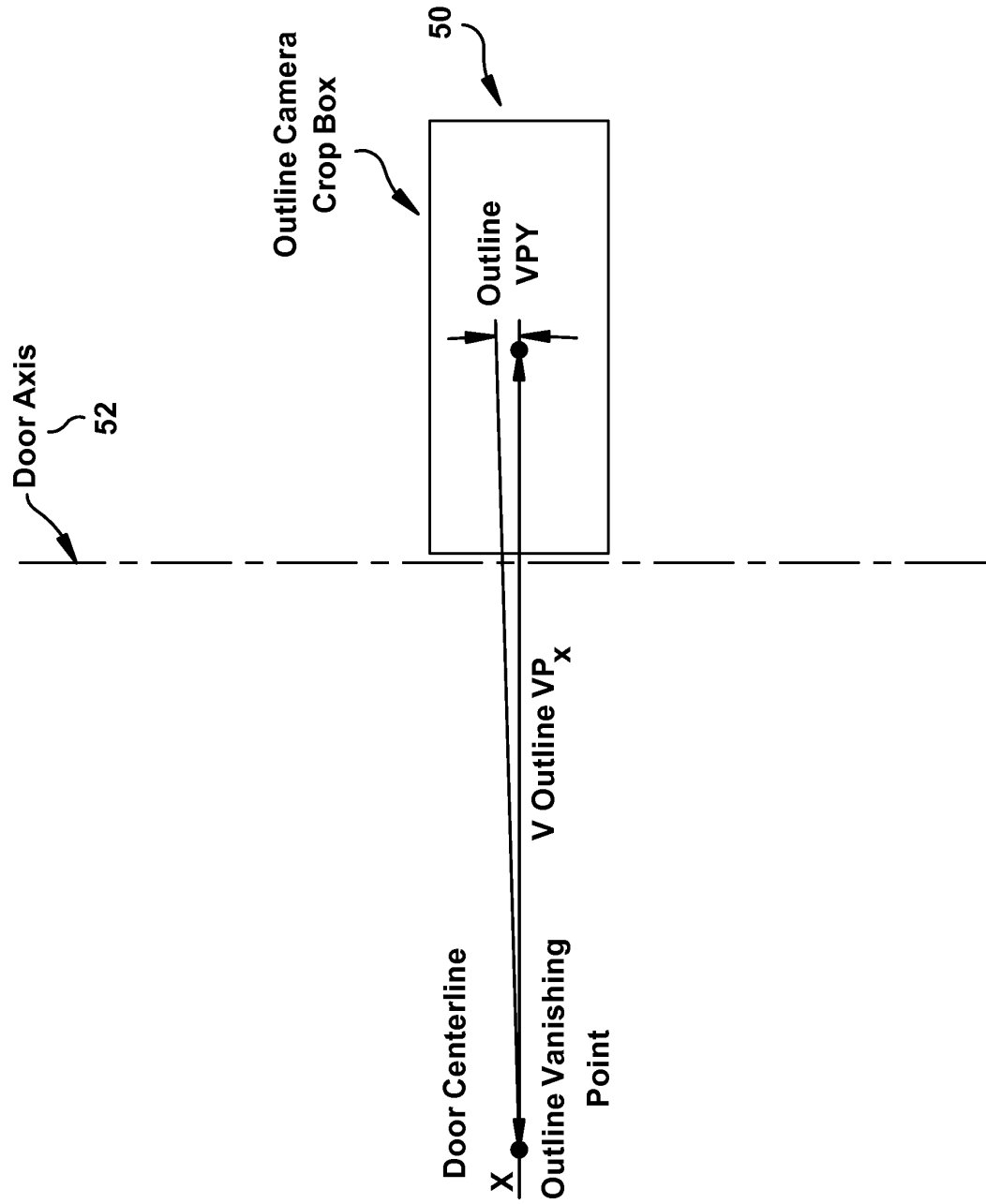
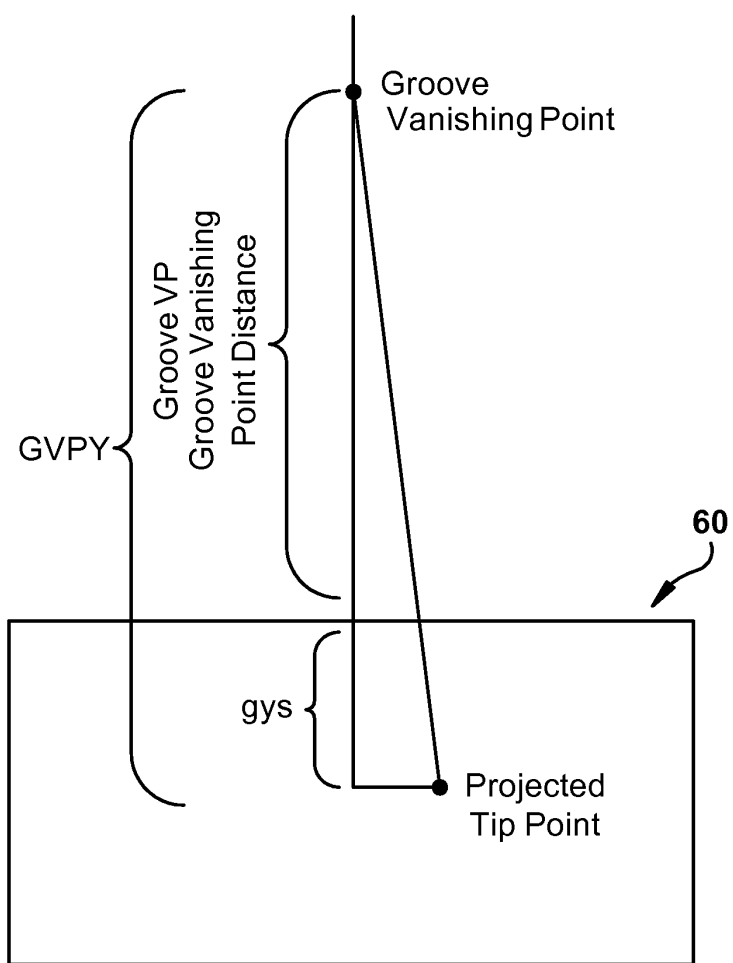
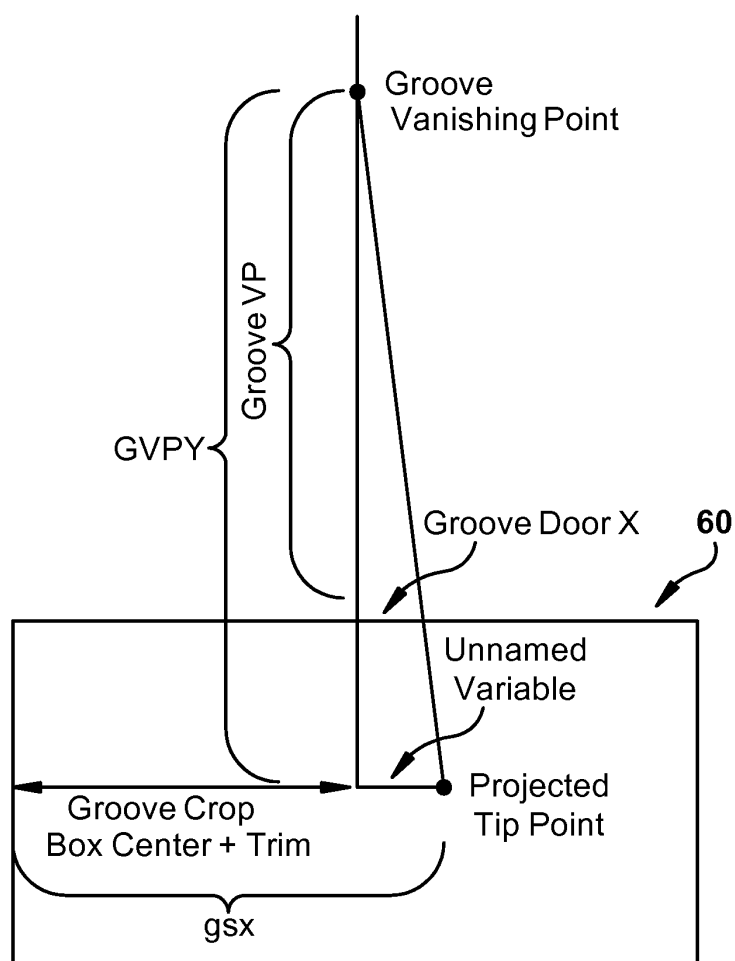
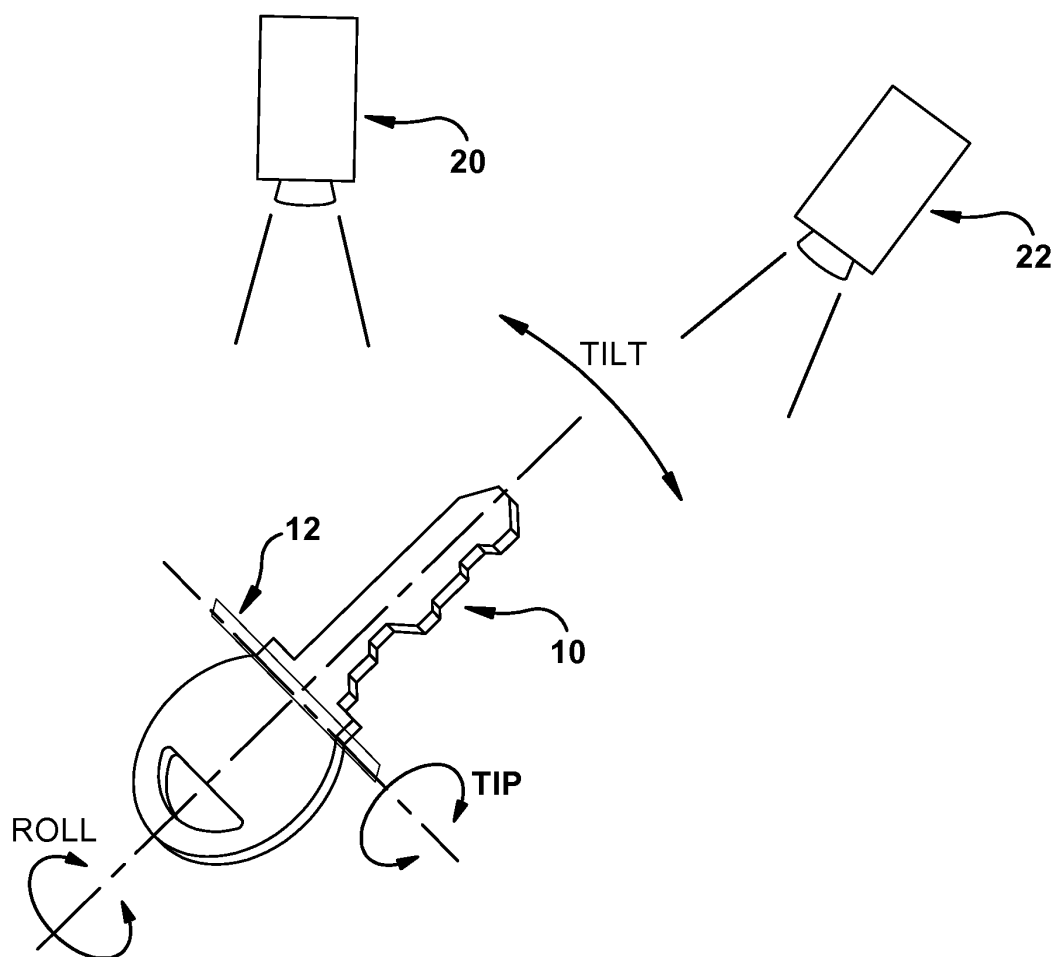


FIG. 11

**FIG. 12**

**FIG. 13**

**FIG. 14**

DECLARATION AND POWER OF ATTORNEY

As a below named inventor, I/We hereby declare that:

My/Our residence, post office address, and citizenship are as stated below next to my/our name.

I/We believe I/We am/are the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter that is claimed and for which a patent is sought on the invention entitled:

KEY BLANK IDENTIFICATION SYSTEM WITH GROOVE SCANNING

the specification of which (check one)

_____ is attached hereto

OR

 X was filed on May 3, 2010 as United States Application Number 12/772,709 and was amended on _____(if applicable).

I/We hereby state that I/We have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment specifically referred to above.

I/We acknowledge the duty to disclose to the United States Patent and Trademark Office all information known to me to be material to patentability as defined in 37 CFR §1.56, including for continuation-in-part applications, material information which became available between the filing date of the prior application and the national or PCT international filing date of the continuation application.

I/We hereby claim foreign priority benefits under 35 U.S.C. Section 119(a)-(d) or (f), or Section 365(b) of any foreign application(s) for patent, inventor's or plant breeder's rights certificate(s), or Section 365(a) of any PCT international application which designated at least one country other than the United States of America, listed below and have also identified below, any foreign application for patent, inventor's or plant breeder's rights certificate(s), or any PCT

{2161004:}

international application having a filing date before that of the application on which priority is claimed:

Prior Foreign Application Number(s)	Country	Foreign Filing Date (MM/DD/YYYY)	Priority Not Claimed	Certified Copy Attached?	
				YES	NO
			☐	☐	☐
			☐	☐	☐

I/We hereby claim the benefit under 35 U.S.C. Section 119(e) of any United States provisional application(s) listed below:

61/215,152 May 1, 2009
(Application Serial No.) (Filing Date)

61/275,654 September 1, 2009
(Application Serial No.) (Filing Date)

I/We hereby claim the benefit under 35 U.S.C. Section 120 of any United States application(s), or Section 365(c) of any PCT International application designating the United States, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of 35 U.S.C. Section 112, I/We acknowledge the duty to disclose to the United States Patent and Trademark Office all information known to me to be material to patentability as defined in Title 37, C.F.R., Section 1.56 which became available between the filing date of the prior application and the national or PCT International filing date of this application.

(Application Serial No.) (Filing Date) (Status)(patented, pending, abandoned)

{2161004:}

I/We hereby declare that all statements made herein of my/our own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

We hereby appoint the following attorney(s) to prosecute this application and to transact all business in the Patent and Trademark Office connected with:

The Attorneys Associated with Customer No 33772

I/We request that correspondence in connection with this application be directed to:

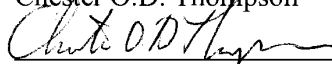
Customer No. 33772

David B. Cupar
McDonald Hopkins LLC
600 Superior Avenue, East
Suite 2100
Cleveland, OH 44114-2653
(216) 348-5400

Inventor's Full Name:

Chester O.D. Thompson

Inventor's Signature:



Citizenship:

USA

Post Office Address:

7377 Amanda Place

Painesville, OH 44077 United States

Place of Residence:

7377 Amanda Place

Painesville, OH 44077 United States

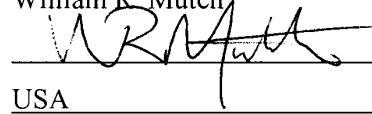
{2161004:}

In re: Thompson et al.
Attorney Docket No.: 16223-00151

Inventor's Full Name:

William R. Mutch

Inventor's Signature:



Citizenship:

USA

Post Office Address:

35284 Nikki Avenue

North Ridgeville, OH 44039 United States

Place of Residence:

35284 Nikki Avenue

North Ridgeville, OH 44039 United States

{2161004:}

Electronic Patent Application Fee Transmittal				
Application Number:				
Filing Date:				
Title of Invention:		KEY BLANK IDENTIFICATION SYSTEM WITH GROOVE SCANNING		
First Named Inventor/Applicant Name:		Chester O.D. Thompson		
Filer:		David Bogdan Cupar/Kathleen Barres		
Attorney Docket Number:		16223-Pending		
Filed as Small Entity				
Utility under 35 USC 111(a) Filing Fees				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
Utility filing Fee (Electronic filing)	4011	1	70	70
Utility Search Fee	2111	1	300	300
Utility Examination Fee	2311	1	360	360
Pages:				
Claims:				
Claims in excess of 20	2202	4	40	160
Miscellaneous-Filing:				
Petition:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Miscellaneous:				
Total in USD (\$)				890

Electronic Acknowledgement Receipt	
EFS ID:	18005249
Application Number:	14162157
International Application Number:	
Confirmation Number:	5914
Title of Invention:	KEY BLANK IDENTIFICATION SYSTEM WITH GROOVE SCANNING
First Named Inventor/Applicant Name:	Chester O.D. Thompson
Customer Number:	33772
Filer:	David Bogdan Cupar/Kathleen Barres
Filer Authorized By:	David Bogdan Cupar
Attorney Docket Number:	16223-Pending
Receipt Date:	23-JAN-2014
Filing Date:	
Time Stamp:	15:24:10
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	\$ 890
RAM confirmation Number	1820
Deposit Account	130265
Authorized User	
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: Charge any Additional Fees required under 37 C.F.R. Section 1.20 (Post Issuance fees)	

File Listing:					
Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Transmittal of New Application	Transmit.pdf	238832	no	2
			09189f50bd4d963d6673c78d921d32ecc2475be8		
Warnings:					
Information:					
2	Application Data Sheet	ADS.pdf	1561452	no	7
			c8d9ab3a0a2a05a438459b7267273bbae3bbd4a4		
Warnings:					
Information:					
3		Application.pdf	132503	yes	22
			6105eb833e87e57c77f9738fa5b0fdd0dea1af2f		
	Multipart Description/PDF files in .zip description				
	Document Description		Start	End	
	Specification		1	18	
	Claims		19	21	
	Abstract		22	22	
Warnings:					
Information:					
4	Drawings-only black and white line drawings	Drawings.pdf	173689	no	12
			f780b0052fa89249954543e3480c6ef739b27173		
Warnings:					
Information:					
5	Oath or Declaration filed	oathanddeclaration.pdf	114460	no	4
			6941458e2b98dbf98f79788ffe4957789a30b573		
Warnings:					
Information:					
6	Fee Worksheet (SB06)	fee-info.pdf	36877	no	2
			165ed086b06ea37c9ef7b27a74b0ad452073f53d		
Warnings:					
Information:					
Total Files Size (in bytes):			2257813		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY. DOCKET NO	TOT CLAIMS	IND CLAIMS
14/162,157	01/23/2014	3722	890	16223-Pending	24	1

CONFIRMATION NO. 5914

33772
MCDONALD HOPKINS LLC
600 Superior Avenue, East
Suite 2100
CLEVELAND, OH 44114-2653

FILING RECEIPT



OC000000066474254

Date Mailed: 02/07/2014

Receipt is acknowledged of this non-provisional patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection. Please verify the accuracy of the data presented on this receipt. **If an error is noted on this Filing Receipt, please submit a written request for a Filing Receipt Correction. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections**

Inventor(s)

Chester O.D. Thompson, Painesville, OH;
William R. Mutch, North Ridgeville, OH;

Applicant(s)

HY-KO PRODUCTS COMPANY, Northfield, OH

Assignment For Published Patent Application

HY-KO PRODUCTS COMPANY, Northfield, OH

Power of Attorney: None

Domestic Priority data as claimed by applicant

This application is a CON of 12/772,709 05/03/2010 PAT 8644619

Foreign Applications for which priority is claimed (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see <http://www.uspto.gov> for more information.) - None.

Foreign application information must be provided in an Application Data Sheet in order to constitute a claim to foreign priority. See 37 CFR 1.55 and 1.76.

If Required, Foreign Filing License Granted: 02/05/2014

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 14/162,157**

Projected Publication Date: 05/22/2014

Non-Publication Request: No

Early Publication Request: No

**** SMALL ENTITY ****

Title

KEY BLANK IDENTIFICATION SYSTEM WITH GROOVE SCANNING

Preliminary Class

409

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications: No

PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

Applicants also are advised that in the case of inventions made in the United States, the Director of the USPTO must issue a license before applicants can apply for a patent in a foreign country. The filing of a U.S. patent application serves as a request for a foreign filing license. The application's filing receipt contains further information and guidance as to the status of applicant's license for foreign filing.

Applicants may wish to consult the USPTO booklet, "General Information Concerning Patents" (specifically, the section entitled "Treaties and Foreign Patents") for more information on timeframes and deadlines for filing foreign patent applications. The guide is available either by contacting the USPTO Contact Center at 800-786-9199, or it can be viewed on the USPTO website at <http://www.uspto.gov/web/offices/pac/doc/general/index.html>.

For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, <http://www.stopfakes.gov>. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4258).

LICENSE FOR FOREIGN FILING UNDER
Title 35, United States Code, Section 184
Title 37, Code of Federal Regulations, 5.11 & 5.15

GRANTED

The applicant has been granted a license under 35 U.S.C. 184, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" followed by a date appears on this form. Such licenses are issued in all applications where the conditions for issuance of a license have been met, regardless of whether or not a license may be required as set forth in 37 CFR 5.15. The scope and limitations of this license are set forth in 37 CFR 5.15(a) unless an earlier license has been issued under 37 CFR 5.15(b). The license is subject to revocation upon written notification. The date indicated is the effective date of the license, unless an earlier license of similar scope has been granted under 37 CFR 5.13 or 5.14.

This license is to be retained by the licensee and may be used at any time on or after the effective date thereof unless it is revoked. This license is automatically transferred to any related applications(s) filed under 37 CFR 1.53(d). This license is not retroactive.

The grant of a license does not in any way lessen the responsibility of a licensee for the security of the subject matter as imposed by any Government contract or the provisions of existing laws relating to espionage and the national security or the export of technical data. Licensees should apprise themselves of current regulations especially with respect to certain countries, of other agencies, particularly the Office of Defense Trade Controls, Department of State (with respect to Arms, Munitions and Implements of War (22 CFR 121-128)); the Bureau of Industry and Security, Department of Commerce (15 CFR parts 730-774); the Office of Foreign Assets Control, Department of Treasury (31 CFR Parts 500+) and the Department of Energy.

NOT GRANTED

No license under 35 U.S.C. 184 has been granted at this time, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" DOES NOT appear on this form. Applicant may still petition for a license under 37 CFR 5.12, if a license is desired before the expiration of 6 months from the filing date of the application. If 6 months has lapsed from the filing date of this application and the licensee has not received any indication of a secrecy order under 35 U.S.C. 181, the licensee may foreign file the application pursuant to 37 CFR 5.15(b).

SelectUSA

The United States represents the largest, most dynamic marketplace in the world and is an unparalleled location for business investment, innovation, and commercialization of new technologies. The U.S. offers tremendous resources and advantages for those who invest and manufacture goods here. Through SelectUSA, our nation works to promote and facilitate business investment. SelectUSA provides information assistance to the international investor community; serves as an ombudsman for existing and potential investors; advocates on behalf of U.S. cities, states, and regions competing for global investment; and counsels U.S. economic development organizations on investment attraction best practices. To learn more about why the United States is the best country in the world to develop technology, manufacture products, deliver services, and grow your business, visit <http://www.SelectUSA.gov> or call +1-202-482-6800.

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875						Application or Docket Number 14/162,157				
APPLICATION AS FILED - PART I										
(Column 1)		(Column 2)		SMALL ENTITY		OTHER THAN SMALL ENTITY				
FOR	NUMBER FILED	NUMBER EXTRA	RATE(\$)	FEE(\$)		RATE(\$)	FEE(\$)			
BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A	70		N/A				
SEARCH FEE (37 CFR 1.16(k), (l), or (m))	N/A	N/A	N/A	300		N/A				
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A	360		N/A				
TOTAL CLAIMS (37 CFR 1.16(j))	24	minus 20 = *	4	x 40 =	160					
INDEPENDENT CLAIMS (37 CFR 1.16(h))	1	minus 3 = *		x 210 =	0.00					
APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$310 (\$155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).				0.00					
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))					0.00					
			TOTAL	890		TOTAL				
* If the difference in column 1 is less than zero, enter "0" in column 2.										
APPLICATION AS AMENDED - PART II										
(Column 1)		(Column 2)		(Column 3)		SMALL ENTITY		OTHER THAN SMALL ENTITY		
AMENDMENT A		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE(\$)	ADDITIONAL FEE(\$)		RATE(\$)	ADDITIONAL FEE(\$)
	Total (37 CFR 1.16(i))	*	Minus	**	=	x	=		x	=
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x	=		x	=
	Application Size Fee (37 CFR 1.16(s))									
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))									
						TOTAL ADD'L FEE			TOTAL ADD'L FEE	
AMENDMENT B		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE(\$)	ADDITIONAL FEE(\$)		RATE(\$)	ADDITIONAL FEE(\$)
	Total (37 CFR 1.16(i))	*	Minus	**	=	x	=		x	=
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x	=		x	=
	Application Size Fee (37 CFR 1.16(s))									
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))									
						TOTAL ADD'L FEE			TOTAL ADD'L FEE	
* If the entry in column 1 is less than the entry in column 2, write "0" in column 3. ** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20". *** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3". The "Highest Number Previously Paid For" (Total or Independent) is the highest found in the appropriate box in column 1.										



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
14/162,157	01/23/2014	Chester O.D. Thompson	16223-Pending

CONFIRMATION NO. 5914

33772

MCDONALD HOPKINS LLC
600 Superior Avenue, East
Suite 2100
CLEVELAND, OH 44114-2653

NOTICE



Date Mailed: 02/07/2014

INFORMATIONAL NOTICE TO APPLICANT

Applicant is notified that the above-identified application contains the deficiencies noted below. No period for reply is set forth in this notice for correction of these deficiencies. However, if a deficiency relates to the inventor's oath or declaration, the applicant must file an oath or declaration in compliance with 37 CFR 1.63, or a substitute statement in compliance with 37 CFR 1.64, executed by or with respect to each actual inventor no later than the expiration of the time period set in the "Notice of Allowability" to avoid abandonment. See 37 CFR 1.53(f).

The item(s) indicated below are also required and should be submitted with any reply to this notice to avoid further processing delays.

A new inventor's oath or declaration that identifies this application (e.g., by Application Number and filing date) is required. The inventor's oath or declaration does not comply with 37 CFR 1.63 in that it:

- does not state that the above-identified application was made or authorized to be made by the person executing the oath or declaration.

Chester O.D. Thompson

William R. Mutch



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
14/162,157	01/23/2014	Chester O.D. Thompson	16223-Pending

33772
MCDONALD HOPKINS LLC
600 Superior Avenue, East
Suite 2100
CLEVELAND, OH 44114-2653

CONFIRMATION NO. 5914
IMPROPER CPOA LETTER



Date Mailed: 02/07/2014

NOTICE REGARDING POWER OF ATTORNEY

This is in response to the power of attorney filed 01/23/2014. The power of attorney in this application is not accepted for the reason(s) listed below:

- The power of attorney from the inventors has not been accepted because the power of attorney must be signed by the applicant for patent. See 37 CFR 1.32(b)(4).

/fhadera/

Office of Data Management, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application: Chester O.D. Thompson, et al.. Group Art Unit: 3722
Serial No.: 14/162,157 Examiner: Not Yet Assigned
Filing Date: January 23, 2014 Docket No.: 16223-00274
Confirmation No.: 5914

Title: KEY IDENTIFICATION SYSTEM WITH GROOVE SCANNING

Mail Stop Missing Parts
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

RESPONSE TO INFORMATIONAL NOTICE TO APPLICANT

Dear Sirs:

In response to Informational Notice to Applicant mailed February 7, 2014, for the above-identified utility application, Applicants submit an executed oath or declaration.

The foregoing submission is believed to meet the requirements of the response to Informational Notice to Applicant. As this Response is being filed electronically on March 7, 2014, Applicants believe no additional fees are due. However, the Commissioner is hereby authorized to charge any additional fees or credit any overpayments to our deposit account no. 13-0265.

Date: March 7, 2014

/Charles F. Gray/
Charles F. Gray (Reg. No.: 67,012)
McDONALD HOPKINS LLC
600 Superior Avenue, E., Suite 2100
Cleveland, OH 44114-2653
Telephone No.: 248-220-1334

{4745139;}

COMBINED ASSIGNMENT AND DECLARATION OF PATENT APPLICATION

Assignment of Patent Application

Whereas, we, Chester O.D. Thompson, having an address at 7377 Amanda Place, Painesville, OH 44077, United States of America; William R. Mutch, having an address at 35284 Nikki Avenue, North Ridgeville, OH 44039, United States of America; hereinafter referred to as "Assignors," have invented, a new and useful invention, for which a U.S. Utility Patent Application was filed on January 23, 2014 having Attorney Docket No.: 16223-00274 and Application Serial No.: 14/162,157; U.S. Utility Patent Application was filed on May 3, 2010 having Attorney Docket No.: 16223-0005 and Application Serial No.: 12/772,709; Provisional Patent Application filed on September 1, 2009 having Attorney Docket No.: 16223-00129 and Application No.: 61/275,654; and Provisional Patent Application filed on May 1, 2009 having Attorney Docket No. 16223-00122 and Application Serial No. 61/215,152 and any subsequent applications filed in connection with the above invention (the "Patent").

Whereas, HY-KO PRODUCTS COMPANY, having an address at 60 Meadow Lane, Northfield, OH 44067, hereinafter referred to as "Assignee," is desirous of acquiring the entire right, title and interest in and to said Patent;

NOW, THEREFORE, in consideration of the sum of ten dollars (\$10.00), and other good and valuable consideration, the receipt and sufficiency of which are hereby acknowledged, we, the Assignors, by these presents do sell, assign and transfer unto Assignee, its successors and assigns, the full and exclusive right to the Patent and all letters patent of foreign countries which may be or have

“KEY BLANK IDENTIFICATION SYSTEM WITH GROOVE SCANNING”

been issued on the invention disclosed in the Patent, all divisions, reissues, and continuations thereof, and all inventions disclosed therein, together with all claims for damages by reason of past or future infringement, with the right to sue for and collect the same for the use and benefit of Assignee and its successors and assigns.

Assignors warrant that they are the exclusive owners of the entire legal and equitable interest in the Patent and the invention disclosed therein, free and clear of all liens and encumbrances; and that they have full power, authority, and capacity to make this Assignment to Assignee. Assignors covenant and agree, for themselves and for their successors and assigns that, at Assignee's request, Assignors will cause to be executed and delivered any applications, affidavits, assignments, and other instruments as may be deemed necessary or desirable by Assignee to secure for or vest in Assignee, its successors or assigns, all right, title, and interest in and to any application, patent, or other right or property covered by this assignment, including the right to apply for and obtain patents in foreign countries under the provisions of the International Convention; and Assignors hereby request and authorize the United States Commissioner of Patents and Trademarks to issue any and all United States patents granted on the Patent to Assignee as owner of the entire right, title, and interest in and to the same, and authorizes appropriately empowered officials of foreign countries to issue any letters patent granted on the Patent to Assignee as owner of the entire right, title, and interest in and to the same.

Declaration (37 Cfr 1.63) For Utility Or Design Application Using An Application Data Sheet (37 Cfr 1.76)

Title of Invention: Key Blank Identification System with Groove Scanning

As the below named inventor, I hereby declare that this declaration is directed to the attached application.

Ref. #16223-00274

"KEY BLANK IDENTIFICATION SYSTEM WITH GROOVE SCANNING"

The above-identified application was made or authorized to be made by me.

I believe that I am the original inventor or an original joint inventor of a claimed invention in the application.

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment specifically referred to above.

I acknowledge the duty to disclose to the United States Patent and Trademark Office all information known to me to be material to patentability as defined in 37 CFR §1.56, including for continuation-in-part applications, material information which became available between the filing date of the prior application and the national or PCT international filing date of the continuation application.

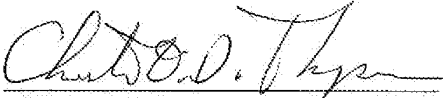
I hereby acknowledge that any willful false statement made in this declaration is punishable under 18 U.S.C. 1001 by fine or imprisonment of not more than five (5) years, or both.

[Signature pages follow.]

Ref. #16223-00274

"KEY BLANK IDENTIFICATION SYSTEM WITH GROOVE SCANNING"

Legal Name of Inventor: Chester O.D. Thompson

By: 
Chester O.D. Thompson

Date: February 22, 2014

Ref. #16223-00274

"KEY BLANK IDENTIFICATION SYSTEM WITH GROOVE SCANNING"

Legal Name of Inventor: William R. Mutch

By: WR Mutch
William R. Mutch

Date: 2/28/14

Electronic Acknowledgement Receipt	
EFS ID:	18407232
Application Number:	14162157
International Application Number:	
Confirmation Number:	5914
Title of Invention:	KEY BLANK IDENTIFICATION SYSTEM WITH GROOVE SCANNING
First Named Inventor/Applicant Name:	Chester O.D. Thompson
Customer Number:	33772
Filer:	David Bogdan Cupar/Kathleen Barres
Filer Authorized By:	David Bogdan Cupar
Attorney Docket Number:	16223-Pending
Receipt Date:	07-MAR-2014
Filing Date:	23-JAN-2014
Time Stamp:	16:34:26
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Applicant Response to Pre-Exam Formalities Notice	ResptolInfo.pdf	52976 d33872ec500721955664e9dc7d8e6067a403ffc6	no	1

Warnings:

Information:

2	Oath or Declaration filed	Declaration.pdf	1220072 8167bbc6424496612ae690e78d64818eb3d45a6b	no	5
Warnings:					
Information:					
Total Files Size (in bytes):				1273048	
This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503. <u>New Applications Under 35 U.S.C. 111</u> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application. <u>National Stage of an International Application under 35 U.S.C. 371</u> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course. <u>New International Application Filed with the USPTO as a Receiving Office</u> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.					



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/162,157	01/23/2014	Chester O.D. Thompson	16223-Pending	5914
33772 7590 04/24/2014 MCDONALD HOPKINS LLC 600 Superior Avenue, East Suite 2100 CLEVELAND, OH 44114-2653			EXAMINER ENTEZARI, MICHELLE M	
			ART UNIT 2665	PAPER NUMBER
			MAIL DATE 04/24/2014	DELIVERY MODE PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 14/162,157	Applicant(s) THOMPSON ET AL.	
	Examiner MICHELLE ENTEZARI	Art Unit 2665	AIA (First Inventor to File) Status No

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTHS FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 1/23/14.
☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on ____.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on ____; the restriction requirement and election have been incorporated into this action.
- 4) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims*

- 5) ☒ Claim(s) 1-24 is/are pending in the application.
5a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 6) ☐ Claim(s) ____ is/are allowed.
- 7) ☒ Claim(s) 1-14 and 16-24 is/are rejected.
- 8) ☒ Claim(s) 15 is/are objected to.
- 9) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

* If any claims have been determined allowable, you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov.

Application Papers

- 10) ☐ The specification is objected to by the Examiner.
- 11) ☐ The drawing(s) filed on ____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

Certified copies:

- a) ☐ All b) ☐ Some** c) ☐ None of the:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. ____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

** See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b)
Paper No(s)/Mail Date ____.
- 3) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. ____.
- 4) ☐ Other: ____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after allowance or after an Office action under *Ex Parte Quayle*, 25 USPQ 74, 453 O.G. 213 (Comm'r Pat. 1935). Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, prosecution in this application has been reopened pursuant to 37 CFR 1.114. Applicant's submission filed on January 23, 2014 has been entered.

Double Patenting

2. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. A nonstatutory double patenting rejection is appropriate where the claims at issue are not identical, but at least one examined application claim is not patentably distinct from the reference claim(s) because the examined application claim is either anticipated by, or would have been obvious over, the reference claim(s). See, e.g., *In re Berg*, 140 F.3d 1428, 46 USPQ2d 1226 (Fed. Cir. 1998); *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*,

686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) or 1.321(d) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the reference application or patent either is shown to be commonly owned with this application, or claims an invention made as a result of activities undertaken within the scope of a joint research agreement. A terminal disclaimer must be signed in compliance with 37 CFR 1.321(b).

The USPTO internet Web site contains terminal disclaimer forms which may be used. Please visit <http://www.uspto.gov/forms/>. The filing date of the application will determine what form should be used. A web-based eTerminal Disclaimer may be filled out completely online using web-screens. An eTerminal Disclaimer that meets all requirements is auto-processed and approved immediately upon submission. For more information about eTerminal Disclaimers, refer to <http://www.uspto.gov/patents/process/file/efs/guidance/eTD-info-I.jsp>.

3. **Claim 21** is rejected on the ground of nonstatutory double patenting as being unpatentable over claim 1 of U.S. Patent No. 8644619. Although the claims at issue are not identical, they are not patentably distinct from each other because the feature “one of said views of said master key includes a view from an angle between perpendicular and parallel to the blade of said master key and not including perpendicular or parallel to the blade of said master key” is shared between the claims, as well as the concept of matching contour information.

Claim Objections

4. **Claims 21-22** are objected to because of the following informalities: Claim 21 ends with a comma and no period, and claim 22 has no period at the end. Appropriate correction is required.

Claim Rejections - 35 USC § 112

5. The following is a quotation of 35 U.S.C. 112(b):
(b) CONCLUSION.—The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the inventor or a joint inventor regards as the invention.

The following is a quotation of 35 U.S.C. 112 (pre-AIA), second paragraph:
The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

6. **Claim 5** recites the limitation "said reflecting device". There is insufficient antecedent basis for this limitation in the claim. Examiner recommends amending claim 4 to depend on claim 3, so both the light at the reflecting device have antecedent basis, or else change "said reflecting device" to "a reflecting device".

Claim Rejections - 35 USC § 103

7. The following is a quotation of pre-AIA 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

8. **Claims 1-8, 12-14, 16-20 and 24 are** rejected under 35 U.S.C. 103(a) as being unpatentable over Campbell et al. (US 20020191849 A1) in view of Prejean (US 6647308 B1).

Regarding claim 1, Campbell et al. disclose key identification system (abstract) comprising: an imaging system including a camera configured to capture an image of the tip of a master key (capture an image of the master key, abstract, [0047], [0051]), wherein said image includes a contour (contour, [0089]-[0094]); a logic configured to analyze said captured image to determine characteristics of said contour and compare said characteristics with characteristics of known key blanks to determine the likelihood of a match between said master key and a known key blank (contour matching score, [0089]—[0094]).

Campbell et al. do not disclose one or more mirrors positioned to allow said camera to capture two or more views of the master key.

Prejean teaches a mirror positioned to allow said camera to capture more than one view of said master key (col. 5, line 55 - col. 6, line 5).

Campbell et al. and Prejean are in the same art of copying keys (Campbell et al., abstract; Prejean, abstract). The addition of Prejean would use a mirror to the imaging setup. It would have been obvious at the time of the invention to one of ordinary skill in

the art to combine the mirror of Prejean with the invention of Campbell et al., as this was known at the time of the invention, would have predictable results, and as this allows more than one view to be captured without needing to physically move the key.

Regarding claim 2, Campbell et al. and Prejean disclose the key identification system of claim 1. Campbell et al. further indicate said logic includes a database containing data related to characteristics of grooves of known key blanks ([0084], [0097], [0100], [0107], [0111] [characteristics of grooves interpreted as number of notches, information about contours, etc.]).

Regarding claim 3, Campbell et al. and Prejean disclose the key identification system of claim 1. Campbell et al. further indicate said imaging system includes a reflecting device (abstract, [0013]-[0015], [0057]-[0062]).

Regarding claim 4, Campbell et al. and Prejean disclose the key identification system of claim 1. Campbell et al. further indicate said imaging system includes a light (abstract, [0044]).

Regarding claim 5, Campbell et al. and Prejean disclose the key identification system of claim 4. Campbell et al. further indicate said light is directed toward said reflecting device ([0058], [0060]).

Regarding claim 6, Campbell et al. and Prejean disclose the key identification system of claim 5. Campbell et al. further indicate said light includes a shield to direct light away from said master key (prior art systems include light shielding, [0008]).

Regarding claim 7, Campbell et al. and Prejean disclose the key identification system of claim 1. Campbell et al. further indicate said captured image is a digital image ([0047]).

Regarding claims 8 and 12, Campbell et al. and Prejean disclose the key identification system of claim 1. Campbell et al. further indicate said captured image comprises a silhouette of said tip and blade of said master key ([0051], [0056], [0076], [0077]).

Regarding claim 13, Campbell et al. and Prejean disclose the key identification system of claim 1. Campbell et al. and Prejean further indicate said characteristics of said contour are determined based on image data from at least two or more views of said master key (Campbell et al., [0050], [0053], [0054]; Prejean, col. 5, line 55 - col. 6, line 5).

Regarding claim 14, Campbell et al. and Prejean disclose the key identification system of claim 13. Campbell et al. and Prejean further indicate said characteristics of said contour are determined based on image data from at least two or more views of said master key (Campbell et al., [0050], [0053], [0054]; Prejean, col. 5, line 55 - col. 6, line

5). Campbell et al. also indicate said logic calculates the geometry of the contour as seen as seen from a view of the tip parallel to the blade based on data from at least said two or more views of said master key (images captured by receiver and second receiver can be combined to create a complete image of the master key, from which the key may be identified, as described in greater detail below, [0053], Fig. 4, Fig. 5, contour information is extracted by analyzing the slope variances in the shape of the outer perimeter of the head and shoulder area, slope variances and sizes may then be combined to form the contour description string, [0086]).

Regarding claim 16, Campbell et al. and Prejean disclose the key identification system of claim 1. Campbell et al. further disclose a key holder to hold said master key (transparent support 142 (referring to FIG. 12) may be provided to receive the master key, [0044]).

Regarding claim 17, Campbell et al. and Prejean disclose the key identification system of claim 16. Campbell et al. further disclose said key holder includes a lower support (transparent support 142 (referring to FIG. 12) may be provided to receive the master key, [0044]).

Regarding claim 18, Campbell et al. and Prejean disclose the key identification system of claim 16. Campbell et al. further disclose said key holder comprises an upper door

(door, [0042], [0073], [0109], from Fig. 1 can see at least the majority of the door is higher than the floor).

Regarding claim 19, Campbell et al. and Prejean disclose the key identification system of claim 16. Campbell et al. and Prejean further disclose a key holder includes a clamp in prior art systems (Campbell et al., [0004]; Prejean, col. 3, lines 35-45).

Regarding claim 20, Campbell et al. and Prejean disclose the key identification system of claim 1. Campbell et al. further disclose one of said views of said master key includes a view from above the master key blade of a groove in the bottom of said blade (Fig. 4, Fig. 5, [0053]).

Regarding claim 24, Campbell et al. and Prejean disclose the key identification system of claim 1. Campbell et al. further disclose said logic includes a tolerance range for each characteristic of said master key to determine whether a master key passes or fails to match a known key blank ([0087], [0104]).

9. **Claim 9** rejected under 35 U.S.C. 103(a) as being unpatentable over Campbell et al. (US 20020191849 A1) and Prejean (US 6647308 B1) as applied to claim 1 above, further in view of Miller et al. (US 7643685 B2).

Regarding claim 9, Campbell et al. and Prejean disclose the key identification system of claim 1. Campbell et al. and Prejean do not explicitly disclose said logic accounts for rolling of said master key with respect to said imaging system to determine characteristics of said contour.

Miller et al. teach a computation that accounts for roll of the object imaged (col. 3, lines 1-10, col. 3, lines 65-68, col. 11, lines 10-15).

The combination of Miller et al. with Campbell et al. and Prejean allows for key rolling. It would have been obvious at the time of the invention to one of ordinary skill in the art to combine the object identification even in the case of rolling of Miller et al., with the device of Campbell et al. and Prejean, as these identification techniques were well known at the time of the invention, incorporating the identification would have predictable results, and as the key placed on the platform may not always lie entirely flat.

10. **Claims 10, 11, and 22 are** rejected under 35 U.S.C. 103(a) as being unpatentable over Campbell et al. (US 20020191849 A1) and Prejean (US 6647308 B1) as applied to claim 1 above, further in view of Almblad et al. (US 6065911 A).

Regarding claim 10, Campbell et al. and Prejean disclose the key identification system of claim 1. Campbell et al. and Prejean do not explicitly disclose said logic accounts for

tilting of said master key with respect to said imaging system to determine characteristics of said contour.

Almblad et al. teach logic accounts for tilting of said master key with respect to said imaging system to determine characteristics of said groove (Almblad et al., accommodates for key tilted/not lying flat due to bulky handle, fig. 3, col. 8, lines 35-45).

The combination of Almblad et al. with Campbell et al. and Prejean allows for key tilting. It would have been obvious at the time of the invention to one of ordinary skill in the art to combine the object identification even in the case of tilting of Almblad et al., with the device of Campbell et al. and Prejean, as these identification techniques were well known at the time of the invention, incorporating the identification would have predictable results, and as the key placed on the platform may not always lie entirely flat.

Regarding claim 11, Campbell et al. and Prejean disclose the key identification system of claim 1. Campbell et al. and Prejean do not explicitly disclose said logic accounts for tipping of said master key with respect to said imaging system to determine characteristics of said contour.

Almblad et al. teach logic accounts for tipping of said master key with respect to said imaging system to determine characteristics of said groove (Almblad et al., accommodates for key tilted/not lying flat due to bulky handle, fig. 3, col. 8, lines 35-45).

The combination of Almblad et al. with Campbell et al. and Prejean allows for key tipping. It would have been obvious at the time of the invention to one of ordinary skill in the art to combine the object identification even in the case of tipping of Almblad et al., with the device of Campbell et al. and Prejean, as these identification techniques were well known at the time of the invention, incorporating the identification would have predictable results, and as the key placed on the platform may not always lie entirely flat.

Regarding claim 22, Campbell et al. and Prejean disclose the key identification system of claim 1. Campbell et al. and Prejean do not explicitly disclose the captured image of said tip includes a contour of a groove in said master key.

Almblad et al. teach a captured image of said tip includes a contour of a groove in said master key (extract three-dimensional grooves, col. 2, lines 30-35, identify curved grooves, col. 4, lines 35-40; extract laterally protected attributes such as groove characteristics using light stripe, col. 11, lines 5-25).

The combination of Almblad et al. with Campbell et al. and Prejean allows for identification of groove contours. It would have been obvious at the time of the invention to one of ordinary skill in the art to combine the groove contours identification of Almblad et al., with the invention of Campbell et al. and Prejean, as these identification techniques were well known at the time of the invention, incorporating the identification would have predictable results, and as one of a limited numbers of ways to identify a key, would have been obvious to try.

11. **Claim 23 is** rejected under 35 U.S.C. 103(a) as being unpatentable over Campbell et al. (US 20020191849 A1) and Prejean (US 6647308 B1) as applied to claim 1 above, further in view of Gimelfarb et al. (US 20060147289 A1).

Regarding claim 23, Campbell et al. and Prejean disclose the key identification system of claim 1. Campbell et al. and Prejean do not explicitly disclose said logic is configured to shift data related to said characteristics of said contour to compare with said known key blank characteristics.

Gimelfarb et al. teach logic is configured to shift data related to said characteristics of said contour to compare with said known key blank characteristics (bittings aligned to master key, slidable along axis, abstract, [0014], [0030], [0035]).

Cambell et al. and Gimelfarb are in the same art of copying keys (Cambell et al., abstract; Gimelfarb, abstract). The addition of Gimelfarb would a slidable alignment method. It would have been obvious at the time of the invention to one of ordinary skill in the art to combine the sliding alignment of Gimelfarb with the invention of Cambell et al. and Prejean, as this was known at the time of the invention, would have predictable results, and as this allows for more easy key positioning and comparison.

Allowable Subject Matter

12. **Claim 15** is objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to MICHELLE ENTEZARI whose telephone number is (571)270-5084. The examiner can normally be reached on M-Th, 7:30am-5pm EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Stephen R. Koziol can be reached on (571)270-1844. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/MICHELLE ENTEZARI/
Primary Examiner, Art Unit 2665

Notice of References Cited	Application/Control No. 14/162,157	Applicant(s)/Patent Under Reexamination THOMPSON ET AL.	
	Examiner MICHELLE ENTEZARI	Art Unit 2665	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-2002/0191849	12-2002	Campbell et al.	382/181
*	B	US-6,647,308	11-2003	Prejean, Ronald Martin	700/117
*	C	US-7,643,685	01-2010	Miller, Michael	382/209
*	D	US-6,065,911	05-2000	Almblad et al.	409/83
*	E	US-2006/0147289	07-2006	Gimelfarb et al.	409/277
	F	US-			
	G	US-			
	H	US-			
	I	US-			
	J	US-			
	K	US-			
	L	US-			
	M	US-			

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

Search Notes 	Application/Control No. 14162157	Applicant(s)/Patent Under Reexamination THOMPSON ET AL.
	Examiner MICHELLE ENTEZARI	Art Unit 2665

CPC- SEARCHED		
Symbol	Date	Examiner
B23C2235/24	4/18/14	Entezari
B23C2235/28	4/18/14	Entezari
B23C2235/41	4/18/14	Entezari
B23C2235/44	4/18/14	Entezari
b23q33/00	4/18/14	Entezari
g06k2209/401	4/18/14	Entezari
g06k2209/40 (keyword limited)	4/18/14	Entezari
y10s83/917 (keyword limited)	4/18/14	Entezari

CPC COMBINATION SETS - SEARCHED		
Symbol	Date	Examiner

US CLASSIFICATION SEARCHED			
Class	Subclass	Date	Examiner
382	203, 205, 209, 110, 141, 305 (keyword limited)	4/18/14	Entezari
409	81-83 (keyword limited)	4/18/14	Entezari

SEARCH NOTES		
Search Notes	Date	Examiner
see EAST search, includes INV	4/18/14-4/21/14	Entezari

INTERFERENCE SEARCH			
US Class/ CPC Symbol	US Subclass / CPC Group	Date	Examiner

<i>Index of Claims</i> 	Application/Control No. 14162157	Applicant(s)/Patent Under Reexamination THOMPSON ET AL.
	Examiner MICHELLE ENTEZARI	Art Unit 2665

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47										
CLAIM		DATE								
Final	Original	04/21/2014								
	1	✓								
	2	✓								
	3	✓								
	4	✓								
	5	✓								
	6	✓								
	7	✓								
	8	✓								
	9	✓								
	10	✓								
	11	✓								
	12	✓								
	13	✓								
	14	✓								
	15	✓								
	16	✓								
	17	✓								
	18	✓								
	19	✓								
	20	✓								
	21	✓								
	22	✓								
	23	✓								
	24	✓								



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
 United States Patent and Trademark Office
 Address: COMMISSIONER FOR PATENTS
 P.O. Box 1450
 Alexandria, Virginia 22313-1450
 www.uspto.gov

BIB DATA SHEET

CONFIRMATION NO. 5914

SERIAL NUMBER	FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.		
14/162,157	01/23/2014	382	2665	16223-Pending		
APPLICANTS HY-KO PRODUCTS COMPANY, Northfield, OH, Assignee (with 37 CFR 1.172 Interest); INVENTORS Chester O.D. Thompson, Painesville, OH; William R. Mutch, North Ridgeville, OH; ** CONTINUING DATA ***** This application is a CON of 12/772,709 05/03/2010 PAT 8644619 ** FOREIGN APPLICATIONS ***** ** IF REQUIRED, FOREIGN FILING LICENSE GRANTED ** ** SMALL ENTITY ** 02/05/2014						
Foreign Priority claimed ☐ Yes ☒ No 35 USC 119(a-d) conditions met ☐ Yes ☐ No Verified and /MICHELLE M ENTENZARI/ Acknowledged Examiner's Signature		☐ Met after Allowance Initials	STATE OR COUNTRY OH	SHEETS DRAWINGS 12	TOTAL CLAIMS 24	INDEPENDENT CLAIMS 1
ADDRESS MCDONALD HOPKINS LLC 600 Superior Avenue, East Suite 2100 CLEVELAND, OH 44114-2653 UNITED STATES						
TITLE KEY BLANK IDENTIFICATION SYSTEM WITH GROOVE SCANNING						
FILING FEE RECEIVED 890	FEES: Authority has been given in Paper No. _____ to charge/credit DEPOSIT ACCOUNT No. _____ for following:			☐ All Fees ☐ 1.16 Fees (Filing) ☐ 1.17 Fees (Processing Ext. of time) ☐ 1.18 Fees (Issue) ☐ Other _____ ☐ Credit		

EAST Search History**EAST Search History (Prior Art)**

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S2	3	S1 and @ad<"20090501"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	NEAR	OFF	2014/04/18 01:01
S1	6	bitting center	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	NEAR	OFF	2014/04/18 01:01
S4	47	master key same mirror and @ad<"20090501"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	NEAR	ON	2014/04/18 01:15
S3	685	master key and mirror and @ad<"20090501"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	NEAR	ON	2014/04/18 01:15
S5	5	master key and key with (copy\$3 or copied or duplicat\$5) and (overlay\$3 or overlaid or superimpos\$3) with (template or known or blank) and @ad<"20090501"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	NEAR	ON	2014/04/18 01:29
S6	91	master key and key with (copy\$3 or copied or duplicat\$5) and match\$3 with tolerance and @ad<"20090501"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	NEAR	ON	2014/04/18 01:35
S7	3	master key and key with (copy\$3 or copied or duplicat\$5) and shift\$3 with (location or position or coordinates) with (teeth or bittings or notches) and @ad<"20090501"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	NEAR	ON	2014/04/18 01:40
S8	66	master key and key with (copy\$3 or	US-PGPUB;	NEAR	ON	2014/04/18;

		copied or duplicat\$5) and align\$5 with (teeth or bittings or notches) and @ad<"20090501"	USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB			01:41
S9	49	master key and key with (copy\$3 or copied or duplicat\$5) and (depth or width or center) with (teeth or bittings or notches) and @ad<"20090501"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	NEAR	ON	2014/04/18 02:06
S10	45	S9 and (sliding or slider or slid or slide or shift\$3 or rotating or rotated or longitudinally)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	NEAR	ON	2014/04/18 02:07
S11	11	(US-20020191849-\$ or US-20060147289-\$ or US-20070224008-\$).did. or (US-5607267-\$ or US-5314274-\$ or US-5271698-\$ or US-6647308-\$ or US-5711643-\$ or US-4717294-\$ or US-4203693-\$ or US-5943890-\$).did.	US-PGPUB; USPAT	NEAR	OFF	2014/04/18 02:16
S13	1239	382/203.ccls.	US-PGPUB; USPAT	NEAR	OFF	2014/04/18 02:28
S19	310	409/81-83.ccls.	US-PGPUB; USPAT	NEAR	OFF	2014/04/18 02:29
S18	2523	382/305.ccls.	US-PGPUB; USPAT	NEAR	OFF	2014/04/18 02:29
S17	2261	382/141.ccls.	US-PGPUB; USPAT	NEAR	OFF	2014/04/18 02:29
S16	477	382/110.ccls.	US-PGPUB; USPAT	NEAR	OFF	2014/04/18 02:29
S15	1890	382/209.ccls.	US-PGPUB; USPAT	NEAR	OFF	2014/04/18 02:29
S14	510	382/205.ccls.	US-PGPUB; USPAT	NEAR	OFF	2014/04/18 02:29
S23	10	B23C2235/28.cpc.	US-PGPUB; USPAT	NEAR	OFF	2014/04/18 02:30
S22	5	B23C2235/24.cpc.	US-PGPUB; USPAT	NEAR	OFF	2014/04/18 02:30
S21	0	B23C2235/00.cpc.	US-PGPUB; USPAT	NEAR	OFF	2014/04/18 02:30
S20	275	B23C3/35.cpc.	US-PGPUB; USPAT	NEAR	OFF	2014/04/18 02:30
S28	198	g06k2209/40.cpc.	US-PGPUB; USPAT	NEAR	OFF	2014/04/18 02:31
S27	18	g06k2209/401.cpc.	US-PGPUB; USPAT	NEAR	OFF	2014/04/18 02:31
S26	35	b23q33/00.cpc.	US-PGPUB; USPAT	NEAR	OFF	2014/04/18 02:31
S25	1	B23C2235/44.cpc.	US-PGPUB; USPAT	NEAR	OFF	2014/04/18 02:31
S24	24	B23C2235/41.cpc.	US-PGPUB;	NEAR	OFF	2014/04/18

			USPAT			02:31
S30	76	(S20 or S28 or S29) and (bitting or notches or notch or teeth) with depth	US-PGPUB; USPAT	NEAR	ON	2014/04/18 02:32
S29	377	y10s83/917.cpc.	US-PGPUB; USPAT	NEAR	OFF	2014/04/18 02:32
S31	66	(S13 or S14 or S15 or S16 or S17 or S18 or S19) and (bitting or notches or notch or teeth) with depth	US-PGPUB; USPAT	NEAR	ON	2014/04/18 03:11
S32	39	Thompson near2 Chester.inv. or Mutch near2 William.inv.	US-PGPUB; USPAT	NEAR	OFF	2014/04/20 17:35
S35	1	S33 and contour with (compar\$5 or match\$3)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	NEAR	ON	2014/04/20 22:33
S33	16	(US-20020191849-\$ or US-20060147289-\$ or US-20070224008-\$ or US-20080145163-\$ or US-20040024486-\$ or US-20130294857-\$ or US-20120243957-\$).did. or (US-5607267-\$ or US-5314274-\$ or US-5271698-\$ or US-6647308-\$ or US-5711643-\$ or US-4717294-\$ or US-4203693-\$ or US-5943890-\$ or US-6406227-\$).did.	US-PGPUB; USPAT	NEAR	OFF	2014/04/20 22:33
S38	3	mirrors with captur\$3 with views! with key	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	NEAR	ON	2014/04/20 23:44
S47	7	master key and key with (copy\$3 or copied or duplicat\$5) and (shield\$3 or direct\$3 light away) near3 (light or illumination) and @ad<"20090501"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	NEAR	ON	2014/04/21 01:49
S68	2	master key and key with (copy\$3 or copied or duplicat\$5) and (square or squarely) cut and @ad<"20090501"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	NEAR	ON	2014/04/21 03:38
S67	2	master key and key with (copy\$3 or copied or duplicat\$5) and (square cut) and @ad<"20090501"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	NEAR	ON	2014/04/21 03:38

EAST Search History (Interference)

< This search history is empty >

4/ 21/ 2014 5:46:05 PM

C:\Users\mentezari\Documents\EAST\Workspaces\14_162_157.wsp



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
14/162,157	01/23/2014	Chester O.D. Thompson	16223-Pending

CONFIRMATION NO. 5914

33772

MCDONALD HOPKINS LLC
600 Superior Avenue, East
Suite 2100
CLEVELAND, OH 44114-2653

PUBLICATION NOTICE



Title:KEY BLANK IDENTIFICATION SYSTEM WITH GROOVE SCANNING

Publication No.US-2014-0139683-A1

Publication Date:05/22/2014

NOTICE OF PUBLICATION OF APPLICATION

The above-identified application will be electronically published as a patent application publication pursuant to 37 CFR 1.211, et seq. The patent application publication number and publication date are set forth above.

The publication may be accessed through the USPTO's publically available Searchable Databases via the Internet at www.uspto.gov. The direct link to access the publication is currently <http://www.uspto.gov/patft/>.

The publication process established by the Office does not provide for mailing a copy of the publication to applicant. A copy of the publication may be obtained from the Office upon payment of the appropriate fee set forth in 37 CFR 1.19(a)(1). Orders for copies of patent application publications are handled by the USPTO's Office of Public Records. The Office of Public Records can be reached by telephone at (703) 308-9726 or (800) 972-6382, by facsimile at (703) 305-8759, by mail addressed to the United States Patent and Trademark Office, Office of Public Records, Alexandria, VA 22313-1450 or via the Internet.

In addition, information on the status of the application, including the mailing date of Office actions and the dates of receipt of correspondence filed in the Office, may also be accessed via the Internet through the Patent Electronic Business Center at www.uspto.gov using the public side of the Patent Application Information and Retrieval (PAIR) system. The direct link to access this status information is currently <http://pair.uspto.gov/>. Prior to publication, such status information is confidential and may only be obtained by applicant using the private side of PAIR.

Further assistance in electronically accessing the publication, or about PAIR, is available by calling the Patent Electronic Business Center at 1-866-217-9197.

Office of Data Management, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

PATENT APPLICATION
IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application: Chester O.D. Thompson et al. Art Unit: 2665
Serial No.: 14/162,157 Examiner: Entezari, Michelle M.
Filing Date: January 23, 2014 Docket No.: 16223-00274
Title: KEY BLANK IDENTIFICATION SYSTEM WITH GROOVE SCANNING

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

RESPONSE TO OFFICE ACTION

Applicants acknowledge receipt of the April 24, 2014 Office Action. As this response is electronically filed on September 24, 2014, along with a request for a two-month extension and the appropriate fee, Applicants believe no additional fees are due. However, if any additional fees are required for this Response, please charge such fees to our Deposit Account No. 13-0265.

{5139849;}

CLAIMS

What is claimed is:

1. (Original) A key identification system comprising:

an imaging system including a camera configured to capture an image of the tip of a master key, wherein said image includes a contour;

a logic configured to analyze said captured image to determine characteristics of said contour and compare said characteristics with characteristics of known key blanks to determine the likelihood of a match between said master key and a known key blank; and

one or more mirrors positioned to allow said camera to capture two or more views of the master key.
2. (Original) The key identification system of claim 1, wherein said logic includes a database containing data related to characteristics of grooves of known key blanks.
3. (Original) The key identification system of claim 1, wherein said imaging system includes a reflecting device.
4. (Currently Amended) The key identification system of claim 1 ~~4~~ 3, wherein said imaging system includes a light.
5. (Original) The key identification system of claim 4, wherein said light is directed toward said reflecting device.
6. (Original) The key identification system of claim 5, wherein said light includes a shield to direct light away from said master key.
7. (Original) The key identification system of claim 1, wherein said captured image is a digital image.

8. (Original) The key identification system of claim 1, wherein said captured image comprises a silhouette of said tip of said master key.
9. (Original) The key identification system of claim 1, wherein said logic accounts for rolling of said master key with respect to said imaging system to determine characteristics of said contour.
10. (Original) The key identification system of claim 1, wherein said logic accounts for tilting of said master key with respect to said imaging system to determine characteristics of said contour.
11. (Original) The key identification system of claim 1, wherein said logic accounts for tipping of said master key with respect to said imaging system to determine characteristics of said contour.
12. (Original) The key identification system of claim 1, wherein said captured image comprises a silhouette of the blade of said master key.
13. (Original) The key identification system of claim 1, wherein said characteristics of said contour are determined based on image data from at least said two or more views of said master key.
14. (Original) The key identification system of claim 13, wherein said logic calculates the geometry of the contour as seen from a view of the tip parallel to the blade based on data from at least said two or more views of said master key.
15. (Original) The key identification system of claim 13, wherein said logic calculates the geometry of the contour as though the tip were squarely cut based on data from at least said two or more views of said master key.

16. (Original) The key identification system of claim 1 further comprising a key holder configured to hold said master key.
17. (Original) The key identification system of claim 16, wherein said key holder includes a lower support.
18. (Original) The key identification system of claim 16, wherein said key holder includes an upper door.
19. (Original) The key identification system of claim 16, wherein said key holder includes a clamp.
20. (Original) The key identification system of claim 1, wherein one of said views of said master key includes a view from above the master key blade of a groove in the bottom of said blade.
21. (Original) The key identification system of claim 1, wherein one of said views of said master key includes a view from an angle between perpendicular and parallel to the blade of said master key and not including perpendicular or parallel to the blade of said master key.
22. (Original) The key identification system of claim 1, wherein the captured image of said tip includes a contour of a groove in said master key
23. (Original) The key identification system of claim 1, wherein the logic is configured to shift data related to said characteristics of said contour to compare with said known key blank characteristics.
24. (Original) The key identification system of claim 1, wherein said logic includes a tolerance range for each characteristic of said master key to determine whether a master key passes or fails to match a known key blank.

REMARKS

In the April 24, 2014 Office Action, claim 21 is rejected on the ground of non-statutory double patenting over U.S. Patent No. 8,644,619. Claim 5 stands rejected under 35 U.S.C. 112 as indefinite for lacking antecedent basis. Claims 1-8, 12-14, 16-20, and 24 stand rejected under 35 U.S.C. 103 as unpatentable over U.S. Publication No. 20020191849 to Campbell et al. (“Campbell”) in view of U.S. Patent No. 6,647,308 to Prejean et al (“Prejean”). Claim 9 stands rejected under 35 U.S.C. 103 as unpatentable over Campbell and Prejean in further view of U.S. Patent No. 7,643,685 to Miller et al. (“Miller”). Claims 10, 11, and 22 stand rejected under 35 U.S.C. 103 as unpatentable over Campbell and Prejean in further view of U.S. Patent No. 6,065,911 to Almblad (“Almblad”). Claim 23 stands rejected under 35 U.S.C. 103 as unpatentable over Campbell and Prejean in further view of U.S. Publication No 20060147289 to Gimelfarb et al. (“Gimelfarb”). The following remarks address each of these issues and place the present application in condition for allowance.

Double Patenting Rejection

The office action rejects claim 21 based on double patenting over U.S. Patent No. 8,644,619. The office action further indicates that the rejection may be overcome by entering a terminal disclaimer. If necessary, applicant will submit the requested terminal disclaimer once the remaining rejections have been addressed and overcome.

35 U.S.C. 112 Rejection

Claim 5 stands rejected as indefinite for lacking antecedent basis. Claim 4 is amended to depend from claim 3, thus providing antecedent basis for the recital of the reflecting device in claim 5. Accordingly, Applicant respectfully requests that the rejection of claim 5 under 35 U.S.C. 112 be withdrawn.

The Pending Claims Are Patentable

Claim 1 recites “one or more mirrors positioned to allow said camera to capture two or more views of the master key.” The office action concedes that Campbell does not teach this feature but alleges that Prejean teaches this feature at col. 5, line 55 – col. 6, line 5. However, the cited reference does not teach the recited feature.

Prejean teaches a key manufacturing method. The method includes a process for extracting exterior surface information of a master key using a holographic camera. (See Prejean col. 5, lines 57-67.) The camera or scanner emits a beam into a series of mirrors. Either the mirrors or master key are designed to move to allow the beam to scan the entirety of the master key. However, Prejean does not disclose the above-recited feature.

By contrast, claim 1 recites “one or more mirrors positioned to allow said camera to capture two or more views of the master key.” In other words, a single camera utilizes one or more mirrors to capture at least two views of the master key. Prejean does not disclose this feature but instead merely recites using a series of mirrors to scan a key.

For at least this reason, claim 1 is patentable over the cited references. Accordingly, Applicant requests that the rejection of claim 1, and all claims depending therefrom, be withdrawn.

CONCLUSION

In light of the foregoing, Applicants submit that the application is now in condition for allowance. If the Examiner has any questions pertaining to the above, then the undersigned attorney would welcome a phone call to provide any further clarification or a formal interview.

Respectfully submitted,

Date: September 24, 2014

/Charles F. Gray/
Charles F. Gray
Reg. No. 67,012
McDonald Hopkins LLC
600 Superior Avenue, E.
Suite 2100
Cleveland, OH 44114-2653
248-220-1334

Electronic Patent Application Fee Transmittal				
Application Number:		14162157		
Filing Date:		23-Jan-2014		
Title of Invention:		KEY BLANK IDENTIFICATION SYSTEM WITH GROOVE SCANNING		
First Named Inventor/Applicant Name:		Chester O.D. Thompson		
Filer:		David Bogdan Cupar/Kathleen Barres		
Attorney Docket Number:		16223-Pending		
Filed as Small Entity				
Utility under 35 USC 111(a) Filing Fees				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Extension - 2 months with \$0 paid	2252	1	300	300

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Miscellaneous:				
Total in USD (\$)				300

Electronic Acknowledgement Receipt	
EFS ID:	20234180
Application Number:	14162157
International Application Number:	
Confirmation Number:	5914
Title of Invention:	KEY BLANK IDENTIFICATION SYSTEM WITH GROOVE SCANNING
First Named Inventor/Applicant Name:	Chester O.D. Thompson
Customer Number:	33772
Filer:	David Bogdan Cupar/Kathleen Barres
Filer Authorized By:	David Bogdan Cupar
Attorney Docket Number:	16223-Pending
Receipt Date:	24-SEP-2014
Filing Date:	23-JAN-2014
Time Stamp:	16:24:05
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	\$ 300
RAM confirmation Number	3082
Deposit Account	130265
Authorized User	
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: Charge any Additional Fees required under 37 C.F.R. Section 1.21 (Miscellaneous fees and charges)	

File Listing:					
Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		ROA.pdf	75878	yes	7
			3297e51ed62a574c376e0afd9f95e3aa8b7ea12		
	Multipart Description/PDF files in .zip description				
	Document Description	Start	End		
	Amendment/Req. Reconsideration-After Non-Final Reject	1	1		
	Claims	2	4		
	Applicant Arguments/Remarks Made in an Amendment	5	7		
Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	30492	no	2
			47cc32d4752c7cdf9617cbddf52d2e0ffb6961d8		
Warnings:					
Information:					
Total Files Size (in bytes):			106370		
This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503. <u>New Applications Under 35 U.S.C. 111</u> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application. <u>National Stage of an International Application under 35 U.S.C. 371</u> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course. <u>New International Application Filed with the USPTO as a Receiving Office</u> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.					

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875				Application or Docket Number 14/162,157		Filing Date 01/23/2014		☐ To be Mailed	
ENTITY: ☐ LARGE ☒ SMALL ☐ MICRO									
APPLICATION AS FILED – PART I									
		(Column 1)		(Column 2)					
FOR		NUMBER FILED		NUMBER EXTRA		RATE (\$)		FEE (\$)	
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))		N/A		N/A		N/A			
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))		N/A		N/A		N/A			
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))		N/A		N/A		N/A			
TOTAL CLAIMS (37 CFR 1.16(i))		minus 20 =		*		X \$ =			
INDEPENDENT CLAIMS (37 CFR 1.16(h))		minus 3 =		*		X \$ =			
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))		If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$310 (\$155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).							
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))									
* If the difference in column 1 is less than zero, enter "0" in column 2.						TOTAL			
APPLICATION AS AMENDED – PART II									
		(Column 1)		(Column 2)		(Column 3)			
AMENDMENT	09/24/2014		CLAIMS REMAINING AFTER AMENDMENT			HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE (\$)	ADDITIONAL FEE (\$)
	Total (37 CFR 1.16(i))		* 24		Minus	** 24	= 0	X \$40 =	0
	Independent (37 CFR 1.16(h))		* 1		Minus	***3	= 0	X \$210 =	0
	☐ Application Size Fee (37 CFR 1.16(s))								
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))								
								TOTAL ADD'L FEE	0
		(Column 1)		(Column 2)		(Column 3)			
AMENDMENT			CLAIMS REMAINING AFTER AMENDMENT			HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE (\$)	ADDITIONAL FEE (\$)
	Total (37 CFR 1.16(i))		*		Minus	**	=	X \$ =	
	Independent (37 CFR 1.16(h))		*		Minus	***	=	X \$ =	
	☐ Application Size Fee (37 CFR 1.16(s))								
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))								
								TOTAL ADD'L FEE	
* If the entry in column 1 is less than the entry in column 2, write "0" in column 3. ** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20". *** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3". The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.									

LIE
/VANESSA BARBER/

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/162,157	01/23/2014	Chester O.D. Thompson	16223-Pending	5914
33772 7590 11/13/2014 MCDONALD HOPKINS LLC 600 Superior Avenue, East Suite 2100 CLEVELAND, OH 44114-2653			EXAMINER ENTEZARI, MICHELLE M	
			ART UNIT 2665	PAPER NUMBER
			NOTIFICATION DATE 11/13/2014	DELIVERY MODE ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

ipmailbox@mcdonaldhopkins.com
jeastin@mcdonaldhopkins.com
tamato@mcdonaldhopkins.com

Office Action Summary	Application No. 14/162,157	Applicant(s) THOMPSON ET AL.	
	Examiner MICHELLE ENTEZARI	Art Unit 2665	AIA (First Inventor to File) Status No

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTHS FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 9/24/14.
☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on ____.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on ____; the restriction requirement and election have been incorporated into this action.
- 4) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims*

- 5) ☒ Claim(s) 1-24 is/are pending in the application.
5a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 6) ☐ Claim(s) ____ is/are allowed.
- 7) ☒ Claim(s) 1-14 and 16-24 is/are rejected.
- 8) ☐ Claim(s) 15 is/are objected to.
- 9) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

* If any claims have been determined allowable, you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov.

Application Papers

- 10) ☐ The specification is objected to by the Examiner.
- 11) ☐ The drawing(s) filed on ____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

Certified copies:

- a) ☐ All b) ☐ Some** c) ☐ None of the:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. ____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

** See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)	3) ☐ Interview Summary (PTO-413)
2) ☐ Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b)	Paper No(s)/Mail Date. ____.
Paper No(s)/Mail Date ____.	4) ☐ Other: ____.

DETAILED ACTION

Response to Amendment

1. Claims 1-24 are pending. Claim 4 is amended. Claims 1-3 and 5-24 are original.

Response to Arguments

2. Applicant's arguments filed September 24, 2014 have been fully considered but they are not persuasive.
3. Regarding the argument on page 5 regarding the double patenting rejection, as the claims are not amended and a terminal disclaimer has not been filed, the double patenting rejection is being maintained at this time.
4. Regarding the argument on page 5 regarding the 35 USC 112 rejection of claim 5, the amendment to claim 4 to correct for antecedent basis is persuasive. The 35 USC 112 rejection of claim 5 is withdrawn.
5. Regarding the argument on page 6 regarding Prejean, examiner disagrees. Prejean teaches one or more mirrors positioned to allow said camera to capture two or more views of the master key, as Prejean states, "In one form of the invention, the means for capturing the exterior surface conformation of the master key 10 is with a holographic camera 12 or the like. Essentially, the scanning unit comprises a beam emitter 14, typically in the form of a laser, which emits a beam of light onto a **series of mirrors 16 and beam splitter(s) 18**. The theory behind such light scanners is that **light**, in a straight line, reflected off of an object, **can be viewed at a different angle to**

reveal the profile conformation of the surface of the object. Either the object is moved or a system of mirrors adjusted to completely scan the object for reading.

Typically, an incident beam of light is broken into two or more beams with at least one transmitted beam being used as an illuminating beam for the object and the other beam being used as a reference beam. A signal beam is produced which is intercepted and read by the camera 12 and converted into electronic data 20.” (col. 5, line 55 – col. 6, line 5). This indicates the mirrors are used to provide multiple angle views of an object.

Double Patenting

6. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the “right to exclude” granted by a patent and to prevent possible harassment by multiple assignees. A nonstatutory double patenting rejection is appropriate where the claims at issue are not identical, but at least one examined application claim is not patentably distinct from the reference claim(s) because the examined application claim is either anticipated by, or would have been obvious over, the reference claim(s). See, e.g., *In re Berg*, 140 F.3d 1428, 46 USPQ2d 1226 (Fed. Cir. 1998); *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) or 1.321(d) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the reference application or patent either is shown to be commonly owned with this application, or claims an invention made as a result of activities undertaken within the scope of a joint research agreement. A terminal disclaimer must be signed in compliance with 37 CFR 1.321(b).

The USPTO internet Web site contains terminal disclaimer forms which may be used. Please visit <http://www.uspto.gov/forms/>. The filing date of the application will determine what form should be used. A web-based eTerminal Disclaimer may be filled out completely online using web-screens. An eTerminal Disclaimer that meets all requirements is auto-processed and approved immediately upon submission. For more information about eTerminal Disclaimers, refer to <http://www.uspto.gov/patents/process/file/efs/guidance/eTD-info-I.jsp>.

7. **Claim 21** is rejected on the ground of nonstatutory double patenting as being unpatentable over claim 1 of U.S. Patent No. 8644619. Although the claims at issue are not identical, they are not patentably distinct from each other because the feature “one of said views of said master key includes a view from an angle between perpendicular and parallel to the blade of said master key and not including perpendicular or parallel to the blade of said master key” is shared between the claims, as well as the concept of matching contour information.

Claim Objections

8. **Claims 21-22** are objected to because of the following informalities: Claim 21 ends with a comma and no period, and claim 22 has no period at the end. Appropriate correction is required.

Claim Rejections - 35 USC § 103

9. The following is a quotation of pre-AIA 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

10. **Claims 1-8, 12-14, 16-20 and 24 are** rejected under 35 U.S.C. 103(a) as being unpatentable over Campbell et al. (US 20020191849 A1) in view of Prejean (US 6647308 B1).

Regarding claim 1, Campbell et al. disclose key identification system (abstract) comprising: an imaging system including a camera configured to capture an image of the tip of a master key (capture an image of the master key, abstract, [0047], [0051]), wherein said image includes a contour (contour, [0089]-[0094]); a logic configured to analyze said captured image to determine characteristics of said contour and compare said characteristics with characteristics of known key blanks to determine the likelihood

of a match between said master key and a known key blank (contour matching score, [0089—[0094]]).

Campbell et al. do not disclose one or more mirrors positioned to allow said camera to capture two or more views of the master key.

Prejean teaches a mirror positioned to allow said camera to capture more than one view of said master key (col. 5, line 55 - col. 6, line 5).

Campbell et al. and Prejean are in the same art of copying keys (Campbell et al., abstract; Prejean, abstract). The addition of Prejean would use a mirror to the imaging setup. It would have been obvious at the time of the invention to one of ordinary skill in the art to combine the mirror of Prejean with the invention of Campbell et al., as this was known at the time of the invention, would have predictable results, and as this allows more than one view to be captured without needing to physically move the key.

Regarding claim 2, Campbell et al. and Prejean disclose the key identification system of claim 1. Campbell et al. further indicate said logic includes a database containing data related to characteristics of grooves of known key blanks ([0084], [0097], [0100], [0107], [0111] [characteristics of grooves interpreted as number of notches, information about contours, etc.]).

Regarding claim 3, Campbell et al. and Prejean disclose the key identification system of claim 1. Campbell et al. further indicate said imaging system includes a reflecting device (abstract, [0013]-[0015], [0057]-[0062]).

Regarding claim 4, Campbell et al. and Prejean disclose the key identification system of claim 1. Campbell et al. further indicate said imaging system includes a light (abstract, [0044]).

Regarding claim 5, Campbell et al. and Prejean disclose the key identification system of claim 4. Campbell et al. further indicate said light is directed toward said reflecting device ([0058], [0060]).

Regarding claim 6, Campbell et al. and Prejean disclose the key identification system of claim 5. Campbell et al. further indicate said light includes a shield to direct light away from said master key (prior art systems include light shielding, [0008]).

Regarding claim 7, Campbell et al. and Prejean disclose the key identification system of claim 1. Campbell et al. further indicate said captured image is a digital image ([0047]).

Regarding claims 8 and 12, Campbell et al. and Prejean disclose the key identification system of claim 1. Campbell et al. further indicate said captured image comprises a silhouette of said tip and blade of said master key ([0051], [0056], [0076], [0077]).

Regarding claim 13, Campbell et al. and Prejean disclose the key identification system of claim 1. Campbell et al. and Prejean further indicate said characteristics of said contour are determined based on image data from at least two or more views of said master key (Campbell et al., [0050], [0053], [0054]; Prejean, col. 5, line 55 - col. 6, line 5).

Regarding claim 14, Campbell et al. and Prejean disclose the key identification system of claim 13. Campbell et al. and Prejean further indicate said characteristics of said contour are determined based on image data from at least two or more views of said master key (Campbell et al., [0050], [0053], [0054]; Prejean, col. 5, line 55 - col. 6, line 5). Campbell et al. also indicate said logic calculates the geometry of the contour as seen as seen from a view of the tip parallel to the blade based on data from at least said two or more views of said master key (images captured by receiver and second receiver can be combined to create a complete image of the master key, from which the key may be identified, as described in greater detail below, [0053], Fig. 4, Fig. 5, contour information is extracted by analyzing the slope variances in the shape of the outer perimeter of the head and shoulder area, slope variances and sizes may then be combined to form the contour description string, [0086]).

Regarding claim 16, Campbell et al. and Prejean disclose the key identification system of claim 1. Campbell et al. further disclose a key holder to hold said master key (transparent support 142 (referring to FIG. 12) may be provided to receive the master key, [0044]).

Regarding claim 17, Campbell et al. and Prejean disclose the key identification system of claim 16. Campbell et al. further disclose said key holder includes a lower support (transparent support 142 (referring to FIG. 12) may be provided to receive the master key, [0044]).

Regarding claim 18, Campbell et al. and Prejean disclose the key identification system of claim 16. Campbell et al. further disclose said key holder comprises an upper door (door, [0042], [0073], [0109], from Fig. 1 can see at least the majority of the door is higher than the floor).

Regarding claim 19, Campbell et al. and Prejean disclose the key identification system of claim 16. Campbell et al. and Prejean further disclose a key holder includes a clamp in prior art systems (Campbell et al., [0004]; Prejean, col. 3, lines 35-45).

Regarding claim 20, Campbell et al. and Prejean disclose the key identification system of claim 1. Campbell et al. further disclose one of said views of said master key includes

a view from above the master key blade of a groove in the bottom of said blade (Fig. 4, Fig. 5, [0053]).

Regarding claim 24, Campbell et al. and Prejean disclose the key identification system of claim 1. Campbell et al. further disclose said logic includes a tolerance range for each characteristic of said master key to determine whether a master key passes or fails to match a known key blank ([0087], [0104]).

11. **Claim 9** rejected under 35 U.S.C. 103(a) as being unpatentable over Campbell et al. (US 20020191849 A1) and Prejean (US 6647308 B1) as applied to claim 1 above, further in view of Miller et al. (US 7643685 B2).

Regarding claim 9, Campbell et al. and Prejean disclose the key identification system of claim 1. Campbell et al. and Prejean do not explicitly disclose said logic accounts for rolling of said master key with respect to said imaging system to determine characteristics of said contour.

Miller et al. teach a computation that accounts for roll of the object imaged (col. 3, lines 1-10, col. 3, lines 65-68, col. 11, lines 10-15).

The combination of Miller et al. with Campbell et al. and Prejean allows for key rolling. It would have been obvious at the time of the invention to one of ordinary skill in the art to

combine the object identification even in the case of rolling of Miller et al., with the device of Campbell et al. and Prejean, as these identification techniques were well known at the time of the invention, incorporating the identification would have predictable results, and as the key placed on the platform may not always lie entirely flat.

12. **Claims 10, 11, and 22 are** rejected under 35 U.S.C. 103(a) as being unpatentable over Campbell et al. (US 20020191849 A1) and Prejean (US 6647308 B1) as applied to claim 1 above, further in view of Almblad et al. (US 6065911 A).

Regarding claim 10, Campbell et al. and Prejean disclose the key identification system of claim 1. Campbell et al. and Prejean do not explicitly disclose said logic accounts for tilting of said master key with respect to said imaging system to determine characteristics of said contour.

Almblad et al. teach logic accounts for tilting of said master key with respect to said imaging system to determine characteristics of said groove (Almblad et al., accommodates for key tilted/not lying flat due to bulky handle, fig. 3, col. 8, lines 35-45).

The combination of Almblad et al. with Campbell et al. and Prejean allows for key tilting. It would have been obvious at the time of the invention to one of ordinary skill in the art to combine the object identification even in the case of tilting of Almblad et al., with the

device of Campbell et al. and Prejean, as these identification techniques were well known at the time of the invention, incorporating the identification would have predictable results, and as the key placed on the platform may not always lie entirely flat.

Regarding claim 11, Campbell et al. and Prejean disclose the key identification system of claim 1. Campbell et al. and Prejean do not explicitly disclose said logic accounts for tipping of said master key with respect to said imaging system to determine characteristics of said contour.

Almblad et al. teach logic accounts for tipping of said master key with respect to said imaging system to determine characteristics of said groove (Almblad et al., accommodates for key tilted/not lying flat due to bulky handle, fig. 3, col. 8, lines 35-45).

The combination of Almblad et al. with Campbell et al. and Prejean allows for key tipping. It would have been obvious at the time of the invention to one of ordinary skill in the art to combine the object identification even in the case of tipping of Almblad et al., with the device of Campbell et al. and Prejean, as these identification techniques were well known at the time of the invention, incorporating the identification would have predictable results, and as the key placed on the platform may not always lie entirely flat.

Regarding claim 22, Campbell et al. and Prejean disclose the key identification system of claim 1. Campbell et al. and Prejean do not explicitly disclose the captured image of said tip includes a contour of a groove in said master key.

Almblad et al. teach a captured image of said tip includes a contour of a groove in said master key (extract three-dimensional grooves, col. 2, lines 30-35, identify curved grooves, col. 4, lines 35-40; extract laterally protected attributes such as groove characteristics using light stripe, col. 11, lines 5-25).

The combination of Almblad et al. with Campbell et al. and Prejean allows for identification of groove contours. It would have been obvious at the time of the invention to one of ordinary skill in the art to combine the groove contours identification of Almblad et al., with the invention of Campbell et al. and Prejean, as these identification techniques were well known at the time of the invention, incorporating the identification would have predictable results, and as one of a limited numbers of ways to identify a key, would have been obvious to try.

13. **Claim 23 is** rejected under 35 U.S.C. 103(a) as being unpatentable over Campbell et al. (US 20020191849 A1) and Prejean (US 6647308 B1) as applied to claim 1 above, further in view of Gimelfarb et al. (US 20060147289 A1).

Regarding claim 23, Campbell et al. and Prejean disclose the key identification system of claim 1. Campbell et al. and Prejean do not explicitly disclose said logic is configured to shift data related to said characteristics of said contour to compare with said known key blank characteristics.

Gimelfarb et al. teach logic is configured to shift data related to said characteristics of said contour to compare with said known key blank characteristics (bittings aligned to master key, slidable along axis, abstract, [0014], [0030], [0035]).

Cambell et al. and Gimelfarb are in the same art of copying keys (Cambell et al., abstract; Gimelfarb, abstract). The addition of Gimelfarb would a slidable alignment method. It would have been obvious at the time of the invention to one of ordinary skill in the art to combine the sliding alignment of Gimelfarb with the invention of Cambell et al. and Prejean, as this was known at the time of the invention, would have predictable results, and as this allows for more easy key positioning and comparison.

Allowable Subject Matter

14. **Claim 15** is objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Conclusion

15. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to MICHELLE ENTEZARI whose telephone number is (571)270-5084. The examiner can normally be reached on M-Th, 7:30am-5pm EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Stephen R. Koziol can be reached on (571)270-1844. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/MICHELLE ENTEZARI/
Primary Examiner, Art Unit 2665

<i>Index of Claims</i> 	Application/Control No. 14162157	Applicant(s)/Patent Under Reexamination THOMPSON ET AL.
	Examiner MICHELLE ENTEZARI	Art Unit 2665

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

☐ Claims renumbered in the same order as presented by applicant				☐ CPA		☐ T.D.		☐ R.1.47	
CLAIM		DATE							
Final	Original	04/21/2014	11/07/2014						
	1	✓	✓						
	2	✓	✓						
	3	✓	✓						
	4	✓	✓						
	5	✓	✓						
	6	✓	✓						
	7	✓	✓						
	8	✓	✓						
	9	✓	✓						
	10	✓	✓						
	11	✓	✓						
	12	✓	✓						
	13	✓	✓						
	14	✓	✓						
	15	✓	O						
	16	✓	✓						
	17	✓	✓						
	18	✓	✓						
	19	✓	✓						
	20	✓	✓						
	21	✓	✓						
	22	✓	✓						
	23	✓	✓						
	24	✓	✓						

PATENT APPLICATION

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application: Chester O.D. Thompson et al. Art Unit: 2665
Serial No.: 14/162,157 Examiner: Entezari, Michelle M.
Filing Date: January 23, 2014 Docket No.: 16223-00274
Title: KEY BLANK IDENTIFICATION SYSTEM WITH GROOVE SCANNING

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

RESPONSE TO FINAL OFFICE ACTION

Applicants acknowledge receipt of the November 13, 2014 Final Office Action. As this response is electronically filed on March 13, 2015, along with a request for a one-month extension and the appropriate fee, Applicants believe no additional fees are due. However, if any additional fees are required for this Response, please charge such fees to our Deposit Account No. 13-0265.

{538587522}
{5139842}

CLAIMS

What is claimed is:

1. (Original) A key identification system comprising:

an imaging system including a camera configured to capture an image of the tip of a master key, wherein said image includes a contour;

a logic configured to analyze said captured image to determine characteristics of said contour and compare said characteristics with characteristics of known key blanks to determine the likelihood of a match between said master key and a known key blank; and

one or more mirrors positioned to allow said camera to capture two or more views of the master key.
2. (Original) The key identification system of claim 1, wherein said logic includes a database containing data related to characteristics of grooves of known key blanks.
3. (Original) The key identification system of claim 1, wherein said imaging system includes a reflecting device.
4. (Previously Presented) The key identification system of claim 3, wherein said imaging system includes a light.
5. (Original) The key identification system of claim 4, wherein said light is directed toward said reflecting device.
6. (Original) The key identification system of claim 5, wherein said light includes a shield to direct light away from said master key.
7. (Original) The key identification system of claim 1, wherein said captured image is a digital image.

{5395875:2}

8. (Original) The key identification system of claim 1, wherein said captured image comprises a silhouette of said tip of said master key.
9. (Original) The key identification system of claim 1, wherein said logic accounts for rolling of said master key with respect to said imaging system to determine characteristics of said contour.
10. (Original) The key identification system of claim 1, wherein said logic accounts for tilting of said master key with respect to said imaging system to determine characteristics of said contour.
11. (Original) The key identification system of claim 1, wherein said logic accounts for tipping of said master key with respect to said imaging system to determine characteristics of said contour.
12. (Original) The key identification system of claim 1, wherein said captured image comprises a silhouette of the blade of said master key.
13. (Original) The key identification system of claim 1, wherein said characteristics of said contour are determined based on image data from at least said two or more views of said master key.
14. (Original) The key identification system of claim 13, wherein said logic calculates the geometry of the contour as seen from a view of the tip parallel to the blade based on data from at least said two or more views of said master key.
15. (Original) The key identification system of claim 13, wherein said logic calculates the geometry of the contour as though the tip were squarely cut based on data from at least said two or more views of said master key.

{5395875:2}

16. (Original) The key identification system of claim 1 further comprising a key holder configured to hold said master key.
17. (Original) The key identification system of claim 16, wherein said key holder includes a lower support.
18. (Original) The key identification system of claim 16, wherein said key holder includes an upper door.
19. (Original) The key identification system of claim 16, wherein said key holder includes a clamp.
20. (Original) The key identification system of claim 1, wherein one of said views of said master key includes a view from above the master key blade of a groove in the bottom of said blade.
21. (Currently Amended) The key identification system of claim 1, wherein one of said views of said master key includes a view from an angle between perpendicular and parallel to the blade of said master key and not including perpendicular or parallel to the blade of said master key[.].
22. (Currently Amended) The key identification system of claim 1, wherein the captured image of said tip includes a contour of a groove in said master key.
23. (Original) The key identification system of claim 1, wherein the logic is configured to shift data related to said characteristics of said contour to compare with said known key blank characteristics.
24. (Original) The key identification system of claim 1, wherein said logic includes a tolerance range for each characteristic of said master key to determine whether a master key passes or fails to match a known key blank.

{5395875:2}

REMARKS

In the November 13, 2014 Office Action, claim 21 is rejected on the ground of non-statutory double patenting over U.S. Patent No. 8,644,619. Claims 21-22 are objected to due to informalities. Claims 1-8, 12-14, 16-20, and 24 stand rejected under 35 U.S.C. 103 as unpatentable over U.S. Publication No. 20020191849 to Campbell et al. (“Campbell”) in view of U.S. Patent No. 6,647,308 to Prejean et al (“Prejean”). Claim 9 stands rejected under 35 U.S.C. 103 as unpatentable over Campbell and Prejean in further view of U.S. Patent No. 7,643,685 to Miller et al. (“Miller”). Claims 10, 11, and 22 stand rejected under 35 U.S.C. 103 as unpatentable over Campbell and Prejean in further view of U.S. Patent No. 6,065,911 to Almblad (“Almblad”). Claim 23 stands rejected under 35 U.S.C. 103 as unpatentable over Campbell and Prejean in further view of U.S. Publication No 20060147289 to Gimelfarb et al. (“Gimelfarb”). The following remarks address each of these issues and place the present application in condition for allowance.

Double Patenting Rejection

The office action rejects claim 21 based on double patenting over U.S. Patent No. 8,644,619. The office action further indicates that the rejection may be overcome by entering a terminal disclaimer. If necessary, applicant will submit the requested terminal disclaimer once the remaining rejections have been addressed and overcome.

Objections

Claims 21 and 22 are objected to due to informalities. Claims 21 and 22 are now amended to correct punctuation. Accordingly, Applicant respectfully requests that the objections to claims 21 and 22 be withdrawn.

{5395875:2}

The Pending Claims Are Patentable

The Office Action relies on the combination of Campbell with Prejean to reject the recited features of Claim 1. Campbell teaches a key identification system and the Office Action states that Campbell does not disclose one or more mirrors positioned to allow said camera to capture two or more views of the master key as recited by claim 1.

The Office Action relies on Prejean to teach a mirror positioned to allow said camera to capture more than one view of said master key and cites to Col. 5, line 55-col. 6, lines 5. The Office Action reasons that it would have been obvious to combine the mirror of Prejean with the invention of Campbell as this would have predictable results and as this allows more than one view to be captured without needing to physically move the key.

Applicants respectfully traverse this conclusion and respectfully submit that this rejection is not appropriate as the suggested combination of references would change the principle operation and require a substantial reconstruction and redesign of the primary reference, Campbell. In particular, the MPEP § 2143.01(VI) states, “[i]f the proposed modification or combination of the prior art would change the principle of operation of the prior art invention being modified, then the teachings of the references are not sufficient to render the claims prima facie obvious. *In re Ratti*, 270 F.2d 810, 813, 123 USPQ 349, 352 (CCPA 1959) (Claims were directed to an oil seal comprising a bore engaging portion with outwardly biased resilient spring fingers inserted in a resilient sealing member. The primary reference relied upon in a rejection based on a combination of references disclosed an oil seal wherein the bore engaging portion was reinforced by a cylindrical sheet metal casing. Patentee taught the device required rigidity for operation, whereas the claimed invention required resiliency. The court reversed the rejection holding the “suggested combination of references would require a substantial reconstruction and redesign of the elements shown in [the primary reference] as well as a change in the basic principle under which the [primary reference] construction was designed to operate.”).

{5395875:2}

Similar to the instant case, the primary reference, Campbell, would require a significant reconstruction that would be substantial enough to meet the “substantial redesign” threshold of *In re Ratti* if it were to be combined with the mirrors of the secondary reference, Prejean. The resultant combination would change the basic principle under which Campbell was designed to operate.

In particular, Campbell discloses the use of a first luminous surface 24 and a second luminous surface 26 within a housing 22 that provides a light tight environment in which a master key 32 may be examined. By enclosing the luminous surfaces, housing 22 prevents unwanted light from reflecting off any internal components of the key identification system. See paragraph [0041]. Additionally, a receiver 28 captures the image of the master key 32 placed on the first luminous surface 24. The receiver 28 is a high resolution digital camera. Paragraph [0047]. The receiver 28 is positioned to obtain an unobstructed view of master key 32. For the master key 32 to be identified, the master key 32 must be disposed within the viewing range 42 of the receiver. See paragraph [0048] and Figures 2 and 3 below, (emphasis added).

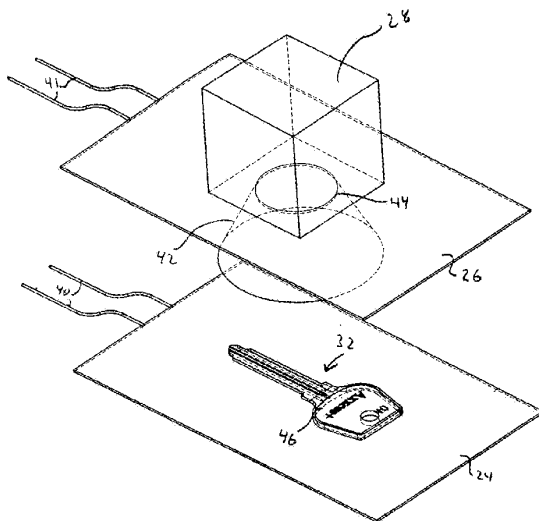


FIG. 2

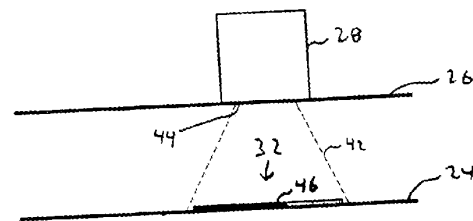


FIG. 3

Contrarily, Prejean relies on a holographic camera 12 and a beam emitter 14 to capture the reflection of illuminating beams off of mirrors 16 and a beam splitter 18. See Col. 5, lines 58-62. This assembly particularly utilizes a three-dimensional scanning technique described as “laser stripe scanning.” See Col. 6, lines 9-11, and Figure 1 below.

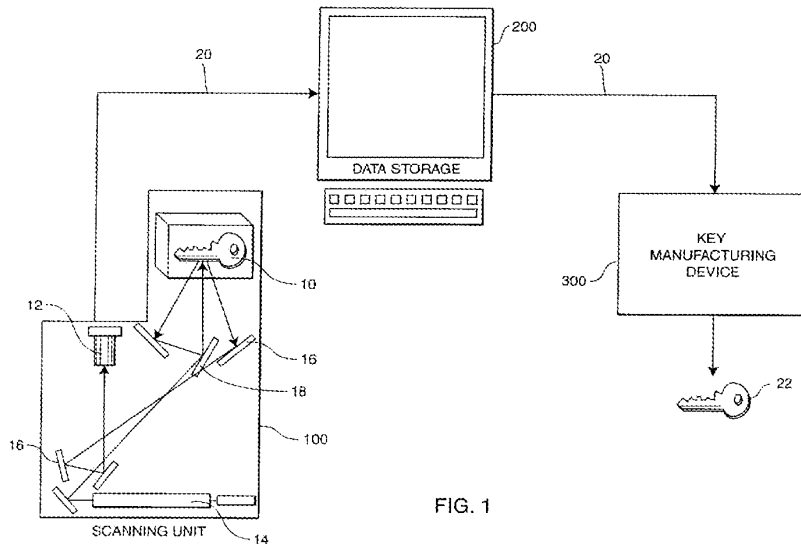


FIG. 1

This is substantially different than the disclosed assembly of Campbell.

The holographic camera required by Prejean is not the same as a high definition camera required by Campbell. Prejean describes the particular models of holographic cameras that are to be used with this “laser striping” technique in Col. 6, lines 6-41. These devices are identified as proprietary and their particular theory of operation and capability are actually described in a set of technical briefs filed with the Prejean application. See Col. 6, lines 38-41.

Campbell would require a significant redesign in that it would additionally require the use of a different type of camera configured to receive a beam of laser light emitted from a beam emitter. Further, Campbell explicitly requires that “the receiver 28 is positioned to obtain an unobstructed view of master key 32” and that “the master key 32 must be disposed within the viewing range 42 of the receiver.” See paragraph [0048] and Figures 2 and 3, (emphasis added).

The addition of mirrors would change the basic principle under which Campbell was designed to

operate as the receiver 28 would now be subject to an obstructed view of the master key 32.

Therefore, the Office Action cannot be permitted to combine these references to arrive at the subject matter recited by claim 1. For at least this reason, claim 1 is patentable over the cited references. Accordingly, Applicant requests that the rejection of claim 1, and all claims depending therefrom, be withdrawn.

CONCLUSION

In light of the foregoing, Applicants submit that the application is now in condition for allowance. If the Examiner has any questions pertaining to the above, then the undersigned attorney would welcome a phone call to provide any further clarification or a formal interview.

Respectfully submitted,

Date: March 13, 2015

/Mark J. Masterson/
Mark J. Masterson
Reg. No. 71,886
McDonald Hopkins LLC
600 Superior Avenue, E.
Suite 2100
Cleveland, OH 44114-2653
216-348-5427

Electronic Patent Application Fee Transmittal				
Application Number:		14162157		
Filing Date:		23-Jan-2014		
Title of Invention:		KEY BLANK IDENTIFICATION SYSTEM WITH GROOVE SCANNING		
First Named Inventor/Applicant Name:		Chester O.D. Thompson		
Filer:		Mark Jason Masterson/Lori Skettle		
Attorney Docket Number:		16223-00274		
Filed as Small Entity				
Filing Fees for Utility under 35 USC 111(a)				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Extension - 1 month with \$0 paid	2251	1	100	100
Miscellaneous:				
Total in USD (\$)				100

Electronic Acknowledgement Receipt	
EFS ID:	21762173
Application Number:	14162157
International Application Number:	
Confirmation Number:	5914
Title of Invention:	KEY BLANK IDENTIFICATION SYSTEM WITH GROOVE SCANNING
First Named Inventor/Applicant Name:	Chester O.D. Thompson
Customer Number:	33772
Filer:	Mark Jason Masterson/Lori Skettle
Filer Authorized By:	Mark Jason Masterson
Attorney Docket Number:	16223-00274
Receipt Date:	13-MAR-2015
Filing Date:	23-JAN-2014
Time Stamp:	13:13:22
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	\$100
RAM confirmation Number	9873
Deposit Account	130265
Authorized User	

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

Charge any Additional Fees required under 37 C.F.R. Section 1.21 (Miscellaneous fees and charges)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		ResponseToFOA.pdf	553993 0451883eed85e96f9548b914c0b7e4442b420ed	yes	9

	Multipart Description/PDF files in .zip description				
	Document Description		Start	End	
	Response After Final Action		1	1	
	Claims		2	4	
	Applicant Arguments/Remarks Made in an Amendment		5	9	

Warnings:

Information:

2	Fee Worksheet (SB06)	fee-info.pdf	30517 518e292f6f2373ca6235bb62a30b4ed31efa524	no	2

Warnings:

Information:

Total Files Size (in bytes):			584510

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

PATENT APPLICATION FEE DETERMINATION RECORD				Application or Docket Number		Filing Date		☐ To be Mailed	
Substitute for Form PTO-875				14/162,157		01/23/2014			
ENTITY: ☐ LARGE ☒ SMALL ☐ MICRO									
APPLICATION AS FILED – PART I									
(Column 1)		(Column 2)							
FOR	NUMBER FILED	NUMBER EXTRA		RATE (\$)		FEE (\$)			
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A		N/A					
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A		N/A					
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A		N/A					
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*		X \$ =					
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*		X \$ =					
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$310 (\$155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).								
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))									
* If the difference in column 1 is less than zero, enter "0" in column 2.				TOTAL					
APPLICATION AS AMENDED – PART II									
(Column 1)		(Column 2)		(Column 3)					
AMENDMENT	03/13/2015	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE (\$)		ADDITIONAL FEE (\$)	
	Total (37 CFR 1.16(i))	* 24	Minus	** 24	= 0	X \$40 =		0	
	Independent (37 CFR 1.16(h))	* 1	Minus	***3	= 0	X \$210 =		0	
	☐ Application Size Fee (37 CFR 1.16(s))								
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))								
TOTAL ADD'L FEE						0			
(Column 1)		(Column 2)		(Column 3)					
AMENDMENT		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE (\$)		ADDITIONAL FEE (\$)	
	Total (37 CFR 1.16(i))	*	Minus	**	=	X \$ =			
	Independent (37 CFR 1.16(h))	*	Minus	***	=	X \$ =			
	☐ Application Size Fee (37 CFR 1.16(s))								
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))								
TOTAL ADD'L FEE									
* If the entry in column 1 is less than the entry in column 2, write "0" in column 3. ** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20". *** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3". The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.									

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/162,157	01/23/2014	Chester O.D. Thompson	16223-00274	5914
33772 7590 03/23/2015 MCDONALD HOPKINS LLC 600 Superior Avenue, East Suite 2100 CLEVELAND, OH 44114-2653			EXAMINER ENTEZARI, MICHELLE M	
			ART UNIT 2665	PAPER NUMBER
			NOTIFICATION DATE 03/23/2015	DELIVERY MODE ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

ipmailbox@mcdonaldhopkins.com

Art Unit: 2665

Continuation of note 12:

Objections to claims 21 and 22 are hereby withdrawn; however, the rejections are maintained.

Double patenting rejection is maintained at this time, as no amendment has been made to the independent claims and no terminal disclaimer has been filed.

Regarding the argument the cameras of Prejean and Campbell are different, examiner notes the different technologies available over time will result in different choices for camera, however, the change of camera would be a simple substitution. It would have been obvious to one having ordinary skill in the art at the time the invention was made to be used with different types of cameras, since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. *In re Leshin*, 125 USPQ 416.

As for having two of either camera chosen, it has been held that discovering an optimum value of a result effective variable (in this case, the number of cameras and mirrors that is considered ideal) involves only routine skill in the art. *In re Boesch*, 617 F.2d 272, 205 USPQ 215 (CCPA 1980).

Regarding the argument that Campbell was designed for an unobstructed view, the addition of a second mirror to obtain a second view would not have to be placed so as to obstruct the view of camera 1. In fact, in most cases there are multiple mirrors and cameras, the items are placed so as not to obstruct the view of any of the cameras.

/MICHELLE ENTEZARI/

Primary Examiner, Art Unit 2665

Advisory Action Before the Filing of an Appeal Brief	Application No. 14/162,157	Applicant(s) THOMPSON ET AL.	
	Examiner MICHELLE ENTEZARI	Art Unit 2665	AIA (First Inventor to File) Status No

--The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

THE REPLY FILED 13 March 2015 FAILS TO PLACE THIS APPLICATION IN CONDITION FOR ALLOWANCE.
NO NOTICE OF APPEAL FILED

1. ☒ The reply was filed after a final rejection. No Notice of Appeal has been filed. To avoid abandonment of this application, applicant must timely file one of the following replies: (1) an amendment, affidavit, or other evidence, which places the application in condition for allowance; (2) a Notice of Appeal (with appeal fee) in compliance with 37 CFR 41.31; or (3) a Request for Continued Examination (RCE) in compliance with 37 CFR 1.114 if this is a utility or plant application. Note that RCEs are not permitted in design applications. The reply must be filed within one of the following time periods:

a) ☐ The period for reply expires _____ months from the mailing date of the final rejection.

b) ☒ The period for reply expires on: (1) the mailing date of this Advisory Action; or (2) the date set forth in the final rejection, whichever is later. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of the final rejection.

c) ☐ A prior Advisory Action was mailed more than 3 months after the mailing date of the final rejection in response to a first after-final reply filed within 2 months of the mailing date of the final rejection. The current period for reply expires _____ months from the mailing date of the prior Advisory Action or SIX MONTHS from the mailing date of the final rejection, whichever is earlier.

Examiner Note: If box 1 is checked, check either box (a), (b) or (c). ONLY CHECK BOX (b) WHEN THIS ADVISORY ACTION IS THE FIRST RESPONSE TO APPLICANT'S FIRST AFTER-FINAL REPLY WHICH WAS FILED WITHIN TWO MONTHS OF THE FINAL REJECTION. ONLY CHECK BOX (c) IN THE LIMITED SITUATION SET FORTH UNDER BOX (c). See MPEP 706.07(f).

Extensions of time may be obtained under 37 CFR 1.136(a). The date on which the petition under 37 CFR 1.136(a) and the appropriate extension fee have been filed is the date for purposes of determining the period of extension and the corresponding amount of the fee. The appropriate extension fee under 37 CFR 1.17(a) is calculated from: (1) the expiration date of the shortened statutory period for reply originally set in the final Office action; or (2) as set forth in (b) or (c) above, if checked. Any reply received by the Office later than three months after the mailing date of the final rejection, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

NOTICE OF APPEAL

2. ☐ The Notice of Appeal was filed on _____. A brief in compliance with 37 CFR 41.37 must be filed within two months of the date of filing the Notice of Appeal (37 CFR 41.37(a)), or any extension thereof (37 CFR 41.37(e)), to avoid dismissal of the appeal. Since a Notice of Appeal has been filed, any reply must be filed within the time period set forth in 37 CFR 41.37(a).

AMENDMENTS

3. ☐ The proposed amendments filed after a final rejection, but prior to the date of filing a brief, will not be entered because

a) ☐ They raise new issues that would require further consideration and/or search (see NOTE below);

b) ☐ They raise the issue of new matter (see NOTE below);

c) ☐ They are not deemed to place the application in better form for appeal by materially reducing or simplifying the issues for appeal; and/or

d) ☐ They present additional claims without canceling a corresponding number of finally rejected claims.

NOTE: _____. (See 37 CFR 1.116 and 41.33(a)).

4. ☐ The amendments are not in compliance with 37 CFR 1.121. See attached Notice of Non-Compliant Amendment (PTOL-324).

5. ☐ Applicant's reply has overcome the following rejection(s): _____.

6. ☐ Newly proposed or amended claim(s) _____ would be allowable if submitted in a separate, timely filed amendment canceling the non-allowable claim(s).

7. ☒ For purposes of appeal, the proposed amendment(s): (a) ☐ will not be entered, or (b) ☐ will be entered, and an explanation of how the new or amended claims would be rejected is provided below or appended.

AFFIDAVIT OR OTHER EVIDENCE

8. ☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

9. ☐ The affidavit or other evidence filed after final action, but before or on the date of filing a Notice of Appeal will not be entered because applicant failed to provide a showing of good and sufficient reasons why the affidavit or other evidence is necessary and was not earlier presented. See 37 CFR 1.116(e).

10. ☐ The affidavit or other evidence filed after the date of filing the Notice of Appeal, but prior to the date of filing a brief, will not be entered because the affidavit or other evidence failed to overcome all rejections under appeal and/or appellant fails to provide a showing of good and sufficient reasons why it is necessary and was not earlier presented. See 37 CFR 41.33(d)(1).

11. ☐ The affidavit or other evidence is entered. An explanation of the status of the claims after entry is below or attached.

REQUEST FOR RECONSIDERATION/OTHER

12. ☒ The request for reconsideration has been considered but does NOT place the application in condition for allowance because: _____.

13. ☐ Note the attached Information *Disclosure Statement*(s). (PTO/SB/08) Paper No(s). _____

14. ☐ Other: _____.

STATUS OF CLAIMS

15. The status of the claim(s) is (or will be) as follows:

Claim(s) allowed: _____.

Claim(s) objected to: 15.

Claim(s) rejected: 1-14, 16-24.

Claim(s) withdrawn from consideration: _____.

	/MICHELLE ENTEZARI/ Primary Examiner, Art Unit 2665

OK TO ENTER

/M.E./ 03/17/2015

PATENT APPLICATION

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application: Chester O.D. Thompson et al. Art Unit: 2665
Serial No.: 14/162,157 Examiner: Entezari, Michelle M.
Filing Date: January 23, 2014 Docket No.: 16223-00274
Title: KEY BLANK IDENTIFICATION SYSTEM WITH GROOVE SCANNING

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

RESPONSE TO FINAL OFFICE ACTION

Applicants acknowledge receipt of the November 13, 2014 Final Office Action. As this response is electronically filed on March 13, 2015, along with a request for a one-month extension and the appropriate fee, Applicants believe no additional fees are due. However, if any additional fees are required for this Response, please charge such fees to our Deposit Account No. 13-0265.

{538587522}
{5139842}

Doc code: RCEX

PTO/SB/30EFS (07-09)

Doc description: Request for Continued Examination (RCE)

Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

**REQUEST FOR CONTINUED EXAMINATION(RCE)TRANSMITTAL
(Submitted Only via EFS-Web)**

Application Number	14162157	Filing Date	2014-01-23	Docket Number (if applicable)	16223-00274	Art Unit	2665
First Named Inventor	Chester O.D. Thompson, et al.			Examiner Name	Entezari, Michelle M.		

This is a Request for Continued Examination (RCE) under 37 CFR 1.114 of the above-identified application.

Request for Continued Examination (RCE) practice under 37 CFR 1.114 does not apply to any utility or plant application filed prior to June 8, 1995, or to any design application. The Instruction Sheet for this form is located at WWW.USPTO.GOV

SUBMISSION REQUIRED UNDER 37 CFR 1.114

Note: If the RCE is proper, any previously filed unentered amendments and amendments enclosed with the RCE will be entered in the order in which they were filed unless applicant instructs otherwise. If applicant does not wish to have any previously filed unentered amendment(s) entered, applicant must request non-entry of such amendment(s).

☐ Previously submitted. If a final Office action is outstanding, any amendments filed after the final Office action may be considered as a submission even if this box is not checked.☐ Consider the arguments in the Appeal Brief or Reply Brief previously filed on _____☐ Other _____☒ Enclosed☒ Amendment/Reply☐ Information Disclosure Statement (IDS)☐ Affidavit(s)/ Declaration(s)☒ Other 3 month extension**MISCELLANEOUS**☐ Suspension of action on the above-identified application is requested under 37 CFR 1.103(c) for a period of months _____
(Period of suspension shall not exceed 3 months; Fee under 37 CFR 1.17(i) required)☐ Other _____**FEES****The RCE fee under 37 CFR 1.17(e) is required by 37 CFR 1.114 when the RCE is filed.**☒ The Director is hereby authorized to charge any underpayment of fees, or credit any overpayments, to
Deposit Account No 130265**SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT REQUIRED**☒ Patent Practitioner Signature☐ Applicant Signature

Doc code: RCEX

Doc description: Request for Continued Examination (RCE)

PTO/SB/30EFS (07-09)

Approved for use through 07/31/2012. OMB 0651-0031

U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Signature of Registered U.S. Patent Practitioner			
Signature	/Mark J. Masterson/	Date (YYYY-MM-DD)	2015-05-13
Name	Mark J. Masterson	Registration Number	71886

This collection of information is required by 37 CFR 1.114. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450.

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these records.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

PATENT APPLICATION

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application: Chester O.D. Thompson et al. Art Unit: 2665
Serial No.: 14/162,157 Examiner: Entezari, Michelle M.
Filing Date: January 23, 2014 Docket No.: 16223-00274
Title: KEY BLANK IDENTIFICATION SYSTEM WITH GROOVE SCANNING

Mail Stop RCE
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

TRANSMITTAL FOR REQUEST FOR CONTINUED EXAMINATION

Enclosed please find a first Request for Continued Examination (RCE) under 37 CFR 1.114 for the above-identified application. Applicant requests that the USPTO charge our deposit account no. 13-0265 \$600.00 for the fee. In the event additional fees are deemed to be due, please charge our Deposit Account No. 13-0265.

Respectfully submitted,

Date: May 13, 2015

/Mark J. Masterson/
Mark J. Masterson
Reg. No. 71,886
McDonald Hopkins LLC
600 Superior Avenue, E.
Suite 2100
Cleveland, OH 44114-2653
(216) 348-5427

{55905840;}

PATENT APPLICATION

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application: Chester O.D. Thompson et al. Art Unit: 2665
Serial No.: 14/162,157 Examiner: Entezari, Michelle M.
Filing Date: January 23, 2014 Docket No.: 16223-00274
Title: KEY BLANK IDENTIFICATION SYSTEM WITH GROOVE SCANNING

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

RESPONSE TO FINAL OFFICE ACTION

Applicants acknowledge receipt of the November 13, 2014 Final Office Action. As this response is electronically filed on May 13, 2015, along with a request for a three-month extension and the appropriate fee, Applicants believe no additional fees are due. However, if any additional fees are required for this Response, please charge such fees to our Deposit Account No. 13-0265.

{559958340;}

CLAIMS

What is claimed is:

1. (Currently Amended) A key identification system comprising:

an imaging system including a camera configured to capture an image of the tip of a master key, wherein said image includes a contour;

a logic configured to analyze said captured image to determine characteristics of said contour and compare said characteristics with characteristics of known key blanks to determine the likelihood of a match between said master key and a known key blank; and

one or more mirrors positioned to allow said camera to capture two or more views of the master key wherein said characteristics of said contour are determined based on image data from at least said two or more views of said master key, and wherein said logic calculates the geometry of the contour based on data from at least said two or more views of said master key.

2. (Original) The key identification system of claim 1, wherein said logic includes a database containing data related to characteristics of grooves of known key blanks.

3. (Original) The key identification system of claim 1, wherein said imaging system includes a reflecting device.

4. (Previously Presented) The key identification system of claim 3, wherein said imaging system includes a light.

5. (Original) The key identification system of claim 4, wherein said light is directed toward said reflecting device.

6. (Original) The key identification system of claim 5, wherein said light includes a shield to direct light away from said master key.

7. (Original) The key identification system of claim 1, wherein said captured image is a digital image.

{5500583;}

8. (Original) The key identification system of claim 1, wherein said captured image comprises a silhouette of said tip of said master key.
9. (Original) The key identification system of claim 1, wherein said logic accounts for rolling of said master key with respect to said imaging system to determine characteristics of said contour.
10. (Original) The key identification system of claim 1, wherein said logic accounts for tilting of said master key with respect to said imaging system to determine characteristics of said contour.
11. (Original) The key identification system of claim 1, wherein said logic accounts for tipping of said master key with respect to said imaging system to determine characteristics of said contour.
12. (Original) The key identification system of claim 1, wherein said captured image comprises a silhouette of the blade of said master key.
13. (Canceled)
14. (Original) The key identification system of claim 13, wherein said logic calculates the geometry of the contour as seen from a view of the tip parallel to the blade based on data from at least said two or more views of said master key.
15. (Currently Amended) The key identification system of ~~claim 13~~claim 1, wherein said logic calculates the geometry of the contour as though the tip were squarely cut based on data from at least said two or more views of said master key.

{5500583;}

16. (Original) The key identification system of claim 1 further comprising a key holder configured to hold said master key.
17. (Original) The key identification system of claim 16, wherein said key holder includes a lower support.
18. (Original) The key identification system of claim 16, wherein said key holder includes an upper door.
19. (Original) The key identification system of claim 16, wherein said key holder includes a clamp.
20. (Original) The key identification system of claim 1, wherein one of said views of said master key includes a view from above the master key blade of a groove in the bottom of said blade.
21. (Previously Presented) The key identification system of claim 1, wherein one of said views of said master key includes a view from an angle between perpendicular and parallel to the blade of said master key and not including perpendicular or parallel to the blade of said master key.
22. (Previously Presented) The key identification system of claim 1, wherein the captured image of said tip includes a contour of a groove in said master key.
23. (Original) The key identification system of claim 1, wherein the logic is configured to shift data related to said characteristics of said contour to compare with said known key blank characteristics.
24. (Original) The key identification system of claim 1, wherein said logic includes a tolerance range for each characteristic of said master key to determine whether a master key passes or fails to match a known key blank.

{5500583;}

25. (New) A key identification system comprising:

an imaging system including a camera in a first position configured to directly capture at least one image of one side of a master key, wherein said image includes a contour;

at least one mirror positioned to allow said camera to capture at least one image of a second side of a master key from a second position wherein the second position is from a different angle than the first position; and

a logic configured to analyze said captured images to determine characteristics of said contour and compare said characteristics with characteristics of known key blanks to determine the likelihood of a match between said master key and a known key blank.

26. (New) The key identification system of claim 25, wherein the at least one mirror is configured to allow the camera to capture one image with multiple views of the master key from different angles.

27. (New) A key identification system comprising:

an imaging system including a camera configured to capture an image of a master key, the image includes a first view and a second view;

a first mirror positioned at a first position to allow said camera to capture the first view of the master key, at least one second mirror positioned at a second position to allow said camera to capture a second view of the master key, wherein the first view is from a different angle than the second view; and

a logic configured to analyze said captured image to determine characteristics of said contour and compare said characteristics with characteristics of known key blanks to determine the likelihood of a match between said master key and a known key blank.

{5500583;}

REMARKS

In the November 13, 2014 Office Action, claim 21 is rejected on the ground of non-statutory double patenting over U.S. Patent No. 8,644,619. Claims 21-22 are objected to due to informalities. Claims 1-8, 12-14, 16-20, and 24 stand rejected under 35 U.S.C. 103 as unpatentable over U.S. Publication No. 20020191849 to Campbell et al. ("Campbell") in view of U.S. Patent No. 6,647,308 to Prejean et al ("Prejean"). Claim 9 stands rejected under 35 U.S.C. 103 as unpatentable over Campbell and Prejean in further view of U.S. Patent No. 7,643,685 to Miller et al. ("Miller"). Claims 10, 11, and 22 stand rejected under 35 U.S.C. 103 as unpatentable over Campbell and Prejean in further view of U.S. Patent No. 6,065,911 to Almblad ("Almblad"). Claim 23 stands rejected under 35 U.S.C. 103 as unpatentable over Campbell and Prejean in further view of U.S. Publication No 20060147289 to Gimelfarb et al. ("Gimelfarb"). The following remarks address each of these issues and place the present application in condition for allowance.

Double Patenting Rejection

The office action rejects claim 21 based on double patenting over U.S. Patent No. 8,644,619. The office action further indicates that the rejection may be overcome by entering a terminal disclaimer. If necessary, applicant will submit the requested terminal disclaimer once the remaining rejections have been addressed and overcome.

Objections

Claims 21 and 22 were objected to due to informalities. Claims 21 and 22 were amended to correct punctuation in the response to final office action mailed March 13, 2015. Accordingly, the Examiner withdrew the objections as indicated by the Advisory Action mailed March 23, 2015. Therefore, all outstanding objections have been sufficiently addressed.

{5500583;}

The Pending Claims Are Patentable

The Office Action relies on the combination of Campbell with Prejean to reject the recited features of Claim 1. The Examiner indicated that claim 15 is objected to as being dependent upon a rejected base claim but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. Claim 15 depends from claim 13 which depends ultimately from claim 1. Claim 1 is now amended to include the subject matter from claim 13 and partially from claim 15.

Claim 1 now additionally recites “one or more mirrors positioned to allow said camera to capture two or more views of the master key wherein said characteristics of said contour are determined based on image data from at least said two or more views of said master key, and wherein said logic calculates the geometry of the contour based on data from at least said two or more views of said master key.” Claim 13 is now canceled.

Notably, Campbell and Prejean do not teach this feature. In particular, Campbell’ does not disclose one or more mirrors positioned to allow said camera to capture two or more views of the master key. However, Prejean does not make up for the deficiencies of Campbell.

In particular, the office action relies on Col. 5, line 55 to Col. 6, line 5 of Prejean to teach a mirror positioned to allow said camera to capture more than one view of said master key. However, Prejean actually teaches using a beam emitter 14 that produces a beam in the form of a laser and a beam splitter 18. The laser beam is broken into two or more beams with one beam used as an illuminating beam for the key and the other beam being used as a reference beam. Prejean particularly states that, “either the object (key) is moved or a system of mirrors adjusted to completely scan the object for reading.” Col. 5, lines 65-67. (emphasis added). Prejean relies on laser scanning by the continual movement of either the key or the mirrors to procure the desired master key data.

{5500583;}

In contrast, the system of recited claim 1 relies on a camera and one or more mirrors to capture two or more views. The camera and mirrors are not configured to move in order for the image to be capture and the logic to analyze the captured images as recited by claim 1. Therefore, it is respectfully submitted that claim 1 and claims 2-12, and 14-24 dependent therefrom and now in condition for allowance.

New Claims

Claims 25-27 are newly added. Claims 25 and 27 are independent claims and particularly recited various configurations of a key identification system. Claim 25 recites a system including a camera in a first position configured to directly capture at least one image of one side of a master key, and at least one mirror positioned to allow said camera to capture at least one image of a second side of a master key from a second position wherein the second position is from a different angle than the first position. Campbell in view of Prejean does not teach these features.

Claim 27 recites a system including a camera configured to capture an image of a master key, the image includes a first view and a second view. A first mirror positioned at a first position to allow said camera to capture the first view of the master key, at least one second mirror positioned at a second position to allow said camera to capture a second view of the master key, wherein the first view is from a different angle than the second view. Additionally, Campbell in view of Prejean does not teach these features.

{5500583;}

CONCLUSION

In light of the foregoing, Applicants submit that the application is now in condition for allowance. If the Examiner has any questions pertaining to the above, then the undersigned attorney would welcome a phone call to provide any further clarification or a formal interview.

Respectfully submitted,

Date: May 13, 2015

/Mark J. Masterson/
Mark J. Masterson
Reg. No. 71,886
McDonald Hopkins LLC
600 Superior Avenue, E.
Suite 2100
Cleveland, OH 44114-2653
216-348-5427

{5500583;}

Electronic Patent Application Fee Transmittal				
Application Number:		14162157		
Filing Date:		23-Jan-2014		
Title of Invention:		KEY BLANK IDENTIFICATION SYSTEM WITH GROOVE SCANNING		
First Named Inventor/Applicant Name:		Chester O.D. Thompson		
Filer:		Mark Jason Masterson/Lori Skettle		
Attorney Docket Number:		16223-00274		
Filed as Small Entity				
Filing Fees for Utility under 35 USC 111(a)				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
Pages:				
Claims:				
Claims in excess of 20	2202	2	40	80
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Extension-of-Time:				
Extension - 3 months with \$0 paid	2253	1	700	700
Miscellaneous:				
Request for Continued Examination	2801	1	600	600
Total in USD (\$)				1380

Electronic Acknowledgement Receipt	
EFS ID:	22337881
Application Number:	14162157
International Application Number:	
Confirmation Number:	5914
Title of Invention:	KEY BLANK IDENTIFICATION SYSTEM WITH GROOVE SCANNING
First Named Inventor/Applicant Name:	Chester O.D. Thompson
Customer Number:	33772
Filer:	Mark Jason Masterson/Lori Skettle
Filer Authorized By:	Mark Jason Masterson
Attorney Docket Number:	16223-00274
Receipt Date:	13-MAY-2015
Filing Date:	23-JAN-2014
Time Stamp:	15:58:23
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	\$1380
RAM confirmation Number	2549
Deposit Account	130265
Authorized User	SKETTLE, LORI

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

Charge any Additional Fees required under 37 C.F.R. Section 1.21 (Miscellaneous fees and charges)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Request for Continued Examination (RCE)	Transmittal.pdf	697640	no	3
			fa63f88afaa636afb63d83bd4338fbb6f6031fa7		
Warnings:					
Information:					
2		RCE.pdf	101594	yes	10
			23e7ddea907cd3542343dd31fb00b07f79ec49e		
	Multipart Description/PDF files in .zip description				
	Document Description		Start	End	
	Request for Continued Examination (RCE)		1	1	
	Response After Final Action		2	2	
	Claims		3	6	
	Applicant Arguments/Remarks Made in an Amendment		7	10	
Warnings:					
Information:					
3	Fee Worksheet (SB06)	fee-info.pdf	34161	no	2
			f8ef3c6c2f488fa608bd301b078339448c8d4893		
Warnings:					
Information:					
Total Files Size (in bytes):			833395		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875				Application or Docket Number 14/162,157		Filing Date 01/23/2014		☐ To be Mailed		
ENTITY: ☐ LARGE ☒ SMALL ☐ MICRO										
APPLICATION AS FILED – PART I										
		(Column 1)		(Column 2)						
FOR		NUMBER FILED		NUMBER EXTRA		RATE (\$)		FEE (\$)		
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))		N/A		N/A		N/A				
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))		N/A		N/A		N/A				
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))		N/A		N/A		N/A				
TOTAL CLAIMS (37 CFR 1.16(i))		minus 20 =		*		X \$ =				
INDEPENDENT CLAIMS (37 CFR 1.16(h))		minus 3 =		*		X \$ =				
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))		If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$310 (\$155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).								
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))										
* If the difference in column 1 is less than zero, enter "0" in column 2.						TOTAL				
APPLICATION AS AMENDED – PART II										
		(Column 1)		(Column 2)		(Column 3)				
AMENDMENT	05/13/2015		CLAIMS REMAINING AFTER AMENDMENT			HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE (\$)	ADDITIONAL FEE (\$)	
	Total (37 CFR 1.16(i))		* 26		Minus	** 24	= 2	X \$40 =	80	
	Independent (37 CFR 1.16(h))		* 3		Minus	***3	= 0	X \$210 =	0	
	☐ Application Size Fee (37 CFR 1.16(s))									
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))									
								TOTAL ADD'L FEE		80
		(Column 1)		(Column 2)		(Column 3)				
AMENDMENT			CLAIMS REMAINING AFTER AMENDMENT			HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE (\$)	ADDITIONAL FEE (\$)	
	Total (37 CFR 1.16(i))		*		Minus	**	=	X \$ =		
	Independent (37 CFR 1.16(h))		*		Minus	***	=	X \$ =		
	☐ Application Size Fee (37 CFR 1.16(s))									
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))									
								TOTAL ADD'L FEE		
* If the entry in column 1 is less than the entry in column 2, write "0" in column 3. ** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20". *** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3". The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.										

LIE
/MARTHA NEWMAN/

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/162,157	01/23/2014	Chester O.D. Thompson	16223-00274	5914
33772 7590 06/23/2015 MCDONALD HOPKINS LLC 600 Superior Avenue, East Suite 2100 CLEVELAND, OH 44114-2653			EXAMINER ENTEZARI, MICHELLE M	
			ART UNIT 2665	PAPER NUMBER
			NOTIFICATION DATE 06/23/2015	DELIVERY MODE ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

ipmailbox@mcdonalddhopkins.com

Office Action Summary	Application No. 14/162,157	Applicant(s) THOMPSON ET AL.	
	Examiner MICHELLE ENTEZARI	Art Unit 2665	AIA (First Inventor to File) Status No

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTHS FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 5/13/15.
☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on ____.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on ____; the restriction requirement and election have been incorporated into this action.
- 4) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims*

- 5) ☒ Claim(s) 1-12 and 14-27 is/are pending in the application.
5a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 6) ☐ Claim(s) ____ is/are allowed.
- 7) ☒ Claim(s) 1-12, 14, and 16-27 is/are rejected.
- 8) ☒ Claim(s) 15 is/are objected to.
- 9) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

* If any claims have been determined allowable, you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov.

Application Papers

- 10) ☐ The specification is objected to by the Examiner.
- 11) ☐ The drawing(s) filed on ____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

Certified copies:

- a) ☐ All b) ☐ Some** c) ☐ None of the:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. ____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

** See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)	3) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. ____
2) ☐ Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b) Paper No(s)/Mail Date ____	4) ☐ Other: ____

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on May 13, 2015 has been entered.

Response to Amendment

2. Claims 1-12 and 14-27 are pending. Claim 13 is cancelled. Claims 25-27 are new.

Response to Arguments

3. Applicant's arguments, filed May 13, 2015, with respect to the objections to claims 21 and 22, along with accompanying amendments, have been fully considered and are persuasive. The objections to claims 21 and 22 have been withdrawn.

4. Applicant's arguments with respect to claims 1-12, 14 and 16-24 have been considered but are moot because the arguments do not apply to the current combination of references being used in the current rejection. It is noted that the claim as written does not require that the mirror stay fixed, thereby the Prejean reference is

still believed to teach this feature, however, to advance prosecution, an alternative reference has hereby been provided.

5. Applicant's amendments, filed May 13, 2015, with respect to the double patenting rejections appear to now distinguish claim 21 as dependent on claim 1 sufficiently from claim 1 of U.S. Patent No. 8644619. The double patenting rejection of claim 21 has been withdrawn.

Claim Rejections - 35 USC § 103

6. The following is a quotation of pre-AIA 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

7. **Claims 1-8, 12, 14, 16-20 and 24-27 are** rejected under 35 U.S.C. 103(a) as being unpatentable over Campbell et al. (US 20020191849 A1) in view of Inoue et al. (US 20100059484 A1) in view of Allred et al. (US 20100110380 A1).

Regarding claim 1, Campbell et al. disclose key identification system (abstract) comprising: an imaging system including a camera configured to capture an image of the tip of a master key (capture an image of the master key, abstract, [0047], [0051]), wherein said image includes a contour (contour, [0089]-[0094]); a logic configured to

analyze said captured image to determine characteristics of said contour and compare said characteristics with characteristics of known key blanks to determine the likelihood of a match between said master key and a known key blank (contour matching score, [0089]-[0094]).

Cambell et al. do not disclose one or more mirrors positioned to allow said camera to capture two or more views of the master key wherein said characteristics of said contour are determined based on image data from at least said two or more views of said master key, and wherein said logic calculates the geometry of the contour based on data from at least said two or more views of said master key.

Inoue et al. teach capturing two or more views of the master key wherein said characteristics of said contour are determined based on image data from at least said two or more views of said master key, and wherein said logic calculates the geometry of the contour based on data from at least said two or more views of said master key (edge shape monitor continuously captures images of the edges, measurement of the groove shape, and the captured images are input to an arithmetic processing unit for image processing, abstract, [0051]-[0055], two cameras used to capture different views, 13a and 13b, Fig. 2A, [0054], [0055]).

Cambell et al. and Inoue do not disclose one or more mirrors positioned to allow said camera to capture two or more views of the master key.

Allred et al. teach in place of two cameras to take images from different perspectives, a single camera, and mirrors configured to provide images of light along different pathways (i.e., from different perspectives) can be used ([0028], [0037]).

Regarding claim 2, Campbell et al. and Inoue et al. and Allred et al. disclose the key identification system of claim 1. Campbell et al. further indicate said logic includes a database containing data related to characteristics of grooves of known key blanks ([0084], [0097], [0100], [0107], [0111] [characteristics of grooves interpreted as number of notches, information about contours, etc.]).

Regarding claim 3, Campbell et al. and Inoue et al. and Allred et al. disclose the key identification system of claim 1. Campbell et al. further indicate said imaging system includes a reflecting device (abstract, [0013]-[0015], [0057]-[0062]).

Regarding claim 4, Campbell et al. and Inoue et al. and Allred et al. disclose the key identification system of claim 1. Campbell et al. further indicate said imaging system includes a light (abstract, [0044]).

Regarding claim 5, Campbell et al. and Inoue et al. and Allred et al. disclose the key identification system of claim 4. Campbell et al. further indicate said light is directed toward said reflecting device ([0058], [0060]).

Regarding claim 6, Campbell et al. and Inoue et al. and Allred et al. disclose the key identification system of claim 5. Campbell et al. further indicate said light includes a shield to direct light away from said master key (prior art systems include light shielding, [0008]).

Regarding claim 7, Campbell et al. and Inoue et al. and Allred et al. disclose the key identification system of claim 1. Campbell et al. further indicate said captured image is a digital image ([0047]).

Regarding claims 8 and 12, Campbell et al. and Inoue et al. and Allred et al. disclose the key identification system of claim 1. Campbell et al. further indicate said captured image comprises a silhouette of said tip and blade of said master key ([0051], [0056], [0076], [0077]).

Regarding claim 14, Campbell et al. and Inoue et al. and Allred et al. disclose the key identification system of claim 13. Campbell et al. and Inoue et al. and Allred et al. further indicate said characteristics of said contour are determined based on image data from at least two or more views of said master key (Campbell et al., [0050], [0053], [0054]; Prejean, col. 5, line 55 - col. 6, line 5, Inoue et al., [0054], [0055], Allred et al., [0028], [0037]). Campbell et al. and Inoue et al. also indicate said logic calculates the geometry of the contour as seen as seen from a view of the tip parallel to the blade based on data from at least said two or more views of said master key (Campbell et al., images

captured by receiver and second receiver can be combined to create a complete image of the master key, from which the key may be identified, as described in greater detail below, [0053], Fig. 4, Fig. 5, contour information is extracted by analyzing the slope variances in the shape of the outer perimeter of the head and shoulder area, slope variances and sizes may then be combined to form the contour description string, [0086]; Inoue et al., abstract, [0051]-[0055]).

Regarding claim 16, Campbell et al. and Inoue et al. and Allred et al. disclose the key identification system of claim 1. Campbell et al. further disclose a key holder to hold said master key (transparent support 142 (referring to FIG. 12) may be provided to receive the master key, [0044]).

Regarding claim 17, Campbell et al. and Inoue et al. and Allred et al. disclose the key identification system of claim 16. Campbell et al. further disclose said key holder includes a lower support (transparent support 142 (referring to FIG. 12) may be provided to receive the master key, [0044]).

Regarding claim 18, Campbell et al. and Inoue et al. and Allred et al. disclose the key identification system of claim 16. Campbell et al. further disclose said key holder comprises an upper door (door, [0042], [0073], [0109], from Fig. 1 can see at least the majority of the door is higher than the floor).

Regarding claim 19, Campbell et al. and Inoue et al. and Allred et al. disclose the key identification system of claim 16. Campbell et al. further disclose a key holder includes a clamp in prior art systems (Campbell et al., [0004]).

Regarding claim 20, Campbell et al. and Inoue et al. and Allred et al. disclose the key identification system of claim 1. Campbell et al. further disclose one of said views of said master key includes a view from above the master key blade of a groove in the bottom of said blade (Fig. 4, Fig. 5, [0053]).

Regarding claim 24, Campbell et al. and Inoue et al. and Allred et al. disclose the key identification system of claim 1. Campbell et al. further disclose said logic includes a tolerance range for each characteristic of said master key to determine whether a master key passes or fails to match a known key blank ([0087], [0104]).

Regarding claim 25, Campbell et al. disclose a key identification system (abstract) comprising: an imaging system including a camera in a first position configured to directly capture at least one image of one side of a master key (capture an image of the master key, abstract, [0047], [0051]), wherein said image includes a contour (contour, [0089]-[0094]); and a logic configured to analyze said captured images to determine characteristics of said contour and compare said characteristics with characteristics of known key blanks to determine the likelihood of a match between said master key and a known key blank (contour matching score, [0089]-[0094]).

Campbell et al. do not disclose at least one mirror positioned to allow said camera to capture at least one image of a second side of a master key from a second position wherein the second position is from a different angle than the first position, or using multiple images to do the analysis.

Inoue et al. teach capturing two or more views of the master key wherein said characteristics of said contour are determined based on image data from at least said two or more views of said master key, and wherein said logic calculates the geometry of the contour based on data from at least said two or more views of said master key (edge shape monitor continuously captures images of the edges, measurement of the groove shape, and the captured images are input to an arithmetic processing unit for image processing, abstract, [0051]-[0055], two cameras used to capture different views, 13a and 13b, Fig. 2A, [0054], [0055]).

Cambell et al. and Inoue do not disclose at least one mirror positioned to allow said camera to capture at least one image of a second side of a master key from a second position wherein the second position is from a different angle than the first position.

Allred et al. teach in place of two cameras to take images from different perspectives, a single camera, and mirrors configured to provide images of light along different pathways (i.e., from different perspectives) can be used ([0028], [0037]).

Regarding claim 26, Cambell et al. and Inoue and Allred et al. disclose the key identification system of claim 25. Allred et al. further teach the at least one mirror is configured to allow the camera to capture one image with multiple views of the master key from different angles ([0028], [0037]).

Regarding claim 27, Campbell et al. disclose a key identification system (abstract) comprising: an imaging system including a camera configured to capture an image of a master key (capture an image of the master key, abstract, [0047], [0051]); and a logic configured to analyze said captured image to determine characteristics of said contour and compare said characteristics with characteristics of known key blanks to determine the likelihood of a match between said master key and a known key blank (contour matching score, [0089]-[0094]).

Campbell et al. do not disclose the image includes a first view and a second view: a first mirror positioned at a first position to allow said camera to capture the first view of the master key, at least one second mirror positioned at a second position to allow said camera to capture a second view of the master key, wherein the first view is from a different angle than the second view.

Inoue et al. teach capturing two or more views of the master key wherein said characteristics of said contour are determined based on image data from at least said

two or more views of said master key, and wherein said logic calculates the geometry of the contour based on data from at least said two or more views of said master key (edge shape monitor continuously captures images of the edges, measurement of the groove shape, and the captured images are input to an arithmetic processing unit for image processing, abstract, [0051]-[0055], two cameras used to capture different views, 13a and 13b, Fig. 2A, [0054], [0055]).

Cambell et al. and Inoue do not disclose at least one mirror positioned to allow said camera to capture at least one image of a second side of a master key from a second position wherein the second position is from a different angle than the first position.

Allred et al. teach in place of two cameras to take images from different perspectives, a single camera, and mirrors configured to provide images of light along different pathways (i.e., from different perspectives) can be used ([0028], [0037]).

8. **Claim 9** rejected under 35 U.S.C. 103(a) as being unpatentable over Campbell et al. (US 20020191849 A1) and Inoue et al. (US 20100059484 A1) and Allred et al. (US 20100110380 A1) as applied to claim 1 above, further in view of Miller et al. (US 7643685 B2).

Regarding claim 9, Campbell et al. and Inoue et al. and Allred et al. disclose the key identification system of claim 1. Campbell et al. and Inoue et al. and Allred et al. do not

explicitly disclose said logic accounts for rolling of said master key with respect to said imaging system to determine characteristics of said contour.

Miller et al. teach a computation that accounts for roll of the object imaged (col. 3, lines 1-10, col. 3, lines 65-68, col. 11, lines 10-15).

The combination of Miller et al. with Campbell et al. and Inoue et al. and Allred et al. allows for key rolling. It would have been obvious at the time of the invention to one of ordinary skill in the art to combine the object identification even in the case of rolling of Miller et al., with the device of Campbell et al. and Inoue et al. and Allred et al., as these identification techniques were well known at the time of the invention, incorporating the identification would have predictable results, and as the key placed on the platform may not always lie entirely flat.

9. **Claims 10, 11, and 22 are** rejected under 35 U.S.C. 103(a) as being unpatentable over Campbell et al. (US 20020191849 A1) and Inoue et al. (US 20100059484 A1) and Allred et al. (US 20100110380 A1) as applied to claim 1 above, further in view of Almblad et al. (US 6065911 A).

Regarding claim 10, Campbell et al. and Inoue et al. and Allred et al. disclose the key identification system of claim 1. Campbell et al. and Inoue et al. and Allred et al. do not

explicitly disclose said logic accounts for tilting of said master key with respect to said imaging system to determine characteristics of said contour.

Almblad et al. teach logic accounts for tilting of said master key with respect to said imaging system to determine characteristics of said groove (Almblad et al., accommodates for key tilted/not lying flat due to bulky handle, fig. 3, col. 8, lines 35-45).

The combination of Almblad et al. with Campbell et al. and Inoue et al. and Allred et al. allows for key tilting. It would have been obvious at the time of the invention to one of ordinary skill in the art to combine the object identification even in the case of tilting of Almblad et al., with the device of Campbell et al. and Inoue et al. and Allred et al., as these identification techniques were well known at the time of the invention, incorporating the identification would have predictable results, and as the key placed on the platform may not always lie entirely flat.

Regarding claim 11, Campbell et al. and Inoue et al. and Allred et al. disclose the key identification system of claim 1. Campbell et al. and Inoue et al. and Allred et al. do not explicitly disclose said logic accounts for tipping of said master key with respect to said imaging system to determine characteristics of said contour.

Art Unit: 2665

Almblad et al. teach logic accounts for tipping of said master key with respect to said imaging system to determine characteristics of said groove (Almblad et al., accommodates for key tilted/not lying flat due to bulky handle, fig. 3, col. 8, lines 35-45).

The combination of Almblad et al. with Campbell et al. and Inoue et al. and Allred et al. allows for key tipping. It would have been obvious at the time of the invention to one of ordinary skill in the art to combine the object identification even in the case of tipping of Almblad et al., with the device of Campbell et al. and Inoue et al. and Allred et al., as these identification techniques were well known at the time of the invention, incorporating the identification would have predictable results, and as the key placed on the platform may not always lie entirely flat.

Regarding claim 22, Campbell et al. and Inoue et al. and Allred et al. disclose the key identification system of claim 1. Campbell et al. and Inoue et al. and Allred et al. do not explicitly disclose the captured image of said tip includes a contour of a groove in said master key.

Almblad et al. teach a captured image of said tip includes a contour of a groove in said master key (extract three-dimensional grooves, col. 2, lines 30-35, identify curved grooves, col. 4, lines 35-40; extract laterally protected attributes such as groove characteristics using light stripe, col. 11, lines 5-25).

The combination of Almblad et al. with Campbell et al. and Inoue et al. and Allred et al. allows for identification of groove contours. It would have been obvious at the time of the invention to one of ordinary skill in the art to combine the groove contours identification of Almblad et al., with the invention of Campbell et al. and Inoue et al. and Allred et al., as these identification techniques were well known at the time of the invention, incorporating the identification would have predictable results, and as one of a limited numbers of ways to identify a key, would have been obvious to try.

10. **Claim 23 is** rejected under 35 U.S.C. 103(a) as being unpatentable over Campbell et al. (US 20020191849 A1) and Inoue et al. (US 20100059484 A1) and Allred et al. (US 20100110380 A1) as applied to claim 1 above, further in view of Gimelfarb et al. (US 20060147289 A1).

Regarding claim 23, Campbell et al. and Inoue et al. and Allred et al. disclose the key identification system of claim 1. Campbell et al. and Inoue et al. and Allred et al. do not explicitly disclose said logic is configured to shift data related to said characteristics of said contour to compare with said known key blank characteristics.

Gimelfarb et al. teach logic is configured to shift data related to said characteristics of said contour to compare with said known key blank characteristics (bittings aligned to master key, slidable along axis, abstract, [0014], [0030], [0035]).

Cambell et al. and Gimelfarb are in the same art of copying keys (Cambell et al., abstract; Gimelfarb, abstract). The addition of Gimelfarb would a slidable alignment method. It would have been obvious at the time of the invention to one of ordinary skill in the art to combine the sliding alignment of Gimelfarb with the invention of Campbell et al. and Inoue et al. and Allred et al., as this was known at the time of the invention, would have predictable results, and as this allows for more easy key positioning and comparison.

Allowable Subject Matter

11. **Claim 15** is objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to MICHELLE ENTEZARI whose telephone number is (571)270-5084. The examiner can normally be reached on M-Th, 7:30am-5pm EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Bhavesh M. Mehta can be reached on (571)272-7453. The fax phone

Art Unit: 2665

number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/MICHELLE ENTEZARI/
Primary Examiner, Art Unit 2665

Notice of References Cited	Application/Control No. 14/162,157		Applicant(s)/Patent Under Reexamination THOMPSON ET AL.	
	Examiner MICHELLE ENTEZARI		Art Unit 2665	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-2010/0110380	05-2010	Allred et al.	351/214
*	B	US-2010/0059484	03-2010	Inoue et al.	219/61.5
	C	US-			
	D	US-			
	E	US-			
	F	US-			
	G	US-			
	H	US-			
	I	US-			
	J	US-			
	K	US-			
	L	US-			
	M	US-			

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

<i>Index of Claims</i> 	Application/Control No. 14162157	Applicant(s)/Patent Under Reexamination THOMPSON ET AL.
	Examiner MICHELLE ENTEZARI	Art Unit 2665

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

☐ Claims renumbered in the same order as presented by applicant		☐ CPA		☐ T.D.		☐ R.1.47			
CLAIM		DATE							
Final	Original	04/21/2014	11/07/2014	06/15/2015					
	1	✓	✓	✓					
	2	✓	✓	✓					
	3	✓	✓	✓					
	4	✓	✓	✓					
	5	✓	✓	✓					
	6	✓	✓	✓					
	7	✓	✓	✓					
	8	✓	✓	✓					
	9	✓	✓	✓					
	10	✓	✓	✓					
	11	✓	✓	✓					
	12	✓	✓	✓					
	13	✓	✓	-					
	14	✓	✓	✓					
	15	✓	O	O					
	16	✓	✓	✓					
	17	✓	✓	✓					
	18	✓	✓	✓					
	19	✓	✓	✓					
	20	✓	✓	✓					
	21	✓	✓	✓					
	22	✓	✓	✓					
	23	✓	✓	✓					
	24	✓	✓	✓					
	25			✓					
	26			✓					
	27			✓					

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S69	393	(two or pair or several or plurality or multiple) near2 (view or perspective or angle or orientation) with (edge or border or contour) near2 (geometry or shape)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	NEAR	ON	2015/06/15 01:57
S70	94	(two or pair or several or plurality or multiple) near2 (view or perspective or image (angle or orientation)) with (edge or border or contour) near2 (geometry or shape)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	NEAR	ON	2015/06/15 02:00
S71	34	S70 and @ad<"20090501"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	NEAR	OFF	2015/06/15 02:01
S73	1	S72 and @ad<"20090501"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	NEAR	OFF	2015/06/15 02:04
S72	1	second adj2 (view or perspective or image (angle or orientation)) with (edge or border or contour) near2 (geometry or shape)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	NEAR	ON	2015/06/15 02:04
S74	428	(views! or perspectives! or image adj2 (angles! or orientations!)) with (edge or border or contour) near2 (geometry or shape)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	NEAR	ON	2015/06/15 02:06
S76	6	S75 and @ad<"20090501"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	NEAR	OFF	2015/06/15 02:07
S75	16	(views! or perspectives! or image adj2 (angles! or orientations!)) with (edge or border or contour) near2 (geometry or shape) with (calculat\$4 or determin\$4 or measur\$3 or judg\$4)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	NEAR	ON	2015/06/15 02:07
S77	247	S74 and @ad<"20090501"	US-PGPUB; USPAT;	NEAR	OFF	2015/06/15 02:10

			USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB			
S78	876	(views! or perspectives! or image adj2 (angles! or orientations!)) with (edge or border or contour or groove or biting) near2 (geometry or shape)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	NEAR	ON	2015/06/15 02:11
S80	30	S79 and @ad<"20090501"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	NEAR	OFF	2015/06/15 02:13
S79	42	S78 and (key blank or master key or inspection)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	NEAR	ON	2015/06/15 02:13
S81	10	(two or pair) adj2 (camera or imaging device) with (edge or border or contour or groove or biting) near2 (geometry or shape)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	NEAR	ON	2015/06/15 02:15
S82	8	S81 and @ad<"20090501"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	NEAR	OFF	2015/06/15 02:16
S84	26	S83 and @ad<"20090501"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	NEAR	OFF	2015/06/15 02:19
S83	58	mirror with (camera or imaging device) same (edge or border or contour or groove or biting) near2 (geometry or shape or profile)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	NEAR	ON	2015/06/15 02:19
S87	74	S86 and @ad<"20090501"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	NEAR	OFF	2015/06/15 12:59
S86	95	(views! or perspectives! or image adj2 (angles! or orientations!)) with (edge or border or contour or groove or biting) near2 (geometry or shape or profile) and (master key or biting analysis or inspect\$4)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	NEAR	ON	2015/06/15 12:59
S90	88	mirror with camera same (two or pair) camera same (views! or perspectives!)	US-PGPUB; USPAT;	NEAR	ON	2015/06/15 13:09

EAST Search History

		and @ad<"20090501"	USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB			
S88	342	mirror with camera same (two or pair) camera and @ad<"20090501"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	NEAR	OFF	2015/06/15: 13:09

EAST Search History (Interference)

< This search history is empty >

6/ 15/ 2015 6:41:39 PM

C:\ Users\ mentezari\ Documents\ EAST\ Workspaces\ 14_162_157.wsp

<i>Search Notes</i> 	Application/Control No. 14162157	Applicant(s)/Patent Under Reexamination THOMPSON ET AL.
	Examiner MICHELLE ENTEZARI	Art Unit 2665

CPC- SEARCHED		
Symbol	Date	Examiner
B23C2235/24	4/18/14	Entezari
B23C2235/28	4/18/14	Entezari
B23C2235/41	4/18/14	Entezari
B23C2235/44	4/18/14	Entezari
b23q33/00	4/18/14	Entezari
g06k2209/401	4/18/14	Entezari
g06k2209/40 (keyword limited)	4/18/14	Entezari
y10s83/917 (keyword limited)	4/18/14	Entezari

CPC COMBINATION SETS - SEARCHED		
Symbol	Date	Examiner

US CLASSIFICATION SEARCHED			
Class	Subclass	Date	Examiner
382	203, 205, 209, 110, 141, 305 (keyword limited)	4/18/14	Entezari
409	81-83 (keyword limited)	4/18/14	Entezari

SEARCH NOTES		
Search Notes	Date	Examiner
see EAST search, includes INV	4/18/14-4/21/14	Entezari
see updated EAST search	6/15/15	Entezari

INTERFERENCE SEARCH			
US Class/ CPC Symbol	US Subclass / CPC Group	Date	Examiner

PATENT APPLICATION

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application: Chester O.D. Thompson et al. Art Unit: 2665
Serial No.: 14/162,157 Examiner: Entezari, Michelle M.
Filing Date: January 23, 2014 Docket No.: 16223-00274
Title: KEY BLANK IDENTIFICATION SYSTEM WITH GROOVE SCANNING

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

RESPONSE TO OFFICE ACTION

Applicants acknowledge receipt of the June 23, 2015 Office Action. As this response is electronically filed on October 22, 2015, along with a request for a one-month extension and the appropriate fee, Applicants believe no additional fees are due. However, if any additional fees are required for this Response, please charge such fees to our Deposit Account No. 13-0265.

{574988640;}

CLAIMS

What is claimed is:

1. (Currently Amended) A key identification system comprising:

an imaging system including a camera configured to capture an image of the tip of a master key, wherein said image includes a contour;

a logic configured to analyze said captured image to determine characteristics of said contour and compare said characteristics with characteristics of known key blanks to determine the likelihood of a match between said master key and a known key blank; and

one or more mirrors positioned to allow said camera to capture two or more views of the master key wherein said characteristics of said contour are determined based on image data from at least said two or more views of said master key wherein at least one said view is substantially a tip end view, and wherein said logic calculates the geometry of the contour based on data from at least said two or more views of said master key.

2. (Original) The key identification system of claim 1, wherein said logic includes a database containing data related to characteristics of grooves of known key blanks.

3. (Original) The key identification system of claim 1, wherein said imaging system includes a reflecting device.

4. (Previously Presented) The key identification system of claim 3, wherein said imaging system includes a light.

5. (Original) The key identification system of claim 4, wherein said light is directed toward said reflecting device.

6. (Original) The key identification system of claim 5, wherein said light includes a shield to direct light away from said master key.

7. (Original) The key identification system of claim 1, wherein said captured image is a {5749886;}

digital image.

8. (Original) The key identification system of claim 1, wherein said captured image comprises a silhouette of said tip of said master key.

9. (Original) The key identification system of claim 1, wherein said logic accounts for rolling of said master key with respect to said imaging system to determine characteristics of said contour.

10. (Original) The key identification system of claim 1, wherein said logic accounts for tilting of said master key with respect to said imaging system to determine characteristics of said contour.

11. (Original) The key identification system of claim 1, wherein said logic accounts for tipping of said master key with respect to said imaging system to determine characteristics of said contour.

12. (Original) The key identification system of claim 1, wherein said captured image comprises a silhouette of the blade of said master key.

13. (Canceled)

14. (Previously Presented) The key identification system of claim 1, wherein said logic calculates the geometry of the contour as seen from a view of the tip parallel to the blade based on data from at least said two or more views of said master key.

15. (Previously Presented) The key identification system of claim 1, wherein said logic calculates the geometry of the contour as though the tip were squarely cut based on data from at least said two or more views of said master key.

{5749886;}

16. (Original) The key identification system of claim 1 further comprising a key holder configured to hold said master key.
17. (Original) The key identification system of claim 16, wherein said key holder includes a lower support.
18. (Original) The key identification system of claim 16, wherein said key holder includes an upper door.
19. (Original) The key identification system of claim 16, wherein said key holder includes a clamp.
20. (Original) The key identification system of claim 1, wherein one of said views of said master key includes a view from above the master key blade of a groove in the bottom of said blade.
21. (Previously Presented) The key identification system of claim 1, wherein one of said views of said master key includes a view from an angle between perpendicular and parallel to the blade of said master key and not including perpendicular or parallel to the blade of said master key.
22. (Previously Presented) The key identification system of claim 1, wherein the captured image of said tip includes a contour of a groove in said master key.
23. (Currently Amended) The key identification system of claim 1, wherein the logic is configured to shift data related to said characteristics of said contour to compare with said known key blank characteristics.
24. (Original) The key identification system of claim 1, wherein said logic includes a tolerance range for each characteristic of said master key to determine whether a master key passes or fails to match a known key blank.

{5749886;}

25. (Currently Amended) A key identification system comprising:

an imaging system including a camera in a first position configured to directly capture at least one image of one side of a master key, wherein said image includes a contour;

at least one mirror positioned to allow said camera to capture at least one image of a second side of a master key from a second position wherein the second position is from a different angle than the first position, wherein the image from the second angle is substantially a tip end view; and

a logic configured to analyze said captured images to determine characteristics of said contour and compare said characteristics with characteristics of known key blanks to determine the likelihood of a match between said master key and a known key blank.

26. (Previously Presented) The key identification system of claim 25, wherein the at least one mirror is configured to allow the camera to capture one image with multiple views of the master key from different angles.

27. (Currently Amended) A key identification system comprising:

an imaging system including a camera configured to capture an image of a master key, the image includes a first view and a second view;

a first mirror positioned at a first position to allow said camera to capture the first view of the master key wherein the first view is a substantial tip end view, at least one second mirror positioned at a second position to allow said camera to capture a second view of the master key, wherein the first view is from a different angle than the second view; and

a logic configured to analyze said captured image to determine characteristics of said contour and compare said characteristics with characteristics of known key blanks to determine the likelihood of a match between said master key and a known key blank.

{5749886;}

REMARKS

In the June 23, 2015 Office Action, claims 1-8, 12, 14, 16-20, and 24-27 stand rejected under 35 U.S.C. 103 as unpatentable over U.S. Publication No. 20020191849 to Campbell et al. (“Campbell”) in view of U.S. Patent Publication No. 20100059484 to Inoue et al. (“Inoue”) in view of U.S. Patent Publication No. 20100110380 to Allred et al. (“Allred”).

Claim 9 stands rejected under 35 U.S.C. 103 as unpatentable over Campbell, Inoue, and Allred in further view of U.S. Patent No. 7,643,685 to Miller et al. (“Miller”).

Claims 10, 11, and 22 stand rejected under 35 U.S.C. 103 as unpatentable over Campbell, Inoue, and Allred in further view of U.S. Patent No. 6,065,911 to Almblad (“Almblad”).

Claim 23 stands rejected under 35 U.S.C. 103 as unpatentable over Campbell, Inoue, and Allred in further view of U.S. Publication No 20060147289 to Gimelfarb et al. (“Gimelfarb”).

Claim 15 stands objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

The following remarks address each of these issues and place the present application in condition for allowance.

Claim 23

Claim 23 has been amended to correct a grammatical error and now recites “said known key blank characteristics.”

Independent Claims 1, 25 and 27

The Office Action relies on the combination of Campbell with Inoue and Allred to reject the recited features of Independent claims 1, 25, and 27.

Claim 1 is now amended to additionally recite, “wherein at least one said view is

{5749886;}

substantially a tip end view.” Claim 25 is now amended to additionally recite, “wherein the image from the second angle is substantially a tip end view.” A portion of this subject matter was originally recited by claim 26. Claim 26 has now been canceled. Claim 27 is now amended to additionally recite, “wherein the first view is a substantial tip end view.” Support for these amendments exists at least in paragraph [0037] and Figures 2a, 2b, 4, 14.

Notably, Campbell, Inoue, and Allred do not teach a key identification system or method that is configured to capture an image of a master key ... wherein at least one of said views or images is a substantial tip end view.

The Office Action cites to Campbell for teaching a key identification system that includes a camera configured to capture an image of the master key. See Campbell Abstract. Campbell teaches to capture a substantially side view image of a key. See Figures 2-5. In particular, Campbell is directed to capturing images of the key that exhibits views of a milling exit shape 76 that exist on the side of the key by the head 64. See Figures 6a, 7a, 8a, and 11a-11d. See at least paragraphs [0098] and [0099]. The milling exit shape 76 is identified by a viewpoint that could only be taken from a substantially side view or image of the key as the milling exit shape 76 is positioned between the blade 72 and head 64 of a key. Therefore, Campbell does not teach a key identification system configured to capture a substantial tip end view as recited by the claims.

Inoue is relied on for teaching capturing two or more views of the master key. However, Inoue does not teach to utilize a substantial tip end view of the master key. In particular, Inoue relates to a system for manufacturing an electric resistance welded steel pipe. Inoue discloses the use of image measurement cameras 13a, 13b to capture the images of the ends of **pipe** that includes irradiation devices 12a, 12b, respectively to measure groove heights h to adjust the welding electric power from the welding power generating equipment. See paragraph [0055]-[0057]. In particular, Inoue states that the optimum welding electric power is calculated on the

{5749886;}

basis for the measurement result of the groove height h and a measurement result of a quality of oxide at the welded portion. See paragraph [0057]. The system of Inoue does not make up for the deficiencies of Campbell as it does not teach utilizing a tip end view of a master key.

Additionally, the type of imaging system disclosed by Inoue could not be combined with Campbell as Campbell would be caused to fail to work in accordance with its intended purposed. Notably, the imaging system of Inoue is designed to capture images from a continuously moving strip of material that is being formed into a pipe. Further, the housing 22 of Campbell requires first and second luminous surface 24 and 26 to illuminate a surface of the key and an opposite side of the key in a static position to properly illuminate the grooves or millings of the key. One skilled in the art would be required to undergo substantial reconfigurations of the luminous surfaces 24, 26 within the housing 22 of Campbell to adopt the particular configuration of the measurement cameras 12a, 12b and irradiation devices 12a, 12b of Inoue. Thus, one skilled in the art would not look to combine the measurement cameras 13a, 13b and irradiation devices 12a, 12b of Inoue into the key identification housing 22 of Campbell. This would ultimately cause Campbell to particularly fail to work in accordance with its intended purpose.

The office action further relies on paragraphs [0028], [0037] of Allred to teach one or more mirrors positioned to allow said camera to capture two or more views of the master key. However, Allred actually teaches an eye measurement apparatus that utilizes cameras to capture various images of a single point on a human eye. The cameras may utilize mirrors to provide images along different pathways, using scattered light from slits provided by projector 122. However, Allred does not teach to capture a substantial tip end view of the master key. Thus, Allred fails to make up for the deficiencies of both Campbell and Inoue.

In contrast, the system of recited independent claims rely on at least one camera and one or more mirrors to capture two or more views. The camera and mirrors are configured to capture

{5749886;}

an image wherein at least one view is a substantial tip end view along with a logic to analyze the captured images as recited by claims 1, 25 and 27.

Therefore, it is respectfully submitted that claim 1 and claims 2-12, and 14-24 dependent therefrom as well as claims 25 and 27 are now in condition for allowance.

CONCLUSION

In light of the foregoing, Applicants submit that the application is now in condition for allowance. If the Examiner has any questions pertaining to the above, then the undersigned attorney would welcome a phone call to provide any further clarification or a formal interview.

Respectfully submitted,

Date: October 22, 2015

/Mark J. Masterson/
Mark J. Masterson
Reg. No. 71,886
McDonald Hopkins LLC
600 Superior Avenue, E.
Suite 2100
Cleveland, OH 44114-2653
216-348-5427

{5749886;}

Electronic Patent Application Fee Transmittal				
Application Number:		14162157		
Filing Date:		23-Jan-2014		
Title of Invention:		KEY BLANK IDENTIFICATION SYSTEM WITH GROOVE SCANNING		
First Named Inventor/Applicant Name:		Chester O.D. Thompson		
Filer:		Mark Jason Masterson/Lori Swanson		
Attorney Docket Number:		16223-00274		
Filed as Large Entity				
Filing Fees for Utility under 35 USC 111(a)				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Extension - 1 month with \$0 paid	1251	1	200	200
Miscellaneous:				
Total in USD (\$)				200

Electronic Acknowledgement Receipt	
EFS ID:	23863928
Application Number:	14162157
International Application Number:	
Confirmation Number:	5914
Title of Invention:	KEY BLANK IDENTIFICATION SYSTEM WITH GROOVE SCANNING
First Named Inventor/Applicant Name:	Chester O.D. Thompson
Customer Number:	33772
Filer:	Mark Jason Masterson/Lori Swanson
Filer Authorized By:	Mark Jason Masterson
Attorney Docket Number:	16223-00274
Receipt Date:	22-OCT-2015
Filing Date:	23-JAN-2014
Time Stamp:	15:15:52
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	\$200
RAM confirmation Number	1436
Deposit Account	130265
Authorized User	SWANSON, LORI

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

Charge any Additional Fees required under 37 C.F.R. Section 1.21 (Miscellaneous fees and charges)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		ResponseToOA.pdf	105151 5ea744d6b9ec163e12e2c5d5fb8244ef5d98eeda	yes	9

	Multipart Description/PDF files in .zip description			
	Document Description	Start	End	
	Amendment/Req. Reconsideration-After Non-Final Reject	1	1	
	Claims	2	5	
	Applicant Arguments/Remarks Made in an Amendment	6	9	

Warnings:

Information:

2	Fee Worksheet (SB06)	fee-info.pdf	30718 5cbf3edc29dea62b042219991f82d012ab6d65ce	no	2

Warnings:

Information:

Total Files Size (in bytes):	135869

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875					Application or Docket Number 14/162,157	Filing Date 01/23/2014	☐ To be Mailed
ENTITY: ☐ LARGE ☒ SMALL ☐ MICRO							
APPLICATION AS FILED – PART I							
(Column 1)		(Column 2)					
FOR	NUMBER FILED	NUMBER EXTRA			RATE (\$)	FEE (\$)	
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A			N/A		
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A			N/A		
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A			N/A		
TOTAL CLAIMS (37 CFR 1.16(j))	minus 20 =	*			X \$ =		
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*			X \$ =		
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$310 (\$155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).						
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))							
* If the difference in column 1 is less than zero, enter "0" in column 2.					TOTAL		
APPLICATION AS AMENDED – PART II							
(Column 1)		(Column 2)		(Column 3)			
AMENDMENT	10/22/2015	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE (\$)	ADDITIONAL FEE (\$)
	Total (37 CFR 1.16(i))	* 26	Minus	** 26	= 0	X \$40 =	0
	Independent (37 CFR 1.16(h))	* 3	Minus	***3	= 0	X \$210 =	0
	☐ Application Size Fee (37 CFR 1.16(s))						
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						
						TOTAL ADD'L FEE	0
(Column 1)		(Column 2)		(Column 3)			
AMENDMENT		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE (\$)	ADDITIONAL FEE (\$)
	Total (37 CFR 1.16(i))	*	Minus	**	=	X \$ =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	X \$ =	
	☐ Application Size Fee (37 CFR 1.16(s))						
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						
						TOTAL ADD'L FEE	
* If the entry in column 1 is less than the entry in column 2, write "0" in column 3. ** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20". *** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3". The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.							

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

Doc code: IDS

Doc description: Information Disclosure Statement (IDS) Filed

PTO/SB/08a (01-10)

Approved for use through 07/31/2012. OMB 0651-0031

U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		14162157
	Filing Date		2014-01-23
	First Named Inventor	Chester O.D. Thompson	
	Art Unit	2665	
	Examiner Name	Michelle M. Entezari	
	Attorney Docket Number	16223-00274	

U.S.PATENTS						Remove
Examiner Initial*	Cite No	Patent Number	Kind Code ¹	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	2430924		1947-11-18	Fowle et al.	
	2	2386816		1945-10-16	Scholz	
	3	2329269		1943-09-14	Jacobi	
	4	2325541		1943-07-27	Poole	
	5	2274012		1942-02-24	Swayze et al.	
	6	2176106		1939-10-17	Segal	
	7	2148668		1939-02-28	Yoskowitz et al.	
	8	2114597		1938-04-19	Goddard	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		14162157	
	Filing Date		2014-01-23	
	First Named Inventor	Chester O.D. Thompson		
	Art Unit	2665		
	Examiner Name	Michelle M. Entezari		
	Attorney Docket Number	16223-00274		

	9	21050099		1938-01-11	Schuyler	
	10	2098728		1937-11-09	McPhee	
	11	2038949		1936-04-28	Mintz	
	12	2032820		1936-03-03	Turrell	
	13	1991151		1935-02-12	Hansen	
	14	1978628		1934-10-30	Hansen	
	15	1961516		1934-06-05	Hansen	
	16	1948260		1934-02-20	Fowler	
	17	1923164		1933-08-22	Roos	
	18	1889461		1932-11-29	Hansen	
	19	1848046		1932-03-01	Caron	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		14162157	
	Filing Date		2014-01-23	
	First Named Inventor	Chester O.D. Thompson		
	Art Unit	2665		
	Examiner Name	Michelle M. Entezari		
	Attorney Docket Number	16223-00274		

	20	1775921		1930-09-16	Williams	
	21	1752668		1930-04-01	Johnson	
	22	1750218		1930-03-11	Falk	
	23	1702488		1929-02-19	Baird	
	24	1674291		1928-06-19	Malone	
	25	1656295		1928-01-17	Schechter	
	26	1628637		1927-05-10	Shaw	
	27	1440459		1923-01-02	Greff	
	28	1390958		1921-09-13	Hulbert	
	29	1367280		1921-02-01	Reiges	
	30	1218653		1917-03-13	Heldrich	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		14162157	
	Filing Date		2014-01-23	
	First Named Inventor		Chester O.D. Thompson	
	Art Unit		2665	
	Examiner Name		Michelle M. Entezari	
	Attorney Docket Number		16223-00274	

	31	1135676		1915-04-13	Engelbert	
	32	1081472		1913-12-16	Tucker	
	33	1059545		1913-04-22	Kunze	
	34	0943806		1909-12-21	Billings	
	35	0466044		1891-12-29	Jacobs	
	36	0288300		1883-11-13	Borowsky	
	37	0040480		1863-03-03	Hill	
	38	7890878		2011-02-15	Bass, et al.	

If you wish to add additional U.S. Patent citation information please click the Add button.

Add

U.S.PATENT APPLICATION PUBLICATIONS

Remove

Examiner Initial*	Cite No	Publication Number	Kind Code ¹	Publication Date	Name of Patentee or Applicant of cited Document	Pages, Columns, Lines where Relevant Passages or Relevant Figures Appear
	1	20110262240		2011-10-27	Mutch et al.	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number	14162157
	Filing Date	2014-01-23
	First Named Inventor	Chester O.D. Thompson
	Art Unit	2665
	Examiner Name	Michelle M. Entezari
	Attorney Docket Number	16223-00274

	2	20090180664		2009-07-16	Efstathiades et al.	
	3	20090074528		2009-03-19	Hadad	
	4	20080252551		2008-10-16	Kubo et al.	
	5	20070234614		2007-10-11	Tarter et al.	
	6	20070224008		2007-09-27	Bass et al.	
	7	20060147289		2006-07-06	Gimelfarb et al.	
	8	20060003676		2006-01-05	Bernard et al.	
	9	20050216120		2005-09-29	Rosenberg et al.	
	10	20050000052		2005-01-06	Byles	
	11	20040253067		2004-12-16	Bosch	
	12	20040095380		2004-05-20	Bass et al.	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		14162157
	Filing Date		2014-01-23
	First Named Inventor	Chester O.D. Thompson	
	Art Unit	2665	
	Examiner Name	Michelle M. Entezari	
	Attorney Docket Number	16223-00274	

	13	20040036595		2004-02-26	Kenny et al.	
	14	20040024486		2004-02-05	Almblad et al.	
	15	20030205070		2003-11-06	Chaum	
	16	20030154135		2003-08-14	Covington et al.	
	17	20030145499		2003-08-07	Tarter et al.	
	18	20020191849		2002-12-19	Campbell et al.	
	19	20020168241		2002-11-14	David et al.	
	20	20020031251		2002-03-14	Campbell et al.	
	21	20010056385		2001-12-27	Timms et al.	
	22	20010033781		2001-10-25	Wills et al.	
	23	20080145163		2008-06-19	Freeman, et al.	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		14162157
	Filing Date		2014-01-23
	First Named Inventor	Chester O.D. Thompson	
	Art Unit	2665	
	Examiner Name	Michelle M. Entezari	
	Attorney Docket Number	16223-00274	

If you wish to add additional U.S. Published Application citation information please click the Add button. **Add**

FOREIGN PATENT DOCUMENTS								Remove
Examiner Initial*	Cite No	Foreign Document Number ³	Country Code ²	Kind Code ⁴	Publication Date	Name of Patentee or Applicant of cited Document	Pages, Columns, Lines where Relevant Passages or Relevant Figures Appear	T ⁵
	1							☐

If you wish to add additional Foreign Patent Document citation information please click the Add button **Add**

NON-PATENT LITERATURE DOCUMENTS			Remove
Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T ⁵
	1		☐

If you wish to add additional non-patent literature document citation information please click the Add button **Add**

EXAMINER SIGNATURE			
Examiner Signature		Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

¹ See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. ² Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). ³ For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. ⁴ Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. ⁵ Applicant is to place a check mark here if English language translation is attached.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number	14162157
	Filing Date	2014-01-23
	First Named Inventor	Chester O.D. Thompson
	Art Unit	2665
	Examiner Name	Michelle M. Entezari
	Attorney Docket Number	16223-00274

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

☐ That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

☐ See attached certification statement.

☒ The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☒ A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Mark J. Masterson/	Date (YYYY-MM-DD)	2015-10-29
Name/Print	Mark J. Masterson	Registration Number	71886

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. **DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these records.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.



Espacenet

Bibliographic data: DE2951065 (A1) — 1981-07-02

Automatic key cutting machine - has cutter for each slot in key moving longitudinally and transversely

Inventor(s): BONORI PIER PAOLO [IT] ± (PAOLO BONORI,PIER)

Applicant(s): F I M A T FABBRICA ITALIANA MA [IT] ± (F.I.M.A.T.-FABBRICA ITALIANA MACCHINE AUTOMATICHE E TRANSFER S.P.A)

Classification: - **international:** B23C3/35; (IPC1-7): B23C3/35

- **cooperative:** B23C3/35

Application number: DE19792951065 19791219

Priority number (s): DE19792951065 19791219

Abstract of DE2951065 (A1)

The key-cutting machine has each cutter (F1,F2) designed to cut one slot (X1-X5) in the blank. The axis of the cutting spindle is parallel to the long axis of the raw key (Q) and is mounted on a cross carriage (S1 etc) and can move backwards and forwards both in the longitudinal direction of the blank key (for aligning the cutters with the position of the slots being cut) and across the blank key (for cutting the slots using a numerical, programmable, data-processing control system (E,F). The blank key is held by a clamp (N) and fed in the clamp by a feed device (29). The machine cuts keys in large quantities.

⑬ BUNDESREPUBLIK
DEUTSCHLAND



DEUTSCHES
PATENTAMT

⑫ **Offenlegungsschrift**
⑪ **DE 29 51 065 A 1**

⑤① Int. Cl. 3:
B 23 C 3/35

⑳ Aktenzeichen: P 29 51 065.4
㉑ Anmeldetag: 19. 12. 79
㉒ Offenlegungstag: 2. 7. 81

Behörden-eigentum

㉓ Anmelder:
F.I.M.A.T.- Fabbrica Italiana Macchine Automatiche e
Transfer S.p.A., Zola Predosa, IT

㉔ Erfinder:
Bonori, Pier Paolo, Bologna, IT

㉕ Vertreter:
Stracke, A., Dipl.-Ing.; Loesenbeck, K., Dipl.-Ing.,
Pat.-Anw., 4800 Bielefeld

DE 29 51 065 A 1

⑤② **Automatische Schlüsselfräsmaschine**

DE 29 51 065 A 1

Patentanwältin
Dr. O. Loesenbeck
Dipl.-Ing. Stracke
Dipl.-Ing. Loesenbeck
48 Bielefeld, Herforder Straße 17

2951065

F.I.M.A.T. Fabbrica Italiana
Macchine Automatiche e
Transfer S.p.A., in 40069
Zola Predosa, Italien.

Patentansprüche

1. Automatische Schlüsselfräsmaschine, insbesondere für die industrielle Schlüsselfertigung, mit einer Spannvorrichtung für den zu bearbeitenden Rohschlüssel und mindestens einem neben dieser Spannvorrichtung angeordneten Fräser zum Einschneiden der Schlüsselkerbung, dadurch gekennzeichnet, dass der Fräser (F1 bzw. F2) zum Einschneiden je einer Schlüsselkerbe (X1 - X5) ausgebildet ist und die parallel zur Längsachse des Rohschlüssels (Q) gerichtete Fräerspindel auf einem Kreuzschlitten (S1, S1' bzw. S2, S2') gelagert und sowohl in der Längsrichtung des Rohschlüssels zum Ausrichten des Fräfers (F1 bzw. F2) mit der Stellung der einzuschneidenden Schlüsselkerbe (X1 - X5) als auch quer zum Rohschlüssel zum Einschneiden der Schlüsselkerbe mit Hilfe einer numerischen, programmierbaren, datenverarbeitenden Steuervorrichtung (E, F) hin und her

130027/0123

verstellbar ist.

2. Automatische Schlüsselfräsmaschine nach Anspruch 1, gekennzeichnet durch eine der Spannvorrichtung (N) und einer vorgeschalteten Zuführungsvorrichtung (29) für die Rohschlüssel (Q) zugeordnete Ein- und Ausschubvorrichtung (31,37,40) zum Einsetzen des zu bearbeiten=den Rohschlüssels (Q) in die Spannvorrichtung (N) und zum Ausziehen des gekerbten Schlüssels aus der Spannvorrichtung (N), wobei diese Ein- und Ausschubvorrichtung (31,37,40) und die Spannvorrichtung (N) in Verbindung mit dem Fräser (F1 bzw. F2) von der selben numerischen, programmierbaren, datenverarbeitenden Steuervorrichtung (E,F) gesteuert werden.

3. Automatische Schlüsselfräsmaschine nach Anspruch 1 und 2, gekennzeichnet durch eine Prägevorrichtung (L) zum Einprägen der Schlüsselnummer bzw. einer der Schlüsselkerbung (Z,Z',Z'') entsprechenden Bezeichnung in die Griffscheibe des Rohschlüssels (Q), eine Räumvorrichtung (44) zur Nachbearbeitung des Anschlags (U) oder der Anschläge des eingespannten Rohschlüssels (Q), eine Entgratvorrichtung (S) zur Entfernung der beim Fräsen der Schlüsselkerbung (Z,Z',Z'') entstandenen Grate und eine Bündelvorrichtung (P) zum Bündeln von mehreren gleichartigen Schlüsseln, wobei Mittel (30, 32,35) zum Fördern der Schlüssel von einer Vorrichtung zur anderen vorgesehen sind und alle diese Vorrichtungen

130027/0123

ORIGINAL INSPECTED

und Fördermittel in Verbindung mit dem Fräser (F1 bzw. F2), der Spannvorrichtung (N) und der dieser zugeordneten Ein- und Ausschubvorrichtung zur Erzielung eines vollautomatischen Arbeitsablaufs von der selben, numerischen, programmierbaren, datenverarbeitenden Steuerungsvorrichtung (E,F) gesteuert werden.

4. Automatische Schlüsselfräsmaschine nach Anspruch 1 bis 3, gekennzeichnet durch einen Schacht (29) mit einem Stapel von schrittweise absenkbaren, von oben zuführbaren Rohschlüsseln (Q) und mit mehreren, in übereinanderliegenden Ebenen angeordneten, zum und vom Schlüsselstapel quer durch den Schacht (29) hindurch bewegbaren Greifschiebern (30,31,32) zur vorübergehenden Einführung je eines Schlüssels in eine zugeordnete, neben dem Schacht (29) vorgesehene Prägevorrichtung (L) bzw. Spannvorrichtung (N) bzw. Entgratvorrichtung (S), während die aus dem unteren Ende des Schachts (29) austretenden Schlüssel mittels einer verschwenkbaren Aufnahme (34) der Bündelvorrichtung (P) zuführbar sind.

5. Automatische Schlüsselfräsmaschine nach einem der Ansprüche 1 bis 4, dadurch gekennzeichnet, dass der Fräser (F1 bzw. F2) auf dem quer zum eingespannten Rohschlüssel (Q) verschiebbaren Oberschlitten (S1 bzw. S2) eines Kreuzschlittens mit in der Längsrichtung des eingespannten Rohschlüssels (Q) verschiebbarem Unter-

130027/0123

schlitten (S1' bzw. S2') gelagert ist.

6. Automatische Schlüsselfräsmaschine nach Anspruch 5, dadurch gekennzeichnet, dass der Oberschlitten (S1 bzw. S2) und der Unterschlitten (S1' bzw. S2') des Kreuzschlittens von je einem elektrischen Schrittmotor über einen zugeordneten Gewindespindelantrieb (5,6 bzw. 105,106) antreibbar sind.

7. Automatische Schlüsselfräsmaschine nach einem der Ansprüche 1 bis 6, dadurch gekennzeichnet, dass der Fräser (F1 bzw. F2) von einem feststehend am Maschinengestell (1) gelagerten Motor (B) über ein ebenfalls feststehend angeordnetes Getriebe (C) und eine Gelenk- bzw. Kardanwelle (A1 bzw. A2) antreibbar ist.

8. Automatische Schlüsselfräsmaschine nach Anspruch 7, dadurch gekennzeichnet, dass das Getriebe (C) als schaltbares Wendegetriebe ausgebildet ist.

9. Automatische Schlüsselfräsmaschine nach einem der Ansprüche 1 bis 8, dadurch gekennzeichnet, dass auf jeder Seite der Spannvorrichtung (N) je ein Fräser (F1 bzw. F2) angeordnet ist und die beiden Fräser (F1 und F2) von einem einzigen, fest am Maschinengestell (1) gelagerten Motor (B) über ein Getriebe (C) mit zwei Ausgängen (18,19) und über je eine Gelenk- bzw. Kardanwelle (A1, A2) unabhängig voneinander antreibbar sind.

130027/0123

10. Automatische Schlüsselfräsmaschine nach einem der Ansprüche 1 bis 9, dadurch gekennzeichnet, dass die Steuervorrichtung (E,F) einen Speicher für die vorübergehende, nach dem Abschluss des Arbeitsablaufs bzw. nach der Fertigung der programmierten Stückanzahl löschbaren Speicherung der Arbeitsinformationen für die Programmierung aufweist.

11. Automatische Schlüsselfräsmaschine nach einem der Ansprüche 1 bis 10, dadurch gekennzeichnet, dass die Steuervorrichtung einen Speicher für die vorübergehende, löschbare Speicherung einer begrenzten Anzahl verschiedener, durch die erste Eingabe der betreffenden Arbeitsinformationen aufstellbarer und durch die wiederholte Eingabe dieser Arbeitsinformationen bzw. einer einfachen Bezeichnung abrufbarer Programme aufweist.

12. Automatische Schlüsselfräsmaschine nach einem der Ansprüche 1 bis 11, dadurch gekennzeichnet, dass die Steuervorrichtung einen Speicher mit einem oder mehreren, festen, durch die Eingabe der betreffenden Arbeitsinformationen bzw. einer einfachen Bezeichnung abrufbaren Programmen aufweist.

13. Automatische Schlüsselfräsmaschine nach einem der Ansprüche 1 bis 12, dadurch gekennzeichnet, dass die Programme der Steuervorrichtung (E,F) die Schlüsselkerbung (Z,Z',Z'') betreffen und die Eingabe der mit

130027/0123

jedem Programm herzustellenden Schlüsselanzahl getrennt durchführbar ist.

14. Automatische Schlüsselfräsmaschine nach einem der Ansprüche 1 bis 13, dadurch gekennzeichnet, dass die Eingabe der Arbeitsinformationen manuell z.B. über eine Tastatur der Steuervorrichtung (E,F) durchführbar ist.

15. Automatische Schlüsselfräsmaschine nach einem der Ansprüche 1 bis 14, dadurch gekennzeichnet, dass die Eingabe der Arbeitsinformationen mit Hilfe eines Informationsträgers, z.B. eines Lochstreifens bzw. Magnetbands durchführbar ist.

130027/0123

ORIGINAL INSPECTED

F.I.M.A.T. Fabbrica Italiana
Macchine Automatiche e
Transfer S.p.A., in 40069
Zola Predosa, Italien.

"Automatische Schlüsselfräsmaschine".

Die Erfindung betrifft eine automatische Schlüsselfräsmaschine, insbesondere für die industrielle Schlüsselfertigung, mit einer Spannvorrichtung für den zu bearbeitenden Rohschlüssel und mindestens einem neben dieser Spannvorrichtung angeordneten Fräser zum Einschneiden der Schlüsselkerbung.

Aufgabe der Erfindung ist es, eine Schlüsselfräsmaschine dieser Art zu schaffen, die einfach und schnell, ohne umständliches und zeitraubendes Umrüsten bzw. ohne Auswechseln von Bauteilen die Herstellung von unterschiedlichen Kerbungen auf je einer beliebig einstellbaren und veränderbaren Anzahl von Schlüsseln ermöglicht.

Diese Aufgabe wird erfindungsgemäss dadurch gelöst, dass der Fräser zum Einschneiden je einer Schlüssel-

130027/0123

kerbe ausgebildet ist und die parallel zur Längsachse des Rohschlüssels gerichtete Fräerspindel auf einem Kreuzschlitten gelagert und sowohl in der Längsrichtung des Rohschlüssels zum Ausrichten des Fräfers mit der Stellung der einzuschneidenden Schlüsselkerbe als auch quer zum Rohschlüssel zum Einschneiden der Schlüsselkerbe mit Hilfe einer numerischen, programmierbaren, datenverarbeitenden Steuervorrichtung hin und her verstellbar ist.

Vorzugsweise weist die erfindungsgemäße automatische Schlüsselfräsmaschine auch eine der Spannvorrichtung und einer vorgeschalteten Zuführungsvorrichtung zugeordnete, zusammen mit dem Fräser und der Spannvorrichtung von der selben Steuervorrichtung gesteuerte Ein- und Ausschubvorrichtung zum Einsetzen des zu kerbenden Rohschlüssels in die Spannvorrichtung und zum Ausziehen des gekerbten Schlüssels aus der Spannvorrichtung auf.

Mit der erfindungsgemäß ausgebildeten Schlüsselfräsmaschine wird also die Schlüsselkerbung durch getrenntes, aufeinanderfolgendes Einschneiden der einzelnen Schlüsselkerben erzielt. Dabei wird ein zum Einschneiden je einer einzelnen Schlüsselkerbe ausgebildeter Fräser benutzt, der durch Verstellung der Fräerspindel in der Längsrichtung des Rohschlüssels aufeinanderfolgend in mehrere, je einer einzuschneidenden

130027/0123

Schlüsselkerbe entsprechende Arbeitsstellungen eingestellt und in jeder Arbeitsstellung durch Verstellung der Fräerspindel quer zum Rohschlüssel zuerst zu diesem hin und dann von diesem weg bewegt wird und dabei die entsprechende Schlüsselkerbe mit der gewünschten Kerbtiefe einschneidet. Diese wiederholten Längs- und Querbewegungen des Fräasers werden durch die Lagerung der Fräerspindel auf einem Kreuzschlitten erzielt und - in Verbindung mit der Spannvorrichtung und der vorzugsweise vorhandenen automatischen Ein- und Ausschubvorrichtung für den zu kerbenden bzw. gekerbten Schlüssel - von einer programmierbaren, numerischen, datenverarbeitenden Steuervorrichtung gesteuert. Es genügt also, dieser Steuervorrichtung die erforderlichen Arbeitsinformationen über Anzahl, Lage und Tiefe der Schlüsselkerben und über die mit der selben Schlüsselkerbung auszuführenden Schlüsselzahl zu geben, damit die erfindungsgemäße Schlüsselfräsmaschine den der eingegebenen Schlüsselkerbung entsprechenden Bewegungsablauf selbsttätig ausführt und entsprechend der eingegebenen Schlüsselanzahl selbsttätig wiederholt. Es ist auch möglich, die Steuervorrichtung auf eine beliebige Anzahl von unterschiedlichen, aufeinanderfolgenden Schlüsselkerbungen und einer beliebigen, jeder Schlüsselkerbung zugeordneten Schlüsselanzahl zu programmieren und dieses Fertigungsprogramm selbsttätig ablaufen zu lassen.

130027/0123

Die Arbeitsinformationen können in die Steuervorrichtung bei jeder Programmierung neu eingegeben und vorübergehend in einem nach dem Abschluss des Arbeitsablaufs bzw. nach der Fertigung der programmierten Stückzahl löschbaren Speicher gespeichert werden. Die Steuervorrichtung kann jedoch auch einen Speicher mit einem oder mehreren festen, durch die Eingabe der Arbeitsinformationen bzw. einer einfachen Bezeichnung abrufbaren Kerbungsprogrammen aufweisen. Die Informationseingabe kann von Hand z.B. über eine Tastatur, oder mit Hilfe eines Informationsträgers, z.B. eines Lochstreifens bzw. Magnetbands erfolgen. Im Einzelnen kann die numerische, programmierbare, datenverarbeitende Steuervorrichtung der erfindungsgemässen Schlüsselfräsmaschine beliebig ausgebildet und mit beliebigem, bei numerischen Steuerungen erforderlichem bzw. üblichem Zubehör ausgestattet sein.

Auch die einzelnen mechanischen Teilen bzw. Vorrichtungen der erfindungsgemässen Schlüsselfräsmaschine können eine beliebige bauliche Ausbildung aufweisen. Besonders günstig für die erfindungsgemässe numerische Steuerung der Schlüsselfräsmaschine hat sich eine Ausführungsform erwiesen, in der nach einem weiteren Merkmal der Erfindung der der Fräser tragende Oberschlitten und der den Oberschlitten tragende Unterschlitten des Kreuzschlittens von je einem elektrischen Schrittmotor über einen zugeordneten Gewindespindelantrieb antreibbar sind.

130027/0123

Da die Bewegungen des Fräasers gegenüber dem eingespannten Rohschlüssel grössenmässig ziemlich beschränkt sind, ist es nach einem weiteren Merkmal der Erfindung aus fertigungstechnischen und wirtschaftlichen Gründen günstig, dass der Fräser von einem feststehend am Maschinengestell gelagerten Motor über ein ebenfalls feststehend angeordnetes Getriebe und eine Gelenk- bzw. Kardanwelle antreibbar ist. Dabei kann das Getriebe als schaltbares Wendegetriebe ausgebildet sein, um den Drehsinn des Fräasers je nach der Querschnittsform des Rohschlüssels derart zu wählen, dass der Fräsgrat auf einer möglichst ebenen und/oder vorspringenden Schlüsselfläche liegt und infolgedessen leicht entfernbar ist.

Die erfindungsgemässe Schlüsselfräsmaschine kann zur Herstellung von Schlüsseln mit einer Kerbenreihe einen einzigen auf einer Seite der Spannvorrichtung für den Rohschlüssel angeordneten Fräser, oder zur Herstellung von Schlüsseln mit zwei Kerbenreihen zwei auf entgegengesetzten Seiten der Spannvorrichtung angeordnete Fräser aufweisen. In diesem letzteren Fall können beide Fräser von einem einzigen, fest am Maschinengestell gelagerten Motor über ein Getriebe mit zwei Ausgängen und über je eine Gelenk- bzw. Kardanwelle unabhängig voneinander angetrieben werden.

Weitere Merkmale und Vorteile der Erfindung ergeben sich aus den Unteransprüchen und der nachstehenden Beschrei-

130027/0123

bung eines in der Zeichnung dargestellten Ausführungs=beispiels. Es zeigt:

Fig. 1 eine schematische Draufsicht auf eine erfindungs=gemässe automatische Schlüsselfräsmaschine für Schlüssel mit zwei Kerbenreihen.

Fig. 2, 3 und 4 drei verschiedene, mit einer erfindungs=gemässen Schlüsselfräsmaschine herstellbare Schlüssel=kerbungen.

Fig. 5 eine Draufsicht auf den Kreuzschlitten einer Fräseereinheit der Schlüsselfräsmaschine nach Fig. 1, teilweise im Schnitt.

Fig. 6 und 7 zwei Querschnitte durch den Kreuzschlitten einer Fräseereinheit nach den Schnittlinien VI-VI und VII-VII der Fig. 5.

Fig. 8 und 9 zwei verschiedene Querschnittsformen des Rohschlüssels, die unterschiedliche Drehrichtungen des Fräasers erfordern.

Fig. 10 eine Vorderansicht des schaltbaren Wendege=triebes für den Antrieb der Fräser.

Fig. 11 einen vertikalen Querschnitt durch das Wende=getriebe nach Fig. 10.

130027/0123

ORIGINAL INSPECTED

Fig. 12 einen Teil des Wendegetriebes nach Fig. 10 und 11, im Schnitt.

Fig. 13 einen vertikalen Längsschnitt durch die Schlüsselfräsmaschine nach Fig. 1, insbesondere durch die Spannvorrichtung, die Ein- und Ausschubvorrichtung und die Beschickungsvorrichtung dieser Maschine.

Fig. 14 eine schematische Vorderansicht der Spannvorrichtung für den Rohschlüssel.

Fig. 15 einen Querschnitt durch die Spannvorrichtung, in grösserem Masstab.

Die dargestellte automatische Schlüsselfräsmaschine weist eine Spannvorrichtung N für den zu bearbeitenden Rohschlüssel Q auf. Diese Spannvorrichtung N besteht aus einer unteren, feststehenden Spannbacke 41 und einer oberen, auf und ab bewegbaren Spannbacke 43. Der Schaft H des Rohschlüssels Q wird zwischen den beiden Spannbacken 41, 43 erfasst und springt mit seinen zu kerbenden Längsrändern seitlich von den geschlossenen Spannbacken vor.

Die untere, feststehende Spannbacke 41 ist an einem Maschinengestellteil 42 befestigt. Die obere, bewegliche Spannbacke 43 ist vorspringend an einem Spannbackenträger 47 befestigt, der auf und ab verschiebbar

130027/0123

in einer vertikalen Führung 48 des Maschinengestellteils 42 gelagert und über einen Schwinghebel 50 bewegbar ist. Der Schwinghebel 50 erstreckt sich in der Längsrichtung des eingespannten Rohschlüssels Q und ist um eine quergerichtete Drehachse 51 schwenkbar im Maschinengestellteil 42 gelagert. Das hintere, d.h. dem Spannbackenträger 47 entgegengesetzte Ende des Schwinghebels 50 ist mit einer Gleitrolle 52 versehen und wird von einem darunterliegenden Betätigungsschieber 53 mit teilweise abgeschrägter Oberfläche abgestützt. Das hintere Ende des Schwinghebels 50 wird dabei von einem darüberliegenden, federbelasteten Stößel 56 dauernd nach unten gegen den Betätigungsschieber 53 gedrückt. Der Betätigungsschieber 53 ist in einer Führung 54 im Maschinengestellteil 42 verschiebbar gelagert und wird von einem hydraulischen oder pneumatischen Zylinder 55 verstellt. Wenn die Gleitrolle 52 des Schwinghebels 50 von dem vollen Teil des Betätigungsschiebers 53 abgestützt wird, ist der Spannbackenträger 47 abgesenkt und das Spannbackenpaar 41,43 geschlossen, wie insbesondere in Fig. 13 und 15 dargestellt ist. Wenn der Betätigungsschieber 53 so verstellt wird, dass sein abgeschrägter Oberflächenteil unter die Gleitrolle 52 des Schwinghebels 50 zu liegen kommt, wird der Spannbackenträger 47 angehoben und das Spannbackenpaar 41,43 geöffnet. Eine einstellbare Anschlagsschraube 49 begrenzt den Aufwärtshub des Spannbackenträgers 47. Der Zustand (offen oder geschlossen) der Spannvorrichtung N d.h. des Spannbacken-

130027/0123

ORIGINAL INSPECTED

paares 41,43 für den Rohschlüssel Q wird der numerischen Steuervorrichtung der Schlüsselfräsmaschine von einem elektrischen Schalter 57 signalisiert, der abwechselnd mit einem verjüngten Abschnitt 58 und mit dem vollen Querschnitt des Betätigungsschiebers 53 zusammenwirkt.

Die erfindungsgemässe Schlüsselfräsmaschine kann für die Herstellung von Schlüsseln mit einer einzigen Kerbenreihe d.h. mit einem einzigen gekerbten Längsrand oder - wie im dargestellten Fall - für die Herstellung von Schlüsseln mit zwei Kerbenreihen, d.h. mit zwei entgegengesetzten gekerbten Längsrändern ausgebildet sein. In dem, in Figur 1 und den Figuren 5 bis 15 dargestellten Ausführungsbeispiel wird der Schaft H des Rohschlüssels Q derart mittig von den Spannbacken 41 und 43 erfasst, dass beide, zu kerbende Längsränder des Rohschlüssels Q frei vorspringen. Ausserdem ist auf jeder Seite der Spannvorrichtung N eine Fräseinheit mit je einem Fräser F1 bzw. F2 angeordnet. Die Drehachse jedes Fräasers F1 bzw. F2 ist parallel zur Längsachse des in der Spannvorrichtung N zwischen den Spannbacken 41,43 festgehaltenen Rohschlüssels Q. Dabei ist jeder Fräser F1 bzw. F2 auf einer Fräerspindel befestigt, die in einem neben der Spannvorrichtung N angeordneten Fräerspindellager M1 bzw. M2 drehbar gelagert ist. Die Spannbacken 41,43 sind seitlich eingewölbt, damit die Fräser F1 und F2

130027/0123

2951065

ungestört die zugeordneten Längsränder des eingespannten Rohschlüssels Q erreichen können, wie insbesondere in Fig. 15 dargestellt ist.

Jedes Fräuserspindellager M1 bzw. M2 ist auf einem Kreuzschlitten gelagert, der einen in der Längsrichtung des eingespannten Rohschlüssels Q auf einem Teil 8 des Maschinengestells 42 hin und her verschiebbaren Unterschlitten S1' bzw. S2' und einen quer zur Längsrichtung des eingespannten Rohschlüssels Q auf dem Unterschlitten S1' bzw. S2' hin und her verschiebbaren Oberschlitten S1 bzw. S2 aufweist. Das Fräuserspindellager M1 bzw. M2 ist auf dem Oberschlitten S1 bzw. S2 befestigt.

Im Einzelnen ist der Unterschlitten S1' bzw. S2' auf dem Maschinengestellteil 8 in Gleitführungen 102 verschiebbar gelagert, die durch quergerichtete elastische Vorspannlieder 103 spielfrei gehalten werden. An einem nach hinten vorspringenden Gehäuseteil 104 des Unterschlittens S1' bzw. S2' ist ein elektrischer Schrittmotor D1' bzw. D2' befestigt, der über eine Kupplung 107 eine zu den Gleitführungen 102 des Unterschlittens S1' bzw. S2' parallele Gewindespindel 105 antreibt. Diese Gewindespindel 105 ist im Unterschlitten S1' bzw. S2' drehbar gelagert und steht mit einer entsprechenden, im Maschinengestellteil 8 festgelegten Schraubenmutter 106 im Eingriff. In ähnlicher Weise ist der Oberschlitten S1 bzw. S2 auf dem betreffenden Unterschlitten S1' bzw.

130027/0123
ORIGINAL INSPECTED

S2' in Gleitführungen 2 verschiebbar gelagert, die durch quergerichtete elastische Vorspannlieder 3 spielfrei gehalten werden. An einem seitlich vorspringenden Gehäuseteil 4 des Oberschlittens S1 bzw. S2 ist ein elektrischer Schrittmotor D1 bzw. D2 befestigt, der über eine Kupplung 7 eine zu den Gleitführungen 2 des Oberschlittens S1 bzw. S2 parallele Gewindespindel 5 antreibt. Diese Gewindespindel 5 ist im Oberschlitten S1 bzw. S2 drehbar gelagert und steht mit einer entsprechenden, im Unterschlitten S1' bzw. S2' befestigten Schraubenmutter 6 im Eingriff.

Mit Hilfe des Kreuzschlittens (Oberschlitten S1 bzw. S2 und Unterschlitten S1' bzw. S2') und der zugeordneten Antriebe (Schrittmotor D1 bzw. D2 und D1' bzw. D2' mit zugeordnetem Gewindespindelantrieb 5,6 bzw. 105,106) können die beiden Fräser F1 bzw. F2 unabhängig voneinander sowohl in der Achsrichtung der betreffenden Fräerspindel, d.h. in der Längsrichtung des eingespannten Rohschlüssels Q als auch quer dazu hin und her verschoben werden. Eine als Ausgangsstellung angenommene Endstellung des Unterschlittens S1' bzw. S2' gegenüber dem Maschinengestellteil 8 und des Oberschlittens S1 bzw. S2 gegenüber dem Unterschlitten S1' bzw. S2' ist durch einen einstellbaren Endanschlag 10 festgelegt. Bei dem in Fig. 5 dargestellten Ausführungsbeispiel besteht der Endanschlag 10 aus einem kolbenartigen Anschlagglied 113, das in

130027/0123

2951065

einer zylinderartigen, z.B. im Unterschlitten S1' vorgesehene Ausnehmung 14 verschiebbar und über eine Stange 13 mit einer Gewindespindel 12 fest verbunden ist. Die Gewindespindel 12 steht mit einer Schraubenmutter 11 im Eingriff, die z.B. am Oberschlitten S1 befestigt ist. Das dem Anschlagglied 113 entgegengesetzte, aus der Schraubenmutter 11 vorspringende Ende der Gewindespindel 12 ist mit einem haubenförmigen Betätigungsgriff 112 versehen, der die feststehende Schraubenmutter 11 umgibt und z.B. eine Skala od.dgl. aufweisen kann. Der beschriebene Endanschlag 10 legt die am weitesten in Richtung auf den eingespannten Rohschlüssel Q vorgeschobene Stellung des Oberschlittens S1 bzw. S2 gegenüber dem betreffenden Unterschlitten S1' bzw. S2' fest. Ein ähnlich ausgebildeter Endanschlag 10 ist zwischen dem Unterschlitten S1' bzw. S2' und dem Maschinengestellteil 8 vorgesehen und setzt die am weitesten in Richtung auf die Griffscheibe des eingespannten Rohschlüssels Q vorgeschobene Stellung des Unterschlittens S1' bzw. S2' gegenüber dem Maschinengestellteil 8 fest. Zwischen dem Maschinengestellteil 8 und dem Unterschlitten S1' bzw. S2' sowie zwischen den beiden Schlitten S1 bzw. S2 und S1' bzw. S2' des Kreuzschlittens sind Schutzbälge 9 od.dgl. vorgesehen.

Die beiden Fräser F1, F2 werden von einem einzigen, gemeinsamen Antriebsmotor B über ein schaltbares Wendegetriebe C und je eine Gelenk- bzw. Kardanwelle A1 bzw.

130027/0123

ORIGINAL INSPECTED

A2 angetrieben. Der Antriebsmotor B und das Gehäuse 16 des Wendegetriebes C sind auf dem Maschinengestell 1 mittig hinter der Spannvorrichtung N befestigt. In dem Gehäuse 16 des Wendegetriebes C sind zwei zueinander parallele Wellen 18 und 19 drehbar gelagert, die mit der Fräuserspindel je eines Fräasers F1 bzw. F2 über eine zugeordnete Gelenk- bzw. Kardanwelle A1 bzw. A2 verbunden sind. Auf der Welle 18 sind im Abstand voneinander zwei gleich grosse Zahnräder 20 und 120 befestigt, von denen das Zahnrad 120 dauernd mit einem auf der Welle 15 des Antriebsmotors B befestigten Ritzel 17 im Eingriff steht. Auf der anderen Welle 19 ist dagegen ein Zahnrad 22 gelagert, das mit Hilfe eines Keils 21 drehfest mit der Welle 19 verbunden, jedoch darauf längsverschiebbar ist. Der scheibenförmige Körper des Zahnrads 22 weist neben der Verzahnung eine Umfangsnut 23 auf, in die ein exzentrisch auf einem Steuergriff 25 vorgesehener Betätigungsstift 24 eingreift. Durch Verdrehung dieses drehbar im Gehäuse 16 des Wendegetriebes C gelagerten Steuergriffs 25 kann das Zahnrad 22 wahlweise abwechselnd in zwei verschiedene Stellungen auf der Welle 19 gebracht werden. In der einen, in Fig. 12 mit vollen Linien dargestellten Stellung des auf der Welle 19 verschiebbaren Zahnrads 22 steht dieses mit dem Zahnrad 22 der Welle 18 im Eingriff. Die beiden Fräser F1, F2 werden infolgedessen in entgegengesetzten Drehrichtungen angetrieben, wie in Fig. 9 mit den zugeordneten Pfeilen F1 und F2 angedeutet ist. Diese

130027/0123

2951065

gleichsinnige Drehung der beiden Fräser F1,F2 ist bei dem in Fig. 9 dargestellten Ausführungsbeispiel günstig, um die Fräsgrate beider Fräser F1,F2 auf der selben, durchgehenden, ebenen Fläche des profilierten Schlüsselschafts H'' nach Fig. 9 zu erhalten. Wenn dagegen das verschiebbare Zahnrad 22 der Welle 19 in die in Fig. 12 gestrichelt dargestellte Stellung gebracht wird, kommt es mit dem auf der Motorwelle 15 befestigten Ritzel 17 in Eingriff. Die beiden Fräser F1 und F2 werden dann in der selben Drehrichtung angetrieben, wie in Fig. 8 mit den entsprechend bezeichneten Pfeilen F1 und F2 angedeutet ist. Dadurch werden die Fräsgrate der beiden Fräser F1,F2 auf zwei entgegengesetzten ebenen Flächen des besonders profilierten Schlüsselschaft H' nach Fig. 8 erhalten und können leichter entfernt werden.

Die Rohschlüssel Q werden der Schlüsselfräsmaschine in Form eines Schlüsselstapels in einem vertikalen Schacht 29 zugeführt, wie insbesondere in Fig. 13 dargestellt ist. Im Bereich dieses Schachtes 29 sind in drei übereinanderliegenden Ebenen drei Greifschieber 30,31 und 32 angeordnet, von denen jeder jeweils einen Schlüssel Q seitlich aus dem Schlüsselstapel ausstösst, vorübergehend in eine neben dem Schacht 29 angeordnete Bearbeitungsvorrichtung einführt und dann wieder in den Schlüsselstapel zurückzieht. Darauf sinkt der ganze Schlüsselstapel um einen einer Schlüsselstärke entsprechenden Schritt ab, wobei der jeweils unterste

130027/0123

Schlüssel in eine unter dem Schacht 29 liegende Aufnahme 34 fällt. Anschliessend wiederholt jeder Greifschieber 30, 31 und 32 seine Aus- und Einschiebebewegung mit dem neu in seinen Arbeitsbereich abgesunkenen Schlüssel Q des Schlüsselstapels.

In dem dargestellten Ausführungsbeispiel überführt der oberste, senkrecht zur Zeichenebene der Fig. 13 bewegte Greifschieber 30 jeweils einen Rohschlüssel Q aus dem Schlüsselstapel vorübergehend in eine danebenliegende, an sich bekannte Prägevorrichtung L, in der die Schlüsselnummer bzw. eine der Schlüsselkerbung entsprechende Bezeichnung in dem in Fig. 2 bis 4 mit R bezeichneten Bereich der Griffscheibe des Rohschlüssels Q geprägt wird. Der mittlere Greifschieber 31 schiebt den Rohschlüssel Q bei angehobener oberer Spannbacke 43 auf die feststehende, untere Spannbacke 41 der Spannvorrichtung N. Nach dem Absenken der oberen Spannbacke 43 wird in weiter unten beschriebenen Weise die Schlüsselkerbung eingeschnitten und der zugeordnete, in Fig. 2 bis 4 dargestellte Schlüsselanschlag U auf ein genau zur Schlüsselkerbung passendes Mass nachbearbeitet. Anschliessend wird die obere Spannbacke 43 angehoben und der Greifschieber 31 zieht den gekerbten Schlüssel aus der Spannvorrichtung N aus. Der unterste Greifschieber 32 schiebt den gekerbten Schlüssel vorübergehend in eine an sich bekannte, unter der Spannvorrichtung N angeordnete Entgratvorrichtung S, in der

130027/0123

die beim Fräsen der Schlüsselkerbung entstandenen Grate entfernt werden. Die unter dem Schacht 29 für den Schlüsselstapel angeordnete Aufnahme 34 ist an einem Schwenkarm 35 befestigt, der um eine vertikale Achse 36 drehbar auf dem Maschinengestell 1 gelagert ist. Wenn in der Aufnahme 34 ein kleiner, vorbestimmter Schlüsselstapel gebildet ist, wird diese Aufnahme 34 von dem Schwenkarm 35 in eine ebenfalls an sich bekannte Bündelvorrichtung P geschwenkt, in der die fertigen Schlüssel mit Hilfe von Schlüsselringen gebündelt werden. Die Schlüsselbündel werden dann in eine Aus-
tragstation T befördert, wo sie in Plastikbehälter od. dgl. abgelegt werden.

Die Greifschieber 30,31,32 sind an je einem Schlitten 40 befestigt, der von einem pneumatischen oder hydraulischen Zylinder 37 in Führungen hin und her verschiebbar ist. An jedem Greifschieberschlitten 40 ist ein einstellbarer Anschlag 39 befestigt, der mit Endschaltern 38 zusammenwirkt, um der numerischen Steuerung der Schlüsselfräsmaschine die Stellung des zugeordneten Greifschiebers 30 bzw. 31,32 zu signalisieren.

Die Nachbearbeitung des Schlüsselanschlags U wird mit Hilfe eines vertikalen, vor dem Spannbackenpaar 41,43 in entsprechenden Führungen des Maschinengestellteils 42 auf und ab verschiebbaren Räumwerkzeugs 44 vorgenommen. Da die dargestellte Schlüsselfräsmaschine für

130027/0123

Schlüssel mit zwei Kerbreihen bestimmt ist, die auch zwei je einer Kerbreihe zugeordnete Schlüsselanschlätze U aufweisen, ist das Räumwerkzeug 44 gabelförmig ausgebildet, d.h. es weist zwei parallele Schenkel auf, zwischen denen der Schlüsselschaft H durchtreten kann. Das Räumwerkzeug 44 wird durch einen pneumatischen oder hydraulischen Zylinder 45 bewegt und wirkt mit zwei Endschaltern 46 zusammen, die der numerischen Steuervorrichtung der Schlüsselfräsmaschine die Stellung des Räumwerkzeugs 44 signalisieren. Im allgemeinen befindet sich das Räumwerkzeug 44 zunächst in einer angehobenen Ausgangsstellung und wird nach der Einführung eines Rohschlüssels Q in die Spannvorrichtung N abgesenkt. Die Schlüsselanschlätze U werden mit diesem einzigen Arbeitshub des Räumwerkzeugs 44 zugerichtet. Das Räumwerkzeug 44 bleibt dann in seiner abgesenkten Stellung während dem anschliessenden Einschneiden der Schlüsselkerbung stehen.

Das Einschneiden der Schlüsselkerbung soll anhand der Figuren 2 bis 4 näher beschrieben werden. In diesen Figuren sind zwar Schlüssel mit einer einzigen Kerbreihe dargestellt, doch auch solche Schlüssel können mit der vorstehend beschriebenen Schlüsselfräsmaschine hergestellt werden, da die beiden Fräser F1 und F2 unabhängig voneinander bewegt und angetrieben werden können. Bei Schlüsseln mit zwei Kerbreihen erfolgt die Bearbeitung doppelseitig und vorzugsweise gleich-

130027/0123

zeitig, jedoch grundsätzlich in der selben nachstehend beschriebenen Weise.

Zum Einschneiden der Schlüsselkerbung Z auf einer Seite des Schlüsselschafts H nach Fig. 2 wird der zugeordnete, vom betreffenden Längsrand des Schlüsselschafts H zurückgezogenen Fräser z.B. der Fräser F1 zuerst in eine der ersten Schlüsselkerbe X1 entsprechende Arbeitsstellung gebracht und dann quer zur Längsrichtung des Rohschlüssels so weit zu diesem hin vorgeschoben, dass er die Schlüsselkerbe X1 mit der gewünschten Tiefe einschneidet. Anschliessend wird der Fräser F1 wieder in Querrichtung so weit vom Schlüsselschaft H weg zurückgezogen, dass er aus der soeben eingeschnittenen Kerbe X1 austritt. Dann wird der Fräser F1 in der Längsrichtung des Rohschlüssels Q bis zur Stellung der nächstfolgenden einzuschneidenden Kerbe X2 verstellt und wieder quer zum Schlüsselschaft H zu diesem hin entsprechend der gewünschten Kerbtiefe vorgeschoben. Nach dem Einschneiden der zweiten Kerbe X2 entfernt sich der Fräser F1 wieder in Querrichtung vom Schlüsselschaft und wird in die nächstfolgende Arbeitsstellung zum Einschneiden der dritten Schlüsselkerbe X3 eingestellt. Der beschriebene Arbeitsvorgang des Fräsers wird zum Einschneiden der Schlüsselkerben X3, X4 und X5 wiederholt.

Ausser der Schlüsselkerbung Z nach Fig. 2 können auch

130027/0123

Schlüsselkerbungen Z' der in Fig. 3 dargestellten Art geschnitten werden, bei denen die Schlüsselkerbung Z' nicht nur verschieden tiefe bzw. weite Kerben X1, X3, X5, sondern auch zwischen den Kerben X1 und X3 bzw. X3 und X5 liegende, gerade Randabschnitte X2' und X4' des Schlüsselschaft H aufweist, die verschieden tief gegenüber dem ursprünglichen Schaftrand des Rohschlüssels abgesetzt sind. In solchen Fällen wird der Fräser F1 z.B. nach dem Einschneiden der Schlüsselkerbe X1 bzw. X3 nur so weit quer zum Schlüsselschaft H von diesem zurückgezogen, bis er die Höhe des anschließenden, geraden Randabschnitts X2' bzw. X4' erreicht. Beim Verfahren des Fräasers F1 in der Längsrichtung des Rohschlüssels Q bis zur nächstfolgend einzuschneidenden Schlüsselkerbe X3 bzw. X5 werden die geraden Randabschnitte X2' bzw. X4' erzeugt. Die Schlüsselkerbung Z' nach Fig. 3 unterscheidet sich also von der Schlüsselkerbung Z nach Fig. 2 dadurch, dass die Zähne K der Schlüsselkerbung Z abgeflacht sind d.h. während der entsprechenden Längsverstellung des Fräasers F1 von diesem abgetragen werden.

Es ist selbstverständlich auch möglich, mit der Schlüsselfräsmaschine nach Fig. 1 und 5 bis 15 auch Schlüsselkerbungen Z'' der in Fig. 4 dargestellten Art herzustellen. Es handelt sich dabei um Schlüsselkerbungen Z'', die eine Kombination der Schlüsselkerbung Z nach Fig. 2 und der Schlüsselkerbung Z' nach Fig. 3

130027/0123

2951065

darstellen. Zum besseren Vergleich ist das Profil der Schlüsselkerbung Z'' nach Fig. 4 mit gestrichelten Linien "y" in Fig. 2 eingetragen.

Die vorstehend beschriebene Schlüsselfräsmaschine ist als vollautomatische Maschine ausgebildet und wird in allen ihren Funktionen von einer numerischen, programmierbaren, datenverarbeitenden Steuervorrichtung E,F gesteuert. Insbesondere werden von dieser Steuervorrichtung die Schrittmotoren D1,D2,D1',D2' der Kreuzschlitten der beiden Fräser F1,F2, die Spannvorrichtung N, das Räumwerkzeug 44, die Greifschieber 30,31,32, die Prägevorrichtung L, der Schwenkarm 35 und die Bündelvorrichtung P gesteuert. Auch der Antriebsmotor B der Fräser F1,F2 kann automatisch von der Steuervorrichtung E,F ein- und ausgeschaltet werden. Dabei kann die Steuervorrichtung entweder für eine der drei Kerbungsarten Z,Z',Z'' nach den Figuren 2,3 und 4, oder für zwei bzw. alle drei dieser Kerbungsarten ausgelegt sein. In den beiden letzteren Fällen wird die jeweils gewünschte Kerbungsart mit Hilfe eines entsprechenden Wählwerks eingestellt.

Die Programmierung der numerisch gesteuerten Schlüsselfräsmaschine kann manuell erfolgen. Die Arbeitsinformationen können bei jeder Programmierung neu in die Steuervorrichtung E,F eingegeben und vorübergehend in einem nach dem Abschluss des Arbeitsablaufs bzw. der

130027/0123

Fertigung der programmierten Stückzahl löschraren Speicher gespeichert werden. Es ist jedoch auch möglich, eine begrenzte Anzahl der manuell eingegebenen Programme beliebig lang zu speichern und nach Bedarf abzurufen. Die Steuervorrichtung kann jedoch statt der manuellen Programmierung oder in Verbindung damit auch einen Speicher mit einem oder mehreren, festen, durch die Eingabe der Arbeitsinformationen bzw. einer einfachen Bezeichnung abrufbaren Programmen aufweisen. Zur Änderung dieser fest gespeicherten Programme ist die Auswechslung von Schaltungsteilen der Steuervorrichtung erforderlich.

Die Informationseingabe kann mit Hilfe einer Tastatur oder eines Informationsträgers z.B. eines Lochstreifens oder eines Magnetbands erfolgen.

Die Steuervorrichtung weist auch manuell betätigte Steuerorgane für die Ver- bzw. Einstellung der verschiedenen beweglichen Bauteile der Schlüsselfräsmaschine, insbesondere der beiden Fräser F1, F2 auf. Vor dem Einschalten des automatischen Fertigungsprogramms werden die Fräser F1, F2 in die erforderliche Ausgangsstellung gebracht, insbesondere mit der Stellung der ersten einzuschneidenden Schlüsselkerbe der zugeordnete Kerbenreihe im Bereich der Schaftspitze des eingespannten Rohschlüssels Q ausgerichtet und bis zur Anlage gegen den entsprechenden Längsrand des Roh-

130027/0123

2951065

schlüssels vorgeschoben oder in die von den Endanschlüssen 10 bestimmten Stellungen zurückgezogen. Mit dem eingegebenen Kerbungsprogramm wird zunächst ein Probeschlüssel hergestellt, der von der Spannvorrichtung N abgenommen und auf Massgenauigkeit kontrolliert wird. Wenn der Probeschlüssel den gestellten Erfordernissen entspricht, wird das Fertigungsprogramm eingeschaltet und durchgeführt. Entspricht dagegen die Kerbung des Probeschlüssels nicht den vorgeschriebenen Toleranzen, wird die Ausgangsstellung der Fräser F1, F2 in der Längs- bzw. Querrichtung des eingespannten Rohschlüssels abgeändert und nachgestellt. Dazu werden die Schrittmotore D1 bzw. D2 oder D1' bzw. D2' mit Hilfe von manuell ausgelösten Steuerimpulsen um einen dem gewünschten Verschiebungsweg der Fräser entsprechenden Winkelbetrag gedreht. Jedem Steuerimpuls eines Schrittmotors entspricht z.B. ein Verschiebungsweg von 1/100 mm des zugeordneten Schlittens S1 bzw. S2 oder S1' bzw. S2'. Die Ausgangsstellung der Fräser F1, F2 kann also mit Hilfe einer genau abgemessenen Impulsanzahl mit grosser Präzision nachgestellt werden. Anschliessend wird das automatische, dem eingestellten und erprobten Kerbungsprogramm entsprechende Fertigungsprogramm eingeschaltet.

Das Bedienungspult der numerischen, programmierbaren, datenverarbeitenden Steuervorrichtung weist ein Wahlwerk für die Anzahl der mit der selben Kerbung auszuführenden Schlüssel und ein Wahlwerk für die Anzahl

130027/0123
ORIGINAL INSPECTED

der zu einem Bündel zusammenzuschliessenden Schlüssel sowie Anzeigevorrichtungen für die Gesamtanzahl der Schlüssel und für die Schlüsselbündelanzahl auf. Ausserdem ist auf dem Bedienungspult der Steuervorrichtung eine als Voll- oder Zehnertastatur ausgebildete, numerische Tastatur für die Eingabe der Arbeitsinformation als codierte Schlüsselkerbung bzw. für die Abrufung vom Speicherwerk der gewünschten Schlüsselkerbung, mit Abschlusstaste und Korrekturtaste vorgesehen. Schliesslich können auch Anzeigewerke für die Form bzw. die Abmessungen der einzuschneidenden Schlüsselkerbung (Kerbungsschritt und Kerbentiefe), ein Bildschirm für die Anzeige der codierten Bezeichnung der Schlüsselkerbung, eine Signalvorrichtung für die Überfüllung des Speichers, Lösch Tasten usw. vorgesehen sein.

130027/0123
Q111

-30
Leersēite

2951065

- 35 -

Nummer:
Int. Cl.³:
Anmeldetag:
Offenlegungstag:

29 51 065
B 23 C 3/35
19. Dezember 1979
2. Juli 1981

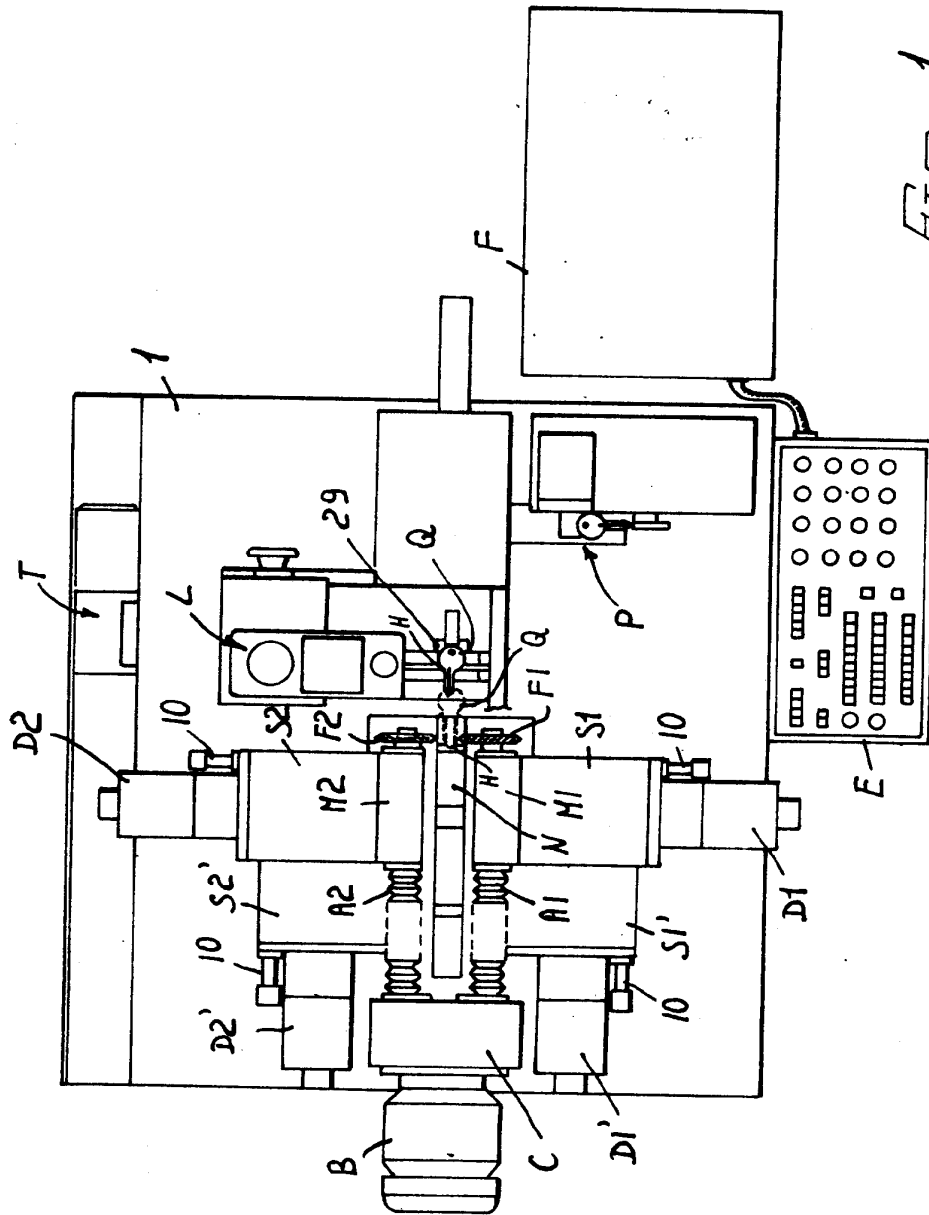


FIG. 1

F.I.M.A.T.

130027/0123

ORIGINAL INSPECTED

10 12 79

- 3A -

2951065

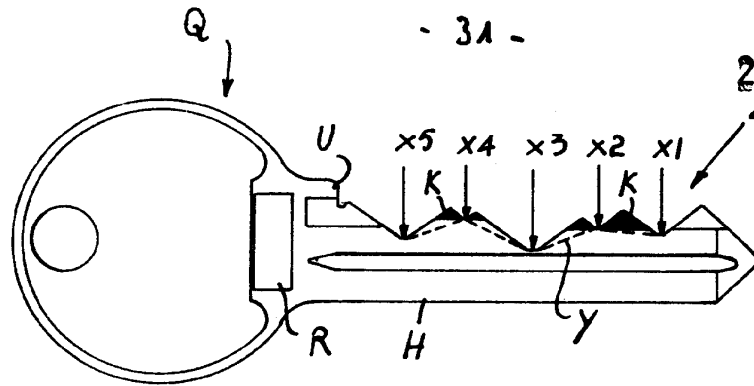


FIG. 2

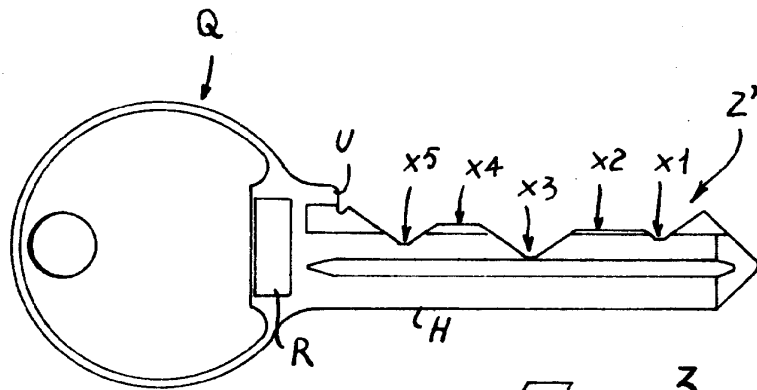


FIG. 3

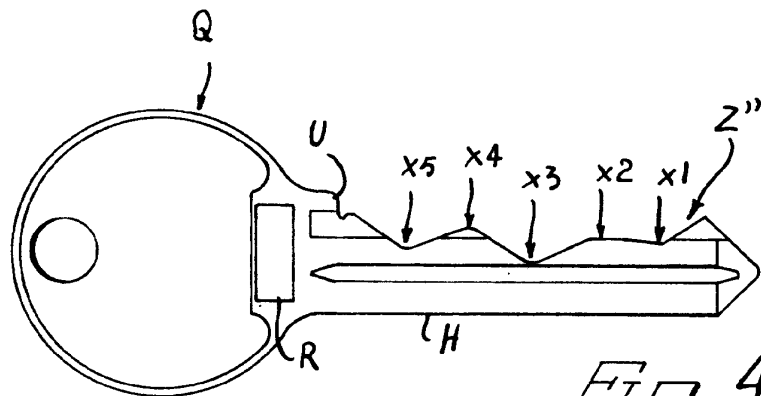


FIG. 4

130027/0123

F.T.M.A.T.

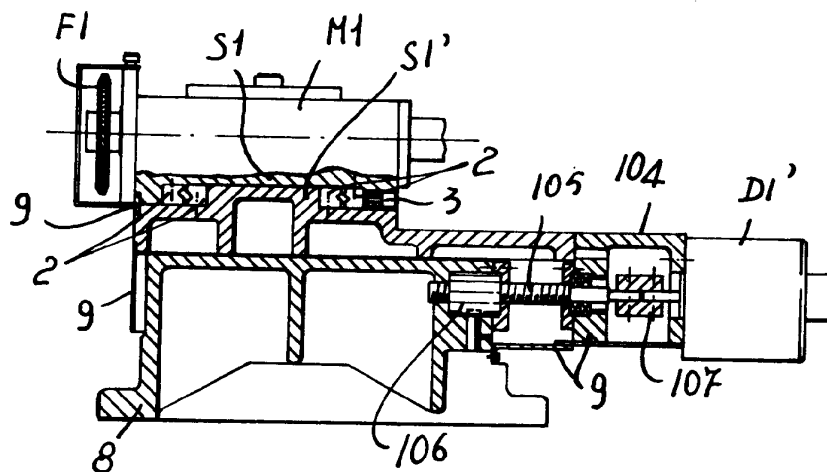


Fig. 6

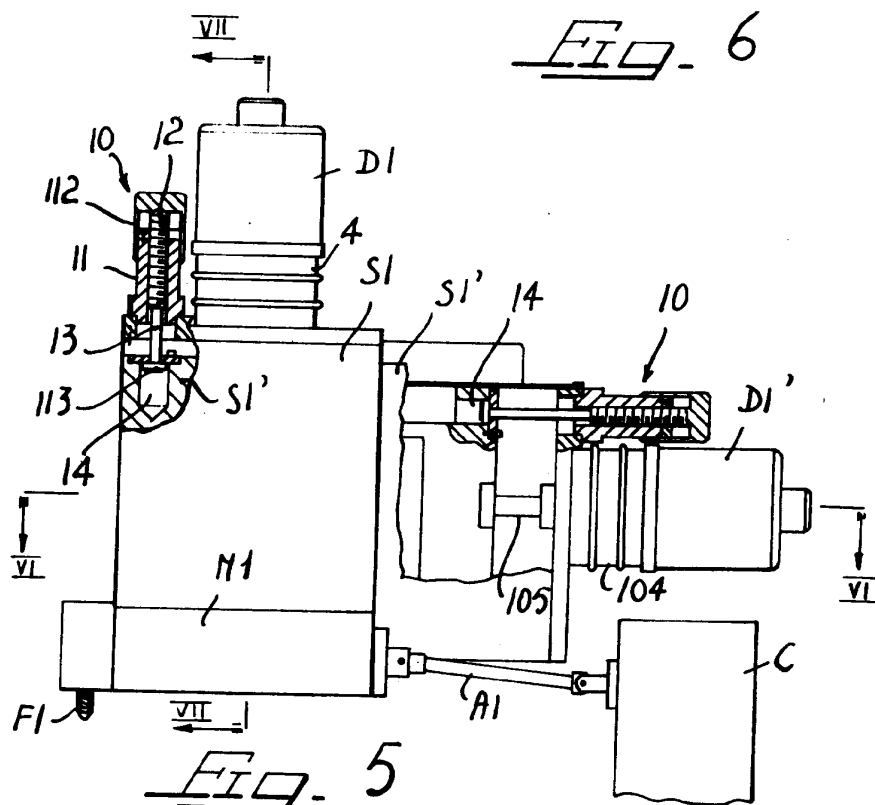
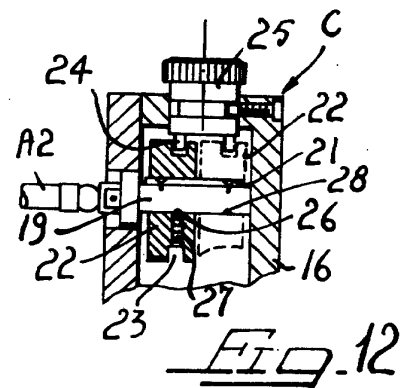
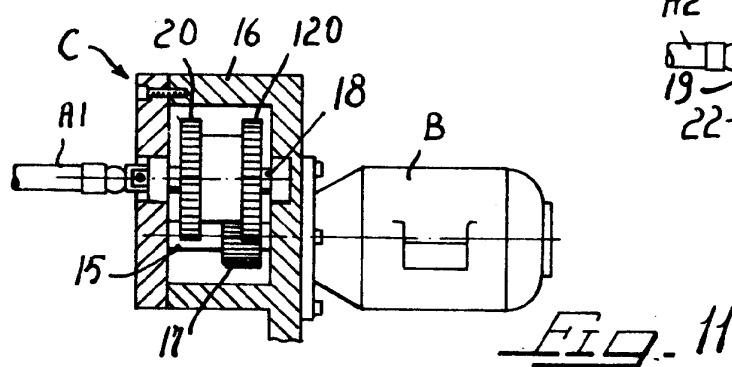
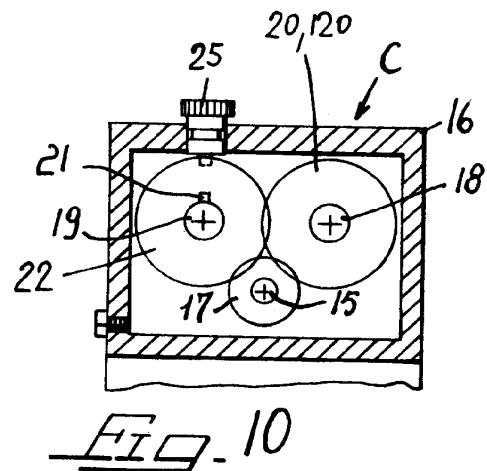
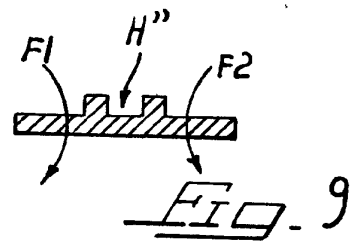
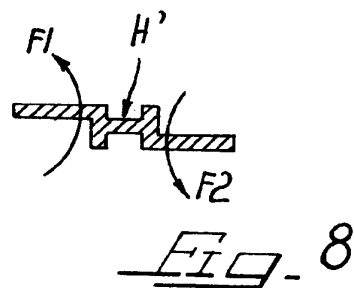
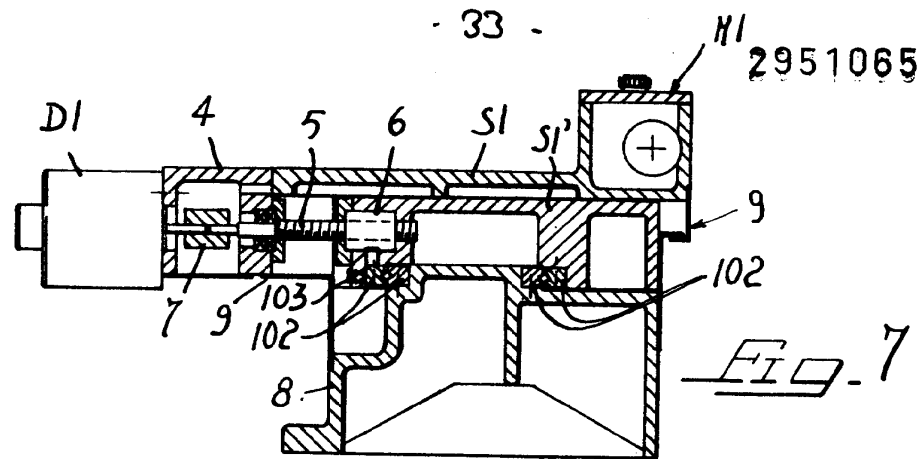


Fig. 5



130027/0123

F.I.M.A.T.

2951065

- 34 -

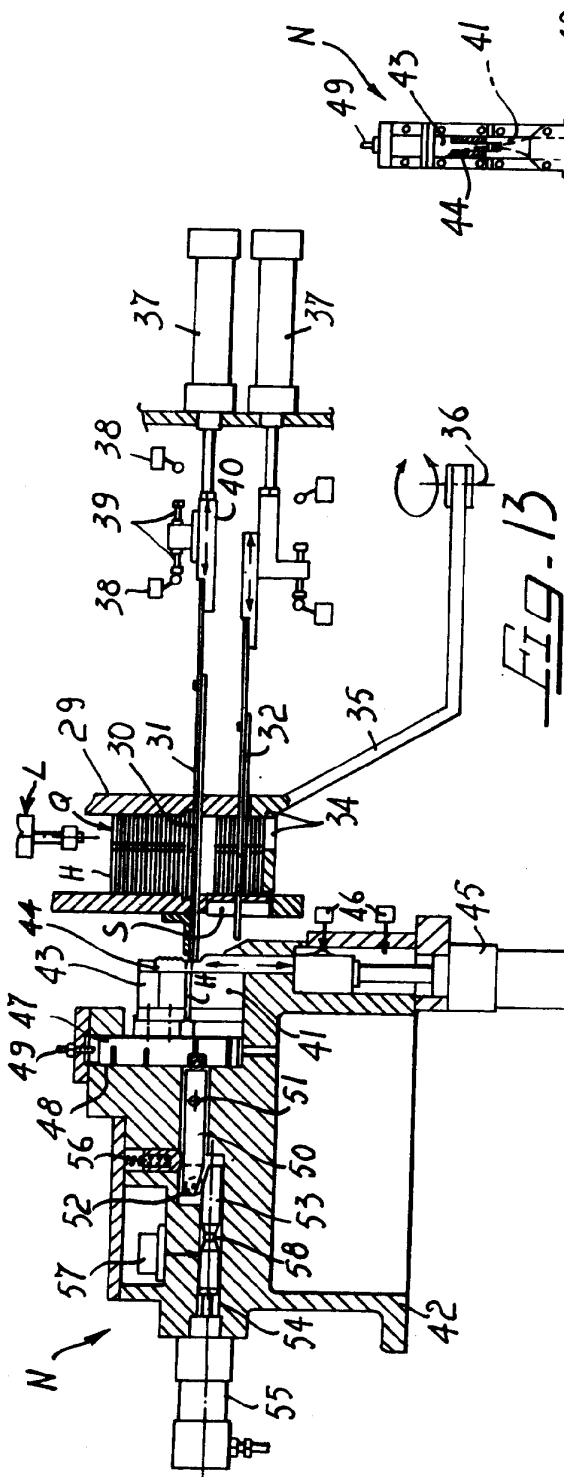


FIG. 13

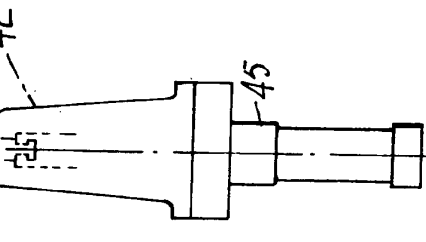


FIG. 14

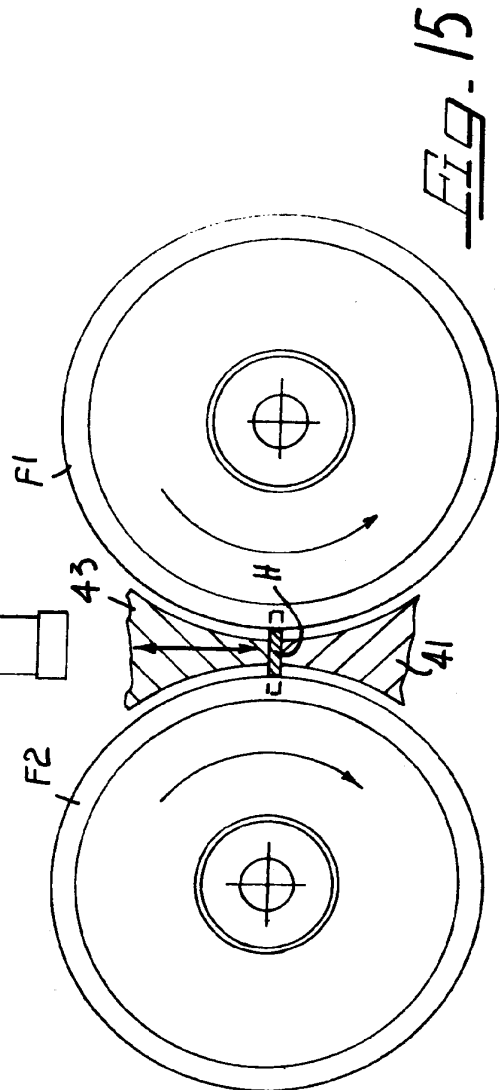


FIG. 15

F.I.M.A.T.

130027/0123
ORIGINAL NOT REPRODUCED



Espacenet

Bibliographic data: EP1976656 (A2) — 2008-10-08**KEY DUPLICATION MACHINE**

Inventor(s): BASS MICHAEL A [US]; MUTCH WILLIAM R [US]; RYAI RICHARD W SR [US]; THOMPSON CHESTER O D [US]; DRAKE ROBERT E [US]; PORRAS RANDALL A [US] ± (BASS, MICHAEL A, ; MUTCH, WILLIAM R, ; RYAI, RICHARD W., SR, ; THOMPSON, CHESTER O. D, ; DRAKE, ROBERT E, ; PORRAS, RANDALL A)

Applicant(s): HY KO PRODUCTS CO [US] ± (HY-KO PRODUCTS COMPANY)

Classification: - international: B23C1/16; B23C3/35; B23Q17/20; G06K9/20; G06K9/46; G06K9/48
- cooperative: B23C3/35; G06K9/2036; G06K9/4661; G06K9/48; B23B2270/32; B23C2235/08; B23C2235/12; B23C2235/41; G06K2209/401; Y10T409/300952; Y10T409/301008; Y10T409/303808

Application number: EP20070709849 20070123

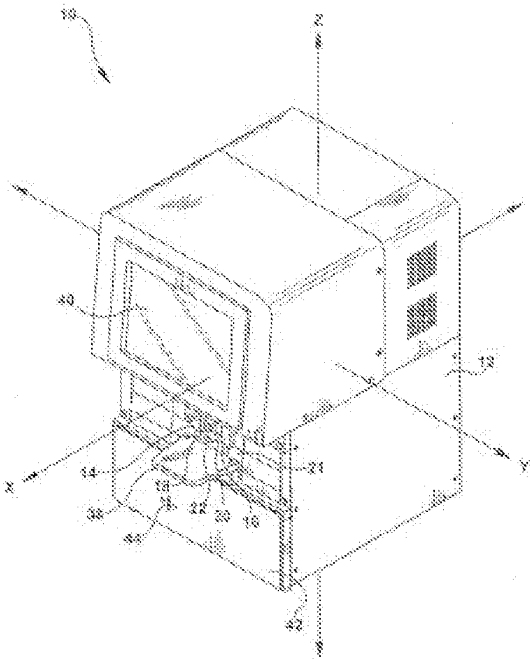
Priority number(s): WO2007US02015 20070123 ; US20060761293P 20060123

Also published as: EP1976656 (A4) EP1976656 (B1) WO2007087389 (A2) WO2007087389 (A3) US2011176881 (A1) more

Abstract not available for EP1976656 (A2)

Abstract of corresponding document: WO2007087389 (A2)

Apparatus, methods, and other embodiments associated with a key duplication machine are described. In one embodiment, an assembly for duplicating a master key includes an optical imaging device, a logic, a clamping assembly, and a cutting member. The optical imaging device is capable of capturing an optical image of at least a portion of the master key. The logic is capable of determining a key pattern of the master key from the optical image of the master key. The clamping assembly is capable of clamping a key blank and the cutting member is capable of cutting a key pattern into said key blank.



(19)



(11) Veröffentlichungsnummer:

(11) Publication number: **EP 1 976 656 A0**

(11) Numéro de publication:

Internationale Anmeldung veröffentlicht durch die
Weltorganisation für geistiges Eigentum unter der Nummer:

WO 2007/087389 (Art. 153(3) EPÜ).

International application published by the World
Intellectual Property Organization under number:

WO 2007/087389 (Art. 153(3) EPC).

Demande internationale publiée par l'Organisation
Mondiale de la Propriété Intellectuelle sous le numéro:

WO 2007/087389 (art. 153(3) CBE).



Espacenet

Bibliographic data: EP0053730 (A1) — 1982-06-16

Key recognition device.

Inventor(s): SCHMALFUSS HARALD DR; BOLZ REINHOLD; HEINZE WERNER; SINSEL FRIEDEL; SCHEIDING UWE DR; SCHNEIDER BERNHARD ± (SCHMALFUSS, HARALD, DR, ; BOLZ, REINHOLD, ; HEINZE, WERNER, ; SINSEL, FRIEDEL, ; SCHEIDING, UWE, DR, ; SCHNEIDER, BERNHARD)

Applicant(s): WEBB SERVICE GMBH [DE] ± (WEBB SERVICE GMBH)

Classification: - international: E05B17/00; G01B11/00; (IPC1-7): G01B11/00; G01B11/24
- cooperative: E05B17/0004; G01B11/00

Application number: EP19810109450 19811031

Priority number(s): DE19803044611 19801127

Also published as: EP0053730 (B1) DE3044611 (A1)

Abstract of EP0053730 (A1)

1. Key recognition device for recognizing key shaft profiles, particularly of flat keys, characterized by an illuminating optical system for illuminating said key (S) shaft (SA) essentially transversely to the longitudinal axis of said key (S) a) at least on two sides at at least one characteristic measuring location (O) of a predetermined longitudinal coordinate of said key (S) and b) at least on one side across its entire length (1) and width (h), a first imaging optical system for producing an image of the transverse profile through light (L1) diffusely reflected generally longitudinally along said key (S) from said shaft (SA) at said measuring location (O), a second imaging optical system for producing an

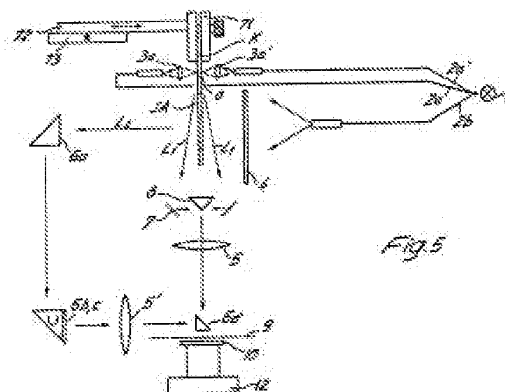


image of the longitudinal profile through light (L2) influenced by the entire said shaft (SA),; a picture recording unit connected with the output of both said imaging optical systems and an analyzer (80) comparing the measured values of said longitudinal and transverse profiles of said key shaft (SA) with stored measured values of key blanks.

(12) **EUROPÄISCHE PATENTANMELDUNG**

(21) Anmeldenummer: **81109450.7**

(51) Int. Cl.³: **G 01 B 11/24**
G 01 B 11/00

(22) Anmeldetag: **31.10.81**

(30) Priorität: **27.11.80 DE 3044611**

(43) Veröffentlichungstag der Anmeldung:
16.06.82 Patentblatt 82/24

(84) Benannte Vertragsstaaten:
AT BE CH DE FR GB IT LI LU NL SE

(71) Anmelder: **Webb Service GmbH**
Ohmstrasse 48
D-6000 Frankfurt/Main 90(DE)

(72) Erfinder: **Schmalfuss, Harald, Dr.**
Rosenring 11 a
D-6054 Rodgau 3(DE)

(72) Erfinder: **Bolz, Reinhold**
Weingartenstrasse 6
D-6093 Flörsheim-Wichern(DE)

(72) Erfinder: **Heinze, Werner**
Prieststrasse 15
D-6000 Frankfurt/Main(DE)

(72) Erfinder: **Sinsel, Friedel**
Severusstrasse 49
D-6000 Frankfurt/Main 50(DE)

(72) Erfinder: **Scheidig, Uwe, Dr.**
Oranienstrasse 34
D-6272 Niedernhausen(DE)

(72) Erfinder: **Schneider, Bernhard**
Weißbächer Wälder 12
D-6238 Hofheim(DE)

(74) Vertreter: **Heidrich, Udo, Dipl.-Phys. Dr. Jur.**
Franziskanerstrasse 30
D-8000 München 80(DE)

(54) Schlüssel-Erkenner.

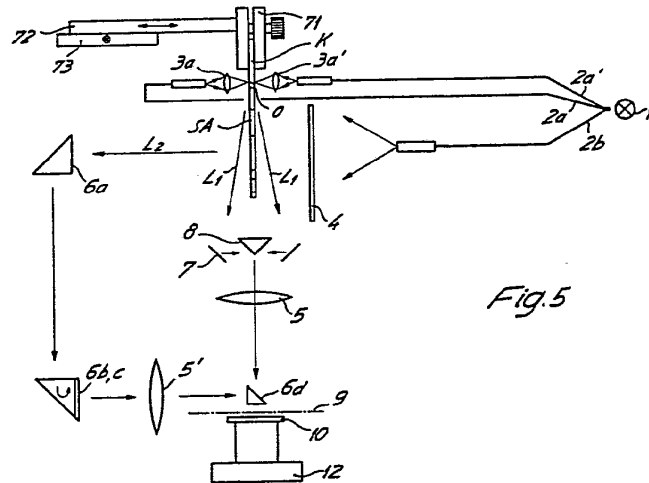
(57) Erstmals wird ein im wesentlichen vollautomatischer Schlüssel-Erkenner zum Erkennen der Schaft-Profilierung von Schlüsseln, insbesondere Flach-Schlüsseln, angegeben.

Er besitzt eine Beleuchtungs-Optik zum Beleuchten des Schlüssel(S)-Schafts (SA) im wesentlichen quer a) im wesentlichen allseitig an mindestens einem charakteristischen Meß-Ort (O) vorgegebener Längs-Koordinate und b) mindestens einseitig über seine gesamte Länge (1) und Breite (h), eine erste Abbildungs-Optik zum Abbilden des Quer-Profils über am Meß-Ort (O) vom Schaft (SA) im wesentlichen längs remittiertes Licht (L₁), und eine zweite Abbildungs-Optik zum Abbilden des Längs-Profils über von durch den gesamten Schaft (SA) beeinflusstes Licht (L₂).

EP 0 053 730 A1

./...





Schlüssel-Erkenner

Die Erfindung betrifft einen Schlüssel-Erkenner nach dem
5 Oberbegriff des Anspruchs 1.

Bei der Duplizierung von Schlüsseln, insbesondere Flach-
Schlüsseln wie "Sicherheits"- und Kfz-Schlüsseln, ist es
bis jetzt notwendig, aus einer großen Anzahl (mehr als
10 20 000) Schlüssel-Rohlinge manuell den richtigen herauszu-
suchen, was ersichtlich sehr erfahrene, geschulte Mitarbei-
ter erfordert.

Es ist daher Aufgabe der Erfindung, erstmalig einen Schlüs-
15 sel-Erkenner zu schaffen, der im wesentlichen, d.h. hin-
sichtlich der eigentlichen Erkennung, vollautomatisch ar-
beitet.

Die erfindungsgemäße Lösung dieser Aufgabe erfolgt durch
20 die Lehre nach dem kennzeichnenden Teil des Anspruchs 1.

Vorteilhafte Ausgestaltungen der Erfindung sind in den
Unteransprüchen angegeben, die grundsätzlich auch die da-
mit jeweils erreichten Vorteile erkennen lassen.

25 Besonders zweckmäßig ist die Ausgestaltung der ersten
Abbildungs-Optik nach dem Anspruch 10, wie in der Figuren-
beschreibung im einzelnen erläutert ist.

30 Demgegenüber ist bisher lediglich folgender Stand der Tech-
nik bekannt geworden:

- (vgl. DE-OS 29 16 862) ein Verfahren zum Vermessen planer zweidimensionaler Objekte bzw. z w e i dimensionaler Projektionen dreidimensionaler Körper; und
- 5 - (vgl. GB-PS 13 85 912) die optische Erkennung allein des Quer-Profils von Stahlknüppeln.

Anhand der Zeichnung wird die Erfindung beispielsweise näher erläutert. Es zeigen:

10

Fig. 1 schematisch einen Flach-Schlüssel mit zu berücksichtigenden Meßgrößen;

15

Fig. 2 ein erfindungsgemäßes Bild von Quer- und Längs-Profil eines Flach-Schlüssels;

Fig. 3 schematisch eine mechanische Schlüssel-Zwangs-Justiervorrichtung;

20

Fig. 4 schematisch eine Schlüssel-Halte- und -Transport-Vorrichtung (zusammen mit der Schlüssel-Zwangs-Justiervorrichtung von Fig. 3);

25

Fig. 5 eine schematische Gesamtansicht eines e r s t e n erfindungsgemäßen Schlüssel-Erkenner (ausgenommen die Signal-Auswertung);

30

Fig. 6 schematisch eine Bildaufnahmeeinheit mit einem Signal-Aufbereiter;

Fig. 7 Signal-Diagramme des Signal-Aufbereiters;

35

Fig. 8 einen Auswerter als Blockschaltbild; und

Fig. 9 einen Schlüssel-Erkenner nach einem
z w e i t e n Ausführungsbeispiel, das
im wesentlichen eine Vereinfachung des
Ausführungsbeispiels gemäß Fig. 5 dar-
stellt.

Zunächst seien anhand von F i g . 1 einige Begriffsbe-
stimmungen zum Schlüssel-Schaft SA eines außerdem einen Kopf
K besitzenden Schlüssels S gegeben:

- Schaftlänge l,
- Profilbreite h,
- Profilstärke d,
- Spitzenform SF,
- Fräsgegenseite FG,
- Anschlaggröße A der Fräsung,
- Profilnut N.

Nunmehr sei auf den Schlüssel-Erkenner selbst eingegangen.

Das hier beschriebene erste Ausführungsbeispiel beschäftigt
sich mit einem Flach-Schlüssel, doch ist die Erfindung auch
ohne weiteres auf andere Schlüssel, z. B. Kreuz- und Chubb-
Schlüssel, anwendbar, sofern die folgenden beschriebenen
Beispiele der Schlüssel-Zwangs-Justiervorrichtung und der
Schlüssel-Halte- und -Transport-Vorrichtung entsprechend
angepaßt werden.

Das hier erläuterte Ausführungsbeispiel des erfindungsgemäs-
sen Schlüssel-Erkenners besitzt im wesentlichen die folgen-
den Baugruppen:

- mechanische Schlüssel-Zwangs-Justiereinrichtung (Fig. 3, 4);
- Schlüssel-Halte- und -Transport-Vorrichtung (Fig. 4);

- Beleuchtungs-Optik und Abbildungs-Optiken (Fig. 5);
- Bildaufnahmeeinheit einschließlich Signalaufbereitung und Steuersignalgewinnung (Fig. 6, 7);
- Auswerter (Fig. 8).

5

Fig. 3 zeigt die mechanische Schlüssel-Zwangs-Justier-
vorrichtung.

10 Sie bringt den Schlüssel-Schaft SA in eine vorgegebene
Stellung, und zwar durch Positionierflächen 52 und 53, an
die sich der Schlüssel-Schaft SA anlegt. Diese Positionier-
flächen sind hier ausgebildet als ein Seiten-Anschlag 51
und ein Längs-Anschlag 52, der den Profil-Anschlag A ab-
stützt.

15

Die Schlüssel-Zwangs-Justiervorrichtung besitzt ferner meh-
rere an den Schlüssel-Schaft SA anlegbare Führungs-Lamellen
55 und genau so viele Andrück-Federn 57, die durch ein Ent-
riegelungsorgan 59,61 außer Wirkung bringbar sind, um den
20 Schlüssel herauszunehmen. Die Führungs-Lamellen 55 sind so
fein verteilt, daß zumindest eine von ihnen in eine Pro-
fil-Nut N des Schafts SA eingreift.

Die Führungs-Lamellen 55 stellen auch sicher, daß die Schlüs-
25 sel-Achse kollinear zu optischen Haupt-Achse der Querprofil-
Abbildung liegt (vgl. dazu weiter unten).

Fig. 4 zeigt (in verkleinertem Maßstab) noch einmal die
mechanische Schlüssel-Zwangs-Justiervorrichtung, nunmehr
30 aber zusammen mit einer Schlüssel-Halte- und -Transport-Vor-
richtung 70, die den Schlüssel S haltet und den Schlüssel-
Schaft SA in die Meß-Stellung transportiert, nachdem sie
ihn von der Schlüssel-Zwangs-Justiervorrichtung 50 übernom-
men hat. Sie besitzt zwei Klemmbacken 71, die den Schlüssel-

Kopf K halten, und zwei geradegeführte Schieber 72 und 73, die (in nicht gezeigter Weise) feststellbar sind. Der Schieber 72 ist in Richtung der Profil-Stärke-Achse, der Schieber 73 in Richtung der Profil-Breiten-Achse beweglich.

5

Mit dem Schieber 72 ist es auch möglich, Schlüssel mit asymmetrischem Kopf (bezüglich des Seiten-Anschlags 51) zu halten.

10 F i g . 5 zeigt zunächst die Beleuchtungs-Optik.

Sie besitzt eine Lichtquelle 1, Lichtleit-Faserbündel 2a, a', b, Zylinder-Linsen 3a, a' und eine Mattscheibe 4.

15

Das Licht der Lichtquelle 1, die z. B. eine 150-W-Halogen-Lampe sein kann, wird auf die Faserbündel 2a, a', b fokussiert.

20 Das Faserbündel 2b dient zur Schattenriß-Beleuchtung des Schlüssel-Schafts SA, während die Bündel 2a, a' für ein Lichtschnittverfahren benötigt werden, wozu ihre Austrittsflächen als Lichtspalte ausgebildet sind (was schematisch angedeutet ist), so daß sie als Querschnittswandler wirken.

25 Das Licht von den Austrittsspalten der Faserbündel 2a und 2a' wird über die vorzugsweise verwendeten Zylinder-Linsen 3a und a' an den Meß-Ort O links und rechts auf die Schaft-Oberfläche als schmales Lichtband projiziert, das dem Profilverlauf folgt.

30

Das Faserbündel 2b beleuchtet die Mattscheibe 4, die sich vor dem Schaft SA befindet.

Fig. 5 zeigt ferner zwei Abbildungs-Optiken, die das Bild von Quer- und Längs-Profil gemäß Fig. 2 erzeugen.

Eine erste Abbildungs-Optik erfaßt das Quer - Profil
5 als am Meß-Ort O remittiertes Licht L_1 der Lichtbänder durch Abbilden über eine Linse 5 in eine Bildebene 9 (Fig. 2). Die optische Achse der Linse 5 ist kollinear mit der Schlüssel-Längsachse. Ein derartiger Aufbau ist besonders einfach, da das gesamte Quer-Profil auf einmal abgebildet wird,
10 außerdem bleibt das Quer-Profil in seinen Proportionen ohne Verzerrungen erhalten. Andererseits werden aber hohe Anforderungen an die Lichtempfindlichkeit und den dynamischen Bereich des opto-elektrischen Sensors gestellt. Schließlich dürfen die Schlüssel nicht gegenüber ihrer Längs-Achse
15 verbogen sein.

Diese Schwierigkeiten werden weitgehend überwunden, wenn die Lichtbänder von den Faserbündeln 2a, 2a' unter einem von der optischen Haupt-Achse abweichenden Winkel betrachtet werden, nämlich mittels der Spiegel-Kombination 7, 7',
20 8, die die beiden Teil-Bilder wieder vereinigt. Das abgebildete Quer-Profil ist jetzt allerdings perspektivisch verzerrt.

25 Ein Schattenriß L_2 des L ä n g s - Profils wird über Prismen 6a - d so umgelenkt bzw. sein Bild um 90° gedreht, daß es über die Linse 5' in die gemeinsame Bildebene 9 abgebildet wird (Fig. 2).

30 Fig. 6 zeigt genauer die Bildaufnahmeeinheit, die in Fig. 5 nur angedeutet ist.

Die Bildaufnahmeeinheit besitzt eine 256-pixel(Bildelement)-CCD-Zeile 10, eine Aufnahme-Elektronik 11, einen Schlitten 12,

einen Gleichstrommotor 13, eine Rutschkupplung 14, eine Spindel 14a, eine Teilkreisscheibe 15, eine Diode 16 zum Lesen der Teilkreisscheiben-Markierungen, eine Synchronisier-Logik 17 sowie Endschalter 18 bis 21.

5

Die CCD-Zeile 10 wird als opto-elektrischer Sensor gewählt, da sie besonders einfach im Aufbau ist. Sie ist auf dem Schlitten 12 so montiert, daß sie die Bildebene 9 gemäß F i g . 2 abtasten kann. Der Antrieb des Schlittens 12 erfolgt über die Rutschkupplung 14 durch den Gleichstrommotor 13. Der mechanische Vorschubweg wird über die Teilkreisscheibe 15, die Diode 16 und die Synchronisier-Logik 17 gemessen. Die Endschalter 18 und 19 definieren den Bildfeld-Bereich in der Bildebene 9, d.h. in diesem Bildfeld werden Informationen erwartet. Der Endschalter 20 schaltet von Vor- auf Rücklauf, der Endschalter 21 ist der Endabschalter für den Schlitten 12. Damit ist dann die Bildaufnahme beendet.

Die analogen elektrischen Signale der CCD-Zeile 10 werden mit Hilfe eines Tiefpass-Filters 22, eines Schmitt-Triggers 23 sowie einer Stufe 24 zur Differenzierung mit Einweg-Gleichrichtung und Pulsformung so aufbereitet, daß danach je CCD-Zeile 10 nur noch zwei Zahlenwerte für das Quer-Profil und ein Zahlenwert für das Längs-Profil zu verarbeiten sind. F i g . 7 zeigt diese Signal-Aufbereitung für das Quer-Profil.

Die Aufnahme-Elektronik 11, die Verarbeitungs-Elektronik 17 und die Endschalter 18 - 21 erzeugen Synchron-Signale, die in den Auswerter 80 gemäß F i g . 8 eingespeist werden, die jetzt näher erläutert sei.

Die zwar binären, jedoch noch analogen aufbereiteten Signale vom Signal-Aufbereiter 30 werden in einer Stufe 81 in digitale Signale umgesetzt und zwischengespeichert. Der so gewonnene Meßgrößen-Satz beschreibt die Konturen von Quer- und Längs-Profil, die dann im nachgeschalteten Segmentierer 83 voneinander getrennt und in ihren Koordinaten normiert werden, so daß sie dann unabhängig von der augenblicklichen absoluten Lage in der Bildebene sind.

10 Die Stufe 85 berechnet dann aus den Kontur-Größen Schlüssel-Merkmale wie Schaftlänge, Nutzahl, Nuttiefe, Nutform, Profil-Breite, Profil-Stärke, Spitzenform, usw. (vgl. dazu auch eingangs Fig. 1) und speichert diese.

15 Einige wesentliche Merkmale davon werden in einem Bereichs-adressen-Speicher 79 zusammengefaßt, der bestimmt, in welchem Bereich des eigentlichen Speichers 89, 91 nach Schlüssel-Rohlings-Daten gesucht werden soll.

20 Der eigentliche Speicher 89, 91 ist zweigeteilt, indem Daten, die häufig benötigt werden, in einem schnellen Massenspeicher 89, z. B. einem Magnetblasenspeicher, abgespeichert sind, dagegen seltener gebrauchte Daten in einem langsamen Massenspeicher 91, z. B. einer Minikassette, um von dort
25 bei Bedarf in den schnellen Massenspeicher 89 übertragen werden zu können.

Ein den Vergleich zwischen den Daten des zu erkennenden Schlüssels und den Schlüssel-Rohlings-Daten vornehmender
30 Vergleicher 87 ist einem Entscheidungsgrößen-Glied 93 vorgeschaltet, auf das ein Schwellen-Glied 95 und eine Anzeige 97 folgen.

Toleranzen können durch einen Toleranz-Geber 77 vorgegeben
35 werden.

Der Auswerter 80 besitzt grundsätzlich zwei Betriebsarten:

In der "Lern"-Betriebsart müssen die Meßgrößen von Schlüssel-Rohlingen aufgenommen, speicherplatz-sparend codiert
5 und abgespeichert werden.

Im "Gebrauchs"-Betrieb werden dann die so gespeicherten Schlüssel-Daten mit den Meßgrößen verglichen, die jeweils
10 von einem zu duplizierenden Schlüssel gewonnen worden sind.

Schließlich sei eingegangen auf ein z w e i t e s Ausführungsbeispiel des erfindungsgemäßen Schlüssel-Erkenners, das gegenüber dem ersten Ausführungsbeispiel stark vereinfacht ist.
15

Ausweislich F i g . 9 wird ein zu erkennender Flach-Schlüssel 1' in eine Haltevorrichtung (nicht gezeigt) eingelegt. Die Schaftlänge, -dicke und -breite sowie die Form der Schaftspitze werden aus dem Schattenbild des Schlüssels
20 gewonnen. Für die Abbildung des Schlüsselprofils, d.h. Lage, Anzahl und Form der Nuten, wird ein inkohärentes Lichtschnittverfahren angewendet. Als Lichtquelle dient eine konventionelle Halogenlampe 2'. Über Lichtleitfasern 3' und 4' werden zwei Spalte 5' und 6' beleuchtet und über zwei
25 Linsensysteme 7' und 8' links und rechts auf den zu untersuchenden Schlüssel 1' in der Höhe der Anschlagsfräsung abgebildet. Das von der Schlüsseloberfläche ausgehende remittierte Licht wird von einem Abbildungslinsensystem 9', dessen optische Achse kollinear zur Schlüssellängsachse
30 ist, auf die Kathode einer Fernsehkamera 10' abgebildet und dann auf einem Monitor 11' dargestellt.

670-32.413Pn-Hd-kr

A n s p r ü c h e

5

1. Schlüssel-Erkennen zum Erkennen der Schaft-Profilierung von Schlüsseln,
- insbesondere Flach-Schlüsseln,
10 g e k e n n z e i c h n e t d u r c h
- eine Beleuchtungs-Optik zum Beleuchten des Schlüssel(S)-Schafts (SA) im wesentlichen quer
a) im wesentlichen allseitig an mindestens einem charakteristischen Meß-Ort (O) vorgegebener Längs-Koordinate und
15 b) mindestens einseitig über seine gesamte Länge (l) und Breite (h),
- eine erste Abbildungs-Optik
- zum Abbilden des Quer-Profils über am Meß-
20 Ort (O) vom Schaft (SA) im wesentlichen längs re-mittiertes Licht (L_1), und
- eine zweite Abbildungs-Optik
- zum Abbilden des Längs-Profils über von durch den gesamten Schaft (SA) beeinflusstes Licht (L_2)
25 (Fig. 1, 2, 5).

30

2. Schlüssel-Erkennen nach Anspruch 1,
dadurch gekennzeichnet,
- daß am Meß-Ort (O)
- der Schaft (SA) seine maximale Breite (h) besitzt
5 (Fig. 1).
3. Schlüssel-Erkennen nach Anspruch 2,
dadurch gekennzeichnet,
10 - daß am Meß-Ort (O)
- sich der Schaft-Anschlag (A) befindet
(Fig. 1).
- 15 4. Schlüssel-Erkennen nach einem der vorhergehenden Ansprüche,
dadurch gekennzeichnet,
- daß die Beleuchtungs-Optik besitzt:
- eine gemeinsame Lichtquelle (1) und
20 - eine Lichtleitfaser-Optik (2) mit mindestens drei Faserbündeln (2a, 2a', 2b),
- von denen zwei (2a, 2a') eine spaltförmige Licht-
austrittsfläche zur Beleuchtung des Meß-
Orts (O) aufweisen
25 (Fig. 5).
5. Schlüssel-Erkennen nach Anspruch 4,
dadurch gekennzeichnet,
30 - daß die beiden Faserbündel (2a, 2a')
- den Schaft (SA) am Meß-Ort (O) jeweils über eine
Zylinder-Linse (3a, 3a') beleuchten
(Fig. 5).

6. Schlüssel-Erkenner nach einem der vorhergehenden Ansprüche,
dadurch gekennzeichnet,
- daß die zweite Abbildungs-Optik
5 - einen Schattenriß des Schafts (SA) erzeugt
(Fig. 5).
7. Schlüssel-Erkenner nach Anspruch 6,
10 dadurch gekennzeichnet,
- daß die Beleuchtungs-Optik
- vor dem Schaft (SA) eine diesen vollständig be-
deckende Mattscheibe (4) besitzt
(Fig. 5).
- 15 8. Schlüssel-Erkenner nach einem der vorhergehenden Ansprüche,
dadurch gekennzeichnet,
20 - daß die beiden Abbildungs-Optiken
- das Quer- und das Längs-Profil des Schafts
(SA) in eine gemeinsame Bildebene (9) abbilden
(Fig. 2; 5).
- 25 9. Schlüssel-Erkenner nach einem der vorhergehenden Ansprüche,
dadurch gekennzeichnet,
- daß die erste Abbildungs-Optik
30 - eine Linse (5) kollinear zur Schaft(SA)-Längs-
achse besitzt
(Fig. 5).

10. Schlüssel-Erkennen nach Anspruch 9,
dadurch gekennzeichnet,
- daß die erste Abbildungs-Optik
- eine Spiegel-Kombination besitzt:
5 - zwei symmetrisch zur Schaft(SA)-Längsachse geneig-
 te Spiegel (7, 7') in größerem Abstand von der
 Längsachse und
 - ein diesen zugeordnetes verspiegeltes Prisma (8)
 zur Umlenkung des Strahlengangs von den beiden
10 Spiegeln (7, 7') in Richtung der Längsachse
 (Fig. 5).
11. Schlüssel-Erkennen nach einem der vorhergehenden An-
15 sprüche,
 dadurch gekennzeichnet,
 - daß die zweite Abbildungs-Optik
 - mehrere Umlenk-Prismen (6a - d) besitzt
 (Fig. 5).
- 20
12. Schlüssel-Erkennen nach einem der vorhergehenden An-
 sprüche,
 gekennzeichnet durch
25 - eine Schlüssel-Zwangs-Justiervorrichtung (50),
 - die den Schlüssel-Schaft (SA) in eine vorgegebene
 Stellung bringt
 (Fig. 3, 4).
- 30

13. Schlüssel-Erkenner nach Anspruch 12,
dadurch gekennzeichnet,
- daß die Schlüssel-Zwangs-Justiervorrichtung (50)
- mindestens eine Positionierfläche (51, 52) besitzt,
5 - an der der Schlüssel-Schaft (SA) anlegbar ist
(Fig. 3, 4).
14. Schlüssel-Erkenner nach Anspruch 13,
10 dadurch gekennzeichnet,
- daß die Positionierflächen vorgesehen sind an
- einem Seiten-Anschlag (51) und
- einem Längs-Anschlag (52)
(Fig. 3, 4).
15
15. Schlüssel-Erkenner nach Anspruch 14,
dadurch gekennzeichnet,
- daß der Längs-Anschlag (52)
20 - den Profil-Anschlag (A) abstützt
(Fig. 3, 4).
16. Schlüssel-Erkenner nach einem der Ansprüche 12 - 15,
25 dadurch gekennzeichnet,
- daß die Schlüssel-Zwangs-Justiervorrichtung (50)
- mehrere an den Schlüssel-Schaft (SA) anlegbare
Führungs-Lamellen (55) und
- genau so viele Andrück-Federn (57) besitzt,
30 - die durch ein Entriegelungsorgan (59, 61) außer
Wirkung bringbar sind
(Fig. 3, 4).

17. Schlüssel-Erkennen nach Anspruch 16,
dadurch gekennzeichnet,
- daß mindestens eine der Führungs-Lamellen (55)
- in eine Profil-Nut (N) des Schafts (SA) eingreift
5 (Fig. 1, 3, 4).
18. Schlüssel-Erkennen nach einem der vorhergehenden Ansprüche,
10 gekennzeichnet durch
- eine Schlüssel-Halte- und -Transport-Vorrichtung (70),
- die den Schlüssel (S) haltet und den Schlüssel-Schaft (SA) in die Meß-Stellung transportiert
(Fig. 4).
15
19. Schlüssel-Erkennen nach Anspruch 18 mit einem der Ansprüche 12 - 17,
dadurch gekennzeichnet,
20 - daß die Schlüssel-Halte- und -Transport-Vorrichtung (70)
- den Schlüssel (S) von der Schlüssel-Zwangs-Justier-vorrichtung (50) übernimmt
(Fig. 4).
25
20. Schlüssel-Erkennen nach Anspruch 18 oder 19,
dadurch gekennzeichnet,
- daß die Schlüssel-Halte- und -Transport-Vorrichtung
30 (70)
- zwei Klemmbacken (71) besitzt
(Fig. 4).

- 7 -

21. Schlüssel-Erkennen nach Anspruch 20,
dadurch gekennzeichnet,
- daß die Klemmbacken (71)
- den Schlüssel-Kopf (K) einspannen
5 (Fig. 4).
22. Schlüssel-Erkennen nach einem der Ansprüche 18 - 21,
dadurch gekennzeichnet,
10 - daß die Schlüssel-Halte- und -Transport-Vorrichtung
(70)
- mindestens einen geradegeführten Schieber (72, 73)
zum Transport des Schlüssel-Schafts (SA) in die
Meß-Stellung besitzt
15 (Fig. 4).
23. Schlüssel-Erkennen nach einem der vorhergehenden An-
sprüche,
20 gekennzeichnet durch
- eine von den beiden Abbildungs-Optiken beaufschlagte
Bildaufnahme-Einheit
- mit beweglichem linearen opto-elektrischen Sen-
sor (10)
25 (Fig. 5, 6).
24. Schlüssel-Erkennen nach Anspruch 23,
dadurch gekennzeichnet,
30 - daß der lineare Sensor
- eine CCD-Zeile (10) ist
(Fig. 5, 6).

25. Schlüssel-Erkennen nach Anspruch 23 oder 24,
dadurch gekennzeichnet,
- daß der lineare Sensor (10)
- durch einen Schlitten (12) verfahrbar ist
5 (Fig. 5, 6).
26. Schlüssel-Erkennen nach Anspruch 25,
dadurch gekennzeichnet,
10 - daß der Schlitten (12) verfahrbar ist
- entlang mehrerer Endschalter (18 - 21) zum Steuern
des Schlitten-Antriebs (13)
(Fig. 6).
- 15 27. Schlüssel-Erkennen nach Anspruch 25 oder 26,
dadurch gekennzeichnet,
- daß der Schlitten (12)
- von einer Spindel (14a) angetrieben ist,
20 - die eine Teilkreisscheibe (15) trägt,
- die von einer Diode (16) abgetastet wird
- hinsichtlich der Teilungs-Markierungen zur Ab-
gabe von Impulsen an eine Synchronisier-Lo-
gik (17)
25 (Fig. 6).
28. Schlüssel-Erkennen nach einem der Ansprüche 23 - 27,
gekennzeichnet durch
30 - einen Signal-Aufbereiter (30),
- der das vom Sensor (10) abgegebene kontinuierliche
analoge Signal (Fig. 7a) in Impulse (Fig. 7d) um-
setzt
(Fig. 6).

29. Schlüssel-Erkennen nach Anspruch 28,
dadurch gekennzeichnet,
- daß der Signal-Aufbereiter (30) besitzt:
- einen Schmitt-Trigger (23) (Fig. 7b),
5 - eine Einheit (24) zur Differenzierung, Einweg-
Gleichrichtung und Pulsformung (Fig. 7c, d)
(Fig. 6).
- 10 30. Schlüssel-Erkennen nach einem der vorhergehenden An-
sprüche,
gekennzeichnet durch
- einen Auswerter (80),
- der die Meßwerte des Schlüssel-Schafts (SA) mit
15 gespeicherten Meßwerten von Schlüssel-Rohlingen
vergleicht
(Fig. 8).
- 20 31. Schlüssel-Erkennen nach Anspruch 30,
dadurch gekennzeichnet,
- daß der Auswerter (80) besitzt:
- einen Segmentierer (83)
- zum Trennen der Meßwerte von Längs- und Quer-Pro-
25 fil und
- zum Normieren der Konturen-Meßwerte der beiden
Profile,
- eine Speicher-Einheit (89, 91)
- zum Speichern der Meßwerte,
30 - einen Vergleicher (87),
- der vom Segmentierer (83) und vom Speicher (89, 91)
beaufschlagt ist, und
- eine Anzeige (97),
- die dem Vergleicher (87) nachgeschaltet ist
35 (Fig. 8).

32. Schlüssel-Erkenner nach Anspruch 30 oder 31,
dadurch gekennzeichnet,
- daß der Auswerter (80) folgende Schaft(SA)-Meßwerte
berücksichtigt:

- 5 - Querprofil in Höhe Anschlag (A),
 - Schaftlänge (l),
 - Profilbreite (h),
 - Profilstärke (d),
 - Spitzenform (SF),
10 - Längsprofil der Fräsgegenseite (FG)
 (Fig. 1, 8).

15

20

25

30

117

0053730

Fig. 1

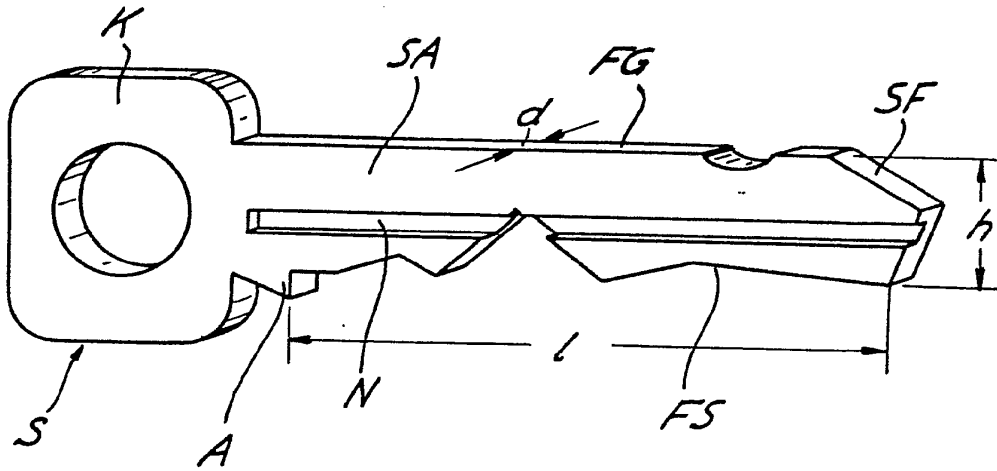
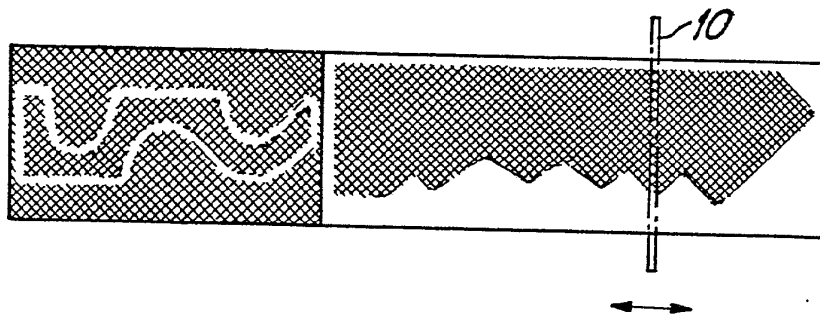
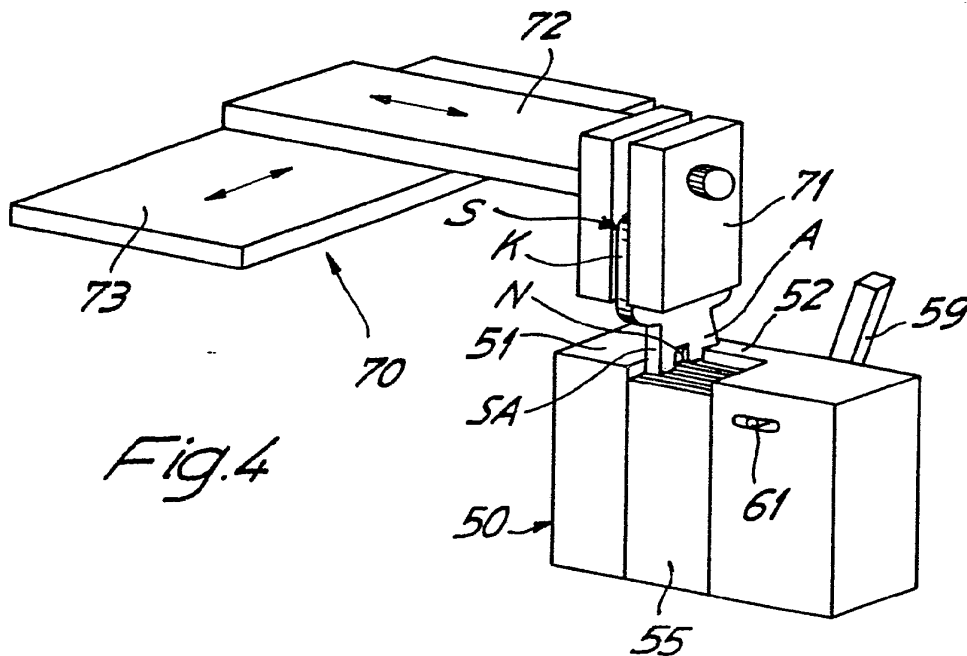
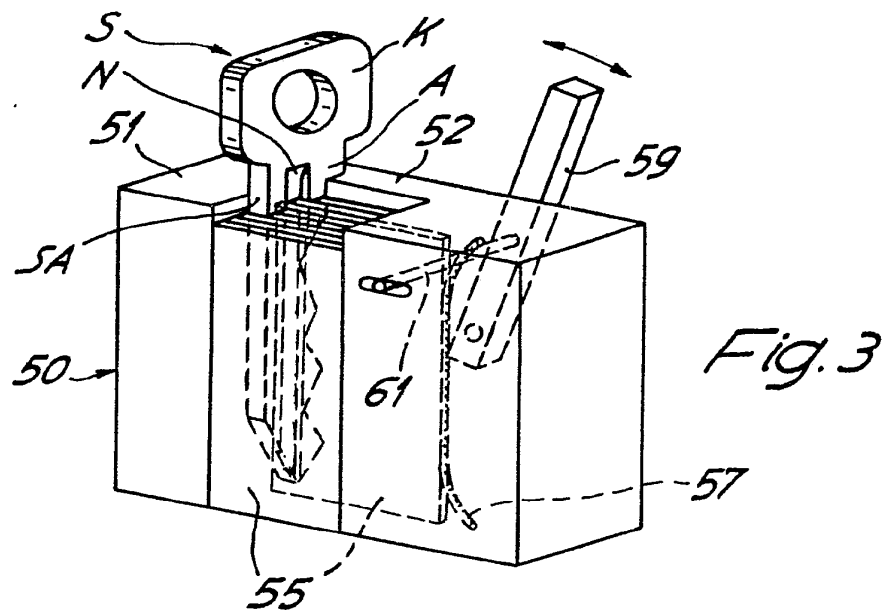
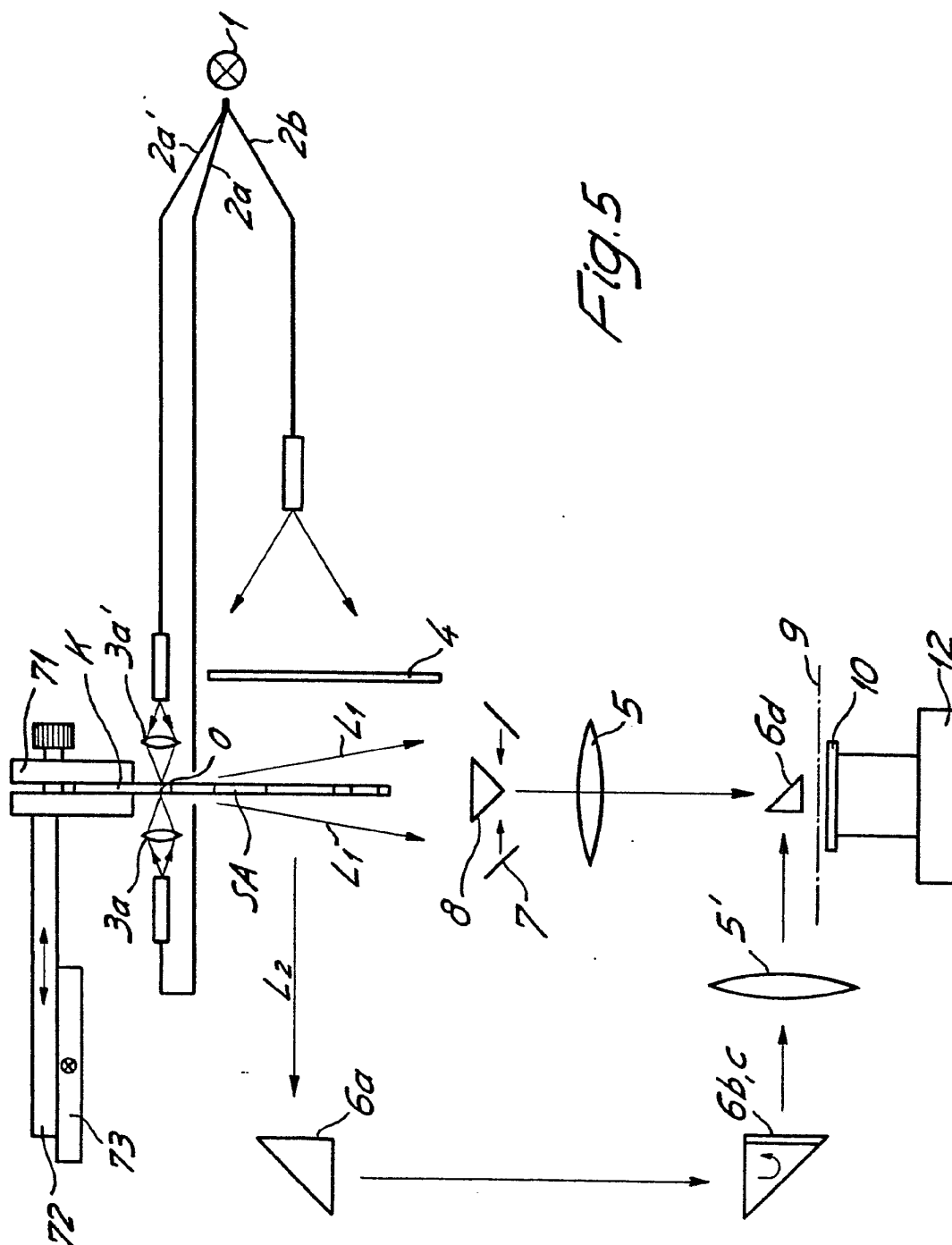


Fig. 2





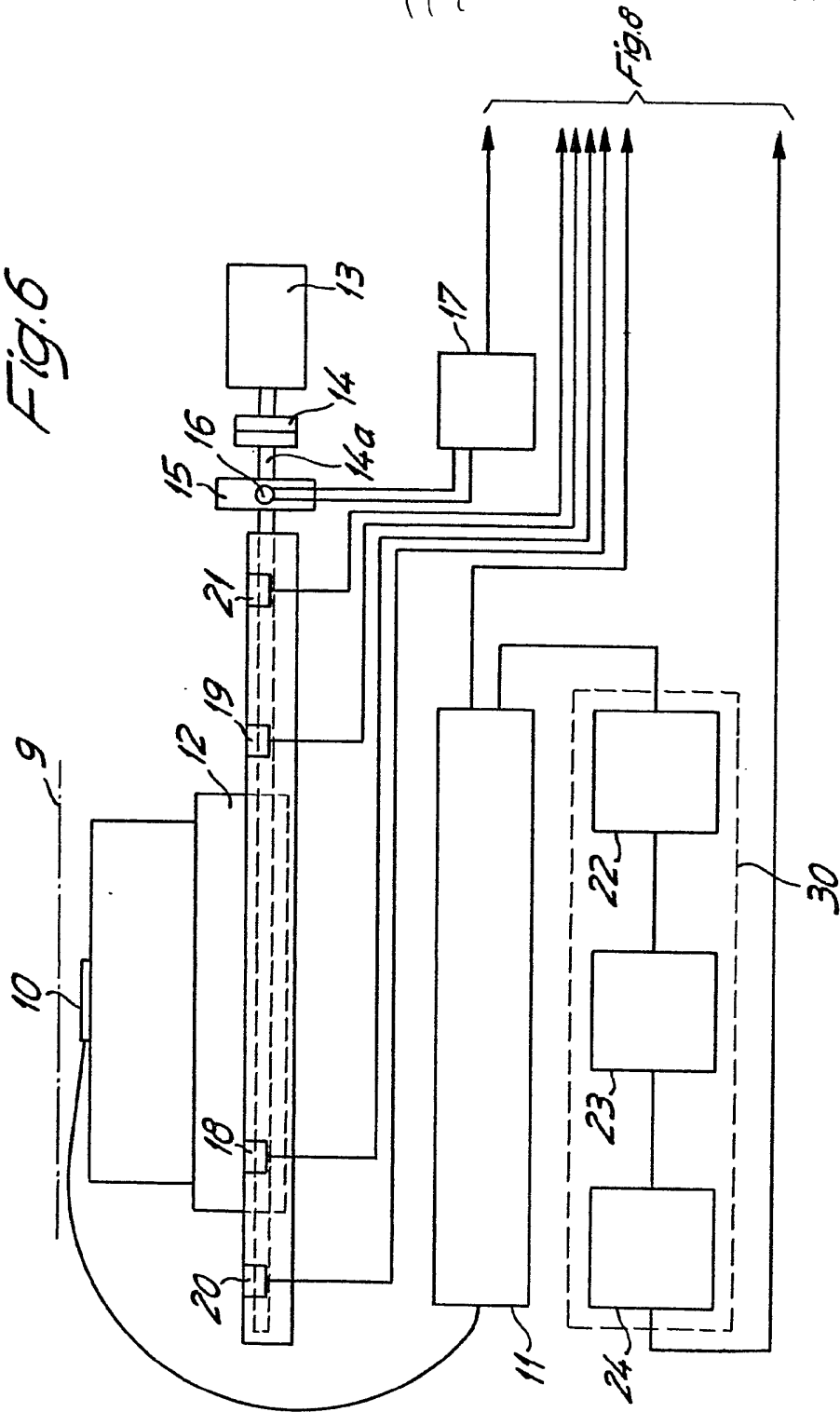
3/7



417

0053730

Fig. 6



5(7

0053730

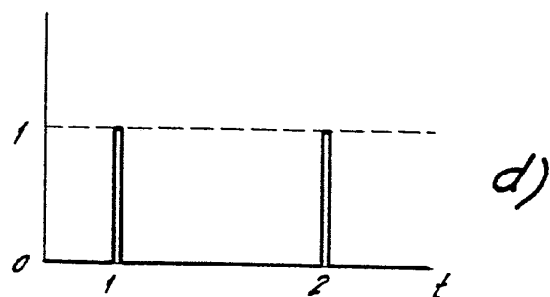
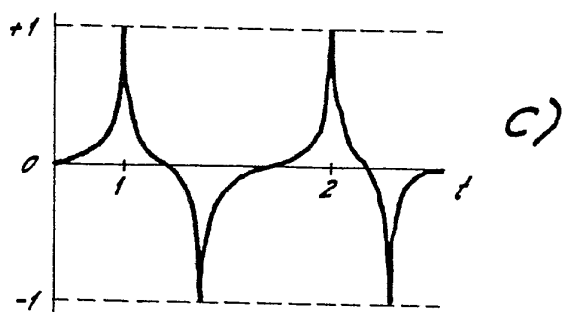
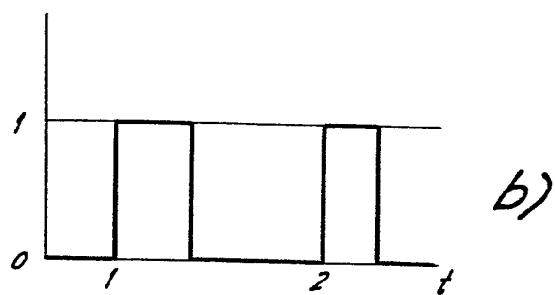
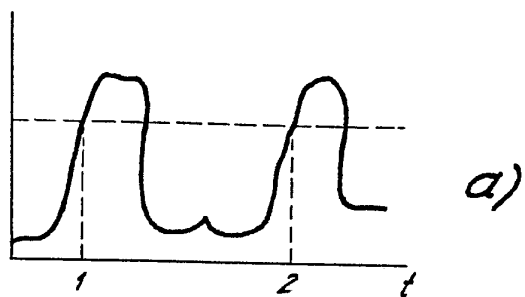
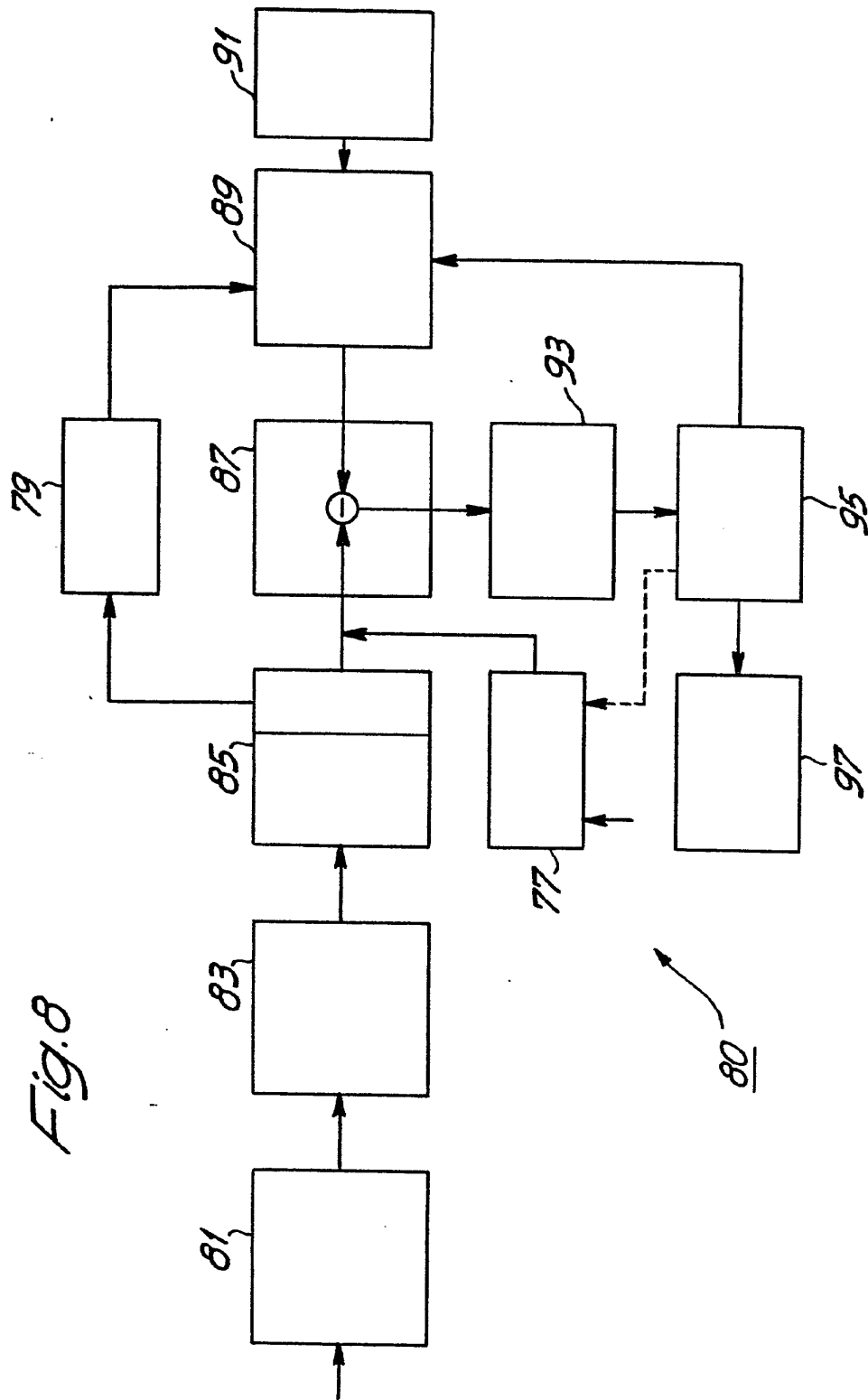


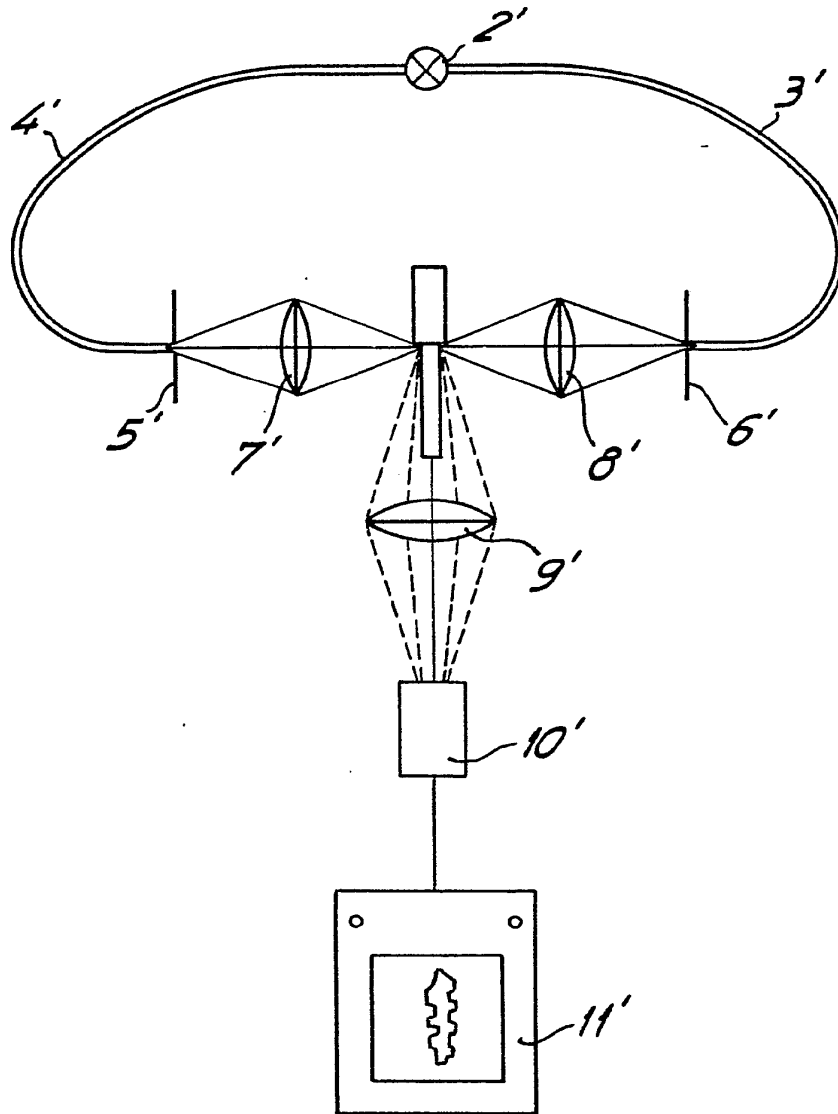
Fig.7



7/7

0053730

Fig. 9





Europäisches
Patentamt

EUROPÄISCHER RECHERCHENBERICHT

0053730

Nummer der Anmeldung

EP 81 10 9450

EINSCHLÄGIGE DOKUMENTE			KLASSIFIKATION DER ANMELDUNG (Int. Cl.)
Kategorie	Kennzeichnung des Dokuments mit Angabe, soweit erforderlich, der maßgeblichen Teile	betrifft Anspruch	
XY	FR - A - 2 350 579 (ROBERT BOSCH GmbH) * Einführung; Seite 9, Zeile 5 - Seite 13, Zeile 13; Figuren 1, 2a, 2b, 3 *	1,6,8 9,23, 24	G 01 B 11/24 11/00
	--		
Y	US - A - 3 399 592 (H. BRACHVOGEL) * Figuren 1,2; Spalte 2, Zeilen 16-55 *	1,10, 11	
	--		
Y	GB - A - 1 385 912 (BRITISH IRON & STEEL RESEARCH ASS.) * Figuren 1,2; Seite 2, Zeile 44 - Seite 3, Zeile 58 *	1,10, 23	G 01 B 11/00 5/00
	--		
Y	FR - A - 1 499 626 (EMHART ZÜRICH S.A.) * Seite 1, Absatz 6 - Seite 2, Absatz 4; Figuren 1,2 *	1,4,5	
	--		
A	FR - A - 2 379 045 (INDUSTRIAL MERCHANDISING SERVICES N.V.) * Figuren 1,2,3,4; Seite 2, Zeile 10 - Seite 3, Zeile 34 *	12,13 15-17	
	--		
Y	US - A - 4 064 534 (TUNG CHANG CHEN et al.) * Figuren 1,1a; Spalte 2, Zeile 55 - Spalte 4, Zeile 6 *	1,7, 31,32	
	--		
	./.		
☒ Der vorliegende Recherchenbericht wurde für alle Patentansprüche erstellt.			
Recherchenort Den Haag			Abschlußdatum der Recherche 18-03-1982
			Prüfer VISSER

EPA form 1503.1 06.78



Europäisches
Patentamt

EUROPÄISCHER RECHERCHENBERICHT

0053730
Nummer der Anmeldung

EP 81 10 9450

-2-

EINSCHLÄGIGE DOKUMENTE			KLASSIFIKATION DER ANMELDUNG (Int. Cl.)
Kategorie	Kennzeichnung des Dokuments mit Angabe, soweit erforderlich, der Maßgeblichen Teile	betrifft Anspruch	
A	US - A - 3 918 816 (G.B. FOSTER et al.) * Figur 2B; Spalte 5, Zeilen 22-46 *	9,10	
			RECHERCHIERTE SACHGEBIETE (Int. Cl.)

EPA Form 1503.2 06.78

(19)



Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Numéro de publication:

0 133 091
A1

(12)

DEMANDE DE BREVET EUROPEEN

(21) Numéro de dépôt: 84401468.8

(51) Int. Cl.⁴: B 23 C 3/35

(22) Date de dépôt: 10.07.84

(30) Priorité: 13.07.83 FR 8312023

(43) Date de publication de la demande:
13.02.85 Bulletin 85/7(84) Etats contractants désignés:
CH DE FR IT LI(71) Demandeur: Société Anonyme H.K. FRANCE
94, Boulevard Richard Lenoir
F-75011 Paris(FR)(72) Inventeur: Kinas, Henry
20, Boulevard Jean Mermoz
F-92200 Neuilly S/Seine(FR)(74) Mandataire: Boivin, Claude
9, rue Edouard-Charton
F-78000 Versailles(FR)

(54) Procédé pour réaliser une clef dont on connaît le numéro ou code et machine pour la mise en oeuvre de ce procédé.

(57) On met en mémoire la ou les images des différents crans que peuvent comporter les clefs à reproduire et les écarts entre ces crans; à partir de cette ou ces images ainsi mises en mémoire, on réalise une superposition d'images de crans en nombre égal à celui des crans à former dans l'ébauche, la superposition étant effectuée en disposant ces images de crans en fonction de la combinaison à réaliser de façon que leur ensemble reproduise cette combinaison; on met en mémoire l'image de la clef ainsi formée; et on commande le déplacement relatif de la fraise et du porteébauche de façon à assurer un balayage continu de l'ébauche, en fonction du contour de l'image ainsi mise en mémoire.

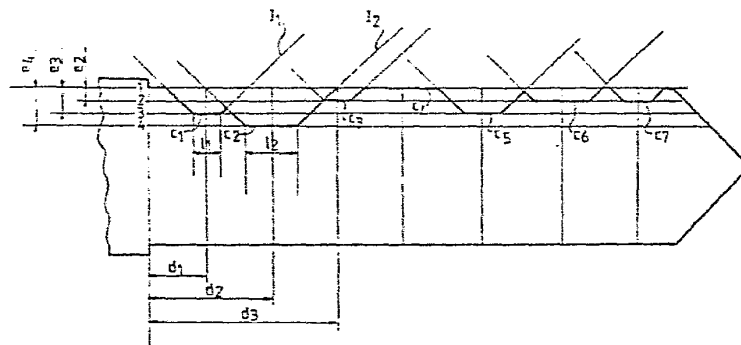
Pour mettre en oeuvre ce procédé, on utilise une machine comportant outre un porte-ébauche (18), une fraise (12) et deux moteurs (16 et 17) pour déplacer le porte-ébauche et la fraise l'un par rapport à l'autre, une première mémoire électronique (1) de la ou des images des crans à former dans l'ébauche, des moyens (3) pour superposer une série d'images de crans en nombre égal à celui de ces crans de façon que leur ensemble reproduise la combinaison à réaliser, et forme l'image correspondante de la clef, une deuxième mémoire électronique (4) de l'image de la clef ainsi obtenue, et des moyens (20) pour commander les deux moteurs (16 et 17) en assurant un balayage continu de l'ébauche en fonction du contour de l'image ainsi réalisée.

EP 0 133 091 A1

./...

Croydon Printing Company Ltd

FIG 1



- 1 -

Procédé pour réaliser une clef dont on connaît le numéro ou code et machine pour la mise en oeuvre de ce procédé.

La présente invention concerne la réalisation automatique de clefs dont on connaît le numéro ou code.

Il existe des machines à reproduire les clefs plates comportant une fraise rotative et un palpeur, ces deux éléments pouvant être
5 déplacés simultanément dans deux directions orthogonales. Souvent ces machines sont utilisées pour reproduire une clef dont on a le modèle et qu'on fixe devant un palpeur. Dans ce cas, on balaie à l'aide du palpeur les crans de la clef modèle; la fraise taille alors dans une ébauche fixée devant elle des crans identiques à
10 ceux de la clef modèle.

Le brevet US 4,188,163 décrit une machine à reproduire les clefs dont on connaît simplement le numéro ou code. Cette machine comporte un certain nombre de barrettes mobiles déterminant la profondeur des crans et leurs positions et devant lesquelles se déplace
15 un palpeur. La fraise a un profil correspondant à celui des crans à tailler dans la clef et le palpeur, en se déplaçant devant les barrettes, détermine la profondeur des divers crans à former dans l'ébauche par la fraise.

Mais cette machine ne permet pas une réalisation automatique de la
20 clef par simple affichage du numéro de cette clef et il est nécessaire de changer de fraise à chaque modification du profil du cran.

présente invention a pour objet un procédé pour réaliser à l'aide d'une fraise une clef dont on connaît le numéro ou code, une ébauche fixée dans un étai porte-ébauche, qui permet, contrairement, une réalisation automatique par simple affichage du numéro de la clef, sans qu'il soit nécessaire de changer de ébauche, même si la clef ou les clefs à réaliser comportent des formes différentes.

Le procédé selon l'invention dans lequel on utilise une fraise universelle, est caractérisé en ce qu'on met en mémoire la ou les positions des différents crans que peuvent comporter les clefs à réaliser et les écarts entre ces crans, qu'à partir de la ou les positions ainsi mises en mémoire, on réalise une superposition d'images de crans en nombre égal à celui des crans à former dans l'ébauche, la superposition étant effectuée en disposant ces images de crans en fonction de la combinaison à réaliser de façon que leur ensemble reproduise cette combinaison, qu'on met en mémoire l'image de la clef ainsi formée, et qu'on commande le déplacement relatif de la fraise et du porte-ébauche de façon à assurer un balayage continu de l'ébauche, en fonction du contour de l'image ainsi mise en mémoire.

L'invention a également pour objet une machine pour la mise en œuvre de ce procédé.

La machine comporte un bâti, un chariot intermédiaire monté coulissant par rapport à ce bâti, dans une première direction, un chariot monté coulissant sur le chariot intermédiaire dans une deuxième direction, un premier moteur pour déplacer le chariot intermédiaire par rapport au bâti, un deuxième moteur pour déplacer le chariot par rapport au chariot intermédiaire, un support de fraise par rapport auquel une fraise est montée à rotation, des moyens pour entraîner la fraise, un porte-ébauche, l'un des supports constitués par le support de fraise et le porte-ébauche supporté par le bâti et l'autre par le chariot, et est caractérisée en ce qu'elle comprend en outre, une première mémoire de positions des images des crans à former dans l'ébauche, des moyens pour superposer une série d'images de crans en nombre égal à celui de ces crans de façon que leur ensemble reproduise la combinaison à réaliser et forme l'image correspondante de la clef, une deuxième mémoire de l'image de la clef ainsi obtenue, et des moyens pour commander les deux moteurs en assurant un balayage continu de l'ébauche en fonction du contour de l'image ainsi mise

en mémoire.

0133091

On a décrit ci-après, à titre d'exemple non limitatif, un mode de réalisation de la machine selon l'invention, avec référence aux dessins annexés dans lesquels :

5 La Figure 1 représente un exemple de clef et les images de ces crans;

 La Figure 2 est un schéma de la machine;

 La Figure 3 en est une vue en plan.

 S'agissant par exemple de réaliser la clef représentée à la Figure 1 qui comporte une série de crans $C_1, C_2, C_3 \dots C_7$ qui sont ici tous trapézoïdaux, mais dans laquelle les crans pairs sont plus larges que les crans impairs, on met dans une mémoire 1 les images I_1 et I_2 des différents crans, qui sont caractérisés par la largeur I_1 et I_2 de leur base et l'angle que font leurs côtés latéraux. Cet angle est ici le même pour les deux images, mais il pourrait être différent; les crans pourraient également avoir un fond non pas plat, mais arrondi. On met également en mémoire les distances telles que d_1, d_2, d_3 , des différents crans à une même origine et les profondeurs telles que e_2, e_3, e_4 des différents numéros de cran.

Sur un tableau 2 on affiche le numéro de la clef à reproduire, qui est dans l'exemple représenté 3421322.

 A l'aide d'un calculateur 3, on réalise, à partir des images I_1 et I_2 , une superposition de ces images de façon que leur ensemble réalise la combinaison affichée; dans l'exemple de la Figure 1, on superpose l'image I_1 placée à une distance d_1 de l'origine de façon que son fond se trouve à une distance e_3 d'une ligne de référence, à une image I_2 placée à une distance $(d_2 - d_1)$ de l'origine de façon que son fond se trouve à une distance e_4 de la ligne de référence, à une image I_1 placée à une distance $(d_3 - d_2)$ de l'origine de façon que son fond se trouve à une distance e_2 de la ligne de référence, etc. On forme ainsi une image de la clef qui est mise dans une mémoire 4.

 La machine utilisée pour la réalisation de la clef comprend un bâti 5 portant un moteur 6 sur l'arbre de sortie 7 duquel est calée une poulie 8. Celle-ci est reliée par une courroie 9 à une poulie 10 qui est calée sur un arbre 11 portant une fraise universelle 12 et montée à rotation dans un support 13 fixé au bâti 5.

0133091

Sur le bâti 3 est monté couissant dans la direction de la flèche f_1 , un chariot intermédiaire 14 sur lequel un deuxième chariot 15 peut coulisser dans la direction de la flèche f_2 perpendiculaire à la direction f_1 . Un moteur 16 porté par le bâti 5
5 permet de déplacer le chariot 14, par exemple par l'intermédiaire d'un système vis-écrou et un moteur 17 porté par ce chariot permet de déplacer le chariot 15.

Le chariot 15 porte un étau 18 propre à maintenir une ébauche de clef 19. On voit qu'il est ainsi possible de déplacer le chariot
10 15 avec l'ébauche 19 qu'il porte, dans n'importe quelle direction par rapport à la fraise.

Un calculateur 20 détermine le contour de l'image de la clef se trouvant dans la mémoire 4 et commande les moteurs 16 et 17 de façon que la fraise 12 balaie de manière continue l'ébauche 19 en
15 fonction de ce contour et reproduise ainsi la clef dont le numéro a été affiché.

Le calculateur peut commander les moteurs 16 et 17 de façon que l'ébauche se déplace suivant un trajet correspondant exactement au contour de la clef, c'est-à-dire déterminé par les intersections des différentes images des crans, comme représenté en traits
20 pleins à la Figure 1. Mais, il peut également commander les moteurs 16 et 17 suivant un trajet correspondant aux intersections des différentes images avec une ligne de référence, comme représenté en traits mixtes, cette ligne étant ici celle correspondant au
25 niveau "1" des crans.

On voit de la description qui précède que le fonctionnement de la machine est entièrement automatique, une fois le numéro de la clef affiché. Une même fraise 12 peut être utilisée quelle que soit la forme des crans.

Revendications

1. Procédé pour réaliser à l'aide d'une fraise universelle une
clef dont on connaît le numéro ou code dans une ébauche fixée
dans un étai porte-ébauche,
caractérisé en ce qu'on met en mémoire la ou les images des dif-
5 férents crans que peuvent comporter les clefs à reproduire et les
écarts entre ces crans, qu'à partir de cette ou ces images ainsi
mises en mémoire, on réalise une superposition d'images de crans
en nombre égal à celui des crans à former dans l'ébauche, la su-
perposition étant effectuée en disposant ces images de crans en
10 fonction de la combinaison à réaliser de façon que leur ensemble
reproduise cette combinaison, qu'on met en mémoire l'image de la
clef ainsi formée, et qu'on commande le déplacement relatif de la
fraise et du porte-ébauche de façon à assurer un balayage continu
de l'ébauche, en fonction du contour de l'image ainsi mise en mé-
15 moire.
2. Procédé selon la revendication 1,
caractérisé en ce que le déplacement relatif de la fraise et du
porte-ébauche est déterminé par les intersections des images des
crans entre elles.
- 20 3. Procédé selon la revendication 1,
caractérisé en ce que le déplacement relatif de la fraise et du
porte-ébauche est déterminé par les intersections des différentes
images avec une ligne de référence.
4. Machine pour la mise en oeuvre du procédé défini à la revendi-
25 cation 1 ou 2, qui comporte un bâti (5), un chariot intermédiaire
(14) monté coulissant par rapport à ce bâti, dans une première
direction (f_1), un chariot (15) monté coulissant sur le chariot
intermédiaire dans une deuxième direction (f_2), un premier moteur
(16) pour déplacer le chariot intermédiaire par rapport au bâti,
30 un deuxième moteur (17) pour déplacer le chariot par rapport au
chariot intermédiaire, un support de fraise (13) par rapport au-
quel une fraise (12) est montée à rotation, des moyens (6) pour
entraîner la fraise et un porte-ébauche (18), l'un des éléments
constitués par le support de fraise (13) et le porte-ébauche (18)
35 étant porté par le bâti (5) et l'autre par le chariot (15),
caractérisée en ce qu'elle comprend, en outre, une première mémoi-
re électronique (1) de la ou des images des crans à former dans
l'ébauche, des moyens (3) pour superposer une série d'images de

crans en nombre égal à celui de ces crans de façon que leur ensemble reproduise la combinaison à réaliser, et forme l'image correspondante de la clef, une deuxième mémoire électronique (4) de l'image de la clef ainsi obtenue, et des moyens (20) pour
5 commander les deux moteurs (16 et 17) en assurant un balayage continu de l'ébauche en fonction du contour de l'image ainsi réalisée.

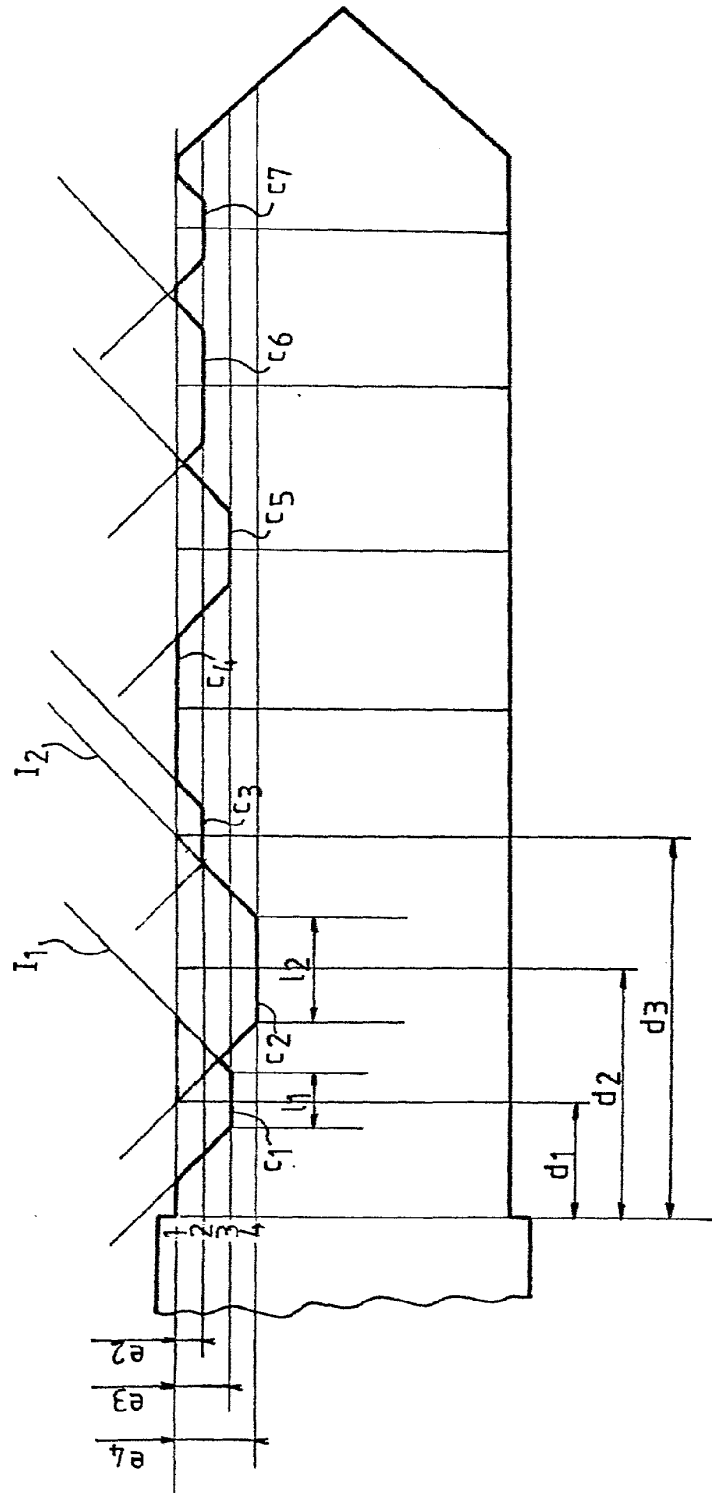
FIG.1

FIG. 3

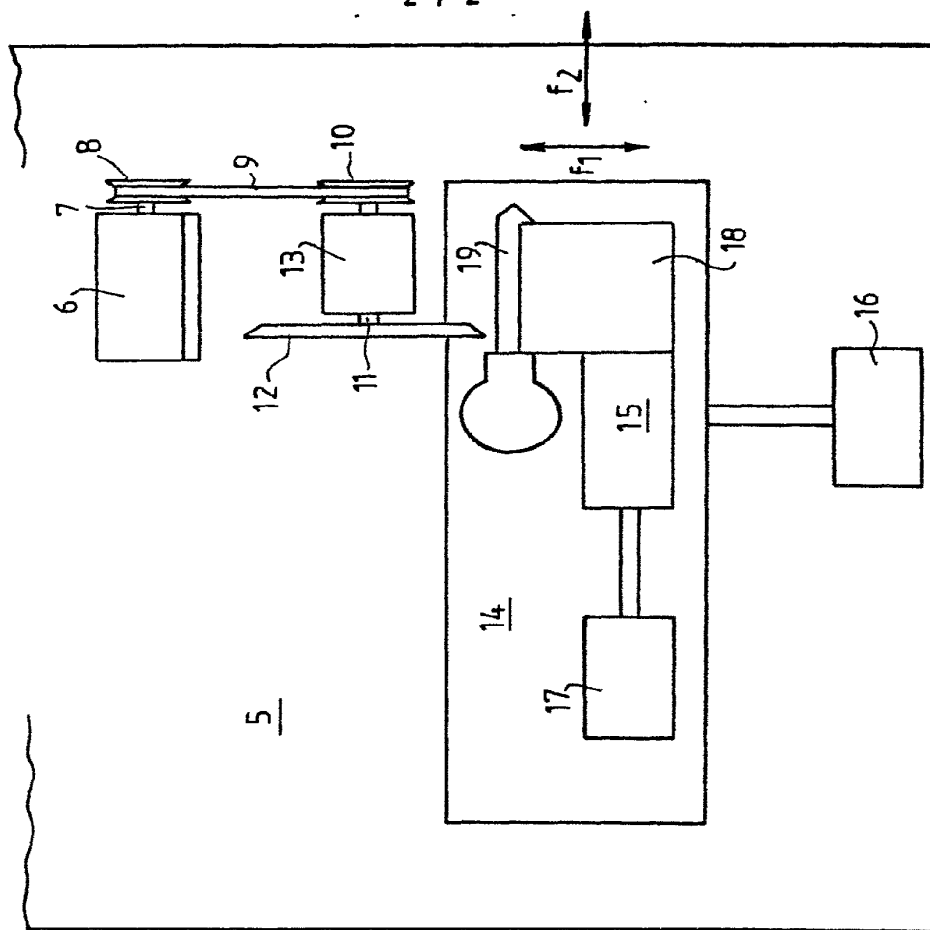
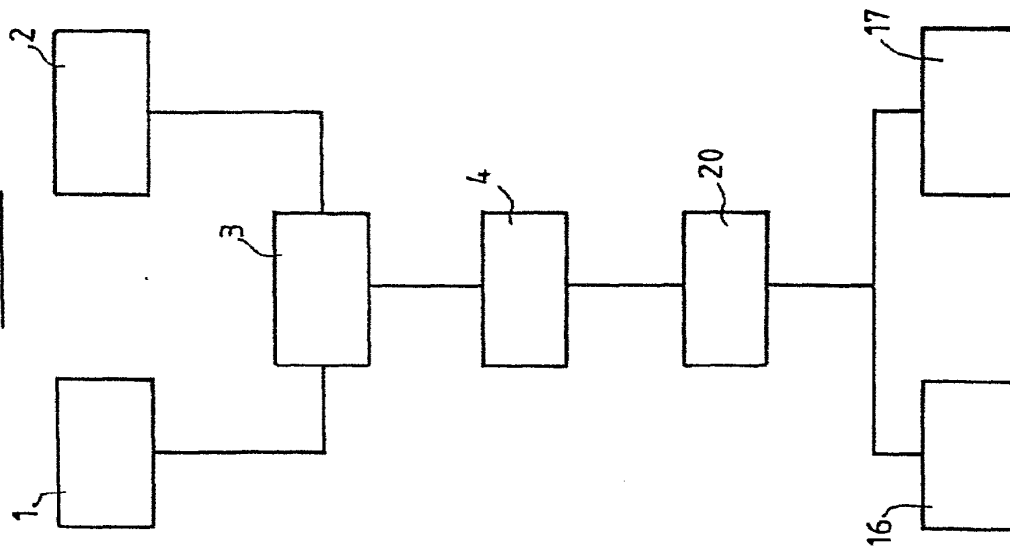


FIG. 2





Office européen
des brevets

RAPPORT DE RECHERCHE EUROPEENNE

0133091

Numéro de la demande

EP 84 40 1468

DOCUMENTS CONSIDERES COMME PERTINENTS			
Catégorie	Citation du document avec indication, en cas de besoin, des parties pertinentes	Revendication concernée	CLASSEMENT DE LA DEMANDE (Int. Cl. 3)
X,D	US-A-4 188 163 (JUSKEVIC) * colonne 3, ligne 23 - colonne 4, ligne 10; figures *	1	B 23 C 3/35

X	FR-A-2 362 694 (NEIMAN) * page 3, ligne 23 - page 4, ligne 21; figures *	1	

X	DE-A-2 951 065 (F.I.M.A.T.) * page 1, ligne 1 - page 2, ligne 1; figures *	1	

X	FR-A-2 410 527 (KIS-FRANCE) * page 4, ligne 28 - page 5, ligne 20; figures *	1	

X	US-A-4 256 423 (JUSKEVIC) * colonne 3, lignes 6-64; figures *	1	DOMAINES TECHNIQUES RECHERCHES (Int. Cl. 3) B 23 C 3/00

X	US-A-4 251 173 (SAUCEDO) * colonne 2, ligne 14 - colonne 3, ligne 32; figures *	1	

X	FR-A-1 016 100 (BOYER) * page 1, colonne de gauche, ligne 18 - colonne de droite, ligne 13; figures *	1	

	---	-/-	
Le présent rapport de recherche a été établi pour toutes les revendications			
Lieu de la recherche LA HAYE		Date d'achèvement de la recherche 05-10-1984	Examineur HORVATH R.C.
CATEGORIE DES DOCUMENTS CITES			
X : particulièrement pertinent à lui seul Y : particulièrement pertinent en combinaison avec un autre document de la même catégorie A : arrière-plan technologique O : divulgation non-écrite P : document intercalaire		T : théorie ou principe à la base de l'invention E : document de brevet antérieur, mais publié à la date de dépôt ou après cette date D : cité dans la demande L : cité pour d'autres raisons & : membre de la même famille, document correspondant	

OE Form 1503 03/82



Office européen
des brevets

RAPPORT DE RECHERCHE EUROPEENNE

0133091

Numéro de la demande

EP 84 40 1468

DOCUMENTS CONSIDERES COMME PERTINENTS			Page 2
Categorie	Citation du document avec indication, en cas de besoin, des parties pertinentes	Revendication concernée	CLASSEMENT DE LA DEMANDE (int. Cl. 3)
X	US-A-3 118 346 (SIMON) * colonne 2, ligne 23 - colonne 3, ligne 32; figures *	1	

X	US-A-3 919 920 (SCHLAGE) * colonne 5, ligne 47 - colonne 6, ligne 8; figures *	1	

Le présent rapport de recherche a été établi pour toutes les revendications			
Lieu de la recherche LA HAYE		Date d'achèvement de la recherche 05-10-1984	Examineur HORVATH R.C.
CATEGORIE DES DOCUMENTS CITES X : particulièrement pertinent à lui seul Y : particulièrement pertinent en combinaison avec un autre document de la même catégorie A : arrière-plan technologique D : divulgation non-écrite P : document intercalaire T : théorie ou principe à la base de l'invention E : document de brevet antérieur, mais publié à la date de dépôt ou après cette date D : cité dans la demande L : cité pour d'autres raisons & : membre de la même famille, document correspondant			

PUB-NO: EP000133091A1
DOCUMENT-IDENTIFIER: EP 0133091 A1
TITLE: Method of producing a key with a known number or code, and machine for carrying out this method.
PUBN-DATE: February 13, 1985
PATENT-FAMILY-ID: 9290976

INVENTOR-INFORMATION:

NAME	COUNTRY
KINAS HENRY	FR

APPLICANT:

NAME	COUNTRY
FRANCE H K	FR

APPL-NO: EP 84401468 A
APPL-DATE: July 10, 1984

PRIORITY-DATA:

PRIORITY-NO	PRIORITY-APPL-DATE
FR 8312023 A	19830713

CPC-CURRENT:

TYPE	CPC/DATE
CPCI	B23C3/35 20130101

INT-CL-CURRENT:

TYPE	IPC/DATE
IPCP	B23C3/35 20060101
IPCS	B23Q33/00 20060101

REF-CITED:

PHASE-COUNTRY/NUMBER/KIND/DATE-NPL-INFO
SER US 3919920 A 19751118
SER US 3118346 A 19640121

SER FR 1016100 A 19521031
SER US 4251173 A 19810217
SER US 4256423 A 19810317
SER FR 2410527 A1 19790629
SER DE 2951065 A1 19810702
SER FR 2362694 A1 19780324
SER US 4188163 A 19800212

ABSTRACT:

The image or images of the various notches which the keys to be copied can have, and the gaps between these notches, are memorised; using this image or these images thus memorised, the same number of notch images as there are notches to be formed in the blank are superposed, the superposition being formed by arranging these notch images as a function of the combination to be produced in such a way that, taken as a whole, they reproduce this combination; the image of the key thus formed is memorised; and the relative displacement of the grinding wheel and of the blank-holder is controlled in such a way as to sweep the blank continuously, as a function of the contour of the image thus memorised. In order to implement this method, a machine is used which comprises, in addition to a blank-holder (18), a grinding wheel (12) and two motors (16 and 17) in order to displace the blank-holder and the grinding wheel relative to each other, a first electronic memory (1) for the image or images of the notches to be formed in the blank, means (3) for superposing a series of the same number of notch images as there are notches in such a way that, taken as a whole, they reproduce the combination to be produced, and form the corresponding image of the key, a second electronic memory (4) for the image of the key thus obtained, and means (20) for controlling the two motors (16 and 17), ensuring a continuous sweeping of the blank as a function of the contour of the image thus produced.

(19)



Europäisches Patentamt
European Patent Office
Office européen des brevets



(11)

EP 0 835 720 A1

(12)

EUROPEAN PATENT APPLICATION

(43) Date of publication:
15.04.1998 Bulletin 1998/16

(51) Int Cl.⁶: **B23Q 39/04, B23Q 35/10,
B23Q 1/01**

(21) Application number: **97500165.2**

(22) Date of filing: **06.10.1997**

(84) Designated Contracting States:
**AT BE CH DE DK ES FI FR GB GR IE IT LI LU MC
NL PT SE**

(72) Inventor: **Alvarez Momoitio, Ignacio
48600 Sopelana (Vizcaya) (ES)**

(30) Priority: **11.10.1996 ES 9602151
07.07.1997 ES 9701509**

(74) Representative: **Hernandez Covarrubias, Arturo
c/o Clarke, Modet & Co.,
Avda. de los Encuartes 21
28760 Tres Cantos (Madrid) (ES)**

(71) Applicant: **Noran, S.L.
48950 Erandio (Vizcaya) (ES)**

(54) Double arm vertical miller

(57) The miller comprises a pair of benches situated on both sides of a framework, in such a manner that on the upper crossbar is mounted, displaceable and guidable, a transverse support that carries a couple of vertical arms on which are mounted the corresponding tools, the arms being displaceable towards one side or the other with respect to the support, while the tool that

is borne by each of the arms may move upward/downward, as well as rotate, in such a manner that a combination of these movements produced by their corresponding motors allows simultaneously making two pieces that are symmetrical or the same, as well as effect simultaneous digitalized work with one arm and milling with the other, after having mounted the corresponding tool on one arm and a digitalizer on the other.

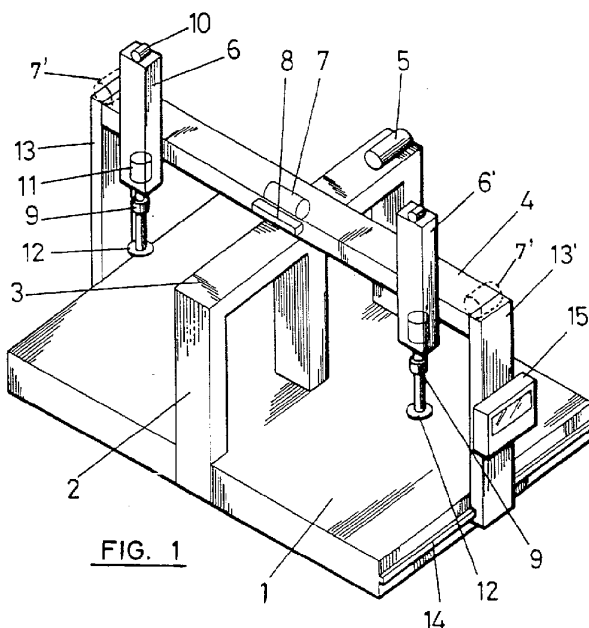


FIG. 1

Description

OBJECT OF THE INVENTION

The invention refers to a double arm vertical miller capable of performing three movements according to the rectangular coordinates, "X", "Y" and "Z", as well as a rotational movement of each one of the two mills fitted on their respective arms.

The miller may simultaneously execute two symmetric or equal parts, as well as simultaneously execute milling or digitizing.

BACKGROUND OF THE INVENTION

Normally milling machines include an arm on which the corresponding tool for picking up shavings is mounted, being complemented with a second arm acting as a test probe, such that in this type of machine it is impossible to simultaneously execute the milling of two parts.

There also exists a type of milling machine with two heads, described in the Spanish utility model, with application number 8802993, which characterizes the fact that one of the heads is mounted on a main shaft, which may be displaced upwards/downwards with respect to the machine frame, whilst the other head is fitted on a mobile frame, which is guided on the mentioned main shaft with the possibility of axial sliding, with respect to the latter and to the mentioned first head.

This solution is closer with an embodiment related to combination of two independent millers than two a double head miller, since its advantages are those of two independent machines and not those of a functionally double machine.

DESCRIPTION OF THE INVENTION

This vertical milling machine, has the particularity of including a double arm, that is, two arms fitted over the ends of a support, with respect to which they may be displaced in a "Y" movement, said support also being able to be displaced according to an "X" movement with respect to the upper crossbar corresponding to a bridge fixed over the corresponding table of lower work, with the particularity that the arms mentioned first of all are holders for the work tools, in this case, of the mills, which may be displaced upwards/downwards, according to the third movement "Z", as well as in a rotational direction, hence enabling equal pieces to be machined, or even to carry out the machining of a piece by means of the tool fitted on one of the arms, and simultaneously to execute digitalizing by means of the corresponding digitalizer, fitted on the opposite arm.

The "X" movement of the upper support to the bridge will be made by means of a motor housed inside said support, preferably in correspondence with an area or intermediate point thereof, and which, for example, with a suitable reducer and pinion will work over a rack

complementary to the corresponding guides which necessarily should incorporate the upper crossbar of the bridge to guide or displace this upper transverse support.

With respect to the "Y" movement of the respective vertical arms carrying the tools, or of a tool and the digitalizer, it will be done by means of a motor for each one of the arms, the latter also being fitted over guides in the respective transverse support, with the particularity that the motor for activating each arm will be located, for example, at the end of the transverse support itself, these motors being able to act over the respective arms with the collaboration of, for example, screws and nuts associated to them.

Regarding the "Z" movement, that is, the vertical displacements of the tool, it is due to the fact that these are fitted with the capability of axial displacement on the vertical arms, that is, they may move longitudinally inside said arms, being activated by means of the corresponding motors located on the upper end of the repeated vertical arms or by means of a motor located on the central part and a set of gears.

Moreover, each mill or tool should be equipped with its corresponding rotational movement for the execution of the cut, a movement that will be provided by another motor located on the coupling part of the tool to the arm.

Unquestionably, all the referred motors to carry out the different movements will be located or housed inside the respective arms or parts, such that the miller as a whole will be a simple machine and through the combination of these movements and structure, the following advantages result:

- It may execute the simultaneous machining of two symmetrical or equal parts, with the advantages of time saving and quality.
- It may simultaneously execute the digitalization with one of the arms, and the machining or milling of one part, with the other, likewise improving time and quality.
- The arrangement of the arms and the combination of movements which may provided to the former, allow milling of all types to be executed, such as models, molds, scale layouts, valves, matrices and aeronautics.
- The movements of the different parts or components of the machine considerably reduce the space, at the same time that two parts may be executed or one part and the simultaneous digitalization, occupying a space which was that required or required with one conventional machine to execute the work with a single arm.

If a single motor is used for the movement of the vertical arms, said motor is directly coupled to one of the shafts in the support, that corresponding to one of the tools, as well as gear which, by means of a clutch device, may be directly connected to the gear, which tops the

other shaft of the miller, or on doing it with the collaboration of an intermediate gear, such that when the clutchable gear is isolated, it only one of the tools of the miller operates, to obtain a single part, when said gear connects directly with that of the other shaft, both tools simultaneously operate, hence obtaining two symmetric parts, whilst when the connection is made with the collaboration of a third gear, intermediate and swinging, both shafts rotate in a same direction, to obtain equal parts.

If the mentioned support is desired, fitted transversely over the intermediate framework, it may be finished at its ends by two stanchions associated to the work bench by means of guides facilitating its displacement, when the mentioned support is slid along the framework, such that the support is materialized in a second framework, installed with a sliding nature, over the intermediate and fixed framework. With the latter, vibrations are prevented and the machine working conditions are improved.

Over one of the stanchions participating in the mobile framework, a viewer may be created to control work development.

The bench may be divided in two parts, on both sides of the intermediate and fixed framework, and if it is desired that each one of the two benches are no longer fixed, becoming mobile with the collaboration of some guides and runners supported over them. In this way, maintaining the bridge fixed, the benches may be separately mobilized to obtain the different parts.

According to another of the characteristics of the invention, the vertical stemples of the support for the tools, which, in turn, slides over the intermediate and fixed framework, become dismountable, allowing, reducing the support stability, the possibility of machining parts of any size.

Returning to the mobility of the benches again, under each one of them, a motor may be placed over a screw-nut set, such that while the end of the screw are fixed to the ends of the bench, the nut is fixed to the intermediate module thereof, hence becoming displaceable in one or other direction on rotating the said motor also in one or other direction.

According to another of the characteristics of the invention, the incorporation to the machine of fixed supports has been foreseen, in which a retractile boss acts, such that by means of bosses of said supports, the benches may be blocked, one at a time or simultaneously, specifically when two equal or symmetric are being executed.

Finally, and according to another of the characteristics of the invention, the existence of a mobile support has also been foreseen with a fixed boss, entrusted with blocking the machine support, immobilizing it with respect to the bridge thereof, in turn, fixed, when necessary. This allows, for example, leaving one of the benches mobile and coupling a market turn-table to the other, at the appropriate distance, machining a crown of infinite

external radius and internal radius depending on the width of the bench, it being possible to simultaneously execute another equal or different part by means of the other arm.

DESCRIPTION OF THE DRAWINGS

To complement the description being made and with the purpose of understanding the characteristics of the invention better, a set of drawings which with an illustrative and nonlimiting character is attached to this descriptive report as an integral part thereof, consist of the following:

Figure 1 shows a schematic perspective view of one version of a double arm miller executed according to the principles of the invention.

Figure 2 shows a schematic profile view, of the set of gears indicated by reference 8 in figure 2.

Figures 3, 4 and 5 show front views of the set of gears shown in figure 3 in positions: to obtain two equal parts, to obtain two symmetric parts and the milling of a single part, respectively.

Figure 6 shows a similar view to that in figure 1, where the miller shows some modifications.

Figure 7 shows a similar view to that in figure 6, where the two benches are partially sectioned showing part of their activation mechanism.

Figure 8 is a view of the miller in figure 6, where the holding supports have been incorporated for the immobilizing bosses of the benches and the supports for coupling to the miller of a turn-table.

Figure 9 schematically shows a plan view of the miller in figure 8 to which a turn-table has been coupled.

PREFERRED EMBODIMENT OF THE INVENTION

Viewing figure 1, it may be observed how the vertical miller shown incorporates a platform or work bench (1) on which is fitted transversely and in the center a fixed framework (2), which defines in its upper part a guide (3) for slides according to the "X" axis of a support (4), with the collaboration of a motor component (5), in turn sliding over guides of the mentioned support (4), respective end arms (6-6'), with the collaboration of two end motors (7') or an intermediate and single motor (7) and by means of a set of gears (8), that will be described below, to obtain the movement "Y", whilst the movement "Z" is obtained thanks to the tool holder heads (9), which are displaceable vertically inside said arms (6-6'), with the collaboration of respective motors (10), motors (11), inside the arms (6-6'), conferring the tools (12) the necessary rotational movement so that they may carry out their milling function. These tools are normally mills, but in a given case may be a digitalizer.

The support (4), as already has been said, receives at its free ends, interlocked, two stanchions (13-13') provided at their lower end with means for coupling to the guides (14) of the margins and corresponding to the

work bench (1), such that the mentioned support (4) becomes a mobile framework offering a greater stability to the combination, absorbing vibrations and permitting a faster work rhythm. In turn, either of these stanchions (13) serves as a support for a viewer (15), allowing the development of the work being executed to be controlled.

Returning once again to the set of gears (8) and as may be especially observed in figures 2 and 3, this consists of a main gear (16) fitted with the possibility of the sliding over an extension (17) of the shaft (18) corresponding to one of the two halves of the support (4), said shaft directly receiving the movement of the motor (7), by means of the belt (19) or any other means of suitable transmission, such that this shaft (18) is kept in movement provided the motor is (7).

The other shaft (18'), that corresponding to the other half of the support (4) after a loaded transmission (20), finishes up in a second gear (21) identical to the gear (16) and laterally dephased with respect to it, until a situation in which said gears remain tangential, it being possible to couple and uncouple them, that is, clutchable and non-clutchable, by means of sliding the main gear (16) over the extension (17) of the shaft (18), between the extreme positions in figures 4 and 5.

Specifically, in the clutch position shown in figure 4 for the gears (16) and (21), the movement is transmitted to the secondary shaft (18'), in a direction contrary to that of the main shaft (18), hence obtaining the simultaneous machining of two symmetric parts, whilst in the position shown in figure 5, in which the gears (16) and (21) are unclutched, only the main shaft (8) moves, a work position corresponding to obtaining a single part.

Finally and to simultaneously obtain two equal parts, the movements of the shafts (18) and (18') should be in the same direction and the existence of a third gear (22) has been foreseen, established over a walking beam (23), which may be activated by any suitable device between the limit positions shown in a continuous and discontinuous plot in figure 2, such that as from the situation of non-operation shown by the discontinuous line, this third gear (22) may be coupled to the gears (16) and (21), as a transmission bridge between them, according to the representation in figure 3, in which said gears (16) and (21) are longitudinally dephased, by which the intended transmission of movement is obtained from the main shaft (18) to the secondary shaft (18'), with movement in a same direction, to obtain equal parts.

In figure 6, a similar view to that of figure 1 is shown, but with the novelty that the bench has been divided into two, with reference numbers (1) and (1'), respectively.

The components shown for one bench or the other have the same references as those shown in figure 1, with the difference that those belonging to bench (1') also carry the "dash".

In figure 7, it may be seen how the stanchions (13-13') can be suppressed, one or both of them, with

the purpose of not being an obstacle in some cases. For this purpose, the mentioned stanchions (13-13') are fixed with a non-movable character to the support (4), it being possible to suppress them if the dimensions of the part to be machined so require (figure 7).

Regarding figures 6 and 7, it may be observed that the benches (1-1') may be longitudinally non-movable, such that they are structured by means of numerous telescopic and hollow modules, inside of which is a motor (25), which acts over a nut (26), fixed to the intermediate module of the corresponding bench (1-1'), acting over a screw (27) between end bearings (28-28'), fixed to the ends of the bench, as may be especially observed in figure 7. In this way, the operative sectors of the benches (1-1') may remain perfectly opposite to each other, as in the case of figure 6, when identical parts have to be machined, or may remain arranged in diametric opposition, as shown in figure 7, when symmetrical parts have to be prepared or they may adopt any other relative position when different parts have to be executed simultaneously.

Anyway, the benches (1-1') may be fixed with the help of fixed supports (29-29', 30-30') provided with a retractile shank (31) which may be housed in holes made in the corresponding edges of the benches (1-1').

Moreover, at the lower end of the vertical stemples (13-13'), a fixed boss (32) is interlocked, such that to the two side bosses, two fixed supports (33-33') are coupled which permit, with the help of two turn-tables (34), consisting of market components and located at a suitable distance, as may be observed in figure 9, to machine crowns of up to an infinite external radius and an internal radius depending on the width of the bench, as already has been said, it being possible to machine two crowns simultaneously, one on each side of the machine, or only one of said crowns and on the other side a part of any shape.

Claims

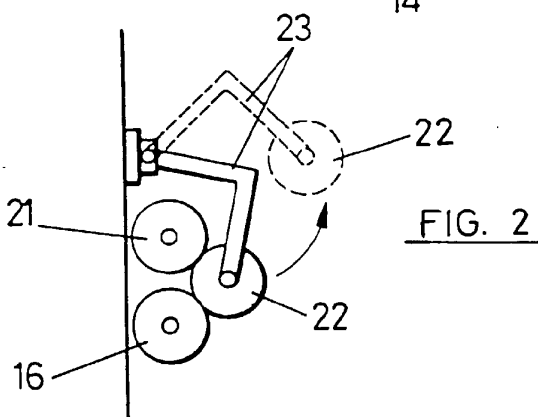
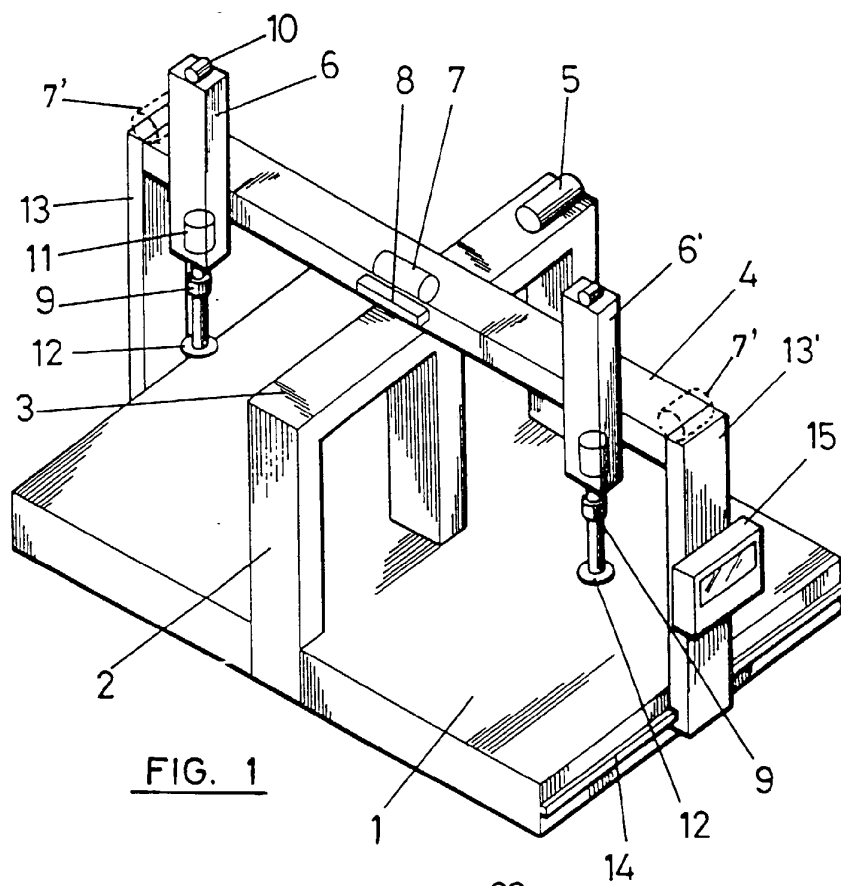
1. Double arm vertical miller, which being foreseen to simultaneously execute the machining of two symmetric or equal parts, or to simultaneously execute a machining and a digitalizing, it is essentially characterized in that it is made as from a framework (2), consisting of three vertical columns and an upper guide crossbar (3), being located on both sides of this framework (2) two benches (1-1'), with the particularity that on the upper guide crossbar (3) of said framework, a transverse support (4) is located, which may be displaced towards one side or the other with respect to this crossbar (3) of the framework, according to an "X" movement; having foreseen that in this support (4), two vertical arms are installed (6) which may be displaced towards one side or the other with respect to the support (4), according to a "Y" movement, these vertical arms (6)

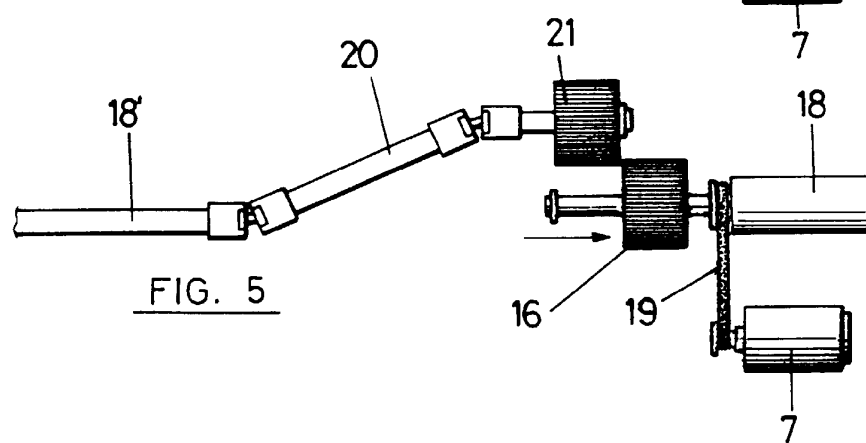
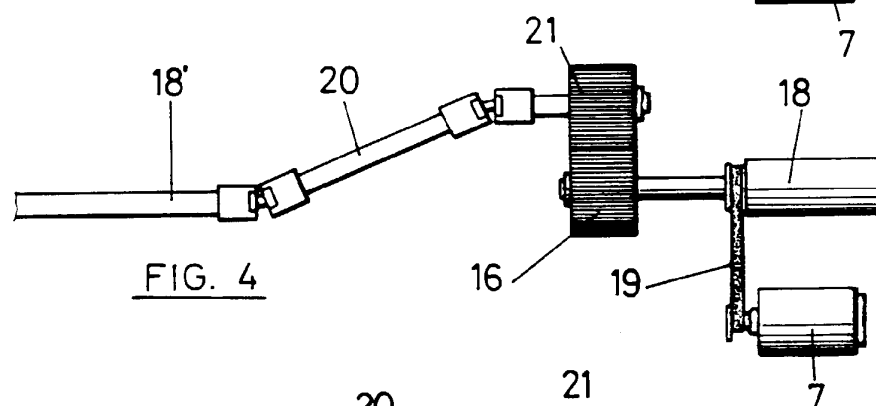
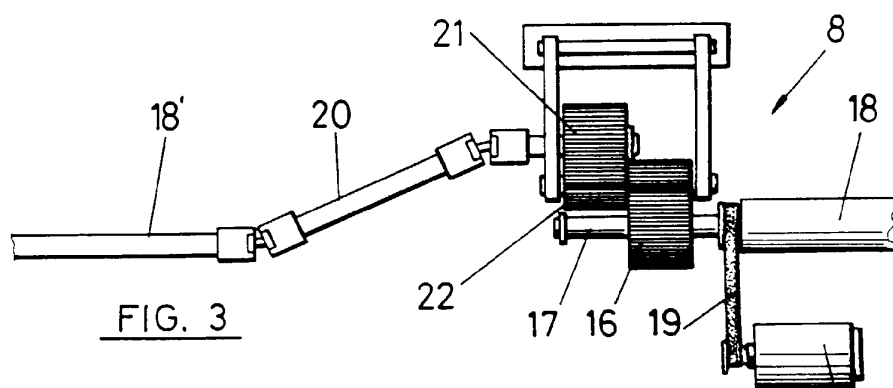
being holders of the corresponding tools or digitalizer (12) which may be displaced upwards/downwards, according to a movement "Z", such that the combination of these movements allows symmetric or equal parts to be executed, as well as to simultaneously carry out digitalizing jobs with one arm and milling with the other.

2. Double arm vertical miller, according to claim 1, characterized in that the "X" movement of the transverse support (4) is made by means of a motor (5), whilst the displacement according to the "Y" movement of the vertical arms (6) is executed, in each case, by a motor (7'), being the two motors (7') located in the upper part of this transverse support (4); it having been foreseen that the "Z" movement corresponding to the vertical upwards/downwards displacement of the tools corresponding to the arms (6) is made by means of corresponding independent motors (10) located in the upper end of the arms (6), and the rotational movement by means of motors (11) arranged in the coupling zone, with the corresponding tool or digitalizer (12).
3. Double arm vertical miller, according to claim 1, characterized in that the displacement for the arms (6-6') along the support (4), is executed by means of single motor (7) which, by means of a set of gear (8), provides movement only to one of the transmission shafts (18) towards one of the arms (6), or to both shafts (18-18'). In the latter case, in the same or opposite direction, according to the simultaneous attainment of two equal or symmetric parts.
4. Double arm vertical miller, according to claim 3, characterized in that the mentioned arm (6) displacement motor (7) on the support (4), acts directly and permanently over one of the shafts (18), counting with an extension (17) over which a main gear (16) is longitudinally displaceable and which may be kept isolated or coupled to a second gear (21) which finishes, across a loaded transmission (20), the end of the other shaft (18'), either directly when symmetrical parts are required, or with the collaboration of a third gear (22) fitted over a walking beam (23), permitting the coupling/uncoupling of said third gear (22), simultaneously, to the main (16) and secondary (21) gears.
5. Double arm vertical miller, according to claims 3 and 4, characterized in that the support (4) for the tool holder arms (6-6') finishes at its free ends in two stanchions (13-13'), which at their lower end are associated to guides (14) made in the edges corresponding to the work bench (1), such that said stanchions (13) convert with the support (4) into a second mobile framework, preventing possible vibrations generated by the operation components of the

machine.

6. Double arm vertical miller, according to claim 5, characterized in that at least one of the mentioned stanchions (13) stabilizing the support (4), constitute the means of support for a viewer (15) of the works to be executed by the machine.
7. Double arm vertical miller, according to claim 3, characterized in that the work bench is divided into two physically independent sectors (1-1'), located on each side of the intermediate and fixed framework (2), with the particularity that each one of these benches are mobile, by means of guides and runners leaning over them.
8. Double arm vertical miller, according to claim 7, characterized in that each bench (1-1') is structured by means of numerous telescopic and hollow modules, inside of which is an activation motor (25), which acts over a nut (26), conveniently interlocked to the intermediate operative module of the bench (1-1'), this nut acts over a screw (27) whose ends are fixed over bearings (28), fixed to the free end of the end modules of the respective benches (1-1'), such that activation in one direction or the other of each motor (25), causes the displacement in one direction or the other of the intermediate operative module (1-1') of the bench.
9. Double arm vertical miller, according to claim 7 and 8, characterized in that to both sides of the work benches (1-1'), there are fixed supports (29-29', 30-30'), in which two bosses or retractiles pivots (31) operate, and which may interlock in holes made in the corresponding edges of the benches, for their optional blocking.
10. Double arm vertical miller, according to claims 7, 8 and 9, characterized in that the vertical stemples (13-13') of the support (4) integrating the mobile framework, are mounted over said support (4) with a non-movable character, to be able to eliminate one or both of them simultaneously, when the part or parts to be machined have dimensions greater than the width of the bench.
11. Double arm vertical miller, according to claims 7 to 10, characterized in that the lower end of each vertical stemple (13-13') of the mobile framework is interlocked to a fixed boss (32) to immobilize the machine bridge, with which a mobile support (33-33') collaborates, all the latter to couple a turn-table (34) to each one of the sides of the machine, conventional in itself, for the machining of large radius crowns.





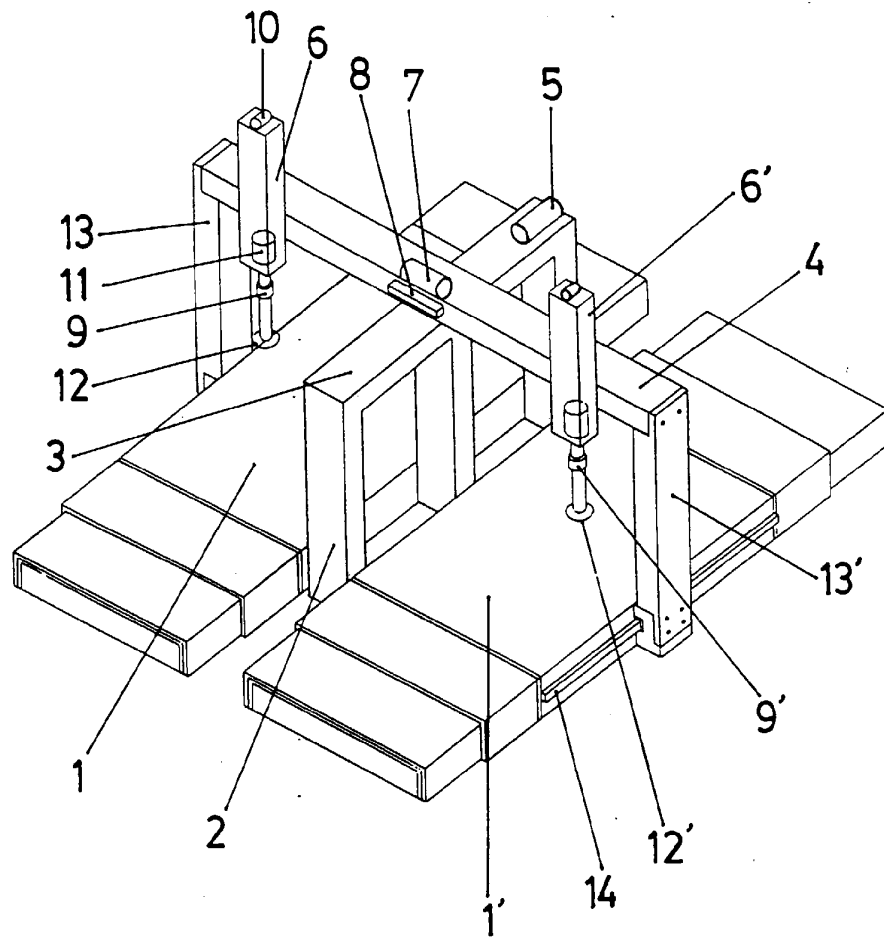


FIG. 6

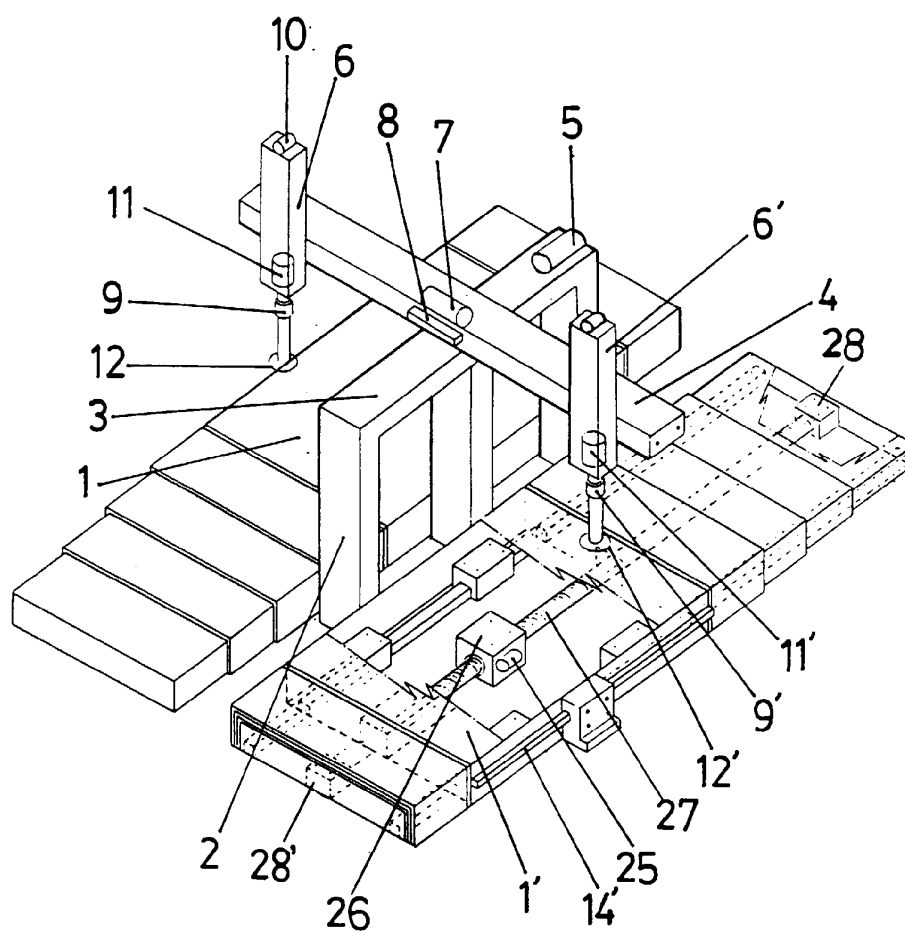


FIG. 7

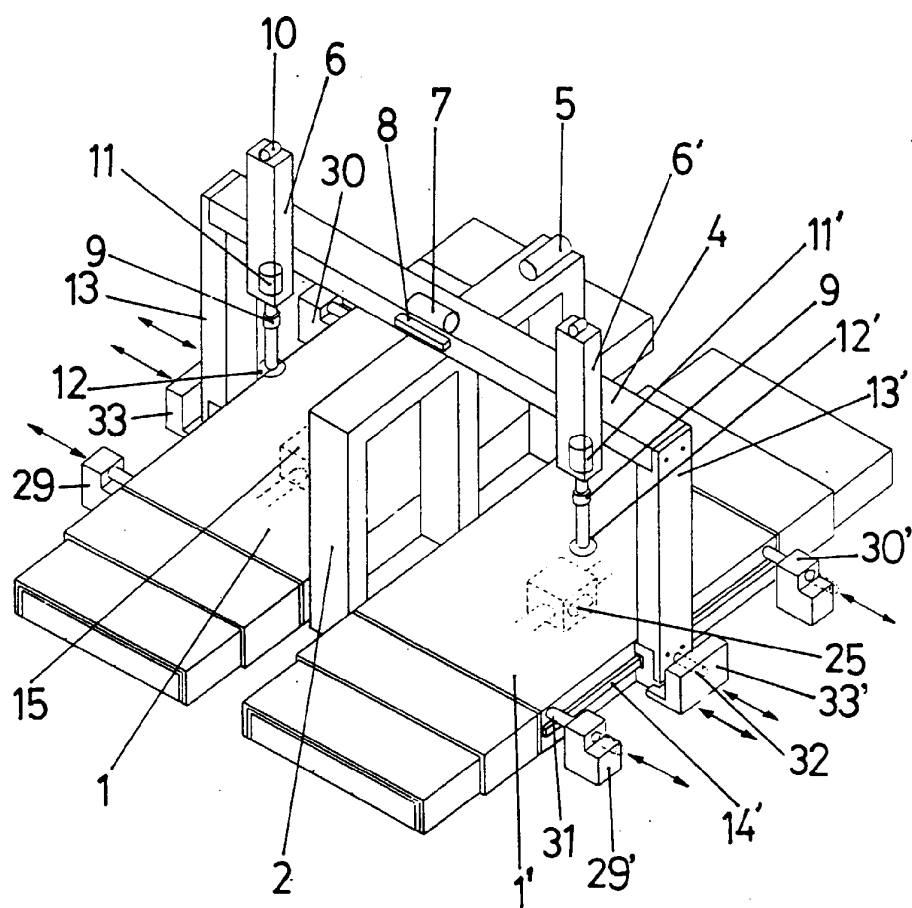


FIG. 8

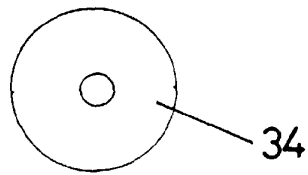
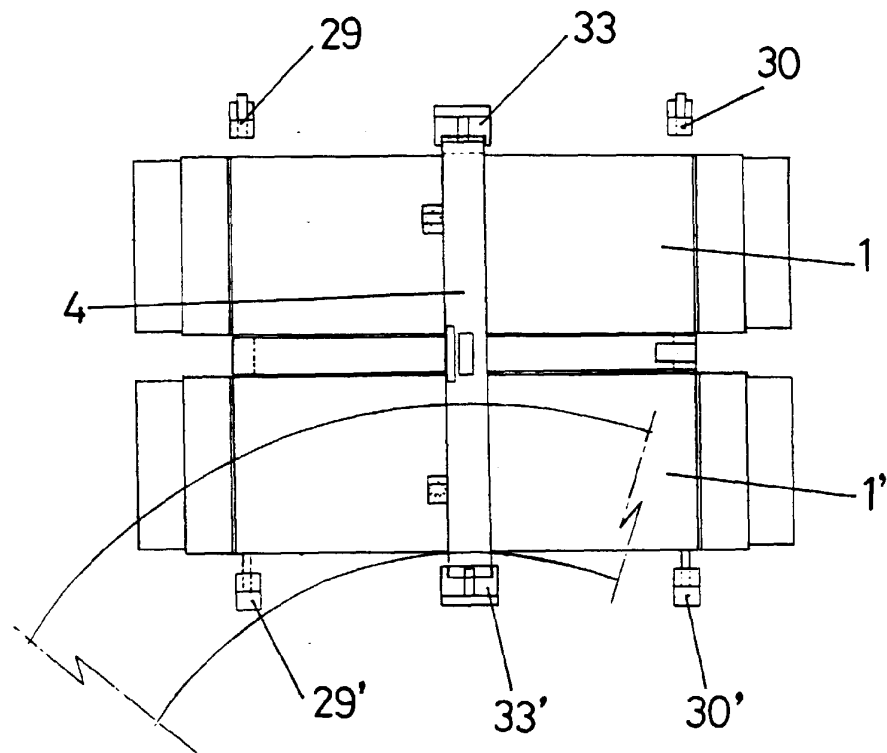


FIG. 9



European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 97 50 0165

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X	DE 37 04 445 A (GERG BLASIUS)	1,3	B23Q39/04 B23Q35/10 B23Q1/01
Y	* the whole document *	2,7	
Y	DE 40 15 570 A (DOERRIES SCHARMANN GMBH) * column 3, line 38 - column 4, line 33; figures 1,2 *	2,7	
X	DE 28 44 088 A (HEYLIGENSTAEDT & CO) * page 6, line 25 - page 7, line 16; figures 1-3 *	1	
A	FR 2 474 365 A (LINE SA) * page 2, line 17 - page 3, line 24; figures 1-6 *	1	
A	US 5 054 175 A (DATE TAKAO) * column 2, line 51 - line 68 * * column 3, line 53 - column 4, line 8; figures 1-9 *	8,9	
			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
			B23Q B23C
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 14 January 1998	Examiner Ljungberg, R
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

EPO FORM 1503 03 82 (P01/C01)

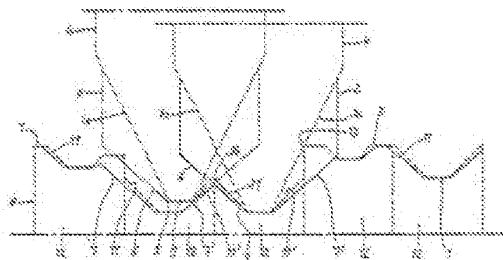


Espacenet

Bibliographic data: FR2499435 (A1) — 1982-08-13**PROCEDE ET DISPOSITIF POUR TAILLER DES ENCOCHES DE CLE A FLANCS INCLINES****Inventor(s):** ERLENBACH MANFRED ± (MANFRED ERLENBACH)**Applicant(s):** BOERKEY NACHF AUGUST [DE] ± (BORKEY NACHFOLGER AUGUST)**Classification:** - **international:** B23C3/35; (IPC1-7): B23C3/35- **cooperative:** B23C3/35**Application number:** FR19820002536 19820211**Priority number(s):** DE19813104809 19810211**Also published as:** DE3104809 (C1) IT1149609 (B)**Abstract of FR2499435 (A1)**

In a key-milling machine for cutting the notches of a key, which correspond to the tumblers of a lock and have sloping notch flanks, with at least one revolving disc milling cutter having cutting-edge flanks adapted to the slope of the key notch flanks to be produced and with at least one slide rest which carries a key blank and is controlled parallel to the cutter shaft as well as by a tracer engageable in the notches of a template and is also

designed to be automatically adjustable transversely to the cutter shaft during the continuous parallel adjustment, the notches in the template corresponding in position and depth to the desired shape of the key notches to be produced, it is proposed that, in order to avoid scores from being produced in the key notch flanks, the template notch flanks (11, 11') have a steeper setting than the flanks (7, 7') of the desired profile of the key notches.



RÉPUBLIQUE FRANÇAISE
INSTITUT NATIONAL
DE LA PROPRIÉTÉ INDUSTRIELLE

PARIS

(11) N° de publication :
(A n'utiliser que pour les
commandes de reproduction).

2 499 435

A1

**DEMANDE
DE BREVET D'INVENTION**

(21) **N° 82 02536**

(54) Procédé et dispositif pour tailler des encoches de clé à flancs inclinés.

(51) Classification internationale (Int. Cl. ³). **B 23 C 3/35.**

(22) Date de dépôt..... 11 février 1982.

(33) (32) (31) Priorité revendiquée : *RFA, 11 février 1981, n° P 31 04 809.9.*

(41) Date de la mise à la disposition du
public de la demande..... B.O.P.I. — « Listes » n° 32 du 13-8-1982.

(71) Déposant : **FIRME AUGUST BORKEY NACHFOLGER**, résidant en RFA.

(72) Invention de : **Manfred Erlenbach.**

(73) Titulaire : *Idem* (71)

(74) Mandataire : **G. Romain,**
6, rue de la Palène, Ménétrol, 63200 Riom.

- 1 -

La présente invention concerne un procédé pour tailler les encoches à flancs inclinés d'une clé qui correspondent aux barbes de pène d'une serrure, au moyen d'une fraiseuse de clés qui comporte au moins
5 une fraise à disque rotative ayant des flancs de taille adaptés à l'inclinaison des flancs des encoches et un support portant au moins une ébauche de clé et déplacé automatiquement d'une part parallèlement à l'arbre de la fraise et, d'autre part, pendant ce déplacement paral-
10 lèle continu, transversalement par rapport à cet arbre par commande d'un palpeur qui peut s'engager dans les encoches d'un gabarit.

L'invention concerne aussi des dispositifs pour mettre en oeuvre ce procédé.

15 Un dispositif déjà connu pour la mise en oeuvre de ce procédé est décrit dans un prospectus de la firme August Börkey Nachf., Gevelsberg, qui représente la fraiseuse de clés n° 963, Cyclomat III.
Dans ce dispositif le gabarit qui coopère avec le palpeur
20 a un contour identique à la forme que le contour des encoches de la clé doit théoriquement présenter, de sorte que les flancs inclinés de ces encoches sont usinés en continu à mesure que le support se déplace automatiquement sans arrêt, cela aussi bien parallèlement à l'arbre
25 de la fraise que transversalement par rapport à cet arbre.

Il s'est cependant révélé que les flancs des encoches de clé ainsi usinés présentaient des stries plus ou moins profondes, analogues à des traces de broutage
30 et pouvant être dues d'une part à l'avance, mais peut-être aussi d'autre part à des résistances par frottement entre le palpeur et le contour du gabarit.

Ces stries peuvent d'une part rendre difficiles l'ouverture et/ou la fermeture de la serrure correspon-
35 dante, d'autre part favoriser l'usure de la clé et des barbes de pène de la serrure.

- 2 -

Le problème auquel l'invention a apporté une solution consistait donc à créer des possibilités d'éviter la formation nuisible de stries sur les flancs inclinés des encoches d'une clé lorsque celles-ci sont taillées
5 au moyen d'une fraiseuse de l'espèce décrite ci-dessus.

La solution à ce problème est, conformément à l'invention, caractérisée par le fait que durant le déplacement de l'ébauche de clé dans le sens transversal la fraise est maintenue éloignée du contour théorique
10 des flancs des encoches de clé, la taille de ce contour n'étant commencée que lorsque la profondeur d'engagement la plus grande est atteinte.

Grâce à ces dispositions, pendant le déplacement transversal de l'ébauche de clé qui est commandé par le
15 palpeur et qui fait que cette ébauche se rapproche de la fraise en même temps qu'elle se déplace sans discontinuité parallèlement à la direction longitudinale de l'arbre de la fraise, cette dernière ne taille dans l'ébauche que des encoches sous-dimensionnées, tandis que
20 l'usinage du contour théorique de ces encoches a lieu pendant qu'il n'y a pas déplacement transversal de l'ébauche de clé, ce qui a pour résultat que les flancs des encoches présentent une qualité de surface considérablement meilleure qu'auparavant.

25 Des qualités de surface sensiblement aussi bonnes pourraient certes être obtenues aussi avec des machines dont le support est commandé manuellement. Mais il faut que pendant le déplacement transversal de ce support, c'est-à-dire lorsqu'il se rapproche sensiblement radiale-
30 ment de l'arbre de la fraise, il n'y ait aucun déplacement du support parallèlement à cet arbre.

Ces dispositions sont toutefois beaucoup plus longues à mettre en oeuvre et, en outre, ne peuvent être appliquées à des fraiseuses de clés dont le support se
35 déplace automatiquement et sans arrêt parallèlement à l'arbre de la fraise.

- 3 -

Lorsque le profil théorique d'une encoche de clé a une largeur supérieure à celle du profil de la fraise, une autre caractéristique du procédé selon l'invention consiste à faire en sorte qu'après exécution de l'un des flancs selon la forme théorique l'ébauche de clé est déplacée exclusivement parallèlement à l'arbre de la fraise en direction du flanc opposé encore à exécuter, et que pendant le déplacement transversal de l'ébauche de clé effectué en même temps que son déplacement parallèle le deuxième flanc exécuté suivant la forme théorique se trouve éloigné de la fraise.

Pour améliorer encore davantage la qualité de surface et la précision des dimensions il est avantageux de prévoir d'effectuer le copiage d'une clé en deux passes de fraisage, en déplaçant le support et par conséquent la clé en continu une fois de droite à gauche et la fois suivante de gauche à droite, ou vice versa, à chaque fois parallèlement à l'arbre de la fraise.

Pour exécuter le procédé selon l'invention tel que décrit ci-dessus au moyen d'une fraiseuse du genre de celle décrite en préambule et avec un gabarit dont les encoches correspondent en position et en profondeur à la forme théorique des encoches à exécuter dans l'ébauche de clé, l'invention prévoit un dispositif qui se caractérise par le fait que les flancs des encoches du gabarit sont, par rapport au profil théorique des encoches de la clé, disposés avec un décalage vers le milieu de l'encoche considérée, et que la largeur du pourtour du palpeur est plus petite que la largeur des taillants du pourtour extérieur de la fraise, la différence entre ces deux largeurs étant égale au degré de décalage des deux flancs d'encoche du gabarit vers l'intérieur par rapport à ceux des encoches de la clé.

Grâce à ces dispositions la fraise est en mesure de

- 4 -

ne tailler le contour théorique des flancs d'encoche de la clé que lorsqu'elle a atteint pour chaque encoche sa plus grande profondeur de pénétration.

5 Une autre caractéristique avantageuse du dispositif selon l'invention tel que défini ci-dessus, permettant aussi à elle seule de mettre en oeuvre le procédé selon l'invention, réside en ce que les flancs d'encoche du gabarit sont plus inclinés que les flancs du profil théorique des encoches de la clé.

10 En outre, pour assurer une haute qualité de surface sur les flancs des encoches de la clé, il est avantageux que le palpeur présente, à partir de son pourtour extérieur, des flancs divergents vers l'extérieur qui présentent la même inclinaison ou une inclinaison plus
15 forte que les flancs des encoches du gabarit.

Le palpeur qui résulte de cette disposition est beaucoup plus stable et moins sujet à vibrer qu'un palpeur à flancs parallèles, et ce sans perturber le déroulement du procédé.

20 Une forme préférée de conception du gabarit se caractérise par le fait qu'il se compose de plusieurs disques juxtaposés sur un axe parallèle à l'arbre de la fraise, ces disques, dont l'épaisseur correspond à la distance théorique entre encoches de la clé voisines
25 l'une de l'autre, pouvant tourner et être fixés en position, chacun d'eux présentant sur son pourtour plusieurs zones situées à des distances radiales différentes de l'axe de rotation, et, dans ces zones, des encoches dont la profondeur varie d'une encoche à l'autre
30 et qui coopèrent avec le palpeur, lequel comporte des flancs qui vont en convergeant symétriquement et cunéiformément en direction de son extrémité, ces flancs pouvant être appliqués sur les arêtes des disques de gabarit et étant conçus pour commander le déplacement transversal
35 du support.

Le gabarit selon l'invention permet, par rapport aux

- 5 -

disques codés connus, d'emmagasiner beaucoup plus d'informations sur un espace extrêmement restreint.

De plus, cette forme préférée du gabarit ouvre une autre possibilité de mettre en oeuvre le procédé
5 selon l'invention, en ce sens que le déplacement du support peut être commandé par les flancs inclinés du palpeur.

L'invention va maintenant être décrite plus en détail à l'aide d'un exemple d'exécution illustré au
10 dessin annexé.

Dans cet exemple le contour 1 de la clé et la fraise 2 montée à rotation sur le bâti sont représentés en traits pleins, tandis que le profil du gabarit 3 et le palpeur 4 fixé au bâti sont représentés en tirets,
15 avec superposition afin de faire comprendre le déroulement du procédé, alors que normalement, c'est-à-dire dans le cas d'une fraiseuse de clés de l'espèce décrite plus haut, notamment pour fabriquer des clés de serrures à barillet, la clé et le gabarit sont disposés sur un support non représenté, parallèlement à l'arbre de la
20 fraiseuse et côte à côte.

La fraise à disque tournant 2 comporte sur son pourtour des tranchants 5 et des flancs de coupe 6 symétriques et inclinés, le profil de coupe de cette fraise
25 correspondant ainsi au profil théorique de la plus grande encoche de la clé.

Toutes les encoches de la clé sont à égale distance les unes des autres. Toutefois, leur profondeur varie d'une encoche à l'autre, de sorte que les flancs 7 des
30 encoches présentent des longueurs différentes.

La longueur de chaque flanc de coupe 6 de la fraise 2 est égale ou, de préférence, supérieure à la plus grande longueur d'un flanc d'encoche 7 à produire.

En ce qui concerne leur nombre et leur position,
35 les encoches dans le gabarit 8 correspondent aux encoches à produire dans la clé.

- 6 -

Le palpeur 4 présente un pourtour frontal 9 parallèle à la direction longitudinale du gabarit 8 et de la clé, et par conséquent parallèle aussi à l'arbre (non représenté) de la fraise 2. Ce palpeur comporte 5 en outre des flancs 10 disposés symétriquement, convergeant de façon cunéiforme en direction du pourtour frontal 9.

Les flancs 11 des encoches dans le gabarit 8 sont, par rapport au profil théorique des flancs 7 des 10 encoches dans la clé, décalés en direction du milieu de l'encoche, et la largeur du pourtour frontal 9 du palpeur est plus petite que celle des tranchants 5 du pourtour de la fraise 2, la différence en moins entre ces deux largeurs étant fonction du degré de ce décalage 15 des flancs. En outre, les flancs 11 des encoches du gabarit 8 sont plus inclinés que les flancs 7 des encoches de la clé.

Le gabarit 8 se compose d'une pluralité de disques 12 juxtaposés, montés sur un axe parallèle à l'arbre 20 (non représenté) de la fraise, avec possibilité de tourner sur cet axe et d'y être fixés en position. Le nombre de ces disques 12 correspond au nombre d'encoches à produire dans la clé. L'épaisseur des disques 12 est égale à la distance de deux encoches de clé voisines 25 l'une de l'autre. Les disques 12 présentent chacun des zones périphériques réparties sur leur pourtour à diverses distances radiales de l'axe sur lequel ces disques sont montés. Dans ces zones périphériques (il peut y en avoir par exemple six sur un disque 12) sont 30 prévues, au milieu de l'étendue parallèle à l'axe, les encoches précédemment décrites, s'étendant dans la direction circonférentielle, de sorte que par rotation de ces disques 12 les uns par rapport aux autres on peut réaliser un grand nombre de profils d'encoche différents 35 entre eux.

Si alors, la clé et le gabarit 8 sont déplacés

- 7 -

automatiquement de droite à gauche en regardant le dessin, d'une part de manière continue parallèlement au disque de fraisage en rotation 2 et au palpeur 4, d'autre part transversalement par rapport à l'arbre de ce

5 disque sous la commande du palpeur 4 représenté en traits mixtes, l'arête frontale de droite de ce palpeur rencontre le flanc d'encoche 11 du gabarit 8, flanc qui est décalé vers l'intérieur et aussi plus incliné que le flanc 7 d'encoche de clé et, en même temps,

10 éloigne de la fraise 2 le dit flanc qui vient d'être usiné, de sorte que durant ce déplacement transversal aucun usinage ultérieur de ce flanc par enlèvement de copeaux ne se produit. Lorsque la fraise 2 et le palpeur 4 franchissent la crête de profil située à droite

15 de cette fraise et de ce palpeur dessinés en traits mixtes, la fraise 2 est maintenue éloignée du profil théorique de la clé par le palpeur 4, et une fois cette crête franchie c'est maintenant l'arête frontale de gauche du palpeur qui, dans l'encoche du gabarit 8, prend

20 appui sur celui des flancs 11 de cette encoche qui est situé en regard de cette arête, de sorte que pendant le déplacement transversal qui s'ensuit en même temps que se poursuit le déplacement parallèle continu seule une encoche de clé est fraisée à une profondeur inférieure à la cote théorique, laquelle ne sera usinée que

25 lorsque la fraise 2 aura atteint la profondeur de coupe la plus grande.

Cette phase est illustrée par la fraise 2 et le palpeur 4 dessinés la première en trait plein, le second en tirets.

30

Lors du déplacement parallèle continu qui se poursuit, le flanc de droite 10 du palpeur 4 rencontre l'arête frontale voisine 13 du disque 12, de sorte qu'à nouveau le flanc 7 de l'encoche de clé produit par la fraise 2

35 s'éloigne de cette dernière du fait du déplacement transversal qui en résulte forcément.

- 8 -

Grâce à cela est évitée avec certitude la formation de stries qui, avec les procédés connus, se produisait sur les flancs 7 des encoches de la clé.

Pour améliorer davantage la qualité de surface
5 et la précision des dimensions il est avantageux d'effectuer un second processus de fraisage avec un déplacement parallèle en sens inverse du premier.

Ce procédé de fraisage avantageux peut être utilisé également lorsque la clé et le gabarit sont maintenus
10 fixes sur le bâti, auquel cas le palpeur 4 et la fraise 2 sont déplacés relativement à la clé et au gabarit.

Pour la fabrication industrielle de clés, plusieurs fraises à disque de même nature peuvent être disposées à distance les unes des autres sur l'arbre de fraisage,
15 en face de chacune desquelles un dispositif de fixation pour un clé est disposé sur un support commun, de sorte qu'autant de clés qu'il y a de fraises et de dispositifs de fixation peuvent être fabriquées en même temps.

Toutes les caractéristiques nouvelles décrites ci-
20 dessus et/ou illustrées sont, individuellement ou en combinaison, considérées comme essentielles pour réaliser l'invention.

- 9 -

REVENDEICATIONS

1. Procédé pour tailler les encoches à flancs inclinés d'une clé qui correspondent aux barbes de pène d'une serrure, au moyen d'une fraiseuse de clés
5 qui comporte au moins une fraise à disque rotative ayant des flancs de taille adaptés à l'inclinaison des flancs des encoches et un support portant au moins une ébauche de clé et déplacé automatiquement d'une part parallèlement à l'arbre de la fraise et, d'autre
10 part, pendant ce déplacement parallèle continu, transversalement par rapport à cet arbre par commande d'un palpeur qui peut s'engager dans les encoches d'un gabarit, ce procédé étant remarquable en ce que durant le déplacement de l'ébauche de clé dans le sens transversal
15 la fraise est maintenue éloignée du contour théorique des flancs des encoches de clé, la taille de ce contour n'étant commencée que lorsque la profondeur d'engagement la plus grande est atteinte.

2. Procédé selon la revendication 1, mis en oeuvre
20 dans le cas où le profil théorique d'une encoche de clé a une largeur plus grande que le profil de la fraise, remarquable en ce qu'après exécution de l'un des flancs selon la forme théorique l'ébauche de clé est déplacée exclusivement parallèlement à l'arbre de la fraise en
25 direction du flanc opposé encore à exécuter, et que pendant le déplacement transversal de l'ébauche de clé effectué en même temps que son déplacement parallèle le deuxième flanc exécuté suivant la forme théorique se trouve éloigné de la fraise.

30 3. Dispositif pour la mise en oeuvre du procédé selon la revendication 1 ou 2, avec une fraiseuse telle que celle décrite au préambule de la revendication 1 et avec un gabarit dont la position et la profondeur des encoches correspondent à la forme théorique des encoches
35 à usiner dans la clé, ce dispositif étant remarquable

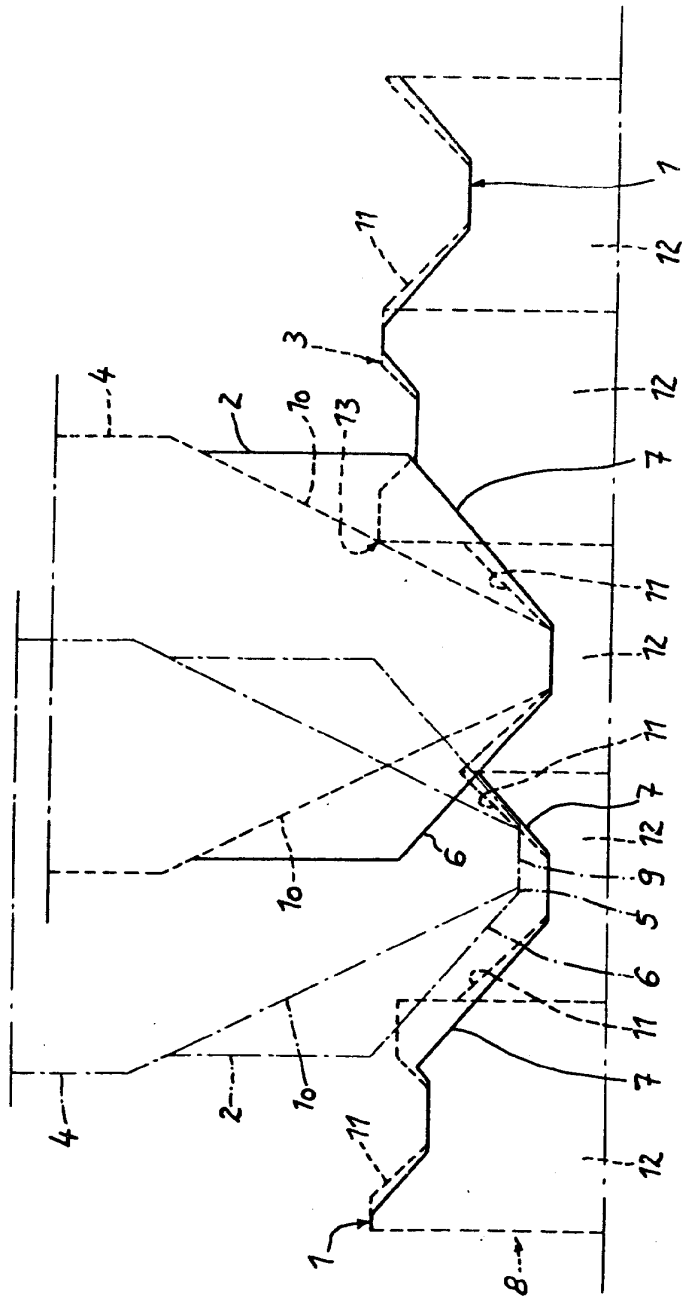
- 10 -

en ce que les flancs (11) des encoches du gabarit (8) sont, par rapport au profil théorique des encoches de la clé, disposés avec un décalage vers le milieu de l'encoche considérée, et que la largeur du pourtour
5 (9) du palpeur (4) est plus petite que la largeur des taillants (5) du pourtour extérieur de la fraise (2), la différence entre ces deux largeurs étant égale au degré de décalage des deux flancs d'encoche (11) du gabarit (8) vers l'intérieur par rapport à ceux des
10 encoches de la clé.

4. Dispositif pour la mise en oeuvre du procédé selon l'invention avec une fraiseuse du type décrit dans la revendication 3, remarquable en ce que les flancs d'encoche (11) du gabarit (8) sont plus incli-
15 nés que les flancs (7) du profil théorique des encoches de la clé.

5. Dispositif selon la revendication 3 ou 4 ou 3 et 4 ensemble, remarquable en ce que le palpeur (4) présente, à partir de son pourtour extérieur, des
20 flancs (10) divergents vers l'extérieur qui présentent la même inclinaison ou une inclinaison plus forte que les flancs (11) des encoches du gabarit (8).

6. Dispositif selon l'une quelconque des revendications précédentes, remarquable en ce que le gabarit
25 (8) se compose de plusieurs disques (12) juxtaposés sur un axe parallèle à l'arbre de la fraise, ces disques, dont l'épaisseur correspond à la distance théorique entre encoches de la clé voisines l'une de l'autre, pouvant tourner et être fixés en position, chacun d'eux pré-
30 sentant sur son pourtour plusieurs zones situées à des distances radiales différentes de l'axe de rotation et, dans ces zones, des encoches dont la profondeur varie d'une encoche à l'autre et qui coopèrent avec le pal-
35 peur (4), lequel comporte des flancs (10) qui vont en convergeant symétriquement et cunéiformément en direction de son extrémité, ces flancs (10) pouvant être appliqués sur les arêtes (13) des disques de gabarit (12) et étant conçus pour commander le déplacement transversal du support.



(12) UK Patent Application (19) GB (11) 2 276 106 (13) A

(43) Date of A Publication 21.09.1994

(21) Application No 9405254.5

(22) Date of Filing 17.03.1994

(30) Priority Data

(31) 9305736

(32) 19.03.1993

(33) GB

(71) Applicant(s)

Autokey (UK) Ltd

(Incorporated in the United Kingdom)

467 Godstone Road, WHYTELEAFE, Surrey, CR3 0BL,
United Kingdom

(72) Inventor(s)

David Alan Clement

Alan McMurray

(74) Agent and/or Address for Service

Raworth Moss & Cook

Raworth House, 36 Sydenham Road, CROYDON,
Surrey, CR0 2EF, United Kingdom

(51) INT CL⁵

B23C 3/35

(52) UK CL (Edition M)

B3K K1D K3C1 K3G1 K3H5 K3H7 K3H9 K7B1 K7B10
K7G K7H K7K K7Q1

(56) Documents Cited

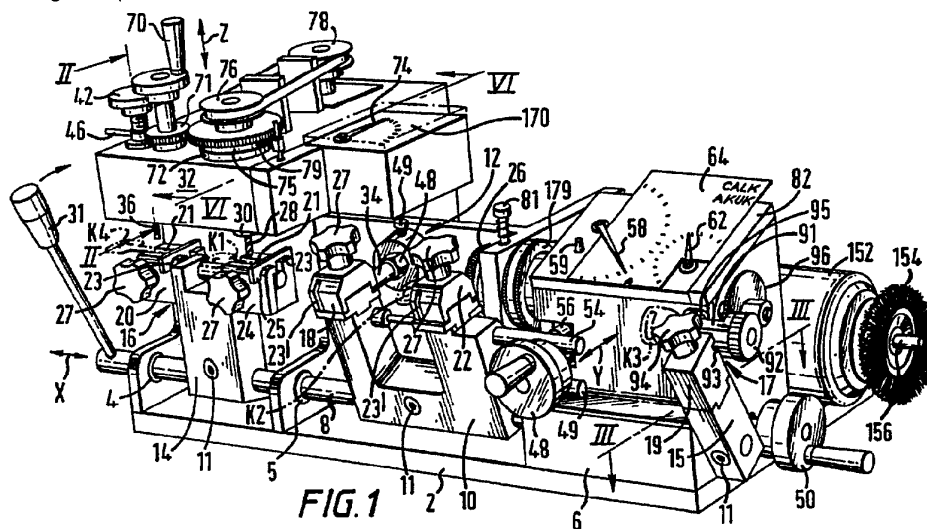
None

(58) Field of Search

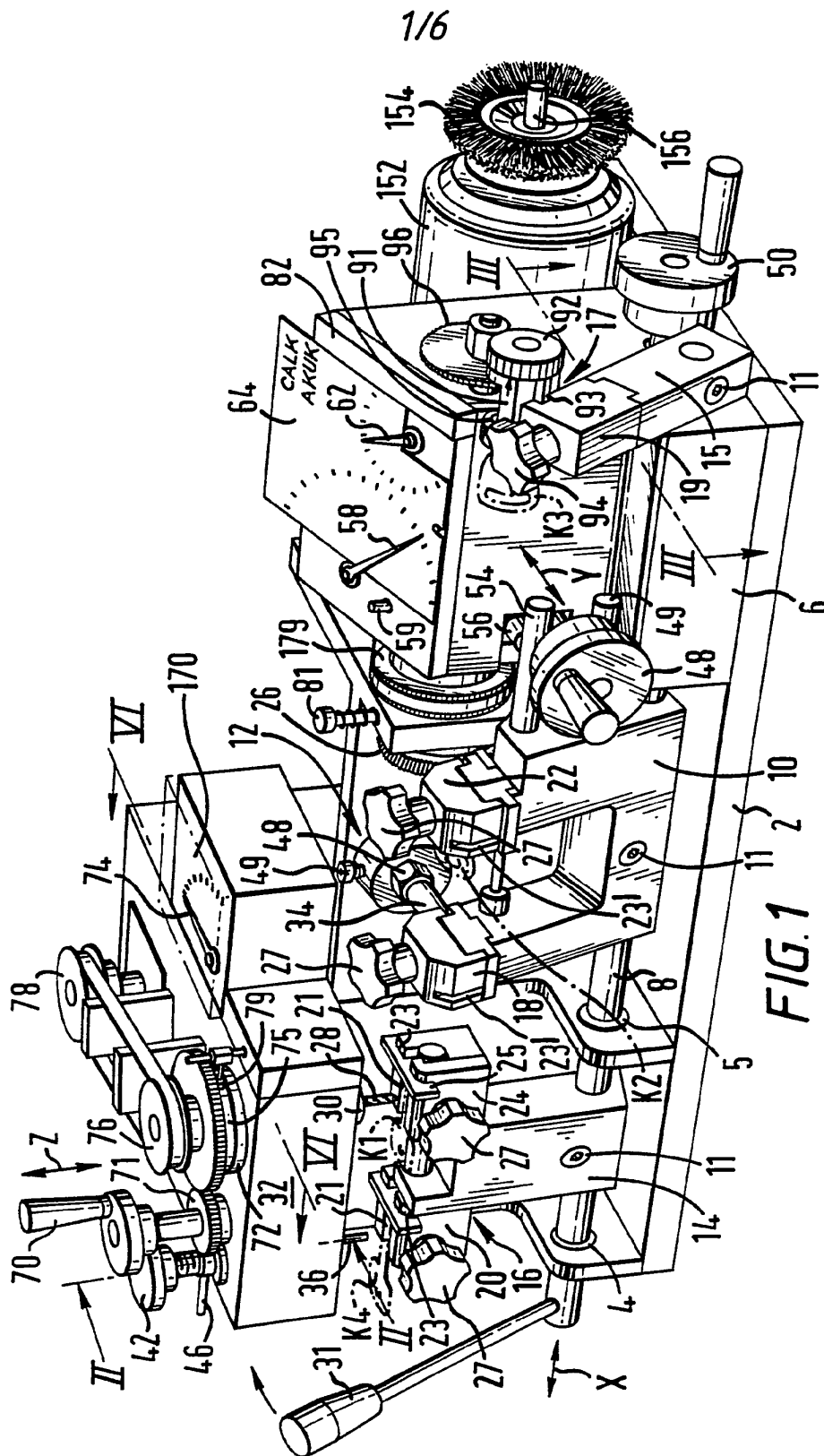
UK CL (Edition M) B3K
INT CL⁵ B23C

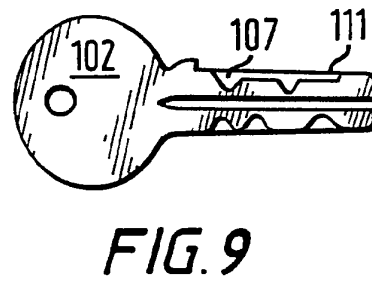
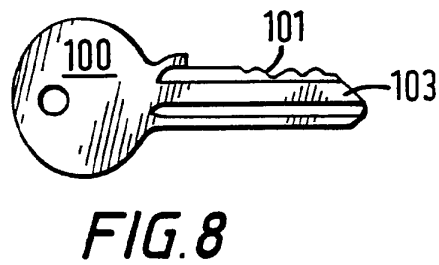
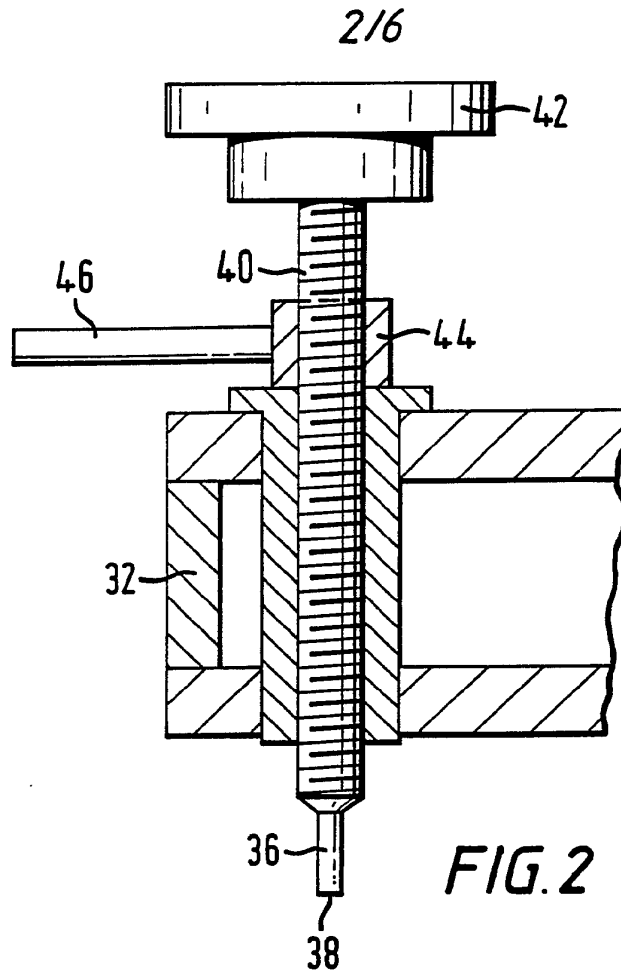
(54) Key mill

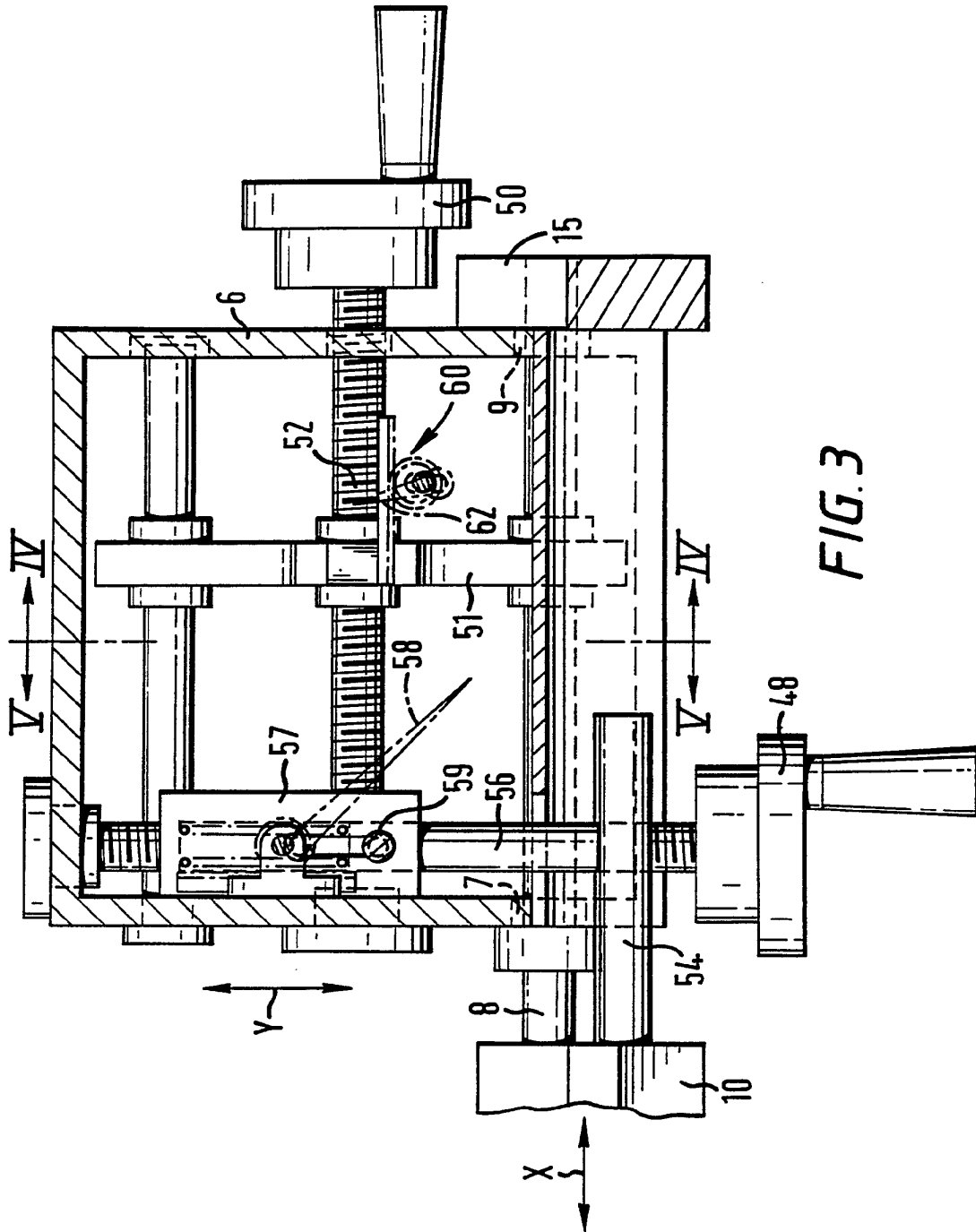
(57) A key mill comprises one or more carriages 10, 14, 15 mounted to a frame 2 with means 50 to move the carriage(s) relative to the frame in an axial direction X and with means 48 to move the carriage(s) transverse Y to the axial direction towards a notch forming means 26, 96 mounted to the frame. A milling head with a milling tool 28 is movable in a further direction Z substantially at a right angle to the axial direction X and at an angle to the transverse direction Y. An indicator 62, 58 is provided for indicating the axial and transverse movement of the carriage and a further indicator 74 is provided for indicating movement of the milling tool in the further direction Z. At least one clamp 19, 22, 24 is provided for clamping a key blank to the carriage(s) so that a key blank held in a clamp 19, 22, 24 may be machined according to a predetermined shape indicated by the indicating means or else duplicated from a master key clamped to the carriage. The machine is designed to provide easy and accurate duplication of keys and to enable a variety of keys to be cut in particular where vertical milling is required.

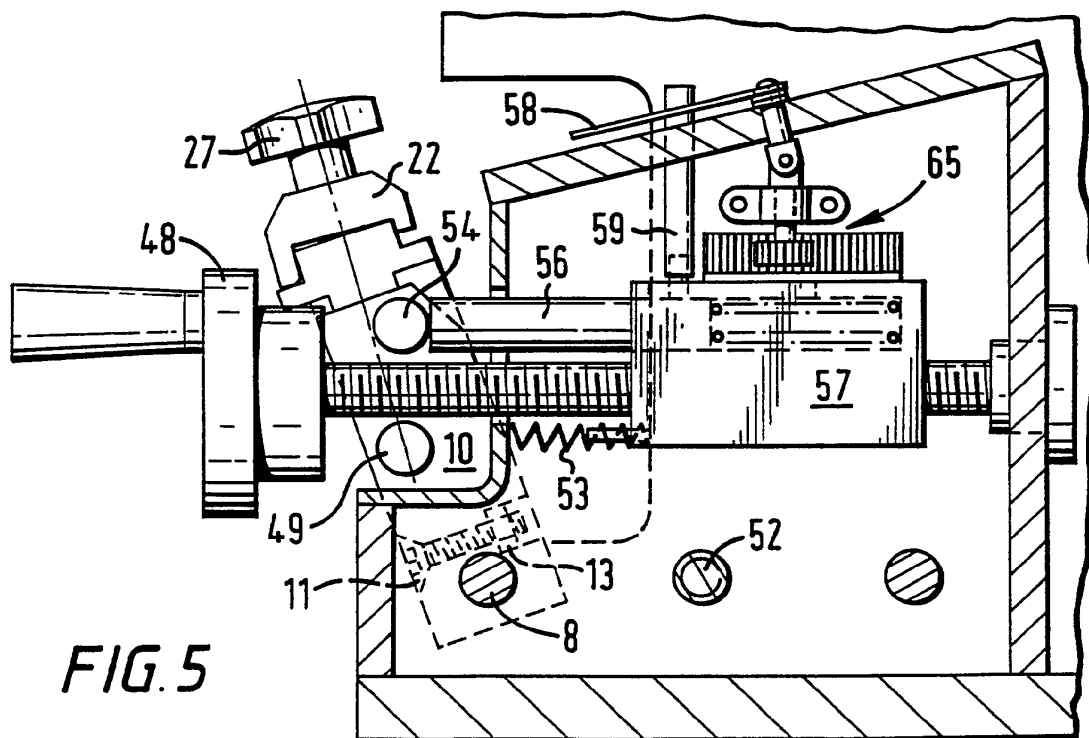
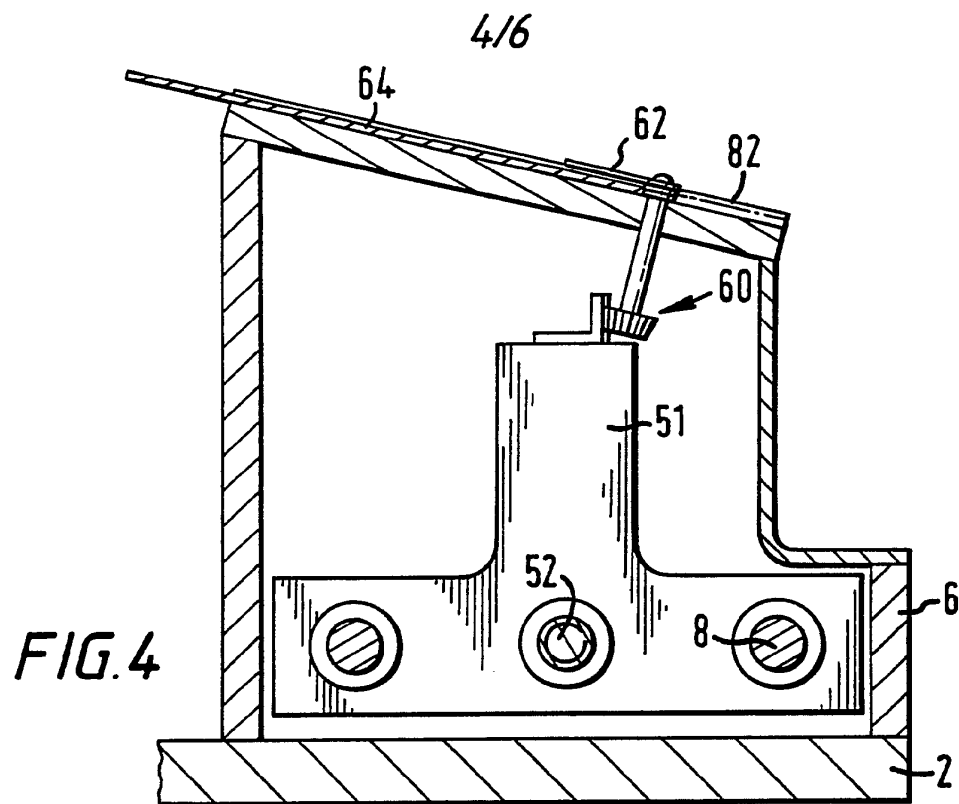


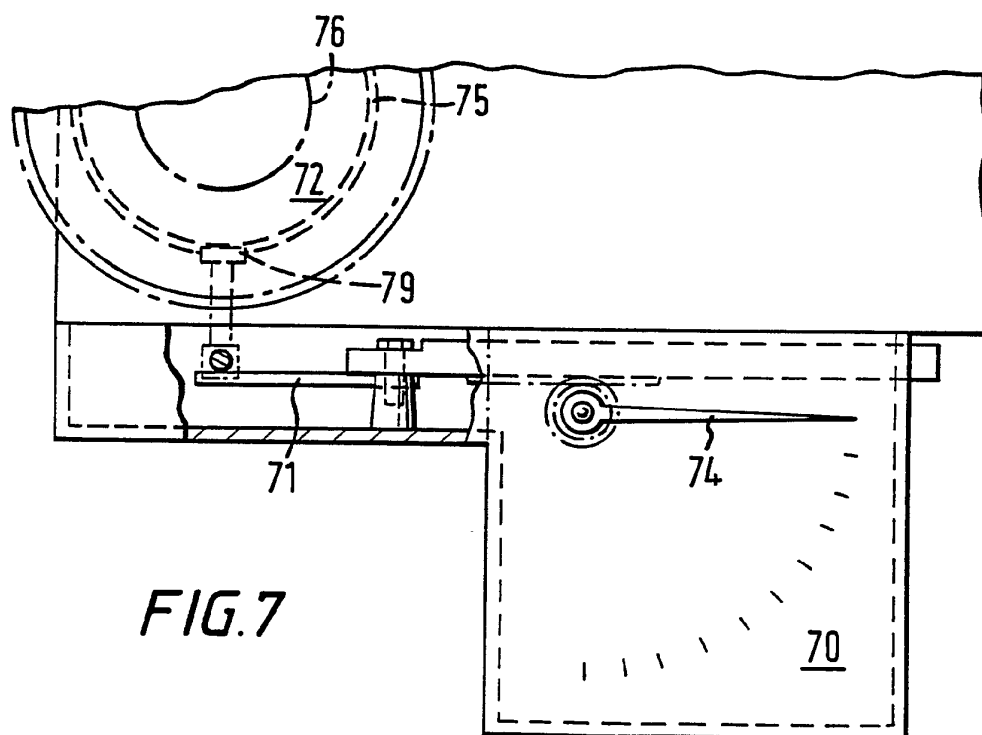
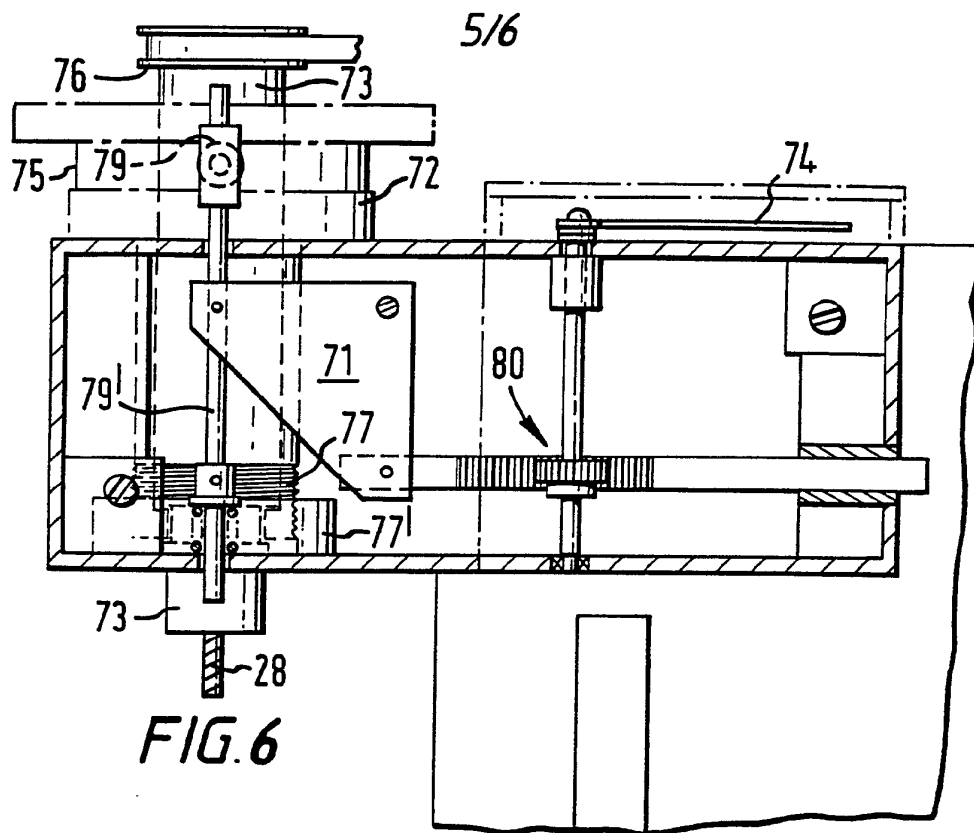
GB 2 276 106 A

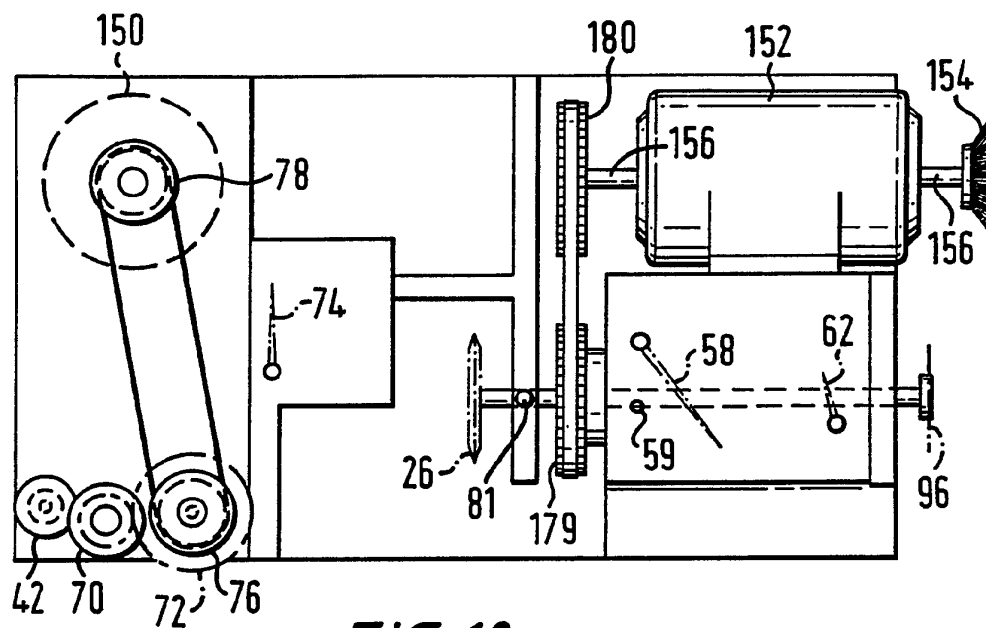










**FIG. 10**

A Key Mill

5 The present invention relates to a key mill for cutting
keys from blanks particularly for duplicating from an
existing key or from a manufacturers specification.

10 Key mills for duplicating keys from blanks are well known.
One such mill is shown and described in US Patent No.
4,117,763 (Uyeda). In the Uyeda mill a key blank is
clamped into a carriage which can be moved in the axial
15 direction of the blank and transverse to that direction
towards a cutting or grinding wheel rotating in the axial
direction so that spaced notches may be cut in the blank.
In order to ensure the notches are in the correct place a
master key or key to be duplicated is clamped into the same
carriage and a follower engaging with the master is used to
20 guide the operator to move the carriage in the axial and
transverse directions. To ensure accuracy when copying
from the key to be duplicated the axial and transverse
movements of the carriage are indicated by two dial
pointers which sweep over a table on which one of several
indexing cards is located. The indexing card has
25 indications for the axial movement or notch spacing and the
transverse movement or notch depth. This arrangement is
quite satisfactory for flat keys but is unsuitable for keys
in which the notches are only partly cut through the blank
that is to say where a vertical cut is required.

30 A key mill according to the invention comprises a frame, at
least one carriage including at least one clamp for
clamping at least a key blank to the carriage, means to
move the carriage relative to the frame in an axial
35 direction, means to move the carriage transverse to the

axial direction towards a key notch forming means mounted to the frame, a milling head arranged to carry a milling tool and to move the tool in a further direction at substantially a right angle to the axial direction and at
5 an angle to the transverse direction, indicator means for indicating the axial and transverse movement of the carriage and further indicator means for indicating movement of the milling tool in the further direction.

10 Preferably the carriage has a first said clamp at a first station adjacent the notch forming means and a second said clamp at a second station adjacent the milling head. In a preferred embodiment there are duplicate clamps at each station and means for following the shape of a key at
15 either duplicate clamp.

An embodiment of the invention will now be described with reference to the accompanying drawings in which:-

20 Figure 1 is a perspective view of a key mill according to the invention,

Figure 2 is a cross-section of a vertical milling head follower for the mill of Figure 1, and
25

Figure 3 is a cross-section of a right hand card holder indexed needle mechanism for the mill of Figure 1 viewed from above,

30 Figure 4 is a cross section of part of the mechanism of Fig. 3 looking horizontally from the left of Fig. 1,

Figure 5 is a cross section of the mechanism of Fig. 3 seen from the right of Fig. 1,
35

Figure 6 is a cross section of a left hand card holder
seen from the right of Fig. 1,

5 Figure 7 is a plan view of the left hand holder of
Fig. 6,

Figure 8 is a key type for horizontal milling,

10 Figure 9 is a key type for vertical milling in the
mill of Figure 1, and

Figure 10 is a diagrammatic plan view of the mill of
Figure 1.

15 The key mill shown in the drawings comprises a frame 2 on
which is mounted by means of bearings 4, 5 and two further
bearings 7 and 9 (see Fig. 3) in frame part 6 a mainshaft
8 axially aligned in the X direction. A first carriage 10
at a first or first horizontal milling station 12 is
20 fixedly mounted at a central point on the shaft, a second
carriage 14 at a second or vertical milling station 16 is
fixedly mounted at an axially spaced position on the shaft
and a third carriage 15 is at a third or auxiliary
horizontal milling station 17.

25 A first key duplicate clamp 18 and a second key duplicate
clamp 20 are provided on the top of respective carriages 10
and 14. A first key blank clamp 22 and a second key blank
clamp 24 are also provided on the top of respective
30 carriages 10 and 14 in locations axially spaced from
duplicate clamps 18 and 20. A third key blank clamp 19 is
provided on top of third carriage 15. Clamp 19 is
removably and reversibly mounted on carriage 15 and
includes a key holder 91 which is slidably adjustable in
35 the X direction on slide way 93 and which is clamped in the

desired position by clamp knob 94. A blank key K3 in holder 91 may also be turned about a horizontal axis by indexed wheel 92, the key blank K3 being held in a key engaging rotatable bearing 95 within holder 91.

5

A slot 21 aligned in the X direction on top of each clamp 20, 24 is provided to receive a key K4 to be duplicated and a key blank K1 respectively. Each slot 21 has a transverse slot 23 in the Y direction into which a removable locating gate 25 is fitted. Pivotal movement of shaft 8 either by means of a handle 31 on shaft 8 or by transverse feed handle 48 causes all the carriages to move transversely towards a first horizontal milling cutter 26 a second horizontal milling cutter 96, and vertical milling tool 28. Shaft 8 is enabled to move in its bearings in its axial direction X so as to move the carriages axially by means of an axial feed handle 50 which turns feed screw 52 (see Fig. 3) to move plate 51 coupled to shaft 8.

20 A milling head 30 is mounted to bracket 32 for vertical movement so that the milling tool 28 can move in a direction towards a key blank K1 in clamp 24 in a direction Z at right angles to the axial direction X of shaft 8 and substantially at right angles to the median transverse tangential direction of movement Y of the carriages.

Means for following the shape of a master or duplicate key K4 clamped in clamps 18 and 20 are respectively followers 34 and 36. Vertical follower 36 shown in Figure 2 is similar to horizontally mounted transverse follower 34 and comprises a follower tip 38 indexed toward the master key K4 (clamped in clamp 20) by a screw threaded shaft 40. Handle 42 is provided to raise the tip 38 from the master key to a disengaged position. Shaft 40 is locked by a lock nut 44 rotatable by handle 46. Similarly nut 48 is provided

to move the follower 34 transversely towards or away from a master key (not shown) clamped in clamp 18. The follower 34 is indexed toward the master key by means of a thread on the follower shaft (not shown) and is locked by screw 49.

5 Clamps 18, 20, 22 and 24 can be rotated through 180° by slackening lock knobs 27 to clamp different shaped master keys and key blanks. Each carriage 10, 14 and 15 is locked to shaft 8 by a clamping screw 11 and nut 13 (shown in Fig. 5) so that the carriages can be adjusted relative to each

10 other and to the respective cutters and card index needles.

In order to move the clamps on carriages 10, 14 and 15 transversely when using an index card to guide the carriages, the transverse feed handle 48 acts on the shaft

15 49 which is fixed to carriage 10 which in turn is fixed to shaft 8 to which carriage 14 is fixed. A spring 53 (see Fig. 5) is provided to urge the carriages back onto handle 48. The transverse movement of the clamps is in reality a pivotal movement about the axis of shaft 8, however the

20 radial distance from the clamping position to the axis of the shaft 8 is sufficiently great as not to make any significant cutting error when milling transversely or axially. Indication of the depth of cut in the transverse direction Y is by means of a rod 54 aligned in the X

25 direction and fixed at one end to carriage 10. Rod 54 abuts at its other end on a sprung rod 56 aligned and movable in the Y direction in block 57. Rod 56 acts through gearing 65 on indicator dial needle 58. Rod 56 can be disengaged from rod 54 by means of a stop 59 which can

30 be engaged in rod 56 when rod 56 is at the rear end of its stroke away from handle 48. This enables the shaft 8 to be pivoted freely against spring 53 to move the carriages in the Y direction by means of handle 31 on shaft 8. Control by handle 31 enables the cutting action either by tool 28

35 or tool 26 to be controlled by pressing a master key in

clamp 20 or clamp 18 onto followers 36 or 34 respectively. Correct axial location of the master key relative the key blank is achieved by locating the master and blank against gates 25 when milling vertically.

5

Axial movement of the carriage is by means of axial feed handle 50 turning feed screw 52. The axial movement is transmitted through rack and pinion gearing 60 to dial needle 62. A card 64 has the necessary indications for depth and spacing positions and is removably held in card holder 82.

10

Vertical movement of milling tool 28 mounted on shaft 73 carried in bearings 75 is controlled by rotation of indexing handle 70 which rotates through a cog wheel 71 an externally toothed cylindrical housing 72 threaded at 77. Vertical movement is indicated by index needle 74 which swings over a dial marked on an index card 170. Tool 28 is driven by pulley 76 in turn driven by a first motor 150 which drives drive pulley 78. Housing 72 is grooved at 75 round its lower part which is engaged by roller pawl 79. Pawl 79 moves up and down with pawl shaft 79' as housing 72 is raised and lowered by rotating in threaded bearing 77'. Pawl shaft 79' then transmits this movement to needle 74 via crank plate 11 and rack and pinion drive 80.

15

20

25

Tool 26 in the horizontal milling section is driven through pulleys 179 and 180 by a second motor 152. A spring detent 81 locks the shaft (not shown) on which cutter tool 26 is mounted so as to enable cutter 26 to be removed from a threaded end of that shaft. A wire brush 154 is mounted on the drive shaft 156 of motor 152.

30

Operation

35

Depending on the type of key to be cut the appropriate key

blank K2, K1 is clamped in clamp 22 or 24 to cut a first key type 100 shown in Fig. 4 which has notches 101 right through the blade 103 or respectively second key type 102 shown in Fig. 5 which has recesses 105 cut perhaps only a third through the thickness of the blade 106 leaving uncut portions 107. That is the first key type blank is fitted into clamp 22 and the second key type blank is fitted into clamp 24 with its tip 109 abutting on gate 25 fitted into slot 23. After clamp knob 27 is tightened gate 25 is removed to allow the tool 28 free passage along the length of the clamp.

In a first cutting method where a master key is not used the vertical depth to be cut in the Z direction by tool 28 is set by aligning needle 74 on an indication on index card 170 by means of handle 70 from the key manufacturers specification. The specification also specifies a particular range of spacing of recesses 105 in the axial or X direction and a range of depths from edge 111 of key 102 in the Y direction. These are indicated on index card 64 which is fitted to card holder 82. Each key has specific X direction locations and Y direction depths taken from a table. The vertical mill motor 150 is switched on. A first cut is made by the tool 28 at the set Z direction depth and at an axial or X direction location set by handle 50 by means of needle 62 against an indication on card 64 and for a Y direction depth from the equivalent of edge 111 on a blank as read off on an indication on card 64 as indicated by needle 58. The individual Z and Y direction settings are obtained from a manufacturers specification for each key. Subsequent cuts are made in the same way.

In a second cutting method for keys of type 102, the master key which may be a duplicate of the master key is clamped into clamp 20 using gate 25 to locate the master in the

correct axial or X direction and then removing the gate.
A blank is similarly clamped in clamp 24 using gate 25.
Handle 48 is disengaged by locking rod in its near position
by stop 59 and the recesses 105 followed by following 36
5 under pressure from handle 31 and by axial movement in the
X direction by turning handle 50.

In a third cutting method where a duplicate of key 100 is
to be made without using a master key the blank is clamped
10 in clamp 22 by handle 22'. The appropriate index card 64
is fitted into card holder 82. The motor 80 is switched on
and cuts made in the blank according to the particular key
specification by cutter 78 adjusting handles 48 and 50 as
necessary.

15 In a fourth cutting method where a master key of the 100
type is present, the master key is clamped in clamp 18 and
a blank in clamp 22. Follower 34 is adjusted and handles
31 and 50 manipulated with the motor 152 switched on so
20 that the shape of the master key is copied onto the blank.

In a fifth cutting method a key blank K3 is inserted into
bearing 95 in holder 91 and the third method is followed.
Where necessary the blank K3 is turned about its horizontal
25 axis by indexed wheel 92.

It will be appreciated that the carriages 10, 14 and 15
although separate are effectively a single carriage being
coupled by shaft 8 and indeed could in theory be a single
30 component; however, five clamps would still be needed for
the embodiment described. Whilst two motors are provided a
single motor could drive both cutters; however, it is
cheaper to provided two motors avoiding thereby the cost of
gearing required for a single motor.

C L A I M S

- 5 1. A key mill comprising a frame, at least one carriage
 including at least one clamp for clamping at least a key
 blank to the carriage, means to move the carriage relative
 to the frame in an axial direction, means to move the
10 carriage transverse to the axial direction towards a key
 notch forming means mounted to the frame, a milling head
 arranged to carry a milling tool and to move the tool in a
 further direction at substantially a right angle to the
 axial direction and at an angle to the transverse
 direction, indicator means for indicating the axial and
15 transverse movement of the carriage and further indicator
 means for indicating movement of the milling tool in the
 further direction.
- 20 2. A key mill according to claim 1 wherein the carriage
 has a first said clamp at a first station adjacent the
 milling head and a second said clamp at a second station
 adjacent the milling head.
- 25 3. A key mill according to claim 2 wherein there are
 duplicate clamps at each station.
4. A key mill according to claim 2 or 3 wherein there are
 means for following the shape of a key at each station.
- 30 5. A key mill according to any one of claims 1 to 4
 wherein at least one clamp has a key blank receiving groove
 axially aligned with the said axial direction and a
 removable gate means for defining an end of the groove.
- 35 6. A key mill according to any one of claims 1 to 5

wherein the indicator means for indicating the axial and transverse movement of the carriage comprises an index card receiving means, a first pointer and a second pointer coupled to the carriage arranged to indicate the axial and transverse movement in relation to an index car on the receiving means.

7. A key mill according to any one of claims 1 to 6 wherein the further indicator means comprises a dial coupled to the milling head which is rotatably adjustable to move in the further direction.

8. A key mill according to claim 2 wherein a third clamp is provided at a third station at which a further milling tool is provided said further milling tool being rotatable about an axis parallel to the axial direction.

9. A key mill according to any one of claims 1 to 8 wherein the carriage or carriages is or are pivotally mounted about an axis in the axial direction.

10. A key mill according to claim 9 wherein the carriage or carriages are mounted on a shaft having a handle mounted thereto for manual movement of the carriage or carriages in the transverse direction.

11. A key mill according to any one of claims 1 to 10 wherein a depthing handle is provided as the means to move the carriage or carriages in the transverse direction, the depthing handle being arranged to bear on the carriage or carriages and wherein means are provided to disengage the action of the depthing handle on the carriage or carriages.

12. A key mill substantially as described with reference to the accompanying drawings.

Patents Act 1977**Examiner's report to the Comptroller under Section 17
(The Search report)**Application number
GB 9405254.5**Relevant Technical Fields**

(i) UK Cl (Ed.M) B3K

(ii) Int Cl (Ed.5) B23C

Search Examiner
V L C PHILLIPSDate of completion of Search
13 APRIL 1994**Databases (see below)**

(i) UK Patent Office collections of GB, EP, WO and US patent specifications.

(ii)

Documents considered relevant
following a search in respect of
Claims :-
1-12**Categories of documents****X:** Document indicating lack of novelty or of inventive step.**Y:** Document indicating lack of inventive step if combined with one or more other documents of the same category.**A:** Document indicating technological background and/or state of the art.**P:** Document published on or after the declared priority date but before the filing date of the present application.**E:** Patent document published on or after, but with priority date earlier than, the filing date of the present application.**&:** Member of the same patent family; corresponding document.

Category	Identity of document and relevant passages	Relevant to claim(s)
	NONE	

Databases: The UK Patent Office database comprises classified collections of GB, EP, WO and US patent specifications as outlined periodically in the Official Journal (Patents). The on-line databases considered for search are also listed periodically in the Official Journal (Patents).



Espacenet

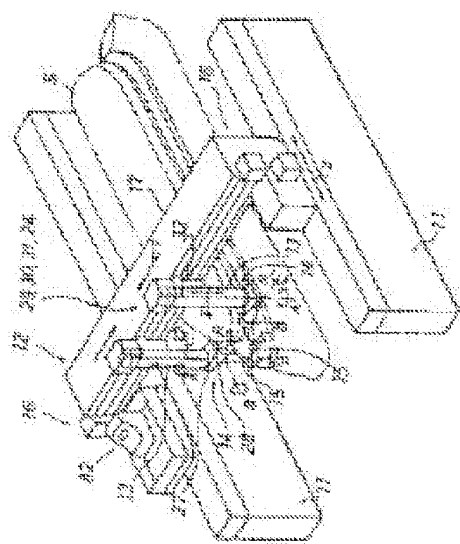
Bibliographic data: JPH04250911 (A) — 1992-09-07

PORTAL CUTTING MACHINE

Inventor(s): MINUMA TADAO ± (MINUMA TADAO)
Applicant(s): ISHIKAWAJIMA HARIMA HEAVY IND ± (ISHIKAWAJIMA HARIMA HEAVY IND CO LTD)
Classification: - **international:** *B23C1/12*; (IPC1-7): B23C1/12
- **cooperative:**
Application number: JP19900409425 19901228
Priority number (s): JP19900409425 19901228

Abstract of JPH04250911 (A)

PURPOSE:To execute cutting with the use of a milling cutter for a workpiece having the recessed curved face of a small radius of curvature. **CONSTITUTION:**A cutter holding member 27 turning around a vertical shaft A is provided at the lower end 14 of a vertical frame 13. A spindle 28 supporting a milling cutter 15 freely rotatably is provided at the extension end of the cutter holding member 27. This spindle 28 turns around a shaft B crossed in the extension direction of the cutter holding member 27. Also on the upper part of the vertical frame 13, servomotors 29, 30 and main driving motor 31 are provided. A rotation transmission system 32 for transmitting the rotation forces transmitted from these motors 29, 30, 31 to the cutter holding member 27, spindle 28 and milling cutter 15, is formed along the vertical frame 13.



(11)特許出願公開番号

(43)公開日 平成4年(1992)9月7日

技術表示箇所

1

【特許請求の範囲】

【請求項1】 並行な桁台上を走行する門型フレームと、該門型フレームに沿って横移動すると共に上下移動自在に形成された縦フレームと、該縦フレームの下端部で軸廻りに回転駆動されるフライスカッタとを有した門型切削機において、上記縦フレームの下端部に、その縦軸廻りに旋回移動されると共に上記縦軸位置から所定の長さだけ延出したカッタ保持部材を設け、該カッタ保持部材の延出端に、上記フライスカッタを回転自在に支持すると共に上記カッタ保持部材の延出方向に交差する軸を中心に戻転移動されるスピンドル部を形成したことを特徴とする門型切削機。

【請求項2】 並行な桁台上を走行する門型フレームと、該門型フレームに沿って横移動すると共に上下移動自在に形成された縦フレームと、該縦フレームの下端部で軸廻りに回転駆動されるフライスカッタとを有した門型切削機において、上記縦フレームの下端部に、その縦軸廻りに旋回移動されると共に上記縦軸位置から所定の長さだけ延出したカッタ保持部材を設け、該カッタ保持部材の延出端に、上記フライスカッタを回転自在に支持すると共に上記カッタ保持部材の延出方向に交差する軸を中心に戻転移動されるスピンドル部を形成し、上記縦フレームの上端部に、上記カッタ保持部材、スピンドル部及びフライスカッタをそれぞれ回転駆動させるための駆動源を設け、該駆動源からの回転を上記下端部に伝達するための回転伝達系を上記縦フレームに沿って形成したことを特徴とする門型切削機。

【発明の詳細な説明】

【0001】

【産業上の利用分野】 本発明は、フライスカッタを適宜直線移動及び回転移動させて自由曲面を有した被工作物を切削加工する門型切削機に関するものである。

【0002】

【従来の技術】 比較的大形の被工作物を切削加工する工作機械として、門型切削機が知られている。この門型切削機は、被工作物を挟んでその長手方向に並行に延長された一対の桁台と、この桁台間に架け渡されてその上を走行移動する門型フレームと、この門型フレームから垂下されてフレーム軌道に沿って水平に横移動すると共に上下移動自在に形成された縦フレームと、この縦フレームの下端部に支持されたフライスカッタとにより主として構成されている。

【0003】 図9及び図10に示すように、この種のフライスカッタ1は、截頭円錐状の台部材2の外周端面に板状の切れ刃3が植設されて成り、駆動モータ4によってその軸心r廻りに高速回転させることで、所望の切削力を得ようになっている。また駆動モータ4及びフライスカッタ1は、縦フレーム5の縦軸Za廻りに回転移動するホルダ6に支持されていると共に、縦軸Zaに直交する水平軸Xb廻りに回転移動されるようになってい

2

る。従ってフライスカッタ1は、縦軸Zaの位置において俯仰及び旋回が可能に支持されているものである。そして予め作製した所定のプログラムを指令機(CNC装置)に入力することによって、これら回転移動(Za、Xb軸廻り)と、門型フレームの走行(X方向)と、縦フレームの横移動(Y方向)及び上下動(Z方向)とを制御することによって、被工作物Wを所定の形状に切削加工するようになっている。

【0004】

【発明が解決しようとする課題】 しかしながら上記従来の門型切削機にあっては、加工できる形状に限度があった。即ち、図示したような凸状の曲面のみで成る被工作物Wであれば問題ないが、例えば模型船のスクリュ部のように比較的曲率半径が小さい凹部を切削加工しようとすると、ホルダ6或いは駆動モータ4の部分が加工対象部分の周囲に接触してしまい、所定の形状にすることが不可能になる。従ってその様な形状のものを切削加工する場合には、ボールエンドミルなどを使用せざるを得ず、切削速度が落ちて作業能率が低下してしまうという問題があった。

【0005】 そこで本発明は、上記事情に鑑み、凹状の曲面を有する被工作物に対してもフライスカッタを使用して切削加工ができる門型切削機を提供すべく創案されたものである。

【0006】

【課題を解決するための手段】 本発明は、並行な桁台上を走行する門型フレームと、この門型フレームに沿って横移動すると共に上下移動自在に形成された縦フレームと、この縦フレームの下端部で軸廻りに回転駆動されるフライスカッタとを有した門型切削機において、縦フレームの下端部に、その縦軸廻りに旋回移動されると共に縦軸位置から所定の長さだけ延出したカッタ保持部材を設け、このカッタ保持部材の延出端に、フライスカッタを回転自在に支持すると共にカッタ保持部材の延出方向に交差する軸を中心に戻転移動されるスピンドル部を形成したものである。

【0007】 また本発明は上記構成に加えてさらに、縦フレームの上端部に、カッタ保持部材、スピンドル部及びフライスカッタをそれぞれ回転駆動させるための駆動源を設け、この駆動源からの回転を下端部に伝達するための回転伝達系を縦フレームに沿って形成したものである。

【0008】

【作用】 上記構成によって、カッタ保持部材は、門型フレームの走行と、縦フレームの横移動及び上下動とに従って、フライスカッタを被工作物の加工対象部分に移動させる。そしてフライスカッタは、カッタ保持部材の延出長さの分だけ縦フレームから突出した位置において旋回すると共に、スピンドル部の回転移動に従って俯仰し、被工作物の凹状曲面の部分に適宜切削する。

【0009】またさらに上記駆動源と回転伝達系とを有した構成によって、駆動源からの回転駆動力は縦フレームに沿って伝達され、カッタ保持部材の旋回移動、スピンドル部の回転移動、及びフライスカッタの回転駆動が為されて、所定の切削加工を行う。

【0010】

【実施例】以下、本発明の実施例を添付図面に従って説明する。

【0011】図1及び図2は、本発明に係わる門型切削機の一実施例を示したものである。

【0012】この門型切削機は、従来と同様に、並行な桁台11上を走行する門型フレーム12と、この門型フレーム12に沿って横移動すると共に上下移動自在に形成された縦フレーム13と、この縦フレーム13の下端部14で適宜軸R廻りに回転駆動されるフライスカッタ15とを備えて構成されている。

【0013】桁台11は、模型船などの被工作物Sを挟んでその長手方向(X)に延長されており、門型フレーム12はその両端部に桁台に沿って自走する走行駆動部16を有し、その間に水平なフレーム部17が架設されている。そしてフレーム部17の一侧に、互いに独立して横移動する二台の縦フレーム13が垂下され、被工作物Sを両側から同時に切削加工できるようになっている。

【0014】縦フレーム13には、フレーム部17の軌道18に係合支持されていると共に、軌道18と平行延長された案内ロッド19に沿って横移動するための移動機構(図示せず)を有した移動体20が備えられ、この移動体20に、円柱状の縦フレーム本体21が支持されている。またその支持構造として、縦フレーム本体21と並行に延長されたねじロッド22と、移動体20に取り付けられ、ねじロッド22に螺合するナット部23とが形成され、縦フレーム本体21の上部に設けられた上下駆動用サーボモータ24が適宜ねじロッド22を正逆回転させることで、縦フレーム本体21が上下移動するようになっている。なお案内ロッド19及びねじロッド22は、移動に追従して実質的に伸縮するスパイラル状のカパ25、26によって覆われている。

【0015】そして縦フレーム13の下端部14には、フライスカッタ15を保持するためのカッタ保持部材27及びスピンドル部28が設けられている。

【0016】カッタ保持部材27は、縦フレーム13に縦軸A廻りに旋回自在に支持されていると共に、その縦軸A位置から所定の長さだけ延出されて形成されている。またスピンドル部28は、そのカッタ保持部材27の延出端において、フライスカッタ15を回転自在に支持すると共に、フライスカッタ15の回転軸R及び縦軸Aに直交する交差軸Bを中心に回転自在に支持されている。即ち交差軸Bは、カッタ保持部材27の延出方向に直交しているものである。従ってフライスカッタ15

は、縦軸Aと交差軸Bとの離間距離Lに相当する長さだけ、実質的に縦フレーム13から径方向に突出されて、俯仰且つ旋回自在に保持されていることになる。

【0017】また本実施例にあっては、縦フレーム13の上部に上下駆動用サーボモータ24と併設されて、カッタ保持部材27、スピンドル部28及びフライスカッタ15を回転駆動させるための駆動源となる保持部材旋回用サーボモータ29、スピンドル回転用サーボモータ30及びメイン駆動モータ31がそれぞれ設けられている。そして、これらモータ29、30、31からの回転力をカッタ保持部材27、スピンドル部28及びフライスカッタ15まで伝達するための回転伝達系32が、縦フレーム13内にその縦軸Aに沿って形成されている。

【0018】図3及び図4に示すように、縦フレーム本体21は、回転駆動系32を収容すべく中空に形成された本体管33と、回転駆動系32であるメインシャフト34及びメインシャフト34を二重に覆う中空シャフト35、36とにより主として構成されている。メインシャフト34は、メイン駆動モータ31の出力軸37に直結され、縦フレーム本体21の上端に形成されている歯車箱38の上板に軸受39を介して支持されている。そしてメインシャフト34の下端部には、カッタ保持部材27内のフライスカッタ回転系に係合するためのベベルギア40が取り付けられている。

【0019】メインシャフト34の径方向外方には、メインシャフト34との間に複数のベアリング41が介設された第一の中空シャフト35が設けられ、スピンドル回転用サーボモータ30の出力軸42とは歯車室38内に収容された平歯車43、44によって連結されている。そしてその下端部には、メインシャフト34のベベルギア40の外側近傍に位置されたベベルギア45が取り付けられている。

【0020】そして第一の中空シャフト35を覆うように第二の中空シャフト36が設けられており、その上端において保持部材旋回用サーボモータ29の出力軸(図示せず)にベベルギア46で接続されていると共に、本体管33と複数の軸受47を介して支持されている。この第二の中空シャフト36の途中位置には、公知の減速機構(ハーモニックドライブ)49が設けられ、その回転速度を1/100程度に落とすと共に、下端部に近く位置されていることで回転伝達系32の剛性を維持できるようになっている。

【0021】この減速機構49は、上下に二分された第二の中空シャフト36の間に形成されており、第二の中空シャフト36の上部側端部50に設けられたベアリング51及びその外側のスプライン52とを有している。そしてこのスプライン52と、本体管33に固定された固定ブロック53及び第二の中空シャフト36の下部側端部54とがそれぞれ噛合することで、スプライン52の歯数比に応じた減速ができるようになっている。

【0022】また第二の中空シャフトの下端部は、適宜
 拡張されて本体管33に摺動するようになっていて共
 に、カット保持部材27のハウジング55にボルト56
 によって固定されている。なお第一の中空シャフト35
 と第二の中空シャフト36との間にも複数のベアリング
 57が設けられ、互いに径方向に所定の間隔が維持され
 るようになっている。

【0023】図5に示すように、カット保持部材27
 は、ハウジング55内に回転自在に支持されて所定の距
 離だけ隔てられた並行な二本の伝動シャフト58、59
 が収容されて成り、第一の伝動シャフト58に取り付け
 られたベベルギア60が、図4に示したメインシャフト
 34のベベルギア40に噛合されるようになっている。
 そしてこの回転は、伝動シャフト58、59と並行にハ
 ウジング55に固定された複数の小ロッド61、62、
 63と、これら小ロッド61、62、63に回転自在に
 支持され互いに噛合する平歯車群64と、伝動シャフト
 58、59に取り付けられた平歯車65、66とによっ
 て、第二の伝動シャフト59に伝達されるようになって
 いる。そして、この第二の伝動シャフト59の平歯車6
 6とは反対側の先端部分に、スピンドル部28が設けら
 れている。

【0024】このスピンドル部28は、フライスカッタ
 15に連結されるカットシャフト67と、カットシャフ
 ト67をその両端で軸受68を介して支持するスピンド
 ルハウジング69とで成り、第二の伝動シャフト59と
 カットシャフト67とが直交する位置関係になるように
 形成されている。カットシャフト67のフライスカッタ
 15と反対側の基端部分には、第二の伝動シャフト59
 に取り付けられたベベルギア70と噛合するベベルギア
 71が取り付けられており、メインシャフト34からの
 高速回転力が伝達されるようになっている。

【0025】そしてスピンドルハウジング69の側部
 は、第二の伝動シャフト59に沿って延出されて、カッ
 タ保持部材27のハウジング55内に嵌入されている。
 この嵌入部72は、ハウジング55及び第二の伝動シャ
 フト59のベベルギア70とそれぞれベアリング73、
 74を介して係合している。従って、スピンドル部28
 は、第二の伝動シャフト59廻りに回転自在に形成され
 ており、その軸心が、スピンドル部28の回転軸（交差
 軸B）となるものである。

【0026】また第二の伝動シャフト59はカット保持
 部材27の回転軸（A）に対して、その両側に略等距離
 だけ延出された長さで形成されており、小ロッド61…
 63側とスピンドル部28側との重量バランスをとるよ
 うになっている。そしてスピンドル部28は、第一の伝
 動シャフト58と第二の伝動シャフト59との間隔
 （L）の分だけ離間されていると共に、第二の伝動シャ
 フト59の延長方向に、その片側延出長さに相当する分
 （図5中M）だけ、カット回転軸Rと回転軸（A）とが

離間されていることになる。

【0027】そしてスピンドル部28を回転させるため
 に、第一の伝動シャフト58に回転自在に支持され第一
 の中空シャフト35のベベルギア45と噛合されるベベ
 ルギア75と、ベベルギア75の外端部に形成された平
 歯車76と、小ロッド61…63に回転自在に設けられ
 た第二の平歯車群77と、第二の伝動シャフト59に回
 転自在に嵌合されたボスブロック78とが設けられてお
 り、これらが順次噛合されている。そしてボスブロッ
 ク78とスピンドル部28の嵌入部72の延出端部とが、
 前記減速機構49と同様なベアリング79及びスプライ
 ン80を有した減速機構81を介して接続されている。
 従って、スピンドル回転用サーボモータ30の回転は、
 適宜減速されて、例えば1/100程度に落とされて伝達さ
 れることになる。

【0028】この他図1に示したように、門型フレーム
 12には、縦フレーム13及び、カット保持部材27、
 スピンドル部28、フライスカッタ15を駆動制御する
 ためのCNC装置82が備えられ、各駆動モータ24、
 29…31に作動信号を出力すべくケーブル（図示せ
 ず）にて接続されている。

【0029】次に実施例の作用を説明する。

【0030】模型船の底部など、自由曲面を有した被工
 作物Sを切削加工するに際して、門型フレーム12を桁
 台11に沿って走行させる（X方向）と共に、門型フレ
 ーム12のフレーム部17に沿って縦フレーム13を適
 宜移動させ（Y方向）、さらに縦フレーム13の本体2
 1を上下駆動用サーボモータ24の駆動によって上下さ
 せて（Z方向）、縦フレーム13の下端部14を加工対
 象箇所位置させる。そしてメイン駆動モータ31を作
 動させて、この回転を順次、メインシャフト34、カッ
 タ保持部材27の伝動シャフト58、59、カットシャ
 フト67に伝達させ、フライスカッタ15を回転駆動さ
 せる。これと同時に、カットシャフト15を該箇所
 に適した方向に向けるべく、サーボモータ29、30を作
 動させて、減速機構49、81により途中でその回転を
 減速しつつ、中空シャフト35、36などを介して、カ
 ッタ保持部材27及びスピンドル部28を回転軸A廻
 りに、そしてスピンドル部29を交差軸B廻りに適宜回
 転移動させる。

【0031】例えば図6に示したような凸状の曲面S₁
 を切削加工するときは、該箇所位置にフライスカッタ15
 の周面が接線状に係合するように、縦フレーム本体21
 を下降させつつ、スピンドル部28を図中時計廻りに回
 転移動させればよい。また図7に示したように、凹状
 の曲面S₂を切削加工するときは、フライスカッタ15の
 周面の一部が接するように、カット保持部材28を旋回
 させて回転軸Rが対象曲面S₂に対して斜めになるよう
 に保ちつつ、上下（Z方向）に移動させる。さらに図8
 に示したように、より曲率半径の小さい凹状曲面S₃を

切削するときには、縦軸Aと回転軸Rとが平行になるようにカッタ保持部材27及びスピンドル部28を移動し保持することで、切削加工を行う。

【0032】これらの動作は、曲面S₁…に応じて適宜モータ24、29…31を作動させるように予め作製したプログラムを、CNC装置82に入力させることにより自動的に行われるものである。

【0033】このように、門型フレーム112と縦フレーム113とを有した門型切削機に、縦軸A廻りに旋回移動されると共に縦フレーム113の下端部114から延出されたカッタ保持部材27と、カッタ保持部材27の延出端にてフライスカッタ15を回転自在に支持すると共に、カッタ回転軸R及び縦軸Aに直交する交差軸Bを中心に回転移動されるスピンドル部28とを設けたので、フライスカッタ15があらゆる姿勢で回転可能になると共に、フライスカッタ15の位置が縦軸Aから所定の距離L、Mだけ離間されていることで、凹状の曲面S₁…を切削する際に、縦フレーム113が切削該当箇所周囲に当接して邪魔することがない。従って、例えば模型船のスクリュー部など、曲率半径の小さい凹状曲面でなる部分に対してもフライスカッタが使用できて、その使用対象範囲を広げることができ、フライスカッタ特有の切削能力を生かすことで、作業能率の向上が達成される。

【0034】また縦フレーム113の上端部に、カッタ保持部材27、スピンドル部28及びフライスカッタ15をそれぞれ回転駆動させるためのサーボモータ29、30及びメイン駆動モータ31を設け、その回転伝達系32を縦フレーム113の本体内に21に形成したので、縦フレーム113の下端部114は、従来のようなモータなどの駆動源が設けられた構造とは異なる極めてコンパクトな構造となつて、種々の被工作物に対応するより高い汎用性が発揮できる。

【0035】そして回転伝達系32としてメインシャフト34、中空シャフト35、36を同軸上に設け、ギア及び減速機構49、81を備えたので、三軸方向(X、Y、Z)へ移動しつつ回転駆動(R、A、B軸廻りの回転)を伝達するという、縦軸113に必要な剛性を確保でき、自動制御におけるフライスカッタの正確な位置決め及び切削回転が達成されるものである。

【0036】なおカッタ保持部材27は、縦フレーム113に対して着脱自在(ボルト締結)に取り付けられた構成になっているので、必要に応じて従来と同様な、旋回軸Aとスピンドル部28の回転軸(交差軸B)とにズレが無いような保持部材や、本実施例とは離間距離(L、M)が異なる構成の保持部材を形成しておいて、必要に応じて交換するようにしてもよい。

【0037】また本発明は、図1に示したような形式の

門型切削機に限るものではなく、同種の工作機械に広く適用されるものである。

【0038】

【発明の効果】以上要するに本発明によれば、次のような優れた効果を発揮する。

【0039】(1)請求項1の構成によれば、フライスカッタの位置が縦フレームから離間されることで、凹状の曲面を切削する際に、縦フレームが切削該当箇所周囲に当接することがなく、フライスカッタが使用できる範囲を広げることができ、切削能率の向上が達成される。

【0040】(2)請求項2の構成によれば、縦フレームの下端部にはモータなどの駆動源がなく、極めてコンパクトになり、より高い汎用性が発揮できる。

【図面の簡単な説明】

【図1】本発明の門型切削機の一実施例を示した斜視図である。

【図2】図1の要部を示した側面図である。

【図3】図1の縦フレームの要部を示した縦断面図である。

【図4】図1の縦フレームの他の要部を示した縦断面図である。

【図5】図2のカッタ保持部材を示した横断面図である。

【図6】本発明の作用を説明するための側面図である。

【図7】本発明の他の作用を説明するための側面図である。

【図8】本発明の他の作用を説明するための側面図である。

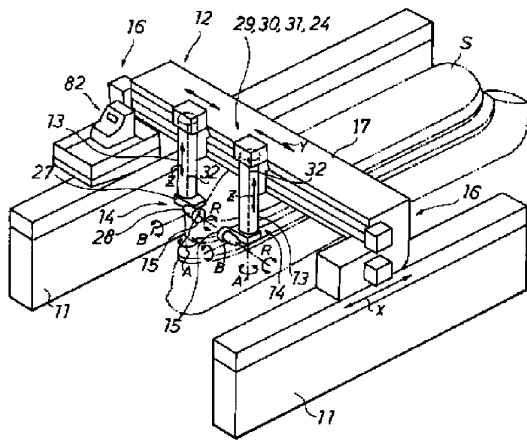
【図9】従来の門型切削機の要部を示した正面図である。

【図10】図9の側面図である。

【符号の説明】

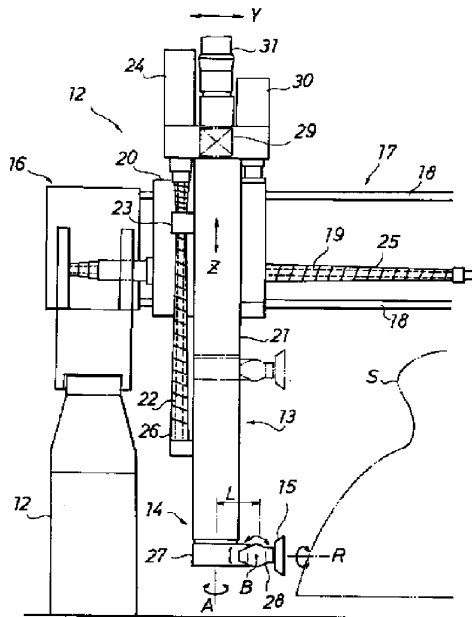
- 11 桁台
- 12 門型フレーム
- 13 縦フレーム
- 14 縦フレームの下端部
- 15 フライスカッタ
- 27 カッタ保持部材
- 28 スピンドル部
- 29 保持部材旋回用サーボモータ(駆動源)
- 30 スピンドル回転用サーボモータ(駆動源)
- 31 メイン駆動モータ(駆動源)
- 32 回転伝達系
- A 縦軸
- B 交差する軸(カッタ保持部材の回転軸)
- R カッタ回転軸

【図1】



- 11… 基台
 12… 門型フレーム
 13… 縦フレーム
 14… 縦フレームの下端部
 15… フライスカッタ
 16… カッタ保持部材
 17… スピンドル部
 18… 保持部材を回転用サーボモータ（駆動源）
 19… スピンドル回転用サーボモータ（駆動源）
 20… メイン駆動モータ（駆動源）
 21… 回転伝達系
 A… 縦軸
 B… カッタ回転軸
 C… 交差する軸（カッタ保持部材の回転軸）

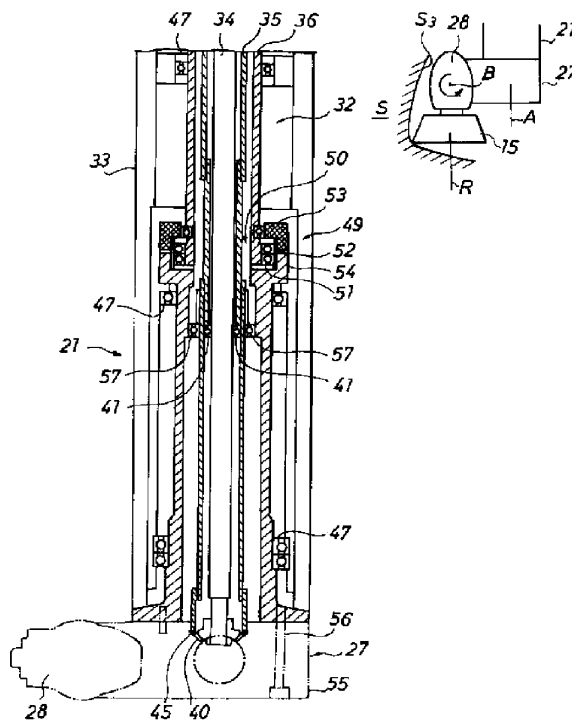
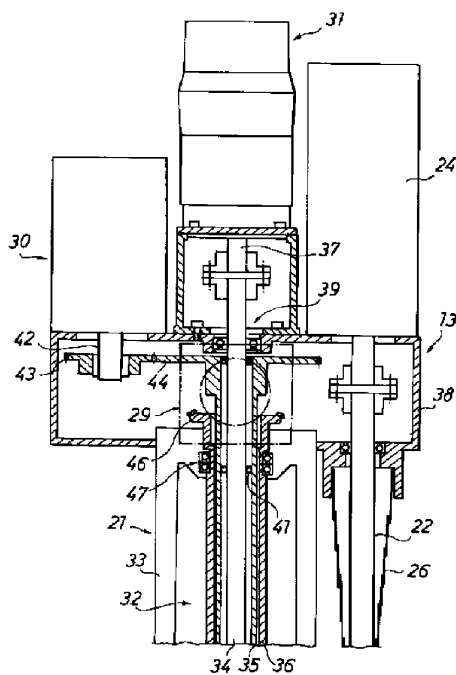
【図2】



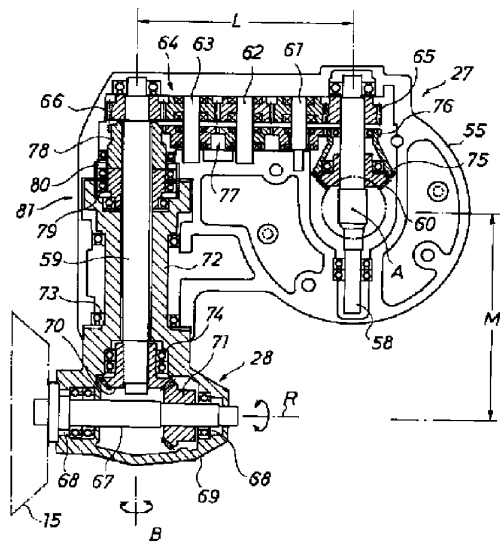
【図4】

【図8】

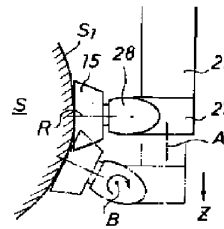
【図3】



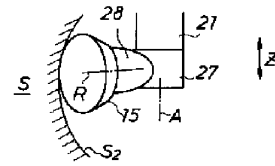
【図5】



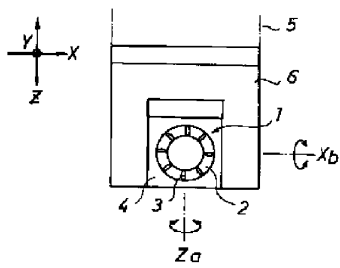
【図6】



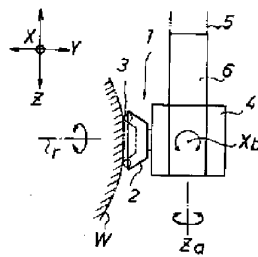
【図7】



【図9】



【図10】





Espacenet

Bibliographic data: JPS63311108 (A) — 1988-12-19

METHOD FOR DISCRIMINATING CREST SHAPE OF KEY UTILIZING PARALLEL LASER BEAM

Inventor(s): NOBUNAGA TAKEHISA; OKAMOTO KUNIHIRO ± (NOBUNAGA TAKEHISA, ; OKAMOTO KUNIHIRO)

Applicant(s): KIKI KAIHATSU KOGYO KK ± (KIKI KAIHATSU KOGYO:KK)

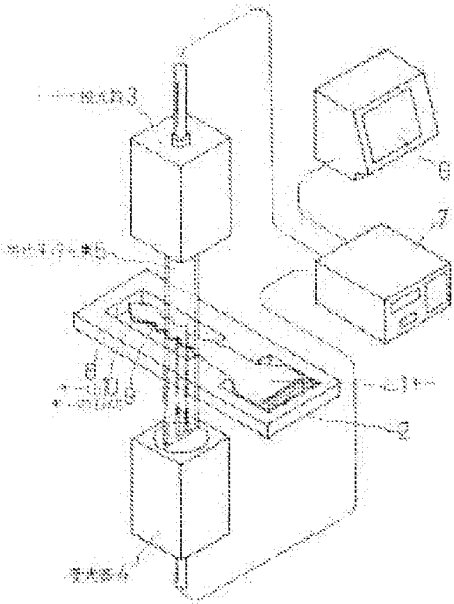
Classification: - **international:** **G01B11/24**; (IPC1-7): G01B11/24
- **cooperative:**

Application number: JP19870147207 19870613

Priority number (s): JP19870147207 19870613

Abstract of JPS63311108 (A)

PURPOSE:To inspect a dimension with high accuracy, by irradiating a key with parallel laser beam or moving the key or beam in the longitudinal direction to measure the width of the crest or valley of the key. **CONSTITUTION:**For example, the key 1 of a car is placed between a laser emitter 3 and a photodetector 4 and the laser beam from the emitter 3 is converted to strip like parallel beam 5 to irradiate the key 1. Then, the key 1 or beam 5 is moved over a predetermined interval in the longitudinal direction to catch the shade shielded by the crest 10 or valley part 9 of the key as the change in the quantity of beam and this signal is sent to a measuring apparatus main body 7 to measure the crest 10 or valley part 9. This width dimension is collated with the key pattern stored in the measuring apparatus main body 7 and the inspection of the dimension of the key and the judge of the quality thereof can be performed with high accuracy.



⑩ 日本国特許庁(JP)

⑪ 特許出願公開

⑫ 公開特許公報(A)

昭63-311108

⑬ Int.Cl.⁴

識別記号

庁内整理番号

⑭ 公開 昭和63年(1988)12月19日

G 01 B 11/24

A-8304-2F

審査請求 未請求 発明の数 1 (全3頁)

⑮ 発明の名称 レーザ平行光束を利用したキー山形状識別方法

⑯ 特 願 昭62-147207

⑰ 出 願 昭62(1987)6月13日

⑱ 発 明 者 信 長 武 久 岡山県総社市泉16-50

⑲ 発 明 者 岡 本 邦 弘 岡山県岡山市正儀4464

⑳ 出 願 人 株式会社 機器開発工 岡山県岡山市今保103番地
業

㉑ 代 理 人 弁理士 森 廣三郎

明 細 書

1. 発明の名称

レーザ平行光束を利用したキー山形状識別方法

2. 特許請求の範囲

1. レーザ投光器(3)と受光器(4)との間に測定しようとするキー(1)を置き、前記投光器から放射されるレーザをキー山(10)の幅より広幅の帯状平行光束(5)としてキー(1)に照射し、キー(1)又は光束(5)をキーの長手方向に移動させてキー山の形状を識別することを特徴とするレーザ平行光束を利用したキー山形状識別方法。

3. 発明の詳細な説明

〈産業上の利用分野〉

本発明は莫大な種類及び数のキー(鍵)を管理する必要のある自動車工業等における、明確なキー識別方法を提供するものである。

〈従来の技術〉

個々のキーを識別するために、従来、次のような方法が採用されていた。

① キーの山谷部の片側に投光器で光を当て、そ

の影をレンズによって拡大し受光器上に投影する。

② 受光器上には多数の受光素子が等間隔に配置されている。

③ これらの受光素子が受光するか受光しないかによってキーの山あるいは谷の高さが判別される。

したがって、キーの山あるいは谷の幅を測定するものではなく、それらがある寸法範囲内にあるか否かを判別するに過ぎなかった。また、判別がキーの片側のみを対象としているため、キー取付治具及びその送り装置等の遊隙によってその判別精度が左右されるという不具合があった。

〈発明が解決しようとする問題点〉

そこで、キーの山あるいは谷の幅について寸法計測ができるようにすること、しかも、それが高精度で可能な方法の検討が課題となっていたのである。

〈問題点を解決するための手段〉

このような課題に関して種々検討した結果、レーザ投光器(3)と受光器(4)との間に測定しようとするキー(1)を置き、前記投光器から放射される

レーザをキー山(10)の幅より広幅の帯状平行光束(5)としてキー(1)に照射し、キー(1)又は光束(5)をキーの長手方向に移動させてキー山の形状を識別することを特徴とするレーザ平行光束を利用したキー山形状識別方法を開発したのである。

〈作用〉

この方法においては、受光器(4)に至るレーザが通常の光と異なって平行光束であるから、投光器(3)と受光器(4)間にあるキー(1)の山あるいは谷の幅は忠実に受光器へ投影される。したがって、キーの山あるいは谷の幅について寸法計測ができ、しかも、それが高精度で可能となる。

〈実施例〉

以下図面によって本発明の実施例を詳細に説明する。

第1図は本発明のキー山形状識別方法を実施可能にする計測装置の斜視図である。

本装置はレーザ投光器(3)と受光器(4)との間に測定しようとするキー(1)を保持する治具(2)が配置されている。このキー保持用治具(2)にはキー

の山谷部に投光されたレーザの平行光束(5)が通過できるような窓(8)が設けられている。投光器から放射されるレーザはキー山(10)の最大幅より広幅の帯状平行光束(5)である。キー(1)に照射後の帯状の平行光束は受光器(4)によって受光され、キーの山(10)あるいは谷部(9)によって遮られた影が光量変化としてとらえられ、キーの全幅に対する信号として取出される。この信号が計測装置本体(7)に送られる。キー(1)(又は光束)は順次長手方向に送られ、すべての山及び谷について測定が行われる。

一般にキーにおいては、その最も重要な要素である山及び谷が長手方向の一定距離ごとに配列されている。これらの山あるいは谷はキー中心に対して対称に配置され、それぞれ異なった高さ、すなわち、異なった幅をもち、その頂部あるいは底部には僅かな平行部が残されている。キーはこの僅かに残された平行部の幅寸法とその長手方向の位置の組合せによって識別される。これらの平行部を結ぶ山あるいは谷の斜面の形状はキーの機能

- 3 -

には関係しない。キーがキーとしての機能を発揮するには厳しい寸法精度が要求されるのはいうまでもない。ちなみに、ある基準位置から山あるいは谷の僅かな平行部までの距離に対して1/100mm、また、山あるいは谷の全幅に対して1/100mmという精度が要求されるようになった。したがって、キー山形状の識別にあたってはこれらの精度を考慮に入れなければならない。

そこで、本発明では取出された信号によって次のことが行われる。

- ① 計測装置本体(7)の記憶装置に記憶されているキーのパターン、すなわち、キーの山あるいは谷部の幅とその長手方向の位置の組合せとを照合することによって、キーNoを検索する。
- ② 演算処理によってすべての山及び谷部の幅寸法を算出する。
- ③ 山及び谷部の幅寸法を前記検索されたキーNoのものと比較して良否の判定をする。

そして、それらの結果はすべてモニター(6)に表示される。

- 5 -

- 4 -

〈発明の効果〉

本発明は以上のようなキー山形状識別方法であるから、

- ① 従来の方法で困難であったキーの山あるいは谷部の幅を高精度で計測することができ、すなわち、高精度の寸法検査を可能としており、
- ② 測定によって得られたデータは他の工程、例えばキー山の切削あるいはシリンダの組立等に効果的に利用できる。

4. 図面の簡単な説明

第1図は本発明のキー山形状識別方法が実施可能な計測装置の斜視図である。

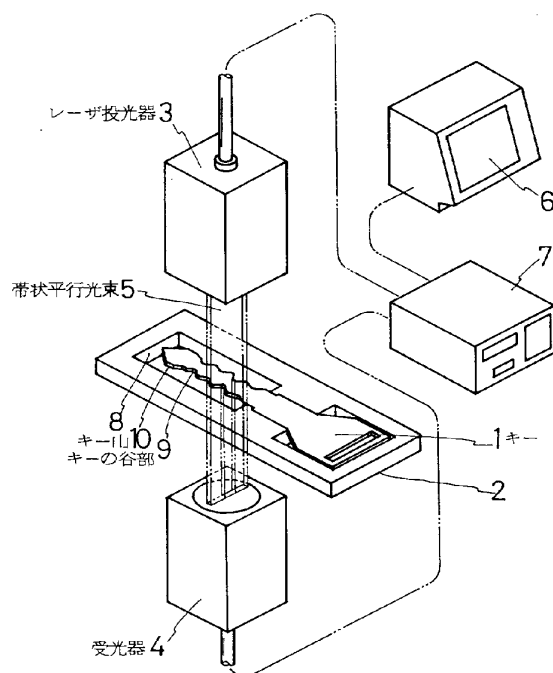
(1) キー	(2) 治具
(3) レーザ投光器	(4) 受光器
(5) 帯状平行光束	(6) モニタ
(7) 計測装置本体	(8) 窓
(9) キーの谷部	(10) キー山

以 上

出願人 株式会社機器開発工業
代理人 弁理士 森 廣 三 郎

- 6 -

第 1 図





Espacenet

Bibliographic data: JPS63311109 (A) — 1988-12-19

METHOD FOR DISCRIMINATING CREST SHAPE OF KEY BY IMAGE PROCESSING

Inventor(s): NOBUNAGA TAKEHISA; OKAMOTO KUNIHIRO ± (NOBUNAGA TAKEHISA, ; OKAMOTO KUNIHIRO)

Applicant(s): KIKI KAIHATSU KOGYO KK ± (KIKI KAIHATSU KOGYO:KK)

Classification: - **international:** **G01B11/24**; (IPC1-7): G01B11/24
- **cooperative:**

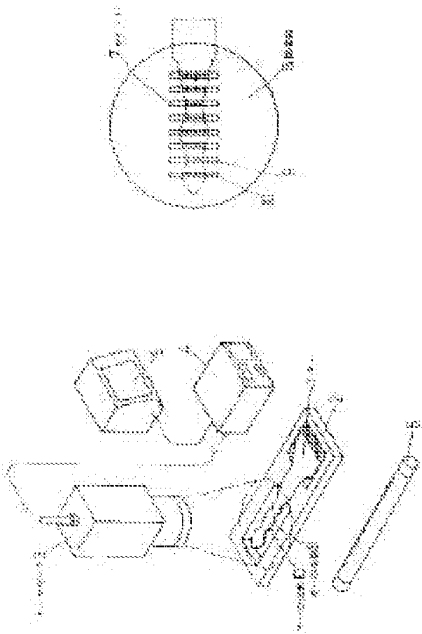
Application number: JP19870147208 19870613

Priority number (s): JP19870147208 19870613

Abstract of JPS63311109 (A)

PURPOSE:To efficiently perform highly accurate inspection, in picking up the image of the crest and valley parts of a key by a sensor camera, by setting a window at the position to be measured in a software manner to perform image processing.

CONSTITUTION:When the images of the crest part 10 and valley part 9 of a key 1 are picked up by a sensor camera 3 constituted of an image pickup element group, slit like windows 7 are set to the crest part 10 and valley part 9 of the key 1 being the positions to be measured in a software manner to perform image pickup. The shade generated by blocking the windows 7 by the crest part 10 and valley part 9 of the key 1 is caught as the change in the quantity of beam to be taken out as a dimension signal and this signal is subjected to image processing. Therefore, it is unnecessary to move the key 1 and, since the dimensions of the crest part 10 and valley part 9 of the key 1 are simultaneously measured with high accuracy, a large number of the keys can be inspected efficiently with high accuracy.



⑤Int.Cl.⁴

識別記号

庁内整理番号

⑬公開 昭和63年(1988)12月19日

G 01 B 11/24

K-8304-2F

審査請求 未請求 発明の数 1 (全3頁)

⑭発明の名称 画像処理によるキー山形状識別方法

⑰特 願 昭62-147208

⑱出 願 昭62(1987)6月13日

⑲発 明 者 信 長 武 久 岡山県総社市泉16-50

⑲発 明 者 岡 本 邦 弘 岡山県岡山市正儀4464

⑲出 願 人 株式会社 機器開発工 岡山県岡山市今保103番地
業

⑲代 理 人 弁理士 森 廣三郎

明 細 書

1. 発明の名称

画像処理によるキー山形状識別方法

2. 特許請求の範囲

1 キー(1)の山部(10)及び谷部(9)をセンサカメラ(3)で撮影する際、総ての測定対象領域にウインド(7)をソフトウェアにより影像部(8)上に設定して画像処理することを特徴とする画像処理によるキー山形状識別方法。

3. 発明の詳細な説明

〈産業上の利用分野〉

本発明は莫大な種類と数のキー(鍵)を管理する必要のある自動車工業等における、明確なキー識別方法を提供するものである。

〈従来の技術〉

個々のキーを識別するために、従来、次のような方法が採用されていた。

- ① キーの山谷部の片側に投光器で光を当て、その影をレンズによって拡大し受光器上に投影する。
② 受光器上には多数の受光素子が等間隔に配置

されている。

③ これらの受光素子が受光するか受光しないかによってキーの山部あるいは谷部の高さが判別される。

したがって、キーの山部あるいは谷部の幅を測定するものではなく、それらがある寸法範囲内にあるか否かを判別するに過ぎなかった。また、判別がキーの片側のみを対象としているため、キー取付治具及びその送り装置等の遊隙によってその判別精度が左右されるという不具合があった。

〈発明が解決しようとする問題点〉

そこで、キーの総ての山部及び谷部の幅寸法を同時に計測することができるようにすること、しかも、それが簡易な装置で可能な方法の検討が課題となっていたのである。

〈問題点を解決するための手段〉

このような課題に関して種々検討した結果、キー(1)の山部(10)及び谷部(9)をセンサカメラ(3)で撮影する際、総ての測定対象領域にウインド(7)をソフトウェアにより影像部(8)上に設定して、

画像処理することによりキー山の形状を識別することを特徴とする画像処理を利用したキー山形状識別方法を開発したのである。

ここにいうウインド(7)をソフトウェアにより影像部(8)上に設定するとは、影像部(8)上に目には見えないが、スリット状の長い枠をコンピュータソフト的に設定することであり設定された状態はモニタ(5)に表示される。画像処理するとは、ウインド(7)内の明暗の存在を光量変化として捕えて処理することである。ウインド(7)の具体例としては、キー山及び谷の位置にその僅かな平行部に相当する厚さを持ち、キー山の最大幅より大きい幅を持つものをプログラム化したものである。

〈作用〉

この方法においては、センサカメラ(3)に至る光がキーの測定範囲全域に同時照射されるので、キー(1)はその移動の必要がなく、キーの山部あるいは谷部の幅について同時計測ができ、しかも、それが高精度で可能となる。

〈実施例〉

- 3 -

ンド(7)内の山部あるいは谷部によって遮られた影が、光量変化として捕えられて画像処理されたうえ、キーの山部あるいは谷部の幅に対する信号として取出される。

一般にキーにおいては、その最も重要な要素である山部及び谷部が長手方向の一定距離ごとに配列されている。これらの山部あるいは谷部はキー中心に対して対称に配置され、それぞれ異なった高さ、すなわち、異なった幅をもち、その頂部あるいは底部には僅かな平行部が残されている。キーはこの僅かに残された平行部の幅寸法とその長手方向の位置の組合せによって識別される。これらの平行部を結ぶ山部あるいは谷部の斜面の形状はキーの機能には関係しない。キーがキーとしての機能を発揮するには厳しい寸法精度が要求されるのはいうまでもない。ちなみに、ある基準位置から山部あるいは谷部の僅かな平行部までの距離に対して1/100mm、また、山部あるいは谷部の全幅に対して1/100mmという精度が要求されるようになった。したがって、キー山形状の識別にあ

- 5 -

以下図面によって本発明の実施例を詳細に説明する。

第1図は本発明のキー山形状識別方法を実施可能にする計測装置の斜視図であり、第2図は画像処理における影像部の様子を示す図である。

本装置はキー(1)がその背後から照明装置(6)を当てて山谷部の全景を撮影できるような治具(2)に取付けられており、その上部にセンサカメラ(3)が取付けられている。このセンサカメラ(3)は撮像素子群で構成された影像部を持ち、キーの山谷部を撮影する。

撮影結果はコントローラ(4)に送られる。コントローラ内にはコンピュータのソフトウェア、すなわちプログラムによって、第2図に示したような、画像処理における影像部(8)の測定対象位置、すなわちキーのすべての山部(10)及び谷部(9)の位置に、その僅かな平行部に相当する厚さを持ちキー山の最大幅より大きい幅を持つスリット状のウインド(7)を設定している。

このような装置で、すべてのスリット状のウイ

- 4 -

たってはこれらの精度を考慮に入れなければならない。

そこで、本発明では取出された信号によってコントローラ内で次のことが行われる。

- ① 記憶装置に記憶されているキーのパターン、すなわち、キーの山部あるいは谷部の幅と、その長手方向の組合せとを照合することによってキーNoを検索する。
- ② 演算処理によってすべての山部及び谷部の幅寸法を算出する。
- ③ 山部及び谷部の幅寸法を前記検索されたキーNoのものと比較して良否の判定をする。

そして、それらの結果はすべてモニタ(5)に表示される。

〈発明の効果〉

本発明は以上のようなキー山形状識別方法であるから、

- ① 従来の方法で困難であったキーの山部あるいは谷部の幅を高精度で計測することができ、すなわち、高精度の寸法検査を可能としており、

- 6 -

② 測定によって得られたデータは他の工程、例えばキー山の切削あるいはシリンダの組立等に効果的に利用できる。

③ 撮影時にキーを移動する必要がないため装置が簡単になる。また、すべての点について同時測定が可能なので効率的である。

4. 図面の簡単な説明

第1図は本発明のキー山形状識別方法を実施可能にする計測装置の斜視図であり、第2図は画像処理における影像部の様子を示す図である。

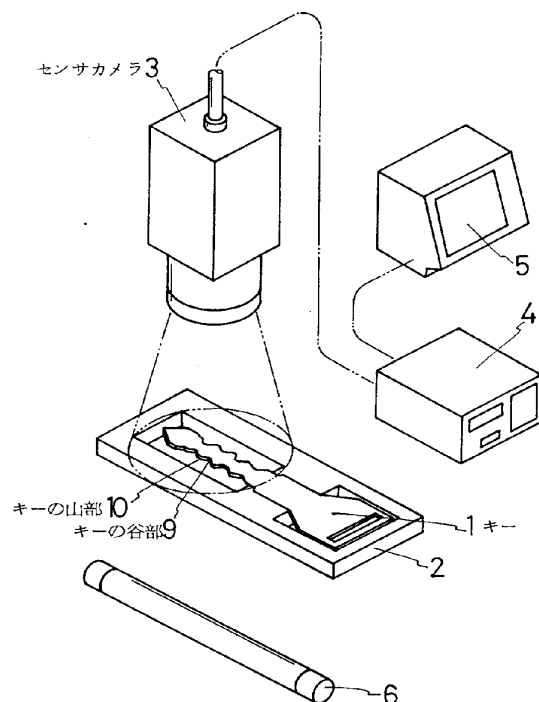
(1) キー	(2) 治具
(3) センサカメラ	(4) コントローラ
(5) モニタ	(6) 照明装置
(7) ウインド	(8) 影像部
(9) キーの谷部	(10) キーの山部

以 上

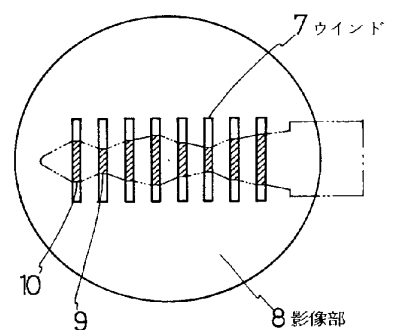
出願人 株式会社機器開発工業
代理人 弁理士 森 廣 三 郎

- 7 -

第 1 図



第 2 図





TÍTULO DE PATENTE NO. 291113

Titular(es):	HY-KO PRODUCTS COMPANY		
Domicilio(s):	Meadow Lane 60, Northfield, Ohio, 44067, E.U.A.		
Denominación:	MÁQUINA DUPLICADORA DE LLAVES.		
Clasificación:	Int.Cl.8: B23C3/35		
Inventor(es):	MICHAEL A. BASS; WILLIAM R. MUTCH; RICHARD W. RYAL, SR.; CHESTER O. D. THOMPSON; ROBERT E. DRAKE; RANDALL A. PORRAS		
SOLICITUD			
Número:	Fecha de presentación internacional:		
MX/a/2008/009440	23 de Enero de 2007		
PRIORIDAD			
País:	Fecha:	Número:	
US	23 de enero de 2006	60/761,293	
Vigencia:	Veinte años		
Fecha de Vencimiento:	23 de enero de 2027		
LA VIGENCIA DE ESTA PATENTE ES IMPRORROGABLE Y ESTÁ SUJETA AL PAGO DE LA TARIFA PARA MANTENER VIGENTES LOS DERECHOS.			

Fecha de expedición: 18 de octubre de 2011

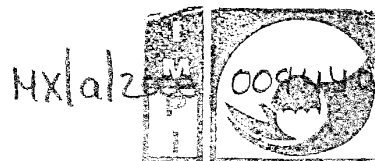
EL DIRECTOR DIVISIONAL DE PATENTES

QUÍM. FABIÁN R. SALAZAR GARCÍA



MX/2011/97212

291113
18-X-2011



MÁQUINA DUPLICADORA DE LLAVES

Instituto
Mexicano
de la Propiedad
Industrial

REFERENCIA CRUZADA CON SOLICITUDES RELACIONADAS

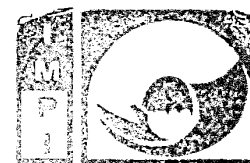
Esta solicitud no provisional reivindica
5 el beneficio de la solicitud provisional de patente
de EE. UU. Núm. 60/761,293, titulada "Máquina
Duplicadora de llaves" ("Key Duplication Machine")
y presentada el 23 de enero de 2006, misma que se
incorpora en su totalidad en la presente como
10 referencia.

CAMPO DE LA INVENCION

Esta invención se refiere, en general, a
un aparato y a los métodos para la duplicación de
15 llaves y, más específicamente, la presente
invención se refiere a un aparato y a los métodos
para obtener duplicados de llaves con base en la
imagen captada de una llave original.

ANTECEDENTES DE LA INVENCION

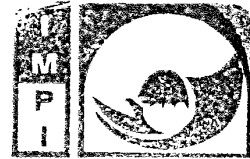
Las máquinas duplicadoras de llaves y las
máquinas talladoras de llaves están diseñadas para
reproducir el patrón de una llave original en una
llave sin labrar o forja. Las máquinas
25 duplicadoras de llaves y las máquinas talladoras de



Instituto
Mexicano
de la Propiedad
Industrial

llaves de la técnica anterior determinan, por lo general, el patrón de una llave original poniendo en contacto físico el patrón de la llave original con un palpador, barra seguidora u otro elemento mecánico de este tipo. Por ejemplo, las máquinas duplicadoras de llaves del arte previo comprenden, normalmente, un par de mordazas o prensas sujetadoras montadas en un carro. La llave original, que tiene un patrón de llave, se coloca en una primera mordaza. Una llave original, manualmente seleccionada por el operador de la máquina, es colocada en una segunda mordaza, la cual está, normalmente, colocada en forma adyacente a la primera mordaza. El palpador se pone en contacto con el patrón de la llave original. Un disco de corte se pone en contacto con un borde de la forja en la que se va a duplicar el patrón de la llave original. El palpador y el disco de corte están acoplados de tal forma que el movimiento del disco de corte está sincronizado con y controlado por el movimiento del palpador.

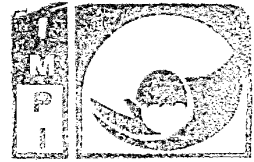
El carro está colocado de manera tal que pueda moverse en forma lineal y pivotante a lo largo de una flecha de soporte longitudinal que, por lo general, es paralela a las hojas de la llave



Instituto
Mexicano
de la Propiedad
Industrial

original y de la forja. Por lo general, el carro
mueve manualmente a lo largo de la flecha,
provocando que el palpador se mueva a lo largo del
patrón de llave de la llave original. Conforme el
5 palpador se mueve a lo largo del patrón de llave de
la llave original para trazar el patrón de llave,
el disco de corte se mueve a lo largo de la hoja de
la forja. El acoplamiento entre el palpador y el
disco de corte controla el movimiento del disco de
10 corte y talla un duplicado del patrón de la llave
original en una forja. Una vez que el proceso de
corte o tallado ha terminado, la llave recién
duplicada puede retirarse de la mordaza y pulirse
en una rueda de pulido o hacerse pasar por un
15 cepillo de alambre para eliminar las rebabas.

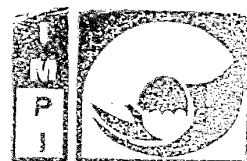
En el proceso de la técnica anterior que
se acaba de describir, el operador de la máquina
talladora de llaves selecciona la forja
manualmente. Es muy importante que el patrón de
20 llave de la llave original sea copiado en una forja
adecuada que tenga la misma hoja de llave y
acanaladuras. Existe un gran número de forjas y no
es fácil distinguir entre sí a muchas de ellas. La
identificación de la forja correcta que se usará en
25 la duplicación necesita, con frecuencia, que se



examine a simple vista una pluralidad de forjas donde las diferencias entre las forjas pueden ser muy sutiles, lo que aumenta de manera significativa

5 el grado de dificultad para identificar la forja adecuada. Con demasiada frecuencia, los comercios que ofrecen el servicio de duplicación de llaves no cuentan con cerrajeros experimentados capaces de identificar de manera consistente y precisa la forja adecuada que deberá ser utilizada. En vez de
10 lo anterior, a un empleado se le ensela como examinar a ojo la que se piensa es la forja correcta y luego cortar y duplicar la llave con el gran riesgo de que la llave duplicada no funcione en forma adecuada.

15 Una vez que el operador ha elegido manualmente la forja, ésta es sometida al proceso de tallado. En caso de que durante la selección manual de la forja se haya cometido algún error, todo el proceso de identificar manualmente la mejor
20 forja y de tallarla mecánicamente deberá iniciarse desde el principio otra vez. Es frecuente que estos errores no logren ser identificados sino hasta después de que el cliente se ha ido de la cerrajería, lo que genera frustración contra este
25 comercio por la hechura de un duplicado que no



Instituto
Mexicano
de la Propiedad
Industrial

sirve.

Aunque las máquinas y los procesos de duplicación de llaves de la técnica anterior están bien establecidos y son ampliamente utilizados, estas máquinas y procesos tienen una tasa de desperdicio relativamente elevada, que depende en gran medida de la experiencia y el criterio de los operarios de la máquina y podría no permitir evaluar la precisión de un duplicado sin que este duplicado tenga que ser probado en su cerradura asociada. Debido a estas y otras limitaciones de la técnica anterior, en el campo técnico se está realizando un esfuerzo constante por mejorar la precisión del corte o tallado, la calidad del tallado, así como la facilidad de uso de las máquinas y los procesos de duplicación de llaves. Las mejoras en las máquinas y procesos de duplicación de llaves que aumenten la precisión y la calidad de un duplicado o que produzcan máquinas que los operadores puedan manejar con facilidad son bien recibidas en la industria de la duplicación de llaves.

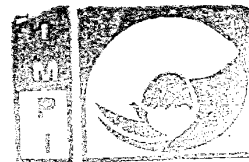
Un objetivo general de la industria es producir máquinas duplicadoras de llaves y procesos que sean tan fáciles de utilizar que cualquier



cliente o consumidor ordinario pueda duplicar una llave con una mínima cantidad de instrucciones y conocimiento mínimo sobre las llaves. Por lo tanto, hay un gran deseo de mejoras en máquinas y procesos para la hechura de duplicados de llaves que simplifiquen el proceso de tallado o que mejoren la precisión al identificar una forja. Adicionalmente, en la industria se realiza un esfuerzo constante por contar con máquinas más económicas, más fáciles de ensamblar y cuyo mantenimiento sea más fácil. El que las máquinas o procesos duplicadores de llaves recientemente desarrollados alcancen cualquiera de estos objetivos, constituiría una mejora significativa con respecto a las costosas y con frecuencia difíciles de utilizar máquinas talladoras de llaves que se conocen actualmente en el campo.

SUMMARY OF THE INVENTION

Se describen aparatos, métodos y otras modalidades asociadas con una máquina duplicadora de llaves. En una modalidad, una unidad para duplicar una llave original incluye un dispositivo óptico para la captación de imágenes, un circuito lógico, una unidad de sujeción y un elemento de



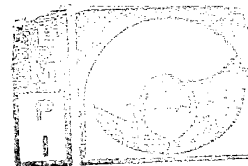
corte. El dispositivo óptico para la captación de imágenes tiene la capacidad de captar una imagen óptica de al menos una parte de la llave original.

5 El circuito lógico tiene la capacidad para determinar un patrón de la llave original a partir de la imagen óptica de la llave original. La unidad de sujeción tiene la capacidad de sujetar una forja y el elemento de corte tiene la capacidad de cortar o tallar en dicha forja el patrón de la llave.

10 En otra modalidad, un método para duplicar una llave original incluye captar la imagen óptica de al menos una porción de la llave original; proveer un circuito lógico para determinar un patrón de la llave original a partir de la imagen
15 óptica de la llave original; sujetar una forja, y tallar en la forja el patrón de la llave.

BREVE DESCRIPCIÓN DE LOS DIBUJOS

En los dibujos que se anexan, mismos que
20 se incorporan y forman parte de esta descripción, se ilustran las modalidades de la invención, las cuales, junto con la descripción general de la invención expuesta anteriormente y la descripción detallada que se presenta más adelante, sirven para
25 ilustrar los principios de esta invención. Los



dibujos y la descripción detallada no están dirigidos a limitar y no limitan el alcance de esta invención o de las reivindicaciones de ninguna

manera. En vez de esto, los dibujos y la descripción detallada describen únicamente modalidades de la invención, y otras modalidades no descritas de la invención queden cubiertas por las reivindicaciones.

La figura 1 es una vista en perspectiva de una modalidad ilustrativa de una máquina duplicadora de llaves de conformidad con la presente invención.

La figura 2 es una vista de frente de la máquina duplicadora de llaves de la figura 1.

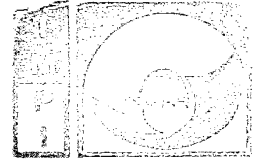
La figura 3 es una vista lateral de la máquina duplicadora de llaves de la figura 1.

La figura 4A es una vista en planta de una llave original.

La figura 4B es una vista en planta de una forja.

La figura 5 es una vista en perspectiva de una llave asegurada en la ranura de la máquina duplicadora de llaves de la figura 1.

La figura 6 es una vista parcial en perspectiva del interior de la máquina duplicadora



Instituto
Mexicano
de la Propiedad
Industrial

de llaves de la figura 1.

La figura 7 es una vista parcial en perspectiva del interior de la máquina duplicadora de llaves de la figura 1.

5 La figura 8 es una vista parcial en perspectiva del interior de la máquina duplicadora de llaves de la figura 1.

La figura 9 es una vista parcial en perspectiva del interior de la máquina duplicadora de llaves de la figura 1.

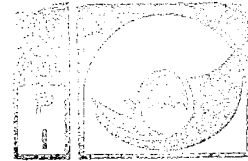
10 La figura 10 es una vista en planta de una forja colocada entre los dedos colocadores de la máquina duplicadora de llaves de la figura 1.

La figura 11 es una vista en perspectiva de un disco de corte y del dedo posicionador de la máquina duplicadora de llaves de la figura 1.

La figura 12 es una vista parcial en perspectiva del interior de la máquina duplicadora de llaves de la figura 1.

20 La figura 13 es una vista en perspectiva de un miembro superior de sujeción de la máquina duplicadora de llaves de la figura 1.

La figura 14 es una vista parcial en perspectiva del interior de la máquina duplicadora de llaves de la figura 1.



La figura 15 es una vista parcial en perspectiva del interior de la máquina duplicadora de llaves de la figura 1.

5 La figura 16 es una vista de frente de un cajón de virutas de la máquina duplicadora de llaves de la figura 1.

La figura 17 es una vista posterior de un cajón de virutas de la máquina duplicadora de llaves de la figura 1.

10 La figura 18 es una vista parcial en perspectiva del interior de la máquina duplicadora de llaves de la figura 1.

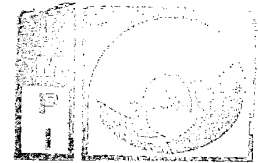
La figura 19 es una vista parcial en perspectiva del interior de la máquina duplicadora de llaves de la figura 1.

La figura 20 es una vista explotada de la máquina duplicadora de llaves de la figura 1.

La figura 21 es una vista explotada de la máquina duplicadora de llaves de la figura 1.

20 La figura 22 es una vista de la pantalla de una interfaz de usuario que se utiliza con la máquina duplicadora de llaves de la figura 1.

La figura 23 es una vista de la pantalla de una interfaz de usuario que se utiliza con la máquina duplicadora de llaves de la figura 1.



La figura 24 es una vista de la pantalla de una interfaz de usuario que se utiliza con la máquina duplicadora de llaves de la figura 1.

5 La figura 25 es una vista de la pantalla de una interfaz de usuario que se utiliza con la máquina duplicadora de llaves de la figura 1.

La figura 26 es una vista de la pantalla de una interfaz de usuario que se utiliza con la máquina duplicadora de llaves de la figura 1.

10

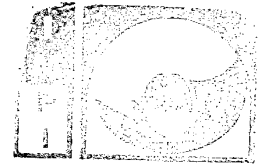
DESCRIPCIÓN DETALLADA DE LA INVENCION

La "Descripción detallada de la invención" solamente describe modalidades de la invención y su intención no es, de ninguna manera, limitar el alcance de las reivindicaciones. Evidentemente, la invención tal y como se describe en las reivindicaciones es más amplia que y no está limitada por las modalidades preferidas, y los términos de las reivindicaciones contienen su significado común completo.

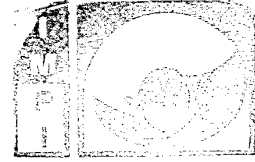
15 20

Como se describe en la presente, el aparato y los métodos pueden ser diseñados para que produzcan duplicados precisos y confiables de llaves originales. En una modalidad, la duplicación de una llave original se facilita gracias a la toma

25



o captación de una imagen óptica del perfil o
silueta de la llave original, que incluye el patrón
de la llave original, y la toma del perfil
silueta de una forja. Como se describirá
5 adicionalmente en la presente, las imágenes tomadas
o captadas pueden ser analizadas por el circuito
lógico para determinar la forja adecuada que deberá
utilizarse para un duplicado, para validar la
selección de la forja adecuada, para facilitar el
10 tallado preciso del patrón de la llave original en
la forja y para validar la precisión del tallado
del patrón de la llave en la forja. El aparato y
los métodos pueden facilitar adicionalmente el
tallado de una gran variedad de tipos de llaves,
15 como por ejemplo, llaves con patrón en un solo
borde, llaves con patrón en dos bordes, llaves tipo
"sidewinder" (con entalladuras no pasantes en ambos
lados de la hoja), llaves para casa, llaves para
automóviles, llaves para comercios y similares. El
20 análisis de las imágenes realizado por el circuito
lógico puede incluir, por ejemplo, que el circuito
lógico almacene imágenes, almacene datos,
cuantifique las medidas físicas con base en la
imagen, recupere los datos de referencia contenidos
25 en una base de datos y acciones similares.



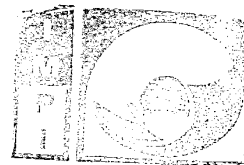
Como se utiliza en la presente, el término "circuito lógico" incluye, aunque no se limita a, hardware, microprogramación cableada, software y/o combinaciones de éstos para realizar una o más funciones o una o más acciones y/o para provocar una función o acción a partir de otro circuito lógico, método y/o sistema. Por ejemplo, con base en una aplicación deseada o conforme a las necesidades, el circuito lógico puede incluir un microprocesador controlado por software, lógica discreta, como la de un circuito integrado de aplicación específica (ASIC, por sus siglas en inglés), un circuito analógico, un circuito digital, un dispositivo lógico programado, un dispositivo de memoria que contiene instrucciones o similares. El circuito lógico puede incluir una o más compuertas, combinaciones de compuertas u otros componentes de circuitos. El circuito lógico también puede estar incorporado por completo en forma de software. Cuando se describen circuitos lógicos de lógica múltiple, puede ser posible incorporar los circuitos lógicos de lógica múltiple en un circuito lógico físico. De manera similar, cuando se describe un solo circuito lógico, puede ser posible distribuir ese circuito lógico



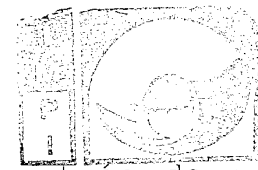
lógico entre circuitos lógicos físicos múltiples, además, como se usa aquí, el término "base de datos" incluye una entidad física y/o lógica que pueda almacenar datos. Una base de datos puede ser, por ejemplo, una base de datos tradicional, una tabla, un archivo, una lista, una cola de espera, un acumulador, una memoria, un registro, etc. Una base de datos puede residir en una entidad lógica y/o física y/o puede estar distribuida entre dos o más entidades lógicas y/o físicas.

Opcionalmente, el aparato y los métodos que aquí se describen pueden aceptar órdenes introducidas por un usuario u operador de una máquina duplicadora de llaves y puede presentarle al usuario u operador de la máquina un resultado para facilitar aún más la duplicación de una llave. Por ejemplo, el aparato puede incluir una interfaz de usuario, como por ejemplo un monitor, una pantalla táctil u otro dispositivo de este tipo, por medio del cual un usuario puede introducir información y en el cual se le puede mostrar información al usuario.

En una modalidad, un método para utilizar la máquina duplicadora de llaves comprende los pasos de insertar en la máquina una llave original,



de tal forma que la hoja de la llave original este
dentro de una zona de la máquina donde se capta la
imagen; captar la imagen del patrón de la llave
original; utilizar el circuito lógico para analizar
5 la imagen captada; comparar la imagen captada con
los datos de forjas contenidos en una base de
datos; determinar la forja adecuada para duplicar
la llave original; enviarle al usuario la
información de salida relacionada con la forja
10 adecuada; retirar la llave original de la máquina;
recuperar e insertar en la máquina la forja
adecuada, de tal modo que la hoja de la forja esté
dentro de la zona de captación de la imagen; captar
una imagen de la forja; utilizar el circuito lógico
15 para analizar la imagen de la forja y validar que
la forja sea la adecuada; alinear la forja;
desplazar la forja hacia la zona de corte de la
máquina; cortar o tallar en la forja el patrón de
la llave original; desplazar la llave recién
20 duplicada hacia la zona de la máquina donde se
capta la imagen; captar una imagen de la llave
duplicada; utilizar el circuito lógico para
analizar la imagen de la llave duplicada; comparar
el análisis de la imagen de la llave original
25 contra el análisis de la imagen de la llave



duplicada para validar la precisión del patrón de la llave tallado en el duplicado de la llave, retirar la llave duplicada de la máquina y desbarbar el duplicado de la llave.

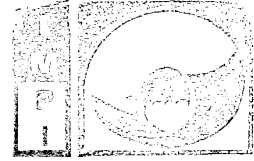
5 En las figuras anexas se ilustra una modalidad a manera de ejemplo de una máquina (10) duplicadora de llaves. La máquina (10) duplicadora de llaves según se describe en la presente tiene numerosas características o mejoras, cada una de las cuales se considera nuevas en forma independiente. Por lo tanto, aunque las modalidades de la presente invención se describen utilizando cada una de estas características o mejoras novedosas en conjunto, nada en la presente descripción debe interpretarse que se necesita una modalidad que incluya o excluya cualquiera de las mejoras particulares descritas en la presente. Además, la máquina (10) duplicadora de llaves que se describe en la presente incorpora un sistema de

10 identificación de forjas y un sistema de corte o tallado de llaves en un mismo aparato. Sin embargo, debe entenderse que cualquiera de los sistemas podría ser utilizado en forma individual o en conjunto. No debe interpretarse que parte alguna de

15 esta descripción limite las características

20

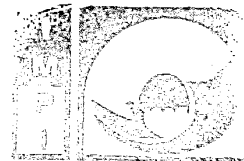
25



Instituto
Mexicano
de la Propiedad
Industrial

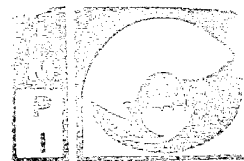
novedosas de cada sistema individual ya sea que se utilice solo o en una unidad integrada. Por tanto, ya que se le describe en la presente como un sistema integral, se obtiene la imagen de la llave original y se le compara con otras forjas para determinar la forja apropiada que se utilizará, en tanto que también se utiliza la imagen de la llave original para suministrar información del patrón de la llave que será tallado en la forja.

Las figuras 4A y 4B ilustran una llave original (22) común y una forja (24). Puesto que se sabe que en la industria cerrajera se utilizan muchos tipos de llaves, por simplicidad, la llave original (22) ilustrada en la figura 4A es una llave de casa ilustrativa, y la forja (24) ilustrada en la figura 4B es una forja (24) ilustrativa para la llave de casa (22). Tanto la llave original (22) como la forja (24) incluyen, normalmente, una cabeza (26) que tiene un arco (28); un resalto (30); una hoja (32) y una acanaladura (34) para bocallave. La acanaladura (34) para bocallave es normalmente una área estrecha formada por fresado a lo largo de la hoja (32) y que permite que la hoja (32) salve las guardas de la bocallave. Para simplificar la



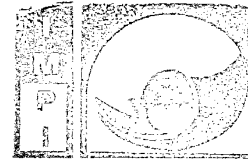
operación de tallado de una llave, estas
acanaladuras (34) para bocallave pueden estar
talladas en la forja (24). Por lo tanto, cuando se
obtiene el duplicado de una llave original (22), la
5 forja (24) debe contener una acanaladura (34) para
bocallave que sea idéntica o similar a la de la
llave original (22). La llave original (22) incluye
un patrón (36), que es un modelo para todo patrón
de llave que tallado en la forja (24) durante la
10 duplicación de la llave original (22). Como se
utiliza en la presente, la "llave original" se
refiere a cualquier llave que tenga un patrón de
llave, ya sea que se trate de una llave original
adquirida con una cerradura y fabricada por el
15 fabricante de la cerradura, o de un duplicado
mandado hacer posteriormente a partir de la llave
original. La referencia a una llave como llave
original indica que la llave sirve como modelo a
partir del cual se tallará un duplicado de la
20 llave, el cual realizará la misma función de abrir
o cerrar como la llave original.

Con referencia a las figuras 1 a 3, se
ilustra una máquina (10) duplicadora de llaves
ensamblada. La máquina (10) incluye una cubierta
25 externa (12) que comprende varios paneles



dispuestos para encerrar y proteger componentes, mecanismos y sistemas internos de la máquina (10) duplicadora de llaves. La máquina (10) incluye además una mordaza de puerta (14), que es empujada contra una base (16) por un miembro empujador (no mostrado). La mordaza de puerta (14) puede ser empujada contra la base (16) por cualquier tipo de miembro empujador, como por ejemplo, un resorte helicoidal de extensión o de compresión, un resorte de torsión, un contrapeso o similar. La mordaza de puerta (14) puede ser levantada, contra la fuerza de empuje por medio de una manija (18).

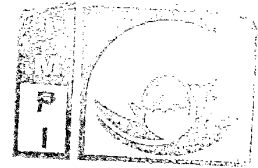
La combinación de la mordaza de puerta (14), la base (16), la manija (18) y el miembro empujador forma un mecanismo de retención (19) que retiene o asegura una la llave original (22) o una forja (24). Como se ilustra en la figura 5, la mordaza de puerta (14) y la base (16) forman una ranura (20) que puede ser utilizada para retener o asegurar una llave original (22) o una forja (24), de tal forma que la hoja (32) de la llave (22) y (24) se coloque dentro de la máquina (10). La fuerza aplicada a la llave (22) y (24) en la ranura (20) es suficiente para retener o mantener en su



lugar a la llave (22) y (24), aunque también permite que la llave (22) o (24) tenga un movimiento que facilite la alineación adecuada de la llave (22) o (24).

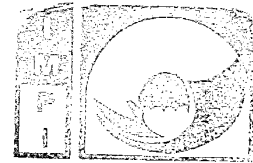
5 Como se describirá en forma adicional, la hoja (32) de una llave (22) y (24) puede estar colocada dentro de la máquina (10) de tal forma que una imagen de la hoja (32) pueda ser captada. Además, la hoja (32) de una forja (24) puede
10 colocarse dentro de la máquina (10) de tal forma que la hoja (32) quede expuesta ante las mordazas y los cortadores. Las mordazas están dispuestas para asegurar en forma rígida y selectiva a la forja (24) y los cortadores están dispuestos para tallar
15 selectivamente el patrón de llave en la hoja (32) de la forja (24) cuando la forja (24) está rígidamente asegurada en las mordazas.

 En una modalidad, la llave (22) y (24) puede estar colocada con un primer lado de la hoja
20 (32) orientado hacia arriba, o la llave (22) y (24) puede girarse 180 grados y colocarse con la primera superficie de la hoja (32) colocada hacia abajo. Como se describirá adicionalmente, en una modalidad de este tipo, la orientación o registro variable de
25 la llave (22) y (24) no afecta la posterior



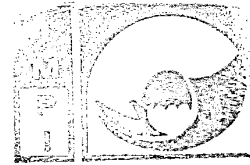
captación, ubicación o tallado de una llave (22) (24). La máquina (10) duplicadora de llaves puede estar organizada de tal modo que el circuito lógico utilizado para analizar las imágenes y controlar el movimiento, la alineación y el tallado de las llaves (22) y (24) pueda detectar la orientación o el registro de la llave (22) y (24) y tener en cuenta esta orientación o registro durante la duplicación de una llave original (22), de modo tal que se realicen los cortes adecuados de la llave sin importar la posición de la forja (24), con la finalidad de promover tanto la facilidad de uso frente al usuario como la velocidad de duplicación.

La mordaza de puerta (14), la base (16), la manija (18) y la ranura (20) están ubicadas en un panel (21) del mecanismo de retención. El panel (21) está dispuesto de tal forma que el panel 21 pueda deslizarse hacia la derecha y hacia la izquierda con respecto a la figura 2. Como se describirá adicionalmente, este movimiento permite que la máquina (10) mueva la hoja (32) de una forja (24) entre una zona de captación de la imagen, en donde puede captarse una imagen de la hoja (32), y la zona de tallado, en la cual, el patrón (36) de llave es tallado en una forja (24).



La máquina (10) duplicadora de llaves incluye una mesa (38) ubicada debajo de la ranura (20). La mesa (38) está ubicada de tal forma que cuando una llave original (22) está asegurada en la ranura (20), la mesa (38) soporta llaves adicionales en un llavero, de modo que el usuario no tiene que sacar la llave original (22) del llavero para la duplicación. En la máquina (10) se ha incorpora un monitor (40) con pantalla táctil, por medio del cual, el usuario puede introducir información y se le puede mostrar información al usuario. Además, debajo de los mecanismos internos de tallado de las llaves se provee un cajón (42) para virutas metálicas que recibe las virutas metálicas generadas durante el tallado de las llaves. El cajón de virutas (42) puede ser retirado de la máquina (10) para facilitar el desecho de las virutas recolectadas. Por conveniencia, también se provee una ranura de desbarbado (44). La ranura (44) conduce hacia un elemento que elimina la rebaba, como una rueda, un cepillo cuadrado o similar, para limpiar y desbarbar las llaves recién talladas.

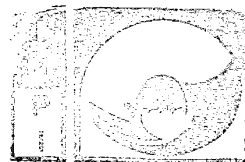
De manera opcional, la máquina (10) puede incorporar un sistema de vacío (no mostrado) para



capturar las virutas generadas al tallar las llaves
conforme las virutas están siendo generadas, y para
ayudar en la limpieza del área de trabajo después
de las operaciones de tallado de llaves. Este
5 sistema de vacío puede estar conectado a la máquina
(10) en las inmediaciones de donde se lleva a cabo
la operación de tallado o dentro o cerca de un
depósito receptor. En la solicitud de patente de
EE. UU. Núm. 10/970,844, titulada "máquina
10 talladora de llaves" ("Key cutting machine"),
presentada el 20 de octubre de 2004, perteneciente
en forma mancomunada a este cesionario, se describe
un sistema ilustrativo de este tipo. La solicitud
de patente 10/970,844 queda, de este modo,
15 explícitamente incorporada en su totalidad como
referencia. La solicitud 10/970,844 describe un
tubo de vacío desmontable con capacidad para
capturar las virutas del tallado de las llaves y
ayudar a la limpieza del área de trabajo después de
20 la operación de tallado. Será claro para los
técnicos en la materia que este tipo de sistema de
vacío puede incorporarse en el aparato de la
presente y conectarse en las inmediaciones de donde
se lleva a cabo la operación de tallado o dentro o
25 cerca del depósito receptor.



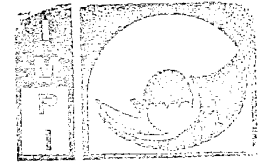
Como se describirá adicionalmente, durante el proceso de la duplicación o tallado de llave, los componentes, mecanismos y sistemas internos de la máquina (10) duplicadora de llaves se mueven y tienen un movimiento con respecto a otros componentes de la máquina (10). Para facilitar la descripción de este tipo de movimientos, se hará referencia a los movimientos con respecto al eje X, al eje Y y al eje Z. La orientación de estos ejes se muestra en las figuras 1 a 3. Cuando en la presente se describe que un movimiento o movimientos se realizan, por ejemplo, "a lo largo del eje X", esta descripción incluye el movimiento a lo largo de cualquier eje paralelo al eje X mostrado en las figuras 1 a 3. Los movimientos a lo largo del eje X son, en general, entre la parte trasera y delantera de la máquina (10), los movimientos a lo largo del eje Y son, en general, entre el lado derecho e izquierdo de la máquina (10), y los movimientos a lo largo del eje Z son, en general, entre la parte superior y la parte inferior de la máquina (10). Como lo entenderán los técnicos en la materia, no se pretende que la descripción del movimiento o los movimientos a lo largo de alguno de los ejes sea



exacta y precisamente a lo largo de dicho eje o en forma paralela al mismo. En la descripción del movimiento a lo largo de un eje se incluye al movimiento que se realiza aproximada o burdamente a lo largo de un eje o en forma paralela a éste. La intención de utilizar las expresiones "a lo largo de un eje" o "alrededor de un eje" es simplificar la descripción general del aparato y los métodos descritos en la presente y no es limitar el alcance o comprensión de tales aparatos y métodos.

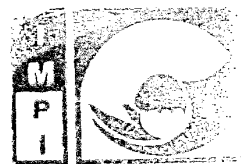
Las figuras 6 a 21 ilustran componentes, mecanismos y sistemas internos ilustrativos de la máquina (10) duplicadora de llaves y se les mencionará al describir los métodos de uso de la máquina (10) para hacer duplicados de llaves originales (22).

Nuevamente con referencia a la figura 5, una llave original (22) o una forja (24) puede estar colocada y retenida en la ranura (20) del panel (21) del mecanismo de retención, de tal forma que la hoja (32) esté colocada dentro de la máquina (10) y en la zona de captación de la imagen. Como se observa mejor en la figura 6, dentro de la máquina (10) está instalado un dispositivo óptico (50) para la captación de imágenes, el cual está



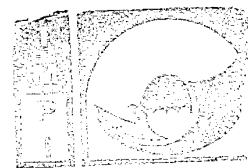
ubicado de modo tal que capte una imagen óptica de una llave (22) y (24) asegurada en la ranura (12). La imagen de la llave (22) y (24) puede incluir, en general, la hoja (32) de la llave (22) y (24), el
5 resalto (30) y al menos una porción de la cabeza (26). Como se utiliza de manera general en la presente, el área de captación de la imagen es un área que está debajo (a lo largo del eje Z) del dispositivo óptico (50) para la captación de
10 imágenes. El dispositivo óptico (50) para la captación de imágenes está ubicado, por lo general, arriba de la llave (22) y (24) y está dirigido hacia abajo, de tal modo que pueda captar una silueta de la llave (22) y (24), que incluye la
15 hoja (32) de la llave (22) y (24).

En una modalidad, el dispositivo óptico (50) para la captación de imágenes es una cámara y la imagen captada es una imagen fotográfica. En una modalidad, la cámara (50) es una cámara digital y
20 la imagen captada es una imagen digital. Una imagen digital puede almacenarse en forma de archivo o en forma de datos y puede ser analizada por el circuito lógico. Como se observa mejor en la figura 6, un tubo (51) (mostrado en sección transversal)
25 puede extenderse hacia abajo desde el dispositivo



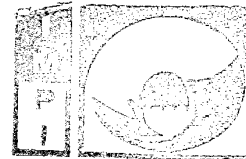
(50) para la captación de imágenes hacia la llave (22) y (24). Un tubo (51) de este tipo puede facilitar la canalización de la luz hacia la cámara y lograr que la imagen captada sea de alta calidad.

5 Para mejorar una imagen captada por el dispositivo óptico (50) para la captación de imágenes, la máquina (10) incluye un sistema que permite la iluminación de fondo de la llave (22) y (24). Como se observa mejor en la figura 7, un
10 panel de iluminación (52), una placa reflectora (54) y una placa bloqueadora (56) cooperan para suministrar la iluminación de fondo de la llave (22) y (24). El panel de iluminación (52) emite
15 luz, la cual es reflejada por la placa reflectora (54) y dirigida hacia la llave (22) o (24). Una superficie (58) de la placa reflectora (54) está recubierta o de otra manera tratada para dispersar y difuminar la luz emitida por el panel de
20 iluminación (52). Esta dispersión y difusión de la luz crea un entorno de iluminación de fondo que mejora las imágenes captadas de la llave (22) y (24). El recubrimiento o tratamiento de la superficie (58) del panel reflector (54) puede ser cualquier tipo de recubrimiento o tratamiento que
25 disperse y difunda la luz en un grado suficiente.



Por ejemplo, la superficie (58) puede estar recubierta con una sustancia granulosa, como, por ejemplo, papel lija; la superficie (58) puede estar pintada; la superficie (58) puede estar maquinada o tener algún otro tipo de tratamiento que la vuelva áspera o rugosa; la superficie (58) también puede incluir algún patrón que disperse y difunda la luz. La placa reflectora (54) puede colocarse en un ángulo relativamente pronunciado, como puede observarse en la figura 7, para reducir la probabilidad de que las virutas del tallado de las llaves puedan caer y pegarse en la superficie (58) de la placa reflectora (54). Un ángulo así aumenta la probabilidad de que las virutas que caigan en la superficie (58) se deslicen fuera de la superficie (58) y se acumulen en el cajón de virutas (42). En una modalidad, cualquier tratamiento o recubrimiento aplicado a la superficie (58) de la placa reflectora (54) se selecciona de modo que sea acorde con el color y la reflectividad de la acumulación de polvo que haya podido acumularse en la superficie (58) debido al tallado de las llaves que se realiza por arriba de la placa reflectora (54).

El panel de iluminación (52) puede incluir



cualquier tipo de dispositivos emisores de luz, como por ejemplo, focos, diodos emisores (LED por las siglas en inglés de "Light Emitting Diodes"), pantallas de cristal líquido (LCD, por las siglas en inglés de "Liquid Crystal Displays") y similares. En una modalidad, el panel de iluminación (52) comprende una matriz de LED equidistantemente separados. En forma alternativa, los LED puede estar irregularmente separados para crear más dispersión y difusión de la luz favorable. En una modalidad, la luz emitida por el panel de iluminación (52) puede estar en el espectro del rojo que, en ciertas condiciones, puede generar imágenes más nítidas de una silueta de llave. Como lo entenderán los técnicos en la materia, otros tipos de sistemas de iluminación de fondo pueden incluir dirigir la luz sobre las virutas o sobre un objeto en el cajón de virutas (42). En la presente se considera e incorpora cualquier configuración particular que suministre luz bien dispersada y difusa adecuada para la iluminación de fondo. En forma alternativa, la iluminación de frente o proveer luz directamente sobre la llave (22) y (24) pueden también utilizarse cuando se captura una imagen de la llave

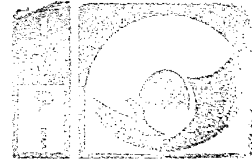


Instituto
Mexicano
de la Propiedad
Industrial

(22) y (24).

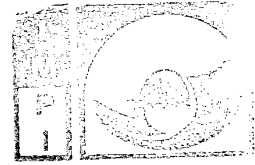
El circuito lógico puede disponerse que analice la iluminación de fondo y la calidad resultante de una imagen captada. Con base en este análisis, la iluminación de fondo puede ajustarse, tanto en dirección o en intensidad, para mejorar las imágenes captadas subsecuentes. Además, la ubicación del panel de iluminación (52), de la placa reflectora (54) y una placa bloqueadora (56) también puede ajustarse para mejorar las imágenes captadas subsecuentes.

El aparato que se ha descrito puede ser utilizado para captar la imagen de la hoja (32) de una llave original (22), incluyendo el patrón de llave (36). Esta imagen captada puede ser analizada por el circuito lógico para cuantificar y definir específicamente el patrón (36) de la llave original. Este análisis puede incluir la cuantificación y definición de la profundidad, el ángulo y de la posición de cada diente del patrón de llave (36); la determinación de si un patrón de llave (36) existe en un lado de la llave (22) (llave de un solo lado) o en ambos lados de la llave (22) (llave de doble lado); la determinación precisa del lugar a lo largo de la hoja (32) donde



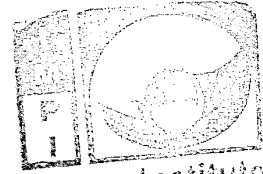
empieza y termina el patrón de llave (36), similares. Adicionalmente, se pueden determinar características superficiales de la hoja (32), como por ejemplo, la presencia, la longitud y el ancho de una acanaladura (34). En una modalidad, las características superficiales de la hoja (32) pueden determinarse colocando al dispositivo óptico (50) para la captación de imágenes en un ángulo con respecto a la superficie de la hoja (32). Como se describirá en forma adicional, esta información puede ser almacenada por el circuito lógico para usarla posteriormente al seleccionar una forja (24), tallar con precisión un patrón de llave en una forja (24) y al comparar el patrón de llave tallado en la forja (24) con el patrón de llave (36) de la llave original (22).

La imagen captada de la hoja (32) de la llave original (22) también puede ser utilizada para determinar específicamente la forja (24) adecuada que debe utilizarse para duplicar la llave original (22). La imagen captada puede ser analizada utilizando el circuito lógico para cuantificar y definir específicamente las características de la hoja (32) de la llave original, como por ejemplo, el tamaño y la forma



del resalto (30), la longitud y el ancho de la hoja (32), ya sea que la llave original (22) sea de un solo lado o de doble lado, o que la hoja (32) incluya algún tipo de escalones o acanaladuras y similares. Para facilitar la identificación de una forja (24) adecuada, el circuito lógico puede comparar las características cuantificadas y definidas de la llave original (22) contra los datos contenidos en una base de datos relacionados con las forjas (24) conocidas. Esta base de datos pueden incluir datos sobre las dimensiones físicas de las forjas (24) conocidas, y el circuito lógico puede realizar comparaciones directas entre las dimensiones físicas de las forjas (24) conocidas y las características de la llave original (22), según se determinaron a partir de la imagen captada. Estas comparaciones pueden llevar a la determinación y selección de la forja (24) adecuada para la llave original (22).

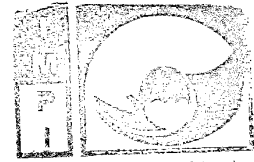
En forma opcional, pueden captarse imágenes adicionales de la llave original (22) con la finalidad de determinar o cuantificar las características superficiales de la llave original (22), como por ejemplo, la acanaladura (34) para bocallave. Tales características superficiales



pueden ayudar a ir cerrando la búsqueda o a elegir la forja (24) adecuada. Tal captación de imágenes puede realizarse proveyendo un anillo de luz

5 y un dispositivo óptico para la captación de imágenes para registrar la vista de la punta o la vista en sección transversal de la llave (24); realizando un barrido con láser en la hoja (32) de la llave para identificar la anchura y separación
10 de una acanaladura (34) para bocallave, o proyectando una sombra sobre la superficie de la hoja (32) para medir las variaciones en el contorno de la sombra relacionado con el contorno del área superficial.

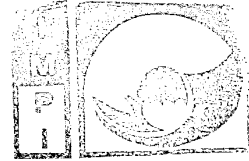
15 Con respecto al barrido con láser de la hoja (32) de la llave, puede utilizarse un barrido puntual usando un solo punto de láser que puede moverse en forma continua a lo largo de una trayectoria, proyectando en ciertos puntos a lo
20 largo de una trayectoria o utilizarse con múltiples barridos puntuales con láser en muchos tipos de configuraciones para adquirir la información necesaria. Debe aclararse que este tipo de barrido podría leer uno o ambos lados de una llave (22). La
25 información sobre la acanaladura (34) puede, del



mismo modo, ser analizada y comparada por el circuito lógico con la información de la acanaladura almacenada en la base de datos que relaciona las forjas (24) conocidas. Por lo tanto,

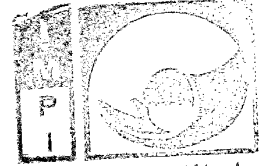
5 con base en la silueta de la llave original (22) y, opcionalmente, en las características de la acanaladura (34) de la llave, el circuito lógico puede identificar una sola forja (24) que deberá ser usada para duplicar la llave original (22).

10 Una vez que la forja (24) adecuada ha sido identificada, la máquina (10) duplicadora de llaves puede dirigir la información de salida directa para indicarle cual es la forja (24) específica identificada. En una modalidad, esta información
15 puede mostrarse en el monitor (40) de pantalla táctil. El usuario puede entonces extraer de un exhibidor de minorista la forja (24) adecuada con base en la información mostrada. En una modalidad, una variedad de forjas (24) puede ser exhibida en
20 un exhibidor o estante de minorista que tiene indicadores luminosos ubicados cerca de cada tipo de forja (24). Una vez que la forja (24) adecuada ha sido identificada, la máquina (10) puede enviar una señal al estante de exhibición y éste puede
25 encender el indicador de luz asociado con la forja



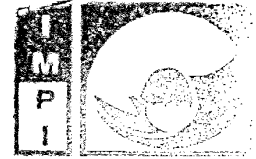
(24) adecuada. Un sistema de este tipo dirige al usuario hacia la forja (24) adecuada y reduce el error del usuario al momento de seleccionar una forja (24). La máquina (10) puede incluir una conexión de visualización (59) (como se observa en la figura 3) para conectar la máquina (10) con el estante de exhibición, a través del cual una señal puede ser enviada desde el estante de exhibición de la máquina (10). Opcionalmente, la máquina (10) y el estante de exhibición pueden estar integrados o la máquina (10) y el estante pueden estar preparados para enviar y recibir señales en forma remota, inalámbrica, etc. Este aparato y métodos se describen en la solicitud de patente de EE. UU. Núm. 10/633,933, presentada el 4 de agosto de 2003 y titulada "Sistema de identificación de objetos" ("Object Identification System"). La solicitud 10/633,933 puede incorporarse o utilizarse de alguna otra manera junto con las modalidades aquí descritas. La solicitud 10/633,933 es propiedad mancomunada de la cesionaria de la presente y, de esta manera, queda explícitamente incorporada en su totalidad como referencia en la presente.

Una vez que la forja (24) adecuada ha sido identificada y retirada por usuario, éste puede



retirar la llave original (22) de la ranura (20) del panel (21) del mecanismo de retención y la forja (24) en la ranura (20). Cuando la forja (24) está colocada en la ranura (20), la forja (24) puede ser validada para asegurarse de que el usuario ha seleccionado la forja adecuada, los mecanismos internos pueden alinear la forja (24), la cual puede sujetarse o asegurarse adicionalmente y puede tallarse un patrón de llave en la forja (24) para obtener un duplicado de la llave original (22). Como se describió anteriormente, la orientación o el registro con el que el usuario inserta la forja (24) en la ranura (20) no afecta las operaciones subsiguientes realizadas sobre la forja (24). El circuito lógico puede analizar las imágenes captadas de la forja (24) insertada para determinar la orientación y ajustar todas las operaciones subsecuentes de conformidad.

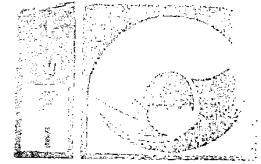
Las figuras 8 y 9 ilustran la colocación de una forja (24) con respecto a los componentes, mecanismos y sistemas internos, según es insertada y asegurada en la ranura (20). En esta posición inicial, la forja (24) está en la zona de captación de la imagen. Para facilitar la ilustración, en las figuras 8 y 9 no se muestra el panel (21) del



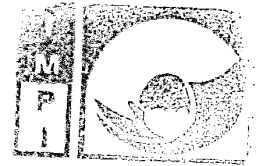
Instituto
Mexicano
de la Propiedad
Industrial

mecanismo de retención. Como se muestra en figura 8, a la izquierda de la forja (24) está colocado un disco izquierdo de corte (60) y a la derecha de la forja (24) está colocado un disco derecho de corte (62), según puede observarse desde el frente de la máquina (10). Una unidad de sujeción (64), que incluye un miembro de mordaza superior (66) y un miembro de mordaza inferior (68), está ubicada a la izquierda de la forja (24), según puede observarse desde el frente de la máquina (10). La unidad de sujeción (64) es usada para sujetar a la forja (24) durante el tallado, el disco izquierdo de corte (60) se utiliza para tallar el lado izquierdo de la forja (24) y el disco derecho de corte (62) se utiliza para tallar el lado derecho de la forja (24).

El circuito lógico puede validar que la forja (24) seleccionada por el usuario y colocada en la máquina (10) es la forja (24) adecuada, según fue previamente identificada. Una imagen de la forja (24) puede captarse por el dispositivo óptico (50) de captación de imágenes, y puede utilizarse al circuito lógico para analizar la imagen. Este análisis puede determinar o cuantificar las características de la forja (24), tales como por



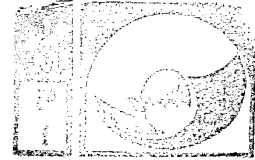
ejemplo, el tamaño y la forma del resalto (30), la longitud y la anchura de la hoja (32), si la forja (24) está diseñada como una llave de un solo lado de dos lados, si la hoja (32) incluye escalones, etc. Estas características determinadas pueden ser comparadas contra los datos referentes a las características de la forja (24) adecuada previamente identificada almacenadas en la base de datos. Siempre y cuando haya concordancia entre las características determinadas en la forja (24) seleccionada por el usuario y las características almacenadas de la forja (24) adecuada previamente identificada, el circuito lógico puede determinar que el usuario ha seleccionado y colocado la forja (24) adecuada. El usuario puede recibir la información de que la forja (24) que ha seleccionado es la adecuada y de que el proceso de duplicación puede continuar. En el caso de que no haya concordancia entre las características determinadas en la forja (24) seleccionada por el usuario y las características almacenadas de la forja adecuada, el circuito lógico puede informarle al usuario que la forja seleccionada no es la adecuada e indicarle que seleccione otra forja (24) para la duplicación de la llave original (22). De



manera opcional, el proceso de duplicación puede detenerse hasta que el usuario coloque una forja (24) adecuada; o la máquina (10) puede incorporar la función de omitir, que permite que un patrón de

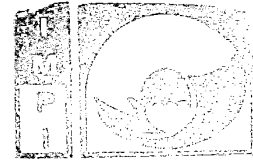
5 llave sea tallado en la forja (24) seleccionada.

Antes de sujetar la forja (24) en la unidad de sujeción (64), la forja (24) puede ser alineada para asegurar que el patrón de llave sea correctamente tallado en la forja (24). La posición
10 de la forja (24), como el usuario la coloca inicialmente en forma manual, puede ser determinada a partir de la imagen captada de la forja (24). Esta imagen es analizada por el circuito lógico y comparada contra la posición ideal para el tallado
15 de la forja (24), y la posición de la forja (24) puede ser ajustada para adaptarla a la posición ideal de tallado. Como se observa mejor en las figuras 9 y 10, un par de dedos posicionadores (72) y (74) de la llave se acoplan con la forja (24)
20 para alinearla. El dedo posicionador izquierdo (72) se acopla con el lado izquierdo de la hoja (32) y el dedo posicionador derecho (74) se acopla con el lado derecho de la hoja (24). Este acoplamiento encuadra a la forja (24) con respecto al eje X y al
25 eje Y para corregir el que el usuario haya colocado



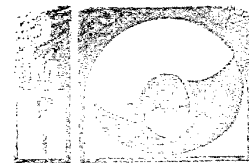
a la forja (24) con un cierto ángulo dentro de la ranura (20). El acoplamiento de los dedos (72) y (74) también puede ubicar en forma adecuada a la hoja (32) a lo largo del eje X. Si el usuario no insertó suficientemente a la forja (24) dentro de la ranura (20), los dedos (72) y (74) pueden mover la hoja (32) a lo largo del eje X hasta la posición adecuada. Como se describió en lo anterior, el mecanismo de retención (19) asegura una forja (24); no obstante, la fuerza aplicada a una llave (22) y (24) por la mordaza de puerta (14) y la base (16) permite que la llave (22) y (24) esté ajustada con respecto a la máquina (10).

El dedo posicionador izquierdo (72) generalmente está fijo con respecto a la forja (24). Esto quiere decir que las fuerzas entre la forja (24) y el dedo posicionador izquierdo (72) no provocan la flexión del dedo posicionador izquierdo (72). No obstante, el dedo posicionador derecho (74) sí está diseñado para flexionarse ligeramente al acoplarse con la forja (24). El dedo posicionador derecho (74) incluye un brazo en voladizo (76) que se flexiona debido a las fuerzas entre el dedo posicionador derecho (74) y la forja (24). Esta deflexión asegura que los dedos (72) y



(74) han apliquen la fuerza suficiente a la forja (24) para agarrarla y alinearla. Cuando los dedos (72) y (74) ya no se necesitan, puede girar hacia arriba para no estorbar. Como se observa mejor en la figura 11, el dedo posicionador derecho (74) está montado en una flecha (78). La flecha (78) está dispuesta de modo que gire alrededor del eje X para hacer girar al dedo (74) hacia arriba o hacia abajo, según sea necesario. Un arreglo semejante hace girar hacia arriba o hacia abajo al dedo posicionador izquierdo (72).

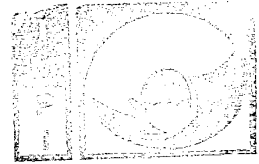
Una vez que los dedos posicionadores (72) y (74) han corregido la alineación de la forja (24) con base en el análisis de la imagen inicial captada, todavía puede tomarse otra imagen de la forja (24) para validar que la alineación sea ahora la adecuada. Además de validar la alineación de la forja (24), esta imagen captada también puede ser utilizada para registrar puntos de referencia a lo largo de la hoja (32), tales como la ubicación del resalto (30) de la llave, la ubicación de la punta de la hoja (32) y similares. Como se describirá en forma adicional, el circuito lógico puede utilizar estos puntos de referencia, así como la determinación de la orientación de la forja (24),



para guiar a los discos de corte (60) y (62) durante el proceso de tallado.

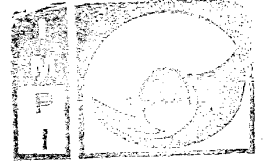
Aunque la alineación de una llave se describe en general con referencia a la alineación de una forja (24) después de que ha sido insertada en la ranura (20), será fácilmente entendido por los técnicos en la materia que los dedos posicionadores (72) y (74) pueden ser utilizados, por ejemplo, para alinear una llave original (22) antes de captar una imagen de la llave (22) que será analizada por el circuito lógico.

Como se muestra en la figura 9, una vez que la forja (24) ha sido correctamente alineada, la unidad de sujeción (64) puede abrirse para admitir la sujeción de la forja (24). En una modalidad, la posición por omisión de la unidad de sujeción es la abierta, y la mordaza está cerrada únicamente cuando sujeta una forja (24). El miembro de mordaza inferior (68) generalmente es fijo y el miembro de mordaza superior (66) está preparado para moverse a lo largo del eje Z. Cuando la unidad de sujeción (64) está abierta, la forja (24) se mueve hacia la izquierda a lo largo del eje Y hasta que la forja (24) esté ubicada entre los miembros de mordaza superior (66) e inferior (68). La forja



(24) se mueve a lo largo del eje X hasta una posición de sujeción específica con respecto a la unidad de sujeción (64), según lo determinó el circuito lógico para la forja (24) específica. El
5 circuito lógico puede colocar específicamente a la forja (24) con respecto a la unidad de sujeción (64), de tal modo que los dos bordes de una hoja (32) de una forja (24) se mantengan expuestos para tallar el patrón de llave en ambos bordes de la
10 hoja (32). Este tipo de arreglo es común en forjas para llaves de dos lados.

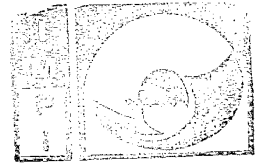
Este movimiento de la forja (24) la lleva de la zona de captación de la imagen hacia la zona de corte o tallado. La unidad de sujeción (64)
15 generalmente está fija con respecto al eje Y y define, de manera general, la zona de corte. La forja (24) se mueve a lo largo del eje Y gracias al movimiento sincronizado de los dedos posicionadores derecho (74) e izquierdo (72) y del panel (21) del
20 mecanismo de retención, el cual incluye a la ranura (20). Como se observa en la figura 12, una vez que la forja (24) está colocada entre los miembros de mordaza superior (66) e inferior (68), el miembro de mordaza superior (66) se mueve hacia abajo a lo
25 largo del eje Z para sujetar a la forja (24) en la



unidad de sujeción (64). Una vez que la forja (24) está asegurada en la unidad de sujeción (64), los dedos posicionadores (72) y (74) giran hacia arriba

alrededor del eje X y se desacoplan de la forja (24). Este movimiento de los dedos (72) y (74) asegura que los discos de corte (60) y (62) tengan acceso tanto a toda la longitud de la hoja (32) como a ambos bordes de la misma.

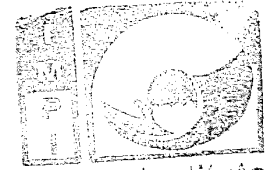
Con referencia a la figura 13, la superficie de sujeción de los miembros de mordaza (66) y (68) tiene forma de T. Las dimensiones del vástago (80) de la superficie de sujeción en forma de T son tales que permitan que tanto el lado derecho como el izquierdo de la hoja (32) de la forja (24) estén expuestos a los discos de corte (60) y (62) cuando la forja (24) está asegurada en la unidad de sujeción (64). La porción de barra (82) de la superficie de sujeción en forma de T está diseñada para acoplarse con la forja (24) en o arriba del resalto (30) y arriba de la porción de la hoja (32) en la que se talla el patrón de llave. Opcionalmente, la superficie de sujeción puede incluir estrías u otras características diseñadas para mejorar el agarre de los miembros de mordaza (66) y (68) sobre la forja (24). Como se observa



mejor en la figura 12, el miembro de mordaza superior (66) puede incluir al menos una acañaladura (84) diseñada para permitir que el

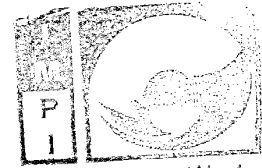
5 miembro de mordaza superior (66) se flexione ligeramente. Estas flexiones leves permiten que las superficies de sujeción de los miembros de mordaza (66) y (68) compensen pequeñas irregularidades en la superficie de la forja (24). Por ejemplo, el miembro de mordaza superior (66) puede desplazarse
10 levemente para admitir logotipos, palabras o números realzados forjados o troquelados en la superficie de la forja (24). Estos ajustes pueden reducir o eliminar la probabilidad de un contacto puntual entre los miembros de mordaza (66) y (68) y
15 la forja (24) y aumentar las probabilidades de que la fuerza de sujeción sea la suficiente para sujetar a la forja (24) durante el proceso de tallado.

Una vez que la forja (24) está sujeta, puede realizarse la operación de tallado. El
20 circuito lógico puede utilizar la información cuantificada y almacenada de la imagen captada del patrón (36) de la llave original (22) para calcular los movimientos precisos de los discos de corte
25 (60) y (62) con respecto a la forja (24) para

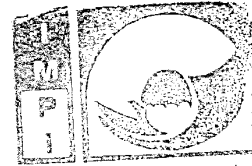


producir el duplicado de la llave. Los movimientos de los discos de corte (60) y (62) son, en general, en dos dimensiones. Los discos (60) y (62) se mueven a lo largo del eje X para tallar el patrón de llave a lo largo de la longitud de la hoja (32). Además, los discos (60) y (62) se mueven en forma independiente a lo largo del eje Y para cortar la profundidad de cada diente del patrón de llave en la hoja (32). Si bien para los discos de corte (60) y (62) pueden utilizarse muchas trayectorias, en una modalidad, los discos de corte (60) y (62) inician cerca del resalto (30) de la forja (24) y avanzan hacia la punta de la hoja (32) de la forja (24) para tallar el patrón de llave en la hoja (32). Los movimientos precisos calculados para los discos de corte (60) y (62) pueden ser transferidos a un cortador CNC de dos ejes, de modo que el patrón (36) de la llave original (22) pueda ser duplicado en la hoja (32) de la forja (24).

Como se muestra en las figuras 14 y 15, una vez que la forja (24) está sujeta y los dedos posicionadores (72) y (74) han sido girados para despejar el camino, los discos de corte (60) y (62) pueden moverse a lo largo del eje Y, hacia la zona de corte, y en acoplamiento con la hoja (32).



Normalmente, los discos (60) y (62) se acoplan con la forja (24) cerca del resalto (30) de la forja (24). Por razones de claridad, en la figura 15 se muestra a la unidad de sujeción (64). Como se describió previamente, los discos de corte (60) y (62) pueden moverse en forma paralela a lo largo del eje X conforme el patrón de llave original es tallado en la forja (24); no obstante, los movimientos de cada uno de los discos de corte (60) y (62) a lo largo del eje Y son independientes. Este movimiento independiente asegura que una llave de doble lado pueda ser producida con rapidez y eficiencia, donde los discos de corte (60) y (62) pasan sólo una vez a lo largo de la hoja (32). La velocidad de rotación de cada uno de los discos de corte (60) y (62) está también controlado independiente. En una modalidad, la velocidad de rotación de cada uno de los discos de corte (60) y (62) se ajusta con base en la profundidad a la que los discos de corte (60) y (62) se mueven en la hoja (32) a lo largo del eje Y. Por ejemplo, en una modalidad, la velocidad de rotación de un disco de corte (60) o (62) se reduce conforme el disco (60) o (62) penetra más profundo en la hoja (32) a lo largo del eje Y. En una modalidad, el movimiento de



los discos (60) y (62) a lo largo del eje X y del eje Y se ajusta con base en las características de tallado. Por ejemplo, para efectuar cortes más profundos en la hoja (32), el movimiento de los discos (60) y (62) en la dirección Y puede reducirse y para cortes más superficiales, el movimiento de los discos (60) y (62) en la dirección Y puede aumentarse. Tales arreglos limitan el desgaste y el tiempo de servicio de los discos de corte (60) y (62).

Si la llave original (22) es una llave de un solo lado, sólo uno de los discos de corte (60) y (62) se pondrá en contacto con la forja (24) para tallar el patrón de llave (36). El circuito lógico puede, con base en la imagen captada de la forja (24), determinar si se utilizará el disco derecho de corte (62) o el disco de corte izquierdo (60). El usuario puede insertar la forja (24) en la ranura (20) sin importar la orientación de la hoja (32). El circuito lógico puede determinar, a partir de la imagen captada, si el patrón de llave debe ser tallado en el borde derecho o en el borde izquierdo de la forja (24), dependiendo del contorno y la forma del resalto (30) de la hoja (32), de la punta de la hoja (32) o de cualquier



otra característica que pueda distinguir los bordes de la hoja (32).

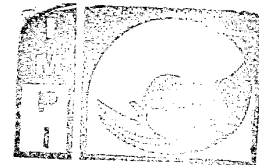
Una vez que el patrón de llave es tallado en la forja (24), el miembro de mordaza superior (66) puede elevarse a lo largo del eje Z, liberando así a la llave recién tallada. La llave recién tallada se mantiene sujeta por el mecanismo de retención (19). La llave recién tallada puede ser devuelta a la zona de captación de la imagen moviendo el panel (21) del mecanismo de retención a la derecha a lo largo del eje Y. Puede tomarse una nueva imagen de la llave recién tallada y compararse con la imagen captada de la llave original (22). El circuito lógico puede utilizar esta comparación para validar que la llave recién tallada está dentro de límites de desviación aceptables con respecto a la llave original (22). La desviación de la llave recién tallada, en comparación con la llave original (22), puede cuantificarse utilizando cualquier método estadístico. Por ejemplo, puede hacerse una serie de mediciones a lo largo del patrón de llave (36) de la llave original y del patrón de llave de la llave recién tallada y éstas pueden cuantificarse. Puede utilizarse la diferencia promedio entre



Instituto
Mexicano
de la Propiedad
Industrial

mediciones comparables para calcular una diferencia promedio y comparar esa diferencia promedio con un límite predeterminado. Los resultados de esta validación pueden mostrárseles al usuario en el monitor (40) de pantalla táctil o usando alguna otra forma de salida.

Una vez que la validación ha terminado, el usuario puede levantar la mordaza de puerta (14) empujada con un resorte, utilizando para ello la manija (18), y retirar de la ranura (20) la llave recién tallada. El circuito lógico puede ser ajustado para que retenga, durante un lapso de tiempo, la imagen captada de la llave original (22), de tal forma que el usuario pueda colocar otra forja (24) adecuada dentro de la ranura (20) y hacer otro duplicado de la llave. En caso de que ya no se necesite hacer más duplicados de la llave, el circuito lógico puede desechar la imagen captada de la llave original (22), prepararse para recibir otra llave original (22) e iniciar un nuevo proceso de duplicación. Estos procesos pueden ser manejados por el circuito lógico con referencia a límites de tiempo o pueden ser manejados por el usuario cuando éste introduce información por medio de una pantalla táctil o de otra interfaz de usuario.



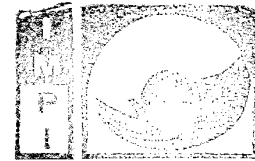
Cuando se retira una llave recién tallada de la máquina, el usuario puede desbarbarla insertando la hoja de la llave recién tallada dentro de la ranura de desbarbado (44). Como se muestra en las figuras 16 y 17, un par de cepillos de desbarbado (86) puede estar asegurado a una superficie interna (88) del cajón de virutas (42) y cerca de la ranura de desbarbado (44). Los cepillos (86) están colocados de tal forma que la hoja de la llave recién tallada se acople con los cepillos conforme la hoja de la llave está siendo insertada dentro de la ranura (44). Como puede observarse en la figura 17, los cepillos pueden ser cuadrados y estar asegurados a una superficie interna (88) del cajón de virutas (42) por medio de elementos sujetadores (90), como por ejemplo, una combinación de tuerca y tornillo. Este arreglo de sujeción permite cambiar con eficiencia los cepillos de desbarbado (86). Además, la forma cuadrada de los cepillos (86) permite que éstos puedan girarse o voltearse conforme un lado de un cepillo (86) se desgasta debido al uso constante, lo que aumenta así la vida útil de los cepillos (86). Este tipo de arreglo permite que los cepillos (86) puedan ser colocados en dieciséis posiciones únicas.



Como se describió anteriormente, el proceso de hacer duplicados de llaves depende del movimiento de muchos componentes, mecanismos y sistemas internos. Este movimiento se facilita, en general, gracias a varios motores montados en el interior de la máquina (10) duplicadora de llaves. Las figuras 18 y 19 ilustran el interior de la máquina (10), visto desde la parte trasera de la máquina (10). Como se muestra en las figuras 18 y 19, la máquina (10) duplicadora de llaves incluye nueve motores independientes que facilitan el movimiento dentro de la máquina (10).

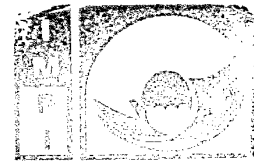
Un motor (92) para el deslizamiento del mecanismo de retención está acoplado al panel (21) del mecanismo de retención para mover el panel (21) del mecanismo de retención a lo largo del eje Y. Este movimiento se realiza conforme la forja (24) se mueve entre la zona de captación de la imagen y la zona de corte.

Un primer motor de deslizamiento (94) está acoplado tanto al disco derecho de corte (62) como al dedo posicionador derecho (74) para mover al disco derecho de corte (62) y al dedo posicionador derecho (74) a lo largo del eje Y. Un segundo motor de deslizamiento (96) está acoplado tanto al disco



izquierdo de corte (60) como al dedo posicionador izquierdo (72) para mover al disco izquierdo de corte (60) y al dedo posicionador izquierdo (72) a lo largo del eje Y. Este movimiento de los dedos posicionadores (72) y (74) y de los discos de corte (60) y (62) ocurre cuando se reúnen varias condiciones. Por ejemplo, cuando los dedos (72) y (74) están acoplados con la hoja (32) de la forja (24), el movimiento de los dedos (72) y (74) a lo largo del eje Y puede mover la forja (24) entre la zona de captación de la imagen y la zona de corte. En otro ejemplo, cuando una forja (24) está asegurada en la unidad de sujeción (64) y los dedos (72) y (74) son girados desacoplándose de la hoja (32), los discos de corte (60) y (62) puede moverse en forma independiente a lo largo del eje Y para facilitar el tallado del patrón (36) en la hoja (32).

Un tercer motor de deslizamiento (97) está acoplado tanto al disco izquierdo de corte (60) como al disco derecho de corte (62) para mover juntos a los discos de corte (60) y (62) a lo largo del eje X. Este movimiento a lo largo del eje X ocurre conforme los discos (60) y (62) se mueven por toda la longitud de la hoja (32) para tallar el

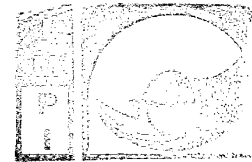


patrón de llave (36) en la hoja.

Un primer motor rotativo (98) está acoplado al disco derecho de corte (62) para hacerlo girar alrededor del eje X conforme el disco (62) talla un patrón de llave (36) en el borde derecho de la hoja (32) de la forja (24). Un segundo motor rotativo (100) está acoplado al disco izquierdo de corte (60) para hacerlo girar alrededor del eje X conforme el disco (60) talla un patrón de llave (36) en el borde izquierdo de la hoja (32) de la forja (24).

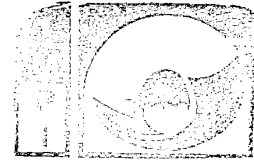
Un tercer motor rotativo (102) está acoplado al dedo posicionador derecho (74) para hacerlo girar alrededor del eje X y para acoplar y desacoplar de la hoja (32) de la forja (24) al dedo (74). Un cuarto motor rotativo (104) está acoplado al dedo posicionador izquierdo (72) para hacerlo girar alrededor del eje X y para acoplar y desacoplar de la hoja (32) de la forja (24) al dedo (72).

Un motor (106) para mordaza está acoplado al miembro de mordaza superior (66) para mover el miembro de mordaza superior (66) alrededor del eje Z. Este movimiento sujeta y libera una forja (24) de la unidad de sujeción (64) antes de y después de

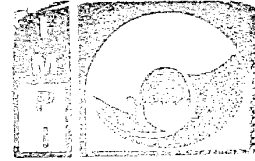


tallar el patrón de llave (36) en la hoja (32) de una forja (24).

La máquina (10) duplicadora de llaves que se ha descrito en la presente, puede diseñarse y fabricarse en forma de un conjunto ensamblado de componentes modulares. En una modalidad, como se observa en las figuras 20 y 21, la máquina (10) puede armarse a partir de cinco componentes modulares. Estos componentes modulares pueden incluir un módulo de base (110), un módulo de panel frontal (112), un módulo de cubierta (114), un módulo de computadora (116) y un módulo de placa de soporte (118). El módulo de base (110) soporta a la máquina (10) y puede brindar soporte estructural para el montaje o soporte de componentes, tales como por ejemplo, el cajón de virutas (42) y el panel de iluminación (52). El módulo del panel frontal (112) puede dar soporte estructural para el montaje o soporte de componentes, tales como por ejemplo, la mordaza de puerta (14), la base (16), la manija (18), el panel (21) del mecanismo de retención y el motor (92) de deslizamiento del mecanismo de retención. El módulo de cubierta (114) puede brindar el soporte estructural para el montaje o soporte de componentes, tales como por

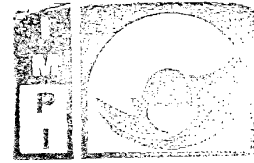


ejemplo, el monitor (40), el armazón del cableado de las alimentaciones de energía. El módulo de la computadora (116) puede dar soporte estructural para el montaje o soporte de componentes, tales como por ejemplo, un disco duro, una unidad central de procesamiento, tarjetas de circuito, unidades lógicas y otros componentes relacionados con las computadoras. El módulo de placa de soporte (118) puede brindar el soporte estructural para el montaje o soporte de los componentes internos de la máquina (10). Por ejemplo, el módulo de placa de soporte (118) puede soportar varios motores, como los motores rotativos (98), (100), (102) y (104) que hacen girar a los discos de corte (60) y (62) y a los dedos posicionadores (72) y (74); a los motores de deslizamiento para el posicionamiento de los discos y de los dedos posicionadores (94), (96) y (97); y al motor (106) para mordaza. Además, el módulo de placa de soporte (118) puede soportar componentes, tales como el dispositivo óptico (50) para la captación de imágenes, la placa reflectora (54), los discos de corte (60) y (62), los dedos posicionadores (72) y (74), etc. Este diseño y ensamble modular mejora la facilidad de fabricación, ensamblado y mantenimiento de una



máquina (10) duplicadora de llaves.

El proceso de duplicar una llave utilizando la máquina (10) duplicadora de llaves tal y como se describió anteriormente puede 5 facilitarse por la interacción entre un usuario y una interfaz de usuario. Por ejemplo, al usuario se le pueden presentar varios métodos opcionales para identificar una forja adecuada para obtener el duplicado de una llave original. Estas opciones 10 pueden mostrarse en una interfaz de usuario, tal como por ejemplo, un monitor de pantalla táctil. Una vez mostradas en el monitor de pantalla táctil, el usuario puede iniciar el proceso de duplicación seleccionando manualmente una de las opciones 15 presentadas. Una primera opción puede necesitar que la máquina duplicadora de llaves determine la forja adecuada tras tomarle una fotografía a la llave original, como se describe en la presente, y comparar las características físicas de la llave 20 original con una base de datos que contiene las características físicas de las forjas. Los resultados de esta comparación pueden arrojar más de una forja potencialmente adecuada. Como se ilustra en la figura 22, la interfaz de usuario 25 puede mostrar gráficamente dos o más forjas que



pueden ser utilizadas para obtener un duplicado de la llave original. El usuario puede seleccionar la forja que prefiera tocando la representación gráfica de una de las forjas (200) y (202). De manera alternativa, el usuario puede seleccionar un elemento gráfico (204) que indica que el usuario pretende insertar en la máquina otra llave original.

Otra opción para identificar una forja adecuada para duplicar una llave original es que el usuario proporcione información conocida específica relacionada con la llave original. Como se muestra en la figura 23, el usuario puede introducir información específica relacionada con la llave original por medio de un monitor con pantalla táctil. El usuario puede seleccionar información específica relacionada con una llave desde una casilla de selección (206) que se llena en forma dinámica. El usuario puede utilizar la casilla de selección para suministrar información, como puede ser, la categoría de la llave (de automóvil, de casa, de candado, etc.), el uso, la marca, el modelo de la cerradura, el año en que la cerradura fue fabricada, el nombre del fabricante o el número de pieza de la llave o la cerradura. El usuario

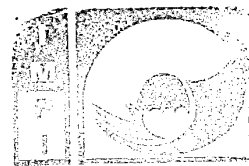


puede cambiar la información mostrada en la casilla de selección (206) tocando los botones asociados con los diferentes tipos de información.

El usuario puede seleccionar la información para la casilla de selección (206) tocando simplemente la información correcta en la casilla de selección (206).

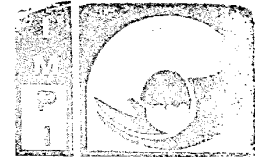
La figura 24 ilustra una interfaz de usuario enfocada específicamente en llaves automotrices. El usuario puede introducir información específica relacionada con una llave original automotriz para identificar la forja adecuada. El usuario puede seleccionar la información, como por ejemplo, la marca del automóvil, el modelo y el año del modelo, a partir de una casilla de selección (210) que se llena en forma dinámica. La información de la casilla de selección (210) puede ser cambiada tocando un botón (212) de la marca del automóvil, un botón (214) del modelo del automóvil y un botón (216) del año del modelo.

En cada una de las opciones descritas anteriormente, la información específica introducida por el usuario puede ser comparada contra una base de base de datos que contiene la



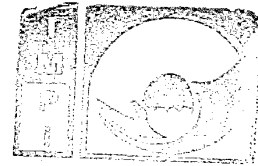
información relacionada con las forjas. Esta
comparación puede utilizarse para identificar
forja adecuada. Una vez que la forja adecuada ha
sido identificada, ésta puede mostrarse en la
5 interfaz de usuario para informarle al usuario cuál
forja debe obtener.

Sin importar el método utilizado para
identificar una forja, la máquina puede estar
preparada para advertirle al usuario que la llave
10 original que se va a copiar puede contener un
microcircuito de computadora, un transpondedor o
algo similar. Estos microcircuitos de computadora y
transpondedores son comunes en las llaves
automotrices. La duplicación de este tipo de llaves
15 puede necesitar la inclusión del correspondiente
microcircuito de computadora para que el duplicado
funcione en forma adecuada. Una vez que se ha
determinado que una llave original puede tener un
microcircuito de computadora, al usuario se le
20 puede indicar que coloque la llave original en o
cerca de un dispositivo diseñado para detectar la
presencia de un microcircuito de computadora en una
llave. Si la llave original incluye un
microcircuito de computadora, el usuario puede
25 recibir la indicación de cómo proceder para



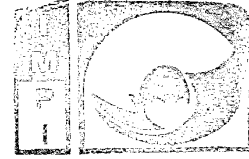
asegurar que se obtenga un duplicado funcional de la llave.

Una vez que la forja adecuada ha sido identificada y el usuario la ha conseguido, la interfaz de usuario puede guiar todavía más al usuario en el proceso de duplicación de la llave original y mostrarle el grado de avance de la duplicación de la llave. Como se muestra en la figura 25, en la interfaz de usuario puede mostrarse una lista de acciones (218). La primera acción mostrada le indica al usuario que cargue la forja. El usuario puede retirar la llave original e insertar la forja adecuada y oprimir una casilla (220) para iniciar el proceso de duplicación de la llave. La máquina (10) duplicadora de llaves puede continuar entonces con acciones adicionales, tales como el escaneado de la forja y la verificación de que la forja adecuada es la que se cargó, la colocación de la forja para asegurar la alineación adecuada, el tallado de la forja, etc. Como se muestra en la figura 26, conforme las acciones se completan, en las casillas (222) pueden mostrarse comprobaciones que indiquen que alguna acción se ha completado. La interfaz de usuario también puede incluir un elemento gráfico para concluir el



proceso del tallado. Por ejemplo, un usuario puede tocar el elemento gráfico de un signo de para detener el proceso de tallado.

El circuito lógico puede estar programado para recolectar y almacenar datos relacionados con los duplicados de llave hechos por la máquina (10) duplicadora de llaves. Por ejemplo, los datos relacionados con el número de duplicados hechos, el número de las diferentes forjas utilizadas en la duplicación de llaves, el número de una forja individual utilizada en la duplicación de una llave, la tasa de éxito al duplicar las llaves, etc. y pueden ser recolectados y almacenados. Esta información y datos pueden ser analizados por el circuito lógico asociado a la máquina (10) o ser descargados para un análisis remoto.

REIVINDICACIONES

Instituto
Mexicano
de la Propiedad
Industrial

1. Una unidad para duplicar una llave original, la unidad caracterizada porque comprende:

5 un dispositivo óptico para la captación de imágenes para captar una imagen óptica de por lo menos una porción de la llave original;

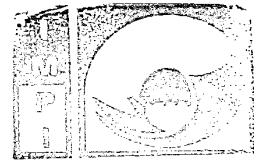
un circuito lógico para determinar un patrón de la llave original a partir de la imagen óptica de la llave original;

10 una unidad de sujeción para sujetar una forja, y

un primer elemento de corte para tallar un patrón de llave en la forja un primer elemento posicionador y un segundo elemento posicionador, 15 donde los elementos posicionadores primero y segundo se acoplan con la llave original o con la forja para posicionar a la llave original o a la forja con respecto a la unidad.

2. La unidad según la reivindicación 1, 20 en donde el patrón de llave tallado en la forja es un duplicado del patrón de la llave original.

3. La unidad según la reivindicación 1, en donde el circuito lógico dirige al primer elemento de corte durante la duplicación del patrón 25 de la llave original.



4. La unidad según la reivindicación 1, en donde la imagen óptica es una imagen digital.

5. La unidad según la reivindicación 1, en donde la unidad de sujeción además comprende:

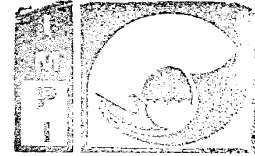
5 un primer miembro de sujeción que tiene una primera superficie sujetadora que define una anchura; y

un segundo miembro de sujeción que tiene una segunda superficie sujetadora que define una anchura.

10 6. La unidad según la reivindicación 5, en donde la forja además comprende una hoja que define una anchura, en donde la anchura del primer miembro de sujeción y la anchura del segundo miembro de sujeción son menores que la anchura de la hoja de la forja.

15 7. La unidad según la reivindicación 1, que además comprende un segundo elemento de corte para tallar el patrón de llave en la forja, donde dichos elementos de corte primero y segundo son capaces de tallar el patrón de llave en cualquier lado de la forja.

20 8. La unidad según la reivindicación 1, en donde el primer elemento de corte es un disco de corte.



9. La unidad según la reivindicación 1, que además comprende un mecanismo de retención para retener la llave original o a la forja.

10. La unidad según la reivindicación 9, en donde el mecanismo de retención además comprende:

una base;

una placa de retención; y

un elemento empujador que empuja la placa de retención hacia la base.

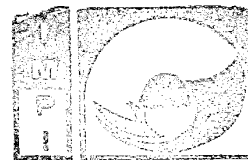
11. La unidad según la reivindicación 1, en donde los elementos posicionadores primero y segundo son capaces de moverse independientes uno del otro.

12. La unidad según la reivindicación 1, que además comprende una interfaz de usuario para mostrarle información de salida al usuario.

13. La unidad según la reivindicación 12, en donde el circuito lógico determina la forja a partir de la imagen óptica de la llave original.

14. La unidad según la reivindicación 13, en donde la identidad de la forja determinada se le muestra al usuario a través de la interfaz de usuario.

15. La unidad según la reivindicación 14,



en donde la interfaz de usuario es un estante de exhibición para mostrar una multitud de forjas.

16. La unidad según la reivindicación 1, en donde la forja puede sujetarse en una primera orientación o en una segunda orientación.

17. Un método para duplicar una llave original, el método caracterizado porque comprende:

captar la imagen óptica de por lo menos una porción de la llave original;

10 acoplar la llave original o la forja entre un primer elemento posicionador y un segundo elemento posicionador para posicionar a la llave original con respecto a la unidad;

15 suministrar un circuito lógico para determinar un patrón de la llave original a partir de la imagen óptica de la llave original;

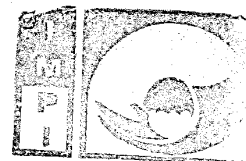
asegurar una forja; y

tallar un patrón de llave en la forja.

18. El método según la reivindicación 17, en donde el patrón de llave tallado en la forja es un duplicado del patrón de la llave original.

19. El método según la reivindicación 17, que además comprende utilizar el circuito lógico para determinar la forja.

20. El método según la reivindicación 19,



Instituto
Mexicano
de la Propiedad
Industrial

que además comprende presentar la forja determinada a un usuario.

21. El método según la reivindicación 19, que además comprende:

5 captar una imagen óptica de por lo menos una porción de la forja; y

utilizar el circuito lógico para validar que la forja corresponda a la llave original.

22. El método según la reivindicación 17, que además comprende:

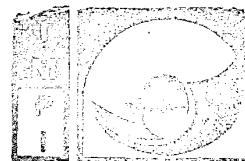
10 captar una imagen óptica de por lo menos una porción del patrón de llave tallado en la forja;

15 usar el circuito lógico para determinar el patrón de llave tallado en la forja; y

usar el circuito lógico para comparar el patrón de llave tallado en la forja con el patrón de la llave original.

23. El método según la reivindicación 22, que comprende utilizar el circuito lógico para validar que el patrón de llave tallado en la forja está dentro de una tolerancia predefinida del patrón de llave de la llave original.

24. El método según la reivindicación 17, en donde los elementos posicionadores primero y



segundo son capaces de mover la llave original o la
forja en dos ejes.

25. El método según la reivindicación 17,
en donde el primer elemento posicionador es
5 controlado por un motor.

26. El método según la reivindicación 17,
en donde el primer elemento posicionador es capaz
de moverse independiente del segundo elemento
posicionador.

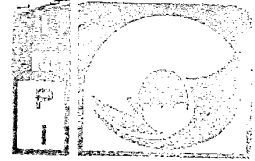
10 27. La unidad según la reivindicación 1,
en donde los elementos posicionadores primero y
segundo son capaces de mover la llave original o la
forja en ambos de un primer eje y un segundo eje.

28. La unidad según la reivindicación 27,
15 en donde el primer eje es aproximadamente
perpendicular al segundo eje.

29. La unidad según la reivindicación 27,
en donde los elementos posicionadores primero y
segundo son capaces de moverse en un tercer eje,
20 diferente de los ejes primer y segundo.

30. La unidad según la reivindicación 1,
en donde al menos uno de los elementos
posicionadores primero y segundo es impulsado por
un motor.

25 31. La unidad según la reivindicación 1,



en donde al menos uno de los elementos
posicionadores primero y segundo es empujado por el resorte.

5 32. La unidad según la reivindicación 1,
en donde los elementos posicionadores primero y
segundo están configurados para insertar la forja
en un mecanismo de sujeción.

10 33. La unidad según la reivindicación 1,
en donde al menos uno de los elementos
posicionadores primero y segundo incluye una
superficie plana posicionada para acoplar un borde
de la llave original o de la forja.

15 34. El método según la reivindicación 17,
que además comprende el paso de desacoplar los
elementos posicionadores primero y segundo de la
llave original o de la forja.

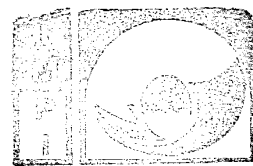
20 35. El método según la reivindicación 34,
en donde los elementos posicionadores primero y
segundo desacoplan la llave original o la forja
previo al tallar un patrón de llave en la forja.



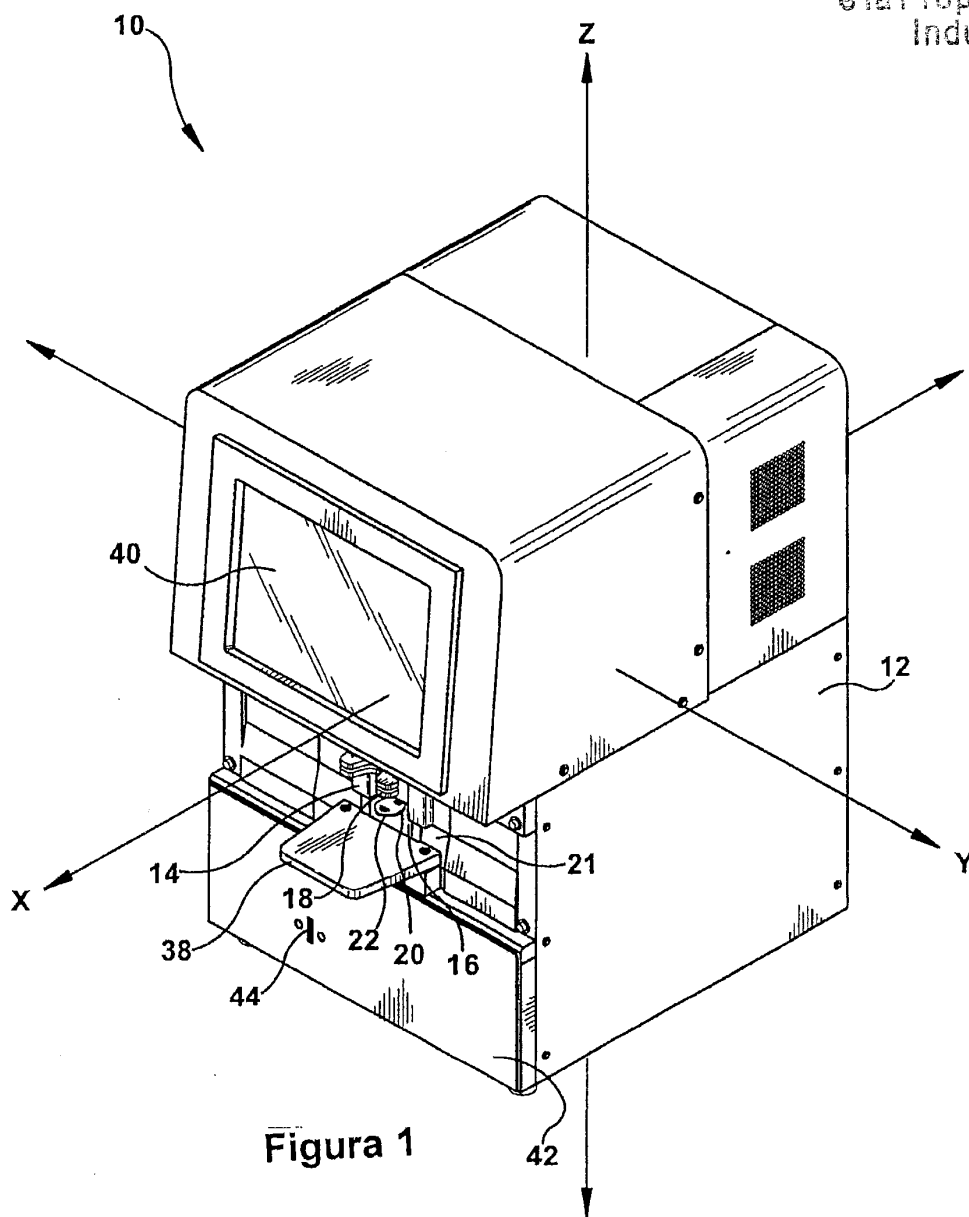
RESUMEN DE LA INVENCIÓN

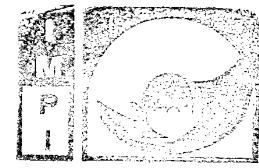
Instituto
Mexicano
de la Propiedad
Industrial

Se describen aparatos, métodos, así como otras modalidades asociadas con una máquina duplicadora de llaves. En una modalidad, una unidad para duplicar una llave original incluye un dispositivo óptico para la captación de imágenes, un circuito lógico, una unidad de sujeción y un elemento de corte. El dispositivo óptico para la captación de imágenes tiene la capacidad de captar una imagen óptica de al menos una parte de la llave original. El circuito lógico tiene la capacidad de determinar un patrón de la llave original a partir de la imagen óptica de la llave original. La unidad de sujeción tiene la capacidad de sujetar una forja y el elemento de corte tiene la capacidad de cortar o tallar un patrón de llave en la forja.



Instituto
Mexicano
de la Propiedad
Industrial





Instituto
Mexicano
de la Propiedad
Industrial

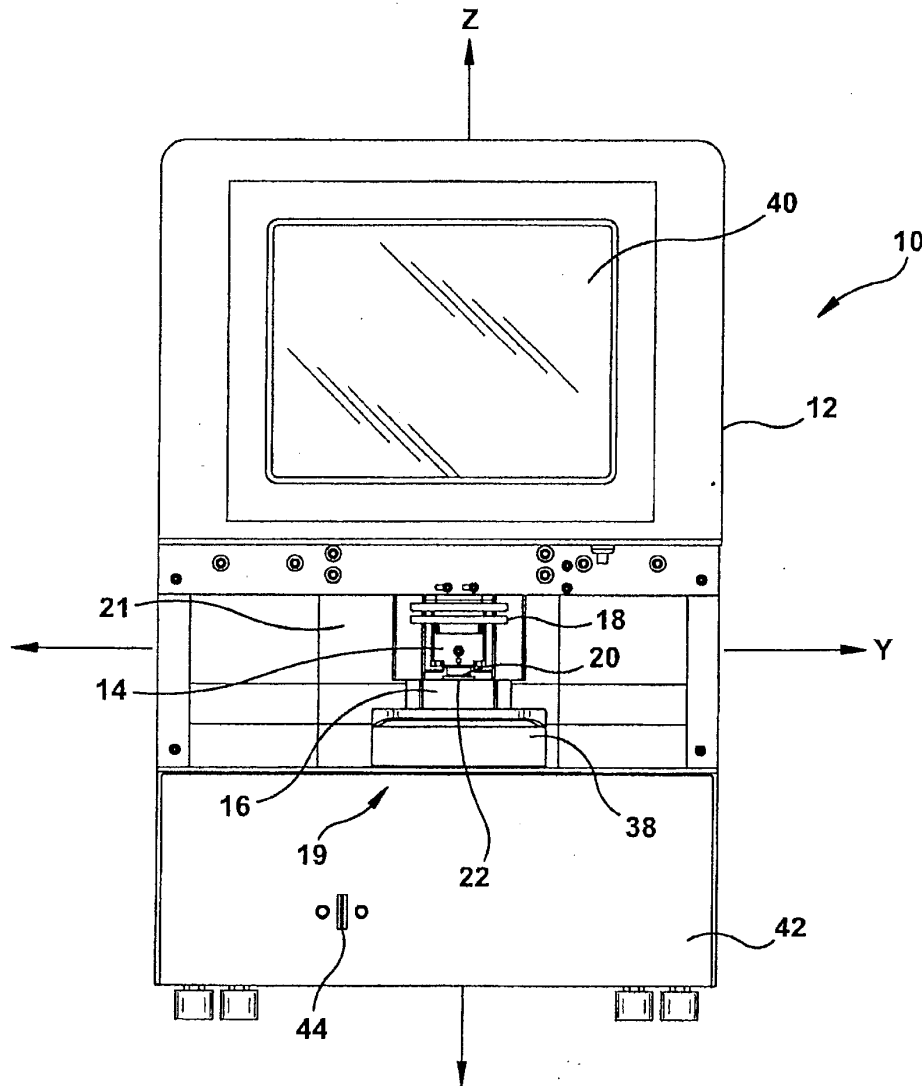
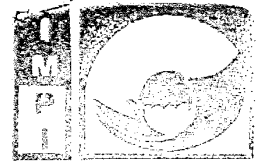


Figura 2



Instituto
Mexicano
de la Propiedad
Industrial

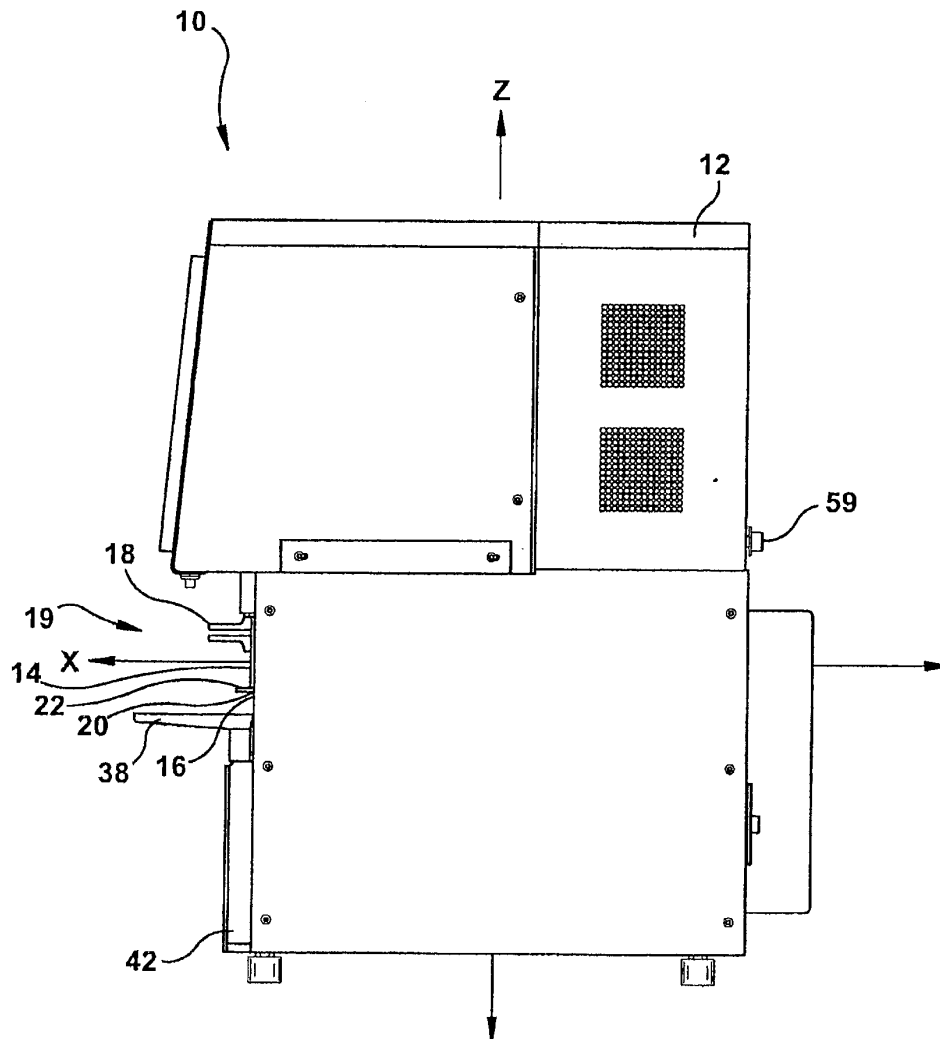
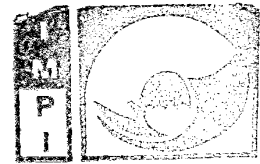


Figura 3



Instituto
Mexicano
de la Propiedad
Industrial

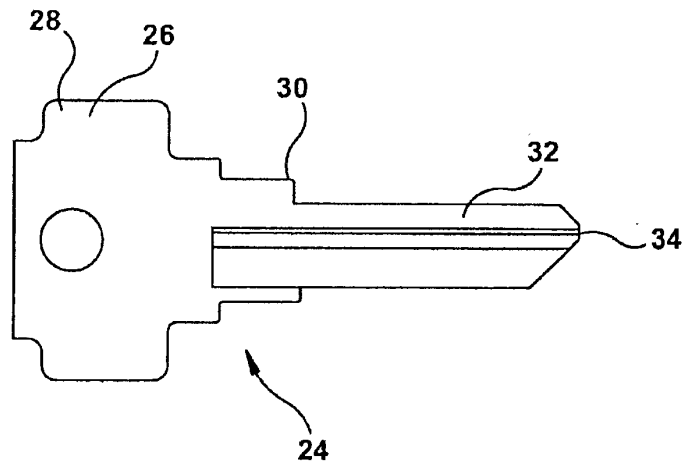


Figura 4b

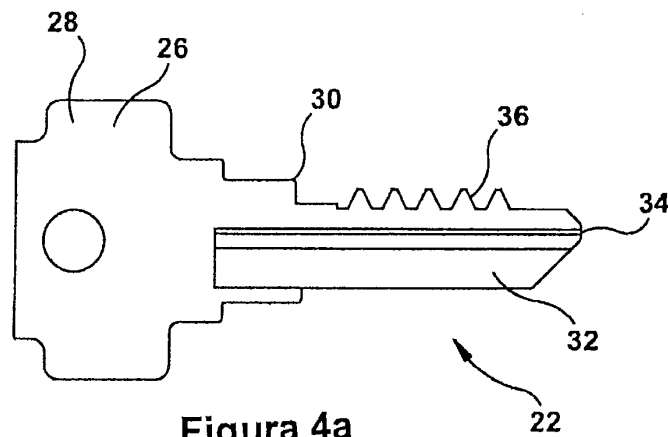
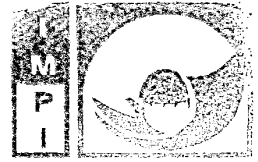


Figura 4a



Instituto
Mexicano
de la Propiedad
Industrial

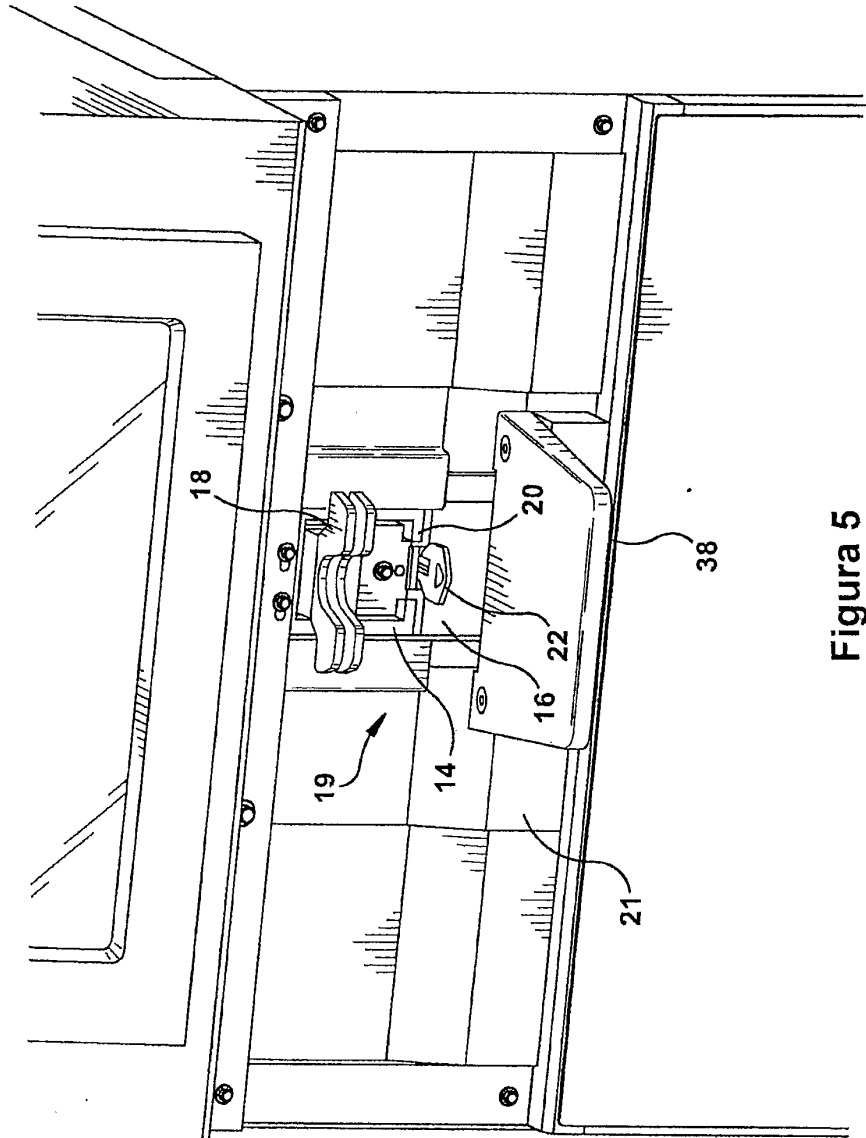
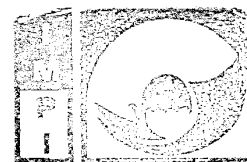


Figura 5



Instituto
Mexicano
de la Propiedad
Industrial

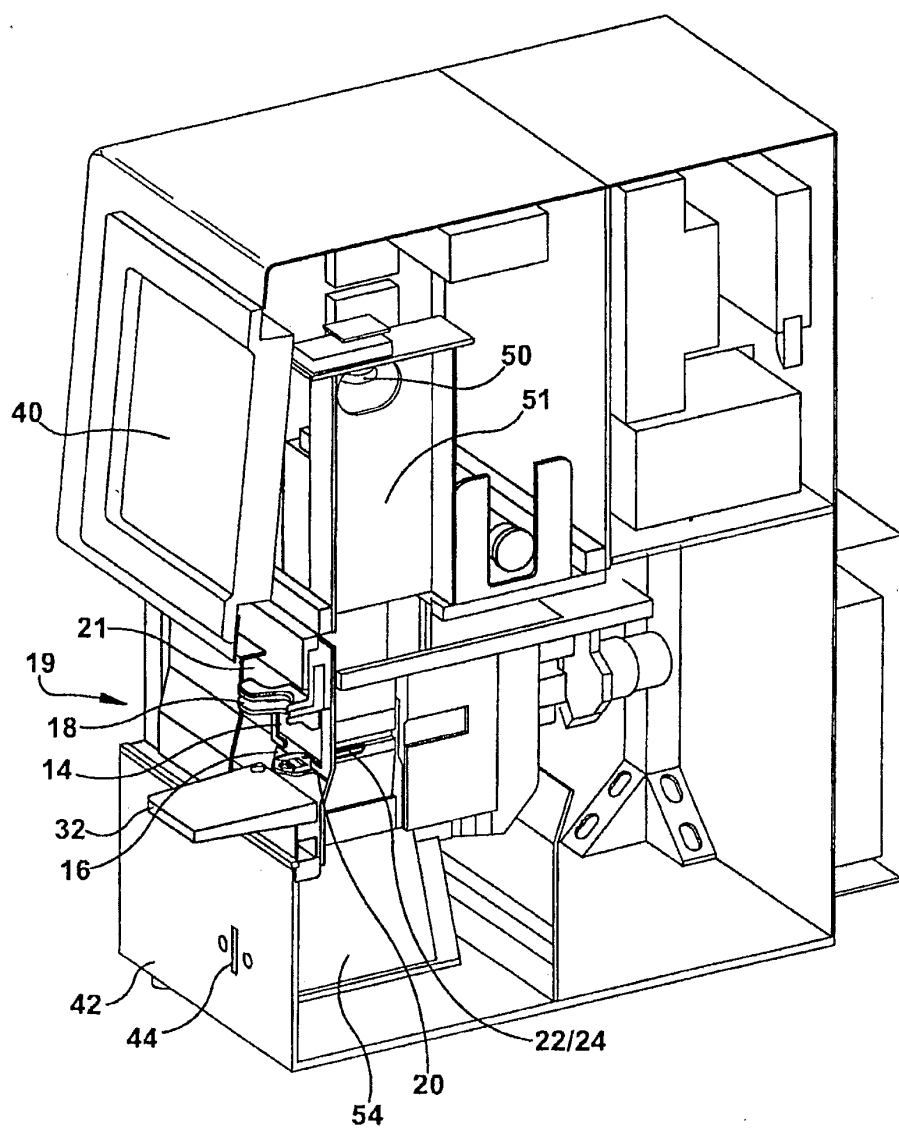
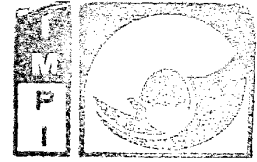


Figura 6



Instituto
Mexicano
de la Propiedad
Industrial

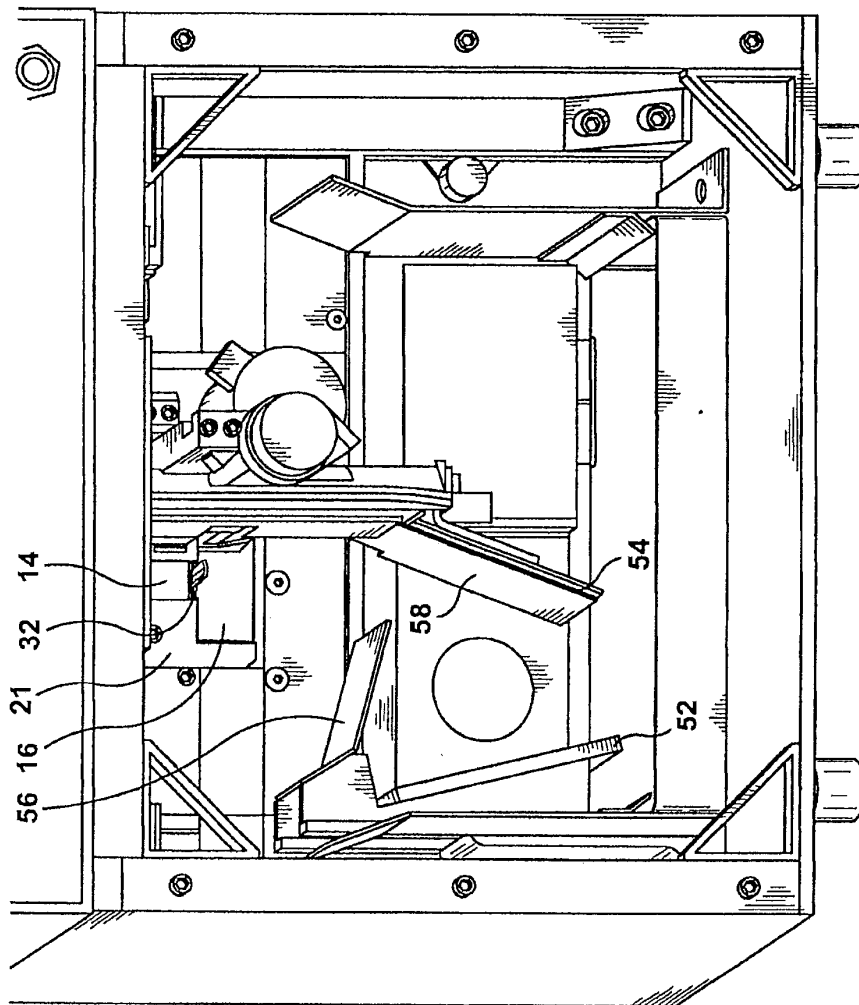
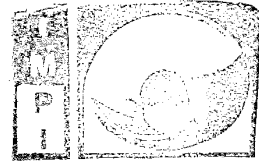


Figura 7



Instituto
Mexicano
de la Propiedad
Industrial

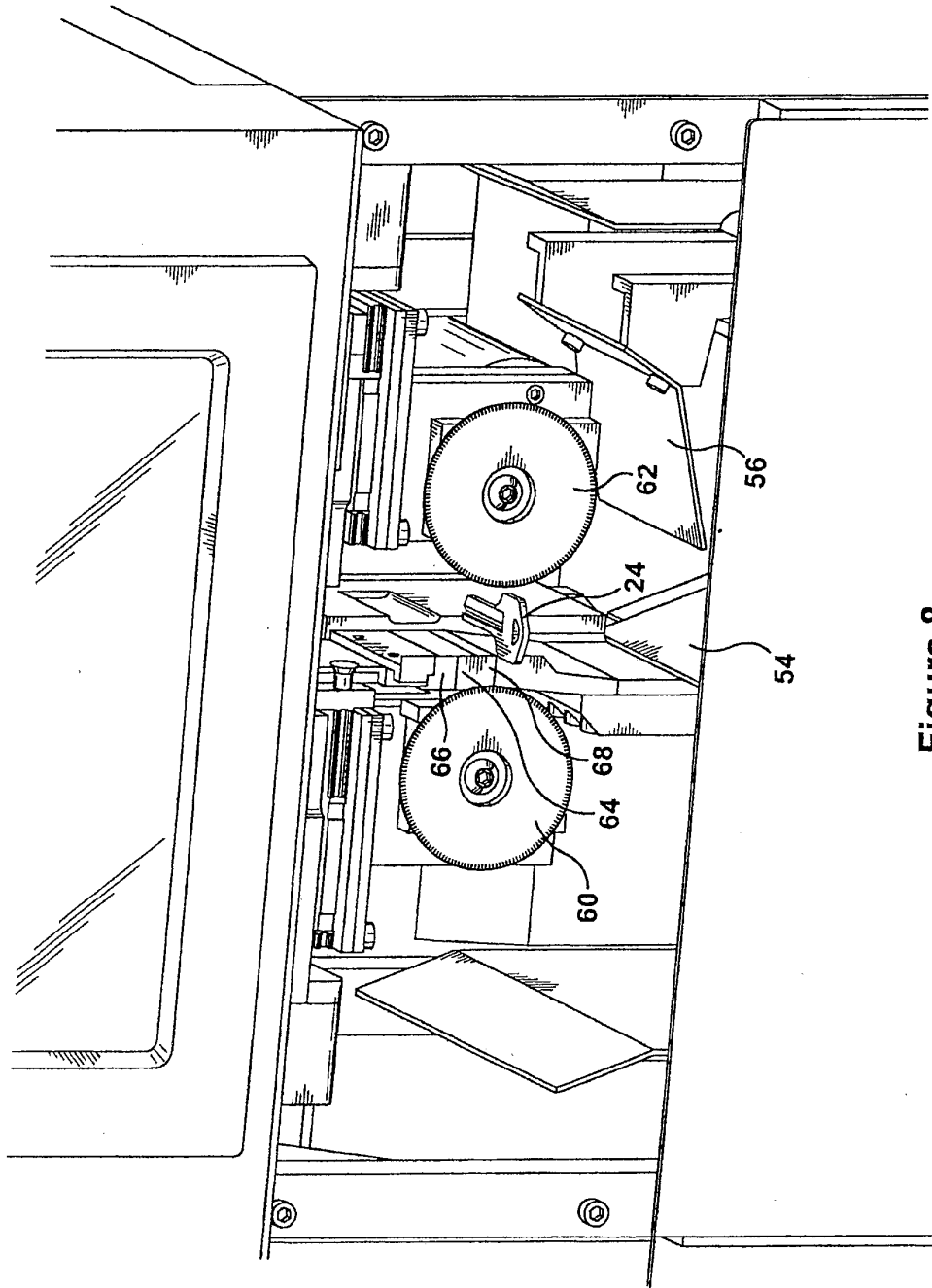
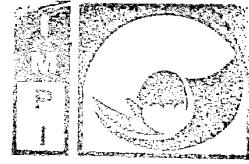


Figura 8



Instituto
Mexicano
de la Propiedad
Industrial

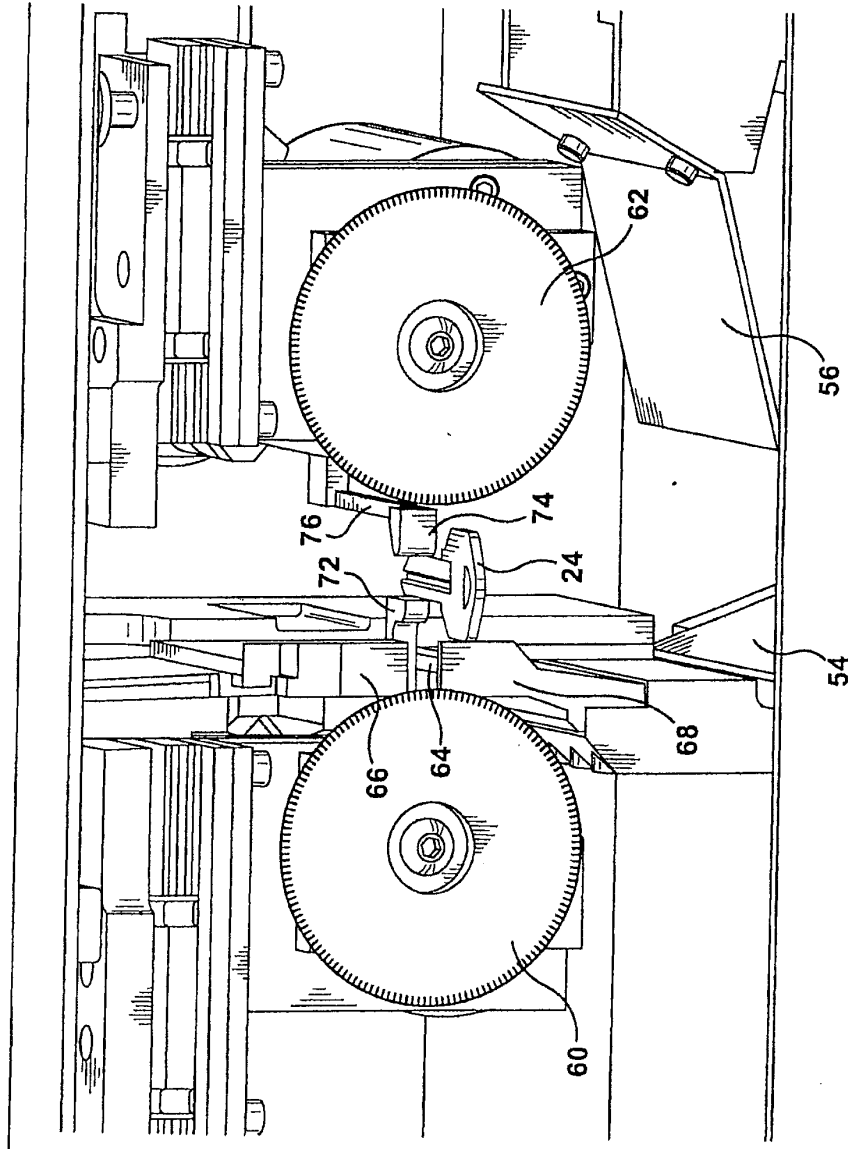
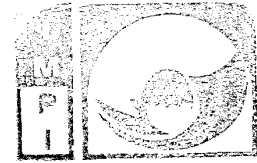


Figura 9

10/26



Instituto
Mexicano
de la Propiedad
Industrial

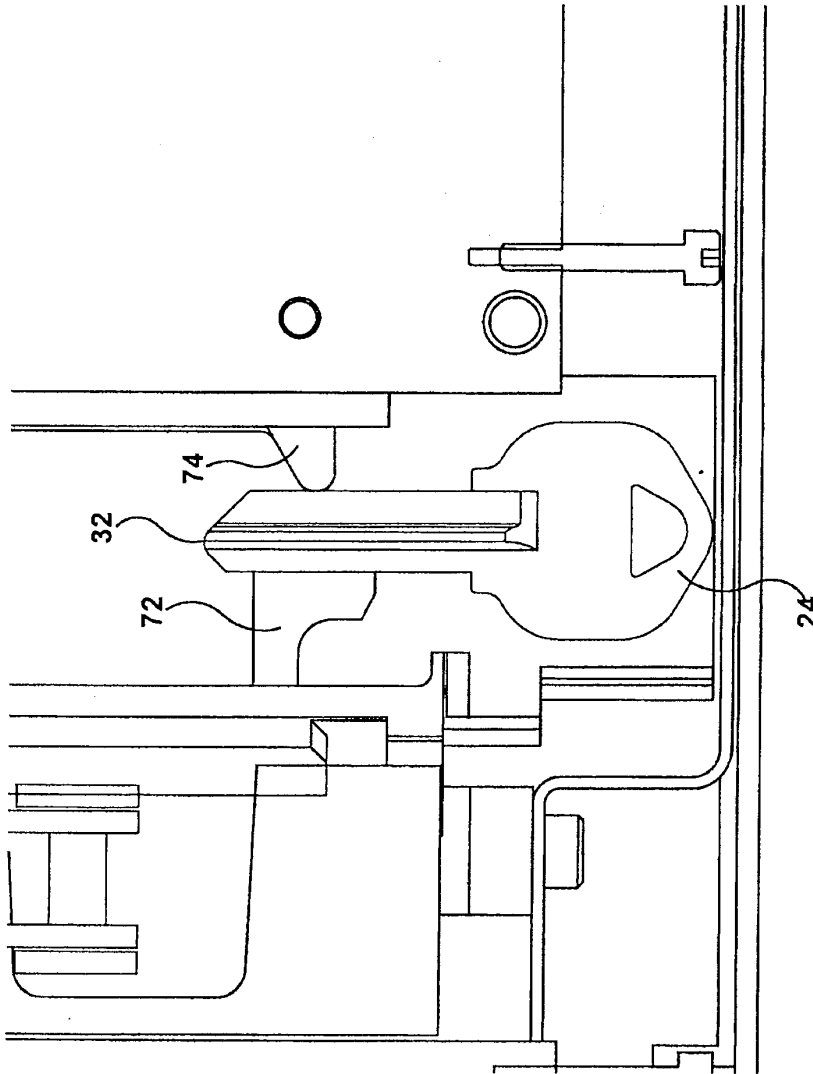
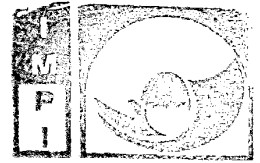


Figura 10



Instituto
Mexicano
de la Propiedad
Industrial

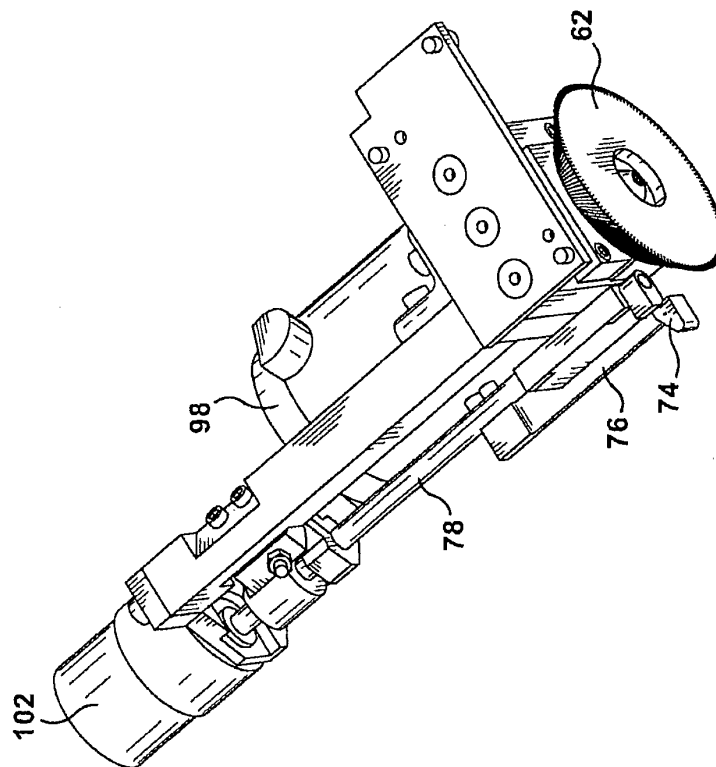
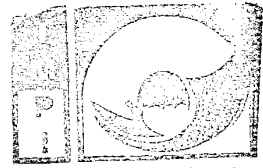


Figura 11

12/26



Instituto
Mexicano
de la Propiedad
Industrial

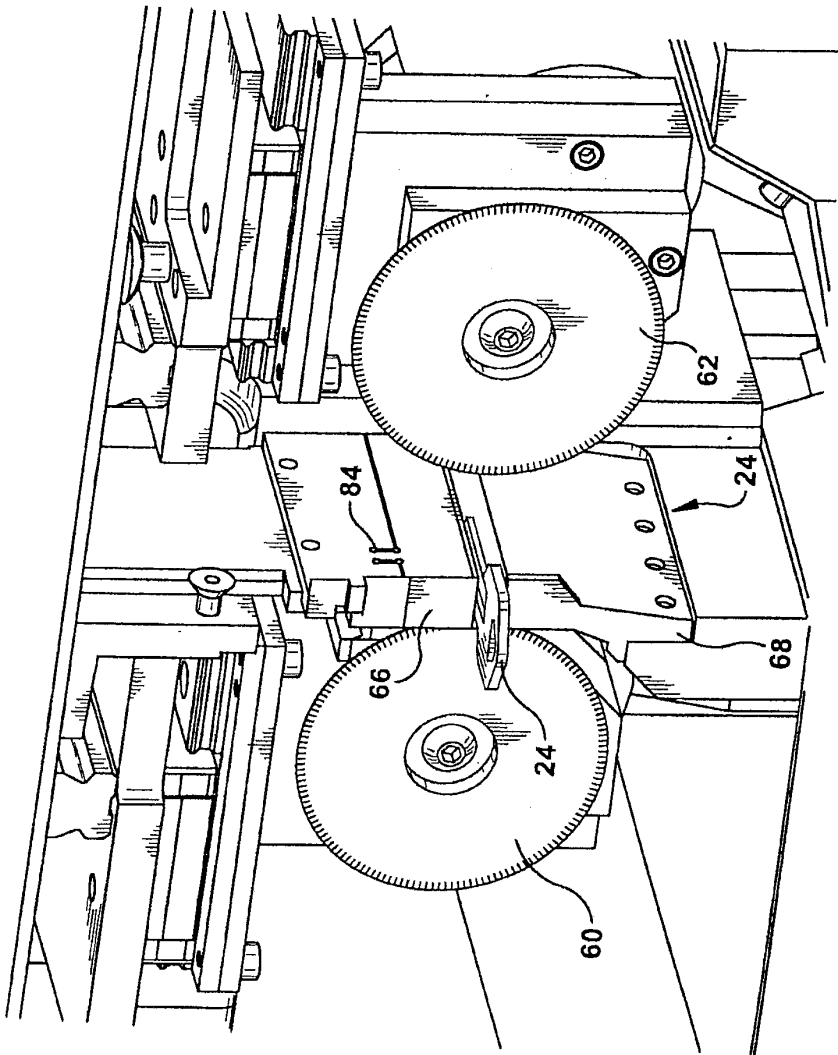
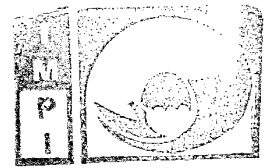


Figura 12



Instituto
Mexicano
de la Propiedad
Industrial

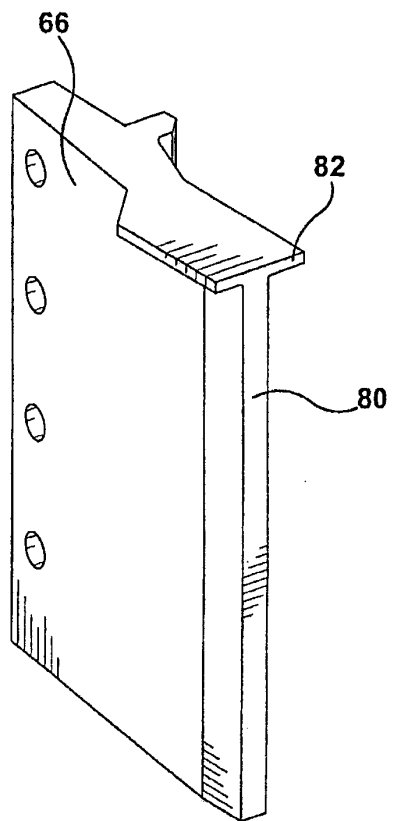
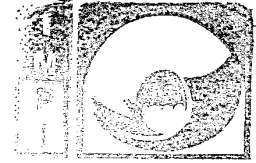


Figura 13



Instituto
Mexicano
de la Propiedad
Industrial

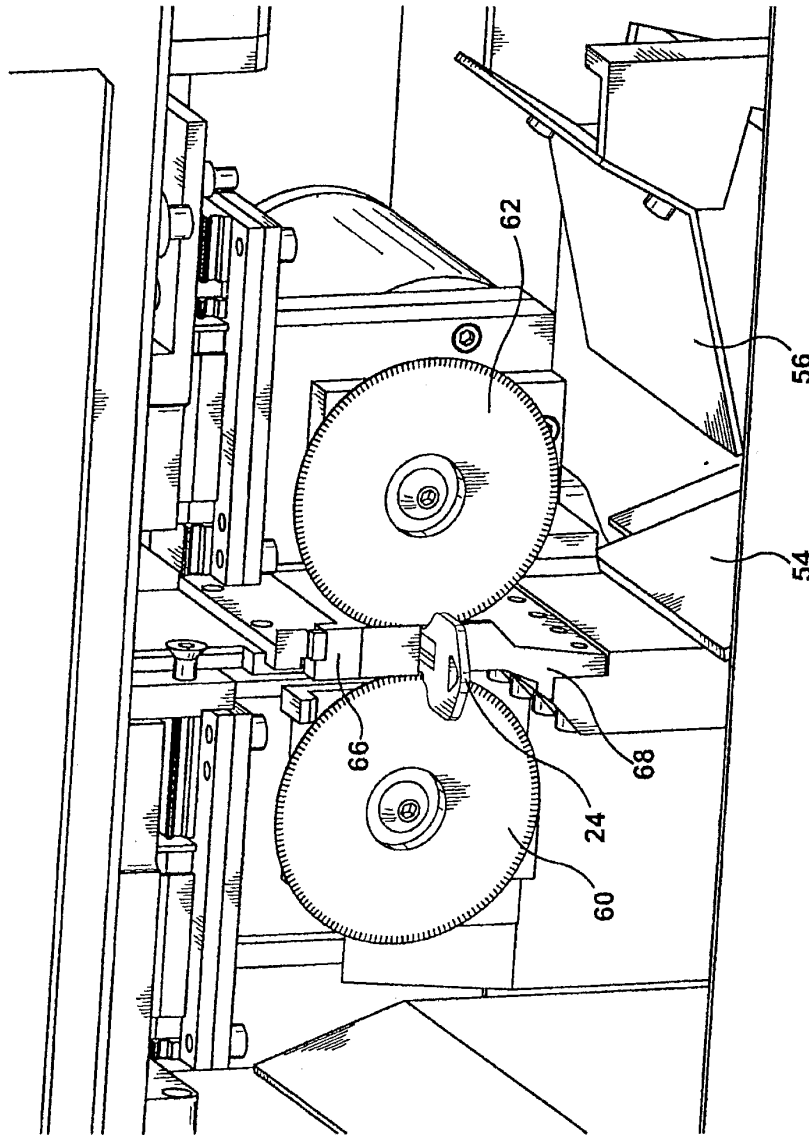
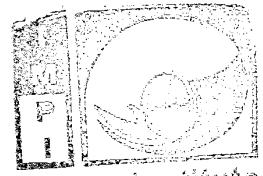


Figura 14



Instituto
Mexicano
de la Propiedad
Industrial

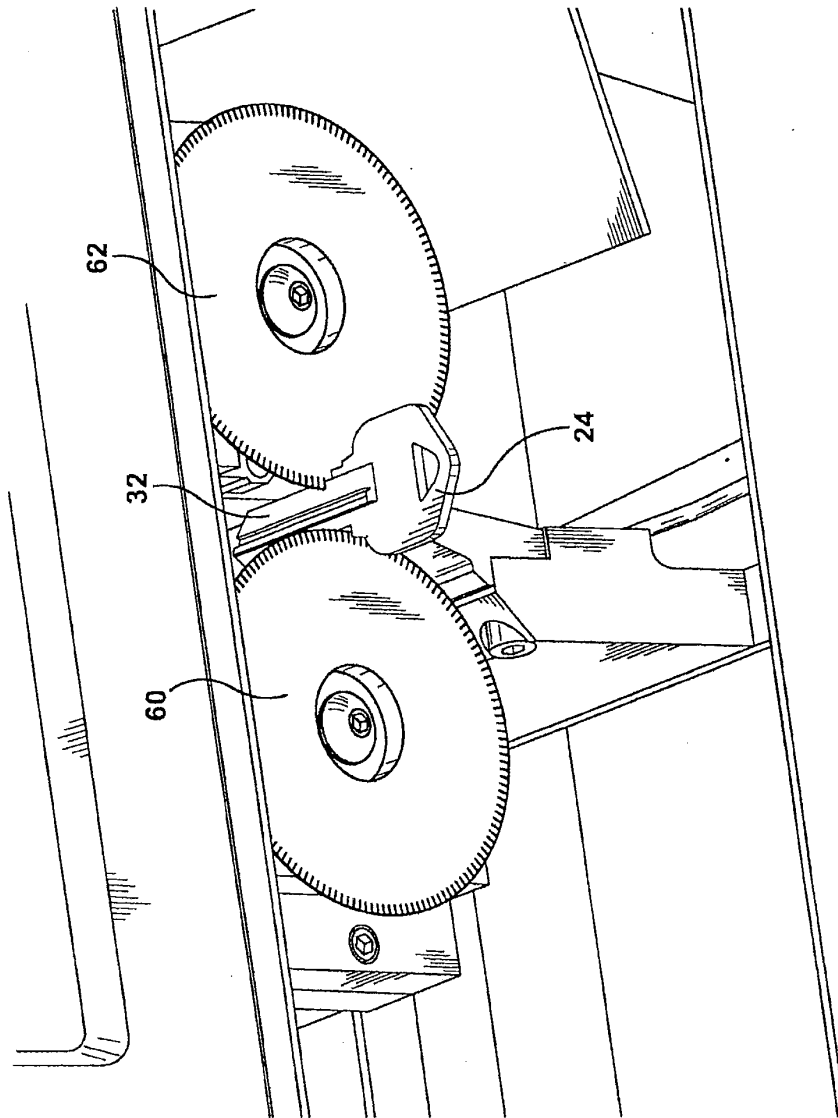
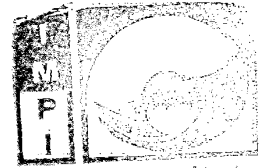


Figura 15



Instituto
Mexicano
de la Propiedad
Industrial

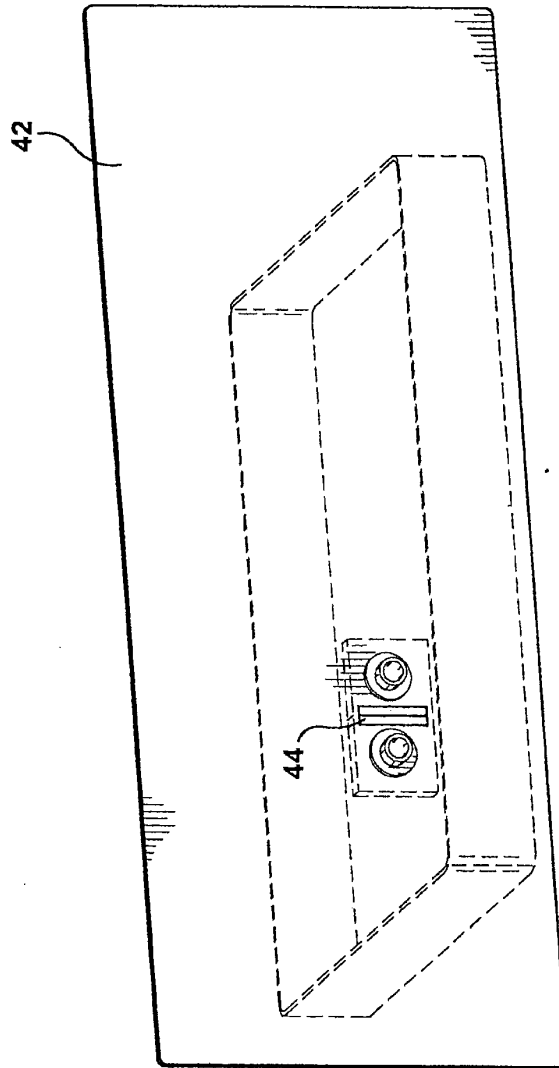
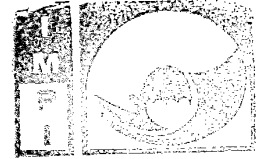


Figura 16



Instituto
Mexicano
de la Propiedad
Industrial

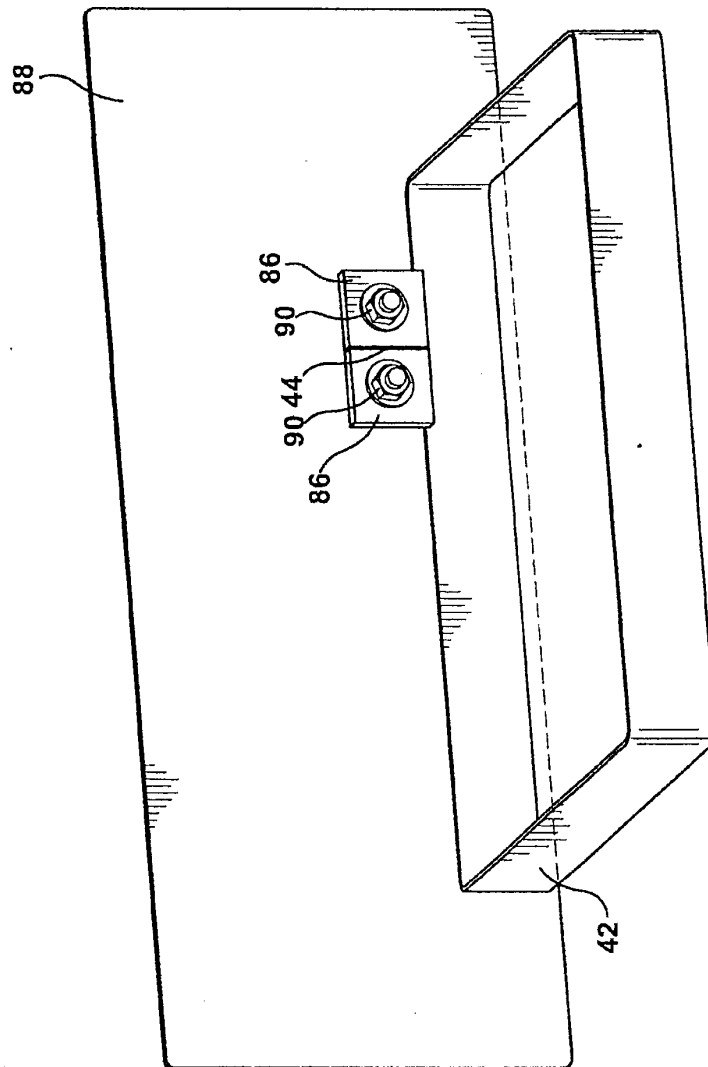


Figura 17



Instituto
Mexicano
de la Propiedad
Industrial

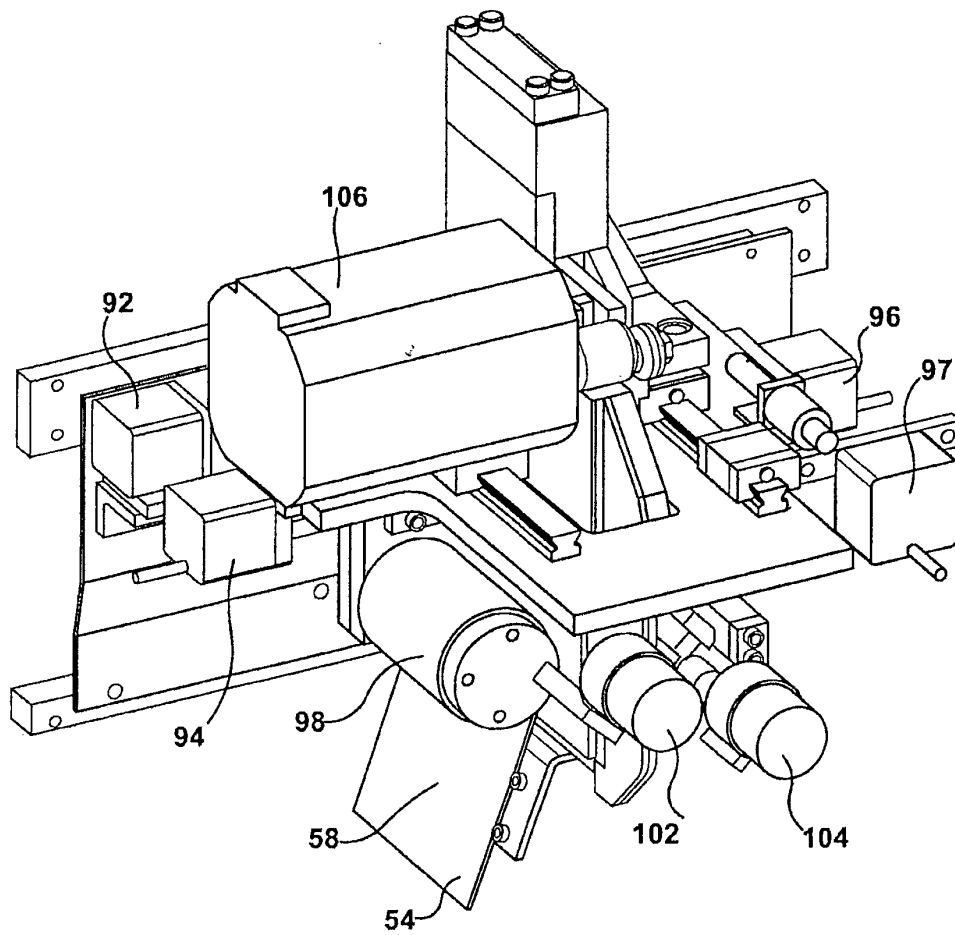
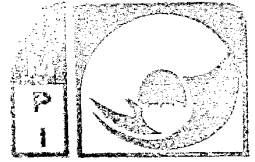


Figura 18



Instituto
Mexicano
de la Propiedad
Industrial

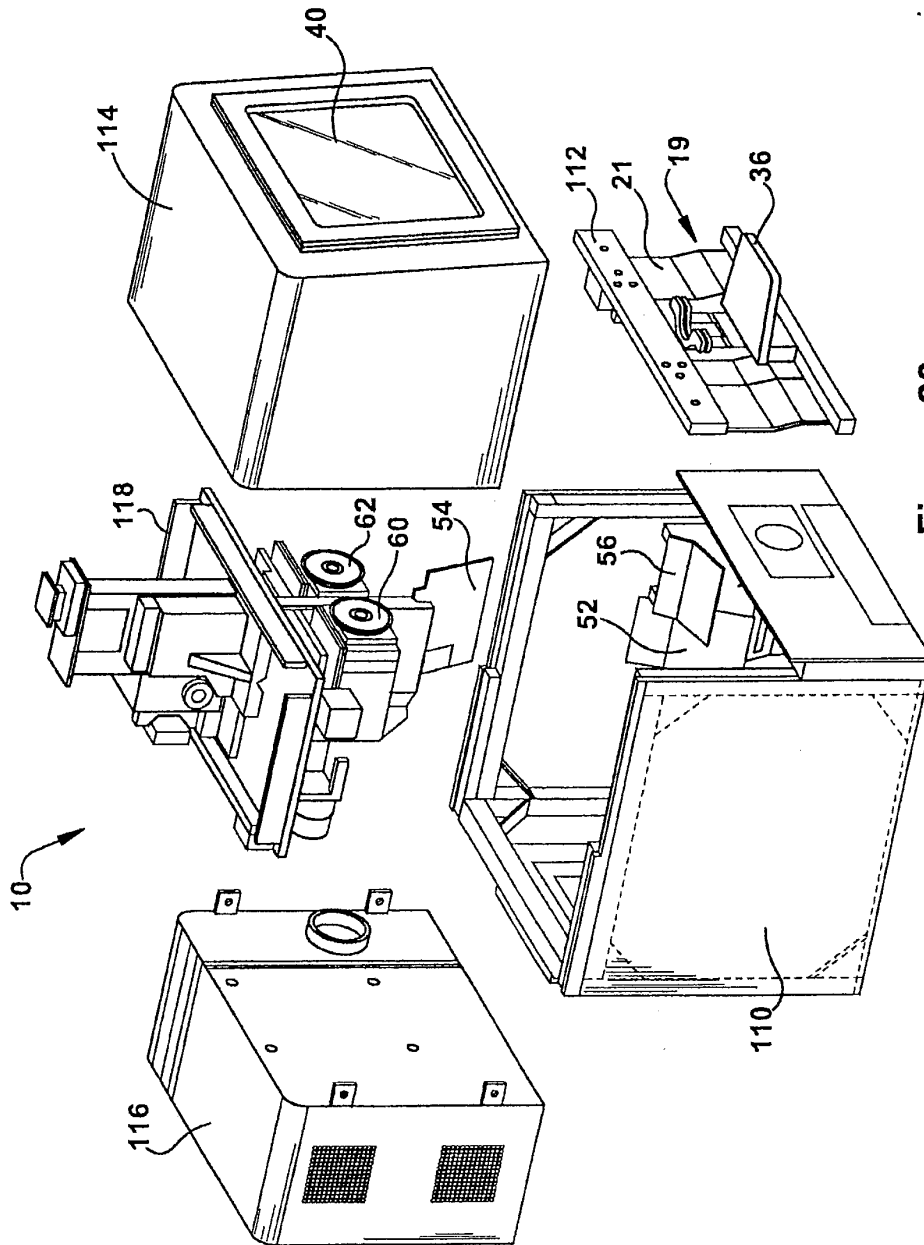
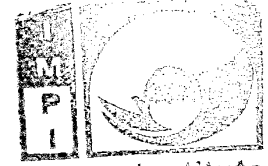


Figura 20



Instituto
Mexicano
de la Propiedad
Industrial

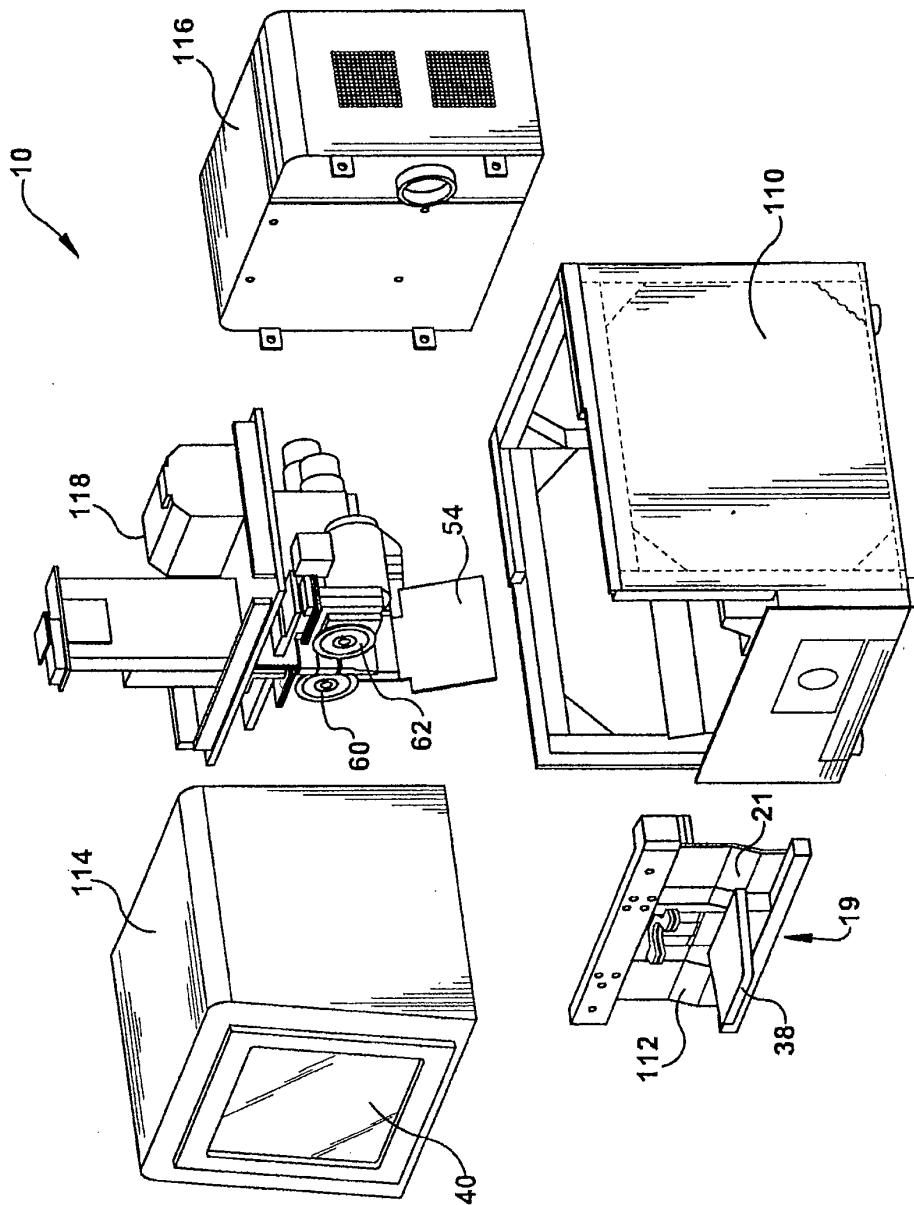
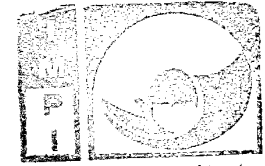


Figura 21

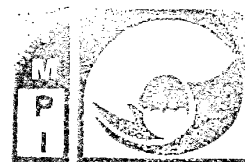


Instituto
Mexicano
de la Propiedad
Industrial

Nueva búsqueda		Menú de utilidades	
200	MFG# 66	202	MFG# 68
Presione para escanear		Presione para escanear	
KW1		SC1	
204		?	
Presione para escanear		Presione para escanear	
		Otra	

Sin selección hecha

Figura 22

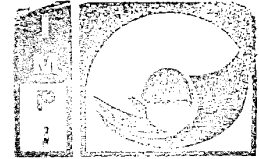


Instituto
Mexicano
de la Propiedad
Industrial

Nueva búsqueda		Revisión manual	Resultados (590)	Menú de utilidades
206 Categorías = INCIERTA = Auto, Camión pequeño, Van Camión pesado, Ind. Farm. Casa y edificio Misceláneos Candado Vehículo Recreacional				
Categoría		= INCIERTA =		
Uso		= INCIERTA =		
Producto/Marca		= INCIERTA =		
Cerradura/Modo		= INCIERTA =		
Año		= INCIERTA =		
Fabricante		= INCIERTA =		
Número de parte		= INCIERTA =		

(Llave de cliente escaneada)

Figura 23

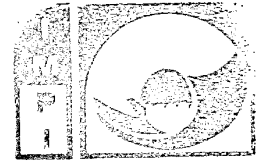


Instituto
Mexicano
de la Propiedad
Industrial

Nueva búsqueda		Revisión manual	Resultados (17)	Menú de utilidades
		Marcas: == INCIERTA == Acura Chevrolet 210 Ford Honda Hummer Lincoln Mazda Mercury Sterling Truck Suzuki		
212	Revisión automotriz			
212	Marca	== INCIERTA ==		
214	Modelo	== INCIERTA ==		
216	Año	== INCIERTA ==		

(Llave de cliente escaneada): Auto, Camión pequeño, Van

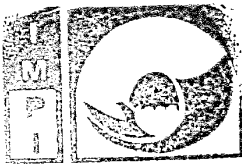
Figura 24



Instituto
Mexicano
de la Propiedad
Industrial

Nueva búsqueda 2:50	Tallar Llave SC1	Regresar a Resultados	220 Presione para iniciar tallado MFG #68 218 ☐ Cargar forja ☐ Verificar forja ☐ Colocar forja ☐ Tallar forja ☐ Reubicar forja ☐ Validar tallado de llave ☐ Completar ciclo Duplicado exitoso Retirar llave tallada
Por favor cargue una forja SC1 sin tallar y presione el botón "Iniciar tallado"			

Figura 25



Instituto
Mexicano
de la Propiedad
Industrial

Nueva búsqueda

 2:25

Tallar llave SC1

Regresar a Resultados

MFG #68

224

ALTO

Presione para detener tallado

☒ Cargar forja

☒ Verificar forja

☒ Colocar forja

☐ Tallar forja

☐ Reubicar forja

☐ Validar tallado de llave

☐ Completar ciclo

222

Figura 26



Espacenet

Bibliographic data: ES2017240 (A6) — 1991-01-01

Installation for the automatic reproduction of keys

Inventor(s): ARTETA ZARRAGOITIA ENRIQUE [ES] $\pm$ (ARTETA ZARRAGOITIA ENRIQUE)

Applicant(s): AREITIO & ARTETA COMUNICAD DE [ES] $\pm$ (AREITIO & ARTETA, COMUNICAD DE BIENES)

Classification: - **international:** B23C3/35; G06K9/00; (IPC1-7): G07F11/70
- **cooperative:** B23C3/35; G06K9/00; G07F11/70; B23C2235/24; B23C2235/41

Application number: ES19890004095 19891130

Priority number (s): ES19890004095 19891130

Abstract of ES2017240 (A6)

Installation for the automatic reproduction of keys, which consists of artificial viewing means for identifying the type of key in the uncut state and the profile of the key to be reproduced, which consist of a microprocessor for governing/controlling the installation, which sends an order/information on the identity of the type of key to a blank-key store and an order/information on the profile of the key to be reproduced to a key duplicator, and having a mechanism for the dispatch, from the key store, of a blank key of the type identified to the key duplicator. Applicable to the field of locksmiths' work.



REGISTRO DE LA
PROPIEDAD INDUSTRIAL
ESPAÑA

⑪ N.º de publicación: ES 2 017 240

⑫ Número de solicitud: 8904095

⑬ Int. Cl.⁵: G07F 11/70

⑭

PATENTE DE INVENCION

A6

⑮ Fecha de presentación: 30.11.89

⑯ Fecha de anuncio de la concesión: 01.01.91

⑰ Fecha de publicación del folleto de patente:
01.01.91

⑱ Titular/es: **Areitio & Arteta,**
Comunidad de Bienes
Algortako Etorbidea, 65 - 1º D
Getxo, Vizcaya, ES

⑲ Inventor/es: **Arteta Zarragoitia, Enrique**

⑳ Agente: **Urizar Barandiarán, Miguel Angel**

㉑ Título: **Instalación para la reproducción automática de llaves.**

㉒ Resumen:

Instalación para la reproducción automática de llaves, que consta de medios de visión artificial de identificación del tipo de llave en bruto y del perfil de la llave a reproducir, que constan de un microprocesador para el gobierno/control de la instalación, que envía una orden/información sobre la identificación del tipo de llave a un depósito de llaves en bruto y una orden/información sobre el perfil de la llave a reproducir un duplicador de llaves y disponiéndose de un mecanismo para el envío desde el depósito de llaves una llave en bruto del tipo identificado al duplicador de llaves. Aplicable en el campo de la cerrajería.

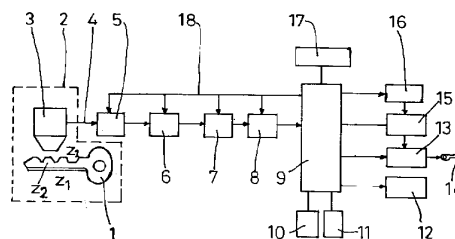


Fig. 1

DESCRIPCION

Las actuales duplicadoras de llaves se limitan a hacer el limado y pulido del perfil dentado de las llaves, quedando para el operario la labor de identificación y selección entre los diferentes modelos y tamaños de éstas, así como el cobro de dichos trabajos.

Ello implica que la instalación de estas duplicadoras se limite a locales especializados (sobre todo ferreterías), restringiendo notablemente la solución que cualquier persona puede necesitar en un momento dado. Además de tener que atenderlas un operario con el coste que ello supone.

Por el contrario muestra instalación se podría instalar en lugares públicos, tales como hipermercados, estaciones de ferrocarril, lugares turísticos, etc., ya que su funcionamiento es totalmente automático (solo habría que colocar la llave a copiar en su lugar y acto seguido meter las monedas, para que funcione).

El presente invento preconiza una instalación para la reproducción automática de llaves, caracterizada porque consta de medios de visión artificial de identificación del tipo de llave en bruto y del perfil de la llave a reproducir, que constan de un microprocesador para el gobierno/control de la instalación, que envía una orden/información sobre la identificación del tipo de llave a un depósito de llaves en bruto y una orden/información sobre el perfil de la llave a reproducir a un duplicador de llaves y disponiéndose de un mecanismo para el envío desde el depósito de llaves una llave en bruto del tipo identificado al duplicador de llaves.

También se caracteriza porque los medios de visión artificial constan de una cámara lineal, un circuito de detección de transiciones y un circuito de ubicación de transiciones, comunicados entre sí, y medios de memoria contenedores de información sobre tipos de llaves en bruto.

También se caracteriza porque se dispone un panel de mandos en conexión con el microprocesador, con un elemento visor analógico del tipo de llave en bruto y un manto para ordenar el envío de una llave en bruto de dicho tipo al duplicador.

También se caracteriza porque dispone de un monedero que reconoce y acepta/rechaza el tipo de pago efectuado por el usuario.

Por ello, la instalación para la reproducción automática de llaves, constituye un invento nuevo que implica actividad inventiva y es susceptible de aplicación industrial, con características propias y ventajosas respecto a las soluciones conocidas que le hacen merecedor del privilegio de explotación exclusiva, a tenor de las Leyes vigentes sobre Propiedad Industrial.

Para comprender mejor el objeto de la presente invención, se representa en los planos una forma preferente de realización práctica, susceptible de cambios accesorios que no desvirtúen su fundamento.

La figura 1 es una representación esquemática de la instalación objeto del invento.

Se describe a continuación un ejemplo de realización práctica, no limitativa, del presente invento. No se descartan en absoluto otros modos de realización en los que se introduzcan cambios accesorios que no desvirtúen su fundamento; por el contrario, el presente invento abarca también todas sus variantes.

La instalación conseguirá reproducir la llave (1) y para ello dispone un espacio de recepción (2) de la llave (1) en que, por ejemplo, se dispone una ranura en la que se introduce la llave, una superficie en la que deposita la llave u otro elemento similar y una cámara (3) lineal o matricial para captar la imagen de la llave (1).

La señal de video (4) de la cámara (3) es enviada a un circuito de conformación y filtraje (5) y de allí a un convertidor analógico-digital (6).

La señal (4) procedente de la cámara (3) porta información sobre el contraste entre la zona en que no hay llave (Z_1) y la zona donde hay llave (Z_2).

En el caso concreto de una cámara lineal en la que la visión se toma linealmente sobre la llave (1) a intervalos de tiempo, la señal (4) lleva información sobre el salto o transición de zona sin llave (Z_1) o zona con llave (Z_2) a zona sin llave (Z_1).

La señal procedente del convertidor A/D (6) es enviada a un circuito de detección de transiciones (7) y a continuación a un circuito de ubicación de transiciones (8) con lo que el microprocesador (9) que gobierna el sistema y con el que se comunica por el bus (18), sabe el valor de las diferentes anchuras de la llave y su ubicación, es decir, conoce el perfil de la llave (1) y tiene información sobre el tipo de llave en bruto de que se trata.

Se ha dispuesto una memoria de trabajo (10) y una memoria de almacenamiento (11). En ellas está almacenada la información de los tipos de llaves en bruto y en consecuencia el microprocesador (9) identifica, por comparación, el tipo de llave en bruto de que se trata.

A continuación el microprocesador (9) ordena a un depósito de llave en bruto (16) que envíe una de las del tipo identificado a un mecanismo (15) de envío de las llaves en bruto a un duplicador (13) convencional de llaves que ya habrá recibido del microprocesador (9) las instrucciones correspondientes al perfil de la llave (1) que tiene que reproducir.

Si se desea, se puede disponer de un panel de mandos (17) en el que aparezca, por ejemplo, un número identificativo del tipo de la llave en bruto identificada por el microprocesador (9) y el propio usuario, apretando el botón correspondiente a dicho número, desencadenar el mismo proceso indicado a partir del depósito de llaves en bruto (16).

Para el funcionamiento de la instalación se dispone un monedero (17) que dispone de medios propios o en virtud de su conexión al resto de la instalación, para reconocer y aceptar o no las monedas o medios de pago correspondiente.

REIVINDICACIONES

1. Instalación para la reproducción automática de llaves, **caracterizada** porque consta de medios de visión artificial de identificación del tipo de llave en bruto y del perfil de la llave a reproducir, que constan de un microprocesador para el gobierno/control de la instalación, que envía una orden/información sobre la identificación del tipo de llave a un depósito de llaves en bruto y una orden/información sobre el perfil de la llave a reproducir a un duplicador de llaves y disponiéndose de un mecanismo para el envío desde el depósito de llaves una llave en bruto del tipo identificado al duplicador de llaves.

2. Instalación para la reproducción automática de llaves, según reivindicación anterior, **caracterizada** porque los medios de visión artificial constan de una cámara lineal, un circuito

de detección de transición y un circuito de ubicación de transiciones, comunicados entre sí, y medios de memoria contenedores de información sobre tipos de llaves en bruto.

3. Instalación para la reproducción automática de llaves, según reivindicaciones anteriores, **caracterizada** porque se dispone un panel de mandos en conexión con el microprocesador, con un elemento visor analógico del tipo de llave en bruto y un mando para ordenar el envío de una llave en bruto de dicho tipo al duplicador.

4. Instalación para la reproducción automática de llaves, según reivindicaciones anteriores, **caracterizada** porque dispone de un monedero que reconoce y acepta/rechaza el tipo de pago efectuado por el usuario.

5. Instalación para la reproducción automática de llaves.

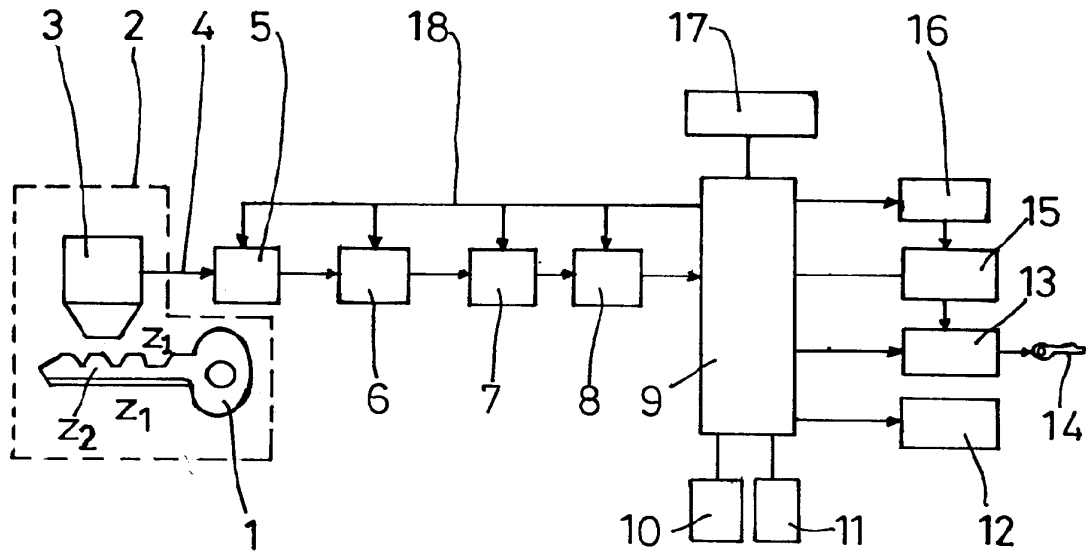


Fig. 1



Espacenet

Bibliographic data: CH673612 (A5) — 1990-03-30

Key cutting machine allowing automatic key copying - with central processor receiving data obtained from original key to control orthogonal stepping motors

Inventor(s): ZULLIGER HANS ± (ZULLIGER, HANS)

Applicant(s): HANS ZULLIGER ± (HANS ZULLIGER)

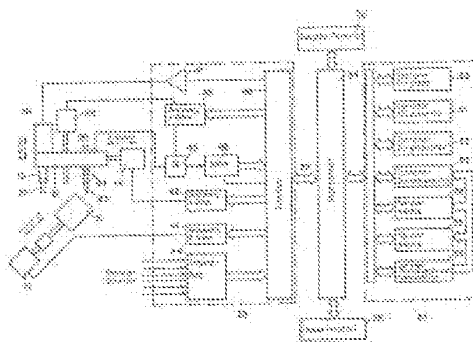
Classification: - international: **B23C3/35; G05B19/42;** (IPC1-7): B23Q35/12
- cooperative: **B23C3/35; G05B19/4207**

Application number: CH19870003982 19871012

Priority number(s): CH19870003982 19871012

Abstract of CH673612 (A5)

The machine has a sliding carriage (12) supporting a rotary spindle (19) with a tool chuck at its free end for the cutting tool (21) displaced along a perpendicular axis (Z) to the carriage (12). The key block is supported in a clamp which can be displaced along a further orthogonal axis (Y). The carriage (12) supports a sensor (24) cooperating with the key to be copied, to supply data to a central control processor (34) controlling the stepping motors (11,14,22) for all 3 coordinate directions. The control processor (34) is coupled to input and output terminals (35,36) and via an interface cable (33) to the mechanical machine control (30). ADVANTAGE - Allows accurate, automatic copying of keys.





SCHWEIZERISCHE EIDGENOSSENSCHAFT
BUNDESAMT FÜR GEISTIGES EIGENTUM

① CH 673 612 A5

⑤ Int. Cl.⁵: B 23 Q 35/12

Erfindungspatent für die Schweiz und Liechtenstein
Schweizerisch-liechtensteinischer Patentschutzvertrag vom 22. Dezember 1978

⑫ PATENTSCHRIFT A5

②① Gesuchsnummer: 3982/87

②② Anmeldungsdatum: 12.10.1987

②④ Patent erteilt: 30.03.1990

④⑤ Patentschrift
veröffentlicht: 30.03.1990

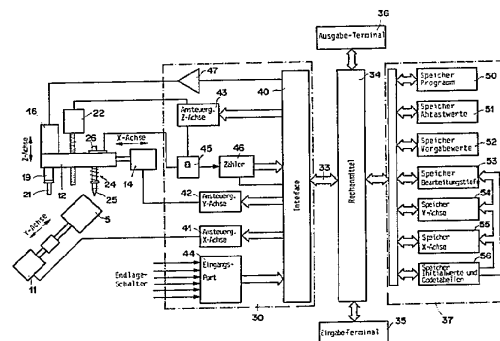
⑦③ Inhaber:
Hans Zulliger, Hünibach

⑦② Erfinder:
Zulliger, Hans, Hünibach

⑦④ Vertreter:
Bovard AG, Bern 25

⑤④ Maschine zur Herstellung von Schlüssel.

⑤⑦ Die Maschine weist einen in einer ersten Richtung (X-Achse) verschiebbaren Schlitten (12), einen am Schlitten befestigten Bearbeitungsmotor (16) mit einem Werkzeug (21) und eine in einer zweiten Richtung (Y-Achse) verschiebbare Spannvorrichtung (5) zum Halten von Schlüsselvorlagen oder Schlüsselrohlingen auf. Am Schlitten (12) ist ebenfalls eine Abtastvorrichtung (24) montiert. Der Bearbeitungsmotor (16) und die Abtastvorrichtung (24) sind in einer dritten Richtung (Z-Achse) bewegbar. Bewegungen in allen drei Richtungen werden durch gesteuerte Schrittmotoren (11, 14, 22) durchgeführt. Im weiteren umfasst die Maschine ein Rechenmittel (34) mit einem Eingabeterminal (35), einem Ausgabeterminal (36) und einem Speichermittel (37). Das Rechenmittel (34) ist über ein Interface-Kabel (33) mit einem am mechanischen Teil der Maschine befestigten Steuerteil (30) verbunden. Anhand verschiedener auswählbarer Arbeitsfunktionen können einerseits Schlüsselvorlagen mit der Abtastvorrichtung (24) automatisch abgetastet und die Abtastwerte in den Speichermitteln (37) gespeichert werden und andererseits können mit gespeicherten Bearbeitungsdaten Schlüsselrohlinge automatisch bearbeitet werden. Dadurch, dass die Abtastwerte im Rechenmittel (34) mit im Speichermittel (37) vorhandenen Vorgabe- oder Sollwerten verglichen und korrigiert werden, lassen sich Abtastfehler infolge Abnutzung, Verschmutzung oder ungenauem Einspannen der Schlüsselvorlage ausschalten.



PATENTANSPRÜCHE

1. Maschine zur Herstellung von Schlüsseln, die einen in wenigstens einer Richtung verschiebbaren Schlitten (12), eine am Schlitten drehbar gelagerte und antreibbare Spindel (19), eine Spannvorrichtung (5) und eine Vorrichtung (24) zum Abtasten von Schlüsselvorlagen (8) aufweist, dadurch gekennzeichnet, dass ein mit der Abtastvorrichtung (24) elektrisch verbundener Steuerteil (30) mit einer Vorrichtung zum Erzeugen eines digitalen Signales (45, 46) in Abhängigkeit des Abtastwertes, ein Rechenmittel (34) und ein Speichermittel (37) zum Speichern des digitalen Signales an einem durch die Abtaststelle adressierten Speicherplatz vorhanden sind und dass der an das Rechenmittel (34) angeschlossene Steuerteil (30) so ausgebildet ist, dass er vom Rechenmittel erhaltene Befehle in Steuersignale für Antriebe (11, 14, 22) zum relativen Bewegen eines Werkzeuges (21) gegenüber dem zu bearbeitenden Schlüsselrohling (9) umwandelt.

2. Maschine nach Anspruch 1, dadurch gekennzeichnet, dass die Abtastvorrichtung (24) ein mit einem Sensor (26) gekoppeltes Tastorgan (25) zum Erzeugen eines Sperrsignales, sobald das Tastorgan mit der Schlüsselvorlage (8) in Berührung kommt, aufweist.

3. Maschine nach Anspruch 1 oder 2, dadurch gekennzeichnet, dass nur eine Spannvorrichtung (5) zum Halten der Schlüsselvorlage (8) während dem Abtasten und des Schlüsselrohlings (9) während dem Bearbeiten desselben vorhanden ist.

4. Maschine nach einem der Ansprüche 1 bis 3, dadurch gekennzeichnet, dass die Bearbeitungsdaten für eine Vielzahl von je mit einem Code versehenen Schlüsseln im Speichermittel (37) abgespeichert sind, und dass der Schlüsselrohling (9) durch mit Hilfe des Codes ausgelesenen Daten bearbeitbar ist.

5. Maschine nach einem der Ansprüche 1 bis 4, dadurch gekennzeichnet, dass das Speichermittel (37) Speicherplätze zum Speichern von vom Schlüsselfabrikat abhängigen Initialwerten aufweist, und dass die Klemmbacken (10) der Spannvorrichtung (5) zum Bearbeiten von verschiedenen Schlüsselfabrikaten austauschbar sind.

6. Maschine nach einem der Ansprüche 1 bis 5, dadurch gekennzeichnet, dass die Antriebe (11, 14, 22) zum Bewegen der Abtastvorrichtung (24) zum Abtasten der Schlüsselvorlage (8) und/oder zum Bewegen des Werkzeuges (21) zum Bearbeiten des Schlüsselrohlings (9), Schrittmotoren sind.

7. Maschine nach einem der Ansprüche 1 bis 6, dadurch gekennzeichnet, dass das Rechenmittel (24) ein Eingabeterminal (35) zum Bestimmen der Arbeitsfunktion der Maschine und zum Eingeben und/oder Korrigieren von Bearbeitungsdaten umfasst.

8. Maschine nach einem der Ansprüche 1 bis 7, dadurch gekennzeichnet, dass das Rechenmittel (34) ein Ausgabeterminal (36) zum Anzeigen der Arbeitsfunktionen anhand eines Menüs und zum Anzeigen wenigstens der Bearbeitungsdaten aufweist.

9. Verfahren zum Betrieb der Maschine nach einem der Ansprüche 1 bis 8, dadurch gekennzeichnet, dass das Abtasten der Schlüsselvorlage (8) und das Bearbeiten des Schlüsselrohlings (9) automatisch ausgeführt werden, dass die Abtaststellen der Schlüsselvorlage (8) durch im Speichermittel (37) vorhandene, durch das Rechenmittel (34) an den Steuerteil (30) ausgegebene und von diesem in Steuersignale umgewandelte Daten zum Positionieren des Tastorgans (25) bestimmt werden, dass das Tastorgan (25) der Abtastvorrichtung (24) an jeder Abtaststelle durch den Steuerteil (30) bewegt wird, bis es die Schlüsselvorlage (8) berührt, dass jeder Abtastwert in ein digitales Signal umgewandelt und im Rechenmittel (34) auf Richtigkeit mit Vorgabewerten verglichen wird, dass die Abtastwerte anhand der Vorgabewerte

2

korrigiert und in dem an das Rechenmittel (34) angeschlossenen Speichermittel (37) gespeichert werden und dass die so gewonnenen korrigierten Daten zum nachfolgenden Bearbeiten wenigstens eines Schlüsselrohlings (9) verwendet werden.

10. Verfahren nach Anspruch 9, dadurch gekennzeichnet, dass mit dem Eingabeterminal (35) Bearbeitungsdaten ins Rechenmittel (34) eingegeben oder vom Speichermittel (37) abgerufen und auf dem Ausgabeterminal (36) angezeigt werden um Schlüssel ohne das Abtasten einer Vorlage herzustellen.

BESCHREIBUNG

Die vorliegende Erfindung betrifft eine Maschine zur Herstellung von Schlüsseln gemäss dem Oberbegriff des Patentanspruches 1 und ein Verfahren zum Betrieb der Maschine nach dem Oberbegriff des Patentanspruches 9.

Es sind Maschinen zur Herstellung von Schlüsseln für Sicherheitsschliesssysteme bekannt mit denen Schlüsselrohlinge anhand einer Schlüsselvorlage bearbeitet werden. Alle diese Maschinen sind so aufgebaut, dass sie einen Abtastteil und einen Bearbeitungsteil aufweisen. Diese beiden Teile sind über einen Mechanismus so miteinander verbunden, dass mit einem im Abtastteil angeordneten Tastkopf durchgeführte Bewegungen über den Mechanismus in gleichartige Bewegungen auf ein Werkzeug, das im Bearbeitungsteil angeordnet ist, übertragen werden. Eine zu kopierende Schlüsselvorlage wird in einer Einspannvorrichtung im Abtastteil eingespannt. Der zu bearbeitende Schlüsselrohling wird von der Einspannvorrichtung im Bearbeitungsteil festgehalten. Eine Bedienungsperson bewegt den Tastkopf im Abtastteil an den in der Schlüsselvorlage vorhandenen Bohrungen oder Fräsungen entlang. Die von der Bedienungsperson mit dem Abtastkopf durchgeführten Bewegungen werden auf das Werkzeug im Bearbeitungsteil übertragen und dieses führt gleiche Bewegungen auf der Oberfläche des Schlüsselrohlings aus und bearbeitet diesen anhand der Schlüsselvorlage.

Bei diesen bekannten Einrichtungen ist es so, dass sie für ein bestimmtes Schlüsselfabrikat gebaut und eingestellt sind und demzufolge nur für ein Fabrikat verwendet werden können. Zudem haben alle diese bekannten Einrichtungen den Nachteil, dass Ungenauigkeiten in der Schlüsselvorlage infolge Verschmutzung oder Abnutzung kopiert werden. Ebenfalls entstehen Differenzen wenn der Abtastfühler nicht genau eingestellt oder die Schlüsselvorlage nicht genau eingespannt ist. Öfters kommt es deshalb vor, dass bearbeitete Schlüsselrohlinge so weit vom Originalzustand der Vorlage abweichen, dass sie nicht gebraucht werden können.

Es ist die Aufgabe der vorliegenden Erfindung, eine Maschine zur Herstellung von Schlüsseln zu schaffen, die ohne die erwähnten Nachteile arbeitet.

Erfindungsgemäss wird diese Aufgabe durch die Merkmale der kennzeichnenden Teile der Patentansprüche 1 und 9 gelöst.

Die Erfindung wird nachstehend anhand von Zeichnungen beispielsweise näher erläutert. Es zeigen:

Fig. 1 eine Funktionsübersicht der Maschine zur Herstellung von Schlüsseln mit der zugehörigen Steuerung,

Fig. 2 eine Frontansicht der Maschine,

Fig. 3 eine Seitenansicht der Maschine,

Fig. 4 ein Flussdiagramm mit den verschiedenen Arbeitsfunktionen,

Fig. 5 ein verfeinertes Flussdiagramm für die Arbeitsfunktion «Abtasten»,

Fig. 6 ein verfeinertes Flussdiagramm für die Arbeitsfunktion «Korrigieren»,

Fig. 7 ein verfeinertes Flussdiagramm für die Arbeitsfunktion «Bearbeiten».

Als Einleitung der Beschreibung des in den Figuren dargestellten Ausführungsbeispiels der Erfindung ist der mechanische Aufbau der Maschine anhand der Figuren 2 und 3 näher erklärt. Eine linke Trägerplatte 2 und eine rechte Trägerplatte 3 sind auf einer Grundplatte 1 rechtwinklig in einem Abstand zueinander angeordnet und mit Schrauben 4 befestigt. Zwischen den parallelen Trägerplatten 2 und 3 ist eine Spannvorrichtung 5 im gezeigten Ausführungsbeispiel ebenfalls mit Schrauben 6 auf der Grundplatte 1 befestigt. Durch Drehen des Spannhebels 7 der Spannvorrichtung 5 können Schlüsselvorlagen 8 oder Schlüsselrohlinge 9 zwischen den Klemmbacken 10 zum Abtasten bzw. zum Bearbeiten eingeklemmt und festgehalten werden. Die Spannvorrichtung 5 ist durch eine durch den Schrittmotor 11 angetriebene und nicht gezeichnete Spindel in der Y-Achse verschiebbar.

Ebenfalls zwischen den beiden Trägerplatten 2 und 3 ist über der Spannvorrichtung 5 ein beweglicher Schlitten 12 angeordnet. Dieser Schlitten 12 ist durch zwei Wellen 13 gehalten und geführt. Ein Schrittmotor 14, der mit einer Schlittenantriebswelle 15 gekoppelt ist, sorgt für die Bewegung des Schlittens in der X-Achse. Am Schlitten 12 ist ein Bearbeitungsmotor 16 mit Briden 17 und 18 befestigt. Der Bearbeitungsmotor 16 weist eine drehbare Spindel 19 auf, deren dem Motor gegenüberliegendes Ende mit einem Spannfutter 20 zur Aufnahme eines Werkzeuges 21 versehen ist. Die Befestigung des Bearbeitungsmotors 16 mit dem Schlitten 12 ist derart, dass er mit der Spindel 19, dem Spannfutter 20 und dem Werkzeug 21 über eine ebenfalls nicht gezeichnete, mit dem Schrittmotor 22 gekoppelte, weitere Spindel abgesenkt und angehoben, d.h. in der Z-Achse verschoben, werden kann. An der mit dem Bearbeitungsmotor 16 verbundenen absenkbaren und anhebbaren Einrichtung 23 ist eine weiter hinten näher beschriebene Abtastvorrichtung 24 befestigt. Diese Abtastvorrichtung befindet sich örtlich zentral hinter dem Spannfutter 20 und ist elektrisch mit dem Steuerteil 30 verbunden, welcher auf der Rückseite der Maschine an den Trägerplatten 2 und 3 befestigt ist.

In der beschriebenen Ausführung lässt sich die Abtastvorrichtung 24 in der X-, Y- und Z-Richtung relativ zu einer Schlüsselvorlage 8, die zwischen den Klemmbacken 10 der Spannvorrichtung 5 eingespannt ist, bewegen, ebenso wie sich das Werkzeug 21 relativ zu einem zwischen den Klemmbacken 10 der Spannvorrichtung 5 festgehaltenen Schlüsselrohling 9 in der X-, Y- und Z-Richtung bewegen lässt. Die relativen Bewegungen der Abtastvorrichtung 24 gegenüber der Schlüsselvorlage 8 bzw. des Werkzeuges 21 gegenüber dem Schlüsselrohling 9 werden für jede Bewegungsrichtung durch je einen Schrittmotor 11, 14 und 22 gesteuert.

Anhand der Fig. 1, 4, 5, 6 und 7 wird im folgenden der Arbeitsablauf der erfindungsgemäßen Maschine näher beschrieben. In der Fig. 1 sind die Hardware-Einrichtungen dargestellt. Anhand der Fig. 4, 5, 6 und 7 werden verschiedene Arbeitsfunktionen näher erläutert.

Die Hardware-Einrichtungen umfassen nebst dem bereits beschriebenen mechanischen Teil der Maschine, den an der Maschine befestigten Steuerteil 30, der über ein Interface-Kabel 33 mit einem Rechenmittel 34 verbunden ist, welches seinerseits eine elektrische Verbindung mit einem Eingabeterminal 35, mit einem Ausgabeterminal 36 und mit einem Speichermittel 37 aufweist. Verschiedene Stromkreise zur Steuerung und Überwachung der Maschine sind im Gehäuse 31 des Steuerteils 30 untergebracht. Jeder Schrittmotor 11, 14 und 22 weist je einen Ansteuerstromkreis 41, 42 und 43 auf. Diese drei Stromkreise sind elektrisch gleich und nach bekannter Art aufgebaut und dienen dazu, vom Rechenmittel 34 über das Interface-Kabel 33 erhaltene und durch das Interface 40 bereitgestellte Signale in eine Anzahl Schrittmotor-

pulse zum Vorwärts- oder Rückwärtsdrehen des entsprechenden Schrittmotors umzuwandeln. Für jede der drei genannten Bewegungsrichtungen (X-, Y- und Z-Achse) sind je zwei in den Zeichnungen nicht dargestellte Endlageschalter im mechanischen Teil der Maschine vorhanden bei deren entsprechenden Betätigung über das Eingangsport 44, das Interface 40 und das Interface-Kabel 33, dem Rechenmittel das Erreichen einer Endlage mitgeteilt wird. Ein logisches UND-Tor 45 und ein Zählerstromkreis 46 sind dazu da, ein digitales Signal in Abhängigkeit eines Abtastwertes der Abtastvorrichtung 24 zu erzeugen und über das Interface 40 und das Interface-Kabel 33 dem Rechenmittel 34 weiterzugeben. Der Bearbeitungsmotor 16 wird über einen Verstärker 47, welcher seine Befehle vom Rechenmittel 34 über das Interface-Kabel 33 und über das Interface 40 erhält, ein- und ausgeschaltet.

Ein handelsüblicher Personalcomputer kann beispielsweise das Rechenmittel 34, das Eingabeterminal 35, das Ausgabeterminal 36 und das Speichermittel 37 umfassen. Die Funktionsweise eines Personalcomputers ist bekannt und wird hier nicht näher beschrieben. Die Speichermittel 37 stellen einen Teil des Arbeitsspeichers des Personalcomputers dar, welcher wiederum in verschiedene Speicherbereiche 50, 51, 52, 53, 54, 55 und 56 aufgeteilt ist. Das Steuerprogramm für die erfindungsgemäße Maschine wird in den Programmspeicher 50 geladen, Initialwerte bzw. Anfangswerte zum Festlegen einer bestimmten Null-Position der Maschine sowie Code einer Vielzahl von Schlüsseln, sind im Speicher für «Initialwerte und Codetabellen» 56 vorhanden. Die in den Speicherbereichen Speicher «X-Achse» 55 und Speicher «Y-Achse» 54 gespeicherten Daten kennzeichnen Abtaststellen für eine Schlüsselvorlage bzw. Bearbeitungsstellen für einen Schlüsselrohling. Das durch das logische UND-Tor 45 und den Zählerstromkreis 46 in Abhängigkeit eines Abtastwertes der Abtastvorrichtung 24 erzeugte digitale Signal, welches über das Interface 40 und über das Interface-Kabel 33 dem Rechenmittel 34 zugeleitet worden ist, wird im Speicher «Abtastwerte» 51 gespeichert. Abtastwerte können infolge von Abnutzung oder Verschmutzung der Schlüsselvorlage Abweichungen vom richtigen Wert aufweisen. Um solche Abweichungen zu erkennen und zu korrigieren, werden die gemessenen Abtastwerte mit gültigen Vorgabewerten aus dem Speicher «Vorgabewerte» 52 verglichen und korrigiert und die Resultate im Speicher «Bearbeitungstiefe» 53 abgelegt.

Anhand der Fig. 4, 5, 6 und 7 werden nun einzelne Arbeitsfunktionen näher beschrieben. Im Flussdiagramm der Fig. 4 ist der gesamte Arbeitsablauf der erfindungsgemäßen Maschine dargestellt. Beim Einschalten der Maschine wird das Steuerprogramm in den Speicherbereich «Programmspeicher» 50 geladen. Das Steuerprogramm führt zuerst eine Initialisierung der Maschine durch, d.h. die Abtastvorrichtung 24 bzw. das Werkzeug 21 werden in eine Null-Position oder Ausgangslage gebracht, die durch ganz bestimmte Initialwerte im Speicher für «Initialwerte und Codetabellen» 56 vorgegeben ist. Das Rechenmittel 34 liest diese Initialwerte aus dem entsprechenden Speicherbereich 56, übergibt sie über das Interface-Kabel 33 dem Interface 40, welches den Stromkreisen zur Ansteuerung der Schrittmotoren 41, 42 und 43 Signale übergibt, worauf die einzelnen Schrittmotoren 11, 14 und 22 die Abtastvorrichtung 24 bzw. das Werkzeug 21 in eine ganz bestimmte Ausgangslage bringen, die beispielsweise eine Endlage, gekennzeichnet durch betätigte Endlageschalter sein kann. Auf dem Ausgabeterminal 36, das in diesem Ausführungsbeispiel ein Bildschirm ist, erscheint ein Auswahlmeneu, das zum Auswählen einer bestimmten Arbeitsfunktion der erfindungsgemäßen Maschine auffordert. So können zum Beispiel eine Neuinitialisierung

für ein anderes Schlüsselfabrikat, das Kopieren einer Schlüsselvorlage, das Bearbeiten eines Schlüsselrohlings oder das Programmieren ausgewählt werden. Die Auswahl erfolgt durch eine entsprechende Eingabe mit dem in unserem Beispiel eine Tastatur darstellenden Eingabeterminal 35. Wählen wir beispielsweise die Arbeitsfunktion «Kopieren» so werden wir vom Bildschirm des Personalcomputers aufgefordert, die Schlüsselvorlage in der Spannvorrichtung 5 einzuspannen. Nachdem wir das richtige Einspannen der Schlüsselvorlage durch Eingabe eines bestimmten Signales mit der Tastatur bestätigt haben, führt die Maschine den Abtastvorgang der Schlüsselvorlage gemäss dem in der Fig. 5 gezeigten Algorithmus selbständig durch. Das Rechenmittel 34 liest aus den Speichern «X-Achse» 55 und «Y-Achse» 54 die Positionswerte für die erste Abtaststelle, übergibt diese Werte über das Interface-Kabel 33 dem Interface 40, welches entsprechende Signale den Stromkreisen 41 und 42 weitergibt. Diese Stromkreise erzeugen Impulse für die Schrittmotoren 11 und 14, wodurch sich die Spannvorrichtung 5 in der Y-Achse und der Schlitten 12 in der X-Achse bewegen, bis sich die Abtastvorrichtung an der ersten Abtaststelle befindet. In der bereits beschriebenen Art, erhält der Ansteuerstromkreis 43 vom Rechenmittel 34 das Kommando, den Schrittmotor 22 zum Absenken der Einrichtung 23 mit der Abtastvorrichtung 24 in Betrieb zu setzen. Die Abtastvorrichtung 24 besteht aus einem Tastorgan 25 und einem Sensor 26. Das Tastorgan 25 ist in axialer Richtung der Abtastvorrichtung 24 bewegbar und übt auf den Sensor 26 einen Druck aus, sobald er mit der Schlüsselvorlage in Berührung kommt. Der Sensor 26, der im beschriebenen Beispiel als Drucksensor ausgebildet ist, erzeugt dadurch ein Sperrsignal. Die vom Ansteuerstromkreis 43 an den Schrittmotor 22 zum Absenken des Tastorgans 25 übermittelten Schrittimpulse werden über das logische UND-Tor 45 im Zählerstromkreis 46 gezählt, bis das vom Sensor 26 erzeugte Sperrsignal das logische UND-Tor 45 sperrt. Im Zählerstromkreis 46 befindet sich ein Wert einer Anzahl Impulse, der dem Abtastwert entspricht. Das Rechenmittel 34 gibt dem Ansteuerstromkreis 43 das Kommando zum Zurückdrehen des Schrittmotors 22, liest über das Interface 40 und das Interface-Kabel 33 den im Zählerstromkreis 46 vorhandenen Abtastwert, speichert ihn im Speicher «Abtastwerte» 51 an einem durch die Abtaststelle adressierten Speicherplatz und stellt den Zählerstromkreis 46 auf Null zurück. Das Rechenmittel 34 fragt die Speicher «X-Achse» 55 und «Y-Achse» 54 nach weiteren Abtaststellen. Sind noch solche vorhanden, wiederholt sich der beschriebene Vorgang, bis sich der Abtastwert der letzten durch die Speicher 55 und 54 adressierten Abtaststellen im Speicher «Abtastwerte» 51 befindet.

Nun werden anhand des in der Fig. 6 dargestellten Flussdiagramms «Korrigieren», ein Abtastwert nach dem anderen, die sich im Speicher «Abtastwerte» 51 befinden, mit allen gültigen Vorgabewerten des Speichers «Vorgabewerte» 52 verglichen, eventuell korrigiert und als Wert für die Bearbeitungstiefe im Speicher «Bearbeitungstiefe» 53 gespeichert. Der Korrekturvorgang wird vom Rechenmittel 34 selbständig wie folgt durchgeführt. Die variable «Abweichung» wird auf einen Maximalwert gesetzt. Der erste Abtastwert A1 des Speichers 51 und der erste Vorgabewert V1 des Speichers 52 werden eingelesen. Der Abtastwert wird mit dem Vorgabewert verglichen und dann wird der Differenzbetrag der beiden Werte gebildet. Wenn die dieser kleiner ist, als die Variable «Abweichung», wird der Variablen «Abweichung» der errechnete Differenzbetrag zugeordnet. Der Vorgabewert V1 wird provisorisch als erste Bearbeitungstiefe angenommen. Nun wird der Abtastwert A1 mit dem nächsten Vorgabewert V2 verglichen. Nehmen wir an, der jetzt errechnete Differenzbetrag ist nicht kleiner, als die Variable «Abweichung»,

4

dann wird der variablen «Abweichung» kein neuer Wert zugeordnet und die vorhin ermittelte Bearbeitungstiefe bleibt erhalten. Dieser Vorgang wird solange durchgeführt, bis der Abtastwert A1 mit allen in unserem Beispiel vorhandenen Vorgabewerten V1 bis V4 verglichen worden ist. In einer weiteren Abfrage wird die oben ermittelte Variable «Abweichung» mit einer Konstanten verglichen und geprüft, ob die Variable «Abweichung» einen plausiblen Wert aufweist oder nicht. Wenn ja, wird die oben ermittelte Bearbeitungstiefe als Wert Z1 im Speicher 53 gespeichert. Wenn nein, wird dem Wert Z1 im Speicher «Bearbeitungstiefe» 53 ein Codewert «X» zugeordnet. Diese beschriebenen Vorgänge wiederholen sich, bis alle Abtastwerte A1 bis An mit allen Vorgabewerten V1 bis V4 verglichen und korrigiert und als Bearbeitungstiefen Z1 bis Zn im Speicher 53 vorhanden sind. Ist dies der Fall, so werden die ermittelten Bearbeitungstiefen, die im Speicher 53 gespeichert sind, als normierte Werte 1 bis 4 entsprechend den Vorgabewerten V1 bis V4 oder als Werte «X» für nicht plausible Abweichungen auf dem Ausgabeterminal 36 angezeigt. Als «X» bezeichnete Bearbeitungstiefen sind durch manuelle Eingaben über das Eingabeterminal 35 zu ersetzen, nachdem die richtige Bearbeitungstiefe der entsprechenden Stelle durch visuelle Betrachtung der Schlüsselvorlage eruiert worden ist. Am Ende dieses Programmteiles «Korrigieren» erscheint auf dem Ausgabeterminal 36 wieder das Auswahlmenu.

Nun kann beispielsweise, auf gleiche Art wie schon beschrieben, die Arbeitsfunktion «Bearbeiten» ausgewählt werden. Ein Flussdiagramm dafür zeigt die Fig. 7. Die Schlüsselvorlage wird aus der Spannvorrichtung 5 entfernt und an ihrer Stelle wird ein Schlüsselrohling in die nur einmal vorhandene Spannvorrichtung eingespannt. Nachdem die richtige Einspannung durch Eingabe eines Signales mit dem Eingabeterminal 35 quittiert worden ist, beginnt der Bearbeitungsvorgang. Analog, wie bereits beim Vorgang «Abtasten» beschrieben, wird nun das Werkzeug 21 anhand der Werte X1 und Y1 in den Speicher «X-Achse» 55 und «Y-Achse» 54 an die erste Abtaststelle gebracht und anschliessend gemäss dem ersten Wert Z1 aus dem Speicher «Bearbeitungstiefe» 53 abgesenkt. Bevor der Absenkvorgang beginnt, erhält der Verstärker 47 vom Rechenmittel 34 ein Signal zum Einschalten des Bearbeitungsmotors 16. Der aus dem Speicher «Bearbeitungstiefe» 53 vom Rechenmittel 34 ausgelesene Wert wird über das Interface-Kabel 33 dem Interface 40 zugeführt und dem Ansteuerstromkreis 43 übergeben. Dieser veranlasst den Schrittmotor 22 durch Impulse, die Einrichtung 23 um einen bestimmten, der Anzahl Impulse proportionalen Betrag, abzusinken. Dadurch wird der Schlüsselrohling an der entsprechenden Stelle bearbeitet. Eine Stelle nach der anderen die durch die Werte in den Speichern «X-Achse» 55 und «Y-Achse» 54 vorgegeben sind, wird auf diese Weise bearbeitet. Die letzte Stelle, die durch die Werte Xn und Yn der Speicher 55 und 54 vorgegeben ist, erfährt eine Bearbeitungstiefe, die zum Wert Zn im Speicher 53 proportional ist. Am Ende der Bearbeitung erscheint auf dem Bildschirm des Personalcomputers wieder das Auswahlmenu. Weitere Arbeitsfunktionen können angewählt werden.

Mit der erfindungsgemässen Maschine ist es auch möglich, Schlüsselrohlinge ohne das vorherige Abtasten von Schlüsselvorlagen herzustellen. Da in den Speichermitteln 37 im Speicher für «Initialwerte und Codetabellen» 56 die Bearbeitungsdaten einer Vielzahl von je mit einem Code versehenen Schlüsseln gespeichert sind, kann beispielsweise anstelle des Abtastens direkt ein Schlüsselcode in die Maschine eingegeben werden. Eine solche Eingabe kann beim Auswählen der Arbeitsfunktion «Bearbeiten» durch Aufforderung durch das Ausgabeterminal 36 erfolgen, wenn vor dieser Arbeitsfunktion keine Abtastung stattgefunden hat. Eine entspre-

chende Eingabe des Schlüsselcodes erfolgt mit dem Eingabeterminal 35.

Die Maschine zur Herstellung von Schlüsseln und das Verfahren zum Betrieb der Maschine gemäss der vorliegenden Erfindung weisen folgende vorteilhaften Merkmale auf. Die Maschine führt sowohl die Abtast- als auch die Bearbeitungsfunktionen automatisch durch. Infolge Abnutzung, Verschmutzung oder ungenauer Einspannung der Schlüssel-

vorlage, aufgetretene Abtastfehler werden erkannt und automatisch oder manuell korrigiert. Da die Bearbeitungsdaten des herzustellenden Schlüssels gespeichert sind, können mehrere unter sich gleiche Schlüssel nacheinander hergestellt werden. Zur Herstellung mehrerer gleicher Schlüssel ist nur ein einziger Abtastvorgang notwendig. Ist der Code des Schlüssels bekannt, so kann ein Schlüssel auch ohne Abtastvorgang hergestellt werden.

FIG. 1

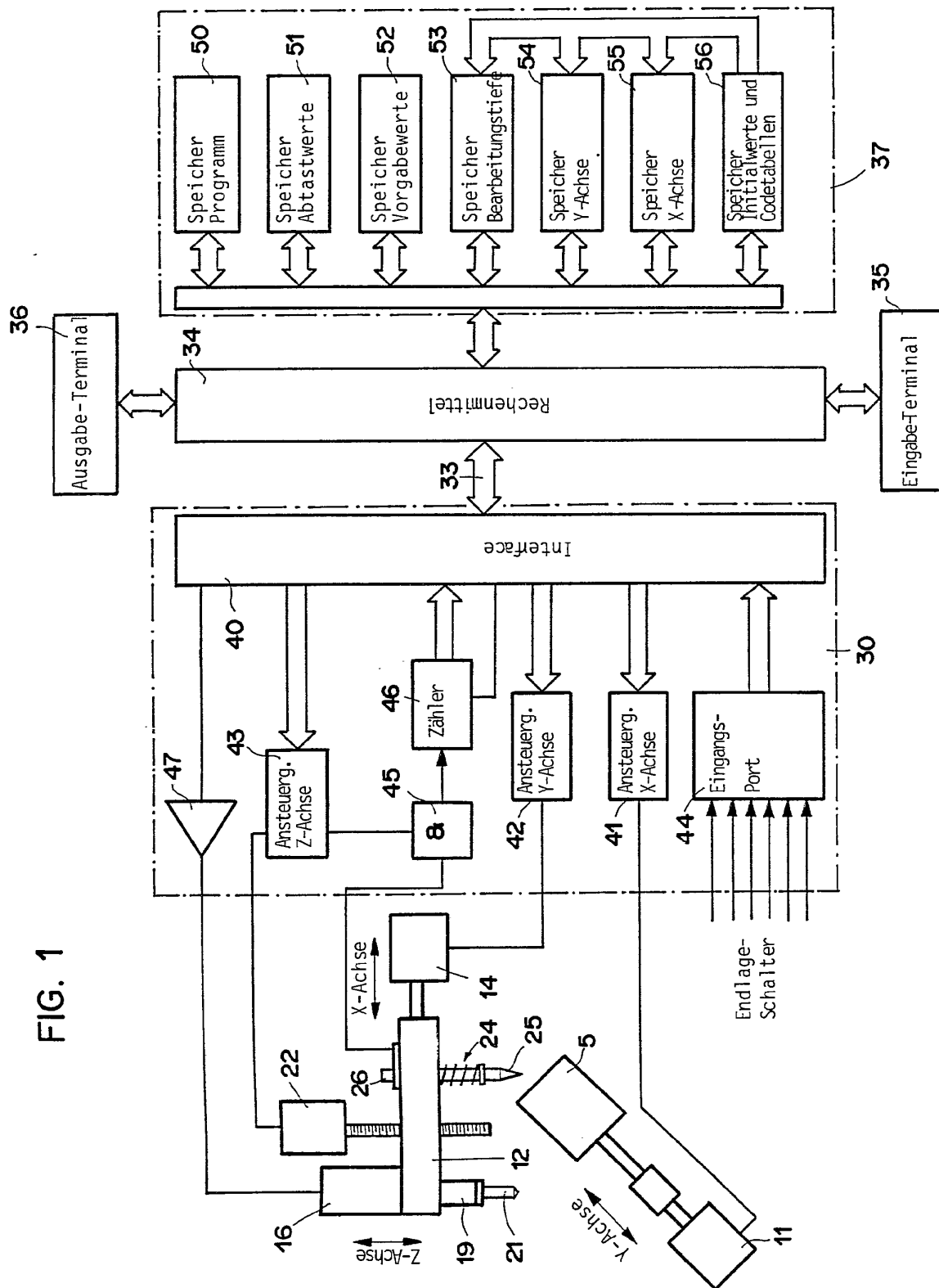




FIG. 3

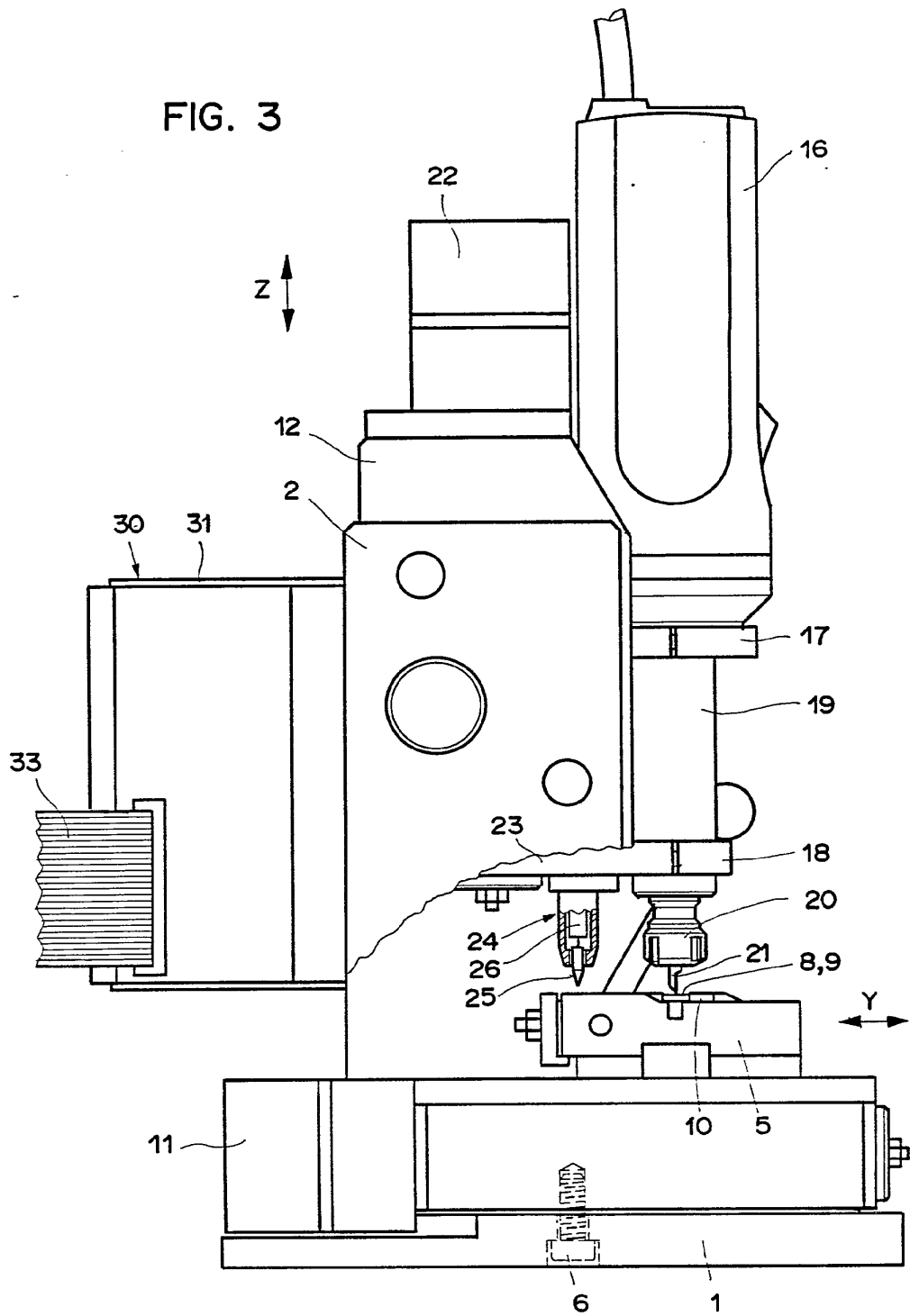
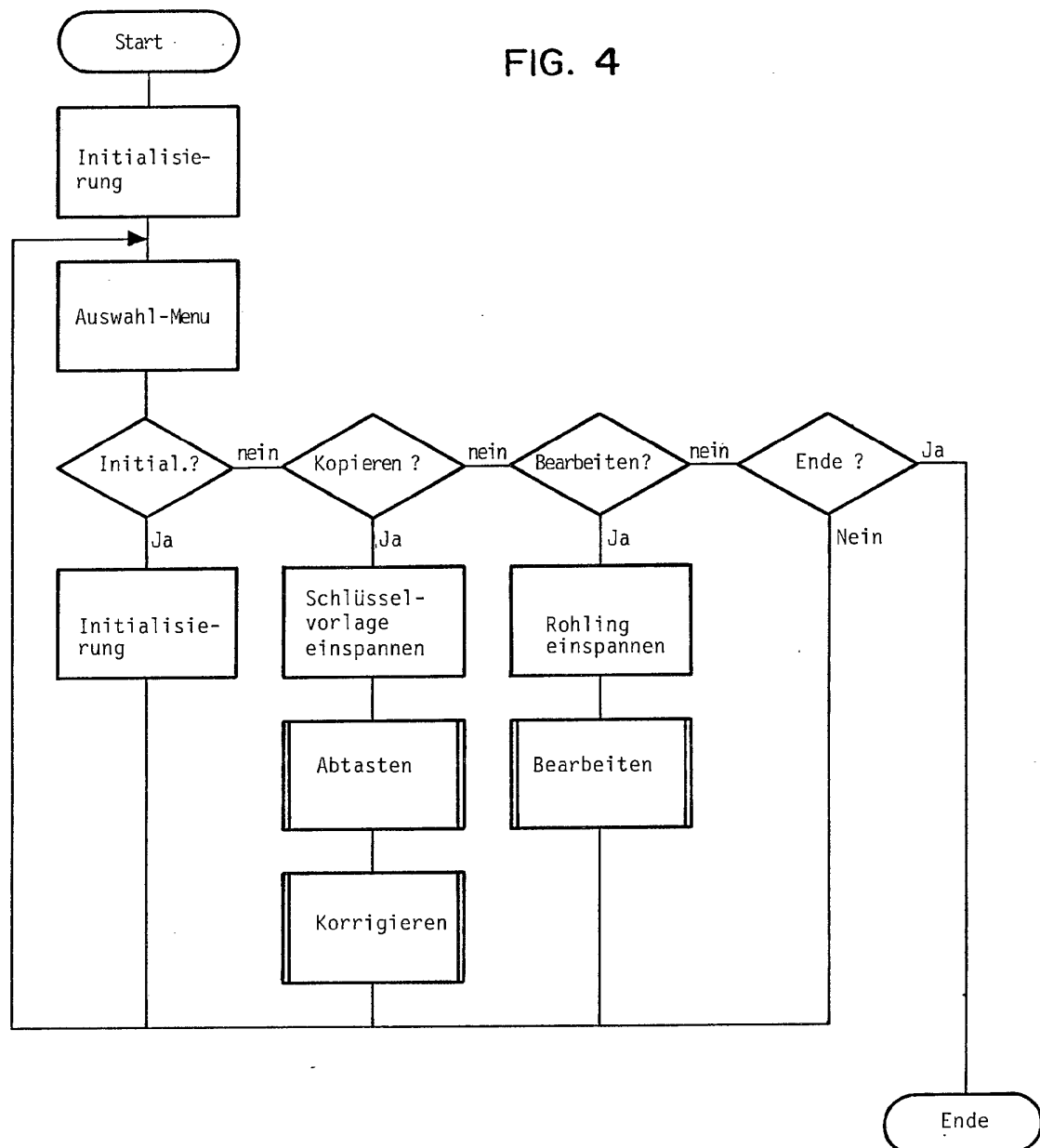


FIG. 4



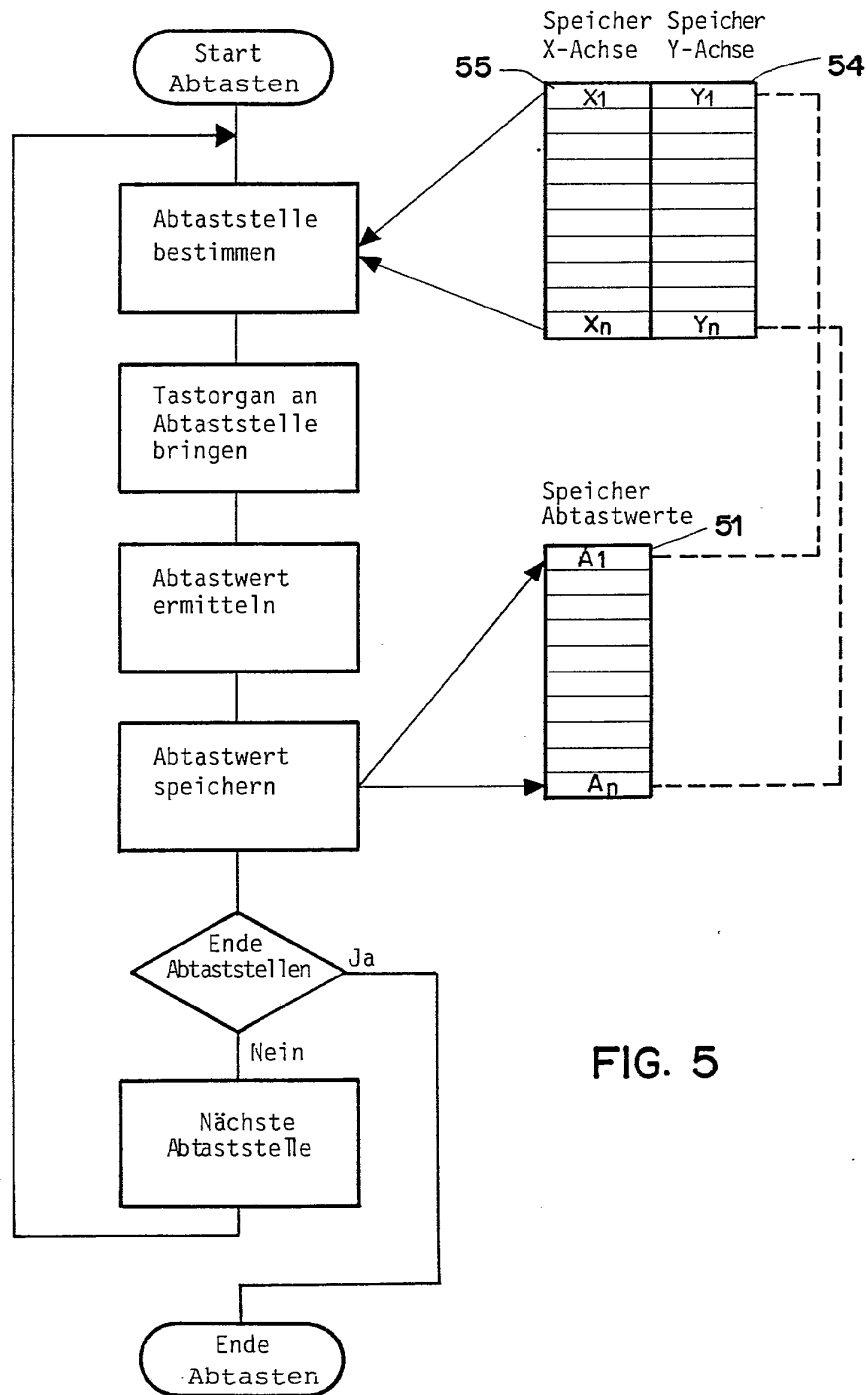


FIG. 5

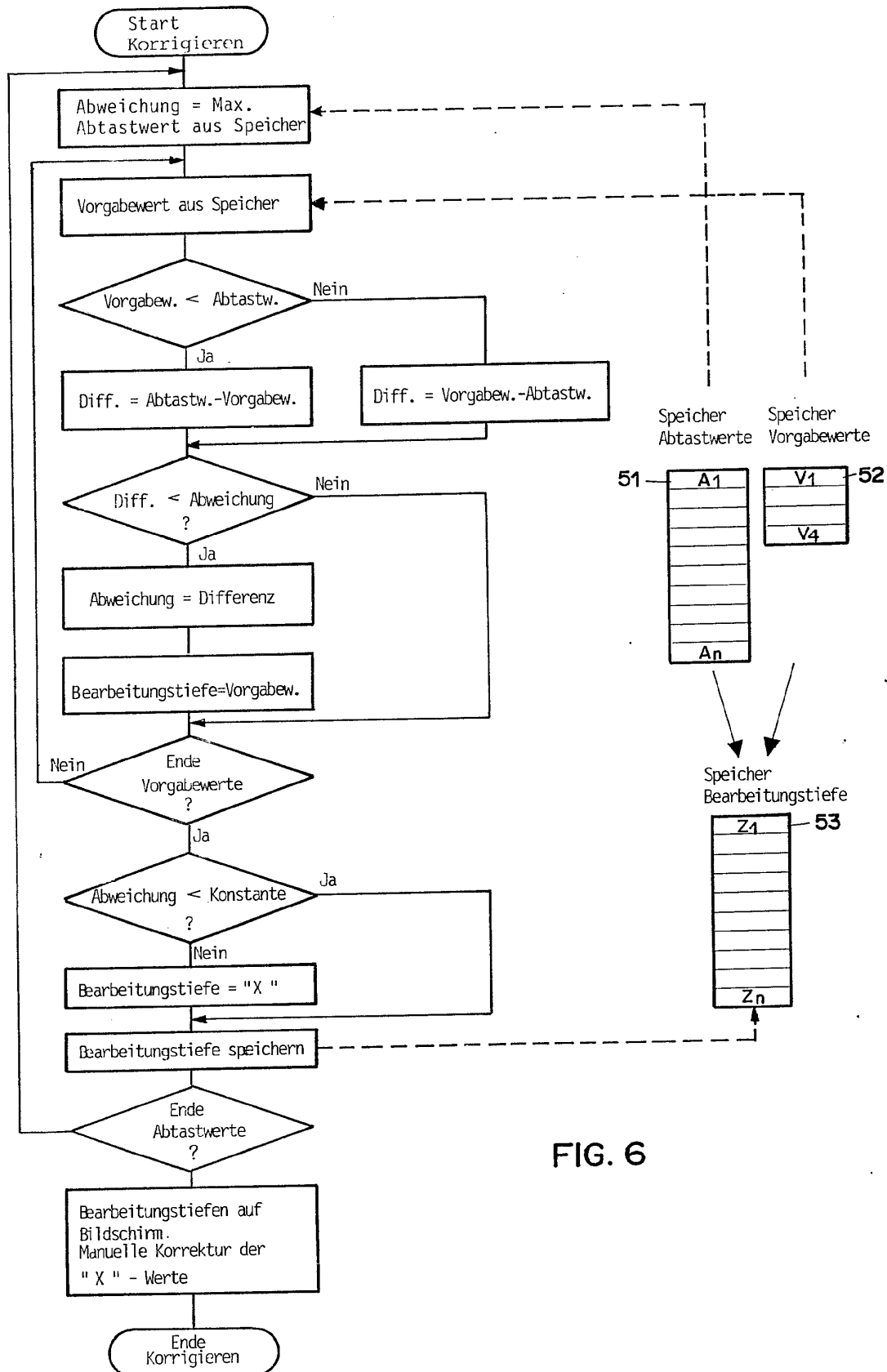


FIG. 6

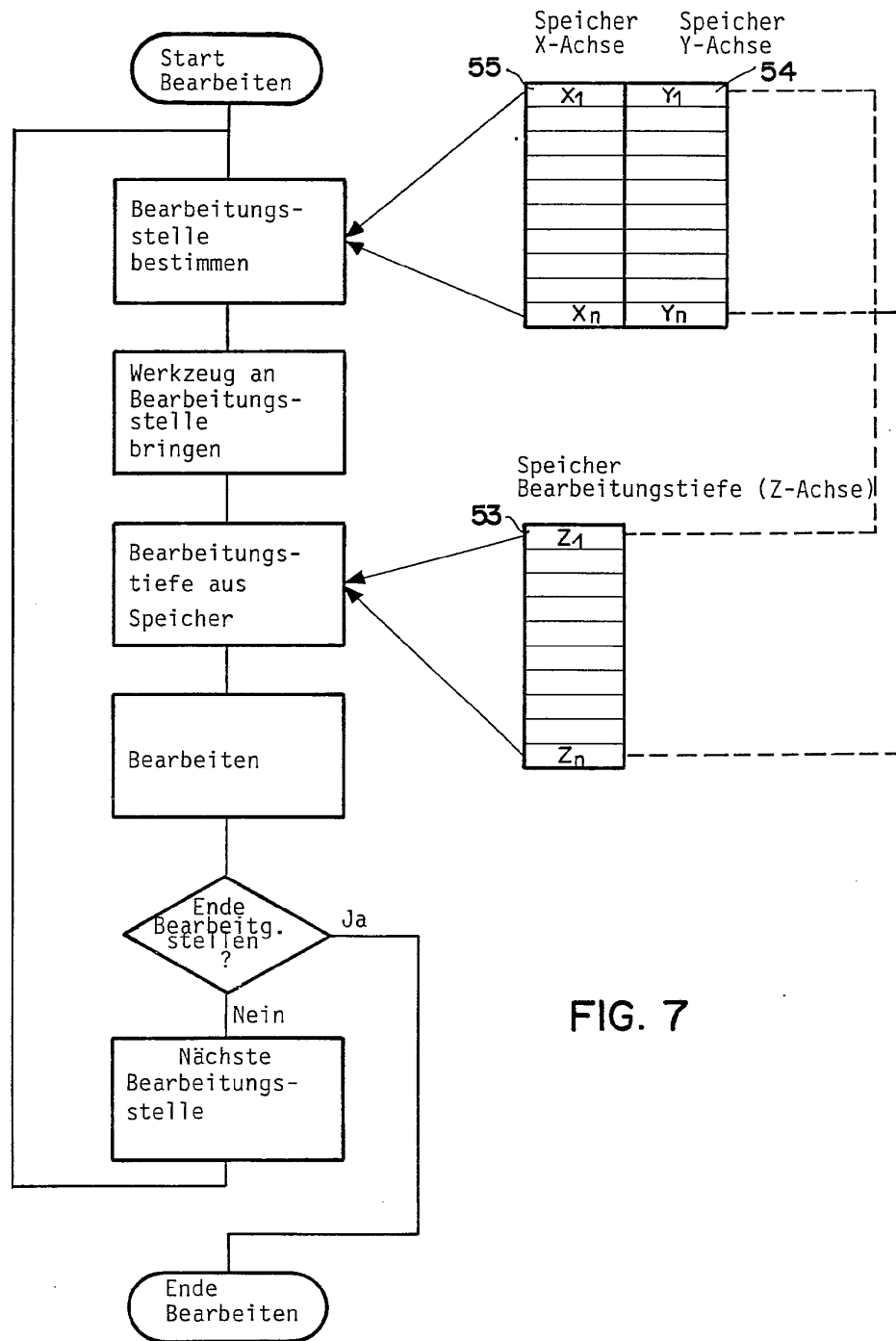


FIG. 7

(51) International Patent Classification:
B23C 3/35 (2006.01)(21) International Application Number:
PCT/US2011/034564(22) International Filing Date:
29 April 2011 (29.04.2011)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
13/006,714 14 January 2011 (14.01.2011) US(71) Applicant (for all designated States except US): **HY-KO PRODUCTS COMPANY** [US/US]; 60 Meadow Lane, Northfield, Ohio 44067 (US).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **MUTCH, William R.** [US/US]; 35284 Nikki Avenue, North Ridgeville, Ohio 44039 (US). **PORRAS, Randall A.** [US/US]; 5918 Porter Road, North Olmsted, Ohio 44070 (US). **FIGORE, Thomas** [—/US]; 635 E 305 St., Willowick, Ohio 44095 (US).(74) Agent: **CUPAR, David B.**; 600 Superior Avenue, E. Ste. 2100, c/o McDonald Hopkins LLC, Cleveland, Ohio 44114 (US).

(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PE, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM,

[Continued on next page]

(54) Title: KEY DUPLICATION MACHINE

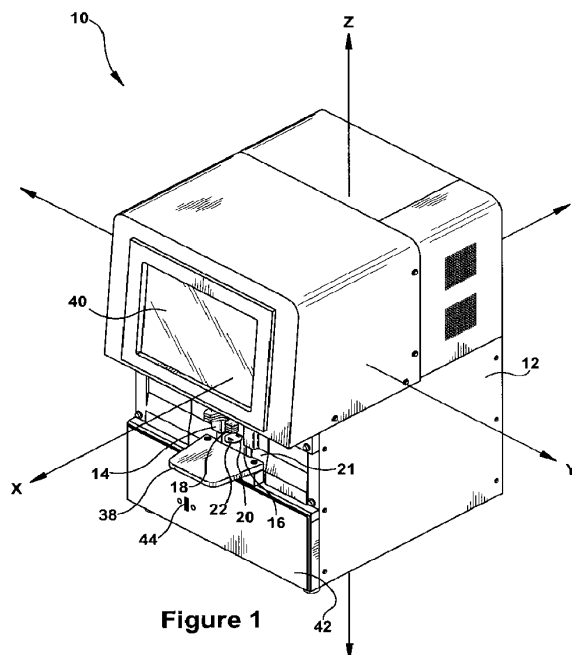


Figure 1

(57) Abstract: Apparatus, methods, and other embodiments associated with a key duplication machine are described. In one embodiment, an assembly for duplicating a master key includes an optical imaging device, a logic, a clamping assembly, and a cutting member. The optical imaging device is capable of capturing an optical image of at least a portion of the master key. The logic is capable of determining a key pattern of the master key from the optical image of the master key. The clamping assembly is capable of clamping a key blank and the cutting member is capable of cutting a key pattern into said key blank.



TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG). **Published:**

— *with international search report (Art. 21(3))*

TITLE**KEY DUPLICATION MACHINE****CROSS REFERENCE TO RELATED APPLICATION**

[0001] This application is a continuation-in-part of U.S. Patent Application Ser. No. 13/006,714 titled “KEY DUPLICATION MACHINE,” filed on January 14, 2011, which is a continuation of U.S. Patent Application Ser. No. 11/656,925 titled “KEY DUPLICATION MACHINE,” filed on January 23, 2007, which claims the benefit of U.S. Provisional Patent Application No. 60/761,293, titled “KEY DUPLICATION MACHINE,” filed January 23, 2006, each of which are hereby incorporated in their entirety.

FIELD OF INVENTION

[0002] This invention relates generally to apparatus and methods for duplicating keys, and more specifically, this invention relates to apparatus and methods for cutting duplicate keys based on a captured image of a master key.

BACKGROUND

[0003] Key duplication and key cutting machines are designed to reproduce a key pattern of a master key onto a key blank. Prior art key duplication and key cutting machines typically determine the key pattern of a master key by mechanically engaging the key pattern of a master key with a stylus, tracer bar, or other such mechanical member. For example, prior art key duplication machines typically comprise a pair of clamps or vise grips mounted on a carriage. A master key, having a key pattern, is placed in a first clamp. A key blank, manually selected by the machine operator, is placed in a second clamp, which is normally positioned adjacent to the first clamp. The stylus is placed in contact with the key pattern of the master key. A cutting wheel is placed in contact with an edge of the key blank, into which the key pattern of the master key is to be duplicated. The stylus and cutting wheel are coupled such

that the movement of the cutting wheel is synchronized with and controlled by the movement of the stylus.

[0004] The carriage is arranged such that the carriage may be moved pivotally and linearly along a longitudinal supporting shaft that is generally parallel to the blades of the master key and key blank. The carriage is typically moved manually along the shaft, causing the stylus to move along the key pattern of the master key. As the stylus moves along the key pattern of the master key to trace the key pattern, the cutting wheel moves along the blade of the key blank. The coupling of the stylus and cutting wheel controls the movement of the cutting wheel and cuts a duplicate key pattern into the key blank. Once the cutting process is completed, the newly duplicated key may be removed from the clamp and buffed on a buffing wheel or swiped across a wire brush to remove any burrs.

[0005] In the prior art process described, the key cutting machine operator manually selects the key blank. It is of great importance that the key pattern of a master key be copied onto an appropriate key blank having the same key blade and grooves. There are numerous key blanks, and many are not readily distinguishable from each other. Identifying the correct key blank for use in duplication often requires visually examination of a plurality of key blanks, where differences between key blanks may be very subtle, significantly increasing the level of difficulty in identifying the proper key blank. All too often, businesses that offer key cutting services are not staffed by experienced locksmiths capable of consistently and accurately identifying the proper key blank to be used. Instead, an employee is shown how to "eyeball" what is thought to be the correct blank and then cut a duplicate key at the substantial risk of the key working improperly.

[0006] Once a key blank is manually chosen by the operator, that key blank goes through the cutting process. If a mistake is made in the manual selection of a key blank, the entire process of manually identifying the best key blank and mechanically cutting the key must begin again. Often, such errors are not identified until after the customer leaves the store, thus resulting in frustration with the retailer due to an unsuccessful key cut.

[0007] Although prior art key duplication machines and processes are well established and widely utilized, such machines and processes produce a relatively high scrap rate, overly rely on the experience and judgment of machine operators, and may not allow for evaluation of the accuracy of a duplicate key without the duplicate key being tested in its associated lock. Due to these and other limitations of the prior art, the art field is constantly striving to

improve cut accuracy, cut quality, and ease of use of key duplication machines and processes. Improvements to key duplication machines and processes that enhance the accuracy and quality of a duplicate key or produce more user-friendly machines are well received in the key duplication industry.

[0008] Automotive keys often utilize transponder chips in the head of the key to provide an enhanced level of security. The automobile or vehicle may be capable of reading the chip in the key and verifying that the proper electronic code is present before allowing the vehicle to start or run. In some newer vehicles these codes are encrypted and/or may be rolling (changing) codes to make the copying of a key even more difficult. This presents a particular challenge to aftermarket key duplicators. Commonly, electronic devices and keys are required to duplicate such automotive keys. The keys have the electronic chips or circuit boards in the head of the key and the duplicator must have an electronic device, such as an antenna, to read the chip or circuit board and write to the key.

[0009] Traditionally, devices designed to interact with keys having chips or circuit boards are stand-alone devices that are designed for transponder programming only. The programming devices consist of an antenna, a circuit board, a firmware, and some type of input/output components (such as input buttons and a display screen). The automotive key duplicator requires a full key cutting machine as well to cut the blades of the new key.

[0010] A general goal of the industry is to develop key duplication machines and processes that are so user-friendly that a customer or general consumer may duplicate a key with minimal instructions and minimal knowledge of keys. Therefore, improvements in machines and processes for cutting and reproducing duplicate keys that simplify the cutting process or improve the accuracy of key blank identification are greatly desired. Further, the industry constantly strives for less expensive, easier to assemble, and easier to maintain machines. Should newly developed key duplication machines or processes achieve any of these objectives, it would be a significant improvement over the expensive and often difficult to use key cutting machines currently known in the field.

SUMMARY OF INVENTION

[0011] Apparatus, methods, and other embodiments associated with a key duplication machine are described. In one embodiment, an assembly for duplicating a master key includes an optical imaging device, a logic, a clamping assembly, and a cutting member. The

optical imaging device is capable of capturing an optical image of at least a portion of the master key. The logic is capable of determining a key pattern of the master key from the optical image of the master key. The clamping assembly is capable of clamping a key blank and the cutting member is capable of cutting a key pattern into said key blank.

[0012] In another embodiment, a method for duplicating a master key includes capturing an optical image of at least a portion of the master key; providing a logic to determine a key pattern of the master key from the optical image of the master key; securing a key blank; and cutting a key pattern into the key blank.

DESCRIPTION OF THE DRAWINGS

[0013] In the accompanying drawings, which are incorporated in and constitute a part of this specification, embodiments of the invention are illustrated, which, together with a general description of the invention given above, and the detailed description given below serve to illustrate the principles of this invention. The drawings and detailed description are not intended to and do not limit the scope of the invention or the claims in any way. Instead, the drawings and detailed description only describe embodiments of the invention, and other embodiments of the invention not described are encompassed by the claims.

[0014] Figure 1 is perspective view of an exemplary embodiment of a key duplication machine in accordance with the present invention;

[0015] Figure 2 is a front view of the key duplication machine of Figure 1;

[0016] Figure 3 is a side view of the key duplication machine of Figure 1;

[0017] Figure 4A is a plan view of a master key;

[0018] Figure 4B is a plan view of a key blank;

[0019] Figure 5 is a perspective view of a key secured in the slot of the key duplication machine of Figure 1;

[0020] Figure 6 is a partial perspective view of the interior of the key duplication machine of Figure 1;

[0021] Figure 7 is a partial perspective view of the interior of the key duplication machine of Figure 1;

[0022] Figure 8 is a partial perspective view of the interior of the key duplication machine of Figure 1;

[0023] Figure 9 is a partial perspective view of the interior of the key duplication machine of Figure 1;

[0024] Figure 10 is a plan view of a key blank positioned between positioner fingers of the key duplication machine of Figure 1;

[0025] Figure 11 is a perspective view of a cutting wheel and positioner finger of the key duplication machine of Figure 1;

[0026] Figure 12 is a partial perspective view of the interior of the key duplication machine of Figure 1;

[0027] Figure 13 is a perspective view of a top clamp member of the key duplication machine of Figure 1;

[0028] Figure 14 is a partial perspective view of the interior of the key duplication machine of Figure 1;

[0029] Figure 15 is a partial perspective view of the interior of the key duplication machine of Figure 1;

[0030] Figure 16 is a front view of a shavings drawer of the key duplication machine of Figure 1;

[0031] Figure 17 is a rear view of a shavings drawer of the key duplication machine of Figure 1;

[0032] Figure 18 is a partial perspective view of the interior of the key duplication machine of Figure 1;

[0033] Figure 19 is a partial perspective view of the interior of the key duplication machine of Figure 1;

- [0034] Figure 20 is an exploded view of the key duplication machine of Figure 1;
- [0035] Figure 21 is an exploded view of the key duplication machine of Figure 1;
- [0036] Figure 22 is a screen shot of a user interface for use with the key duplication machine of claim 1;
- [0037] Figure 23 is a screen shot of a user interface for use with the key duplication machine of claim 1;
- [0038] Figure 24 is a screen shot of a user interface for use with the key duplication machine of claim 1;
- [0039] Figure 25 is a screen shot of a user interface for use with the key duplication machine of claim 1; and
- [0040] Figure 26 is a screen shot of a user interface for use with the key duplication machine of claim 1.
- [0041] Figure 27 illustrates an embodiment of a key duplication machine having an key chip reader.
- [0042] Figure 28 illustrates an embodiment of a key load point for a key duplication machine having an embedded key chip reader.
- [0043] Figure 29 illustrates a zoomed in cut-away view of a key load point for a key duplication machine having an embedded key chip reader.

DETAILED DESCRIPTION OF THE INVENTION

[0044] The Detailed Description of the Invention merely describes embodiments of the invention and is not intended to limit the scope of the claims in any way. Indeed, the invention as described by the claims is broader than and unlimited by the preferred embodiments, and the terms in the claims have their full ordinary meaning.

[0045] As described herein, apparatus and methods can be designed to produce accurate and reliable duplicates of master keys. In one embodiment, the duplication of a master key is facilitated by the capture of an optical image of a profile or silhouette of the master key, including the key pattern of the master key, and the capture of a profile or silhouette of a key

blank. As will be further described herein, the captured images may be analyzed by logic to determine the proper key blank to be used for a duplicate key, validate the selection of the proper key blank, facilitate the accurate cutting of the key pattern of the master key into the key blank, and validate the accuracy of the key pattern cut into the key blank. The apparatus and methods may further facilitate the cutting of a substantial variety of key types, such as single-sided keys, double-sided keys, sidewinder keys, house keys, automobile keys, commercial keys, and the like. The analysis of images by logic may include, for example, the logic storing images, storing data, quantifying physical measurements based on the image, retrieving referencing data contained in a database, and the like.

[0046] As used herein, the term “logic” includes but is not limited to hardware, firmware, software and/or combinations of each to perform a function(s) or an action(s), and/or to cause a function or action from another logic, method, and/or system. For example, based on a desired application or needs, logic may include a software controlled microprocessor, discrete logic like an application specific integrated circuit (ASIC), an analog circuit, a digital circuit, a programmed logic device, a memory device containing instructions, or the like. Logic may include one or more gates, combinations of gates, or other circuit components. Logic may also be fully embodied as software. Where multiple logical logics are described, it may be possible to incorporate the multiple logical logics into one physical logic. Similarly, where a single logical logic is described, it may be possible to distribute that single logical logic between multiple physical logics. In addition, as used herein, the term “database” includes a physical and/or logical entity that can store data. A database may be, for example, a traditional database, a table, a file, a list, a queue, a heap, a memory, a register, and so on. A database may reside in one logical and/or physical entity and/or may be distributed between two or more logical and/or physical entities.

[0047] Optionally, the apparatus and methods described herein may accept input from a user or operator of a key duplication machine and may provide output to the user or operator of the machine to further facilitate key duplication. For example, the apparatus may include a user interface, such as monitor, touch screen, or other such device, through which a user may enter information and information may be displayed to the user.

[0048] In an embodiment, a method of using the key duplication machine comprises the steps of inserting a master key into the machine such that the blade of the master key is within an imaging zone of the machine; capturing an image of the key pattern of the master key;

utilizing logic to analyze the captured image; comparing the captured image with data on key blanks contained in a database; determining the proper key blank for duplicating the master key; outputting information regarding the proper key blank to the user; removing the master key from the machine; retrieving and inserting the proper key blank into the machine such that the blade of the key blank is within the imaging zone of the machine; capturing an image of the key blank; using logic to analyze the image of the key blank and validating that the key blank is proper; aligning the key blank; moving the key blank to a cutting zone of the machine; cutting the key pattern of the master key into the key blank; moving the newly-cut duplicate key to the imaging zone of the machine; capturing an image of the duplicate key; using logic to analyze the image of the duplicate key; compare the analysis of the image of the master key with the analysis of the image of the duplicate key to validate the accuracy of the key pattern cut into the duplicate key; removing the duplicate key from the machine; and de-burring the duplicate key.

[0049] An exemplary embodiment of a key duplication machine **10** is illustrated in the accompanying Figures. The key duplication machine **10** as described herein has numerous features or improvements, each of which are believed to be independently novel. Therefore, while embodiments of the present invention are described as utilizing each of these novel features or improvements in the aggregate, nothing in the present description should be interpreted as requiring an embodiment to include or exclude any of the particular improvements described herein. In addition, the key duplication machine **10** described herein incorporates a key blank identification system and a key cutting system into a single apparatus. However, it should be understood that either system could be used individually or used together. Nothing in this description should be interpreted to limit novel features of each individual system as used alone or in an integrated unit. Therefore, as described herein as an integrated system, a master key is imaged and compared with other key blanks to determine the appropriate key blank to be used, while also utilizing the master key image to provide key pattern information to be cut into the key blank.

[0050] Figures 4A and 4B illustrate a common master key **22** and key blank **24**. While it is known that numerous types of keys are used in the key industry, for simplicity the master key **22** illustrated in Figure 4A is an exemplary house key, and the key blank **22** illustrated in Figure 4B is a exemplary key blank **24** for the house key **22**. Both the master key **22** and key blank **24** typically include a head **26** having a bow **28**, a shoulder **30**, a blade **32**, and a

keyway groove **34**. The keyway groove **34** is typically a narrow, milled-out area along the length of the blade **32** that allows the blade **32** to bypass the wards in a keyway. Such keyway grooves **34** may already be cut into the key blank **24** to simplify the key cutting operation. Therefore, when duplicating a master key **22**, a key blank **24** must include a keyway groove **34** that is either identical to or similar to the master key **22**. The master key **22** includes a key pattern **36**, which is a model for any key pattern cut into the key blank **24** in duplicating the master key **22**. As used herein, master key refers to any key that has a key pattern, whether an original key purchased with a lock and fabricated by the manufacturer of the lock or a subsequent duplication of the original key. The reference to a key as a master key indicates that the key serves as a model from which to cut a duplicate key to perform the same unlocking function as the master key.

[0051] With reference to Figures 1 through 3, an assembled key duplication machine **10** is illustrated. The machine **10** includes an outer shell **12**, comprising a number of panels arranged to enclose and protect internal components, mechanisms, and systems of the key duplication machine **10**. The machine **10** further includes a key load position to load a key into the machine. The key load position may comprise a door clamp **14**, which is biased against a base **16** with a biasing member (not shown). The door clamp **14** may be biased against the base **16** by any biasing member such as, for example, an extension or compression coil spring, a torsion spring, a counterweight, or the like. The door clamp **14** may be raised against the biasing force by a handle **18**.

[0052] The combination of the door clamp **14**, base **16**, handle **18**, and biasing member forms a retention mechanism **19** for retaining or securing a master key **22** or key blank **24**. As illustrated in Figure 5, the door clamp **14** and the base **16** form a slot **20** that may be utilized to retain or secure a master key **22** or key blank **24** such that the blade **32** of the key **22** and **24** is located within the machine **10**. The force placed on the key **22** and **24** in the slot **20** is sufficient to retain or hold the key **22** and **24** in place but also allows some movement of the key **22** and **24** to facilitate proper alignment of the key **22** and **24**.

[0053] As will be further described, the blade **32** of a key **22** and **24** may be positioned within the machine **10** such that an image of the blade **32** may be captured. In addition, the blade **32** of a key blank **24** may be positioned within the machine **10** such that the blade **32** is exposed to clamps and cutters. The clamps are arranged to selectively rigidly secure the key blank **24**,

and the cutters are arranged to selectively cut a key pattern into the blade **32** of the key blank **24** when the key blank **24** is rigidly secured in the clamps.

[0054] In an embodiment, the key **22** and **24** may be positioned with a first side of the blade **32** facing upward, or the key **22** and **24** may be rotated 180 degrees and positioned with the first surface of the blade **32** positioned downward. As will be further described, in such an embodiment, such variable orientation or registration of the key **22** and **24** does not affect the subsequent imaging, positioning or cutting of a key **22** and **24**. The key duplication machine **10** may be arranged such that logic used to analyze images and control the movement, alignment, and cutting of keys **22** and **24** may detect the orientation or registration of the key **22** and **24** and account for such orientation or registration during the duplication of a master key **22** so that the proper key cuts are made regardless of the positioning of the key blank **24** so as to promote user friendliness and speed of duplication.

[0055] The door clamp **14**, base **16**, handle **18**, and slot **20** are located on a retention mechanism panel **21**. The panel **21** is arranged such that the panel **21** may slide to the left and right, with respect to Figure 2. As will be further described, such movement allows the machine **10** to move the blade **32** of a key blank **24** between an imaging zone, where an image of the blade **32** may be captured, and a cutting zone, where a key pattern **36** may be cut into a key blank **24**.

[0056] The key duplication machine **10** includes a table **38** located below the slot **20**. The table **38** is positioned such that when a master key **22** is secured in the slot **20**, the table **38** holds additional keys on a key ring so that the user does not have to remove the master key **22** from its key ring for the purposes of duplication. A touch-screen monitor **40** is incorporated into the machine **10**, through which a user may enter information and information may be displayed to the user. In addition, a metal shavings drawer **42** is provided beneath the internal key cutting mechanisms to catch metal shavings generated during the cutting of keys. The shavings drawer **42** may be removed from the machine **10** to facilitate the disposal of collected shavings. For convenience, a de-burring slot **44** is provided. The slot **44** leads to a burr-cleaning member such as a wheel, square brush, or the like, to clean and de-burr newly cut keys.

[0057] Optionally, a vacuum system (not shown) may be incorporated into the machine **10** to capture key cutting shavings as they are generated and to assist in cleaning the work area

after key cutting operations. Such a vacuum system may be attached to the machine **10** in the vicinity of the cutting operation or in or near a catch basin. Such an exemplary system is described in U.S. Patent Application No. 10/970,844, titled KEY CUTTING MACHINE, filed on October 20, 2004, and commonly owned by the present assignee. The 10/970,844 patent application is hereby expressly incorporated by reference in its entirety. The 10/970,844 application describes a removable vacuum tube capable of capturing key cutting shavings and assisting in cleaning the work area after the key cutting operation. It will be clear to those skilled in the art that such a vacuum system could be incorporated into the present apparatus and attached in the vicinity of the cutting operation or in or near the catch basin.

[0058] As will be further described, during the process of duplicating or cutting a key, internal components, mechanisms, and systems of the key duplication machine **10** experience motion and movement relative to other components of the machine **10**. To facilitate the description of such motion and movements, reference will be made to movements relative to an X-axis, Y-axis, and Z-axis. The orientations of these axes are shown in Figures 1 through 3. When motion or movement is described herein as “moving along the X-axis,” for example, this description includes motion along any axis parallel to the X-axis shown in Figures 1 through 3. Movements along the X-axis are generally between the front and back of the machine **10**, movements along the Y-axis are generally between the left side and right side of the machine **10**, and movements along the Z-axis are generally between the top and bottom of the machine **10**. As will be understood by those skilled in the art, descriptions of motion or movement along an axis are not intended to be exactly and precisely along or parallel to such an axis. Movement and motion that is approximately or roughly along an axis or parallel to an axis are included in the description of motion or movement along an axis. The use of “along an axis” or “about an axis” are intended to simplify a general description of the apparatus and methods described herein and not intended to limit the scope or understanding of such apparatus and methods.

[0059] Figures 6 through 21 illustrate exemplary internal components, mechanisms, and systems of the key duplication machine **10** and will be referenced in describing methods for using the machine **10** to form duplicate keys from master keys **22**.

[0060] Referring again to Figure 5, a master key **22** or key blank **24** may be placed and retained in the slot **20** in the retention mechanism panel **21** such that the blade **32** is

positioned within the machine **10** and in the imaging zone. As best seen in Figure 6, an optical imaging device **50** is mounted within the machine **10** and positioned such that it captures an optical image of a key **22** and **24** secured in the slot **20**. The image of the key **22** and **24** may generally include the blade **32** of the key **22** and **24**, the key shoulder **30**, and at least a portion of the head **26**. As generally used herein, the imaging area is an area that is below (along the Z-axis) the optical imaging device **50**. The optical imaging device **50** is generally positioned above the key **22** and **24** and directed downward such that a silhouette of the key **22** and **24**, including the blade **32** of the key **22** and **24**, may be captured.

[0061] In one embodiment, the optical imaging device **50** is a camera, and the image captured is a photographic image. In an embodiment, the camera **50** is a digital camera, and the image captured is a digital image. A digital image may be stored in file form or in data form and may be analyzed by logic. As best seen in Figure 6, a tube **51** (shown in cross-section) may extend downward from the imaging device **50** towards the key **22** and **24**. Such a tube **51** may facilitate the channeling of light to the camera and result in a high quality captured image.

[0062] To enhance an image captured by the optical imaging device **50**, the machine **10** includes a system for providing backlighting to the key **22** and **24**. As best seen in Figure 7, a lighting panel **52**, reflector plate **54**, and a blocking plate **56** cooperate to provide backlighting to the key **22** and **24**. The lighting panel **52** emits light, which is reflected off the reflector plate **54** and directed towards the key **22** and **24**. A surface **58** of the reflector plate **54** is coated or otherwise treated to disperse and diffuse light emitting from the lighting panel **52**. This dispersion and diffusion of light creates a backlighting environment that enhances captured images of the key **22** and **24**. The coating or treatment of the surface **58** of the reflector panel **54** may be any coating or treatment that sufficiently disperses and diffuses light. For example, the surface **58** may be coated with a gritty substance, such as sandpaper; the surface **58** may be painted; the surface **58** may be machined or otherwise treated to roughen the surface **58**; or the surface **58** may include a pattern that disperses and diffuses light. The reflector plate **54** may be arranged at a relatively steep angle, as best seen in Figure 7, to decrease the likelihood that shavings from the cutting of keys may fall onto and stick to the surface **58** of the reflector plate **54**. Such an angle makes it likely that shavings falling onto the surface **58** will slide off the surface **58** and settle into the shavings drawer **42**. In an embodiment, any treatment or coating applied to the surface **58** of the reflector plate **54** is

selected to match the color and reflectivity of any buildup of dust that may accumulate onto the surface **58** due to the cutting of keys above the reflection plate **54**.

[0063] The lighting panel **52** may include any type of light-emitting devices such as, for example, light bulbs, light emitting diodes (LED), liquid crystal displays (LCD), and the like. In an embodiment, the light panel **52** comprises a matrix of evenly spaced LEDs. Alternatively, LEDs may be unevenly spaced so as to create more favorable light dispersion and diffusion. In an embodiment, the light emitted from the lighting panel **52** may be in the red spectrum, which may, under certain circumstances, create crisper images of a key silhouette. As will be understood by those skilled in the art, other types of backlighting systems may include directing light on the shavings or an object in the shavings drawer **42**. Any particular configuration that provides well-dispersed and diffused light appropriate for backlighting is contemplated and incorporated herein. Alternatively, front lighting or providing light directly to the key **22** and **24** may also be used when capturing an image of the key **22** and **24**.

[0064] The logic may be arranged to analyze the backlighting and the resulting quality of a captured image. Based on such analysis, the backlighting may be adjusted, such as in direction or in intensity, to improve subsequent captured images. In addition, the positioning of the lighting panel **52**, reflector plate **54**, and a blocking plate **56** may also be adjusted to improve subsequent captured images.

[0065] The apparatus as described may be utilized to capture the image of the blade **32** of a master key **22**, including the key pattern **36**. Such a captured image may be analyzed by logic to quantify and specifically define the key pattern **36** of the master key. Such analysis may include quantifying and defining the depth, angle, and position of each tooth in the key pattern **36**; determining whether there is a key pattern **36** on one side of the key **22** (a single-sided key) or on both sides of the key **22** (a double-sided key); determining precisely where along the blade **32** the key pattern **36** begins and ends; and the like. In addition, surface features of the blade **32**, such as the presence, length, and width of a key groove **34**, may be determined. In one embodiment, surface features of the blade **32** may be determined by positioning the optical imaging device **50** to an angle with respect to the surface of the blade **32**. As will be further described, such information may be stored by the logic for subsequent use in selecting a key blank **24**, precisely cutting a key pattern into a key blank **24** and in

comparing the key pattern cut into the key blank **24** and the key pattern **36** of the master key **22**.

[0066] The captured image of the blade **32** of the master key **22** may also be used to specifically determine the proper key blank **24** to use when duplicating the master key **22**. The captured image may be analyzed using logic to quantify and specifically define features of the master key blade **32** such as, for example, the size and shape of the shoulder **30**, the length and width of the blade **32**, whether the master key **22** is single-sided or double-sided, whether the blade **32** includes any steps or grooves, and the like. To facilitate the identification of a proper key blank **24**, the logic may compare the quantified and defined features of the master key **22** with data in a database regarding known key blanks **24**. Such a database may include data on the physical dimensions of known key blanks **24**, and the logic may make direct comparisons between physical dimensions of known key blanks **24** and the features of the master key **22** as determined from the captured image. Such comparisons may lead to the determination and selection of the proper key blank **24** for the master key **22**.

[0067] Optionally, additional imaging of the master key **22** may be performed to determine or quantify surface features of the master key **22** such as, for example, the keyway groove **34**. Such surface features may assist in narrowing or choosing the proper key blank **24**. Such imaging may be performed by providing a ring of structured light about the key blade **32** and an optical imaging device to record a tip view or cross-sectional view of the key **24**, performing a laser scan across the key blade **32** to identify the width and spacing of a keyway groove **34**, or projecting a shadow across the surface of the blade **32** to measure the variations in shadow contour related to surface area contour.

[0068] With regard to a laser scan of the key blade **32**, a dot scan may be utilized using a single laser dot that may be moved continuously along a path, projected at certain points along a path, or utilized with multiple laser dot scans in numerous types of configurations to acquire the necessary information. It should be clear that such a scan could read one or both sides of a key **22**. Information on the groove **34** may likewise be analyzed and compared by the logic to groove information stored in the database related to known key blanks **24**. Therefore, based upon the master key **24** silhouette and, optionally, the key groove **34** features, the logic may identify a single key blank **24** for use in duplicating the master key **24**.

[0069] Once the proper key blank **24** is identified, the key duplication machine **10** may direct output information to the user to indicate which specific key blank **24** is identified. In one embodiment, such information may be displayed on the touch-screen monitor **40**. The user may then retrieve the proper key blank **24** from a retail display based on the displayed information. In an embodiment, various key blanks **24** may be displayed on a display or retail rack with light indicators positioned near each type of key blank **24**. Once the proper key blank **24** is identified, the machine **10** may send a signal to the display rack and the display rack may illuminate the light indicator associated with the proper key blank **24**. Such a system directs the user to the proper key blank **24** and reduces user error in selecting a key blank **24**. The machine **10** may include a display connection **59** (as seen in Figure 3) to connect the machine **10** to the display rack, through which a signal may be sent from the display rack from the machine **10**. Optionally, the machine **10** and display rack may be integrated or the machine **10** and rack may be arranged to send and receive signals remotely, wirelessly, etc. Such apparatus and methods are described in U.S. Patent Application No. 10/633,933, filed on August 4, 2003, and titled OBJECT IDENTIFICATION SYSTEM. The 10/633,933 application may be incorporated or otherwise utilized with embodiments described herein. The 10/633,933 application is commonly owned by the present assignee and hereby expressly incorporated herein by reference in its entirety.

[0070] Once the proper key blank **24** is identified and retrieved by the user, the user may remove the master key **24** from the slot **20** in the retention mechanism panel **21** and place the key blank **24** in the slot **20**. When the key blank **24** is placed into the slot **20**, the key blank **24** may be validated to insure that the proper key blank was retrieved by the user, internal mechanisms may align the key blank **24**, the key blank **24** may be further secured or clamped, and a key pattern may be cut into the key blank **24** to duplicate the master key **22**. As previously described, the orientation or registration at which the user inserts the key blank **24** in the slot **21** does not affect the subsequent operations on the key blank **24**. The logic may analyze captured images of the inserted blank **24** to determine the orientation and adjust all subsequent operations accordingly.

[0071] Figures 8 and 9 illustrate the positioning of a key blank **24** relative to internal components, mechanisms, and systems as it is initially inserted and secured in the slot **20**. In this initial position, the key blank **24** is in the imaging zone. The retention mechanism panel **21** is not shown in Figures 8 and 9 for clarity. As shown in Figure 8, a left cutting wheel **60** is

positioned to the left of the key blank **24** and a right cutting wheel **62** is positioned to the right of the key blank **24** as viewed from the front of the machine **10**. A clamping assembly **64**, including a top clamp member **66** and a bottom clamp member **68**, is located to the left of the key blank **24** as viewed from the front of the machine **10**. The clamping assembly **64** is used to clamp the key blank **24** during cutting, the left cutting wheel **60** is utilized to cut the left side of the key blank **24**, and the right cutting wheel **62** is utilized to cut the right side of the key blank **24**.

[0072] The logic may validate that the key blank **24** selected by the user and positioned in the machine **10** is the proper key blank **24**, as previously identified. An image of the key blank **24** may be captured by the optical imaging device **50**, and logic may be used to analyze the image. Such analysis may determine or quantify features of the key blank **24** such as, for example, the size and shape of the shoulder **30**, the length and width of the blade **32**, whether the blank **24** is designed as a single-sided or double-sided key, whether the blade **32** includes any steps, and the like. Such determined features may be compared to data regarding features of the previously-identified proper key blank **24** stored in the database. Provided the determined features of the user-selected key blank **24** and the stored features of the previously-identified proper key blank are in agreement, the logic may determine that the proper key blank **24** was selected and positioned by the user. The user may be informed that the user-selected blank **24** is proper, and the duplication process may continue. If the determined features of the user-selected key blank **24** and stored features of the proper key blank are in not in agreement, the logic may inform the user that an improper key blank was selected and instruct the user to reselect a key blank **24** for duplication of the master key **22**. Optionally, the duplication process may be halted until the user positions a proper key blank **24**, or the machine **10** may incorporate an override function to allow a key pattern to be cut into the selected key blank **24**.

[0073] Prior to clamping the key blank **24** in the clamping assembly **64**, the key blank **24** may be aligned to insure a key pattern is properly cut into the blank **24**. The position of the key blank **24**, as initially manually positioned by the user, may be determined from the captured image of the blank **24**. This image is analyzed by logic and compared to the ideal position for cutting the blank **24**, and the positioning of the blank **24** is adjusted to conform to the ideal cutting position. As best shown in Figures 9 and 10, a pair of key positioner fingers **72** and **74** engages the key blank **24** to align the blank **24**. The left positioner finger **72**

engages the left side of the blade **32**, and the right positioner finger **74** engages the right side of the blade **24**. This engagement squares the key blank **24** with respect to the X-axis and Y-axis to correct for a user having placed the blank **24** into the slot **20** at an angle. The engagement of the fingers **72** and **74** may also properly position the blade **32** along the X-axis. If the user did not insert the blank **24** far enough into the slot **20**, the fingers **72** and **74** may move the blade **32** along the X-axis to the proper position. As previously described, the retention mechanism **19** secures a blank key **24**; however, the force applied to a key **22** and **24** by the door clamp **14** and base **16** allows the key **22** and **24** to be adjusted relative to the machine **10**.

[0074] The left positioner finger **72** is generally fixed with respect to the blank **24**. This is to say that forces between the blank **24** and the left positioner finger **72** do not cause the left positioner finger **72** to deflect. The right positioner finger **74**, however, is designed to deflect slightly upon engagement with the blank **24**. The right positioner finger **74** includes a cantilever arm **76** that deflects due to forces between the right positioner finger **74** and the blank **24**. Such deflection insures that sufficient force is applied to the blank **24** by the fingers **72** and **74** to grip and align the blank **24**. When the fingers **72** and **74** are not needed, they may be rotated upwards and out of the way. As best shown in Figure 11, the right positioner finger **74** is mounted onto a shaft **78**. The shaft **78** is arranged to rotate about the X-axis to rotate the finger **74** upward and downward as needed. A similar arrangement rotates the left positioner finger **72** upward and downward.

[0075] Once the positioner fingers **72** and **74** have corrected the alignment of the blank **24** based on the analysis of the initial captured image, yet another image of the blank **24** may be captured to validate that the alignment is now proper. In addition to validating the alignment of the blank **24**, this captured image may be utilized to record reference points along the blade **32** such as the location of the key shoulder **30**, the location of the tip of the blade **32**, and the like. As will be further described, the logic may use such reference points, along with the determination of the orientation of the key blank **24**, to guide the cutting wheels **60** and **62** during the cutting process.

[0076] Although the alignment of a key is generally described with reference to the alignment of a key blank **24** upon the insertion of the blank **24** into the slot **20**, it will be readily understood by those skilled in the art that the positioner fingers **72** and **74** may be

used, for example, to align a master key 22 prior to capturing an image of the key 22 to be analyzed by the logic.

[0077] As shown in Figure 9, once the blank 24 is properly aligned, the clamping assembly 64 may be opened to accommodate the clamping of the blank 24. In an embodiment, the default position of the clamp assembly is open, and the clamp is closed only when clamping a key blank 24. The bottom clamp member 68 is generally fixed, and the top clamp member 66 is arranged to move along the Z-axis. When the clamping assembly 64 is opened, the blank 24 is moved to the left along the Y-axis until the blank 24 is positioned between the top member 66 and bottom member 68 clamps. The blank 24 is moved along the X-axis to a specific clamping position relative to the clamping assembly 64 as determined by the logic for the specific key blank 24. The logic may specifically position the blank 24 relative to the clamping assembly 64 such that both edges of a blade 32 of a key blank 24 remain exposed for the cutting of a key pattern into both edges of the blade 32. Such an arrangement is common for double-sided key blanks.

[0078] Such movement of the key blank 24 moves the blank 24 from the imaging zone to the cutting zone. The clamp assembly 64 is generally fixed with respect to the Y-axis and generally defines the cutting zone. The blank 24 is moved along the Y-axis by the synchronized movement of the left 72 and right 74 positioner fingers and the retention mechanism panel 21, which includes the slot 20. As seen in Figure 12, once the blank 24 is positioned between the top 66 and bottom 68 clamp members, the top clamp member 66 is moved downward along the Z-axis to secure the blank 24 in the clamp assembly 64. Once the blank 24 is secured in the clamp assembly 64, the positioner fingers 72 and 74 are rotated upward about the X-axis and out of engagement with the blank 24. Such movement of the fingers 72 and 74 ensures that the cutting wheels 60 and 62 have access to the full length of the blade 32 and both edges of the blade 32.

[0079] With reference to Figure 13, the clamping surface of the clamp members 66 and 68 are T-shaped. The stem 80 of the T-shaped clamping surface is sized such that both the left side and right side of the key blank 24 blade 32 is exposed to the cutting wheels 60 and 62 when the blank 24 is clamped in the clamping assembly 64. The bar portion 82 of the T-shaped clamping surface is designed to engage the blank 24 at or above the key shoulder 30 and above the portion of the blade 32 into which a key pattern is cut. Optionally, the clamping surface may include knurls or other features designed to improve the grip of the

clamp members **66** and **68** on the blank **24**. As best seen in Figure 12, the top clamp member **66** may include at least one groove **84** designed to allow a top clamp member **66** to deflect slightly. Such slight deflections may allow the clamping surfaces of the clamp members **66** and **68** to adjust for small irregularities in the surface of the blank **24**. For example, the top clamp member **66** may displace slightly so as to accommodate raised logos, words, or numbers stamped or forged into the surface of the blank **24**. Such accommodations may reduce or eliminate the chance of point contact between the clamping members **66** and **68** and the blank **24** and increase the chances that the clamping force is sufficient to hold the blank **24** during the cutting process.

[0080] Once the key blank **24** is clamped, the cutting operation can be performed. The logic may use the quantified and stored information from the captured image of the key pattern **36** of the master key **22** to calculate precise movements of the cutting wheels **60** and **62**, with respect to the key blank **24**, to produce a duplicate key. The movements of the cutting wheels **60** and **62** are generally two-dimensional. The wheels **60** and **62** are moved along the X-axis to cut the key pattern along the length of the blade **32**. In addition, the wheels **60** and **62** move independently along the Y-axis to cut the depth of each tooth of the key pattern into the blade **32**. While numerous paths for the cutting wheels **60** and **62** may be utilized, in an embodiment, the cutting wheels **60** and **62** begin near the shoulder **30** of the key blank **24** and proceed to the tip of the key blank **24** blade **32** to cut the key pattern into the blade **32**. The precise movements calculated for the cutting wheels **60** and **62** may be transferred to a 2-axis CNC cutter so that the key pattern **36** of the master key **22** may be duplicated on the blade **32** of the key blank **24**.

[0081] As shown in Figures 14 and 15, once the key blank **24** is clamped and the positioning fingers **72** and **74** are rotated out of the way, the cutting wheels **60** and **62** may be moved along the Y-axis, into the cutting zone, and into engagement with the blade **32**. Typically, the wheels **60** and **62** engage the blank **24** near the shoulder **30** of the blank **24**. The clamp assembly **64** is not shown in Figure 15 for clarity. As previously described, the cutting wheels **60** and **62** may move in parallel along the X-axis as the key pattern is cut into the blank **24**; however, the movements of each cutting wheel **60** and **62** along the Y-axis are independent. This independent movement insures that a double-sided key may be produced quickly and efficiently, with the cutting wheels **60** and **62** passing along the length of the blade **32** only once. The rotational speed of each cutting wheel **60** and **62** is also independently controlled.

In one embodiment, the rotational speed of each cutting wheel **60** and **62** is adjusted based on the depth at which the cutting wheel **60** and **62** is moved into the blade **32** along the Y-axis. For example, in an embodiment, the rotational speed of a cutting wheel **60** and **62** is slowed as the wheel **60** and **62** moves deeper into the blade **32** along the Y-axis. In an embodiment, the movement of the wheels **60** and **62** along the X-axis and Y-axis are adjusted based on the features of the cut. For example, for deeper cuts into the blade **24**, the movement of the wheels **60** and **62** in the Y-direction may be slowed, and for shallower cuts, the movement of the wheels **60** and **62** in the Y-direction may be increased. Such arrangements limit wear and service time of the cutting wheels **60** and **62**.

[0082] If the master key **22** is a single-sided key, only one of the cutting wheels **60** and **62** is engaged with the blank **24** to cut the key pattern **36**. The logic may make a determination on whether the left **60** or right **62** cutting wheel is to be utilized based on the captured image of the key blank **24**. The user may insert the blank **24** into the slot **20** without regard to the orientation of the blade **24**. The logic may determine from the captured image whether the key pattern should be cut into the left edge or the right edge of the key blank **24** based on the contour and shape of the shoulder **30** of the blade **32**, the tip of the blade **32**, or any other characteristic that may distinguish the edges of the blade **32**.

[0083] Once the key pattern is cut into the key blank **24**, the top clamp member **66** may be lifted along the Z-axis, releasing the newly-cut key. The newly-cut key remains secured by the retention mechanism **19**. The newly-cut key may be returned to the imaging zone by moving the retention mechanism panel **21** to the right along the Y-axis. A new image of the newly-cut key may be captured and compared to the captured image of the master key **22**. Logic may utilize such a comparison to validate that the newly-cut key is within acceptable deviation from the master key **22**. The deviation of the newly-cut key as compared to the master key **22** may be quantified by any statistic method. For example, a number of measurements along the key pattern **36** of the master key and the key pattern of the newly-cut key may be taken and quantified. The average difference of the comparable measurements may be used to calculate an average difference and compare that average difference to a predetermined limit. The results of such a validation may be displayed to the user on the touch-screen monitor **40** or otherwise output to the user.

[0084] Once the validation is completed, the user may lift the spring-biased door clamp **14** using the handle **18** and remove the newly-cut key from the slot **20**. The logic may be

arranged to retain the captured image of the master key **22** for a period of time, such that the user may place another proper key blank **24** into the slot **20** and cut yet another duplicate key. If no additional duplicate keys are required, the logic may discard the captured image of the master key **22** and prepare to receive another master key **22** and begin the duplication process anew. Such processes may be driven by the logic with regard to time limits or may be driven by the user inputting information through a touch screen or other user interface.

[0085] When a newly-cut key is removed from machine, the user may de-burr the key by inserting the blade of the newly-cut key into the de-burring slot **44**. As shown in Figures 16 and 17, a pair of de-burring brushes **86** may be secured to an interior surface **88** of the shaving drawer **42** and proximate to the de-burring slot **44**. The brushes **86** are positioned such that the blade of the newly-cut key engages the brushes as the blade is inserted into the slot **44**. As seen in Figure 17, the brushes may be square and secured to an interior surface **88** of the shavings drawer **42** with fasteners **90** such as, for example, a bolt and nut combination. Such a fastening arrangement allows for efficient exchanging of de-burring brushes **86**. In addition, the square shape of the brushes **86** allows the brushes **86** to be rotated or flipped as one side of a brush **86** becomes worn due to repeated use, thus increasing the service life of a brush **86**. Such an arrangement may provide for sixteen unique positions for the pair of brushes **86**.

[0086] As described above, the process of cutting duplicate keys relies on the movement of numerous interior components, mechanisms, and systems. Such movement is generally facilitated through a number of motors mounted within the key duplication machine **10**. Figures 18 and 19 illustrate the interior of the machine **10** as viewed from the rear of the machine **10**. As shown in Figures 18 and 19, the key duplication machine **10** includes nine independent motors to facilitate movement within the machine **10**.

[0087] A retention mechanism slide motor **92** is coupled to the retention mechanism panel **21** to move the retention mechanism panel **21** along the Y-axis. Such movement occurs as a key blank **24** is moved between the imaging zone and the cutting zone.

[0088] A first slide motor **94** is coupled to both the right cutting wheel **62** and the right positioner finger **74** to move the right cutting wheel **62** and the right positioner finger **74** along the Y-axis. A second slide motor **96** is coupled to both the left cutting wheel **60** and the left positioner finger **72** to move the left cutting wheel **60** and the left positioner finger **72**

along the Y-axis. Such movement of the positioner fingers 72 and 74 and the cutting wheels 60 and 62 occur under a number of conditions. For example, when the fingers 72 and 74 are engaged with the blade 32 of a key blank 24, movement of the fingers 72 and 74 along the Y-axis may move the blank 24 between the imaging zone and the cutting zone. In another example, when a key blank 24 is secured in the clamping assembly 64 and the fingers 72 and 74 are rotated out of engagement with the blade 32, the cutting wheels 60 and 62 may be independently moved along the Y-axis to facilitate the cutting of the key pattern 36 into the blade 32.

[0089] A third slide motor 97 is coupled to both the left 60 and right 62 cutting wheels to move the cutting wheels 60 and 62 together along the X-axis. Such movement along the X-axis occurs as the wheels 60 and 62 move along the length of the blade 32 to cut the key pattern 36 into the blade.

[0090] A first rotational motor 98 is coupled to the right cutting wheel 62 to rotate the right cutting wheel 62 about the X-axis as the wheel 62 cuts a key pattern 36 into the right edge of a key blank 24 blade 32. A second rotational motor 100 is coupled to the left cutting wheel 60 to rotate the left cutting wheel 60 about the X-axis as the wheel 60 cuts a key pattern 36 into the left edge of a key blank 24 blade 32.

[0091] A third rotational motor 102 is coupled to the right positional finger 74 to rotate the finger 74 about the X-axis to engage and disengage the finger 74 with the blade 32 of the key blank 24. A fourth rotational motor 104 is coupled to the left positional finger 72 to rotate the finger 72 about the X-axis to engage and disengage the finger 72 with the blade 32 of the key blank 24.

[0092] A clamp motor 106 is coupled to the top clamp member 66 to move the top clamp member 66 along the Z-axis. Such movement clamps and unclamps a key blank 24 in the clamp assembly 64 prior to and after the cutting of key patterns 36 into the blade 32 of a blank 24.

[0093] The key duplication machine 10 as described herein may be designed and fabricated as an assembly of modular components. In an embodiment, as shown in Figures 20 and 21, the machine 10 may be assembled from five modular components. Such modular components may include a base module 110, a front panel module 112, a hood module 114, a computer module 116, and a support plate module 118. The base module 110 supports the machine 10

and may provide structural support for the mounting or holding of components such as, for example, the shavings drawer **42** and the lighting panel **52**. The front panel module **112** may provide structural support for the mounting or holding of components such as, for example, the door clamp **14**, base **16**, handle **18**, retention mechanism panel **21**, and retention mechanism slide motor **92**. The hood module **114** may provide structural support for the mounting or holding of components such as, for example, the monitor **40**, wiring chassis, and power supplies. The computer module **116** may provide structural support for the mounting or holding of components such as, for example, a hard drive, a central processing unit, circuit boards, logic units, and other such computer related components. The support plate module **118** may provide structural support for the mounting or holding of internal components of the machine **10**. For example, the support plate module **118** may support a number of motors, such as the rotational motors **98**, **100**, **102**, and **104** for rotating the cutting wheels **60** and **62** and positioner fingers **72** and **74**; slide motors for positioning the wheels and positioner fingers **94**, **96**, and **97**; and the clamp motor **106**. In addition, the support plate module **118** may support components such as the optical imaging device **50**, reflector plate **54**, the cutting wheels **60** and **62**, positioner fingers **72** and **74**, etc. Such modular design and assembly increases the ease of manufacture, assembly, and maintenance of a key duplication machine **10**.

[0094] The process of duplicating a key using the key duplication machine **10** as described above may be facilitated through the interaction of a user with a user interface. For example, the user may be given a number of optional methods for identifying a proper key blank for the duplication of a master key. Such options may be displayed on a user interface such as, for example, a touch-screen monitor. Once displayed on a touch-screen monitor, the user may initiate the duplication process by manually selecting one of the offered options. A first option may request that the key duplication machine determine the proper key blank by taking a photograph of the master key, as described herein, and comparing the physical characteristics of the master key to a database containing physical characteristics of key blanks. The results of such a comparison may yield more than one potentially appropriate key blank. As illustrated in Figure 22, the user interface may graphically display two or more key blanks that may be used to duplicate the master key. The user may select the preferred key blank by touching a graphic representation of one of the key blanks **200** and **202**. Alternatively, the user may select a graphic **204** indicating the user intends to insert another master key into the machine.

[0095] Another option for identifying a proper key blank for the duplication of a master key is for a user to provide specific known information regarding the master key. As shown in Figure 23, the user may enter specific information regarding a master key through a touch-screen monitor. The user may select specific information regarding a key from a dynamically populated selection box **206**. The user may utilize the selection box to provide information such as the category of the key (automobile, house, padlock, etc.), the use, the make, the model of lock, the year lock was manufactured, the name of the manufacturer, or the part number of key or lock. The user may toggle the information displayed in the selection box **206** by touching buttons **208** associated with the different types of information. The user may select information for the selection box **206** by simply touching the correct information in the selection box **206**.

[0096] Figure 24 illustrates a user interface directed specifically to automobile keys. The user may enter specific information regarding an automobile master key to identify the proper key blank. The user may select information such as automobile make, model, and model year from a dynamically populated selection box **210**. The information in the selection box **210** may be toggled by touching an automobile make button **212**, an automobile model button **214**, and a model year button **216**.

[0097] In each of the options described above, specific information entered by the user may be compared to a database containing information regarding key blanks. Such a comparison may be used to identify the proper key blank. Once the proper key blank is identified, the key blank may be displayed on the user interface to inform the user which key blank should be retrieved by the user.

[0098] Regardless of the method used to identify a key blank, the machine may be arranged to warn a user that a master key to be copied may contain a computer chip, transponder, or the like. Such computer chips and transponders are common in automobile keys. Duplicates for such keys may need to include a corresponding computer chip in order for the duplicate to be successful. Once it is determined that a master key may have a computer chip, the user may be instructed to place the master key in or near a device designed to sense the presence of a computer chip in a key. If the master key does include a computer chip, the user may be instructed on how to proceed to ensure a functional duplicate key is made.

[0099] Once a proper key blank is identified and retrieved by the user, the user interface may further guide the user in duplicating the master key and displaying the progress of duplication of the key. As shown in Figure 25, a list of actions **218** may be displayed on the user interface. The first action shown instructs the user to load a key blank. The user may remove the master key and insert the proper key blank and press a box **220** to initiate the key duplication process. The key duplication machine **10** may then proceed with additional actions such as scanning the blank and verifying the proper blank is loaded, positioning the key blank to insure proper alignment, cutting the key blank, etc. As shown in Figure 26, as actions are completed, checks may be displayed in boxes **222** to indicate that an action has been completed. The user interface may also include a graphic to terminate the cutting process. For example, a user may touch a graphic of a stop sign **224** to stop the cutting process.

[0100] In an embodiment, best illustrated in Figures 27-29, the key duplication machine **10** may include a read/write device **226** to interface with a microchip or circuit board embedded within a key. The read/write device **226** may be any type of transponder or receiver, such as an antenna. While the read/write device **226** will be referred to as an antenna **226**, it will be appreciated that the read/write device **226** may be any read/write device known in the industry.

[0101] The antenna **226** may be positioned on the key duplication machine **10** to interface with a master key **22** or key blank **24** located in the slot **20**. For example, the retention mechanism panel **21** may include an outer shell **228** disposed about the slot **20**. The outer shell may comprise an opening **230**. The opening **230** may be any appropriate size or shape, such as circular, square, or any other appropriate shape. The opening **230** may surround the slot **20** allowing a key to be passed through the opening **230** into the slot **20**.

[0102] The antenna **226** may be positioned about the opening **230**. For example, as illustrated in the cut-away view of Figure 29, the antenna **226** may be embedded in the outer shell **228**, such as wrapped about a circular opening **230**. The antenna **226** may surround a key inserted into the slot **20** to facilitate both reading data and information on an existing master key **22** and writing to the new key blank **24**. It will be appreciated that a single antenna **226** may be provided to perform both the read and write functions. However, in an embodiment, multiple antennas **226** may be used to perform the read and write functions at one or more frequencies.

[0103] Traditionally, chip key readers and writers were designed with the antenna disposed away from metal objects and other electronics. General consensus from designers of such read/write devices was that such objects and electronics would provide interference with the signals received and transmitted by the antenna. Interference can also occur between antennas when multiple antennas are present. After much analysis, development and experimentation, the embodiments described herein were successfully designed to integrate one or more antennas into the key load position. Specifically, in an embodiment, a pair of antenna windings is precisely disposed about the opening 230 such that the read and write functionalities are not affected by the surrounding metal or each other.

[0104] The primary reason to integrate the read/write device 226 may be to integrate the reading of the microchip or circuit board embedded within a master key 22 and write an appropriate functional code to a microchip or circuit board embedded on a key blank 24. An additional and important benefit is that the information read from a master key 22 may be used to assist in the identification of the master key 22. The database of key blanks 24 may include data related to information that may be read from a microchip or circuit board embedded with a master key 22. To facilitate the identification of a proper key blank 24, the logic may compare the data read from a master key 22 to the data stored in the database for known key blanks 24. Such comparisons can be used to help in the determination and selection of the proper key blank 24 for the master key 22.

[0105] The key duplication machine 10 may include one or more manual levers 232 for actuating the door clamp 14. As illustrated in Figures 27-29, the retention mechanism panel 21 may include two levers 232. The levers 232 may be any appropriate size and shape, such as flat and elongated. Further, the levers 232 may be positioned at any appropriate position, such as connected to the outer shell 228 and positioned above the opening 230.

[0106] In an embodiment, the key duplication machine 10 includes two levers 232. The levers 232 may be interconnected with one another at a pivot point 234. Each lever 232 may pivot about the pivot point.

[0107] The levers 232 may facilitate opening of the slot 20. For example, pressing down on the lever 232 may facilitate upward movement of the door clamp 14, while lifting up on the lever 232 may facilitate downward movement of the door clamp 14. It will be appreciated that other mechanical components, such as gears, bearings, connecting arms, and other

mechanical components may be utilized to facilitate the motion transfer from the levers **232** to the door clamp **14**.

[0108] The logic may be arranged to collect and store data regarding key duplications performed by the key duplication machine **10**. For example, data regarding the number of key duplications performed, the number of different key blanks used in key duplication, the number of an individual key blank used in key duplication, success rate of duplicating keys, and the like may be collected and stored. Such information and data may be analyzed by the logic associated with the machine **10** or be downloaded for remote analysis.

CLAIMS

We claim:

1. A key duplicating machine comprising:
a key load position to receive a key;
an antenna configured to communicate with a key located at said key load position;
and
a cutting member configured to cut a key pattern into a key blank at said key load position.
2. The machine of claim 1, wherein said antenna is configured to transmit data to said key.
3. The machine of claim 1, wherein said antenna is configured to receive data from said key.
4. The machine of claim 1, wherein said key is a master key.
5. The machine of claim 1, wherein said key is a key blank.
6. The machine of claim 1, wherein said key includes a microchip embedded therein.
7. The machine of claim 1, wherein said antenna comprises at least one pair of windings.
8. The machine of claim 1 further comprising an outer shell having an opening positioned about said key load position.
9. The machine of claim 5, wherein said opening is circular.
10. The machine of claim 5, wherein said antenna is wound about said opening.
11. The machine of claim 1, wherein said key load position comprises a base and a door clamp.

12. The machine of claim 8, wherein said door clamp is movable with respect to said base.
13. The machine of claim 9 further comprising at least one lever configured to actuate movement of said door clamp.
14. The machine of claim 1, wherein said cutting member is a cutting wheel.
15. A key duplicating machine comprising:
 - a key load position to receive a key;
 - an antenna configured to communicate with a key located at said key load position;
 - and
 - an imaging system configured to capture data related to said key at said key load position.
16. The machine of claim 15, wherein said antenna is configured to transmit data to said key.
17. The machine of claim 15, wherein said antenna is configured to receive data from said key.
18. The machine of claim 15, wherein said key is a master key.
19. The machine of claim 15, wherein said key is a key blank.
20. The machine of claim 15, wherein said key blank includes a microchip embedded therein.
21. The machine of claim 15, wherein said antenna comprises at least one pair of windings.
22. The machine of claim 15 further comprising an outer shell having an opening positioned about said key load position.

23. The machine of claim 22, wherein said opening is circular.
24. The machine of claim 22, wherein said antenna is wound about said opening.
25. The machine of claim 15, wherein said key load position comprises a base and a door clamp.
26. The machine of claim 25, wherein said door clamp is movable with respect to said base.
27. The machine of claim 25 further comprising at least one lever configured to actuate movement of said door clamp.
28. The machine of claim 15, wherein said imaging system includes a camera.

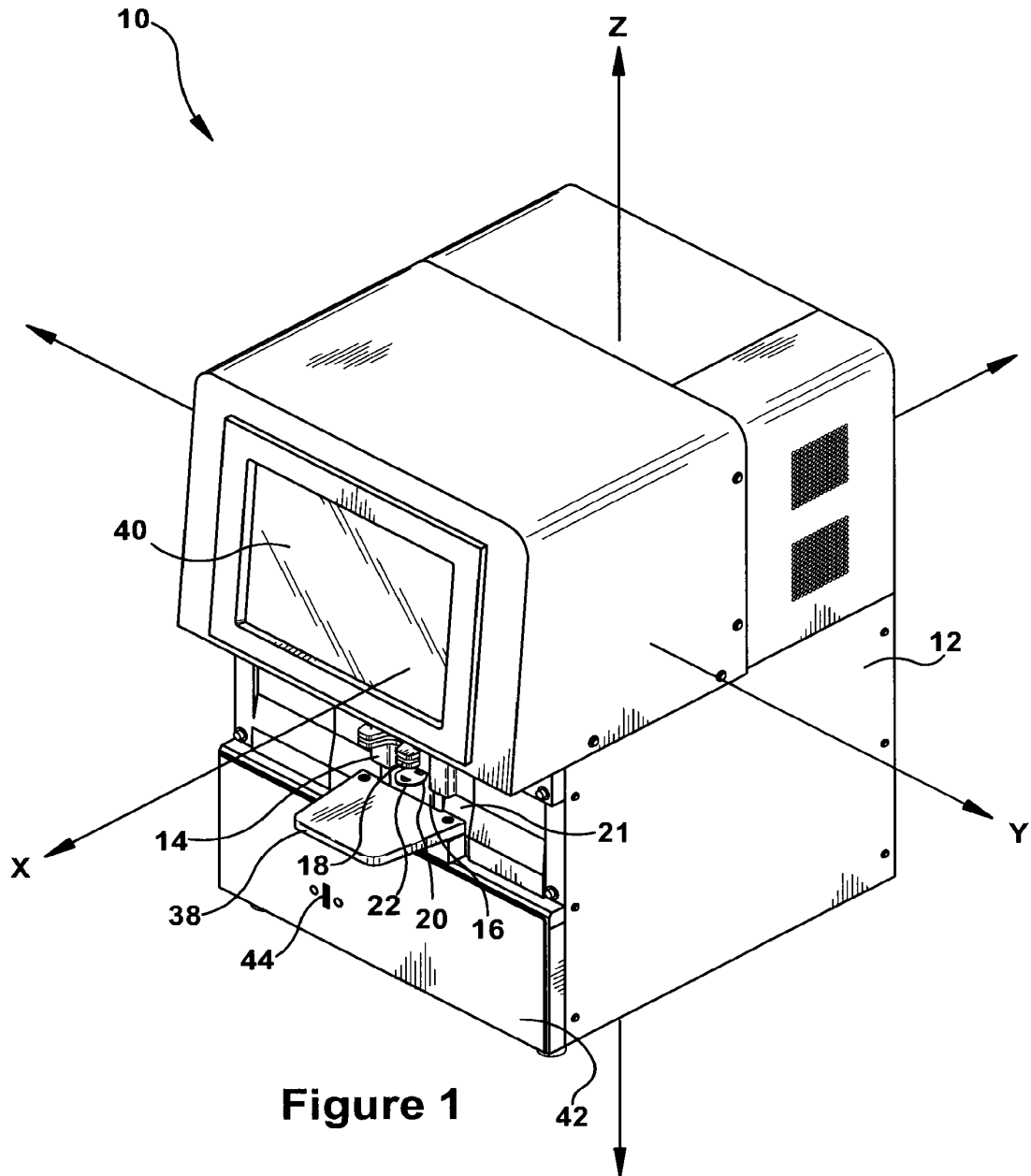


Figure 1

2/29

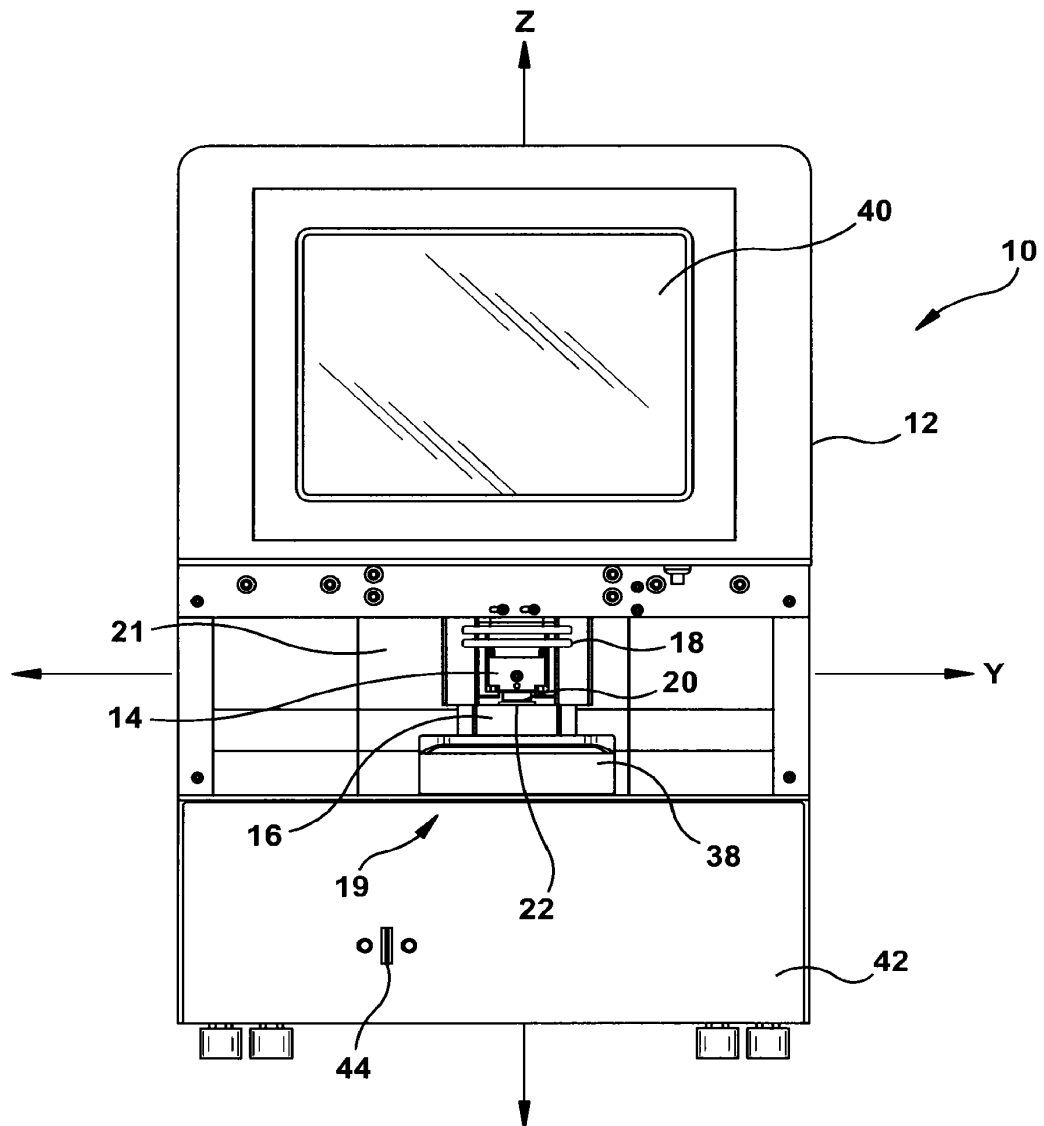


Figure 2

3/29

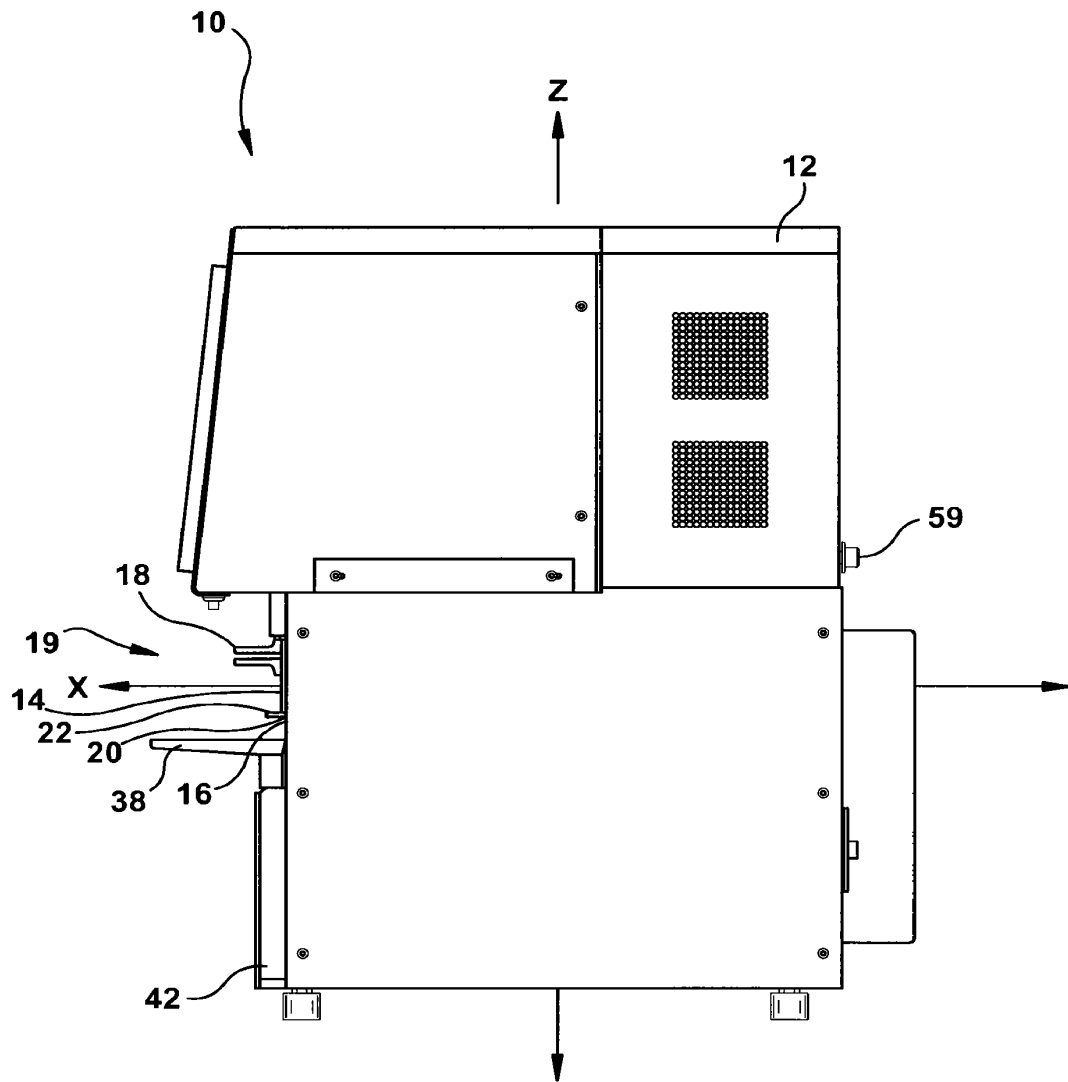


Figure 3

4/29

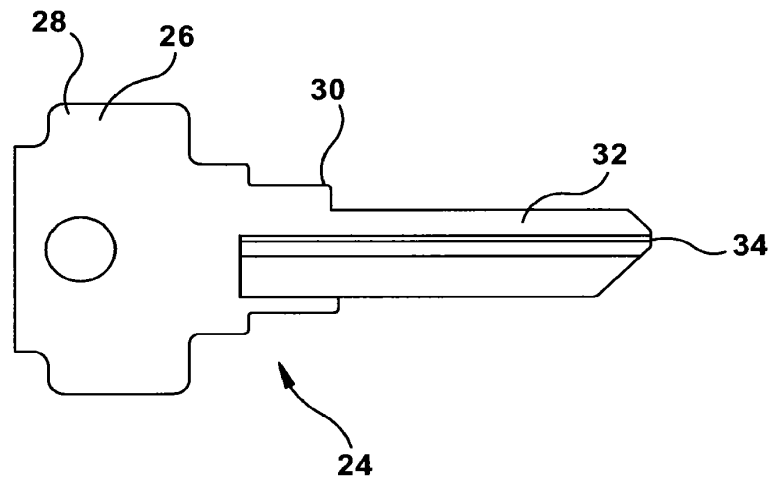


Figure 4b

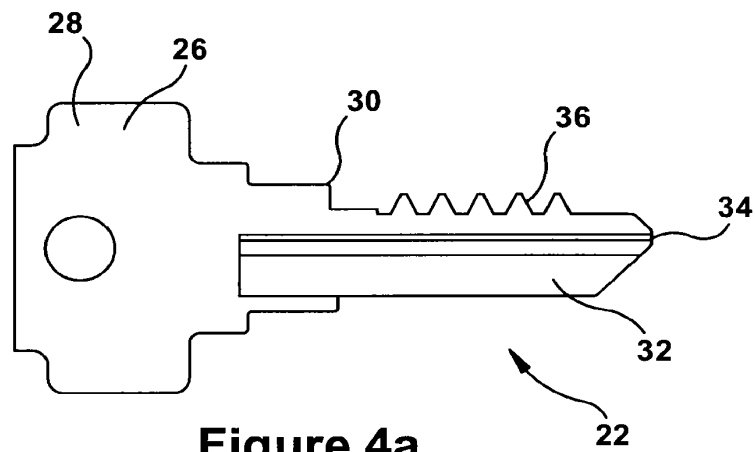


Figure 4a

5/29

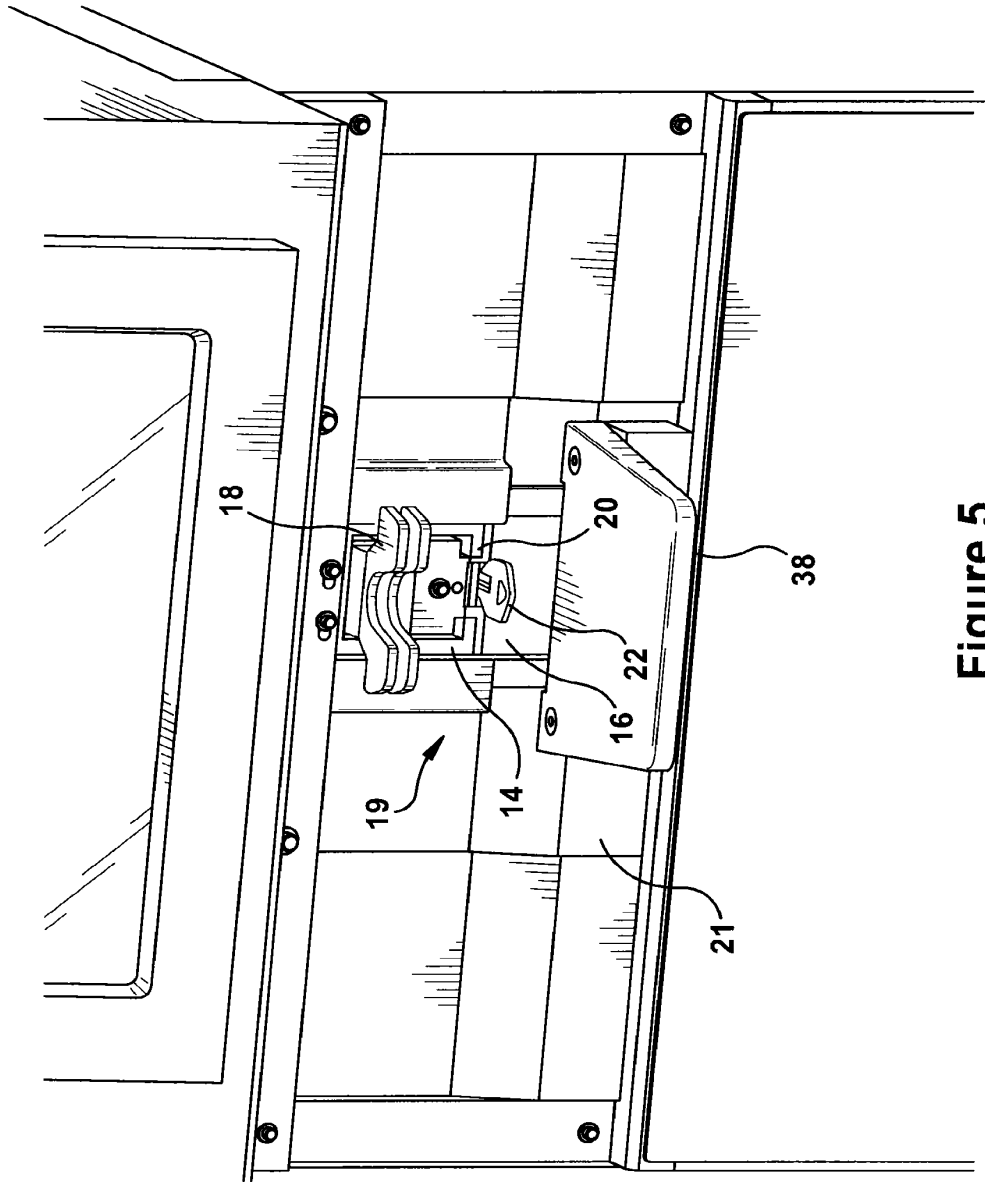


Figure 5

6/29

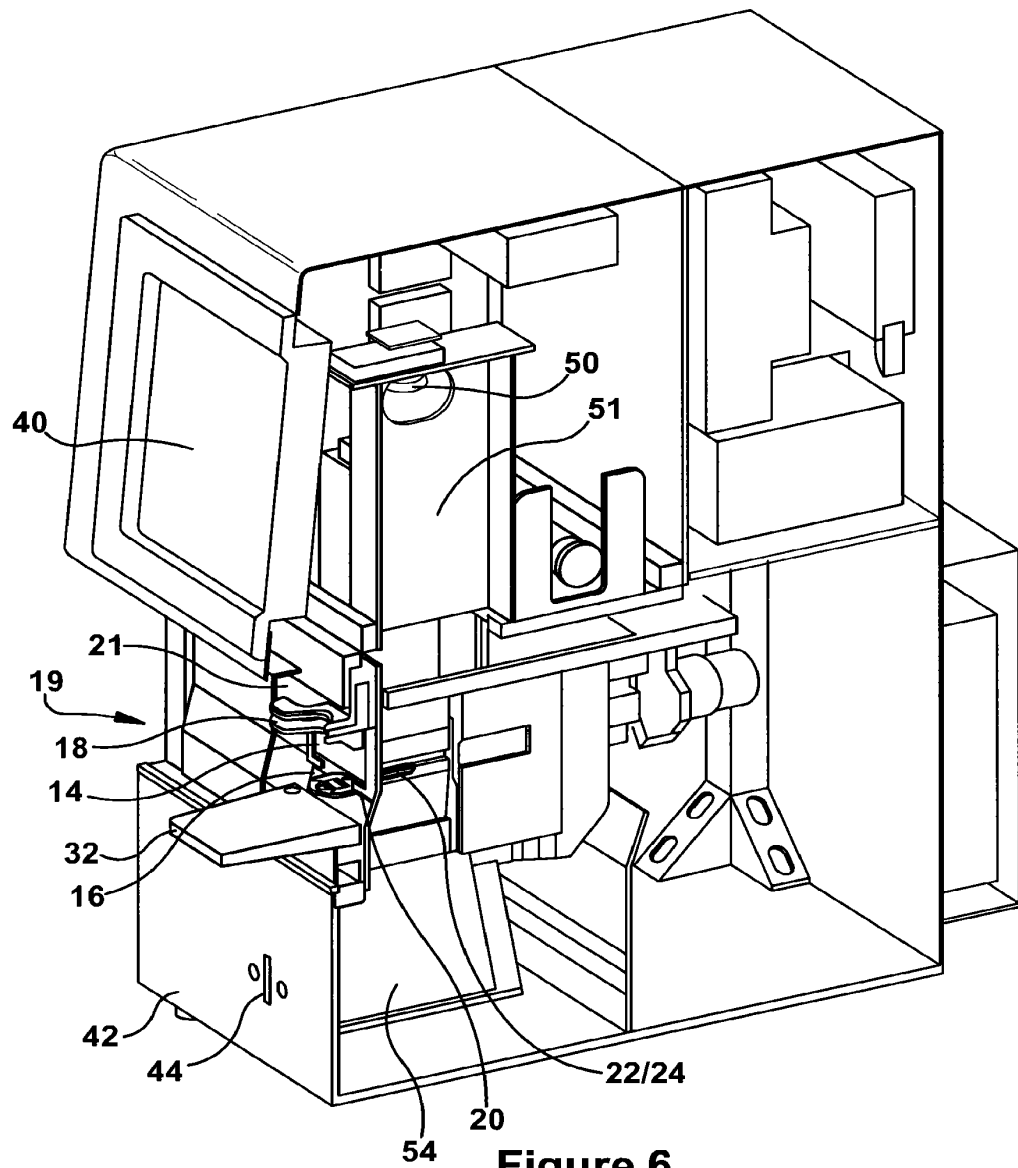


Figure 6

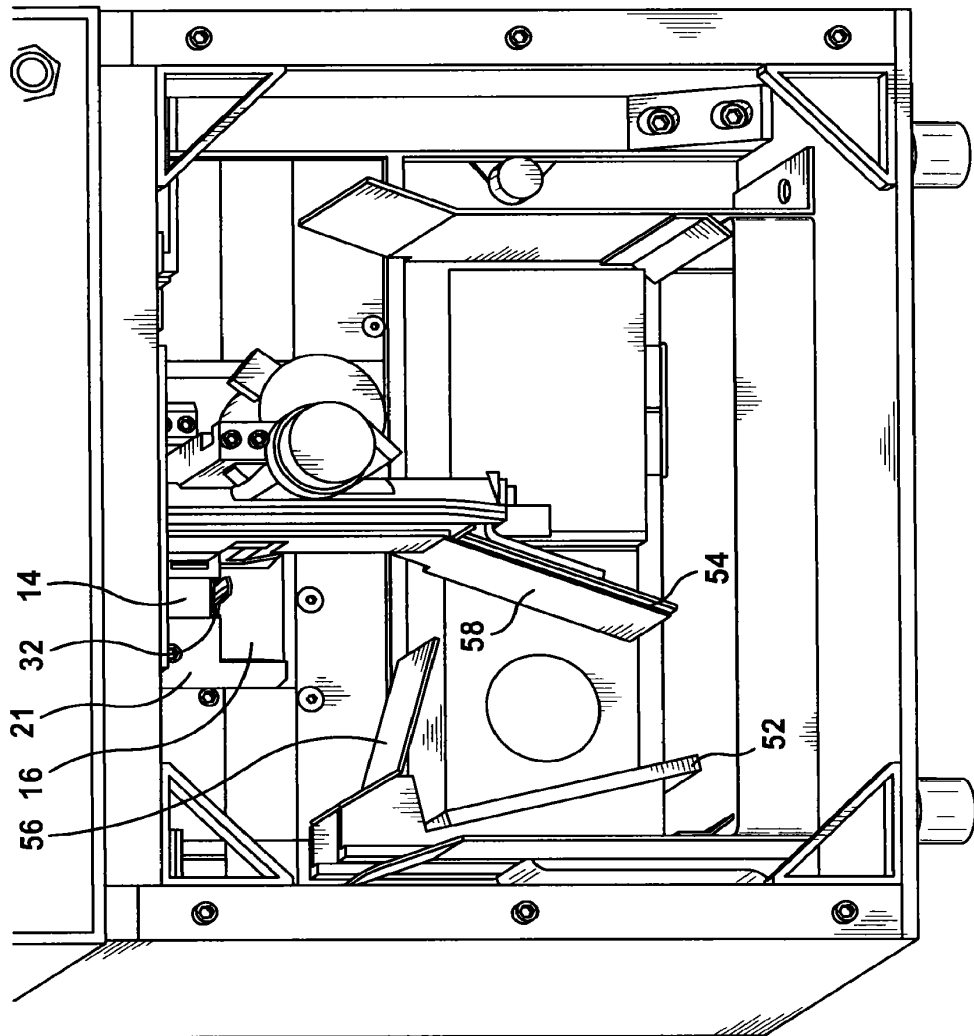


Figure 7

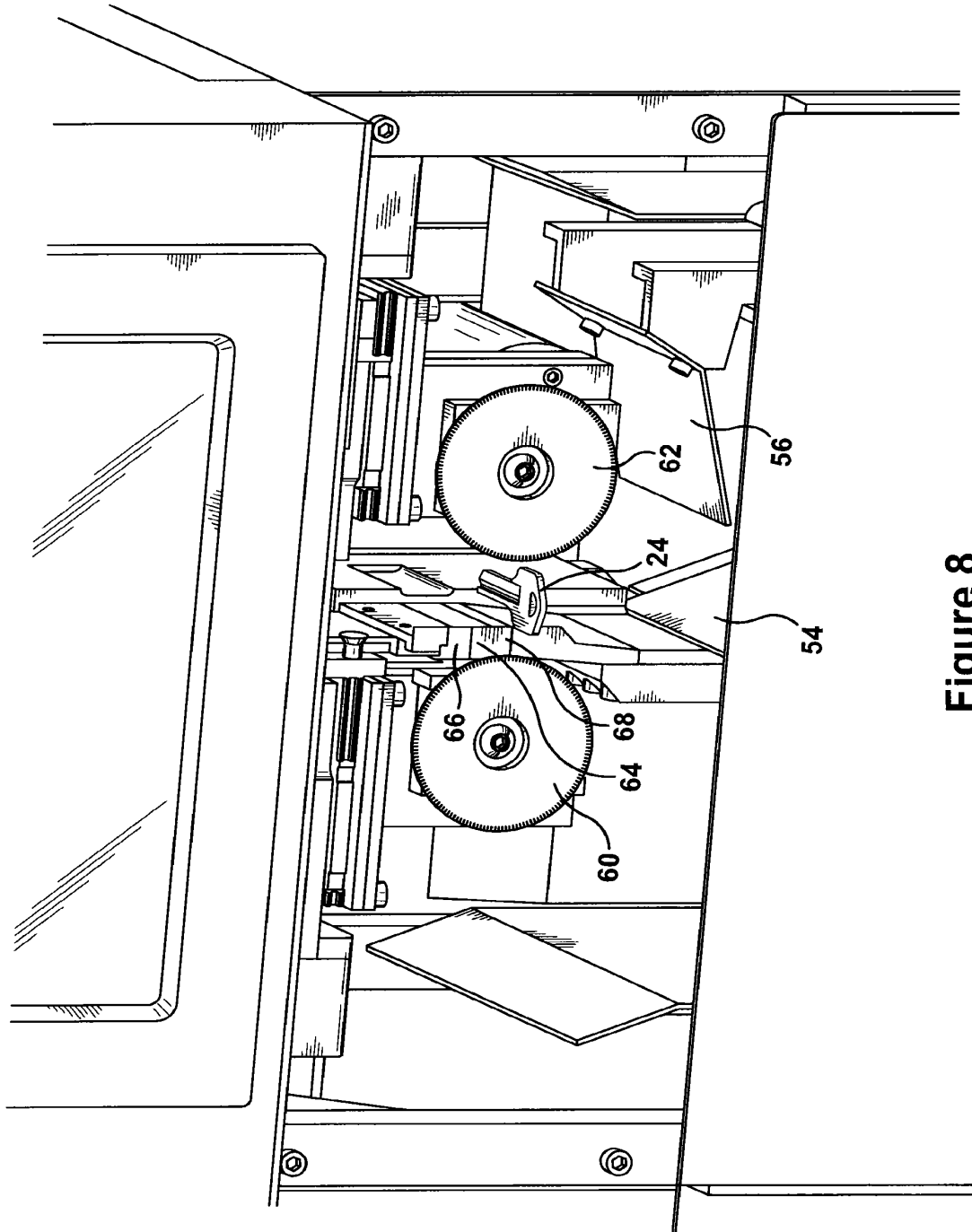


Figure 8

9/29

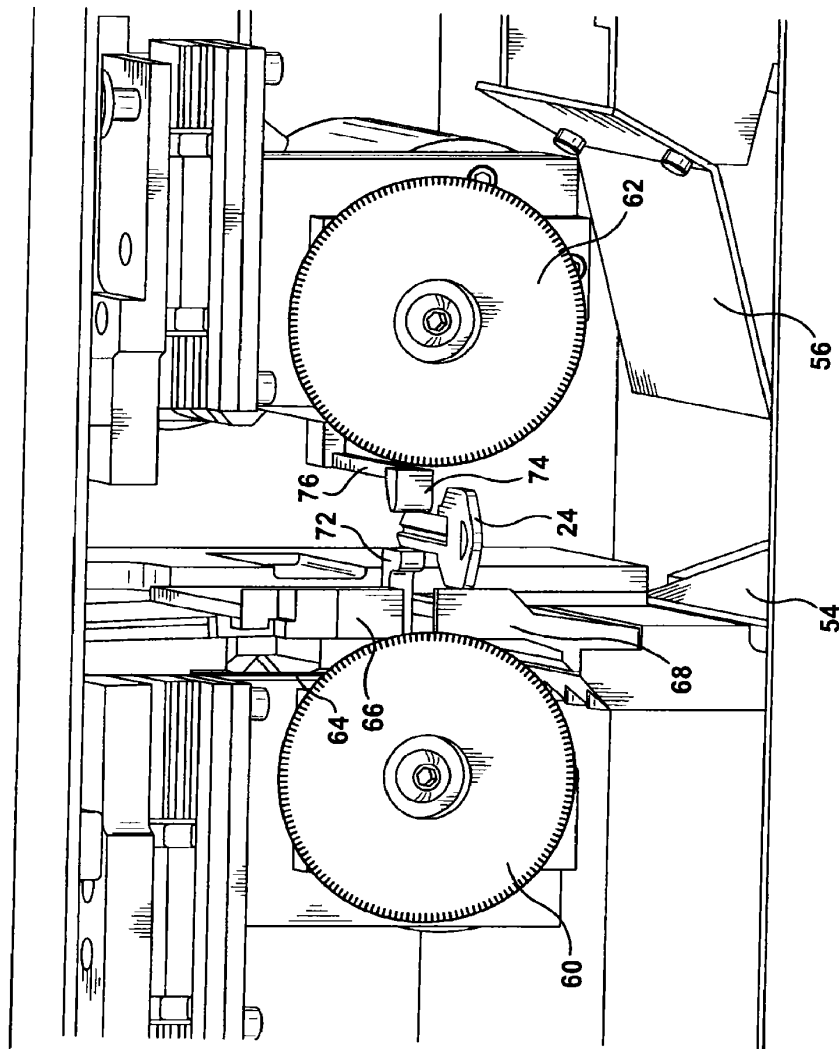


Figure 9

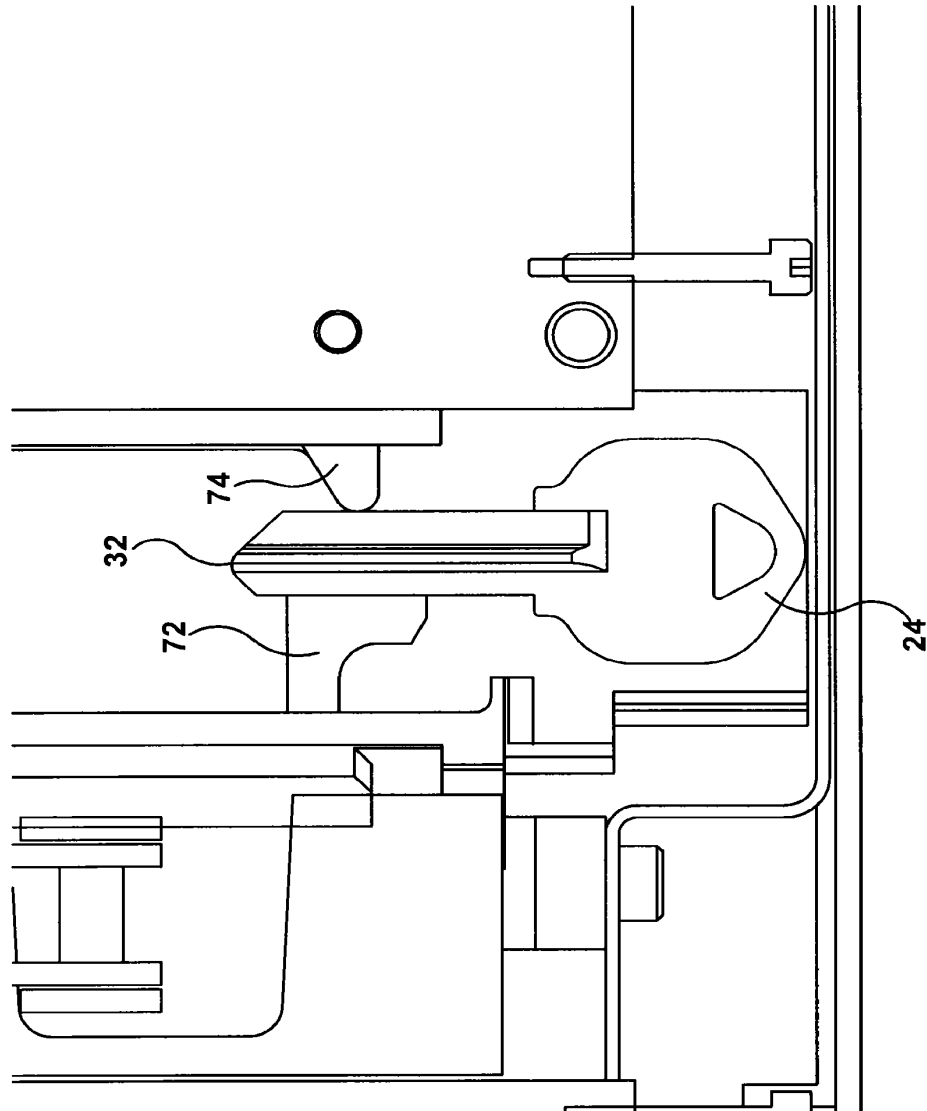


Figure 10

11/29

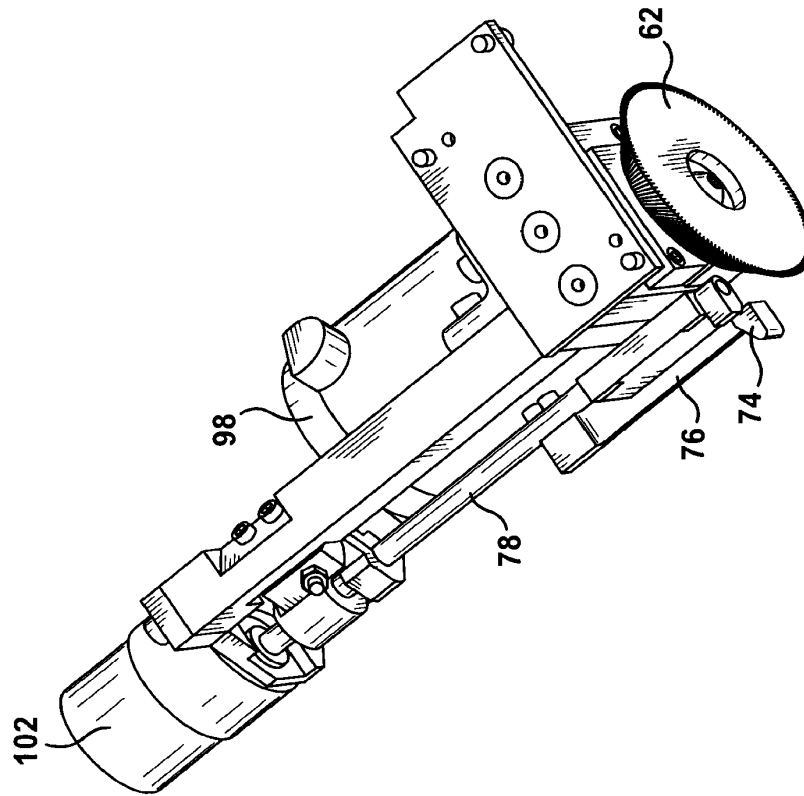


Figure 11

12/29

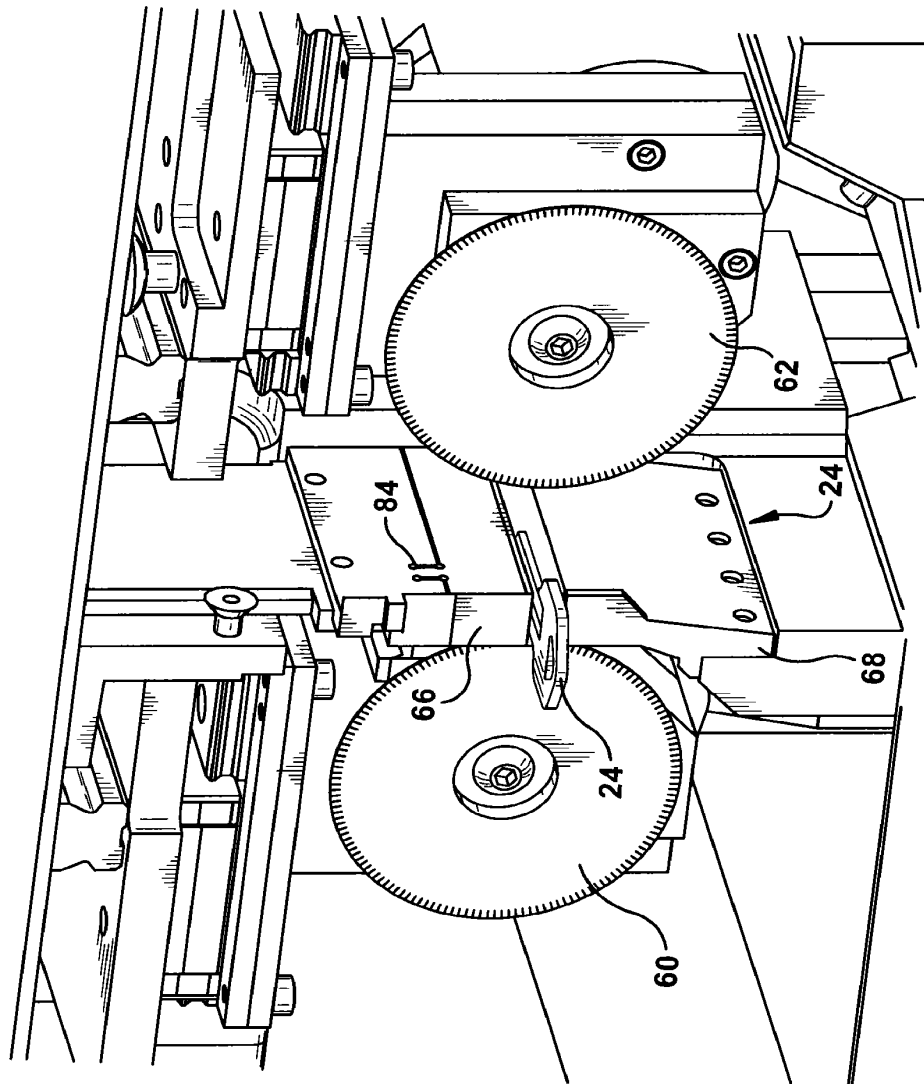


Figure 12

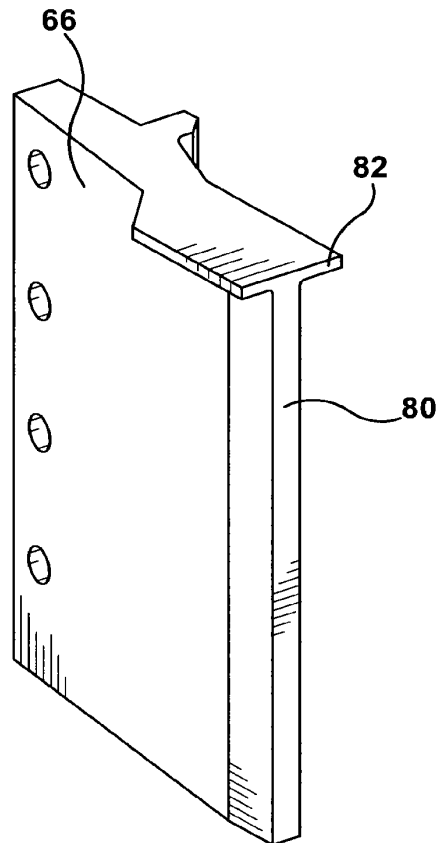


Figure 13

14/29

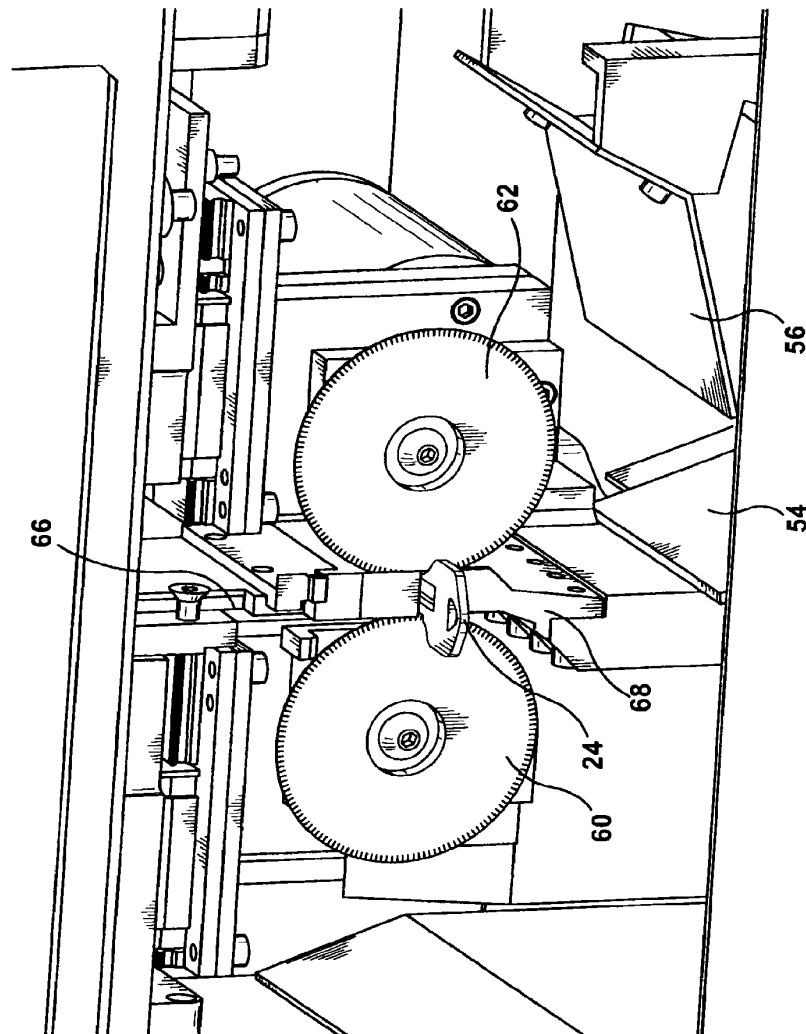


Figure 14

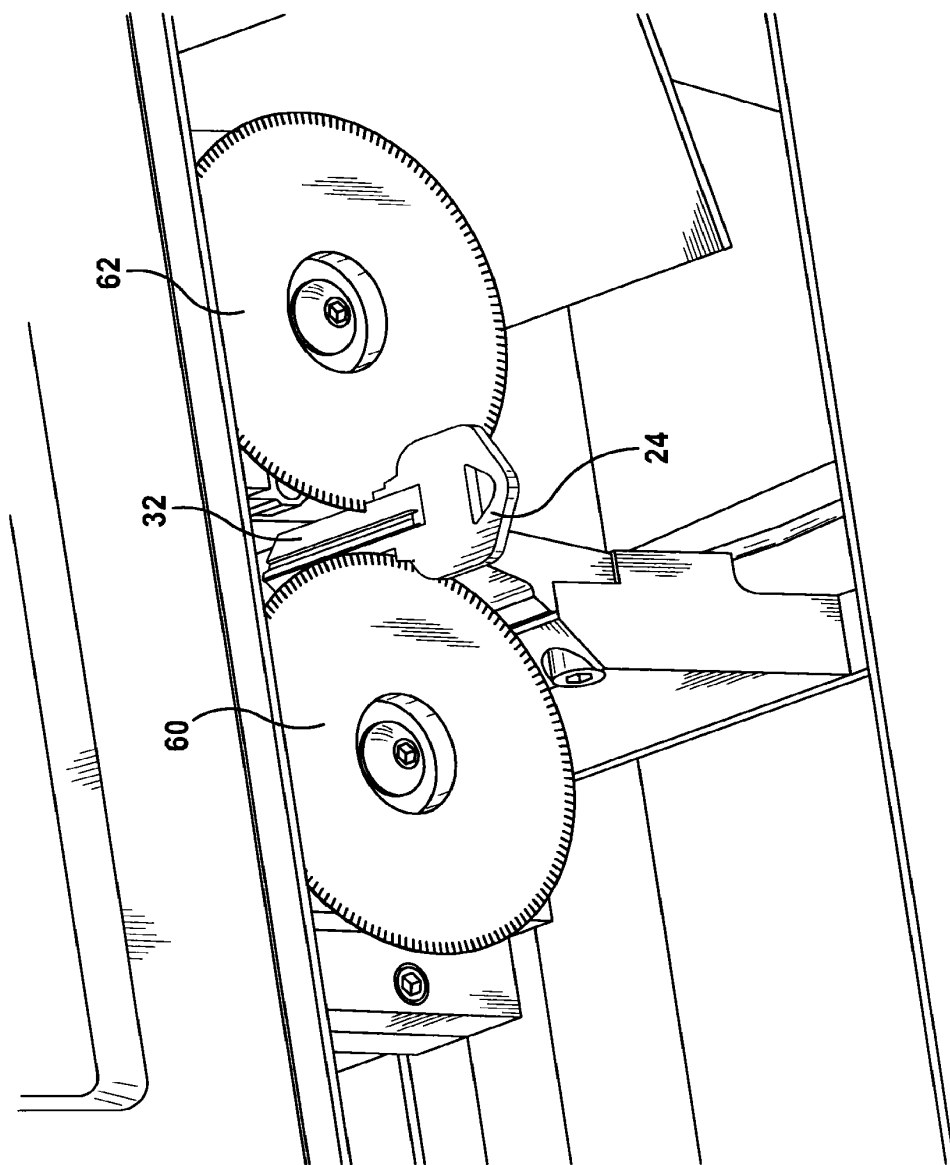


Figure 15

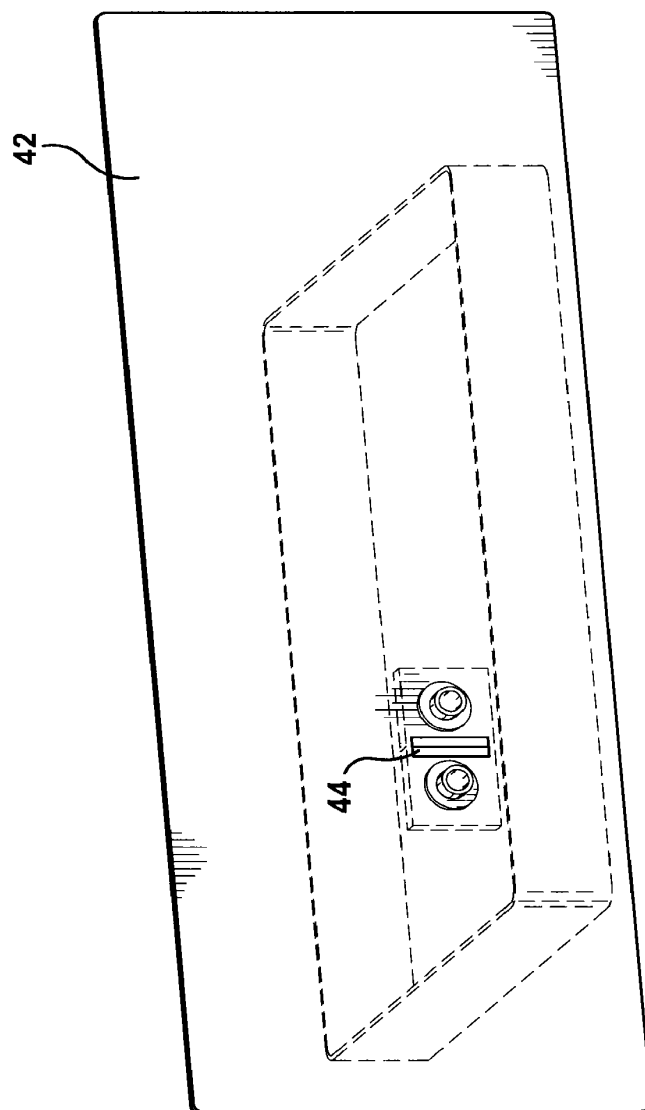


Figure 16

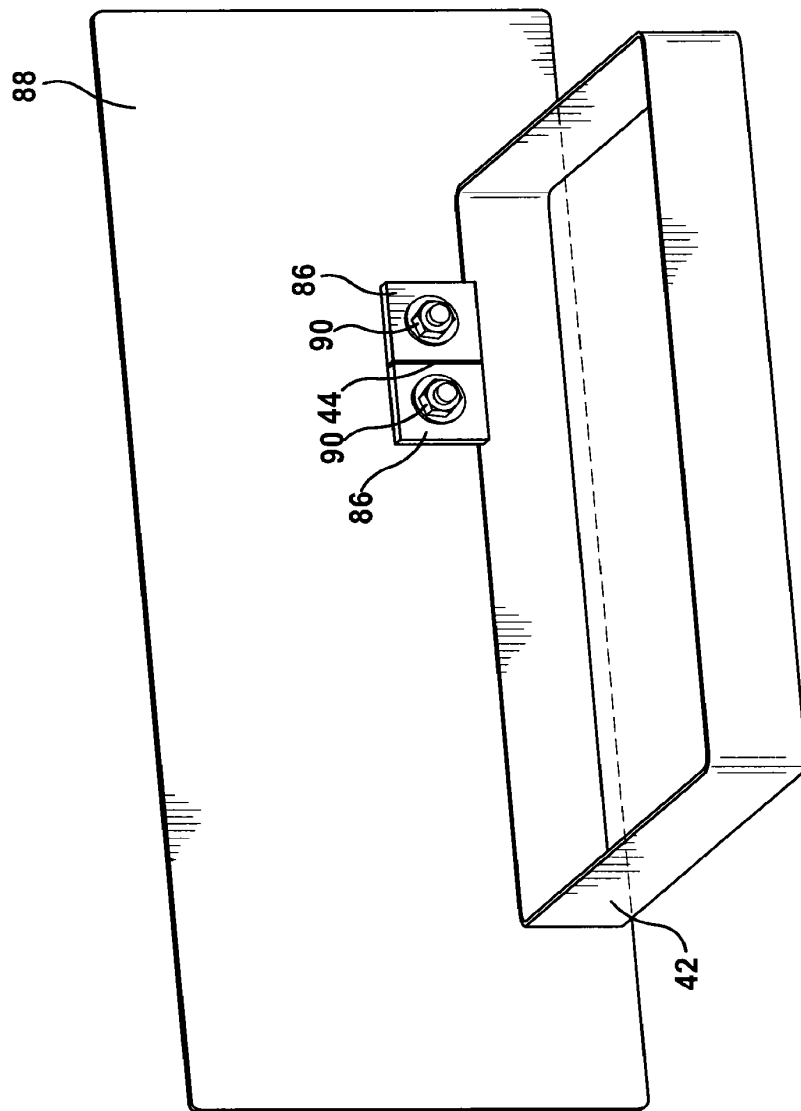


Figure 17

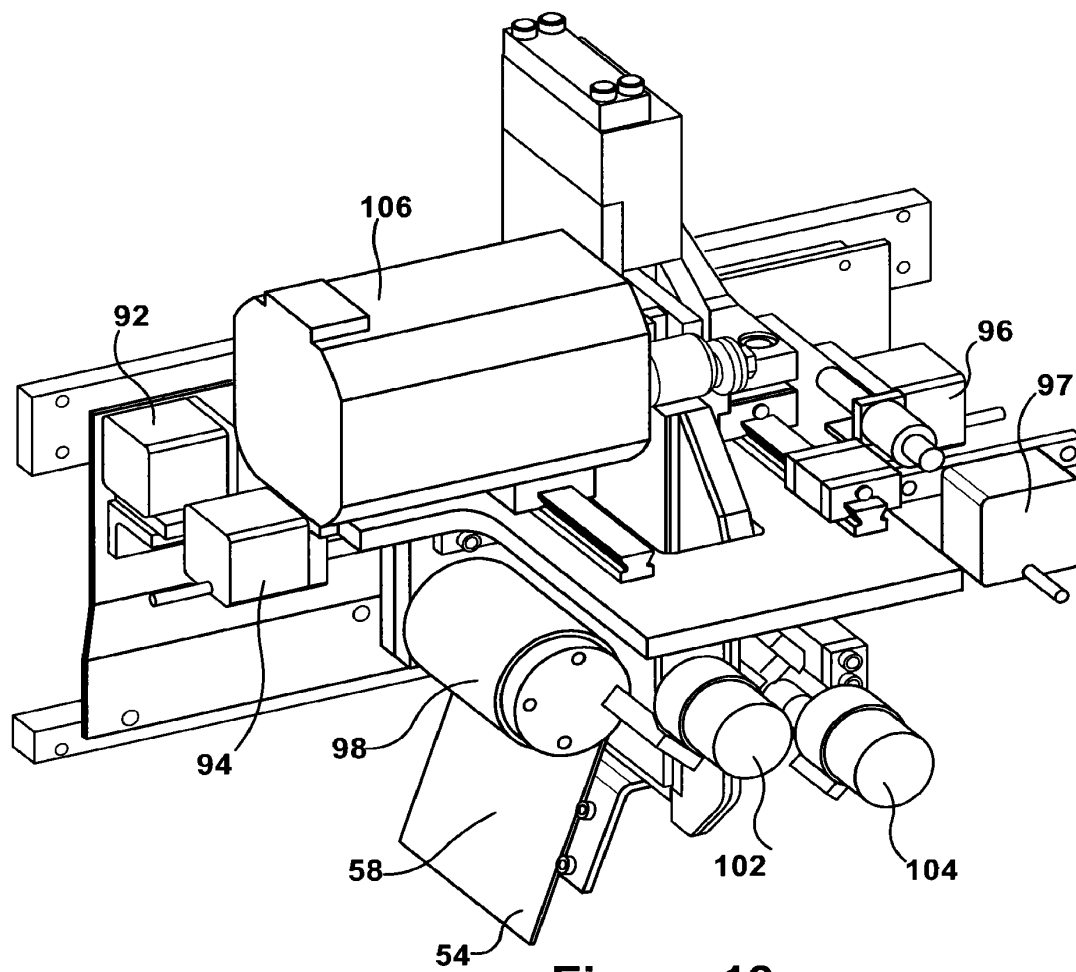


Figure 18

19/29

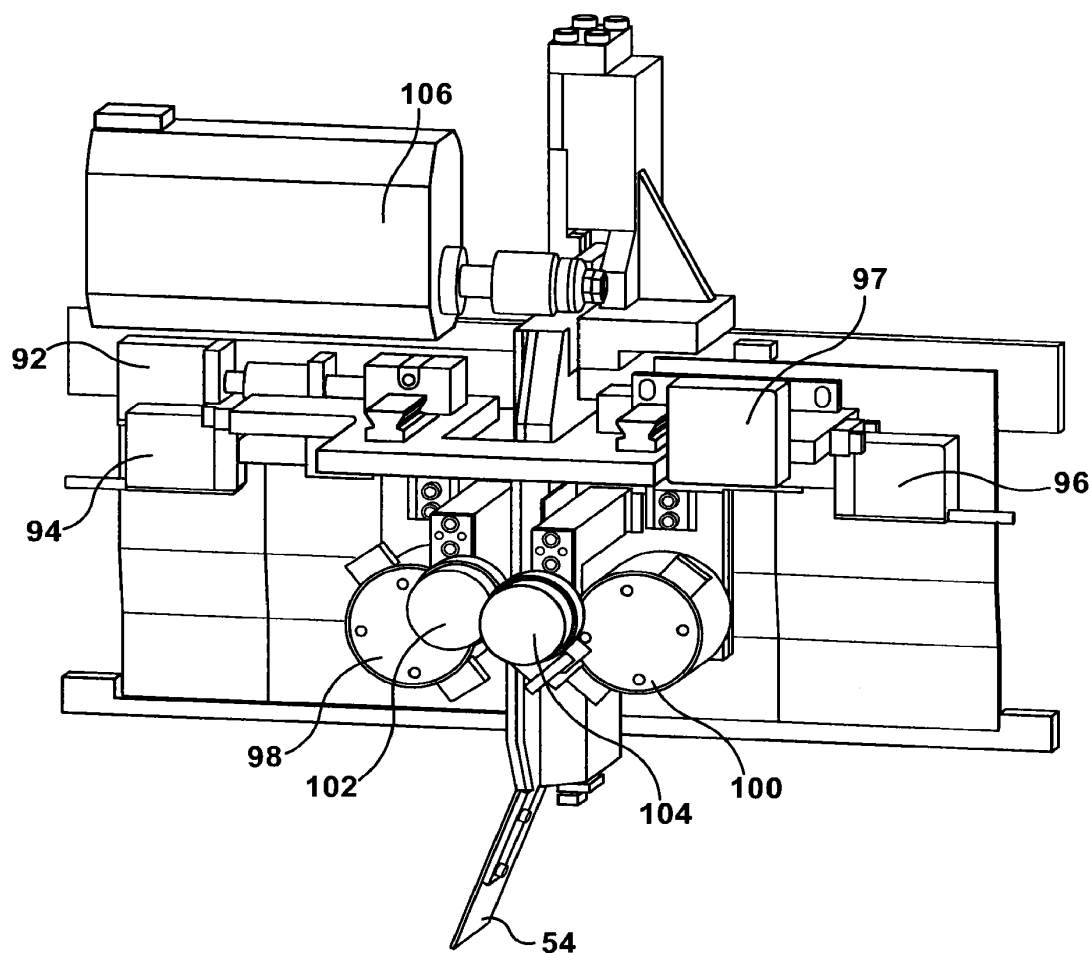


Figure 19

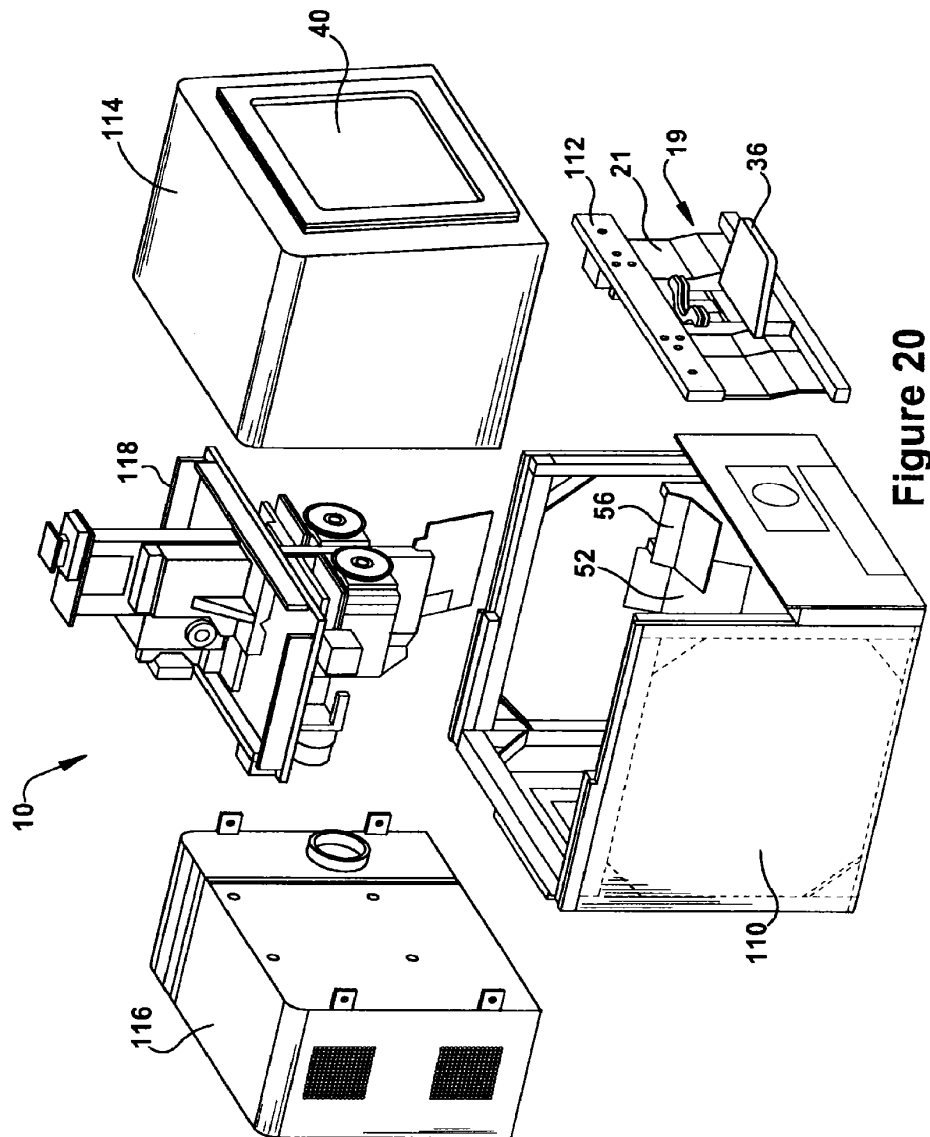


Figure 20

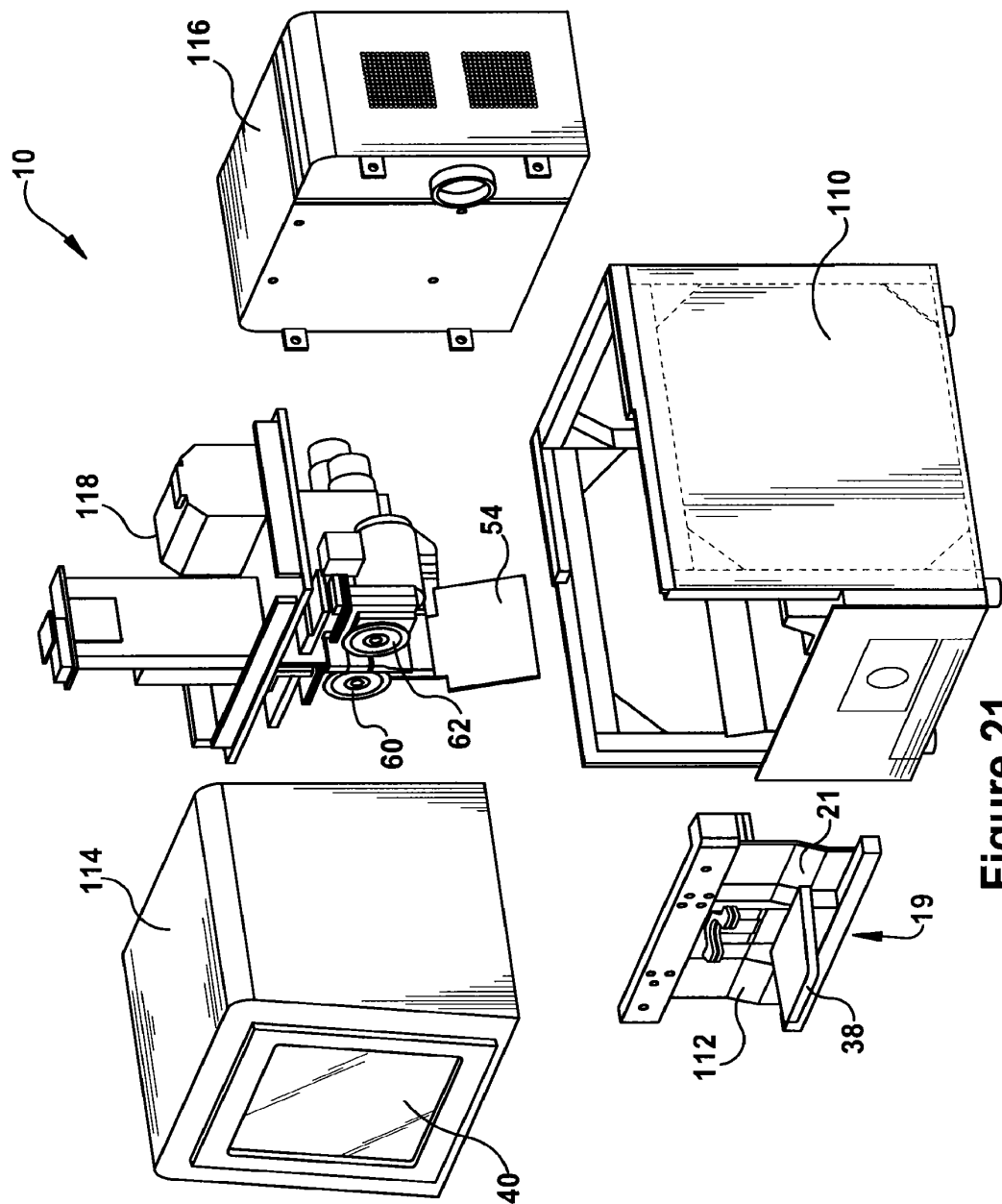


Figure 21

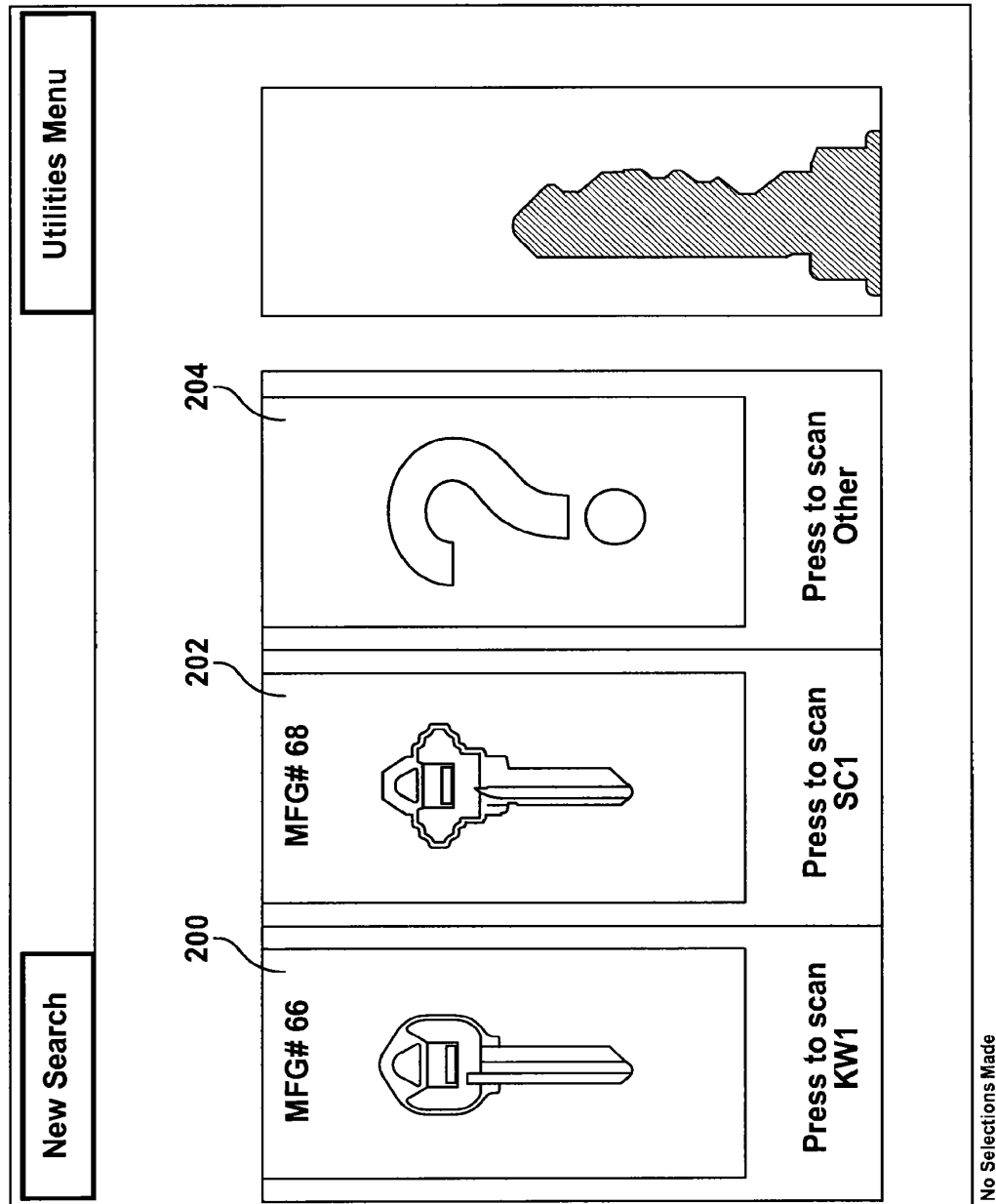


Figure 22

23/29

New Search		 2:10	Manual Lookup	Results (590)	Utilities Menu
				Categories	
				- = UNCERTAIN = -	
				Auto, Small Truck, Van	
				Heavy Truck, Ind., Farm	
				House and Building	
				Miscellaneous	
				Padlock	
				Recreational Vehicle	
Category		- = UNCERTAIN = -			
Use		- = UNCERTAIN = -			
Product/Make		- = UNCERTAIN = -			
Lock/Mode		- = UNCERTAIN = -			
Year		- = UNCERTAIN = -			
Manufacturer		- = UNCERTAIN = -			
Part Number		- = UNCERTAIN = -			

(Scanned Customer Key)

Figure 23

24/29

New Search		 2:49	Manual Lookup	Results (17)	Utilities Menu
Automotive Lookup				Makes: == UNCERTAIN == Acura Chevrolet <u>210</u> Ford Honda Hummer Lincoln Mazda Mercury Sterling Truck Suzuki	
212	Make	== UNCERTAIN ==			
214	Model	== UNCERTAIN ==			
216	Year	== UNCERTAIN ==			

(Scanned Customer Key) : Auto, Small Truck, Van

Figure 24

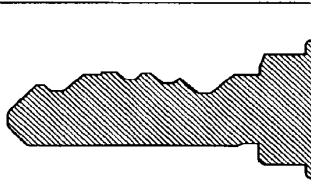
New Search

 2:50

Cut SC1 Key

Back to Results

220



Press to Start Cutting

MFG

218

☐ Load Key Blank

☐ Verifying Key Blank

☐ Positioning Key Blank

☐ Cutting Key Blank

☐ Repositioning Key Blank

☐ Validating Cut Key

☐ Completing Cycle

Duplication Successful

Remove Cut Key

Please load an uncut SC1 blank and press the 'Start Cutting' button

Figure 25


2,25

New Search

Cut SC1 Key

Back to Results

224



Press to Stop Cutting

MFG

☒ Load Key Blank

☒ Verifying Key Blank

☒ Positioning Key Blank

☐ Cutting Key Blank

☐ RePositioning Key Blank

☐ Validating Cut Key

☐ Completing Cycle

222

Figure 26

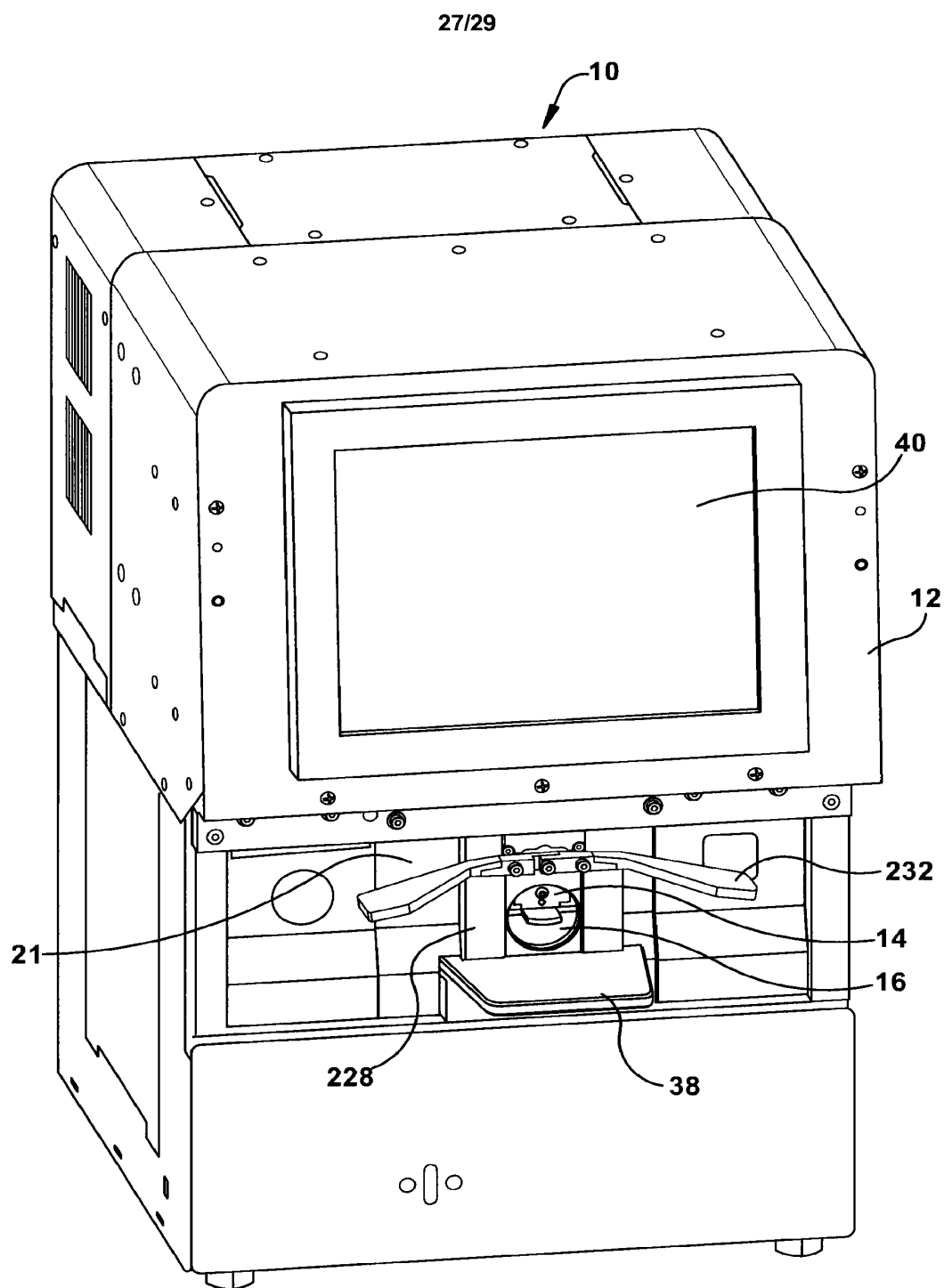


Figure 27

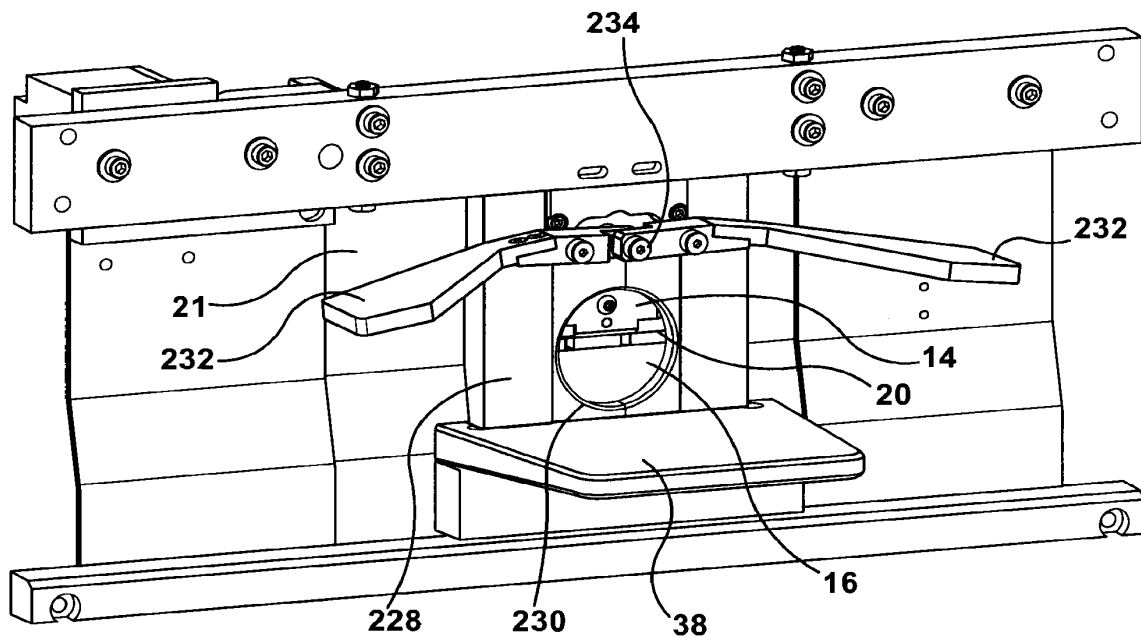


Figure 28

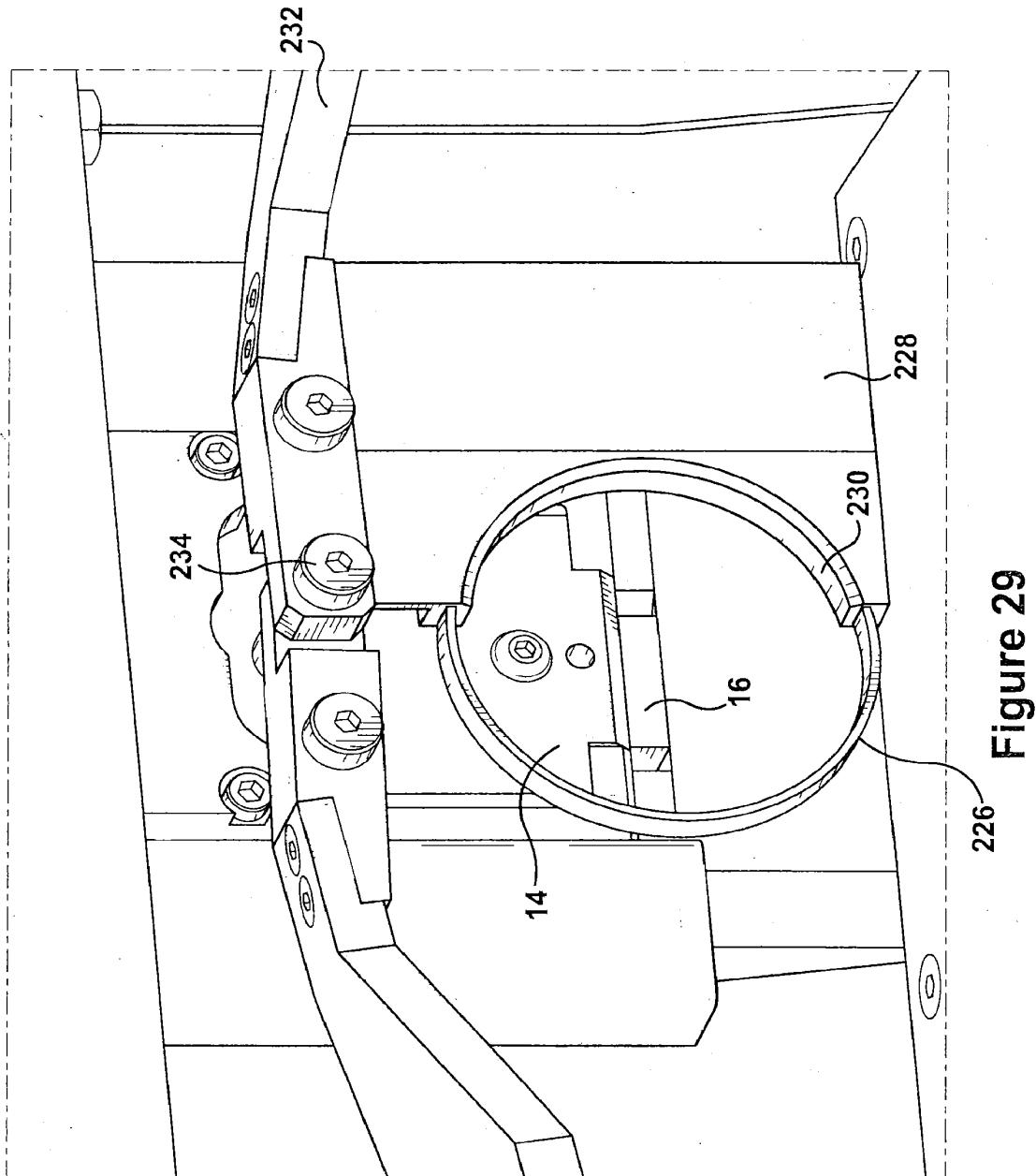


Figure 29

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2011/034564

A. CLASSIFICATION OF SUBJECT MATTER IPC(8) - B23C 3/35 (2011.01) USPC - 409/81 According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED Minimum documentation searched (classification system followed by classification symbols) IPC(8) - B23C 1/16, 3/35 (2011.01) USPC - 76/110; 83/413; 269/157; 409/81, 84, 132, 277 Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) PatBase, Google Patents		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2007/0224008 A1 (BASS et al) 27 September 2007 (27.09.2007) entire document	1-6, 8, 11-12, 14-20, 22, 25-28

Y		7, 9-10, 13, 21, 23-24
Y	US 2008/0252551 A1 (KUBO et al) 16 October 2008 (16.10.2008) entire document	7, 21
Y	US 2,274,012 A (SWAYZE et al) 24 February 1942 (24.02.1942) entire document	9-10, 13, 23-24
A	US 5,676,504 A (MUELLER et al) 14 October 1997 (14.10.1997) entire document	1-28
☐ Further documents are listed in the continuation of Box C. ☐		
* Special categories of cited documents: "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier application or patent but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family		
Date of the actual completion of the international search 08 July 2011		Date of mailing of the international search report 15 JUL 2011
Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-3201		Authorized officer: Blaine R. Copenheaver PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774

Form PCT/ISA/210 (second sheet) (July 2009)

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
2 August 2007 (02.08.2007)

PCT

(10) International Publication Number
WO 2007/087389 A2

(51) International Patent Classification:
B23C 1/16 (2006.01)

(21) International Application Number:
PCT/US2007/002015

(22) International Filing Date: 23 January 2007 (23.01.2007)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
60/761,293 23 January 2006 (23.01.2006) US

(71) Applicant (for all designated States except US): **HY-KO PRODUCTS COMPANY** [US/US]; 60 Meadow Lane, Northfield, OH 44067 (US).

(72) Inventors: **BASS, Michael, A.**; 17552 Lakesedge Trail, Chagrin Falls, OH 44023 (US). **MUTCH, William, R.**; 35284 Nikki Avenue, North Ridgeville, Ohio 44039 (US). **RYAL, Richard, W., Sr.**; 12496 Athena Drive, North Royalton, OH 44133 (US). **THOMPSON, Chester, O. D.**; 7377 Amanda Place, Painesville, OH 44077 (US).

DRAKE, Robert, E.; 2828 Stark Drive, Willoughby Hills, OH 44094 (US). **PORRAS, Randall, A.**; 5918 Porter Road, North Olmsted, OH 44070 (US).

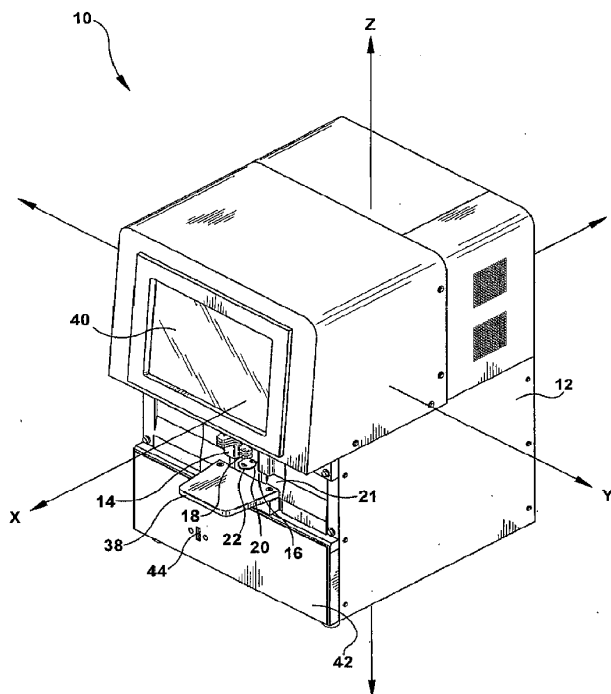
(74) Agent: **PRIBISICH, Risto**; McDonald Hopkins LLC, 600 SUPERIOR AVENUE, E., Suite 2100, Cleveland, OH 44114 (US).

(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LV, LY, MA, MD, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM),

[Continued on next page]

(54) Title: KEY DUPLICATION MACHINE



(57) Abstract: Apparatus, methods, and other embodiments associated with a key duplication machine are described. In one embodiment, an assembly for duplicating a master key includes an optical imaging device, a logic, a clamping assembly, and a cutting member. The optical imaging device is capable of capturing an optical image of at least a portion of the master key. The logic is capable of determining a key pattern of the master key from the optical image of the master key. The clamping assembly is capable of clamping a key blank and the cutting member is capable of cutting a key pattern into said key blank.

WO 2007/087389 A2



European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, LV, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

Published:

- *without international search report and to be republished upon receipt of that report*

TITLE**KEY DUPLICATION MACHINE****CROSS REFERENCE TO RELATED APPLICATION**

[0001] This non-provisional application claims the benefit of U.S. Provisional Patent Application No. 60/761,293, titled "KEY DUPLICATION MACHINE," filed January 23, 2006, which is hereby incorporated in its entirety.

FIELD OF INVENTION

[0002] This invention relates generally to apparatus and methods for duplicating keys, and more specifically, this invention relates to apparatus and methods for cutting duplicate keys based on a captured image of a master key.

BACKGROUND

[0003] Key duplication and key cutting machines are designed to reproduce a key pattern of a master key onto a key blank. Prior art key duplication and key cutting machines typically determine the key pattern of a master key by mechanically engaging the key pattern of a master key with a stylus, tracer bar, or other such mechanical member. For example, prior art key duplication machines typically comprise a pair of clamps or vise grips mounted on a carriage. A master key, having a key pattern, is placed in a first clamp. A key blank, manually selected by the machine operator, is placed in a second clamp, which is normally positioned adjacent to the first clamp. The stylus is placed in contact with the key pattern of the master

key. A cutting wheel is placed in contact with an edge of the key blank, into which the key pattern of the master key is to be duplicated. The stylus and cutting wheel are coupled such that the movement of the cutting wheel is synchronized with and controlled by the movement of the stylus.

[0004] The carriage is arranged such that the carriage may be moved pivotally and linearly along a longitudinal supporting shaft that is generally parallel to the blades of the master key and key blank. The carriage is typically moved manually along the shaft, causing the stylus to move along the key pattern of the master key. As the stylus moves along the key pattern of the master key to trace the key pattern, the cutting wheel moves along the blade of the key blank. The coupling of the stylus and cutting wheel controls the movement of the cutting wheel and cuts a duplicate key pattern into the key blank. Once the cutting process is completed, the newly duplicated key may be removed from the clamp and buffed on a buffing wheel or swiped across a wire brush to remove any burrs.

[0005] In the prior art process described, the key cutting machine operator manually selects the key blank. It is of great importance that the key pattern of a master key be copied onto an appropriate key blank having the same key blade and grooves. There are numerous key blanks, and many are not readily distinguishable from each other. Identifying the correct key blank for use in duplication often requires visually examination of a plurality of key blanks, where differences between key blanks may be very subtle, significantly increasing the level of difficulty in identifying the proper key blank. All too often, businesses that offer key cutting services are not staffed by experienced locksmiths capable of consistently and accurately identifying the proper key blank to be used. Instead, an employee is shown how to "eyeball" what is thought to be the correct blank and then cut a duplicate key at the substantial risk of the key working improperly.

[0006] Once a key blank is manually chosen by the operator, that key blank goes through the cutting process. If a mistake is made in the manual selection of a key blank, the entire process of manually identifying the best key blank and mechanically cutting the key must begin again. Often, such errors are not identified until after the

customer leaves the store, thus resulting in frustration with the retailer due to an unsuccessful key cut.

[0007] Although prior art key duplication machines and processes are well established and widely utilized, such machines and processes produce a relatively high scrap rate, overly rely on the experience and judgment of machine operators, and may not allow for evaluation of the accuracy of a duplicate key without the duplicate key being tested in its associated lock. Due to these and other limitations of the prior art, the art field is constantly striving to improve cut accuracy, cut quality, and ease of use of key duplication machines and processes. Improvements to key duplication machines and processes that enhance the accuracy and quality of a duplicate key or produce more user-friendly machines are well received in the key duplication industry.

[0008] A general goal of the industry is to develop key duplication machines and processes that are so user-friendly that a customer or general consumer may duplicate a key with minimal instructions and minimal knowledge of keys. Therefore, improvements in machines and processes for cutting duplicate keys that simplify the cutting process or improve the accuracy of key blank identification are greatly desired. Further, the industry constantly strives for less expensive, easier to assemble, and easier to maintain machines. Should newly developed key duplication machines or processes achieve any of these objectives, it would be a significant improvement over the expensive and often difficult to use key cutting machines currently known in the field.

SUMMARY OF INVENTION

[0009] Apparatus, methods, and other embodiments associated with a key duplication machine are described. In one embodiment, an assembly for duplicating a master key includes an optical imaging device, a logic, a clamping assembly, and a cutting member. The optical imaging device is capable of capturing an optical image of at least a portion of the master key. The logic is capable of determining a key pattern of the master key from the optical image of the master key. The clamping assembly is

capable of clamping a key blank and the cutting member is capable of cutting a key pattern into said key blank.

[0010] In another embodiment, a method for duplicating a master key includes capturing an optical image of at least a portion of the master key; providing a logic to determine a key pattern of the master key from the optical image of the master key; securing a key blank; and cutting a key pattern into the key blank.

DESCRIPTION OF THE DRAWINGS

[0011] In the accompanying drawings, which are incorporated in and constitute a part of this specification, embodiments of the invention are illustrated, which, together with a general description of the invention given above, and the detailed description given below serve to illustrate the principles of this invention. The drawings and detailed description are not intended to and do not limit the scope of the invention or the claims in any way. Instead, the drawings and detailed description only describe embodiments of the invention, and other embodiments of the invention not described are encompassed by the claims.

[0012] Figure 1 is perspective view of an exemplary embodiment of a key duplication machine in accordance with the present invention;

[0013] Figure 2 is a front view of the key duplication machine of Figure 1;

[0014] Figure 3 is a side view of the key duplication machine of Figure 1;

[0015] Figure 4A is a plan view of a master key;

[0016] Figure 4B is a plan view of a key blank;

[0017] Figure 5 is a perspective view of a key secured in the slot of the key duplication machine of Figure 1;

[0018] Figure 6 is a partial perspective view of the interior of the key duplication machine of Figure 1;

[0019] Figure 7 is a partial perspective view of the interior of the key duplication machine of Figure 1;

[0020] Figure 8 is a partial perspective view of the interior of the key duplication machine of Figure 1;

[0021] Figure 9 is a partial perspective view of the interior of the key duplication machine of Figure 1;

[0022] Figure 10 is a plan view of a key blank positioned between positioner fingers of the key duplication machine of Figure 1;

[0023] Figure 11 is a perspective view of a cutting wheel and positioner finger of the key duplication machine of Figure 1;

[0024] Figure 12 is a partial perspective view of the interior of the key duplication machine of Figure 1;

[0025] Figure 13 is a perspective view of a top clamp member of the key duplication machine of Figure 1;

[0026] Figure 14 is a partial perspective view of the interior of the key duplication machine of Figure 1;

[0027] Figure 15 is a partial perspective view of the interior of the key duplication machine of Figure 1;

[0028] Figure 16 is a front view of a shavings drawer of the key duplication machine of Figure 1;

[0029] Figure 17 is a rear view of a shavings drawer of the key duplication machine of Figure 1;

[0030] Figure 18 is a partial perspective view of the interior of the key duplication machine of Figure 1;

[0031] Figure 19 is a partial perspective view of the interior of the key duplication machine of Figure 1;

[0032] Figure 20 is an exploded view of the key duplication machine of Figure 1;

[0033] Figure 21 is an exploded view of the key duplication machine of Figure 1;

[0034] Figure 22 is a screen shot of a user interface for use with the key duplication machine of claim 1;

[0035] Figure 23 is a screen shot of a user interface for use with the key duplication machine of claim 1;

[0036] Figure 24 is a screen shot of a user interface for use with the key duplication machine of claim 1;

[0037] Figure 25 is a screen shot of a user interface for use with the key duplication machine of claim 1; and

[0038] Figure 26 is a screen shot of a user interface for use with the key duplication machine of claim 1.

DETAILED DESCRIPTION OF THE INVENTION

[0039] The Detailed Description of the Invention merely describes embodiments of the invention and is not intended to limit the scope of the claims in any way. Indeed, the invention as described by the claims is broader than and unlimited by the preferred embodiments, and the terms in the claims have their full ordinary meaning.

[0040] As described herein, apparatus and methods can be designed to produce accurate and reliable duplicates of master keys. In one embodiment, the duplication of a master key is facilitated by the capture of an optical image of a profile or silhouette of the master key, including the key pattern of the master key, and the capture of a profile or silhouette of a key blank. As will be further described herein, the captured images may be analyzed by logic to determine the proper key blank to be used for a duplicate key, validate the selection of the proper key blank, facilitate the

accurate cutting of the key pattern of the master key into the key blank, and validate the accuracy of the key pattern cut into the key blank. The apparatus and methods may further facilitate the cutting of a substantial variety of key types, such as single-sided keys, double-sided keys, sidewinder keys, house keys, automobile keys, commercial keys, and the like. The analysis of images by logic may include, for example, the logic storing images, storing data, quantifying physical measurements based on the image, retrieving referencing data contained in a database, and the like.

[0041] As used herein, the term “logic” includes but is not limited to hardware, firmware, software and/or combinations of each to perform a function(s) or an action(s), and/or to cause a function or action from another logic, method, and/or system. For example, based on a desired application or needs, logic may include a software controlled microprocessor, discrete logic like an application specific integrated circuit (ASIC), an analog circuit, a digital circuit, a programmed logic device, a memory device containing instructions, or the like. Logic may include one or more gates, combinations of gates, or other circuit components. Logic may also be fully embodied as software. Where multiple logical logics are described, it may be possible to incorporate the multiple logical logics into one physical logic. Similarly, where a single logical logic is described, it may be possible to distribute that single logical logic between multiple physical logics. In addition, as used herein, the term “database” includes a physical and/or logical entity that can store data. A database may be, for example, a traditional database, a table, a file, a list, a queue, a heap, a memory, a register, and so on. A database may reside in one logical and/or physical entity and/or may be distributed between two or more logical and/or physical entities.

[0042] Optionally, the apparatus and methods described herein may accept input from a user or operator of a key duplication machine and may provide output to the user or operator of the machine to further facilitate key duplication. For example, the apparatus may include a user interface, such as monitor, touch screen, or other such device, through which a user may enter information and information may be displayed to the user.

[0043] In an embodiment, a method of using the key duplication machine comprises the steps of inserting a master key into the machine such that the blade of the master key is within an imaging zone of the machine; capturing an image of the key pattern of the master key; utilizing logic to analyze the captured image; comparing the captured image with data on key blanks contained in a database; determining the proper key blank for duplicating the master key; outputting information regarding the proper key blank to the user; removing the master key from the machine; retrieving and inserting the proper key blank into the machine such that the blade of the key blank is within the imaging zone of the machine; capturing an image of the key blank; using logic to analyze the image of the key blank and validating that the key blank is proper; aligning the key blank; moving the key blank to a cutting zone of the machine; cutting the key pattern of the master key into the key blank; moving the newly-cut duplicate key to the imaging zone of the machine; capturing an image of the duplicate key; using logic to analyze the image of the duplicate key; compare the analysis of the image of the master key with the analysis of the image of the duplicate key to validate the accuracy of the key pattern cut into the duplicate key; removing the duplicate key from the machine; and de-burring the duplicate key.

[0044] An exemplary embodiment of a key duplication machine 10 is illustrated in the accompanying Figures. The key duplication machine 10 as described herein has numerous features or improvements, each of which are believed to be independently novel. Therefore, while embodiments of the present invention are described as utilizing each of these novel features or improvements in the aggregate, nothing in the present description should be interpreted as requiring an embodiment to include or exclude any of the particular improvements described herein. In addition, the key duplication machine 10 described herein incorporates a key blank identification system and a key cutting system into a single apparatus. However, it should be understood that either system could be used individually or used together. Nothing in this description should be interpreted to limit novel features of each individual system as used alone or in an integrated unit. Therefore, as described herein as an integrated system, a master key is imaged and compared with other key blanks to determine the

appropriate key blank to be used, while also utilizing the master key image to provide key pattern information to be cut into the key blank.

[0045] Figures 4A and 4B illustrate a common master key 22 and key blank 24. While it is known that numerous types of keys are used in the key industry, for simplicity the master key 22 illustrated in Figure 4A is an exemplary house key, and the key blank 22 illustrated in Figure 4B is a exemplary key blank 24 for the house key 22. Both the master key 22 and key blank 24 typically include a head 26 having a bow 28, a shoulder 30, a blade 32, and a keyway groove 34. The keyway groove 34 is typically a narrow, milled-out area along the length of the blade 32 that allows the blade 32 to bypass the wards in a keyway. Such keyway grooves 34 may already be cut into the key blank 24 to simplify the key cutting operation. Therefore, when duplicating a master key 22, a key blank 24 must include a keyway groove 34 that is either identical to or similar to the master key 22. The master key 22 includes a key pattern 36, which is a model for any key pattern cut into the key blank 24 in duplicating the master key 22. As used herein, master key refers to any key that has a key pattern, whether an original key purchased with a lock and fabricated by the manufacturer of the lock or a subsequent duplication of the original key. The reference to a key as a master key indicates that the key serves as a model from which to cut a duplicate key to perform the same unlocking function as the master key.

[0046] With reference to Figures 1 through 3, an assembled key duplication machine 10 is illustrated. The machine 10 includes an outer shell 12, comprising a number of panels arranged to enclose and protect internal components, mechanisms, and systems of the key duplication machine 10. The machine 10 further includes a door clamp 14, which is biased against a base 16 with a biasing member (not shown). The door clamp 14 may be biased against the base 16 by any biasing member such as, for example, an extension or compression coil spring, a torsion spring, a counterweight, or the like. The door clamp 14 may be raised against the biasing force by a handle 18.

[0047] The combination of the door clamp 14, base 16, handle 18, and biasing member forms a retention mechanism 19 for retaining or securing a master key 22 or key blank 24. As illustrated in Figure 5, the door clamp 14 and the base 16 form a

slot 20 that may be utilized to retain or secure a master key 22 or key blank 24 such that the blade 32 of the key 22 and 24 is located within the machine 10. The force placed on the key 22 and 24 in the slot 20 is sufficient to retain or hold the key 22 and 24 in place but also allows some movement of the key 22 and 24 to facilitate proper alignment of the key 22 and 24.

[0048] As will be further described, the blade 32 of a key 22 and 24 may be positioned within the machine 10 such that an image of the blade 32 may be captured. In addition, the blade 32 of a key blank 24 may be positioned within the machine 10 such that the blade 32 is exposed to clamps and cutters. The clamps are arranged to selectively rigidly secure the key blank 24, and the cutters are arranged to selectively cut a key pattern into the blade 32 of the key blank 24 when the key blank 24 is rigidly secured in the clamps.

[0049] In an embodiment, the key 22 and 24 may be positioned with a first side of the blade 32 facing upward, or the key 22 and 24 may be rotated 180 degrees and positioned with the first surface of the blade 32 positioned downward. As will be further described, in such an embodiment, such variable orientation or registration of the key 22 and 24 does not affect the subsequent imaging, positioning or cutting of a key 22 and 24. The key duplication machine 10 may be arranged such that logic used to analyze images and control the movement, alignment, and cutting of keys 22 and 24 may detect the orientation or registration of the key 22 and 24 and account for such orientation or registration during the duplication of a master key 22 so that the proper key cuts are made regardless of the positioning of the key blank 24 so as to promote user friendliness and speed of duplication.

[0050] The door clamp 14, base 16, handle 18, and slot 20 are located on a retention mechanism panel 21. The panel 21 is arranged such that the panel 21 may slide to the left and right, with respect to Figure 2. As will be further described, such movement allows the machine 10 to move the blade 32 of a key blank 24 between an imaging zone, where an image of the blade 32 may be captured, and a cutting zone, where a key pattern 36 may be cut into a key blank 24.

[0051] The key duplication machine 10 includes a table 38 located below the slot 20. The table 38 is positioned such that when a master key 22 is secured in the slot 20, the table 38 holds additional keys on a key ring so that the user does not have to remove the master key 22 from its key ring for the purposes of duplication. A touch-screen monitor 40 is incorporated into the machine 10, through which a user may enter information and information may be displayed to the user. In addition, a metal shavings drawer 42 is provided beneath the internal key cutting mechanisms to catch metal shavings generated during the cutting of keys. The shavings drawer 42 may be removed from the machine 10 to facilitate the disposal of collected shavings. For convenience, a de-burring slot 44 is provided. The slot 44 leads to a burr-cleaning member such as a wheel, square brush, or the like, to clean and de-burr newly cut keys.

[0052] Optionally, a vacuum system (not shown) may be incorporated into the machine 10 to capture key cutting shavings as they are generated and to assist in cleaning the work area after key cutting operations. Such a vacuum system may be attached to the machine 10 in the vicinity of the cutting operation or in or near a catch basin. Such an exemplary system is described in U.S. Patent Application No. 10/970,844, titled KEY CUTTING MACHINE, filed on October 20, 2004, and commonly owned by the present assignee. The 10/970,844 patent application is hereby expressly incorporated by reference in its entirety. The 10/970,844 application describes a removable vacuum tube capable of capturing key cutting shavings and assisting in cleaning the work area after the key cutting operation. It will be clear to those skilled in the art that such a vacuum system could be incorporated into the present apparatus and attached in the vicinity of the cutting operation or in or near the catch basin.

[0053] As will be further described, during the process of duplicating or cutting a key, internal components, mechanisms, and systems of the key duplication machine 10 experience motion and movement relative to other components of the machine 10. To facilitate the description of such motion and movements, reference will be made to movements relative to an X-axis, Y-axis, and Z-axis. The orientations of these axes are shown in Figures 1 through 3. When motion or movement is described herein as

“moving along the X-axis,” for example, this description includes motion along any axis parallel to the X-axis shown in Figures 1 through 3. Movements along the X-axis are generally between the front and back of the machine 10, movements along the Y-axis are generally between the left side and right side of the machine 10, and movements along the Z-axis are generally between the top and bottom of the machine 10. As will be understood by those skilled in the art, descriptions of motion or movement along an axis are not intended to be exactly and precisely along or parallel to such an axis. Movement and motion that is approximately or roughly along an axis or parallel to an axis are included in the description of motion or movement along an axis. The use of “along an axis” or “about an axis” are intended to simplify a general description of the apparatus and methods described herein and not intended to limit the scope or understanding of such apparatus and methods.

[0054] Figures 6 through 21 illustrate exemplary internal components, mechanisms, and systems of the key duplication machine 10 and will be referenced in describing methods for using the machine 10 to form duplicate keys from master keys 22.

[0055] Referring again to Figure 5, a master key 22 or key blank 24 may be placed and retained in the slot 20 in the retention mechanism panel 21 such that the blade 32 is positioned within the machine 10 and in the imaging zone. As best seen in Figure 6, an optical imaging device 50 is mounted within the machine 10 and positioned such that it captures an optical image of a key 22 and 24 secured in the slot 20. The image of the key 22 and 24 may generally include the blade 32 of the key 22 and 24, the key shoulder 30, and at least a portion of the head 26. As generally used herein, the imaging area is an area that is below (along the Z-axis) the optical imaging device 50. The optical imaging device 50 is generally positioned above the key 22 and 24 and directed downward such that a silhouette of the key 22 and 24, including the blade 32 of the key 22 and 24, may be captured.

[0056] In one embodiment, the optical imaging device 50 is a camera, and the image captured is a photographic image. In an embodiment, the camera 50 is a digital camera, and the image captured is a digital image. A digital image may be stored in file form or in data form and may be analyzed by logic. As best seen in Figure 6, a

tube 51 (shown in cross-section) may extend downward from the imaging device 50 towards the key 22 and 24. Such a tube 51 may facilitate the channeling of light to the camera and result in a high quality captured image.

[0057] To enhance an image captured by the optical imaging device 50, the machine 10 includes a system for providing backlighting to the key 22 and 24. As best seen in Figure 7, a lighting panel 52, reflector plate 54, and a blocking plate 56 cooperate to provide backlighting to the key 22 and 24. The lighting panel 52 emits light, which is reflected off the reflector plate 54 and directed towards the key 22 and 24. A surface 58 of the reflector plate 54 is coated or otherwise treated to disperse and diffuse light emitting from the lighting panel 52. This dispersion and diffusion of light creates a backlighting environment that enhances captured images of the key 22 and 24. The coating or treatment of the surface 58 of the reflector panel 54 may be any coating or treatment that sufficiently disperses and diffuses light. For example, the surface 58 may be coated with a gritty substance, such as sandpaper; the surface 58 may be painted; the surface 58 may be machined or otherwise treated to roughen the surface 58; or the surface 58 may include a pattern that disperses and diffuses light. The reflector plate 54 may be arranged at a relatively steep angle, as best seen in Figure 7, to decrease the likelihood that shavings from the cutting of keys may fall onto and stick to the surface 58 of the reflector plate 54. Such an angle makes it likely that shavings falling onto the surface 58 will slide off the surface 58 and settle into the shavings drawer 42. In an embodiment, any treatment or coating applied to the surface 58 of the reflector plate 54 is selected to match the color and reflectivity of any buildup of dust that may accumulate onto the surface 58 due to the cutting of keys above the reflection plate 54.

[0058] The lighting panel 52 may include any type of light-emitting devices such as, for example, light bulbs, light emitting diodes (LED), liquid crystal displays (LCD), and the like. In an embodiment, the light panel 52 comprises a matrix of evenly spaced LEDs. Alternatively, LEDs may be unevenly spaced so as to create more favorable light dispersion and diffusion. In an embodiment, the light emitted from the lighting panel 52 may be in the red spectrum, which may, under certain circumstances, create crisper images of a key silhouette. As will be understood by

those skilled in the art, other types of backlighting systems may include directing light on the shavings or an object in the shavings drawer 42. Any particular configuration that provides well-dispersed and diffused light appropriate for backlighting is contemplated and incorporated herein. Alternatively, front lighting or providing light directly to the key 22 and 24 may also be used when capturing an image of the key 22 and 24.

[0059] The logic may be arranged to analyze the backlighting and the resulting quality of a captured image. Based on such analysis, the backlighting may be adjusted, such as in direction or in intensity, to improve subsequent captured images. In addition, the positioning of the lighting panel 52, reflector plate 54, and a blocking plate 56 may also be adjusted to improve subsequent captured images.

[0060] The apparatus as described may be utilized to capture the image of the blade 32 of a master key 22, including the key pattern 36. Such a captured image may be analyzed by logic to quantify and specifically define the key pattern 36 of the master key. Such analysis may include quantifying and defining the depth, angle, and position of each tooth in the key pattern 36; determining whether there is a key pattern 36 on one side of the key 22 (a single-sided key) or on both sides of the key 22 (a double-sided key); determining precisely where along the blade 32 the key pattern 36 begins and ends; and the like. In addition, surface features of the blade 32, such as the presence, length, and width of a key groove 34, may be determined. In one embodiment, surface features of the blade 32 may be determined by positioning the optical imaging device 50 to an angle with respect to the surface of the blade 32. As will be further described, such information may be stored by the logic for subsequent use in selecting a key blank 24, precisely cutting a key pattern into a key blank 24 and in comparing the key pattern cut into the key blank 24 and the key pattern 36 of the master key 22.

[0061] The captured image of the blade 32 of the master key 22 may also be used to specifically determine the proper key blank 24 to use when duplicating the master key 22. The captured image may be analyzed using logic to quantify and specifically define features of the master key blade 32 such as, for example, the size and shape of

the shoulder 30, the length and width of the blade 32, whether the master key 22 is single-sided or double-sided, whether the blade 32 includes any steps or grooves, and the like. To facilitate the identification of a proper key blank 24, the logic may compare the quantified and defined features of the master key 22 with data in a database regarding known key blanks 24. Such a database may include data on the physical dimensions of known key blanks 24, and the logic may make direct comparisons between physical dimensions of known key blanks 24 and the features of the master key 22 as determined from the captured image. Such comparisons may lead to the determination and selection of the proper key blank 24 for the master key 22.

[0062] Optionally, additional imaging of the master key 22 may be performed to determine or quantify surface features of the master key 22 such as, for example, the keyway groove 34. Such surface features may assist in narrowing or choosing the proper key blank 24. Such imaging may be performed by providing a ring of structured light about the key blade 32 and an optical imaging device to record a tip view or cross-sectional view of the key 24, performing a laser scan across the key blade 32 to identify the width and spacing of a keyway groove 34, or projecting a shadow across the surface of the blade 32 to measure the variations in shadow contour related to surface area contour.

[0063] With regard to a laser scan of the key blade 32, a dot scan may be utilized using a single laser dot that may be moved continuously along a path, projected at certain points along a path, or utilized with multiple laser dot scans in numerous types of configurations to acquire the necessary information. It should be clear that such a scan could read one or both sides of a key 22. Information on the groove 34 may likewise be analyzed and compared by the logic to groove information stored in the database related to known key blanks 24. Therefore, based upon the master key 24 silhouette and, optionally, the key groove 34 features, the logic may identify a single key blank 24 for use in duplicating the master key 24.

[0064] Once the proper key blank 24 is identified, the key duplication machine 10 may direct output information to the user to indicate which specific key blank 24 is

identified. In one embodiment, such information may be displayed on the touch-screen monitor 40. The user may then retrieve the proper key blank 24 from a retail display based on the displayed information. In an embodiment, various key blanks 24 may be displayed on a display or retail rack with light indicators positioned near each type of key blank 24. Once the proper key blank 24 is identified, the machine 10 may send a signal to the display rack and the display rack may illuminate the light indicator associated with the proper key blank 24. Such a system directs the user to the proper key blank 24 and reduces user error in selecting a key blank 24. The machine 10 may include a display connection 59 (as seen in Figure 3) to connect the machine 10 to the display rack, through which a signal may be sent from the display rack from the machine 10. Optionally, the machine 10 and display rack may be integrated or the machine 10 and rack may be arranged to send and receive signals remotely, wirelessly, etc. Such apparatus and methods are described in U.S. Patent Application No. 10/633,933, filed on August 4, 2003, and titled OBJECT IDENTIFICATION SYSTEM. The 10/633,933 application may be incorporated or otherwise utilized with embodiments described herein. The 10/633,933 application is commonly owned by the present assignee and hereby expressly incorporated herein by reference in its entirety.

[0065] Once the proper key blank 24 is identified and retrieved by the user, the user may remove the master key 24 from the slot 20 in the retention mechanism panel 21 and place the key blank 24 in the slot 20. When the key blank 24 is placed into the slot 20, the key blank 24 may be validated to insure that the proper key blank was retrieved by the user, internal mechanisms may align the key blank 24, the key blank 24 may be further secured or clamped, and a key pattern may be cut into the key blank 24 to duplicate the master key 22. As previously described, the orientation or registration at which the user inserts the key blank 24 in the slot 21 does not affect the subsequent operations on the key blank 24. The logic may analyze captured images of the inserted blank 24 to determine the orientation and adjust all subsequent operations accordingly.

[0066] Figures 8 and 9 illustrate the positioning of a key blank 24 relative to internal components, mechanisms, and systems as it is initially inserted and secured in the slot

20. In this initial position, the key blank 24 is in the imaging zone. The retention mechanism panel 21 is not shown in Figures 8 and 9 for clarity. As shown in Figure 8, a left cutting wheel 60 is positioned to the left of the key blank 24 and a right cutting wheel 62 is positioned to the right of the key blank 24 as viewed from the front of the machine 10. A clamping assembly 64, including a top clamp member 66 and a bottom clamp member 68, is located to the left of the key blank 24 as viewed from the front of the machine 10. The clamping assembly 64 is used to clamp the key blank 24 during cutting, the left cutting wheel 60 is utilized to cut the left side of the key blank 24, and the right cutting wheel 62 is utilized to cut the right side of the key blank 24.

[0067] The logic may validate that the key blank 24 selected by the user and positioned in the machine 10 is the proper key blank 24, as previously identified. An image of the key blank 24 may be captured by the optical imaging device 50, and logic may be used to analyze the image. Such analysis may determine or quantify features of the key blank 24 such as, for example, the size and shape of the shoulder 30, the length and width of the blade 32, whether the blank 24 is designed as a single-sided or double-sided key, whether the blade 32 includes any steps, and the like. Such determined features may be compared to data regarding features of the previously-identified proper key blank 24 stored in the database. Provided the determined features of the user-selected key blank 24 and the stored features of the previously-identified proper key blank are in agreement, the logic may determine that the proper key blank 24 was selected and positioned by the user. The user may be informed that the user-selected blank 24 is proper, and the duplication process may continue. If the determined features of the user-selected key blank 24 and stored features of the proper key blank are in not in agreement, the logic may inform the user that an improper key blank was selected and instruct the user to reselect a key blank 24 for duplication of the master key 22. Optionally, the duplication process may be halted until the user positions a proper key blank 24, or the machine 10 may incorporate an override function to allow a key pattern to be cut into the selected key blank 24.

[0068] Prior to clamping the key blank 24 in the clamping assembly 64, the key blank 24 may be aligned to insure a key pattern is properly cut into the blank 24. The

position of the key blank 24, as initially manually positioned by the user, may be determined from the captured image of the blank 24. This image is analyzed by logic and compared to the ideal position for cutting the blank 24, and the positioning of the blank 24 is adjusted to conform to the ideal cutting position. As best shown in Figures 9 and 10, a pair of key positioner fingers 72 and 74 engages the key blank 24 to align the blank 24. The left positioner finger 72 engages the left side of the blade 32, and the right positioner finger 74 engages the right side of the blade 24. This engagement squares the key blank 24 with respect to the X-axis and Y-axis to correct for a user having placed the blank 24 into the slot 20 at an angle. The engagement of the fingers 72 and 74 may also properly position the blade 32 along the X-axis. If the user did not insert the blank 24 far enough into the slot 20, the fingers 72 and 74 may move the blade 32 along the X-axis to the proper position. As previously described, the retention mechanism 19 secures a blank key 24; however, the force applied to a key 22 and 24 by the door clamp 14 and base 16 allows the key 22 and 24 to be adjusted relative to the machine 10.

[0069] The left positioner finger 72 is generally fixed with respect to the blank 24. This is to say that forces between the blank 24 and the left positioner finger 72 do not cause the left positioner finger 72 to deflect. The right positioner finger 74, however, is designed to deflect slightly upon engagement with the blank 24. The right positioner finger 74 includes a cantilever arm 76 that deflects due to forces between the right positioner finger 74 and the blank 24. Such deflection insures that sufficient force is applied to the blank 24 by the fingers 72 and 74 to grip and align the blank 24. When the fingers 72 and 74 are not needed, they may be rotated upwards and out of the way. As best shown in Figure 11, the right positioner finger 74 is mounted onto a shaft 78. The shaft 78 is arranged to rotate about the X-axis to rotate the finger 74 upward and downward as needed. A similar arrangement rotates the left positioner finger 72 upward and downward.

[0070] Once the positioner fingers 72 and 74 have corrected the alignment of the blank 24 based on the analysis of the initial captured image, yet another image of the blank 24 may be captured to validate that the alignment is now proper. In addition to validating the alignment of the blank 24, this captured image may be utilized to record

reference points along the blade 32 such as the location of the key shoulder 30, the location of the tip of the blade 32, and the like. As will be further described, the logic may use such reference points, along with the determination of the orientation of the key blank 24, to guide the cutting wheels 60 and 62 during the cutting process.

[0071] Although the alignment of a key is generally described with reference to the alignment of a key blank 24 upon the insertion of the blank 24 into the slot 20, it will be readily understood by those skilled in the art that the positioner fingers 72 and 74 may be used, for example, to align a master key 22 prior to capturing an image of the key 22 to be analyzed by the logic.

[0072] As shown in Figure 9, once the blank 24 is properly aligned, the clamping assembly 64 may be opened to accommodate the clamping of the blank 24. In an embodiment, the default position of the clamp assembly is open, and the clamp is closed only when clamping a key blank 24. The bottom clamp member 68 is generally fixed, and the top clamp member 66 is arranged to move along the Z-axis. When the clamping assembly 64 is opened, the blank 24 is moved to the left along the Y-axis until the blank 24 is positioned between the top member 66 and bottom member 68 clamps. The blank 24 is moved along the X-axis to a specific clamping position relative to the clamping assembly 64 as determined by the logic for the specific key blank 24. The logic may specifically position the blank 24 relative to the clamping assembly 64 such that both edges of a blade 32 of a key blank 24 remain exposed for the cutting of a key pattern into both edges of the blade 32. Such an arrangement is common for double-sided key blanks.

[0073] Such movement of the key blank 24 moves the blank 24 from the imaging zone to the cutting zone. The clamp assembly 64 is generally fixed with respect to the Y-axis and generally defines the cutting zone. The blank 24 is moved along the Y-axis by the synchronized movement of the left 72 and right 74 positioner fingers and the retention mechanism panel 21, which includes the slot 20. As seen in Figure 12, once the blank 24 is positioned between the top 66 and bottom 68 clamp members, the top clamp member 66 is moved downward along the Z-axis to secure the blank 24 in the clamp assembly 64. Once the blank 24 is secured in the clamp assembly 64, the

positioner fingers 72 and 74 are rotated upward about the X-axis and out of engagement with the blank 24. Such movement of the fingers 72 and 74 ensures that the cutting wheels 60 and 62 have access to the full length of the blade 32 and both edges of the blade 32.

[0074] With reference to Figure 13, the clamping surface of the clamp members 66 and 68 are T-shaped. The stem 80 of the T-shaped clamping surface is sized such that both the left side and right side of the key blank 24 blade 32 is exposed to the cutting wheels 60 and 62 when the blank 24 is clamped in the clamping assembly 64. The bar portion 82 of the T-shaped clamping surface is designed to engage the blank 24 at or above the key shoulder 30 and above the portion of the blade 32 into which a key pattern is cut. Optionally, the clamping surface may include knurls or other features designed to improve the grip of the clamp members 66 and 68 on the blank 24. As best seen in Figure 12, the top clamp member 66 may include at least one groove 84 designed to allow a top clamp member 66 to deflect slightly. Such slight deflections may allow the clamping surfaces of the clamp members 66 and 68 to adjust for small irregularities in the surface of the blank 24. For example, the top clamp member 66 may displace slightly so as to accommodate raised logos, words, or numbers stamped or forged into the surface of the blank 24. Such accommodations may reduce or eliminate the chance of point contact between the clamping members 66 and 68 and the blank 24 and increase the chances that the clamping force is sufficient to hold the blank 24 during the cutting process.

[0075] Once the key blank 24 is clamped, the cutting operation can be performed. The logic may use the quantified and stored information from the captured image of the key pattern 36 of the master key 22 to calculate precise movements of the cutting wheels 60 and 62, with respect to the key blank 24, to produce a duplicate key. The movements of the cutting wheels 60 and 62 are generally two-dimensional. The wheels 60 and 62 are moved along the X-axis to cut the key pattern along the length of the blade 32. In addition, the wheels 60 and 62 move independently along the Y-axis to cut the depth of each tooth of the key pattern into the blade 32. While numerous paths for the cutting wheels 60 and 62 may be utilized, in an embodiment, the cutting wheels 60 and 62 begin near the shoulder 30 of the key blank 24 and

proceed to the tip of the key blank 24 blade 32 to cut the key pattern into the blade 32. The precise movements calculated for the cutting wheels 60 and 62 may be transferred to a 2-axis CNC cutter so that the key pattern 36 of the master key 22 may be duplicated on the blade 32 of the key blank 24.

[0076] As shown in Figures 14 and 15, once the key blank 24 is clamped and the positioning fingers 72 and 74 are rotated out of the way, the cutting wheels 60 and 62 may be moved along the Y-axis, into the cutting zone, and into engagement with the blade 32. Typically, the wheels 60 and 62 engage the blank 24 near the shoulder 30 of the blank 24. The clamp assembly 64 is not shown in Figure 15 for clarity. As previously described, the cutting wheels 60 and 62 may move in parallel along the X-axis as the key pattern is cut into the blank 24; however, the movements of each cutting wheel 60 and 62 along the Y-axis are independent. This independent movement insures that a double-sided key may be produced quickly and efficiently, with the cutting wheels 60 and 62 passing along the length of the blade 32 only once. The rotational speed of each cutting wheel 60 and 62 is also independently controlled. In one embodiment, the rotational speed of each cutting wheel 60 and 62 is adjusted based on the depth at which the cutting wheel 60 and 62 is moved into the blade 32 along the Y-axis. For example, in an embodiment, the rotational speed of a cutting wheel 60 and 62 is slowed as the wheel 60 and 62 moves deeper into the blade 32 along the Y-axis. In an embodiment, the movement of the wheels 60 and 62 along the X-axis and Y-axis are adjusted based on the features of the cut. For example, for deeper cuts into the blade 24, the movement of the wheels 60 and 62 in the Y-direction may be slowed, and for shallower cuts, the movement of the wheels 60 and 62 in the Y-direction may be increased. Such arrangements limit wear and service time of the cutting wheels 60 and 62.

[0077] If the master key 22 is a single-sided key, only one of the cutting wheels 60 and 62 is engaged with the blank 24 to cut the key pattern 36. The logic may make a determination on whether the left 60 or right 62 cutting wheel is to be utilized based on the captured image of the key blank 24. The user may insert the blank 24 into the slot 20 without regard to the orientation of the blade 24. The logic may determine from the captured image whether the key pattern should be cut into the left edge or the

right edge of the key blank 24 based on the contour and shape of the shoulder 30 of the blade 32, the tip of the blade 32, or any other characteristic that may distinguish the edges of the blade 32.

[0078] Once the key pattern is cut into the key blank 24, the top clamp member 66 may be lifted along the Z-axis, releasing the newly-cut key. The newly-cut key remains secured by the retention mechanism 19. The newly-cut key may be returned to the imaging zone by moving the retention mechanism panel 21 to the right along the Y-axis. A new image of the newly-cut key may be captured and compared to the captured image of the master key 22. Logic may utilize such a comparison to validate that the newly-cut key is within acceptable deviation from the master key 22. The deviation of the newly-cut key as compared to the master key 22 may be quantified by any statistic method. For example, a number of measurements along the key pattern 36 of the master key and the key pattern of the newly-cut key may be taken and quantified. The average difference of the comparable measurements may be used to calculate an average difference and compare that average difference to a predetermined limit. The results of such a validation may be displayed to the user on the touch-screen monitor 40 or otherwise output to the user.

[0079] Once the validation is completed, the user may lift the spring-biased door clamp 14 using the handle 18 and remove the newly-cut key from the slot 20. The logic may be arranged to retain the captured image of the master key 22 for a period of time, such that the user may place another proper key blank 24 into the slot 20 and cut yet another duplicate key. If no additional duplicate keys are required, the logic may discard the captured image of the master key 22 and prepare to receive another master key 22 and begin the duplication process anew. Such processes may be driven by the logic with regard to time limits or may be driven by the user inputting information through a touch screen or other user interface.

[0080] When a newly-cut key is removed from machine, the user may de-burr the key by inserting the blade of the newly-cut key into the de-burring slot 44. As shown in Figures 16 and 17, a pair of de-burring brushes 86 may be secured to an interior surface 88 of the shaving drawer 42 and proximate to the de-burring slot 44. The

brushes 86 are positioned such that the blade of the newly-cut key engages the brushes as the blade is inserted into the slot 44. As seen in Figure 17, the brushes may be square and secured to an interior surface 88 of the shavings drawer 42 with fasteners 90 such as, for example, a bolt and nut combination. Such a fastening arrangement allows for efficient exchanging of de-burring brushes 86. In addition, the square shape of the brushes 86 allows the brushes 86 to be rotated or flipped as one side of a brush 86 becomes worn due to repeated use, thus increasing the service life of a brush 86. Such an arrangement may provide for sixteen unique positions for the pair of brushes 86.

[0081] As described above, the process of cutting duplicate keys relies on the movement of numerous interior components, mechanisms, and systems. Such movement is generally facilitated through a number of motors mounted within the key duplication machine 10. Figures 18 and 19 illustrate the interior of the machine 10 as viewed from the rear of the machine 10. As shown in Figures 18 and 19, the key duplication machine 10 includes nine independent motors to facilitate movement within the machine 10.

[0082] A retention mechanism slide motor 92 is coupled to the retention mechanism panel 21 to move the retention mechanism panel 21 along the Y-axis. Such movement occurs as a key blank 24 is moved between the imaging zone and the cutting zone.

[0083] A first slide motor 94 is coupled to both the right cutting wheel 62 and the right positioner finger 74 to move the right cutting wheel 62 and the right positioner finger 74 along the Y-axis. A second slide motor 96 is coupled to both the left cutting wheel 60 and the left positioner finger 72 to move the left cutting wheel 60 and the left positioner finger 72 along the Y-axis. Such movement of the positioner fingers 72 and 74 and the cutting wheels 60 and 62 occur under a number of conditions. For example, when the fingers 72 and 74 are engaged with the blade 32 of a key blank 24, movement of the fingers 72 and 74 along the Y-axis may move the blank 24 between the imaging zone and the cutting zone. In another example, when a key blank 24 is secured in the clamping assembly 64 and the fingers 72 and 74 are rotated out of

engagement with the blade 32, the cutting wheels 60 and 62 may be independently moved along the Y-axis to facilitate the cutting of the key pattern 36 into the blade 32.

[0084] A third slide motor 97 is coupled to both the left 60 and right 62 cutting wheels to move the cutting wheels 60 and 62 together along the X-axis. Such movement along the X-axis occurs as the wheels 60 and 62 move along the length of the blade 32 to cut the key pattern 36 into the blade.

[0085] A first rotational motor 98 is coupled to the right cutting wheel 62 to rotate the right cutting wheel 62 about the X-axis as the wheel 62 cuts a key pattern 36 into the right edge of a key blank 24 blade 32. A second rotational motor 100 is coupled to the left cutting wheel 60 to rotate the left cutting wheel 60 about the X-axis as the wheel 60 cuts a key pattern 36 into the left edge of a key blank 24 blade 32.

[0086] A third rotational motor 102 is coupled to the right positional finger 74 to rotate the finger 74 about the X-axis to engage and disengage the finger 74 with the blade 32 of the key blank 24. A fourth rotational motor 104 is coupled to the left positional finger 72 to rotate the finger 72 about the X-axis to engage and disengage the finger 72 with the blade 32 of the key blank 24.

[0087] A clamp motor 106 is coupled to the top clamp member 66 to move the top clamp member 66 along the Z-axis. Such movement clamps and unclamps a key blank 24 in the clamp assembly 64 prior to and after the cutting of key patterns 36 into the blade 32 of a blank 24.

[0088] The key duplication machine 10 as described herein may be designed and fabricated as an assembly of modular components. In an embodiment, as shown in Figures 20 and 21, the machine 10 may be assembled from five modular components. Such modular components may include a base module 110, a front panel module 112, a hood module 114, a computer module 116, and a support plate module 118. The base module 110 supports the machine 10 and may provide structural support for the mounting or holding of components such as, for example, the shavings drawer 42 and the lighting panel 52. The front panel module 112 may provide structural support for the mounting or holding of components such as, for example, the door clamp 14, base

16, handle 18, retention mechanism panel 21, and retention mechanism slide motor 92. The hood module 114 may provide structural support for the mounting or holding of components such as, for example, the monitor 40, wiring chassis, and power supplies. The computer module 116 may provide structural support for the mounting or holding of components such as, for example, a hard drive, a central processing unit, circuit boards, logic units, and other such computer related components. The support plate module 118 may provide structural support for the mounting or holding of internal components of the machine 10. For example, the support plate module 118 may support a number of motors, such as the rotational motors 98, 100, 102, and 104 for rotating the cutting wheels 60 and 62 and positioner fingers 72 and 74; slide motors for positioning the wheels and positioner fingers 94, 96, and 97; and the clamp motor 106. In addition, the support plate module 118 may support components such as the optical imaging device 50, reflector plate 54, the cutting wheels 60 and 62, positioner fingers 72 and 74, etc. Such modular design and assembly increases the ease of manufacture, assembly, and maintenance of a key duplication machine 10.

[0089] The process of duplicating a key using the key duplication machine 10 as described above may be facilitated through the interaction of a user with a user interface. For example, the user may be given a number of optional methods for identifying a proper key blank for the duplication of a master key. Such options may be displayed on a user interface such as, for example, a touch-screen monitor. Once displayed on a touch-screen monitor, the user may initiate the duplication process by manually selecting one of the offered options. A first option may request that the key duplication machine determine the proper key blank by taking a photograph of the master key, as described herein, and comparing the physical characteristics of the master key to a database containing physical characteristics of key blanks. The results of such a comparison may yield more than one potentially appropriate key blank. As illustrated in Figure 22, the user interface may graphically display two or more key blanks that may be used to duplicate the master key. The user may select the preferred key blank by touching a graphic representation of one of the key blanks 200 and 202. Alternatively, the user may select a graphic 204 indicating the user intends to insert another master key into the machine.

[0090] Another option for identifying a proper key blank for the duplication of a master key is for a user to provide specific known information regarding the master key. As shown in Figure 23, the user may enter specific information regarding a master key through a touch-screen monitor. The user may select specific information regarding a key from a dynamically populated selection box 206. The user may utilize the selection box to provide information such as the category of the key (automobile, house, padlock, etc.), the use, the make, the model of lock, the year lock was manufactured, the name of the manufacturer, or the part number of key or lock. The user may toggle the information displayed in the selection box 206 by touching buttons 208 associated with the different types of information. The user may select information for the selection box 206 by simply touching the correct information in the selection box 206.

[0091] Figure 24 illustrates a user interface directed specifically to automobile keys. The user may enter specific information regarding an automobile master key to identify the proper key blank. The user may select information such as automobile make, model, and model year from a dynamically populated selection box 210. The information in the selection box 210 may be toggled by touching an automobile make button 212, an automobile model button 214, and a model year button 216.

[0092] In each of the options described above, specific information entered by the user may be compared to a database containing information regarding key blanks. Such a comparison may be used to identify the proper key blank. Once the proper key blank is identified, the key blank may be displayed on the user interface to inform the user which key blank should be retrieved by the user.

[0093] Regardless of the method used to identify a key blank, the machine may be arranged to warn a user that a master key to be copied may contain a computer chip, transponder, or the like. Such computer chips and transponders are common in automobile keys. Duplicates for such keys may need to include a corresponding computer chip in order for the duplicate to be successful. Once it is determined that a master key may have a computer chip, the user may be instructed to place the master key in or near a device designed to sense the presence of a computer chip in a key. If

the master key does include a computer chip, the user may be instructed on how to proceed to ensure a functional duplicate key is made.

[0094] Once a proper key blank is identified and retrieved by the user, the user interface may further guide the user in duplicating the master key and displaying the progress of duplication of the key. As shown in Figure 25, a list of actions 218 may be displayed on the user interface. The first action shown instructs the user to load a key blank. The user may remove the master key and insert the proper key blank and press a box 220 to initiate the key duplication process. The key duplication machine 10 may then proceed with additional actions such as scanning the blank and verifying the proper blank is loaded, positioning the key blank to insure proper alignment, cutting the key blank, etc. As shown in Figure 26, as actions are completed, checks may be displayed in boxes 222 to indicate that an action has been completed. The user interface may also include a graphic to terminate the cutting process. For example, a user may touch a graphic of a stop sign 224 to stop the cutting process.

[0095] The logic may be arranged to collect and store data regarding key duplications performed by the key duplication machine 10. For example, data regarding the number of key duplications performed, the number of different key blanks used in key duplication, the number of an individual key blank used in key duplication, success rate of duplicating keys, and the like may be collected and stored. Such information and data may be analyzed by the logic associated with the machine 10 or be downloaded for remote analysis.

CLAIMS

Having thus described the invention, we claim:

1. An assembly for duplicating a master key, said assembly comprising:
an optical imaging device for capturing an optical image of at least a portion of said master key;
a logic for determining a key pattern of said master key from said optical image of master key;
a clamping assembly for clamping a key blank; and
a first cutting member for cutting a key pattern into said key blank.
2. The assembly of claim 1, where said key pattern cut into key blank is a duplication of said key pattern of master key.
3. The assembly of claim 2, where said logic directs said first cutting member during duplication of said key pattern of master key.
4. The assembly of claim 1, where said optical image is a digital image.
5. The assembly of claim 1, where said clamping assembly further comprises:
a first clamping member having a first clamping surface defining a width; and
a second clamping member having a second clamping surface defining a width.
6. The assembly of claim 5, where said key blank further comprises a blade defining a width, where said width of first clamping member and said width of second clamping member are less than said width of blade of key blank.
7. The assembly of claim 1, further comprising a second cutting member for cutting said key pattern into key blank, where said first and second cutting members are capable of simultaneously cutting said key pattern into key blank.

8. The assembly of claim 1, where said first cutting member is a cutting wheel.
9. The assembly of claim 1, further comprising a retention mechanism for retaining said master key or said key blank.
10. The assembly of claim 9, where said retention mechanism further comprises:
a base;
a retention plate; and
a biasing member biasing said retention plate towards said base.
11. The assembly of claim 1, further comprising a first positioning member and a second positioning member, where said first and second positioning members engage said master key or said key blank to position said master key or said key blank relative to said assembly.
12. The assembly of claim 1, further comprising a user interface for providing output to a user.
13. The assembly of claim 12, where said logic determines said key blank from said optical image of said master key.
14. The assembly of claim 13, where identity of said determined key blank is output to said user by said user interface.
15. The assembly of claim 14, where said user interface is a display rack for the display of a plurality of key blanks.
16. The assembly of claim 1, where said key blank may be clamped in a first orientation or a second orientation.
17. A method for duplicating a master key, said method comprising:

capturing an optical image of at least a portion of said master key;
providing a logic to determine a key pattern of said master key from said optical image of master key;
securing a key blank; and
cutting a key pattern into said key blank.

18. The method of claim 17, where said key pattern cut into key blank is a duplication of said key pattern of master key.
19. The method of claim 17 further comprising using logic to determine said key blank.
20. The method of claim 19 further comprising outputting said determined key blank to a user.
21. The method of claim 19 further comprising:
capturing an optical image of at least a portion of said key blank; and
using said logic to validate said key blank matches said master key.
22. The method of claim 17 further comprising:
capturing an optical image of at least a portion of said key pattern cut into key blank;
using said logic to determine said key pattern cut into key blank; and
using said logic to compare said key pattern cut into key blank with said key pattern of master key.
23. The method of claim 22 comprising using said logic to validate that said key pattern cut into key blank is within a predefined tolerance of said key pattern of master key.
24. An assembly for identifying a key blank for the duplication of a master key, said assembly comprising:

an optical imaging device for capturing an optical image of at least a portion of said master key;
a logic for determining at least one feature of said master key from said optical image of master key for comparison with at least one feature of a plurality of key blanks, and identifying which of the plurality of key blanks is the proper key blank for duplication of said master key.

25. The assembly of claim 24, where identity of said proper key blank is output to a user by a user interface.

26. The assembly of claim 25, where said user interface is a display rack for the display of said plurality of key blanks.

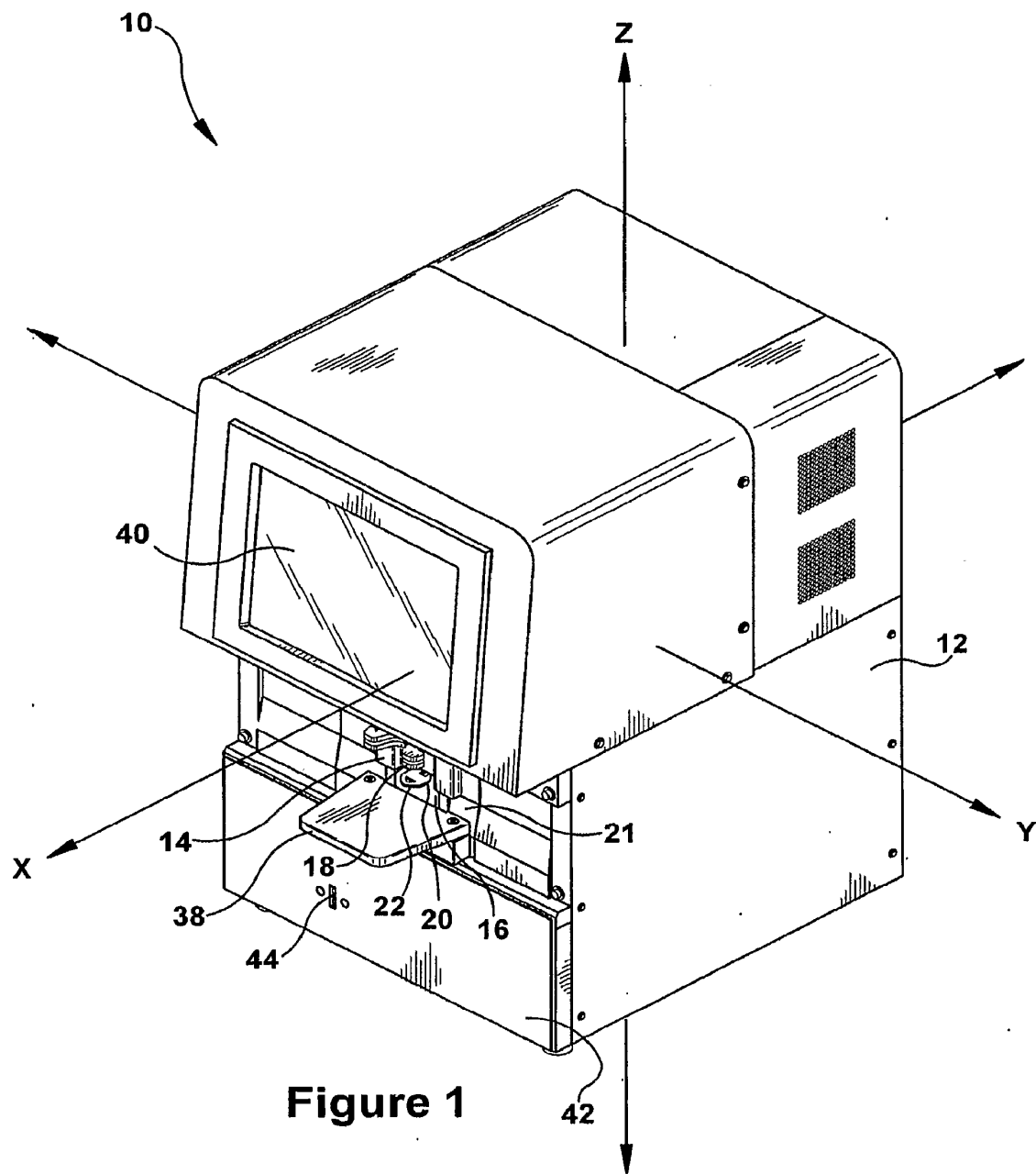
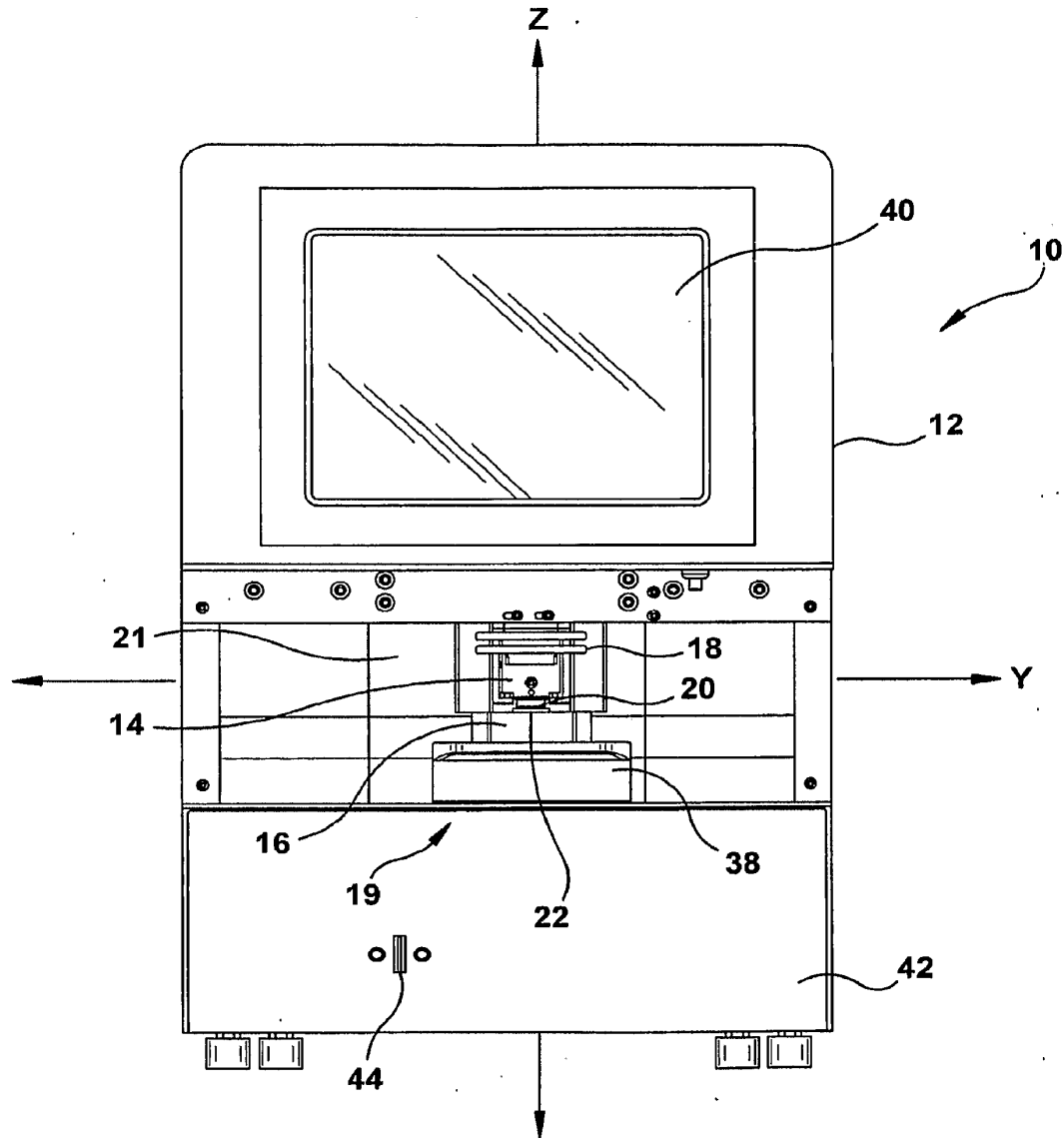


Figure 1

SUBSTITUTE SHEET (RULE 26)

**Figure 2**

SUBSTITUTE SHEET (RULE 26)

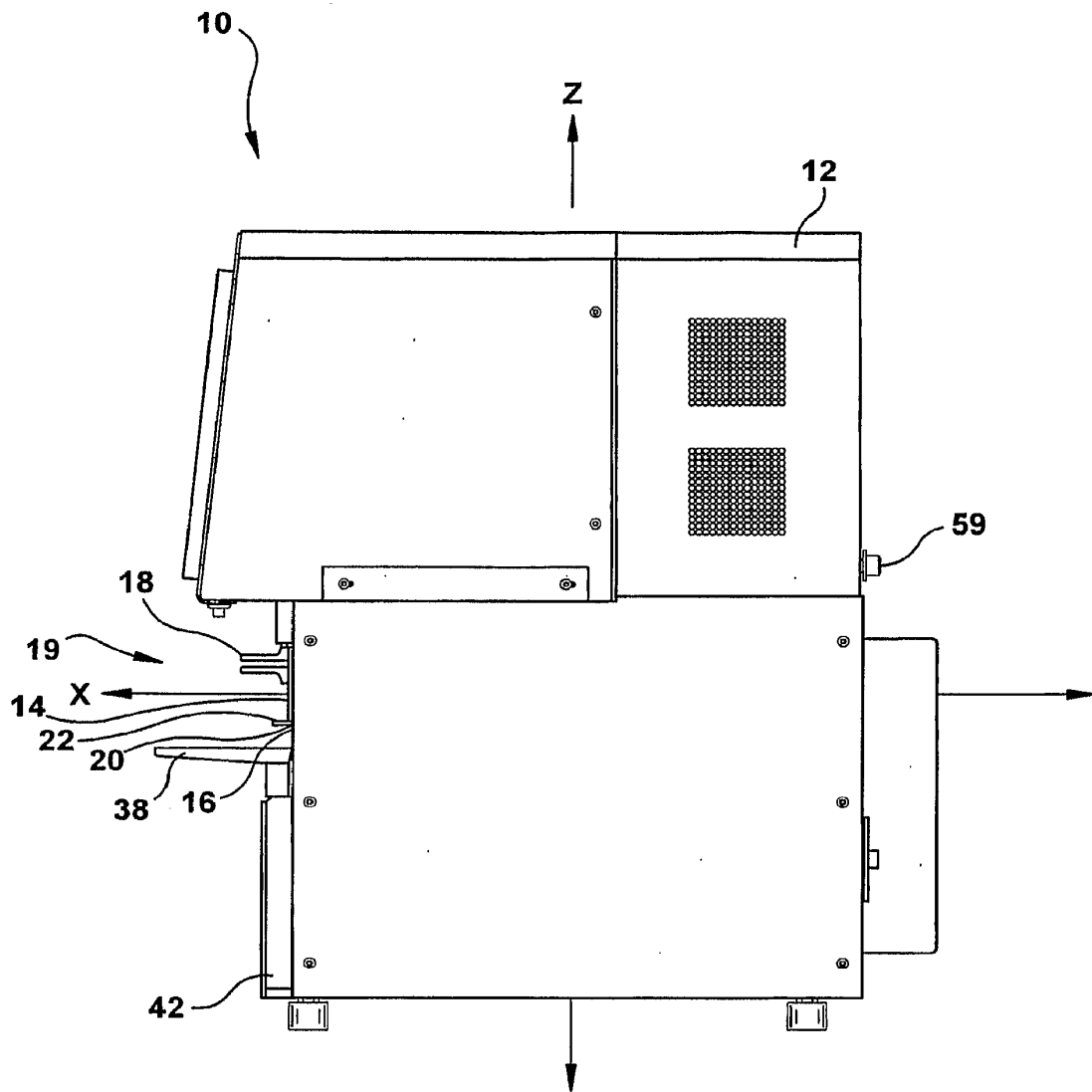


Figure 3

SUBSTITUTE SHEET (RULE 26)

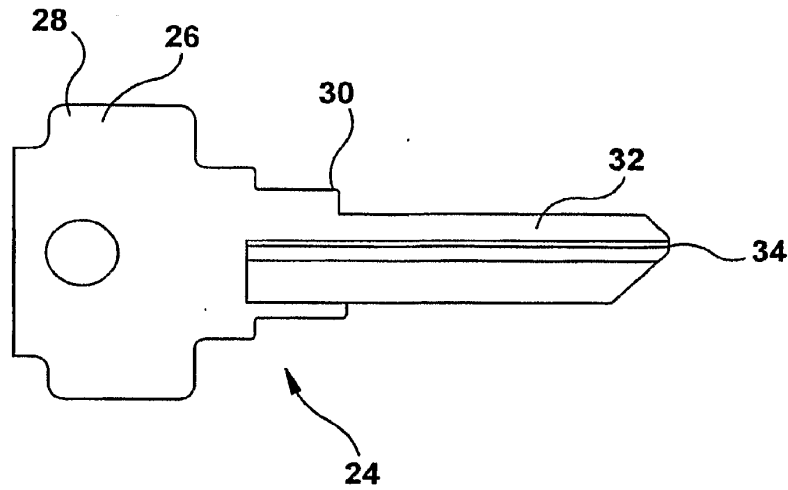


Figure 4b

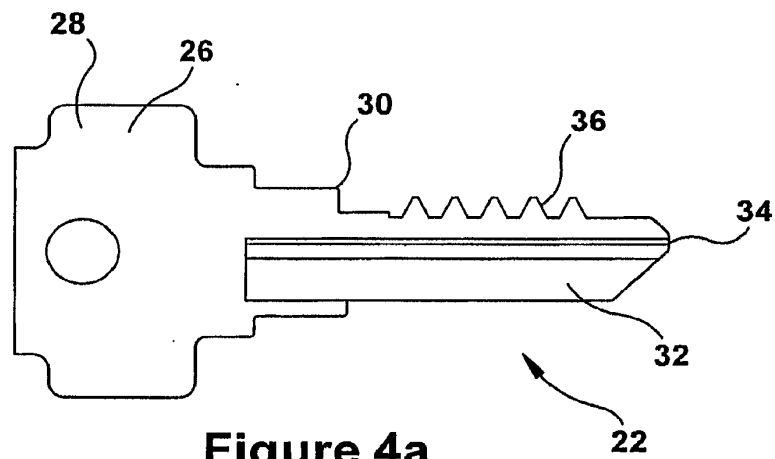


Figure 4a

SUBSTITUTE SHEET (RULE 26)

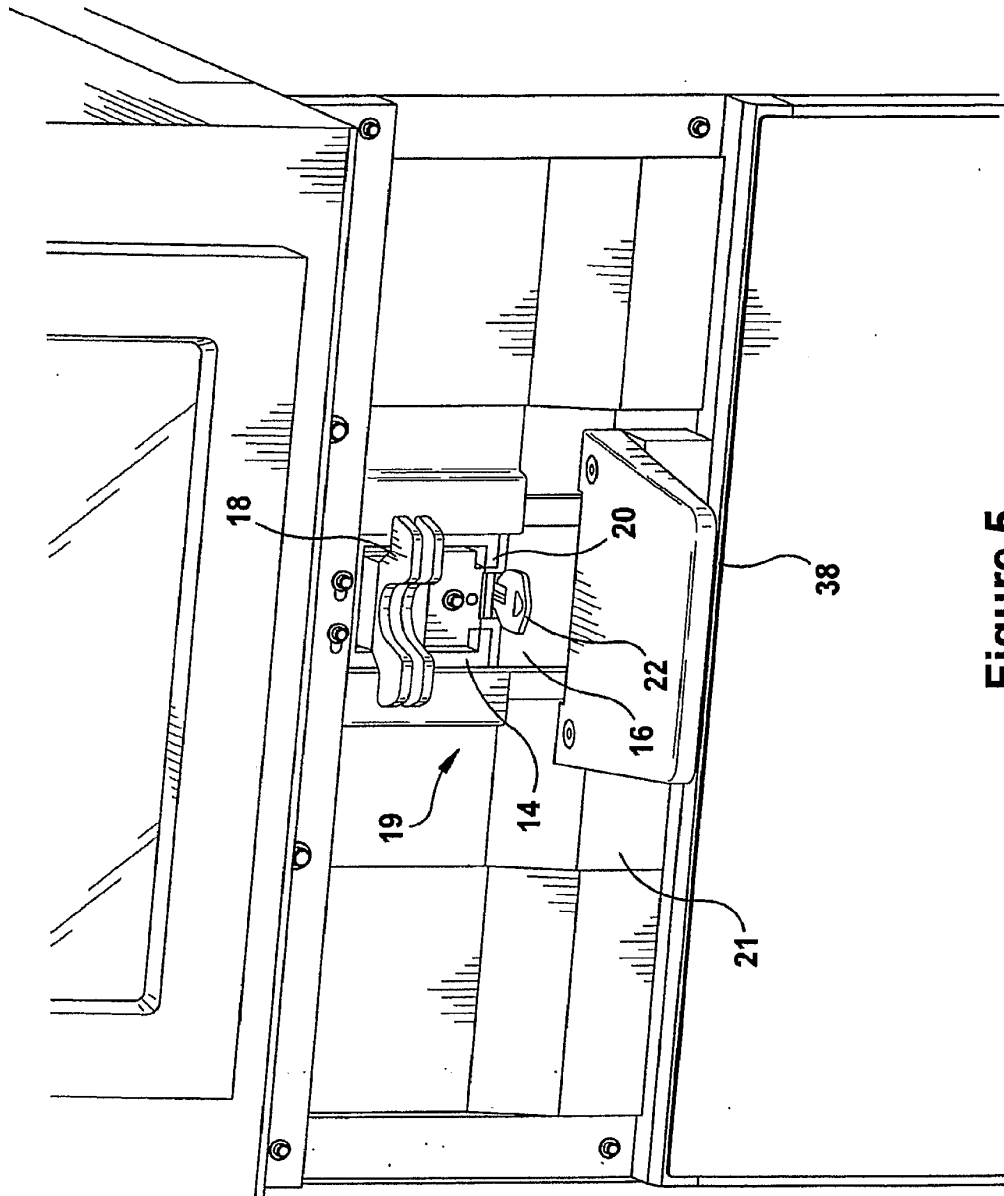
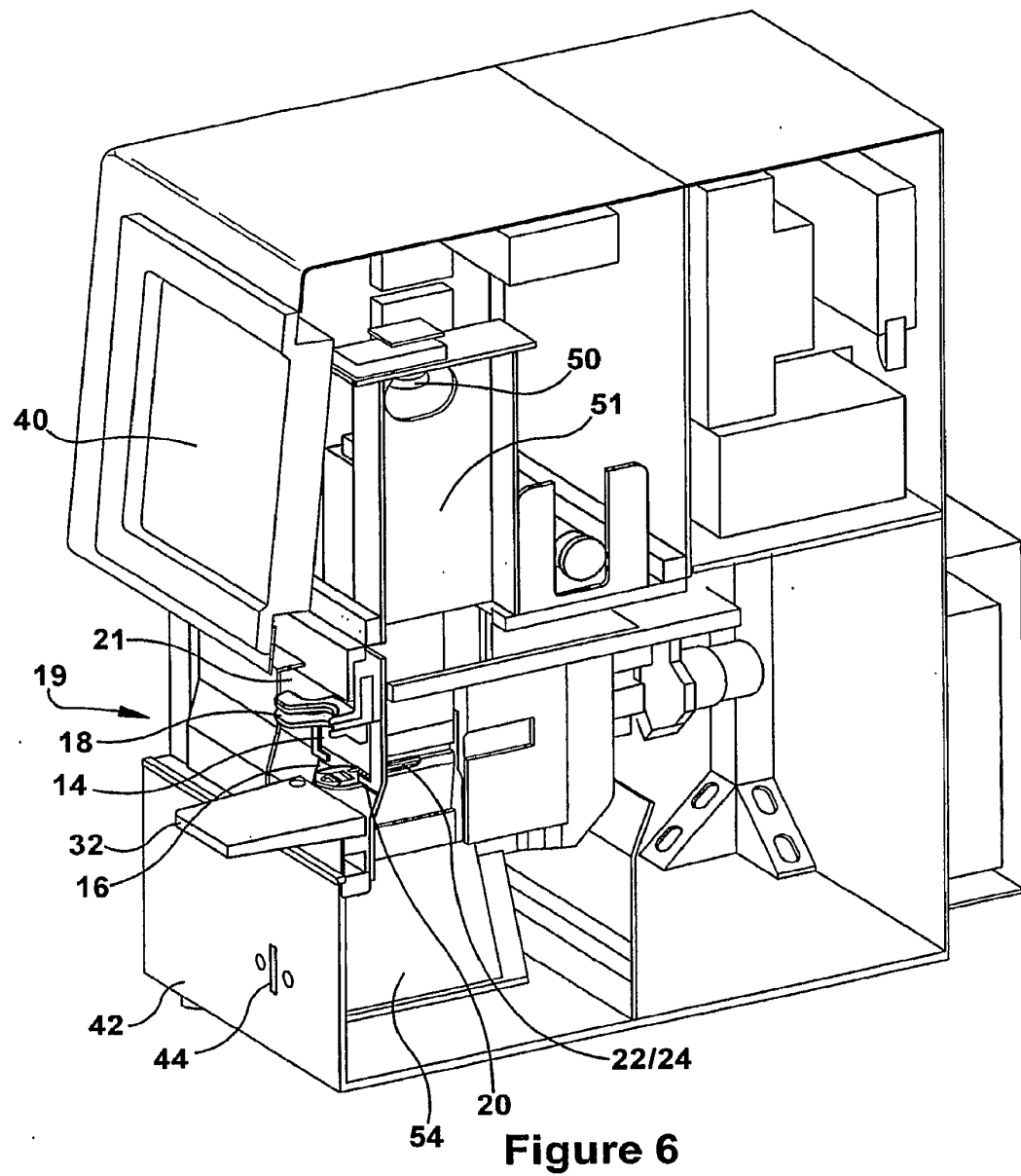


Figure 5

SUBSTITUTE SHEET (RULE 26)



SUBSTITUTE SHEET (RULE 26)

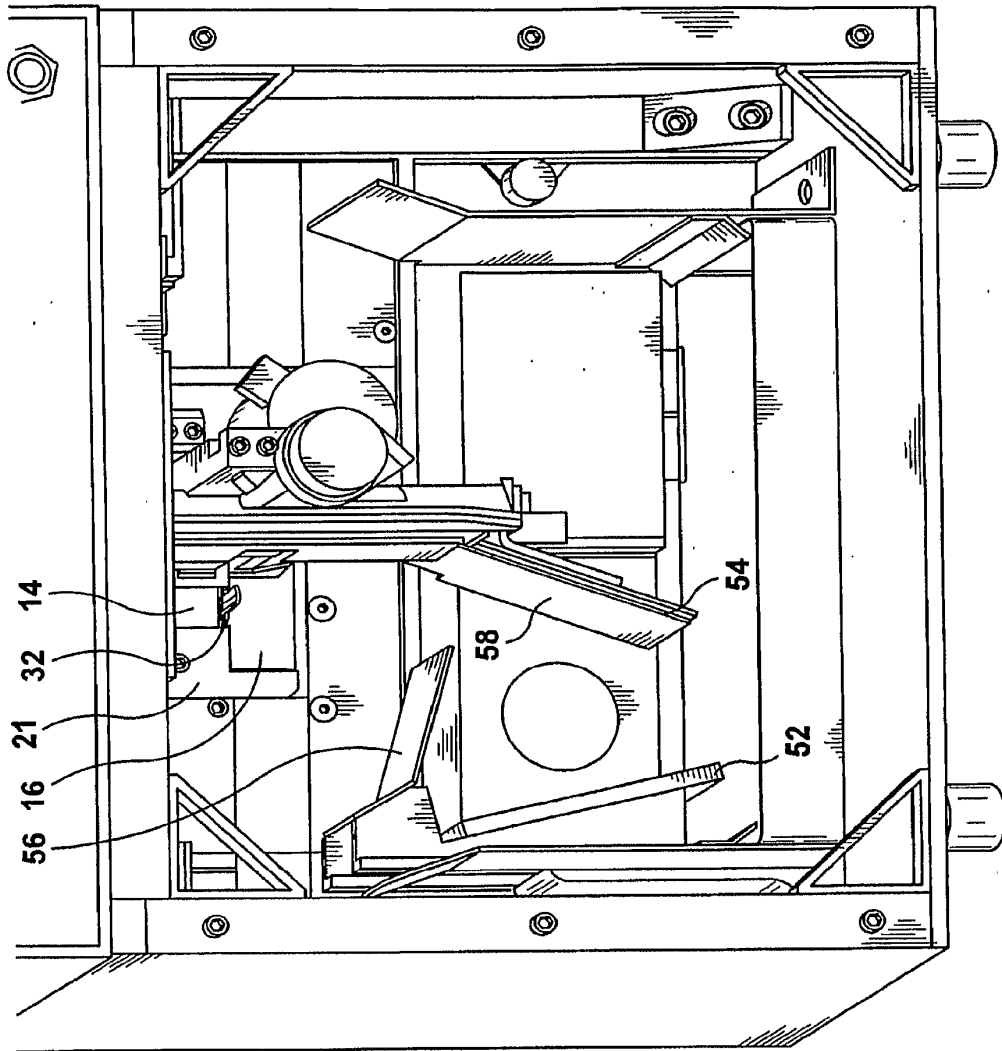


Figure 7

SUBSTITUTE SHEET (RULE 26)

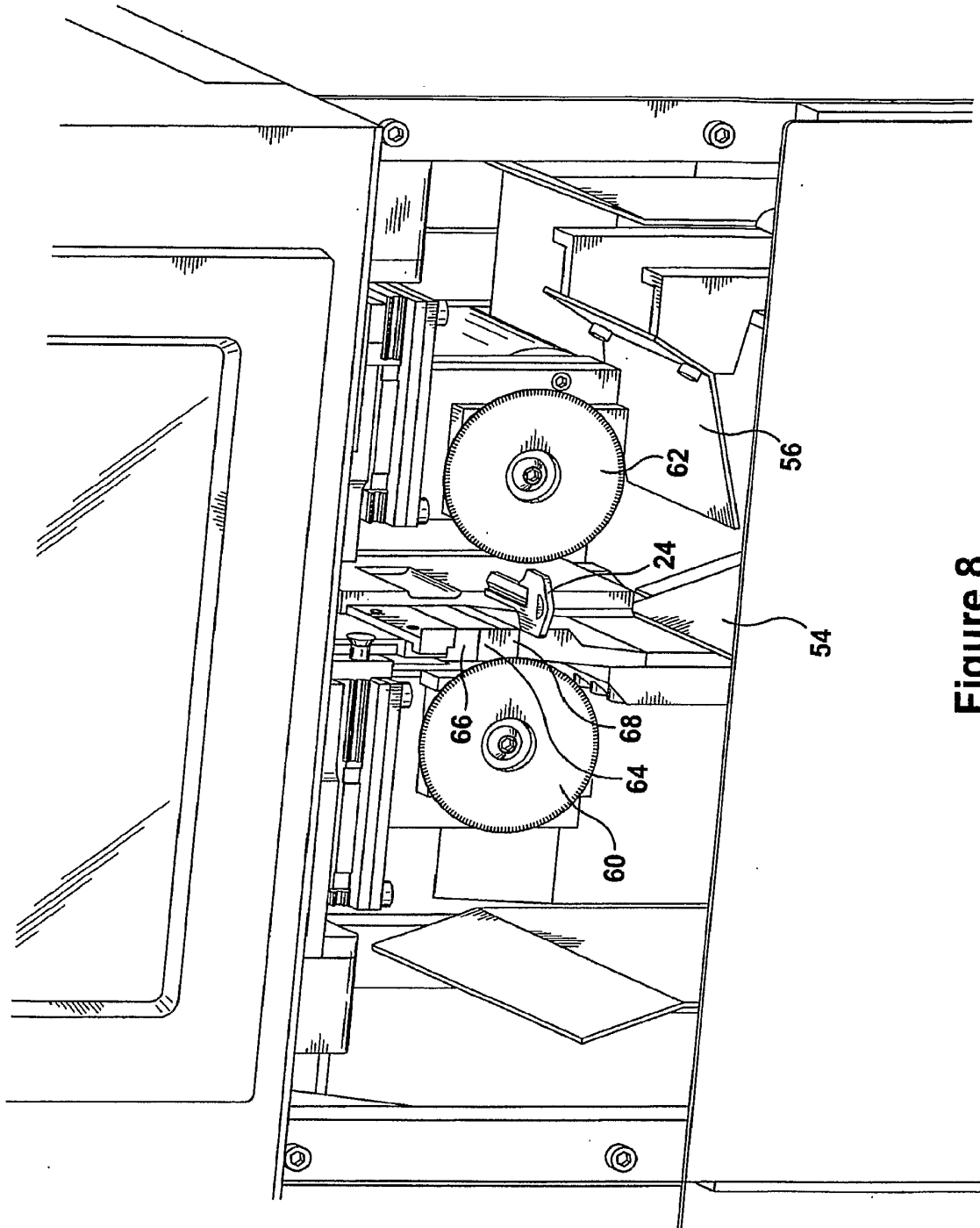


Figure 8

SUBSTITUTE SHEET (RULE 26)

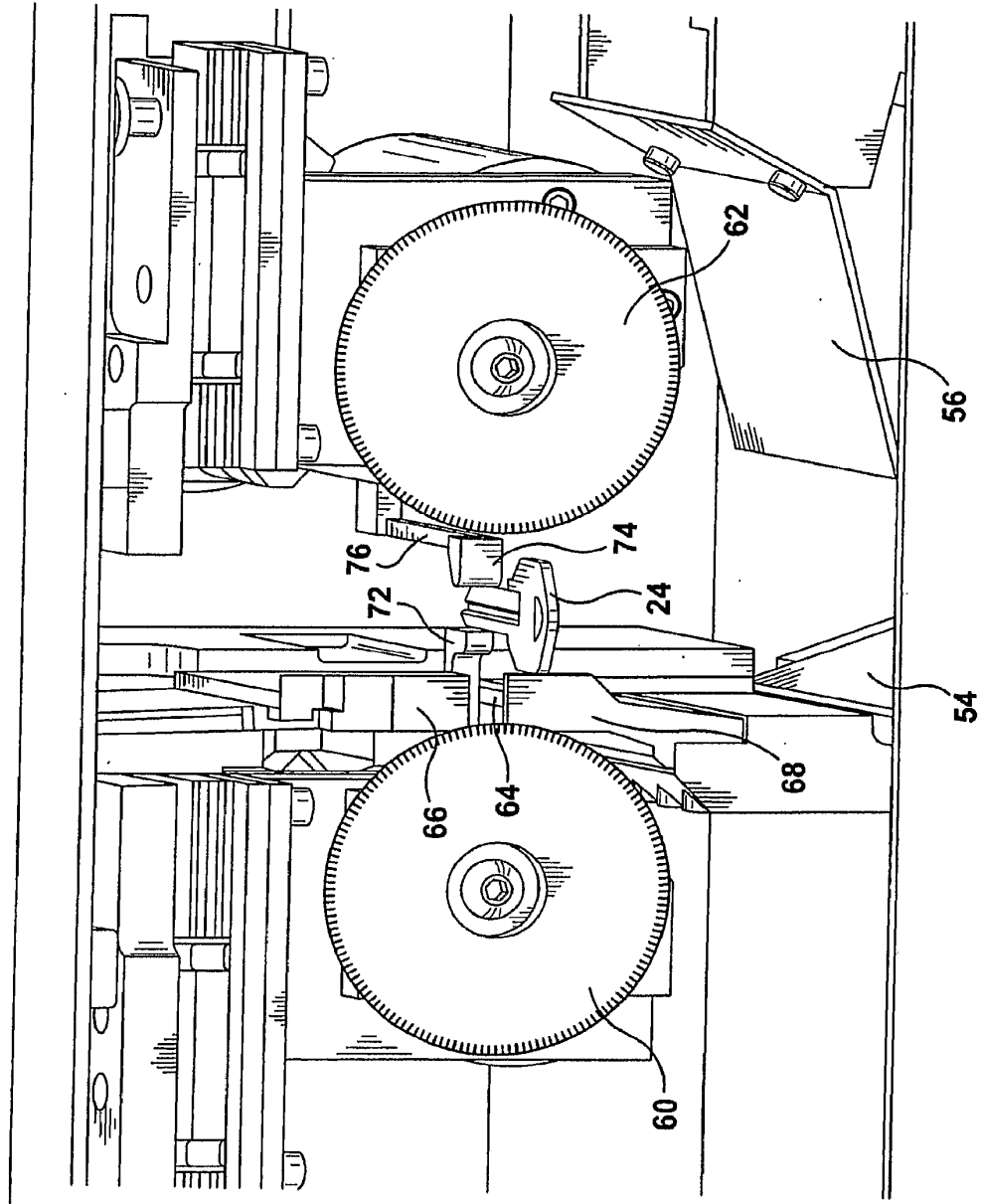


Figure 9

SUBSTITUTE SHEET (RULE 26)

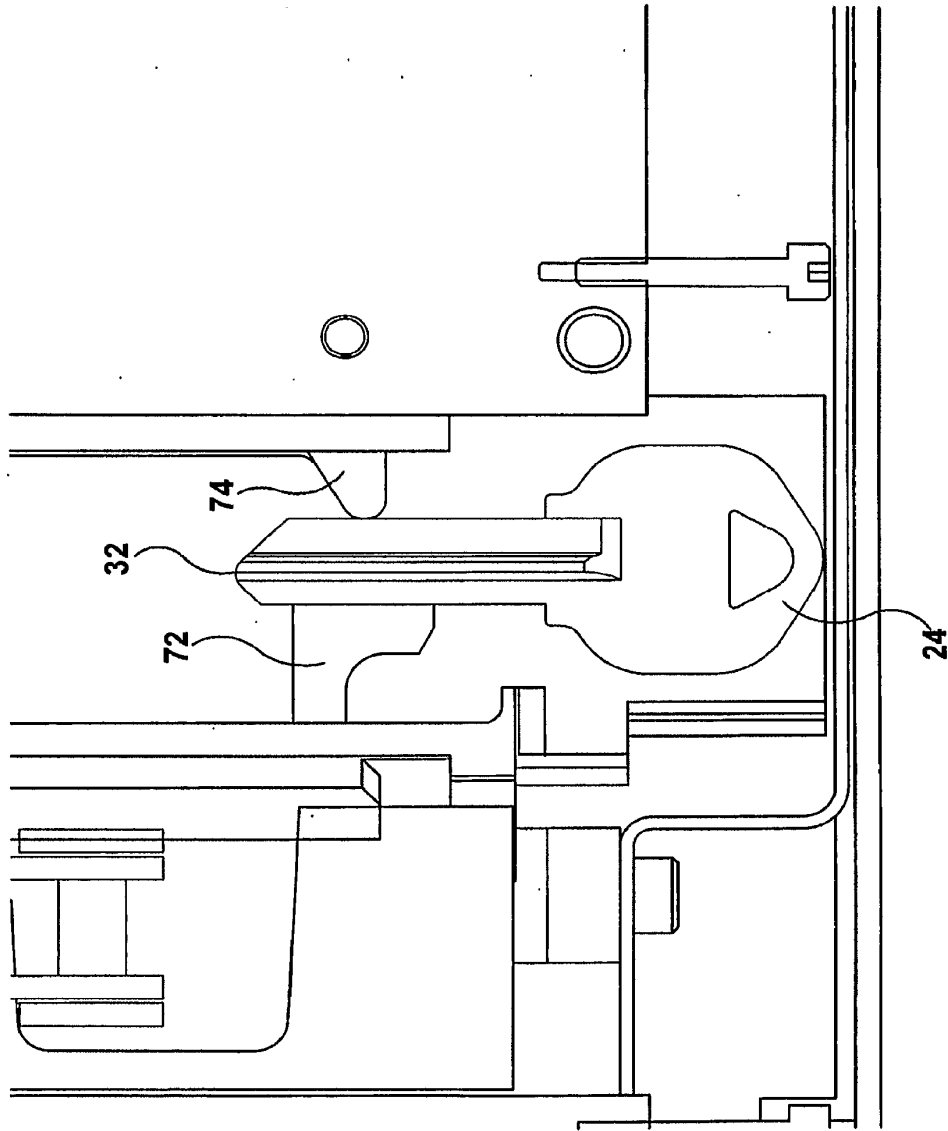


Figure 10

SUBSTITUTE SHEET (RULE 26)

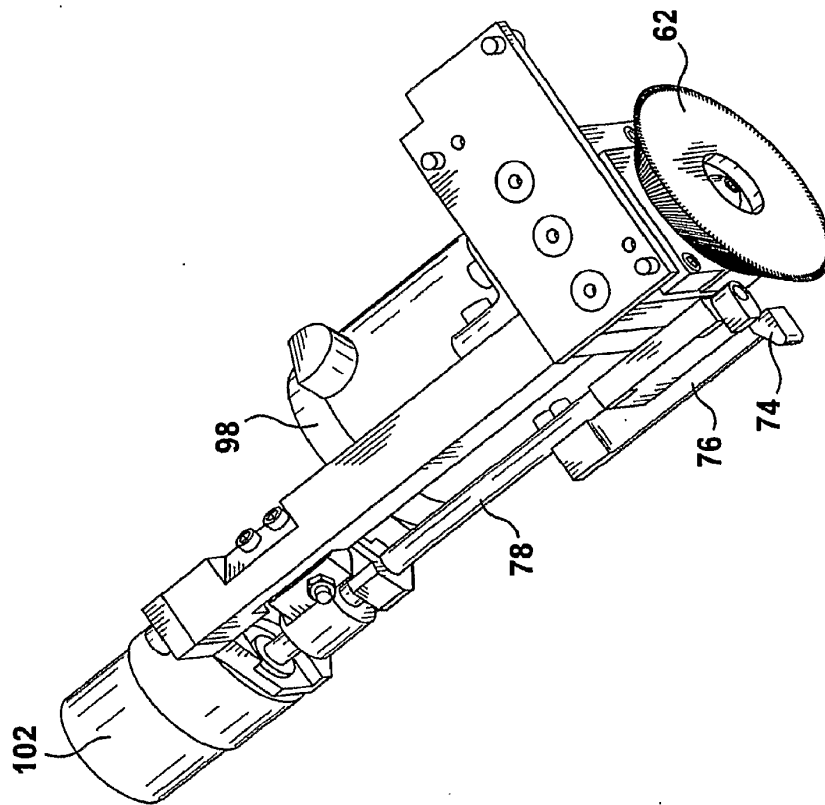


Figure 11

SUBSTITUTE SHEET (RULE 26)

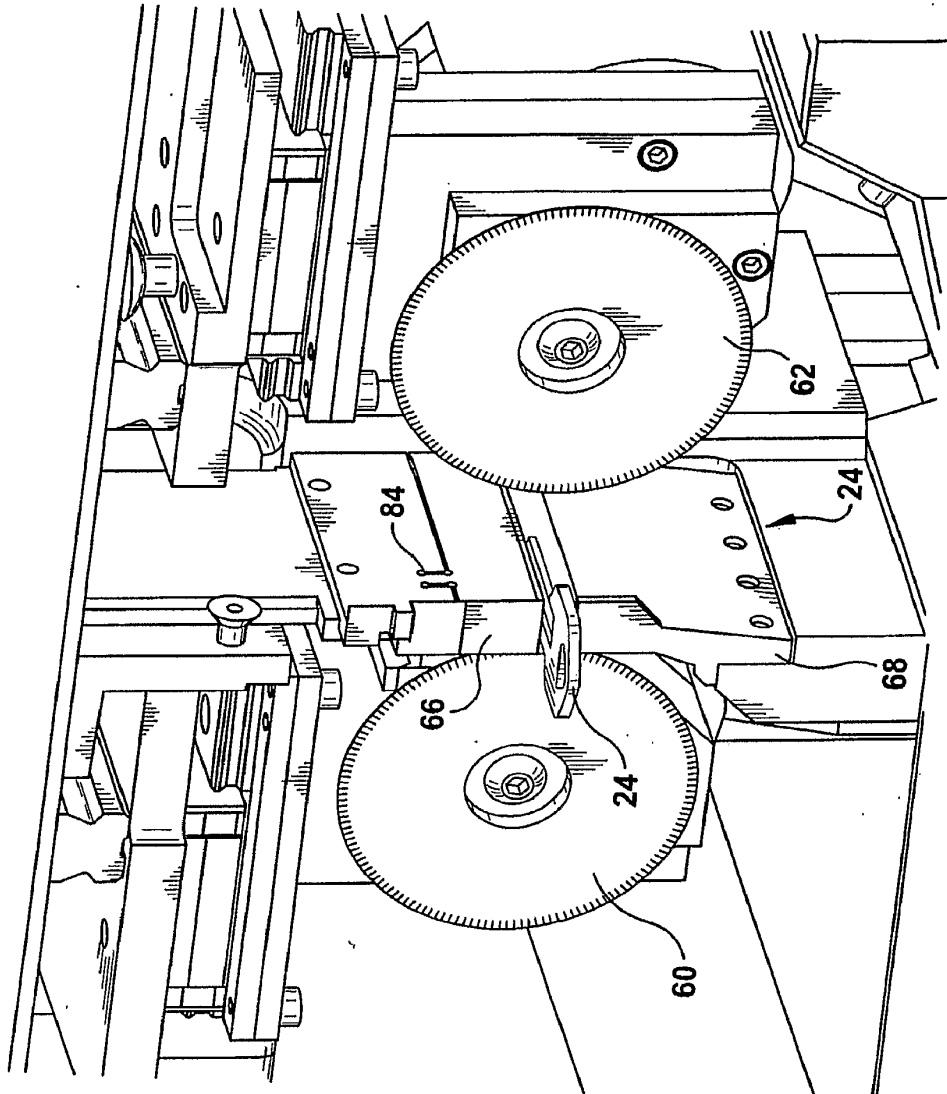


Figure 12

SUBSTITUTE SHEET (RULE 26)

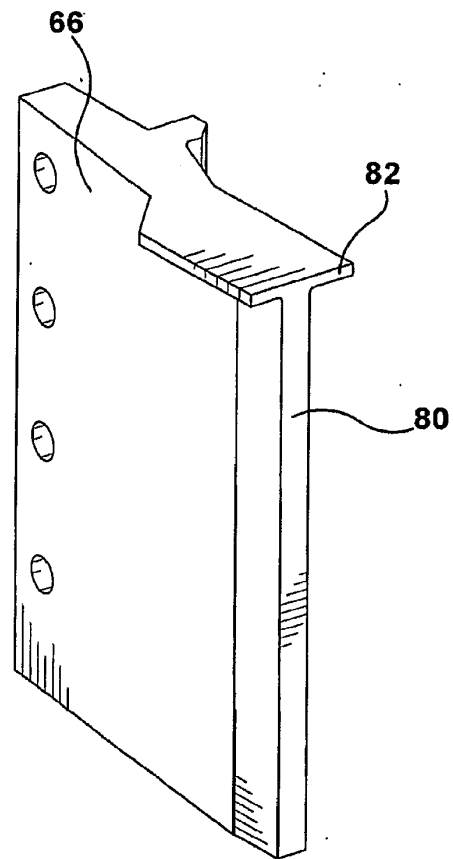


Figure 13

SUBSTITUTE SHEET (RULE 26)

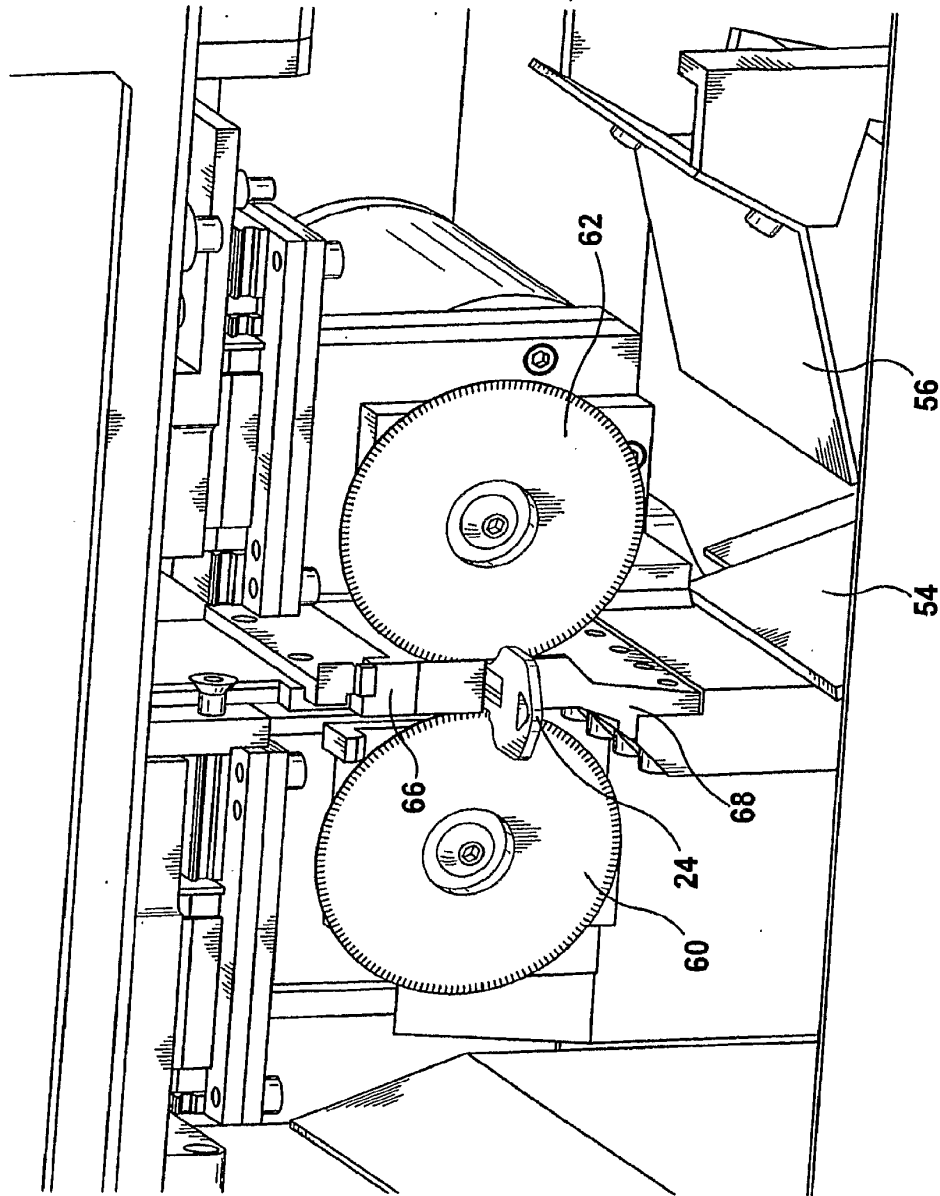


Figure 14

SUBSTITUTE SHEET (RULE 26)

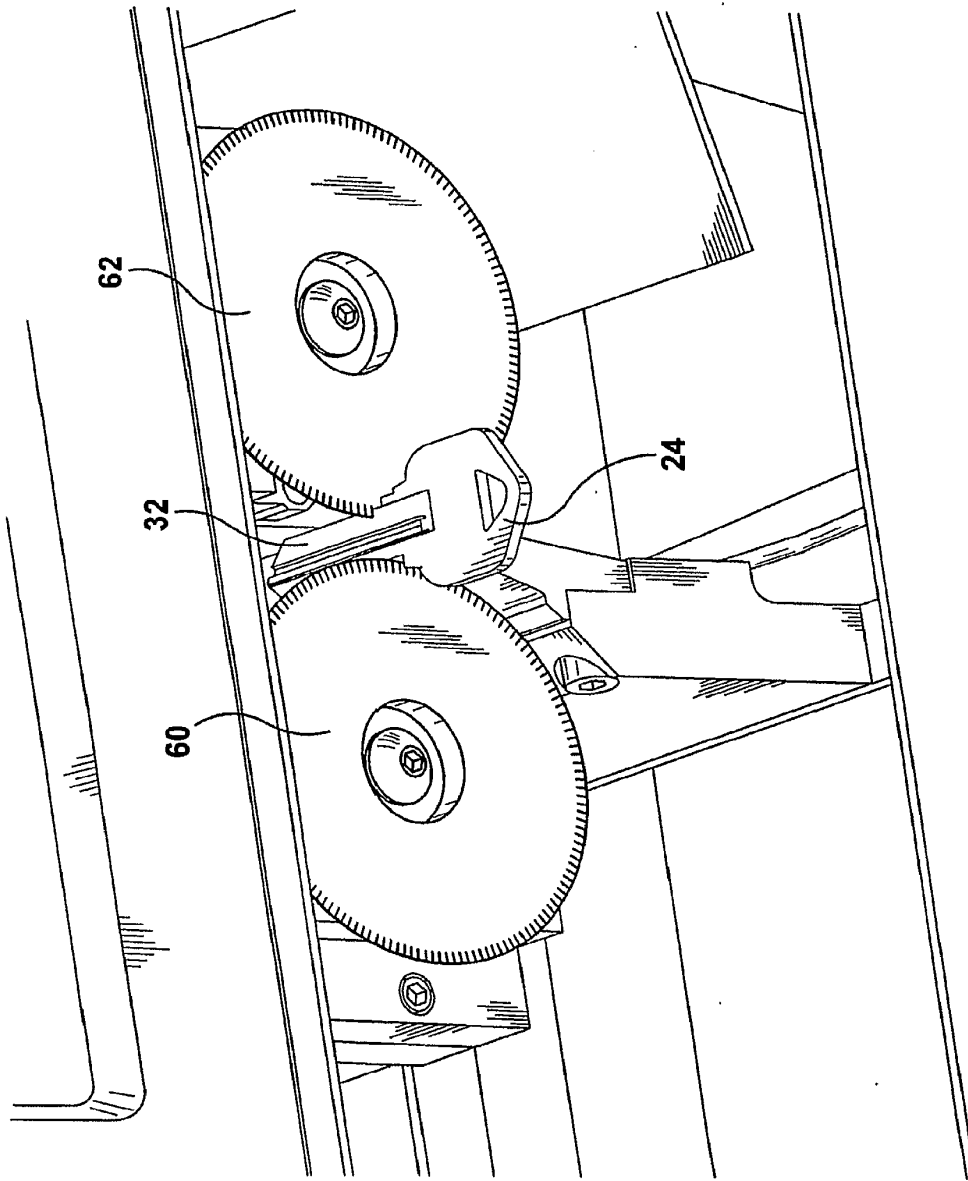


Figure 15

SUBSTITUTE SHEET (RULE 26)

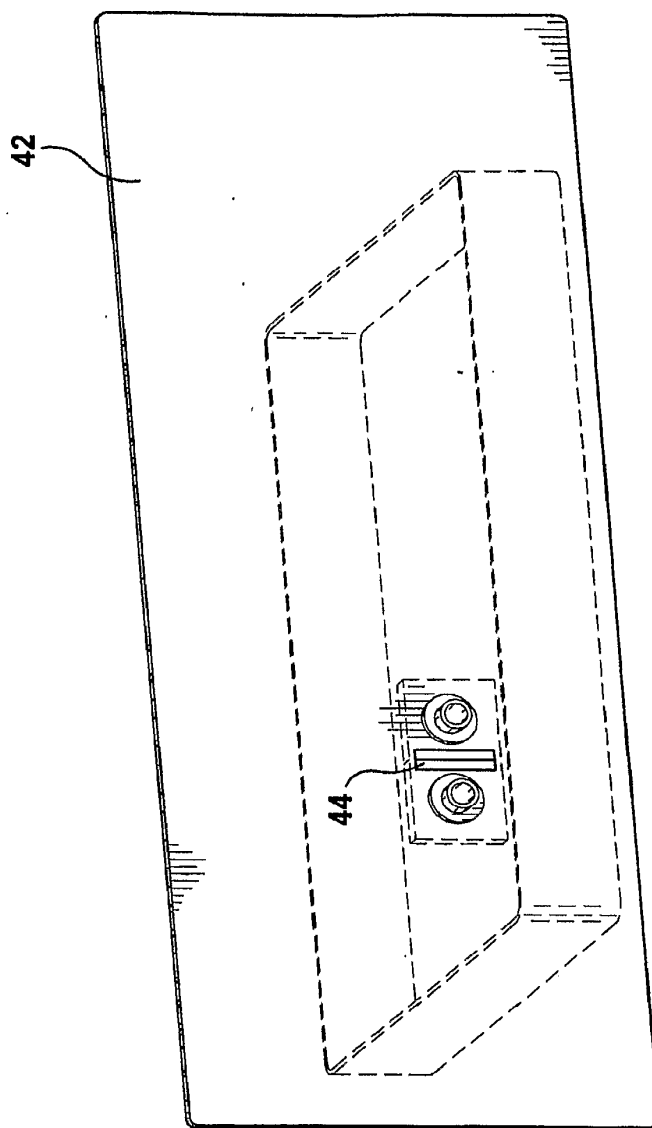


Figure 16

SUBSTITUTE SHEET (RULE 26)

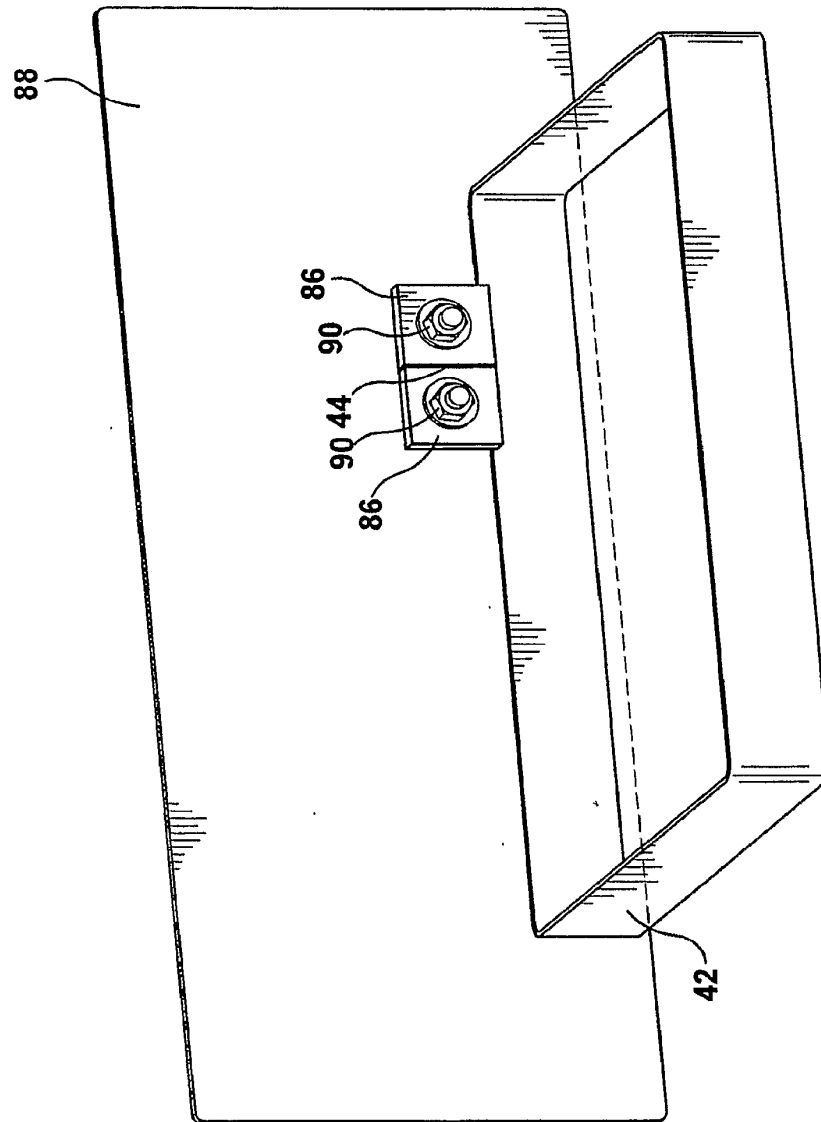


Figure 17

SUBSTITUTE SHEET (RULE 26)

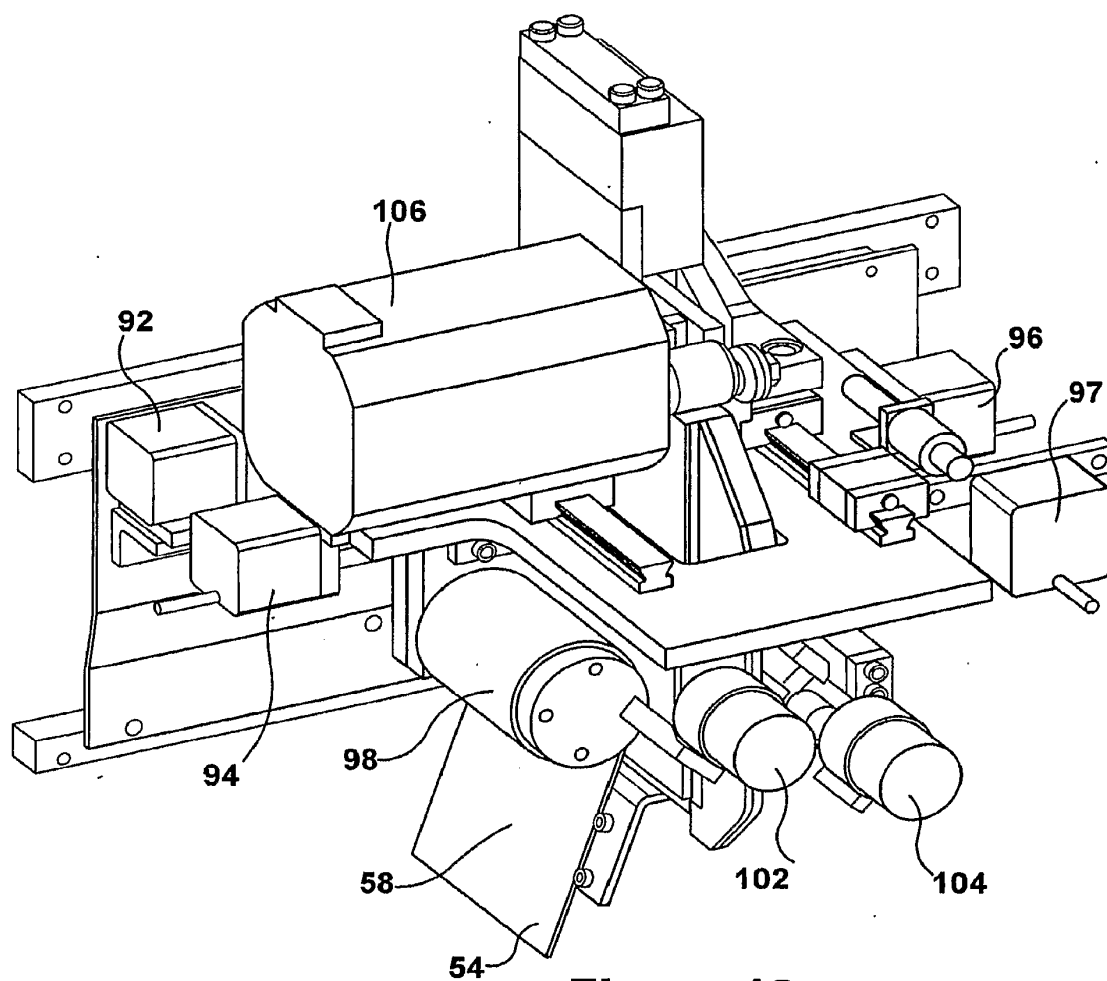


Figure 18

SUBSTITUTE SHEET (RULE 26)

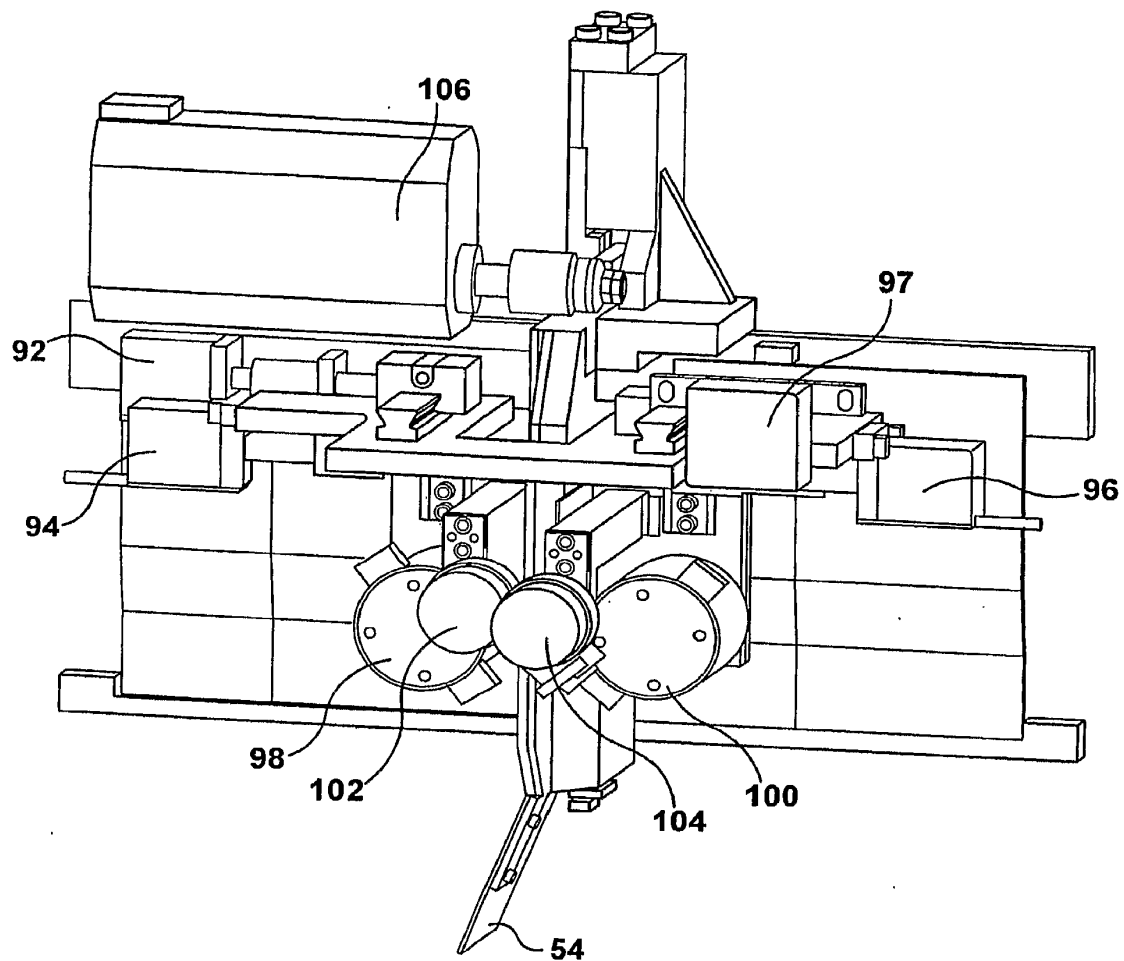


Figure 19

SUBSTITUTE SHEET (RULE 26)

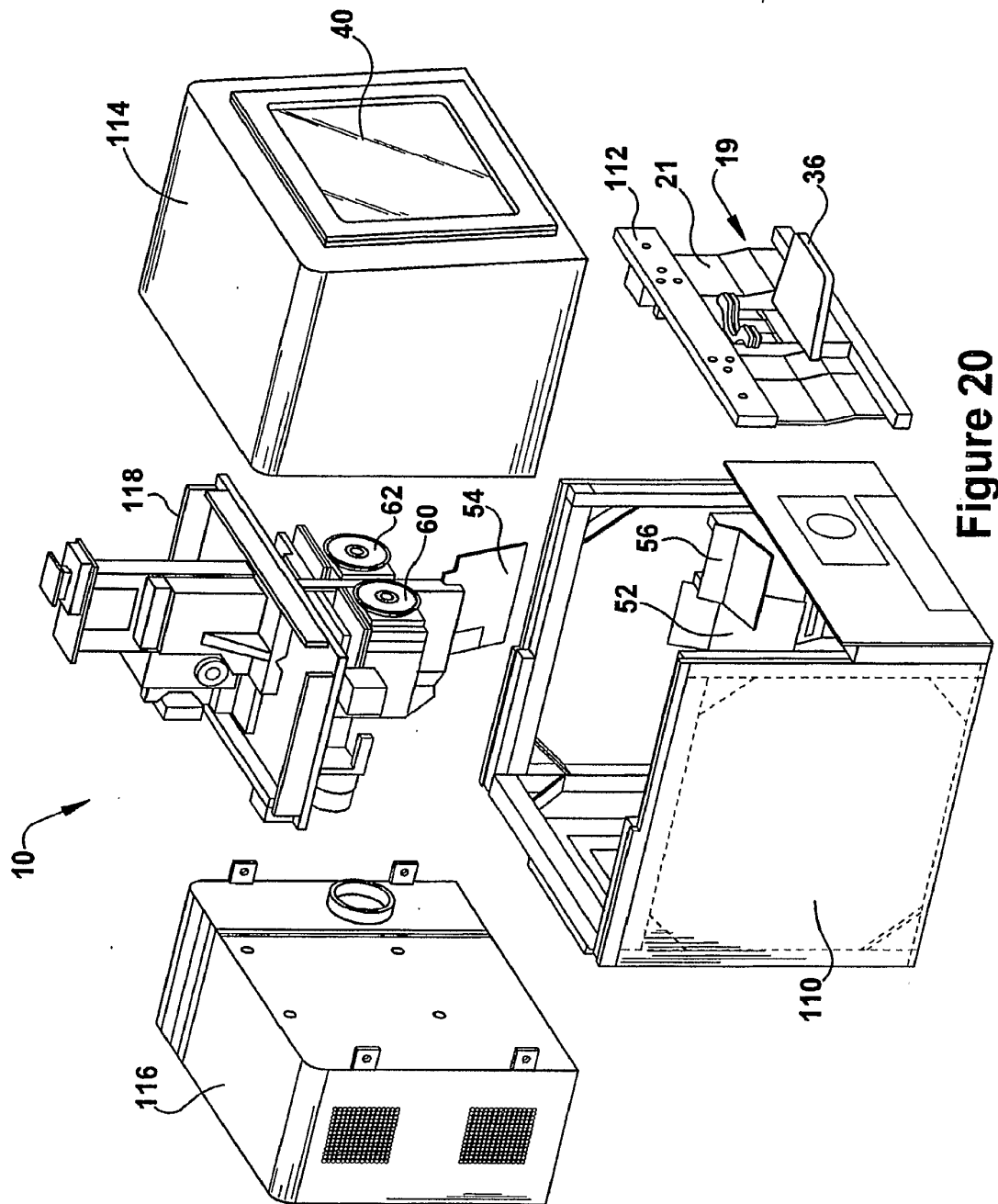


Figure 20

SUBSTITUTE SHEET (RULE 26)

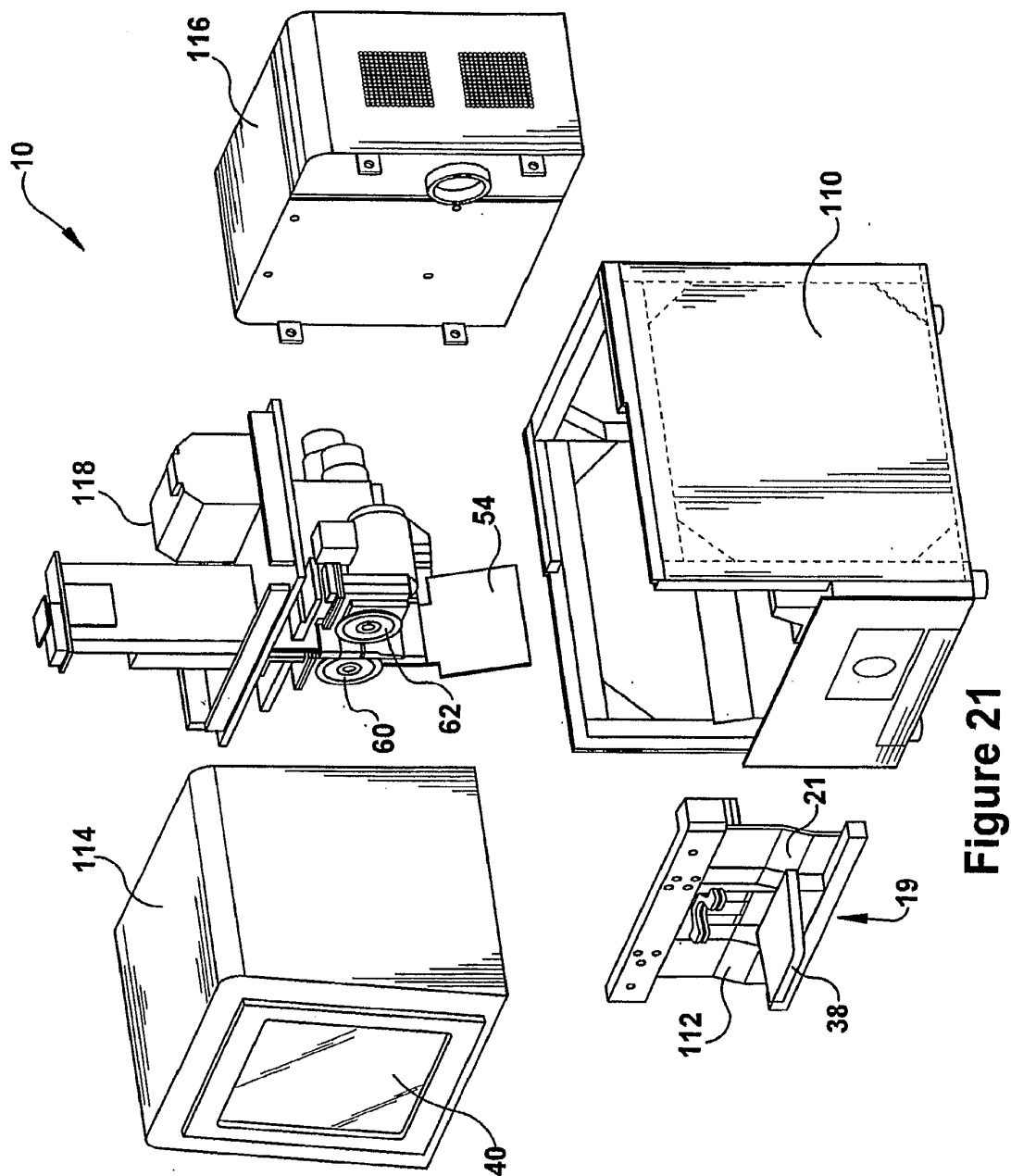


Figure 21

SUBSTITUTE SHEET (RULE 26)

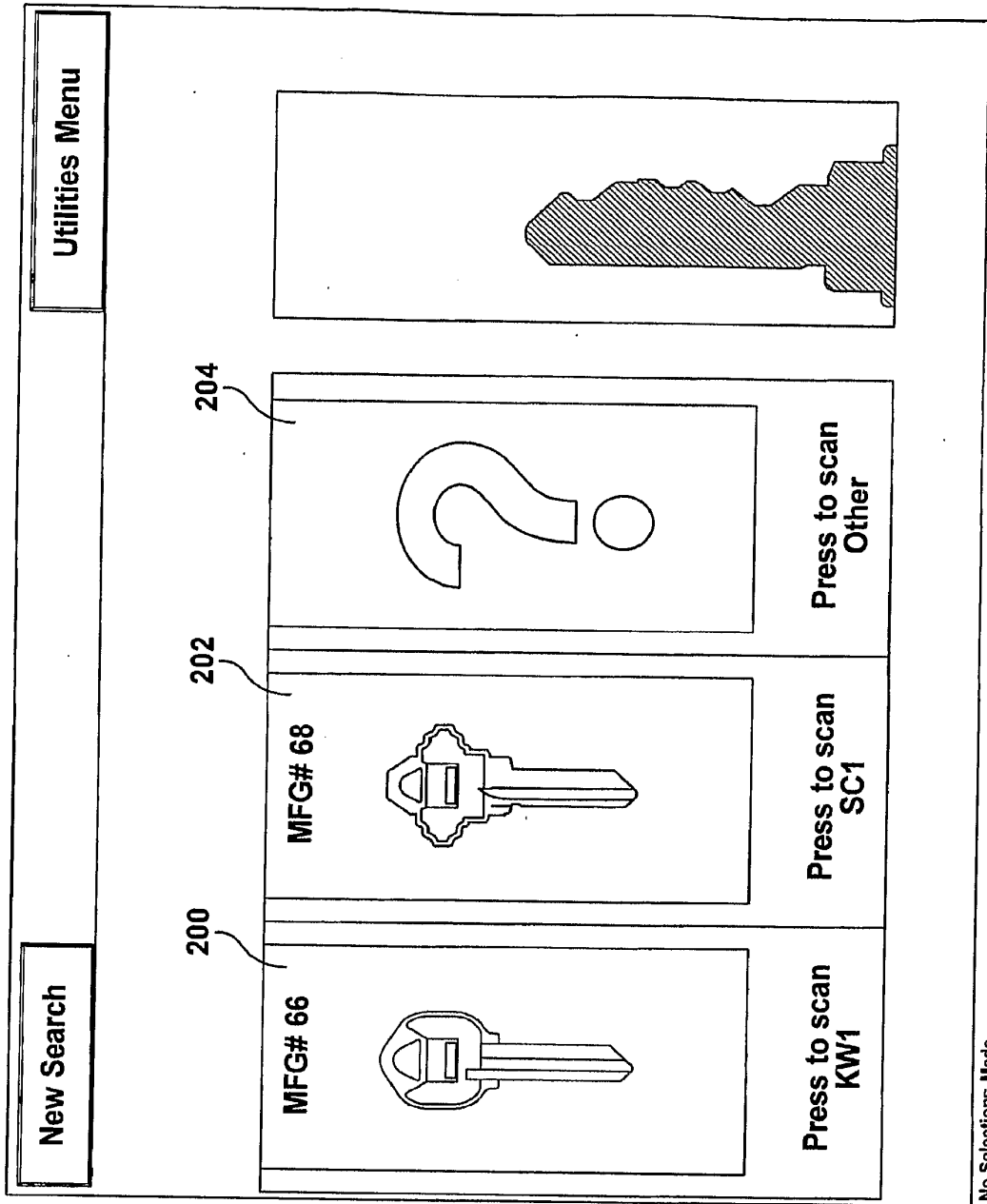


Figure 22

SUBSTITUTE SHEET (RULE 26)

New Search  Manual Lookup

2:10

Results (590)

Utilities Menu

206

Categories

-= UNCERTAIN =-

Auto, Small Truck, Van

Heavy Truck, Ind., Farm

House and Building

Miscellaneous

Padlock

Recreational Vehicle

Category	-= UNCERTAIN =-
Use	-= UNCERTAIN =-
Product/Make	-= UNCERTAIN =-
Lock/Mode	-= UNCERTAIN =-
Year	-= UNCERTAIN =-
Manufacturer	-= UNCERTAIN =-
Part Number	-= UNCERTAIN =-

208

208

(Scanned Customer Key)

Figure 23

SUBSTITUTE SHEET (RULE 26)

New Search		2:49	Manual Lookup	Results (17)	Utilities Menu
Automotive Lookup				Makes: -- UNCERTAIN -- Acura Chevrolet Ford <u>210</u> Honda Hummer Lincoln Mazda Mercury Sterling Truck Suzuki	
212		Make	-- UNCERTAIN --		
214		Model	-- UNCERTAIN --		
216		Year	-- UNCERTAIN --		

(Scanned Customer Key) : Auto, Small Truck, Van

Figure 24

SUBSTITUTE SHEET (RULE 26)

New Search
 2:50

Cut SC1 Key

Back to Results

218

☐ Load Key Blank

☐ Verifying Key Blank
☐ Positionig Key Blank
☐ Cutting Key Blank
☐ Repositioning Key Blank
☐ Validating Cut Key
☐ Completing Cycle

220

Press to Start Cutting

MFG #68

Duplication Successful

Remove Cut Key

Please load an uncut SC1 blank and press the 'Start Cutting' button

Figure 25

SUBSTITUTE SHEET (RULE 26)

New Search



2:25

Cut SC1 Key

Back to Results

MFG #68

224

STOP

Press to Stop Cutting

☒ Load Key Blank

☒ Verifying Key Blank

☒ Positioning Key Blank

☐ Cutting Key Blank

☐ RePositioning Key Blank

☐ Validating Cut Key

☐ Completing Cycle

222

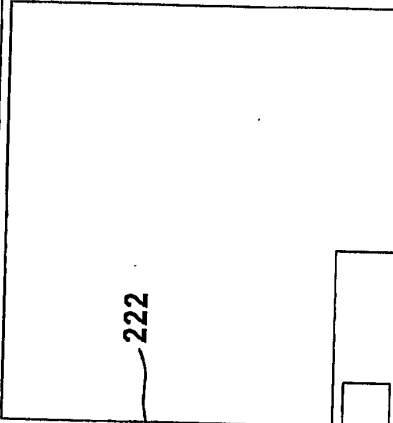


Figure 26

SUBSTITUTE SHEET (RULE 26)

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property
Organization
International Bureau



(43) International Publication Date
12 May 2005 (12.05.2005)

PCT

(10) International Publication Number
WO 2005/042196 A1

(51) International Patent Classification⁷: **B23C 3/35**

(21) International Application Number:
PCT/US2004/034947

(22) International Filing Date: 20 October 2004 (20.10.2004)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
60/512,636 20 October 2003 (20.10.2003) US

(71) Applicant: **HY-KO PRODUCTS COMPANY** [US/US];
7370 Northfield Road, Walton Hills, OH 44146-6106 (US).

(72) Inventors: **RYAL, Richard, William, SR.**; 12496 Athena
Drive, North Royalton, OH 44133 (US). **BASS, Michael,
A.**; 17552 Lakesedge Trail, Chagrin Falls, OH 44023 (US).

(74) Agent: **EARP, Robert, H., III**; McDonald Hopkins, Co.,
LPA, 600 Superior Avenue, Suite 2100, Cleveland, OH
44114 (US).

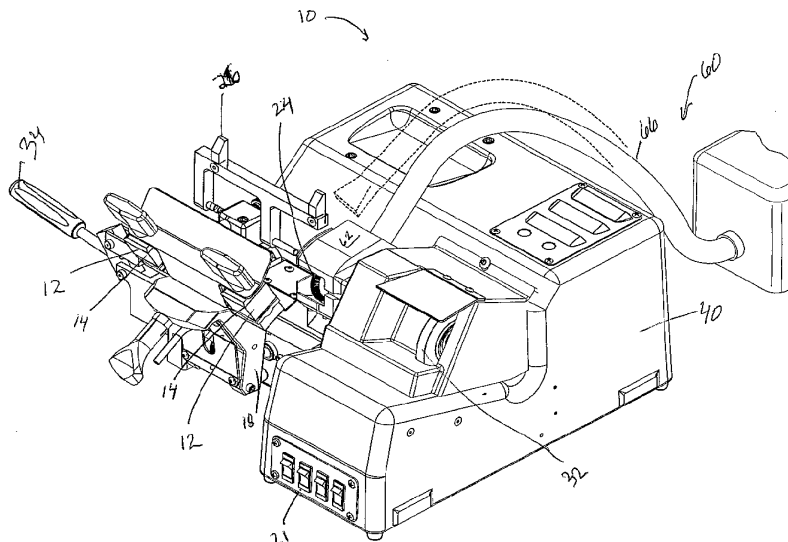
(81) Designated States (*unless otherwise indicated, for every kind of national protection available*): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

(84) Designated States (*unless otherwise indicated, for every kind of regional protection available*): ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:
— with international search report

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: KEY CUTTING MACHINE



(57) Abstract: A key cutting machine having a vacuum port connected to the housing and capable of removeably connecting a vacuum tube thereto so that when the vacuum tube is connected to the vacuum port the vacuum tube is capable of collecting key shavings created during a key cutting operation and, when the vacuum tube is disconnected from vacuum port, the vacuum tube can be used to collect key shavings on or surrounding the key cutting machine. Additional improvements or features of a key cutting machine are also described.

WO 2005/042196 A1

TITLE

KEY CUTTING MACHINE

RELATED APPLICATIONS

[0001] This application claims the benefit of priority of United States Provisional Patent Application Serial No. 60/512,636, filed on October 20, 2003, the entire disclosure of which is hereby incorporated by reference herein.

BACKGROUND

[0002] The present invention relates to key cutting machines that duplicate and cut the key pattern from a master key on to a key blank and, more particularly, to key cutting machines having features for improved performance and ease of operation.

[0003] Key cutting machines typically comprise a pair of vise grips or clamps mounted on a carriage. A master key having a keyway groove or grooves if necessary and a key pattern already cut therein is placed in one of the vise grips or clamps on the carriage and a key blank awaiting to be cut having an identical keyway groove or grooves as necessary is placed in the adjacent vise grip or clamp on the carriage. The key pattern of the master key faces a stylus or tracer bar on the key cutting machine and the key blank faces a cutting wheel. The carriage is pivotally and linearly movable along a longitudinal

supporting shaft and presses the key pattern of the master key against the tracer bar and the key blank against the cutting wheel. The carriage is then manually shifted longitudinally along supporting shaft thereby causing the key pattern on the master key to travel on the tracer bar and impart corresponding pivotal movement to the carriage so that the cutting wheel cuts the identical key pattern into the corresponding key blank. The key blank cut with the master key pattern is then removed from the vise or grip and buffed on a buffing wheel to remove any burrs.

[0004] While the above-identified description is directed to manual key cutting machines (machines in which the motion of the carriage results directly from user manipulation), there are also similar automatic key cutting machines. Such automatic key cutting machines can have a similar structure, but the carriage moves during the key cutting operation as driven by the motor of the key cutting machine.

[0005] Further, regardless of the particular operational characteristics of a key cutting machine, metal shavings result from the cutting wheel cutting a key pattern into a key blank. These metal shavings can accumulate if the key cutting machine is not cleaned on a regular basis and most advantageously after each key cutting operation. These metal shavings can fall into the housing of the key cutting machine and disrupt the operation of the machine or cause injury to the operator as they are very sharp and can cut an operator attempting to operate the key cutting machine.

[0006] It is an object of the present invention to provide a key cutting machine that can be operated in three different modes; automatic, semi-automatic, and manual.

[0007] It is a further object of the present invention to provide a key cutting machine that is adaptable to utilize a vacuum system for removing metal shavings from the cutter area.

[0008] Yet another object of the present invention is to provide a key cutting machine having all motors and working parts mounted to the underside of the housing away from any metal shavings and dirt which gather below.

[0009] Yet another object of the present invention is to provide a computer interface so that the key cutting machine may be operated according to instructions from a Key I.D. system (as described in U.S. Patent Application No. 10/633,933, filed on August 4, 2003, herein incorporated by reference herein) or automatic feeder system.

DESCRIPTION OF THE DRAWINGS

[0010] Objects and advantages together with the operation of the invention may be better understood by reference to the following detailed description taken in connection with the following illustrations, wherein:

[0011] FIG. 1 is a perspective view of the key cutting machine of the present invention.

[0012] FIG. 2 is an exploded view of the key cutting machine of FIG. 1.

[0013] FIG. 3 is a view of the carriage.

[0014] FIG. 4 is a side view of FIG. 3.

[0015] FIG. 5 is a left side view of the key cutting machine of FIG. 1.

[0016] FIG. 6 is a partial top view of the key cutting machine in the carriage-down position.

[0017] FIG. 7 is a left side cross-sectional view of the key cutting machine in an engaged carriage-up position.

[0018] FIG. 8 is a front view of the key cutting machine of FIG. 7.

[0019] FIG. 9 is a fragmented cross-sectional view of the carriage in an engaged carriage-up cutting position.

[0020] FIG. 10 is a view of the carriage of FIG. 9 in its engaged carriage-up position flexed away from the cutting position.

[0021] FIG. 11 is a cross-sectional view of the carriage locked in a carriage-down position.

[0022] FIG. 12 is a side view of a key blank.

[0023] FIG. 13 is a side view of a master key.

DETAILED DESCRIPTION OF THE INVENTION

[0024] The key cutting machine of the present invention, generally designated as 10, is shown in the accompanying drawings. The key cutting machine 10 as described herein has numerous features or improvements, each of which are believed to be independently novel. Therefore, while the preferred embodiment of the present invention is described as utilizing each of these novel features or improvements in the aggregate, the appended claims should only be limited by the structure described therein and interpreted independently of all other features or improvements described herein. The present description in conjunction with the accompanying drawings should clearly enable one skilled in the art to reproduce the components and function of the key cutting machine. The following description will describe in detail the present invention with reference to the several drawings.

[0025] With reference to FIGS. 12 and 13, a brief introduction to key blanks and master keys is as follows. A key blank generally 100 comprises a head 102, a shoulder 104, and a blade 106. Key blanks can also be provided with keyway grooves 108 which are long, narrow, milled-out areas along the sides of the blade 106 that allow the blade 106 to bypass the wards in the keyway. Such keyway grooves 108 may already be cut into a key blank so as to make the key cutting operation more simplified. Therefore, when duplicating a master key, a key blank 100 must be identified as either identical to or

similar to the master key. The master key 110 is cut from a key blank 100 and like references are described with like numerals. The master key 110 generally comprises a head 102, a shoulder 104, a blade 106, and a keyway groove 108. However, the master key 110 has a key pattern 112 already cut into the blade 106. The particular key pattern 112 corresponds to the pin and tumbler design of a lock.

[0026] With reference to FIGS. 1 and 2, a brief description of the structure of the key cutting machine 10 of the present invention is as follows. An exploded view showing the parts and assembly of the key cutting machine 10 is shown in FIG. 2. The assembled key cutting machine is shown in FIG. 1. The key cutting machine 10 includes a pair of vise grips or clamps 12 having top jaws 14 and bottom jaws 16 which are mounted on a carriage 18. A master key 110 having a key pattern 112 already cut therein is placed within the left-most clamp 12 on the carriage 18 and a key blank 100 awaiting to be cut having an identical keyway groove 108 as the master key 112 is placed in the adjacent clamp 12 on the carriage 18. The gauge fork 26 is used to align the master key 110 and the key blank 100 in the correct and exact orientation within the clamps 12. The carriage 18 is mounted on a carriage rod 20 so that the carriage 18 is moveable longitudinally along the carriage rod 20 and is also moveable radially so that the carriage 18 can be moveable between a carriage down position (FIG. 11) and a carriage up position (FIG. 9). A switch 21 automatically engages the motor when the carriage 18 is moved toward a carriage up position.

[0027] As best shown in FIG. 6, the key cutting machine 10 includes a stylus or tracer 22 that faces the key pattern 112 of the mounted master key 110. The cutting wheel 24 faces the mounted key blank 100. Therefore, as the carriage 18 is pivotally and linearly movable along the longitudinal carriage rod 20 and the master key 110 is pressed against the tracer 22, the key blank 100 is likewise pressed against the cutting wheel 24 to the same depth as permitted by the tracer 22 against the master key 110 and the carriage 18 is longitudinally moveable to cut the key pattern 112 from the master key 110 into the key blade 106 of the key blank 100.

[0028] A feature or improvement of the key cutting machine 10 of the present invention is that the key cutting machine 10 is operable in three modes: automatic, semi-automatic, and manual. Therefore, with the master key 110 and key blank 100 held within the jaws 12 which are mounted on the carriage 18, the carriage 18 is permitted to move relative to the key cutting machine 10 in three modes.

[0029] To operate the key cutting machine 10 in an automatic mode, the master key 110 and key blank 100 are placed in the appropriate jaws 12. The gauge fork 26 is used to verify the proper position and alignment of the master key 110 and key blank 100 and then rotated to an out of the way position as shown in FIG. 7. The carriage 18 is then rotated to a carriage up position (FIG. 5) and the carriage 18 is held against the machine 10 by a roller bearing-plate configuration. As best shown in FIG. 6, a roller bearing 28 is mounted to the carriage 18. With the carriage 18 in a carriage up position (FIG. 7), the roller bearing 28 is spring biased into engagement and under the guide plate 30. With the

roller bearing 28 engaged under the guide plate 30 (as shown in FIGS. 7, 9 and 10), the carriage 18 is still moveable longitudinally along the carriage rod 20 while the carriage 18 is spring biased toward the cutting wheel 24 (as shown in FIG. 9). However, the carriage 18 can still be partially rotated away from the cutting wheel 24 against the spring bias when required while in the carriage-up engaged position (as shown in FIG. 10).

[0030] After the carriage 18 is set in a carriage up position and the roller bearing 28 engages the guide plate 30, the carriage 18 is moved along the carriage rod 20 to a position where the tracer 22 engages the master key 110 adjacent the head 102. With the carriage 18 being spring biased against the cutting wheel 24, when the carriage 18 is moved longitudinally to the left, the tracer 22 engages the pattern 112 in the master key 110 and the cutting wheel 24 cuts the identical pattern into the key blank 100. With the carriage 18 in the carriage-up master key and key blank aligned position, the machine 10 is turned on and the autocycle button is pushed thereby engaging the automatic cycle. Without input from the user, the motor draws the carriage 18 to the left and the key pattern 112 of the master key 110 is cut into the blade 106 of the key blank 100. When the carriage 18 gets to a position at the end of the cutting process, the roller bearing 28 will extend beyond and disengage from the guide plate 30 and allow the carriage 18 to fall to a carriage down position as shown in FIG. 6. During such a fall to the carriage down position, the rotational switch automatically turns the cutting wheel 24 off. The newly cut key blank is then removed from the jaw and buffed in the brush 32.

[0031] The operation of the key cutting machine 10 in a manual mode is identical to that of the automatic mode except that the automatic switch is not engaged so as to run the carriage 18 automatically. The master key 110 and key blank 100 are placed in the appropriate jaws 12. The gauge fork 26 is used to verify the proper position and alignment of the master key 110 and key blank 100 and then rotated to an out of the way position. The carriage 18 is then rotated to a carriage up position and the carriage 18 is held against the machine 10 by the engagement between the roller bearing 28 and guide plate 30. Preferably, the carriage 18 is moved along the carriage rod 20 to a position where the tracer 22 engages the master key 110 adjacent the head 102, although the carriage 18 can be moved at any position therealong. With the carriage 18 being spring biased against the cutting wheel 24, when the carriage 18 is moved longitudinally to the left by the user through pivoting of the handle 34, the tracer 22 engages the pattern 112 in the master key 110 and the cutting wheel 24 cuts the identical pattern into the key blank 100. The user can move the carriage 18 at will longitudinally and the master key pattern 112 is cut into the key blank 100. When the cutting process is complete, the user simply moves the carriage 18 to a position at the end of the cutting process so that the roller bearing 28 will extend beyond the guide plate 30 so that the carriage 18 falls to a carriage down position as shown in FIG. 5. During such a fall to the carriage down position, the rotational switch automatically turns the cutting wheel 24 off. The newly cut key blank is then removed from the jaw 12 and buffed in the brush 32.

[0032] The operation of the key cutting machine 10 in a semi-automatic mode is identical to that of the automatic mode except that at the end of the automatic cycle when the roller

bearing 28 disengages from the guide plate 30, the user can take control of the carriage 18 and move the carriage 18 to a carriage up position and continue the cutting process. Like all modes, once the roller bearing 28 disengages the guide plate 30, the user can move the carriage 18 to the carriage up position and not engage the roller bearing 28 and guide plate 30 so that the user can manually move the carriage 18 to continue the cutting process. As the carriage 18 approaches the carriage up position, the rotational switch engages and the cutting wheel 24 is actuated so that the user can manually perform the key cutting operation.

[0033] To ensure that the key blank 100 and master key 110 are positioned properly within the key cutting machine 10, the key cutting machine 10 includes an additional improvement or feature wherein the jaws 12 are selectable for properly clamping and holding numerous types of keys therein. In particular, the upper and lower jaws 14, 16 are rotatable to provide separate clamping areas therebetween to accommodate different types of master keys and key blanks for accommodating key width and particular groove structures. Therefore, depending upon the type of master key and key blank being used, the jaws 12 of the key cutting machine 10 must be rotated to accommodate particular key configurations. These such jaw positions can be color coded or identified to assist the operator in identifying the proper jaws to use with particular master key and key blank configurations.

[0034] Another improvement or feature of the present invention is a novel assembly to prevent key cutting shavings from interfering with the performance of the key cutting

machine 10. The key cutting machine 10 of the present invention includes a housing 40 that mounts over a bottom cover 42. However, the components of the key cutting machine 10 are not mounted on the bottom cover 42 as in most other key cutting machines. With the present invention, all motors, electrical wiring, and switches are mounted to the underside of the cast housing 40 and above the base 42 so that any metal shavings and debris entering the housing 40 will fall past the internal components and collect on the bottom cover 42. Such a configuration will prevent such shavings and debris from interfering with the operation of the components.

[0035] Yet another improvement or feature of the present invention is that the construction of major components is modular in form. As shown in the accompanying drawings, the key cutting machine includes three distinct modules that are assembled and mounted to the exterior housing. Should any of these modules fail, or components of the modules, the entire machine does not have to be removed or disassembled. Preferably, a module can be easily replaced by a technician so as to minimize down time of the machine. Such modularity of components mounted directly on the housing permits cost effective maintenance and repair of the key cutting machine and ease of access and repair to specific components at the field level. Modules 1, 2 and 3 are shown in FIG. 2.

[0036] Still another improvement or feature of the key cutting machine 10 is the utilization of a vacuum assembly 60. And while the vacuum assembly 60 could be integrally formed with the key cutting machine 10, the preferred embodiment utilizes a removable vacuum system 60 capable of being connected to the key cutting machine 10.

[0037] As shown best in FIG. 1, a vacuum system 60 can be mounted on or near the key cutting machine 10 and plugged into a power supply outlet, preferably the power supply outlet 44 as shown in FIG. 5. A housing 62 over the cutting wheel 24 prevents access to the cutting wheel 24 to prevent accidental contact therewith. A vacuum port 64 is located within the housing 62 so as to provide vacuum communication between the interior of the housing 62 and the vacuum system 60. The vacuum tube 66 is removeably connected to the vacuum port 64 so that when the vacuum tube 66 is connected to the vacuum port 64, the vacuum 60 is capable of collecting key shavings from within the housing 62 created during a key cutting operation. When the vacuum tube 66 is disconnected from the vacuum port 64, the vacuum tube 66 can be used as a hand-held vacuum wand to vacuum metal shavings from the key cutting area and surrounding area for general clean-up. Preferably the vacuum 60 is actuated when the cutting wheel 24 is actuated.

[0038] It is also anticipated that the key cutting machine 10 of the present invention is also capable of connection to a computer or other mechanism (not shown) so as to interface with a key identification system as disclosed in the incorporated patent application to make the key cutting process a totally automatic identification, transfer, and cutting system. Such a fully automated system can utilize a robotic arm or other transfer device that would retrieve a key blank identified by the identification system and place that key blank into the locking jaws 12 so that a user would not have to operate the key cutting machine 10 or transfer the key blank to the key cutting machine 10.

[0039] A further improvement or feature of the key cutting machine 10 is a carriage and rotating arm having an improved lever latch and carriage locking mechanism as shown in FIGS. 5, 7 and 11. The locking mechanism locks the carriage 18 and stops the cutter after the key is cut. The user is then required to pull the trigger 70 to release the latching mechanism 72 on the carriage 18 to permit movement of the carriage 18 and activation of the cutting wheel 24 so as not to accidentally activate the cutting wheel 24.

CLAIMS

1. A key cutting machine comprising:
a housing;
a key cutting element located at least partially within said housing; and
a vacuum port connected to said housing, said vacuum port capable of
removeably connecting a vacuum tube that, when connected to said vacuum port, is
capable of collecting key shavings created during a key cutting operation and, when said
tube is disconnected from said vacuum port, said tube can be used to collect key shavings
on or surrounding said key cutting machine.
2. The key cutting machine of claim 1 wherein said vacuum port includes a quick-
disconnect element permitting selectable connection and disconnection of said vacuum
tube.
3. The key cutting machine of claim 2 wherein said quick-disconnect element
comprises at least one aperture for receiving at least one connection element associated
with said vacuum tube.
4. The key cutting machine of claim 2 wherein said quick-disconnect element
comprises at least one protrusion capable of being received within at least one aperture
associated with said vacuum tube.

5. The key cutting machine of claim 1 further comprising at least one power supply outlet integral therewith for electrically connecting an external electrical device thereto.
6. The key cutting machine of claim 5 wherein said power supply outlet is activated only when said key cutting element is activated.
7. The key cutting machine of claim 6 wherein said external electrical device is a vacuum device having a vacuum tube capable of removable connection to said vacuum port.
8. A key cutting machine comprising:
a housing having a vacuum port;
a key cutting element located at least partially within said housing;
a vacuum device;
a tube connected to said vacuum device and removeably connected to said vacuum port, so that when said tube is connected to said vacuum port, said vacuum device is capable of collecting key shavings created during the key cutting operation and, when said tube is disconnected from said vacuum port, said tube can be used to collect key shavings in an area generally surrounding said key cutting machine.
9. The key cutting machine of claim 8 wherein said vacuum port includes a quick-disconnect element permitting reliable connection and disconnection of said vacuum tube.

10. The key cutting machine of claim 9 wherein said quick-disconnect element comprises at least one aperture for receiving at least one connection element associated with said vacuum tube.
11. The key cutting machine of claim 9 wherein said quick-disconnect element comprises at least one protrusion capable of being received within at least one aperture associated with said vacuum tube.
12. The key cutting machine of claim 8 wherein said vacuum device is activated only when said key cutting element is activated.
13. The key cutting machine of claim 8 wherein said tube is made of plastic.

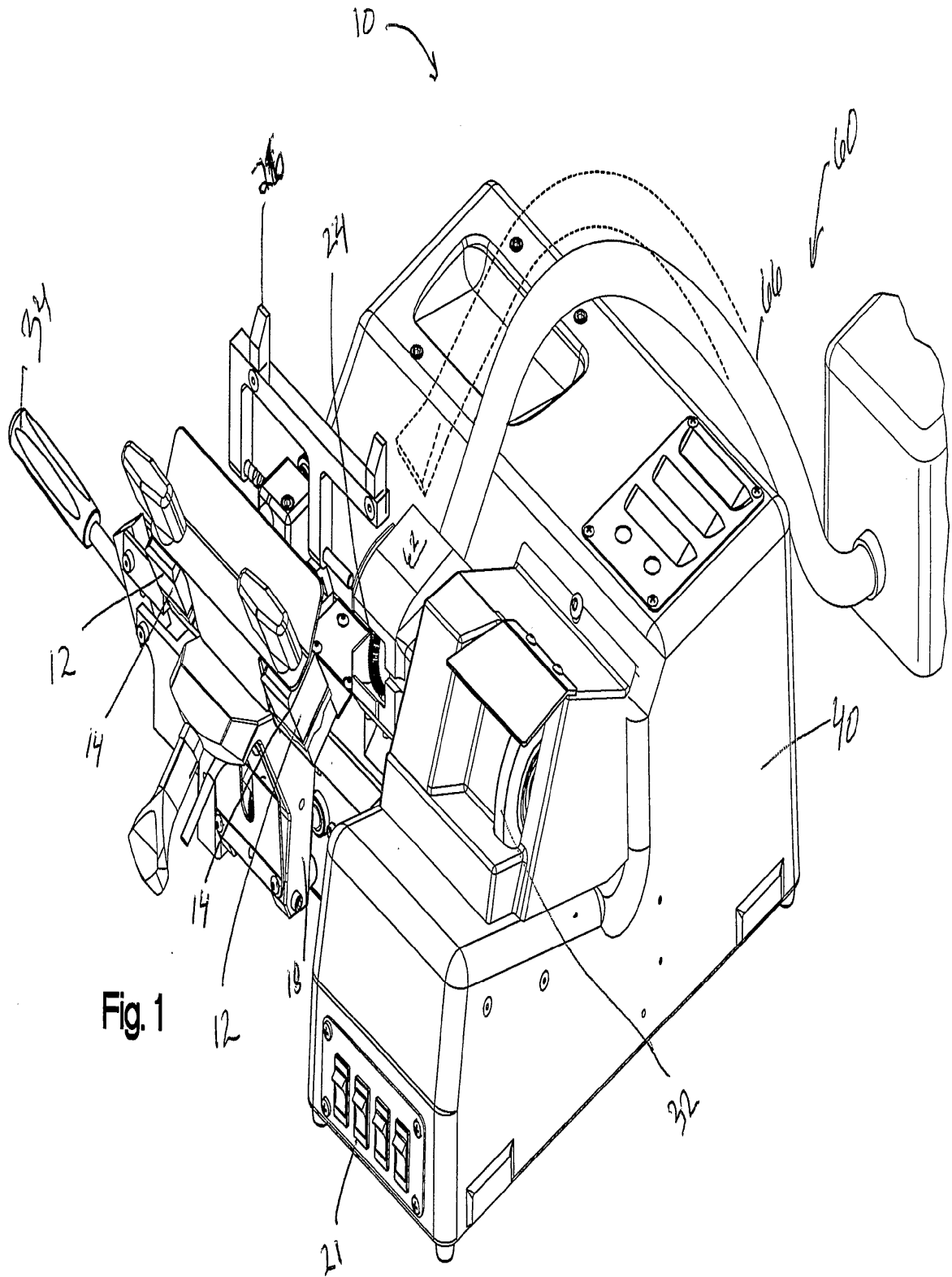


Fig. 1

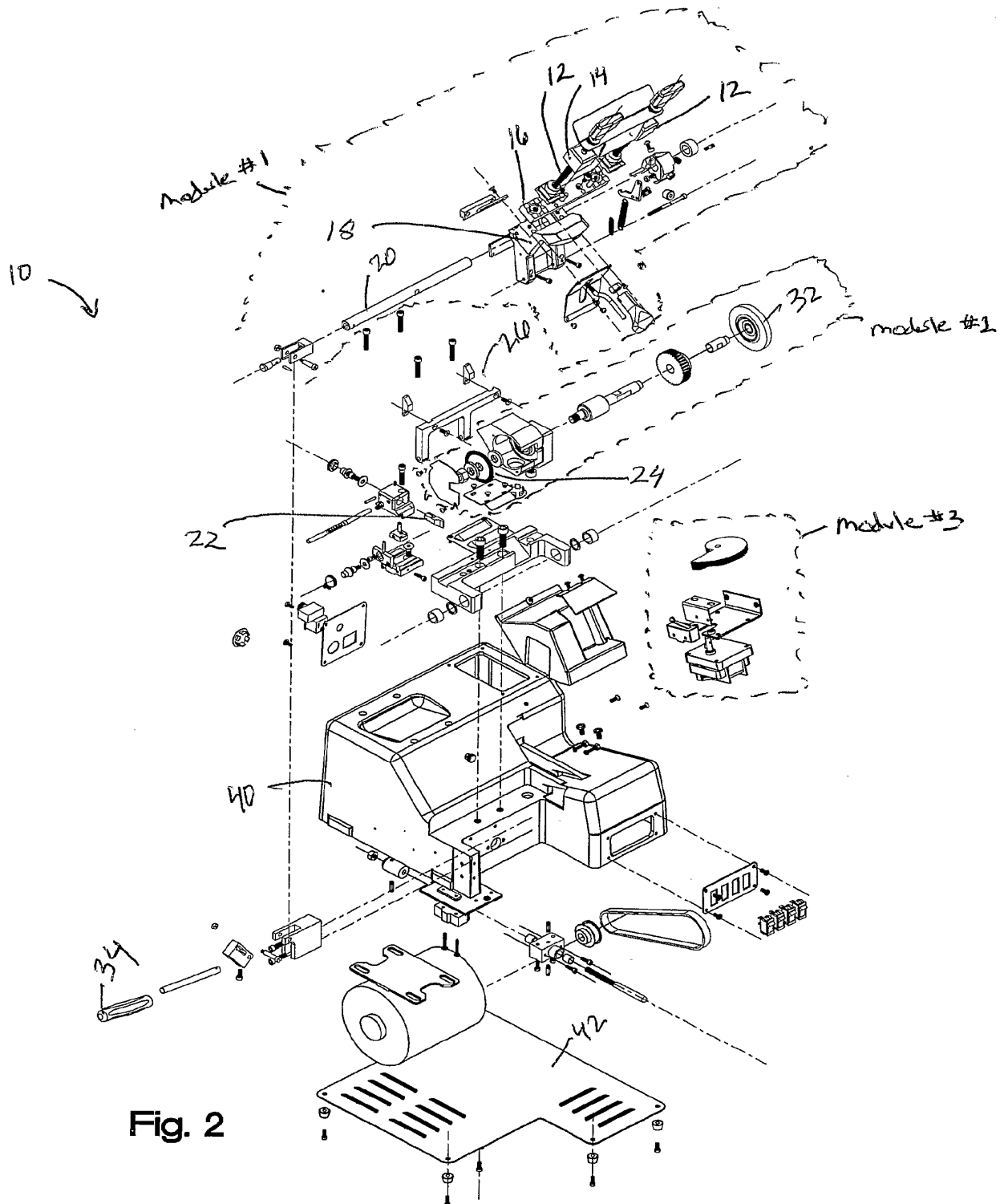
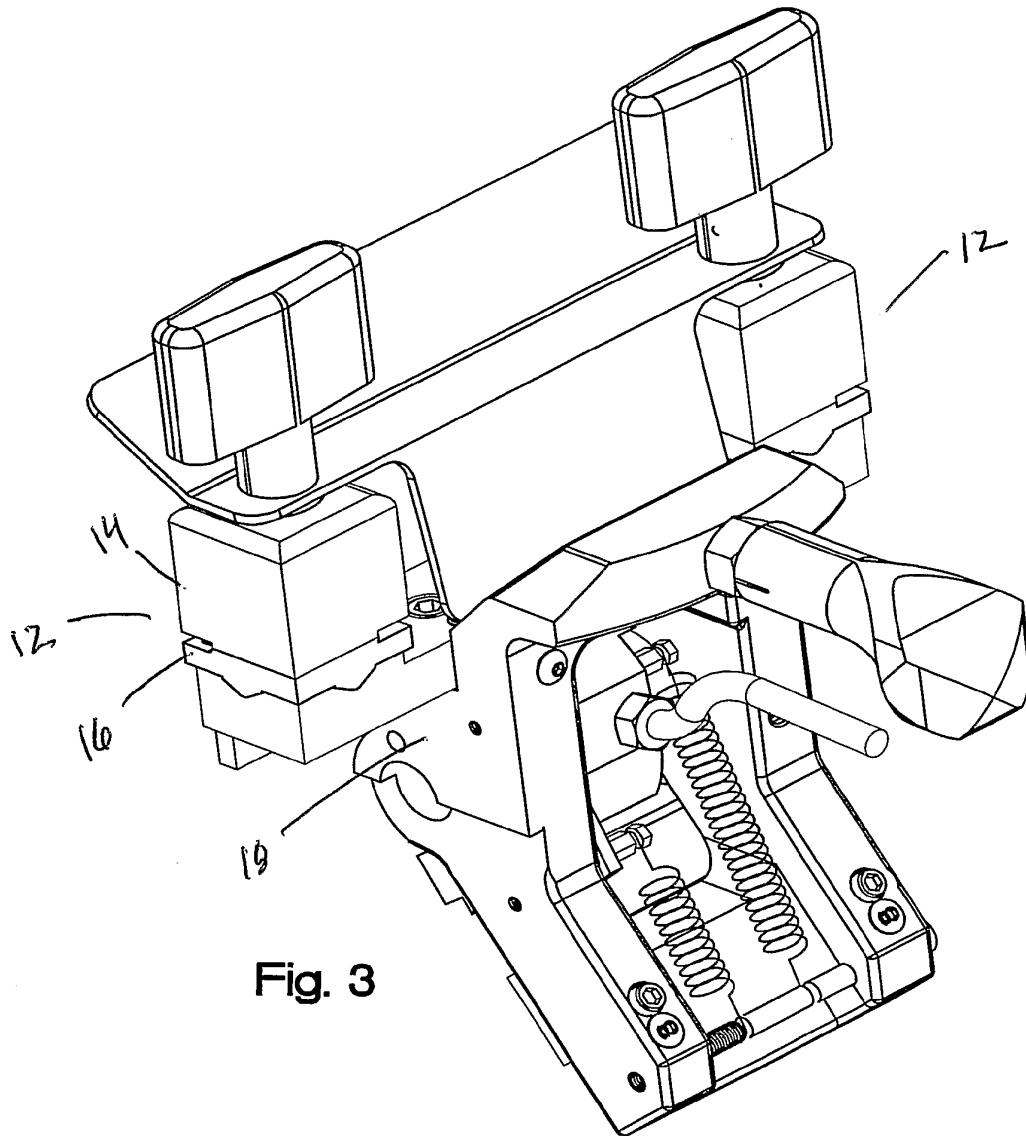


Fig. 2



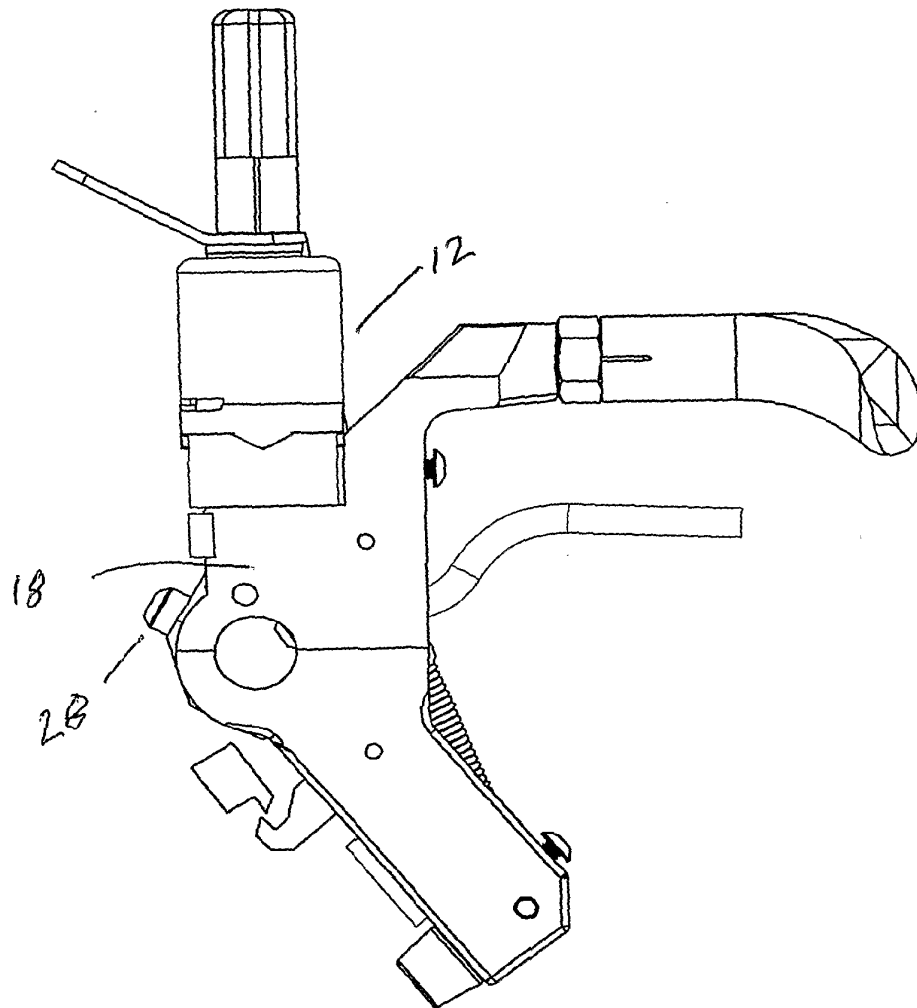


FIG. 4

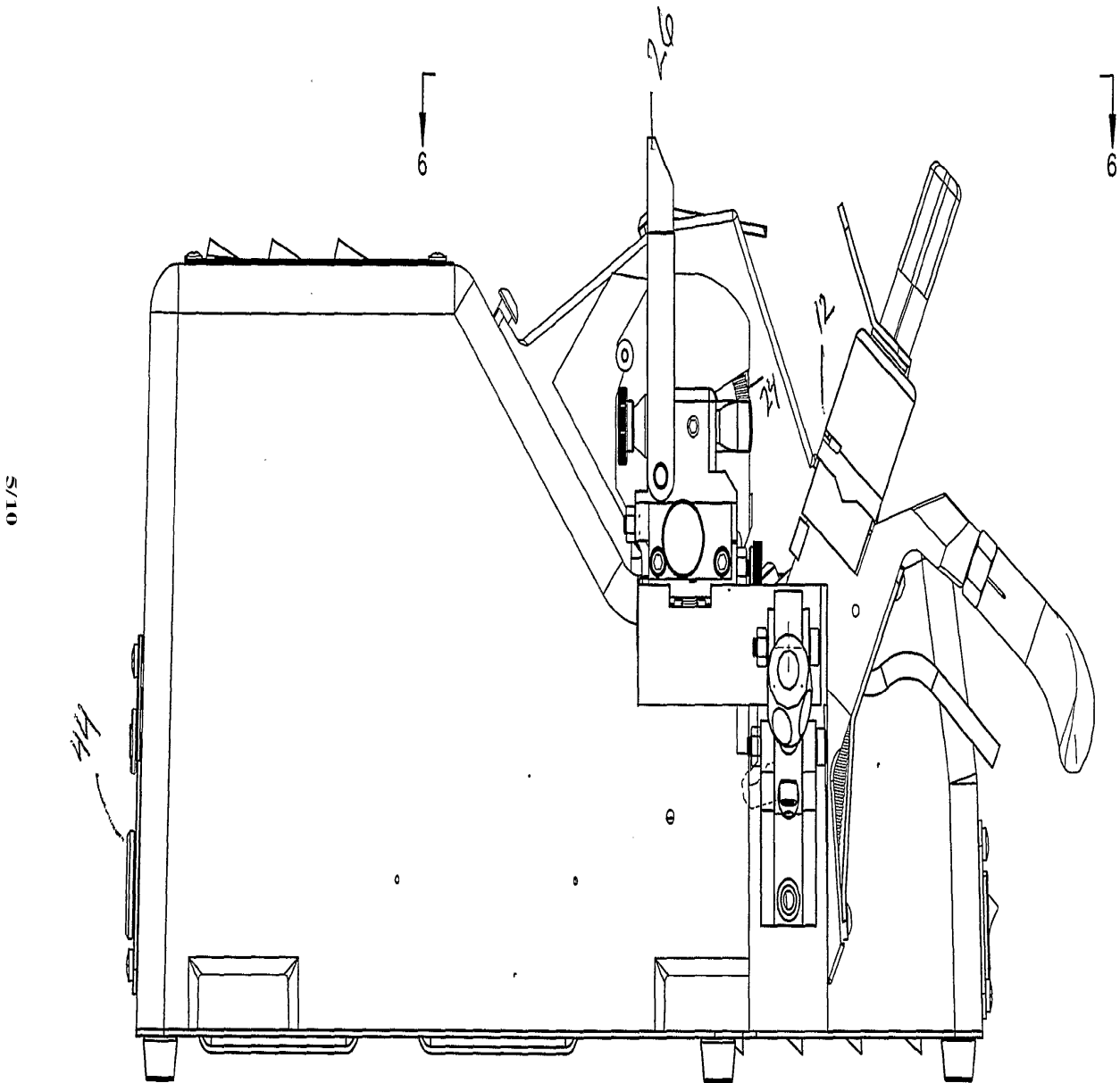


Fig. 5

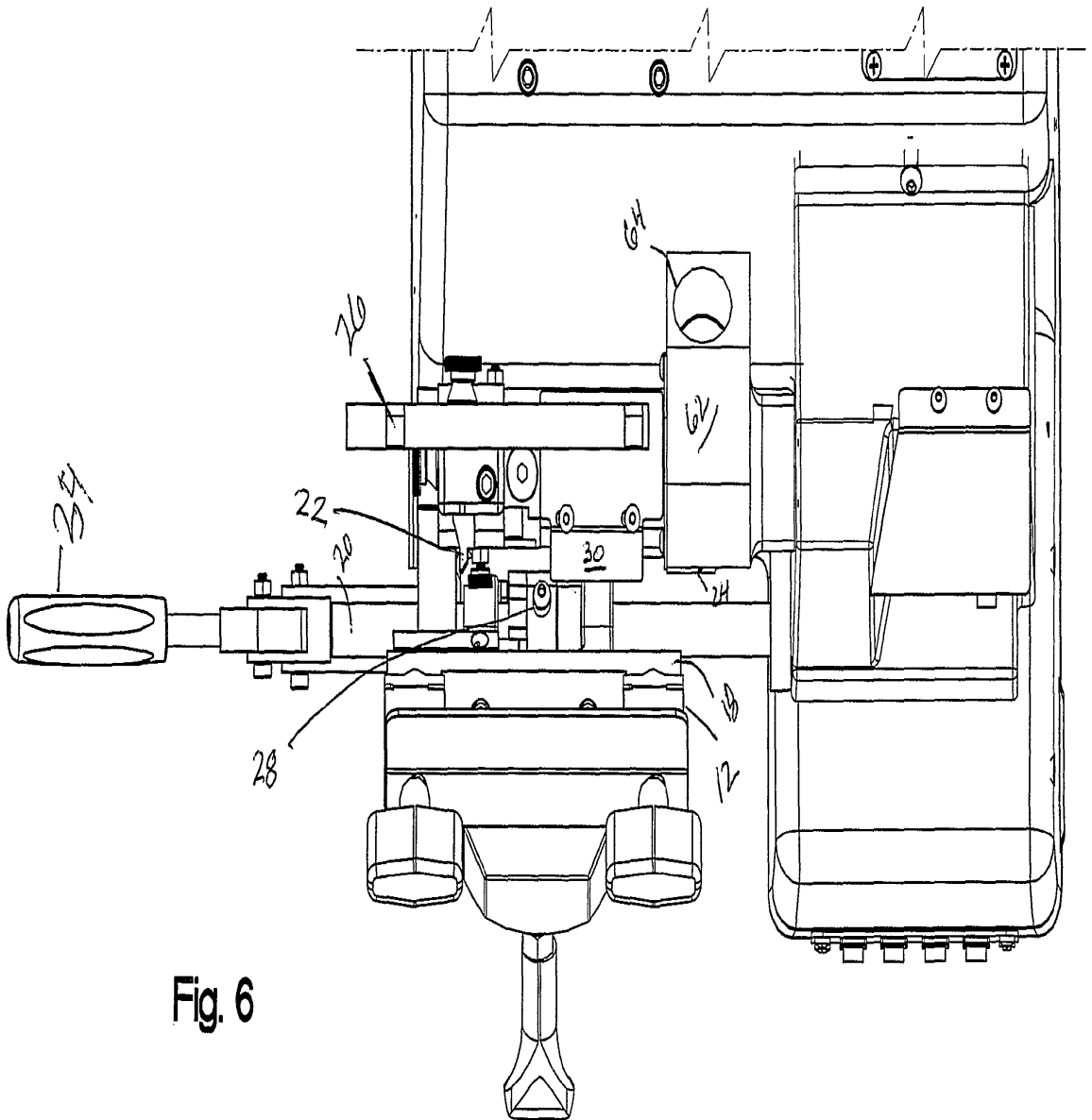


Fig. 6

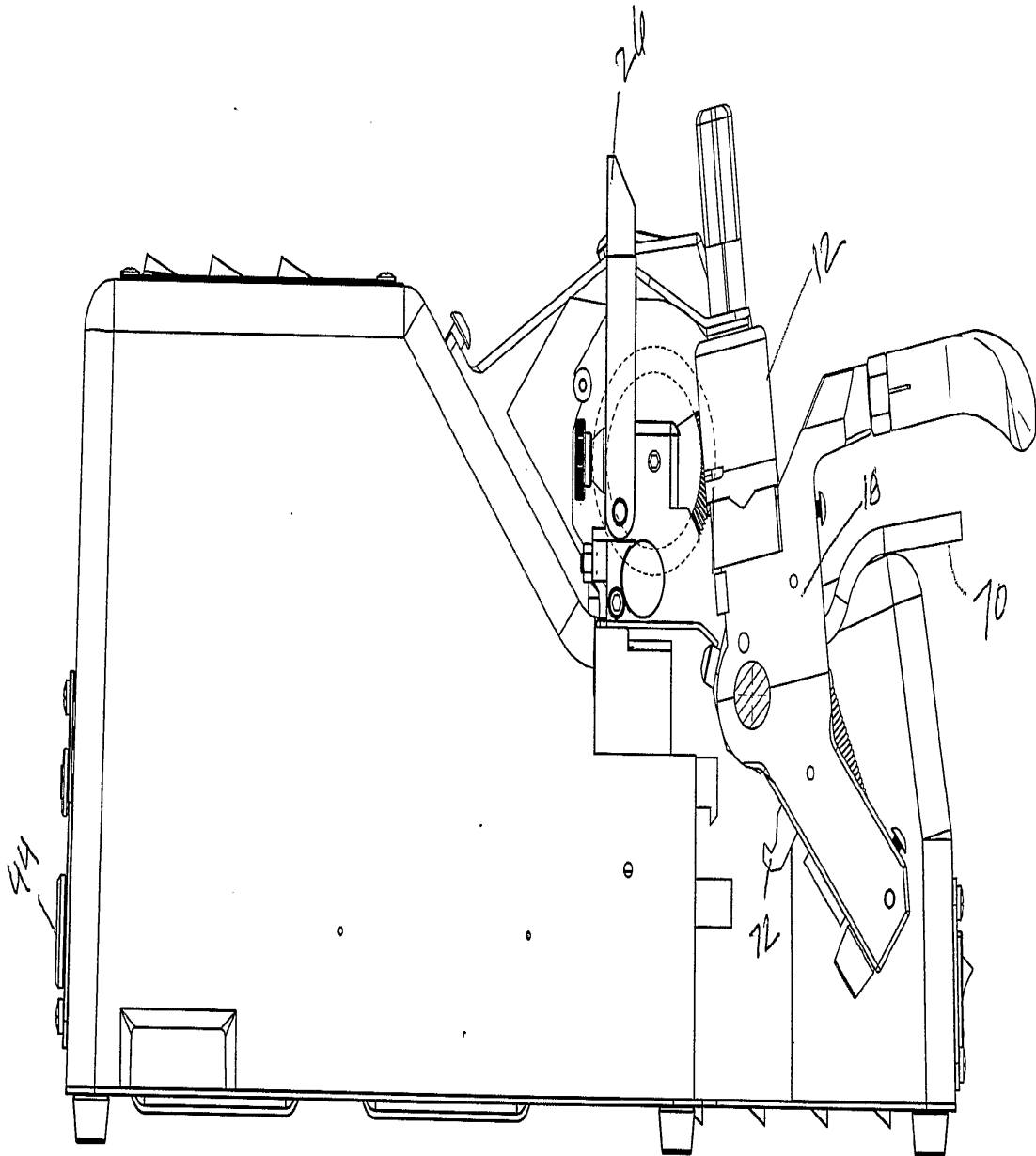
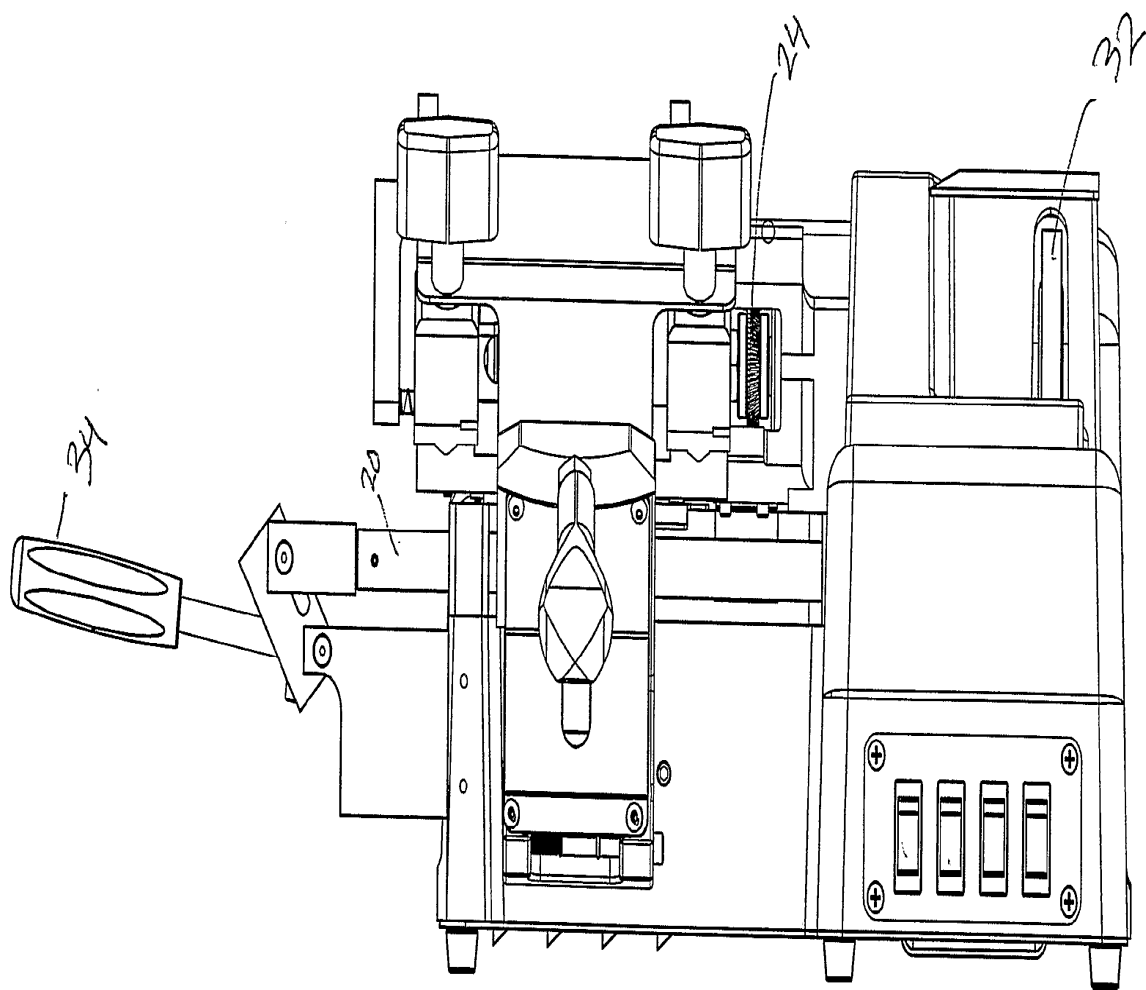


Fig. 7



8/10

Fig. 8

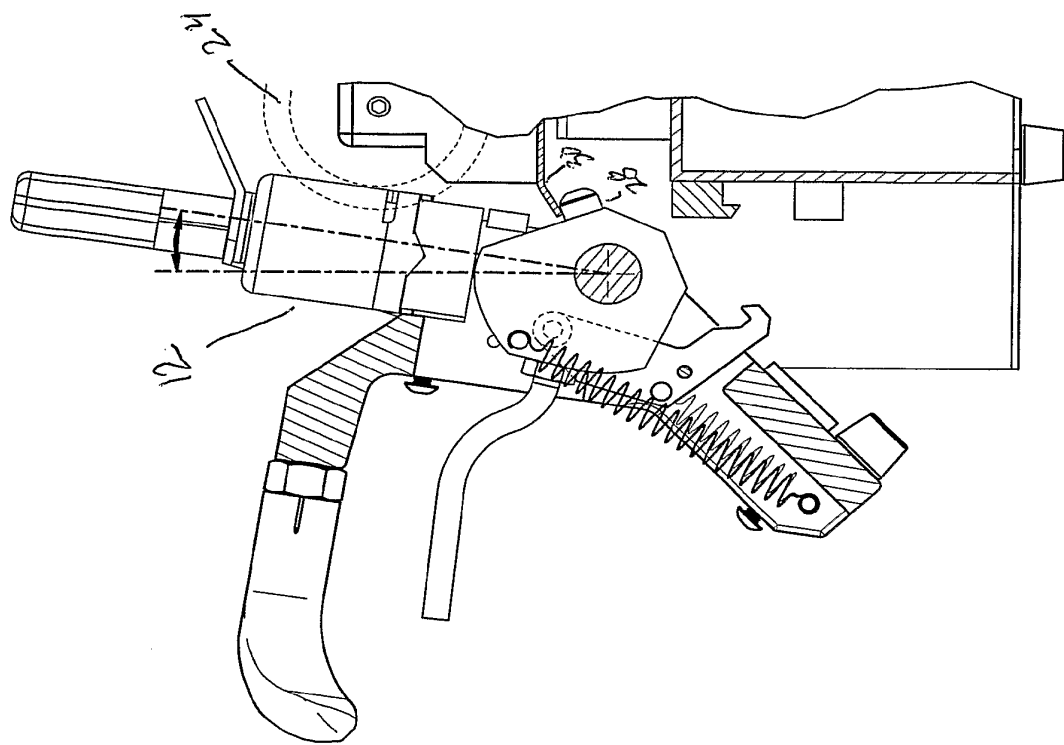


FIG. 9

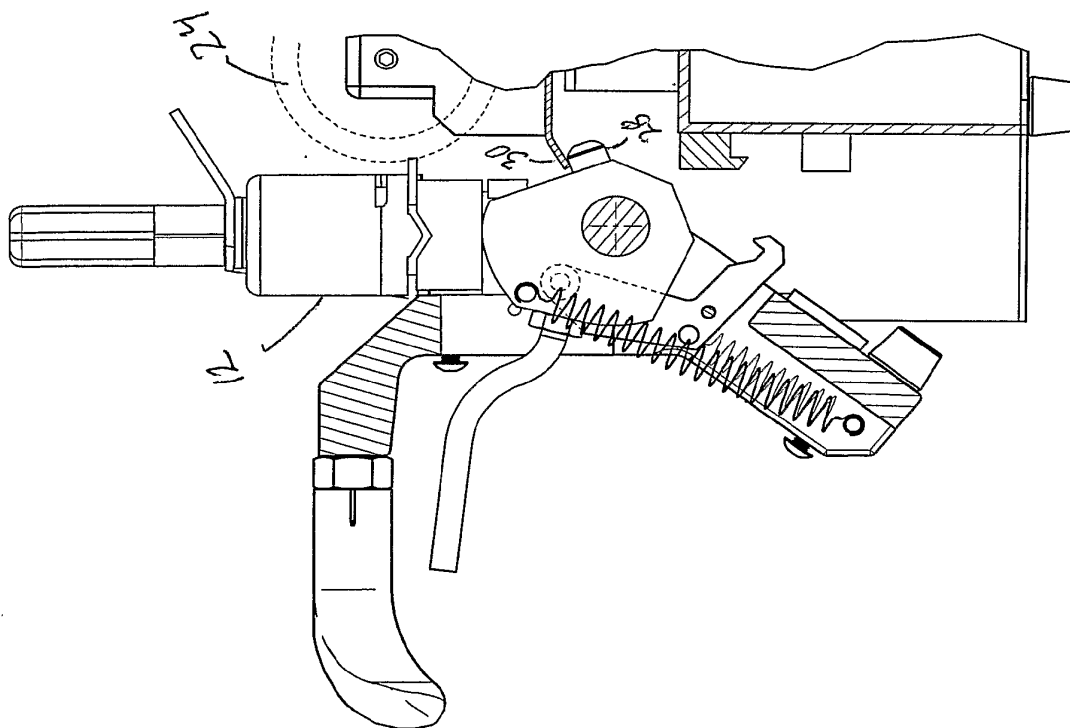


FIG. 10

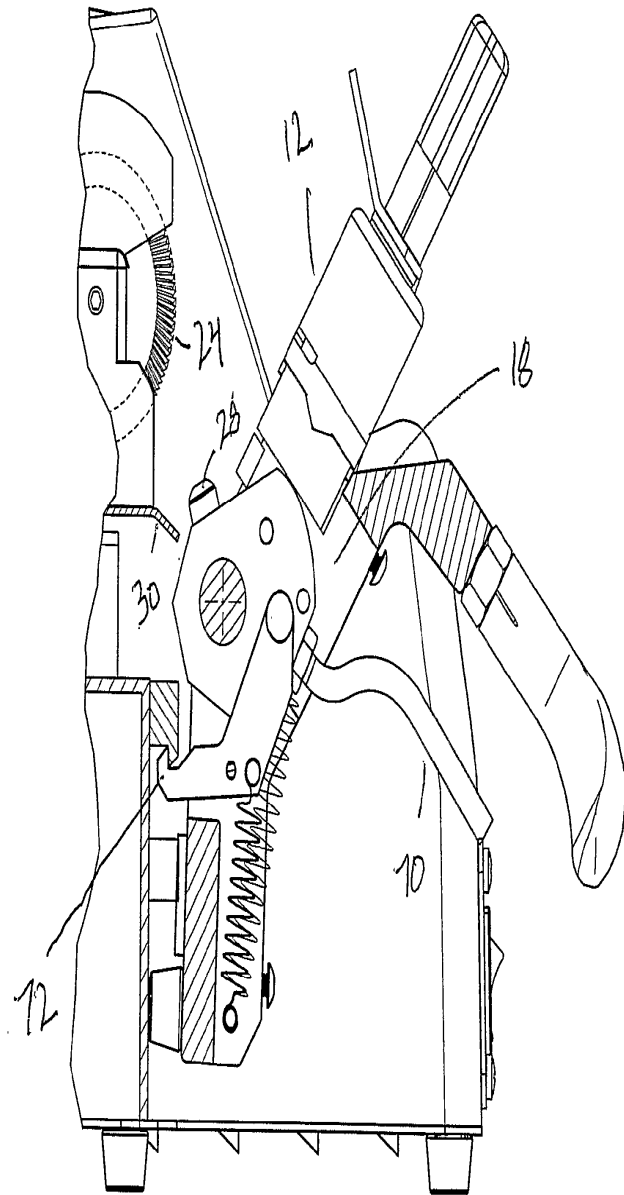


FIG. 11

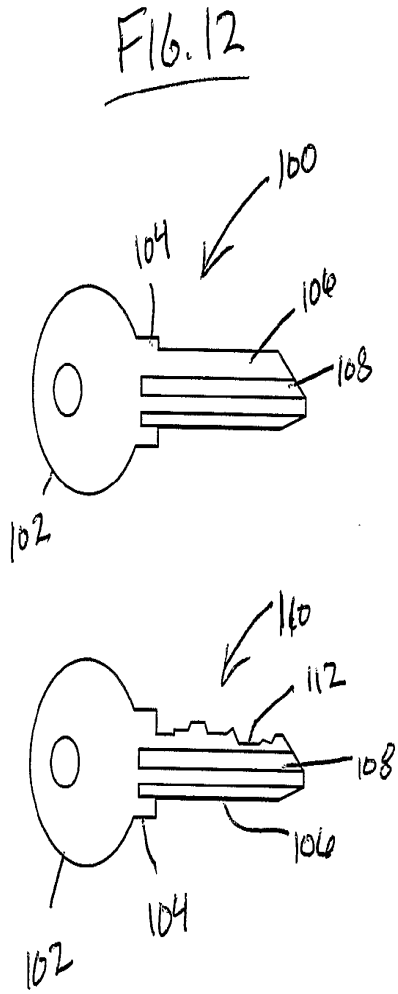


FIG. 13

FIG. 12

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US04/34947

A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) : B23C 3/35

US CL : 409/81

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
U.S. : Please See Continuation Sheet

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EAST

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X, P --- Y	US 2002/0168241 A1 (DAVID et al.) 14 November 2002 (14.11.2002), see entire document	1, 2, 5, 8, 9 ----- 3, 4, 10, 11, 13
Y	US 3,773,360 A (TIMBERS) 20 November 1973 (20.11.1973), see figure 1	3,4,10,11
X --- Y	US 4,541,760 A (ZOUKEI) 17 September 1985 (17.09.1985), figures 1-4, column 6, lines 34-36	1, 5-8, 12 ----- 2-4, 9-11, 13
Y	US 4,697,300 A (WARLOP) 6 October 1987 (06.10.1987), column 2, lines 21-32	13
A	US 6,602,030 B1 (MARKBREIT) 5 August 2003 (05.08.2003), see entire document	1-13
A	US 5,171,112 A (ROLAND) 15 December 1992 (15.12.1992), see entire document	1-13
A	US 6,179,531 B1 (JAW) 30 January 2001 (30.01.2001), see entire document	1-13

☒ Further documents are listed in the continuation of Box C.		☐ See patent family annex.	
* Special categories of cited documents: "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier application or patent published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed		"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family	
Date of the actual completion of the international search 31 January 2005 (31.01.2005)		Date of mailing of the international search report 22 FEB 2005	
Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US Commissioner for Patents P.O. Box 1450 Alexandria, Virginia 22313-1450 Facsimile No. (703) 305-3230		Authorized officer Derris Banks Telephone No. 571-272-4419	

Form PCT/ISA/210 (second sheet) (January 2004)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US04/34947

C. (Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 3,682,041 A (ESSIG) 8 August 1972 (08.08.1972), see entire document	1-13

Form PCT/ISA/210 (continuation of second sheet) (January 2004)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US04/34947

Continuation of B. FIELDS SEARCHED Item 1:
409/81, 82, 83
76/110

Form PCT/ISA/210 (extra sheet) (January 2004)

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
3 January 2002 (03.01.2002)

PCT

(10) International Publication Number
WO 02/01480 A1

(51) International Patent Classification⁷: **G06F 19/00**,
B23C 1/16

(72) Inventor; and

(75) Inventor/Applicant (for US only): **JURCZAK, Paul**
[PL/US]; 1662 Vineyard Drive, Gurnee, IL 60031 (US).

(21) International Application Number: PCT/US00/42438

(74) Agent: **MCKENNA, Michael, R.**; Suite 3800, 500 West
Madison, Chicago, IL 60661 (US).

(22) International Filing Date: 1 December 2000 (01.12.2000)

(25) Filing Language: English

(81) Designated States (national): AU, CA, JP, US.

(26) Publication Language: English

(84) Designated States (regional): European patent (AT, BE,
CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC,
NL, PT, SE, TR).

(30) Priority Data:
60/168,334 1 December 1999 (01.12.1999) US

Published:

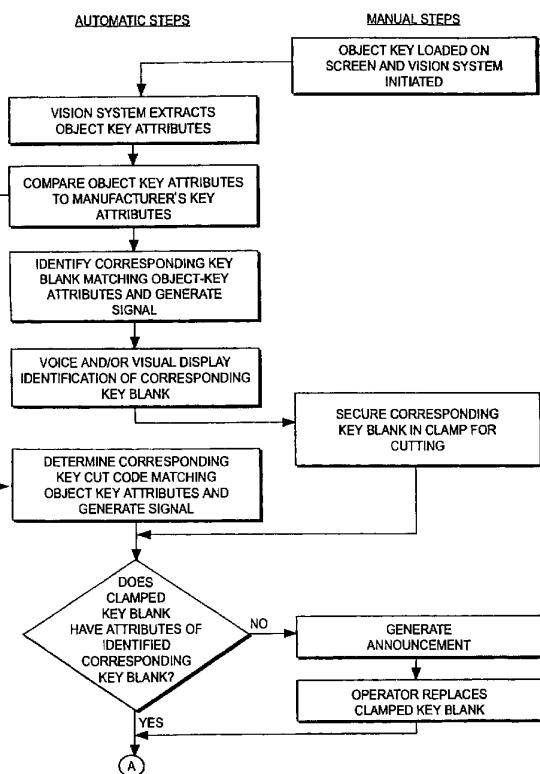
— with international search report

— before the expiration of the time limit for amending the
claims and to be republished in the event of receipt of
amendments

(71) Applicant and
(72) Inventor: **ALMBLAD, Robert, E.** [US/US]; 440 Banbury
Road, Mundelein, IL 60060 (US).

[Continued on next page]

(54) Title: OPERATOR ASSISTED METHOD FOR MAKING KEYS



(57) Abstract: The invention relates to operator assisted methods for making keys including automatically extracting key attributes from an object key, comparing the key attributes of the object key to known manufacturer's key attributes stored in memory of a data processing unit to identify a corresponding key blank, and verbally announcing to an operator the identity of the corresponding key blank so that the operator can secure the corresponding key blank in a clamp for cutting. In this process, the verbal announcement may comprise voice identification and a visual display. The invention relates to an improved key making machine that automatically extracts characteristics of an object key without human intervention. The position and alignment of the object key is automatically determined, key characteristics extracted and compared with known key manufacturers' information stored in memory, an appropriate key blank is identified, cut and dispensed to the customer.



For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

OPERATOR ASSISTED METHOD FOR MAKING KEYS

The applicant claims the benefit of the following prior filed provisional application, U.S. Serial No. 60/168,334 by the same inventors.

5

TECHNICAL FIELD

This invention generally relates to methods and apparatus for semi-automatic key making. More particularly, the invention extracts key attributes of an object key.

10

BACKGROUND OF THE INVENTION

15

The key making art has taught us that each lock manufacturer has adopted a number of different key blanks, each with its own unique shape and specific groove characteristics. Furthermore, for each key blank its manufacturer has assigned one or more known key cut codes that define the manner in which the key blank can be cut to match the manufacturer's lock.

20

25

There are several thousand types of key blanks in the world. When a key is presented to be duplicated by a locksmith or a skilled operator of a semi-automated device, he must be skilled at working with the customer's key (object key) to determine which key blank it is among the thousands made, and he must also be skilled at trace cutting the notches (cuts or bits) of the customer's key into a correctly identified key blank. If the wrong key blank is chosen, then it will

not operate in the customer's lock. Also, if the key cuts are not traced precisely, then the new key will not work in the lock.

One method of key identification is to inspect the blade of the key and any stamping, the grooves, and the length, and to match the girth of the blade in one of many slots to determine the correct key blank. In the Alnblad et al. patent, U.S. Patent No. 5,807,042, measurement of the cuts in a key and then comparing this information to the grooves and/or outer shape to new key duplicating the original can be automatically selected and cut.

Various types of key making machines currently exist which identify and utilize a key manufacturer's coding to duplicate a customer's key. U.S. Patent Nos: 5,807,042 and 6,065,911 issued to the applicant on June 7, 1997 and May 23, 2000 respectively, provide some background for the key cutting technology. Alternative technology is located in relevant patents cited in the International Search Report of applicant's PCT/US99/08957 application: U.S. Patent No. 4,845,764 issued to Ueda et al., July 4, 1984, U.S. Patent No. 4,929,843 issued to Chmielewski, Jr., et al. on May 29, 1990, U.S. Patent No. 5,128,531 issued to Fadel, July 7, 1992; U.S. Patent No. 5,517,299 issued to Teratani et al. in May 14, 1996, U.S. Patent No. 4,652,765, issued to Nishihara on March 24, 1987 and France Patent No. 2,489,535 issued to Gariod et al. issued in March 5, 1982. However, no prior art patent known to the

-3-

applicant teaches a method or apparatus that automatically extracts key cut codes of an object key to determine the proper key blank for making a new key and verbally announcing that key blank determination audibly with instructions in the operator's language and confirming said instructions with a graphic display, such as an LCD display. Nor do any prior art patents known to the applicant teach a self referential auto calibration process to correct for operator error and component wear which affects key making quality.

Earlier methods and apparatuses for key making required skill on the part of an operator to fixture the object key in some specific fashion and to have some special knowledge of key blanks with some kind of training.

The important invention disclosed herein is designed to be operated by an inexperienced operator who possesses some limited skills.

No other operator assisted device for making keys has disclosed a non-contact means for extracting laterally exposed attributes, comprising three dimensional grooves, outer shape and laterally exposed key cuts, of an object key. Nor has the prior art taught a key making apparatus or method that automatically establishes an operative positional relationship between a key blank and the key making machine.

To alleviate these problems, and others which will

-4-

become apparent from the disclosure which follows, the present invention provides a key making apparatus that tells the operator what key blank to use in the machine after it is automatically determined by viewing the object key. The identification contemplated is at least one of an audio instruction and an LCD display, preferably both.

Moreover, the process can measure its own work pieces before and after cutting, and compute what errors there are from both the operator and machine wear out and any other out of adjustment factors. If the error is too great, the process will reject the key being cut, inform the operator, and then recut another key correcting for the error detected. This "auto calibration" process will enhance the quality and efficiency of making keys.

The methods extract information from an object key, extracts the attribute information necessary for it to determine the correct key blank and the correct key cut codes and a method of cutting the correct codes in to a key blank despite any deficiencies in the codes of the object key.

Attribute information is extracted by the instant apparatus automatically reading an object key and comparing the attributes of the object key with a master pattern memory of known manufacturers' keys. Then it selects the proper matching key blank and cuts it to the original key cut codes established by the manufacturer.

-5-

Alternatively, the key blank can be trace-cut,
duplicating the used attributes of the object key.
Alternatively, key cuts hybridizing the key cut features
of the object key and the key cut codes of a known
5 manufacturer's key may be determined for use with the
corresponding key blank.

ADVANTAGES OF THIS INVENTION

Unlike the foregoing devices which teach structures
that require the precision of a trained locksmith to
10 properly place the key correctly within a vice or
similar holding device, the instant invention allows the
object key to be loosely situated within a specified but
yet broader area.

A preferred embodiment of the operator assisted key
15 making machine provides a generally horizontal support
surface as a means for loosely supporting the object
key. The key making machine operates automatically to
determine the position of the key, to extract key
attributes so that a corresponding key blank can be
20 identified, and corresponding key cut codes can be
identified and cut into the corresponding key blank to
make a new key conforming to the manufacturer's original
specifications. Every necessary aspect of the key
making process has been incorporated into the preferred
25 embodiments of the instant apparatus.

A preferred version of the key making apparatus of
the current invention, now has embodiments utilizing a

-6-

stationary vision system that requires an initial back lighting sequence which provides information so that a family of possible key blanks may be determined. It further provides means for determining the initial
5 location of the object key which is disposed loosely on the support surface.

In an earlier embodiment of the key making apparatus disclosed in U.S. Patent No. 5,807,042, the light stripe generator and camera were mounted to a
10 moveable arm and moved in tandem. The camera received reflected light stripe images. In the current embodiment, the camera may now be stationary, positioned above the object key support surface, and the light stripe generator may now be rotatably disposed about an
15 axis parallel to any one of the light stripes generated on to the object key. The light stripe generator is selectively rotatable between a first position where a light stripe generated projects adjacent to an end of the object key support surface and a second position
20 where a light stripe generated projects adjacent to the opposite end of the object key support surface.

One means for locating a rotatable position of the light stripe generator includes a limit/positioning switch which is engaged when the light stripe generator
25 is in the first position and a second limit/positioning switch which is engaged when the light stripe generator is in the second position.

A line perpendicular to a plurality of parallel

-7-

light stripes projected on to the object key is the preferred position of the longitudinal axis of the object key for determining identifying attributes of the object key. This preferred position has a rotated angle of the longitudinal axis of the object key of zero degrees. Even when the rotated angle of the longitudinal axis of the object key is approximately five degrees from the preferred position, identifying attributes of the object key can still be determined. Enhancements in imaging equipment quality have allowed these tolerances to expand accordingly.

Moreover, horizontal leveling is no longer required since attributes, including laterally protected and laterally exposed, can still be determined because the errors from shadowing, due to a rotated angle or an object key not entirely horizontal, are within the tolerances of the camera equipment. If the angular displacement of the object key is not within the tolerances of the equipment, a signal can be generated initiating a communication to the user to "straighten out the key".

Backlighting initially provides information regarding object key placement including relative orientation of the longitudinal axis of the object key relative to the line perpendicular to the light stripes. Multiple light stripes images are processed.

In a preferred embodiment of the present invention without a rotational means for supporting an object key,

-8-

a stationary mount or surface is provided upon which an operator may place an object key. This surface may have placement indicia to aid the user in situating the key. Placement indicia is an alignment guide, including any indication, symbol, sign or marking, which serves to guide the user in the placement of the object key. If the user's placement of the object key does not fit within the tolerances of the current camera's capabilities, a voice message to the operator to put the object key "straighter" relative to the alignment guide disposed on the supporting surface can be generated.

Another embodiment of the instant invention comprises a non-contact method for extracting attributes of an object key. In this method and apparatus both externally exposed and laterally protected attributes may be extracted. It involves the use of a means for receiving object images, such as a camera, which has a lens capable of viewing a shallow focal plane.

The disclosed embodiments of the instant invention can identify and produce not only American made keys, but those of Europe and throughout the world which have laterally protected cuts and curved grooves as well.

The instant semi-automatic key making apparatus provides an efficient and convenient means of making new keys. The apparatus of the present invention performs all of the required functions to achieve the objective of making a key that meets the specifications of the original manufacturer. Additionally, the methods

-9-

disclosed provide that the apparatus may acquire new information about the wear down of the machine components, which may be added to the machine's database, thus, allowing the machine to auto calibrate.

5 Moreover, the methods disclosed herein requires little skill on the part of the operator or any knowledge of keys. Particularly when compared to the foregoing devices, the instant invention is operator-friendly. Ease of use is a critical advantage.

10 Still other advantages will be apparent from the disclosure that follows.

SUMMARY OF THE INVENTION

The invention relates to methods for making keys. The operator assisted method of making keys comprises

15 the steps of automatically extracting key attributes from an object key, comparing the key attributes of the object key to known manufacturer's key attributes stored in memory of a data processing unit to identify a corresponding key blank, verbally announcing to the

20 operator the identity of the corresponding key blank so that the operator can secure the corresponding key blank in a clamp for cutting, and comparing the key attributes of the object key to known manufacturer's key attributes stored in memory of the data processing unit to

25 determine a corresponding key cut code for the corresponding key blank. In this process, the verbally announcing to the operator the identity of the

-10-

corresponding key blank comprises at least one of a voice identifying and a visually displaying of the identification of the corresponding key blank.

5 There has thus been outlined, rather broadly, the more important features of the invention in order that the detailed description thereof that follows may be better understood, and in order that the present contribution to the art may be better appreciated. There are, of course, additional features of the
10 invention that will be described hereinafter and which will form the subject matter of the claims appended hereto. Those skilled in the art will appreciate that the conception upon which this disclosure is based, may readily be utilized as a basis for the designing of
15 other structures, methods and systems for carrying out the several purposes of the present invention. It is important, therefore, that the claims be regarded as including such equivalent constructions insofar as they do not depart from the spirit and scope of the present
20 invention.

BRIEF DESCRIPTION OF THE DRAWINGS

Preferred embodiments of the invention are described hereinafter with reference to the accompanying drawing wherein:

25 Fig. 1 is a flow diagram of a preferred embodiment of the operation of the operator assisted method of making keys showing both the manual steps undertaken by

-11-

the operator and the automatic steps taken by the apparatus described in the specification for performing the process (Figs. 1, 2 and 3, taken together diagram the preferred processes of the operator assisted method for making keys of the present invention);

Fig. 2 is a flow diagram of a verification method showing steps to verify that the operator has clamped the proper key blank; and

Fig. 3 is a flow diagram of a preferred process of the invention which verifies that the clamped key blank has been positioned for cutting within a predetermined threshold and further showing that a process whereby the machine self adjusts for component wear.

DETAILED DESCRIPTION OF THE INVENTION

The preferred embodiments depicted in the drawing include a semi-automatic key making process, flow diagrams of preferred methods of operation, and block diagrams of various components. The discussion that follows, without limiting the scope of the invention, will refer to the invention as depicted in the drawing, showing methods that will make new keys requiring only minimum skill on the part of the operator.

An operator assisted method of making keys is provided by the instant invention. The steps include automatically extracting key attributes from an object key, comparing the key attributes of the object key to known manufacturer's key attributes stored in memory of

-12-

a data processing unit to identify a corresponding key blank, and verbally announcing to the operator the identity of the corresponding key blank so that the operator can secure the corresponding key blank in a clamp for cutting. Preferably, in the operator assisted method of making keys, the verbally announcing to the operator the identity of the corresponding key blank comprises at least one of a voice identification and a visual display of the identification of the corresponding key blank.

The operator assisted method of making keys preferably includes steps of comparing the key attributes of the object key to known manufacturer's key attributes stored in memory of the data processing unit to determine a corresponding key cut code for the corresponding key blank and making key cuts in the corresponding key blank in line with the corresponding key cut code.

Additionally, the operator assisted method of making keys may comprise the steps of determining a positional relationship of the clamped key blank relative to a preselected datum and rejecting the positional relationship of the clamped key blank by generating a signal verbally announcing to the operator the need to reposition and re-clamp the key blank when the positional relationship is beyond a predetermined threshold.

Furthermore, the operator assisted method may

-13-

include the steps of determining a positional relationship of the clamped key blank relative to a preselected datum, rejecting the positional relationship of the clamped key blank by generating a signal verbally announcing to the operator the need to reposition and re-clamp the key blank, when the positional relationship is beyond a predetermined threshold, and making adjustments to the key cuts to correct for the positional relationship of the key blank relative to the preselected datum.

A preferred step of the operator assisted method of making keys requires comparing the key cuts made to the corresponding key blank with manufacturer's key cuts in line with the corresponding key cut codes to determine a cutting variance and adjusting the preselected datum to correct for the cutting variance, so that any cutting variances resulting from wearing down of an element of key making equipment can be corrected. Moreover, the step of rejecting the cut key blank and generating a signal for verbally announcing to the operator that the clamped key blank needs to be replaced, when the cutting variance exceeds a predetermined amount may be included.

The operator assisted method of making keys may also comprise the steps of verifying that the key blank secured in the clamp by the operator has the key attributes of the identified corresponding key blank and rejecting the clamped key blank by generating a signal for verbally announcing to the operator that the

-14-

clamped key blank needs to be replaced, when the clamped key blank fails to correspond to the identified corresponding key blank.

In another preferred process of the operator assisted method of making keys, the following steps are included:

- a. determining a positional relationship of the clamped key blank relative to a preselected datum;
- b. rejecting the positional relationship of the clamped key blank by generating a signal verbally announcing to the operator the need to reposition and re-clamp the key blank, when the positional relationship is beyond a predetermined threshold;
- c. making adjustments to cutting key cuts to correct for the positional relationship of the key blank relative to the preselected datum;
- d. comparing key cuts made to the corresponding key blank with key cuts in line with the corresponding key cut codes to determine a cutting variance and adjusting the selected datum to correct for the cutting variance; and
- e. rejecting the cut key blank and informing the attendant to replace the corresponding key blank.

Another preferred process of the operator assisted method of making keys comprises the steps of automatically extracting key attributes from an object key, comparing the key attributes of the object key to known manufacturer's key attributes stored in memory of

-15-

a data processing unit to identify a corresponding key blank, verbally announcing to the operator the identity of the corresponding key blank so that the operator can secure the corresponding key blank in a clamp for cutting, and comparing the key attributes of the object key to known manufacturer's key attributes stored in memory of the data processing unit to determine a corresponding key cut code for the corresponding key blank. In this process of this important invention, the verbally announcing to the operator the identity of the corresponding key blank comprises at least one of a voice identifying and a visually displaying of the identification of the corresponding key blank.

Furthermore, the operator assisted method of making keys of the foregoing preferred method may further comprise the steps of verifying that the key blank secured in the clamp by the operator has the key attributes of the identified corresponding key blank, rejecting the clamped key blank by generating a signal for verbally announcing to the operator that the clamped key blank needs to be replaced, when the clamped key blank fails to correspond to the identified corresponding key blank, determining a positional relationship of the clamped key blank relative to a preselected datum, rejecting the positional relationship of the clamped key blank by generating a signal verbally announcing to the operator the need to reposition and re-clamp the key blank, when the positional relationship

-16-

is beyond a predetermined threshold, making key cuts in the corresponding key blank in line with the corresponding key cut code, comparing the key cuts made to the corresponding key blank with manufacturer's key cuts in line with the corresponding key cut codes to determine a cutting variance and adjusting the preselected datum to correct for the cutting variance, so that any cutting variances resulting from wearing down of an element of key making equipment can be corrected, and rejecting the cut key blank and generating a signal for verbally announcing to the operator that the clamped key blank needs to be replaced, when the cutting variance exceeds a predetermined amount.

One method for automatically making keys comprises establishing an operative positional relationship between an object key and a means for extracting laterally protected attributes of an object key while leaving the object key independent of forcible holding and extracting laterally protected attributes of an object key independent of physical contact.

In a preferred embodiment of the invention both laterally protected and laterally exposed attributes of an object key are recognized and compared with a master pattern memory to identify a corresponding key blank having a hole in the handle and its associated key cut code.

Another method comprises receiving an object key on

-17-

a rotatable means for supporting an object key having a transparent section, backlighting the object key by passing light through a transparent section of the supporting means and projecting an object image, receiving at least one object image of the object key, determining from the object image the position of the longitudinal centerline of the object key in a generally horizontal position relative to a light stripe which may be projected on to the object key by a light stripe generator, producing an output signal corresponding to the determination, and rotating the means for supporting an object key for alignment with a line perpendicular to the light stripe.

The most current preferred method for making keys utilizing attributes of an object key having a longitudinal axis comprises loosely supporting the object key by receiving the object key on a surface, determining the initial relative orientation of the object key including computing angular displacement of a longitudinal axis of the object key relative to a line perpendicular to a fixed datum, and extracting attributes including at least one of laterally protected attributes and laterally exposed key cuts of the loosely supported object key. In this manner, key cut codes of the object key can be recognized.

Any structured light may be used for applications requiring surface feature extraction. Structured light being defined as any method, including filtering,

-18-

polarizing, lensing, aperturing, and light placement at appropriate angles of incidence, that controls the light path between its source, the illuminated object and the camera.

5 In its preferred form, either a laser or any other collimated light source in which all of the light waves travel parallel to one another is used to produce sharply defined shadows of parts placed in its path which can be cast either directly onto a sensor or on to
10 a flat surface where it can then be measured. Backlighting produces a silhouette image of an object contour or polyline. A preferred embodiment utilizes for a backlight source a 7 watt bulb with a light diffuser of opaque plastic.

15 A key method of establishing an operative positional relationship between an object key and a means for extracting attributes of an object key while leaving the object key independent of constraint and may be employed with any known method of extracting
20 attributes of an object key including those utilizing physical contact.

 The present invention provides that the means for receiving an object image comprises at least one camera, the camera being a pixel device for oriented fiber optic
25 arrays. The camera is available from a number of manufacturers and is a 256 grey scale charge-coupled device (CCD) high resolution camera and a 4/40 lens. Signal output of the camera is sent to a frame grabber

-19-

installed in the computing means. A standard 486 PC or higher capacity data processing unit may act as the computing means.

Some of the identifying attributes of an object key are disposed on its silhouette. These laterally exposed attributes may include the outer shape, and the exposed key cuts. Other identifying attributes of an object key cannot be seen on the silhouette. Such laterally protected attributes may include groove characteristics extending longitudinally along the blade of an object key or as laterally protected key cuts or recessed dimples. Additionally, the silhouette view provides information about the location of the handle and the blade of the object key, so that the light stripe generator can be positioned to project a light stripe on to the object key where its grooves begin.

A means is provided for storing memory data of rejected object keys. These object keys are rejected because they do not have corresponding master code signals matching the code signals from the result of said recognition of the pixel pattern of the object key. By storing memory data of rejected object keys, the key making apparatus may acquire additional information about keys that are not as yet available in its master pattern memory. This can serve to assist in the expansion of the memory database.

A laser adapted to produce an array which forms a line may be applied.

-20-

Furthermore, the light stripe method functions to recognize laterally protected attributes of the object key which result from capturing the image of at least one light stripe being projected obliquely on to the blade thereof.

A preferred process involves the following steps: projecting at least one light stripe obliquely on to an object key; receiving an object image of the light stripe of laterally protected attributes of the object key, recognizing a pixel pattern from the object image, producing a series of code signals that define traits of the recognized pixel pattern for each target pixel from the result of the recognition, comparing the code signals with master code signals from a master pattern memory, the master code signals defining traits of a master pixel pattern of a selected manufacturer's key, and producing an identifying signal from such comparison, the identifying signal defining a corresponding key blank with a predetermined master pattern having master code signals that match code signals from the result of the recognition of the pixel pattern of the object key. In addition, key cut codes may also be identified utilizing this method.

The key cut attributes of the object key are extracted by the backlighting method previously discussed. If the key cut codes of an identified key blank fail to match up, then the "expert" rejection mode is initiated.

-21-

The identifying signal of the key making apparatus, may further defines both a key cut code and key cut features of the object key that correspond generally with key cut codes identified with the corresponding key blank.

It will be obvious to one skilled in the art of image recognition that other methods employing optical character recognition, magnetic resonance imaging, or hologramatic imaging could be utilized. Moreover, an apparatus employing other known light generators and light receivers, could easily be employed.

While this invention has been described in connection with the best mode presently contemplated by the inventor for carrying out his invention, the preferred embodiments described and shown are for purposes of illustration only, and are not to be construed as constituting any limitations of the invention. Modifications will be obvious to those skilled in the art, and all modifications that do not depart from the spirit of the invention are intended to be included within the scope of the appended claims.

Furthermore, the purpose of the foregoing abstract is to enable the U.S. Patent and Trademark Office and the public generally, and especially the scientist, engineers and practitioners in the art who are not familiar with patent or legal terms of phraseology, to determine quickly from a cursory inspection the nature and essence of the technical disclosure of the

-22-

application. The abstract is neither intended to define the invention of the application, which is measured by the claims, nor is it intended to be limiting as to the scope of the invention in any way.

5 These together with other objects of the invention, along with the various features of novelty which characterize the invention are pointed out with particularity in the claims annexed to and forming a part of this disclosure. For a better understanding of
10 the invention, its operating advantages and the specific objects attained by its uses, reference should be made to the accompanying drawing and descriptive matter in which there is illustrated preferred embodiments of the invention.

-23-

What is claimed as being new and desired to be protected is as follows:

1. An operator assisted method of making keys comprising the steps of:

- 5 a. automatically extracting key attributes from an object key;
- b. comparing the key attributes of the object key to known manufacturer's key attributes stored in memory of a data processing unit to
- 10 identify a corresponding key blank; and
- c. verbally announcing to the operator the identity of the corresponding key blank, whereby, the operator can secure the corresponding key blank in a clamp for
- 15 cutting.

2. The operator assisted method of making keys of claim 1, further comprising the step of comparing the key attributes of the object key to known manufacturer's key attributes stored in memory of the data processing

20 unit to determine a corresponding key cut code for the corresponding key blank.

3. The operator assisted method of making keys of claim 1, wherein the verbally announcing to the operator the identity of the corresponding key blank comprises at

25 least one of a voice identification and a visual display of the identification of the corresponding key blank.

4. The operator assisted method of making keys of

-24-

claim 2, further comprising the step of making key cuts in the corresponding key blank in line with the corresponding key cut code.

5 5. The operator assisted method of making keys of claim 1, further comprising the steps of:

 a. determining a positional relationship of the clamped key blank relative to a preselected datum; and

 b. rejecting the positional relationship of the clamped key blank by generating a signal verbally
10 announcing to the operator the need to reposition and re-clamp the key blank, when the positional relationship is beyond a predetermined threshold.

 6. The operator assisted method of making keys of claim 4, further comprising the steps of:

15 a. determining a positional relationship of the clamped key blank relative to a preselected datum;

 b. rejecting the positional relationship of the clamped key blank by generating a signal verbally
 announcing to the operator the need to reposition and
20 re-clamp the key blank, when the positional relationship is beyond a predetermined threshold; and

 c. making adjustments to the key cuts to correct for the positional relationship of the key blank relative to the preselected datum.

25 7. The operator assisted method of making keys of claim 4, further comprising the step of comparing the key cuts made to the corresponding key blank with manufacturer's key cuts in line with the corresponding

-25-

key cut codes to determine a cutting variance and adjusting the preselected datum to correct for the cutting variance,

5 whereby, any cutting variances resulting from wearing down of an element of key making equipment can be corrected.

8. The operator assisted method of making keys of claim 7, further comprising the step of rejecting the cut key blank and generating a signal for verbally
10 announcing to the operator that the clamped key blank needs to be replaced, when the cutting variance exceeds a predetermined amount.

9. The operator assisted method of making keys of claim 1, further comprising the steps of:

15 a. verifying that the key blank secured in the clamp by the operator has the key attributes of the identified corresponding key blank; and

 b. rejecting the clamped key blank by generating a signal for verbally announcing to the operator that
20 the clamped key blank needs to be replaced, when the clamped key blank fails to correspond to the identified corresponding key blank.

10. An operator assisted method of making keys comprising the steps of:

25 a. determining a positional relationship of the clamped key blank relative to a preselected datum;

 b. rejecting the positional relationship of the clamped key blank by generating a signal verbally

-26-

announcing to the operator the need to reposition and re-clamp the key blank, when the positional relationship is beyond a predetermined threshold;

5 c. making adjustments to cutting key cuts to correct for the positional relationship of the key blank relative to the preselected datum;

d. comparing key cuts made to the corresponding key blank with key cuts in line with the corresponding key cut codes to determine a cutting variance and
10 adjusting the selected datum to correct for the cutting variance; and

e. rejecting the cut key blank and informing the attendant to replace the corresponding key blank.

11. An operator assisted method of making keys
15 comprising the steps of:

a. automatically extracting key attributes from an object key;

b. comparing the key attributes of the object key to known manufacturer's key attributes stored
20 in memory of a data processing unit to identify a corresponding key blank;

c. verbally announcing to the operator the identity of the corresponding key blank, whereby, the operator can secure the
25 corresponding key blank in a clamp for cutting,

wherein the verbally announcing to the operator the identity of the corresponding key

-27-

blank comprises at least one of a voice identifying and a visually displaying of the identification of the corresponding key blank; and

- 5 d. comparing the key attributes of the object key to known manufacturer's key attributes stored in memory of the data processing unit to determine a corresponding key cut code for the corresponding key blank.

- 10 12. The operator assisted method of making keys of claim 11, further comprising the steps of:

 a. verifying that the key blank secured in the clamp by the operator has the key attributes of the identified corresponding key blank;

- 15 b. rejecting the clamped key blank by generating a signal for verbally announcing to the operator that the clamped key blank needs to be replaced, when the clamped key blank fails to correspond to the identified corresponding key blank;

- 20 c. determining a positional relationship of the clamped key blank relative to a preselected datum;

- d. rejecting the positional relationship of the clamped key blank by generating a signal verbally announcing to the operator the need to reposition and
25 re-clamp the key blank, when the positional relationship is beyond a predetermined threshold;

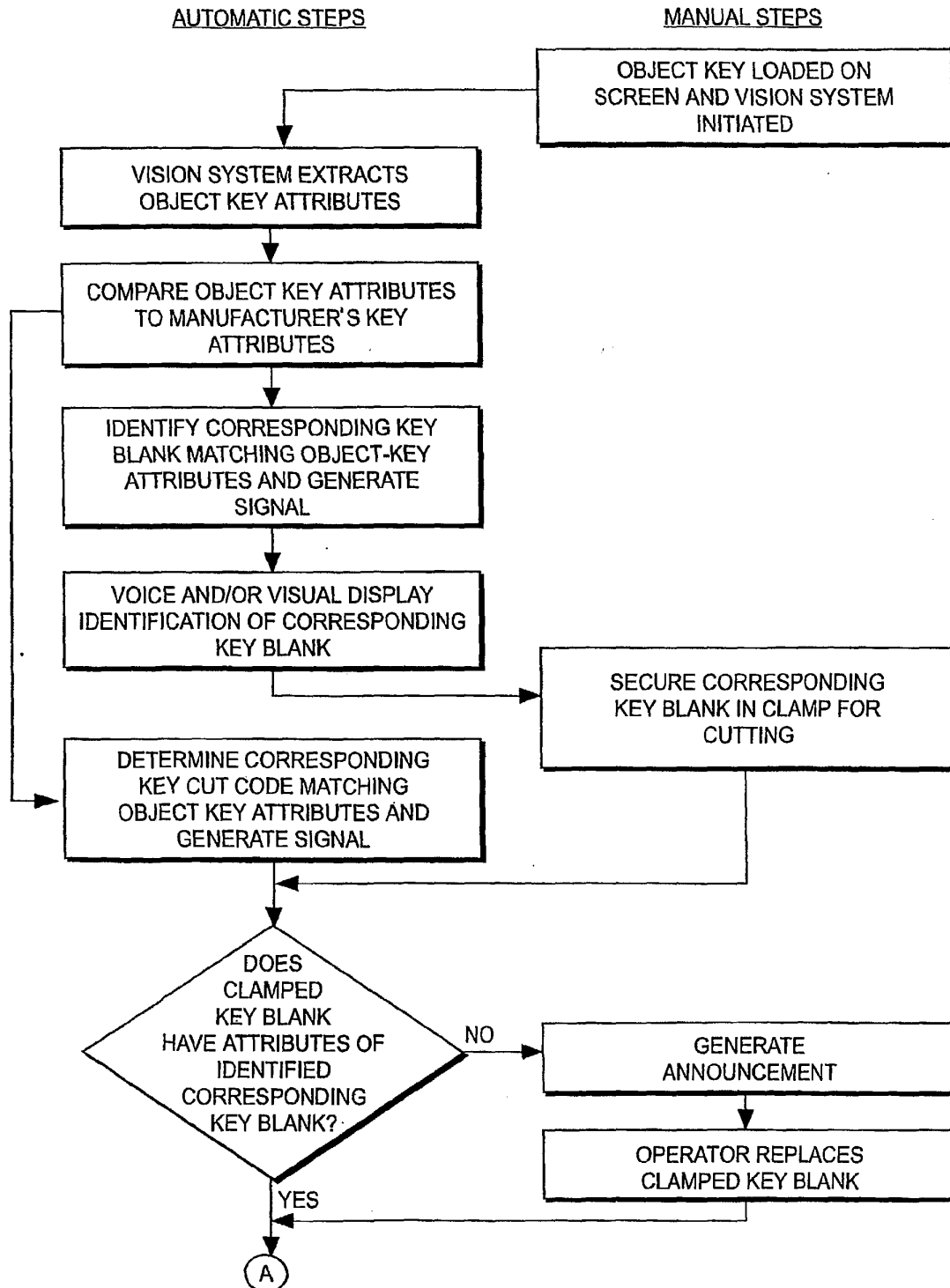
 e. making key cuts in the corresponding key blank in line with the corresponding key cut code;

-28-

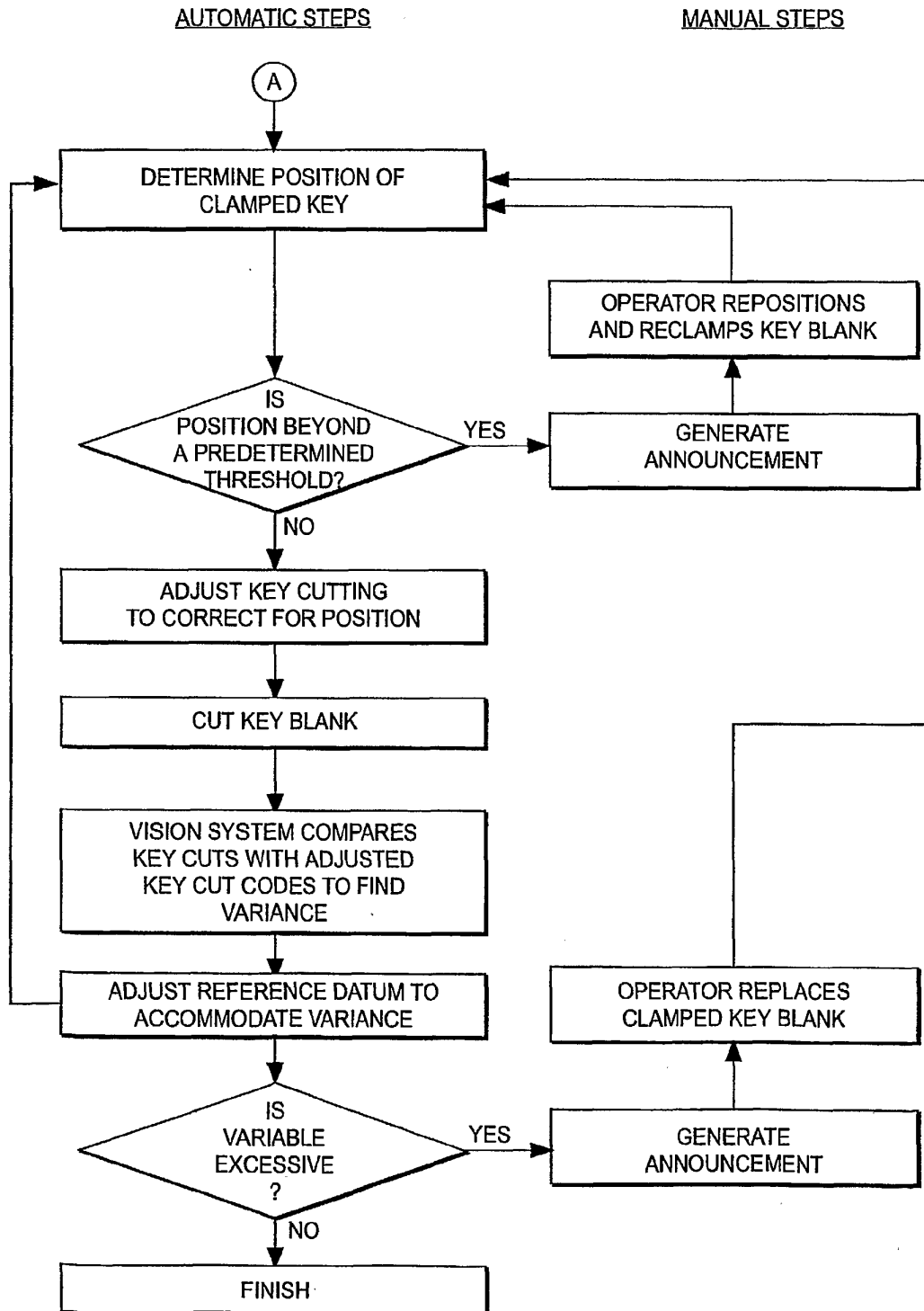
f. comparing the key cuts made to the corresponding key blank with manufacturer's key cuts in line with the corresponding key cut codes to determine a cutting variance and adjusting the preselected datum to correct for the cutting variance,

whereby, any cutting variances resulting from wearing down of an element of key making equipment can be corrected; and

g. rejecting the cut key blank and generating a signal for verbally announcing to the operator that the clamped key blank needs to be replaced, when the cutting variance exceeds a predetermined amount.

1/2
FIG. 1

SUBSTITUTE SHEET (RULE 26)

2/2
FIG. 2

SUBSTITUTE SHEET (RULE 26)

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US00/42438

A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) : G06F 19/00; B23C 1/16

US CL : 700/161; 409/96

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 700/161, 17, 83, 117, 118, 180, 185; 409/96, 81, 82, 83; 399/81

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
Please See Continuation Sheet**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y, P	US 6,152,662 A (TITUS et al) 28 November 2000 (28.11.2000), Abstract; figures 8-10, 13-15, 19-24; column 1, line 10 - column 2, line 17; column 8, line 35 - column 17, line 35.	1-4
---		-----
A, P		5-12
Y	US 4,469,553 A (WHITEHEAD) 04 September 1984 (04.09.1984), column 2, lines 42-66; column 6, lines 30-46.	1-4
A	US 5,807,042 A (ALMBLAD et al) 15 September 1998 (15.09.1998), all.	1-12
A	US 4,899,391 A (CIMINO et al) 06 February 1990 (06.02.1990), Abstract; column 1, lines 5-30; column 2, line 40 - column 6, line 17.	1-12

☐ Further documents are listed in the continuation of Box C.☐ See patent family annex.

* Special categories of cited documents:	
"A" document defining the general state of the art which is not considered to be of particular relevance	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"E" earlier application or patent published on or after the international filing date	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"O" document referring to an oral disclosure, use, exhibition or other means	"&" document member of the same patent family
"P" document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search

14 September 2001 (14.09.2001)

Date of mailing of the international search report

05 NOV 2001

Name and mailing address of the ISA/US

Commissioner of Patents and Trademarks

Box PCT

Washington, D.C. 20231

Facsimile No. (703)305-3230

Authorized officer

William Grant

James R. Matthews

Telephone No. (703) 305-9600

Form PCT/ISA/210 (second sheet) (July 1998)

INTERNATIONAL SEARCH REPORT

International Application No.

PCT/US00/42438

Continuation of B. FIELDS SEARCHED Item 3:

EAST BRS

Search Terms: (key adj cut adj code), ((operator adj assisted) with (manufacturing or making)),
(((operator or user) adj (prompt or instruct\$4)) and (making adj keys)),
(((key adj blank) and (key adj cutting)) and (verbal or audible or audio or voice)),
((verbal or audible or audio or voice) adj (prompt or instruct\$4) adj (operator or user)),
(((key adj blank) and (making adj keys)) and instruct\$4)),
((key adj blank(and (making adj keys)), ((verbal adj instructions) and prompt),
(((verbal adj instructions) same (prompt or operator))

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
9 August 2001 (09.08.2001)

PCT

(10) International Publication Number
WO 01/57472 A1

(51) International Patent Classification⁷: **G01B 11/24**,
E05B 17/00, B23C 3/00

(74) Agent: **MCINTYRE, Iain, A.**; Altera Law Group, LLC,
Suite 100, 6500 City West Parkway, Minneapolis, MN
55344 (US).

(21) International Application Number: PCT/US01/03196

(22) International Filing Date: 31 January 2001 (31.01.2001)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
09/495,090 1 February 2000 (01.02.2000) US

(71) Applicant (for all designated States except US): **MA-
CHINE MAGIC LLC** [US/US]; 11900 Wayzata Boule-
vard, Minnetonka, MN 55305 (US).

(81) Designated States (*national*): AE, AL, AM, AT, AU, AZ,
BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, DE, DK,
DM, EE, ES, FI, GB, GD, GE, GI, GM, GR, GU, ID, IL,
IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU,
LV, MA, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT,
RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA,
UG, US, UZ, VN, YU, ZA, ZW.

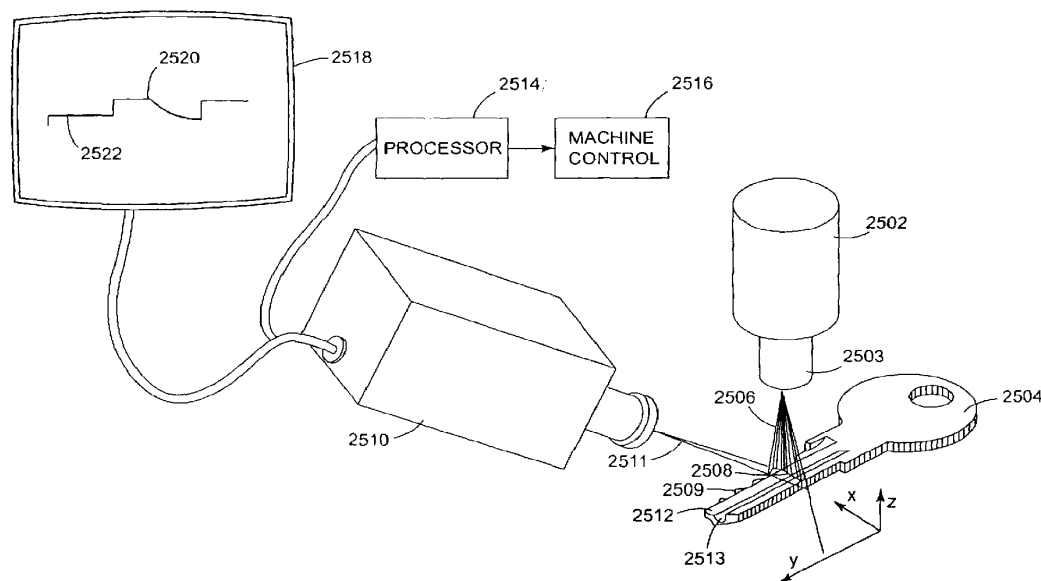
(84) Designated States (*regional*): ARIPO patent (GH, GM,
KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian
patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European
patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE,
IT, LU, MC, NL, PT, SE, TR), OAPI patent (BF, BJ, CF,
CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published:

— with international search report

For two-letter codes and other abbreviations, refer to the "Guid-
ance Notes on Codes and Abbreviations" appearing at the begin-
ning of each regular issue of the PCT Gazette.

(54) Title: KEY MEASUREMENT APPARATUS AND METHOD



(57) Abstract: In a method and apparatus for measuring an original key, a line of the light is focused onto the key surface in a direction perpendicular to the key surface. A camera, or other type of detector is disposed to receive light deflected by the key at an oblique angle. The keyway and keycode of the key can be determined from the deflected pattern of light.

5

KEY MEASUREMENT APPARATUS AND METHOD

This is a continuation-in-part of application serial no. 09/122,248, filed July 24th, 1998, which is a continuation-in-part of Patent No. 5,908,273, filed
10 July 31, 1997, both of which are incorporated herein by reference.

Field of the Invention

The present invention is directed generally to a method and apparatus for measuring a key, in particular a method for measuring a key in
15 order to make a subsequent duplicate of the key.

Background

Hundreds of millions of keys are generated in the United States each year by making a duplicate from an original key or from a parent duplicate key. The duplication process commonly takes place in a hardware store, or
20 the like, that is equipped with a key duplication machine.

Duplicating a key is difficult task, typically requiring high skill in operating the duplicating machine. A high degree of skill is particularly required when duplicating a double sided key in order to achieve correct registration of the second side after cutting the first side. Due to the high
25 probability of making an error when duplicating a key, a significant number of the duplicate keys made each year are discarded as being unusable.

Since there is a wide variation in the types of keys manufactured, the locksmith or hardware store where the duplicate is made has to carry a large number of different key blanks, often numbering in the thousands, in
30 inventory from which an appropriate blank is selected for forming the duplicate key. When faced with duplicating a key of unknown origin, the person performing the duplication is presented with the difficult task of

selecting the correct key blank with which to manufacture the duplicate.
This may lead to the selection of the wrong key blank, thus resulting in an unusable duplicate key.

5 The security hierarchy adopted by many key manufacturers includes thicker keys with relatively complex keyways for use in single locks, and master keys that are thinner and have relatively simple keyways. Often, master key blanks are employed for forming duplicate keys in an attempt to reduce the number of key blanks required in inventory, irrespective of whether the key being duplicated is a master key or is cut for a single lock.
10 Consequently, the security hierarchy is compromised when a large number of keys cut from master key blanks enter into use.

One manufacturer has adopted a system that uses a small number of key blanks in which it is claimed most keys can be duplicated, thus reducing the level of skill required of the person performing the duplication. However,
15 this system still requires a significant inventory of different key blanks and, additionally, is subject to the problem of low-skilled operators making a large number of rejectable duplicate keys.

Therefore, there remains a need for a key duplicating system which further reduces the number of types of key blanks required to be carried in
20 inventory. Additionally, there is a need to remove the factor of operator skill level from the duplication process so that fewer rejectable duplicate keys are manufactured.

Summary of the Invention

Generally, the present invention relates to an apparatus and method
25 for measuring the original key from which a duplicate key is to be made. In particular, the method permits measurement of the keyway and the keycode so that machining instructions may be developed to form the duplicate key using the measurements of the keyway and keycode of the original key.

To be completed after claims are finalized.

30

The above summary of the present invention is not intended to describe each illustrated embodiment or every implementation of the

present invention. The figures and the detailed description which follow more particularly exemplify these embodiments.

Brief Description of the Drawings

The invention may be more completely understood in consideration of
5 the following detailed description of various embodiments of the invention in connection with the accompanying drawings, in which:

FIG. 1A is a perspective view of a key;

FIG. 1B is a cross-sectional view of the key taken through the section
1B-1B shown in FIG. 1A;

10 FIG. 2 is a perspective view of a key duplicating apparatus measuring a keycode of a master key in accordance with an embodiment of the present invention;

FIG. 3 is a perspective view of a key duplicating apparatus measuring a keyway of a master key;

15 FIG. 4 is a partial perspective view of a key duplicating apparatus cutting a keyway in a blank preform;

FIG. 5 is a partial perspective view of a key duplicating apparatus cutting a keycode in a blank preform;

20 FIG. 6 illustrates an optically based measurement system for use in the key duplicating apparatus;

FIG. 7A illustrates an optically based measurement of a keycode;

FIG. 7B illustrates an optically based measurement of a keyway;

FIG. 7C illustrates a mechanically based measurement of a keycode;

FIG. 7D illustrates a mechanically based measurement of a keyway;

25 FIG. 8 illustrates the measurement of a key using a video technique;

FIG. 9 is a block diagram schematic of a control system for a key duplicating apparatus;

FIG. 10 lists process steps for measuring an original key;

FIG. 11 lists process steps for measuring a keyway or a keycode;

30 FIG. 12 illustrates a system calibration standard block;

FIGs. 13 and 14 list process steps for forming a duplicate key;

FIG. 15 lists process steps for analyzing measured key profile data;

FIG. 16 lists process steps for producing cutting instructions for a keyway;

FIG. 17 lists process steps for producing cutting instructions for a keycode;

5 FIG. 18 illustrates a number of cutters used for producing a keyway in a duplicate key;

FIG. 19 illustrates a first system for measuring a keyway using structured light;

10 FIG. 20 illustrates exemplary results produced by the system illustrated in FIG. 19;

FIG. 21 illustrates a method of obtaining keycode and keyway information from a key using an optical reader;

FIG. 22 illustrates a system for obtaining keycode and keyway information from a key having an identification transponder;

15 FIG. 23 illustrates method steps for obtaining keyway machining instructions for the system illustrated in FIG. 22;

FIG. 24 illustrates a system for obtaining keycode and keyway information from a key using electrical contacts;

20 FIG. 25 illustrates a second system for measuring a keyway using structured light according to an embodiment of the invention;

FIG. 26 illustrates a schematic of the second system for measuring a keyway using structured light according to an embodiment of the invention

FIG. 27 illustrates a key illuminated with a perpendicular light beam and a light beam at an oblique angle;

25 FIG. 28 illustrates ideal and measured profiles of a key using the second system for measuring a keyway using structured light; and

FIG. 29 illustrates a measured profile using structured light incident on the key at an oblique angle.

30 While the invention is amenable to various modifications and alternative forms, specifics thereof have been shown by way of example in the drawings and will be described in detail. It should be understood, however, that the intention is not to limit the invention to the particular embodiments described. On the contrary, the intention is to cover all

modifications, equivalents, and alternatives falling within the spirit and scope of the invention as defined by the appended claims.

Detailed Description

The present invention is directed to a method and apparatus for
5 duplicating a key that provides a significant benefit in avoiding the need for
maintaining an inventory of different types of key blanks. The present
invention advantageously provides for a large number of different types of
keys to be cut from one type of blank preform. The preform may simply be a
piece of stock metal material: no keycode or keyway need be present on the
10 preform prior to the duplication process taking place. In a typical duplication
process, the preform may be cut to the correct length, width and thickness,
in addition to having the keycode and keyway formed thereon. Additionally,
the number of unusable duplicates is reduced because the duplication
process of the present invention obviates the need for a skilled operator.
15 Therefore, unlike conventional key duplicators, the key duplicator of the
present invention need not be located where there is an operator having a
high level of skill, such as a hardware store, or a locksmith.

It will be appreciated that the use of the terms "copy" and "duplicate"
should not be taken to mean that the second key formed as a copy of the
20 original key is exactly the same as the original key in every way. The
duplicate key may have a different shape of key bow, for example. Also, the
details of the key code or the keyway in the duplicate may be different, for
example one or more corners of the original key may be rounded due to
wear, while the duplicate key may not be formed with the rounded corners.
25 The words "copy" and "duplicate" may be taken as referring to a process that
makes a duplicate key whose keyway and keycode are sufficiently close to
those of the original key that the duplicate can operate the lock for which the
original key was designed.

Figure 1A illustrates the various component parts of a key 100. The
30 key shaft 102 extends from the key bow 104. The key bow 104 is the
portion typically held by the user when using the key. The shaft 102 has a

keycode 106 along one edge. The bow 104 may be provided with a numerical code 108 that corresponds to the keycode 106.

The cross section of the shaft 102 has a particular shape, known as the keyway 110. The profile of the keyway 110 is illustrated in FIG. 1B, which shows a cross section 1B-1B through the shaft 102. The keyway 110 illustrated includes a notch 112 on a first side of the shaft 102 and another notch 114 and land 116 on the second side of the shaft 102. The notches 112 and 114 and land 116 run the length of the shaft and mate with the aperture of the lock when the key 100 is inserted.

It will be appreciated that the key shown in FIGs. 1A and 1B is only an example of a key and is not intended to limit the scope of the invention in any way. For example, the key 100 may be a double-sided key, in which case the keycode is found on opposite edges of the shaft. Generally, although not always the case, the same keycode is provided on each edge of a double-sided key so that it may be inserted into the lock in either orientation. Additionally, it will be appreciated that keys come with many different keyway profiles. Indeed, it is one of the major problems in the key industry that, due to the large number of different keyways, a large number of key blanks have to be held in inventory.

Figures 2-5 illustrate one particular embodiment of a key-duplicating apparatus 200. FIGs. 2 and 3 illustrate the key-duplicating apparatus 200 in an "original-measuring" mode, in which the original key 202 to be copied is measured for its keycode 242 and keyway 240. FIGs. 4 and 5 illustrate the key-duplicating apparatus 200 in a "key-fabricating" mode, in which a duplicate key is cut from a blank preform 246. The preform 246 is held between the key holder 204 and a tip holder 248.

Referring initially to FIG. 2, a key 202 is held by a key holder 204. The key holder 204 holds the bow 206 of the key 202 so that the shank 208 is accessible by the measuring device 210 and the cutting tool 212. The key holder 204 is mounted on a translation stage 214 that travels in the x-direction. The x-translation stage is driven by a stepper motor 216. The x-translation stage 214 is mounted on top of a second translation stage 218, oriented for translation in the y-direction. The y-translation stage 218 is

driven by a stepper motor 220. The y-translation stage 218 is mounted on a third translation stage 222 which provides translation in the z-direction. The z-translation stage 222 is driven by another stepper motor 224. The stepper motors 216, 220, and 224 are controlled by a controller (not illustrated) so
5 that the key can be positioned at any point in x, y, z within the range of travel of the translation stages 214, 218 and 222.

A rotatable platform is positioned above the key holder 204 and the stack of translation stages 214, 218 and 222. The rotatable platform 226 holds the measuring device 210 and the cutting tool 212. The rotatable
10 platform 226 is rotated using a rotator drive 228. The rotator drive 228 is used for rotating the rotatable platform 226 between two positions, namely: a) the cutting tool 212 being perpendicular to the key shank 208, and b) the cutting tool 212 being parallel to the key shank 208. Accordingly, the rotator drive 228 rotates the rotatable platform 226 between two positions,
15 separated by 90°. The rotator drive 228 includes a stepper motor 230 and a drive belt 232 positioned around the periphery of the rotatable platform 226 and a pulley 234 mounted on the shaft 236 of the stepper motor 230.

The key holder 204 is also rotatable, and its rotating motion is controlled by a second rotary stepping motor 238, illustrated in FIGs. 4 and
20 5. Accordingly, the key 202 may be rotated for measuring either its keycode or its keyway. FIG. 2 illustrates the key 202 oriented with its keycode directed towards the measuring device 210 so that the key-duplicating apparatus 200 can measure the keycode 242 of the key 202.

Figure 3 illustrates the same apparatus as FIG. 2, except that here
25 the key 202 has been rotated through 90° into position for measurement of the keyway 249 by the measuring device 210.

The rotatable platform 226 is mounted to an apparatus frame (not illustrated) by a rotatable bushing 244.

Figure 4 illustrates the cutting tool 212, including a number of edge
30 cutters 250 used for cutting the keyway profile, a key-code cutter 252, and a wire brush 254 arranged on a shaft 256. The shaft 256 is supported at either end by shaft supports 258 that are attached to the underside of the

rotatable platform 226 (shown in dashed lines in FIGs. 4 and 5). The shaft 256 is rotated by the cutting tool motor 260.

Figure 4 illustrates the apparatus 200 in a "keyway cutting" mode, with one of the edge cutters 250 forming a groove along the preform 246 to make a keyway 262. The edge cutters 250 are selected so as to provide a variety of shapes of cutter profiles for cutting the keyway 262 into the blank preform 246.

Figure 5 illustrates the same apparatus as in FIG. 4, but in a "keycode cutting" mode. Here, the blank preform 246 has been rotated through 90° from the position illustrated in FIG. 4. Additionally, the rotatable platform 226 has been rotated through 90° so that the shaft 256 is parallel with the blank preform 246. The blank preform 246 has been brought into position by the x-, y- and z-translation stages 212, 218 and 222 so as to engage the keycode cutter 252 on the edge of the blank preform 246. The blank preform is translated relative to the keycode cutter 252 by the x-, y- and z-translation stages 214, 218 and 222 as the keycode cutter 252 is rotated by the cutting tool motor 260. The keycode 264 is cut into the edge of the key according to the relative movements of the translation stages 214, 218 and 222.

Different types of edge cutters 250, that may be provided on the shaft 212, are illustrated in FIG. 18. The edge cutters 250 are selected to provide the apparatus 200 with a wide capability for cutting different types of keyway profiles. The right- and left-angled cutters 1800 and 1802 permit angled channels to be cut. Channels having side slopes less steep than the cutters 1800 and 1802 may be cut using a procedure having a series of multiple passes. Use of flat cutters 1804, 1806 and 1808 results in the removal of material leaving a flat finished surface. The flat cutters 1804, 1806 and 1808 are provided in a variety of widths. The narrowest flat cutter 1804 may be used, for example, to cut a flat bottom into a narrow channel. The widest flat cutter 1808 may be used for cutting down large portions of the preform, for example in reducing the original thickness of the preform to the thickness of the original key 202 that is being duplicated. Use of the rounded cutter 1810 results in a rounded channel. Although the rounded cutter has only

one radius of curvature, channels having different radii may be formed by controlling the movement of the preform 246 in all three directions x, y, and z while the channel is being cut. The "V" cutter 1812 has a "V" profile to cut a v-shaped channel. The selection of edge cutters 250 illustrated here is not
5 intended to limit the invention. It will be appreciated that additional edge cutters, having shapes different from those illustrated here, may also be employed in forming the keyway.

Figure 6 illustrates an optically based measuring device for measuring the keycode and the keyway of the key which is to be duplicated.
10 The measuring device 610 employs a laser 612, or other light source, to direct a light beam 614 which is collimated by collimating lens 616. The measuring device 610 includes collection optics 618 for receiving a light beam deflected by a target, and a linear photo-detector array 620 that detects the light collected by the collection optics 618. The laser 612 and
15 the photo-detector array 620 are both coupled to an electronics package 622 which controls the output from the laser 612, and receives the detected signals from the photo-detector array 620. The electronics package 622 may also analyze the detected signals before directing data along communications link 624 to a control processor. The processor may also
20 direct control signals into the measuring device 610 through the communications link 624. It will be appreciated that other detectors, such as a position sensitive optical detector or the like, may be used for detecting a position of the light beam.

The measuring device 610 operates as follows. The collection optics
25 618 and the photo-detector array 620 receive light deflected (scattered or reflected) from a target which is spaced from the measuring device 610 by a certain distance. If the target 626 is positioned at a nominal distance, then the light deflected by the target 626 and received by the collection optics 618 is consequently directed onto the photo-detector array 620 at position A.
30 If the target 626' is positioned further from the measuring device 610 than the nominal distance, then the light (shown as a dash-dotted line) deflected the target 626' and collected by the collection optics 618 illuminates a different portion of the photo-detector array 620, shown as position B.

Moreover, if the target 626' is positioned closer to the measuring device 610 than the nominal distance, then the light (shown as a dashed line) deflected by the target 626 and collected by the collection optics 618 illuminates the photo-detector array at a different position, illustrated as position C.

5 Therefore, by detecting the position on the photo-detector array of the deflected light from the target, the distance to the target may be estimated. In one mode of operation, the position of the target 626 is varied relative to the measuring device 610 until the light collected by the collection optics 618 illuminates the photo-detector array 620 at position A.

10 In operation, the speed of translation of the translation stages may be adjusted, depending on how far the key 202 is measured to be away from the nominal separation from the measuring device 610. For example, if the key 202 is determined to be relatively far from the nominal separation, then the translation speed may be high. Once the target key is determined to be
15 within a predetermined range of the nominal separation, then the translation speed may be set to be slower, and the translation speed is reduced to zero once the key is at the nominal separation.

A numerical profile of the key 202 corresponding to its physical shape can be constructed by tracking the amount of translation in three dimensions
20 required to achieve the nominal separation between the measuring device 610 and a series of measurement points along the key 202.

Figure 7A illustrates the measurement of a keycode 700 on a key 702 using a light-based measuring device 710. A light-based measuring device 702 uses an optical interaction, such as reflecting, scattering or blocking a
25 light beam, to produce an optical signal that can be used in determining the position of a point on the key 702. It is assumed that the shank of the key 704 is aligned parallel with the y-axis. The measuring device 710 transmits a first light beam 706 to illuminate a spot on the edge of the key shank 704, designated as spot A. The light 708 deflected to the photo-detector 718 is
30 detected by the collection optics and photo-detector array which determines whether point A is at the nominal distance, or either closer or further from the nominal distance. The detected light may be reflected or scattered by the key 702. The position of the key 702 is altered accordingly, to bring

position A to the nominal distance. The position of the key 702 is recorded by tracking the movements of the translation states to achieve the nominal separation between point A and the measuring device 710. The key 702 is then translated in the y-direction so that the first light beam 706 illuminates point B, positioned close to point A but spaced by a pre-selected separation in the y-direction. The process of positioning point B at the nominal distance relative to the measuring device 710 is repeated, and the amount of translation in the y- and z-directions required to move position B to the nominal distance are noted. The key is then translated again in the y-direction so that position C is illuminated by the first light beam 706. Again, the key is adjusted in the z-direction to position point C at the nominal distance from the measuring device 710. Again, the amount of translation in y and z to place point C at the nominal distance is recorded. This procedure is repeated over the entire length of the key shank 704, from the tip 712 to the stop 714, so that the whole keycode 700 is measured.

The second edge 716 of the key shank 704 may also be measured. Where the key 702 is single-sided, as illustrated in FIG. 7A, then the measurement along the second edge 716 yields a straight line.

Where the key 702 is a double-sided key, the keycode 700 is provided on either edge of the key shank 704. Moreover, a double-sided key is typically rotationally symmetrical about an axis along the center of the key shank 704 so that the keycodes provided on the edges of the shank are identical and the keyways are the same on both sides of the key 702. The measurement on both edges of the key 716 and 718 provides independent measurements of the keycode 700. It is an important feature of the present invention that since both edges of the key shank 704 are measured, it is possible to duplicate a key where the keycodes cut on either edge are different from each other.

Figure 7B illustrates the measurement of a keyway profile on the key 702. The process of measuring the keyway profile 720 is similar to that used in measuring the keycode 700. First, the key 702 is rotated through 90° relative to the orientation used for measuring the keycode 700 so that the measuring device 710 can illuminate portions along the side 722 of the

key shank 704. The keyway profile 720 is measured by positioning successive spots across the side 722 of the key shank 704 at the nominal distance from the measuring device 710. The measurement of the keyway profile 720 is advantageously made at the widest portion of the key shank 704 so that measurement of the entire keyway profile 720 is assured. The widest portion of the key shank 704 may be deduced from the measurements of the keycode 700 performed earlier.

In the descriptions of measuring the keycode and the keyway given above, it was assumed that the key shank was parallel to the y-axis, and that the side 722 of the key 702 lay parallel to the x-axis. It will be appreciated that the key 702 may not always be aligned exactly with the axis of the translation stages. However, it will also be appreciated that any deviation from such alignment may be accounted for in the software driving the translation of the translation stages. Thus, in the measurement of both the keycode and keyway, the key 702 may be translated in all three directions - x, y and z - to perform the measurement.

It will be appreciated that other optical methods may be used to measure the profile of the key 702. For example, rather than detecting light deflected by the key surface, a detector may be positioned on a side of the key 702 opposite from the light source. A point on the keycode may then be detected by moving the key across the light beam so as to cut off the light beam passing to the detector, and recording the positions of the translation stages when the beam is cut off. This may be performed for a number of points along the keycode, so as to "map" the profile of the keycode.

It will also be appreciated that the keycode 700 and the keyway 720 of the key 702 may be measured using other methods. One such method is illustrated in FIG. 7C, where the keycode 700 is measured using a mechanical follower 724. The mechanical follower 724 has a small tip 726 that is sensitive to a force applied when brought into contact with the key edge 718. The steps for measuring the keycode 700 are similar to those discussed regarding the light-based measuring device, where a series of points along the edge 718 of the key 702 are brought into a specific position

in three-dimensional space by adjusting the translation stages on which the key is mounted. The specific position in three-dimensional space is defined by the tip 726 of the mechanical follower 724.

Figure 7D illustrates the mechanical follower 724 in use for measuring the keyway profile 720 of the key 702. Like the keycode measurement of the previous figure, the tip 726 of the mechanical follower 724 defines a point in three-dimensional space to which a series of positions across the shaft 704 of the key 702 are brought into contact. By measuring the displacement in x, y and z, the keyway profile 720 can be measured. As with the measurement of the keyway profile 720 using the light-based measurement system 710, both sides of the shank 704 are measured to produce a complete keyway profile.

Figure 8 illustrates an embodiment of a measuring device that utilizes a video camera for measuring the profile of a key 802. An image of the key 802 is recorded by the video camera 804, which converts the optical image into a video signal. The video signal is transmitted on the video line 806 to the video image processor 808. The video image processor 808 converts the received video signal into key profile data using, for example, a pattern recognition technique. The key profile data contain information on the dimensions and shape of the key imaged in the camera 804. The key profile data are then converted into a series of motion control signals to control the movement of the translation stages for cutting the duplicate key.

This video approach to key measurement may provide all the required profile information using two images, one image taken from the side of the key 802 as illustrated to provide keycode information, and the other image taken of the key tip 812 in a direction along the axis of the key 802 to give keyway information. It will be appreciated that a video measurement system requires the video camera 804 and the key 802 be movable relative to each other in such a way as to permit side-on and end-on views to be taken. Thus, a video camera could be mounted on a rotating mount, for example, to allow an image to be taken of the side of the key 802 and the end of the key 802, while the key 802 remains stationary, or two fixed mount cameras 804 could be employed in orthogonal orientations.

Figure 9 illustrates a block schematic of an embodiment of a control system for the key-duplication apparatus that may be used to control the embodiment of the duplicating apparatus illustrated in FIGs. 2-5. In this particular embodiment, the control system 900 is based on an embedded
5 PC central control system 902 having a number of plug-in interfaces for interfacing with various subsystems of the apparatus. The control system 902 may include a memory device 904, such as a read only memory, erasable read only memory, magnetic tape or disk, CD-ROM, or the like for storing information.

10 The central control system 902 controls several motors 216, 220, 224, 230, and 238 via the plug-in motor interface 914. The x-axis stepper motor 216 controls the x-position of the key and the blank preform. The y-axis stepper motor 220 controls the y-position of the key and the blank preform, and the z-axis stepper motor 224 controls the z-position of the key
15 and the blank preform. The a-axis stepper motor 238 controls the orientation of the key 202 and the blank preform 246 in the key holder 204, so that an edge or a flat surface is presented to the key-duplication apparatus 200 for measurement or cutting. The b-axis motor 230 controls the rotational position of the cutting tool 212 so that the cutting tool 212 can
20 cut either parallel or perpendicular to the axis of the key shank or the axis of the blank preform 246.

The measuring system 210 is coupled to the central control system 902 via the plug-in measuring interface 918. The measuring system 210 transmits measurement data to the central control system 902 during
25 measurement operations. For example, while measuring the keycode of a key, the measuring system 210 transmits information to the central control system 902 related to the relative position of the point on the key being measured to the nominal position. The central control system directs the x-, y- and z-axis motors 216, 220 and 224 accordingly to move the
30 measurement point on the key into the nominal position. The motor interface 914 may also relay step completed information to the control system 902 so that the control system 902 maintains tracking of the position of the stepper motors 216, 220, 224, 230 and 238.

A user may interact with the apparatus via a display 920 and a keypad 922, which are interfaced with the central control system 902 via the plug-in operator interface 924. The display 920 is used for displaying information to the user concerning, for example whether or not the submitted
5 key can be duplicated. In turn, the user may enter data, information or commands to the central control system 902 via the keypad 922. Such information or commands may include how many duplicate keys are to be produced from the submitted original key.

Other subsystems controlled by the central control system 902
10 include the cutting tool motor 260 and the key holder solenoid 928, which are controlled via the digital I/O interface 930. The central control system 902 controls the speed and direction of the cutting tool motor 260 according to the type of operation. For example, the cutting motor may operate at slower speeds for cutting the keyway profile than for the cutting the keycode,
15 since there is typically more material to be removed when cutting the keyway than when cutting the keycode. Also, when deburring with the wire brush, the cutting tool motor 926 may be operated at a higher speed than during a cutting operation, and in both directions. The key holder may be operated by a solenoid 928 so as to automatically grip and release the key
20 and blank preform from the holder.

A communications interface 940 is connected to the control system 902 which provides for communication with external sources. For example, the communications interface 940 may include a telephone modem that permits the control system 902 to receive information on the shape and
25 dimensions of standard keycode elements from key manufacturers, or to receive a listing of known key types (combinations of keyway and keycode) that have been reported to be stolen.

A list of process steps for measuring a key are provided in FIG. 10. Initially, the key 202 that is to be copied is inserted in the key holder 204, at
30 step 1000. The first keycode 242 is measured along the first edge of the key 202, at step 1002. The key 202 is then rotated through 180° in the key holder 204 to expose the second edge of the key 202 to the measuring system 210, at step 1004. The keycode profile of the second edge of the

key 202 is then measured, at step 1006. Measurement of both edges of the key 202 provides information for the subsequent cutting process. An advantage of measuring the opposite edges, or the opposite sides, of the key 202 is that the controller 900 may determine if the key 202 is held in the key holder 204 with the longitudinal axis of the key parallel to a translation axis of the apparatus 200, or whether there is an angle between the key axis and the translation axis. The determination of such an angle permits the controller 900 to include the angle in subsequent analysis of the measurement data and development of cutting instructions. However, the operator may also indicate to the controller 902 that the key is single-sided, for example via the operator interface 904, thus ordering the apparatus to measure only the first edge of the key 202.

After measuring the keycodes, the key 202 is then rotated through 90° in the key holder 204, at step 1008, thus exposing the first side of the key to the measuring system 210 so that the keyway on the first side may be measured. Next, the controller 902 determines from the measurements of the keycodes where the widest point of the key blade is located, and the measurement system 210 is positioned at the widest point, at step 1010. This ensures that subsequent measurements of the keyways on either side of the key 202 include the complete keyway. Next, the keyway profile of the first side of the key 202 is measured, at step 1012. The key 202 is then rotated through 180° to expose the second side of the key 202 to the measuring system 210 at step 1014. Next, the keyway profile on the second side of the key 202 is measured, at step 1016. The key 202 may then be removed from the key holder 204, at step 1018.

A sequence of steps for making a measurement of a keycode or keyway is provided in FIG. 11. At the start of the sequence, the apparatus 200 is calibrated by setting the positions of the translation stages 214, 218, and 222 at a fiduciary zero for all three axes, x, y, z, at step 1100. The zeroes are set for each axis by setting the measurement 210 to locate the x-axis, y-axis, and z-axis zero steps on the system calibration standard block 270, illustrated in FIG. 2. This block is shown in greater detail in FIG. 12. The block 270 includes a number of bolt holes 1200 to receive bolts so that

the block 270 can be firmly attached to the x-translation stage 214. The upper surface 1202 of the block 270 acts as the z-axis zero reference. The block also has two edges 1204 and 1206 which act as x- and y-axis reference zeroes, respectively. The initial zeroing of the apparatus 200 is performed by locating the zero surfaces and edges of the block 270 using the measuring unit 210.

The x- and y-axes are zeroed when the measuring unit detects their respective zero-edges 1204 and 1206. The z-axis is zeroed on the top surface 1202 of the block 270.

The machining axes, x, y, and z, are provided with end-of-travel motion limit switches. The calibration block is located just inside the limits of the x, y, and z travel and is initially found by first slewing each axis to its respective zero end limit switch, then stepping off the switch until the measuring unit 210 detects the appropriate reference edge or surface of the block 270. Thus, the zeroes for each axis are located close to the end of the travel on each axis.

The two rotary axes are stepped in one direction until their zero limit switch is encountered, and then stepped away to the point of signal loss.

After the zeroes have been set, the x, y, and z translation stages 214, 218, and 222 are slewed to locate the beginning point for the first scan, at step 1102. The scan start position is located outside of the maximum expected envelope of space for the key geometry to be measured, and may be simply a point in space relative to the zeroed point.

The scanning translation stages are slewed to detect where the key geometry starts, at step 1104. One or more of the translation stages 214, 218, and 222 is slewed until the measuring unit 210 detects the presence of a key surface. Then the z-axis is advanced or retracted to null the scan standoff distance, i.e., to set the nominal separation between the key surface and the measuring unit 210. The distances from the previously set zeroes traveled by the translation stages 214, 218, and 222 are recorded.

Next, the geometry of the key is followed and recorded up to the end of that particular scan, in step 1106, using the step and repeat process described above with regard to FIGs. 7 and 8. From the geometry-start

position obtained in step 1104, the scanning axis is stepped to scan to the next position to be measured. Holding the scan at the reference position, the z-axis is stepped up or down to achieve the nominal separation from the measuring unit. The axis positions are recorded. A new reference position
5 is found and the translations of each translation stage 214, 218, and 222 are recorded. The axis positions thus recorded represent a digitized form of the key shape that has been scanned, offset by the z-axis stand-off distance.

A sequence of steps for machining a duplicate key using the measurements of the original key are listed in FIGs. 13 and 14. First, the
10 data measured from the original key are analyzed and a sequence of cuts for forming the duplicate key is developed in step 1300, for machining the first side of the preform 246. The preform is inserted into the holder 204 and held at its far end by the tip holder 248, in step 1302. The keyway on the first side of the preform 246 is machined using the edge cutters 250, in step
15 1304. The preform 246 is then rotated through 180°, in step 1306. If not already done, the sequence of cuts for forming the second keyway on the second side of the preform 246 is developed, in step 1308. The second keyway on the second side of the preform 246 is then machined using the edge cutters 250, in step 1310. The preform 246 is then rotated through
20 90°, in step 1312, to expose a first edge to the keycode cutter 252. Also, the platform 226 is rotated through 90°, in step 1314 so that the shaft 212 lies parallel to the preform 246, and the keycode cutting tool 252 is correctly oriented relative to the preform 246.

If not already done, numerical instructions for cutting the keycodes on
25 the preform 246 are developed in step 1316. The first keycode is machined on the first edge of the preform 246, at step 1400. The preform 246 is then rotated about its axis by 180° to expose the second edge to the keycode cutter 252, in step 1402. The second keycode is then machined on the second edge of the preform at step 1404. The second keycode pass may
30 be only for cutting the backside edge of a single sided duplicate. In forming the keycodes, the machined preform 246 may be separated from its tip held in the tip holder 248.

After all the cutting operations are over, the machined preform represents a duplicate of the original key. The duplicate key is deburred, in step 1406, using the wire brush 254 to remove any burrs or cuttings, and to soften any sharp edges which may be dangerous to a user.

5 Next, the platform 226 is rotated back into position, which permits measurements to be made of the duplicate key, in step 1408. The keycodes and keyways of the duplicate key are measured, in step 1410, and compared with those of the original key 202, in step 1412. Any variances between the two measurements are noted, in step 1414, and a flag is set, in
10 step 1416, if the variances in measurement between the original key 202 and the duplicate key exceed a predetermined threshold, for example a few thousandths of an inch. Any variances thus measured may be indicative of wear on the key-duplicating apparatus 200: this is discussed further hereinbelow. The duplicate key is then removed from the apparatus, at step
15 1418.

A sequence of steps for analyzing measured key profile data are provided in FIG. 15. First, any anomalies or glitches present in the data measured from the original key are removed, in step 1500. This is done using generalized key-shape knowledge to remove any possible abnormal
20 details that the measuring unit 210 might generate in error. Next, the raw data are smoothed, in step 1502, using a smoothing algorithm to mathematically smooth the scanned data.

Next, the measured key shape is compared to known key geometries, in step 1504. Here, the measured key shape is compared to stored, known
25 key-shape data, for example, as supplied by key manufacturers, to determine if a match might exist. Key-shape data may be downloaded to the apparatus 200 via a telephone or other communications link through the communications interface 940, or may be stored locally in the memory device 904. These data may include key shapes of high security keys
30 whose duplication is forbidden, or combinations of keyway profiles and keycodes for keys that have been reported to be lost or stolen. In step 1505, a decision is then made, based on the results of the comparison in step 1504, on whether or not to duplicate the measured key. For example, if

the measured key is shown to be close to a standard key shape provided by a key manufacturer, the shape of the standard key may be used for the instructions for cutting the duplicate, rather than the measured data, since the measured key may be worn and may no longer retain the same shape and size as when new. Also, if the measured key is determined to be lost or stolen, a signal may be directed through the communications interface 940 to another location, such as a manufacturer's information desk or the police.

The duplicate key is then formed on the preform 246, in step 1508, using the measured, de-glitched, and smoothed data to machine the duplicate. The duplicate key is then measured in step 1508 and the anomalies removed and the raw data smoothed, in step 1510.

The measurements of the duplicate key are compared with those of the original key 202, in step 1512. A decision on whether to accept the duplicate key, rework the duplicate key or abort the duplicate key is made in step 1514. This decision is made on the results of the comparison in step 1512. If the measurements of the duplicate key are acceptably accurate in comparison with the measurements of the original key 202, then the duplicate key is deemed to be acceptable. A flag may be set to indicate if the duplicate key is to be aborted. A new preform may then be loaded into the holder 204 and tip holder 248 and a new duplicate key cut. The offset between the measurement results for the original key 202 and the duplicate key are logged, in step 1516, along with a listing of which edge cutters 250 were used in cutting the keyways on the preform 246. It will be appreciated that the edge cutters 250, the keycode cutting tool 252, and the motion system, including the translation stages 214, 218, and 222, may wear with use. Such wear can be compensated for in gradual increments by keeping a record of the machine and specific cutting performance after each use.

The logged results are compared to previously logged results in step 1518. By comparing the results after each usage to previous results, sudden changes in system performance can be discovered. By comparing the present results to older or average data, the controller can make decisions on how to gradually compensate for machine or cutter wear.

Any cutter or machine maintenance needs are flagged, in step 1520, for example, by sending a message to the display 920 or through the communication interface 940 to a maintenance desk. When the gradual compensation discussed with regard to step 1518 reaches certain preset
5 limits, the particular cutter or machine element showing excessive offset or error is flagged for future repair or replacement. This maintenance status log may be available for uploading to a central monitoring station, or displayed on the display 920.

A sequence of steps for producing cutting instructions for a keyway is illustrated in FIG. 16. First, a match is made between the measured keyway
10 profile and the cutters required to cut the profile, in step 1600. Using the de-glitched and smoothed keyway profile data from the original key, the shape geometry of the keyway profile is matched to one or more edge cutters 250. In performing this matching, the processor selects for each keyway channel
15 the keyway cutter that will remove the most material and will most closely approach the profile without overcutting, for the first pass. Each channel of the keyway on each side of the key may require multiple machining passes using more than one edge cutter 250 to produce the profile line within the acceptable profile tolerance.

20 Next, the machine stroke is generated for producing the keyway. Using the edge cutters 250 selected in step 1600 for each keyway channel, the stroke or pass pattern is computed that approximates the keyway profile shape within the acceptable profile tolerance. Each keyway channel is computed for each side of the key individually. By approximating the
25 desired keyway profile within the acceptable keyway profile tolerance with the fewest number of machining strokes or passes, then the machining time for performing the keyways may be minimized.

The keyway cutter selection order is then optimized, in step 1604. One method of optimizing the selection order is to order of cutter passes per
30 channel so that minimizes cutter selection motion, i.e. the transverse motion of the preform 246 to move from one edge cutter 250 to another is reduced, while permitting maximum material removal per pass. This method may be used to minimize the time to complete a given keyway side. The keyway on

the first side of the preform 246 is completed prior to rotating the key for machining the keyway on the opposite side.

5 A sequence of steps for determining a cutting sequence for keycodes is illustrated in FIG. 17. First, the usability of the scanned keycode data is determined, in step 1700. Using the de-glitched and smoothed keycode data measured from the original key, and using known keycode step increments for keys of the measured style and geometry, information supplied by the original manufacturer, the usability of the measured data without compensation is determined. Keycode data that is either too heavy or too thin may be the result of measuring from a worn key or an oversized
10 duplicate of the manufactured key. The controller 900 may request from the user, for example, through the display 920, whether compensation should be applied and also whether the key may be oversized or worn. The duplicate key can then be made according to standard keycode increments for the style and geometry of the original key 202. If the keycode data are
15 not generally offset, but instead are incrementally offset, then the controller may decide that no compensation for wear or oversized conditions should be included.

Next, the keycode cutting sequence is generated, in step 1702.
20 Keycodes are machined in a single direction pass per edge, starting at the key bow and progressing to the key tip. The keycode cutter 252 is positioned perpendicular to the keyway access on the key bow side, flat on the perimeter, and 45° beveled on the key tip side. The keycode cutter is oriented with the rotating access parallel to the keyway access. A
25 continuous machining pass is started with a plunge cut at the key bow end, followed by side cutting with angled transitions either in or out to reach and machine each keycode step of the key. Double-sided keys are machined on each edge sequentially. Keycode passes may be repeated at incremental depths, and/or partial passes until the final geometry is reached.

30 Various other methods of determining the keycode and the profile of the keyway of the original key, within the scope of the invention, may be used in addition to those methods described above, that use, for example, electromagnetic, optical, electrical magnetic, or mechanical techniques.

One method is the use of structured light, which is useful for obtaining height profiles of quasi-flat objects, such as a keyway of a key. A system for monitoring a keyway profile using structured light is illustrated in FIG. 19. The system 1900 includes a laser stripe generator 1902 that illuminates the key 1904. The laser stripe generator generates a beam of light 1906 that comes to a line focus 1908 on the surface of the key 1904. The laser stripe generator may be, for example, the model SNF-501L-670S-5-10, produced by Lasiris Inc. This model is capable of producing a focused line about 15 mm in length (0.6") and 38 μ m wide (0.0015") at a stand-off distance of about 90 mm (3.5").

A video camera 1910, such as a 2-D CCD camera, is positioned above the key 1904 to receive light deflected from the line focus 1908 on the surface of the key 1904. The camera 1910 may be, for example, a high resolution, monochromatic video camera such as the model TM-7 produced by Pulnix, the Hitachi KP-M2, and the Costar CV-M50. A high resolution camera typically has a CCD detector with 768 x 494 pixels, although other sizes of CCD detector may also be used. It will be appreciated that the measurement resolution of deep features on the surface of the key 1904 may be affected by the depth of field of the light beam 1906.

The axis of the camera 1910 is positioned at an angle relative to the direction of the light beam 1906. Therefore, the camera detects a lateral shift in the position of the line focus 1908 arising from a change in the height of the surface. When the angle is selected to be 45°, as illustrated, a unit change in the height of the surface causes a unit change in the lateral position of the light stripe on the surface of the key 1904. The line focus 1908 is positioned at a point along the key where the key blade 1912 is widest, thus ensuring that the measurement of the keyway profile covers all the features of the keyway.

Once the camera 1910 has detected the line focus 1908, the detection data are passed to a processor, 1914, which may include a screen grabber, for analysis. The processor 1914 analyzes the data to determine the shape and size of the keyway profile. Once the profile is determined,

the processor 1914' assembles machining instructions for cutting the measured keyway profile into the blank preform.

5 An example of the output signal from the camera 1910 is illustrated in FIG. 20, which shows the measured profile for the key 1904 of FIG. 19. The end portions 2002 of the signal correspond to those portions 1922 that are incident on the supporting surface for the key shown in FIG. 19. The outer edges of the key shown at points A and B correspond to shoulders 1923 and 1925. The long portion of the signal 2004 corresponds to the portion 1924 that lies between the first shoulder 1923 and the groove 1913. The angled portion of the signal 2006 corresponds to the angled face of the groove 1913. The remaining flat portion 2008 of the signal corresponds with the short flat section from the groove 1913 to the second shoulder 1925. The signal 2000 is shown plotted as a function of distance in two dimensions. The data may also be stored digitally, and converted to distance measurements where a calibration factor for pixel spacing is known.

It will be appreciated that variations of this method of detecting the keyway profile may be used. For example, rather than projecting a line focus on to the key, the light projector may scan a spot across the key to resemble a line focus. Additionally, the detector may also be a 1-D detector array that is translated across the field of view to generate a series of 1-D images that form a composite 2-D image.

Another embodiment of a system for measuring a key is illustrated in FIG. 25. A light source 2502 illuminates a key 2504 with a beam of light 2506 that comes to a line focus 2508 on the surface of the key 2504. The light source 2502 may include a laser and a lens system 2503 to provide a focused stripe of light. This may be, for example the model SNF-501L-6705-5-10 manufactured by Lasiris Inc. The light source 2502 may produce a fan of light that focuses to the stripe, or may scan a focused spot to form the focused stripe. The light beam 2506 is directed substantially perpendicular to the upper surface 2512 of the key 2504 that includes a groove 2513 forming at least part of the keyway. The light 2506 incident on the key 2504 is approximately perpendicular to the y-axis, which is parallel

to the shank of the key. The light 2506 is incident on the key 2504 over a range of angles in the x-direction because the light 2506 diverges from the light source 2502 in the x-direction. The focusing optics in the light source 2502 may be adapted to compensate for the different path lengths traveled
5 by different rays propagating at different x-angles so that each ray focuses in substantially the same z-plane. The upper surface 2512 may also be referred to as a major surface.

A detector 2510, for example a 2-D charge-coupled-device (CCD) camera, or the like, is positioned to receive light deflected by the surface
10 2512 at an angle relative to the direction of the light beam 2506. The detector 2510 may be a high resolution, monochromatic video camera such as the model CV-M50 manufactured by Castor. A high resolution camera typically has a CCD detector with 768 x 494 pixels, although other sizes of CCD detector may also be used. It will be appreciated that the
15 measurement resolution of deep features on the surface of the key 2504 may be affected by the depth of field of the focus 2508 of the light beam 2506.

The output from the detector 2510 may be transmitted to a processor 2514, which analyzes the data and converts it to machining instructions for
20 generating a duplicate key. The machining instructions may be directed to the machining control 2516 to control the generation of the duplicate key. A view of the light detected by the detector 2510 may be displayed by a display 2518, which shows a measured profile 2520 of the surface 2512. The data received by the detector 2510 may be used to determine not only
25 the profile of the key surface 2512, to reveal the keyway, but may also be used to measure the keycode, by scanning either the key 2504 or the light source 2502 in the y-direction. The profile 2520 changes as the beam 2506 is passed along the length of the key 2504. In particular, the length of the left portion 2522 of the profile changes in a manner corresponding to the
30 keycode 2509 cut in the left edge of the key 2504. The changes in the length of the left portion 2522 may be stored and correlated with the position on the key to produce data associated with the keycode. It will be appreciated that the keycode of a double-sided key, one having a key code

on each edge, may also be measured in the same manner. It will further be appreciated that the keycode may also be measured without scanning the light beam 2506 along the key 2504, for example by using multiple beams of light and multiple detectors.

5 This embodiment of measuring the key 2504, with the light beam 2506 approximately perpendicular to the key surface 2512, has advantages relative to the embodiment illustrated in FIG. 19, where the video camera 1910 is perpendicular to the key surface and the light beam 1906 is incident at an oblique angle on the key surface. It is useful to define the angle θ ,
10 which is the angle between the incoming light beam 2506, approximately perpendicular to the key surface 2512, and the axis 2511 of the detector 2510. This is illustrated in FIG. 26. The angle θ is typically greater than about 30°, although it may be smaller than this. The angle θ may be 45° or greater.

15 One of the advantages is explained with reference to FIG. 27A, which shows a key 2702 with two lines of light 2704 and 2706. The first line 2704 represents the focal line of light where the light source is perpendicular to the key surface 2708, while line 2706 represents the focal line of light where the light is incident on the surface 2808 at a non-perpendicular angle, for
20 example as shown in FIG. 19.

 The cross-section of the key 2702 is assumed be the section 2710 illustrated in FIG. 27B, and the illuminated surface 2708 is shown to comprise four separate components: the first part 2708a, is flat, the second part 2708b is a groove having a vertical side and a curved side, the third
25 part 2708c is flat and at the same level as the first part 2708a, and the fourth part 2708d is also flat but at a level below the third part. 2708c.

 The lines of light 2704 and 2706 each have components 2704a - 2704d and 2706a - 2706d respectively that correspond to the different parts 2708a - 2708d of the surface 2708. The widths of the lines 2704 and 2706
30 are exaggerated in the figure for clarity. The first part 2704a of the first light line 2704 is the line focus, where it is assumed that the light focuses on the first part 2708a of the key surface 2708. The second part 2704b of the first light line corresponds to the grooved surface 2708b. The width of the

second part 2704b is greater nearer the first part 2704a, corresponding to the deepest part of the groove 2708b. Since the light beam 2506 has a finite depth of focus, the light reaching the bottom of the groove is out of focus, and therefore forms a broader line than on the first part 2704a. The width of the second part 2704b decreases towards the third part 2704c, corresponding to the wall of the groove 2708b curving up to meet the third part 2708c. The width of the third part 2704c of the first light line 2704 is similar to the width of the first part 2704c, since the third part of the surface 2708c is at the same height as the first part 2708a. The width of the fourth part 2704d of the first light line 2704 is larger than the width of the third part 2704c, since the fourth surface part 2708d is lower than the third surface part 2708c, hence the light is out of focus.

The first part 2706a of the second light line 2706 line is the line focus, where it is assumed that the light focuses on the first part 2708a of the key surface 2708. The second part 2706b of the second light line corresponds to the grooved surface 2708b. The width of the second part 2706b is greater nearer the first part 2706a, corresponding to the deepest part of the groove 2708b. Furthermore, the maximum width of the second part 2706b is larger than the maximum width of the second part 2704b of the first light line 2704, since there is a greater path difference for the light to reach the bottom of the groove 2708b. Hence, the light reaching the bottom of the groove 2708b is further out of focus when the light is incident at an oblique angle than when the light is incident perpendicular. The second part 2706b narrows and curves towards the third part 2706c, corresponding to the wall of the groove 2708b curving up to meet the third part 2708c. The width of the third part 2706c of the second light line 2706 is similar to the width of the first part 2706c, since the third surface part 2708c is at the same height as the first part 2708a. The width of the fourth part 2706d of the second light line 2706 is larger than the width of the third part 2706c, since the fourth surface part 2708d is lower than the third surface part 2708c. Furthermore, the width of the fourth part 2706d of the second light line 2706 is greater than the width of the fourth part 2704d of the first light line 2706,

since the oblique illumination of the second light line 2706 results in the fourth part 2706 being further out of focus.

Therefore, perpendicular illumination of the key results in narrower light stripes than where the illumination is oblique, which may result in increased resolution when analyzing the signal detected by the camera, thus leading to the generation of more accurate duplicate keys.

Perpendicular illumination of the key also results in a more accurate measurement of the key code. In FIG. 27A, the y-axis locations of the light line components 2706a-2706d produced with oblique illumination vary with the height of the key surface. This can lead to measurement errors of the y-axis co-ordinate of the key code along the length of the key. The y-axis locations of the light line components 2704a-2704d produced with perpendicular illumination do not vary with the height of the key surface, thus eliminating any y-axis co-ordinate measurement errors which may be introduced by changes in the height of the key surface along the edge of the key. This feature and the narrower light stripe generated by the perpendicular illumination both lead to improved resolution and accuracy of the measured key code information.

Another advantage to perpendicular illumination is that the noise in the measured data is reduced. This is discussed with respect to FIGs. 28 and 29. The first line 2802 in FIG. 28 shows the ideal profile of the key. The second line 2804 shows actual data of the key when the illumination is perpendicular to the key surface. The second line 2804 shows some stray data points 2806 that are associated with a corner of the key surface. However, these stray data points 2806 appear only on one side of the line 2804 and may simply be discarded in the analysis of the data. It is believed that the stray data points arise from multidirectional reflections of light by the machined surface of the key.

FIG. 29 shows measurements of the same key taken when the light from the light source is incident on the key at an oblique angle. The orientation of the key is the mirror image of that when the measurement of FIG. 28 was made. However, the data line 2902 shows, for example at region 2904 that stray data points fall on both sides of the line, rather than

just one side. This makes analysis of the measured data more difficult, and reduces the likelihood that the measurements made with oblique illumination will lead to accurate machining instructions for the duplicate key.

5 To summarize, illuminating the key with a light beam perpendicular to the major key surface being measured provides advantages over the use of a light beam at an oblique angle. These advantages include an increased resolution arising from the depth-of-focus effect, and reduced noise levels in the measured data.

Another method for determining the keyway profile of a key is to
10 optically read a code from the key itself, and correlate the code with a particular keyway profile. For example, the key illustrated in FIG. 1A shows a key 100 with a key code 108 stamped on the key bow 104. Conventionally, the key code 108 contains information only related to the keycode 106. However, the key code 108 may be configured to contain
15 information related to the keyway 110. Thus, a user may be able to read the number off the key bow 104 and refer to a look-up table or otherwise process the information provided by the number to identify the keyway profile associated with the code 108 read from the key bow 104.

Also, in an automated version of the method just described, a video
20 camera may be used to record an image of the key code 108 and the results analyzed to determine the code read off the key 100 by the camera. After determining the code, the code could be used, for example, with a look-up table to relate the code read off the key 100 with the key's keyway profile. Additionally, the code provided by the key, in this embodiment or
25 any other embodiment described herein, may include machining instructions for the processor to follow.

In another approach, shown in FIG. 21, the key 2100 may include a code, such as a bar code 2112 on the key bow 2104. The bar code may be read by a bar code reader 2114, and the code that is read off the key 2100
30 then related, such as through a look-up table or other method, to the keyway profile 2106 of the key 2100. The bar code reader 2114 may operate in a manner similar to bar code readers as are used in offices and supermarket sales check-out units, where the bar code reader 2114 illuminates the key

2100 with a line of light, and the code 2112 is read from the light reflected by the bar code 2112.

Another method of determining the keyway profile of a key, particularly useful for car keys that include a security transponder, is illustrated in FIG. 22. Here, the key 2200 is of the type commonly used as a car door and ignition key, where the key bow 2202 contains a miniaturized RF transponder 2204. This type of key is often used to provide extra security because a transmitter located in the steering column of the car interrogates the key 2200 once it is placed in the ignition. If the transponder 2204 does not respond with the correct code, which may be a 64-bit digital code, then the car's ignition is disabled. The RF transponder 2204 is typically inductively powered by the transmitter.

The transponder 2204 may also be used to identify the keyway profile 2206 of the key 2200. The system 2210 used for interrogating the key 2200 includes a processor 2212 that generates an interrogation signal which is converted into a transmissible signal in the transmitting unit 2214. The interrogation signal 2216 is transmitted by an antenna 2218. The transponder 2204 in the key 2200, responds by transmitting a response signal 2220 that is received by the antenna 2218 and detected in a detector 2222. The detected signal is typically analyzed and amplified in the amplifier and analyzer 2224 where it is converted into processor-readable form, before being returned to the processor 2212.

The processor 2212 is connected to a memory 2226 that typically contains a look-up table that relates the response code received from the key 2200 with the keyway profile 2206. After the processor 2212 has determined which keyway profile 2206 is associated with the response code received from the key 2200, the processor 2212 generates machining instructions for the machine control unit 2228 that controls the cutting tools used to cut the appropriate keyway in the key preform.

Method steps for this method are illustrated in FIG. 23. The system 2210 interrogates the key 2200 and receives the identification code back from the transponder, at step 2302. The received data are analyzed, at step 2304 and then passed to the processor 2212 in a form suitable for the

processor 2212. If applicable, the processor 2212 determines which portion of the received code corresponds to keyway profile information, at step 2306. The processor then determines, for example using a look-up table, which particular keyway profile is associated with the identification code, at
5 step 2308. The processor then forms a set of machining instructions for cutting the keyway profile in the key preform, at step 2310. These instructions are passed to the machine controller 2228 that controls the cutting tools.

Other forms of transponder may be used. For example, the key may
10 optically transmit a response signal, for example in the visible or infrared portions of the spectrum, rather than an RF response signal. In addition, the key may receive an optical interrogation signal, using a photodetector rather than an RF receiving antenna.

Another method of determining the keyway profile of a key is
15 illustrated in FIG. 24. In this method, the key 2400 includes an electronic circuit, typically in the bow portion 2402, that is provided with electrical contacts 2404. The key 2400 may be placed in a key reader 2410 that includes reader contacts 2412 that mate up with the key contacts 2406. The reader contacts 2412 are connected, through an input interface 2414, with a
20 processor 2416. Once the processor 2416 is in contact with the key 2400, the processor can interrogate the electronic circuit for information related to the keyway profile. For example, the information supplied by the key may include a description of the keyway profile, but more likely includes a code that the processor 2416 can use with a look-up table stored in a memory
25 unit 2418 to determine the keyway profile. This method has similarities to that described above in connection with FIGs. 22 and 23, but where the signals passed between the processor 2416 and key 2400 are electrical. Once the processor 2416 has determined which keyway profile is associated with the key 2400, the processor 2416 can generate or retrieve
30 machining instructions to pass on to the machine control unit 2420 that controls the machining process when fabricating the keyway profile in the key preform.

While various examples were provided above, the present invention is not limited to the specifics of the examples. For example, the duplication apparatus may be provided with two holders, one for holding the key to be copied and the other for holding the preform. Also, the apparatus may be
5 inverted or rotated to allow cutting scraps to fall free of the machine elements. Furthermore, the processor may incorporate the machine control unit that controls the formation of the duplicate key.

Additionally, it is possible to supply semi-prepared preforms to the duplicating apparatus, where the keycode has already been cut or partly
10 formed. The duplicating apparatus may simply measure the keyway of the original key and duplicate the keyway in the preform, and may also duplicate the remainder of the keycode if necessary.

As noted above, the present invention is applicable to duplicating keys from original keys from a blank preform. It is believed to be particularly
15 useful in producing duplicate keys where it is desirable to reduce the expected degree of skill of the operator and to reduce the number of rejected duplicates. Accordingly, the present invention should not be considered limited to the particular examples described above, but rather should be understood to cover all aspects of the invention as fairly set out in
20 the attached claims. Various modifications, equivalent processes, as well as numerous structures to which the present invention may be applicable will be readily apparent to those of skill in the art to which the present invention is directed upon review of the present specification. The claims are intended to cover such modifications and devices.

WE CLAIM:

1. A method of measuring an original key having a keyway on a major surface of a key shaft, comprising:
illuminating the major surface of the key shaft with a line of light focused approximately on the major surface of the original key, the light propagating in a direction substantially perpendicular to an axis of the original key parallel to the shaft; and
detecting light deflected from the light beam by the surface of the original key at an angle, θ , non-perpendicular to the major surface.
2. The method of claim 1, further comprising focusing the light beam to a line focus approximately on the major surface of the original key.
3. The method of claim 1, further comprising focusing the light beam to a spot focus and scanning the spot focus across the shaft of the original key.
4. The method of claim 1, further comprising determining the keyway of the original key from the detected light.
5. The method of claim 4, further comprising machining, in a key preform, a keyway duplicate of the keyway of the original key.
6. The method of claim 5, further comprising generating a signal indicative of the keyway of the original key and generating machining instructions for machining the duplicate keyway in the preform from the signal indicative of the keyway of the original key.
7. The method of claim 1, wherein the angle θ is at least 30° .
8. The method of claim 1, further comprising translating the line of light along the shaft of the original key.

9. The method of claim 8, further comprising translating the line of light along the shaft of the original key between one end of a key code of the key and the other end of the key code.

10. The method of claim 1, further comprising determining the key code of the original key from the detected light.

11. The method of claim 10, further comprising translating the line of light along the shaft of the original key between one end of a key code of the original key and the other end of the key code and generating a signal indicative of the key code of the original key.

12. The method of claim 11, further comprising generating machining instructions for machining a duplicate key code in a key preform from the signal indicative of the key code of the original key and forming the duplicate key code in the key preform using the machining instructions.

13. The method of claim 10, further comprising machining, in a key preform, a key code duplicate of the key code of the original key.

14. A system for measuring an original key having a keyway on a major surface of a key shaft, comprising:

means for illuminating the major surface of the key shaft with a line of light focused approximately on the major surface of the original key, the light propagating in a direction substantially perpendicular to an axis of the original key parallel to the shaft; and

means for detecting light deflected from the light beam by the surface of the original key at an angle, θ , non-perpendicular to the major surface.

15. A system for measuring an original key having at least one groove in a first major surface of a key shaft forming a keyway, the system comprising:

a key holder to hold the original key in a pre-selected position with the key shaft approximately parallel to a first axis;

a light source producing a beam of light directed substantially perpendicular to the first axis towards the first major surface; and

a light detector positioned to receive light deflected in a direction substantially non-perpendicular to the first axis when the original key is held in the key holder at the pre-selected position.

16. The system of claim 15, wherein one of the key holder and the light source is mounted on a translation element to permit movement of the key holder relative to the beam of light in a direction parallel to the first axis.

17. The system of claim 16, further comprising a controller coupled to the translation element to control movement of the translation stage, and coupled to the light detector to receive data from the light detector.

18. The system of claim 15, wherein the key holder is rotatable so as to present a second major surface to the light source for illumination when the original key is held in the key holder.

19. The system of claim 15, wherein the light source includes a focusing element to focus the light beam to a spot focused approximately at the first major surface and a scanning element to scan the focused spot across the shaft of the original key when the original key is in the key holder.

20. The system of claim 15, wherein the light source includes a focusing element to focus the light beam to a line focus focused approximately at the first major surface of the key when the key is held in the key holder.

21. The system of claim 15, wherein the light detector includes a two-dimensional array of light detecting elements.

22. The system of claim 15, wherein the light detector is positioned to receive light deflected by the key at an angle of at least 30° relative to the first axis.

23. The system of claim 15, further comprising a controller to generate a signal indicative of the keyway of the original key from light detected by the light detector.

24. The system of claim 23, further comprising machining tools coupled to receive machining instructions from the controller for machining a duplicate keyway in a key preform, the machining instructions based on the signal indicative of the keyway of the original key.

25. The system of claim 24, wherein the controller further generates a signal indicative of the key code of the original key from the light detected by the light detector and the machining tools are coupled to receive machining instructions from the controller for machining a duplicate key code in the key preform based on the signal indicative of the key code of the original key.

26. The system of claim 15, further comprising a controller to generate a signal indicative of the key code of the original key from light detected by the light detector.

27. The system of claim 26, further comprising machining tools coupled to receive machining instructions from the controller for machining a duplicate key code in a key preform, the machining instructions based on the signal indicative of the key code of the original key.

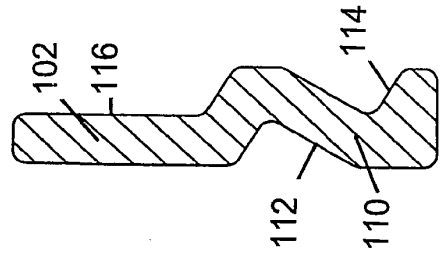


Fig. 1B

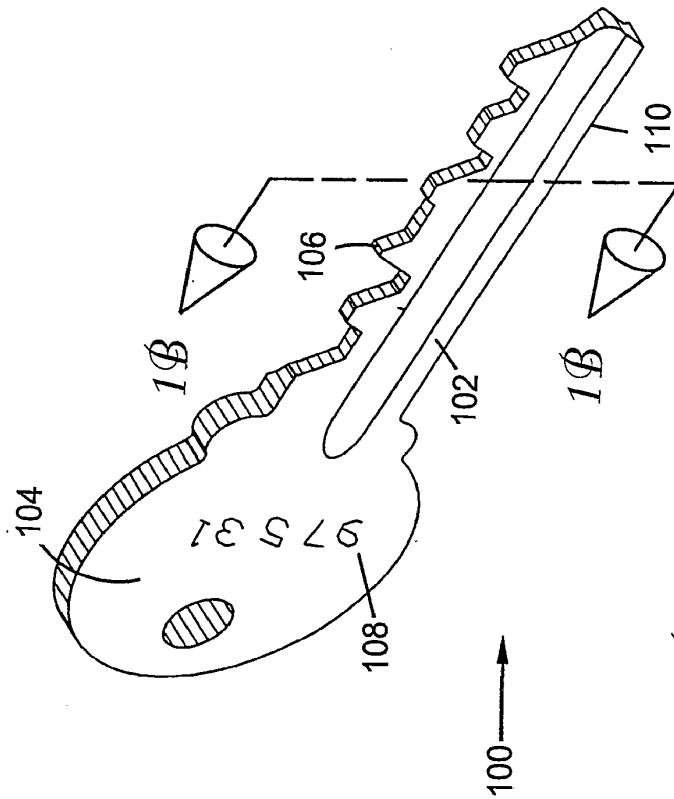


Fig. 1A

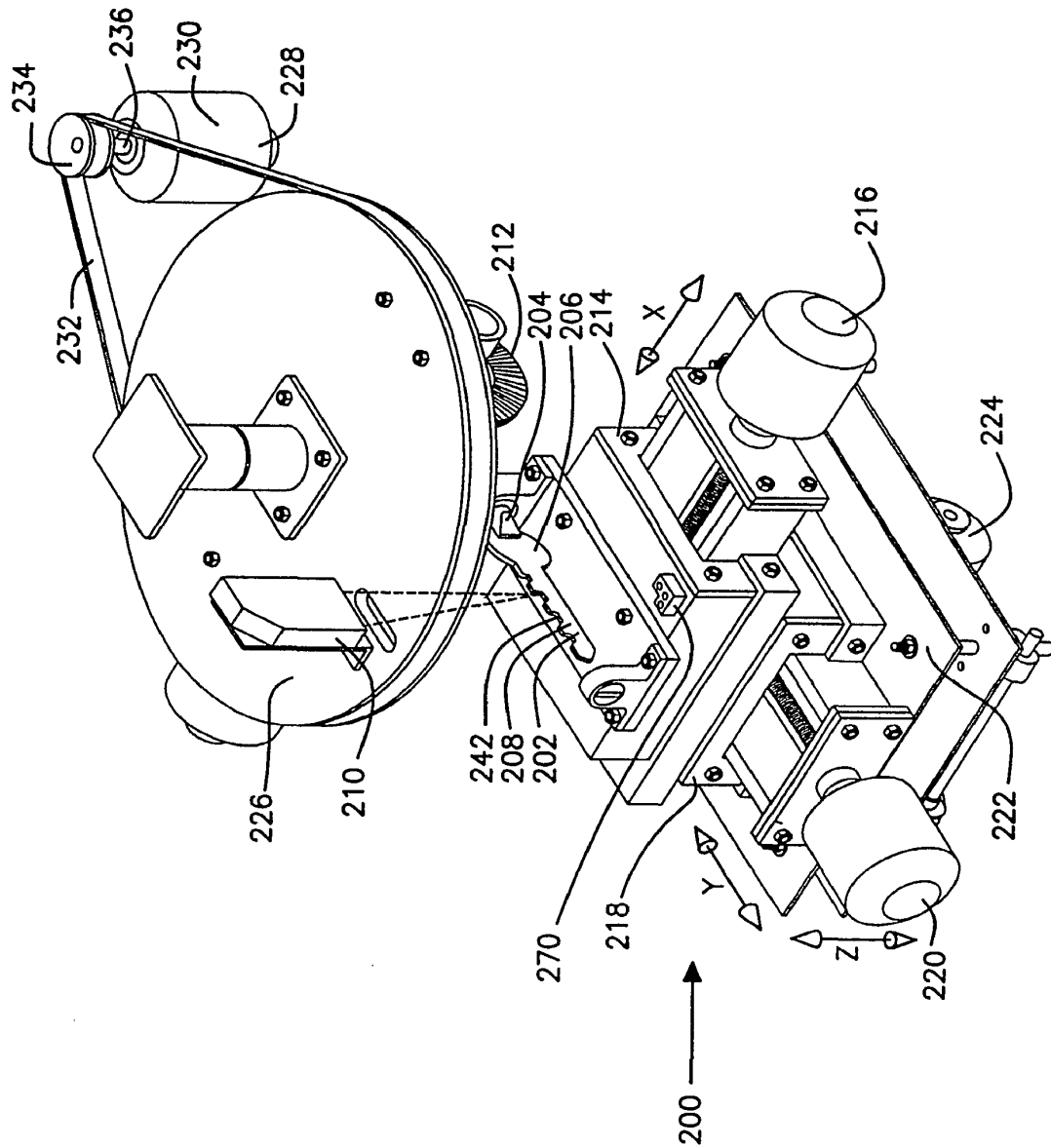


Fig. 2

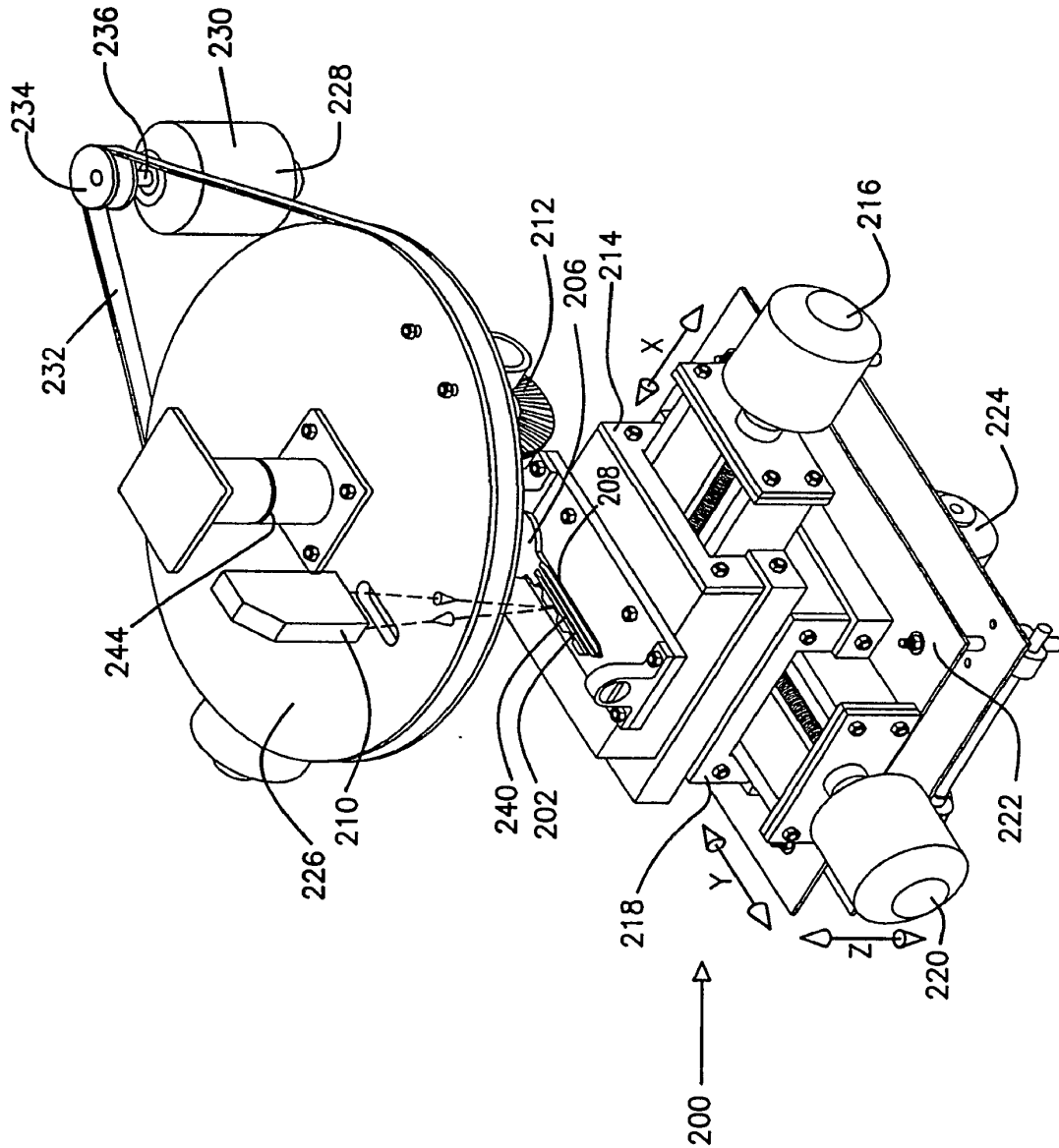


Fig. 3

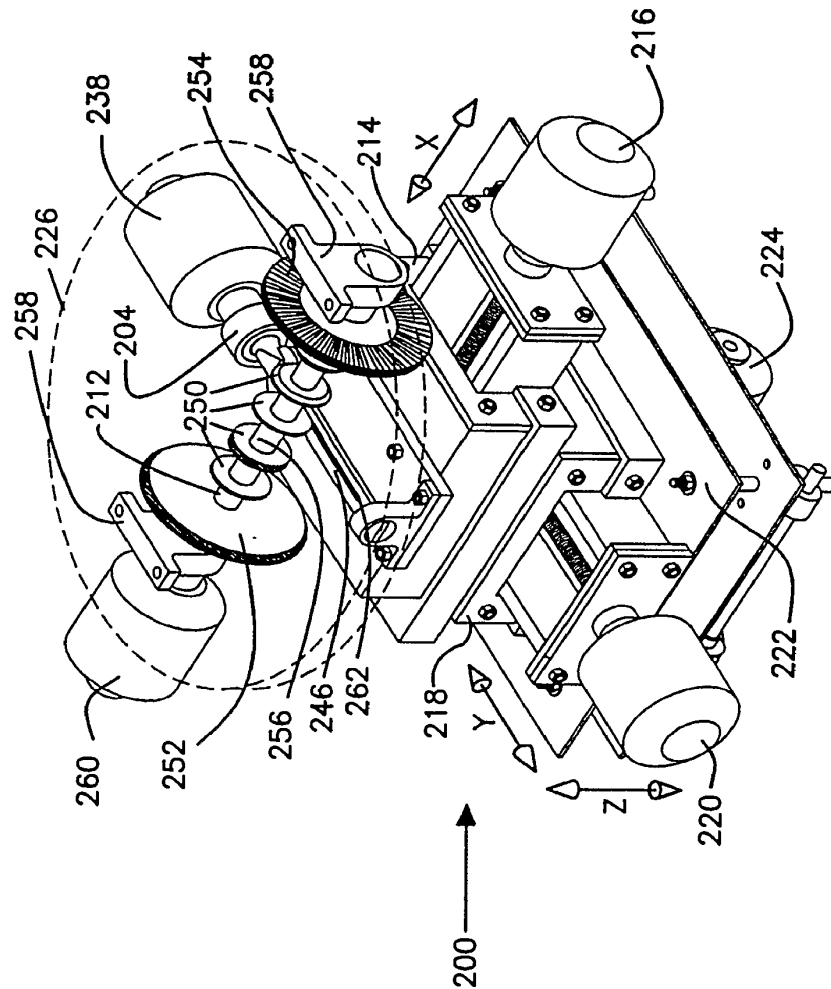


Fig. 4

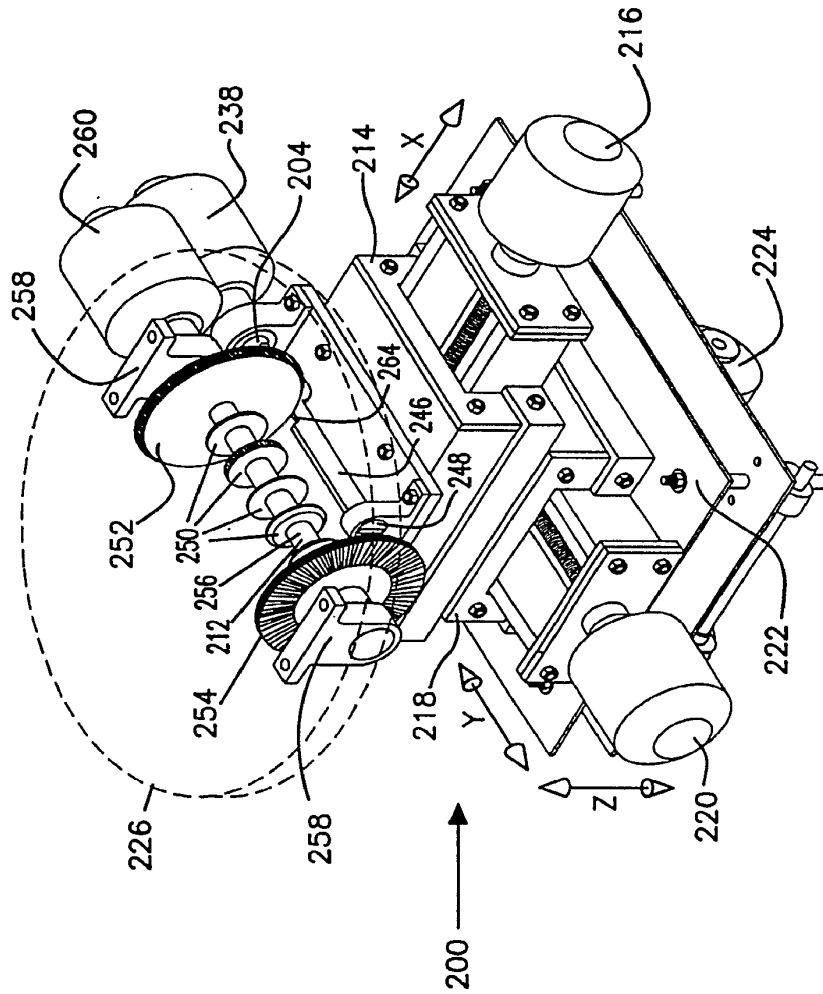
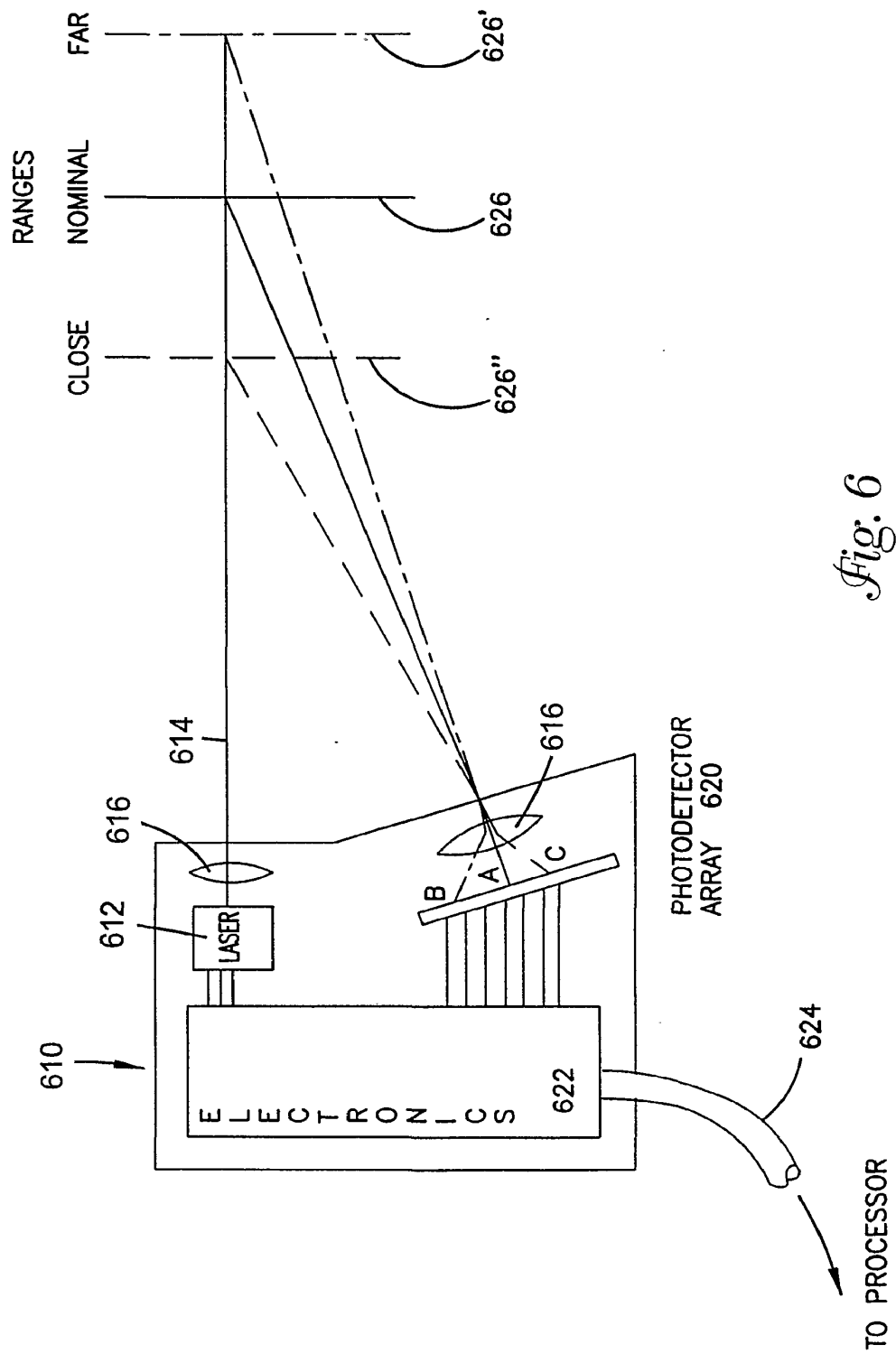


Fig. 5



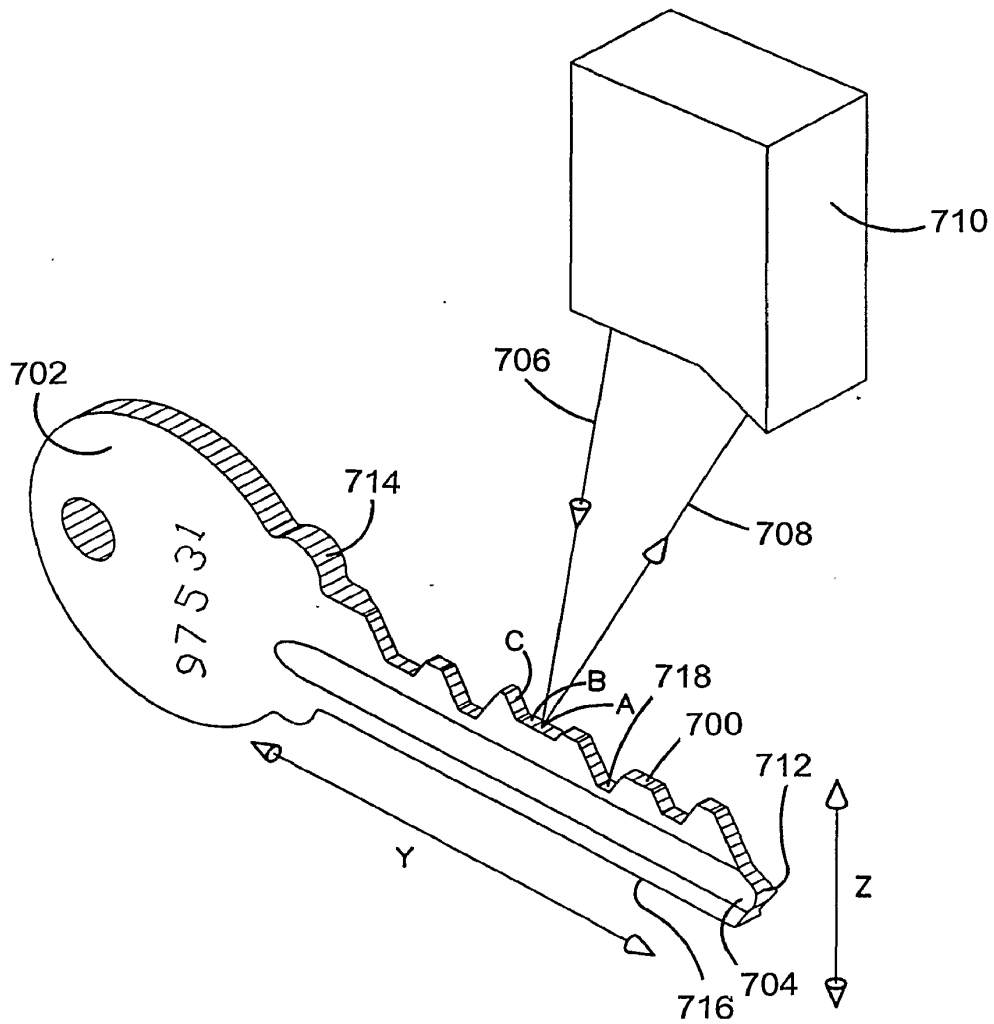


Fig. 7A

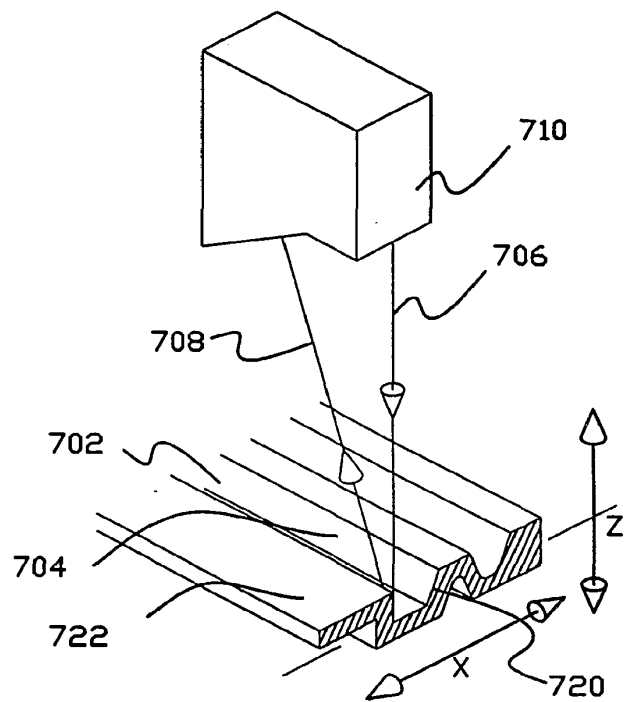
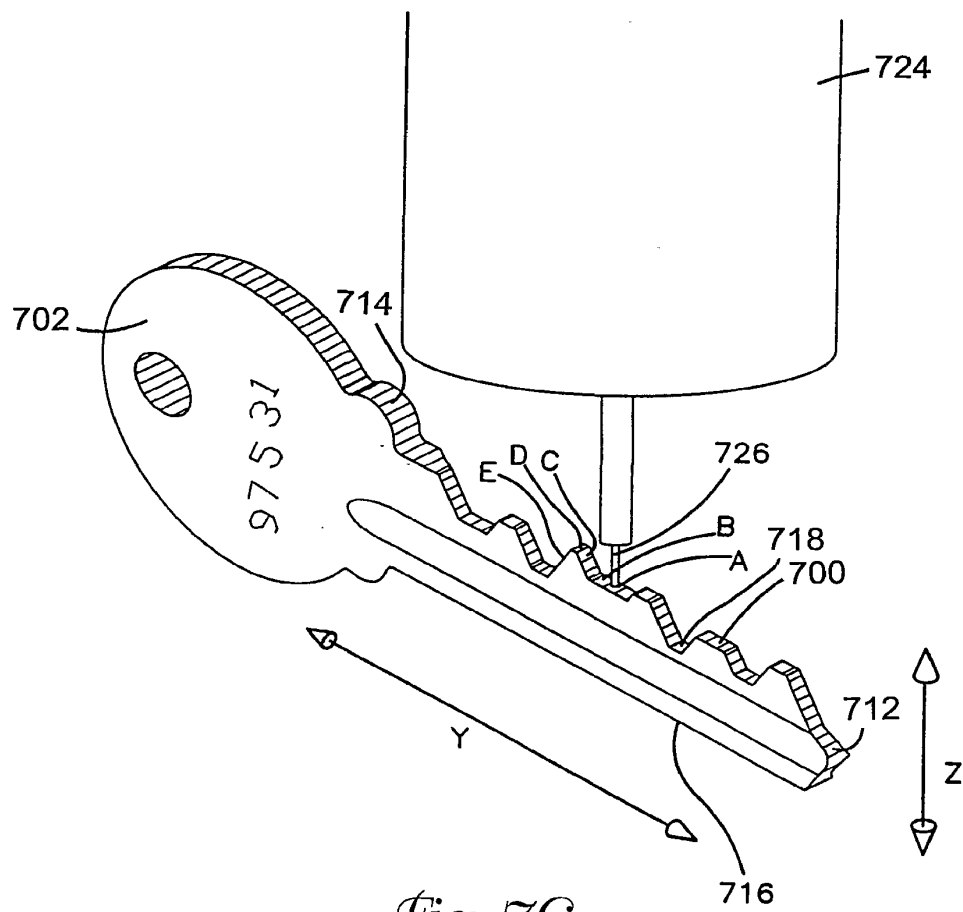


Fig. 7B



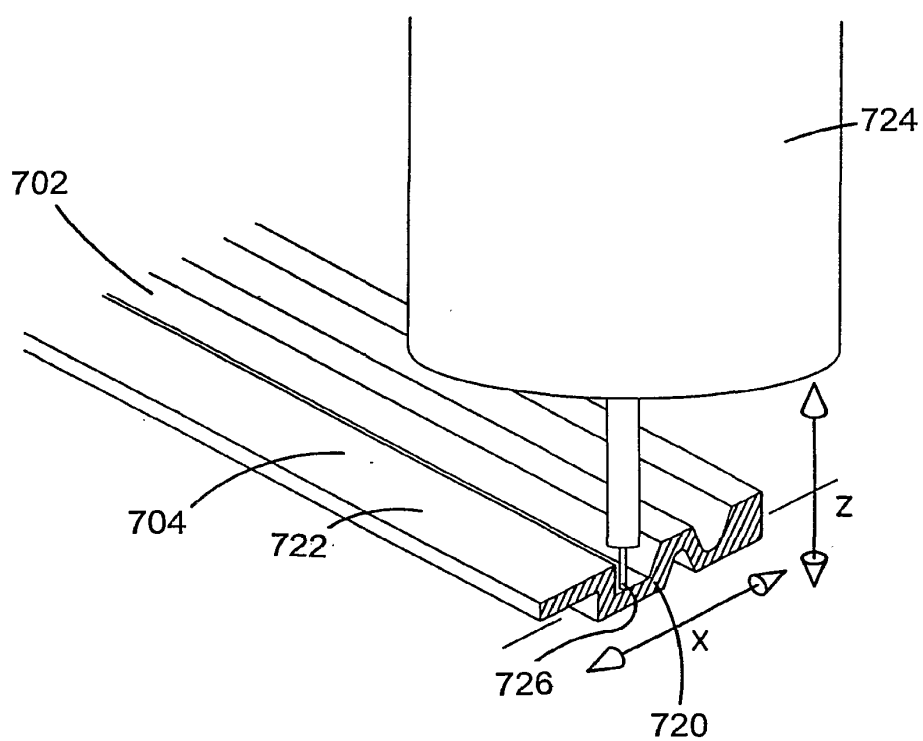


Fig. 7D

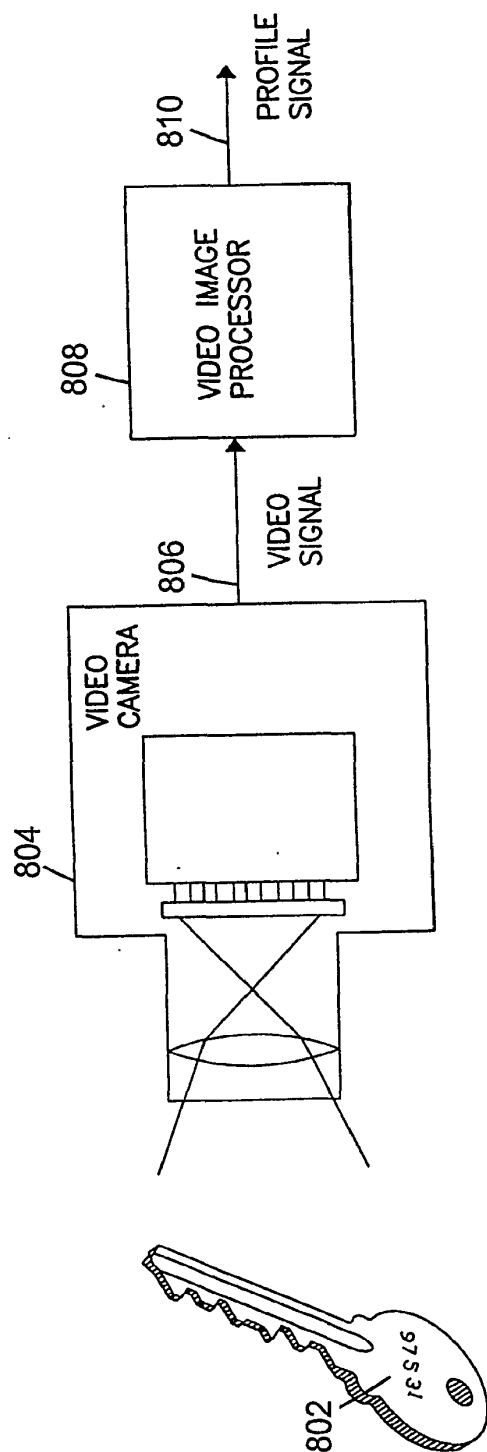
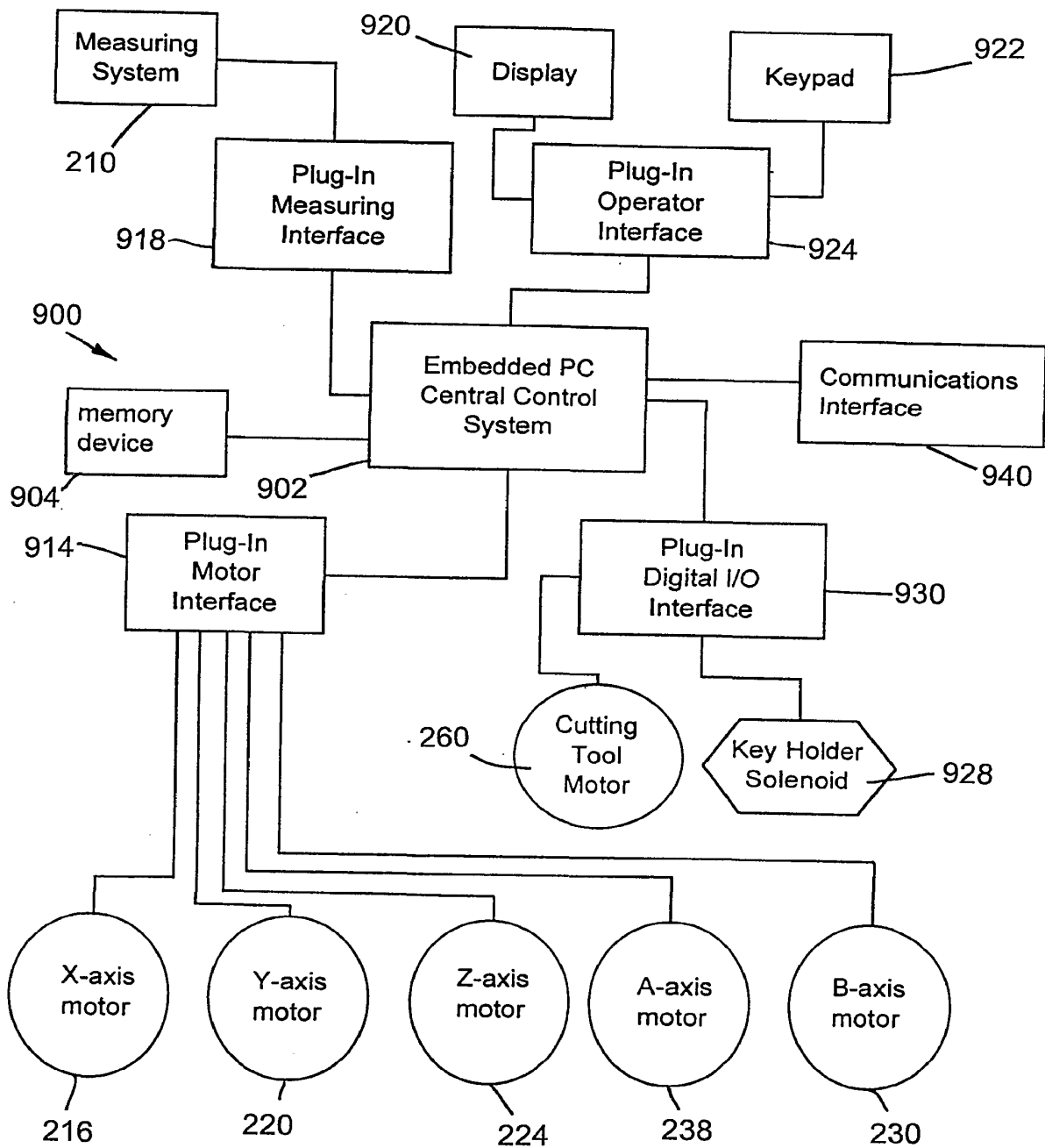


Fig. 8

*Fig. 9*

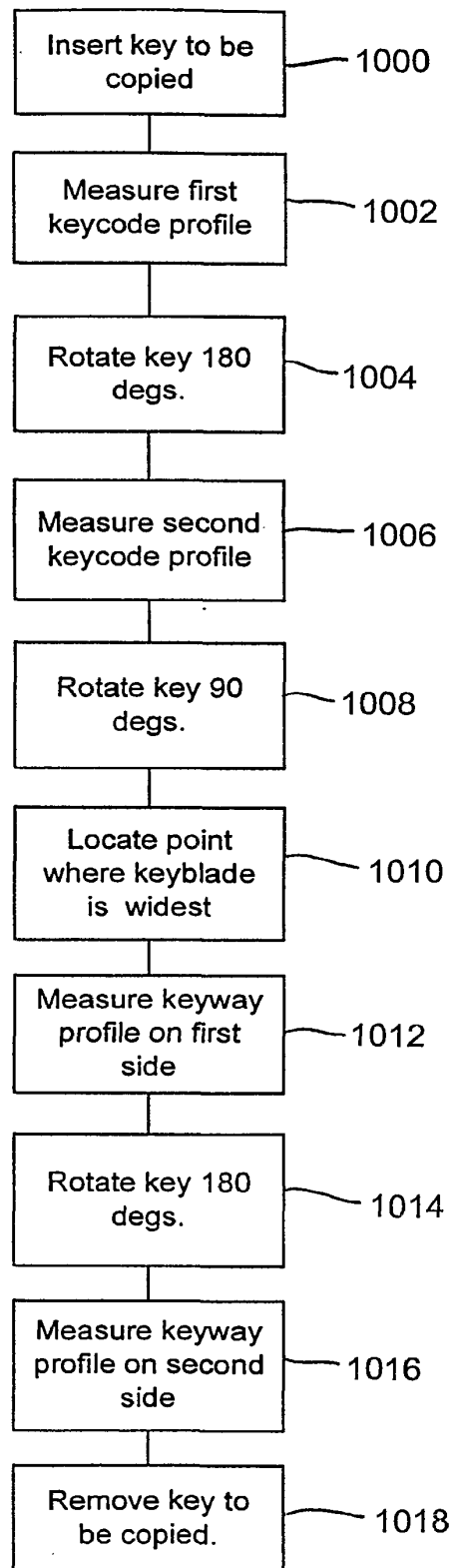
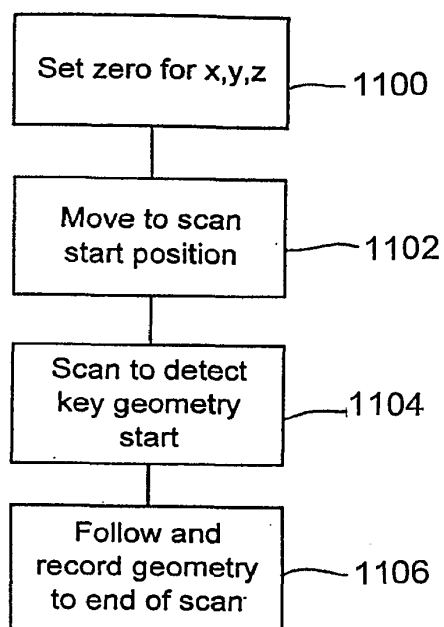
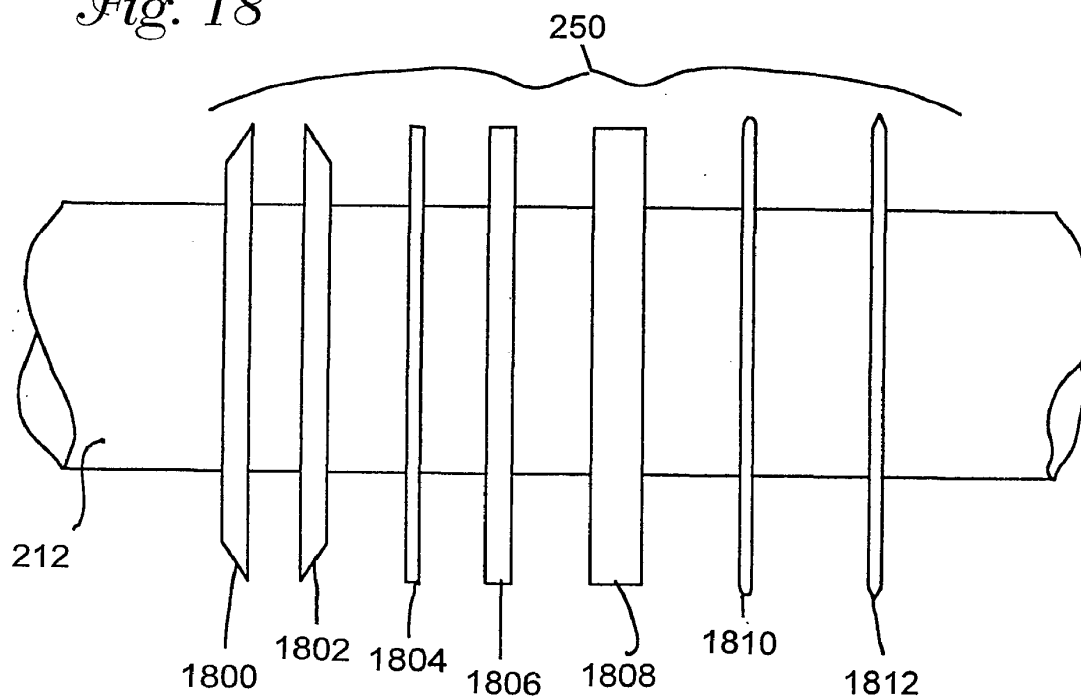
*Fig. 10*

Fig. 11*Fig. 18*

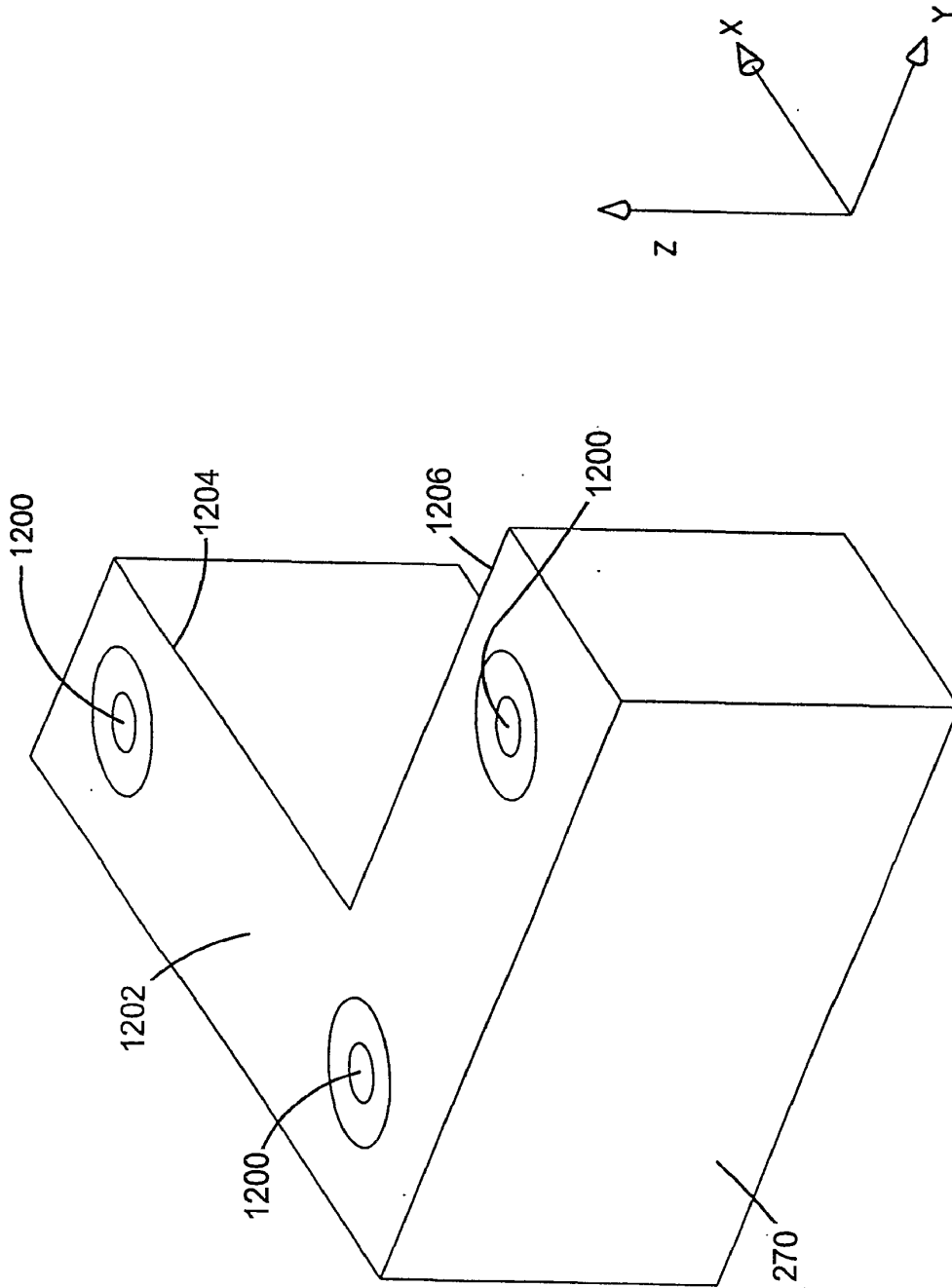
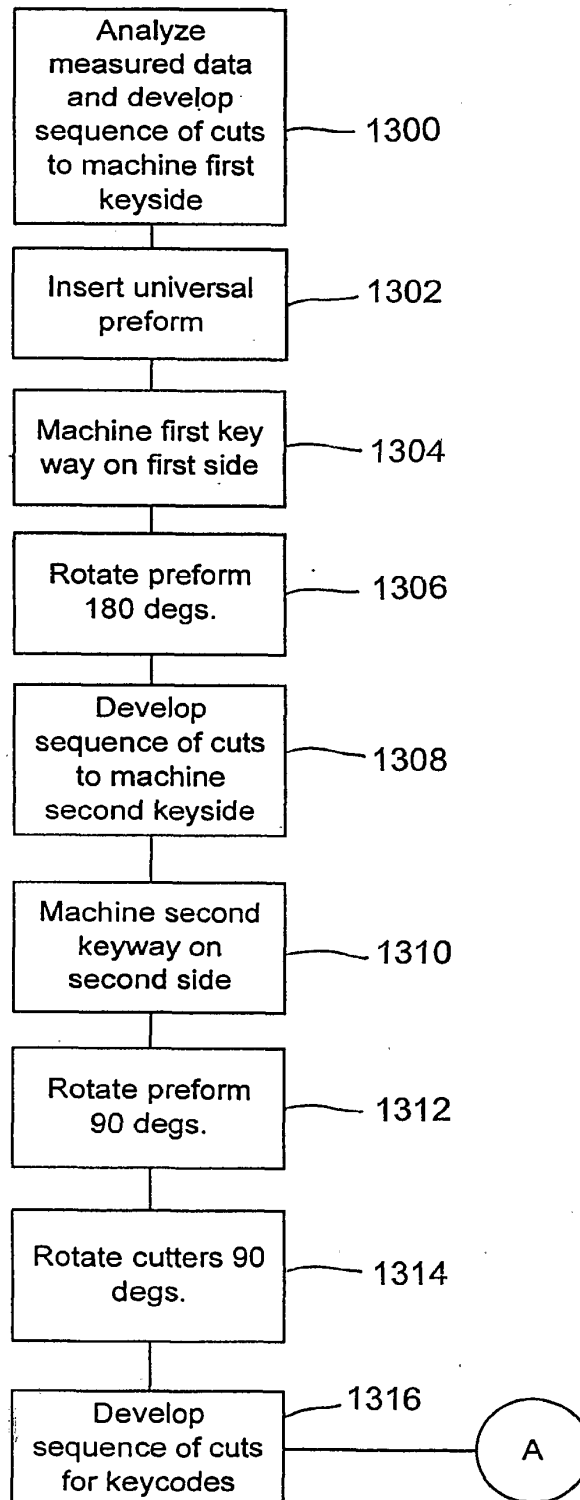


Fig. 12

Fig. 13

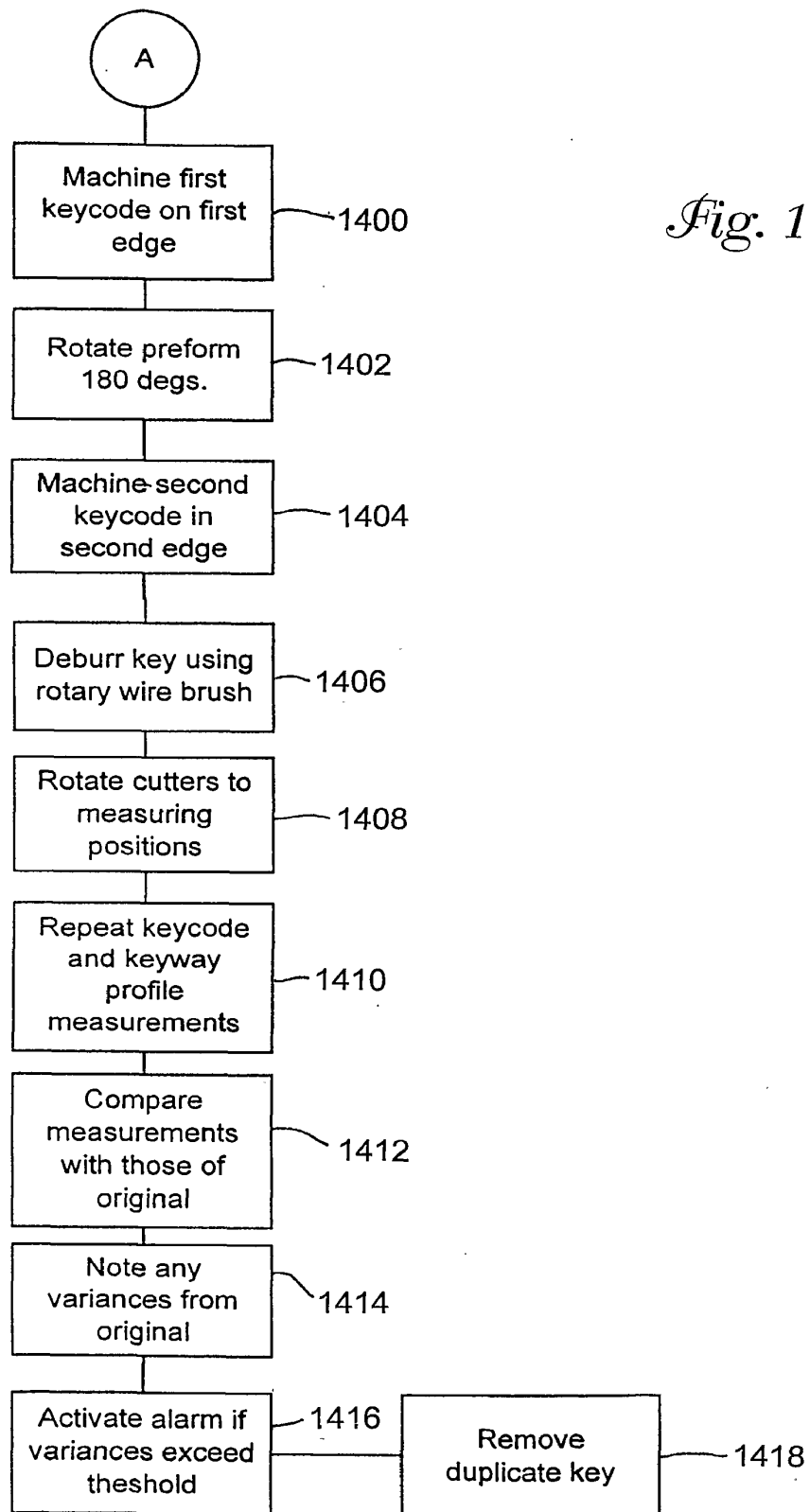
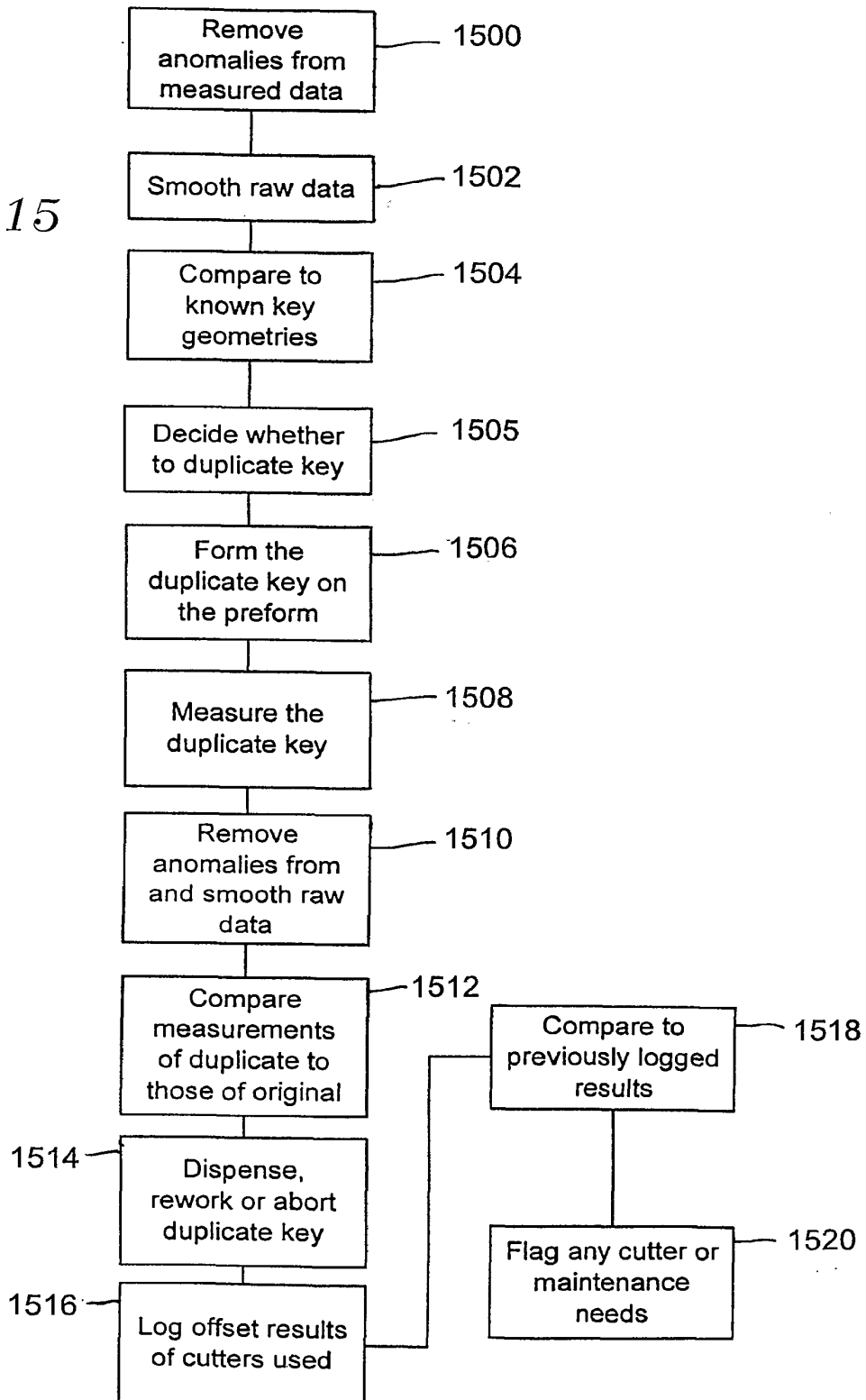
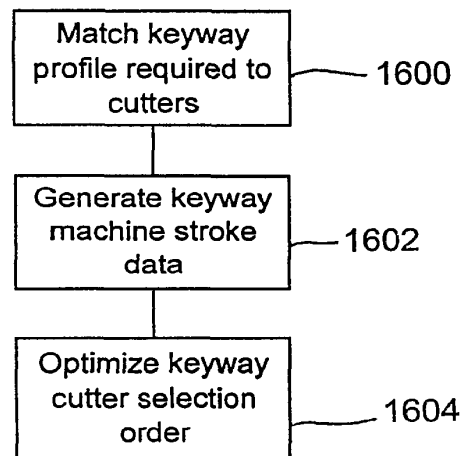
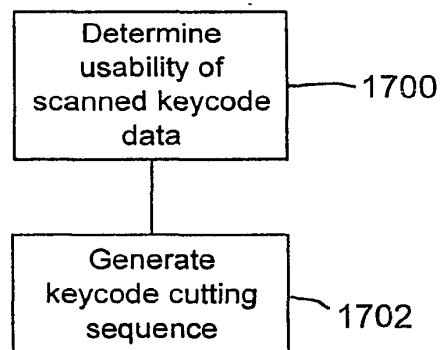
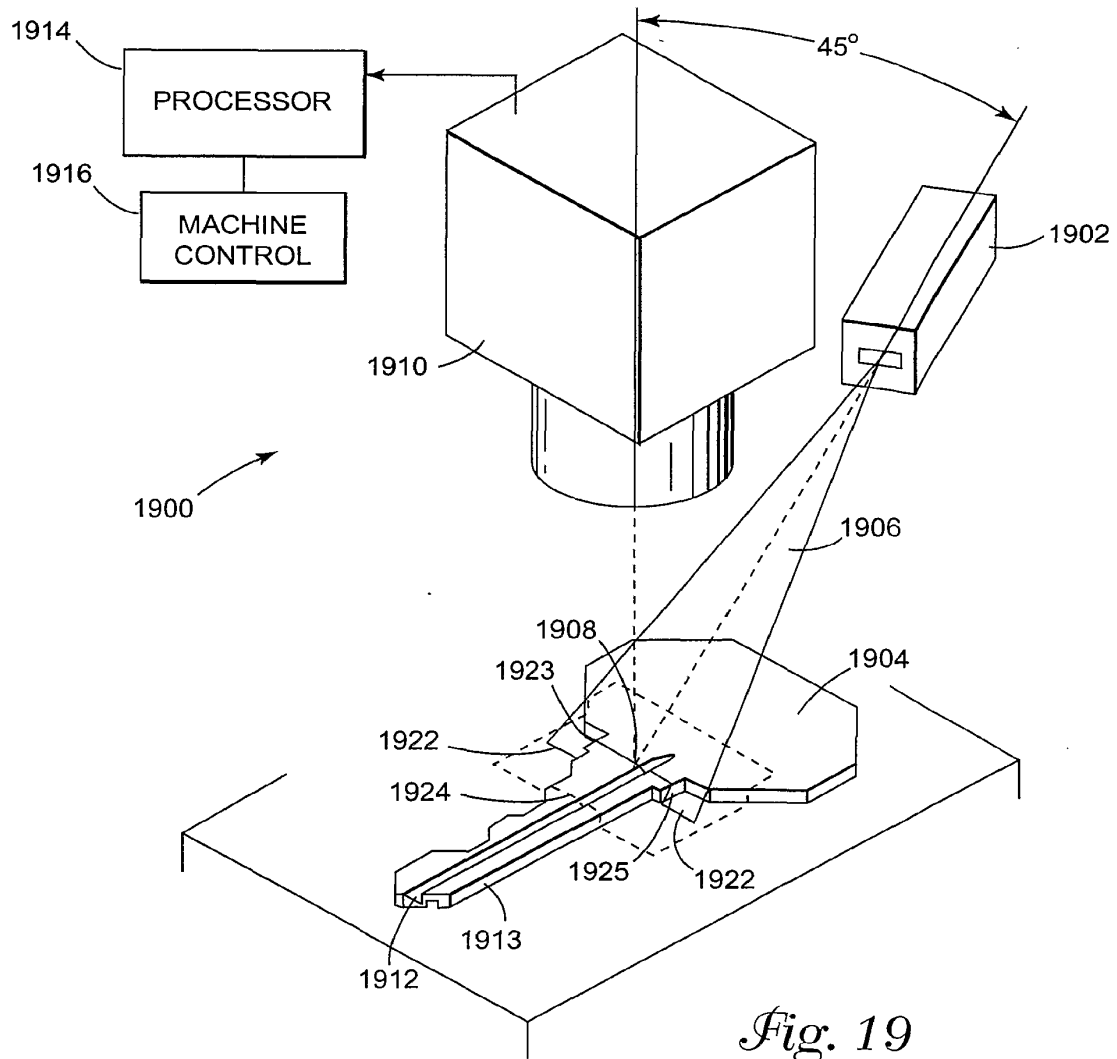


Fig. 15

*Fig. 16**Fig. 17*



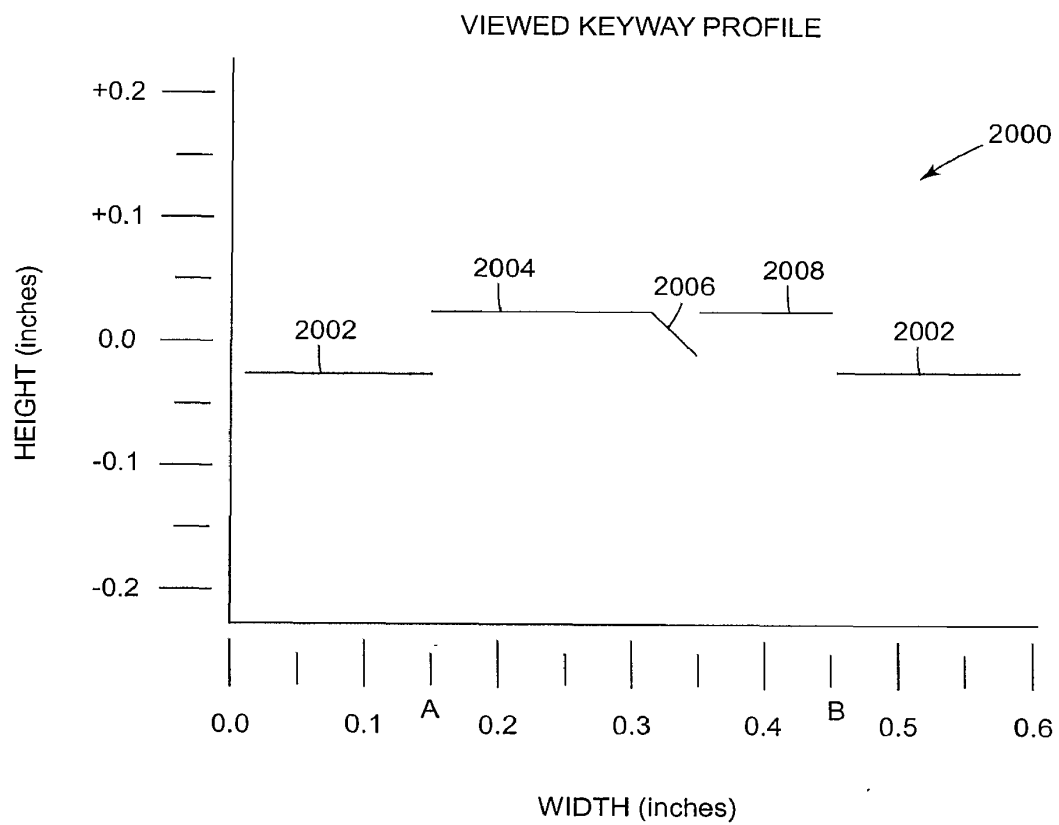
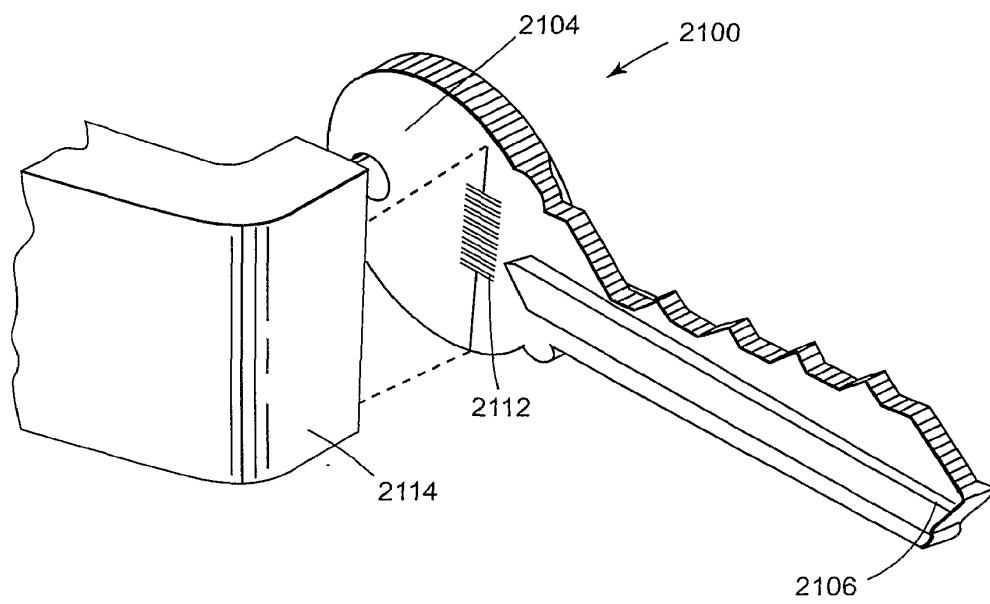
*Fig. 20*

Fig. 21



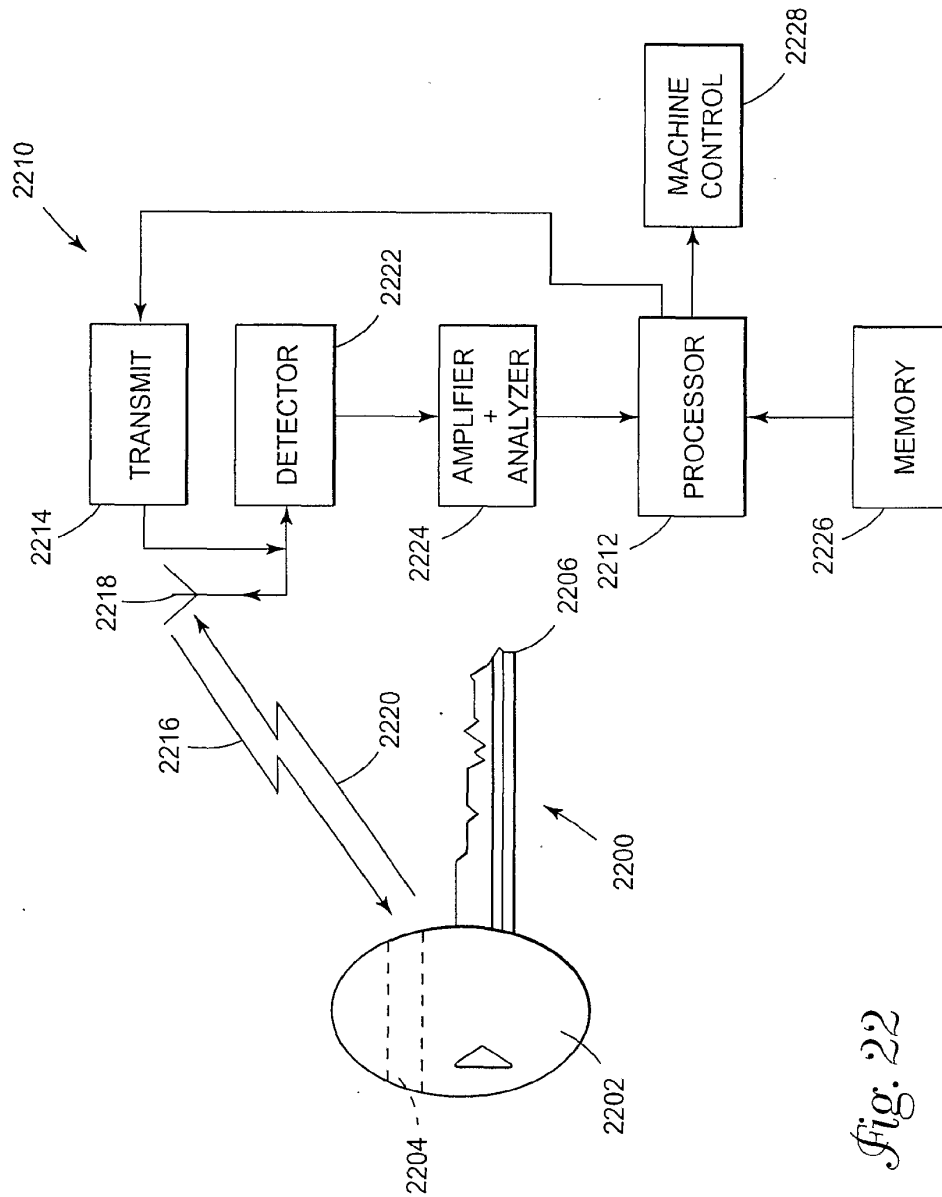
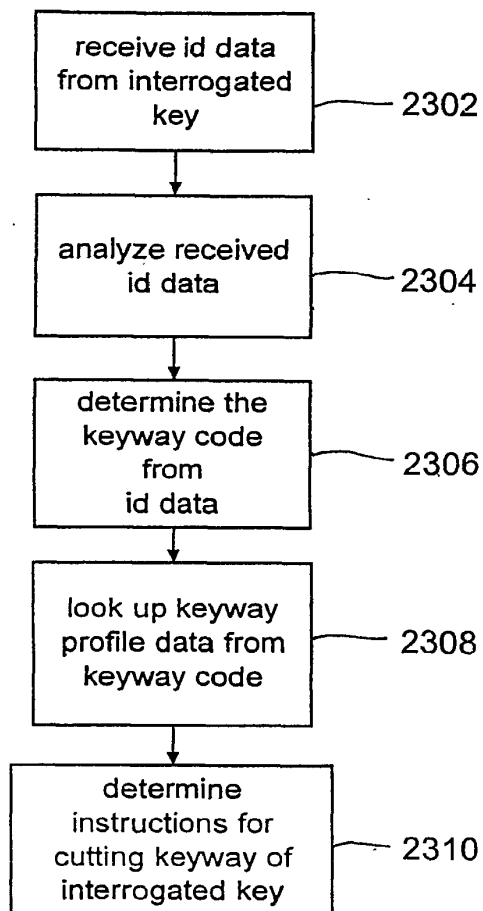


Fig. 22

*Fig. 23*

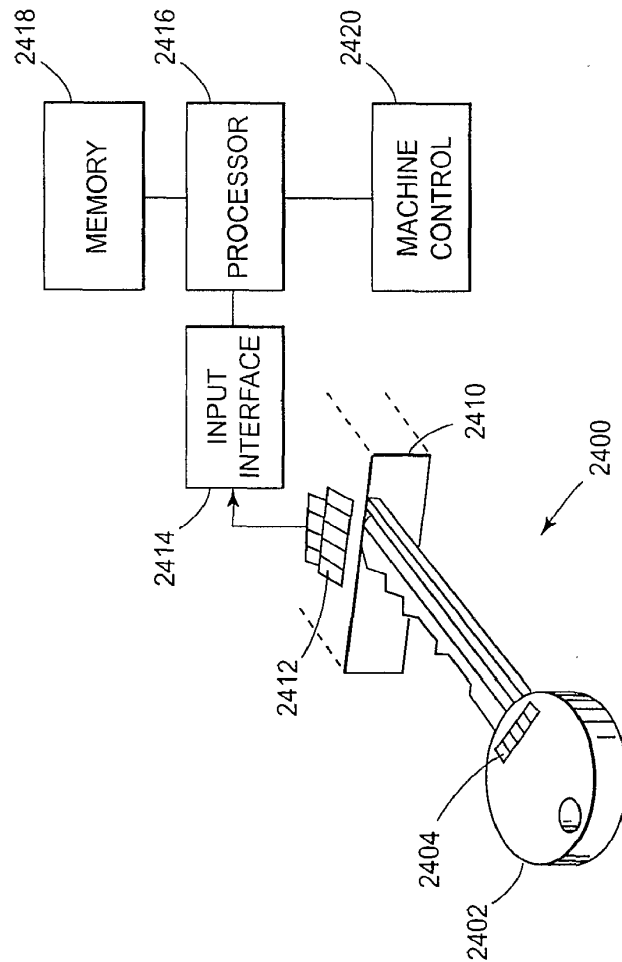


Fig. 24

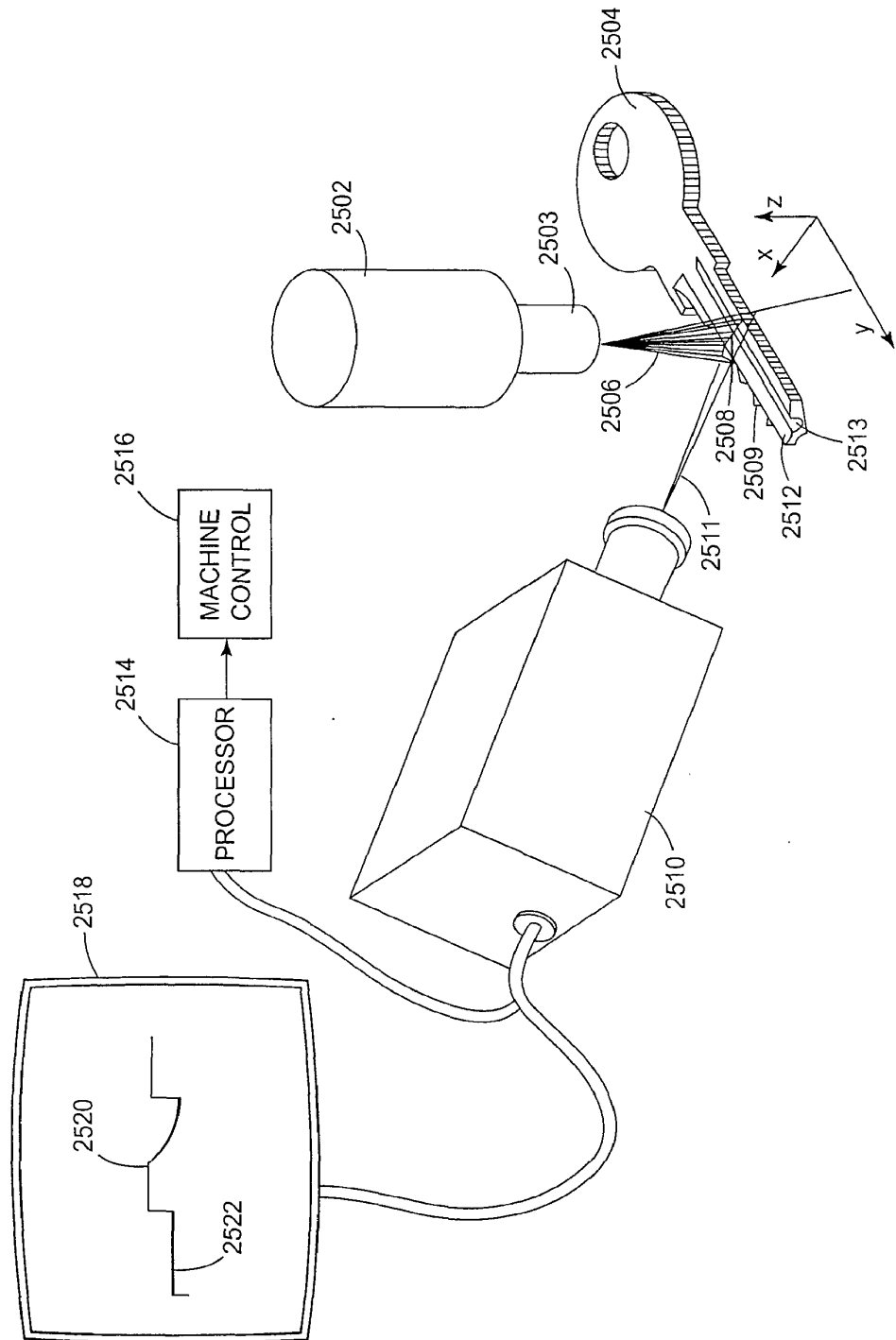
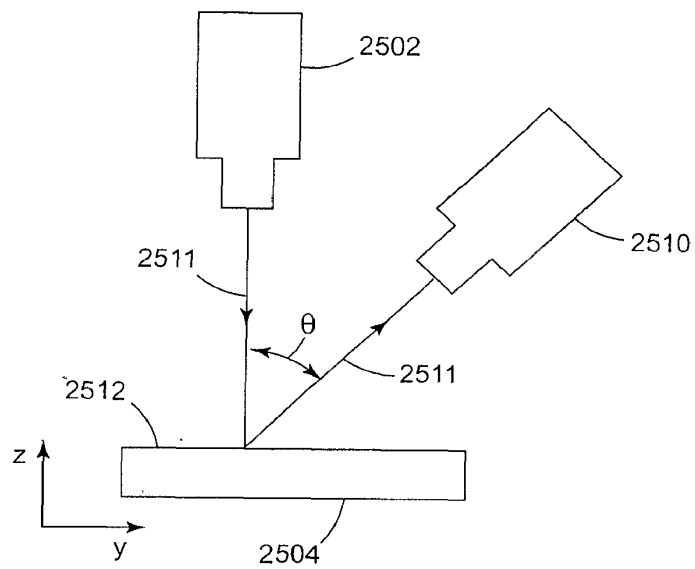
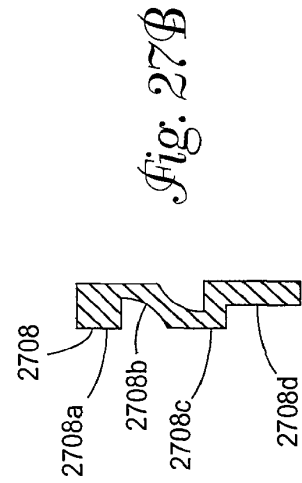
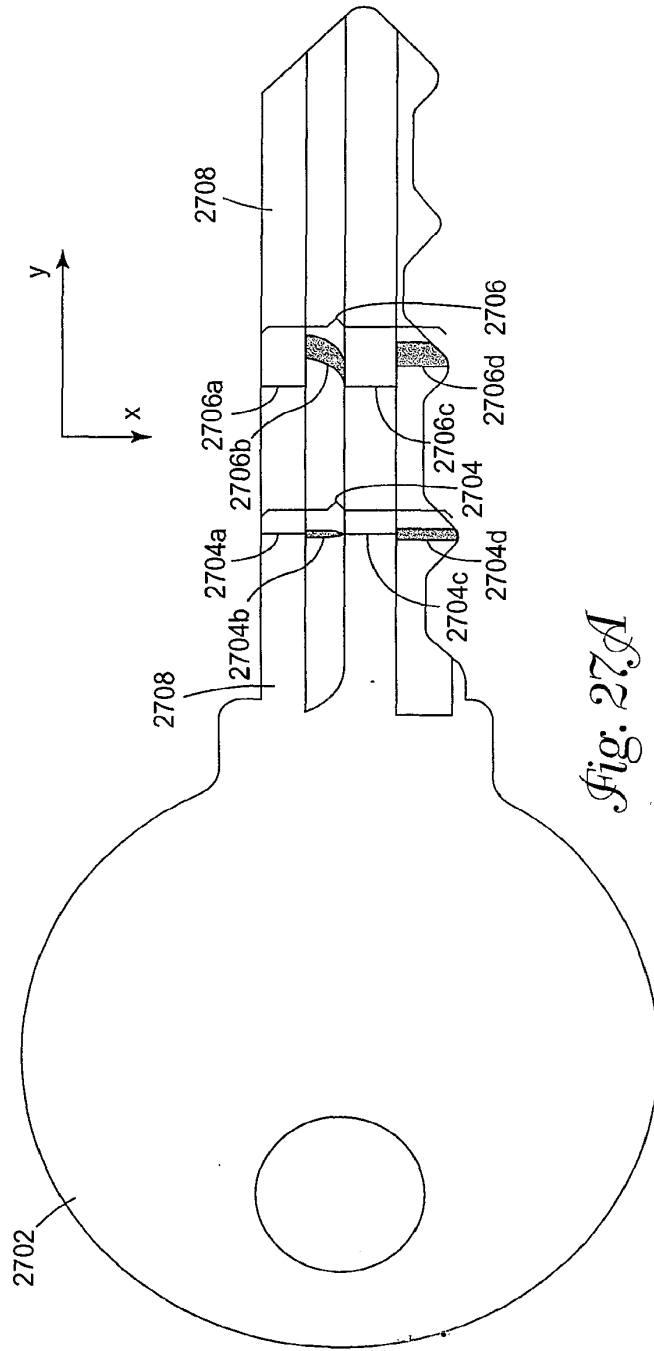
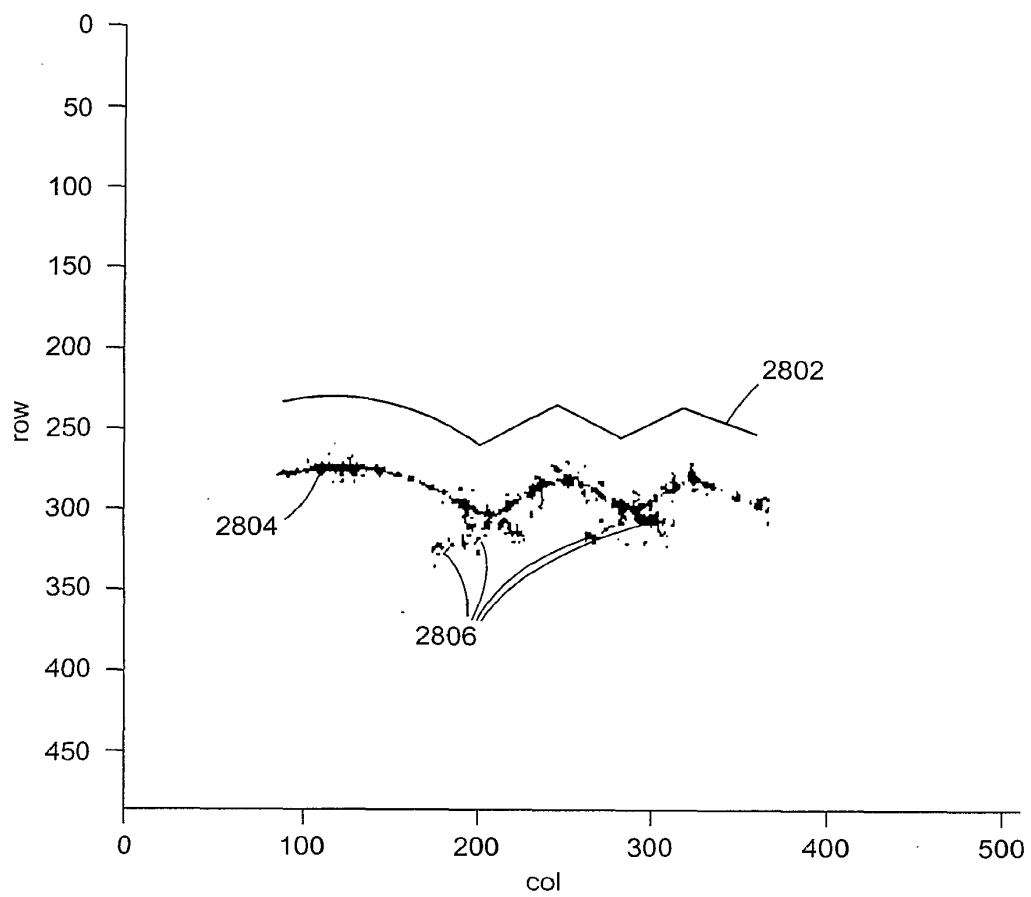
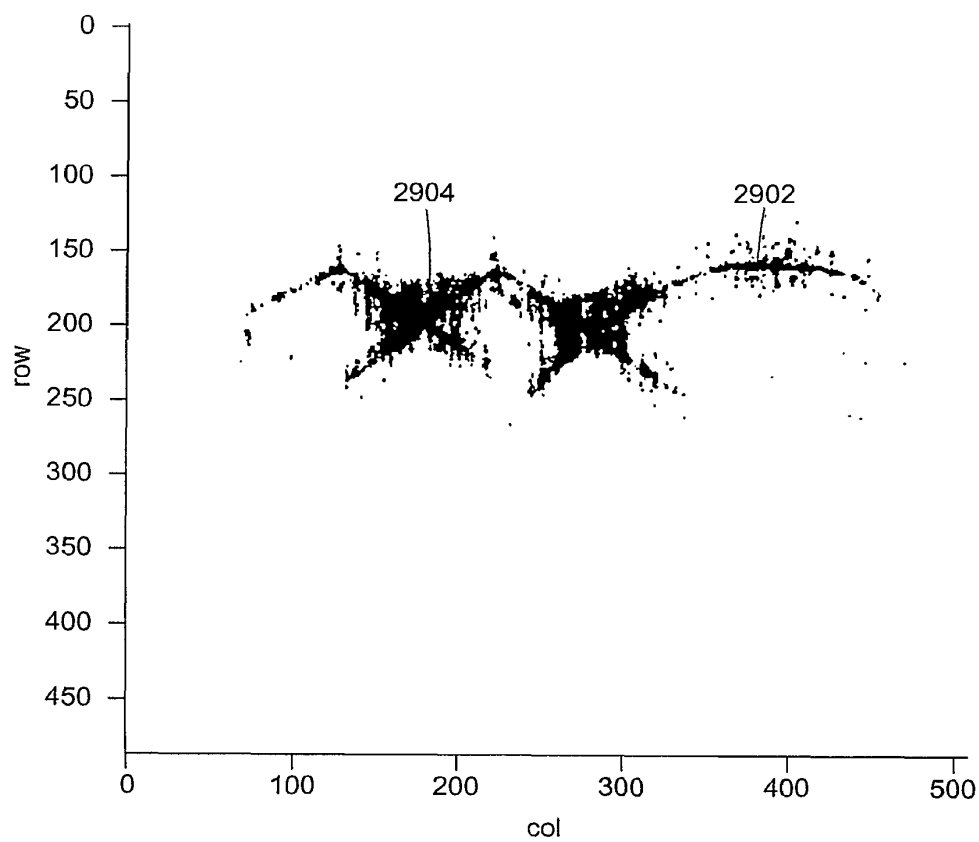


Fig. 25

*Fig. 26*



*Fig. 28*

*Fig. 29*

INTERNATIONAL SEARCH REPORT

national Application No
PCT/US 01/03196

A. CLASSIFICATION OF SUBJECT MATTER IPC 7 G01B11/24 E05B17/00 B23C3/00		
According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED Minimum documentation searched (classification system followed by classification symbols) IPC 7 G01B E05B B23C		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
Electronic data base consulted during the international search (name of data base and, where practical, search terms used) EPO-Internal, PAJ		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 0 053 730 A (WEBB SERVICE GMBH) 16 June 1982 (1982-06-16) claim 1	1, 14, 15
A	US 5 807 042 A (BLIN JOHN ET AL) 15 September 1998 (1998-09-15) claim 38	1
A	PATENT ABSTRACTS OF JAPAN vol. 013, no. 149 (P-855), 12 April 1989 (1989-04-12) & JP 63 311109 A (KIKI KAIHATSU KOGYO:KK), 19 December 1988 (1988-12-19) abstract	1
	-/--	
☒ Further documents are listed in the continuation of box C. ☒ Patent family members are listed in annex.		
* Special categories of cited documents : "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier document but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art. "&" document member of the same patent family		
Date of the actual completion of the international search 4 May 2001		Date of mailing of the international search report 11/05/2001
Name and mailing address of the ISA European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016		Authorized officer De Gussem, J

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

national Application No

PCT/US 01/03196

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	PATENT ABSTRACTS OF JAPAN vol. 013, no. 149 (P-855), 12 April 1989 (1989-04-12) & JP 63 311108 A (KIKI KAIHATSU KOGYO:KK), 19 December 1988 (1988-12-19) abstract	1
A	----- PATENT ABSTRACTS OF JAPAN vol. 009, no. 002 (P-325), 8 January 1985 (1985-01-08) & JP 59 153106 A (HITACHI DENSHI ENGINEERING KK), 1 September 1984 (1984-09-01) abstract -----	1

Form PCT/ISA/210 (continuation of second sheet) (July 1992)

page 2 of 2

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/US 01/03196

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0053730 A	16-06-1982	DE 3044611 A AT 15720 T DE 3172364 D	25-11-1982 15-10-1985 24-10-1985
US 5807042 A	15-09-1998	US 6065911 A	23-05-2000
JP 63311109 A	19-12-1988	NONE	
JP 63311108 A	19-12-1988	NONE	
JP 59153106 A	01-09-1984	NONE	

PCTWORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification⁶ :
B23C 3/35**A1**(11) International Publication Number: **WO 96/19309**

(43) International Publication Date: 27 June 1996 (27.06.96)

(21) International Application Number: PCT/US94/14862

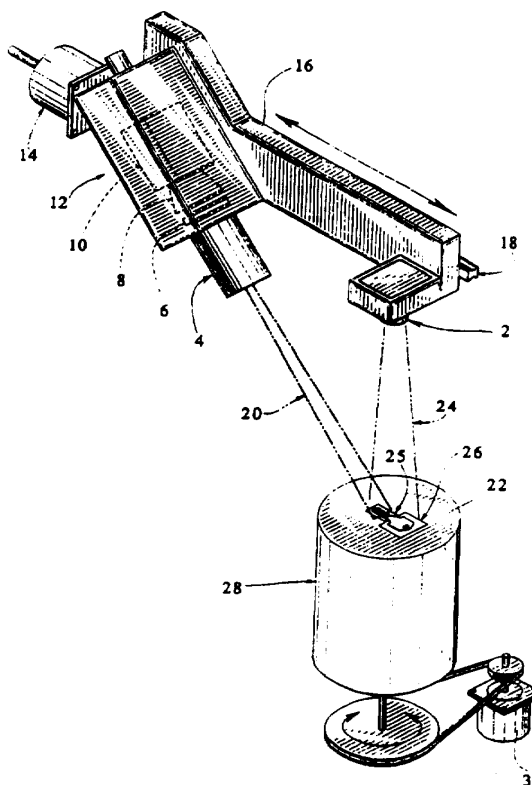
(22) International Filing Date: 22 December 1994 (22.12.94)

(71)(72) Applicant and Inventor: ALMBLAD, Robert, E.
[US/US]; 440 Banbury Road, Mundelein, IL 60060 (US).(72) Inventors: BLIN, John; 1903 Stanton Court, Arlington Heights,
IL 60004 (US). JURCZAK, Paul; 1662 Vineyard Drive,
Gurnee, IL 60031 (US).(74) Agent: MCKENNA, Michael, R.; Law Firm of Michael R.
McKenna, Suite 3800, 500 West Madison, Chicago, IL
60661 (US).(81) Designated States: AU, CA, JP, KP, US, European patent (AT,
BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL,
PT, SE).**Published***With international search report.*

(54) Title: METHOD AND APPARATUS FOR AUTOMATICALLY MAKING KEYS

(57) Abstract

The invention relates to a key making machine that automatically extracts characteristics of an object key without human intervention. An object key (32) is automatically aligned, key characteristics extracted and compared with known key manufactures' information stored in memory, an appropriate key blank (78) in a robotically accessible inventory (82) is selected, cut, deburred, and automatically dispensed to the customer.



FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AT	Austria	GB	United Kingdom	MR	Mauritania
AU	Australia	GE	Georgia	MW	Malawi
BB	Barbados	GN	Guinea	NE	Niger
BE	Belgium	GR	Greece	NL	Netherlands
BF	Burkina Faso	HU	Hungary	NO	Norway
BG	Bulgaria	IE	Ireland	NZ	New Zealand
BJ	Benin	IT	Italy	PL	Poland
BR	Brazil	JP	Japan	PT	Portugal
BY	Belarus	KE	Kenya	RO	Romania
CA	Canada	KG	Kyrgyzstan	RU	Russian Federation
CF	Central African Republic	KP	Democratic People's Republic of Korea	SD	Sudan
CG	Congo	KR	Republic of Korea	SE	Sweden
CH	Switzerland	KZ	Kazakhstan	SI	Slovenia
CI	Côte d'Ivoire	LI	Liechtenstein	SK	Slovakia
CM	Cameroon	LK	Sri Lanka	SN	Senegal
CN	China	LU	Luxembourg	TD	Chad
CS	Czechoslovakia	LV	Larvia	TG	Togo
CZ	Czech Republic	MC	Monaco	TJ	Tajikistan
DE	Germany	MD	Republic of Moldova	TT	Trinidad and Tobago
DK	Denmark	MG	Madagascar	UA	Ukraine
ES	Spain	ML	Mali	US	United States of America
FI	Finland	MN	Mongolia	UZ	Uzbekistan
FR	France			VN	Viet Nam
GA	Gabon				

-1-

METHOD AND APPARATUS FOR AUTOMATICALLY MAKING KEYS

TECHNICAL FIELD

This invention generally relates to methods and apparatus for automatic key making. More particularly, the invention extracts key attributes of an object key without mechanically fixturing and without physically contacting the key after the key making apparatus independently positions the object key for such extraction without human intervention.

BACKGROUND OF THE INVENTION

The key making art has taught us that each lock manufacturer has adopted a number of different key blanks, each with its own unique shape and specific groove characteristics. Furthermore, for each key blank its manufacturer has assigned one or more known key cut codes that define the manner in which the key blank can be cut to match the manufacturer's lock.

There are several thousand types of key blanks in the world. When a key is presented to be duplicated by a locksmith, he must be skilled at looking, inspecting, and measuring the customer's key (object key) to determine which key blank it is among the thousands made, and he must also be skilled at trace cutting the notches (cuts or bits) of the customer's key into a

-2-

correctly identified key blank. If the wrong key blank is chosen, then it will not operate in the customer's lock. Also, if the key cuts are not traced precisely, then the new key will not work in the lock.

5 The traditional method of key identification is to inspect the handle (bow) and any stamping, the grooves, and the length. What has not been done, is to measure the cuts in a key, and then compare this information to the grooves and/or outer shape to determine the type of
10 key blank.

 For each key with an elongated blade and a handle, the blade has longitudinal grooves determined by the manufacturer to match its locks. Notches are cut into at least one side of the blade. The handle normally
15 has a hole disposed along the longitudinal centerline which is adapted to allow the key to be used on a key ring. The grooves of a key begin at the point that the blade extends from the handle.

 The manufacturer's key cut codes define the
20 relationship between the cuts and key blank, and between one cut and another. The following characteristics (attributes) are representative: (1) the distance from the key shoulder to the center of the first cut; (2) the distance between cuts, i.e. the
25 distance being measured from the center of one cut to the center of an adjacent cut; (3) the depth of each cut; (4) the angle of each cut; (5) the length of the flat at the bottom of each cut; (6) the distance between the tip and key shoulder; and (7) the distance

-3-

from the key shoulder to the center of the first cut. Once attributes, such as key outer shape, groove characteristics, and key cut features of an object key can be extracted, recognized, and compared to that which was supplied by an original key manufacturer, a new key duplicating the original can be automatically selected and cut.

Since the shape of the blade, grooves and key cut codes define the functional features of a key, this is the information that must be identified and utilized to make a proper key. In other words, if the shape of the blade, key cut codes, or grooves are wrong, the key will not operate the lock. Even though the handle may be different, if the shape of the blade, codes, and grooves are correct, it will still operate the lock.

Various types of key making machines currently exist which identify and utilize a key manufacturer's coding to duplicate a customer's key. However, none of the following patents teaches a method or apparatus that extracts key cut codes of an object key absent some means of physically making referential contact with the object key. Nor do the patents discussed disclose a method or apparatus that extracts the aforementioned key attributes without physically making referential contact with the key after the key making apparatus independently positions the object key for such extraction without human intervention.

U. S. Patent No. 2,070,228, issued in 1935, is the

-4-

seminal patent relating to key cut codes. The device taught measures relative depth of key cuts using spring loaded tumblers which make physical contact with the key cuts. Analysis of the slope of the key cut is not considered. The acquired data is then used by a locksmith to determine an appropriate key code.

U. S. Patent No. 4,090,303, relating to a key decoding apparatus, discloses a method of determining the original key cuts utilizing manufacturers' predetermined key cut depth and spacing. The key decoding apparatus disclosed employs an index card having sequential indexes thereon corresponding to a predetermined coded depth of the key desired to be duplicated. This card is inserted into a housing and the key to be duplicated is inserted into a slot in the housing where it engages an indexing member which enters one of the key cuts on the key and indicates on the card the coded depth of that key cut. The angle of the cut of the same key cut may also be determined. The remaining key cuts of the key may be decoded in like manner.

The '303 disclosure does not teach the use of key cut spacing and depth to determine the key blank, rather this determination is left to the locksmith. It neither aids in the selection of a manufacturer's index (coding) card nor in the selection of a key blank. What '303 does disclose is that when a manufacturer's predetermined key cut depth and spacing index card is

-5-

independently selected by the locksmith, the correct depth of the key cuts can be duplicated. The same index card is then inserted into a housing which includes an indexing drum having key cuts therein with
5 spacing that corresponds to the predetermined coded spacing of the key to be duplicated.

Some of the drawbacks to these designs are that each teaches the utilization of a manufacturer's index card data as the criteria to determine which key blank
10 is appropriate. But an individual locksmith first has to determine which key blank he will use without the use of the manufacturer's index cards.

Alternative technology is available in the form of U.S. Patent No. 3,865,011 issued to Patriquin in 1975
15 which reveals an automatic key duplicating apparatus which discloses a sample device for receiving and retaining a sample key in a vice. The principal disadvantage of such a device is its requirement for proper positioning requiring the skills of a mechanical
20 operator such as a locksmith.

Additionally, U.S. Patent No. 3,796,130 issued in 1974 to Gartner reveals a semi-automatic key
duplicating and vending machine. This device requires the customer to place his key into one of a plurality
25 of slots, each slot adapted to receive a key blade of a different cross-section corresponding to the shape of one of the key blanks in storage. Selection of the proper slots provides a means for selecting the

-6-

appropriate key blank in storage and automatically
positions such blank for trace cutting a duplicate
profile to that of the customer's key. The principal
disadvantages of such a device are that smaller keys
5 fit into larger holes, its inability to determine the
differences in key blade length or shoulder position
which can distinguish one key blank from another, and
the fact that this device merely duplicates the cut
features of the customer's key which may be overly
10 worn.

U. S. Patent No. 4,717,294 discloses a key cutting
device which cuts key blanks by employing a set of
coded depth keys supplied by the lock manufacturer.

U. S. Patent No. 4,899,391 discloses a system for
15 identifying an appropriate key blank from a pattern
comprised of a plurality of horizontal grooves of a
predetermined depth and spacing taken from the image of
the front profile of the key. The principal
disadvantage of such a device is its need to be
20 precisely fixtured and it needs to take images of the
grooves from the blade tip. Length of the blade and
shoulder position cannot be determined and
discontinuities result from slight bends in the blade
and/or surface imperfections. Moreover, keys with worn
25 tips cannot be read accurately at all.

U.S. Patent No. 3,442,174 issued to Weiner et al.
for a key blank dispensing and cutting apparatus which
requires the assistance of the customer in selecting a

-7-

slot in which to insert the blade of the key. Once having found the slot, the blank identification process is completed. Unfortunately, the apparatus only allowed for identification of the profile of the key and could not take into account keys having identical profiles and varying lengths and shoulder positions and smaller keys that fit into larger holes. Moreover, the apparatus was limited to forty eight known key blanks, whereas the instant device teaches no such limitation. Additionally, the selection method disclosed reveals mechanical push rods, one for each of forty eight key blanks to push a key blank out of its respective key blank container. In the instant device only one robotic means for withdrawal of a key blank from a key dispenser is required for all stored key blanks.

Other representative art includes U.S. Patent Nos. 5,245,329, 5,050,462, 4,929,129, and 3,358,561.

These earlier methods and apparatus for automatic key making required skill on the part of the operator to fixture the object key in some fashion and to have some special knowledge of key blanks with some kind of training. Moreover, the prior art methods to decode keys required instruments and gadgets that only locksmiths would be familiar with.

While unrelated to the key making art, the following patents are nevertheless of note. U. S. Patent No. 4,809,341 teaches a method and apparatus used in semiconductor device fabrication for a reticle

-8-

or mask image, which has a slight modification of reduction or magnification, using a comparison method in which the real image pattern is compared with the pattern produced from design data; and U. S. Patent No. 4,805,224 which reveals a pattern recognition method and device employing second order differential analysis of distinctive features.

The citation of the foregoing publications is not an admission that any particular publication constitutes prior art, or that any publication alone or in conjunction with others, renders unpatentable any claim of the present application. None of the cited publications is believed to detract from the patentability of the claimed invention.

Unlike the key vending machines referenced above, the important invention disclosed herein is designed to be operated by an inexperienced customer who possesses neither the skills of a trained locksmith nor those of a skilled imaging operator.

Moreover, deficiencies in the prior art relating to proper sizing of the object key, elimination of distortions and surface flaws, and the need to mechanically fixture the object key have not been remedied by the art disclosed.

No other device for automatically making keys has disclosed a non-contact means for extracting laterally exposed attributes, comprising three dimensional grooves, outer shape and laterally exposed key cuts, of

-9-

an object key. Nor has the prior art taught a key making apparatus or method that automatically establishes an operative positional relationship between an object key and the key making machine without pre-fixturing the object key in a vice or some other holding device.

To alleviate these problems, and others which will become apparent from the disclosure which follows, the present invention provides a key making apparatus that automatically establishes an operative positional relationship between an object key and the components of the apparatus that extract information from an object key, extracts the attribute information necessary for it to determine the correct key blank and the correct key cut codes and a method of automatically cutting the correct codes in to a key blank despite any deficiencies in the codes of the object key.

Attribute information is extracted by the instant apparatus automatically reading an object key and comparing the attributes of the object key with a master pattern memory of known manufacturers' keys. Then it selects the proper matching key blank and cuts it to the original key cut codes established by the manufacturer. Alternatively, the key blank can be trace-cut, duplicating the used attributes of the object key.

-10-

ADVANTAGES OF THIS INVENTION

Unlike the foregoing devices which teach structures that require fixturing an object key requiring the precision of a trained locksmith to properly place the key within a vice or similar holding device, the instant invention allows the key to be loosely situated within a specified but yet broader area. Thereafter, the key making machine operates automatically to position the key, to extract key attributes so that a corresponding key blank stored in the machine can be identified, and corresponding key cut codes can be identified and cut into the corresponding key blank to make a new key conforming to the manufacturer's original specifications. Every necessary aspect of the key making process has been incorporated into the preferred embodiments of the instant apparatus.

Furthermore, a superior method and apparatus is disclosed herein which allows the internal grooves to be identified more accurately. The prior art discussed above reveals a method for looking down the front profile of the key, that is, looking longitudinally from the tip of the blade. This method is subject to inaccuracies due to distortions from wear and blade bending. Moreover, the system is unable to determine blade length, shoulder position, or attribute information.

-11-

By combining a backlighting method, which sees the outer shape of the key, including its key cut features, and a light stripe method, which obliquely projects a light stripe on to the blade producing a multi-dimensional image, the disadvantages of the prior art have been overcome.

The disclosed embodiment of the instant invention can identify and produce not only American made keys, but those of Europe and throughout the world having laterally protected cuts and curved grooves as well.

The instant automatic key making apparatus provides an efficient and convenient means of making new keys. The apparatus of the present invention performs all of the required functions to achieve the objective of making a key that meets the specifications of the original manufacturer. Additionally, the methods disclosed provide that the apparatus may acquire new key information which may be added to the machine's database, thus, allowing the range of applicable customer keys to expand.

Moreover, the methods disclosed herein requires no skill on the part of the operator or any knowledge of keys. Particularly when compared to the foregoing devices, the instant invention is user-friendly.

The embodiments of the disclosed invention reveal a self-service key making apparatus requiring few instructions and little or no skill or special knowledge on the part of the customer. Ease of use is

-12-

a critical advantage. It is no harder to use than a photocopy machine - no greater level of complexity is required.

5 Still other advantages will be apparent from the disclosure that follows.

SUMMARY OF THE INVENTION

The invention relates to methods and apparatus for automatically making keys by extracting key cut codes, or other attributes, of an object key without
10 physically contacting the key in such extraction process. Additionally, the key making apparatus may independently position the object key for such extraction without human intervention.

The key making apparatus may comprise a
15 transparent section on which an object key may be supported which is rotatable, and a backlighting means is used to pass light through the transparent section and project an image of the object key. From the image received, the position of the longitudinal centerline
20 of the object key relative to a fixed datum is determined and an output signal generated. The object key may then be rotated to align it. Object key attributes may thus be extracted without fixturing or confining the object key in a holder or like device and
25 a correct key blank may be identified.

Moreover, after extracting essential attribute information which is then compared with known key

-13-

manufacturer's information stored in memory, an appropriate key blank in a robotically accessible inventory is selected, cut, deburred, and automatically dispensed.

5

BRIEF DESCRIPTION OF THE DRAWINGS

Preferred embodiments of the invention are described hereinafter with reference to the accompanying drawing wherein:

10

FIG. 1 is a perspective view of a preferred embodiment of a rotatable object key supporting means and an assembly of the light stripe generator and camera of the automatic key making apparatus of the present invention;

15

FIG. 2 is a fragmentary side elevation view of a preferred embodiment of a transparent section of the object key supporting means with an object key disposed in a sloped position thereon of the automatic key making apparatus of the present invention;

20

FIG. 3 is a fragmentary side elevation view of a preferred embodiment of the transparent section of the object key supporting means of FIG. 2 with the handle section lowered and horizontal light obstructed by the blade of the object key disposed flatly on the blade section thereof of the automatic key making apparatus of the present invention;

25

FIG. 4 is a cut-away perspective view of a preferred embodiment of the rotatable object key

-14-

supporting means showing the backlighting means, the horizontal adjustment means, and tandem movement of the assembly of the light stripe generator and camera of the automatic key making apparatus of the present invention;

FIG. 5 is a perspective view of a preferred embodiment of the key effector base showing the subbase linear slide motion guides;

FIG. 6 is a partially exploded perspective view showing a positional relationship of a preferred embodiment of a key dispenser cup to a key holding container and the key effector, respectively;

FIG. 7 is a perspective view of a preferred embodiment of the dispenser cup showing its hinged door;

FIG. 8 is a perspective view of a preferred embodiment of the key effector showing a clamp and spring biased block in an exploded format;

FIG. 9 is a perspective view of a preferred embodiment of the key holding container showing its relationship to one key blank of a stack of key blanks;

FIG. 10 is a side elevation view of a preferred embodiment of the dispenser cup with the hinged door closed and the key holding container, shown in phantom, disposed therein, and the clamp and rod of the key effector in a pre-engagement position;

FIG. 11 is a side elevation view of a preferred embodiment of the dispenser cup with the hinged door

-15-

engaged by the clamp of the key effector to open same and the key holding container, shown in phantom, disposed therein, and a pin disposed upwardly on the rod engaged with a hole in the handle of a key blank;

5 FIG. 12 is a partial cut-away side elevation view of a preferred embodiment of the key effector with the key blank secured in position for cutting;

10 FIG. 13 is a side elevation view of a preferred embodiment of a rotatable cutting wheel and associated anvils for cutting a key blank;

15 FIG. 14 is a partial perspective view of a preferred embodiment of a spatial orthogonal array of the dispenser cups and associated key holding containers in relation to a representation of the key effector, shown in phantom;

 FIG. 15 is a top plan view of representative shapes of different keys;

20 FIG. 16 is a top plan view of a cut key and representative light stripes projected thereon, with a representation of the characteristics of the key from the respective light stripes;

 FIG. 17 is a flow diagram of a preferred embodiment of the operation of the automatic key making apparatus of the present invention;

25 FIG. 18 is a block diagram of a preferred embodiment of the electrically actuated components of the automatic key making apparatus of the present invention;

-16-

FIGS. 19, 19A, and 19B, are, respectively, perspective views of a key having laterally protected attributes: FIG. 19 showing a key having laterally protected key cuts and a linear groove, FIG. 19A showing a key having a laterally protected linear groove and a laterally protected curved groove, and FIG. 19B showing a key having a laterally protected linear groove and a plurality of laterally protected recessed dimples; and

FIGS. 20, 20A, 20B, 20C, AND 20D, are, respectively, top plan views of representative shapes of different key blanks, each having a uniformly disposed hip to support registration of the key blank when secured by the key effector (not shown).

DETAILED DESCRIPTION OF THE INVENTION

The preferred embodiments depicted in the drawing include an automatic key making apparatus, a flow diagram of a preferred method of operation, and a block diagram of various components. The discussion that follows, without limiting the scope of the invention, will refer to the invention as depicted in the drawing, showing methods and embodiments of an apparatus that will automatically make new keys requiring only minimum skill on the part of the user (customer).

A preferred method for automatically making keys comprises establishing an operative positional relationship between an object key and a means for

-17-

extracting attributes of an object key while leaving the object key independent of constraint and then extracting attributes of an object key.

5 This method is achieved by an automatic key making apparatus, which in one of its preferred embodiments, orients the object key into an operative positional relationship before extracting its attributes, leaving the object key independent of constraint. In another embodiment laterally exposed attributes are extracted
10 independent of physical contact.

One method for automatically making keys comprises establishing an operative positional relationship between an object key and a means for extracting laterally protected attributes of an object key while
15 leaving the object key independent of forcible holding and extracting laterally protected attributes of an object key independent of physical contact.

In a preferred embodiment of the invention both laterally protected and laterally exposed attributes of
20 an object key are recognized and compared with a master pattern memory to identify a corresponding key blank having a hole in the handle and its associated key cut code.

Another method comprises receiving an object key
25 on a rotatable means for supporting an object key having a transparent section, backlighting the object key by passing light through a transparent section of the supporting means and projecting an object image,

-18-

receiving at least one object image of the object key,
determining from the object image the position of the
longitudinal centerline of the object key in a
generally horizontal position relative to a light
5 stripe which may be projected on to the object key by a
light stripe generator, producing an output signal
corresponding to the determination, and rotating the
means for supporting an object key for alignment with a
line perpendicular to the light stripe.

10 Any structured light may be used for applications
requiring surface feature extraction. Structured light
being defined as any method, including filtering,
polarizing, lensing, aperturing, and light placement at
appropriate angles of incidence, that controls the
15 light path between its source, the illuminated object
and the camera.

In its preferred form, collimated light in which
all of the light waves travel parallel to one another,
is used to produce sharply defined shadows of parts
20 placed in its path which can be cast either directly
onto a sensor or on to a flat surface where it can then
be measured. Backlighting produces a silhouette image
of an object contour or polyline. A preferred
embodiment utilizes for a backlight source a 7 watt
25 bulb with a light diffuser of opaque plastic.

As shown in the drawing, this invention
establishes an operative positional relationship
between the object key 32 and the automatic key making

-19-

apparatus. The pedestal 28 on which the object key may be placed may be rotated by an offset motor drive 30, as shown in FIG. 4. Thus, even if a customer does not orient the object key 32 properly, backlighting will reveal its orientation and the transparent section (blade section 25 and handle section 26, taken together) of the pedestal 28 can be rotated to re-orient the object key. The camera 2 is used to receive the object image of the object key 32 produced by backlighting and it produces an output signal which can be processed by computer to determine the position of the longitudinal centerline of the object key 32 relative to a fixed datum.

A key method of establishing an operative positional relationship between an object key and a means for extracting attributes of an object key while leaving the object key independent of constraint and may be employed with any known method of extracting attributes of an object key including those utilizing physical contact.

Another method for automatically making keys involves aligning an object key with a horizontal plane.

As best shown in FIGS. 2 and 3 of the drawing, the present invention provides that when an object key 32 is placed on the transparent section (25, 26) of the pedestal 28, it may not be lying flat due to a bulky key handle 34. The instant invention remedies this

-20-

problem utilizing a horizontal light generator 38 and horizontal light receiver 39 (see FIG. 4) positioned immediately above the pedestal 28 that allows light to be transmitted and received under the key blade 36.

5 The handle 34 can then be lowered until the blade 36 is positioned flatly on the blade section 25.

In this embodiment of the apparatus, the transparent section has a blade section 25 proximate to a handle section 26 and the handle section is movable vertically from an upper position which is parallel to the plane of the blade section (illustrated in FIG. 2) to a lower position at a spaced distance below the plane of the blade section (illustrated in FIG. 3). The handle section 26 is sized and adapted to support the handle of an object key 32 that has a blade 36 and a handle 34. The blade section 25 is sized and adapted to support the blade of an object key.

The means for aligning an object key with a horizontal plane includes a horizontal light generator 38 arranged and adapted to project a generally horizontal beam of light immediately above the transparent section and transverse to the blade of an object key which may be supported on the transparent section. The light generator could be as common as a light bulb or as sophisticated as a fiber optic cable.

As best shown in FIG. 4 of the drawing, the present invention provides that when the backlight 48

-21-

turns off and a horizontal light is projected immediately above the pedestal 28 and transverse to a blade 36 of the object key 32 which is supported on a blade section 25 and an adjacent handle section 25 of the transparent section for a blade and handle, respectively, of the object key 32; and the horizontal beam of light which is not obstructed by the blade of the object key disposed on the blade section is received by a horizontal light receiver 39 which produces at least one output signal. As best shown in FIG. 2 of the drawing, if the blade 36 of the object key is not positioned flatly on the blade section 25, horizontal light above a minimum threshold will be received and the vertical elevation of the handle section 26 of the transparent section will be incrementally lowered in relation to the output signal.

The steps of the previous paragraph are repeated until the light received no longer exceeds the minimum threshold, indicating that the blade of the object key is disposed flatly on the blade section.

In some instances the customer may forget to place the object key 32 on the pedestal 28. In such instances, the horizontal leveling light will not be blocked regardless of the handle section height adjustment. This will indicate that either the key is not positioned on the transparent section or that the customer forgot to insert the key altogether, triggering a signal to open the key access door (not

-22-

shown in the drawing) and the customer will be re-instructed to place the key.

By projecting a generally horizontal beam of light immediately above a means for supporting an object key and transverse to the blade of the object key which may be supported thereon and receiving the light of the horizontal beam that is not obstructed by the blade of an object key disposed on the blade section of the means for supporting an object key and producing at least one output signal, and incrementally lowering the vertical elevation of the handle section of the means for supporting an object key in relation to said second output signal, and repeating these sequential steps a specified number of times, the non-existence of an object key can be determined and an appropriate signal generated. Such signal would indicate that there was a lack of an object key blocking the light reception, which would indicate that the object key was not disposed on the supporting means. In such a case the signal would produce a response wherein an overhead light (not shown in the drawing) would be turned on, appropriate instructions would be displayed to the customer, and the access door would open.

The horizontal light generated would be obstructed by the blade of an object key, if it were disposed horizontally on the blade section of the transparent section of the pedestal, as shown in FIG. 3. Otherwise, when the blade of an object key is other

-23-

than horizontally disposed in face to face contact with the blade section, the light generated will be seen by a horizontal light receiver disposed to receive light from the horizontal light generator that is not
5 obstructed by the blade.

In the present embodiment, an output signal would be produced by the light receiver. The output signal would correspond to the quantum of light received or be generated as a fixed constant while a specified
10 threshold of light is being received. A fiber optic sensor may be employed.

As best shown in FIG. 3 of the drawing, to adjust the vertical elevation of the handle section 26 for controlling the horizontal pitch of an object key
15 disposed on the transparent section of the means for supporting an object key, the horizontal control means actuates a motor drive 44 to lower the handle section 26, whereby, an object key having a handle thickness larger than its blade thickness which is disposed on
20 the transparent section of the means for supporting an object key may be aligned with a horizontal plane by lowering the handle section on which the handle of the object key is supported in finite steps in response to the output signal generated by the horizontal light
25 receiver 39.

Alternatively, a means to raise the blade section coupled with a like movement of the horizontal light generator and receiver could be utilized to coordinate

-24-

a face to face relationship between the blade section and the blade of the object key. Such an alternative system could alternatively require an adjustment of the coordinates for the imaging process. This alternative embodiment is not reflected in the drawing.

In a preferred embodiment of the automatic key making device, as shown in FIGS. 2 and 3, the means for adjusting the vertical elevation of the handle section 26 of the means for supporting an object key comprises a stepper linear actuator 44 having a shaft physically connected to the handle section 26 and at least one linear slide 40 disposed vertically for sliding support of the moving section. Servo actuators can likewise be employed. A stepper linear actuator is preferred because it can move the handle down in 0.010 inch increments.

One preferred process for automatically making keys comprises the sequential steps: a. receiving an object key on a rotatable means for supporting an object key having a transparent section; b. backlighting the object key by passing light through the transparent section of the supporting means and projecting an image; c. receiving at least one object image of the object key; d. determining from the object image the position of the longitudinal centerline of the object key in a horizontal plane relative to a light stripe projected on to the object key by a light stripe generator; e. producing an output signal

-25-

corresponding to the determination; f. rotating the means for supporting an object key for alignment with a line perpendicular to a light stripe which may be projected on to the object key by a light stripe generator in relation to the output signal; g. projecting a generally horizontal beam of light immediately above the means for supporting an object key and transverse to a blade of an object key supported on the transparent section thereof, the transparent section having a blade section and an adjacent handle section for a blade and handle, respectively, of the object key; h. receiving the horizontal beam of light that is not obstructed by the blade of an object key disposed on the blade section of the means for supporting an object key and producing at least one output signal; i. incrementally lowering the vertical elevation of the handle section of the means for supporting an object key in relation to the output signal; and j. repeating sequential steps g, h, and i until the light received no longer exceeds a minimum threshold, indicating that the blade of the object key is disposed flatly on the blade section.

Operation from the customer's perspective, the customer places a key (the "object key") through an access door and on to an illuminated pedestal in accordance with the monitor's instructions. The customer may be required to close the access door (or initiate its operation by pressing a button or

-26-

depositing money), which turns off an overhead light creating a small "dark room" for the key. Furthermore, closing the door trips a mechanical switch that activates the apparatus to begin the following events:

5 a backlight 48 is turned on and an image of the object key is captured to determine the position of its longitudinal centerline and the object key is rotated a few degrees, if necessary, to be in proper alignment for a light stripe picture.

10 As best shown in FIG. 1 and 4 of the drawing, the present invention provides that the means for receiving an object image comprises at least one camera, the camera 2 being a pixel device for oriented fiber optic arrays. The preferred camera is available from a

15 number of manufacturers and is a 256 grey scale CCD high resolution camera and a 4/40 lens. Signal output of the camera is sent to a frame grabber installed in the computing means. A standard 486 PC may act as the computing means.

20 Some of the identifying attributes of an object key are disposed on its silhouette. These laterally exposed attributes may include the outer shape, see FIG. 15, and the exposed key cuts, as shown on the object key 32 of FIG. 16. Other identifying attributes

25 of an object key cannot be seen on the silhouette. Such laterally protected attributes may include groove characteristics 116 extending longitudinally along the blade of an object key or as laterally protected key

-27-

cuts 114 or recessed dimples 112, as shown in FIG. 19. Additionally, the silhouette view provides information about the location of the handle and the blade of the object key, so that the light stripe generator can be positioned to project a light stripe on to the object key where its grooves begin.

The instant invention teaches a means to extract the laterally exposed attributes using backlighting and a means to extract the laterally protected attributes using a light stripe which is illustrated in FIG. 1.

In an embodiment of this invention, as shown in FIGS. 1 and 4, an object key may be placed on a transparent section (25, 26) of a pedestal 28 and backlit by a light source 48 through a lens 46 positioned below the object key so that light passes through the transparent section (25, 26) and projects an image of the object key. The transparent section of the pedestal 28 may lie in a generally horizontal plane. A suitable camera 2 is positioned to receive the image and produce an output signal which can be supplied to a computer as a means for identifying the laterally exposed attributes of the object key.

Then the backlight 48 is turned on and about five (5) pictures are taken, the camera 2 is then moved in three quarter ($3/4$) inch increments across a distance of about four (4) inches and the five (5) pictures are repeated at each location; these pictures are then digitalized and electronically gathered together to

-28-

form one silhouette of the key in the form of a
polyline; information about the shape, depth of cut,
location of cuts, and location of the shoulder, etc.
are extracted and stored in memory (RAM). The number
5 of pictures taken will obviously depend on the quality
and capability of the camera.

The extracted silhouette of the object key
information is compared to silhouette information of
known manufacturers' keys that are stored in memory
10 (ROM), whereby, a matching key blank may be identified.

Another process for automatically making keys
comprises receiving an object key on a transparent
section of a means for supporting an object key,
backlighting the object key by passing light through
15 the transparent section of the supporting means and
projecting an object image, receiving at least one
object image of the object key, producing an output
signal, and identifying laterally exposed attributes of
the object key responsive to the output signal.

20 Additionally, a comparison can be made where each
master code signal defining traits of a master pixel
pattern limited to the laterally exposed attributes of
a selected manufacturer's key.

From such identified laterally exposed attributes,
25 a corresponding key blank and associated key cut codes
may be determined. However, this procedure is not as
reliable as the multi-recognition process herein
described.

-29-

With the object image captured by the camera and processed by the computer through an analog/digital converter, the attributes of an object key may be identified. The computer provides a pattern
5 recognition means for recognizing a pixel pattern from an object image of the object key, and for producing a series of code signals with respect to each target pixel from the result of the recognition. The code signals define traits of the recognized pixel pattern
10 for each target pixel, where the pixel patterns define attributes of the object key. Moreover, the computer is programmed to discriminate between various pixel patterns. A pattern memory in which a set of predetermined master patterns is stored in the ROM of
15 the computer. Each predetermined master pattern is a plurality of master code signals. The master code signals define traits of a master pixel pattern, where the master pixel pattern defines attributes of a selected manufacturer's key. The computer is
20 programmed to compare the code signals from the pattern recognition means with a corresponding master code signal and to produce an identifying signal, which defines a corresponding key blank with a predetermined master pattern having master code signals that match
25 code signals from the result of the recognition of the pixel pattern of the object key. This process allows a corresponding key blank matching attributes of a known manufacturer's key to be determined.

-30-

In a preferred embodiment, the pattern recognition means recognizes laterally exposed attributes represented on a polyline of a silhouette of the object key. The laterally exposed attributes may include the outer shape of an object key, as illustrated in FIG. 15, or the laterally exposed key cuts, as shown on the cut key 32 of FIG. 16. When the laterally exposed attributes of an object key are recognized and compared to the master pattern memory, a corresponding key blank matching the outer shape of a known manufacturer's key may be determined.

Moreover, a plurality of discrete object images of the object key may be produced and captured, and gathered together to form an integrated pixel pattern which may be processed for recognition. In such embodiment, the code signals define traits of the recognized pixel pattern for each target pixel, where the integrated pixel pattern defines attributes of the object key.

The apparatus for making keys may backlight the object key, capture its image, repositioning the camera, and repeat the process, producing a series of backlit images which can be gathering together for an integrated image and corresponding output signal.

In addition, the referenced master pattern memory for comparison with the results of the recognition of the light stripe image may be limited to those having master code signals corresponding to the previously

-31-

determined manufacturer's keys as determined from the previous match.

5 If there are no matches, an "expert" rejection mode is initiated wherein the backlight is turned off and an overhead light (not shown in the drawing) is turned on and at least one, but preferably five (5), pictures are taken across the four (4) inches. These pictures are gathered together and stored on the hard drive (RAM) of the computer. This type of picture, 10 when brought upon the monitor, looks just like a "picture" of the key and can be viewed at a later time by a resident locksmith to determine exactly what kind of key it is. If it is a key that the machine should have been able to identify, but could not because the 15 handle or some other feature of the key was slightly different, then this new information about this particular key may be added to the master memory of key silhouettes so that the next time it can be recognized. In this way, the machine will get "smarter and smarter" 20 with use. Lastly, as the access door opens, the monitor will instruct the customer that our key making apparatus cannot currently make a duplicate of the object key and that it should be taken to a locksmith.

25 In the currently contemplated best mode of the invention, the automatic key making apparatus has a CRT video monitor which displays advertisement material and a variety of instructions. See FIG. 18 for an relational view of the electronically actuated

-32-

components of the disclosed invention.

An initial rejection process is initiated when there is a lack of master code signals matching the primary code signals from the result of the recognition of the pixel pattern of the object key. In response to the rejection signal, an overhead light is turned on illuminating the object key and a picture taken of the illuminated object key. The attribute information from the picture is stored in memory.

A means is provided for storing memory data of rejected object keys. These object keys are rejected because they do not have corresponding master code signals matching the code signals from the result of said recognition of the pixel pattern of the object key. By storing memory data of rejected object keys, the key making apparatus may acquire additional information about keys that are not as yet available in its master pattern memory. This can serve to assist in the expansion of the memory database.

Additional rejection signals may be generated during the process as is more fully discussed hereinafter. See FIG. 17 for a preferred method of the processes described herein.

Referring to FIG. 4, the invented apparatus comprises a light stripe generator 12 which produces and projects a light stripe (see FIG. 16). The instant apparatus requires that the object key be aligned such that the light stripe projected on to the object key is

-33-

precisely perpendicular to the longitudinal centerline of the object key. As shown in FIG. 16, a light stripe projected obliquely on to an object key reflect a two dimensional pattern (illustrated as 20a, 20b, 20c, and 20d) which can be used to interpret the three dimensional characteristics of the key from the respective light stripes.

The preferred embodiments depicted in FIGS. 1 and 4 of the drawing include a light stripe generator 12 arranged and adapted to project at least one light stripe obliquely on to the object key 32 and a means for receiving an image of the projected light stripe reflected from the object key.

The light stripe generator 12 may be comprised of a collimated light source, i.e. a bulb 10, a disk having a slit 6, and an convex lens 4, where the disk 6 is positioned between the light source 10 and the lens 4 to project a light stripe. The light stripe generator 12 uses a 1.6/75 lens to produce a pattern light source with a 25 watt halogen light source. A preferred embodiment provides for the light of the of the light stripe generator to pass through a slit of 0.005 inches giving a .015 inch wide light stripe at the object key.

Alternatively, a laser adapted to produce an array which forms a line may be applied.

Furthermore, the light stripe method functions to recognize laterally protected attributes of the object

-34-

key which result from capturing the image of at least one light stripe being projected obliquely on to the blade thereof.

A preferred process involves the following steps:

5 projecting at least one light stripe obliquely on to an object key; receiving an object image of the light stripe of laterally protected attributes of the object key, recognizing a pixel pattern from the object image, producing a series of code signals that define traits

10 of the recognized pixel pattern for each target pixel from the result of the recognition, comparing the code signals with master code signals from a master pattern memory, the master code signals defining traits of a master pixel pattern of a selected manufacturer's key,

15 and producing an identifying signal from such comparison, the identifying signal defining a corresponding key blank with a predetermined master pattern having master code signals that match code signals from the result of the recognition of the pixel

20 pattern of the object key. In addition, key cut codes may also be identified utilizing this method.

In another application of the foregoing method the steps may be taken in the sequence presented.

If the silhouette matches, then we match the light

25 stripe with the master light stripes of one or more keys with the same silhouette in memory.

To insure optimum image capture of the object key, the camera 2 may be moved along the rail 18 and a

-35-

series of camera pictures taken and then gathered together to form a composite picture as to the light stripe, as best shown in FIGS. 1 and 4. It is preferred that the movement of the assembly be made in increments of about .050 inches. Furthermore, by varying the exposure factors, reflectivity variations which may result from object key wear and dirt, may be corrected when the plurality of sequential images of the light stripe taken along an object key are gathered together and aberrant images are discarded.

The light stripe generator 12 is actuated to project a light stripe on to the blade of the object key (the object key may be rotated 90 degrees, if necessary, to align its longitudinal centerline at a right angle with the light stripe). In a preferred embodiment, the camera 2 takes about five (5) light stripe pictures over a distance of about one-half ($1/2$) inch, so a picture is taken every one-tenth ($1/10$) of an inch at five (5) different locations, with the first being taken near the shoulder where grooves begin. At each light stripe location, a number of pictures are taken at different exposure times to compensate for surface reflectivity.

The exposure times start fast and finish slow. Time factors are 2, 4, 8, 16, 32, 64, 128, etc., with pictures taken until either the last picture is overexposed or the maximum time limit is reached, at which point the camera moves to the next light stripe

-36-

location and begins the next set of pictures at increasing exposure times. The optimum picture at a specific location is selected for comparison using the best exposure times and the best picture location.

- 5 A method for automatically making keys comprises:
- a. backlighting an object key and projecting an image;
 - b. receiving at least one backlit object image of the object key;
 - c. recognizing a pixel pattern from the backlit object image;
 - d. producing a series of primary code signals that define traits of the recognized pixel pattern for each target pixel from the result of the recognition, the target pixels defining a polyline of laterally exposed attributes of the object key;
 - e. comparing the primary code signals relating to the outline shape of the polyline with corresponding master code signals from a master pattern memory, each master code signal defining traits of a master pixel pattern of the shape of a selected manufacturer's key;
 - f. producing a first rejection signal from such comparison, the rejection signal defining a lack of corresponding master code signals matching the primary code signals from the result of the recognition of the pixel pattern of the object key; and, in response to the first rejection signal:
 - g. turning on an overhead light and illuminating the object key;
 - h. receiving at least one object image of the illuminated object key and producing first memory signal; and
 - i. storing the first memory signal.
- 10
- 15
- 20
- 25

-37-

As best shown in FIG. 1 of the drawing, the present invention provides a preferred embodiment of the invention where the light stripe generator 12 and the camera 2 are in a fixed positional relationship with each other and may be repositioned in tandem. This is accomplished by affixing the generator 12 and camera 2 to a holding bracket 16 which is movable linearly along a rail 18 that is parallel to the longitudinal centerline of the object key as it is positioned to have the light stripe projected on to it. The best mode contemplated is for the light stripe generator 12 to be positioned at a 45 degree angle from the plane of the top 22 of the pedestal 28.

As shown in FIG. 1 of the drawing, the present invention provides an elongated horizontal rail 18 having its longitudinal axis lying perpendicular to the light stripe. A bracket 16 slidably supported by the rail 18, with the bracket 16 supporting the light stripe generator 12 and the camera 2 for receiving an image 24 of the light stripe. The camera 2 and the light stripe generator 12 are attached to the bracket 16 and in fixed positional relationship with each other. A motor 14 moves the bracket 16 along the rail 18, whereby, the light stripe generator 12 and the camera 2 can be moved in tandem along the rail 18 and images 24 of the light stripe projected along an object key may be extracted.

It should be readily understood that the process

-38-

of varying the exposure for the light stripe images and the process of repositioning the imaging assembly are complementary and may therefore be used separately or together.

5 As best shown in flow diagram, FIG. 17 of the drawing, the present invention provides that if the light stripe information fails to match, then an inquiry mode is initiated to determine whether there may be information on another side of the object key
10 from information in the master pattern memory relating to the previously selected manufacturer's key, if there is, then the monitor instructs the customer to "turn the key over" and "close the door", and the entire process to this point is repeated. This time the light
15 stripe information is taken from the other side of the key in an attempt to identify the key with this additional information. If there is no additional useful information on the other side of the object key as determined from the master memory or from looking at
20 the other side, then the "expert" rejection mode is initiated.

 An inquiry process to determine whether additional attribute information is disposed on the underside of an object key includes: a. backlighting an object key
25 and projecting an image; b. receiving at least one backlit object image of the object key; c. recognizing a pixel pattern from the backlit object image; d. producing a series of primary code signals that define

-39-

traits of the recognized pixel pattern for each target pixel from the result of the recognition, the target pixels defining a polyline of laterally exposed attributes of the object key; e. comparing the primary code signals relating to outline shape of the polyline with corresponding master code signals from a master pattern memory, each master code signal defining traits of a master pixel pattern relating to the shape of a selected manufacturer's key; f. producing a first identifying signal from such comparison, the first identifying signal defining a corresponding key blank with a predetermined master pattern having master code signals that match code signals from the result of the recognition of the pixel pattern of the object key, whereby, a corresponding selected manufacturer's key and a corresponding key blank responsive to the first identifying signal may be determined; g. projecting at least one light stripe on to an object key; h. receiving an object image of the light stripe of laterally protected attributes of the object key; i. recognizing a pixel pattern from the object image of the light stripe of the laterally protected attributes of the object key; j. producing a series of secondary code signals that define traits of the recognized pixel pattern for each target pixel from the result of the recognition, the target pixels defining a light stripe of the laterally protected attributes of the object key; k. comparing each of the secondary code signals

-40-

with corresponding master code signals from a master pattern memory, each master code signal defining traits of a master pixel pattern of the laterally protected attributes of the selected manufacturer's key; l.

5 producing an inquiry signal from such comparison, the inquiry signal defining a lack of corresponding master code signals matching the secondary code signals from the result of the recognition of the pixel pattern of the object key; and, in response to the inquiry signal:

10 m. determining whether there may be information on another side of the object key from the master pattern memory relating to the selected manufacturer's key, and producing a rejection signal, the rejection signal defining a lack of information on another side of the
15 object key; and, in response to the rejection signal:
n. turning on an overhead light and illuminating the object key; o. receiving at least one object image of the illuminated object key and producing a memory signal; and p. storing the memory signal.

20 The key cut attributes of the object key are extracted by the backlighting method previously discussed. If the key cut codes of an identified key blank fail to match up, then the "expert" rejection mode is initiated.

25 A method for automatically making keys comprises:
a. projecting a light stripe from a light stripe generator obliquely on to an object key; b. receiving an object image of the light stripe of the object key;

-41-

c. repositioning an assembly of the light stripe generator and the object image receiver which are in fixed positional relationship with each other; d. repeating steps a, b, and c; e. gathering together the plurality of object images and producing an integrated object image; f. recognizing a pixel pattern from the integrated object image; g. producing a series of code signals that define traits of the recognized pixel pattern for each target pixel from the result of the recognition; h. comparing the code signals with corresponding master code signals from a master pattern memory, each master code signal defining traits of a master pixel pattern of laterally protected attributes of a selected manufacturer's key; and i. producing an identifying signal from such comparison, the identifying signal defining a corresponding key blank with a predetermined master pattern having master code signals that match code signals from the result of the recognition of the pixel pattern of the object key.

A preferred multi-recognition process, illustrated in part in the flow diagram, FIG. 17 (but excluding the inquiry and rejection steps of the diagram), comprises: a. receiving an object key having a blade and a handle on a rotatable means for supporting an object key having a transparent section with a fixed blade section adjacent to a movable handle section; b. backlighting the object key by passing light through the transparent section of the supporting means and projecting an

-42-

image; c. receiving at least one object image of the object key; d. determining from the object image the position of the longitudinal centerline of the object key relative to a light stripe which may be projected on to the object key by a light stripe generator; e. producing a first output signal corresponding to the determination; f. rotating the means for supporting an object key for alignment with a line perpendicular to a light stripe which may be projected on to the object key by a light stripe generator in relation to the first output signal; g. projecting a generally horizontal beam of light immediately above the means for supporting an object key and transverse to the blade of the object key supported thereon; h. receiving the light of the horizontal beam that is not obstructed by the blade of an object key disposed on the blade section of the means for supporting an object key and producing at least one second output signal; i. incrementally lowering the vertical elevation of the handle section of the means for supporting an object key in relation to the second output signal; and j. repeating sequential steps g, h, and i until the light received no longer exceeds a minimum threshold, indicating that the blade of the object key is disposed flatly on the blade section; k. continuing to backlight the object key by passing light through the transparent section of the supporting means and projecting an image; l. receiving at least one backlit object image

-43-

of the object key; m. recognizing a pixel pattern from the backlit object image; n. producing a series of primary code signals that define traits of the recognized pixel pattern for each target pixel from the result of the recognition, the target pixels defining a polyline of laterally exposed attributes of the object key; o. comparing the primary code signals relating to outline shape of the polyline with corresponding master code signals from a master pattern memory, each master code signal defining traits of a master pixel pattern relating to the shape of a selected manufacturer's key; p. producing a first identifying signal from such comparison, the first identifying signal defining a corresponding key blank with a predetermined master pattern having master code signals that match code signals from the result of the recognition of the pixel pattern of the object key, whereby, a corresponding selected manufacturer's key and a corresponding key blank responsive to the first identifying signal may be determined; q. projecting at least one light stripe obliquely on to an object key disposed on the transparent section, thereby creating an image of laterally protected attributes of the object key; r. receiving an object image of the light stripe of the laterally protected attributes of the object key; s. recognizing a pixel pattern from the object image of the light stripe of the laterally protected attributes of the object key; t. producing a series of secondary

-44-

code signals that define traits of the recognized pixel pattern for each target pixel from the result of the recognition, the target pixels defining a light stripe of the laterally protected attributes of the object key; u. comparing each of the secondary code signals with a corresponding master code signal from the master pattern memory, the master code signals defining traits of a master pixel pattern relating to the laterally protected attributes of the selected manufacturer's key; v. producing a second identifying signal from such comparison, the second identifying signal defining that the corresponding key blank with a predetermined master pattern having master code signals matches the secondary code signals from the result of the recognition of the pixel pattern of the laterally protected attributes of the object key; w. comparing the primary code signals relating to laterally exposed key cut features of the polyline with the master code signal from the master pattern memory, the master code signals defining traits of a master pixel pattern of key cut codes of the selected manufacturer's key; x. producing a third identifying signal from such comparison, the third identifying signal defining a key cut code of the selected manufacturer's key with a predetermined master pattern having master code signals that match the primary code signals from the result of the recognition of the pixel pattern of the laterally exposed attributes of the object key, whereby, the key

-45-

cut code of the object key is identified and the corresponding key blank is confirmed, in response to the third identifying signal; y. selecting the corresponding key blank from a plurality of key blanks from the identifying signal; z. grasping the key blank; 5 aa. positioning the key blank for cutting; and ab. cutting key cut features into the key blank to create a new key.

10 A composite light stripe is stored in memory. This light stripe information is compared to master pattern memory relating to the previously identified key blank. If the light stripe information matches, then the apparatus continues by attempting to match the key codes: i.e. depths, spaces and distances with all the 15 master codes of the key blank previously identified by the outer shape of the silhouette and by light stripe.

In instance during the preferred multi-recognition process there may arise a lack of correspondence between a. outer shape image recognition and the master 20 pattern memory; b. the light stripe image recognition and the master pattern memory corresponding the key blank identified with the outer shape image recognition; or c. the key cut feature image recognition and the master pattern memory corresponding 25 the key blank identified with the outer shape image recognition which was verified with the light stripe image recognition. In such instances, a rejection signal will be initiated turning on an overhead light

-46-

and illuminating the object key, receiving at least one object image of the illuminated object key and producing a memory signal, and storing the memory signal. See FIG. 17. If required because of the configuration of the components relative to the access door of the apparatus, the pedestal 28 is then reverse rotated to place it in its starting position, the light stripe generator 12 is turned off, and the overhead light is turned on and the access door automatically opens permitting the customer to remove the object key.

If the automatic key making apparatus has successfully identified a corresponding key blank, the key cuts and the corresponding key cut codes, and the corresponding key blank is in the machines' inventory, then the monitor gives the customer instructions on how to enter a number of copies of keys desired to be made and how much money to put in a currency acceptor. The timing of this step may easily be advanced.

If we do get all three matches, then the automatic key making apparatus selects the appropriate key blank and cuts it by reference to the original manufacturer's key cut code specifications (OEM) contained in memory. The apparatus could trace cut the key. Alternatively, cuts could be a combination of the OEM and trace cutting.

The most reliable identification method involves obtaining all three matches. It is to be understood that a lesser number of matches, with a lesser standard

-47-

of reliability, could be employed as well.

Additionally, the methods for automatically making keys described above may further comprise the following additional steps: a. selecting a key blank

5 corresponding to the identifying signal from a plurality of key blanks; b. grasping the key blank; c. positioning the key blank for cutting; d. cutting key cut features into the corresponding key blank to create a new key; e. deburring the new key; and f. dispensing
10 the new key. As shown in FIG. 18, an evacuation fan or similar device may be employed to gather burrs.

As best shown in FIG. 12, the key making apparatus comprises a means for grasping a key blank 78 while leaving the blade thereof free of constraint for
15 cutting. Notably, a preferred embodiment of the invention allows a blade that has at least one longitudinal cuttable side edge to be cut while the side of the blade opposite the cuttable side edge is free of restriction.

20 As shown in FIG. 20, a key blank comprises a blade with a tip 150 on the distal end and which terminates at the shoulder 148 on its proximate end, a shank extending longitudinally from the shoulder 148 to the hip 140 and a handle 142 having a hole 144 centrally
25 disposed in the handle. As shown on FIG. 12, a preferred embodiment of the means for grasping is a key effector which engages a section of the key blank consisting of its handle and its shank, while leaving

-48-

the opposite side of said blade free of constraint.
Alternatively, the section of the key blank so engaged
may be the solely the handle or solely the shank.

5 The key effector may be positioned to place the
key blank in operative relationship with a means for
cutting the longitudinal cuttable side edge thereof.
FIG. 13 shows a rotary cutting wheel that may be
employed to make key cuts in the blade of a key blank.
A key blank having a blade with two longitudinal
10 cuttable side edges may be grasped by a means for
grasping, such as the key effector, and a first
longitudinal cuttable side edge of the blade thereof
placed in a face to face cutting relationship with a
first side of the rotary cutting wheel, whereby cuts
15 are made in the first cuttable side edge of the key
blank. After which the means for grasping and the key
blank engaged thereto may be moved in a direction which
is perpendicular to longitudinal centerline of the key
blank and which passes through a line extending from
20 the axis of the rotary cutting wheel to position a
second longitudinal cuttable side edge of the key blank
for cutting. The means for grasping and the key blank
engaged thereto may then be moved to promote a face to
face cutting relationship between the second
25 longitudinal cuttable side edge of the key blank and
the opposite side of the cutting wheel, whereby cuts
are made in the second longitudinal cuttable side edge
of the key blank.

-49-

As is evident from the foregoing disclosure, a method for automatically making keys may comprise grasping a key blank having a blade and making cuts in the blade while leaving the blade free of constraint.

5 Additionally, where the blade of the key blank has at least one longitudinal cuttable side edge, a process for making keys automatically may involve making cuts in a longitudinal cuttable side edge of the blade while leaving the opposite side of the blade free of
10 constraint.

Such processes may additionally include grasping a key blank having a blade with at least one longitudinal cuttable side edge and a handle, by its handle, by its shank, or by a section of the key blank comprising its
15 handle and its shank.

Alternatively, in connection with a key blank having a blade with two longitudinal cuttable side edges, a method for automatically making keys may comprise cutting, with a first side of a rotary cutting
20 wheel, a first longitudinal cuttable side edge of the key blank while leaving the opposite side of said blade free of constraint, and cutting the other longitudinal cuttable side edge of the key blank from the opposite side of the cutting wheel while leaving the opposite
25 side of said blade free of constraint. The opposite (or other) side of the cutting wheel being a locality relative to the cutting wheel that is approximately 180 degrees from the first side of the rotary cutting

-50-

wheel, that is, the locality relative to the cutting wheel where the key blank engages the cutting wheel during cutting of the first longitudinal cuttable side edge of the key blank.

5 Furthermore, a preferred method for automatically making keys comprises cutting, with a first side of a rotary cutting wheel, a longitudinal cuttable side edge of a key blank having a blade with two longitudinal cuttable side edges while leaving the opposite side of
10 the blade free of constraint, moving the key blank in a direction which is perpendicular to its longitudinal centerline and which passes through a line extending from the axis of the rotary cutting wheel to position a second longitudinal cuttable side edge in a face to
15 face relationship with the opposite side of the rotary cutting wheel for cutting, and cutting, with the opposite side of the rotary cutting wheel, the second longitudinal cuttable side edge of the key blank while leaving the opposite side of said blade free of
20 constraint.

 Additionally, a method for automatically making keys comprises grasping a key blank having a blade with two longitudinal cuttable side edges, a shank and a handle, by the section of the key blank consisting of
25 its handle and its shank, cutting, with a first side of a rotary cutting wheel, a first longitudinal cuttable side edge of a key blank while leaving the opposite side of said blade free of constraint, moving the key

-51-

blank to position a second longitudinal cuttable side edge in a face to face relationship with the opposite side of the cutting wheel, and cutting, with the opposite side of the cutting wheel, the second longitudinal cuttable side edge of the key blank while leaving the opposite side of said blade free of constraint. Movement of the key blank from the position where the first longitudinal cuttable side edge is cut to the position where the second longitudinal cuttable side edge is cut can be accomplished most efficiently by moving the key blank in a direction which is perpendicular to its longitudinal centerline and which passes through a line extending from the axis of the rotary cutting wheel. Other movements which achieve the same end result are easily cognizable.

Furthermore, another embodiment of the means for cutting (not shown in the drawing) comprises two rotary cutting wheels. One arrangement of such rotary cutting wheels is to dispose each wheel in a common plane, in a side by side relationship, for example, at a sufficient distance from one another to allow the blade of a key blank to be positioned therebetween for cutting. In such an arrangement, each longitudinal cuttable cutting side edge may be cut by one of the rotary cutting wheels.

As best shown in FIGS. 7 and 9 of the drawing, the present invention provides a preferred embodiment

-52-

having a means for storing a plurality of key blanks 78. Such means includes a plurality of key holding containers 82, each for holding a stack of like key blanks 78 and a dispenser cup 80 disposed at the bottom of each key holding container 78, as shown in FIG. 6, each of the dispenser cups having an opening at the top suitably sized and adapted to receive a key holding container and having a proximate front wall with a passage 86 disposed therein and a bottom wall, having at least one upwardly extending nub 92 rising more than one key blank thickness on which a key holding container 78 may be disposed, with a slot 81 centrally disposed along a portion thereof extending continuously from the passage disposed in the front wall through which a key blank may be withdrawn, as shown in FIG. 7. Each of the dispenser cups having its opening aligned in a like direction.

As best shown in FIG. 14 of the drawing, the present invention provides that the dispenser cups 80 are disposed in a spatial array 100 of columns and rows, wherein the columns and rows are arranged orthogonally with each dispenser cup in a row being disposed at a like elevation and with the rows being generally parallel to the proximate front walls thereof. Each row of dispenser cups 80 has a vertically spaced distance from the dispenser cups of an adjacent row, forming a generally uniform stepped relationship therebetween with the dispenser cups of a

-53-

row facing the proximate front walls of the dispenser cups in an adjacent row being at a elevated spaced distance relative thereto. The spaced distance is sufficient to allow the means for grasping to access a key blank from any dispenser cup and to remove same.

5 A preferred embodiment of the invention has at least one key holding container 82 having an opening at the bottom and an opening at the top and a generally uniform vertical cavity disposed therein. The cavity is suitably sized and adapted to hold a stack of horizontally positioned key blanks 78. There is a dispenser cup for each key holding container. The dispenser cups each have an opening at the top suitably sized and adapted to receive a key holding container and a proximate front wall with a passage 86 disposed therein and a bottom wall with a slot 81 centrally disposed along a portion thereof extending continuously from the passage 86 disposed in the front wall. The passage 86 is suitably sized to allow a key blank 78 to be withdrawn horizontally therethrough and has an overhead door 88 disposed thereon. As best shown in FIG. 10 of the drawing, the door 88 has a outwardly projecting contour with a live hinge pivot means 88a and it is arranged and adapted to move between a generally closed position (as shown in FIG. 10) and an open position in which the live hinge pivot means 88a is compressed leaving the passage 86 sufficiently open to permit a key blank 78 to be withdrawn therefrom (as

-54-

shown in FIG. 11). This unique hinged door 88 permits a key blank positioned at the bottom of the stack to be withdrawn and the key blank positioned immediately above the bottom key blank is effectively blocked from moving horizontally by the position of the door 88.

To complete the key making process the identified corresponding key blank 78 is grasped by a key effector 72 and positioned for cutting. As shown in FIG. 13, key cut features are then cut into the key blank using a rotary cutting wheel 102 which allows cuts to be easily made to both edges of the blade, if that is required.

A preferred embodiment of a means for grasping a corresponding key blank comprises a key effector 72 having a base 56, a moveable pin positioning assembly having a pin which is suitably sized and adapted to extend into a hole 94 in the handle of a key blank 78, and a means for clamping.

As best shown in FIG. 8 of the drawing, the present invention provides the pin positioning assembly comprising a footing 84, a pair of upwardly disposed opposing collar members 75, a sleeve 83, and a rod 85 having the pin 89 uprightly and radially disposed on a distal end thereof, each of the opposing collar members 75 comprises: a bottom surface arranged and adapted to be supported on top of the footing 84 and to support the sleeve 83 disposed laterally therebetween, an inwardly directed flange extending from and parallel to

-55-

its upper surface at a spaced distance from each other, each of the flanges extends over the supported sleeve 83 to limit the sleeve from independent upward movement, a proximate side wall, a distal side wall, an interior side wall, and an exterior side wall, each of the side walls having its bottom edge connected to the side edges of a bottom wall and its top edge connected to the side edges of a top surface, respectively. Each of the exterior side wall is co-planar with a lateral side surface of the footing 84, the bottom wall of each of the collar members 75 and its top surface each lie in a horizontal plane, and its side walls each lie in a vertical plane, the interior side wall is arranged and adapted to engage a side exterior wall of the sleeve 83 to limit lateral movement of same. A recess 75b forming an opening in its upper surface suitably sized and adapted to receive a spring 73 and a block 71, and an upwardly extending lip 75a on the distal end of its upper surface, each of the lips 75a on each of the respective collar members lies in a vertical plane and has a space therebetween greater than the lateral width of any of said plurality of key blanks taken across its shoulder and less than the lateral width of any of said plurality of key blanks 78 taken across its handle, a spring 73 and a spring biased block 71 normally exposed from the recess 75b in the upper surface thereof with the top of the block 71 extending higher than the vertical lips 75a and which may be compressed therein

-56-

by the clamping means. As shown in FIG. 12, each block 71 may have a sloped face 71a on the distal side wall to facilitate downward movement of the block 71 when laterally contacted by a key blank 78 being withdrawn.

5 As will be understood by those skilled in the art, the vertical lips 75a shown in the drawing as being flat and both lying in the same vertical plane, may be upraised vertical poles or flat uprising surfaces that are not necessarily co-planar. The one common feature

10 of all such embodiments is the distance between the lips for it is at this proximate area that the lips will contact a selected key blank.

In combination with the key making apparatus described, at least one key blank (see FIG. 20 et al.)

15 having a means for registering adapted to support the key blank against the upwardly extending lips 75a of the key effector 72 is provided. By supporting the means for registering against the upwardly extending lips 75a, the key blank can be uniformly secured to the

20 key effector 72.

As shown in FIG. 20, the means for registering comprises a hip 140 disposed longitudinally between the shoulder 148 and the handle 142 of the key blank. The hip 140 has an upper nub 140a and a mirror image lower

25 nub disposed symmetrically about the longitudinal centerline of the key blank, each nub having a uniform contour with adjacent longitudinal and transverse contact surfaces, said longitudinal contact surface 146

-57-

extends generally longitudinally from the transverse contact surface toward the shoulder and said transverse contact surface emanates in a plane that is perpendicular to the longitudinal centerline of said key blank, each of said longitudinal contact surfaces 146 is disposed at a lateral distance from the longitudinal centerline that is greater than one half of the lateral width of the key blank taken across its shoulder 148. Alternatively, each of the contact surfaces 146 may be disposed at a lateral distance from the longitudinal centerline of the key blank sufficient to allow each of the contact surfaces to simultaneously engage an upwardly extending lip 75a of the respective collar members of the key effector 72. The hip 140 of the key blank is adapted to register the key blank by uniformly supporting it against the upwardly extending lips 75a of the key effector 72.

As shown in FIGS. 20, 20A, 20B, 20C, and 20D, the key blanks disclosed herein are improved key blanks, for use with an automatic key making apparatus having a key effector with upwardly extending lips for grasping a key blank, of the type in which a key blank of generally planar configuration having an elongated blade with a blade tip 150 on one end and a blade butt on the other end, a shoulder 148 extending laterally from the blade butt, a handle 142, and a shank between the shoulder 148 and the handle 142, wherein the improvement comprises a means for registering adapted

-58-

to support the key blank against the upwardly extending lips of the key effector.

5 The means for registering of the improved key blank includes a hip 140 disposed longitudinally between the shoulder and the handle of the key blank. The hip 140 has an upper nub 140a and a mirror image lower nub disposed symmetrically about the longitudinal centerline of the key blank. Each nub having a uniform contour with adjacent longitudinal and transverse
10 contact surfaces, said longitudinal contact surface extends generally longitudinally from the transverse contact surface toward the shoulder and said transverse contact surface emanates in a plane that is perpendicular to the longitudinal centerline of said
15 key blank, and each of said longitudinal contact surfaces is disposed at a lateral distance from the longitudinal centerline that is greater than one half of the lateral width of the key blank taken across its shoulder. Note that the improvements disclosed can be
20 employed with any kind of handle and any kind of blade, only the hip 140 criteria must be uniform.

 In another preferred embodiment, the means for registering comprises a hip 140 disposed longitudinally between the shoulder 148 and the handle 142 of the key
25 blank, where the hip 140 has an upper nub 140a and a mirror image lower nub disposed symmetrically about the longitudinal centerline of the key blank. Each nub has a uniform contour with a contact surface emanating from

-59-

a plane that is perpendicular to the longitudinal centerline of the key blank, and each of the contact surfaces is disposed at a lateral distance from the longitudinal centerline of the key blank sufficient to
5 allow each of the contact surfaces 146 to simultaneously engage an upwardly extending lip 75a of the respective collar members 75 of the key effector. In this way, the hip 140 of the key blank is adapted to register the key blank by uniformly supporting it
10 against the upwardly extending lips 75a of the key effector 72.

The sleeve 83 has a generally elongated shape with a cylindrical cavity extending longitudinally therein forming openings on each end thereof and a cavity
15 surface arranged and adapted to slidingly secure the rod 85 which may move axially therein. As best shown in FIG. 8, the sleeve 83 further has a slot centrally disposed longitudinally along its upper surface whereby the rod 85 may move axially within the sleeve 83
20 without the upwardly extending pin 89 being impeded.

Referring also to FIG. 6, the rod 85 is axially connected at its proximate end to a first actuable means 68 for providing axial movement and having a diameter slightly smaller than the diameter of the
25 cylindrical cavity of the sleeve 83 so that it may slidingly move axially therein. The top of the upwardly extending pin 89 extending higher than the top of normally exposed spring biased blocks 71. The

-60-

5 springs 73 serve to temporarily hold a key blank 78 in key pressing position prior to clamping and further providing potential energy to discharge the key blank following cutting and the removal of the means for clamping.

10 Referring again to FIG. 8, the footing 84 has the shape of a square prism with a horizontal upper surface, two lateral side walls, and a proximate side wall and a distal side wall and the sleeve is supported by and positioned between the upwardly disposed opposing collar members 75. The upwardly disposed opposing collar members 75 are supported by and attached to the upper surface of the footing 84.

15 As shown in FIG. 6, the means for clamping comprises a clamp 74, connected to a second actuatable means 70 for providing vertical movement, having a bottom wall, two parallel side walls, and a top wall, and having a rectangular aperture 98 bounded by the bottom surface of the top wall, the top surface of the bottom wall and the interior surface of each side wall. The rectangular aperture 98 of the clamp 74 is suitably sized and adapted to encompass the footing 84 and collar members 75 of the pin positioning assembly and move vertically with respect thereto between a first position, in which the bottom surface of the top wall is at a spaced distance above the upwardly extending pin 89, and a second position, in which the lower surface of the top wall is below the upper edge of the

20

25

-61-

upwardly extending lips 75a of the collar members 75 and in operative association with the upper surface of the collar members 75.

As shown in FIG. 5, the base 56 has four subbases including a first subbase 52 having a fixed position and a first system of linear slide motion guides, comprised of at least one linear rail 54 and associated slide 61, disposed thereon, a second subbase 58 engaged to the first system of linear slide motion guides and moveable thereon and having a second system of linear slide motion guides, comprised of at least one linear rail 60 and associated slide 63, disposed thereon, a third subbase 62 engaged to the second system of linear slide motion guides and moveable thereon and having a third system of linear slide motion guides, comprised of at least one linear rail 64 and associated slide 65, disposed thereon, and a fourth subbase 66 engaged to the third system of linear slide motion guides and moveable thereon and having the key effector 72 attached thereto.

The second subbase 58 has a first subbase motor means (not shown in the drawing) to move it along the first system of linear slide motion guides engaging it to the first subbase 52, the third subbase 62 has a second subbase motor means (not shown in the drawing) to move it along the second system of linear slide motion guides engaging it to the second subbase 58, the fourth subbase 66 has a third subbase motor means (not

-62-

shown in the drawing) to move it along the third system of linear slide motion guides engaging it to the third subbase 62. The respective systems of linear slide motion guides are arranged mutually perpendicular, whereby, each of the subbase motor means moves the key effector 72 linearly in a direction perpendicular to the movement effected by the other subbase motor means.

Referring to the illustration in FIG. 6 and details shown in FIGS. 10 and 11, the key effector 72 operably withdraws a key blank 78 from the key dispenser cup 80 by positioning the upwardly extending pin 89 at a spaced distance below and in alignment with a hole 94 in the handle of a corresponding key blank 78 and with the clamp 74 disposed in the first position, as shown in FIG. 10. The key effector 72 is moved up to a point where the pin 89 enters the hole 94 of the bottom key blank 78 in the stack. As the key effector 72 is moved upwardly placing the pin 89 into engagement with the hole 94 in the handle of the corresponding key blank 78, the upper surface of the top wall of the clamp 74 push against the hinged door 88 of the dispenser cup 80 opening the door 88 to allow access for withdrawing the key blank 78, as shown in FIG. 11.

A preferred method comprises actuating at least one subbase motor drive to position a key effector in operative association with a corresponding key blank in response to an identifying signal, actuating a first actuatable means 68 to cause the key effector to withdraw

-63-

the corresponding key blank 78 from a holding means,
actuating a second actuatable means 70 to secure the
corresponding key blank 78 with a clamping means,
actuating at least one subbase motor drive for the
5 means for cutting, actuating at least one subbase motor
drive to position the key effector and the secured
corresponding key blank in operative association with
the means for cutting to cut a new key, actuating the
second actuatable means to release the clamping means,
10 and actuating at least one subbase motor drive to
position the new key for dispensing.

The key effector 72 has a control means
operatively connected to each of the subbase motor
means and to the first and second actuatable means (68
15 and 70, respectively) for withdrawing the corresponding
key blank 78 from the dispenser cup 80 and restraining
the movement of the corresponding key blank 78 with the
clamp 74.

A method for automatically grasping and cutting
20 during the key making process comprises actuating at
least one subbase motor drive, each of said subbase
motor drives being arranged and adapted to move one of
the moveable subbases, to position a key effector 82
having a moveable rod 85 with an upwardly extending pin
25 89 in operative association with a corresponding key
blank 78 in response to an identifying signal,
actuating the first actuatable means 68 to horizontally
move the rod 85 axially to position the upwardly

-64-

extending pin 89 at a spaced distance below and in alignment with a hole 94 in the handle of the corresponding key blank 78, actuating a motor drive to vertically position the pin 89 of the key effector 72 into the hole 94 in the handle of the corresponding key blank 78, actuating the first actuatable means 68 to horizontally draw in the rod 85 axially to withdraw the corresponding key blank 78 from a holding means, actuating the second actuatable means 70 to secure the corresponding key blank 78 with a clamping means, actuating a means for cutting, actuating at least one subbase motor drive to position the key effector and the secured corresponding key blank in operative association with the means for cutting to cut a new key, actuating the second actuatable means 70 to release the clamping means, and actuating at least one subbase motor drive to position the new key for dispensing.

As the key effector pin 89 is pulled back, the key handle passes over the upwardly extending lips 75a of the collar members 75, the clamp 74 is moved 95% down and the pin 89 is moved forward pushing the handle of the key blank 78 forward causing the front of the key handle to engage the upwardly extending lips and a pressure is applied, as shown in FIG. 12.

Approximately fifty pound per square inch of pressure is preferred. Then, the clamp 74 is moved down further until approximately fifty pound per square inch of pressure is exerted on the key blank handle. The key

-65-

blank 78 is now securely clamped.

As shown in FIG. 12, the rod 85 may have a second upwardly extending pin 87 to activate a limit switch 96, which shown in phantom.

5 To insure accuracy in the key cutting operation, a means for indicating the actual position of the key blank relative to the key effector is provided to correct misalignments that may occur.

10 The foregoing method comprises the steps of actuating at least one subbase motor drive to position the key effector and the secured corresponding key blank in operative association with a position indicator to determine the actual position of the key blank relative to the key effector, and producing a
15 positioning signal for correcting alignment between the cutting wheel and the misaligned key blank. The secured key blank is moved over to a position indicator where its is measured at two points. One point near the tip of the key blank and the other near the handle.
20 This information is stored and processed so that when the cuts are made in the key blank 78, the exact alignment of the secured key blank is taken into account. If the key blank is skewed a little, then the cuts can be correspondingly corrected. One such
25 position indicator with a reading range from 0 to 25 millimeters distributed as Fowler Ultra-Digit Mark IV indicator is preferred.

The motors that finitely move the various

-66-

components of the apparatus preferably range from 2 amp to 8 amp and can be servo or stepper motors similar to those manufactured by Anaheim. The motors may be controlled by a motion control board installed on the PC such as those manufactured by NuLOGIC.

As best shown in FIG. 13 of the drawing, the present invention provides a means for cutting key cut features into the corresponding key blank comprises a key cutting wheel 102 rotatable in at least one direction and having at least one anvil 106 adjacent thereto for each rotatable cutting direction. Each anvil 106 has a flat contact surface (104 and 108, respectively) lying in a plane that is perpendicular to a tangent line of the cutting wheel 102. Additionally, the anvil 106 serves to brace the blade of a corresponding key blank 78 disposed flatly on the flat contact surface (104 or 108) thereof by the key effector 72 for cutting and to block movement of the key blank 78 caused by the tangential forces generated by the key cutting wheel 102. As illustrated in FIG. 18, the key effector control means selectively actuates each of the subbase motor means to dispose the blade of the corresponding key blank 78 grasped by the key effector 72 flatly on the flat contact surface (104 or 108) of the anvil 106 and to place selected portions of the key blank 78 in operative cutting relation to the key cutting wheel 102 in response to the identifying signal, whereby key cut features are cut into the key

-67-

blank 78.

The key making apparatus preferably cuts key cut features into the key blank in accordance with the selected lock manufacturer's original key cut codes.

5 These manufacturer original key cut codes are stored in the master pattern memory.

Alternatively, although not the preferred method since it may copy worn, dirty, or damaged aspects of an object key, the identifying signal may further define
10 key cut features of the object key that can be cut into a new key blank.

After cutting the cut key is moved over to a deburring means (basically a knife edge) and the newly cut portion of the key is dragged across the knife edge
15 scrapping off any burrs.

For deburring, the key effector control means selectively actuates each of the subbase motor means to place the key effector in position to deburr - to make physical contact with an object whereby burrs are
20 removed.

After the cutting operation is complete, the key effector control means selectively actuates each of the subbase motor means to place the key effector in position to dispense the new key. In such position the
25 second actuable means is actuated to raise the clamp and the first actuable means is actuated to move the rod proximately to release the new key from contact with the upwardly extending lips.

-68-

By means of a computing means (see FIG. 18), the required object key positioning can be controlled. A computer comprising a first ROM for storing a program controlling the operation of said components and said
5 controlling means, RAM for storing extracted attributes and the position of the object key and various data associated with operation, and a CPU for executing said program and a second ROM for storing the plurality specific key manufacturers' data representing at least
10 master patterns for the plurality of selected key blanks disposed in the key blank dispensers.

In the foregoing disclosure, a preferred means for identifying attributes of an object key, for determining the position of the longitudinal centerline
15 of the object key relative to a light stripe, for controlling the horizontal leveling, for recognizing the object key attributes, for storing such information about the object keys and the plurality of key blanks (master pattern memory), for comparing, and for
20 selecting a corresponding key blank and associated key cut codes, a computing means having an analog/digital signal converter is preferred.

While the current best mode contemplates the use of one computer to serve all controlling and processing
25 functions, individual controllers could easily be employed. A positioning control means is operably connected and responsive to the output signal from the means for determining the position of the object key

-69-

and is operably connected to a means for rotating the transparent section of the pedestal. In this mode, the longitudinal centerline of an object key can be aligned perpendicular to a light stripe projected on to the object key by a light stripe generator and the light stripe generator can be positioned to project a light stripe on to the object key at the location where the grooves begin.

In another preferred embodiment of the invention for automatically making keys a non-contact means for extracting attributes of an object key comprises a light stripe generator which is arranged and adapted to project at least one light stripe obliquely on to an object key and a light receiver is arranged and adapted to receive an image of the projected light stripe reflected from the object key, and a means for identifying attributes relating to key cut codes of an object key that is operably connected and responsive to the output signal from the means for receiving an object image.

It will be obvious to one skilled in the art of image recognition that other methods employing optical character recognition, magnetic resonance imaging, or hologramatic imaging could be utilized. Moreover, an apparatus employing other known light generators and light receivers, could easily be employed.

While this invention has been described in connection with the best mode presently contemplated by

-70-

the inventor for carrying out his invention, the preferred embodiments described and shown are for purposes of illustration only, and are not to be construed as constituting any limitations of the invention. Modifications will be obvious to those skilled in the art, and all modifications that do not depart from the spirit of the invention are intended to be included within the scope of the appended claims.

Furthermore, the purpose of the foregoing abstract is to enable the U.S. Patent and Trademark Office and the public generally, and especially the scientist, engineers and practitioners in the art who are not familiar with patent or legal terms of phraseology, to determine quickly from a cursory inspection the nature and essence of the technical disclosure of the application. The abstract is neither intended to define the invention of the application, which is measured by the claims, nor is it intended to be limiting as to the scope of the invention in any way.

These together with other objects of the invention, along with the various features of novelty which characterize the invention are pointed out with particularity in the claims annexed to and forming a part of this disclosure. For a better understanding of the invention, its operating advantages and the specific objects attained by its uses, reference should be made to the accompanying drawing and descriptive matter in which there is illustrated preferred

-71-

embodiments of the invention.

-72-

What is claimed as being new and desired to be protected is as follows:

1. A key making apparatus comprising:

a means for extracting attributes of an object

5 key; and

a non-fixturing means for establishing an operative positional relationship between an object key and the means for extracting attributes of an object key.

10 2. A key making apparatus comprising:

a non-contact means for extracting laterally exposed attributes of an object key.

3. A key making apparatus comprising:

15 a non-contact means for extracting attributes of an object key; and

a non-fixturing means for establishing an operative positional relationship between an object key and the non-contact means for extracting attributes of an object key.

20 4. The key making apparatus of claim 2, wherein the non-contact means for extracting laterally exposed attributes of an object key comprises:

25 a means for backlighting arranged and adapted to pass light through a transparent section of a supporting means and project an image of an object key positioned thereon;

a means for receiving at least one object image of

-73-

an object key positioned on said transparent section and producing an output signal; and

a means for identifying laterally exposed attributes of an object key that is operably connected and responsive to the output signal of the means for receiving an object image of the object key.

5 5. The key making apparatus of claim 3, wherein the non-contact means for extracting attributes of an object key comprises:

10 a means for backlighting arranged and adapted to pass light through a transparent section of a supporting means and project an image of an object key positioned thereon;

15 a means for receiving at least one object image of an object key positioned on said transparent section and producing an output signal; and

20 a means for identifying attributes of an object key that is operably connected and responsive to the output signal from the means for receiving an object image of the object key.

 6. The key making apparatus of claim 1, wherein the non-fixturing means for establishing an operative positional relationship comprises:

25 a means for supporting an object key having a transparent section on which the object key may be placed, said means for supporting an object key being rotatable;

 a means for backlighting arranged and adapted to

-74-

pass light through the transparent section of the supporting means and project an image of the object key positioned thereon;

5 a means for receiving the object image of the object key and producing an output signal;

a means for determining the position of the longitudinal centerline of the object key relative to a light stripe which may be projected on to the object key by a light stripe generator responsive to the output signal produced by the receiving means;

10

a means for rotating the means for supporting an object key;

an object key positioning control means that is operably connected and responsive to an output signal from the means for determining the position of the object key and that is operably connected to the means for rotating the means for supporting an object key,

15

whereby, the longitudinal centerline of an object key can be aligned perpendicular to a light stripe projected on to the object key by a light stripe generator.

20

7. The key making apparatus of claim 3, wherein the non-fixturing means for establishing an operative positional relationship comprises:

25 a means for supporting an object key having a transparent section on which the object key may be placed, said means for supporting an object key being rotatable;

-75-

a means for backlighting arranged and adapted to pass light through the transparent section of the supporting means and project an image of the object key positioned thereon;

5 a means for receiving the object image of the object key and producing an output signal;

a means for determining the position of the longitudinal centerline of the object key relative to a light stripe which may be projected on to the object key by a light stripe generator responsive to the
10 output signal produced by the receiving means;

a means for rotating the means for supporting an object key;

15 an object key positioning control means that is operably connected and responsive to an output signal from the means for determining the position of the object key and that is operably connected to the means for rotating the means for supporting an object key,

20 whereby, the longitudinal centerline of an object key can be aligned perpendicular to a light stripe projected on to the object key by a light stripe generator.

25 8. The key making apparatus of claim 5, wherein the non-fixturing means for establishing an operative positional relationship comprises:

the means for supporting an object key having a transparent section on which the object key may be placed being rotatable;

-76-

a means for determining the position of the longitudinal centerline of the object key relative to a light stripe which may be projected on the object key by a light stripe generator from the output signal produced by the receiving means;

a means for rotating the means for supporting an object key;

an object key positioning control means that is operably connected and responsive to an output signal from the means for determining the position of the object key and that is operably connected to the means for rotating the means for supporting an object key,

whereby, the longitudinal centerline of an object key can be aligned perpendicular to a light stripe which may be projected on to the object key by a light stripe generator.

9. The key making apparatus of claim 6, wherein the means for supporting an object key further comprises a means for aligning an object key with a horizontal plane.

10. The key making apparatus of claim 7, wherein the means for supporting an object key further comprises a means for aligning an object key with a horizontal plane.

11. The key making apparatus of claim 8, wherein the means for supporting an object key further comprises a means for aligning an object key with a horizontal plane.

-77-

12. The key making apparatus of claim 8, wherein:

a. the non-fixturing means for establishing an operative positional relationship further includes:

the transparent section having a blade
5 section proximate to a handle section,

said handle section being movable vertically from an upper position which is parallel to the plane of the blade section to a lower position at a spaced distance below the plane of the blade section,

10 said handle section being sized and adapted to support the handle of an object key having a blade and a handle,

said blade section being sized and adapted to support the blade of an object key; and

15 b. the means for aligning an object key with a horizontal plane includes:

a horizontal light generator arranged and adapted to project a generally horizontal beam of light immediately above the means for supporting an object
20 key and transverse to the blade of an object key which may be supported on the transparent section thereof;

a horizontal light receiver disposed to receive light from the horizontal light generator that is not obstructed by the blade of an object key
25 disposed on the blade section of the means for supporting an object key, which receiver produces at least one output signal;

a means for adjusting the vertical elevation

-78-

of the handle section of the means for supporting an object key;

5 a horizontal control means that is operably connected and responsive to the output signal from the horizontal light receiver and that is operably connected to the means for adjusting the vertical elevation of the handle section of the means for supporting an object key,

10 whereby, an object key having a handle thickness larger than its blade thickness which is disposed on the transparent section of the means for supporting an object key may be aligned with a horizontal plane by lowering the handle section on which the handle of the object key is supported in
15 response to the output signal generated by the horizontal light receiver arranged to receive light when the blade of said object key is not disposed flatly on said blade section.

20 13. The key making apparatus of claim 12, wherein the means for adjusting the vertical elevation of the handle section of the means for supporting an object key comprises:

25 a linear actuator having a shaft physically connected to the handle section and at least one linear slide disposed vertically for sliding support.

14. The key making apparatus of claim 2, wherein the non-contact means for extracting attributes of an object key comprises:

-79-

a. a light stripe generator arranged and adapted to project at least one light stripe obliquely on to the object key; and

5 b. a means for receiving an object image is arranged and adapted to receive an image of the projected light stripe reflected from the object key, whereby, the laterally protected attributes of the object key can be extracted.

10 15. The key making apparatus of claim 3, wherein the non-contact means for extracting attributes of an object key comprises:

a. a light stripe generator arranged and adapted to project at least one light stripe obliquely on to the object key; and

15 b. a means for receiving an object image is arranged and adapted to receive an image of the projected light stripe reflected from the object key, whereby, the laterally protected attributes of the object key can be extracted.

20 16. The key making apparatus of claim 4, wherein the non-contact means for extracting attributes of an object key comprises:

25 a. a light stripe generator arranged and adapted to project at least one light stripe obliquely on to the object key; and

b. a means for receiving an object image is arranged and adapted to receive an image of the projected light stripe reflected from the object key,

-80-

whereby, the laterally protected attributes of the object key can be extracted.

17. The key making apparatus of claim 12, wherein: a. the non-contact means for extracting attributes of an object key comprises a light stripe generator arranged and adapted to project at least one light stripe obliquely on to the object key disposed on the transparent section; and

b. the means for receiving an object image is arranged and adapted to receive an image of the projected light stripe reflected from the object key, whereby, the laterally protected attributes of the object key be identified by the means for identifying.

18. The key making apparatus of claim 17, wherein the light stripe generator comprises a collimated light source, a disk having a slit, and an convex lens, said disk being positioned between the light source and the lens to project a light stripe.

19. The key making apparatus of claim 17, wherein the light stripe generator comprises a laser producing an array which forms a line projected therefrom.

20. The key making apparatus of claim 17, wherein the means for receiving an object image comprises at least one camera, said camera being a pixel device for oriented fiber optic arrays.

21. The key making apparatus of claim 4, wherein the means for identifying attributes of an object key

-81-

comprises:

a. a pattern recognition means for recognizing a pixel pattern from an object image of the object key, and for producing a series of code signals with respect to each target pixel from the result of said recognition, said code signals defining traits of the recognized pixel pattern for each target pixel, said pixel patterns defining attributes of the object key; and

b. a discrimination means having a pattern memory in which a set of predetermined master patterns is stored, said predetermined master patterns being a plurality of master code signals, said master code signals defining traits of a master pixel pattern, said master pixel pattern defining attributes of a selected manufacturer's key, for comparing the code signals from the pattern recognition means with a corresponding master code signal, and for producing an identifying signal,

said identifying signal defines a corresponding key blank having a hole in the handle thereof with a predetermined master pattern having master code signals that match code signals from the result of the recognition of the pixel pattern of the object key,

whereby, a corresponding key blank matching attributes of a known manufacturer's key may be determined.

-82-

22. The key making apparatus of claim 4, wherein the means for identifying attributes of an object key comprises:

5 a. a pattern recognition means for recognizing an integrated pixel pattern from a plurality of discrete object images of the object key, and for producing a series of code signals with respect to each target pixel from the result of said recognition, said code signals defining traits of the recognized pixel
10 pattern for each target pixel, said integrated pixel pattern defining attributes of the object key; and

b. a discrimination means having a pattern memory in which a set of predetermined master patterns is stored, said predetermined master patterns being a
15 plurality of master code signals, said master code signals defining traits of a master pixel pattern, said master pixel pattern defining attributes of a selected manufacturer's key, for comparing the code signals from the pattern recognition means with a corresponding
20 master code signal, and for producing an identifying signal,

said identifying signal defines a corresponding key blank having a hole in the handle thereof with a predetermined master pattern having
25 master code signals that match code signals from the result of the recognition of the pixel pattern of the object key,

whereby, a corresponding key blank matching

-83-

attributes of a known manufacturer's key may be determined.

23. The key making apparatus of claim 4, wherein the means for identifying attributes of an object key comprises:

a. a pattern recognition means for recognizing at least one object image of the object key, and for producing a series of code signals with respect to each target pixel from the result of said recognition, said code signals defining traits of the recognized pixel pattern for each target pixel, said pixel patterns defining laterally exposed attributes represented on a polyline of a silhouette of the object key; and

b. a discrimination means having a pattern memory in which a set of predetermined master patterns is stored, said predetermined master patterns being a plurality of master code signals, said master code signals defining traits of a master pixel pattern, said master pixel pattern defining laterally exposed attributes of a selected manufacturer's key, for comparing the code signals from the pattern recognition means with a corresponding master code signal, and for producing an identifying signal,

said identifying signal defines a corresponding key blank having a hole in the handle thereof with a predetermined master pattern having master code signals that match code signals from the result of the recognition of the pixel pattern of the

-84-

object key,

whereby, a corresponding key blank matching the outer shape of a known manufacturer's key may be determined.

5 24. The key making apparatus of claim 14, wherein the means for identifying attributes of an object key comprises:

10 a. a pattern recognition means for recognizing a pixel pattern of at least one object image of the object key, and for producing a series of code signals with respect to each target pixel from the result of said recognition, said code signals defining traits of the recognized pixel pattern for each target pixel, said pixel pattern defining laterally protected
15 attributes of the object key resulting from at least one light stripe being projected obliquely on to the blade thereof; and

20 b. a discrimination means having a pattern memory in which a set of predetermined master patterns is stored, said predetermined master patterns being a plurality of master code signals, said master code signals defining laterally protected attributes of a selected manufacturer's key, for comparing the code signals from the pattern recognition means with a
25 corresponding master code signal, and for producing an identifying signal,

said identifying signal defines a corresponding key blank having a hole in the handle

-85-

thereof with a predetermined master pattern having master code signals that match code signals from the result of the recognition of the pixel pattern of the object key,

5 whereby, a key blank corresponding to a manufacturer's key identified with known laterally protected attributes that match the laterally protected attributes of the object key may be determined.

10 25. The key making apparatus of claim 23, wherein:

 a. the pattern recognition means for recognizing a pixel pattern of at least one object image of the object key wherein said pixel pattern defining laterally protected attributes of the object key
15 resulting from at least one light stripe being projected obliquely on to the blade thereof; and

 b. the discrimination means having a pattern memory in which a set of predetermined master patterns is stored, said predetermined master patterns being a
20 plurality of master code signals, said master code signal further defining laterally protected attributes of a selected manufacturer's key, for comparing the code signals from the pattern recognition means with a corresponding master code signal, and for producing an
25 identifying signal,

 said identifying signal defines a corresponding key blank having a hole in the handle thereof with a predetermined master pattern having

-86-

master code signals that match code signals from the result of the recognition of the pixel pattern of the object key,

5 whereby, a key blank corresponding to a manufacturer's key identified with known laterally protected and laterally exposed attributes that match the attributes of the object key may be determined.

10 26. The key making apparatus of claim 21, wherein the identifying signal further defines a key cut code identified with the corresponding key blank,

 whereby, key cuts conforming to the key cut codes of a known manufacturer's key may be determined.

15 27. The key making apparatus of claim 22, wherein the identifying signal further defines a key cut code identified with the corresponding key blank,

 whereby, key cuts conforming to the key cut codes of a known manufacturer's key may be determined.

20 28. The key making apparatus of claim 23, wherein the identifying signal further defines a key cut code identified with the corresponding key blank,

 whereby, key cuts conforming to the key cut codes of a known manufacturer's key may be determined.

25 29. The key making apparatus of claim 25, wherein the identifying signal further defines a key cut code identified with the corresponding key blank,

 whereby, key cuts conforming to the key cut codes of a known manufacturer's key may be determined.

30. The key making apparatus of claim 21, wherein

-87-

the identifying signal further defines key cut features of the object key that correspond generally with key cut codes identified with the corresponding key blank, whereby, the key cut features of the object key may be determined for use with the corresponding key blank.

31. The key making apparatus of claim 25, wherein the identifying signal further defines key cut features of the object key that correspond generally with key cut codes identified with the corresponding key blank, whereby, the key cut features of the object key may be determined for use with the corresponding key blank.

32. The key making apparatus of claim 17, wherein the means for identifying attributes of an object key comprises:

a. a pattern recognition means for recognizing at least one object image of the object key, and for producing a series of code signals with respect to each target pixel from the result of said recognition, said code signals defining traits of the recognized pixel pattern for each target pixel, said pixel patterns defining attributes of the object key; and

b. a discrimination means having a pattern memory in which a set of predetermined master patterns is stored, said predetermined master patterns being a plurality of master code signals, said master code signals defining traits of a master pixel pattern, each

-88-

master pixel pattern defining attributes of a selected manufacturer's key, for comparing the code signals from the pattern recognition means with a corresponding master code signal, and for producing an identifying signal,

said identifying signal defines a corresponding key blank having a hole in the handle thereof and its associated key cut code with a predetermined master pattern having master code signals that match code signals from the result of the recognition of the pixel pattern of the object key,

whereby, a corresponding key blank matching a known manufacturer's key and its associated key cut code may be determined.

33. The key making apparatus as in any one of claims 14, 15, 16, 17, 24, 25, 29, 31, or 32, wherein the non-contact means for extracting attributes of an object key further comprises:

a. an elongated horizontal rail having its longitudinal axis lying perpendicular to the light stripe;

b. a bracket slidably supported by said rail, said bracket supporting the light stripe generator and the means for receiving an image of the light stripe which are attached thereto and in fixed positional relationship with each other; and

c. a means for moving the bracket along the rail, whereby, the light stripe generator and the

-89-

means for receiving an image of the light stripe may move in tandem along the rail and images of the light stripe projected along an object key may be extracted.

34. A method for automatically making keys which comprises:

a. establishing an operative positional relationship between an object key and a means for extracting attributes of an object key while leaving said object key independent of constraint; and

b. extracting attributes of an object key.

35. A method for automatically making keys which comprises extracting laterally exposed attributes of an object key independent of physical contact.

36. A method for automatically making keys which comprises:

a. establishing an operative positional relationship between an object key and a means for extracting attributes of an object key while leaving said object key independent of constraint; and

b. extracting attributes of an object key independent of physical contact.

37. A method for automatically making keys which comprises:

a. establishing an operative positional relationship between an object key and a means for extracting laterally protected attributes of an object key while leaving said object key independent of constraint; and

-90-

b. extracting laterally protected attributes of an object key independent of physical contact.

38. A method for automatically making keys which comprises:

- 5 a. receiving an object key on a transparent section of a means for supporting an object key;
- b. backlighting the object key by passing light through the transparent section of the supporting means and projecting an object image;
- 10 c. receiving at least one object image of the object key;
- d. producing an output signal; and
- e. identifying laterally exposed attributes of the object key responsive to the output signal.

15 39. A method for automatically making keys which comprises:

- a. receiving an object key on a rotatable means for supporting an object key having a transparent section;
- 20 b. backlighting the object key by passing light through the transparent section of the supporting means and projecting an object image;
- c. receiving at least one object image of the object key;
- 25 d. determining from the object image the position of the longitudinal centerline of the object key in a generally horizontal position relative to a light stripe which may be projected on to the object

-91-

key by a light stripe generator;

e. producing an output signal corresponding to said determination; and

5 f. rotating the means for supporting an object key for alignment with a line perpendicular to a light stripe which may be projected on to the object key by a light stripe generator.

10 40. A method for automatically making keys which comprises aligning an object key with a horizontal plane.

41. A method for automatically making keys which comprises the steps in the order set forth:

15 a. projecting a generally horizontal beam of light immediately above the means for supporting an object key and transverse to a blade of an object key supported on the transparent section thereof, said transparent section having a blade section and an adjacent handle section for a blade and handle, respectively, of an object key;

20 b. receiving the horizontal beam of light which is not obstructed by the blade of an object key disposed on the blade section of the means for supporting an object key and producing at least one output signal;

25 c. incrementally lowering the vertical elevation of the handle section of the means for supporting an object key in relation to said output signal; and

d. repeating sequential steps a, b, and c until

-92-

the light received no longer exceeds a minimum threshold, indicating that the blade of said object key is disposed flatly on the blade section.

5 42. A method for automatically making keys which comprises the sequential steps:

 a. receiving an object key on a rotatable means for supporting an object key having a transparent section;

10 b. backlighting the object key by passing light through the transparent section of the supporting means and projecting an image;

 c. receiving at least one object image of the object key;

15 d. determining from the object image the position of the longitudinal centerline of the object key in a horizontal plane relative to a light stripe projected on to the object key by a light stripe generator;

20 e. producing an output signal corresponding to said determination;

25 f. rotating the means for supporting an object key for alignment with a line perpendicular to a light stripe which may be projected on to the object key by a light stripe generator in relation to said output signal;

 g. projecting a generally horizontal beam of light immediately above the means for supporting an object key and transverse to a blade of an object key

-93-

supported on the transparent section thereof, said transparent section having a blade section and an adjacent handle section for a blade and handle, respectively, of the object key;

5 h. receiving the horizontal beam of light that is not obstructed by the blade of an object key disposed on the blade section of the means for supporting an object key and producing at least one output signal;

10 i. incrementally lowering the vertical elevation of the handle section of the means for supporting an object key in relation to said output signal; and

 j. repeating sequential steps g, h, and i until the light received no longer exceeds a minimum
15 threshold, indicating that the blade of said object key is disposed flatly on the blade section.

43. A method for automatically making keys which comprises:

20 a. projecting at least one light stripe obliquely on to an object key;

 b. receiving an object image of the light stripe of laterally protected attributes of the object key;

 c. recognizing a pixel pattern from said object image;

25 d. producing a series of code signals that define traits of the recognized pixel pattern for each target pixel from the result of said recognition;

 e. comparing the code signals with master code

-94-

signals from a master pattern memory, said master code signals defining traits of a master pixel pattern of a selected manufacturer's key; and

5 f. producing an identifying signal from such comparison, said identifying signal defining a corresponding key blank with a predetermined master pattern having master code signals that match code signals from the result of the recognition of the pixel pattern of the object key.

10 44. A method for automatically making keys which comprises:

a. projecting at least one light stripe obliquely on to an object key;

15 b. receiving an object image of the light stripe of laterally protected attributes of the object key;

c. recognizing a pixel pattern from said object image;

20 d. producing a series of code signals that define traits of the recognized pixel pattern for each target pixel from the result of said recognition;

25 e. comparing the code signals with master code signals from a master pattern memory, said master code signals defining traits of master pixel patterns which define laterally protected attributes of a selected manufacturer's key; and

f. producing an identifying signal from such comparison, said identifying signal defining key cut codes with a predetermined master pattern having master

-95-

code signals that match code signals from the result of the recognition of the pixel pattern of the object key, whereby, key cuts conforming to the key cut codes may be cut in to a corresponding key blank.

5 45. A method for automatically making keys which comprises the sequential steps:

 a. projecting at least one light stripe obliquely on to an object key;

 b. receiving an object image of the light stripe
10 of laterally protected attributes of the object key;

 c. recognizing a pixel pattern from said object image;

 d. producing a series of code signals that define traits of the recognized pixel pattern for each
15 target pixel from the result of said recognition;

 e. comparing the code signals with corresponding master code signals from a master pattern memory, said master code signals defining traits of a master pixel pattern of laterally protected attributes of a selected
20 manufacturer's key; and

 f. producing an identifying signal from such comparison, said identifying signal defining a corresponding key blank with a predetermined master pattern having master code signals that match code
25 signals from the result of the recognition of the pixel pattern of the object key.

 46. A method for automatically making keys which comprises:

-96-

a. receiving an object key on a means for supporting an object key having a transparent section;

b. backlighting the object key by passing light through the transparent section of the supporting means and projecting an image;

c. receiving at least one object image of the object key;

d. recognizing a pixel pattern from said object image;

e. producing a series of code signals that define traits of the recognized pixel pattern for each target pixel from the result of said recognition, said target pixels defining a polyline of laterally exposed attributes of the object key;

f. comparing the code signals with corresponding master code signals from a master pattern memory, each master code signal defining traits of a master pixel pattern of laterally exposed attributes of a selected manufacturer's key;

g. producing an identifying signal from such comparison; and

h. identifying laterally exposed attributes of the object key responsive to the output signal.

47. A method for automatically making keys which comprises:

a. receiving at least one object key on a means for supporting an object key having a transparent section;

-97-

b. backlighting the object key by passing light through the transparent section of the supporting means and projecting an object image;

c. receiving an object image of the object key;

5 d. repositioning the object image receiver;

e. repeating steps b, c, and d;

f. gathering together the plurality of object images and producing at least one integrated output signal; and

10 g. identifying laterally exposed attributes of the object key responsive to the integrated output signal.

48. A method for automatically making keys which comprises:

15 a. backlighting an object key and projecting an object image;

b. receiving an object image of the object key;

c. repositioning the object image receiver;

d. repeating steps a, b, and c;

20 e. gathering together the plurality of object images and producing an integrated object image;

f. recognizing a pixel pattern from said integrated object image;

25 g. producing a series of code signals that define traits of the recognized pixel pattern for each target pixel from the result of said recognition;

h. comparing the code signals with corresponding master code signals from a master pattern memory, each

-98-

master code signal defining traits of a master pixel pattern of laterally exposed attributes of a selected manufacturer's key; and

5 i. producing an identifying signal from such comparison, said identifying signal defining a corresponding key blank with a predetermined master pattern having master code signals that match code signals from the result of the recognition of the pixel pattern of the object key.

10 49. A method for automatically making keys which comprises:

a. projecting a light stripe from a light stripe generator obliquely on to an object key;

15 b. receiving an object image of the light stripe of the object key;

c. repositioning an assembly of the light stripe generator and the object image receiver which are in fixed positional relationship with each other;

d. repeating steps a, b, and c;

20 e. gathering together the plurality of object images and producing an integrated object image;

f. recognizing a pixel pattern from said integrated object image;

25 g. producing a series of code signals that define traits of the recognized pixel pattern for each target pixel from the result of said recognition;

h. comparing the code signals with corresponding master code signals from a master pattern memory, each

-99-

master code signal defining traits of a master pixel pattern of laterally protected attributes of a selected manufacturer's key; and

5 i. producing an identifying signal from such comparison, said identifying signal defining a corresponding key blank with a predetermined master pattern having master code signals that match code signals from the result of the recognition of the pixel pattern of the object key.

10 50. A method for automatically making keys which comprises:

a. projecting a light stripe from a light stripe generator obliquely on to an object key;

15 b. receiving an object images of the light stripe of the object key;

c. varying the exposure time for the object receiver;

d. repeating steps a, b, and c;

20 e. comparing the plurality of object images, discarding any aberrant object images, and producing an optimum object image of the remaining object images;

f. recognizing a pixel pattern from said optimum object images;

25 g. producing a series of code signals that define traits of the recognized pixel pattern for each target pixel from the result of said recognition;

h. comparing the code signals with corresponding master code signals from a master pattern memory, each

-100-

master code signal defining traits of a master pixel pattern of a selected manufacturer's key; and

i. producing an identifying signal from such comparison, said identifying signal defining a corresponding key blank with a predetermined master pattern having master code signals that match code signals from the result of the recognition of the pixel pattern of the object key.

51. A method for automatically making keys which comprises:

a. projecting a light stripe from a light stripe generator obliquely on to an object key;

b. receiving an object image of the light stripe of the object key;

c. varying the exposure time for the object receiver;

d. repeating steps a, b, and c;

e. comparing the plurality of object images, discarding any aberrant object images, and producing an optimum object image of the remaining object images;

f. repositioning an assembly of the light stripe generator and the object image receiver which are in fixed positional relationship with each other;

g. repeating steps a, b, c, d, and e;

h. gathering together the plurality of optimum object images and producing at least one integrated output signal;

i. recognizing a pixel pattern from said

-101-

integrated object images;

j. producing a series of code signals that define traits of the recognized pixel pattern for each target pixel from the result of said recognition;

5 k. comparing the code signals with corresponding master code signals from a master pattern memory, each master code signal defining traits of a master pixel pattern of a selected manufacturer's key; and

10 l. producing an identifying signal from such comparison, said identifying signal defining a corresponding key blank with a predetermined master pattern having master code signals that match code signals from the result of the recognition of the pixel pattern of the object key.

15 52. The method for automatically making keys as in any one of claims 43-51, comprising the following additional steps:

a. selecting a key blank corresponding to said identifying signal from a plurality of key blanks;

20 b. grasping said key blank;

c. positioning said key blank for cutting;

d. cutting key cut features into said corresponding key blank to create a new key;

e. deburring said new key; and

25 f. dispensing said new key.

53. A method for automatically making keys which comprises:

a. receiving an object key having a blade and a

-102-

handle on a rotatable means for supporting an object key having a transparent section with a fixed blade section adjacent to a movable handle section;

5 b. backlighting the object key by passing light through the transparent section of the supporting means and projecting an image;

 c. receiving at least one object image of the object key;

10 d. determining from the object image the position of the longitudinal centerline of the object key relative to a light stripe which may be projected on to the object key by a light stripe generator;

 e. producing a first output signal corresponding to said determination;

15 f. rotating the means for supporting an object key for alignment with a line perpendicular to a light stripe which may be projected on to the object key by a light stripe generator in relation to said first output signal;

20 g. projecting a generally horizontal beam of light immediately above the means for supporting an object key and transverse to the blade of the object key supported thereon;

25 h. receiving the light of the horizontal beam that is not obstructed by the blade of an object key disposed on the blade section of the means for supporting an object key and producing at least one second output signal;

-103-

i. incrementally lowering the vertical elevation of the handle section of the means for supporting an object key in relation to said second output signal; and

5 j. repeating sequential steps g, h, and i until the light received no longer exceeds a minimum threshold, indicating that the blade of said object key is disposed flatly on the blade section;

10 k. continue backlighting the object key by passing light through the transparent section of the supporting means and projecting an image;

l. receiving at least one backlit object image of the object key;

15 m. recognizing a pixel pattern from said backlit object image;

20 n. producing a series of primary code signals that define traits of the recognized pixel pattern for each target pixel from the result of said recognition, said target pixels defining a polyline of laterally exposed attributes of the object key;

25 o. comparing the primary code signals relating to outline shape of the polyline with corresponding master code signals from a master pattern memory, each master code signal defining traits of a master pixel pattern relating to the shape of a selected manufacturer's key;

p. producing a first identifying signal from such comparison,

-104-

said first identifying signal defining a corresponding key blank with a predetermined master pattern having master code signals that match code signals from the result of the recognition of the pixel pattern of the object key,

whereby, a corresponding selected manufacturer's key and a corresponding key blank responsive to the first identifying signal may be determined;

q. projecting at least one light stripe obliquely on to an object key disposed on the transparent section, thereby creating an image of laterally protected attributes of said object key;

r. receiving an object image of the light stripe of the laterally protected attributes of the object key;

s. recognizing a pixel pattern from said object image of the light stripe of the laterally protected attributes of the object key;

t. producing a series of secondary code signals that define traits of the recognized pixel pattern for each target pixel from the result of said recognition, said target pixels defining a light stripe of the laterally protected attributes of the object key;

u. comparing each of the secondary code signals with a corresponding master code signal from the master pattern memory, said master code signals defining traits of a master pixel pattern relating to the

-105-

laterally protected attributes of the selected manufacturer's key;

v. producing a second identifying signal from such comparison, said second identifying signal
5 defining that the corresponding key blank with a predetermined master pattern having master code signals matches the secondary code signals from the result of the recognition of the pixel pattern of the laterally protected attributes of the object key;

10 w. comparing the primary code signals relating to laterally exposed key cut features of the polyline with the master code signal from the master pattern memory, said master code signals defining traits of a master pixel pattern of key cut codes of the selected
15 manufacturer's key;

x. producing a third identifying signal from such comparison, said third identifying signal defining a key cut code of the selected manufacturer's key with a predetermined master pattern having master code
20 signals that match the primary code signals from the result of the recognition of the pixel pattern of the laterally exposed attributes of the object key,

whereby, the key cut code of the object key is identified and the corresponding key blank is
25 confirmed, in response to the third identifying signal;

y. selecting the corresponding key blank from a plurality of key blanks from said identifying signal;

z. grasping said key blank;

-106-

aa. positioning said key blank for cutting; and
ab. cutting key cut features into said key blank
to create a new key.

5

54. A method for automatically making keys which
comprises:

10

a. selecting a corresponding key blank from a
plurality of key blanks in response to an identifying
signal;
b. grasping said key blank;
c. positioning said key blank for cutting; and
d. cutting key cut features into said key blank
in accordance with the lock manufacturer's original key
cut features to create a new key.

15

55. A method for automatically making keys which
comprises:

20

a. actuating at least one subbase motor drive to
position a key effector in operative association with a
corresponding key blank in response to an identifying
signal;

b. actuating a first actuatable means to cause the
key effector to withdraw the corresponding key blank
from a holding means;

c. actuating a second actuatable means to secure
the corresponding key blank with a clamping means;

25

d. actuating at least one subbase motor drive
for a means for cutting;

e. actuating at least one subbase motor drive to
position the key effector and the secured corresponding

-107-

key blank in operative association with the means for cutting to cut a new key;

f. actuating the second actuatable means to release the clamping means; and

5 g. actuating at least one subbase motor drive to position the new key for dispensing.

56. A method for automatically making keys which comprises:

10 a. receiving at least one object image of an object key;

b. recognizing a pixel pattern from said object image;

15 c. producing a series of code signals that define traits of the recognized pixel pattern for each target pixel from the result of said recognition, said target pixels defining attributes of the object key;

20 d. comparing the primary code signals with corresponding master code signals from a master pattern memory, each master code signal defining traits of a master pixel pattern of attributes of a selected manufacturer's key;

25 e. producing a rejection signal from such comparison, said rejection signal defining a lack of master code signals matching the primary code signals from the result of said recognition of the pixel pattern of the object key; and, in response to said rejection signal:

f. turning on an overhead light and illuminating

-108-

the object key;

g. receiving at least one object image of the illuminated object key and producing a memory signal; and

5 h. storing said memory signal.

57. A method for automatically making keys which comprises:

a. backlighting an object key and projecting an image;

10 b. receiving at least one backlit object image of the object key;

c. recognizing a pixel pattern from said backlit object image;

15 d. producing a series of primary code signals that define traits of the recognized pixel pattern for each target pixel from the result of said recognition, said target pixels defining a polyline of laterally exposed attributes of the object key;

20 e. comparing the primary code signals relating to the outline shape of the polyline with corresponding master code signals from a master pattern memory, each master code signal defining traits of a master pixel pattern of the shape of a selected manufacturer's key;

25 f. producing a first rejection signal from such comparison, said rejection signal defining a lack of corresponding master code signals matching the primary code signals from the result of said recognition of the pixel pattern of the object key; and, in response to

-109-

said first rejection signal:

g. turning on an overhead light and illuminating the object key;

5 h. receiving at least one object image of the illuminated object key and producing first memory signal; and

i. storing said first memory signal.

58. A method for automatically making keys which comprises:

10 a. backlighting an object key and projecting an image;

b. receiving at least one backlit object image of the object key;

15 c. recognizing a pixel pattern from said backlit object image;

d. producing a series of primary code signals that define traits of the recognized pixel pattern for each target pixel from the result of said recognition, said target pixels defining a polyline of laterally exposed attributes of the object key;

20 e. comparing the primary code signals relating to outline shape of the polyline with corresponding master code signals from a master pattern memory, each master code signal defining traits of a master pixel pattern relating to the shape of a selected manufacturer's key;

25 f. producing a first identifying signal from such comparison,

-110-

said first identifying signal defining a corresponding key blank with a predetermined master pattern having master code signals that match code signals from the result of the recognition of the pixel pattern of the object key,

whereby, a corresponding selected manufacturer's key and a corresponding key blank responsive to the first identifying signal may be determined;

g. projecting at least one light stripe on to an object key;

h. receiving an object image of the light stripe of laterally protected attributes of the object key;

i. recognizing a pixel pattern from said object image of the light stripe of the laterally protected attributes of the object key;

j. producing a series of secondary code signals that define traits of the recognized pixel pattern for each target pixel from the result of said recognition, said target pixels defining a light stripe of the laterally protected attributes of the object key;

k. comparing each of the secondary code signals with corresponding master code signals from a master pattern memory, each master code signal defining traits of a master pixel pattern of the laterally protected attributes of the selected manufacturer's key;

l. producing an inquiry signal from such comparison, said inquiry signal defining a lack of

-111-

corresponding master code signals matching the secondary code signals from the result of said recognition of the pixel pattern of the object key; and, in response to said inquiry signal:

5 m. determining whether there may be information on another side of the object key from the master pattern memory relating to the selected manufacturer's key, and producing a rejection signal, said rejection signal defining a lack of information on another side
10 of the object key; and, in response to said rejection signal:

 n. turning on an overhead light and illuminating the object key;

 o. receiving at least one object image of the
15 illuminated object key and producing a memory signal; and

 p. storing said memory signal.

59. A method for automatically making keys which comprises:

20 a. backlighting the object key by passing light through the transparent section of the supporting means and projecting an image;

 b. receiving at least one backlit object image of the object key;

25 c. recognizing a pixel pattern from said backlit object image;

 d. producing a series of primary code signals that define traits of the recognized pixel pattern for

-112-

each target pixel from the result of said recognition,
said target pixels defining a polyline of laterally
exposed attributes of the object key;

5 e. comparing the primary code signals relating
to an outline shape of the polyline with corresponding
master code signals from a master pattern memory, each
master code signal defining traits of a master pixel
pattern of the shape of a selected manufacturer's key;

10 f. producing a first identifying signal from
such comparison, said first identifying signal defining
a corresponding key blank with a predetermined master
pattern having master code signals that match code
signals from the result of the recognition of the pixel
pattern of the object key,

15 whereby, a corresponding selected
manufacturer's key and a corresponding key blank
responsive to the first identifying signal may be
determined; and

20 g. projecting at least one light stripe on to an
object key;

h. receiving an object image of the light stripe
of laterally protected attributes of the object key;

25 i. recognizing a pixel pattern from said object
image of the light stripe of the laterally protected
attributes of the object key;

j. producing a series of secondary code signals
that define traits of the recognized pixel pattern for
each target pixel from the result of said recognition

-113-

of the pixel pattern from said object image of the light stripe of the laterally protected attributes of the object key;

5 k. comparing each of the secondary code signals with corresponding master code signals from a master pattern memory, each master code signal defining traits of a master pixel pattern of the laterally protected attributes of the selected manufacturer's key;

10 l. producing an inquiry signal from such comparison, said inquiry signal defining corresponding master code signals matching the secondary code signals from the result of said recognition of the pixel pattern of the object key; and, in response to said inquiry signal:

15 m. determining whether there may be information on another side of the object key from the master pattern memory relating to the selected manufacturer's key, and producing a restart signal, said restart signal defining further information on another side of
20 the object key; and, in response to said restart signal:

n. providing instructions to flip over the object key; and

o. repeating steps a through k.

25 60. A method for automatically making keys which comprises:

a. backlighting an object key and projecting an image;

-114-

b. receiving at least one backlit object image of the object key;

c. recognizing a pixel pattern from said backlit object image;

5 d. producing a series of primary code signals that define traits of the recognized pixel pattern for each target pixel from the result of said recognition, said target pixels defining a polyline of laterally exposed attributes of the object key;

10 e. comparing the primary code signals relating to outline shape of the polyline with corresponding master code signals from a master pattern memory, each master code signal defining traits of a master pixel pattern relating to the shape of a selected
15 manufacturer's key;

f. producing a first identifying signal from such comparison,

said first identifying signal defining a corresponding key blank with a predetermined master
20 pattern having master code signals that match code signals from the result of the recognition of the pixel pattern of the object key,

whereby, a corresponding selected manufacturer's key and a corresponding key blank
25 responsive to the first identifying signal may be determined;

g. projecting at least one light stripe on to an object key disposed on the transparent section, thereby

-115-

creating an image of laterally protected attributes of said object key;

h. receiving an object image of the light stripe of the laterally protected attributes of the object key;

i. recognizing a pixel pattern from said object image of the light stripe of the laterally protected attributes of the object key;

j. producing a series of secondary code signals that define traits of the recognized pixel pattern for each target pixel from the result of said recognition, said target pixels defining a light stripe of the laterally protected attributes of the object key;

k. comparing each of the secondary code signals with a corresponding master code signal from the master pattern memory, said master code signals defining traits of a master pixel pattern relating to the laterally protected attributes of the selected manufacturer's key;

l. producing a second identifying signal from such comparison, said second identifying signal defining that the corresponding key blank with a predetermined master pattern having master code signals matches the secondary code signals from the result of the recognition of the pixel pattern of the laterally protected attributes of the object key;

m. comparing the primary code signals relating to laterally exposed key cut features of the polyline

-116-

with the master code signal from the master pattern memory, said master code signals defining traits of a master pixel pattern of key cut codes of the selected manufacturer's key;

5 n. producing a rejection signal from such comparison, said rejection signal defining a lack of corresponding master code signals matching the primary code signals from the result of said recognition of the pixel pattern of the object key; and, in response to
10 said rejection signal:

 o. turning on an overhead light and illuminating the object key;

 p. receiving at least one object image of the illuminated object key and producing a memory signal;
15 and

 q. storing said memory signal.

61. The method for automatically making keys as in claim 56, further comprising displaying key reject instructions and opening an access door.

20 62. A method for automatically making keys which comprises:

 a. actuating at least one subbase motor drive to position a key effector having a moveable rod with an upwardly extending pin in operative association with a
25 corresponding key blank in response to an identifying signal;

 b. actuating a first actuatable means to horizontally move the rod axially to position the

-117-

upwardly extending pin at a spaced distance below and in alignment with a hole in the handle of the corresponding key blank;

5 c. actuating a motor drive to position the pin of the key effector vertically into the hole in the handle of the corresponding key blank;

d. actuating the first actuatable means to horizontally draw in the rod axially to withdraw the corresponding key blank from a holding means;

10 e. actuating a second actuatable means to secure the corresponding key blank with a clamping means;

f. actuating a means for cutting;

15 g. actuating at least one subbase motor drive to position the key effector and the secured corresponding key blank in operative association with the means for cutting to cut a new key;

h. actuating the second actuatable means to release the clamping means; and

20 i. actuating at least one subbase motor drive to position the new key for dispensing.

63. The method for automatically making keys in claim 62 comprising actuating at least one subbase motor drive to position the key effector and the secured corresponding key blank in operative
25 association with a position indicator to determine the actual position of the key blank relative to the key effector, and producing a positioning signal for correcting a misalignment.

-118-

64. The key making apparatus of claim 4, wherein the means for identifying attributes of an object key comprises a computing means having an analog/digital signal converter.

5 65. The key making apparatus of claim 5, wherein the means for identifying attributes of an object key comprises a computing means having an analog/digital signal converter.

10 66. The key making apparatus of claim 6, wherein the means for determining the position of the longitudinal centerline of the object key relative to a light stripe comprises a computing means having an analog/digital signal converter.

15 67. The key making apparatus of claim 12, wherein the horizontal control means comprises a computing means having an analog/digital signal converter.

68. The key making apparatus of claim 14, wherein the recognition means comprises a computing means having an analog/digital signal converter.

20 69. The key making apparatus of claim 21, comprising a means for storing a plurality of key blanks, a means for selecting a corresponding key blank from the plurality of key blanks in response to said identifying signal, and a means for grasping a
25 corresponding key blank.

70. The key making apparatus of claim 69, wherein the means for storing a plurality of key blanks comprises:

-119-

a. a plurality of key holding containers, each for holding a stack of like key blanks; and

b. a dispenser cup disposed at the bottom of each key holding container,

5 each of said dispenser cups having an opening at the top suitably sized and adapted to receive a key holding container and having a proximate front wall with a passage disposed therein and a bottom wall with a slot centrally disposed along a portion thereof
10 extending continuously from the passage disposed in said front wall through which a key blank may be withdrawn,

each of said dispenser cups having its opening aligned in a like direction,

15 said dispenser cups being disposed in a spatial array of columns and rows, said columns and rows being arranged orthogonally,

each dispenser cup in a row being disposed at a like elevation, said row being generally parallel to
20 the proximate front walls thereof,

each row of dispenser cups having a vertically spaced distance from the dispenser cups of an adjacent row and forming a generally uniform stepped relationship therebetween with the dispenser cups of a
25 row facing the proximate front walls of the dispenser cups in an adjacent row being at a elevated spaced distance relative thereto, said spaced distance being sufficient to allow the means for grasping to access a

-120-

key blank and to remove same.

71. The key making apparatus of claim 69, wherein the means for storing a plurality of key blanks comprises:

5 a. at least one key holding container having an opening at the bottom and an opening at the top and a generally uniform vertical cavity disposed therein, said cavity being suitably sized and adapted to hold a stack of horizontally positioned key blanks; and

10 b. a dispenser cup for each key holding container, said dispenser cup having a opening at the top suitably sized and adapted to receive a key holding container and having a proximate front wall with a passage disposed therein and a bottom wall with a slot centrally disposed along a portion thereof extending continuously from the passage disposed in said front wall,

15 said passage being suitably sized to allow a key blank to be withdrawn horizontally therethrough and having an overhead door disposed thereon,

20 said door having a outwardly projecting contour with a live hinge pivot means and being arranged and adapted to move between a generally closed position and an open position in which the live hinge pivot means is compressed leaving the passage sufficiently open to permit a key to be withdrawn therefrom,

 whereby, a key blank positioned at the bottom

-121-

of the stack may be withdrawn and the key blank positioned immediately above the bottom key blank is effectively blocked from moving horizontally by said door.

5 72. The key making apparatus of claim 69, wherein the means for grasping comprises a key effector having a base, a moveable pin positioning assembly having a pin which is suitably sized and adapted to extend into a hole in the handle of a key blank, and a means for
10 clamping,

 a. said pin positioning assembly comprises a footing, a pair of upwardly disposed opposing collar members, a sleeve, and a rod having the pin uprightly and radially disposed on a distal end thereof,

15 (1) each of the opposing collar members comprises:

 a bottom surface arranged and adapted to be supported on top of the footing and to support the sleeve disposed laterally therebetween, an inwardly
20 directed flange extending from and parallel to its upper surface at a spaced distance from each other, each of said flanges extends over the supported sleeve to limit the sleeve from independent upward movement,

 a proximate side wall, a distal side wall, an
25 interior side wall, and an exterior side wall, each of the side walls having its bottom edge connected to the side edges of a bottom wall and its top edge connected to the side edges of a top surface, respectively,

-122-

each of the exterior side wall is co-planar
with a lateral side surface of the footing,
the bottom wall of each of the collar members
and its top surface each lie in a horizontal plane, and
5 its side walls each lie in a vertical plane,
the interior side wall is arranged and
adapted to engage a side exterior wall of the sleeve to
limit lateral movement of same,
a recess forming an opening in its upper
10 surface suitably sized and adapted to receive a spring
and a block, and
an upwardly extending lip on the distal end
of its upper surface, each of said lips on each of the
respective collar members lies in a vertical plane and
15 has a space therebetween greater than the lateral width
of any of said plurality of key blanks taken across its
shoulder and less than the lateral width of any of said
plurality of key blanks taken across its handle,
a spring and a spring biased block which are
20 normally exposed from the recess in the upper surface
thereof with the top of said block extending higher
than the vertical lips and which may be compressed
therein by the clamping means;
(2) the sleeve has a generally elongated shape
25 with a cylindrical cavity extending longitudinally
therein forming openings on each end thereof and a
cavity surface arranged and adapted to slidingly secure
the rod which may move axially therein,

-123-

said sleeve further has a slot centrally disposed longitudinally along its upper surface whereby the rod may move axially within the sleeve without the upwardly extending pin being impeded;

5 (3) said rod being axially connected at its proximate end to a first actuable means for providing axial movement and having a diameter slightly smaller than the diameter of the cylindrical cavity of the sleeve so that it may slidably move axially therein;

10 (4) the top of said upwardly extending pin extending higher than the top of normally exposed spring biased blocks;

15 (5) said footing having the shape of a square prism with a horizontal upper surface, two lateral side walls, and a proximate side wall and a distal side wall,

20 said sleeve being supported by and positioned between the upwardly disposed opposing collar members, the upwardly disposed opposing collar members being supported by and attached to the upper surface of the footing,

25 b. the means for clamping comprises a clamp being connected to a second actuable means for providing vertical movement and having a bottom wall, two parallel side walls, and a top wall, and having a rectangular aperture bounded by the bottom surface of the top wall, the top surface of the bottom wall and the interior surface of each side wall,

-124-

said rectangular aperture is suitably sized and adapted to encompass the footing and collar members of the pin positioning assembly and move vertically with respect thereto between a first position, in which the bottom surface of the top wall is at a spaced distance above the upwardly extending pin, and a second position, in which the lower surface of the top wall is below the upper edge of the upwardly extending lips of the collar members and in operative association with the upper surface of the collar members;

c. said base having four subbases including a first subbase having a fixed position and a first system of linear slide motion guides disposed thereon, a second subbase engaged to the first system of linear slide motion guides and moveable thereon and having a second system of linear slide motion guides disposed thereon, a third subbase engaged to the second system of linear slide motion guides and moveable thereon and having a third system of linear slide motion guides disposed thereon, and a fourth subbase engaged to the third system of linear slide motion guides and moveable thereon and having the key effector attached thereto,

the second subbase has a first subbase motor means to move the subbase along the linear slide motion guides engaging it to the first subbase,

the third subbase has a second subbase motor means to move the subbase along the linear slide motion guides engaging it to the second subbase,

-125-

the fourth subbase has a third subbase motor means to move the subbase along the linear slide motion guides engaging it to the third subbase,

the respective linear slide motion guides are arranged mutually perpendicular, whereby, each of said subbase motor means moves the key effector linearly in a direction perpendicular to the movement effected by the other subbase motor means; and

d. said key effector further having control means operatively connected to each of said subbase motor means and to said first and second actuatable means for withdrawing the corresponding key blank from the dispenser cup and restraining the movement of said corresponding key blank with the clamping means.

73. The key making apparatus of claim 72, wherein the key effector with the upwardly extending pin at a spaced distance below and in alignment with a hole in the handle of the corresponding key blank and the clamping means disposed in the first position is arranged and adapted to move the pin into engagement with the hole in the handle of the corresponding key blank as the upper surface of the top wall of the clamping means push against the hinged door of the dispenser cup opening said door to allow access for withdrawing said key blank.

74. The key making apparatus of claim 71, further comprising a means for cutting key cut features into the corresponding key blank to produce a new key.

-126-

75. The key making apparatus of claim 74, wherein the means for cutting key cut features into the corresponding key blank comprises a means for indicating the actual position of the key blank relative to the key effector, whereby misalignments may be corrected.

76. The key making apparatus of claim 74, wherein the means for cutting key cut features into the corresponding key blank comprises a key cutting wheel rotatable in at least one direction and having at least one anvil adjacent thereto for each rotatable cutting direction,

each anvil having a flat contact surface lying in a plane that is perpendicular to a tangent line of said cutting wheel and said anvil further being arranged and adapted to brace the blade of a corresponding key blank disposed flatly on the flat contact surface thereof by the key effector for cutting and to block movement of the key blank caused by the tangential forces generated by the key cutting wheel; and

the key effector control means selectively actuates each of said subbase motor means to dispose the blade of the corresponding key blank grasped by the key effector flatly on the flat contact surface of the anvil and to place selected portions of said key blank in operative cutting relation to said key cutting wheel in response to the identifying signal, whereby key cut

-127-

features are cut into said key blank.

77. The key making apparatus of claim 74, wherein the key cut features cut into the key blank are in accordance with the selected lock manufacturer's original key cut codes, whereby a key having attributes of the selected manufacturer's original key cut codes stored in the master pattern memory are generated.

78. The key making apparatus of claim 74, wherein the key cut features cut into the key blank duplicate those of the object key.

79. The key making apparatus of claim 76, wherein the key effector control means selectively actuates each of the subbase motor means to place the key effector in position to dispense the new key, and wherein the control means actuates the second actuatable means to raise the clamp and the first actuatable means to move the rod proximately to release the new key from contact with the upwardly extending lips, whereby the new key can be dispensed.

80. The key making apparatus of claim 76, further comprising a means for deburring a key, and wherein the key effector control means selectively actuates each of the subbase motor means to place the key effector in position to deburr and dispense the new key, and wherein the control means actuates the second actuatable means to raise the clamp and the first actuatable means to move the rod proximately to release the new key from contact with the upwardly extending lips, whereby the

-128-

new key can be dispensed.

81. A key making apparatus as in one of claims 1, 3-7, 9-11, 14-16, 21-31, 64-66, or 68-80, in which the non-fixturing means for establishing an operative positional relationship comprises:

a. a means for supporting an object key having a transparent section on which the object key may be placed being rotatable,

the transparent section having a blade section proximate to a handle section,

said handle section being movable vertically from an upper position which is parallel to the plane of the blade section to a lower position at a spaced distance below the plane of the blade section,

said handle section being sized and adapted to support the handle of an object key having a blade and a handle,

said blade section being sized and adapted to support the blade of an object key;

b. a means for determining the position of the longitudinal centerline of the object key relative to a light stripe which may be projected on the object key by a light stripe generator from the output signal produced by the receiving means;

c. a means for rotating the means for supporting an object key;

d. an object key positioning control means that is operably connected and responsive to an output

-129-

signal from the means for determining the position of the object key and that is operably connected to the means for rotating the means for supporting an object key,

5 whereby, the longitudinal centerline of an object key can be aligned perpendicular to a light stripe which may be projected on to the object key by a light stripe generator; and

10 e. a means for aligning an object key with a horizontal plane comprising:

15 a horizontal light generator arranged and adapted to project a generally horizontal beam of light immediately above the means for supporting an object key and transverse to the blade of an object key which may be supported on the transparent section thereof;

20 a horizontal light receiver disposed to receive light from the horizontal light generator that is not obstructed by the blade of an object key disposed on the blade section of the means for supporting an object key, which receiver produces at least one output signal;

 a means for adjusting the vertical elevation of the handle section of the means for supporting an object key;

25 a horizontal control means that is operably connected and responsive to the output signal from the horizontal light receiver and that is operably connected to the means for adjusting the vertical

-130-

elevation of the handle section of the means for supporting an object key,

whereby, an object key having a handle thickness larger than its blade thickness which is disposed on the transparent section of the means for supporting an object key may be aligned with a horizontal plane by lowering the handle section on which the handle of the object key is supported in response to the output signal generated by the horizontal light receiver arranged to receive light when the blade of said object key is not disposed flatly on said blade section.

82. The key making apparatus of claim 6, wherein the non-contact means for extracting attributes of an object key comprises:

a. a light stripe generator which arranged and adapted to project at least one light stripe obliquely on to an object key;

b. a means for receiving an object image is arranged and adapted to receive an image of the projected light stripe reflected from the object key; and

c. a means for identifying attributes relating to key cut codes of an object key that is operably connected and responsive to the output signal from the means for receiving an object image.

83. The key making apparatus of claim 21, wherein the non-contact means for extracting attributes of an

-131-

object key comprises:

a. a means for storing memory data of rejected object keys that do not have corresponding master code signals matching the code signals from the result of said recognition of the pixel pattern of the object key,

whereby, the key making apparatus may acquire additional information about keys that are not as yet available in its master pattern memory.

84. A method for automatically making keys which comprises:

a. projecting a generally horizontal beam of light immediately above a means for supporting an object key and transverse to the blade of the object key supported thereon;

b. receiving the light of the horizontal beam that is not obstructed by the blade of an object key disposed on the blade section of the means for supporting an object key and producing at least one output signal;

c. incrementally lowering the vertical elevation of the handle section of the means for supporting an object key in relation to said second output signal; and

d. repeating sequential steps a, b, and c, a specified number of times;

e. producing a non-existent key rejection signal from such specified number of repetitions, said non-

-132-

existent key rejection signal defining a lack of an object key blocking the light reception, indicating that the object key was not disposed on the supporting means; and, in response to said non-existent key rejection signal:

f. turning on an overhead light, displaying instructions, and opening an access door.

85. In the key making apparatus of claim 72, including at least one key blank having a means for registering adapted to support the key blank against the upwardly extending lips of the key effector, whereby the key blank can be uniformly secured to said key effector.

86. The key making apparatus of claim 85, wherein the means for registering comprises a hip disposed longitudinally between the shoulder and the handle of the key blank, said hip having an upper nub and a mirror image lower nub disposed symmetrically about the longitudinal centerline of the key blank, each nub having a uniform contour with adjacent longitudinal and transverse contact surfaces, said longitudinal contact surface extends generally longitudinally from the transverse contact surface toward the shoulder and said transverse contact surface emanates in a plane that is perpendicular to the longitudinal centerline of said key blank, each of said longitudinal contact surfaces is disposed at a lateral distance from the longitudinal

-133-

centerline that is greater than one half of the lateral width of the key blank taken across its shoulder,

whereby the hip of the key blank is adapted to register the key blank by uniformly supporting it against the upwardly extending lips of the key effector.

87. The key making apparatus of claim 85, wherein the means for registering comprises a hip disposed longitudinally between the shoulder and the handle of the key blank, said hip having an upper nub and a mirror image lower nub disposed symmetrically about the longitudinal centerline of the key blank, each nub having a uniform contour with adjacent longitudinal and transverse contact surfaces, said longitudinal contact surface extends generally longitudinally from the transverse contact surface toward the shoulder and said transverse contact surface emanates in a plane that is perpendicular to the longitudinal centerline of said key blank, each of said longitudinal contact surfaces is disposed at a lateral distance from the longitudinal centerline of the key blank sufficient to allow each of said contact surfaces to simultaneously engage an upwardly extending lip of the respective collar members of the key effector,

whereby the hip of the key blank is adapted to register the key blank by uniformly supporting it against the upwardly extending lips of the key effector.

-134-

88. An improved key blank for use with an automatic key making apparatus having a key effector with upwardly extending lips for grasping a key blank of the type, in which a key blank of generally planar configuration having an elongated blade with a blade tip on one end and a blade butt on the other end, a shoulder extending laterally from the blade butt, a handle, and a shank between the shoulder and the handle, wherein the improvement comprises a means for registering adapted to support the key blank against the upwardly extending lips of the key effector, whereby the key blank can be uniformly secured to said key effector.

89. The improved key blank of claim 88, wherein the means for registering comprises a hip disposed longitudinally between the shoulder and the handle of the key blank, said hip having an upper nub and a mirror image lower nub disposed symmetrically about the longitudinal centerline of the key blank, each nub having a uniform contour with adjacent longitudinal and transverse contact surfaces, said longitudinal contact surface extends generally longitudinally from the transverse contact surface toward the shoulder and said transverse contact surface emanates in a plane that is perpendicular to the longitudinal centerline of said key blank, each of said longitudinal contact surfaces is disposed at a lateral distance from the longitudinal centerline that is greater than one half of the lateral

-135-

width of the key blank taken across its shoulder,
whereby the hip of the key blank is adapted to
register the key blank by uniformly supporting it
against the upwardly extending lips of the key
effector.

5

90. The improved key blank of claim 88, wherein
the means for registering comprises a hip disposed
longitudinally between the shoulder and the handle of
the key blank, said hip having an upper nub and a
mirror image lower nub disposed symmetrically about the
longitudinal centerline of the key blank, each nub
having a uniform contour with adjacent longitudinal and
transverse contact surfaces, said longitudinal contact
surface extends generally longitudinally from the
transverse contact surface toward the shoulder and said
transverse contact surface emanates in a plane that is
perpendicular to the longitudinal centerline of said
key blank, each of said longitudinal contact surfaces
is disposed at a lateral distance from the longitudinal
centerline of the key blank sufficient to allow each of
said contact surfaces to simultaneously engage an
upwardly extending lip of the respective collar members
of the key effector,

10

15

20

whereby the hip of the key blank is adapted to
register the key blank by uniformly supporting it
against the upwardly extending lips of the key
effector.

25

91. A key making apparatus comprising a means for

-136-

grasping a key blank having a blade while leaving the blade free of constraint for cutting.

5 92. The key making apparatus of claim 91, wherein the blade has at least one longitudinal cuttable side edge and the side of the blade opposite the cuttable side edge is free of constraint.

10 93. The key making apparatus of claim 92, wherein the key blank further comprises a shank and a handle, and the means for grasping engages a section of the key blank and positions the key blank in operative relationship with a means for cutting the longitudinal cuttable side edge thereof, said section consisting of its handle and its shank, while leaving the opposite side of said blade free of constraint.

15 94. The key making apparatus of claim 92, wherein the key blank further comprises a handle, and the means for grasping engages the handle and positions the key blank in operative relationship with a means for cutting a longitudinal cuttable side edge thereof, while leaving the opposite side of said blade free of constraint.

20 95. The key making apparatus of claim 92, wherein the key blank further comprises a shank, and the means for grasping engages the shank and positions the key blank in operative relationship with a means for cutting a longitudinal cuttable side edge thereof, while leaving the opposite side of said blade free of constraint.

-137-

96. A key making apparatus comprising:

a. a means for grasping a key blank having a blade with two longitudinal cuttable side edges while leaving the blade free of constraint for cutting;

b. a rotary cutting wheel; and

c. a means for moving the means for grasping and the key blank engaged thereto in a face to face cutting relationship between a first longitudinal cuttable side edge of the key blank and a first side of the cutting wheel, whereby cuts are made in the first cuttable side edge of the key blank, for moving the means for grasping and the key blank engaged thereto to position a second longitudinal cuttable side edge of the key blank for cutting, and for moving the means for grasping and the key blank engaged thereto in a face to face cutting relationship between the second longitudinal cuttable side edge of the key blank and the opposite side of the cutting wheel, whereby cuts are made in the second longitudinal cuttable side edge of the key blank.

97. A method for automatically making keys which comprises grasping a key blank having a blade and making cuts in the blade while leaving the blade free of constraint.

98. A method for automatically making keys which comprises grasping a key blank having a blade with at least one longitudinal cuttable side edge and making cuts in a longitudinal cuttable side edge of the blade

-138-

while leaving the opposite side of the blade free of constraint.

5 99. A method for automatically making keys which comprises grasping a key blank having a blade with at least one longitudinal cuttable side edge and a handle, by its handle and making cuts in a longitudinal cuttable side edge thereof while leaving the opposite side of said blade free of constraint.

10 100. A method for automatically making keys which comprises grasping a key blank having a blade with at least one longitudinal cuttable side edge and a shank, by its shank and making cuts in a longitudinal cuttable side edge thereof while leaving the opposite side of said blade free of constraint.

15 101. A method for automatically making keys which comprises grasping a key blank having a blade with at least one longitudinal cuttable side edge, a shank and a handle, by the section of the key blank consisting of its handle and its shank, and making cuts in a
20 longitudinal cuttable side edge thereof while leaving the opposite side of said blade free of constraint.

 102. A method for automatically making keys which comprises:

25 a. cutting, with a first side of a rotary cutting wheel, a first longitudinal cuttable side edge of a key blank having a blade with two longitudinal cuttable side edges while leaving the opposite side of said blade free of constraint; and

-139-

b. cutting the other longitudinal cuttable side edge of the key blank from the opposite side of the cutting wheel while leaving the opposite side of said blade free of constraint.

5 103. A method for automatically making keys which comprises:

a. cutting, with a first side of a rotary cutting wheel, a first longitudinal cuttable side edge of a key blank having a blade with two longitudinal cuttable side edges while leaving the opposite side of said blade free of constraint;

10

b. moving the key blank to position a second longitudinal cuttable side edge in a face to face relationship with the opposite side of the rotary cutting wheel for cutting; and

15

c. cutting, with the opposite side of the rotary cutting wheel, the second longitudinal cuttable side edge of the key blank while leaving the opposite side of said blade free of constraint.

20

104. A method for automatically making keys which comprises:

a. grasping a key blank having a blade with two longitudinal cuttable side edges, a shank and a handle, by the section of the key blank consisting of its handle and its shank;

25

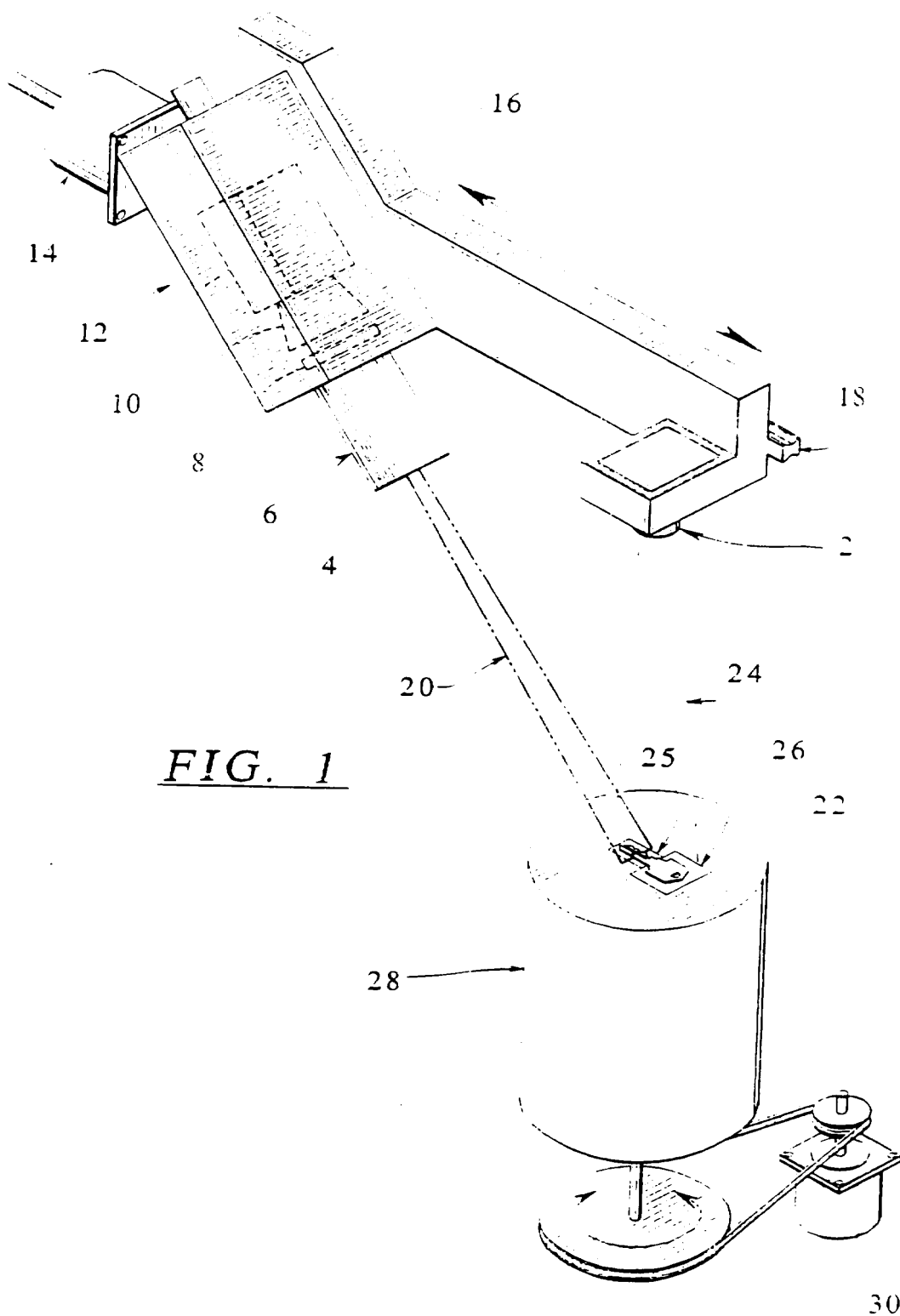
b. cutting, with a first side of a rotary cutting wheel, a first longitudinal cuttable side edge of a key blank while leaving the opposite side of said

-140-

blade free of constraint;

- 5 c. moving the key blank to position a second
 longitudinal cuttable side edge in a face to
 face relationship with the opposite side of
 the cutting wheel; and
- d. cutting, with the opposite side of the
 cutting wheel, the second longitudinal
 cuttable side edge of the key blank while
10 leaving the opposite side of said blade free
 of constraint.

1 / 15



2 / 15

FIG. 2

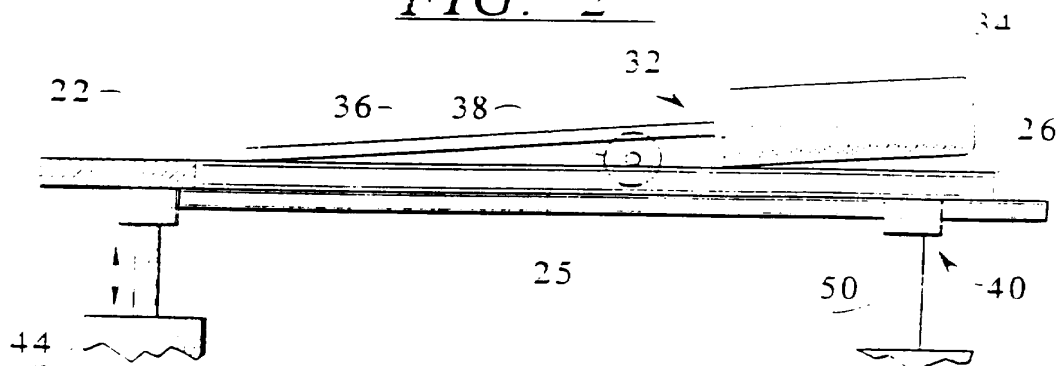


FIG. 3

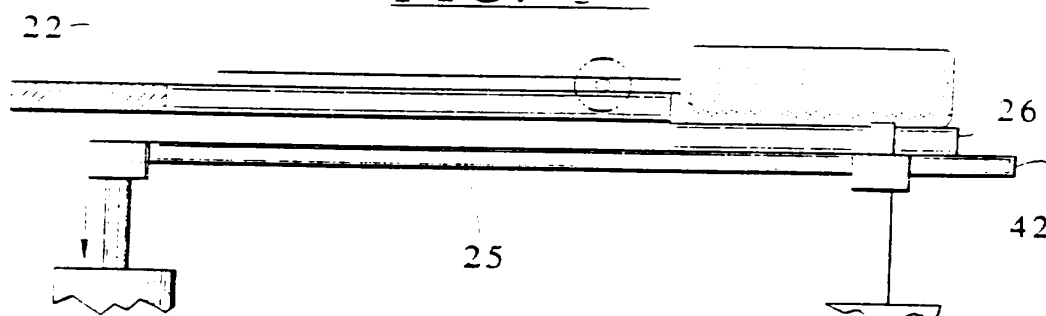


FIG. 19A

FIG. 19

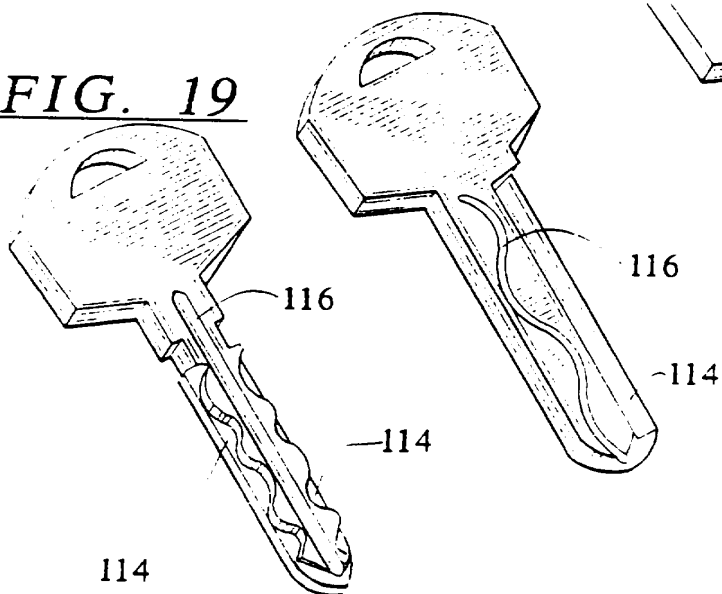
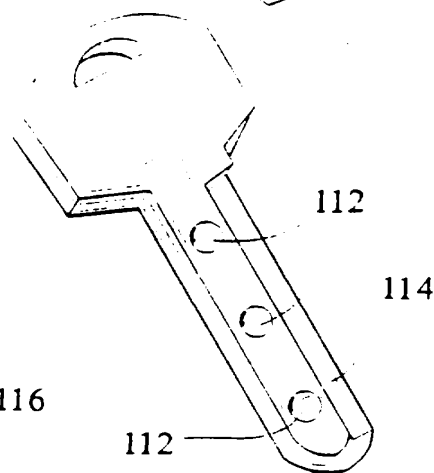
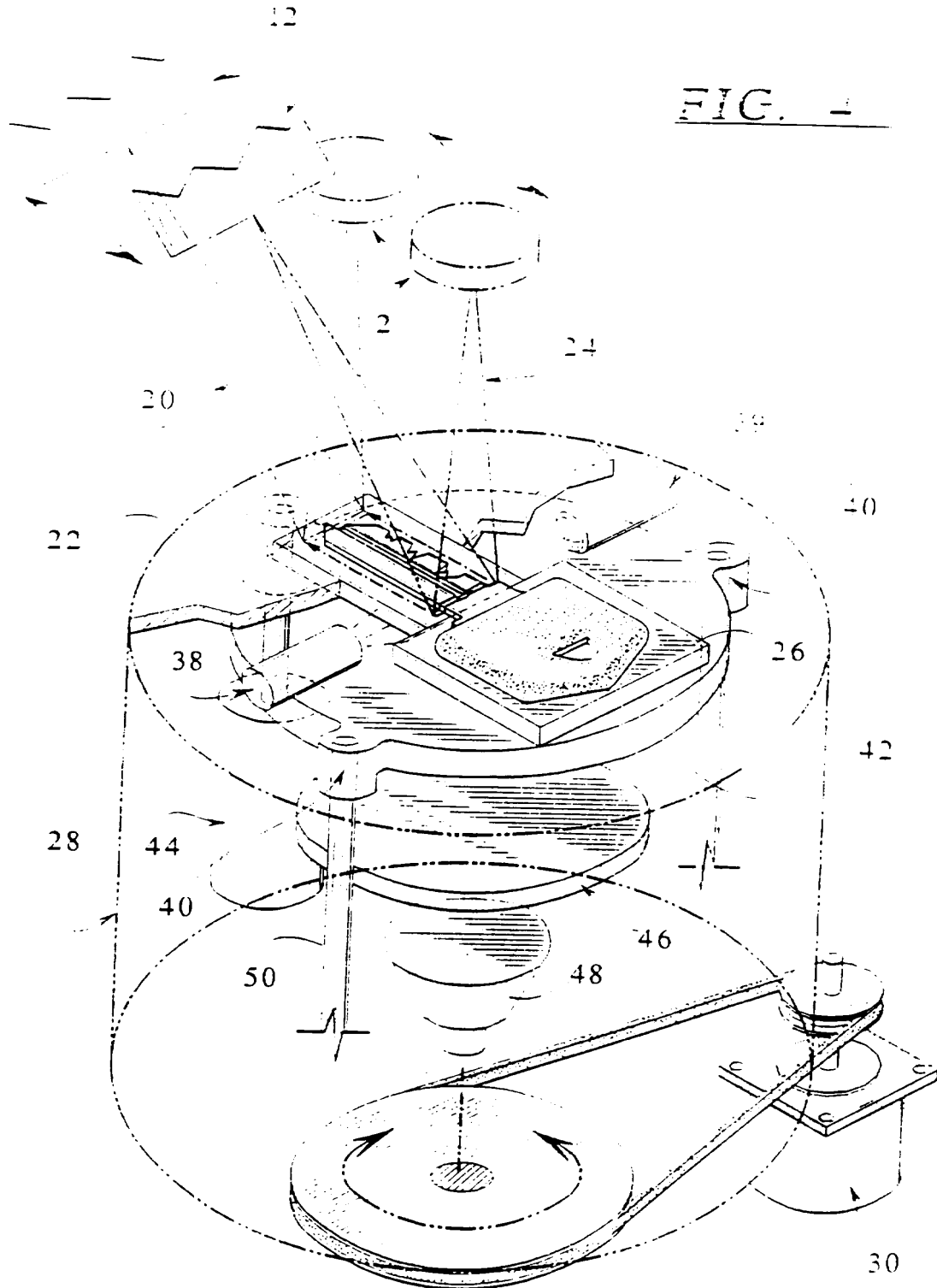


FIG. 19B



3 / 1 5



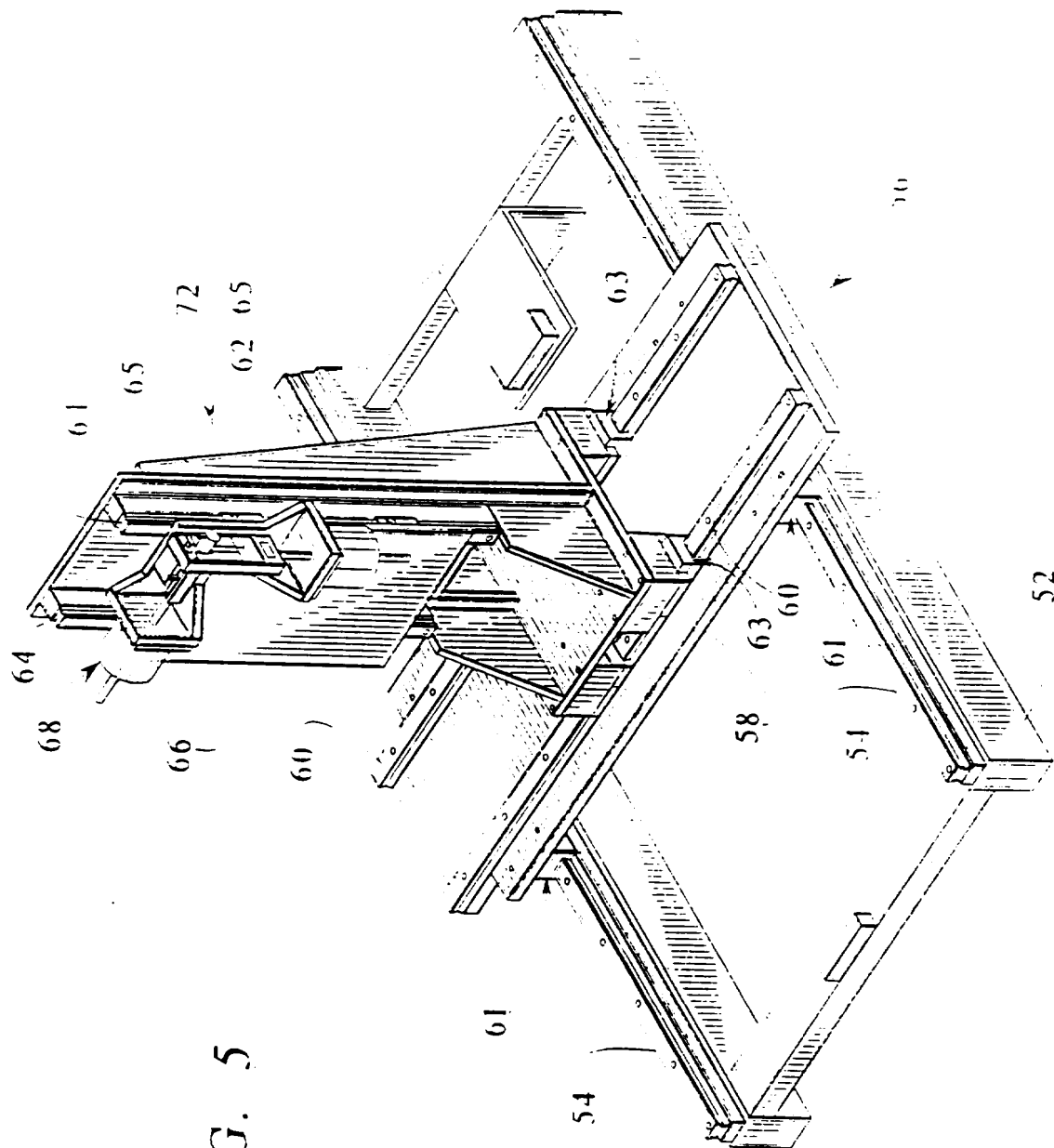
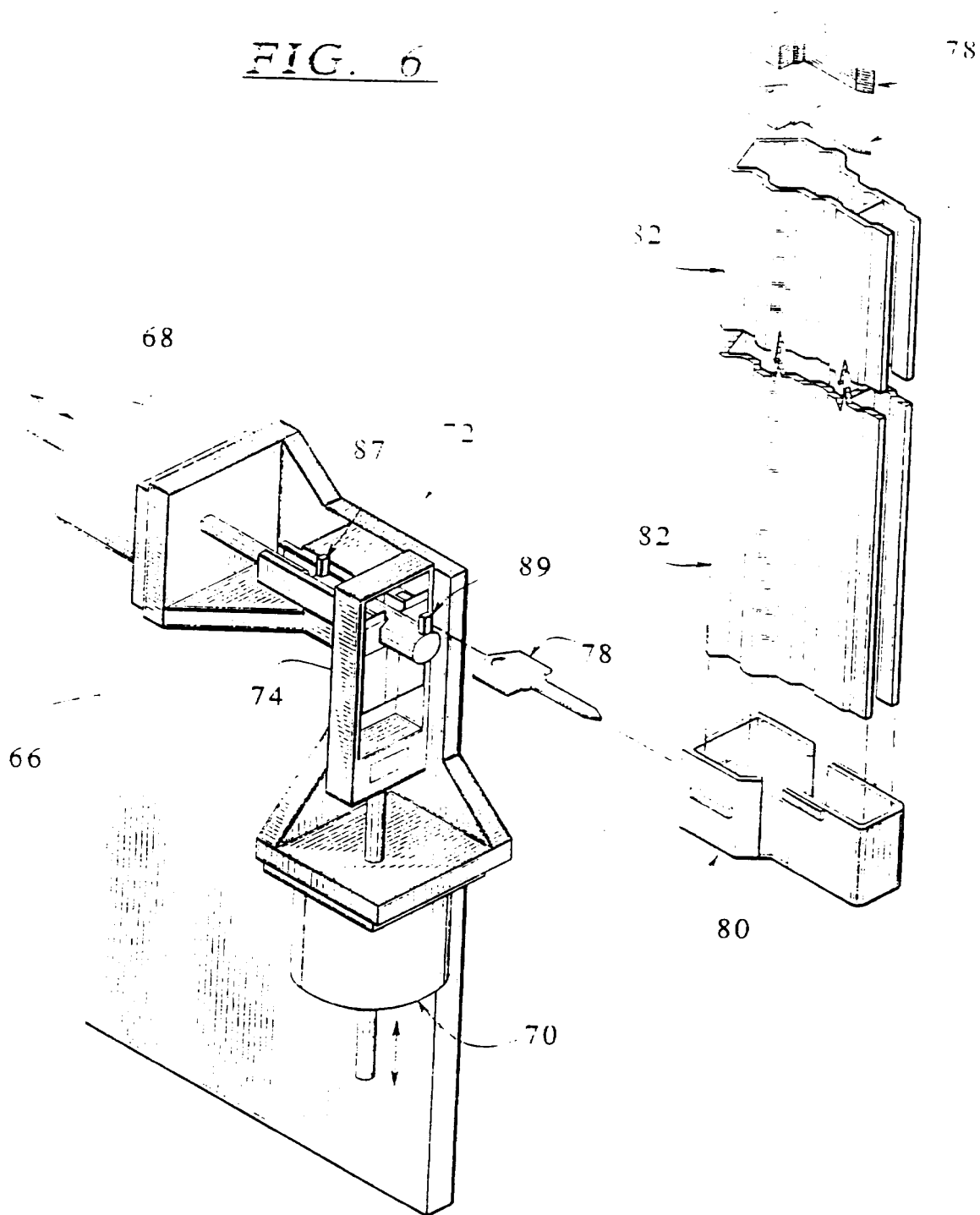


FIG. 5

5 / 1 5

FIG. 6



6 / 15

FIG. 9

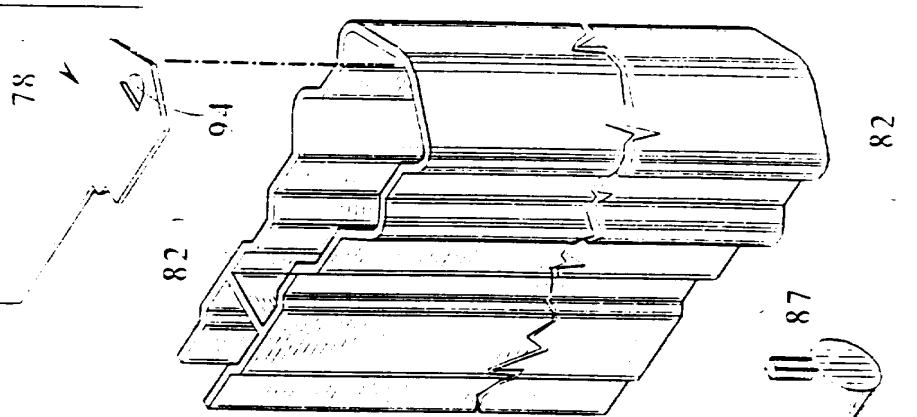


FIG. 8

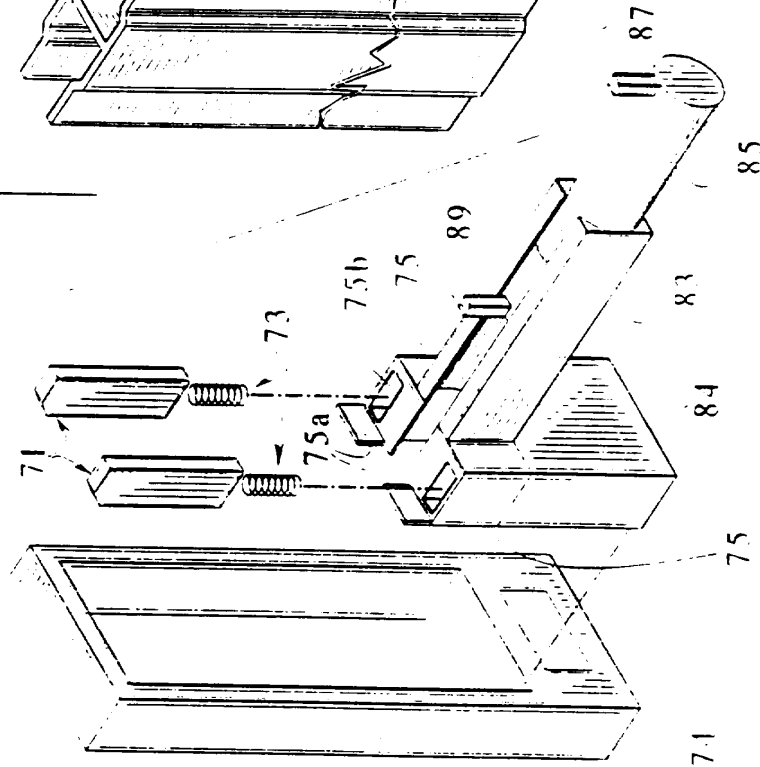


FIG. 7

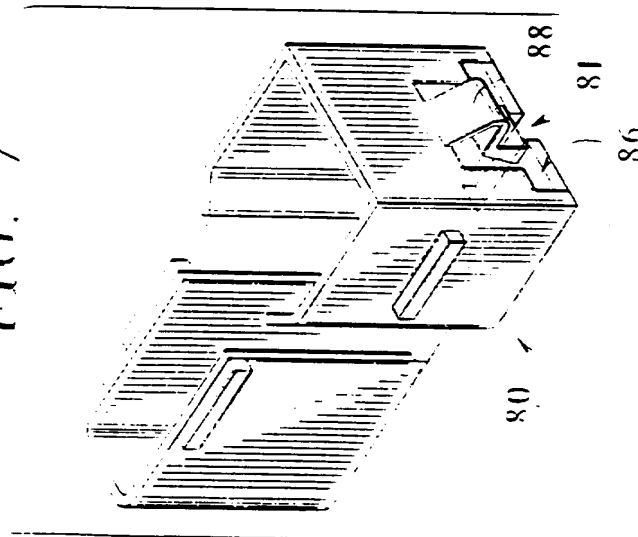


FIG. 10

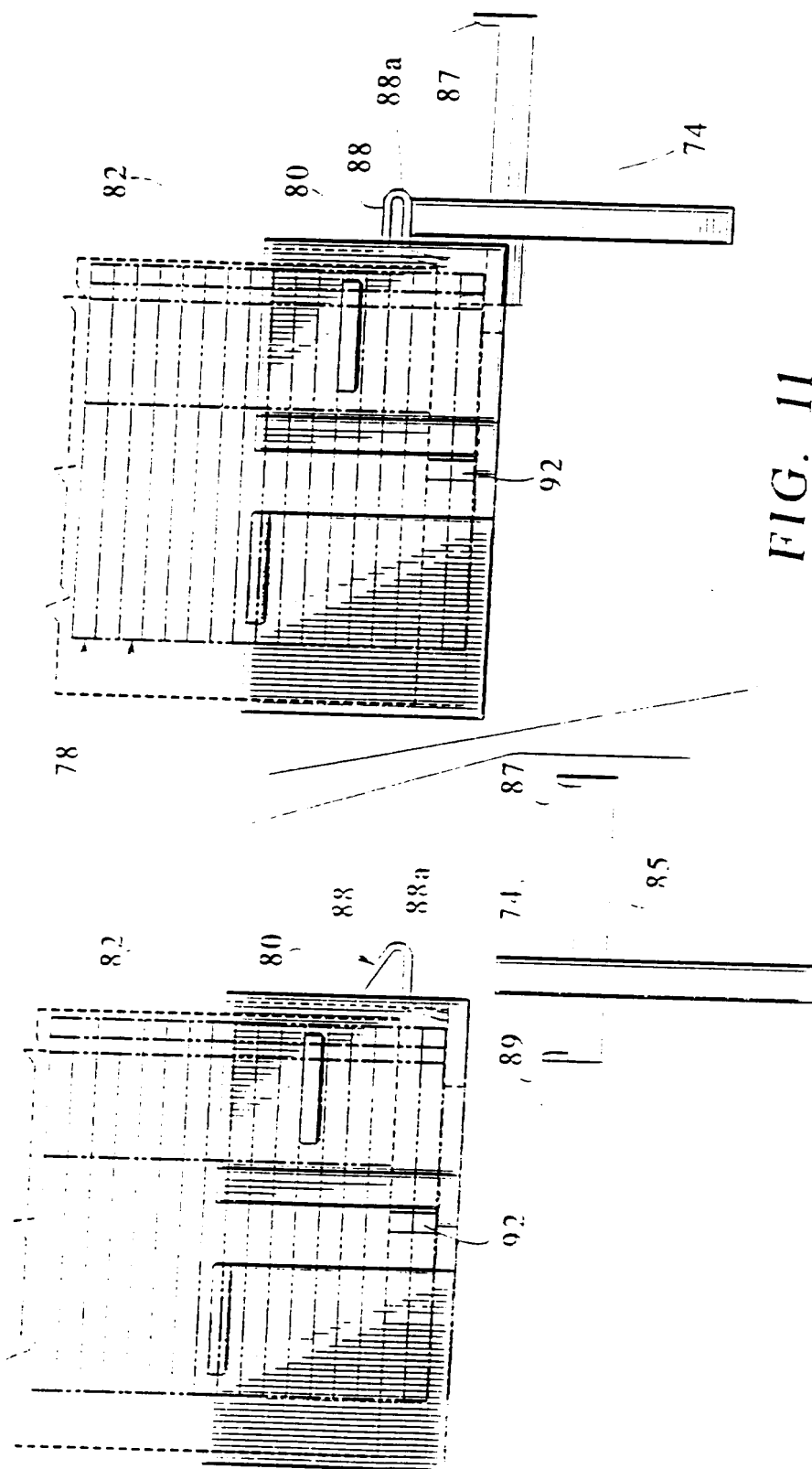
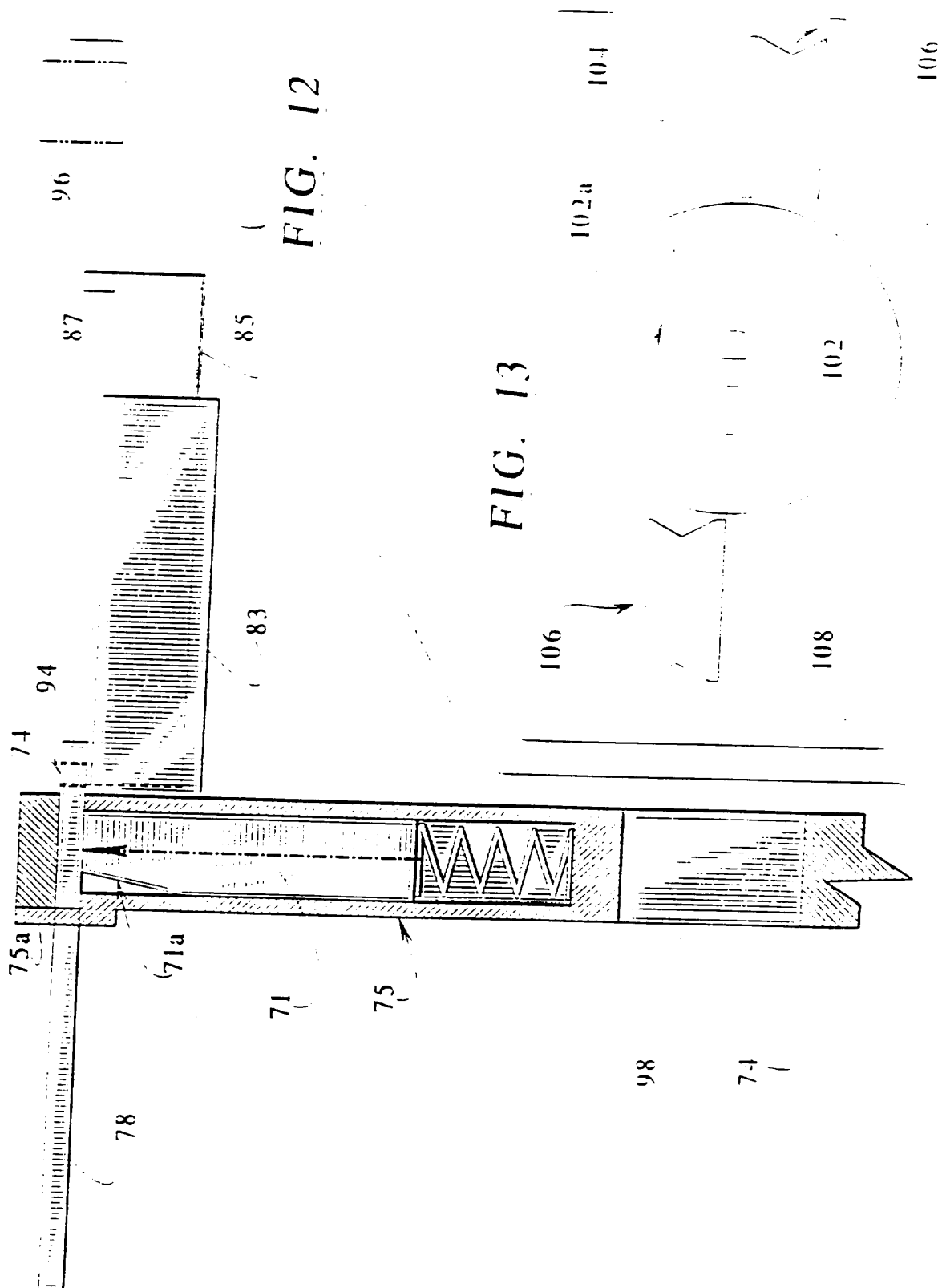


FIG. 11



9 / 1 5

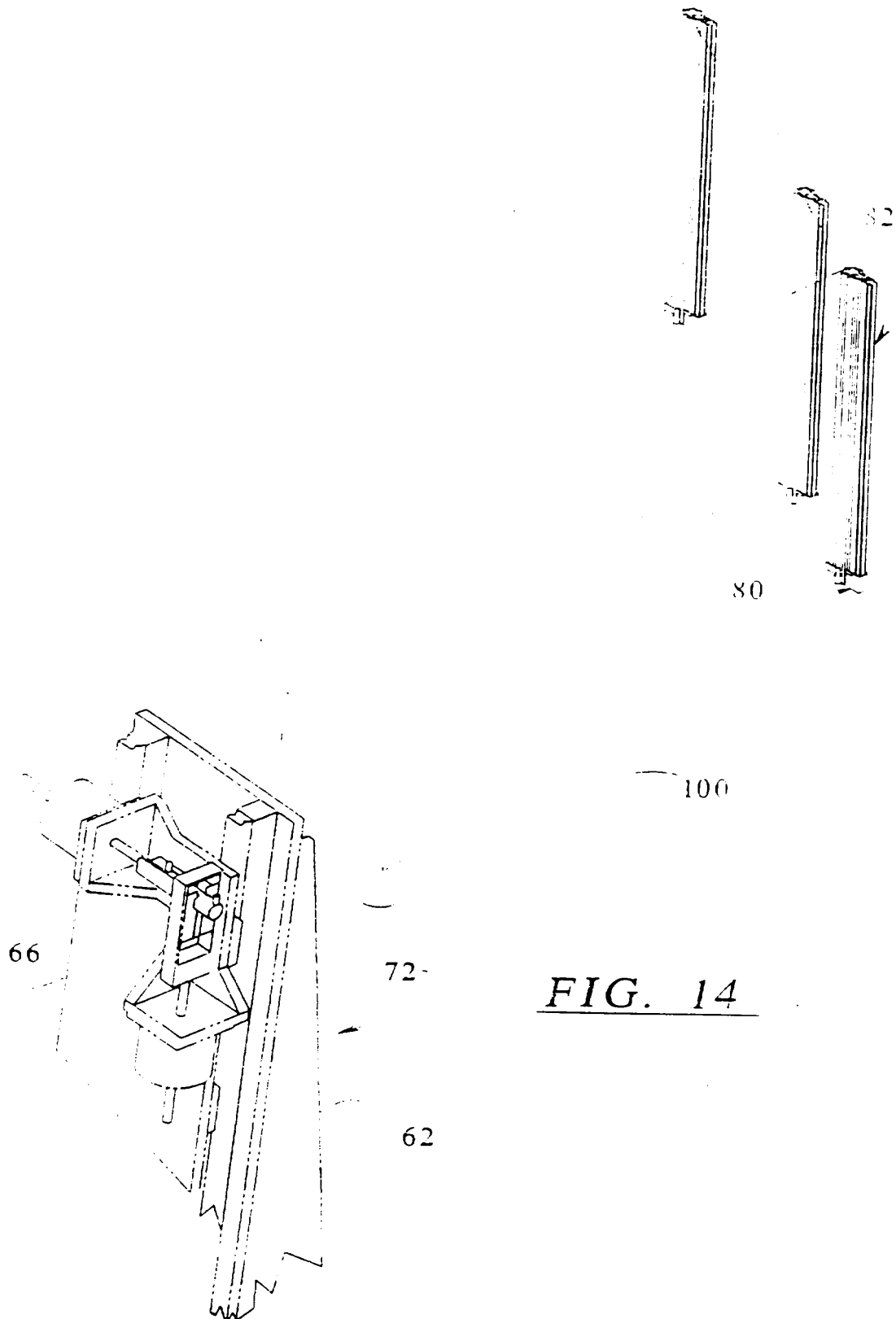


FIG. 16

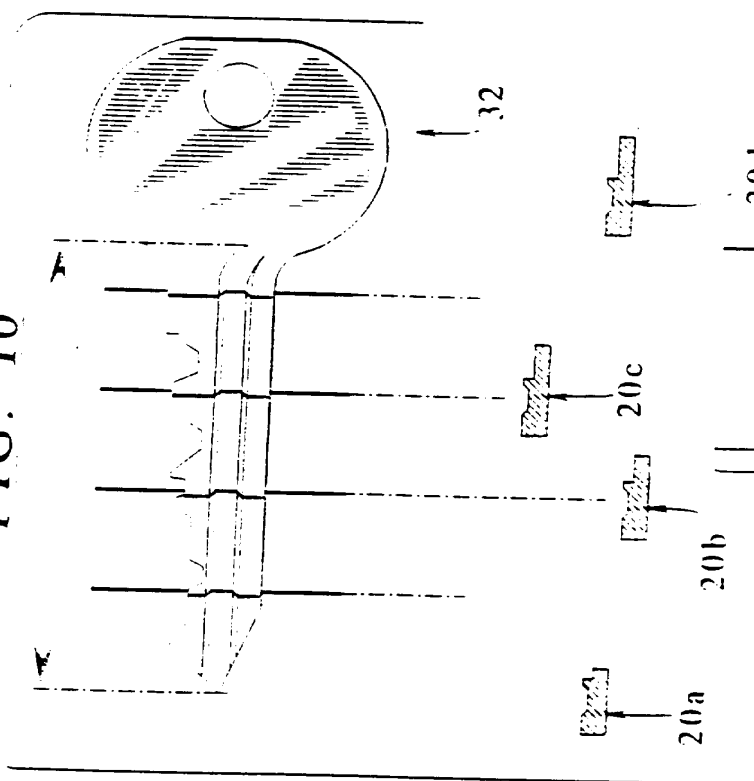


FIG. 15

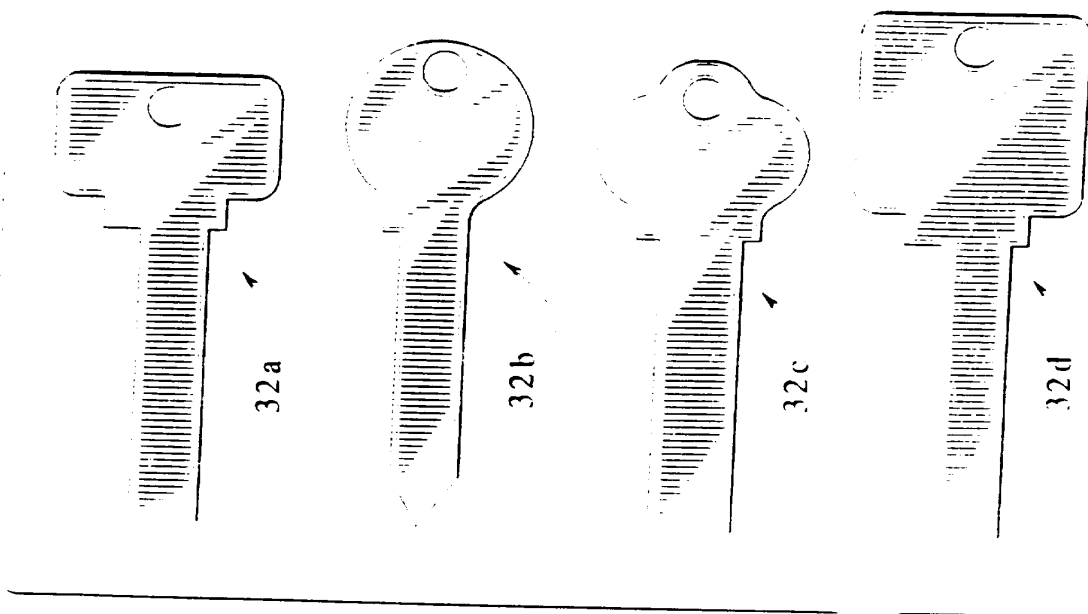


FIG. 17

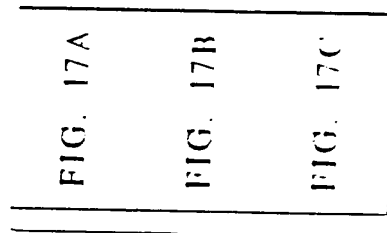
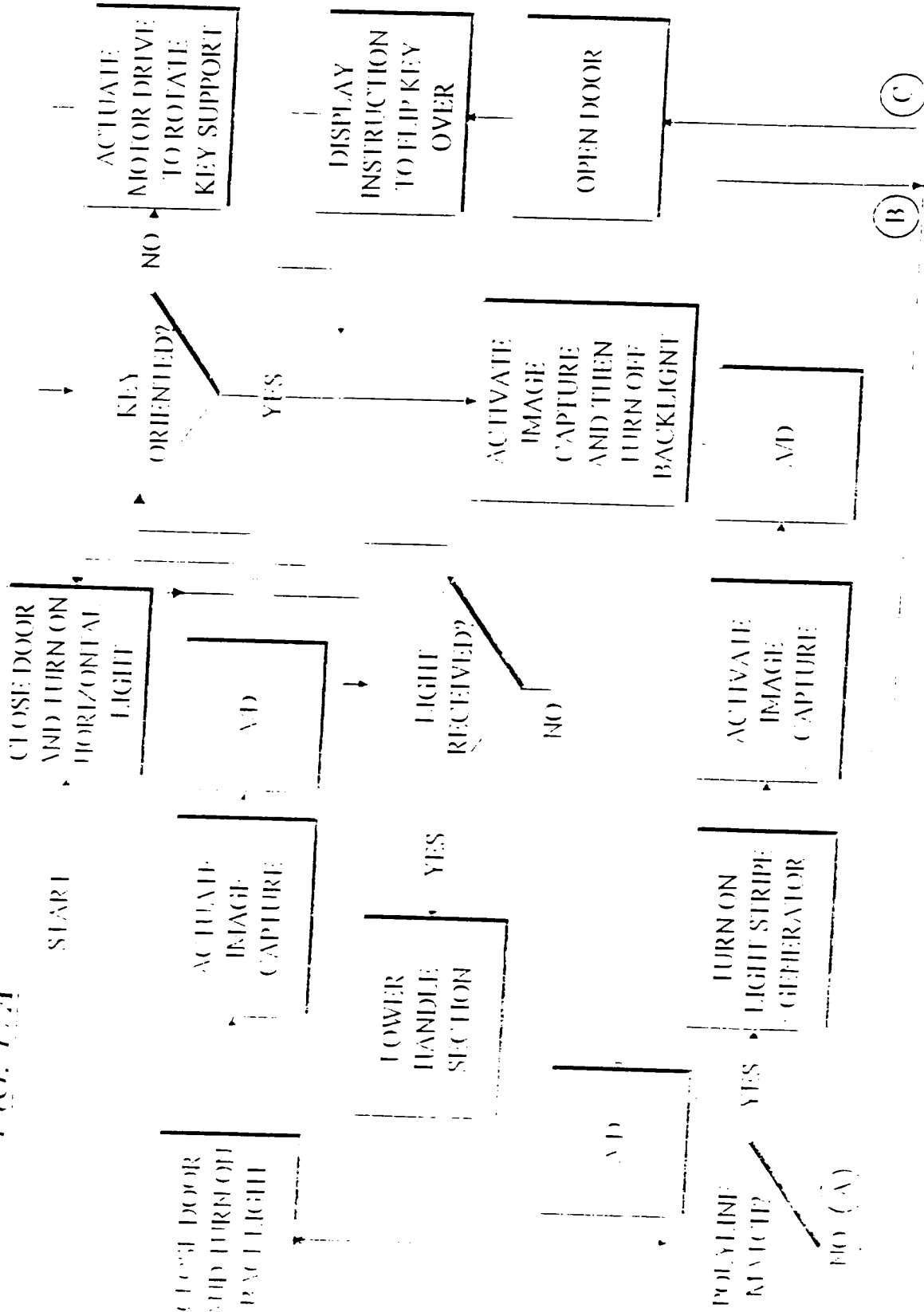
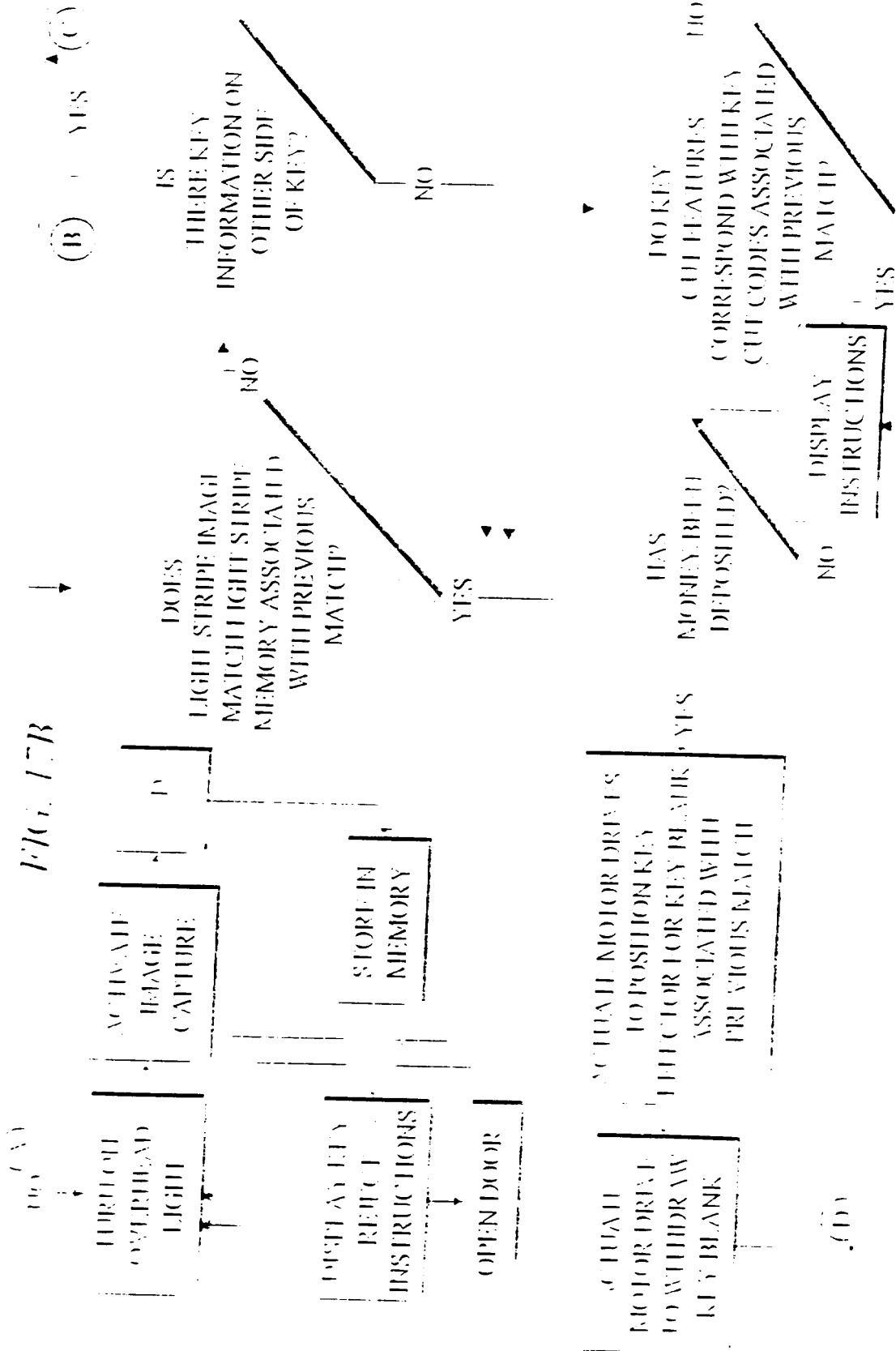


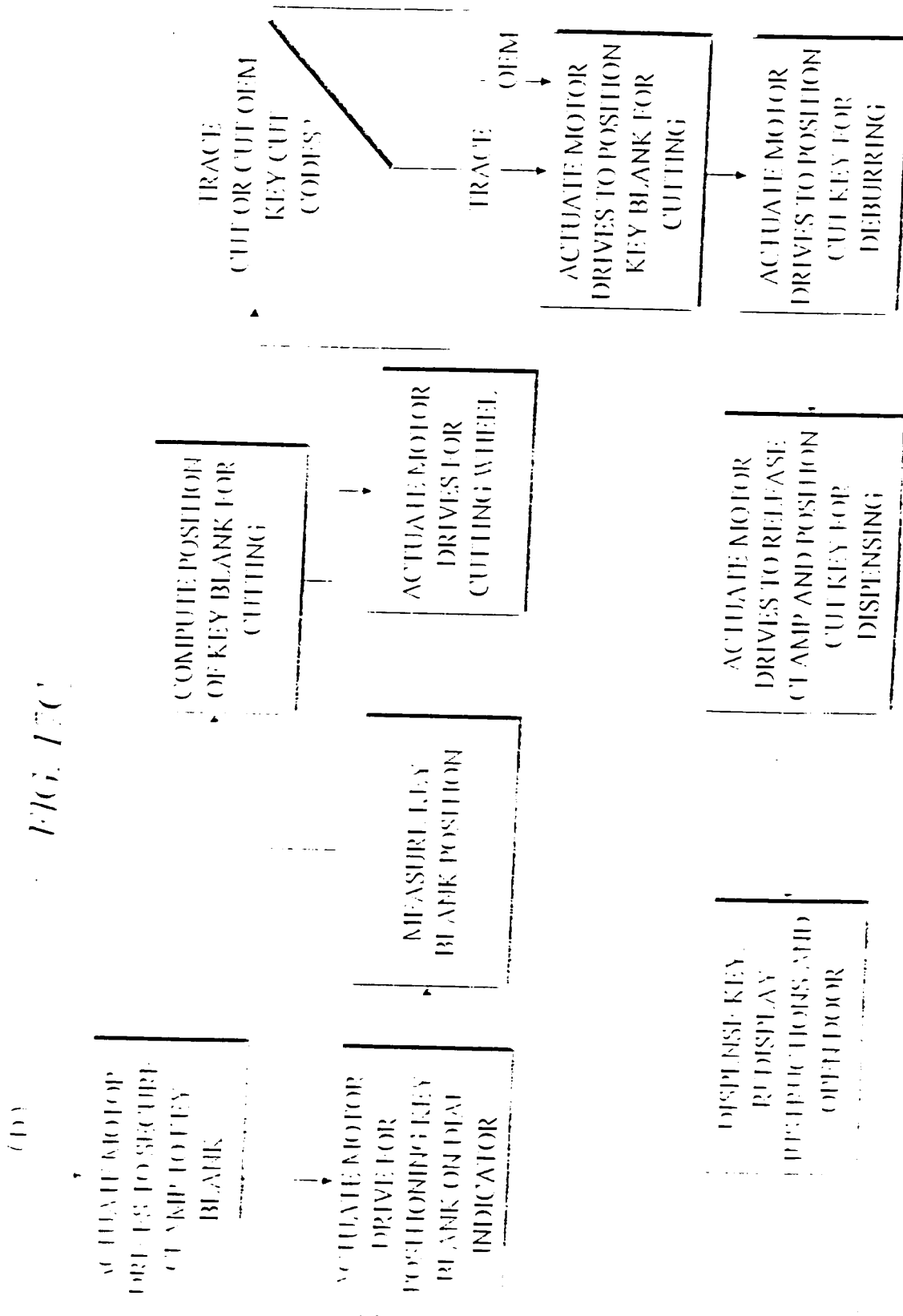
FIG. 17A



12 / 15

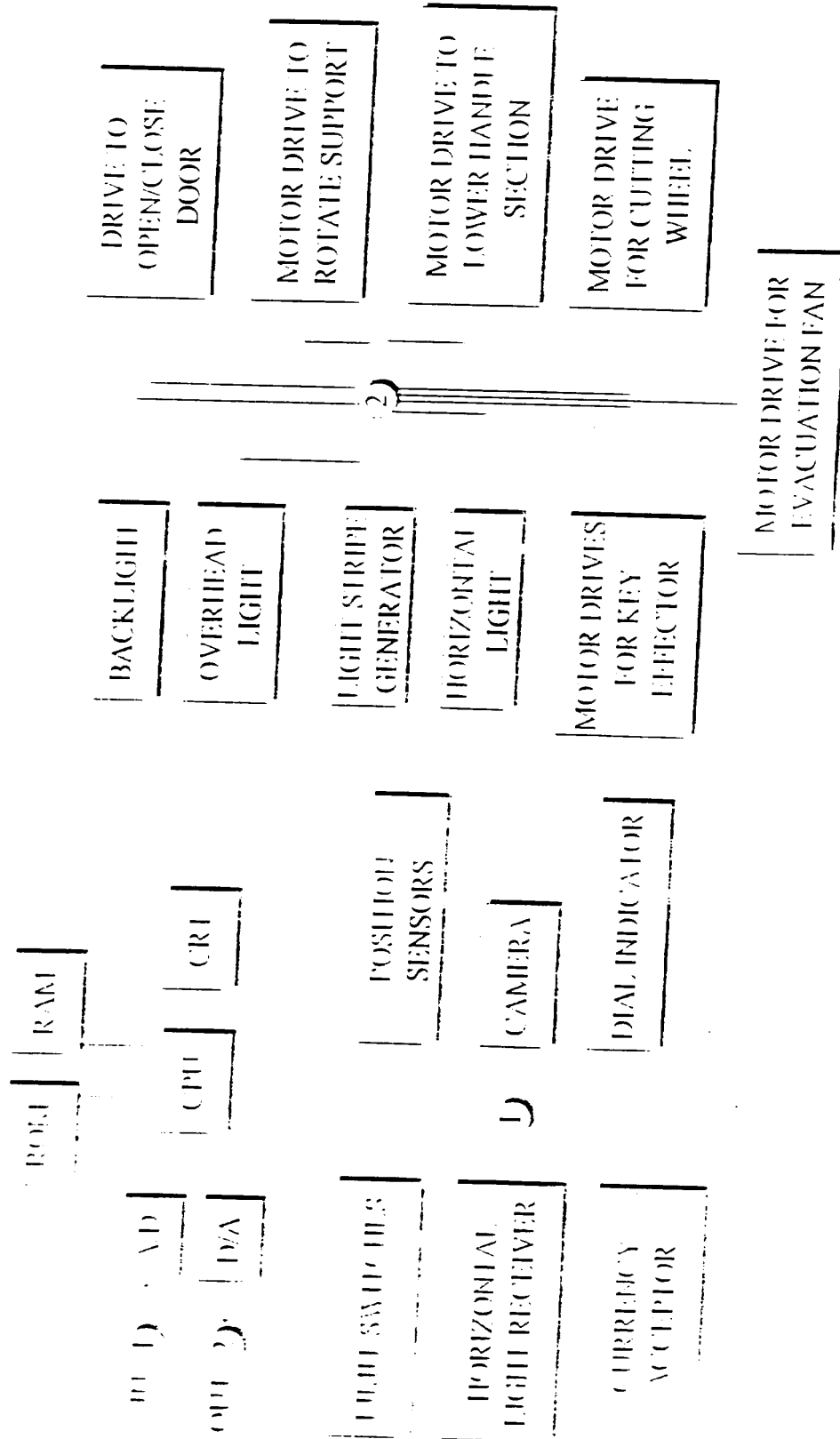


13 / 15

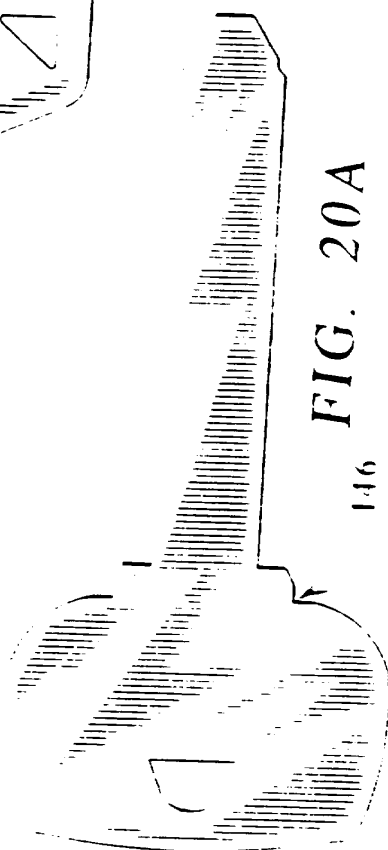
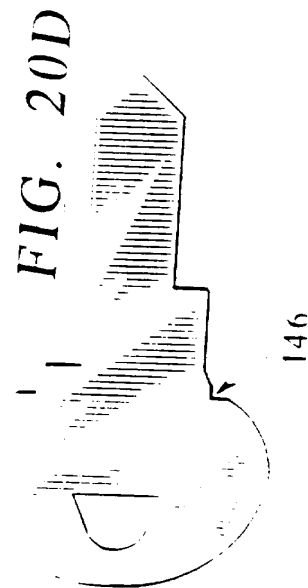
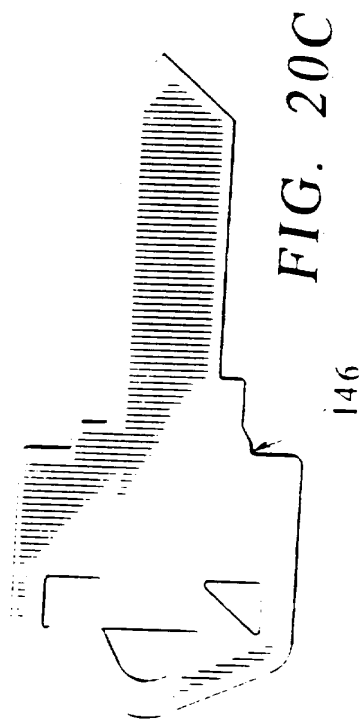
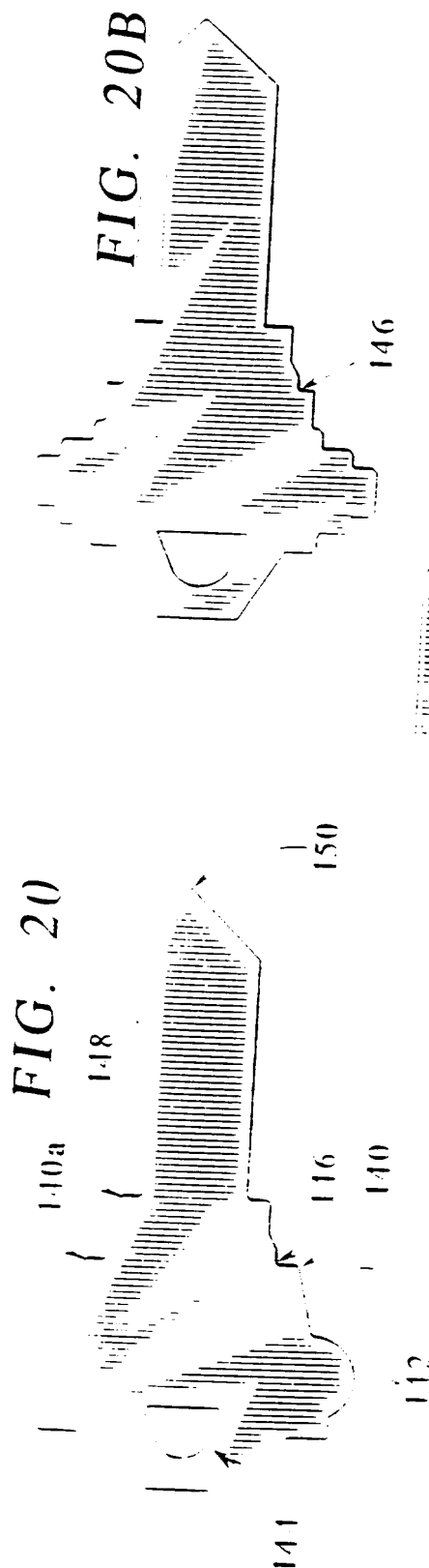


14 / 15

FIG. 18



15 / 15



INTERNATIONAL SEARCH REPORT

International application No.
PCT/US94/14862

A. CLASSIFICATION OF SUBJECT MATTER

IPC(6) : B23C 3/35

US CL : 409/81

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 409/81,82,83,84; 382/1,8

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US, A, 4,143,582 (HEIMANN) 13 MARCH 1979 COL. 11, LINE 63-COL. 13, LINE 30. FIGS. 9A-9C.	1-3,34-37, 40,54,55
X	US, A, 4,324,513 (HUGHES) 13 APRIL 1982, COL. 6, LINE 60- COL. 8, LINE 27. FIGS. 9-16.	88-104
A	US, A, 5,129,010 (HIGUCHI, ET AL.) 07 JULY 1992 WHOLE DOCUMENT.	1-87
A	US, A, 5,193,120 (GAMACHE, ET AL.) 09 MARCH 1993 WHOLE DOCUMENT.	1-87
A	US, A, 4,899,391 (CIMINO, ET AL.) 06 FEBRUARY 1990.	1-87
A	US, A, 3,796,130 (GARTNER) 12 MARCH 1974.	70-73

☒ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

Special categories of cited documents:		T		later document published after the international filing date or priority date and not in conflict with the application but used to understand the principles or theory underlying the invention
A	document defining the general state of the art which is not considered to be of particular relevance			
E	earlier document published on or after the international filing date	*X*		document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
L	document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	*Y*		document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
O	document referring to an oral disclosure, use, exhibition or other means			
P	document published prior to the international filing date but later than the priority date claimed	*Z*		document member of the same patent family

Date of the actual completion of the international search

07 APRIL 1995

Date of mailing of the international search report

05 MAY 1995

Name and mailing address of the ISA/US
Commissioner of Patents and Trademarks
Box PCT
Washington, D.C. 20231

Facsimile No. (703) 305-3230

Authorized officer

Z.R. BILINSKY

Telephone No. (703) 308-1741

Patent Specialist
Group 8000

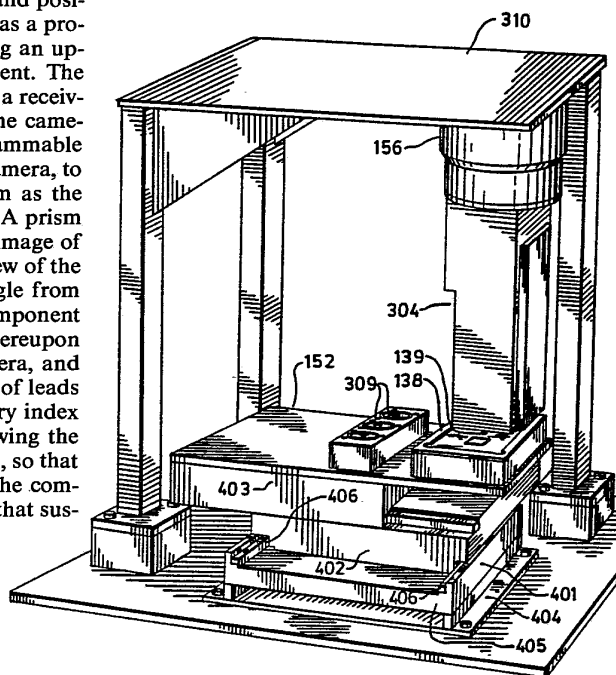
3200

Form PCT/ISA/210 (second sheet)(July 1992)*



INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification ⁵ : H05K 13/08	A1	(11) International Publication Number: WO 91/13535 (43) International Publication Date: 5 September 1991 (05.09.91)
(21) International Application Number: PCT/CA91/00055 (22) International Filing Date: 26 February 1991 (26.02.91) (30) Priority data: 9004246.6 26 February 1990 (26.02.90) GB (71) Applicant (for all designated States except US): ATS AUTOMATION TOOLING SYSTEMS INC. [CA/CA]; 80 Alpine Road, Kitchener, Ontario N2E 1A1 (CA). (72) Inventors; and (75) Inventors/Applicants (for US only) : WOERNER, Klaus, Dietmar [CA/CA]; R.R. 2, Cambridge, Ontario N1R 5S3 (CA). WOOTTON, Gerald, Ralph [CA/CA]; 19 John Street, Plattsville, Ontario N0J 1S0 (CA).		(74) Agent: ARMSTRONG, R., Craig; Carson, Armstrong, 285 Fountain Street South, Cambridge, Ontario N3H 1J2 (CA). (81) Designated States: AT (European patent), BE (European patent), CA, CH (European patent), DE (European patent), DK (European patent), ES (European patent), FR (European patent), GB (European patent), GR (European patent), IT (European patent), LU (European patent), NL (European patent), SE (European patent), US. Published <i>With international search report.</i>
(54) Title: VISION SYSTEM FOR INSPECTION OF ELECTRONIC COMPONENTS (57) Abstract A vision system for inspection of the leads of electronic components is provided. At least one camera is mounted on a frame and positioned above an inspection platform. The inspection platform has a programmable X-Y table supporting an inspection pedestal having an upwards facing vacuum quill to receive and retain the component. The pedestal carries the components on a programmable path from a receiving area, under the camera(s), and thence to a pickup area. The camera(s) is/are rotatably mounted about a vertical axis on a programmable rotary index table. There is a dedicated image buffer for each camera, to which camera data is transferred for processing by the system as the component continues to be moved through its inspection path. A prism arrangement is disposed beneath each camera for splitting the image of the leads, such that part of the camera lens receives a vertical view of the leads, while the other part views the leads at a substantial angle from the vertical. A computer controls the X-Y table to drive the component to a position with one set of leads beneath the camera(s), whereupon camera data may be recorded to the image buffer for the camera, and for thence driving the component to a position with another set of leads beneath the camera(s), and for rotating the programmable rotary index table to orient the camera(s) to the correct orientation for viewing the leads. At least one calibration reticle is mounted on the platform, so that the camera can be calibrated. Near infrared LEDs illuminate the components, and near infrared filters are used on the camera(s), so that susceptibility to ambient lighting conditions is avoided.		



FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AT	Austria	ES	Spain	MG	Madagascar
AU	Australia	FI	Finland	ML	Mali
BB	Barbados	FR	France	MN	Mongolia
BE	Belgium	GA	Gabon	MR	Mauritania
BF	Burkina Faso	GB	United Kingdom	MW	Malawi
BG	Bulgaria	GN	Guinea	NL	Netherlands
BJ	Benin	GR	Greece	NO	Norway
BR	Brazil	HU	Hungary	PL	Poland
CA	Canada	IT	Italy	RO	Romania
CF	Central African Republic	JP	Japan	SD	Sudan
CG	Congo	KP	Democratic People's Republic of Korea	SE	Sweden
CH	Switzerland	KR	Republic of Korea	SN	Senegal
CI	Côte d'Ivoire	LI	Liechtenstein	SU	Soviet Union
CM	Cameroon	LK	Sri Lanka	TD	Chad
CS	Czechoslovakia	LU	Luxembourg	TG	Togo
DE	Germany	MC	Monaco	US	United States of America
DK	Denmark				

1

VISION SYSTEM FOR INSPECTION OF ELECTRONIC COMPONENTSTECHNICAL FIELD

This invention relates to apparatus for installing fine pitch components onto printed circuit boards (PCBs). More specifically, the invention relates to a vision system used to inspect components prior to mounting them on the circuit board. The vision system, or inspection station, can be used in a system which combines component acquisition, inspection and placement in a highly efficient and effective manner, or can also be used as a stand-alone unit through its dedicated microcomputer.

BACKGROUND ART

Fine pitch components are those electrical components typically intended for surface mounting on printed circuit boards and having very small spacing between leads. Surface mount technology has recently become well known, and typically involves reflow soldering of leads to the surface of the printed circuit board, rather than passing the leads through holes in the board.

Robotic devices are now in common use in various industrial processes such as, for instance, the production of electronic circuit boards. One area of technology where it has been found feasible to perform visual inspections using a robotic device relates to the surface mount placement of electronic components including packaged semiconductor chips and fine pitch leaded devices. The increasing miniaturization of critical electronic surface mount components's dimensions introduces considerations which make the capability of 100% inspection (and accept/reject decisions) of surface mount components essential or highly desirable. These

smaller electronic components are more fragile and are very easily damaged during routine handling. The rework costs associated with very delicate and very small components are escalating, making placement of damaged components very undesirable.

All robotic devices used for visual inspection require a means for inspecting a component. One vision inspection means commonly used is a fixed station in which cameras are fixed in place around a receptacle designed to hold in place a component for inspection, into which vision inspection station a component is deposited by a handling device before inspection, and removed from after inspection, after which a new component is picked up and this cycle is repeated.

Two major flaws intrinsic to such vision inspection assembly designs stem from the extensive and repeated material handling steps necessary for this inspection means. Firstly, repeated extensive handling of components frequently can damage very small and very delicate components, and cause component lead damage. In cases where the leads of a packaged microchip become damaged, the component may fail the mechanical tolerance inspection criteria, and thereby be rejected, with consequent loss of circuit board assembly cycle time and incurring of the increased costs associated with repair or replacement of the damaged component. Secondly, repeated material handling steps take up a considerable proportion of total cycle time, thereby slowing the total process rate.

The vision inspection system of the present invention may be used to visually inspect a component contemporaneously with a component acquisition subsystem and a component placement subsystem, and to pass the component through the vision inspection system to a

component placement subsystem adjacent the vision inspection system.

DISCLOSURE OF INVENTION

It is an object of the present invention to
5 minimize the impact of 100% inspection on process rate by providing an inspection apparatus that can operate efficiently in parallel with a component acquisition subsystem and a component placement subsystem.

It is a further object of the present invention
10 to achieve a high degree of flexibility within a minimally complex configuration of modest size and cost.

It is a further object of the invention to provide a component inspection station which can operate independently if desired, or as a module in a component
15 installation system.

In the invention, the method of solving these difficulties is to place the electronic component on a programmable vision inspection pedestal (including programmable illumination) which carries the components
20 on a programmable path from the working envelope of the component acquisition subsystem through a vision inspection assembly and thence into the working envelope of the component placement subsystem. The independent vision inspection pedestal performs its operations
25 contemporaneously with the operations of the component acquisition stage and the placement head. Sequencing in this manner allows components to be placed while other components are simultaneously being inspected, and while still other components are being picked from feeder
30 trays. System cycle time is thus substantially reduced. This pass-through design feature permits unobstructed movement of components from input to output (i.e. the acquisition of a component to its being surface mounted on a printed circuit board). Since motion is a major

cycle time component, this pass-through arrangement represents the optimal solution. Additionally, the inspection stage acts as a buffer queue of size one. In effect, this buys back cycle time so long as the
5 component inspection system part of the cycle is not excessively long.

The preferred embodiment of the invention combines transport and inspection steps in a single robotic device, and provides a generic facility for
10 precise three-dimensional inspection of most electronic surface mount components, including chip components and fine pitch leaded devices.

The mechanism of the invention is capable of performing the dual programmable functions of both
15 visually inspecting electronic surface mount components and passing a component through the vision inspection system to a pickup point following visual inspection. Thus, component handling and potential resulting lead damage are limited.

20 The vision inspection system concept both in hardware and software design maximizes the use of hardware and software modules which have been developed through extensive experience in printed circuit board factory automation. In addition to being able to
25 accept/reject individual electronic components upon comparison of data obtained by visual inspection of a given component with established component type-specific criteria, the invention can programmably analyze the data of a given individual component to determine the least
30 risk use (best fit) for the component, thereby recovering a significant proportion of marginal components and increasing process yield.

The system is designed to handle Quad Flat Packs (QFP), Tape Automated Bonded (TAB), and other flat

5

pack leaded components with gull-wing or similar lead forms.

The system uses machine vision to measure X, Y and Z position in 3 dimensions of all leads of a component. From these primary measurements the following inferences are made:

- Missing leads;
- Lead pitch error (sweep and skew type);
- Toc in/out;
- 10 Body center X;Y;Rz based on all lead tip coordinates;
- Best fit algorithms for placement; and
- Coplanarity

The output of the vision inspection station is a serial data stream, consisting of a combination of the above measurements. The data is available either through a serial port, or through a network card (Ethernet, or Arcnet).

The flexibility of the design allows it to perform these tasks in a stand-alone mode for other applications. Since the system is data driven, it gives maximum flexibility to the user. Data files may be easily configured to input key component dimensions and inspection tolerance limits. Similarly, configuration files may describe the type of measurement to be performed and the data type to be transmitted to a host computer. Since the vision inspection station control computer has a hard disk, data logging can be performed on the system and data may be transmitted at a later time to another location.

The vision inspection station was designed to inspect any size surface mount component which will fit within the working envelope of the X-Y stage. Component types may be described or changed through data files, without any change to the operating software.

The system is fully self-calibrating from three built-in chrome-on-glass reticles, manufactured to a precision of ± 0.00005 cm. (± 0.000020 inches). Calibration is carried out automatically under software control.

- 5 Cameras are calibrated from one of the three reticles, which is set at the nominal component lead height. Calibration of the measurement cameras establishes the following:

- 10 X-Y table origin;
Camera pixel size;
Rotary axis (wrist) null orientation with respect to X-Y table axis motion;
Null-tool coordinates for the cameras;
The line of intersect between the X;Y plane and
15 the 45 deg. plane; and
45 degree mirror alignment with respect to the X;Y plane.

- Z-dimension calibration is verified using the other two reticles, which are placed at +25 mm. and -25
20 mm. (+.010 and -.010 inches) above and below nominal height respectively. This ensures that camera misalignments, mirror block errors and offsets from the rotational axis are fully compensated.

- The placement alignment camera, which has no
25 measurement role, is centered on a fiducial marker with a known relationship to the vacuum quills on the light table. Vacuum quills are then located under the measurement cameras with respect to the fiducial.

- The system consists of the following major
30 components:

System controller (AT compatible, including vision processor, disk, motion and illumination controller);

X-Y positioning stage carrying the inspection light table, with vacuum nests and self calibration reticles;

Optical head, mounted on a precision wrist, or
5 rotary indexer; and

Framework.

The principle of operation can be described as follows: An upwards facing vacuum quill is mounted to a programmable precision positioning stage which steps the
10 component past one or more downward looking area cameras mounted to an overhead rotary indexer. The component positioning stage is comprised of two programmable axes (X and Y) each with an approximate 20 cm. (eight inch) programmable travel and extremely high repeatability.

15 The optics that are incorporated allow each of two cameras to see both the top view of the component as well as a 45 degree view of the lead tips in space. Casting both views on the same camera ensures long term optical alignment stability. The purpose of using two
20 cameras with the fields overlapping at the margins is to increase the combined field of view. Illumination is provided by an LED light panel. By using red LEDs and red filters on all cameras the system's susceptibility to ambient lighting conditions is eliminated as ambient
25 lighting normally has a very small component of red energy.

A precision chrome-on-glass reticle is mounted on the light table and serves for camera calibration. The reticle incorporates a precision grid of squares
30 photo etched onto the glass plate. By viewing the reticle with the camera, any optical distortions in the camera lens are measured as a distortion of the grid lines. The distortions are mapped and used to correct the optical readings. Also, a set of translating
35 coordinates are generated to transform the image seen by

the vision system to real world coordinates based on the known alignments of the reticle pattern.

Multiple "snapshots" are taken of the component leads on each side of the component while the component is stepped along the lead rows by the X-Y table. The rotary indexer is used to move the inspection camera(s) around the four sides of the component. Each camera is provided with a dedicated image buffer to which camera data is transferred for processing by the system as the component continues to be moved through its inspection path.

The image analysis routines perform lead inspection including lead splay, lead toe in, toe out, lead count, coplanarity and lead presence. For this design, coplanarity is defined as the largest deviation of a lead tip Z position from the seating plane of the component. The seating plane is evaluated as a roll and pitch from a point at the component's lead center. The Z position of this point is calculated as the average Z position of all the component lead tips.

Based on the data received of inspection, "pass/fail" decisions and component offsets for pickup are then passed to the component installation system controller.

In the overall component installation system, the inspection stage tends to be the slowest stage, and can be operated on an intermittent sampling basis if desired, to achieve greater speed at the expense of some certainty of accuracy, i.e. if a decision is made to forego 100% inspection. The invention does however readily permit 100% inspection if that is desired.

BRIEF DESCRIPTION OF DRAWINGS

In order that the invention may be more clearly understood, the preferred embodiment thereof will now be

described in detail by way of example, with reference to the accompanying drawings and photos, in which:

Fig. 1 is a perspective view of the preferred embodiment of the overall component installation system;

5 Fig. 2 is a perspective view of the vision inspection station of the present invention;

Fig. 3 is a side view of the station of Fig. 2;

Fig. 4 is a front view of the station of Fig.

2;

10 Fig. 5 is a partial perspective view from the rear of the station of Fig. 2;

Fig. 6 is another side view of the inspection head of Fig. 2;

15 Fig. 7 is a cross section of the vision inspection head at C-C in Fig. 6;

Fig. 8 is a side view of the vision inspection head of Fig. 6 with the side plate removed;

Fig. 9 is a front view of the vision inspection head of Fig. 6 with dust cover removed;

20 Fig. 10 is a front view showing the mirror block arrangement;

Fig. 11 is a side view of the mirror block arrangement, corresponding to Fig. 10;

25 Fig. 12 is a ray diagram corresponding to Fig. 11;

Fig. 13 is a reproduction of the image produced in a camera in the vision inspection head; and

Fig. 14 is a block diagram of the system.

BEST MODE FOR CARRYING OUT THE INVENTION

30 System Overview

The preferred embodiment of the overall component installation system provides a system which is capable of excising, forming, inspecting, placing and soldering fine pitch components onto printed circuit

10

boards. This invention relates to the inspection stage of that system.

The overall component installation system, illustrated in Fig. 1, has a base 1. Mounted on top of the base is a top plate 3, to which all system components are mounted.

The system has the following main components or subsystems, all directed and sequenced by a personal computer such as an AT-compatible controller:

- 10 (1) PCB conveyor: A dual belt PCB conveyor 6, which moves boards through the placement stage and allows pass-through board handling.
- (2) Component installation system: A four-axis placement platform is provided for placement and "hot bar" reflow soldering of fine pitch components onto the surface of the circuit board. The system includes a component acquisition stage 200, the vision inspection stage 300 of the present invention, and a component placement or installation stage 400.

The component acquisition stage has a two-axis servo-driven pick and place unit 121, which travels the length of a set of hardened steel tracks 122. The pick and place unit is equipped with a pneumatically-actuated Z-axis vacuum gripper 124 on a vertically compliant slide 126, constituting the third axis.

The pickup head, namely vacuum quill 130, is moved inline with the component pickup or dropoff point. The vacuum quill is then extended and lowered into the tooling for component pickup from the feeder, and transfers it to the vision inspection pedestal 138 of the inspection stage. The vision inspection pedestal 138 has upwardly facing vacuum quills 139 to hold the component in place. Which quill is to be used is selected depending on the size of the component. It is the

11

inspection stage which is the focus of this invention, and it will be described in greater detail below.

The quill assembly 20 of the installation stage is movable between a pick-up position at the right end of carriage 21 in Fig. 1, i.e. from the inspection stage, and the installation or deposition position at which quill assembly 20 sits in Fig. 1. The placement stage uses a "split axis" concept involving the three-axis quill assembly 20 and a single-axis board positioning subsystem, all directed and sequenced by a personal computer such as an AT-compatible controller. Incoming boards are positioned in the X axis while the placement head simultaneously moves overhead along the Y axis. The placement head also contains a Z and theta axis resulting in a total of four degrees of freedom for the system. A swivelling ball and socket head at the end of the placement head actually provides even further freedom of movement, lockable in the desired orientation for correct placement.

Components are picked from the vision inspection pedestal by the quill assembly 20 and are moved in a straight line past an upward looking camera 158. As the camera field of view is filled strobed "snapshots" are taken of the component to corner register the component leads.

"Snapshot" data is collected by a Coreco Oculus 300 (trademark) imaging board which is installed into the system controller backplane. Camera data is analyzed by high level routines written in the C programming language.

"Snapshots" are taken of the component held in the placement quill while it is in movement without slowing the motions of the placement head. The placement head has previously examined local placement fiducials with its camera and the board positioning system has been

12

moved to the proper position for placement. The component is then lowered to the surface of the board for installation via reflow soldering.

The Vision Inspection System

5 Physical configuration of the vision system is such that it presents a relatively small system footprint of no greater than 0.5 metre per side, exclusive of the space required for feeders. The vision inspection system can be linked to existing lines in a fully pass-through
10 configuration allowing components to pass through the vision inspection system while a component is being inspected.

 The vision inspection system has the following main components or subsystems, all directed and sequenced
15 by a personal computer such as an AT-compatible controller:

- 20 (1) Vision inspection pedestal 138: A multi-position pedestal 138 with upwards facing vacuum quills 139, mounted to a programmable micro positioning stage which precisely moves components through the vision inspection assembly and allows pass-through component handling.
- 25 (2) Vision inspection assembly: A gantry 310 with three vertical supports is provided for support of the vision inspection assembly. The vision inspection assembly includes a programmable X-Y table 152, a programmable rotary index table 156, a vision inspection head 304, and a
30 permanent camera calibration device 309.

The subsystems and components will now be described in greater detail.

Vision Inspection Pedestal

The component inspection platform has been configured as a pass-through system which is accessed by the customer's existing component acquisition stage.

- 5 Components are passed to an upwards facing vacuum quill 139 on the pedestal 138 mounted to a programmable micro positioning stage which precisely moves the vision inspection pedestal along two programmable axes (X and Y), each with programmable travel and extremely high
10 repeatability, through the vision inspection system directly underneath the vision inspection assembly to the working envelope of the component placement stage.

Vision Inspection Assembly

- The inspection station includes a programmable
15 X-Y table 152; programmable rotary index table 156; multi-position component pedestal 138 including programmable illumination, vision inspection head 304, including one or more cameras 305, 306, lenses 307, optical multiplexer generally indicated at 308,
20 programmable illumination (not shown); permanent calibration device 309; gantry frame structure generally indicated at 310; and general purpose computer including image processing peripheral hardware and motion control hardware (not shown).

- 25 The programmable X-Y table 152 comprises a base section 401, an intermediate section 402 and a top section 403. The base section 401 includes plate 404, support 405, and a pair of rails 406. Rails 406 are disposed on opposite sides of the top surface of support
30 405 to permit the intermediate section 402 to move across the top of support 402.

The main structure of the vision inspection assembly is the gantry 310 constructed of stress-relieved materials of constant temperature coefficient, mounted to

a base to which all cell tooling and the vision inspection pedestal is mounted. While measurements of components being inspected are being obtained, components are placed at the center of this gantry structure. The
5 camera(s) preferably are also mounted near and rotate about this center, as described below, thereby minimizing the runout error introduced by temperature changes. Mounted to the under surface of the top plane of the gantry is a programmable rotary index table 156. The
10 rotary index table is capable of programmably rotating through 360 degrees in a fixed plane parallel to that of the base to which the gantry is mounted. The vision inspection head 304 is mounted to the rotary index table's surface most proximate to the base to which the
15 gantry and the vision inspection pedestal are attached. Thus, the vision inspection head is also capable of programmably rotating through 360 degrees in a fixed plane parallel to that of the base.

The vision inspection head comprises one or
20 more cameras, lenses and mirrors, an optical multiplexer, and programmable illumination. Currently commercially available camera and digital image processors restrict the maximum obtainable resolution in the line scanning direction. Since the vision inspection head is mounted
25 on a programmable rotary index table, the camera(s) can always be positioned so that critical measurements are made in the orthogonal direction to video line scanning. Pointing error of the camera(s) and image blurring due to vibration are minimized by maintaining a very short and
30 completely folded optical path. Since this in turn emphasizes the effect of apparent magnitude versus object distance, the required measurement accuracies (less than 4 microns) can only be properly achieved by means of three-dimensional (3-D) imaging which this vision
35 inspection system provides. An additional benefit of a

15

short working distance is that absolute intensity of illumination can be held to reasonable limits (i.e. within a factory setting). Good quality lighting can be programmably configured to each specific imaging task.

5 Programmable illumination incorporated into the vision inspection pedestal provides backlighting for inspection of component outline. Programmable illumination incorporated into the vision head provides variable frontlighting. The illumination is provided by LED light
10 sources arrayed in such a manner that various rows and columns of LEDs can be programmably switched on and off according to the illumination pattern required for each particular component. Near infrared LEDs and near infrared filters are used on one or more cameras, and
15 thus the vision inspection system's susceptibility to ambient lighting conditions is eliminated, because ambient lighting normally has a very small component of near infrared energy.

The optics that are incorporated into the
20 vision inspection head allow each camera to see a top view of the component as well as an angled side elevation view of the lead tips in space.

After loading components onto the pedestal, the components are moved in a straight line past the two
25 downward-looking cameras. Multiple "snapshots" are taken of the component while the component continues to be moved through its inspection path. The component is then accelerated in the other axis, the overhead cameras are rotated 90 degrees via the turntable 156, and a similar
30 procedure is carried out for the leads on the other two sides of the component.

Alternatively, if there is only one camera, after components are loaded onto the pedestal, they are moved to the location of the downward-looking camera. A
35 "snapshot" is taken of the area of the leads on one side

of the component, the camera rotates 90 degrees, the component is moved to position another side under the cameras, and another snapshot is taken. The process is repeated until all four sides have been viewed. This inspection may take place on every component, or on an intermittent sampling basis.

The vision inspection pedestal conveys the component across the vision inspection system's field of view at a constant velocity. The ability to also programmably offset the vision inspection pedestal motion increases the flexibility of the vision inspection system in that one or more pedestals of varying dimensions (designed to support and transport a wide set of variably sized components) may be used to transport a component from the input handoff coordinate to the inspection coordinate(s) to output handoff coordinate, simply by programmably offsetting the X-Y table motions. Hence, component changeover may be instantaneous, depending only upon software programming.

By using miniature solid state cameras in CCIR format, image planes of approximately 590 (lines) x 800 (elements) x 8 (bit) resolution can be achieved. Even with currently available sub-pixel measurement techniques, this fails to achieve the required resolution to field of view ratio ($\sim 4 \times 10^{-5}$). The vision inspection system overcomes this limitation in two ways. The first is through the use of multiple cameras which are optically and digitally multiplexed to provide a larger composite image plane. The second means involves repositioning the programmable X-Y table such that multiple overlapping images of the component can be accumulated.

The use of 3-D imaging is essential to achieving the required precision and accuracy of inspection. The preferred embodiment of this invention

achieves stereoscopic 3-D imaging within a single image sensor plane by optically multiplexing two perspectives of the same region of space into the same camera via a single lens. The relationship of the views is controlled
5 stringently by means of a very precisely manufactured array of plane mirrors, as described below, and depends on mechanical parameters alone. A single image sensor is used to detect all of the image data. Thus, the stereo images are temporally concurrent and have predictably
10 matched contrast levels. Given that illuminated surfaces (and specifically, the vision inspection pedestal backlight) lie predominantly in one plane, the contrast of the stereoscopic views can be compensated for relative intensity by adjusting the optical sensitivity of the two
15 views with independent neutral density filters. The use of independent neutral density filters is essential for optimal performance when digitizing the inspection image to finite resolution (because sub-pixel measurement resolution is sensitive to the effective digital
20 resolution of image contrast).

The lens arrangement is seen in Figs. 4 and 5, and in more detail in Figs. 10 and 11. Figs. 10 and 11 are corresponding views, at right angles to each other. Fig. 10 simply shows the mirror arrangement which
25 facilitates the use of two cameras, one to look at each half of the leads on one side of the component, since one camera could not have a sufficiently large field of view without sacrificing resolution.

Fig. 11, and the corresponding ray diagram,
30 Fig. 12, show how the simultaneous viewing of the leads from the top and at 45 degrees is achieved. Fig. 13 shows a typical processed image which results. The required three-dimensional information can be calculated from the image.

System stability and measurement accuracy can be continuously verified by means of a permanently attached calibration device which is imaged between machine cycles. The calibration device comprises a set of precision glass reticles 309 arranged so that the relationships of optical paths and effects of lens distortion can be determined from the displacement of the grid lines with respect to the vision system coordinates. A set of translating coordinates are developed to transform the image observed by the vision inspection system to real world coordinates based on the known spacing of the reticle pattern. This mapping increases the accuracy of the vision system.

A separate 386 compatible computer is provided for control of the vision system and motion control of the X-Y table 152. Camera data is collected and assembled for display on a CRT monitor by vision imaging boards installed into the computer backplane. Camera data is analyzed by high level routines in the C programming language. Component inspection algorithms are data driven such that new components can be accommodated simply by making a local data file entry specifying major component attributes such as lead count, lead spacing and toe-to-toe dimension. Parts are not taught as such, rather a generic software model of the components to be processed is provided allowing new components to be learned from design data alone. Component inspection and positioning algorithms are implemented in a layered fashion such that some parts of the inspection process can be disabled or executed on a sampling basis only.

The computer is IBM AT compatible, with industrial enclosure, 80386/20 processor, 80387 coprocessor, minimum 2 MByte memory, 60 MByte hard drive, VGA card and color monitor. The operating system is QNX,

in real-time, with multitasking. There is a vision processor, vision monitor, Galil X-Y controller with scale readback capability, network card as required, and serial and parallel ports to control the rotary indexer, illumination, and serial communications.

The vision routines perform lead inspection including lead splay, lead toe in, lead toe out, lead count, coplanarity and lead presence. The data received as a result of these inspections, is compared to lead inspection criteria for each type of component (stored on the microcomputer hard drive), and each component is either accepted or rejected based on these lead inspection criteria. Component offsets which have passed inspection and been accepted for pickup by the placement head (and later surface mounting to a circuit board) are then carried by the vision pedestal directly under the pickup point for pickup by the quill assembly for placement. Components rejected by the vision inspection stage are picked by the placement head and deposited onto a reject shuttle which moves the component back within reach of the component acquisition stage. When the acquisition stage has an empty quill and there is sufficient time available, the rejected component is transferred to a reject tray. By operating in this manner, operator attention is not required to remove a rejected component from the placement quill and the reject cycle does not affect the system throughput. The component position within the reject tray is recorded and the failure data corresponding to each component is written to disk for later retrieval.

It will be appreciated that the above description relates to the preferred embodiment by way of example only. Many obvious variations could be envisioned, and such variations are considered to be

within the scope of the invention, whether or not expressly described above.

It must be emphasized that although the vision system is described within the context of a specific
5 overall system for the installation of components, it could be readily adapted to a different system, or indeed used as a stand-alone inspection system if desired.

With the invention, it is possible to process a large variety of components in sizes ranging from 1 to
10 100 mm on a side. Component specification changeover that is software dependent only. Measurements can be acquired over a 100mm x 100mm x 2mm region of interest, to 4 microns or better.

The invention is capable of high speed pattern
15 recognition of randomly-oriented objects, with conventional image acquisition technology. Total cycle time including materials handling should not exceed 10 seconds while maintaining a maximum acceleration limit of 1 g.

20 The invention permits the desired measurement resolution to be achieved with accuracy and repeatability, accounting for additional constraints of temperature stability, resistance to vibration, optimization of optical image quality, and optimization
25 of image sampling.

INDUSTRIAL APPLICABILITY

As disclosed above, the invention has utility in the field of inspecting components for mounting onto printed circuit boards.

CLAIMS:

1. In a vision system for inspection of the leads of electronic components, comprising at least one camera mounted on a frame and positioned above an inspection platform, the improvement characterized by:
- 5 said inspection platform comprising a programmable X-Y table supporting an inspection pedestal having an upwards facing vacuum quill to receive and retain said component, said pedestal carrying the components on a programmable path from a receiving area, under said camera(s), and thence to a pickup area;
- 10 said at least one camera being rotatably mounted about a vertical axis on a programmable rotary index table;
- 15 a dedicated image buffer for each camera, to which camera data is transferred for processing by the system as the component continues to be moved through its inspection path;
- 20 a prism arrangement disposed beneath each said camera for splitting the image of said leads, such that part of said camera lens receives a vertical view of the leads, while the other part views the leads at a substantial angle from the vertical; and
- 25 computer control means for driving said component to a position with one set of leads beneath said camera(s), whereupon camera data may be recorded to said image buffer for said camera, and for thence driving said component to a position with another set of leads beneath said camera(s), and for rotating said
- 30 programmable rotary index table to orient said camera(s) to the correct orientation for viewing said leads.

2. A system as recited in claim 1, further characterized by at least one calibration reticle mounted on said platform, whereby said camera can be calibrated.

3. A system as recited in claim 1, further
5 characterized by said components being illuminated by near infrared LEDs and by near infrared filters being used said camera(s), whereby said system's susceptibility to ambient lighting conditions is avoided.

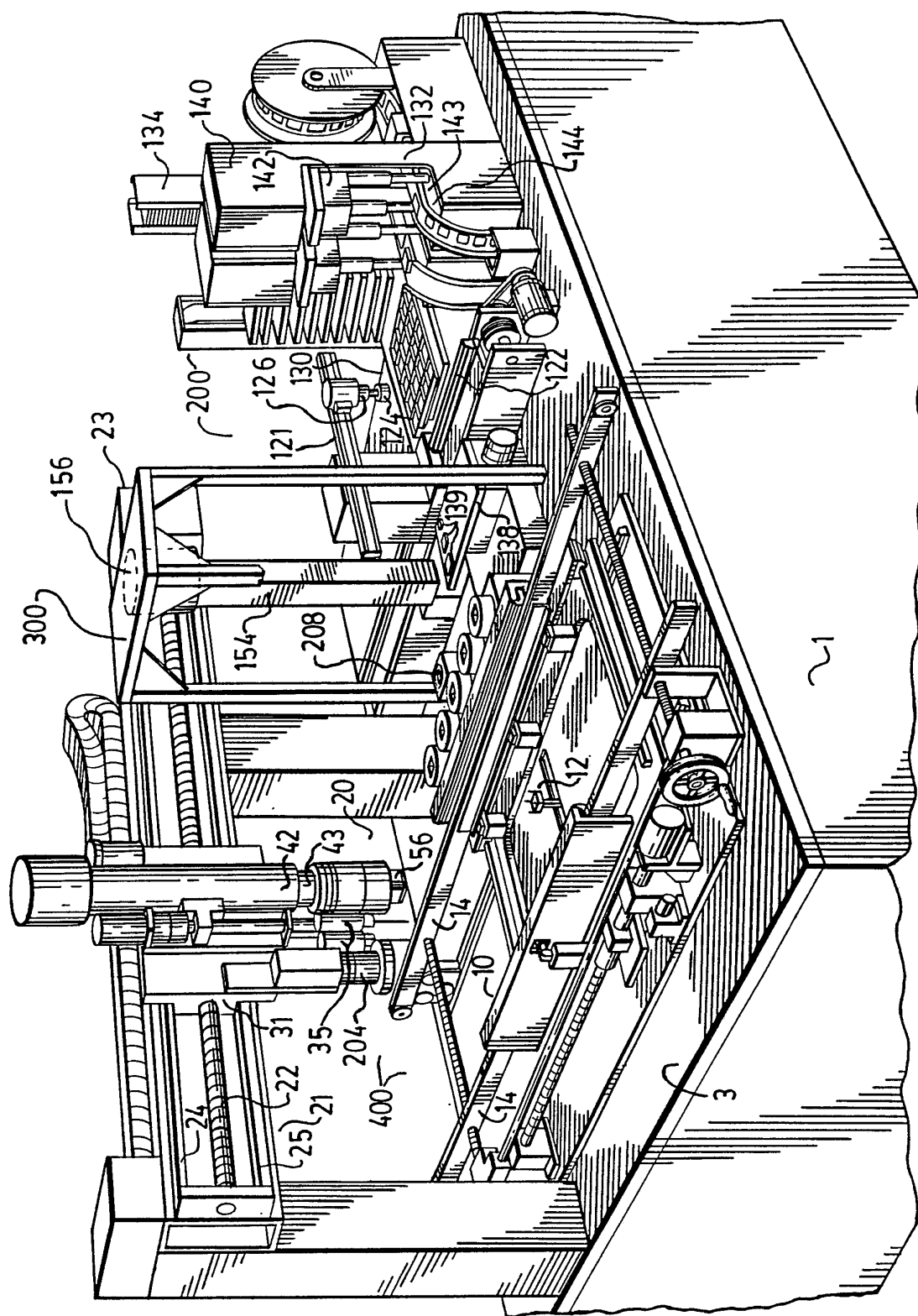


FIG. 1.

SUBSTITUTE SHEET

2/12

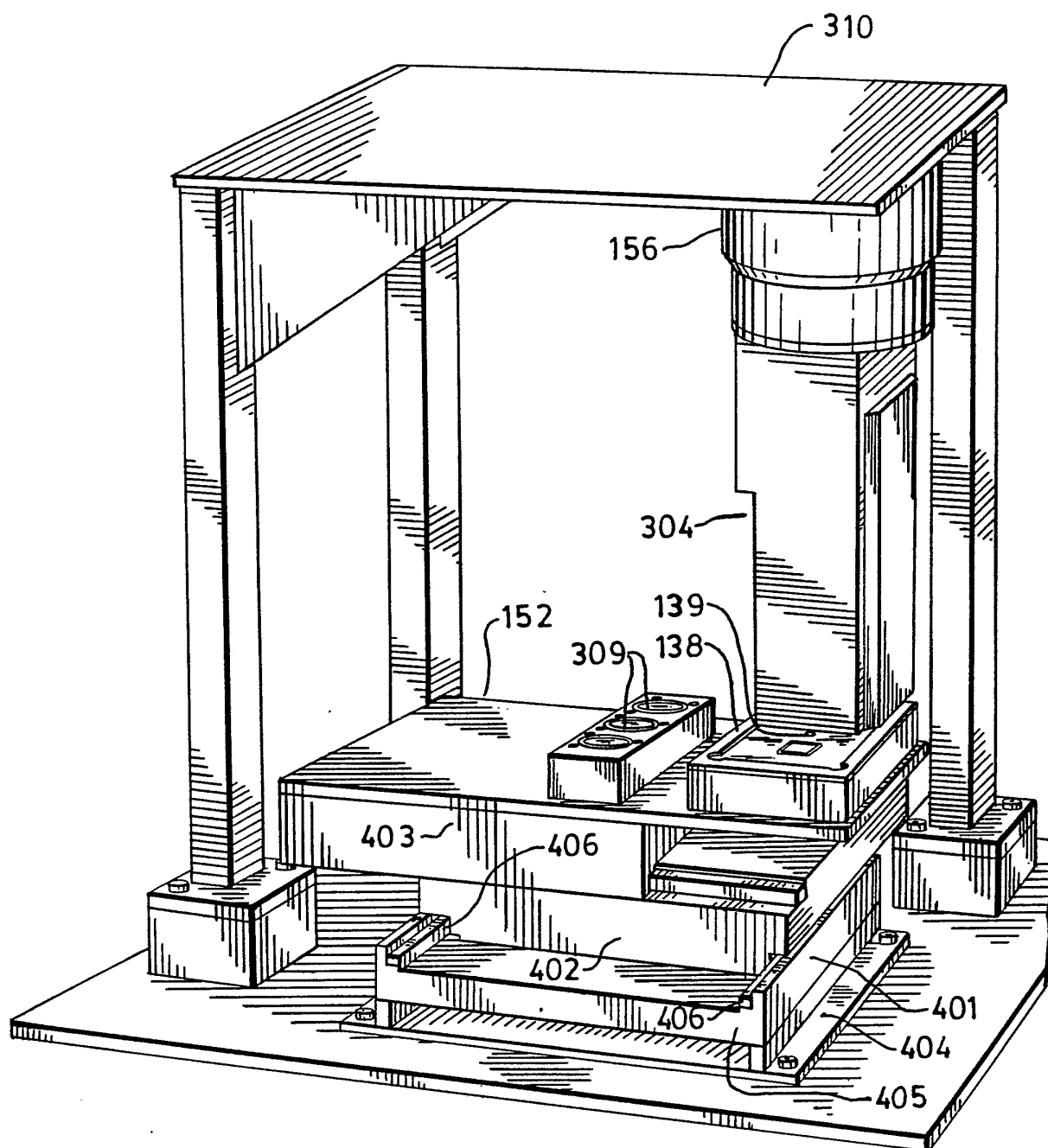


FIG. 2.
SUBSTITUTE SHEET

3/12

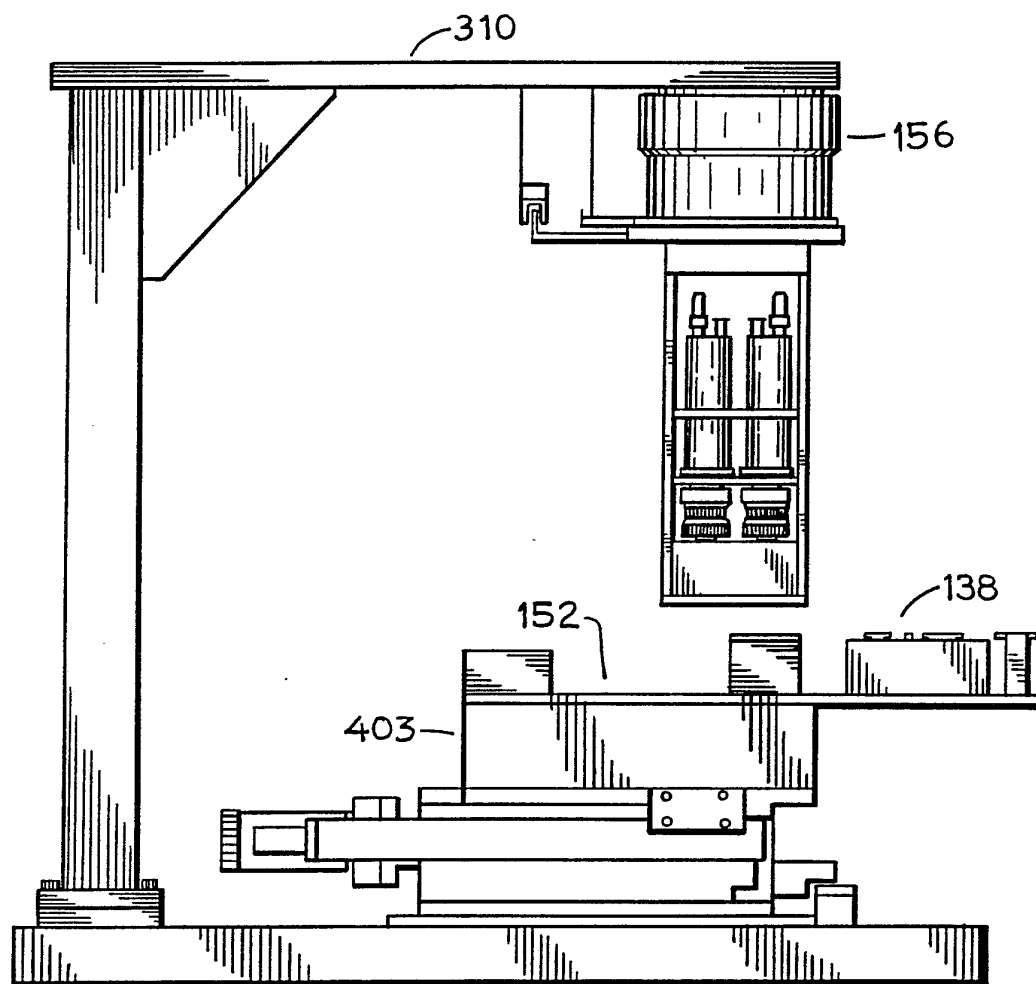


FIG.3.

SUBSTITUTE SHEET

4/12

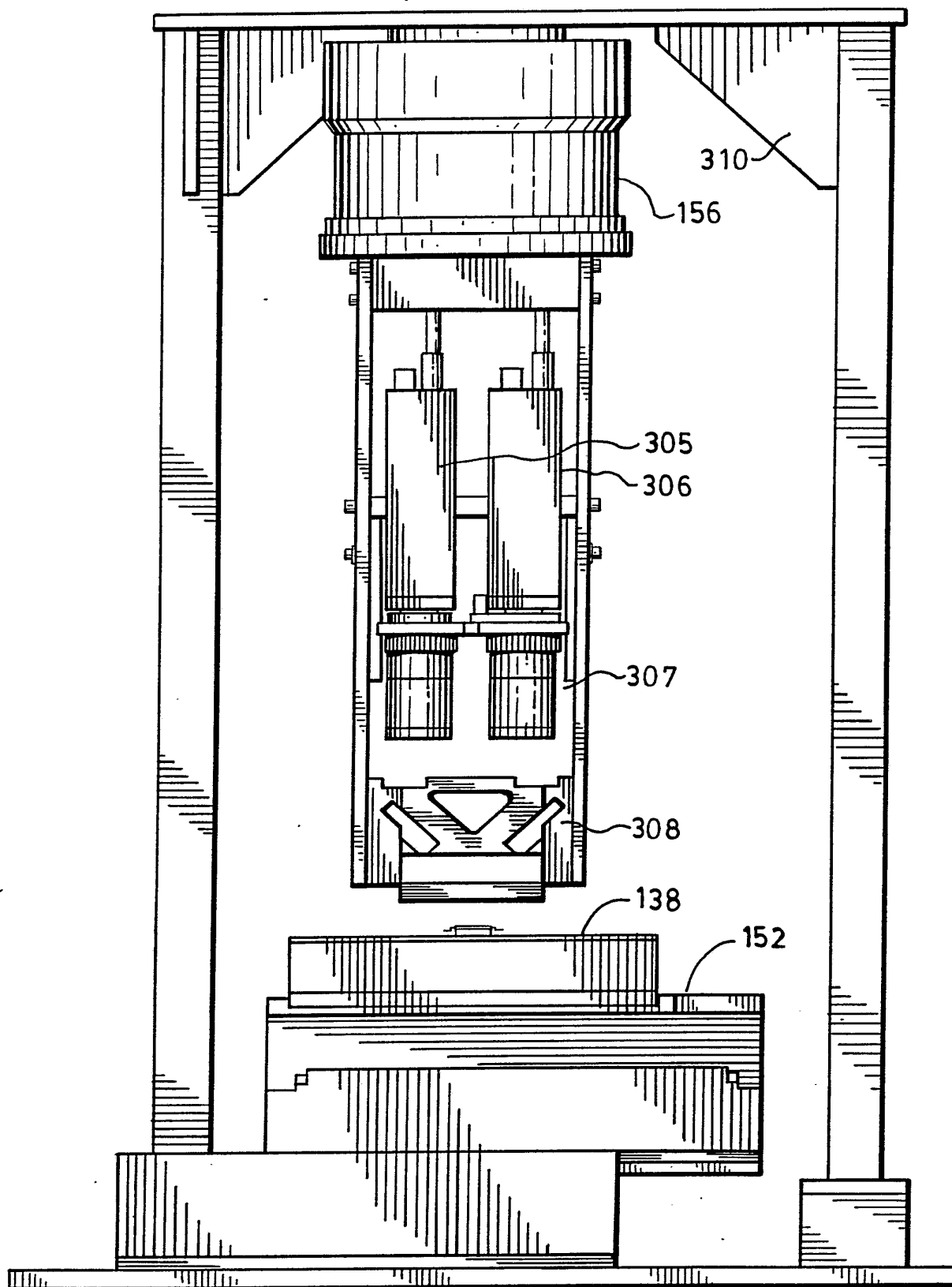


FIG.4.
SUBSTITUTE SHEET

5/12

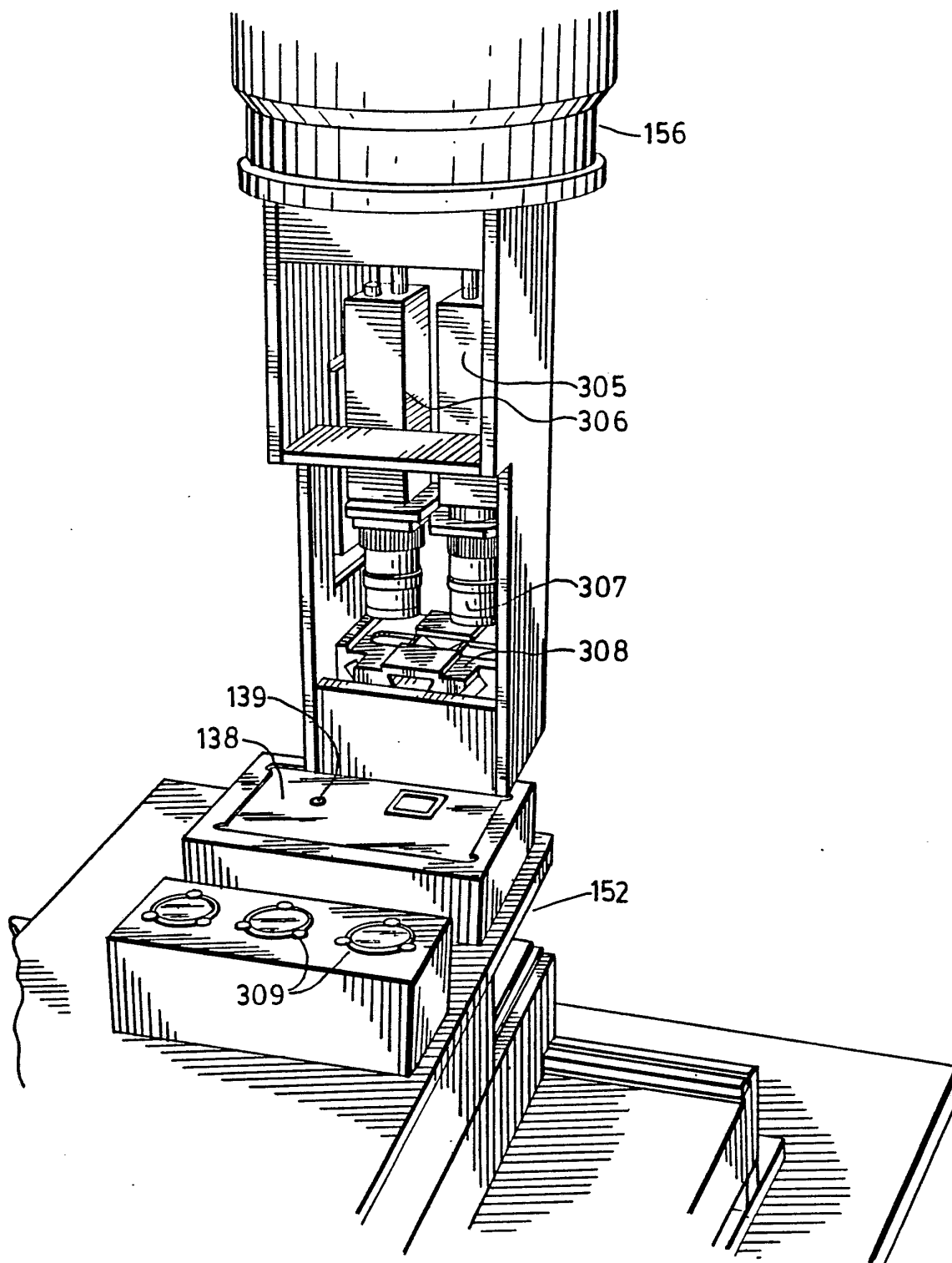


FIG. 5.
SUBSTITUTE SHEET

6/12

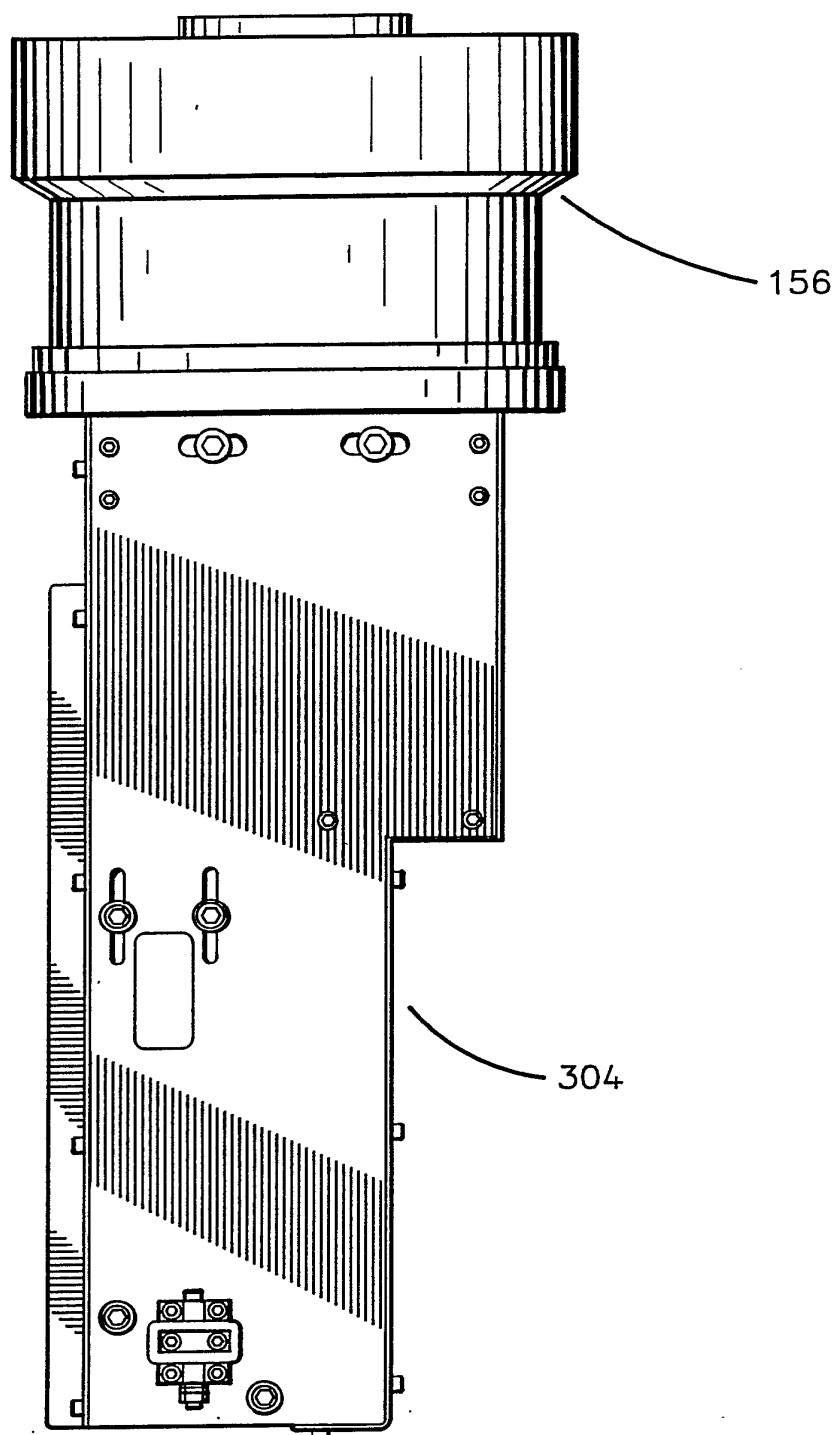


FIG. 6.
SUBSTITUTE SHEET

7/12

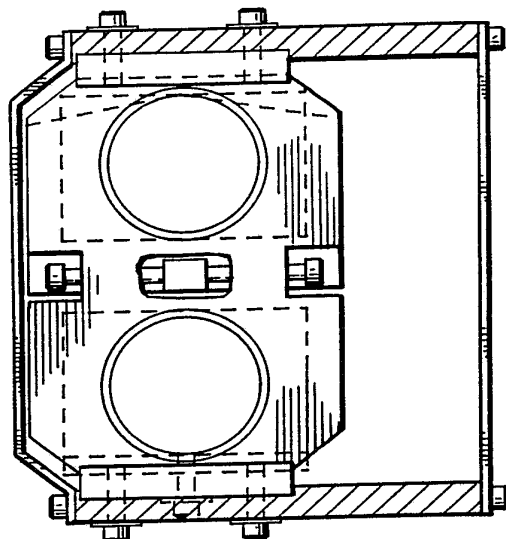


FIG. 7.

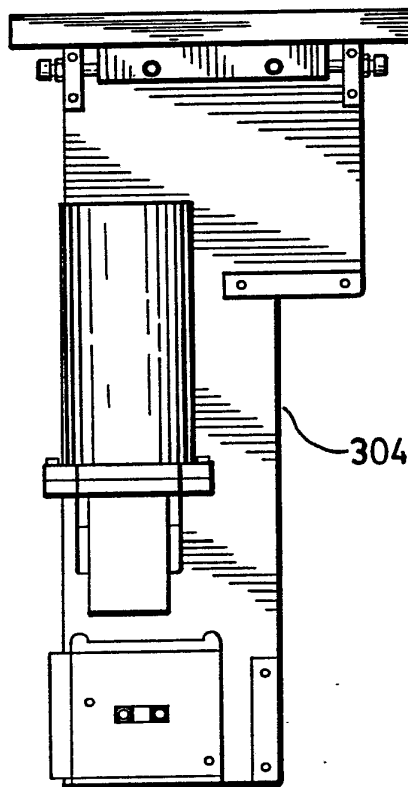


FIG. 8.
SUBSTITUTE SHEET

8/12

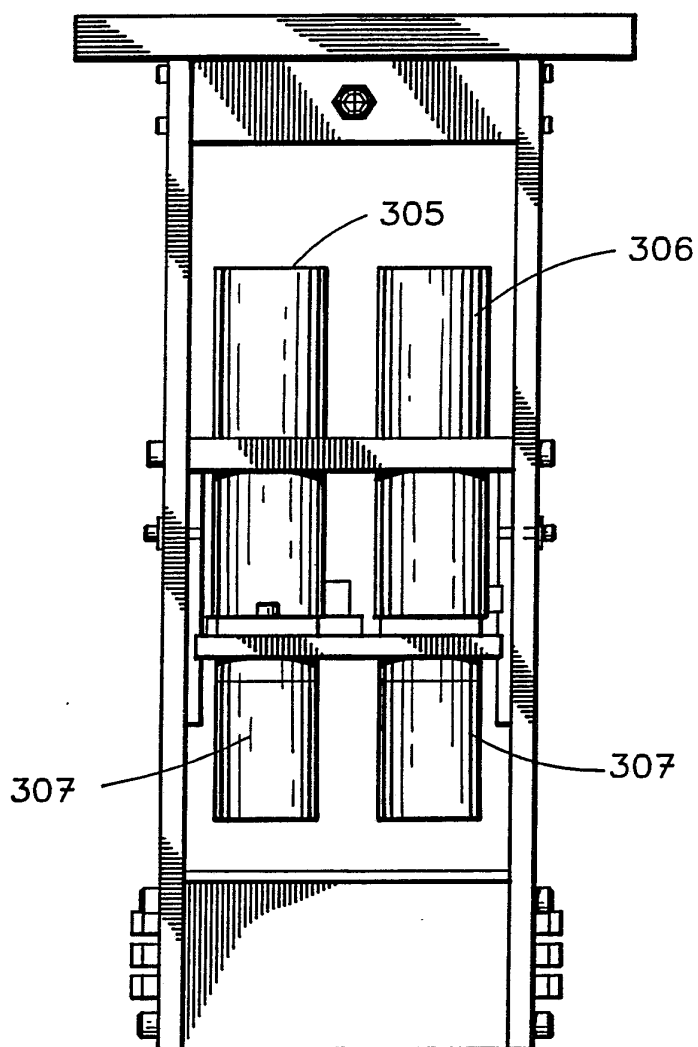


FIG. 9.

SUBSTITUTE SHEET

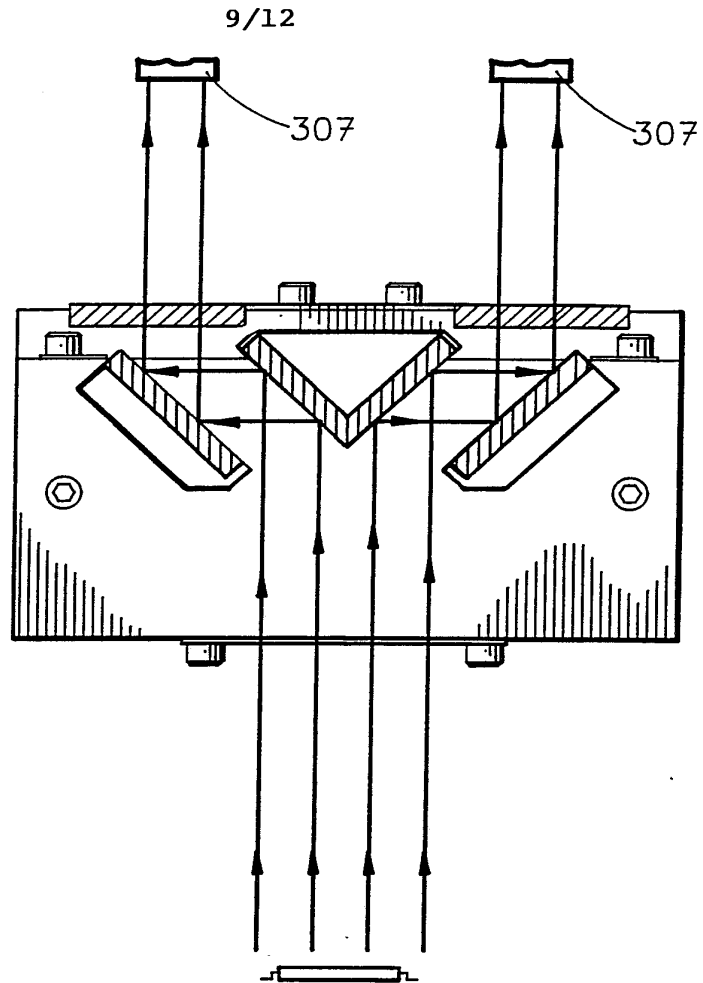


FIG. 10.

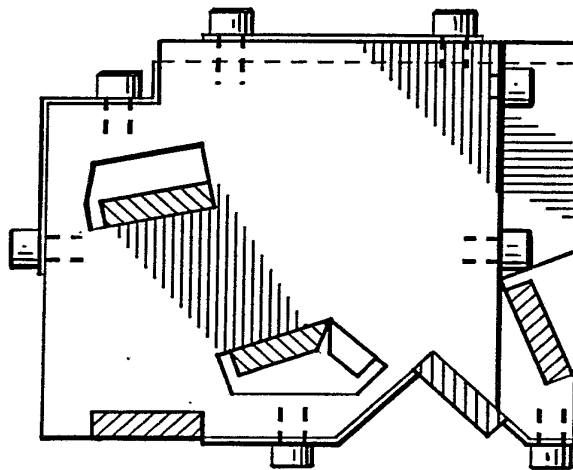


FIG. 11.
SUBSTITUTE SHEET

10/12

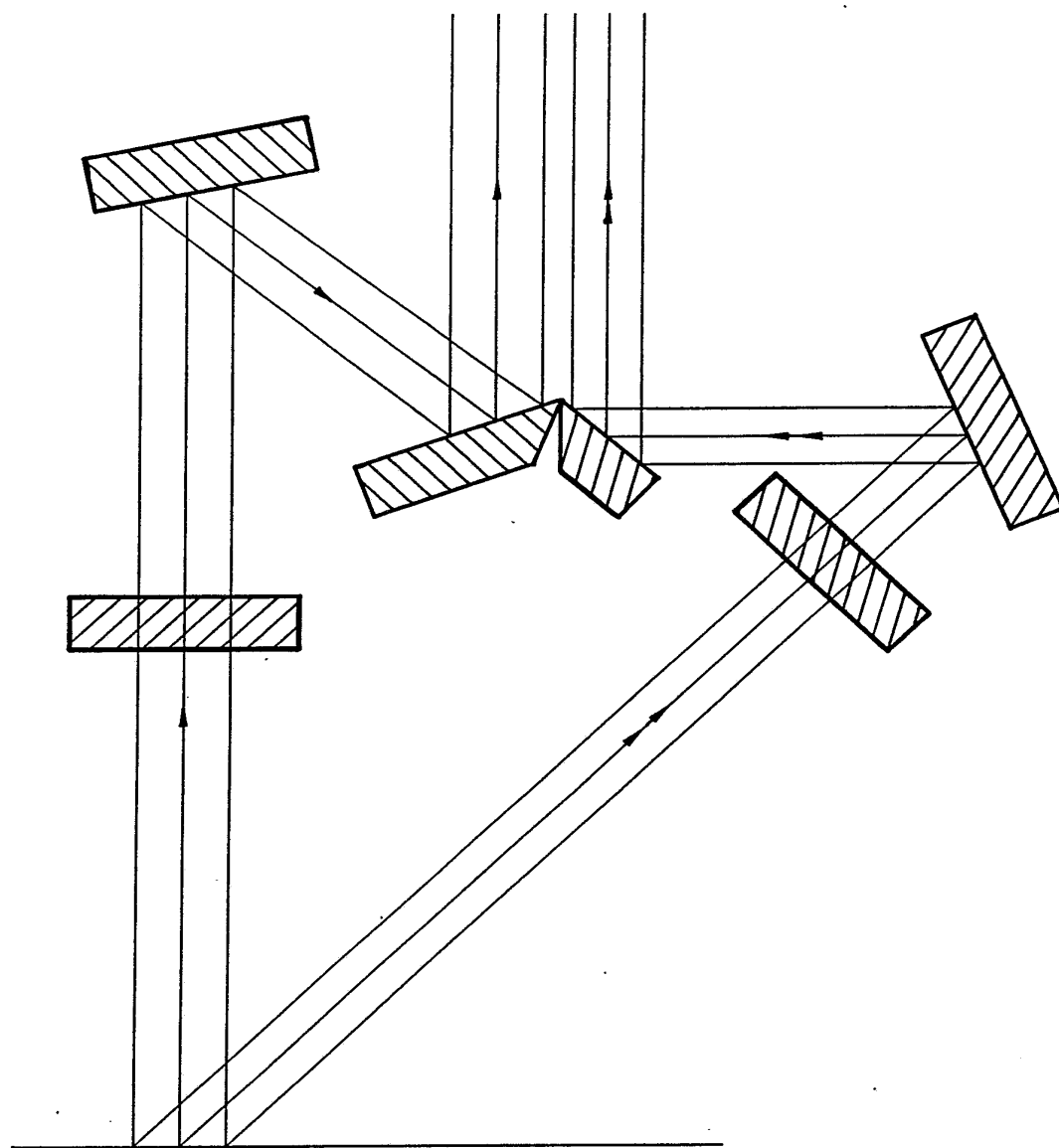


FIG. 12.
SUBSTITUTE SHEET

11/12

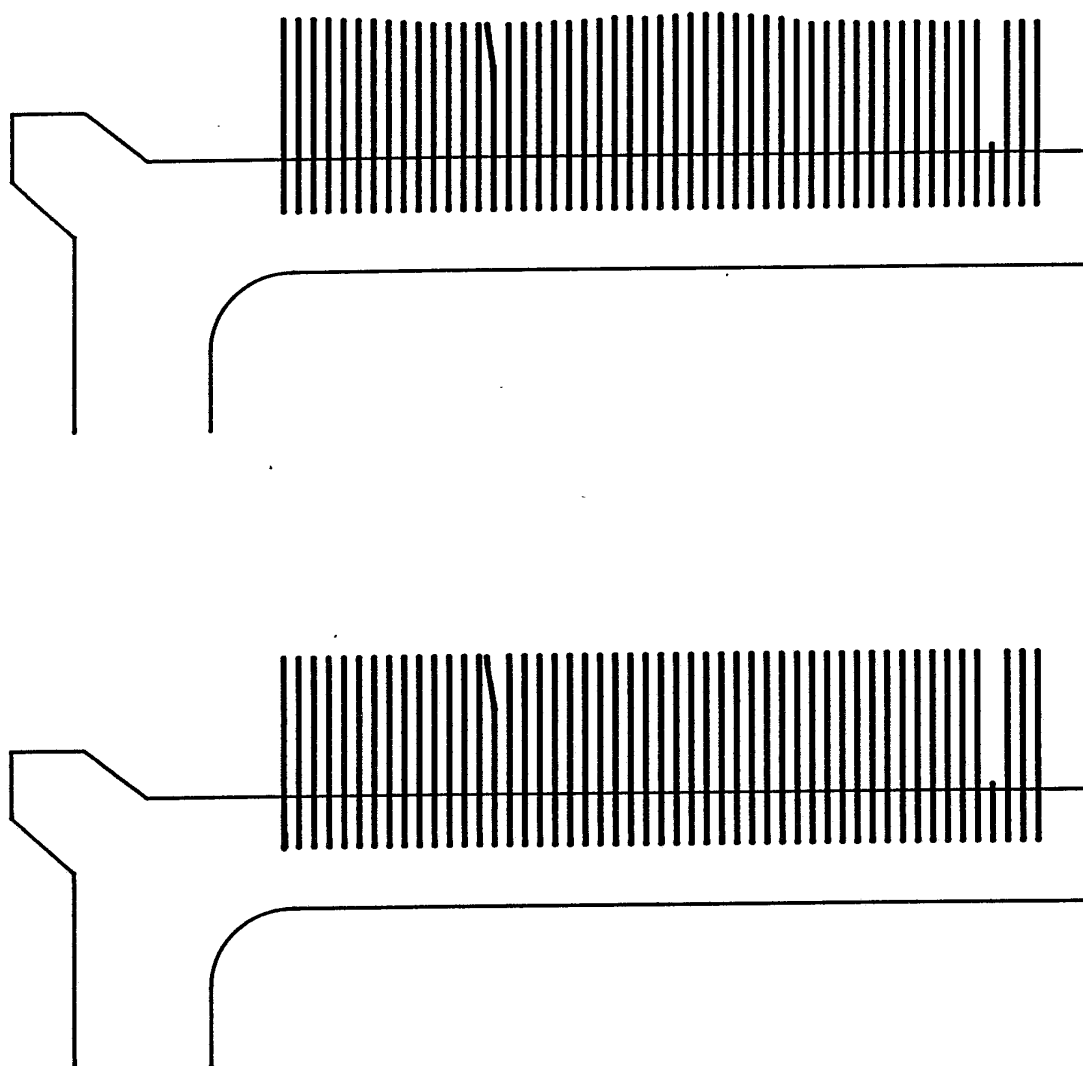


FIG. 13.

SUBSTITUTE SHEET

12/12

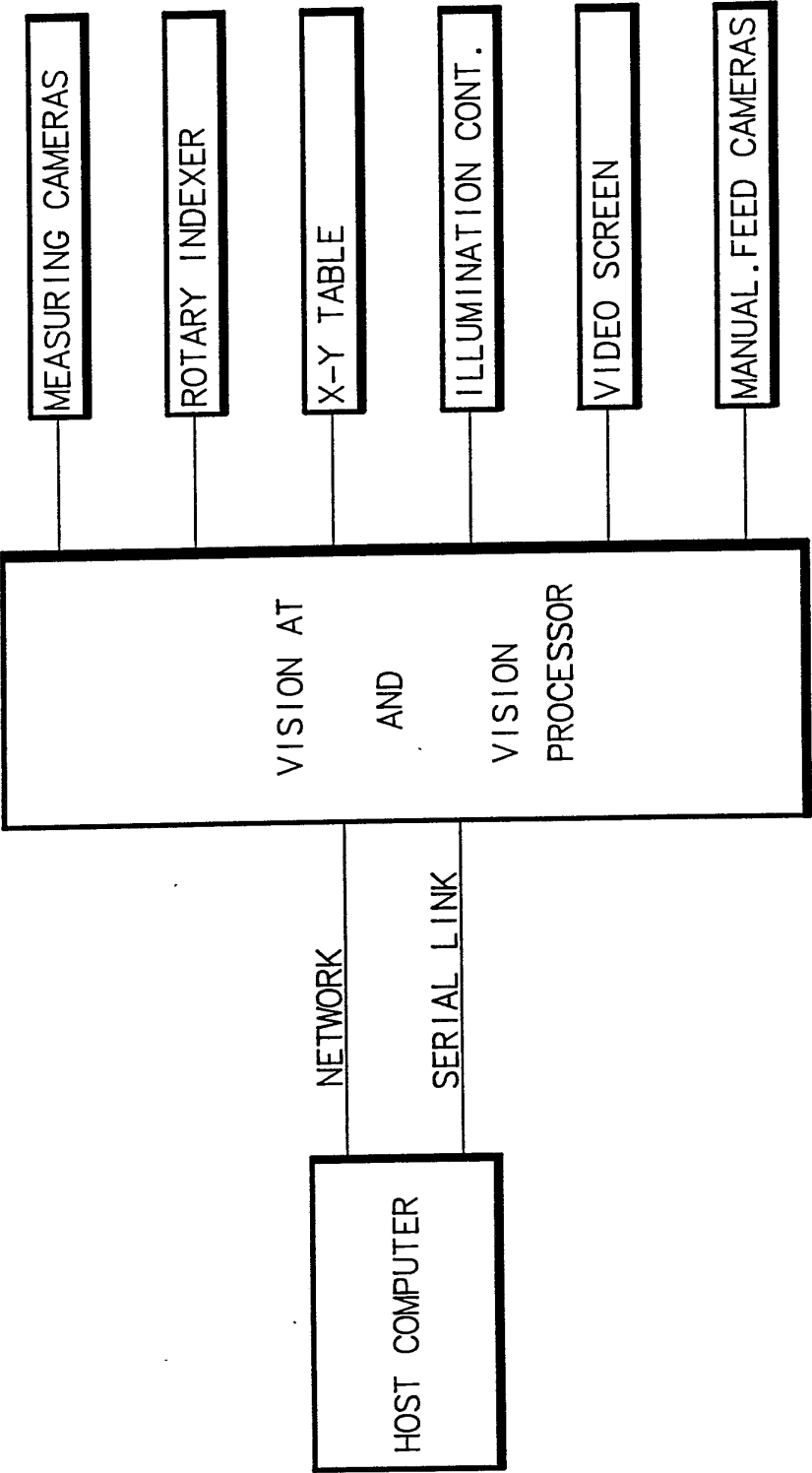


FIG.14.

SUBSTITUTE SHEET

INTERNATIONAL SEARCH REPORT

International Application No

PCT/CA 91/00055

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) * According to International Patent Classification (IPC) or to both National Classification and IPC IPC ⁵ : H 05 K 13/08		
II. FIELDS SEARCHED Minimum Documentation Searched ⁷ Classification System Classification Symbols IPC ⁵ H 05 K, H 01 L Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched *		
III. DOCUMENTS CONSIDERED TO BE RELEVANT *		
Category *	Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²	Relevant to Claim No. ¹³
A	EP, A, 0336114 (SIEMENS) 11 October 1989 see column 3, lines 33-51; figure 1 ---	1, 3
A	DE, A, 2630139 (SIEMENS) 12 January 1978 see page 10, lines 11-30; figure 1 ---	1
A	US, A, 4674670 (WATANABE) 23 June 1987 see column 6, line 58 - column 7, line 4; figure 6 -----	1
* Special categories of cited documents: ¹⁰ "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier document but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art. "G" document member of the same patent family		
IV. CERTIFICATION Date of the Actual Completion of the International Search 13th May 1991 International Searching Authority EUROPEAN PATENT OFFICE		Date of Mailing of this International Search Report 19 JUN 1991 Signature of Authorized Officer PISS I. TAZELAAR

Form PCT/ISA/210 (second sheet) (January 1985)

**ANNEX TO THE INTERNATIONAL SEARCH REPORT
ON INTERNATIONAL PATENT APPLICATION NO.**

CA 9100055
SA 44719

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report. The members are as contained in the European Patent Office EDP file on 14/06/91. The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP-A- 0336114	11-10-89	DE-U- 8804665	01-06-88
DE-A- 2630139	12-01-78	None	
US-A- 4674670	23-06-87	JP-A- 61047647	08-03-86
		JP-A- 61051932	14-03-86
		US-A- 4763827	16-08-88

EPO FORM P0479

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification ⁵ : B23Q 35/128	A1	(11) International Publication Number: WO 90/03867 (43) International Publication Date: 19 April 1990 (19.04.90)
(21) International Application Number: PCT/EP89/01157 (22) International Filing Date: 2 October 1989 (02.10.89) (30) Priority data: 84136 A/88 3 October 1988 (03.10.88) IT (71) Applicant (for all designated States except US): SILCA S.P.A. [IT/IT]; Via Podgora, 20, Zona Industriale, I-31029 Vittorio Veneto (IT). (72) Inventor; and (75) Inventor/Applicant (for US only) : FADEL, Paolo [IT/IT]; Via Manzoni, I-31048 S. Biagio di Callalta (IT). (74) Agent: PIOVESANA, Paolo; Corso del Popolo, 70, I-30172 Mestre (IT).		(81) Designated States: AT (European patent), AU, BB, BE (European patent), BF (OAPI patent), BG, BJ (OAPI patent), BR, CF (OAPI patent), CG (OAPI patent), CH (European patent), CM (OAPI patent), DE (European patent), DK, FI, FR (European patent), GA (OAPI patent), GB (European patent), HU, IT (European patent), JP, KP, KR, LK, LU (European patent), MC, MG, ML (OAPI patent), MR (OAPI patent), MW, NL (European patent), NO, RO, SD, SE (European patent), SN (OAPI patent), SU, TD (OAPI patent), TG (OAPI patent), US. Published <i>With international search report.</i>
(54) Title: OPTICAL PROFILE READER, PARTICULARLY FOR KEY DUPLICATING MACHINE (57) Abstract An optical profile reader, particularly for key duplicating machines, characterised by comprising: a photoemitter (16) positioned on one side of the profile (11) to be read, a photodetector (21) facing said photoemitter (16) on the opposite side of said profile to be read, an electronic circuit controlled by the output signal of said photodetector (21) and comprising a threshold discriminator (25) set at a value between the values corresponding to the maximum illumination state and minimum illumination state of said photodetector (21), and mechanical means (5, 8) for causing the profile (11) to be read (by 21) to move orthogonal to the direction of and relative to the light beam striking said profile, said mechanical means being controlled by said threshold discriminator circuit (25).		

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AT	Austria	ES	Spain	MG	Madagascar
AU	Australia	FI	Finland	ML	Mali
BB	Barbados	FR	France	MR	Mauritania
BE	Belgium	GA	Gabon	MW	Malawi
BF	Burkina Faso	GB	United Kingdom	NL	Netherlands
BG	Bulgaria	HU	Hungary	NO	Norway
BJ	Benin	IT	Italy	RO	Romania
BR	Brazil	JP	Japan	SD	Sudan
CA	Canada	KP	Democratic People's Republic of Korea	SE	Sweden
CF	Central African Republic			SN	Senegal
CG	Congo	KR	Republic of Korea	SU	Soviet Union
CH	Switzerland	LI	Liechtenstein	TD	Chad
CM	Cameroon	LK	Sri Lanka	TG	Togo
DE	Germany, Federal Republic of	LU	Luxembourg	US	United States of America
DK	Denmark	MC	Monaco		

-1-

**OPTICAL PROFILE READER,
PARTICULARLY FOR KEY DUPLICATING MACHINE**

This invention relates to an optical profile reader, particularly for key duplicating machine.

Known optical readers are used for example in robotics for controlling the shape and dimensions of workpieces. These
5 are devices of undoubted reliability but they are also very complicated and can find practical use only in highly sophisticated equipment, their cost being so high that they could not be conveniently used in other sectors such as in key duplicating machines. In this latter sector the profile
10 of a key is in fact generally read mechanically by sliding along the profile of the original key to be duplicated a feeler mechanically connected to a cutter which duplicates this profile on a blank key to be cut.

One drawback of this known reading system is that the
15 movement of the feeler in contact with the key profile results in mutual wear.

The wear undergone by the feeler results in a loss of reproductive accuracy, while the wear undergone by the original key can mean that with the passing of time it is no
20 longer possible to use it to cut further keys able to operate the respective lock, and that finally the key itself is of no further use.

A further drawback of a mechanical key reader is that

- 2 -

the data which is read must be used directly and immediately, and cannot be memorized. It is therefore not possible to delay the use of the data, and in particular where a certain number of copies are to be obtained from a given original it is necessary to repeat the reading this number of times, with all the aforesaid drawbacks which arise with each reading.

An object of the invention is to provide an optical reader for profiles in general, and particularly for key duplicating machines, which is of reliable operation, is of low cost and can be constructed using components easily available commercially.

A further object of the invention is to provide an optical reader which allows the read information to be preserved for subsequent and repeated use.

These and further objects which will be apparent from the description given hereinafter are attained according to the invention by an optical profile reader, particularly for key duplicating machines, characterised by comprising:

- a photoemitter positioned on one side of the profile to be read,
- a photodetector facing said photoemitter on the opposite side of said profile to be read,
- an electronic circuit controlled by the output signal of

- 3 -

said photodetector and comprising a threshold discriminator set at a value between the values corresponding to the maximum illumination state and minimum illumination state of said photodetector, and

- 5 - mechanical means for causing the profile to be read to move orthogonal to the direction of and relative to the light beam striking said profile, said mechanical means being controlled by said threshold discriminator circuit.

A preferred embodiment of the present invention is
10 described hereinafter with reference to the accompanying drawings in which:

Figure 1 a plan schematic view of a key duplicating machine provided with the optical reader according to the invention,

- 15 Figure 2 shows in side detailed view the duplicating machine according to the invention,

Figure 3 shows the block diagram of the optical reader, and
Figure 4 is a schematic view showing the principle on which the operation of said reader is based.

- 20 As can be seen from the figures the optical reader according to the invention is applied to a key duplicating machine comprising a base 1 on which there is disposed a conventional cross table 2, ie a longitudinal slide 3 (with

- 4 -

reference to the longitudinal axis of the keys) mobile along a dovetail 4 provided in said base 1 and driven by an electrical stepping motor 5.

The longitudinal slide 3 is also provided with a 5 dovetail guide along which an overlying transverse slide 7 runs, driven by another electrical stepping motor 8.

Two clamps 9 and 10 of conventional type are applied to the slide 7 for clamping an original key 11 to be duplicated and a blank key 12 to be cut.

10 The optical reader according to the invention, indicated overall by 13, and a cutter 14 rotated by an electric motor 15 are fixed to the base 1 spaced apart by the distance between the reference planes of the two clamps 9 and 10 respectively, and facing these latter.

15 The optical reader 13 comprises:

- a photoemitter 16 consisting for example of a LED and disposed above the plane in which the original key 11 is clamped in the clamp 9,
- a first lens 17 also disposed above said clamping plane for 20 the purpose of collimating the luminous rays originating from the LED 16,
- a second lens 18 disposed below said clamping plane for the purpose of causing the collimated beam to converge, and

- 5 -

- a screen 19 disposed at a distance from said lens 18 greater than double focal length thereof. The screen 19 is constructed of a material opaque to light rays, such as metal, and comprises a small hole 20 beyond which there is positioned a photodetector 21, such as a photodiode or phototransistor.

The photodetector 21 is connected to a preamplifier 22, the output of which is connected to a microprocessor 23 and to an amplifier 24.

The output of the amplifier 24 is connected to a threshold discriminator circuit 25 provided with two outputs which control the rotation of the electric motor 8 in the two different directions.

The threshold discriminator 25 is set to discriminate a signal level corresponding to 50% of the maximum illumination of the photodetector 21 by the photoemitter 16. As in practice the threshold discriminator circuit 25 has an inherent sensitivity, it will provide a signal at one of the two outputs when the output signal from the photodetector 21 is less by a certain sensitivity threshold than that corresponding to 50% of its maximum illumination, and will provide a signal at the other output when the signal from the photodetector 21 is greater by said threshold sensitivity

- 6 -

than that corresponding to 50% of its maximum illumination. The illumination conditions of the photodetector 21 at the nominal illumination value and at the two extreme values which determine the observation "window" are illustrated 5 schematically by the reference numerals 26, 26' and 26" in Figure 4.

The microprocessor 23 controls the power to the photoemitter 16 and also controls the entire operation of the apparatus, and in particular ensures that only after the 10 motor 8 has halted in the correct position does the motor 5 advance through one step.

The operation of the aforesaid apparatus is as follows: after placing the original key 11 in the clamp 9 and the blank key to be cut 10 in the clamp 12, the machine is powered.

15 This involves an initial setting operation, effected before the key 11 is interposed between the photoemitter 16 and photodetector 21. Under these conditions the microprocessor 23 regulates the power to the photoemitter 16 such that the output voltage of the preamplifier 22 attains a 20 predetermined value. At this point the motor 8 is automatically operated to advance the slide 4 stepwise so that the original key 11 moves towards the optical reader 13.

This movement continues until the initial portion of the

- 7 -

profile of the key 11 begins to interfere with the path of the light beam between the two lenses 17 and 18. Following this interference the quantity of light which strikes the photodetector 21 begins to fall below the initial recorded value. The key 11 advances as the motor 8 continues to be controlled by the threshold discriminator 25 until the illumination of the photodetector 21 is such that the output signal of the amplifier 24 falls within the observation window 26', 26'', which signifies that the key profile falls approximately along the middle of the hole 20. Under these conditions the output signal of the threshold discriminator circuit 25 is interrupted, the motor 8 stops and the pin of the longitudinal motor 5 is caused to advance.

The advancement of the key 11 relative to the optical reader 13 due to this advancing movement of the motor 5 generally results in a different degree of illumination of the photodetector 21, to produce an output signal from the amplifier 24 which causes the motor 8 to operate in the sense of moving the key 11 towards or away from the reader, so as to return the output signal of the amplifier 24 to within the window of the threshold discriminator 25.

In practice the original key 11 oscillates about the position in which it obscures 50% of the hole 20, the

- 8 -

amplitude of this oscillation being related to the sensitivity of the threshold discriminator circuit 25, whereas the movements depend on the "step" of the motor 8. In addition as this oscillation occurs the motor 5 is also operated, to move in that direction which causes the key 11 to move between the two lenses 17 and 18 of the optical reader 13. The combined effect of these two movements is to move the original key 11 relative to the hole 20, in accordance with its profile.

10 As the distance between the light beam of the optical reader 13 and the operating "line" of the cutter is fixed and equal to the distance between the two keys 11 and 12, the movements of the slide 7 along the profile of the original key 11 result in the formation of a substantially identical
15 profile on the blank key 12 by the cutter 14.

In this manner, using the optical reader according to the invention an original key can be duplicated without any mutual rubbing contact being required between the key and a feeler, and consequently without either undergoing wear. In
20 addition the succession of commands to the two motors 5 and 8 can be memorized together with a corresponding reference code for that particular key, so that if further duplications are required it is a simple matter to feed said code in and

- 9 -

obtain a copy of the original key without the need for said original key to be present.

This is achieved by means of a very simple device which can be constructed with parts easily available commercially,
5 is of low cost and at the same time is of high sensitivity and operating precision.

- 10 -

C L A I M S

1. An optical profile reader, particularly for key duplicating machines, characterised by comprising:
 - a photoemitter (16) positioned on one side of the profile
 - 5 (11) to be read,
 - a photodetector (21) facing said photoemitter (16) on the opposite side of said profile to be read,
 - an electronic circuit controlled by the output signal of said photodetector (21) and comprising a threshold
 - 10 discriminator (25) set at a value between the values corresponding to the maximum illumination state and minimum illumination state of said photodetector (21), and
 - mechanical means (5,8) for causing the profile (11) to be read (by 21) to move orthogonal to the direction of and
 - 15 relative to the light beam striking said profile, said mechanical means being controlled by said threshold discriminator circuit (25).
2. An optical reader as claimed in claim 1, characterised in that between the photoemitter (16) and photodetector (21)
- 20 there is interposed an optical system comprising at least two lenses (17,18) situated on opposite sides of the profile (11) to be read, the lens (17) close to the photoemitter (16) being arranged to collimate the light rays originating from

- 11 -

said photoemitter (16), and which then traverse the profile to be read in a direction orthogonal to the plane which contains it, the other lens (18) being arranged to again converge said rays in order to project the image of said profile onto a surface (19) disposed at a distance from said lens which is greater than double its focal length, the photodetector (21) being situated in a position facing a small hole (20) provided in said surface.

3. An optical reader as claimed in claim 1, characterised in that between the photoemitter (16) and photodetector (21) there is interposed an optical system comprising a lens (17) arranged to deviate the light rays originating from said photoemitter (16) in order to project the image of said profile (11) between the focus and double the focal length onto a surface (19) disposed at a distance of more than double said focal length and comprising a small hole (20), facing which said photodetector (21) is disposed.

4. An optical reader as claimed in claim 1, characterised in that the electronic circuit controlled by said photodetector (21) comprises a preamplifier (22) followed by an amplifier (24) for controlling the threshold discriminator circuit (25).

5. An optical reader as claimed in claim 4, characterised

- 12 -

in that the electronic circuit controlled by said photodetector (21) comprises a microprocessor (23) which acts automatically on the power supply to said photoemitter (16) in order to adjust that output signal of said preamplifier
5 (22) corresponding to maximum illumination of said photodetector (21) to a predetermined set value.

6. An optical reader as claimed in claim 1, characterised in that the threshold discriminator circuit (25) is set at a value corresponding to 50% of maximum illumination of said
10 photodetector (21).

7. An optical reader as claimed in claim 1, characterised in that the threshold discriminator circuit (25) is provided with two outputs which control in the two opposite directions the mechanical means (5) for moving said profile (11).

15 8. A key duplicating machine using an optical reader claimed in one or more of the preceding claims, characterised by comprising:

- a clamp (10) for a blank key (12) to be cut and facing a cutter (14),
- 20 - a clamp (9) for an original key (11) to be duplicated and facing said optical reader (13),
- a stepping motor (8) controlled in the two directions of rotation by the two outputs of the threshold discriminator

- 13 -

circuit (25) and arranged to cause said original key to be duplicated (11) to undergo said relative movements orthogonal to the longitudinal axis,

- a stepping motor (5) for causing the keys to undergo
5 relative movements parallel to the longitudinal axis,
the operation of said motor (5) being conditional on the original key (11) having attained the correct position relative to said optical reader (13) as required for the reading of its profile.

1/2

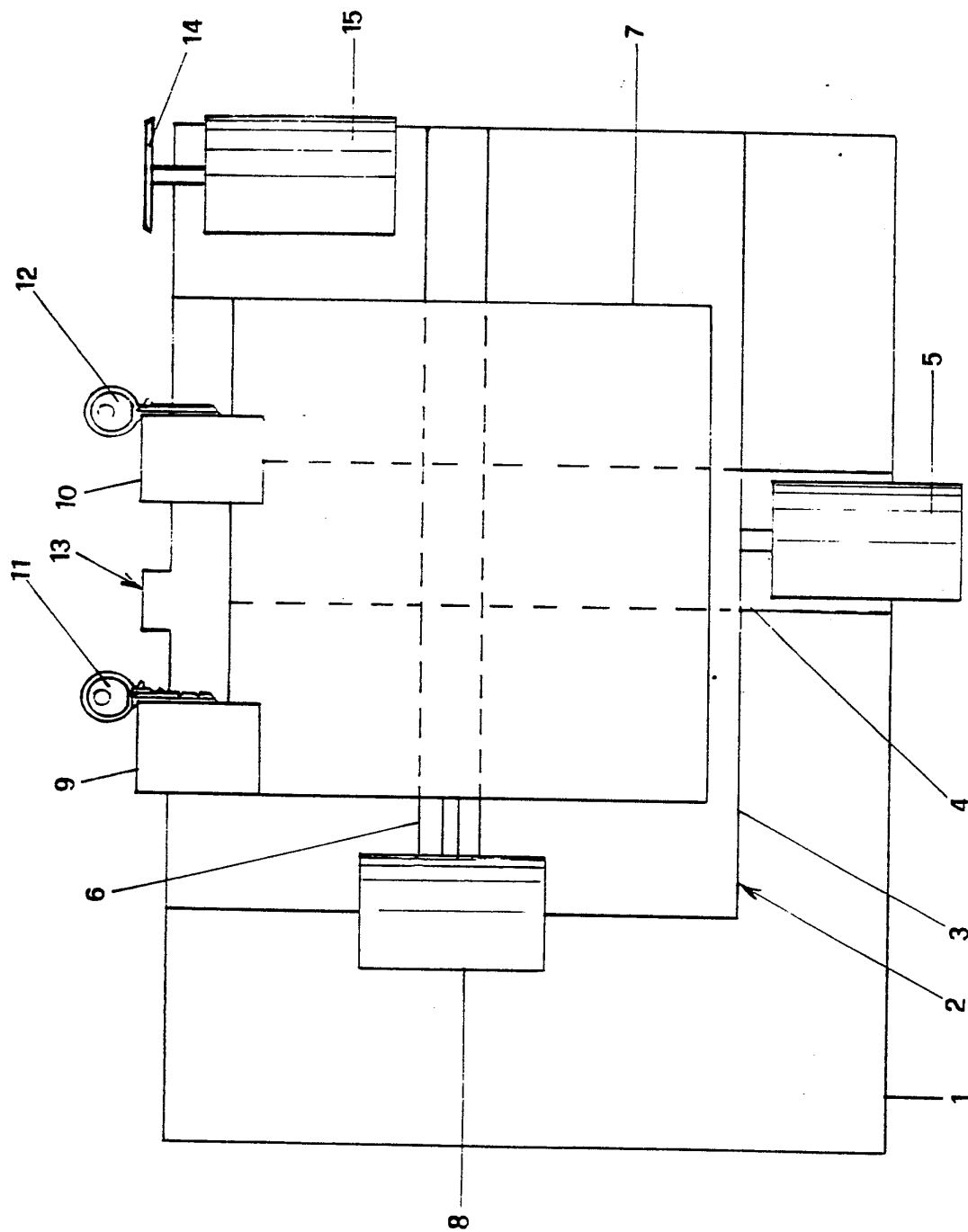


FIG.1

2/2

FIG.2

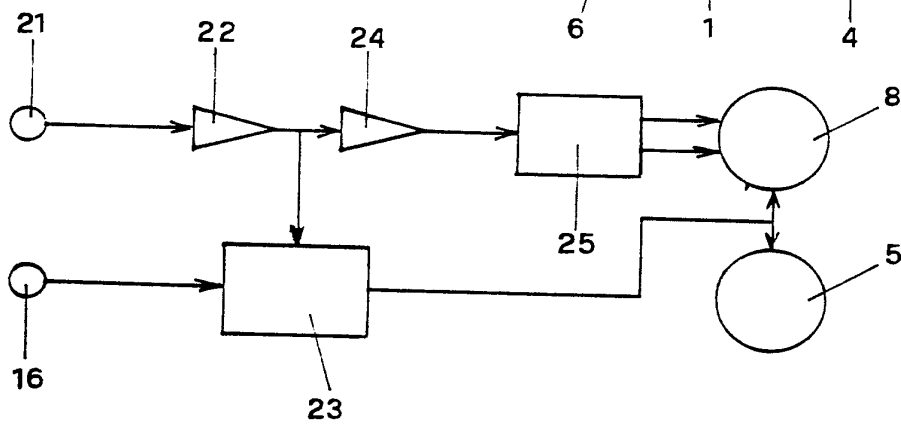
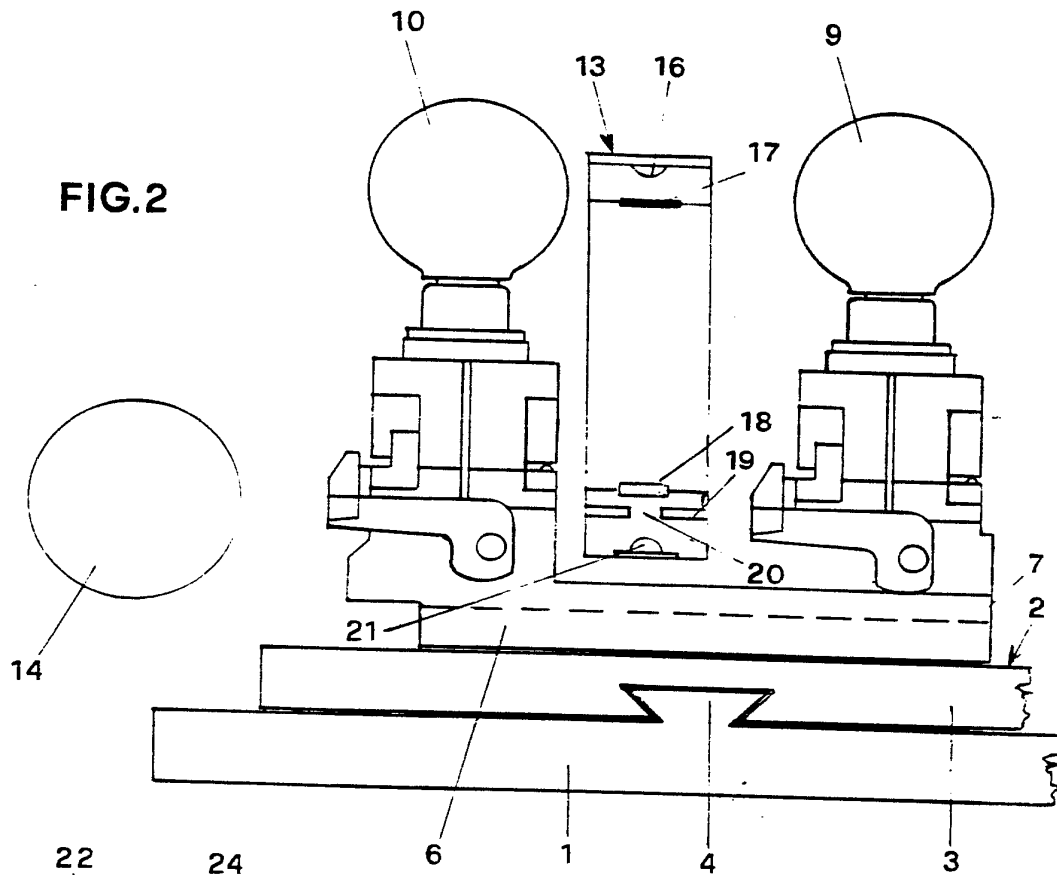


FIG.3

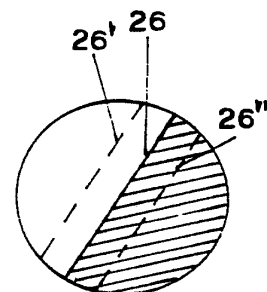


FIG.4

INTERNATIONAL SEARCH REPORT

International Application No.

PCT/EP 89/01157

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) ⁶ According to International Patent Classification (IPC) or to both National Classification and IPC: Int.Cl. 5 B23Q35/128		
II. FIELDS SEARCHED		
Minimum Documentation Searched ⁷		
Classification System	Classification Symbols	
Int.Cl. 5	B23Q ; B23C	
Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched ⁸		
III. DOCUMENTS CONSIDERED TO BE RELEVANT⁹		
Category	Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²	Relevant to Claim No. ¹³
Y	GB,A,2006426 (DAINIPPON SCREEN SEIZO K.K.) 02 May 1979 see the whole document	1
A	see figure 13 ---	2, 3
Y	US,A,4657448 (A. ALEXANDER) 14 April 1987 see the whole document	1
A	---	8
A	US,A,3429207 (W. JOHN) 25 February 1969 see columns 3 - 4; figure 2	2, 3
A	US,A,3259022 (VIETORISZ) 05 July 1966 see column 3, line 52 - column 4, line 52; figure 4	2-8
A	EP,A,0133091 (H.K. FRANCE_S.A.) 13 February 1985 see the whole document ---	2-8
¹⁰ Special categories of cited documents: "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier document but published on or after the international filing date "I" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "F" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art. "&" document member of the same patent family		
IV. CERTIFICATION		
Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report	
12 JANUARY 1990	- 1. 02. 90	
International Searching Authority	Signature of Authorized Officer	
EUROPEAN PATENT OFFICE	MOYLE J. F.	

Form PCT/ISA/210 (second sheet) (January 1985)

**ANNEX TO THE INTERNATIONAL SEARCH REPORT
ON INTERNATIONAL PATENT APPLICATION NO.**

PCT/EP 89/01157
SA 31626

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report.
The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

12/01/90

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
GB-A-2006426	02-05-79	JP-A- 54033101 DE-A, C 2833974 US-A- 4498109 US-A- 4300170	10-03-79 01-03-79 05-02-85 10-11-81
US-A-4657448	14-04-87	None	
US-A-3429207	25-02-69	None	
US-A-3259022		None	
EP-A-0133091	13-02-85	FR-A, B 2548938 JP-A- 60076906	18-01-85 01-05-85

EPO FORM PWT9

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82



Espacenet

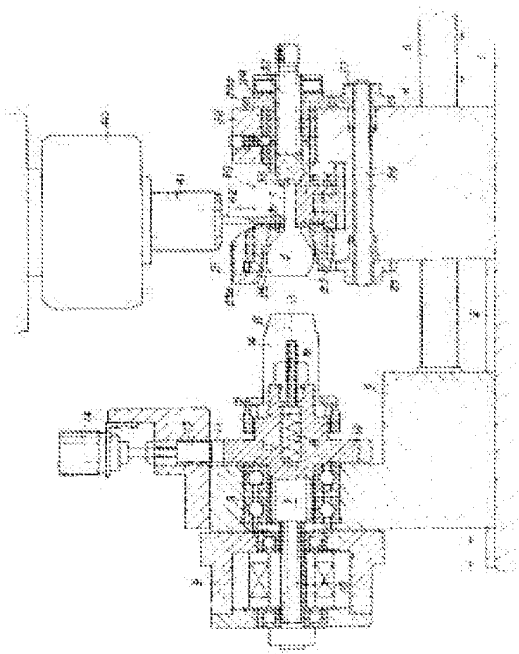
Bibliographic data: JPS59201708 (A) — 1984-11-15**MACHINING DEVICE OF KEY**

Inventor(s): TSUNODA TSUTOMU ± (TSUNODA TSUTOMU)
Applicant(s): TSUGAMI TOTSUKI KK ± (TSUGAMI TOTSUKI KK)
Classification: - **international:** B23B41/00; (IPC1-7): B23B41/00
- **cooperative:** B23B41/00
Application number: JP19830072358 19830425
Priority number(s): JP19830072358 19830425
Also published as: JPS615845 (B2)

Abstract of JPS59201708 (A)

PURPOSE:To promote work efficiency to be improved when a digital code key is machined, by utilizing a numerically controlled (NC) drill machine for use of general purpose.

CONSTITUTION:Respectively arranging a spindle 7, pusher 16 and the first, second rotary units 23, 24 in a row on each of the first and the second supporting blocks 3, 4, a device is constituted so as to machine a key one by one. Plural rows of similar mechanisms, being parallelly provided on each of the supporting blocks 3, 4, enables many pieces of the keys to be simultaneously machined, thus improving efficiency of the work. Further the device, after inserting a key element (d) to be mounted to a recessed part 29 of truncated cone shape, automatically performs the work of holding the key element (d) and turning its machined face to be positioned.



⑩ 日本国特許庁 (JP)

⑪ 特許出願公開

⑫ 公開特許公報 (A)

昭59—201708

⑮ Int. Cl.³
B 23 B 41/00

識別記号

庁内整理番号
7528—3C

⑬ 公開 昭和59年(1984)11月15日

発明の数 1
審査請求 有

(全 8 頁)

⑭ 鍵の加工装置

東京都板橋区徳丸 4—25—13

⑯ 特 願 昭58—72358

⑰ 出 願 人 津上特機株式会社

⑱ 出 願 昭58(1983) 4 月25日

東京都中央区銀座 7 丁目15番 5
号

⑲ 発 明 者 角田勉

⑳ 代 理 人 弁理士 和田成則

明 細 書

1. 発明の名称

鍵の加工装置

2. 特許請求の範囲

(1) NCドリルマシンのXYテーブル上に載置
固定可能で、かつその上面には直線状ガイドを有
する基台と；

少なくとも一方が前記直線状ガイドに案内され、
かつ互いに接触可能に対向配置させて前記基台上
に設けられた第1、第2の支持ブロックとからな
り；

前記第1の支持ブロックの対向端面には、水平
軸を中心に回転自在に支承され、かつ先端部を半
割円錐台状に形成してなる押圧子が突出されると
ともに、該ブロックには前記押圧子を90°回転
送り可能な駆動源が搭載され；

前記第2の支持ブロックには、前記直線状ガイ
ドと直交する溝を挟んで対向する第1、第2の支
持壁部が形成されるとともに、前記両支持壁部に
は、前記押圧子と同一の回転中心を有し、かつ互

いに運動して回転する第1、第2の回転体がそれ
ぞれ支承され；

前記第1の回転体には、前記第1の支持ブロッ
ク側に開口する円錐台状凹部が形成されるととも
に、該凹部の終端壁には、鍵の軸部断面に対応す
る貫通孔が形成され；

前記第2の回転体の第1の支持壁側の面には、
鍵の先端部に嵌合する凹部が形成されてなること
を特徴とする鍵の加工装置。

(2) 前記第2の支持ブロックの溝には、鍵の下
面を押当てるための押当て治具がスライド自在に
設けられ；

前記押当て治具には、水平状態に支持された鍵
の下面高さに対応する第1の水平面と、垂直状態
に支持された鍵の下面高さに対応する第2の水平
面と、これら第1、第2の水平面間に形成される
逃げ凹部が形成されてなることを特徴とする特許
請求の範囲第1項に記載の鍵の加工装置。

3. 発明の詳細な説明

《発明の分野》

この発明は、例えば鍵軸部の表裏両面および左右両側端面の何れにもコード孔を有するデジタルコード鍵の加工等に好適な鍵の加工装置に関する。《従来技術とその問題点》

第1図にデジタルコード鍵の一例を示す。このデジタルコード鍵aは、摘子部bと鍵軸部cとの形状加工を施してなる鍵エレメントdに対して、その鍵軸部cの表裏両面e、fおよび左右両側端面g、hに、3段階に深さを異ならせてなるコード孔i、j…を一列に配列して構成されている。

一方、このデジタルコード鍵aに対応する錠側の鍵孔内周面には、各コード孔位置に対応してピンが出没自在に設けられ、このピンの出没深さに基づいてコード一致判別が行なわれる。ここで、表裏両面および左右両側端面にコード孔が形成されていることから、出没ピンの配列間隔をさほど密にせずとも全体のコード桁を増大できる等の特徴がある。

また、表裏両面e、fのコードは互いに同一で、また左右両側端面g、hのコードについても互い

に同一となっているため、鍵aを鍵孔に挿入するに際して上下の方向性を制限されることがなく、このため暗闇等においても容易に鍵孔に挿入できる等の利点があり、また用途としては、ファイルロッカー、ファイルキャビネット等広くオフィス機器等に使用される。

ところで、従来この種デジタルコード鍵の加工にあつては、ドリルマシンのテーブル上に所定の位置決め治具を固定し、これに孔明け加工が変るたびに鍵エレメントdを垂直あるいは水平に手作業で取付け直し、各コード孔の加工をドリルにより手作業で行なっていた。このため、この種デジタルコード鍵aの加工にあつては、作業能率が悪いことから、加工工数、加工時間ともに増大し、これがコストアップの要因に繋がるという問題があった。

他方、以上の問題の解決手段としては、鍵エレメントdの加工用に専用の全自動加工機械を製作することもあるが、製品需要等を考えた場合、経済性の観点からは必ずしも得策ではない。

《発明の目的》

この発明の目的は、この種デジタルコード鍵の加工のために専用の自動加工機械を製作するのではなく、汎用のNCドリルマシンを利用し、かつ鍵エレメントの位置決めに関してのみ省力化を図り、これにより工数低減および作業能率の向上を実現してコストダウンを可能にすることにある。

《発明の構成と効果》

この発明は上記の目的を達成するために、NCドリルマシンのXYテーブル上に載置固定可能で、かつその上面には直線状ガイドを有する基台を設けるとともに、この基台上には少なくとも一方が前記直線状ガイドに案内され、かつ互いに接離可能に対向配置させて第1、第2の支持ブロックを設ける。

前記第1の支持ブロックの対向端面には、水平軸を中心に回転自在に支承され、かつ先端部を半割円垂台状に形成してなる押圧子を突出させて設けるとともに、該ブロックにはまた前記押圧子を90°回転送り可能な駆動源を搭載する。

前記第2の支持ブロックには、前記直線状ガイドと直交する溝を挟んで対向する第1、第2の支持壁部を形成し、前記両支持壁部には、前記押圧子と同一の回転中心を有し、かつ互いに連動して回転する第1、第2の回転体をそれぞれ支承する。

前記第1の回転体には前記第1の支持ブロック側に開口する円錐台状凹部を形成するとともに、該凹部の終端壁には、鍵の軸部断面に対応する貫通孔を形成する。

前記第2の回転体の第1の支持壁側の面には、鍵の先端部に嵌合する凹部を形成する。

以上の構成によれば、鍵エレメントa前記円錐台状凹部に挿入載置した後は、鍵エレメントaの保持および加工面の回転位置決めについては自動的に行なわれる。このため、NCドリルマシンのXYテーブルの動きを各コード孔の位置に対応して制御し、かつ各コード孔の深さに相当する情報でドリルの昇降動作を制御すれば、表裏両面e、fおよび左右両側端面g、hに対する各コード孔の自動加工が可能となる。

《実施例の説明》

第2図はこの発明に係わる鍵の加工装置の一実施例を示す側断面図である。同図において平板状基台1はNCドリルマシンの図示しないXYテーブル上のT溝にボルトを介して載置固定可能に構成され、かつこの基台1の上面側には直線状ガイド(この例では突条)2が一体に形成されている。

基台1上には、第1の支持ブロック3が直線状ガイド2に案内されつつスライド自在に設けられるとともに、これと対向する直線状ガイド2の一端部には第2の支持ブロック4が基台1と一体に固定させて設けられている。

また、第1の支持ブロック3は第2の支持ブロック4を貫通するロッド5を介して図示しない流体シリンダへと連結され、この流体シリンダの前後進動作に連動して第1の支持ブロック3と第2の支持ブロック4とは互いに対向しつつスライドして接近または離隔するようになっている。

第1の支持ブロック3上には、軸受6を介してスピンドル7が回転自在に支承されており、この

スピンドル7の回転中心軸8はガイド2と平行な水平軸となっている。

また、第1の支持ブロック3の一侧にはパルスモータ9が取付けられ、このモータ9の回転軸10は前記スピンドル7へと直結されており、このためスピンドル7はパルスモータ9によって回転駆動される。

スピンドル7の先端側外周にはその外周面90°間隔でスロット11を刻設してなるディスク部12が一体に形成されている。また、このディスク部12の外周と対向するその上面側には、前記スロット11に係合するピン13が出没自在に設けられるとともに、このピン13は第1のブロック3に取付けられた流体シリンダ14によって出沒制御されるようになっている。

このため、ピン13をディスク部12のスロット11へと突出させることによって、スピンドル7は90°回転する毎に回り止め固定されるようになっている。

スピンドル7の先端部には、カップリング15

を介して、第4図に示す如く先端部を半割円錐台状に形成してなる押圧子16が取付けられており、また、スピンドル7の先端部に設けられた軸孔17内には圧縮スプリング18が縮装され、この圧縮スプリング18によって押圧ピン19がスピンドル7の先端側へと出沒自在に付勢されて設けられている。

このように、第1の支持ブロック3の第2の支持ブロック4側への対向端面からは、水平軸8を中心に回転自在に支承され、かつ先端部を半割円錐台状に形成してなる押圧子16が突出されるとともに、該ブロック3には前記押圧子16を90°回転送り可能なパルスモータ9(駆動源)が搭載されている。

他方、第2の支持ブロック4には、前記直線状ガイド2と直交する方向へ延びる溝20を挟んで対向する第1、第2の支持壁部21、22が形成されるとともに、これらの支持壁部21、22には、前記押圧子16と同一の回転中心軸8を有する第1、第2の回転体23、24がそれぞれ支承

されている。

そして、第1の回転体23と第2の回転体24とは、第1の回転体23の外周に形成されたギア部23a、このギア部23aと噛合する歯車25、この歯車25と一体に回転する回転軸26、この回転軸26と一体に回転する歯車27、この歯車27と噛合し、かつ前記第2の回転体24の外周に形成されたギア部24aを介して連結されており、このため互いに同期して同一速度で回転するように構成されている。

第1の回転体21には、第2図および第4図に示す如く、前記第1の支持ブロック3側に開口する円錐台状凹部29が形成されるとともに、該凹部29の終端壁30には、鍵エレメントdの軸部cの付け根の断面形状に対応する貫通孔31が形成されている。

また、第2の回転体24により一体に保持された中心部材32の先端面には、前記鍵エレメントdの軸部cの先端部に係合する凹部33が形成されている。

従って、鍵エレメントdの軸部3を、第1の支持壁部23の凹部29へ挿入するとともに、これを貫通孔31を貫通して第2の支持壁部22へと突出させ、その先端を中心部材32の先端凹部33に嵌合させることによって、鍵エレメントdの軸部cを第1、第2の回転体23、24間に架け渡した状態で支持できるようになっている。

第1、第2の支持壁部21、22間に形成された溝20内には、ガイドレール34が敷設されるとともに、このガイドレール34上には、第5図に示す如く、第1、第2の支持壁部21、22間に架け渡された鍵軸部cの下面を押当てるための押当て治具35がスライド自在に設けられ、この押当て治具35はガイドレール34の一端に固定された流体シリンダ36を介して駆動されるようになっている。

そして、この押当て治具35には、第5図(A)に示す如く、水平状態に支持された鍵軸部cの下面高さに対応する第1の水平面37と、第5図(C)に示す如く、垂直状態に支持された鍵軸部

cの下面高さに対応する第2の水平面38と、これら第1、第2の水平面37、38間に形成される逃げ凹部39とが形成されている。

この逃げ凹部39は、第5図(B)に示す如く、第1、第2の回転体23、24の回転とともに、鍵軸部cが回転した際、その回転軌跡が第1、第2の水平面37、38に引っ掛かることを防止するためのものである。

なお、第2図において、40はドリルマシンの加工ヘッド、41はチャック、42はドリルである。

次に、以上の構成からなる本発明装置の動作の一例を簡単に説明する。まず、各鍵番号に対応するコードを予め別途に設定する。この設定作業は、例えばコンピュータにより乱数コードを発生させながらその中の1つを選択するとともに、これら選択されたコードの中から鍵として不適当なコードを除外することによって自動的に行なうことができる。

また、各コードのフォーマットは、各デジット

を3種類の重み付で表わす複数桁のデジタルコードで表わされており、各デジットの値は、それぞれ該当するコード孔iの深さに対応している。

次いで、このようにして設定されたコードを鑽孔テープに表わし、この鑽孔テープをNCドリルマシンに読込ませて内部メモリに記憶させる。

他方、NCドリルマシン側においては、鍵エレメントdの鍵軸部cの表裏両面e、fおよび左右両側端面g、hに形成される各コード孔iの位置への位置決め制御プログラムを記憶させるとともに、各コード孔iの加工に際する深さ情報については変数として与え、この変数については前記内部メモリに記憶された各コードの各デジットの値が自動的に代入されるように設定する。

また、NCドリルマシン側においては、第1図に示す鍵軸部cの表裏両面e、fおよび左右両側端面g、hにそれぞれ形成された一列のコード孔加工が終了するたびに、外部にその旨を示すコマンドを出力するように構成する。

他方、NCドリルマシンの制御部とは別に、次

のような機能を有する外部制御部を、例えばシーケンサ、マイコンボード等によって構成する。

すなわち、所定の押釦操作等に応じて、まず第1の支持ブロック3をスライドさせて第2の支持ブロック4側へと所定距離接近移動させる。次いで、流体シリンダ36を駆動して押当て治具35を所定位置まで移動させ、鍵軸部cの下面に当接させる。次いで、ドリルマシン側へ孔明け加工の指示を与える。次いで、NCドリルマシン側から各一列のコード加工が終了したことを表わす信号が与えられると、流体シリンダ36を駆動して鍵軸部cの下面に逃げ凹部39を位置させた後、パルスモータ9駆動してこれを90°回転させ、再び鍵軸部cの下面に治具35を当接させる。次いで、流体シリンダ14を駆動してピン13をスロット11内へ突出させ、スピンドル7の回り止めを行ない、再びマシン側へ孔明け加工の指示を与える。以後、一列のコード加工が終了した信号が与えられるたびに、流体シリンダ14を駆動してピン15をスロット11内から後退させて回り止

めを解除させるとともに、再度パルスモータ9を90°回転させ、同時に治具35を適宜に駆動して以後同様な処理を鍵軸部cの表裏、左右側端面のそれぞれに対する孔明け加工が終了するまで4回繰り返す。

次いで、最後の面の加工が終了したことがマシン側から検出された場合、流体シリンダ(図示せず)を駆動して第1の支持ブロック3を第2の支持ブロック4から離隔させる。

このような外部制御部を例えばシーケンサ等で構成した後、実際の加工に際しては、次のような作業手順でこれを行なう。まず、第4図に示す如く、第1の回転体23の凹部29の平面部29aが水平となる状態に初期設定した後、鍵エレメントdをこの凹部29内に差込み、平面部29aに摘子部2を載置するとともに、第2図に示す如く、軸部cを第1の回転体23と第2の回転体24との間に架け渡す。

次いで、外部制御部に対して所定の操作指令が与えられると、図示しない流体シリンダが駆動さ

れてロッド5を介して第1の支持ブロック3は第2の支持ブロック4側へと移動し、これに伴ない押圧子16の先端は凹部29内へと突入する。このとき、押圧子16側から突出するピン19の先端が、鍵エレメントdの摘子部bの後端部を押圧することによって、鍵エレメントdは凹部29の奥方へと押し込まれると同時に、摘子部bと軸部cとの境界端面が貫通孔31の外周縁に当たって規制され、正確な挿入位置にセットされる。更に、押圧子16先端部外周に形成されたテーパ部16aが、凹部29の内周に形成されたテーパ部29bに案内されることによって、鍵エレメントdの摘子部bは凹部29の平面部29aと押圧子16の平面部16bとの間において挟持固定される。

次いで、以上の鍵エレメントdのセット操作が終了すると、マシン側に所定のコマンドが与えられ、XYテーブルが移動してドリル42の先端は、鍵エレメントdの軸部cの全長の中で、最初のコード孔位置へと位置決め制御される。

次いで、前述した各コードの最初のデジットの値が読込まれて、当該読込まれたデータに基づいてコード孔の深さが検出され、該当する深さの孔明け加工が行なわれる。

以後、順次XYテーブルが移動して、次のコード孔位置へとドリル42の先端は位置決めされ、同様にして次のデジットの孔深さデータに基づくコード孔加工が行なわれ、次いで軸方向一列のコード孔加工が終了すると、マシン側から外部制御部に対して所定のコマンドが与えられる。

すると、外部制御部からの信号によって流体シリンダ36が駆動され、押当て治具35は第5図(A)の状態から第5図(B)の状態へとスライドし、鍵エレメント軸部cの下方には逃げ凹部39が位置する状態となる。

次いで、再び外部制御部からの位置でパルスモータ9が90°回転駆動されて、第5図(B)に示す如く鍵エレメントの軸部3は90°回転し、第3図に示す垂直状態となる。

また、回転が終了すると同時に、ピン13はス

ロット11内に突出され、これによりスピンドル7の回り止め固定が行なわれる。

次いで、流体シリンダ36が再び駆動され、押当て治具35がスライドして、第5図(B)の位置から第5図(C)の位置へと移動し、これにより垂直状態となった鍵軸部cの下面側には押当て治具35の第2の水平面38が当接することになる。

以後、前述と同様に、XYテーブルが適宜駆動されて、ドリル42の先端部は各コード孔位置へと順次位置決めされ、当該面の一列のコード加工が全て終了すると同時に、以上の動作が繰り返し行なわれ、これにより鍵軸部cの表裏両面e、fおよび左右両側端面g、hに順次コード孔加工が自動的に行なわれることになる。

また、鍵軸部cが垂直あるいは水平何れの位置にある場合にも、その下面側には自動的に押当て治具35の上面が当接するため、ドリル42の加工に際しても、鍵エレメントdの軸部cが撓むような虞れもなく、これにより高精度の孔明け加工

を行なうことができる。

次いで、鍵軸部cの表裏両面e、fおよび左右両側端面g、hに対する加工が全て終了すると、外部制御部からの信号によって図示しない流体シリンダが駆動され、ロッド5を介して第1の支持ブロック3は第2の支持ブロック4から離隔され、再び第2図の状態に復帰する。

この状態において、鍵工元素dを抜き取り、新たな鍵工元素dを挿入し、以後同様にして順次鍵加工を行なうことができる。

なお、前記実施例では、第1、第2の各支持ブロック3、4上にそれぞれスピンドル7、押圧子16、第1、第2の回転体23、24を一列に配置し、1本ずつ鍵加工を行なうように構成したが、各支持ブロック3、4上に同様な機構を並列に複数列設ければ、同時に多数本の鍵加工を行なうことができることは勿論である。

4. 図面の簡単な説明

第1図は本発明に係わる鍵の一例を示す図、第2図は本発明装置の側断面図、第3図は同装置の

加工状態を示す側断面図、第4図は押圧子と凹部との関係を模式的に示す斜視図、第5図は押当て治具の動作を模式的に示す斜視図である。

- 1 …… 基台
- 2 …… 直線状ガイド
- 3 …… 第1の支持ブロック
- 4 …… 第2の支持ブロック
- 7 …… スピンドル
- 8 …… 回転軸
- 9 …… パルスモータ
- 11 …… スロット
- 13 …… ピン
- 14 …… 流体シリンダ
- 16 …… 押圧子
- 16a …… テーパー部
- 16b …… 平面部
- 18 …… 圧縮スプリング
- 19 …… 押圧ピン
- 20 …… 溝
- 21 …… 第1の支持壁部

- 22 …… 第2の支持壁部
- 23 …… 第1の回転体
- 24 …… 第2の回転体
- 25、27 …… 歯車
- 26 …… 回転軸
- 29 …… 半割円錐台状凹部
- 31 …… 貫通孔
- 33 …… 溝
- 34 …… ガイドレール
- 35 …… 押当て治具
- 36 …… 流体シリンダ
- 37 …… 第1の水平面
- 38 …… 第2の水平面
- 39 …… 逃げ凹部
- 42 …… ドリル

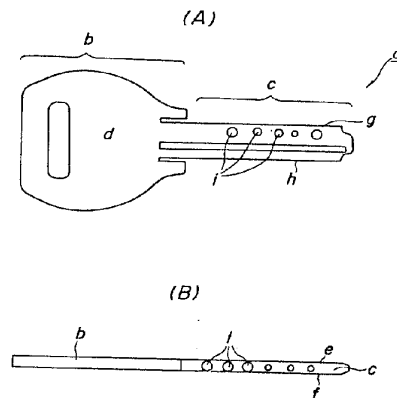
特許出願人

津上特機株式会社

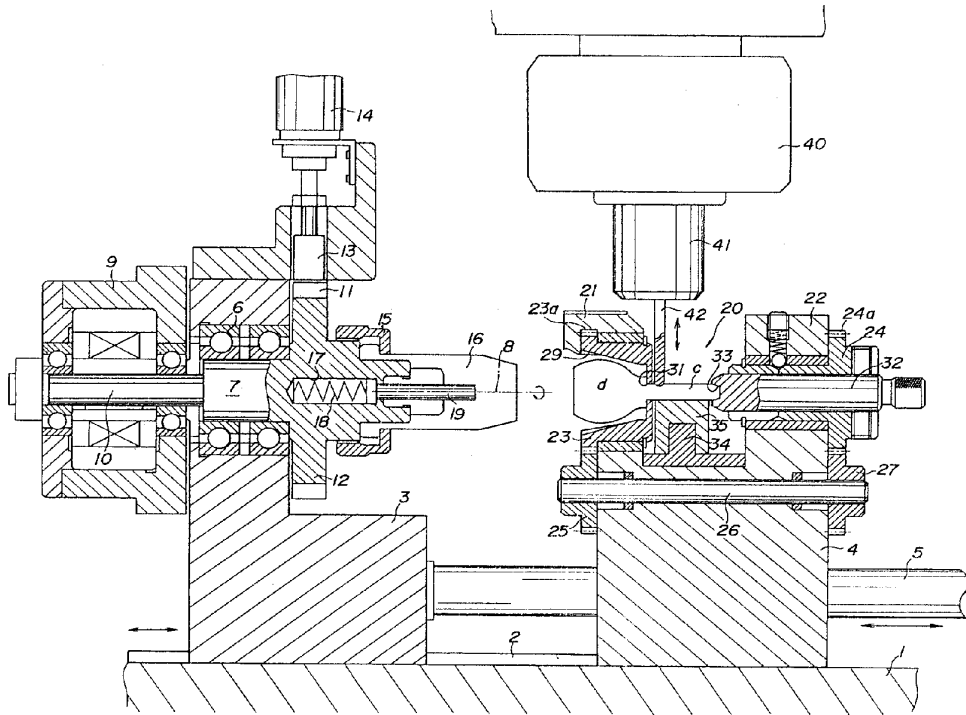
代理人

弁理士 和田成

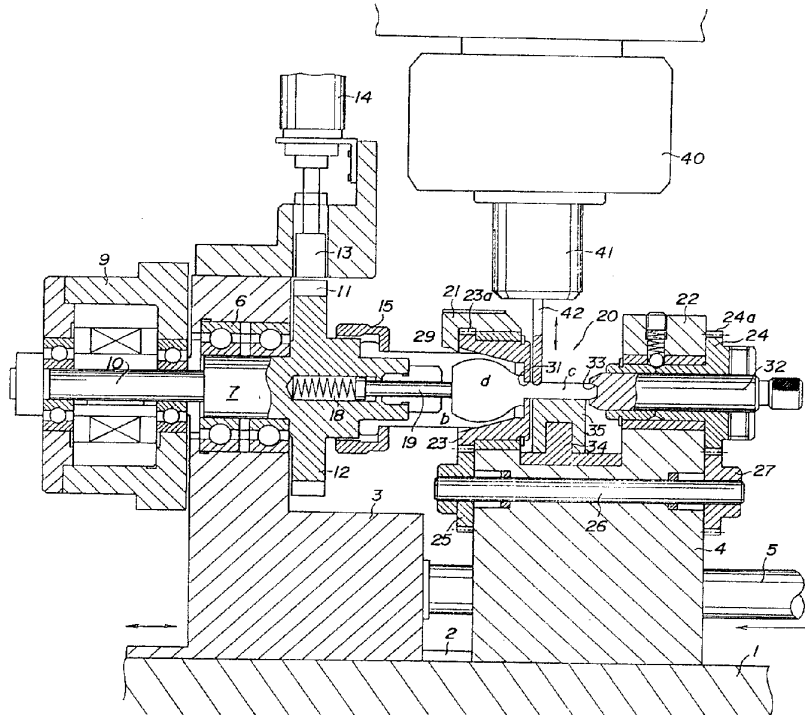
第1図



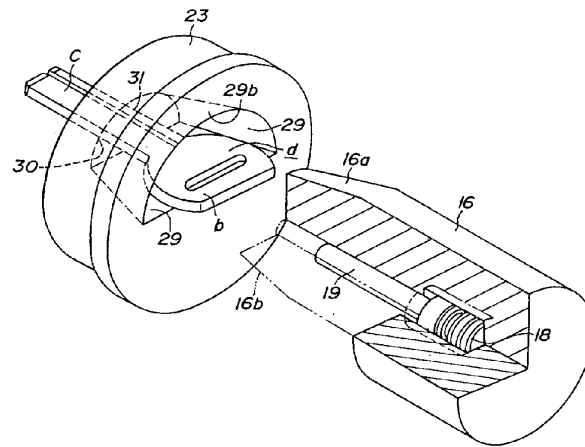
第 2 図



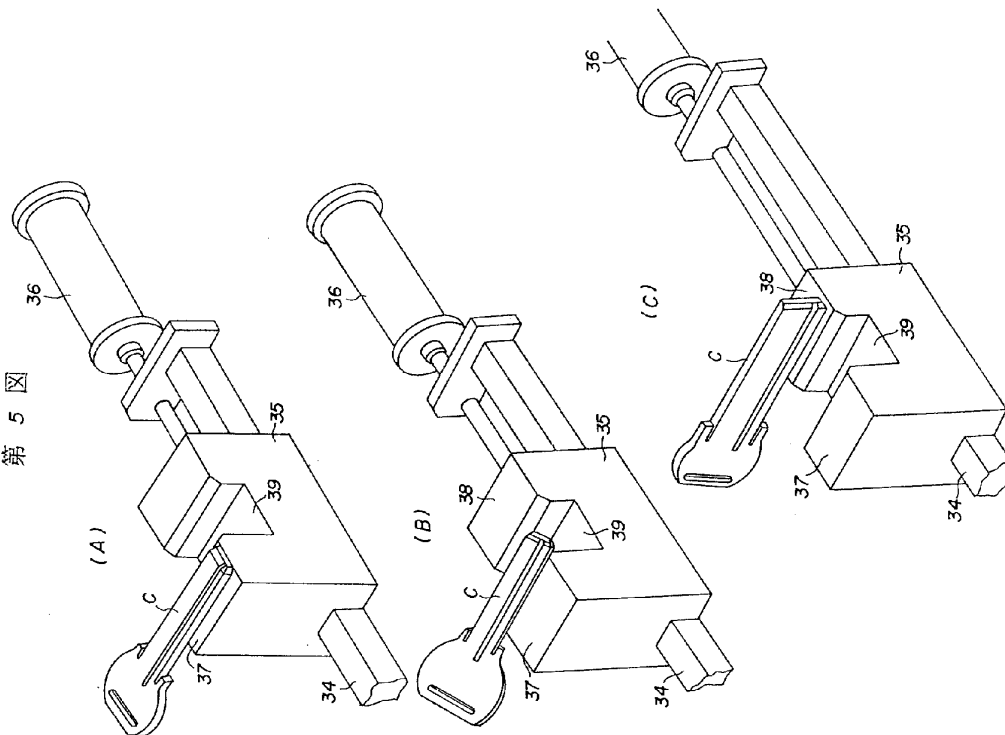
第 3 図



第 4 図



第 5 図



PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter I of the Patent Cooperation Treaty)

(PCT Rule 44bis)

Applicant's or agent's file reference 16223-00178P	FOR FURTHER ACTION	See item 4 below
International application No. PCT/US2011/034564	International filing date (<i>day/month/year</i>) 29 April 2011 (29.04.2011)	Priority date (<i>day/month/year</i>) 14 January 2011 (14.01.2011)
International Patent Classification (8th edition unless older edition indicated) See relevant information in Form PCT/ISA/237		
Applicant MUTCH, William R.		

1.	This international preliminary report on patentability (Chapter I) is issued by the International Bureau on behalf of the International Searching Authority under Rule 44 bis.1(a).																								
2.	This REPORT consists of a total of 5 sheets, including this cover sheet. In the attached sheets, any reference to the written opinion of the International Searching Authority should be read as a reference to the international preliminary report on patentability (Chapter I) instead.																								
3.	This report contains indications relating to the following items: <table style="width: 100%; border: none;"> <tr> <td style="width: 5%; text-align: center;">☒</td> <td style="width: 30%;">Box No. I</td> <td style="width: 65%;">Basis of the report</td> </tr> <tr> <td style="text-align: center;">☐</td> <td>Box No. II</td> <td>Priority</td> </tr> <tr> <td style="text-align: center;">☐</td> <td>Box No. III</td> <td>Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</td> </tr> <tr> <td style="text-align: center;">☐</td> <td>Box No. IV</td> <td>Lack of unity of invention</td> </tr> <tr> <td style="text-align: center;">☒</td> <td>Box No. V</td> <td>Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</td> </tr> <tr> <td style="text-align: center;">☐</td> <td>Box No. VI</td> <td>Certain documents cited</td> </tr> <tr> <td style="text-align: center;">☐</td> <td>Box No. VII</td> <td>Certain defects in the international application</td> </tr> <tr> <td style="text-align: center;">☐</td> <td>Box No. VIII</td> <td>Certain observations on the international application</td> </tr> </table>	☒	Box No. I	Basis of the report	☐	Box No. II	Priority	☐	Box No. III	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability	☐	Box No. IV	Lack of unity of invention	☒	Box No. V	Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement	☐	Box No. VI	Certain documents cited	☐	Box No. VII	Certain defects in the international application	☐	Box No. VIII	Certain observations on the international application
☒	Box No. I	Basis of the report																							
☐	Box No. II	Priority																							
☐	Box No. III	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability																							
☐	Box No. IV	Lack of unity of invention																							
☒	Box No. V	Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement																							
☐	Box No. VI	Certain documents cited																							
☐	Box No. VII	Certain defects in the international application																							
☐	Box No. VIII	Certain observations on the international application																							
4.	The International Bureau will communicate this report to designated Offices in accordance with Rules 44bis.3(c) and 93bis.1 but not, except where the applicant makes an express request under Article 23(2), before the expiration of 30 months from the priority date (Rule 44bis .2).																								

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland Facsimile No. +41 22 338 82 70	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%;">Date of issuance of this report 16 July 2013 (16.07.2013)</td> <td style="width: 50%;">Authorized officer</td> </tr> <tr> <td colspan="2" style="text-align: center; padding: 10px;">Simin Baharlou</td> </tr> <tr> <td colspan="2">e-mail: pt09.pct@wipo.int</td> </tr> </table>	Date of issuance of this report 16 July 2013 (16.07.2013)	Authorized officer	Simin Baharlou		e-mail: pt09.pct@wipo.int	
Date of issuance of this report 16 July 2013 (16.07.2013)	Authorized officer						
Simin Baharlou							
e-mail: pt09.pct@wipo.int							

Form PCT/IB/373 (January 2004)

PATENT COOPERATION TREATY

From the
INTERNATIONAL SEARCHING AUTHORITY

To: DAVID CUPAR
C/O MCDONALD HOPKINS LLC
600 SUPERIOR AVENUE, E. STE. 2100
CLEVELAND, OH 44114

PCT

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43bis.1)

Date of mailing
(day/month/year) 15 JUL 2011

Applicant's or agent's file reference
16223-00178P

FOR FURTHER ACTION

See paragraph 2 below

International application No.

PCT/US2011/034564

International filing date (day/month/year)

29 April 2011

Priority date (day/month/year)

14 January 2011

International Patent Classification (IPC) or both national classification and IPC

IPC(8) - B23C 3/35 (2011.01)

USPC - 409/81

Applicant HY-KO PRODUCTS COMPANY

1. This opinion contains indications relating to the following items:

- ☒ Box No. I Basis of the opinion
- ☐ Box No. II Priority
- ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI Certain documents cited
- ☐ Box No. VII Certain defects in the international application
- ☐ Box No. VIII Certain observations on the international application

2. **FURTHER ACTION**

If a demand for international preliminary examination is made, this opinion will be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1bis(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

3. For further details, see notes to Form PCT/ISA/220.

Name and mailing address of the ISA/US
Mail Stop PCT, Attn: ISA/US
Commissioner for Patents
P.O. Box 1450, Alexandria, Virginia 22313-1450
Facsimile No. 571-273-3201

Date of completion of this opinion

08 July 2011

Authorized officer:

Blaine R. Copenheaver

PCT Helpdesk: 571-272-4300
PCT OSP: 571-272-7774

Form PCT/ISA/237 (cover sheet) (July 2009)

**WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY**

International application No.
PCT/US2011/034564

Box No. 1 Basis of this opinion

1. With regard to the **language**, this opinion has been established on the basis of:
 - ☒ the international application in the language in which it was filed.
 - ☐ a translation of the international application into _____ which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b)).
2. ☐ This opinion has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43*bis*.1(a))
3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, this opinion has been established on the basis of a sequence listing filed or furnished:
 - a. (means)
 - ☐ on paper
 - ☐ in electronic form
 - b. (time)
 - ☐ in the international application as filed
 - ☐ together with the international application in electronic form
 - ☐ subsequently to this Authority for the purposes of search
4. ☐ In addition, in the case that more than one version or copy of a sequence listing has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.
5. Additional comments:

**WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY**

International application No.

PCT/US2011/034564

Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims	7, 9-10, 13, 21, 23-24	YES
	Claims	1-6, 8, 11-12, 14-20, 22, 25-28	NO
Inventive step (IS)	Claims	None	YES
	Claims	1-28	NO
Industrial applicability (IA)	Claims	1-28	YES
	Claims	None	NO

2. Citations and explanations:

Claims 1-6, 8, 11-12, 14-20, 22, 25-28 lack novelty under PCT Article 33(2) as being anticipated by Bass et al.

Referring to Claim 1, Bass et al. disclose a key duplicating machine comprising a key load position to receive a key (Para. [0048]), an antenna (Para. [0061] - regarding the logic may compare the quantified and defined features of the master key 22 with data in a database regarding known key blanks 24), configured to communicate with a key located at said key load position (Para. [0061]), and a cutting member (Fig. 8, Left and right cutting wheels 60, 62), configured to cut a key pattern into a key blank at said key load position (Para. [0066]).

Referring to Claim 2, Bass et al. disclose a key duplicating machine as in Claim 1, and further disclose wherein said antenna (Para. [0061] - regarding the logic may compare the quantified and defined features of the master key 22 with data in a database regarding known key blanks 24), is configured to transmit data to said key (Paras. [0061], [0065]).

Referring to Claim 3, Bass et al. disclose a key duplicating machine as in Claim 1, and further disclose wherein said antenna (Para. [0061] - regarding the logic may compare the quantified and defined features of the master key 22 with data in a database regarding known key blanks 24), is configured to receive data from said key (Para. [0061] - regarding the logic may make direct comparisons between physical dimensions of known key blanks 24 and the features of the master key 22).

Referring to Claim 4, Bass et al. disclose a key duplicating machine as in Claim 1, and further disclose wherein said key is a master key (Fig. 1, master key 22).

Referring to Claim 5, Bass et al. disclose a key duplicating machine as in Claim 1, and further disclose wherein said key is a key blank (Fig. 4b key blank 24).

Referring to Claim 6, Bass et al. disclose a key duplicating machine as in Claim 1, and further disclose wherein said key includes a microchip embedded therein (Para. [0093]).

Referring to Claim 8, Bass et al. disclose a key duplicating machine as in Claim 1, and further disclose further comprising an outer shell (Fig. 1, outer shell 12), having an opening positioned about said key load position (Fig. 1, and Para. [0046]).

Referring to Claim 11, Bass et al. disclose a key duplicating machine as in Claim 1, and further disclose wherein said key load position comprises a base (Fig. 2, base 16), and a door clamp (Fig. 2, door clamp 14).

Referring to Claim 12, Bass et al. disclose a key duplicating machine as in Claim 8, and further disclose wherein said door clamp (Fig. 2, door clamp 14), is movable with respect to said base (Fig. 2, base 16, and Para. [0046]).

Referring to Claim 14, Bass et al. disclose a key duplicating machine as in Claim 1, and further disclose wherein said cutting member (Fig. 8, Left and right cutting wheels 60, 62), is a cutting wheel (Para. [0066]).

Referring to Claim 15, Bass et al. disclose a key duplicating machine comprising a key load position to receive a key (Para. [0048]), an antenna (Para. [0061] - regarding the logic may compare the quantified and defined features of the master key 22 with data in a database regarding known key blanks 24), configured to communicate with a key located at said key load position (Para. [0061]), and an imaging system (Fig. 6, optical imaging device 50), configured to capture data related to said key at said key load position (Para. [0056]).

Referring to Claim 16, Bass et al. disclose a key duplicating machine as in Claim 15, and further disclose wherein said antenna (Para. [0061] - regarding the logic may compare the quantified and defined features of the master key 22 with data in a database regarding known key blanks 24), is configured to transmit data to said key (Paras. [0061], [0065]).

Referring to Claim 17, Bass et al. disclose a key duplicating machine as in Claim 15, and further disclose wherein said antenna (Para. [0061] - regarding the logic may compare the quantified and defined features of the master key 22 with data in a database regarding known key blanks 24), is configured to receive data from said key (Para. [0061] - regarding the logic may make direct comparisons between physical dimensions of known key blanks 24 and the features of the master key 22).

Form PCT/ISA/237 (Box No. V) (July 2009)

**WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY**

International application No.

PCT/US2011/034564

Supplemental Box

In case the space in any of the preceding boxes is not sufficient.

Continuation of:

Referring to Claim 18, Bass et al. disclose a key duplicating machine as in Claim 15, and further disclose wherein said key is a master key (Fig. 1, master key 22).

Referring to Claim 19, Bass et al. disclose a key duplicating machine as in Claim 15, and further disclose wherein said key is a key blank (Fig. 4b key blank 24).

Referring to Claim 20, Bass et al. disclose a key duplicating machine as in Claim 15, and further disclose wherein said key includes a microchip embedded therein (Para. [0093]).

Referring to Claim 22, Bass et al. disclose a key duplicating machine as in Claim 15, and further disclose further comprising an outer shell (Fig. 1, outer shell 12), having an opening positioned about said key load position (Fig. 1, and Para. [0046]).

Referring to Claim 25, Bass et al. disclose a key duplicating machine as in Claim 15, and further disclose wherein said key load position comprises a base (Fig. 2, base 16), and a door clamp (Fig. 2, door clamp 14).

Referring to Claim 26, Bass et al. disclose a key duplicating machine as in Claim 25, and further disclose wherein said door clamp (Fig. 2, door clamp 14), is movable with respect to said base (Fig. 2, base 16, and Para. [0046]).

Referring to Claim 27, Bass et al. disclose a key duplicating machine as in Claim 25, and further disclose further comprising at least one lever (Fig. 2, handle 18), configured to actuate movement of said door clamp (Para. [0046]).

Referring to Claim 28, Bass et al. disclose a key duplicating machine as in Claim 15, and further disclose wherein said imaging system (Fig. 6, optical imaging device 50), includes a camera (Para. [0056]).

Claims 7, 21 lack an inventive step under PCT Article 33(3) as being obvious over Bass et al. in view of Kubo et al.

Referring to Claim 7, Bass et al. disclose all the limitations of Claim 1, but do not disclose wherein said antenna comprises at least one pair of windings. However, Kubo et al. teach a coil antenna and portable electronic apparatus comprising wherein an antenna (Fig. 2, antenna 100), comprises at least one pair of windings (Fig. 2, windings 2A, 2B). Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to have an antenna comprise at least one pair of windings as taught by Kubo et al. with the invention of Bass et al., for the purpose of customizing the shape of the antenna.

Referring to Claim 21, Bass et al. disclose all the limitations of Claim 15, but do not disclose wherein said antenna comprises at least one pair of windings. However, Kubo et al. teach a coil antenna and portable electronic apparatus comprising wherein an antenna (Fig. 2, antenna 100), comprises at least one pair of windings (Fig. 2, windings 2A, 2B). Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to have an antenna comprise at least one pair of windings as taught by Kubo et al. with the invention of Bass et al., for the purpose of customizing the shape of the antenna.

Claims 9-10, 13, 23-24 lack an inventive step under PCT Article 33(3) as being obvious over Bass et al. in view of Swayze et al.

Referring to Claim 9, Bass et al. disclose all the limitations of Claim 5, but do not disclose wherein said opening is circular. However, Swayze et al. teach an antenna comprising wherein an opening is circular (Fig. 3, and Pg. 1, Col. 2, Lns. 19-27). Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to have an opening circular as taught by Swayze et al. with the invention of Bass et al., for the purpose of allowing the key into a slot.

Referring to Claim 10, Bass et al. disclose all the limitations of Claim 5, but do not disclose wherein said antenna is wound about said opening. However, Swayze et al. teach an antenna comprising wherein an antenna is wound about an opening (Fig. 3, and Pg. 1, Col. 2, Lns. 46-52). Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to have an antenna wound about said opening as taught by Swayze et al. with the invention of Bass et al., for the purpose of receiving clearer reception.

Referring to Claim 13, Bass et al. in view of Swayze et al. disclose all the limitations of Claim 9, and Bass et al. further disclose further comprising at least one lever (Fig. 2, handle 18), configured to actuate movement of said door clamp (Para. [0046]).

Referring to Claim 23, Bass et al. disclose all the limitations of Claim 22, but do not disclose wherein said opening is circular. However, Swayze et al. teach an antenna comprising wherein an opening is circular (Fig. 3, and Pg. 1, Col. 2, Lns. 19-27). Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to have an opening circular as taught by Swayze et al. with the invention of Bass et al., for the purpose of allowing the key into a slot.

Referring to Claim 24, Bass et al. disclose all the limitations of Claim 22, but do not disclose wherein said antenna is wound about said opening. However, Swayze et al. teach an antenna comprising wherein an antenna is wound about an opening (Fig. 3, and Pg. 1, Col. 2, Lns. 46-52). Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to have an antenna wound about said opening as taught by Swayze et al. with the invention of Bass et al., for the purpose of receiving clearer reception.

Claims 1-28 meet the criteria set out in PCT Article 33(4), and thus have industrial applicability because the subject matter claimed can be made or used in industry.

From the INTERNATIONAL SEARCHING AUTHORITY

PCT

To: DAVID CUPAR
C/O MCDONALD HOPKINS LLC
600 SUPERIOR AVENUE, E. STE. 2100
CLEVELAND, OH 44114

NOTIFICATION OF TRANSMITTAL OF
THE INTERNATIONAL SEARCH REPORT AND
THE WRITTEN OPINION OF THE INTERNATIONAL
SEARCHING AUTHORITY, OR THE DECLARATION

(PCT Rule 44.1)

Date of mailing (day/month/year)	15 JUL 2011
Applicant's or agent's file reference 16223-00178P 192	FOR FURTHER ACTION See paragraphs 1 and 4 below
International application No. PCT/US2011/034564	International filing date (day/month/year) 29 April 2011
Applicant HY-KO PRODUCTS COMPANY	

1. ☒ The applicant is hereby notified that the international search report and the written opinion of the International Searching Authority have been established and are transmitted herewith.

Filing of amendments and statement under Article 19:

The applicant is entitled, if he so wishes, to amend the claims of the international application (see Rule 46):

When? The time limit for filing such amendments is normally two months from the date of transmittal of the international search report.

Where? Directly to the International Bureau of WIPO, 34 chemin des Colombettes
1211 Geneva 20, Switzerland, Facsimile No.: +41 22 338 82 70

For more detailed instructions, see *PCT Applicant's Guide*, International Phase, paragraphs 9.004 – 9.011.

2. ☐ The applicant is hereby notified that no international search report will be established and that the declaration under Article 17(2)(a) to that effect and the written opinion of the International Searching Authority are transmitted herewith.
3. ☐ With regard to any protest against payment of (an) additional fee(s) under Rule 40.2, the applicant is notified that:
- ☐ the protest together with the decision thereon has been transmitted to the International Bureau together with any request to forward the texts of both the protest and the decision thereon to the designated Offices.
- ☐ no decision has been made yet on the protest; the applicant will be notified as soon as a decision is made.

4. **Reminders**

The applicant may submit comments on an informal basis on the written opinion of the International Searching Authority to the International Bureau. The International Bureau will send a copy of such comments to all designated Offices unless an international preliminary examination report has been or is to be established. Following the expiration of 30 months from the priority date, these comments will also be made available to the public.

Shortly after the expiration of **18 months** from the priority date, the international application will be published by the International Bureau. If the applicant wishes to avoid or postpone publication, a notice of withdrawal of the international application, or of the priority claim, must reach the International Bureau before the completion of the technical preparations for international publication (Rules 90bis.1 and 90bis.3).

Within **19 months** from the priority date, but only in respect of some designated Offices, a demand for international preliminary examination must be filed if the applicant wishes to postpone the entry into the national phase until **30 months** from the priority date (in some Offices even later); otherwise, the applicant must, within **20 months** from the priority date, perform the prescribed acts for entry into the national phase before those designated Offices.

In respect of other designated Offices, the time limit of **30 months** (or later) will apply even if no demand is filed within 19 months.

For details about the applicable time limits, Office by Office, see www.wipo.int/pct/en/texts/time_limits.html and the *PCT Applicant's Guide*, National Chapters.

Name and mailing address of the ISA/ Mail Stop PCT, Attn: ISA/US Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-3201	Authorized officer Blaine R. Copenheaver PCT Helpdesk: 571-272-4300 Telephone No. PCT OSP: 571-272-7774

Form PCT/ISA/220 (July 2010)

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference 16223-00178P	FOR FURTHER ACTION see Form PCT/ISA/220 as well as, where applicable, item 5 below.	
International application No. PCT/US2011/034564	International filing date (day/month/year) 29 April 2011	(Earliest) Priority Date (day/month/year) 14 January 2011
Applicant HY-KO PRODUCTS COMPANY		

This international search report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This international search report consists of a total of 2 sheets.

☐ It is also accompanied by a copy of each prior art document cited in this report.

1. Basis of the report

a. With regard to the language, the international search was carried out on the basis of:

☒ the international application in the language in which it was filed.

☐ a translation of the international application into _____ which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b)).

b. ☐ This international search report has been established taking into account the rectification of an obvious mistake authorized by or notified to this Authority under Rule 91 (Rule 43.6bis(a)).

c. ☐ With regard to any nucleotide and/or amino acid sequence disclosed in the international application, see Box No. I.

2. ☐ Certain claims were found unsearchable (see Box No. II).

3. ☐ Unity of invention is lacking (see Box No. III).

4. With regard to the title,

☒ the text is approved as submitted by the applicant.

☐ the text has been established by this Authority to read as follows:

5. With regard to the abstract,

☒ the text is approved as submitted by the applicant.

☐ the text has been established, according to Rule 38.2, by this Authority as it appears in Box No. IV. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. With regard to the drawings,

a. the figure of the drawings to be published with the abstract is Figure No. 1

☒ as suggested by the applicant.

☐ as selected by this Authority, because the applicant failed to suggest a figure.

☐ as selected by this Authority, because this figure better characterizes the invention.

b. ☐ none of the figures is to be published with the abstract.

Form PCT/ISA/210 (first sheet) (July 2009)

INTERNATIONAL SEARCH REPORT		International application No. PCT/US2011/034564
A. CLASSIFICATION OF SUBJECT MATTER IPC(8) - B23C 3/35 (2011.01) USPC - 409/81 According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED Minimum documentation searched (classification system followed by classification symbols) IPC(8) - B23C 1/16, 3/35 (2011.01) USPC - 76/110; 83/413; 269/157; 409/81, 84, 132, 277 Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) PatBase, Google Patents		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2007/0224008 A1 (BASS et al) 27 September 2007 (27.09.2007) entire document	1-6, 8, 11-12, 14-20, 22, 25-28
Y		7, 9-10, 13, 21, 23-24
Y	US 2008/0252551 A1 (KUBO et al) 16 October 2008 (16.10.2008) entire document	7, 21
Y	US 2,274,012 A (SWAYZE et al) 24 February 1942 (24.02.1942) entire document	9-10, 13, 23-24
A	US 5,676,504 A (MUELLER et al) 14 October 1997 (14.10.1997) entire document	1-28
☐ Further documents are listed in the continuation of Box C. ☐		
* Special categories of cited documents: "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier application or patent but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family		
Date of the actual completion of the international search 08 July 2011		Date of mailing of the international search report 15 JUL 2011
Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-3201		Authorized officer: Blaine R. Copenheaver PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774

Form PCT/ISA/210 (second sheet) (July 2009)

From the
INTERNATIONAL SEARCHING AUTHORITY

To: DAVID CUPAR
C/O MCDONALD HOPKINS LLC
600 SUPERIOR AVENUE, E. STE. 2100
CLEVELAND, OH 44114

PCT

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43bis.1)

Date of mailing
(day/month/year) 15 JUL 2011

Applicant's or agent's file reference
16223-00178P

FOR FURTHER ACTION

See paragraph 2 below

International application No.

PCT/US2011/034564

International filing date (day/month/year)

29 April 2011

Priority date (day/month/year)

14 January 2011

International Patent Classification (IPC) or both national classification and IPC

IPC(8) - B23C 3/35 (2011.01)

USPC - 409/81

Applicant HY-KO PRODUCTS COMPANY

1. This opinion contains indications relating to the following items:

- ☒ Box No. I Basis of the opinion
- ☐ Box No. II Priority
- ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI Certain documents cited
- ☐ Box No. VII Certain defects in the international application
- ☐ Box No. VIII Certain observations on the international application

2. FURTHER ACTION

If a demand for international preliminary examination is made, this opinion will be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1bis(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

3. For further details, see notes to Form PCT/ISA/220.

Name and mailing address of the ISA/US
Mail Stop PCT, Attn: ISA/US
Commissioner for Patents
P.O. Box 1450, Alexandria, Virginia 22313-1450
Facsimile No. 571-273-3201

Date of completion of this opinion

08 July 2011

Authorized officer:

Blaine R. Copenheaver

PCT Helpdesk: 571-272-4300
PCT OSP: 571-272-7774

Form PCT/ISA/237 (cover sheet) (July 2009)

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

international application no.
PCT/US2011/034564

Box No. I Basis of this opinion

1. With regard to the **language**, this opinion has been established on the basis of:
☒ the international application in the language in which it was filed.
☐ a translation of the international application into _____ which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b)).
2. ☐ This opinion has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43*bis*.1(a)).
3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, this opinion has been established on the basis of a sequence listing filed or furnished:
 - a. (means)
☐ on paper
☐ in electronic form
 - b. (time)
☐ in the international application as filed
☐ together with the international application in electronic form
☐ subsequently to this Authority for the purposes of search
4. ☐ In addition, in the case that more than one version or copy of a sequence listing has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.
5. Additional comments:

Box No. V	Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement		
1. Statement			
Novelty (N)	Claims	7, 9-10, 13, 21, 23-24	YES
	Claims	1-6, 8, 11-12, 14-20, 22, 25-28	NO
Inventive step (IS)	Claims	None	YES
	Claims	1-28	NO
Industrial applicability (IA)	Claims	1-28	YES
	Claims	None	NO
2. Citations and explanations:			
Claims 1-6, 8, 11-12, 14-20, 22, 25-28 lack novelty under PCT Article 33(2) as being anticipated by Bass et al. Referring to Claim 1, Bass et al. disclose a key duplicating machine comprising a key load position to receive a key (Para. [0048]), an antenna (Para. [0061] - regarding the logic may compare the quantified and defined features of the master key 22 with data in a database regarding known key blanks 24), configured to communicate with a key located at said key load position (Para. [0061]), and a cutting member (Fig. 8, Left and right cutting wheels 60, 62), configured to cut a key pattern into a key blank at said key load position (Para. [0066]). Referring to Claim 2, Bass et al. disclose a key duplicating machine as in Claim 1, and further disclose wherein said antenna (Para. [0061] - regarding the logic may compare the quantified and defined features of the master key 22 with data in a database regarding known key blanks 24), is configured to transmit data to said key (Paras. [0061], [0065]). Referring to Claim 3, Bass et al. disclose a key duplicating machine as in Claim 1, and further disclose wherein said antenna (Para. [0061] - regarding the logic may compare the quantified and defined features of the master key 22 with data in a database regarding known key blanks 24), is configured to receive data from said key (Para. [0061] - regarding the logic may make direct comparisons between physical dimensions of known key blanks 24 and the features of the master key 22). Referring to Claim 4, Bass et al. disclose a key duplicating machine as in Claim 1, and further disclose wherein said key is a master key (Fig. 1, master key 22). Referring to Claim 5, Bass et al. disclose a key duplicating machine as in Claim 1, and further disclose wherein said key is a key blank (Fig. 4b key blank 24). Referring to Claim 6, Bass et al. disclose a key duplicating machine as in Claim 1, and further disclose wherein said key includes a microchip embedded therein (Para. [0093]). Referring to Claim 8, Bass et al. disclose a key duplicating machine as in Claim 1, and further disclose further comprising an outer shell (Fig. 1, outer shell 12), having an opening positioned about said key load position (Fig. 1, and Para. [0046]). Referring to Claim 11, Bass et al. disclose a key duplicating machine as in Claim 1, and further disclose wherein said key load position comprises a base (Fig. 2, base 16), and a door clamp (Fig. 2, door clamp 14). Referring to Claim 12, Bass et al. disclose a key duplicating machine as in Claim 8, and further disclose wherein said door clamp (Fig. 2, door clamp 14), is movable with respect to said base (Fig. 2, base 16, and Para. [0046]). Referring to Claim 14, Bass et al. disclose a key duplicating machine as in Claim 1, and further disclose wherein said cutting member (Fig. 8, Left and right cutting wheels 60, 62), is a cutting wheel (Para. [0066]). Referring to Claim 15, Bass et al. disclose a key duplicating machine comprising a key load position to receive a key (Para. [0048]), an antenna (Para. [0061] - regarding the logic may compare the quantified and defined features of the master key 22 with data in a database regarding known key blanks 24), configured to communicate with a key located at said key load position (Para. [0061]), and an imaging system (Fig. 6, optical imaging device 50), configured to capture data related to said key at said key load position (Para. [0056]). Referring to Claim 16, Bass et al. disclose a key duplicating machine as in Claim 15, and further disclose wherein said antenna (Para. [0061] - regarding the logic may compare the quantified and defined features of the master key 22 with data in a database regarding known key blanks 24), is configured to transmit data to said key (Paras. [0061], [0065]). Referring to Claim 17, Bass et al. disclose a key duplicating machine as in Claim 15, and further disclose wherein said antenna (Para. [0061] - regarding the logic may compare the quantified and defined features of the master key 22 with data in a database regarding known key blanks 24), is configured to receive data from said key (Para. [0061] - regarding the logic may make direct comparisons between physical dimensions of known key blanks 24 and the features of the master key 22).			

Form PCT/ISA/237 (Box No. V) (July 2009)

Supplemental Box

In case the space in any of the preceding boxes is not sufficient.

Continuation of:

Referring to Claim 18, Bass et al. disclose a key duplicating machine as in Claim 15, and further disclose wherein said key is a master key (Fig. 1, master key 22).

Referring to Claim 19, Bass et al. disclose a key duplicating machine as in Claim 15, and further disclose wherein said key is a key blank (Fig. 4b key blank 24).

Referring to Claim 20, Bass et al. disclose a key duplicating machine as in Claim 15, and further disclose wherein said key includes a microchip embedded therein (Para. [0093]).

Referring to Claim 22, Bass et al. disclose a key duplicating machine as in Claim 15, and further disclose further comprising an outer shell (Fig. 1, outer shell 12), having an opening positioned about said key load position (Fig. 1, and Para. [0046]).

Referring to Claim 25, Bass et al. disclose a key duplicating machine as in Claim 15, and further disclose wherein said key load position comprises a base (Fig. 2, base 16), and a door clamp (Fig. 2, door clamp 14).

Referring to Claim 26, Bass et al. disclose a key duplicating machine as in Claim 25, and further disclose wherein said door clamp (Fig. 2, door clamp 14), is movable with respect to said base (Fig. 2, base 16, and Para. [0046]).

Referring to Claim 27, Bass et al. disclose a key duplicating machine as in Claim 25, and further disclose further comprising at least one lever (Fig. 2, handle 18), configured to actuate movement of said door clamp (Para. [0046]).

Referring to Claim 28, Bass et al. disclose a key duplicating machine as in Claim 15, and further disclose wherein said imaging system (Fig. 6, optical imaging device 50), includes a camera (Para. [0056]).

Claims 7, 21 lack an inventive step under PCT Article 33(3) as being obvious over Bass et al. in view of Kubo et al.

Referring to Claim 7, Bass et al. disclose all the limitations of Claim 1, but do not disclose wherein said antenna comprises at least one pair of windings. However, Kubo et al. teach a coil antenna and portable electronic apparatus comprising wherein an antenna (Fig. 2, antenna 100), comprises at least one pair of windings (Fig. 2, windings 2A, 2B). Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to have an antenna comprise at least one pair of windings as taught by Kubo et al. with the invention of Bass et al., for the purpose of customizing the shape of the antenna.

Referring to Claim 21, Bass et al. disclose all the limitations of Claim 15, but do not disclose wherein said antenna comprises at least one pair of windings. However, Kubo et al. teach a coil antenna and portable electronic apparatus comprising wherein an antenna (Fig. 2, antenna 100), comprises at least one pair of windings (Fig. 2, windings 2A, 2B). Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to have an antenna comprise at least one pair of windings as taught by Kubo et al. with the invention of Bass et al., for the purpose of customizing the shape of the antenna.

Claims 9-10, 13, 23-24 lack an inventive step under PCT Article 33(3) as being obvious over Bass et al. in view of Swayze et al.

Referring to Claim 9, Bass et al. disclose all the limitations of Claim 5, but do not disclose wherein said opening is circular. However, Swayze et al. teach an antenna comprising wherein an opening is circular (Fig. 3, and Pg. 1, Col. 2, Lns. 19-27). Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to have an opening circular as taught by Swayze et al. with the invention of Bass et al., for the purpose of allowing the key into a slot.

Referring to Claim 10, Bass et al. disclose all the limitations of Claim 5, but do not disclose wherein said antenna is wound about said opening. However, Swayze et al. teach an antenna comprising wherein an antenna is wound about an opening (Fig. 3, and Pg. 1, Col. 2, Lns. 46-52). Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to have an antenna wound about said opening as taught by Swayze et al. with the invention of Bass et al., for the purpose of receiving clearer reception.

Referring to Claim 13, Bass et al. in view of Swayze et al. disclose all the limitations of Claim 9, and Bass et al. further disclose further comprising at least one lever (Fig. 2, handle 18), configured to actuate movement of said door clamp (Para. [0046]).

Referring to Claim 23, Bass et al. disclose all the limitations of Claim 22, but do not disclose wherein said opening is circular. However, Swayze et al. teach an antenna comprising wherein an opening is circular (Fig. 3, and Pg. 1, Col. 2, Lns. 19-27). Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to have an opening circular as taught by Swayze et al. with the invention of Bass et al., for the purpose of allowing the key into a slot.

Referring to Claim 24, Bass et al. disclose all the limitations of Claim 22, but do not disclose wherein said antenna is wound about said opening. However, Swayze et al. teach an antenna comprising wherein an antenna is wound about an opening (Fig. 3, and Pg. 1, Col. 2, Lns. 46-52). Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to have an antenna wound about said opening as taught by Swayze et al. with the invention of Bass et al., for the purpose of receiving clearer reception.

Claims 1-28 meet the criteria set out in PCT Article 33(4), and thus have industrial applicability because the subject matter claimed can be made or used in industry.

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY (Chapter I of the Patent Cooperation Treaty)

(PCT Rule 44bis)

Applicant's or agent's file reference 16223-00153	FOR FURTHER ACTION	See item 4 below
International application No. PCT/US2010/033414	International filing date (<i>day/month/year</i>) 03 May 2010 (03.05.2010)	Priority date (<i>day/month/year</i>) 01 May 2009 (01.05.2009)
International Patent Classification (8th edition unless older edition indicated) See relevant information in Form PCT/ISA/237		
Applicant HY-KO PRODUCTS		

1.	This international preliminary report on patentability (Chapter I) is issued by the International Bureau on behalf of the International Searching Authority under Rule 44 bis.1(a).																								
2.	This REPORT consists of a total of 5 sheets, including this cover sheet. In the attached sheets, any reference to the written opinion of the International Searching Authority should be read as a reference to the international preliminary report on patentability (Chapter I) instead.																								
3.	This report contains indications relating to the following items: <table style="width: 100%; border: none;"> <tr> <td style="width: 5%; text-align: center;">☒</td> <td style="width: 30%;">Box No. I</td> <td>Basis of the report</td> </tr> <tr> <td style="text-align: center;">☐</td> <td>Box No. II</td> <td>Priority</td> </tr> <tr> <td style="text-align: center;">☐</td> <td>Box No. III</td> <td>Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</td> </tr> <tr> <td style="text-align: center;">☐</td> <td>Box No. IV</td> <td>Lack of unity of invention</td> </tr> <tr> <td style="text-align: center;">☒</td> <td>Box No. V</td> <td>Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</td> </tr> <tr> <td style="text-align: center;">☐</td> <td>Box No. VI</td> <td>Certain documents cited</td> </tr> <tr> <td style="text-align: center;">☐</td> <td>Box No. VII</td> <td>Certain defects in the international application</td> </tr> <tr> <td style="text-align: center;">☐</td> <td>Box No. VIII</td> <td>Certain observations on the international application</td> </tr> </table>	☒	Box No. I	Basis of the report	☐	Box No. II	Priority	☐	Box No. III	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability	☐	Box No. IV	Lack of unity of invention	☒	Box No. V	Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement	☐	Box No. VI	Certain documents cited	☐	Box No. VII	Certain defects in the international application	☐	Box No. VIII	Certain observations on the international application
☒	Box No. I	Basis of the report																							
☐	Box No. II	Priority																							
☐	Box No. III	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability																							
☐	Box No. IV	Lack of unity of invention																							
☒	Box No. V	Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement																							
☐	Box No. VI	Certain documents cited																							
☐	Box No. VII	Certain defects in the international application																							
☐	Box No. VIII	Certain observations on the international application																							
4.	The International Bureau will communicate this report to designated Offices in accordance with Rules 44bis.3(c) and 93bis.1 but not, except where the applicant makes an express request under Article 23(2), before the expiration of 30 months from the priority date (Rule 44bis .2).																								

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland Facsimile No. +41 22 338 82 70	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="padding: 2px;">Date of issuance of this report 01 November 2011 (01.11.2011)</td> </tr> <tr> <td style="padding: 2px;"> Authorized officer Lingfei Bai </td> </tr> </table> e-mail: pt02.pct@wipo.int	Date of issuance of this report 01 November 2011 (01.11.2011)	Authorized officer Lingfei Bai
Date of issuance of this report 01 November 2011 (01.11.2011)			
Authorized officer Lingfei Bai			

Form PCT/IB/373 (January 2004)

PATENT COOPERATION TREATY

From the
INTERNATIONAL SEARCHING AUTHORITY

To: DAVID CUPAR
MCDONALD HOPKINS LLC
600 SUPERIOR AVENUE, EAST
SUITE 2100
CLEVELAND, OH 44114

PCT

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43bis.1)

Date of mailing
(day/month/year)

18 AUG 2010

Applicant's or agent's file reference
16223-00153

FOR FURTHER ACTION

See paragraph 2 below

International application No.
PCT/US2010/033414

International filing date (day/month/year)
03 May 2010

Priority date (day/month/year)
01 May 2009

International Patent Classification (IPC) or both national classification and IPC
IPC(8) - B23C 1/16 (2010.01)
USPC - 409/81

Applicant HY-KO PRODUCTS

1. This opinion contains indications relating to the following items:

- ☒ Box No. I Basis of the opinion
- ☐ Box No. II Priority
- ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI Certain documents cited
- ☐ Box No. VII Certain defects in the international application
- ☐ Box No. VIII Certain observations on the international application

2. **FURTHER ACTION**

If a demand for international preliminary examination is made, this opinion will be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1bis(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

3. For further details, see notes to Form PCT/ISA/220.

Name and mailing address of the ISA/US
Mail Stop PCT, Attn: ISA/US
Commissioner for Patents
P.O. Box 1450, Alexandria, Virginia 22313-1450
Facsimile No. 571-273-3201

Date of completion of this opinion
05 August 2010

Authorized officer:

Blaine R. Copenheaver

PCT Helpdesk: 571-272-4300
PCT OSP: 571-272-7774

Form PCT/ISA/237 (cover sheet) (July 2009)

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITYInternational application No.
PCT/US2010/033414

Box No. I Basis of this opinion

1. With regard to the **language**, this opinion has been established on the basis of:
- ☒ the international application in the language in which it was filed.
- ☐ a translation of the international application into _____ which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b)).
2. ☐ This opinion has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43*bis*.1(a))
3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, this opinion has been established on the basis of a sequence listing filed or furnished:
- a. (means)
- ☐ on paper
- ☐ in electronic form
- b. (time)
- ☐ in the international application as filed
- ☐ together with the international application in electronic form
- ☐ subsequently to this Authority for the purposes of search
4. ☐ In addition, in the case that more than one version or copy of a sequence listing has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.
5. Additional comments:

**WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY**

International application No.

PCT/US2010/033414

Box No. V	Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement																											
1. Statement <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 30%; vertical-align: top;">Novelty (N)</td> <td style="width: 10%; vertical-align: top;">Claims</td> <td style="width: 40%; border-bottom: 1px solid black;">1-23</td> <td style="width: 20%; text-align: right; vertical-align: bottom;">YES</td> </tr> <tr> <td></td> <td style="vertical-align: top;">Claims</td> <td style="border-bottom: 1px solid black;">None</td> <td style="text-align: right; vertical-align: bottom;">NO</td> </tr> <tr> <td style="vertical-align: top;">Inventive step (IS)</td> <td style="vertical-align: top;">Claims</td> <td style="border-bottom: 1px solid black;">23</td> <td style="text-align: right; vertical-align: bottom;">YES</td> </tr> <tr> <td></td> <td style="vertical-align: top;">Claims</td> <td style="border-bottom: 1px solid black;">1-22</td> <td style="text-align: right; vertical-align: bottom;">NO</td> </tr> <tr> <td style="vertical-align: top;">Industrial applicability (IA)</td> <td style="vertical-align: top;">Claims</td> <td style="border-bottom: 1px solid black;">1-23</td> <td style="text-align: right; vertical-align: bottom;">YES</td> </tr> <tr> <td></td> <td style="vertical-align: top;">Claims</td> <td style="border-bottom: 1px solid black;">None</td> <td style="text-align: right; vertical-align: bottom;">NO</td> </tr> </table>					Novelty (N)	Claims	1-23	YES		Claims	None	NO	Inventive step (IS)	Claims	23	YES		Claims	1-22	NO	Industrial applicability (IA)	Claims	1-23	YES		Claims	None	NO
Novelty (N)	Claims	1-23	YES																									
	Claims	None	NO																									
Inventive step (IS)	Claims	23	YES																									
	Claims	1-22	NO																									
Industrial applicability (IA)	Claims	1-23	YES																									
	Claims	None	NO																									
2. Citations and explanations: Claims 1-22 lack an inventive step under PCT Article 33(3) as being obvious over Bass et al in view of Wills et al. Bass et al discloses in Fig. 1-10, a key identification system (Page 2, Par. (0040)) comprising: [Cim. 1] an imaging system (as stated on Page 5, Par. (0062), wherein the system includes an optical imaging device (digital camera) and a laser scanner) configured to capture an image of the tip (not shown, but stated on Page 5, Par. (0062), lines 7 and 8) of a master key (22), wherein said captured image of said tip includes a contour of a groove in said master key (as stated on Page 5, Par. (0062), lines 9-13); and a logic configured to analyze said captured image to determine characteristics of said groove based on said contour (as stated on Page 5, Par. (0061), lines 1-9) and further to compare said characteristics of said groove with groove characteristics of known key blanks to determine the likelihood of a match between said master key and a known key blank (comparing sequence is stated on Page 3, Par. 0043, lines 6-7 and 20-23); [Cim. 2] wherein said logic includes a database containing data related to characteristics of grooves of known key blanks (as stated on Page 5, Par. (0061), lines 9-14); [Cim. 3] wherein said imaging system includes a camera (50, as stated on Page 4, Par. (0056)); [Cim. 4] wherein said imaging system includes a reflecting device (reflector plate (54)); [Cim. 5] wherein said imaging system includes a light (lighting panel (52)); [Cim. 6] wherein said light is directed toward said reflecting device (as stated on Page 4, Par. (0057), lines 6-8); [Cim. 7] wherein said light includes a shield (blocking plate (56)); [Cim. 8] wherein said captured image is a digital image (as stated on Page 4, Par. (0056)); [Cim. 9] wherein said captured image comprises a silhouette of said tip of said master key (as stated on Page 4, Par. (0055), lines 12-16); [Cim. 11, 12, 13] wherein said logic accounts for rolling, tilting and tipping of said master key with respect to said imaging system to determine characteristics of said groove (wherein variable positioning is taken into account and does not affect imaging as stated on Page 3, Par. (0049), lines 1-12); [Cim. 15] an overhead camera positioned above and approximately perpendicular to said master key (as stated on Page 4, Par. (0055), lines 12-16); [Cim. 16] wherein said groove characteristics are determined based on image data from both said imaging system and said overhead camera (as stated on Page 5, Par. (0062), lines 1-4); [Cim. 17] wherein said logic calculates the geometry of the groove contour ("quantify surface features.. such as the keyway groove" and "identify the width and spacing of a keyway groove" as stated on Page 5, Par. (0062)) as seen from a view of the tip parallel to the blade ("tip view" as stated on Page 5, Par. (0062) line 7 and 8) based on data from both said imaging system and said overhead camera (as stated on Page 5, Par. (0062), line 1, wherein the imaging system is used in addition with imaging device (50, as stated on Page 4, Par. (0056) and Page 5, Par. (0060)); [Cim. 19] a key holder (retention mechanism, (19) as shown in Fig. 2, 3 and 6)) configured to hold said master key (22); [Cim. 20] wherein said key holder includes a lower support (base, (16) as shown in Fig. 1-3); [Cim. 21] wherein said key holder includes an upper door (door clamp (14) as shown in Fig. 1-3); and [Cim. 22] wherein said key holder includes a clamp (also door clamp (14) as shown in Fig. 1-3). However, Bass et al does not disclose: [Cim. 1] wherein the imaging system captures an image at an angle between perpendicular and parallel to the blade of said master key; [Cim. 7] a shield to direct light away from said master key; [Cim. 10] wherein said characteristics of said groove include the geometric shape of said groove; [Cim. 14] a mirror positioned to reflect an image of said master key to be captured by said camera; [Cim. 18] wherein said logic calculates the geometry of the groove contour as though the tip were squarely cut based on data from both said imaging system and said overhead camera. Wills et al discloses in Fig. 1A-9, a key identification system (Col. 5, lines 66 and 67) comprising: [Cim. 1] wherein the imaging system (in this case a laser (39) as shown in Fig. 6-9, which generates a beam of light to analyze the key's surface) captures an image at an angle (8, as shown in Fig. 6-9) between perpendicular and parallel (as shown in Fig. 6-9, and as stated in Col. 12, lines 4-16) to the blade of said master key; [Cim. 10] wherein said characteristics of said groove include the geometric shape of said groove (wherein the groove(s) are considered to be the milling (as stated in Col. 5, lines 55-65), in which the geometric shapes being analyzed are considered to be the "non-planar portions" of the side of the key as stated in Col. 11, lines 51-60); [Cim. 14] a mirror (29, as seen in Fig. 9) positioned to reflect an image of said master key to be captured by said camera (as stated in Col. 7, lines 45-50); [Cim. 18] wherein said logic calculates the geometry of the groove contour as though the tip were squarely cut based on data (wherein the biting analysis (stated in Col. 16, lines 52-60) of the logic determines the groove contour in which the tip back to tip head are measured to determine cut geometry (as stated in Col. 19, lines 42-57) from both said imaging system and said overhead camera (as stated in Col. 19, lines 60-64)). Therefore, it would have been obvious to one having ordinary skill in the art at the time of the invention to modify Bass et al's key identification system with an imaging system: that an image at an angle between the perpendicular and parallel axis of the key blade; wherein the characteristics of the groove include the geometric shape of the groove; a mirror positioned to reflect the image of the master key to be captured by camera; and wherein the logic calculates the groove contour of the key through the tip of the key, all as taught Wills et al for the purpose of providing an exact image of the master key which is to be duplicated onto another key blank. In regards to Claim 7, wherein a shield is used to direct light away from the master key, a recitation of the intended use of the claimed invention must result in a structural difference between the claimed invention and the prior art in order to patentably distinguish the claimed invention from the prior art. If the prior art is capable of performing the intended use then it meets the claim. Therefore, the shield of Bass et al is capable of being used to direct light away from the master key.																												

Form PCT/ISA/237 (Box No. V) (July 2009)

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

International application No.

PCT/US2010/033414

Supplemental Box

In case the space in any of the preceding boxes is not sufficient.

Continuation of:

Claim 23 meets the criteria set out in PCT Article 33(2)-(3), because the prior art does not fairly teach or fairly suggest wherein a camera is positioned above the blade of the key and configured to capture an image of a groove in the bottom (opposite surface) of the blade. Wills et al is the closest reference to disclose the claim limitation, however, Wills et al does not disclose wherein the imaging system is positioned at an angle above the key blade, but is angled to capture the bottom groove by the tip is a laser beam, not a camera.

Claims 1-23 meet the criteria set out in PCT Article 33(4), and thus have industrial applicability because the subject matter claimed can be made or used in industry.

Form PCT/ISA/237 (Supplemental Box) (July 2009)

PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference 16223-00153	FOR FURTHER ACTION see Form PCT/ISA/220 as well as, where applicable, item 5 below.	
International application No. PCT/US2010/033414	International filing date (day/month/year) 03 May 2010	(Earliest) Priority Date (day/month/year) 01 May 2009
Applicant HY-KO PRODUCTS		

This international search report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This international search report consists of a total of 2 sheets.

☐ It is also accompanied by a copy of each prior art document cited in this report.

1. Basis of the report

a. With regard to the **language**, the international search was carried out on the basis of:

- ☒ the international application in the language in which it was filed.
☐ a translation of the international application into _____ which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b)).

b. ☐ This international search report has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43.6bis(a)).

c. ☐ With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, see Box No. I.

2. ☐ **Certain claims were found unsearchable** (see Box No. II).

3. ☐ **Unity of invention is lacking** (see Box No. III).

4. With regard to the **title**,

- ☒ the text is approved as submitted by the applicant.
☐ the text has been established by this Authority to read as follows:

5. With regard to the **abstract**,

- ☒ the text is approved as submitted by the applicant.
☐ the text has been established, according to Rule 38.2, by this Authority as it appears in Box No. IV. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. With regard to the **drawings**,

- a. the figure of the **drawings** to be published with the abstract is Figure No. 1
☒ as suggested by the applicant.
☐ as selected by this Authority, because the applicant failed to suggest a figure.
☐ as selected by this Authority, because this figure better characterizes the invention.
- b. ☐ none of the figures is to be published with the abstract.

Form PCT/ISA/210 (first sheet) (July 2009)

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US2010/033414

A. CLASSIFICATION OF SUBJECT MATTER

IPC(8) - B23C 1/16 (2010.01)

USPC - 409/81

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC(8) - B23C 1/16, 3/35; B23Q 3/00 (2010.01)

USPC - 76/110; 269/142, 226, 227, 329; 382/100, 181, 218, 219; 409/81, 82, 131, 132

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

USPTO EAST System (US, USPG-PUB, EPO, DERWENT)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 2007/0224008 A1 (BASS et al) 27 September 2007 (27.09.2007) entire document	1-22
Y	US 6,064,747 A (WILLS et al) 16 May 2000 (16.05.2000) entire document	1-22
A	US 6,406,227 B1 (TITUS et al) 18 June 2002 (18.06.2002) entire document	1-22
A	US 2002/0031251 A1 (CAMPBELL et al) 14 March 2002 (14.03.2002) entire document	1-22
A	US 6,449,381 B1 (YANOVSKY et al) 10 September 2002 (10.09.2002) entire document	1-22

☐ Further documents are listed in the continuation of Box C.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

05 August 2010

Date of mailing of the international search report

18 AUG 2010

Name and mailing address of the ISA/US

Mail Stop PCT, Attn: ISA/US, Commissioner for Patents

P.O. Box 1450, Alexandria, Virginia 22313-1450

Facsimile No. 571-273-3201

Authorized officer:

Blaine R. Copenheaver

PCT Helpdesk: 571-272-4300

PCT OSP: 571-272-7774

Form PCT/ISA/210 (second sheet) (July 2009)

PATENT COOPERATION TREATY

From the
INTERNATIONAL SEARCHING AUTHORITY

PCT

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43bis.1)

To: DAVID CUPAR MCDONALD HOPKINS LLC 600 SUPERIOR AVENUE, EAST SUITE 2100 CLEVELAND, OH 44114		Date of mailing (day/month/year) 18 AUG 2010
Applicant's or agent's file reference 16223-00153		FOR FURTHER ACTION See paragraph 2 below
International application No. PCT/US2010/033414	International filing date (day/month/year) 03 May 2010	Priority date (day/month/year) 01 May 2009
International Patent Classification (IPC) or both national classification and IPC IPC(8) - B23C 1/16 (2010.01) USPC - 409/81		
Applicant HY-KO PRODUCTS		

1. This opinion contains indications relating to the following items:

- ☒ Box No. I Basis of the opinion
☐ Box No. II Priority
☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
☐ Box No. IV Lack of unity of invention
☒ Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
☐ Box No. VI Certain documents cited
☐ Box No. VII Certain defects in the international application
☐ Box No. VIII Certain observations on the international application

2. FURTHER ACTION

If a demand for international preliminary examination is made, this opinion will be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1bis(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

3. For further details, see notes to Form PCT/ISA/220.

Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-3201	Date of completion of this opinion 05 August 2010	Authorized officer: Blaine R. Copenheaver PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774

Form PCT/ISA/237 (cover sheet) (July 2009)

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITYInternational application No.
PCT/US2010/033414

Box No. I Basis of this opinion

1. With regard to the **language**, this opinion has been established on the basis of:
- ☒ the international application in the language in which it was filed.
- ☐ a translation of the international application into _____ which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b)).
2. ☐ This opinion has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43*bis*.1(a))
3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, this opinion has been established on the basis of a sequence listing filed or furnished:
- a. (means)
- ☐ on paper
- ☐ in electronic form
- b. (time)
- ☐ in the international application as filed
- ☐ together with the international application in electronic form
- ☐ subsequently to this Authority for the purposes of search
4. ☐ In addition, in the case that more than one version or copy of a sequence listing has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.
5. Additional comments:

**WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY**

International application No.

PCT/US2010/033414

Box No. V	Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement																											
1. Statement <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 30%; vertical-align: top;">Novelty (N)</td> <td style="width: 10%; vertical-align: top;">Claims</td> <td style="width: 40%; border-bottom: 1px solid black;">1-23</td> <td style="width: 20%; text-align: right;">YES</td> </tr> <tr> <td></td> <td style="vertical-align: top;">Claims</td> <td style="border-bottom: 1px solid black;">None</td> <td style="text-align: right;">NO</td> </tr> <tr> <td style="vertical-align: top;">Inventive step (IS)</td> <td style="vertical-align: top;">Claims</td> <td style="border-bottom: 1px solid black;">23</td> <td style="text-align: right;">YES</td> </tr> <tr> <td></td> <td style="vertical-align: top;">Claims</td> <td style="border-bottom: 1px solid black;">1-22</td> <td style="text-align: right;">NO</td> </tr> <tr> <td style="vertical-align: top;">Industrial applicability (IA)</td> <td style="vertical-align: top;">Claims</td> <td style="border-bottom: 1px solid black;">1-23</td> <td style="text-align: right;">YES</td> </tr> <tr> <td></td> <td style="vertical-align: top;">Claims</td> <td style="border-bottom: 1px solid black;">None</td> <td style="text-align: right;">NO</td> </tr> </table>					Novelty (N)	Claims	1-23	YES		Claims	None	NO	Inventive step (IS)	Claims	23	YES		Claims	1-22	NO	Industrial applicability (IA)	Claims	1-23	YES		Claims	None	NO
Novelty (N)	Claims	1-23	YES																									
	Claims	None	NO																									
Inventive step (IS)	Claims	23	YES																									
	Claims	1-22	NO																									
Industrial applicability (IA)	Claims	1-23	YES																									
	Claims	None	NO																									
2. Citations and explanations: Claims 1-22 lack an inventive step under PCT Article 33(3) as being obvious over Bass et al in view of Wills et al. Bass et al discloses in Fig. 1-10, a key identification system (Page 2, Par. (0040)) comprising: [Cim. 1] an imaging system (as stated on Page 5, Par. (0062), wherein the system includes an optical imaging device (digital camera) and a laser scanner) configured to capture an image of the tip (not shown, but stated on Page 5, Par. (0062), lines 7 and 8) of a master key (22), wherein said captured image of said tip includes a contour of a groove in said master key (as stated on Page 5, Par. (0062), lines 9-13); and a logic configured to analyze said captured image to determine characteristics of said groove based on said contour (as stated on Page 5, Par. (0061), lines 1-9) and further to compare said characteristics of said groove with groove characteristics of known key blanks to determine the likelihood of a match between said master key and a known key blank (comparing sequence is stated on Page 3, Par. 0043, lines 6-7 and 20-23); [Cim. 2] wherein said logic includes a database containing data related to characteristics of grooves of known key blanks (as stated on Page 5, Par. (0061), lines 9-14); [Cim. 3] wherein said imaging system includes a camera (50, as stated on Page 4, Par. (0056)); [Cim. 4] wherein said imaging system includes a reflecting device (reflector plate (54)); [Cim. 5] wherein said imaging system includes a light (lighting panel (52)); [Cim. 6] wherein said light is directed toward said reflecting device (as stated on Page 4, Par. (0057), lines 6-8); [Cim. 7] wherein said light includes a shield (blocking plate (56)); [Cim. 8] wherein said captured image is a digital image (as stated on Page 4, Par. (0056)); [Cim. 9] wherein said captured image comprises a silhouette of said tip of said master key (as stated on Page 4, Par. (0055), lines 12-16); [Cim. 11, 12, 13] wherein said logic accounts for rolling, tilting and tipping of said master key with respect to said imaging system to determine characteristics of said groove (wherein variable positioning is taken into account and does not affect imaging as stated on Page 3, Par. (0049), lines 1-12); [Cim. 15] an overhead camera positioned above and approximately perpendicular to said master key (as stated on Page 4, Par. (0055), lines 12-16); [Cim. 16] wherein said groove characteristics are determined based on image data from both said imaging system and said overhead camera (as stated on Page 5, Par. (0062), lines 1-4); [Cim. 17] wherein said logic calculates the geometry of the groove contour ("quantify surface features.. such as the keyway groove" and "identify the width and spacing of a keyway groove" as stated on Page 5, Par. (0062)) as seen from a view of the tip parallel to the blade ("tip view" as stated on Page 5, Par. (0062) line 7 and 8) based on data from both said imaging system and said overhead camera (as stated on Page 5, Par. (0062), line 1, wherein the imaging system is used in addition with imaging device (50, as stated on Page 4, Par. (0056) and Page 5, Par. (0060)); [Cim. 19] a key holder (retention mechanism, (19) as shown in Fig. 2, 3 and 6)) configured to hold said master key (22); [Cim. 20] wherein said key holder includes a lower support (base, (16) as shown in Fig. 1-3); [Cim. 21] wherein said key holder includes an upper door (door clamp (14) as shown in Fig. 1-3); and [Cim. 22] wherein said key holder includes a clamp (also door clamp (14) as shown in Fig. 1-3). However, Bass et al does not disclose: [Cim. 1] wherein the imaging system captures an image at an angle between perpendicular and parallel to the blade of said master key; [Cim. 7] a shield to direct light away from said master key; [Cim. 10] wherein said characteristics of said groove include the geometric shape of said groove; [Cim. 14] a mirror positioned to reflect an image of said master key to be captured by said camera; [Cim. 18] wherein said logic calculates the geometry of the groove contour as though the tip were squarely cut based on data from both said imaging system and said overhead camera. Wills et al discloses in Fig. 1A-9, a key identification system (Col. 5, lines 66 and 67) comprising: [Cim. 1] wherein the imaging system (in this case a laser (39) as shown in Fig. 6-9, which generates a beam of light to analyze the key's surface) captures an image at an angle (8, as shown in Fig. 6-9) between perpendicular and parallel (as shown in Fig. 6-9, and as stated in Col. 12, lines 4-16) to the blade of said master key; [Cim. 10] wherein said characteristics of said groove include the geometric shape of said groove (wherein the groove(s) are considered to be the milling (as stated in Col. 5, lines 55-65), in which the geometric shapes being analyzed are considered to be the "non-planar portions" of the side of the key as stated in Col. 11, lines 51-60); [Cim. 14] a mirror (29, as seen in Fig. 9) positioned to reflect an image of said master key to be captured by said camera (as stated in Col. 7, lines 45-50); [Cim. 18] wherein said logic calculates the geometry of the groove contour as though the tip were squarely cut based on data (wherein the biting analysis (stated in Col. 16, lines 52-60) of the logic determines the groove contour in which the tip back to tip head are measured to determine cut geometry (as stated in Col. 19, lines 42-57) from both said imaging system and said overhead camera (as stated in Col. 19, lines 60-64)). Therefore, it would have been obvious to one having ordinary skill in the art at the time of the invention to modify Bass et al's key identification system with an imaging system: that an image at an angle between the perpendicular and parallel axis of the key blade; wherein the characteristics of the groove include the geometric shape of the groove; a mirror positioned to reflect the image of the master key to be captured by camera; and wherein the logic calculates the groove contour of the key through the tip of the key, all as taught Wills et al for the purpose of providing an exact image of the master key which is to be duplicated onto another key blank. In regards to Claim 7, wherein a shield is used to direct light away from the master key, a recitation of the intended use of the claimed invention must result in a structural difference between the claimed invention and the prior art in order to patentably distinguish the claimed invention from the prior art. If the prior art is capable of performing the intended use then it meets the claim. Therefore, the shield of Bass et al is capable of being used to direct light away from the master key.																												

Form PCT/ISA/237 (Box No. V) (July 2009)

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

International application No.

PCT/US2010/033414

Supplemental Box

In case the space in any of the preceding boxes is not sufficient.

Continuation of:

Claim 23 meets the criteria set out in PCT Article 33(2)-(3), because the prior art does not fairly teach or fairly suggest wherein a camera is positioned above the blade of the key and configured to capture an image of a groove in the bottom (opposite surface) of the blade. Wills et al is the closest reference to disclose the claim limitation, however, Wills et al does not disclose wherein the imaging system is positioned at an angle above the key blade, but is angled to capture the bottom groove by the tip is a laser beam, not a camera.

Claims 1-23 meet the criteria set out in PCT Article 33(4), and thus have industrial applicability because the subject matter claimed can be made or used in industry.

Form PCT/ISA/237 (Supplemental Box) (July 2009)

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter I of the Patent Cooperation Treaty)

(PCT Rule 44bis)

Applicant's or agent's file reference 16223-00058PCT	FOR FURTHER ACTION	See item 4 below
International application No. PCT/US2007/002015	International filing date (<i>day/month/year</i>) 23 January 2007 (23.01.2007)	Priority date (<i>day/month/year</i>) 23 January 2006 (23.01.2006)
International Patent Classification (8th edition unless older edition indicated) See relevant information in Form PCT/ISA/237		
Applicant HY-KO PRODUCTS COMPANY		

1.	This international preliminary report on patentability (Chapter I) is issued by the International Bureau on behalf of the International Searching Authority under Rule 44 bis.1(a).																									
2.	This REPORT consists of a total of 6 sheets, including this cover sheet. In the attached sheets, any reference to the written opinion of the International Searching Authority should be read as a reference to the international preliminary report on patentability (Chapter I) instead.																									
3.	This report contains indications relating to the following items: <table border="0"><tr><td>☒</td><td>Box No. I</td><td>Basis of the report</td></tr><tr><td>☐</td><td>Box No. II</td><td>Priority</td></tr><tr><td>☐</td><td>Box No. III</td><td>Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</td></tr><tr><td>☐</td><td>Box No. IV</td><td>Lack of unity of invention</td></tr><tr><td>☒</td><td>Box No. V</td><td>Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</td></tr><tr><td>☐</td><td>Box No. VI</td><td>Certain documents cited</td></tr><tr><td>☐</td><td>Box No. VII</td><td>Certain defects in the international application</td></tr><tr><td>☐</td><td>Box No. VIII</td><td>Certain observations on the international application</td></tr></table>		☒	Box No. I	Basis of the report	☐	Box No. II	Priority	☐	Box No. III	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability	☐	Box No. IV	Lack of unity of invention	☒	Box No. V	Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement	☐	Box No. VI	Certain documents cited	☐	Box No. VII	Certain defects in the international application	☐	Box No. VIII	Certain observations on the international application
☒	Box No. I	Basis of the report																								
☐	Box No. II	Priority																								
☐	Box No. III	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability																								
☐	Box No. IV	Lack of unity of invention																								
☒	Box No. V	Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement																								
☐	Box No. VI	Certain documents cited																								
☐	Box No. VII	Certain defects in the international application																								
☐	Box No. VIII	Certain observations on the international application																								
4.	The International Bureau will communicate this report to designated Offices in accordance with Rules 44bis.3(c) and 93bis.1 but not, except where the applicant makes an express request under Article 23(2), before the expiration of 30 months from the priority date (Rule 44bis .2).																									

	Date of issuance of this report 29 July 2008 (29.07.2008)
The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland Facsimile No. +41 22 338 82 70	Authorized officer Beate Giffo-Schmitt e-mail: pt03.pct@wipo.int

Form PCT/IB/373 (January 2004)

PATENT COOPERATION TREATY

From the
INTERNATIONAL SEARCHING AUTHORITY

To: Risto Pribisich
Mcdonald Hopkins LLC
600 Superior Avenue, E.
Suite 2100
Cleveland, OH 44114

PCT

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43bis.1)

Date of mailing
(day/month/year)

28 SEP 2007

Applicant's or agent's file reference
16223-00058PCT

FOR FURTHER ACTION

See paragraph 2 below

International application No.

PCT/US 07/02015

International filing date (day/month/year)

23 January 2007 (23.01.2007)

Priority date (day/month/year)

23 January 2006 (23.01.2006)

International Patent Classification (IPC) or both national classification and IPC

IPC(8) - B23C 1/16 (2007.01)

USPC - 409/81

Applicant Hy-Ko Products Company

1. This opinion contains indications relating to the following items:

- ☒ Box No. I Basis of the opinion
- ☐ Box No. II Priority
- ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI Certain documents cited
- ☐ Box No. VII Certain defects in the international application
- ☐ Box No. VIII Certain observations on the international application

2. **FURTHER ACTION**

If a demand for international preliminary examination is made, this opinion will be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1bis(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

3. For further details, see notes to Form PCT/ISA/220.

Name and mailing address of the ISA/US
Mail Stop PCT, Attn: ISA/US
Commissioner for Patents
P.O. Box 1450, Alexandria, Virginia 22313-1450
Facsimile No. 571-273-3201

Date of completion of this opinion

11 August 2007 (11.08.2007)

Authorized officer:

Lee W. Young

PCT Helpdesk: 571-272-4300
PCT OSP: 571-272-7774

Form PCT/ISA/237 (cover sheet) (April 2007)

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

International application No.

PCT/US 07/02015

Box No. I Basis of this opinion

1. With regard to the **language**, this opinion has been established on the basis of:
 - ☒ the international application in the language in which it was filed.
 - ☐ a translation of the international application into _____ which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b)).
2. ☐ This opinion has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43*bis*.1(a))
3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, this opinion has been established on the basis of:
 - a. type of material
 - ☐ a sequence listing
 - ☐ table(s) related to the sequence listing
 - b. format of material
 - ☐ on paper
 - ☐ in electronic form
 - c. time of filing/furnishing
 - ☐ contained in the international application as filed
 - ☐ filed together with the international application in electronic form
 - ☐ furnished subsequently to this Authority for the purposes of search
4. ☐ In addition, in the case that more than one version or copy of a sequence listing and/or table(s) relating thereto has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.
5. Additional comments:

**WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY**

International application No.

PCT/US 07/02015

Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims	7, 15 and 20	YES
	Claims	1-6, 8-14, 16-19, 21-26	NO
Inventive step (IS)	Claims	none	YES
	Claims	1-26	NO
Industrial applicability (IA)	Claims	1-26	YES
	Claims	none	NO

2. Citations and explanations:

Claims 1-6, 8-14, 16-19 and 21-23 lack novelty under PCT Article 33(3) as being anticipated by US 5,908,273 A to Titus et al. (herein after Titus).

With respect to claim 1, Titus discloses an assembly (key duplicating apparatus 200, Fig 2-5) for duplicating a master key (original key 202; col 3 In 58-61, Fig 2-5), the assembly comprising: an optical imaging device (video camera 804, video image processor 808, Fig 8; control system 900, Fig 9) for capturing an optical image (image of key; col 8 In 1-27, Fig 8) of at least a portion of the master key, a logic (video image processor 808; col 8 In 1-13) for determining a key pattern (key code 700; col 6 In 21-22, col 7 In 6-20, Fig 7a, 7b) of the master key from the optical image of master key, a clamping assembly (key holder 204; col 3 In 66 to col 4 In 14, Fig 2) for clamping a key blank (blank preform 246; col 3 In 57-65) and a first cutting member (key-code cutter 252; col 4 In 44-50, Fig 4) for cutting a key pattern (key-code; col 4 In 51-56, Fig 4) into the key blank.

With respect to claim 2, Titus discloses an assembly (key duplicating apparatus 200; Fig 2-5) where the key pattern (key-code; col 4 In 51-56) cut into the key blank (blank preform 246; col 4 In 51-56) is a duplication of the key pattern of master key (original key 202; col 3 In 58-61, Fig 2-5).

With respect to claim 3, Titus discloses an assembly (key duplicating apparatus 200; Fig 2-5) where the logic (control system 900; col 9 In 1-34, Fig 9) directs the first cutting member (key-code cutter 252 via cutting tool motor 260) during duplication of the key pattern (key-code; col 4 In 51-56) of master key (original key 202; col 3 In 58-61, Fig 2-5).

With respect to claim 4, Titus discloses an assembly (key duplicating apparatus 200; Fig 2-5) where the optical image (image of key; col 8 In 1-27, Fig 8) is a digital image (via video image processor 808 is controlled by embedded PC central control system 902 via digital I/O interface 930; col 9 In 1-25).

With respect to claim 5, Titus discloses an assembly (key duplicating apparatus 200; Fig 2-5) where the clamping assembly (key holder 204; col 3 In 66 to col 4 In 14, Fig 2) further comprises, a first clamping member (x-translation stage 214, y-translation stage 218, key holder 204; col 3 In 66 to col 4 In 14, Fig 2) having a first clamping surface (x-translation stage 214) defining a width (x-direction; col 3 In 66 to col 4 In 14) and a second clamping member (y-translation stage 218; col 3 In 66 to col 4 In 14) having a second clamping surface (upper surface of y-translation stage 218) defining a width (y-direction; col 3 In 66 to col 4 In 14).

With respect to claim 6, Titus discloses an assembly (key duplicating apparatus 200; Fig 2-5) where the key blank (blank preform 245) further comprises a blade (key shaft 102; col 3 In 36-44, Fig 1A) defining a width where the width of the first clamping member (key holder 204; col 3 In 66 to col 4 In 14, Fig 2) and the width of the second clamping member (col 13 In 53-62) are less than the width of the blade of the key blank.

With respect to claim 8, Titus discloses an assembly (key duplicating apparatus 200; Fig 2-5) where the first cutting member (key code cutter 252, edge cutters 250; col 5 In 1-29) is a cutting wheel (Fig 4, 5).

With respect to claim 9, Titus discloses an assembly (key duplicating apparatus 200; Fig 2-5) further comprising a retention mechanism (key holder 204, Fig 2) for retaining the master key (original key 202; col 3 In 58-61) or the key blank (blank preform 245).

With respect to claim 10, Titus discloses an assembly (key duplicating apparatus 200; Fig 2-5) where the retention mechanism further comprises a base (x-translation stage 214, y-translation stage 218, key holder 204; col 3 In 66 to col 4 In 14, Fig 2) a retention plate (tip holder 248; col 12 In 29-39) and a biasing member (key holder solenoid 928; col 9 In 23-25, Fig 9) biasing the retention plate towards the base.

With respect to claim 11, Titus discloses an assembly (key duplication apparatus 200; Fig 2-5) further comprising a first positioning member (x-translation stage 214, key holder 204; col 3 In 66 to col 4 In 14, Fig 2) and a second positioning member (y-translation stage 218), wherein the first and second positioning members engage the master key (original key 202) or the key blank (blank preform 245) to position the master key or the key blank relative to the assembly.

See continuation sheet.

**WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY**

International application No.

PCT/US 07/02015

Supplemental Box

In case the space in any of the preceding boxes is not sufficient.

Continuation of:
Box V, item 2. Citations and explanations.

With respect to claim 12, Titus discloses an assembly (key duplication apparatus 200; Fig 2-5) further comprising a user interface (display 920; col 9 ln 1-10) for providing output to a user.

With respect to claim 13, Titus discloses an assembly (key duplication apparatus 200; Fig 2-5) where the logic determines the key blank (blank preform 245) from the optical image of the master key (original key 202). (Cutting tool motor 260 is controlled by the central control system 902; col 9 ln 11-25).

With respect to claim 14, Titus discloses an assembly (key duplication apparatus 200; Fig 2-5) where identity of the determined key blank is output to the user by the user interface. (Titus discloses wherein if the measured key is determined to be lost or stolen, a signal may be directed through the communications interface 940; col 12 ln. 10-14.)

With respect to claim 16, Titus discloses an assembly (key duplication apparatus 200; Fig 2-5) where the key blank (blank preform 245) may be clamped in a first orientation or a second orientation. (Titus discloses inserting a double-sided key in either orientation; col 3 ln 45-56.)

With respect to claim 17, Titus discloses a method for duplicating a master key (original key 202) the method comprising capturing an optical image (optical image; col 8 ln 1-13) of at least a portion of the master key, providing a logic (via central control system 902) to determine a key pattern (key code) of the master key from the optical image of the master key, securing a key blank (blank preform 245) and cutting a key pattern into the key blank. (See col 9 ln 1-25, col 10 ln 6-22.)

With respect to claim 18, Titus discloses a method where the key pattern (key code) cut into the key blank (blank preform 245) is a duplication of the key pattern of the master key (original key 202). (See col 3 ln 57-65.)

With respect to claim 19, Titus discloses a method further comprising using logic to determine the key blank (blank preform 245). (See col 12 ln 20-39.)

With respect to claim 21, Titus discloses a method further comprising, capturing an optical image (optical image; col 8 ln 1-13) of at least a portion of the key blank (blank preform 245) and using the logic to validate the key blank matches the master key (original key 202). (Titus discloses using edge cutters 250 stroke or pass pattern computed that approximates the keyway profile shape is within acceptable tolerances; col 13 ln. 3-12.)

With respect to claim 22, Titus discloses a method further comprising capturing an optical image of at least a portion of the key pattern cut into key blank (blank preform 245), using the logic to determine the key pattern cut into key blank, and using the logic to compare the key pattern cut into the key blank with the key pattern of the master key. (See col 11 ln 36-47).

With respect to claim 23, Titus discloses a method comprising using the logic to validate that the key pattern cut into the key plank (blank preform 245) is within a predefined tolerance of the key pattern of the master key (original key 202). (See col 11 ln 36-47).

Claims 24-26 lack novelty under PCT Article 33(2) as being anticipated by 2004/0095380 A1 to Bass et al. (herein after Bass).

With respect to claim 24, Bass discloses an assembly for identifying a key blank (identification system 10, Key Identification System KIDS) for the duplication of a master key (master key; Bass para [0048], the assembly comprising, an optical imaging device (machine-recognizable object verification system, bar code scanner; Bass para [0058]) for capturing an optical image of at least a portion of the master key, a logic for determining at least one feature (manufacturer; Bass para [0031]) of the master key from the optical image of aster key for comparison with at least one feature of a plurality of key blanks, and identifying which of the plurality of key blanks is the proper key blank (via indicative display rack; Bass para [0035], [0041]) and identifying which of the plurality of key blanks is the proper key blank for duplication of the master key.

With respect to claim 25, Bass discloses an assembly where identity of the proper key blank is output to a user by a user interface (display rack; Bass para [0035], [0041]).

With respect to claim 26, Bass discloses an assembly wherein the user interface is a display rack (display rack; Bass para [0035], [0041]) for the display of the plurality of key blanks.

See continuation sheet.

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US 07/02015

Supplemental Box

In case the space in any of the preceding boxes is not sufficient.

Continuation of:
Box V, item 2. Citations and explanations.

Claims 7 and 20 lack an inventive step under PCT Article 33(3) as being obvious over Titus.

With respect to claim 7, Titus discloses an assembly (key duplication apparatus 200; Fig 2-5) further comprising a second cutting member (edge cutters 250; col 5 ln 4-29, Fig 18) for cutting the key pattern into key blank (blank preform 245), yet fails to disclose where the first and second cutting members are capable of simultaneously cutting the key pattern into the key blank. However, Titus discloses forming a keyway on a first side of a blank and subsequently forming a keyway on a second side of a blank for permitting maximum material removal per pass. (col 13 ln 3-23, Claim 37). Hence, it would have been obvious to one of skill in the art to duplicate the first cutting member of Titus to construct an assembly comprising a second cutting member for cutting the key pattern into a key blank, where the first and second cutting members are capable of simultaneously cutting the key pattern into a key blank for maximizing material removal per pass as taught by Titus.

With respect to claim 20, Titus discloses a method of duplicating a master key (original key 202) with a key blank (blank preform 245) wherein the user is signaled through the communication interface (940) concerning the measured key, yet fails to disclose a method further comprising outputting the determined key blank to a user. Hence, it would have been obvious to one of skill in the art to combine the signaling through the communication interface with the identification of the key blank of Titus, to formulate a method further comprising outputting the determined key blank to a user as taught by Titus. (col 12 ln 10-14.)

Claim 15 lacks an inventive step under PCT Article 33(3) as being obvious over Titus in view of Bass.

With respect to claim 15, Titus discloses an assembly (key duplication apparatus 200) comprising a user interface (display 920; Titus col 9 ln 1-10), yet fails to disclose an interface further comprising a display rack. However, Bass discloses a object identification system for identification of key blanks comprising a display rack (display rack 100; Bass para [0070]) for indicating the appropriate key blank. Hence, it would have been obvious to one of skill in the art to combine the assembly (key duplication apparatus 200) comprising a user interface (display 920) of Titus with the display rack (display rack 100) of Bass to construct an assembly where the user interface is a display rack for the display of a plurality of key blanks as taught by Bass.

Claims 1-26 have industrial applicability as defined by PCT Article 33(4) because the subject matter can be made or used by industry.

PATENT COOPERATION TREATY

From the INTERNATIONAL SEARCHING AUTHORITY

PCT

To: Risto Pribisich
Mcdonald Hopkins LLC
600 Superior Avenue, E.
Suite 2100
Cleveland, OH 44114

NOTIFICATION OF TRANSMITTAL OF
THE INTERNATIONAL SEARCH REPORT AND
THE WRITTEN OPINION OF THE INTERNATIONAL
SEARCHING AUTHORITY, OR THE DECLARATION

(PCT Rule 44.1)

Date of mailing (day/month/year) **28 SEP 2007**

Applicant's or agent's file reference
16223-00058PCT

FOR FURTHER ACTION See paragraphs 1 and 4 below

International application No.
PCT/US 07/02015

International filing date
(day/month/year) **23 January 2007 (23.01.2007)**

Applicant **Hy-Ko Products Company**

1. ☒ The applicant is hereby notified that the international search report and the written opinion of the International Searching Authority have been established and are transmitted herewith.

Filing of amendments and statement under Article 19:

The applicant is entitled, if he so wishes, to amend the claims of the international application (see Rule 46):

When? The time limit for filing such amendments is normally two months from the date of transmittal of the international search report.

Where? Directly to the International Bureau of WIPO, 34 chemin des Colombettes
1211 Geneva 20, Switzerland, Facsimile No.: +41 22 740 14 35

For more detailed instructions, see the notes on the accompanying sheet.

2. ☐ The applicant is hereby notified that no international search report will be established and that the declaration under Article 17(2)(a) to that effect and the written opinion of the International Searching Authority are transmitted herewith.

3. ☐ **With regard to the protest** against payment of (an) additional fee(s) under Rule 40.2, the applicant is notified that:
- ☐ the protest together with the decision thereon has been transmitted to the International Bureau together with the applicant's request to forward the texts of both the protest and the decision thereon to the designated Offices.
- ☐ no decision has been made yet on the protest; the applicant will be notified as soon as a decision is made.

4. **Reminders**

Shortly after the expiration of **18 months** from the priority date, the international application will be published by the International Bureau. If the applicant wishes to avoid or postpone publication, a notice of withdrawal of the international application, or of the priority claim, must reach the International Bureau as provided in Rules 90bis.1 and 90bis.3, respectively, before the completion of the technical preparations for international publication.

The applicant may submit comments on an informal basis on the written opinion of the International Searching Authority to the International Bureau. The International Bureau will send a copy of such comments to all designated Offices unless an international preliminary examination report has been or is to be established. These comments would also be made available to the public but not before the expiration of 30 months from the priority date.

Within **19 months** from the priority date, but only in respect of some designated Offices, a demand for international preliminary examination must be filed if the applicant wishes to postpone the entry into the national phase **until 30 months** from the priority date (in some Offices even later); otherwise, the applicant must, **within 20 months** from the priority date, perform the prescribed acts for entry into the national phase before those designated Offices.

In respect of other designated Offices, the time limit of **30 months** (or later) will apply even if no demand is filed within 19 months.

See the Annex to Form PCT/IB/301 and, for details about the applicable time limits, Office by Office, see the *PCT Applicant's Guide*, Volume II, National Chapters and the WIPO Internet site.

Name and mailing address of the ISA/US
Mail Stop PCT, Attn: ISA/US
Commissioner for Patents
P.O. Box 1450, Alexandria, Virginia 22313-1450
Facsimile No. 571-273-3201

Authorized officer:

Lee W. Young

PCT Helpdesk: 571-272-4300
PCT OSP: 571-272-7774

Form PCT/ISA/220 (January 2004)

(See notes on accompanying sheet)

PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference 16223-00058PCT	FOR FURTHER ACTION	see Form PCT/ISA/220 as well as, where applicable, item 5 below.
International application No. PCT/US 07/02015	International filing date (<i>day/month/year</i>) 23 January 2007 (23.01.2007)	(Earliest) Priority Date (<i>day/month/year</i>) 23 January 2006 (23.01.2006)
Applicant Hy-Ko Products Company		

This international search report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This international search report consists of a total of 2 sheets.

☐ It is also accompanied by a copy of each prior art document cited in this report.

1. Basis of the report

a. With regard to the **language**, the international search was carried out on the basis of:

- ☒ the international application in the language in which it was filed.
☐ a translation of the international application into _____ which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b)).

b. ☐ This international search report has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43.6bis(a)).

c. ☐ With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, see Box No. I.

2. ☐ **Certain claims were found unsearchable** (see Box No. II).

3. ☐ **Unity of invention is lacking** (see Box No. III).

4. With regard to the **title**,

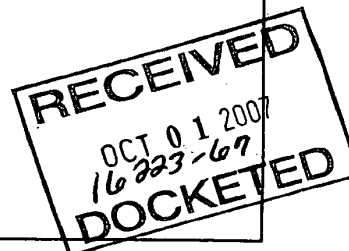
- ☒ the text is approved as submitted by the applicant.
☐ the text has been established by this Authority to read as follows:

5. With regard to the **abstract**,

- ☒ the text is approved as submitted by the applicant.
☐ the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box No. IV. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. With regard to the **drawings**,

- a. the figure of the **drawings** to be published with the abstract is Figure No. 1
☒ as suggested by the applicant.
☐ as selected by this Authority, because the applicant failed to suggest a figure.
☐ as selected by this Authority, because this figure better characterizes the invention.
- b. ☐ none of the figures is to be published with the abstract.



Form PCT/ISA/210 (first sheet) (April 2007)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 07/02015

A. CLASSIFICATION OF SUBJECT MATTER

IPC(8) - B23C 1/16 (2007.01)

USPC - 409/81

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC (8): B23C 1/16 (2007.01)

USPC: 409/81

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

IPC (8): B23C 1/16 (2007.01)

USPC: 409/81, 93, 96

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

PubWEST(USPT,PGPB,EPAB,JPAB); Internet search via Google Web and Google Patent search engines.

Search Terms Used: key, duplicator, duplication, duplicate, optical, image, digital

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X --- Y	US 5,908,273 A (TITUS et al.) 01 June 1999 (01.06.1999), col 3 ln 45 to col 4 ln 14, col 4 ln 51-56, col 5 ln 1-29, col 6 ln 21-22, col 7 ln 6-20, col 8 ln 1-27, col 9 ln 1-34, col 10 ln 6-22, col 11 ln 36-47, col 12 ln 10-39, col 13 ln 3-23, 53-62, Fig 2-5, 7a, 7b, 8, 9, 18, claim 37	1-14 and 16-23 ----- 15
X --- Y	US 2004/0095380 A1 (BASS et al.) 20 May 2004 (20.05.2004), para [0031], [0035], [0041], [0048], [0058], [0070]	24-26 ----- 15
A	US 6,406,227 B1 (TITUS et al.) 18 June 2002 (18.06.2002), Fig 6, 9	1-26
A	US 6,588,995 B2 (WILLS et al.) 08 July 2003 (08.07.2003), Fig 8, 9	1-26

☐ Further documents are listed in the continuation of Box C.


* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

11 August 2007 (11.08.2007)

Date of mailing of the international search report

28 SEP 2007

Name and mailing address of the ISA/US

Mail Stop PCT, Attn: ISA/US, Commissioner for Patents

P.O. Box 1450, Alexandria, Virginia 22313-1450

Facsimile No. 571-273-3201

Authorized officer:

Lee W. Young

PCT Helpdesk: 571-272-4300

PCT OSP: 571-272-7774

PATENT COOPERATION TREATY

From the
INTERNATIONAL SEARCHING AUTHORITY

To: Risto Pribisich
Mcdonald Hopkins LLC
600 Superior Avenue, E.
Suite 2100
Cleveland, OH 44114

PCT

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43bis.1)

Date of mailing
(day/month/year)

28 SEP 2007

Applicant's or agent's file reference
16223-00058PCT

FOR FURTHER ACTION

See paragraph 2 below

International application No.

PCT/US 07/02015

International filing date (day/month/year)

23 January 2007 (23.01.2007)

Priority date (day/month/year)

23 January 2006 (23.01.2006)

International Patent Classification (IPC) or both national classification and IPC

IPC(8) - B23C 1/16 (2007.01)

USPC - 409/81

Applicant Hy-Ko Products Company

1. This opinion contains indications relating to the following items:

- ☒ Box No. I Basis of the opinion
- ☐ Box No. II Priority
- ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI Certain documents cited
- ☐ Box No. VII Certain defects in the international application
- ☐ Box No. VIII Certain observations on the international application

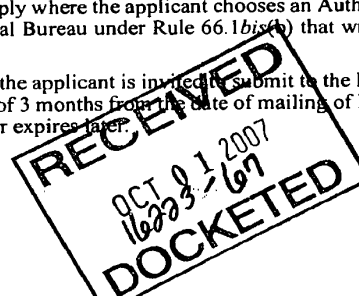
2. FURTHER ACTION

If a demand for international preliminary examination is made, this opinion will be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1bis(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

3. For further details, see notes to Form PCT/ISA/220.



Name and mailing address of the ISA/US
Mail Stop PCT, Attn: ISA/US
Commissioner for Patents
P.O. Box 1450, Alexandria, Virginia 22313-1450
Facsimile No. 571-273-3201

Date of completion of this opinion

11 August 2007 (11.08.2007)

Authorized officer:

Lee W. Young

PCT Helpdesk: 571-272-4300
PCT OSP: 571-272-7774

Form PCT/ISA/237 (cover sheet) (April 2007)

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

International application No.

PCT/US 07/02015

Box No. I Basis of this opinion

1. With regard to the **language**, this opinion has been established on the basis of:
 - ☒ the international application in the language in which it was filed.
 - ☐ a translation of the international application into _____ which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b)).
2. ☐ This opinion has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43bis.1(a))
3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, this opinion has been established on the basis of:
 - a. type of material
 - ☐ a sequence listing
 - ☐ table(s) related to the sequence listing
 - b. format of material
 - ☐ on paper
 - ☐ in electronic form
 - c. time of filing/furnishing
 - ☐ contained in the international application as filed
 - ☐ filed together with the international application in electronic form
 - ☐ furnished subsequently to this Authority for the purposes of search
4. ☐ In addition, in the case that more than one version or copy of a sequence listing and/or table(s) relating thereto has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.
5. Additional comments:

**WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY**

International application No.

PCT/US 07/02015

Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims	7, 15 and 20	YES
	Claims	1-6, 8-14, 16-19, 21-26	NO
Inventive step (IS)	Claims	none	YES
	Claims	1-26	NO
Industrial applicability (IA)	Claims	1-26	YES
	Claims	none	NO

2. Citations and explanations:

Claims 1-6, 8-14, 16-19 and 21-23 lack novelty under PCT Article 33(3) as being anticipated by US 5,908,273 A to Titus et al. (herein after Titus).

With respect to claim 1, Titus discloses an assembly (key duplicating apparatus 200, Fig 2-5) for duplicating a master key (original key 202; col 3 In 58-61, Fig 2-5), the assembly comprising: an optical imaging device (video camera 804, video image processor 808, Fig 8; control system 900, Fig 9) for capturing an optical image (image of key; col 8 In 1-27, Fig 8) of at least a portion of the master key, a logic (video image processor 808; col 8 In 1-13) for determining a key pattern (key code 700; col 6 In 21-22, col 7 In 6-20, Fig 7a, 7b) of the master key from the optical image of master key, a clamping assembly (key holder 204; col 3 In 66 to col 4 In 4, Fig 2) for clamping a key blank (blank preform 246; col 3 In 57-65) and a first cutting member (key-code cutter 252; col 4 In 44-50, Fig 4) for cutting a key pattern (key-code; col 4 In 51-56, Fig 4) into the key blank.

With respect to claim 2, Titus discloses an assembly (key duplicating apparatus 200; Fig 2-5) where the key pattern (key-code; col 4 In 51-56) cut into the key blank (blank preform 246; col 4 In 51-56) is a duplication of the key pattern of master key (original key 202; col 3 In 58-61, Fig 2-5).

With respect to claim 3, Titus discloses an assembly (key duplicating apparatus 200; Fig 2-5) where the logic (control system 900; col 9 In 1-34, Fig 9) directs the first cutting member (key-code cutter 252 via cutting tool motor 260) during duplication of the key pattern (key-code; col 4 In 51-56) of master key (original key 202; col 3 In 58-61, Fig 2-5).

With respect to claim 4, Titus discloses an assembly (key duplicating apparatus 200; Fig 2-5) where the optical image (image of key; col 8 In 1-27, Fig 8) is a digital image (via video image processor 808 is controlled by embedded PC central control system 902 via digital I/O interface 930; col 9 In 1-25).

With respect to claim 5, Titus discloses an assembly (key duplicating apparatus 200; Fig 2-5) where the clamping assembly (key holder 204; col 3 In 66 to col 4 In 4, Fig 2) further comprises, a first clamping member (x-translation stage 214, y-translation stage 218, key holder 204; col 3 In 66 to col 4 In 14, Fig 2) having a first clamping surface (x-translation stage 214) defining a width (x-direction; col 3 In 66 to col 4 In 14) and a second clamping member (y-translation stage 218; col 3 In 66 to col 4 In 14) having a second clamping surface (upper surface of y-translation stage 218) defining a width (y-direction; col 3 In 66 to col 4 In 14).

With respect to claim 6, Titus discloses an assembly (key duplicating apparatus 200; Fig 2-5) where the key blank (blank preform 245) further comprises a blade (key shaft 102; col 3 In 36-44, Fig 1A) defining a width where the width of the first clamping member (key holder 204; col 3 In 66 to col 4 In 4, Fig 2) and the width of the second clamping member (col 13 In 53-62) are less than the width of the blade of the key blank.

With respect to claim 8, Titus discloses an assembly (key duplicating apparatus 200; Fig 2-5) where the first cutting member (key code cutter 252, edge cutters 250; col 5 In 1-29) is a cutting wheel (Fig 4, 5).

With respect to claim 9, Titus discloses an assembly (key duplicating apparatus 200; Fig 2-5) further comprising a retention mechanism (key holder 204, Fig 2) for retaining the master key (original key 202; col 3 In 58-61) or the key blank (blank preform 245).

With respect to claim 10, Titus discloses an assembly (key duplicating apparatus 200; Fig 2-5) where the retention mechanism further comprises a base (x-translation stage 214, y-translation stage 218, key holder 204; col 3 In 66 to col 4 In 14, Fig 2) a retention plate (tip holder 248; col 12 In 29-39) and a biasing member (key holder solenoid 928; col 9 In 23-25, Fig 9) biasing the retention plate towards the base.

With respect to claim 11, Titus discloses an assembly (key duplication apparatus 200; Fig 2-5) further comprising a first positioning member (x-translation stage 214, key holder 204; col 3 In 66 to col 4 In 14, Fig 2) and a second positioning member (y-translation stage 218), wherein the first and second positioning members engage the master key (original key 202) or the key blank (blank preform 245) to position the master key or the key blank relative to the assembly.

See continuation sheet.

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

International application No.

PCT/US 07/02015

Supplemental Box

In case the space in any of the preceding boxes is not sufficient.

Continuation of:
Box V, item 2. Citations and explanations.

With respect to claim 12, Titus discloses an assembly (key duplication apparatus 200; Fig 2-5) further comprising a user interface (display 920; col 9 ln 1-10) for providing output to a user.

With respect to claim 13, Titus discloses an assembly (key duplication apparatus 200; Fig 2-5) where the logic determines the key blank (blank preform 245) from the optical image of the master key (original key 202). (Cutting tool motor 260 is controlled by the central control system 902; col 9 ln 11-25).

With respect to claim 14, Titus discloses an assembly (key duplication apparatus 200; Fig 2-5) where identity of the determined key blank is output to the user by the user interface. (Titus discloses wherein if the measured key is determined to be lost or stolen, a signal may be directed through the communications interface 940; col 12 ln. 10-14.)

With respect to claim 16, Titus discloses an assembly (key duplication apparatus 200; Fig 2-5) where the key blank (blank preform 245) may be clamped in a first orientation or a second orientation. (Titus discloses inserting a double-sided key in either orientation; col 3 ln 45-56.)

With respect to claim 17, Titus discloses an method for duplicating a master key (original key 202) the method comprising capturing an optical image (optical image; col 8 ln 1-13) of at least a portion of the master key, providing a logic (via central control system 902) to determine a key pattern (key code) of the master key from the optical image of the master key, securing a key blank (blank preform 245) and cutting a key pattern into the key blank. (See col 9 ln 1-25, col 10 ln 6-22.)

With respect to claim 18, Titus discloses a method where the key pattern (key code) cut into the key blank (blank preform 245) is a duplication of the key pattern of the master key (original key 202). (See col 3 ln 57-65.)

With respect to claim 19, Titus discloses a method further comprising using logic to determine the key blank (blank preform 245). (See col 12 ln 20-39.)

With respect to claim 21, Titus discloses a method further comprising, capturing an optical image (optical image; col 8 ln 1-13) of at least a portion of the key blank (blank preform 245) and using the logic to validate the key blank matches the master key (original key 202). (Titus discloses using edge cutters 250 stroke or pass pattern computed that approximates the keyway profile shape is within acceptable tolerances; col 13 ln. 3-12.)

With respect to claim 22, Titus discloses a method further comprising capturing an optical image of at least a portion of the key pattern cut into key blank (blank preform 245), using the logic to determine the key pattern cut into key blank, and using the logic to compare the key pattern cut into the key blank with the key pattern of the master key. (See col 11 ln 36-47).

With respect to claim 23, Titus discloses a method comprising using the logic to validate that the key pattern cut into the key plank (blank preform 245) is within a predefined tolerance of the key pattern of the master key (original key 202). (See col 11 ln 36-47).

Claims 24-26 lack novelty under PCT Article 33(2) as being anticipated by 2004/0095380 A1 to Bass et al. (herein after Bass).

With respect to claim 24, Bass discloses an assembly for identifying a key blank (identification system 10, Key Identification System KIDS) for the duplication of a master key (master key; Bass para [0048], the assembly comprising, an optical imaging device (machine-recognizable object verification system, bar code scanner; Bass para [0058]) for capturing an optical image of at least a portion of the master key, a logic for determining at least one feature (manufacturer; Bass para [0031]) of the master key from the optical image of aster key for comparison with at least one feature of a plurality of key blanks, and identifying which of the plurality of key blanks is the proper key blank (via indicative display rack; Bass para [0035], [0041]) and identifying which of the plurality of key blanks is the proper key blank for duplication of the master key.

With respect to claim 25, Bass discloses an assembly where identity of the proper key blank is output to a user by a user interface (display rack; Bass para [0035], [0041]).

With respect to claim 26, Bass discloses an assembly wherein the user interface is a display rack (display rack; Bass para [0035], [0041]) for the display of the plurality of key blanks.

See continuation sheet.

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US 07/02015

Supplemental Box

In case the space in any of the preceding boxes is not sufficient.

Continuation of:
Box V, item 2. Citations and explanations.

Claims 7 and 20 lack an inventive step under PCT Article 33(3) as being obvious over Titus.

With respect to claim 7, Titus discloses an assembly (key duplication apparatus 200; Fig 2-5) further comprising a second cutting member (edge cutters 250; col 5 in 4-29, Fig 18) for cutting the key pattern into key blank (blank preform 245), yet fails to disclose where the first and second cutting members are capable of simultaneously cutting the key pattern into the key blank. However, Titus discloses forming a keyway on a first side of a blank and subsequently forming a keyway on a second side of a blank for permitting maximum material removal per pass. (col 13 in 3-23, Claim 37). Hence, it would have been obvious to one of skill in the art to duplicate the first cutting member of Titus to construct an assembly comprising a second cutting member for cutting the key pattern into a key blank, where the first and second cutting members are capable of simultaneously cutting the key pattern into a key blank for maximizing material removal per pass as taught by Titus.

With respect to claim 20, Titus discloses a method of duplicating a master key (original key 202) with a key blank (blank preform 245) wherein the user is signaled through the communication interface (940) concerning the measured key, yet fails to disclose a method further comprising outputting the determined key blank to a user. Hence, it would have been obvious to one of skill in the art to combine the signaling through the communication interface with the identification of the key blank of Titus, to formulate a method further comprising outputting the determined key blank to a user as taught by Titus. (col 12 in 10-14.)

Claim 15 lacks an inventive step under PCT Article 33(3) as being obvious over Titus in view of Bass.

With respect to claim 15, Titus discloses an assembly (key duplication apparatus 200) comprising a user interface (display 920; Titus col 9 in 1-10), yet fails to disclose an interface further comprising a display rack. However, Bass discloses a object identification system for identification of key blanks comprising a display rack (display rack 100; Bass para [0070]) for indicating the appropriate key blank. Hence, it would have been obvious to one of skill in the art to combine the assembly (key duplication apparatus 200) comprising a user interface (display 920) of Titus with the display rack (display rack 100) of Bass to construct an assembly where the user interface is a display rack for the display of a plurality of key blanks as taught by Bass.

Claims 1-26 have industrial applicability as defined by PCT Article 33(4) because the subject matter can be made or used by industry.

NOTES TO FORM PCT/ISA/220

These Notes are intended to give the basic instructions concerning the filing of amendments under Article 19. The Notes are based on the requirements of the Patent Cooperation Treaty, the Regulations and the Administrative Instructions under that Treaty. In case of discrepancy between these Notes and those requirements, the latter are applicable. For more detailed information, see also the *PCT Applicant's Guide*, a publication of WIPO.

In these Notes, "Article," "Rule" and "Section" refer to the provisions of the PCT, the PCT Regulations and the PCT Administrative Instructions, respectively.

INSTRUCTIONS CONCERNING AMENDMENTS UNDER ARTICLE 19

The applicant has, after having received the international search report and the written opinion of the International Searching Authority, one opportunity to amend the claims of the international application. It should however be emphasized that, since all parts of the international application (claims, description and drawings) may be amended during the international preliminary examination procedure, there is usually no need to file amendments of the claims under Article 19 except where, e.g. the applicant wants the latter to be published for the purposes of provisional protection or has another reason for amending the claims before international publication. Furthermore, it should be emphasized that provisional protection is available in some States only (see *PCT Applicant's Guide*, Volume I/A, Annexes B1 and B2).

The attention of the applicant is drawn to the fact that amendments to the claims under Article 19 are not allowed where the International Searching Authority has declared, under Article 17(2), that no international search report would be established (see *PCT Applicant's Guide*, Volume I/A, paragraph 296).

What parts of the international application may be amended ?

Under Article 19, only the claims may be amended.

During the international phase, the claims may also be amended (or further amended) under Article 34 before the International Preliminary Examining Authority. The description and drawings may only be amended under Article 34 before the International Preliminary Examining Authority.

Upon entry into the national phase, all parts of the international application may be amended under Article 28 or, where applicable, Article 41.

When ? Within 2 months from the date of transmittal of the international search report or 16 months from the priority date, whichever time limit expires later. It should be noted, however, that the amendments will be considered as having been received on time if they are received by the International Bureau after the expiration of the applicable time limit but before the completion of the technical preparations for international publication (Rule 46.1).

Where not to file the amendments ?

The amendments may only be filed with the International Bureau and not with the receiving Office or the International Searching Authority (Rule 46.2).

Where a demand for international preliminary examination has been/is filed, see below.

How ? Either by cancelling one or more entire claims, by adding one or more new claims or by amending the text of one or more of the claims as filed.

A replacement sheet must be submitted for each sheet of the claims which, on account of an amendment or amendments, differs from the sheet originally filed.

All the claims appearing on a replacement sheet must be numbered in Arabic numerals. Where a claim is cancelled, no renumbering of the other claims is required. In all cases where claims are renumbered, they must be renumbered consecutively (Section 205(b)).

The amendments must be made in the language in which the international application is to be published.

What documents must/accompany the amendments ?

Letter (Section 205(b)):

The amendments must be submitted with a letter.

The letter will not be published with the international application and the amended claims. It should not be confused with the "Statement under Article 19(1)" (see below, under "Statement under Article 19(1)").

The letter must be in English or French, at the choice of the applicant. However, if the language of the international application is English, the letter must be in English; if the language of the international application is French, the letter must be in French.

NOTES TO FORM PCT/ISA/220 (continued)

The letter must indicate the differences between the claims as filed and the claims as amended. It must, in particular, indicate, in connection with each claim appearing in the international application (it being understood that identical indications concerning several claims may be grouped), whether

- (i) the claim is unchanged;
- (ii) the claim is cancelled;
- (iii) the claim is new;
- (iv) the claim replaces one or more claims as filed;
- (v) the claim is the result of the division of a claim as filed.

The following examples illustrate the manner in which amendments must be explained in the accompanying letter:

1. [Where originally there were 48 claims and after amendment of some claims there are 51]:
"Claims 1 to 29, 31, 32, 34, 35, 37 to 48 replaced by amended claims bearing the same numbers, claims 30, 33 and 36 unchanged; new claims 49 to 51 added."
2. [Where originally there were 15 claims and after amendment of all claims there are 11]:
"Claims 1 to 15 replaced by amended claims 1 to 11."
3. [Where originally there were 14 claims and the amendments consist in cancelling some claims and in adding new claims]:
"Claims 1 to 6 and 14 unchanged; claims 7 to 13 cancelled; new claims 15, 16 and 17 added." or
"Claims 7 to 13 cancelled; new claims 15, 16 and 17 added; all other claims unchanged."
4. [Where various kinds of amendments are made]:
"Claims 1-10 unchanged; claims 11 to 13, 18 and 19 cancelled; claims 14, 15 and 16 replaced by amended claim 14; claim 17 subdivided into amended claims 15, 16 and 17; new claims 20 and 21 added."

"Statement under Article 19(1)" (Rule 46.4)

The amendments may be accompanied by a statement explaining the amendments and indicating any impact that such amendments might have on the description and the drawings (which cannot be amended under Article 19(1)).

The statement will be published with the international application and the amended claims.

It must be in the language in which the international application is to be published.

It must be brief, not exceeding 500 words if in English or if translated into English.

It should not be confused with and does not replace the letter indicating the differences between the claims as filed and as amended. It must be filed on a separate sheet and must be identified as such by a heading, preferably by using the words "Statement under Article 19(1)."

It may not contain any disparaging comments on the international search report or the relevance of citations contained in that report. Reference to citations, relevant to a given claim, contained in the international search report may be made only in connection with an amendment of that claim.

Consequence if a demand for international preliminary examination has already been filed

If, at the time of filing any amendments and any accompanying statement, under Article 19, a demand for international preliminary examination has already been submitted, the applicant must preferably, at the time of filing the amendments (and any statement) with the International Bureau, also file with the International Preliminary Examining Authority a copy of such amendments (and of any statement) and, where required, a translation of such amendments for the procedure before that Authority (see Rules 55.3(a) and 62.2, first sentence). For further information, see the Notes to the demand form (PCT/IPEA/401).

If a demand for international preliminary examination is made, the written opinion of the International Searching Authority will, except in certain cases where the International Preliminary Examining Authority did not act as International Searching Authority and where it has notified the International Bureau under Rule 66.1bis(b), be considered to be a written opinion of the International Preliminary Examining Authority. If a demand is made, the applicant may submit to the International Preliminary Examining Authority a reply to the written opinion together, where appropriate, with amendments before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later (Rule 43bis.1(c)).

Consequence with regard to translation of the international application for entry into the national phase

The applicant's attention is drawn to the fact that, upon entry into the national phase, a translation of the claims as amended under Article 19 may have to be furnished to the designated/elected Offices, instead of, or in addition to, the translation of the claims as filed.

For further details on the requirements of each designated/elected Office, see the *PCT Applicant's Guide*, Volume II.

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter I of the Patent Cooperation Treaty)

(PCT Rule 44bis)

Applicant's or agent's file reference 16223-00154	FOR FURTHER ACTION		See item 4 below
International application No. PCT/US2010/033421	International filing date (<i>day/month/year</i>) 03 May 2010 (03.05.2010)	Priority date (<i>day/month/year</i>) 01 May 2009 (01.05.2009)	
International Patent Classification (8th edition unless older edition indicated) See relevant information in Form PCT/ISA/237			
Applicant HY-KO PRODUCTS			

1.	This international preliminary report on patentability (Chapter I) is issued by the International Bureau on behalf of the International Searching Authority under Rule 44 bis.1(a).																								
2.	This REPORT consists of a total of 5 sheets, including this cover sheet. In the attached sheets, any reference to the written opinion of the International Searching Authority should be read as a reference to the international preliminary report on patentability (Chapter I) instead.																								
3.	This report contains indications relating to the following items: <table style="width: 100%; border: none;"> <tr> <td style="width: 5%; text-align: center;">☒</td> <td style="width: 30%;">Box No. I</td> <td>Basis of the report</td> </tr> <tr> <td style="text-align: center;">☐</td> <td>Box No. II</td> <td>Priority</td> </tr> <tr> <td style="text-align: center;">☐</td> <td>Box No. III</td> <td>Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</td> </tr> <tr> <td style="text-align: center;">☐</td> <td>Box No. IV</td> <td>Lack of unity of invention</td> </tr> <tr> <td style="text-align: center;">☒</td> <td>Box No. V</td> <td>Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</td> </tr> <tr> <td style="text-align: center;">☐</td> <td>Box No. VI</td> <td>Certain documents cited</td> </tr> <tr> <td style="text-align: center;">☐</td> <td>Box No. VII</td> <td>Certain defects in the international application</td> </tr> <tr> <td style="text-align: center;">☐</td> <td>Box No. VIII</td> <td>Certain observations on the international application</td> </tr> </table>	☒	Box No. I	Basis of the report	☐	Box No. II	Priority	☐	Box No. III	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability	☐	Box No. IV	Lack of unity of invention	☒	Box No. V	Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement	☐	Box No. VI	Certain documents cited	☐	Box No. VII	Certain defects in the international application	☐	Box No. VIII	Certain observations on the international application
☒	Box No. I	Basis of the report																							
☐	Box No. II	Priority																							
☐	Box No. III	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability																							
☐	Box No. IV	Lack of unity of invention																							
☒	Box No. V	Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement																							
☐	Box No. VI	Certain documents cited																							
☐	Box No. VII	Certain defects in the international application																							
☐	Box No. VIII	Certain observations on the international application																							
4.	The International Bureau will communicate this report to designated Offices in accordance with Rules 44bis.3(c) and 93bis.1 but not, except where the applicant makes an express request under Article 23(2), before the expiration of 30 months from the priority date (Rule 44bis .2).																								

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland Facsimile No. +41 22 338 82 70	Date of issuance of this report 01 November 2011 (01.11.2011) Authorized officer Nora Lindner e-mail: pt03.pct@wipo.int

Form PCT/IB/373 (January 2004)

PATENT COOPERATION TREATY

From the
INTERNATIONAL SEARCHING AUTHORITY

To: DAVID B. CUPAR
MCDONALD HOPKINS LLC
600 SUPERIOR AVENUE, EAST
CLEVELAND, OH 44114

PCT

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43bis.1)

Date of mailing
(day/month/year)

17 SEP 2010

Applicant's or agent's file reference
16223-00154

FOR FURTHER ACTION

See paragraph 2 below

International application No.

PCT/US 10/33421

International filing date (day/month/year)

03 May 2010 (03.05.2010)

Priority date (day/month/year)

01 May 2009 (01.05.2009)

International Patent Classification (IPC) or both national classification and IPC

IPC(8) - B21K 13/00, B23C 1/16 (2010.01)

USPC - 76/110, 409/81

Applicant HY-KO PRODUCTS

1. This opinion contains indications relating to the following items:

- ☒ Box No. I Basis of the opinion
- ☐ Box No. II Priority
- ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI Certain documents cited
- ☐ Box No. VII Certain defects in the international application
- ☐ Box No. VIII Certain observations on the international application

2. FURTHER ACTION

If a demand for international preliminary examination is made, this opinion will be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1bis(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

3. For further details, see notes to Form PCT/ISA/220.

Name and mailing address of the ISA/US
Mail Stop PCT, Attn: ISA/US
Commissioner for Patents
P.O. Box 1450, Alexandria, Virginia 22313-1450
Facsimile No. 571-273-3201

Date of completion of this opinion

22 July 2010 (22.07.2010)

Authorized officer:

Lee W. Young

PCT Helpdesk: 571-272-4300
PCT OSP: 571-272-7774

Form PCT/ISA/237 (cover sheet) (July 2009)

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITYInternational application No.
PCT/US 10/33421

Box No. I Basis of this opinion

1. With regard to the **language**, this opinion has been established on the basis of:
- ☒ the international application in the language in which it was filed.
- ☐ a translation of the international application into _____ which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b)).
2. ☐ This opinion has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43*bis*.1(a))
3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, this opinion has been established on the basis of a sequence listing filed or furnished:
- a. (means)
- ☐ on paper
- ☐ in electronic form
- b. (time)
- ☐ in the international application as filed
- ☐ together with the international application in electronic form
- ☐ subsequently to this Authority for the purposes of search
4. ☐ In addition, in the case that more than one version or copy of a sequence listing has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.
5. Additional comments:

**WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY**

International application No.

PCT/US 10/33421

Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims	None	YES
	Claims	1-20	NO
Inventive step (IS)	Claims	None	YES
	Claims	1-20	NO
Industrial applicability (IA)	Claims	1-20	YES
	Claims	None	NO

2. Citations and explanations:

Claims 1-20 lack novelty under PCT Article 33(2) as being anticipated by US 2007/0224008 A1 to Bass, et al. (hereinafter .Bass.).

Regarding claim 1, Bass teaches a key identification system comprising: a sensing system configured to extract biting information from a master key (para [0043]); and a logic configured to analyze said biting information to determine characteristics of said bittings of said master key and further to compare said characteristics of said bittings with biting characteristics of known key blanks to determine the likelihood of a match between said master key and a known key blank (para [0061]).

Regarding claim 2, Bass teaches that said logic includes a database containing data related to biting characteristics of known key blanks (para [0061]).

Regarding claim 3, Bass teaches that said sensing system comprises an imaging system (para [0060]).

Regarding claim 4, Bass teaches that said imaging system is configured to capture an image of the bittings of said master key (para [0060]).

Regarding claim 5, Bass teaches that said imaging system includes a camera (para [0056]).

Regarding claim 6, Bass teaches that said camera is positioned perpendicular to the blade of said master key (para [0055]).

Regarding claim 7, Bass teaches that said imaging system includes a light (para [0058]).

Regarding claim 8, Bass teaches that said captured image is a digital image (para [0056]).

Regarding claim 9, Bass teaches a key holder to hold said master key (para [0047]).

Regarding claim 10, Bass teaches that said key holder comprises a support and an upper door (base 16 and door clamp 14; para [0047]).

Regarding claim 11, Bass teaches that said data related to biting characteristics of known key blanks includes a set of depths at given blade spacing points associated with a given key blank (para [0060]).

Regarding claim 12, Bass teaches that said data related to biting characteristics of known key blanks includes a set of biting flat widths at given blade spacing points associated with a given key blank (para [0060]).

Regarding claim 13, Bass teaches that said data related to biting characteristics of known key blanks includes a set of biting centers associated with a given key blank (para [0061]).

Regarding claim 14, Bass teaches that said logic compares the depth of the master key biting at each spacing point to said set of depths for said given key blank (para [0060]).

Regarding claim 15, Bass teaches that said logic computes a score for said given key blank based on the comparison between the depths of said master key at each spacing point and said set of depths for said given key blank (inherent to a comparison logic; para [0060]).

(see continuation in supplemental box)

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

International application No.

PCT/US 10/33421

Supplemental Box

In case the space in any of the preceding boxes is not sufficient.

Continuation of:
Box No. V(2) -- Citations and Explanations

Regarding claim 16, Bass teaches that said logic compares the biting flat widths of the master key biting at each spacing point to said set of biting flat widths for said given key blank (inherent to a comparison logic; para [0060]).

Regarding claim 17, Bass teaches that said logic computes a score for said given key blank based on the comparison between the biting flat widths of said master key at each spacing point and said set of biting flat widths for said given key blank (inherent to a comparison logic; para [0060]).

Regarding claim 18, Bass teaches that said logic compares the biting centers of the master key biting to said set of biting centers for said given key blank (inherent to a comparison logic; para [0060]).

Regarding claim 19, Bass teaches that said logic computes a score for said given key blank based on the comparison between the biting centers of said master key and said set of biting centers for said given key blank (inherent to a comparison logic; para [0060]).

Regarding claim 20, Bass teaches that said logic analyzes one of a biting depth, a biting flat width, and a biting center of said master key at a blade spacing point shifted from said blade spacing point associated with a given key blank (determining where along the blade the key pattern begins; para [0060]).

Claims 1-20 have industrial applicability as defined by PCT Article 33(4) because the subject matter can be made or used in industry.

PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference 16223-00154	FOR FURTHER ACTION see Form PCT/ISA/220 as well as, where applicable, item 5 below.	
International application No. PCT/US 10/33421	International filing date (<i>day/month/year</i>) 03 May 2010 (03.05.2010)	(Earliest) Priority Date (<i>day/month/year</i>) 01 May 2009 (01.05.2009)
Applicant HY-KO PRODUCTS		

This international search report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This international search report consists of a total of 2 sheets.

☐ It is also accompanied by a copy of each prior art document cited in this report.

1. Basis of the report

a. With regard to the language, the international search was carried out on the basis of:

- ☒ the international application in the language in which it was filed.
☐ a translation of the international application into _____ which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b)).

b. ☐ This international search report has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43.6bis(a)).

c. ☐ With regard to any nucleotide and/or amino acid sequence disclosed in the international application, see Box No. I.

2. ☐ Certain claims were found unsearchable (see Box No. II).

3. ☐ Unity of invention is lacking (see Box No. III).

4. With regard to the title,

- ☒ the text is approved as submitted by the applicant.
☐ the text has been established by this Authority to read as follows:

5. With regard to the abstract,

- ☒ the text is approved as submitted by the applicant.
☐ the text has been established, according to Rule 38.2, by this Authority as it appears in Box No. IV. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. With regard to the drawings,

a. the figure of the drawings to be published with the abstract is Figure No. 1

- ☒ as suggested by the applicant.
☐ as selected by this Authority, because the applicant failed to suggest a figure.
☐ as selected by this Authority, because this figure better characterizes the invention.

b. ☐ none of the figures is to be published with the abstract.

Form PCT/ISA/210 (first sheet) (July 2009)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 10/33421

A. CLASSIFICATION OF SUBJECT MATTER IPC(8) - B21K 13/00, B23C 1/16 (2010.01) USPC - 76/110, 409/81 According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED Minimum documentation searched (classification system followed by classification symbols) IPC (8) - B21K 13/00, B23C 1/16 (2010.01) USPC - 76/110, 409/81 Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched USPC - 76/1, 101.1; 409/79, 84, 93; 70/266, 336, 393, 406 Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) PUBWEST (PGPB,USPT,USOC,EPAB,JPAB) Terms - image imaging camera blank select choose determine identify light door master key biting Google - key blank identification digital camera master; key blank identification digital camera logic holder door		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2007/0224008 A1 (BASS, ET AL.) 27 September 2007 (27.09.2007), para [0043], [0047], [0055]-[0061]	1-20
A	US 5,127,532 A (CIMINO, ET AL.) 07 July 1992 (07.07.1992), entire document	1-20
A	US 6,065,911 A (ALMBLAD, ET AL.) 23 May 2000 (23.05.2000), entire document	1-20
☐ Further documents are listed in the continuation of Box C. ☐		
* Special categories of cited documents: "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier application or patent but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family		
Date of the actual completion of the international search 21 July 2010 (21.07.2010)		Date of mailing of the international search report 17-SEP-2010
Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-3201		Authorized officer: Lee W. Young PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774

Form PCT/ISA/210 (second sheet) (July 2009)

PATENT COOPERATION TREATY

PCT/US2011/034564

From the INTERNATIONAL BUREAU

PCT

NOTIFICATION CONCERNING
TRANSMITTAL OF COPY OF INTERNATIONAL
PRELIMINARY REPORT ON PATENTABILITY
(CHAPTER I OF THE PATENT COOPERATION
TREATY)
(PCT Rule 44bis.1(c))

To:

CUPAR, David B.
600 Superior Avenue, E. Ste. 2100
c/o McDonald Hopkins LLC
Cleveland, Ohio 44114
ETATS-UNIS D'AMERIQUE

Date of mailing (day/month/year) 25 July 2013 (25.07.2013)		
Applicant's or agent's file reference 16223-00178P 192		IMPORTANT NOTICE
International application No. PCT/US2011/034564	International filing date (day/month/year) 29 April 2011 (29.04.2011)	Priority date (day/month/year) 14 January 2011 (14.01.2011)
Applicant MUTCH, William R. et al		

The International Bureau transmits herewith a copy of the international preliminary report on patentability (Chapter I of the Patent Cooperation Treaty)

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland Facsimile No. +41 22 338 82 70	Authorized officer Simin Baharlou e-mail: pt09.pct@wipo.int

Form PCT/IB/326 (January 2004)

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY (Chapter I of the Patent Cooperation Treaty)

(PCT Rule 44bis)

Applicant's or agent's file reference 16223-00178P	FOR FURTHER ACTION See item 4 below	
International application No. PCT/US2011/034564	International filing date (<i>day/month/year</i>) 29 April 2011 (29.04.2011)	Priority date (<i>day/month/year</i>) 14 January 2011 (14.01.2011)
International Patent Classification (8th edition unless older edition indicated) See relevant information in Form PCT/ISA/237		
Applicant MUTCH, William R.		

1. This international preliminary report on patentability (Chapter I) is issued by the International Bureau on behalf of the International Searching Authority under Rule 44 bis.1(a). 2. This REPORT consists of a total of 5 sheets, including this cover sheet. In the attached sheets, any reference to the written opinion of the International Searching Authority should be read as a reference to the international preliminary report on patentability (Chapter I) instead.																										
3. This report contains indications relating to the following items: <table border="0"> <tr> <td>☒</td> <td>Box No. I</td> <td>Basis of the report</td> </tr> <tr> <td>☐</td> <td>Box No. II</td> <td>Priority</td> </tr> <tr> <td>☐</td> <td>Box No. III</td> <td>Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</td> </tr> <tr> <td>☐</td> <td>Box No. IV</td> <td>Lack of unity of invention</td> </tr> <tr> <td>☒</td> <td>Box No. V</td> <td>Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</td> </tr> <tr> <td>☐</td> <td>Box No. VI</td> <td>Certain documents cited</td> </tr> <tr> <td>☐</td> <td>Box No. VII</td> <td>Certain defects in the international application</td> </tr> <tr> <td>☐</td> <td>Box No. VIII</td> <td>Certain observations on the international application</td> </tr> </table> 4. The International Bureau will communicate this report to designated Offices in accordance with Rules 44bis.3(c) and 93bis.1 but not, except where the applicant makes an express request under Article 23(2), before the expiration of 30 months from the priority date (Rule 44bis .2).			☒	Box No. I	Basis of the report	☐	Box No. II	Priority	☐	Box No. III	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability	☐	Box No. IV	Lack of unity of invention	☒	Box No. V	Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement	☐	Box No. VI	Certain documents cited	☐	Box No. VII	Certain defects in the international application	☐	Box No. VIII	Certain observations on the international application
☒	Box No. I	Basis of the report																								
☐	Box No. II	Priority																								
☐	Box No. III	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability																								
☐	Box No. IV	Lack of unity of invention																								
☒	Box No. V	Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement																								
☐	Box No. VI	Certain documents cited																								
☐	Box No. VII	Certain defects in the international application																								
☐	Box No. VIII	Certain observations on the international application																								

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland Facsimile No. +41 22 338 82 70		Date of issuance of this report 16 July 2013 (16.07.2013) Authorized officer Simin Baharlou e-mail: pt09.pct@wipo.int

Form PCT/IB/373 (January 2004)

PATENT COOPERATION TREATY

From the
INTERNATIONAL SEARCHING AUTHORITY

To: DAVID CUPAR
C/O MCDONALD HOPKINS LLC
600 SUPERIOR AVENUE, E. STE. 2100
CLEVELAND, OH 44114

PCT

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43bis.1)

Date of mailing
(day/month/year)

15 JUL 2011

Applicant's or agent's file reference
16223-00178P

FOR FURTHER ACTION

See paragraph 2 below

International application No.

PCT/US2011/034564

International filing date (day/month/year)

29 April 2011

Priority date (day/month/year)

14 January 2011

International Patent Classification (IPC) or both national classification and IPC

IPC(8) - B23C 3/35 (2011.01)

USPC - 409/81

Applicant HY-KO PRODUCTS COMPANY

1. This opinion contains indications relating to the following items:

- ☒ Box No. I Basis of the opinion
- ☐ Box No. II Priority
- ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI Certain documents cited
- ☐ Box No. VII Certain defects in the international application
- ☐ Box No. VIII Certain observations on the international application

2. FURTHER ACTION

If a demand for international preliminary examination is made, this opinion will be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1bis(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

3. For further details, see notes to Form PCT/ISA/220.

Name and mailing address of the ISA/US
Mail Stop PCT, Attn: ISA/US
Commissioner for Patents
P.O. Box 1450, Alexandria, Virginia 22313-1450
Facsimile No. 571-273-3201

Date of completion of this opinion

08 July 2011

Authorized officer:

Blaine R. Copenheaver

PCT Helpdesk: 571-272-4300
PCT OSP: 571-272-7774

Form PCT/ISA/237 (cover sheet) (July 2009)

**WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY**

International application No.
PCT/US2011/034564

Box No. 1 Basis of this opinion

1. With regard to the language, this opinion has been established on the basis of:
 - ☒ the international application in the language in which it was filed.
 - ☐ a translation of the international application into _____ which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b)).
2. ☐ This opinion has been established taking into account the rectification of an obvious mistake authorized by or notified to this Authority under Rule 91 (Rule 43bis.1(a))
3. With regard to any nucleotide and/or amino acid sequence disclosed in the international application, this opinion has been established on the basis of a sequence listing filed or furnished:
 - a. (means)
 - ☐ on paper
 - ☐ in electronic form
 - b. (time)
 - ☐ in the international application as filed
 - ☐ together with the international application in electronic form
 - ☐ subsequently to this Authority for the purposes of search
4. ☐ In addition, in the case that more than one version or copy of a sequence listing has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.
5. Additional comments:

**WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY**

International application No.

PCT/US2011/034564

Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims	7, 9-10, 13, 21, 23-24	YES
	Claims	1-6, 8, 11-12, 14-20, 22, 25-28	NO
Inventive step (IS)	Claims	None	YES
	Claims	1-28	NO
Industrial applicability (IA)	Claims	1-28	YES
	Claims	None	NO

2. Citations and explanations:

Claims 1-6, 8, 11-12, 14-20, 22, 25-28 lack novelty under PCT Article 33(2) as being anticipated by Bass et al.

Referring to Claim 1, Bass et al. disclose a key duplicating machine comprising a key load position to receive a key (Para. [0048]), an antenna (Para. [0061] - regarding the logic may compare the quantified and defined features of the master key 22 with data in a database regarding known key blanks 24), configured to communicate with a key located at said key load position (Para. [0061]), and a cutting member (Fig. 8, Left and right cutting wheels 60, 62), configured to cut a key pattern into a key blank at said key load position (Para. [0066]).

Referring to Claim 2, Bass et al. disclose a key duplicating machine as in Claim 1, and further disclose wherein said antenna (Para. [0061] - regarding the logic may compare the quantified and defined features of the master key 22 with data in a database regarding known key blanks 24), is configured to transmit data to said key (Paras. [0061], [0065]).

Referring to Claim 3, Bass et al. disclose a key duplicating machine as in Claim 1, and further disclose wherein said antenna (Para. [0061] - regarding the logic may compare the quantified and defined features of the master key 22 with data in a database regarding known key blanks 24), is configured to receive data from said key (Para. [0061] - regarding the logic may make direct comparisons between physical dimensions of known key blanks 24 and the features of the master key 22).

Referring to Claim 4, Bass et al. disclose a key duplicating machine as in Claim 1, and further disclose wherein said key is a master key (Fig. 1, master key 22).

Referring to Claim 5, Bass et al. disclose a key duplicating machine as in Claim 1, and further disclose wherein said key is a key blank (Fig. 4b key blank 24).

Referring to Claim 6, Bass et al. disclose a key duplicating machine as in Claim 1, and further disclose wherein said key includes a microchip embedded therein (Para. [0093]).

Referring to Claim 8, Bass et al. disclose a key duplicating machine as in Claim 1, and further disclose further comprising an outer shell (Fig. 1, outer shell 12), having an opening positioned about said key load position (Fig. 1, and Para. [0046]).

Referring to Claim 11, Bass et al. disclose a key duplicating machine as in Claim 1, and further disclose wherein said key load position comprises a base (Fig. 2, base 16), and a door clamp (Fig. 2, door clamp 14).

Referring to Claim 12, Bass et al. disclose a key duplicating machine as in Claim 8, and further disclose wherein said door clamp (Fig. 2, door clamp 14), is movable with respect to said base (Fig. 2, base 16, and Para. [0046]).

Referring to Claim 14, Bass et al. disclose a key duplicating machine as in Claim 1, and further disclose wherein said cutting member (Fig. 8, Left and right cutting wheels 60, 62), is a cutting wheel (Para. [0066]).

Referring to Claim 15, Bass et al. disclose a key duplicating machine comprising a key load position to receive a key (Para. [0048]), an antenna (Para. [0061] - regarding the logic may compare the quantified and defined features of the master key 22 with data in a database regarding known key blanks 24), configured to communicate with a key located at said key load position (Para. [0061]), and an imaging system (Fig. 6, optical imaging device 50), configured to capture data related to said key at said key load position (Para. [0056]).

Referring to Claim 16, Bass et al. disclose a key duplicating machine as in Claim 15, and further disclose wherein said antenna (Para. [0061] - regarding the logic may compare the quantified and defined features of the master key 22 with data in a database regarding known key blanks 24), is configured to transmit data to said key (Paras. [0061], [0065]).

Referring to Claim 17, Bass et al. disclose a key duplicating machine as in Claim 15, and further disclose wherein said antenna (Para. [0061] - regarding the logic may compare the quantified and defined features of the master key 22 with data in a database regarding known key blanks 24), is configured to receive data from said key (Para. [0061] - regarding the logic may make direct comparisons between physical dimensions of known key blanks 24 and the features of the master key 22).

Form PCT/ISA/237 (Box No. V) (July 2009)

**WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY**

International application No.

PCT/US2011/034564

Supplemental Box

In case the space in any of the preceding boxes is not sufficient.

Continuation of:

Referring to Claim 18, Bass et al. disclose a key duplicating machine as in Claim 15, and further disclose wherein said key is a master key (Fig. 1, master key 22).

Referring to Claim 19, Bass et al. disclose a key duplicating machine as in Claim 15, and further disclose wherein said key is a key blank (Fig. 4b key blank 24).

Referring to Claim 20, Bass et al. disclose a key duplicating machine as in Claim 15, and further disclose wherein said key includes a microchip embedded therein (Para. [0093]).

Referring to Claim 22, Bass et al. disclose a key duplicating machine as in Claim 15, and further disclose further comprising an outer shell (Fig. 1, outer shell 12), having an opening positioned about said key load position (Fig. 1, and Para. [0046]).

Referring to Claim 25, Bass et al. disclose a key duplicating machine as in Claim 15, and further disclose wherein said key load position comprises a base (Fig. 2, base 16), and a door clamp (Fig. 2, door clamp 14).

Referring to Claim 26, Bass et al. disclose a key duplicating machine as in Claim 25, and further disclose wherein said door clamp (Fig. 2, door clamp 14), is movable with respect to said base (Fig. 2, base 16, and Para. [0046]).

Referring to Claim 27, Bass et al. disclose a key duplicating machine as in Claim 25, and further disclose further comprising at least one lever (Fig. 2, handle 18), configured to actuate movement of said door clamp (Para. [0046]).

Referring to Claim 28, Bass et al. disclose a key duplicating machine as in Claim 15, and further disclose wherein said imaging system (Fig. 6, optical imaging device 50), includes a camera (Para. [0056]).

Claims 7, 21 lack an inventive step under PCT Article 33(3) as being obvious over Bass et al. in view of Kubo et al.

Referring to Claim 7, Bass et al. disclose all the limitations of Claim 1, but do not disclose wherein said antenna comprises at least one pair of windings. However, Kubo et al. teach a coil antenna and portable electronic apparatus comprising wherein an antenna (Fig. 2, antenna 100), comprises at least one pair of windings (Fig. 2, windings 2A, 2B). Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to have an antenna comprise at least one pair of windings as taught by Kubo et al. with the invention of Bass et al., for the purpose of customizing the shape of the antenna.

Referring to Claim 21, Bass et al. disclose all the limitations of Claim 15, but do not disclose wherein said antenna comprises at least one pair of windings. However, Kubo et al. teach a coil antenna and portable electronic apparatus comprising wherein an antenna (Fig. 2, antenna 100), comprises at least one pair of windings (Fig. 2, windings 2A, 2B). Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to have an antenna comprise at least one pair of windings as taught by Kubo et al. with the invention of Bass et al., for the purpose of customizing the shape of the antenna.

Claims 9-10, 13, 23-24 lack an inventive step under PCT Article 33(3) as being obvious over Bass et al. in view of Swayze et al.

Referring to Claim 9, Bass et al. disclose all the limitations of Claim 5, but do not disclose wherein said opening is circular. However, Swayze et al. teach an antenna comprising wherein an opening is circular (Fig. 3, and Pg. 1, Col. 2, Lns. 19-27). Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to have an opening circular as taught by Swayze et al. with the invention of Bass et al., for the purpose of allowing the key into a slot.

Referring to Claim 10, Bass et al. disclose all the limitations of Claim 5, but do not disclose wherein said antenna is wound about said opening. However, Swayze et al. teach an antenna comprising wherein an antenna is wound about an opening (Fig. 3, and Pg. 1, Col. 2, Lns. 46-52). Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to have an antenna wound about said opening as taught by Swayze et al. with the invention of Bass et al., for the purpose of receiving clearer reception.

Referring to Claim 13, Bass et al. in view of Swayze et al. disclose all the limitations of Claim 9, and Bass et al. further disclose further comprising at least one lever (Fig. 2, handle 18), configured to actuate movement of said door clamp (Para. [0046]).

Referring to Claim 23, Bass et al. disclose all the limitations of Claim 22, but do not disclose wherein said opening is circular. However, Swayze et al. teach an antenna comprising wherein an opening is circular (Fig. 3, and Pg. 1, Col. 2, Lns. 19-27). Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to have an opening circular as taught by Swayze et al. with the invention of Bass et al., for the purpose of allowing the key into a slot.

Referring to Claim 24, Bass et al. disclose all the limitations of Claim 22, but do not disclose wherein said antenna is wound about said opening. However, Swayze et al. teach an antenna comprising wherein an antenna is wound about an opening (Fig. 3, and Pg. 1, Col. 2, Lns. 46-52). Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to have an antenna wound about said opening as taught by Swayze et al. with the invention of Bass et al., for the purpose of receiving clearer reception.

Claims 1-28 meet the criteria set out in PCT Article 33(4), and thus have industrial applicability because the subject matter claimed can be made or used in industry.

Form PCT/ISA/237 (Supplemental Box) (July 2009)

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		14162157
	Filing Date		2014-01-23
	First Named Inventor	Chester O.D. Thompson	
	Art Unit	2665	
	Examiner Name	Michelle M. Entezari	
	Attorney Docket Number	16223-00274	

U.S. PATENTS						Remove
Examiner Initial*	Cite No	Patent Number	Kind Code ¹	Issue Date	Name of Patentee or Applicant of cited Document	Pages, Columns, Lines where Relevant Passages or Relevant Figures Appear
	1	8644619		2014-02-04	Thompson et al.	
	2	8634655		2014-01-21	Thompson et al.	
	3	8585029		2013-11-19	Ryai, Sr.	
	4	8532809		2013-09-10	Freeman	
	5	8128322		2012-03-06	Bass et al.	
	6	7918629		2011-04-05	Belflower et al.	
	7	7891919		2011-02-22	Bass et al.	
	8	7643685		2010-01-05	Miller	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		14162157	
	Filing Date		2014-01-23	
	First Named Inventor	Chester O.D. Thompson		
	Art Unit	2665		
	Examiner Name	Michelle M. Entezari		
	Attorney Docket Number	16223-00274		

	9	7484446		2009-03-02	Gula	
	10	7214011		2007-05-08	Ryai, Sr. et al.	
	11	7163364		2007-01-16	Foscan et al.	
	12	7114894		2006-10-03	Mueller et al.	
	13	7114436		2006-10-03	Mueller	
	14	7111894		2006-09-26	Kora et al.	
	15	7010498		2006-03-07	Berstis	
	16	6965911		2005-11-15	Coffman et al.	
	17	6959862		2005-11-01	Neumark	
	18	6895100		2005-05-17	Pacenzia et al.	
	19	6839451		2005-01-04	Campbell et al.	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		14162157
	Filing Date		2014-01-23
	First Named Inventor	Chester O.D. Thompson	
	Art Unit	2665	
	Examiner Name	Michelle M. Entezari	
	Attorney Docket Number	16223-00274	

	20	6839449		2005-01-04	Campbell et al.	
	21	6836553		2004-12-28	Campbell et al.	
	22	6817814		2004-11-16	Mueller	
	23	6801829		2004-10-05	Kawai	
	24	6711557		2004-03-23	Palaniappan	
	25	6687565		2004-02-03	Wetterlin et al.	
	26	6647308		2003-11-11	Prejean	
	27	6641339		2003-11-04	Chies et al.	
	28	6612142		2003-09-02	Capwell	
	29	6602030		2003-08-05	Markbreit	
	30	6588995		2003-07-08	Wills et al.	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		14162157
	Filing Date		2014-01-23
	First Named Inventor	Chester O.D. Thompson	
	Art Unit	2665	
	Examiner Name	Michelle M. Entezari	
	Attorney Docket Number	16223-00274	

	31	6543972		2003-04-08	Cimino	
	32	6478515		2002-11-12	Mueller	
	33	6449381		2002-09-10	Yanovsky et al.	
	34	6415931		2002-07-09	Mueller	
	35	6406227		2002-06-18	Titus et al.	
	36	D455104		2002-04-02	Hillman et al.	
	37	6321430		2001-11-27	Goldman et al.	
	38	6243960		2001-06-12	Andrews et al.	
	39	6186711		2001-02-13	Mueller	
	40	6185311		2001-02-06	Yanovsky et al.	
	41	6179531		2001-01-30	Jaw	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		14162157
	Filing Date		2014-01-23
	First Named Inventor	Chester O.D. Thompson	
	Art Unit	2665	
	Examiner Name	Michelle M. Entezari	
	Attorney Docket Number	16223-00274	

	42	6175638		2001-01-16	Yanovsky	
	43	6152662		2000-11-28	Titus et al.	
	44	6094953		2000-08-01	Evans	
	45	6082580		2000-07-04	Mueller et al.	
	46	6065911		2000-05-23	Almblad et al.	
	47	6064747		2000-05-16	Wills et al.	
	48	6059495		2000-05-09	Mueller et al.	
	49	6053677		2000-04-25	Juchinewicz	
	50	5997795		1999-12-07	Danforth et al.	
	51	5997224		1999-12-07	Beauregard et al.	
	52	5984597		1999-11-16	Chen	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number	14162157
	Filing Date	2014-01-23
	First Named Inventor	Chester O.D. Thompson
	Art Unit	2665
	Examiner Name	Michelle M. Entezari
	Attorney Docket Number	16223-00274

	53	5982491		1999-11-09	Breyer et al.	
	54	5966457		1999-10-12	Lemelson	
	55	5964554		1999-10-12	Drori	
	56	5940229		1999-08-17	Baumgarten	
	57	5926388		1999-07-20	Kimbrough et al.	
	58	5908273		1999-06-01	Titus et al.	
	59	5906365		1999-05-25	Wu	
	60	5886775		1999-03-23	Houser et al.	
	61	5855836		1999-01-05	Leyden et al.	
	62	5807042		1998-09-15	Almblad et al.	
	63	5771176		1998-06-23	Froehlich et al.	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		14162157
	Filing Date		2014-01-23
	First Named Inventor	Chester O.D. Thompson	
	Art Unit	2665	
	Examiner Name	Michelle M. Entezari	
	Attorney Docket Number	16223-00274	

	64	5764156		1998-06-09	Chaloux	
	65	5739766		1998-04-14	Chaloux	
	66	5711643		1998-01-27	Parr et al.	
	67	5771176		1998-06-23	Froehlich et al.	
	68	5677522		1997-10-14	Rice et al.	
	69	5676504		1997-10-14	Mueller et al.	
	70	5671523		1997-09-30	Juchinewicz	
	71	RE35518		1997-05-27	Sussina	
	72	5660509		1997-08-26	Cole et al.	
	73	5630332		1997-05-20	Aldieri et al.	
	74	5617323		1997-04-01	Stansberry et al.	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		14162157
	Filing Date		2014-01-23
	First Named Inventor	Chester O.D. Thompson	
	Art Unit	2665	
	Examiner Name	Michelle M. Entezari	
	Attorney Docket Number	16223-00274	

	75	5607267		1997-03-04	Heredia et al.	
	76	5594652		1997-01-14	Penn et al.	
	77	5592728		1997-01-14	Susnjara	
	78	5583443		1996-12-10	McMurtry et al.	
	79	5556240		1996-09-17	Almblad	
	80	5555176		1996-09-10	Menhennett et al.	
	81	5552992		1996-09-03	Hunter	
	82	5545367		1996-08-13	Bae et al.	
	83	5543103		1996-08-06	Hogan et al.	
	84	5538374		1996-07-23	Cole et al.	
	85	5515903		1996-05-14	Hronas et al.	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		14162157
	Filing Date		2014-01-23
	First Named Inventor	Chester O.D. Thompson	
	Art Unit	2665	
	Examiner Name	Michelle M. Entezari	
	Attorney Docket Number	16223-00274	

	86	5503785		1996-04-02	Crump et al.	
	87	5497888		1996-03-12	Michaels et al.	
	88	5496138		1996-03-05	Drori	
	89	5485399		1996-01-16	Saigo et al.	
	90	5443339		1995-08-22	Heredia et al.	
	91	5441369		1995-08-15	Foscan et al.	
	92	5429202		1995-07-04	Millard et al.	
	93	5416591		1995-05-16	Yoshimura et al.	
	94	5393967		1995-02-28	Rice et al.	
	95	5382784		1995-01-17	Eberhardt	
	96	5365812		1994-11-22	Harnden	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		14162157
	Filing Date		2014-01-23
	First Named Inventor	Chester O.D. Thompson	
	Art Unit	2665	
	Examiner Name	Michelle M. Entezari	
	Attorney Docket Number	16223-00274	

	97	5363463		1994-11-08	Kleinerman	
	98	5360299		1994-11-01	Oliana	
	99	5351409		1994-10-04	Heredia	
	100	5330168		1994-07-19	Enomoto et al.	
	101	D348393		1994-07-05	Neitzke et al.	
	102	5314274		1994-05-24	Heredia et al.	
	103	5311758		1994-05-17	Neitzke et al.	
	104	5311756		1994-05-17	Villani	
	105	5311286		1994-05-10	Pike	
	106	5308360		1994-05-03	Neitzke et al.	
	107	5307151		1994-04-26	Hof et al.	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		14162157
	Filing Date		2014-01-23
	First Named Inventor	Chester O.D. Thompson	
	Art Unit	2665	
	Examiner Name	Michelle M. Entezari	
	Attorney Docket Number	16223-00274	

	108	5293687		1994-03-15	Willoughby, Jr. et al.	
	109	5271698		1993-12-21	Heredia et al.	
	110	5259708		1993-11-09	Brice	
	111	5255199		1993-10-19	Barkman et al.	
	112	5244321		1993-09-14	Sopko	
	113	5229619		1993-07-20	Van Amstel	
	114	5201203		1993-04-13	Almblad	
	115	5192469		1993-03-09	Smalley et al.	
	116	5171112		1992-12-15	Roland	
	117	5167171		1992-12-01	Heredia	
	118	5165315		1992-11-24	Terada	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number	14162157
	Filing Date	2014-01-23
	First Named Inventor	Chester O.D. Thompson
	Art Unit	2665
	Examiner Name	Michelle M. Entezari
	Attorney Docket Number	16223-00274

	119	5146689		1992-09-15	Roland	
	120	5144561		1992-09-01	Soper	
	121	5139246		1992-08-18	Yakou	
	122	5130064		1992-07-14	Smalley et al.	
	123	5128531		1992-07-07	Fadel	
	124	5127532		1992-07-07	Cimino et al.	
	125	5122018		1992-06-16	Zion	
	126	5119190		1992-06-02	Lemelson	
	127	5111056		1992-05-05	Yoshimura et al.	
	128	5096346		1992-03-17	Ueda	
	129	5094538		1992-03-10	Reedman et al.	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		14162157	
	Filing Date		2014-01-23	
	First Named Inventor		Chester O.D. Thompson	
	Art Unit		2665	
	Examiner Name		Michelle M. Entezari	
	Attorney Docket Number		16223-00274	

	130	5088864		1992-02-18	Yanagida	
	131	5083759		1992-01-28	Pollak et al.	
	132	5058940		1991-10-22	Hart	
	133	5056204		1991-10-15	Bartschi	
	134	5043144		1991-08-27	Gordon et al.	
	135	5029459		1991-07-09	Almblad	
	136	4998349		1991-03-12	Killeen	
	137	4993291		1991-02-19	Sopko	
	138	4971489		1990-11-20	Womack	
	139	4969782		1990-11-13	Castain	
	140	4941335		1990-07-17	Allen	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		14162157
	Filing Date		2014-01-23
	First Named Inventor	Chester O.D. Thompson	
	Art Unit	2665	
	Examiner Name	Michelle M. Entezari	
	Attorney Docket Number	16223-00274	

	141	4929843		1990-05-29	Chmielewski, Jr. et al.	
	142	4929129		1990-05-29	Dickson	
	143	4909892		1990-03-20	Quinn et al.	
	144	4899391		1990-02-06	Cimino et al.	
	145	4898504		1990-02-06	Agius et al.	
	146	4868559		1989-09-19	Pinnow	
	147	4853866		1989-08-01	Andrada Galan et al.	
	148	4848116		1989-07-18	Lizotte	
	149	4845764		1989-07-04	Ueda et al.	
	150	4839913		1989-06-13	Annis et al.	
	151	4845764		1989-07-04	Ueda et al.	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		14162157
	Filing Date		2014-01-23
	First Named Inventor	Chester O.D. Thompson	
	Art Unit	2665	
	Examiner Name	Michelle M. Entezari	
	Attorney Docket Number	16223-00274	

	152	4821393		1989-04-18	Spigarelli	
	153	4821200		1989-04-11	Oberg	
	154	4809341		1989-02-28	Matsui et al.	
	155	4805224		1989-02-14	Koezuka et al.	
	156	4803371		1989-02-07	Durland	
	157	4783829		1988-11-08	Miyakawa et al.	
	158	4780032		1988-10-25	Uyeda et al.	
	159	4767110		1988-08-30	Yang	
	160	4741652		1988-05-03	Marchal	
	161	4717294		1988-01-05	Grasser	
	162	4710808		1987-12-01	Hoogenboom et al.	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		14162157
	Filing Date		2014-01-23
	First Named Inventor	Chester O.D. Thompson	
	Art Unit	2665	
	Examiner Name	Michelle M. Entezari	
	Attorney Docket Number	16223-00274	

	163	4697300		1987-10-06	Warlop	
	164	4687389		1987-08-18	Santii et al.	
	165	4679331		1987-07-14	Koontz	
	166	4677835		1987-07-07	Almblad	
	167	4671711		1987-06-09	Steinbach et al.	
	168	4666351		1987-05-19	Marchal	
	169	4657448		1987-04-14	Alexander	
	170	4656590		1987-04-07	Ace	
	171	4653104		1987-03-24	Tamura	
	172	4652765		1987-03-24	Nishihara	
	173	4652738		1987-03-24	Nishihara et al.	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		14162157
	Filing Date		2014-01-23
	First Named Inventor	Chester O.D. Thompson	
	Art Unit	2665	
	Examiner Name	Michelle M. Entezari	
	Attorney Docket Number	16223-00274	

	174	4651604		1987-03-24	Almblad et al.	
	175	4648585		1987-03-10	Yang	
	176	4647028		1987-03-03	Yang	
	177	4638567		1987-01-27	Leversee	
	178	4625107		1986-11-25	Planke	
	179	4614465		1986-09-30	Wu	
	180	4601185		1986-07-22	Sheldon	
	181	4592683		1986-06-03	Wu	
	182	4562759		1986-01-07	Schmitt	
	183	4558215		1985-12-10	Kaneko et al.	
	184	4557488		1985-12-10	Litherland	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		14162157
	Filing Date		2014-01-23
	First Named Inventor	Chester O.D. Thompson	
	Art Unit	2665	
	Examiner Name	Michelle M. Entezari	
	Attorney Docket Number	16223-00274	

	185	4553844		1985-11-19	Nakagawa et al.	
	186	4551046		1985-11-05	Kinas	
	187	4545569		1985-10-08	Schroder et al.	
	188	4541760		1985-09-17	Zoueki	
	189	4526498		1985-07-02	Fieldhouse	
	190	4525908		1985-07-02	Bernstein	
	191	4521142		1985-06-04	Juskevici	
	192	4479673		1984-10-30	Inaba et al.	
	193	4472056		1984-09-18	Nakagawa et al.	
	194	4468994		1984-09-04	Lieptz	
	195	4453432		1984-06-12	Widen	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		14162157
	Filing Date		2014-01-23
	First Named Inventor	Chester O.D. Thompson	
	Art Unit	2665	
	Examiner Name	Michelle M. Entezari	
	Attorney Docket Number	16223-00274	

	196	4437150		1984-03-13	Dahlgren, Jr. et al.	
	197	4433487		1984-02-28	Roland	
	198	4432142		1984-02-21	Korsak	
	199	4426179		1984-01-17	Jefferson	
	200	4373414		1983-02-15	Agius	
	201	4359299		1982-11-16	Sagarian	
	202	4354780		1982-10-19	Bougiouris	
	203	4301373		1981-11-17	Sjodin	
	204	4300836		1981-11-17	Holmes, Jones F. et al.	
	205	4300170		1981-11-10	Sakamoto	
	206	4300042		1981-11-10	Oldenkamp et al.	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number	14162157
	Filing Date	2014-01-23
	First Named Inventor	Chester O.D. Thompson
	Art Unit	2665
	Examiner Name	Michelle M. Entezari
	Attorney Docket Number	16223-00274

	207	4294096		1981-10-13	Heimann	
	208	4283859		1981-08-18	Roland	
	209	4281379		1981-07-28	Austin	
	210	4256423		1981-03-17	Juskevic	
	211	4251173		1981-02-17	Saucedo	
	212	D257758		1981-01-06	Limacher	
	213	4233746		1980-11-18	Troillet	
	214	4223791		1980-09-23	Taggart	
	215	4188163		1980-02-12	Juskevic	
	216	4172632		1979-10-30	Holmes, Jr.	
	217	4171161		1979-10-16	Jung	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number	14162157
	Filing Date	2014-01-23
	First Named Inventor	Chester O.D. Thompson
	Art Unit	2665
	Examiner Name	Michelle M. Entezari
	Attorney Docket Number	16223-00274

	218	4166949		1979-09-04	Pold et al.	
	219	D251365		1979-03-20	Lipinski	
	220	4143582		1979-03-13	Heimann	
	221	4132151		1979-01-02	Weber	
	222	4121292		1978-10-17	Galanis et al.	
	223	4117763		1978-10-03	Uyeda	
	224	4105340		1978-08-08	Kempf	
	225	4092806		1978-06-06	Wich	
	226	4090303		1978-05-23	Uyeda	
	227	4088060		1978-05-09	Johns	
	228	4062261		1977-12-13	Stahl	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		14162157	
	Filing Date		2014-01-23	
	First Named Inventor		Chester O.D. Thompson	
	Art Unit		2665	
	Examiner Name		Michelle M. Entezari	
	Attorney Docket Number		16223-00274	

	229	4051748		1977-10-04	Sherman	
	230	4023464		1977-05-17	Zion	
	231	4019415		1977-04-26	Wich	
	232	4012991		1977-03-22	Uyeda	
	233	3981214		1976-09-21	Wich	
	234	3978764		1976-09-07	Patriquin	
	235	3956968		1976-05-18	Crasnianski	
	236	3955179		1976-05-04	Planke	
	237	3945298		1976-03-23	Cockroft	
	238	3919920		1975-11-18	Schlage	
	239	3919589		1975-11-11	Hanak	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		14162157	
	Filing Date		2014-01-23	
	First Named Inventor	Chester O.D. Thompson		
	Art Unit	2665		
	Examiner Name	Michelle M. Entezari		
	Attorney Docket Number	16223-00274		

	240	3902382		1975-09-02	Lieptz	
	241	3884121		1975-05-20	Agius	
	242	3880047		1975-04-29	Dosier	
	243	3870895		1975-03-11	Lax et al.	
	244	3865011		1975-02-11	Patriquin	
	245	3848235		1974-11-12	Lewis et al.	
	246	3826555		1974-07-30	Matsumoto	
	247	3810416		1974-05-14	Nelms, Jr.	
	248	3807276		1974-04-30	Oliver	
	249	3796130		1974-03-12	Gartner	
	250	3795174		1974-03-05	Oliver et al.	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		14162157	
	Filing Date		2014-01-23	
	First Named Inventor		Chester O.D. Thompson	
	Art Unit		2665	
	Examiner Name		Michelle M. Entezari	
	Attorney Docket Number		16223-00274	

	251	3792639		1974-02-19	Richens et al.	
	252	3773360		1973-11-20	Timbers	
	253	3769865		1973-11-06	Kleist	
	254	Re27665		1973-06-12	Spain	
	255	3722341		1973-03-27	Hungerford, Jr. et al.	
	256	3707999		1973-01-02	Coats	
	257	3682041		1972-08-08	Essig	
	258	3675536		1972-07-11	Hungerford, Jr. et al.	
	259	3656402		1972-04-18	French	
	260	3633451		1972-01-11	Lieptz	
	261	3651573		1972-03-28	Kaplan	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		14162157	
	Filing Date		2014-01-23	
	First Named Inventor	Chester O.D. Thompson		
	Art Unit	2665		
	Examiner Name	Michelle M. Entezari		
	Attorney Docket Number	16223-00274		

	262	3625111		1971-12-07	Carlo et al.	
	263	3602092		1971-08-31	Richens	
	264	3599147		1971-08-10	Rogers et al.	
	265	Re26848		1970-04-07	Simon	
	266	3499366		1970-03-10	Spain	
	267	3496636		1970-02-24	Lieptz	
	268	3466747		1969-09-16	Patriquin et al.	
	269	3457831		1969-07-29	Adler et al.	
	270	3442174		1969-05-06	Weiner et al.	
	271	3440906		1969-04-29	Allen	
	272	3430535		1969-03-04	Haggstrom	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		14162157
	Filing Date		2014-01-23
	First Named Inventor	Chester O.D. Thompson	
	Art Unit	2665	
	Examiner Name	Michelle M. Entezari	
	Attorney Docket Number	16223-00274	

	273	3429207		1969-02-25	John	
	274	3424056		1969-01-28	Stolove et al.	
	275	3418882		1968-12-31	Brand	
	276	3388619		1968-06-18	Schreiber et al.	
	277	3323420		1967-06-06	Roxburgh	
	278	3305100		1967-02-21	Barbee	
	279	3286597		1966-11-22	Schwartz	
	280	32856596		1966-11-22	Lieptz	
	281	3276328		1966-10-04	Schreiber et al.	
	282	3259022		1966-07-05	Vietorisz	
	283	3257908		1966-06-28	Haggstrom	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		14162157	
	Filing Date		2014-01-23	
	First Named Inventor	Chester O.D. Thompson		
	Art Unit	2665		
	Examiner Name	Michelle M. Entezari		
	Attorney Docket Number	16223-00274		

	284	3245149		1966-04-12	Haggstrom	
	285	3172969		1965-03-09	Haggstrom	
	286	3138999		1964-06-30	Haggstrom	
	287	3094039		1963-06-18	Spain	
	288	3053149		1962-09-11	Rossetti	
	289	2940183		1960-06-14	Fromberg	
	290	2929177		1960-03-22	Sheps	
	291	2860884		1958-11-18	Sloan et al.	
	292	2728251		1955-12-27	Turner	
	293	2707335		1955-05-03	Falk	
	294	2645978		1953-07-21	Sejarto et al.	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		14162157	
	Filing Date		2014-01-23	
	First Named Inventor	Chester O.D. Thompson		
	Art Unit	2665		
	Examiner Name	Michelle M. Entezari		
	Attorney Docket Number	16223-00274		

	295	2622485		1952-12-23	Martellotti	
	296	2605294		1952-07-29	Barnhart	
	297	2582012		1952-01-08	Currier	
	298	2556577		1951-06-12	Drake	
	299	2499124		1950-02-28	Zipp et al.	
	300	2445041		1948-07-13	Scholz	

If you wish to add additional U.S. Patent citation information please click the Add button. [Add](#)

U.S.PATENT APPLICATION PUBLICATIONS						Remove
Examiner Initial*	Cite No	Publication Number	Kind Code ¹	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1					

If you wish to add additional U.S. Published Application citation information please click the Add button. [Add](#)

FOREIGN PATENT DOCUMENTS								Remove
Examiner Initial*	Cite No	Foreign Document Number ³	Country Code ² j	Kind Code ⁴	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T ⁵

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		14162157	
	Filing Date		2014-01-23	
	First Named Inventor		Chester O.D. Thompson	
	Art Unit		2665	
	Examiner Name		Michelle M. Entezari	
	Attorney Docket Number		16223-00274	

	1	DE2951065	DE		1981-07-02	F.I.M.A.T. Fabbrica Italiana Macchine Automatiche		☐
	2	EP1976656	EP		2014-10-29	Hy-Ko Products Company		☐
	3	EP0053730	EP		1981-10-31	Webb Service GmbH		☐
	4	EP0133091	EP		1985-02-13	Societe Anonyme H.K. France		☐
	5	EP0835720	EP		1998-04-15	Noran, S.L.		☐
	6	FR2499435	FR		1982-08-13	Firme August Borkey Nachfolger		☐
	7	GB2276106	GB		1994-09-21	Autokey (UK) Ltd.		☐
	8	H04-250911	JP		1992-09-07	Ishikawajima Harima Heavy Ind.		☐
	9	S63-311108	JP		1988-12-19	Kiki Kalihatsu Kogyo KK		☐
	10	S63-311109	JP		1988-12-19	Kiki Kalihatsu Kogyo KK		☐
	11	291113	MX		2007-01-23	Hy-Ko Products Company		☐

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		14162157	
	Filing Date		2014-01-23	
	First Named Inventor		Chester O.D. Thompson	
	Art Unit		2665	
	Examiner Name		Michelle M. Entezari	
	Attorney Docket Number		16223-00274	

	12	ES2017240	ES		1991-01-01	Areitio & Arteta Comunicad de		☐
	13	CH673612	CH		1990-03-30	Hans Zulliger		☐
	14	WO2012096685	WO		2012-07-19	Hy-Ko Products Company		☐
	15	WO2007087389	WO		2007-08-02	Hy-Ko Products Company		☐
	16	WO2005042196	WO		2005-05-12	Hy-Ko Products Company		☐
	17	WO200201480	WO		2002-01-03	Almblad, Robert E.		☐
	18	WO2001/057472	WO		2001-08-09	Machine Magic LLC		☐
	19	WO1996/19309	WO		1996-06-27	Almblad, Robert E.		☐
	20	WO1991/13535	WO		1991-09-05	ATS Automation Tooling Systems Inc.		☐
	21	WO1990/03867	WO		1990-04-19	Silca S.P.A.		☐
	22	JPS59201708	JP		1984-11-15	Tsugami Totsuki KK		☐

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		14162157
	Filing Date		2014-01-23
	First Named Inventor	Chester O.D. Thompson	
	Art Unit	2665	
	Examiner Name	Michelle M. Entezari	
	Attorney Docket Number	16223-00274	

If you wish to add additional Foreign Patent Document citation information please click the Add button				Add
NON-PATENT LITERATURE DOCUMENTS				Remove
Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T ⁵	
	1	Chinese Office Action, Application No. 200780009675.0, Hy-Ko Products Company, December 4 2009.	☐	
	2	Chinese Office Action, Application No. 201080024166.7, Hy-Ko Products Company, December 6, 2013.	☐	
	3	Chinese Office Action, Application No. 201080024166.7, Hy-Ko Products Company, September 30, 2014.	☐	
	4	Chinese Office Action, Application No. 201080024163.3, Hy-Ko Products Company, August 1, 2013.	☐	
	5	Supplementary European Search Report, Application No. 07709849.9 - 1702/ 1976656, Hy-Ko Products Company, May 15, 2013.	☐	
	6	Extended European Search Report, Application No. 07709849.9 - 1702/ 1976656, Hy-Ko Products Company, April 26, 2013.	☐	
	7	European Communication pursuant to Article 94(3) EPC, Application No. 10 770 489.2-1901, Hy-Ko Products, June 27, 2014.	☐	
	8	Supplementary European Search Report, Application No. 10770489.2 - 1901/ 2424690, Hy-Ko Products, November 12, 2013.	☐	
	9	Extended European Search Report, 10770489.2-1901 / 2424690, Hy-Ko Products, October 25, 2013.	☐	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number	14162157
	Filing Date	2014-01-23
	First Named Inventor	Chester O.D. Thompson
	Art Unit	2665
	Examiner Name	Michelle M. Entezari
	Attorney Docket Number	16223-00274

	10	European Communication pursuant to Article 94(3) EPC, Application No. 12 003 030.9 - 1702, Hy-Ko Products Company, March 20, 2014.	☐
	11	European Communication pursuant to Article 94(3) EPC, Application No. 12 003 030.9 - 1702, Hy-Ko Products Company, July 30, 2013.	☐
	12	Extended European Search Report, Application No. 12003030.9 - 2302, Hy-Ko Products Company, September 4, 2012.	☐
	13	European Communication pursuant to Article 94(3) EPC, Application No. 03 767 220.1 - 2201, Hy-Ko Products, August 18, 2010.	☐
	14	European Supplementary Search Report, Application No. 03767220.1 - 2201, Hy-Ko Products, July 18, 2007.	☐
	15	Mexican Office Action, Application No. MX/A/2011/011630, Hy-Ko Products, November 18, 2014.	☐
	16	Mexican Office Action, Application No. MX/A/2011/011630, Hy-Ko Products, April 28, 2014.	☐
	17	International Preliminary Report on Patentability, PCT/US2011/034564, Mutch, William R. et al., July 16, 2013.	☐
	18	International Search Report and the Written Opinion of the International Searching Authority, PCT/US2011/034564, Hy-Ko Products Company, July 15, 2011.	☐
	19	International Preliminary Report on Patentability, PCT/US2010/033414, Hy-Ko Products et al., November 1, 2011.	☐
	20	International Search Report and the Written Opinion of the International Searching Authority, PCT/US2010/033414, Hy-Ko Products, August 18, 2010.	☐

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		14162157
	Filing Date		2014-01-23
	First Named Inventor	Chester O.D. Thompson	
	Art Unit	2665	
	Examiner Name	Michelle M. Entezari	
	Attorney Docket Number	16223-00274	

	21	International Preliminary Report on Patentability, PCT/US2007/002015, Hy-Ko Products Company, July 29, 2008.	☐
	22	International Search Report and the Written Opinion of the International Searching Authority, PCT/US2007/02015, Hy-Ko Products Company, September 28, 2007.	☐
	23	International Preliminary Report on Patentability, PCT/US2010/033421, Hy-Ko Products et al., November 1, 2011.	☐
	24	International Search Report and the Written Opinion of the International Searching Authority, PCT/US2010/033421, Hy-Ko Products, September 17, 2010.	☐
	25	Giuliani Productivity Through Flexibility, Multicode CCE-1, 2 pages.	☐
	26	Giuliani Productivity Through Flexibility, Multicode CCE-2, 3 pages.	☐
	27	FARZIN MOKHTARIAN and HIROSHI MURASE, Silhouette-Based Object Recognition through Curvature Scale Space, IEEE, Proceedings from Fourth International Conference on Computer Vision, 1993, pages 269-274.	☐
	28	IHTISHAM KABIR, A Computer Vision System Using Fast, One Pass Algorithms, (Thesis), Graduate Division of the University of California, Davis, 1986 pages 1-164.	☐
	29	ROGER D. QUINN et al., Design of an Agile Manufacturing Workcell for Light Mechanical Applications, April, 1996, pages 858 - 863, Proceedings from the 1996 IEEE International Conference on Robotics and Automation, Minneapolis, Minnesota.	☐
	30	ANIL K. JAIN, Fundamentals of Digital Image Processing, Ch. 9, Image Analysis and Computer Vision, University of California, Davis, 1989, pages 342 - 430, Prentice Hall, Inc., Englewood Cliffs, NJ.	☐
	31	AMIR NOVINI, Fundamentals of Machine Vision Lighting, IEEE, Proceedings of Northcon 93 Electrical and Electronics Convention, 1993, pages 38 - 46.	☐

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		14162157
	Filing Date		2014-01-23
	First Named Inventor	Chester O.D. Thompson	
	Art Unit	2665	
	Examiner Name	Michelle M. Entezari	
	Attorney Docket Number	16223-00274	

	32	WESLEY E. SNYDER, Industrial Robots Computer Interfacing and Control, Ch., 13 Computer Vision, North Carolina State University, 1985, pages, 248 - 283, Prentice-Hall, Inc., Englewood, NJ.	☐
	33	European Search Report for European Patent Application No. 12 00 3030, dated August 27, 2012.	☐
	34	International Preliminary Report on Patentability for International Patent Application No. PCT/US2011/034564, dated July 25, 2013.	☐
	35		☐
	36		☐

If you wish to add additional non-patent literature document citation information please click the Add button **Add**

EXAMINER SIGNATURE

Examiner Signature		Date Considered	

***EXAMINER:** Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

¹ See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. ² Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). ³ For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. ⁴ Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. ⁵ Applicant is to place a check mark here if English language translation is attached.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number	14162157
	Filing Date	2014-01-23
	First Named Inventor	Chester O.D. Thompson
	Art Unit	2665
	Examiner Name	Michelle M. Entezari
	Attorney Docket Number	16223-00274

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

☐ That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

☐ See attached certification statement.

☒ The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☒ A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Mark J. Masterson/	Date (YYYY-MM-DD)	2015-10-29
Name/Print	Mark J. Masterson	Registration Number	71886

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. **DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these records.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Electronic Patent Application Fee Transmittal				
Application Number:		14162157		
Filing Date:		23-Jan-2014		
Title of Invention:		KEY BLANK IDENTIFICATION SYSTEM WITH GROOVE SCANNING		
First Named Inventor/Applicant Name:		Chester O.D. Thompson		
Filer:		Mark Jason Masterson/Erika Fulkerson		
Attorney Docket Number:		16223-00274		
Filed as Large Entity				
Filing Fees for Utility under 35 USC 111(a)				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Miscellaneous:				
Submission- Information Disclosure Stmt	1806	1	180	180
Total in USD (\$)				180

Electronic Acknowledgement Receipt	
EFS ID:	23935940
Application Number:	14162157
International Application Number:	
Confirmation Number:	5914
Title of Invention:	KEY BLANK IDENTIFICATION SYSTEM WITH GROOVE SCANNING
First Named Inventor/Applicant Name:	Chester O.D. Thompson
Customer Number:	33772
Filer:	Mark Jason Masterson/Erika Fulkerson
Filer Authorized By:	Mark Jason Masterson
Attorney Docket Number:	16223-00274
Receipt Date:	29-OCT-2015
Filing Date:	23-JAN-2014
Time Stamp:	17:49:09
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	\$180
RAM confirmation Number	4893
Deposit Account	130265
Authorized User	FULKERSON, ERIKA

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

Charge any Additional Fees required under 37 C.F.R. Section 1.21 (Miscellaneous fees and charges)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Transmittal Letter	IDSCVR.pdf	67423	no	1
			a28a51be1484eae47478e31451e79db154145257		
Warnings:					
Information:					
2	Information Disclosure Statement (IDS) Form (SB08)	IDS2.PDF	613766	no	9
			c1eca216fd6153ab06f636067977d20fd8d71cc4		
Warnings:					
Information:					
3	Foreign Reference	DE2951065.pdf	1411612	no	37
			81106a18c8f4a6cfbe63fcbcf058178504f6f5a0		
Warnings:					
Information:					
4	Foreign Reference	EP1976656.PDF	138056	no	3
			0b82e13458d0af3c5d6dac1eb2488be60b43f09f		
Warnings:					
Information:					
5	Foreign Reference	EP0053730.pdf	883526	no	32
			2fba83a10754493f918e5ae13b056166f3be7ea4		
Warnings:					
Information:					
6	Foreign Reference	EP133091_4.pdf	592485	no	14
			79609a1ee18d00b3ee041a89c004b6ba71be3bbb		
Warnings:					
Information:					
7	Foreign Reference	EP0835720.PDF	549495	no	12
			85d11bca80985a113be16ba84257d0679a98cae		
Warnings:					
Information:					

8	Foreign Reference	FR2499435.PDF	670649	no	13
			da9ed5fe298b0e688e4552478b45a8d4f322a93d		
Warnings:					
Information:					
9	Foreign Reference	GB2276106.PDF	695089	no	18
			386420b08aeff67d79c8f0dce23e67216c31a7d9		
Warnings:					
Information:					
10	Foreign Reference	JP4250911.pdf	667843	no	9
			a1b4830cfe2a1d0d3a7afbccab1707a7f2c77300		
Warnings:					
Information:					
11	Foreign Reference	JPS63311108.PDF	238718	no	5
			abefffa3f7b6ba617e5299b346a73b4eda0d521		
Warnings:					
Information:					
12	Foreign Reference	JPS63311109.PDF	252781	no	5
			876f38e8ca70a4bd83105a9b76d7cbb5c9cd8060		
Warnings:					
Information:					
13	Foreign Reference	MX291113.PDF	11174355	no	96
			b6d0f05751692ebe1f1ab301a98b2c9bc4b6e663		
Warnings:					
Information:					
14	Foreign Reference	ES2017240.PDF	274928	no	5
			8e96c86bb22ba983604e829c97ddd70ec8f67928		
Warnings:					
Information:					
15	Foreign Reference	CH673612.PDF	782041	no	13
			927eeb2102ae7cbf795dd3a05631c31d7364e03d		
Warnings:					
Information:					
16	Foreign Reference	WO2012096685.pdf	2243965	no	62
			41e543aa0c10c1373c7e2a91b6000f30d59944b8		
Warnings:					
Information:					

17	Foreign Reference	WO2007087389.pdf	2222564	no	59
			bc410f4535f34d2557c756eb99de0b5a37a163a		
Warnings:					
Information:					
18	Foreign Reference	WO2005042196.PDF	1002392	no	30
			d4b295716f22167886baea4ef57f79c1e34b4ac2		
Warnings:					
Information:					
19	Foreign Reference	WO200201480.PDF	1242108	no	34
			1dfd50e793dd2343590f19016c90974b8d653426		
Warnings:					
Information:					
20	Foreign Reference	WO0157472.pdf	2502307	no	70
			b45f891dc232515c429b459499aea6fca2cd4a61		
Warnings:					
Information:					
21	Foreign Reference	WO9619309.pdf	5232162	no	158
			e651e866490ed2a089ef593d2f10ada2fce63694		
Warnings:					
Information:					
22	Foreign Reference	WO91013535.pdf	1534823	no	38
			03ddfb5c72a7f935a0e5995597721be9e587c14c		
Warnings:					
Information:					
23	Foreign Reference	WO199003867.PDF	523303	no	19
			71ddbbedf63f70665ccd5398621e8ba7f0b77fba2		
Warnings:					
Information:					
24	Foreign Reference	JPS59201708.PDF	592149	no	10
			d878d8bfff62c14125fa1e250ff97e04e55cfd6d		
Warnings:					
Information:					
25	Non Patent Literature	CNOA120409.PDF	1743329	no	15
			2c1a84371304c3ded397f170f1c478376a7dc0ee		
Warnings:					

The page size in the PDF is too large. The pages should be 8.5 x 11 or A4. If this PDF is submitted, the pages will be resized upon entry into the Image File Wrapper and may affect subsequent processing

Information:

26	Non Patent Literature	CNOA120613_2.pdf	149462	no	14
			13035205c4a7f73e851b3c8fa31ebb97a82e9841		

Warnings:

Information:

27	Non Patent Literature	CNOA093014_3.pdf	803908	no	24
			65ba6318ab5fcb08b144364b1b411c8af4a9b682		

Warnings:

Information:

28	Non Patent Literature	CNOA080113_4.pdf	544108	no	16
			cf1242cdc410db00edfc91d7e877a2969a69d26c		

Warnings:

Information:

29	Non Patent Literature	SESR51513.pdf	95520	no	3
			9c2211b4af6402e4abd9e197fc3e9dbf0eac4caa		

Warnings:

Information:

30	Non Patent Literature	EESR042613.PDF	103638	no	4
			fa6d6e6dbe8bec63e3a8c6eb4eb45bd50d2952bb		

Warnings:

Information:

31	Non Patent Literature	EPC062714.PDF	316244	no	5
			0cc4b29cee9afeb7a17df234b9cc71791e47077e		

Warnings:

Information:

32	Non Patent Literature	SESR111213.PDF	108176	no	1
			aa0fa47e0c2392a69b97c51273861f8e8a2ca509		

Warnings:

Information:

33	Non Patent Literature	EESR102513.PDF	525827	no	7
			88a913fff16762397711df79547827b4939900d3		

Warnings:

Information:

34	Non Patent Literature	EPC032014.PDF	310169	no	4
			56ed5dd60f56d65ac4f5fe89c5e29113cac132c		
Warnings:					
Information:					
35	Non Patent Literature	EPC073013.PDF	5309208	no	72
			dfa9d80171c117efef1a8c76fb07f2e18ead836		
Warnings:					
Information:					
36	Non Patent Literature	EESR090412.PDF	309162	no	6
			67cfcf124133a70afa00693913ae65eff1968c89		
Warnings:					
Information:					
37	Non Patent Literature	EPC081810.PDF	663481	no	6
			e15e2713efc67783c6e541c7e00f82a368ba6d30		
Warnings:					
Information:					
38	Non Patent Literature	ESSR071807.PDF	358194	no	5
			ecce2beead207dbb3bfc556d7a013bf848cc ea7a9		
Warnings:					
Information:					
39	Non Patent Literature	MXOA111814.PDF	443300	no	6
			83222a53489ff1eb6883e9c3c5bfd79be8334851		
Warnings:					
Information:					
40	Non Patent Literature	MXOA42814.PDF	318285	no	6
			d52ba2b34538bb17b45b58bd5f6c0d8cbf860dbb		
Warnings:					
Information:					
41	Non Patent Literature	IPR071613.PDF	263622	no	5
			8debfb82f9afe7c09de1b3389f6c5673a86f0020		
Warnings:					
Information:					
42	Non Patent Literature	ISR71511.pdf	377605	no	7
			90a82a56d528c484d1de746c0a65ce4a5a5637f0		
Warnings:					
Information:					

43	Non Patent Literature	IPR110111_19.PDF	231558	no	5
			752b253a0afb56a9f2bfe18f0310f814895345f4		
Warnings:					
Information:					
44	Non Patent Literature	ISRWO081810.PDF	290707	no	6
			81732235b2dc20b00dc082029cd9e714617f0080		
Warnings:					
Information:					
45	Non Patent Literature	IPR072908.PDF	360095	no	6
			dc66384aa4283b89a4775f2a35af64fd096de69		
Warnings:					
Information:					
46	Non Patent Literature	ISR92807.pdf	620900	no	10
			b0adc8ce40ebb4a2a103dddb19bfbdcbd5cd2ab		
Warnings:					
Information:					
47	Non Patent Literature	IPR110111_23.PDF	188607	no	5
			f6c3546b0e3d16b83c5cc32658d3ac6877348110		
Warnings:					
Information:					
48	Non Patent Literature	ISR091710.PDF	91669	no	2
			b73f5b0b469f8bfab46558fe61f70612b0970cb0		
Warnings:					
Information:					
49	Non Patent Literature	CCE_1.pdf	1381624	no	2
			f6002fe50be06d4b799e856bd533cc41fef4d113		
Warnings:					
Information:					
50	Non Patent Literature	CCE_2.pdf	1319544	no	2
			612d8279fc29a43583d00d97aa8099437211f24d		
Warnings:					
Information:					
51	Non Patent Literature	Mokhtarian.pdf	399618	no	6
			78b7c9f9d7280196e5a0295c4bb913e13fc150cf		
Warnings:					
Information:					

52	Non Patent Literature	Kabir.pdf	8467545	no	164
			76c2cb44963b03e0c1e9329084754a25931b1e30		
Warnings:					
Information:					
53	Non Patent Literature	Quinn.pdf	452698	no	6
			994228fbbefca55407f8f06c7526e00763bd86fa		
Warnings:					
Information:					
54	Non Patent Literature	Jain.pdf	4639741	no	92
			12ce2b630f87cb55d8ac49d478aabe65edd41352		
Warnings:					
Information:					
55	Non Patent Literature	Novini.pdf	790244	no	9
			45fc47c3261f0d11ce5dc910a8d366c6a315fe3a		
Warnings:					
Information:					
56	Non Patent Literature	Snyder.pdf	1605514	no	37
			2ae81ff74070730b6bf101db864e471e3421cef5		
Warnings:					
Information:					
57	Non Patent Literature	ESR82712.pdf	47645	no	3
			e951a3e15d7982b1398317888e1813a862ddc132		
Warnings:					
Information:					
58	Non Patent Literature	IPR072513.PDF	256471	no	6
			5a6c7225e770f5f8d34db8cdf977ce210ea49196		
Warnings:					
Information:					
59	Information Disclosure Statement (IDS) Form (SB08)	IDS1.PDF	621032	no	36
			36aa1d35890eeacdb459a502fb77c6021bf7846e		
Warnings:					
Information:					
60	Fee Worksheet (SB06)	fee-info.pdf	30862	no	2
			81a120e886d64a01815a42f7c912b672f705298f		
Warnings:					
Information:					

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

PATENT APPLICATION
IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application:	Chester O. D. Thompson	Group Art Unit:	2665
Serial No.:	14/162,157	Examiner:	Michelle M. Entezari
Filing Date:	January 23, 2014	Docket No.:	16223-00274
		Confirmation No.:	5914

Title: KEY BLANK IDENTIFICATION SYSTEM WITH GROOVE SCANNING

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

TRANSMITTAL LETTER FOR INFORMATION DISCLOSURE STATEMENT

Applicant submits an Information Disclosure Statement pursuant to 37 CFR 1.17(p) in which a second e-IDS is necessary to submit a complete IDS for which a fee is required. As a second e-IDS is necessary to submit a complete IDS, and is submitted on the same date as the first e-IDS, the required \$180.00 submission fee is included.

In the event additional fees are deemed due, please charge deposit account number 13-0265.

Date: October 29, 2015

Respectfully submitted,

/Mark J. Masterson/
Mark J. Masterson, Reg. No. 71,886
McDonald Hopkins LLC
600 Superior Avenue, E.
Suite 2100
Cleveland, OH 44114-2653
(216) 430-2017

{5773129;}



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/162,157	01/23/2014	Chester O.D. Thompson	16223-00274	5914
33772 7590 12/17/2015 MCDONALD HOPKINS LLC 600 Superior Avenue, East Suite 2100 CLEVELAND, OH 44114-2653			EXAMINER ENTEZARI, MICHELLE M	
			ART UNIT 2665	PAPER NUMBER
			NOTIFICATION DATE 12/17/2015	DELIVERY MODE ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

ipmailbox@mcdonalddhopkins.com

Office Action Summary	Application No. 14/162,157	Applicant(s) THOMPSON ET AL.	
	Examiner MICHELLE ENTEZARI	Art Unit 2665	AIA (First Inventor to File) Status No

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTHS FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 10/22/15.
☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on ____.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on ____; the restriction requirement and election have been incorporated into this action.
- 4) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims*

- 5) ☒ Claim(s) 1-12 and 14-27 is/are pending in the application.
5a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 6) ☐ Claim(s) ____ is/are allowed.
- 7) ☒ Claim(s) 1-12, 14 and 16-27 is/are rejected.
- 8) ☒ Claim(s) 15 is/are objected to.
- 9) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

* If any claims have been determined allowable, you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov.

Application Papers

- 10) ☐ The specification is objected to by the Examiner.
- 11) ☐ The drawing(s) filed on ____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

Certified copies:

- a) ☐ All b) ☐ Some** c) ☐ None of the:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. ____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

** See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)	3) ☐ Interview Summary (PTO-413)
	Paper No(s)/Mail Date. ____
2) ☒ Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b)	4) ☐ Other: ____
Paper No(s)/Mail Date <u>10/29/15</u>	

DETAILED ACTION

Response to Amendment

1. Claims 1-12 and 14-27 are pending. Claims 1-12 and 14-27 are amended directly or by dependency on an amended claim. Claim 13 is cancelled.

Response to Arguments

2. Applicant's arguments filed October 22, 2015 have been fully considered but they are not persuasive. Regarding the argument that Campbell won't work with Inoue as Campbell is directed to a moving object, it is noted that something that an whether an object is moving configuration or stationary would be a design choice, as there is not a hardware limitation indicating the object has to be one or the other. The imaged object would just be a matter of design choice. Regarding the argument about luminous surfaces, it is noted that adding an illumination source would be obvious and easy to implement, as any light would be able to provide this.
3. Regarding the argument about the substantial tip end view, it is noted that Campbell takes an image of the key, which will include the tip. As the claim does not exclude also imaging the rest of the key along with the tip, it is disclosed by Campbell. Further, should the claim be amended to exclude the rest of the key, this could still be obvious as a design choice, therefore, the examiner does not recommend further amending in that manner. Inoue indicates taking multiple views of an object, which could be any object, by design choice.

Claim Rejections - 35 USC § 103

4. The following is a quotation of pre-AIA 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

5. **Claims 1-8, 12, 14, 16-20 and 24-27 are** rejected under 35 U.S.C. 103(a) as being unpatentable over Campbell et al. (US 20020191849 A1) in view of Inoue et al. (US 20100059484 A1) in view of Allred et al. (US 20100110380 A1).

Regarding claim 1, Campbell et al. disclose key identification system (abstract) comprising: an imaging system including a camera configured to capture an image of the tip of a master key (capture an image of the master key, abstract, [0047], [0051]), wherein said image includes a contour (contour, [0089]-[0094]); a logic configured to analyze said captured image to determine characteristics of said contour and compare said characteristics with characteristics of known key blanks to determine the likelihood of a match between said master key and a known key blank (contour matching score, [0089]-[0094]). Campbell et al. indicate taking an image of a whole key ([0055]), therefore, Campbell et al. disclose taking at least a tip end view.

Cambell et al. do not disclose one or more mirrors positioned to allow said camera to capture two or more views of the master key wherein said characteristics of said

contour are determined based on image data from at least said two or more views of said master key, and wherein said logic calculates the geometry of the contour based on data from at least said two or more views of said master key.

Inoue et al. teach capturing two or more views of the master key wherein said characteristics of said contour are determined based on image data from at least said two or more views of said master key, and wherein said logic calculates the geometry of the contour based on data from at least said two or more views of said master key (edge shape monitor continuously captures images of the edges, measurement of the groove shape, and the captured images are input to an arithmetic processing unit for image processing, abstract, [0051]-[0055], two cameras used to capture different views, 13a and 13b, Fig. 2A, [0054], [0055]).

Cambell et al. and Inoue do not disclose one or more mirrors positioned to allow said camera to capture two or more views of the master key.

Allred et al. teach in place of two cameras to take images from different perspectives, a single camera, and mirrors configured to provide images of light along different pathways (i.e., from different perspectives) can be used ([0028], [0037]).

Regarding claim 2, Campbell et al. and Inoue et al. and Allred et al. disclose the key identification system of claim 1. Campbell et al. further indicate said logic includes a

database containing data related to characteristics of grooves of known key blanks ([0084], [0097], [0100], [0107], [0111] [characteristics of grooves interpreted as number of notches, information about contours, etc.]).

Regarding claim 3, Campbell et al. and Inoue et al. and Allred et al. disclose the key identification system of claim 1. Campbell et al. further indicate said imaging system includes a reflecting device (abstract, [0013]-[0015], [0057]-[0062]).

Regarding claim 4, Campbell et al. and Inoue et al. and Allred et al. disclose the key identification system of claim 1. Campbell et al. further indicate said imaging system includes a light (abstract, [0044]).

Regarding claim 5, Campbell et al. and Inoue et al. and Allred et al. disclose the key identification system of claim 4. Campbell et al. further indicate said light is directed toward said reflecting device ([0058], [0060]).

Regarding claim 6, Campbell et al. and Inoue et al. and Allred et al. disclose the key identification system of claim 5. Campbell et al. further indicate said light includes a shield to direct light away from said master key (prior art systems include light shielding, [0008]).

Regarding claim 7, Campbell et al. and Inoue et al. and Allred et al. disclose the key identification system of claim 1. Campbell et al. further indicate said captured image is a digital image ([0047]).

Regarding claims 8 and 12, Campbell et al. and Inoue et al. and Allred et al. disclose the key identification system of claim 1. Campbell et al. further indicate said captured image comprises a silhouette of said tip and blade of said master key ([0051], [0056], [0076], [0077]).

Regarding claim 14, Campbell et al. and Inoue et al. and Allred et al. disclose the key identification system of claim 13. Campbell et al. and Inoue et al. and Allred et al. further indicate said characteristics of said contour are determined based on image data from at least two or more views of said master key (Campbell et al., [0050], [0053], [0054]; Prejean, col. 5, line 55 - col. 6, line 5, Inoue et al., [0054], [0055], Allred et al., [0028], [0037]). Campbell et al. and Inoue et al. also indicate said logic calculates the geometry of the contour as seen as seen from a view of the tip parallel to the blade based on data from at least said two or more views of said master key (Campbell et al., images captured by receiver and second receiver can be combined to create a complete image of the master key, from which the key may be identified, as described in greater detail below, [0053], Fig. 4, Fig. 5, contour information is extracted by analyzing the slope variances in the shape of the outer perimeter of the head and shoulder area, slope

variances and sizes may then be combined to form the contour description string, [0086]; Inoue et al., abstract, [0051]-[0055]).

Regarding claim 16, Campbell et al. and Inoue et al. and Allred et al. disclose the key identification system of claim 1. Campbell et al. further disclose a key holder to hold said master key (transparent support 142 (referring to FIG. 12) may be provided to receive the master key, [0044]).

Regarding claim 17, Campbell et al. and Inoue et al. and Allred et al. disclose the key identification system of claim 16. Campbell et al. further disclose said key holder includes a lower support (transparent support 142 (referring to FIG. 12) may be provided to receive the master key, [0044]).

Regarding claim 18, Campbell et al. and Inoue et al. and Allred et al. disclose the key identification system of claim 16. Campbell et al. further disclose said key holder comprises an upper door (door, [0042], [0073], [0109], from Fig. 1 can see at least the majority of the door is higher than the floor).

Regarding claim 19, Campbell et al. and Inoue et al. and Allred et al. disclose the key identification system of claim 16. Campbell et al. further disclose a key holder includes a clamp in prior art systems (Campbell et al., [0004]).

Regarding claim 20, Campbell et al. and Inoue et al. and Allred et al. disclose the key identification system of claim 1. Campbell et al. further disclose one of said views of said master key includes a view from above the master key blade of a groove in the bottom of said blade (Fig. 4, Fig. 5, [0053]).

Regarding claim 24, Campbell et al. and Inoue et al. and Allred et al. disclose the key identification system of claim 1. Campbell et al. further disclose said logic includes a tolerance range for each characteristic of said master key to determine whether a master key passes or fails to match a known key blank ([0087], [0104]).

Regarding claim 25, Campbell et al. disclose a key identification system (abstract) comprising: an imaging system including a camera in a first position configured to directly capture at least one image of one side of a master key (capture an image of the master key, abstract, [0047], [0051]), wherein said image includes a contour (contour, [0089]-[0094]); and a logic configured to analyze said captured images to determine characteristics of said contour and compare said characteristics with characteristics of known key blanks to determine the likelihood of a match between said master key and a known key blank (contour matching score, [0089]-[0094]).

Campbell et al. do not disclose at least one mirror positioned to allow said camera to capture at least one image of a second side of a master key from a second position

wherein the second position is from a different angle than the first position, or using multiple images to do the analysis.

Inoue et al. teach capturing two or more views of the master key wherein said characteristics of said contour are determined based on image data from at least said two or more views of said master key, and wherein said logic calculates the geometry of the contour based on data from at least said two or more views of said master key (edge shape monitor continuously captures images of the edges, measurement of the groove shape, and the captured images are input to an arithmetic processing unit for image processing, abstract, [0051]-[0055], two cameras used to capture different views, 13a and 13b, Fig. 2A, [0054], [0055]).

Cambell et al. and Inoue do not disclose at least one mirror positioned to allow said camera to capture at least one image of a second side of a master key from a second position wherein the second position is from a different angle than the first position.

Allred et al. teach in place of two cameras to take images from different perspectives, a single camera, and mirrors configured to provide images of light along different pathways (i.e., from different perspectives) can be used ([0028], [0037]).

Regarding claim 26, Cambell et al. and Inoue and Allred et al. disclose the key identification system of claim 25. Allred et al. further teach the at least one mirror is

configured to allow the camera to capture one image with multiple views of the master key from different angles ([0028], [0037]).

Regarding claim 27, Campbell et al. disclose a key identification system (abstract) comprising: an imaging system including a camera configured to capture an image of a master key (capture an image of the master key, abstract, [0047], [0051]); and a logic configured to analyze said captured image to determine characteristics of said contour and compare said characteristics with characteristics of known key blanks to determine the likelihood of a match between said master key and a known key blank (contour matching score, [0089]-[0094]).

Campbell et al. do not disclose the image includes a first view and a second view: a first mirror positioned at a first position to allow said camera to capture the first view of the master key, at least one second mirror positioned at a second position to allow said camera to capture a second view of the master key, wherein the first view is from a different angle than the second view.

Inoue et al. teach capturing two or more views of the master key wherein said characteristics of said contour are determined based on image data from at least said two or more views of said master key, and wherein said logic calculates the geometry of the contour based on data from at least said two or more views of said master key (edge shape monitor continuously captures images of the edges, measurement of the

groove shape, and the captured images are input to an arithmetic processing unit for image processing, abstract, [0051]-[0055], two cameras used to capture different views, 13a and 13b, Fig. 2A, [0054], [0055]).

Cambell et al. and Inoue do not disclose at least one mirror positioned to allow said camera to capture at least one image of a second side of a master key from a second position wherein the second position is from a different angle than the first position.

Allred et al. teach in place of two cameras to take images from different perspectives, a single camera, and mirrors configured to provide images of light along different pathways (i.e., from different perspectives) can be used ([0028], [0037]).

6. **Claim 9** rejected under 35 U.S.C. 103(a) as being unpatentable over Campbell et al. (US 20020191849 A1) and Inoue et al. (US 20100059484 A1) and Allred et al. (US 20100110380 A1) as applied to claim 1 above, further in view of Miller et al. (US 7643685 B2).

Regarding claim 9, Campbell et al. and Inoue et al. and Allred et al. disclose the key identification system of claim 1. Campbell et al. and Inoue et al. and Allred et al. do not explicitly disclose said logic accounts for rolling of said master key with respect to said imaging system to determine characteristics of said contour.

Miller et al. teach a computation that accounts for roll of the object imaged (col. 3, lines 1-10, col. 3, lines 65-68, col. 11, lines 10-15).

The combination of Miller et al. with Campbell et al. and Inoue et al. and Allred et al. allows for key rolling. It would have been obvious at the time of the invention to one of ordinary skill in the art to combine the object identification even in the case of rolling of Miller et al., with the device of Campbell et al. and Inoue et al. and Allred et al., as these identification techniques were well known at the time of the invention, incorporating the identification would have predictable results, and as the key placed on the platform may not always lie entirely flat.

7. **Claims 10, 11, and 22 are** rejected under 35 U.S.C. 103(a) as being unpatentable over Campbell et al. (US 20020191849 A1) and Inoue et al. (US 20100059484 A1) and Allred et al. (US 20100110380 A1) as applied to claim 1 above, further in view of Almblad et al. (US 6065911 A).

Regarding claim 10, Campbell et al. and Inoue et al. and Allred et al. disclose the key identification system of claim 1. Campbell et al. and Inoue et al. and Allred et al. do not explicitly disclose said logic accounts for tilting of said master key with respect to said imaging system to determine characteristics of said contour.

Almblad et al. teach logic accounts for tilting of said master key with respect to said imaging system to determine characteristics of said groove (Almblad et al., accommodates for key tilted/not lying flat due to bulky handle, fig. 3, col. 8, lines 35-45).

The combination of Almblad et al. with Campbell et al. and Inoue et al. and Allred et al. allows for key tilting. It would have been obvious at the time of the invention to one of ordinary skill in the art to combine the object identification even in the case of tilting of Almblad et al., with the device of Campbell et al. and Inoue et al. and Allred et al., as these identification techniques were well known at the time of the invention, incorporating the identification would have predictable results, and as the key placed on the platform may not always lie entirely flat.

Regarding claim 11, Campbell et al. and Inoue et al. and Allred et al. disclose the key identification system of claim 1. Campbell et al. and Inoue et al. and Allred et al. do not explicitly disclose said logic accounts for tipping of said master key with respect to said imaging system to determine characteristics of said contour.

Almblad et al. teach logic accounts for tipping of said master key with respect to said imaging system to determine characteristics of said groove (Almblad et al., accommodates for key tilted/not lying flat due to bulky handle, fig. 3, col. 8, lines 35-45).

The combination of Almblad et al. with Campbell et al. and Inoue et al. and Allred et al. allows for key tipping. It would have been obvious at the time of the invention to one of ordinary skill in the art to combine the object identification even in the case of tipping of Almblad et al., with the device of Campbell et al. and Inoue et al. and Allred et al., as these identification techniques were well known at the time of the invention, incorporating the identification would have predictable results, and as the key placed on the platform may not always lie entirely flat.

Regarding claim 22, Campbell et al. and Inoue et al. and Allred et al. disclose the key identification system of claim 1. Campbell et al. and Inoue et al. and Allred et al. do not explicitly disclose the captured image of said tip includes a contour of a groove in said master key.

Almblad et al. teach a captured image of said tip includes a contour of a groove in said master key (extract three-dimensional grooves, col. 2, lines 30-35, identify curved grooves, col. 4, lines 35-40; extract laterally protected attributes such as groove characteristics using light stripe, col. 11, lines 5-25).

The combination of Almblad et al. with Campbell et al. and Inoue et al. and Allred et al. allows for identification of groove contours. It would have been obvious at the time of the invention to one of ordinary skill in the art to combine the groove contours identification of Almblad et al., with the invention of Campbell et al. and Inoue et al. and

Allred et al., as these identification techniques were well known at the time of the invention, incorporating the identification would have predictable results, and as one of a limited numbers of ways to identify a key, would have been obvious to try.

8. **Claim 23 is** rejected under 35 U.S.C. 103(a) as being unpatentable over Campbell et al. (US 20020191849 A1) and Inoue et al. (US 20100059484 A1) and Allred et al. (US 20100110380 A1) as applied to claim 1 above, further in view of Gimelfarb et al. (US 20060147289 A1).

Regarding claim 23, Campbell et al. and Inoue et al. and Allred et al. disclose the key identification system of claim 1. Campbell et al. and Inoue et al. and Allred et al. do not explicitly disclose said logic is configured to shift data related to said characteristics of said contour to compare with said known key blank characteristics.

Gimelfarb et al. teach logic is configured to shift data related to said characteristics of said contour to compare with said known key blank characteristics (bitings aligned to master key, slidable along axis, abstract, [0014], [0030], [0035]).

Cambell et al. and Gimelfarb are in the same art of copying keys (Cambell et al., abstract; Gimelfarb, abstract). The addition of Gimelfarb would a slidable alignment method. It would have been obvious at the time of the invention to one of ordinary skill in the art to combine the sliding alignment of Gimelfarb with the invention of Campbell et

al. and Inoue et al. and Allred et al., as this was known at the time of the invention, would have predictable results, and as this allows for more easy key positioning and comparison.

Allowable Subject Matter

9. **Claim 15** is objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Conclusion

10. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to MICHELLE ENTEZARI whose telephone number is (571)270-5084. The examiner can normally be reached on M-Th, 7:30am-5pm EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Stephen R. Koziol can be reached on (571)270-1844. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/MICHELLE ENTEZARI/
Primary Examiner, Art Unit 2665

Doc code: IDS

PTO/SB/08a (01-10)

Doc description: Information Disclosure Statement (IDS) Filed

Approved for use through 07/31/2012. OMB 0851-0031

U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		14162157
	Filing Date		2014-01-23
	First Named Inventor	Chester O.D. Thompson	
	Art Unit	2665	
	Examiner Name	Michelle M. Entezari	
	Attorney Docket Number	16223-00274	

U.S.PATENTS						Remove
Examiner Initial*	Cite No	Patent Number	Kind Code ¹	Issue Date	Name of Patentee or Applicant of cited Document	Pages, Columns, Lines where Relevant Passages or Relevant Figures Appear
	1	8644619		2014-02-04	Thompson et al.	
	2	8634655		2014-01-21	Thompson et al.	
	3	8585029		2013-11-19	Ryai, Sr.	
	4	8532809		2013-09-10	Freeman	
	5	8128322		2012-03-06	Bass et al.	
	6	7918629		2011-04-05	Belflower et al.	
	7	7891919		2011-02-22	Bass et al.	
	8	7643685		2010-01-05	Miller	

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /M.M.E/

**INFORMATION DISCLOSURE
STATEMENT BY APPLICANT**
(Not for submission under 37 CFR 1.99)

Application Number	14162157
Filing Date	2014-01-23
First Named Inventor	Chester O.D. Thompson
Art Unit	2665
Examiner Name	Michelle M. Entezari
Attorney Docket Number	16223-00274

9	7484446		2009-03-02	Gula	
10	7214011		2007-05-08	Ryai, Sr. et al.	
11	7163364		2007-01-16	Foscan et al.	
12	7114894		2006-10-03	Mueller et al.	
13	7114436		2006-10-03	Mueller	
14	7111894		2006-09-26	Kora et al.	
15	7010498		2006-03-07	Berstis	
16	6965911		2005-11-15	Coffman et al.	
17	6959862		2005-11-01	Neumark	
18	6895100		2005-05-17	Pacenzia et al.	
19	6839451		2005-01-04	Campbell et al.	

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /M.M.E/

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number	14162157 - GAU: 2665 14162157
	Filing Date	2014-01-23
	First Named Inventor	Chester O.D. Thompson
	Art Unit	2665
	Examiner Name	Michelle M. Entezari
	Attorney Docket Number	16223-00274

	20	6839449		2005-01-04	Campbell et al.	
	21	6836553		2004-12-28	Campbell et al.	
	22	6817814		2004-11-16	Mueller	
	23	6801829		2004-10-05	Kawai	
	24	6711557		2004-03-23	Palaniappan	
	25	6687565		2004-02-03	Wetterlin et al.	
	26	6647308		2003-11-11	Prejean	
	27	6641339		2003-11-04	Chies et al.	
	28	6612142		2003-09-02	Capwell	
	29	6602030		2003-08-05	Markbreit	
	30	6588995		2003-07-08	Wills et al.	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number	14162157 - GAU: 2665 14162157
	Filing Date	2014-01-23
	First Named Inventor	Chester O.D. Thompson
	Art Unit	2665
	Examiner Name	Michelle M. Entezari
	Attorney Docket Number	16223-00274

	31	6543972		2003-04-08	Cimino	
	32	6478515		2002-11-12	Mueller	
	33	6449381		2002-09-10	Yanovsky et al.	
	34	6415931		2002-07-09	Mueller	
	35	6406227		2002-06-18	Titus et al.	
	36	D455104		2002-04-02	Hillman et al.	
	37	6321430		2001-11-27	Goldman et al.	
	38	6243960		2001-06-12	Andrews et al.	
	39	6186711		2001-02-13	Mueller	
	40	6185311		2001-02-06	Yanovsky et al.	
	41	6179531		2001-01-30	Jaw	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		14162157 - GAU: 2665	
	Filing Date		2014-01-23	
	First Named Inventor	Chester O.D. Thompson		
	Art Unit	2665		
	Examiner Name	Michelle M. Entezari		
	Attorney Docket Number	16223-00274		

	42	6175638		2001-01-16	Yanovsky	
	43	6152662		2000-11-28	Titus et al.	
	44	6094953		2000-08-01	Evans	
	45	6082580		2000-07-04	Mueller et al.	
	46	6065911		2000-05-23	Almblad et al.	
	47	6064747		2000-05-16	Wills et al.	
	48	6059495		2000-05-09	Mueller et al.	
	49	6053677		2000-04-25	Juchinewicz	
	50	5997795		1999-12-07	Danforth et al.	
	51	5997224		1999-12-07	Beauregard et al.	
	52	5984597		1999-11-16	Chen	

EFS Web 2.1.17 ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /M.M.E/

**INFORMATION DISCLOSURE
STATEMENT BY APPLICANT**
(Not for submission under 37 CFR 1.99)

Application Number	14162157
Filing Date	2014-01-23
First Named Inventor	Chester O.D. Thompson
Art Unit	2665
Examiner Name	Michelle M. Entezari
Attorney Docket Number	16223-00274

53	5982491		1999-11-09	Breyer et al.	
54	5966457		1999-10-12	Lemelson	
55	5964554		1999-10-12	Drori	
56	5940229		1999-08-17	Baumgarten	
57	5926388		1999-07-20	Kimbrough et al.	
58	5908273		1999-06-01	Titus et al.	
59	5906365		1999-05-25	Wu	
60	5886775		1999-03-23	Houser et al.	
61	5855836		1999-01-05	Leyden et al.	
62	5807042		1998-09-15	Almblad et al.	
63	5771176		1998-06-23	Froehlich et al.	

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /M.M.E/

**INFORMATION DISCLOSURE
STATEMENT BY APPLICANT**
(Not for submission under 37 CFR 1.99)

Application Number	14162157
Filing Date	2014-01-23
First Named Inventor	Chester O.D. Thompson
Art Unit	2665
Examiner Name	Michelle M. Entezari
Attorney Docket Number	16223-00274

64	5764156		1998-06-09	Chaloux	
65	5739766		1998-04-14	Chaloux	
66	5711643		1998-01-27	Parr et al.	
67	5771176		1998-06-23	Froehlich et al.	
68	5677522		1997-10-14	Rice et al.	
69	5676504		1997-10-14	Mueller et al.	
70	5671523		1997-09-30	Juchinewicz	
71	RE35518		1997-05-27	Sussina	
72	5660509		1997-08-26	Cole et al.	
73	5630332		1997-05-20	Aldieri et al.	
74	5617323		1997-04-01	Stansberry et al.	

**INFORMATION DISCLOSURE
STATEMENT BY APPLICANT**
(Not for submission under 37 CFR 1.99)

Application Number	14162157
Filing Date	2014-01-23
First Named Inventor	Chester O.D. Thompson
Art Unit	2665
Examiner Name	Michelle M. Entezari
Attorney Docket Number	16223-00274

75	5607267		1997-03-04	Heredia et al.	
76	5594652		1997-01-14	Penn et al.	
77	5592728		1997-01-14	Susnjara	
78	5583443		1996-12-10	McMurtry et al.	
79	5556240		1996-09-17	Almblad	
80	5555176		1996-09-10	Menhennett et al.	
81	5552992		1996-09-03	Hunter	
82	5545367		1996-08-13	Bae et al.	
83	5543103		1996-08-06	Hogan et al.	
84	5538374		1996-07-23	Cole et al.	
85	5515903		1996-05-14	Hronas et al.	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number	14162157
	Filing Date	2014-01-23
	First Named Inventor	Chester O.D. Thompson
	Art Unit	2665
	Examiner Name	Michelle M. Entezari
	Attorney Docket Number	16223-00274

	86	5503785		1996-04-02	Crump et al.	
	87	5497888		1996-03-12	Michaels et al.	
	88	5496138		1996-03-05	Drori	
	89	5485399		1996-01-16	Saigo et al.	
	90	5443339		1995-08-22	Heredia et al.	
	91	5441369		1995-08-15	Foscan et al.	
	92	5429202		1995-07-04	Millard et al.	
	93	5416591		1995-05-16	Yoshimura et al.	
	94	5393967		1995-02-28	Rice et al.	
	95	5382784		1995-01-17	Eberhardt	
	96	5365812		1994-11-22	Hamden	

**INFORMATION DISCLOSURE
STATEMENT BY APPLICANT**
(Not for submission under 37 CFR 1.99)

Application Number	14162157
Filing Date	2014-01-23
First Named Inventor	Chester O.D. Thompson
Art Unit	2665
Examiner Name	Michelle M. Entezari
Attorney Docket Number	16223-00274

97	5363463		1994-11-08	Kleinerman	
98	5360299		1994-11-01	Oliana	
99	5351409		1994-10-04	Heredia	
100	5330168		1994-07-19	Enomoto et al.	
101	D348393		1994-07-05	Neitzke et al.	
102	5314274		1994-05-24	Heredia et al.	
103	5311758		1994-05-17	Neitzke et al.	
104	5311756		1994-05-17	Villani	
105	5311286		1994-05-10	Pike	
106	5308360		1994-05-03	Neitzke et al.	
107	5307151		1994-04-26	Hof et al.	

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /M.M.E/

**INFORMATION DISCLOSURE
STATEMENT BY APPLICANT**
(Not for submission under 37 CFR 1.99)

Application Number	14162157
Filing Date	2014-01-23
First Named Inventor	Chester O.D. Thompson
Art Unit	2665
Examiner Name	Michelle M. Entezari
Attorney Docket Number	16223-00274

	108	5293687		1994-03-15	Willoughby, Jr. et al.	
	109	5271698		1993-12-21	Heredia et al.	
	110	5259708		1993-11-09	Brice	
	111	5255199		1993-10-19	Barkman et al.	
	112	5244321		1993-09-14	Sopko	
	113	5229619		1993-07-20	Van Amstel	
	114	5201203		1993-04-13	Almblad	
	115	5192469		1993-03-09	Smalley et al.	
	116	5171112		1992-12-15	Roland	
	117	5167171		1992-12-01	Heredia	
	118	5165315		1992-11-24	Terada	

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /M.M.E/

**INFORMATION DISCLOSURE
STATEMENT BY APPLICANT**
(Not for submission under 37 CFR 1.99)

Application Number	14162157
Filing Date	2014-01-23
First Named Inventor	Chester O.D. Thompson
Art Unit	2665
Examiner Name	Michelle M. Entezari
Attorney Docket Number	16223-00274

119	5146689		1992-09-15	Roland	
120	5144561		1992-09-01	Soper	
121	5139246		1992-08-18	Yakou	
122	5130064		1992-07-14	Smalley et al.	
123	5128531		1992-07-07	Fadel	
124	5127532		1992-07-07	Cimino et al.	
125	5122018		1992-06-16	Zion	
126	5119190		1992-06-02	Lemelson	
127	5111056		1992-05-05	Yoshimura et al.	
128	5096346		1992-03-17	Ueda	
129	5094538		1992-03-10	Reedman et al.	

**INFORMATION DISCLOSURE
STATEMENT BY APPLICANT**
(Not for submission under 37 CFR 1.99)

Application Number	14162157
Filing Date	2014-01-23
First Named Inventor	Chester O.D. Thompson
Art Unit	2665
Examiner Name	Michelle M. Entezari
Attorney Docket Number	16223-00274

	130	5088864		1992-02-18	Yanagida	
	131	5083759		1992-01-28	Pollak et al.	
	132	5058940		1991-10-22	Hart	
	133	5056204		1991-10-15	Bartschi	
	134	5043144		1991-08-27	Gordon et al.	
	135	5029459		1991-07-09	Almblad	
	136	4998349		1991-03-12	Killeen	
	137	4993291		1991-02-19	Sopko	
	138	4971489		1990-11-20	Womack	
	139	4969782		1990-11-13	Castain	
	140	4941335		1990-07-17	Allen	

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /M.M.E/

**INFORMATION DISCLOSURE
STATEMENT BY APPLICANT**
(Not for submission under 37 CFR 1.99)

Application Number	14162157
Filing Date	2014-01-23
First Named Inventor	Chester O.D. Thompson
Art Unit	2665
Examiner Name	Michelle M. Entezari
Attorney Docket Number	16223-00274

141	4929843		1990-05-29	Chmielewski, Jr. et al.	
142	4929129		1990-05-29	Dickson	
143	4909892		1990-03-20	Quinn et al.	
144	4899391		1990-02-06	Cimino et al.	
145	4898504		1990-02-06	Agius et al.	
146	4868559		1989-09-19	Pinnow	
147	4853866		1989-08-01	Andrada Galan et al.	
148	4848116		1989-07-18	Lizotte	
149	4845764		1989-07-04	Ueda et al.	
150	4839913		1989-06-13	Annis et al.	
151	4845764		1989-07-04	Ueda et al.	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number	14162157 - GAU: 2665 14162157
	Filing Date	2014-01-23
	First Named Inventor	Chester O.D. Thompson
	Art Unit	2665
	Examiner Name	Michelle M. Entezari
	Attorney Docket Number	16223-00274

	152	4821393		1989-04-18	Spigarelli	
	153	4821200		1989-04-11	Oberg	
	154	4809341		1989-02-28	Matsui et al.	
	155	4805224		1989-02-14	Koezuka et al.	
	156	4803371		1989-02-07	Durland	
	157	4783829		1988-11-08	Miyakawa et al.	
	158	4780032		1988-10-25	Uyeda et al.	
	159	4767110		1988-08-30	Yang	
	160	4741652		1988-05-03	Marchal	
	161	4717294		1988-01-05	Grasser	
	162	4710808		1987-12-01	Hoogenboom et al.	

**INFORMATION DISCLOSURE
STATEMENT BY APPLICANT**
(Not for submission under 37 CFR 1.99)

Application Number	14162157
Filing Date	2014-01-23
First Named Inventor	Chester O.D. Thompson
Art Unit	2665
Examiner Name	Michelle M. Entezari
Attorney Docket Number	16223-00274

163	4697300		1987-10-06	Warlop	
164	4687389		1987-08-18	Santii et al.	
165	4679331		1987-07-14	Koontz	
166	4677835		1987-07-07	Almblad	
167	4671711		1987-06-09	Steinbach et al.	
168	4666351		1987-05-19	Marchal	
169	4657448		1987-04-14	Alexander	
170	4656590		1987-04-07	Ace	
171	4653104		1987-03-24	Tamura	
172	4652765		1987-03-24	Nishihara	
173	4652738		1987-03-24	Nishihara et al.	

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /M.M.E/

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number	14162157 - GAU: 2665 14162157
	Filing Date	2014-01-23
	First Named Inventor	Chester O.D. Thompson
	Art Unit	2665
	Examiner Name	Michelle M. Entezari
	Attorney Docket Number	16223-00274

	174	4651604		1987-03-24	Almblad et al.	
	175	4648585		1987-03-10	Yang	
	176	4647028		1987-03-03	Yang	
	177	4638567		1987-01-27	Leversee	
	178	4625107		1986-11-25	Planke	
	179	4614465		1986-09-30	Wu	
	180	4601185		1986-07-22	Sheldon	
	181	4592683		1986-06-03	Wu	
	182	4562759		1986-01-07	Schmitt	
	183	4558215		1985-12-10	Kaneko et al.	
	184	4557488		1985-12-10	Litherland	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		14162157 - GAU: 2665 14162157	
	Filing Date		2014-01-23	
	First Named Inventor	Chester O.D. Thompson		
	Art Unit	2665		
	Examiner Name	Michelle M. Entezari		
	Attorney Docket Number	16223-00274		

	185	4553844		1985-11-19	Nakagawa et al.	
	186	4551046		1985-11-05	Kinas	
	187	4545569		1985-10-08	Schroder et al.	
	188	4541760		1985-09-17	Zoueki	
	189	4526498		1985-07-02	Fieldhouse	
	190	4525908		1985-07-02	Bernstein	
	191	4521142		1985-06-04	Juskevici	
	192	4479673		1984-10-30	Inaba et al.	
	193	4472056		1984-09-18	Nakagawa et al.	
	194	4468994		1984-09-04	Lieptz	
	195	4453432		1984-06-12	Widen	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		14162157 - GAU: 2665 14162157	
	Filing Date		2014-01-23	
	First Named Inventor	Chester O.D. Thompson		
	Art Unit	2665		
	Examiner Name	Michelle M. Entezari		
	Attorney Docket Number	16223-00274		

	196	4437150		1984-03-13	Dahlgren, Jr. et al.	
	197	4433487		1984-02-28	Roland	
	198	4432142		1984-02-21	Korsak	
	199	4426179		1984-01-17	Jefferson	
	200	4373414		1983-02-15	Agius	
	201	4359299		1982-11-16	Sagarian	
	202	4354780		1982-10-19	Bougiouris	
	203	4301373		1981-11-17	Sjodin	
	204	4300836		1981-11-17	Holmes, Jones F. et al.	
	205	4300170		1981-11-10	Sakamoto	
	206	4300042		1981-11-10	Oldenkamp et al.	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		14162157 - GAU: 2665 14162157	
	Filing Date		2014-01-23	
	First Named Inventor	Chester O.D. Thompson		
	Art Unit	2665		
	Examiner Name	Michelle M. Entezari		
	Attorney Docket Number	16223-00274		

	207	4294096		1981-10-13	Heimann	
	208	4283859		1981-08-18	Roland	
	209	4281379		1981-07-28	Austin	
	210	4256423		1981-03-17	Juskevic	
	211	4251173		1981-02-17	Saucedo	
	212	D257758		1981-01-06	Limacher	
	213	4233746		1980-11-18	Troillet	
	214	4223791		1980-09-23	Taggart	
	215	4188163		1980-02-12	Juskevic	
	216	4172632		1979-10-30	Holmes, Jr.	
	217	4171161		1979-10-16	Jung	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		14162157 - GAU: 2665	
	Filing Date		2014-01-23	
	First Named Inventor	Chester O.D. Thompson		
	Art Unit	2665		
	Examiner Name	Michelle M. Entezari		
	Attorney Docket Number	16223-00274		

	218	4166949		1979-09-04	Pold et al.	
	219	D251365		1979-03-20	Lipinski	
	220	4143582		1979-03-13	Heimann	
	221	4132151		1979-01-02	Weber	
	222	4121292		1978-10-17	Galanis et al.	
	223	4117763		1978-10-03	Uyeda	
	224	4105340		1978-08-08	Kempf	
	225	4092806		1978-06-06	Wich	
	226	4090303		1978-05-23	Uyeda	
	227	4088060		1978-05-09	Johns	
	228	4062261		1977-12-13	Stahl	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		14162157 - GAU: 2665
	Filing Date		2014-01-23
	First Named Inventor	Chester O.D. Thompson	
	Art Unit	2665	
	Examiner Name	Michelle M. Entezari	
	Attorney Docket Number	16223-00274	

	229	4051748		1977-10-04	Sherman	
	230	4023464		1977-05-17	Zion	
	231	4019415		1977-04-26	Wich	
	232	4012991		1977-03-22	Uyeda	
	233	3981214		1976-09-21	Wich	
	234	3978764		1976-09-07	Patriquin	
	235	3956968		1976-05-18	Crasnianski	
	236	3955179		1976-05-04	Planke	
	237	3945298		1976-03-23	Cockroft	
	238	3919920		1975-11-18	Schlage	
	239	3919589		1975-11-11	Hanak	

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /M.M.E/

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		14162157 - GAU: 2665	
	Filing Date		2014-01-23	
	First Named Inventor	Chester O.D. Thompson		
	Art Unit	2665		
	Examiner Name	Michelle M. Entezari		
	Attorney Docket Number	16223-00274		

	240	3902382		1975-09-02	Lieptz	
	241	3884121		1975-05-20	Agius	
	242	3880047		1975-04-29	Dosier	
	243	3870895		1975-03-11	Lax et al.	
	244	3865011		1975-02-11	Patriquin	
	245	3848235		1974-11-12	Lewis et al.	
	246	3826555		1974-07-30	Matsumoto	
	247	3810416		1974-05-14	Nelms, Jr.	
	248	3807276		1974-04-30	Oliver	
	249	3796130		1974-03-12	Gartner	
	250	3795174		1974-03-05	Oliver et al.	

**INFORMATION DISCLOSURE
STATEMENT BY APPLICANT**
(Not for submission under 37 CFR 1.99)

Application Number	14162157
Filing Date	2014-01-23
First Named Inventor	Chester O.D. Thompson
Art Unit	2665
Examiner Name	Michelle M. Entezari
Attorney Docket Number	16223-00274

251	3792639		1974-02-19	Richens et al.	
252	3773360		1973-11-20	Timbers	
253	3769865		1973-11-06	Kleist	
254	Re27665		1973-06-12	Spain	
255	3722341		1973-03-27	Hungerford, Jr. et al.	
256	3707999		1973-01-02	Coats	
257	3682041		1972-08-08	Essig	
258	3675536		1972-07-11	Hungerford, Jr. et al.	
259	3656402		1972-04-18	French	
260	3633451		1972-01-11	Lieptz	
261	3651573		1972-03-28	Kaplan	

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /M.M.E/

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		14162157 - GAU: 2665 14162157	
	Filing Date		2014-01-23	
	First Named Inventor		Chester O.D. Thompson	
	Art Unit		2665	
	Examiner Name		Michelle M. Entezari	
	Attorney Docket Number		16223-00274	

	262	3625111		1971-12-07	Carlo et al.	
	263	3602092		1971-08-31	Richens	
	264	3599147		1971-08-10	Rogers et al.	
	265	Re26848		1970-04-07	Simon	
	266	3499366		1970-03-10	Spain	
	267	3496636		1970-02-24	Lieptz	
	268	3466747		1969-09-16	Patriquin et al.	
	269	3457831		1969-07-29	Adler et al.	
	270	3442174		1969-05-06	Weiner et al.	
	271	3440906		1969-04-29	Allen	
	272	3430535		1969-03-04	Haggstrom	

EFS Web 2.1.17 ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /M.M.E/

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		14162157 - GAU: 2665 14162157	
	Filing Date		2014-01-23	
	First Named Inventor	Chester O.D. Thompson		
	Art Unit	2665		
	Examiner Name	Michelle M. Entezari		
	Attorney Docket Number	16223-00274		

	273	3429207		1969-02-25	John	
	274	3424056		1969-01-28	Stolove et al.	
	275	3418882		1968-12-31	Brand	
	276	3388619		1968-06-18	Schreiber et al.	
	277	3323420		1967-06-06	Roxburgh	
	278	3305100		1967-02-21	Barbee	
	279	3286597		1966-11-22	Schwartz	
	280	32856596		1966-11-22	Lieptz	
	281	3276328		1966-10-04	Schreiber et al.	
	282	3259022		1966-07-05	Vietorisz	
	283	3257908		1966-06-28	Haggstrom	

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /M.M.E/

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number	14162157
	Filing Date	2014-01-23
	First Named Inventor	Chester O.D. Thompson
	Art Unit	2665
	Examiner Name	Michelle M. Entezari
	Attorney Docket Number	16223-00274

	284	3245149		1966-04-12	Haggstrom	
	285	3172969		1965-03-09	Haggstrom	
	286	3138999		1964-06-30	Haggstrom	
	287	3094039		1963-06-18	Spain	
	288	3053149		1962-09-11	Rossetti	
	289	2940183		1960-06-14	Fromberg	
	290	2929177		1960-03-22	Sheps	
	291	2860884		1958-11-18	Sloan et al.	
	292	2728251		1955-12-27	Turner	
	293	2707335		1955-05-03	Falk	
	294	2645978		1953-07-21	Sejarto et al.	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		14162157 - GAU: 2665 14162157	
	Filing Date		2014-01-23	
	First Named Inventor	Chester O.D. Thompson		
	Art Unit	2665		
	Examiner Name	Michelle M. Entezari		
	Attorney Docket Number	16223-00274		

	295	2622485		1952-12-23	Martellotti	
	296	2605294		1952-07-29	Barnhart	
	297	2582012		1952-01-08	Currier	
	298	2556577		1951-06-12	Drake	
	299	2499124		1950-02-28	Zipp et al.	
	300	2445041		1948-07-13	Scholz	

If you wish to add additional U.S. Patent citation information please click the Add button.

Add

U.S.PATENT APPLICATION PUBLICATIONS

Remove

Examiner Initial*	Cite No	Publication Number	Kind Code ¹	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1					

If you wish to add additional U.S. Published Application citation information please click the Add button.

Add

FOREIGN PATENT DOCUMENTS

Remove

Examiner Initial*	Cite No	Foreign Document Number ³	Country Code ²	Kind Code ⁴	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T ⁵

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /M.M.E/

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		14162157 - GAU: 2665 14162157	
	Filing Date		2014-01-23	
	First Named Inventor		Chester O.D. Thompson	
	Art Unit		2665	
	Examiner Name		Michelle M. Entezari	
	Attorney Docket Number		16223-00274	

	1	DE2951065	DE		1981-07-02	F.I.M.A.T. Fabbrica Italiana Macchine Automatiche		☐
	2	EP1976656	EP		2014-10-29	Hy-Ko Products Company		☐
	3	EP0053730	EP		1981-10-31	Webb Service GmbH		☐
	4	EP0133091	EP		1985-02-13	Societe Anonyme H.K. France		☐
	5	EP0835720	EP		1998-04-15	Noran, S.L.		☐
	6	FR2499435	FR		1982-08-13	Firme August Borkey Nachfolger		☐
	7	GB2276106	GB		1994-09-21	Autokey (UK) Ltd.		☐
	8	H04-250911	JP		1992-09-07	Ishikawajima Harima Heavy Ind.		☐
	9	S63-311108	JP		1988-12-19	Kiki Kalihatsu Kogyo KK		☐
	10	S63-311109	JP		1988-12-19	Kiki Kalihatsu Kogyo KK		☐
	11	291113	MX		2007-01-23	Hy-Ko Products Company		☐

EFS Web 2.1.17 ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /M.M.E/

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number	14162157 - GAU: 2665 14162157
	Filing Date	2014-01-23
	First Named Inventor	Chester O.D. Thompson
	Art Unit	2665
	Examiner Name	Michelle M. Entezari
	Attorney Docket Number	16223-00274

	12	ES2017240	ES		1991-01-01	Areitio & Arteta Comunicad de		☐
	13	CH673612	CH		1990-03-30	Hans Zulliger		☐
	14	WO2012096685	WO		2012-07-19	Hy-Ko Products Company		☐
	15	WO2007087389	WO		2007-08-02	Hy-Ko Products Company		☐
	16	WO2005042196	WO		2005-05-12	Hy-Ko Products Company		☐
	17	WO200201480	WO		2002-01-03	Almblad, Robert E.		☐
	18	WO2001/057472	WO		2001-08-09	Machine Magic LLC		☐
	19	WO1996/19309	WO		1996-06-27	Almblad, Robert E.		☐
	20	WO1991/13535	WO		1991-09-05	ATS Automation Tooling Systems Inc.		☐
	21	WO1990/03867	WO		1990-04-19	Silca S.P.A.		☐
	22	JPS59201708	JP		1984-11-15	Tsugami Totsuki KK		☐

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /M.M.E/

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number	14162157 - GAU: 2665 14162157
	Filing Date	2014-01-23
	First Named Inventor	Chester O.D. Thompson
	Art Unit	2665
	Examiner Name	Michelle M. Entezari
	Attorney Docket Number	16223-00274

If you wish to add additional Foreign Patent Document citation information please click the Add button			Add
NON-PATENT LITERATURE DOCUMENTS			Remove
Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T ⁵
	1	Chinese Office Action, Application No. 200780009675.0, Hy-Ko Products Company, December 4 2009.	☐
	2	Chinese Office Action, Application No. 201080024166.7, Hy-Ko Products Company, December 6, 2013.	☐
	3	Chinese Office Action, Application No. 201080024166.7, Hy-Ko Products Company, September 30, 2014.	☐
	4	Chinese Office Action, Application No. 201080024163.3, Hy-Ko Products Company, August 1, 2013.	☐
	5	Supplementary European Search Report, Application No. 07709849.9 - 1702/ 1976656, Hy-Ko Products Company, May 15, 2013.	☐
	6	Extended European Search Report, Application No. 07709849.9 - 1702/ 1976656, Hy-Ko Products Company, April 26, 2013.	☐
	7	European Communication pursuant to Article 94(3) EPC, Application No. 10 770 489.2-1901, Hy-Ko Products, June 27, 2014.	☐
	8	Supplementary European Search Report, Application No. 10770489.2 - 1901/ 2424690, Hy-Ko Products, November 12, 2013.	☐
	9	Extended European Search Report, 10770489.2-1901 / 2424690, Hy-Ko Products, October 25, 2013.	☐

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /M.M.E/

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number	14162157 - GAU: 2665 14162157
	Filing Date	2014-01-23
	First Named Inventor	Chester O.D. Thompson
	Art Unit	2665
	Examiner Name	Michelle M. Entezari
	Attorney Docket Number	16223-00274

	10	European Communication pursuant to Article 94(3) EPC, Application No. 12 003 030.9 - 1702, Hy-Ko Products Company, March 20, 2014.	☐
	11	European Communication pursuant to Article 94(3) EPC, Application No. 12 003 030.9 - 1702, Hy-Ko Products Company, July 30, 2013.	☐
	12	Extended European Search Report, Application No. 12003030.9 - 2302, Hy-Ko Products Company, September 4, 2012.	☐
	13	European Communication pursuant to Article 94(3) EPC, Application No. 03 767 220.1 - 2201, Hy-Ko Products, August 18, 2010.	☐
	14	European Supplementary Search Report, Application No. 03767220.1 - 2201, Hy-Ko Products, July 18, 2007.	☐
	15	Mexican Office Action, Application No. MX/A/2011/011630, Hy-Ko Products, November 18, 2014.	☐
	16	Mexican Office Action, Application No. MX/A/2011/011630, Hy-Ko Products, April 28, 2014.	☐
	17	International Preliminary Report on Patentability, PCT/US2011/034564, Mutch, William R. et al., July 16, 2013.	☐
	18	International Search Report and the Written Opinion of the International Searching Authority, PCT/US2011/034564, Hy-Ko Products Company, July 15, 2011.	☐
	19	International Preliminary Report on Patentability, PCT/US2010/033414, Hy-Ko Products et al., November 1, 2011.	☐
	20	International Search Report and the Written Opinion of the International Searching Authority, PCT/US2010/033414, Hy-Ko Products, August 18, 2010.	☐

EFS Web 2.1.17 ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /M.M.E/

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number	14162157 - GAU: 2665 14162157
	Filing Date	2014-01-23
	First Named Inventor	Chester O.D. Thompson
	Art Unit	2665
	Examiner Name	Michelle M. Entezari
	Attorney Docket Number	16223-00274

21	International Preliminary Report on Patentability, PCT/US2007/002015, Hy-Ko Products Company, July 29, 2008.	☐
22	International Search Report and the Written Opinion of the International Searching Authority, PCT/US2007/02015, Hy-Ko Products Company, September 28, 2007.	☐
23	International Preliminary Report on Patentability, PCT/US2010/033421, Hy-Ko Products et al., November 1, 2011.	☐
24	International Search Report and the Written Opinion of the International Searching Authority, PCT/US2010/033421, Hy-Ko Products, September 17, 2010.	☐
25	Giuliani Productivity Through Flexibility, Multicode CCE-1, 2 pages.	☐
26	Giuliani Productivity Through Flexibility, Multicode CCE-2, 3 pages.	☐
27	FARZIN MOKHTARIAN and HIROSHI MURASE, Silhouette-Based Object Recognition through Curvature Scale Space, IEEE, Proceedings from Fourth International Conference on Computer Vision, 1993, pages 269-274.	☐
28	IHTISHAM KABIR, A Computer Vision System Using Fast, One Pass Algorithms, (Thesis), Graduate Division of the University of California, Davis, 1986 pages 1-164.	☐
29	ROGER D. QUINN et al., Design of an Agile Manufacturing Workcell for Light Mechanical Applications, April, 1996, pages 858 - 863, Proceedings from the 1996 IEEE International Conference on Robotics and Automation, Minneapolis, Minnesota.	☐
30	ANIL K. JAIN, Fundamentals of Digital Image Processing, Ch. 9, Image Analysis and Computer Vision, University of California, Davis, 1989, pages 342 - 430, Prentice Hall, Inc., Englewood Cliffs, NJ.	☐
31	AMIR NOVINI, Fundamentals of Machine Vision Lighting, IEEE, Proceedings of Northcon 93 Electrical and Electronics Convention, 1993, pages 38 - 46.	☐

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /M.M.E/

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number	14162157 - GAU: 2665 14162157
	Filing Date	2014-01-23
	First Named Inventor	Chester O.D. Thompson
	Art Unit	2665
	Examiner Name	Michelle M. Entezari
	Attorney Docket Number	16223-00274

32	WESLEY E. SNYDER, Industrial Robots Computer Interfacing and Control, Ch., 13 Computer Vision, North Carolina State University, 1985, pages, 248 - 283, Prentice-Hall, Inc., Englewood, NJ.	☐
33	European Search Report for European Patent Application No. 12 00 3030, dated August 27, 2012.	☐
34	International Preliminary Report on Patentability for International Patent Application No. PCT/US2011/034564, dated July 25, 2013.	☐
35		☐
36		☐

If you wish to add additional non-patent literature document citation information please click the Add button **Add**

EXAMINER SIGNATURE

Examiner Signature	/MICHELLE M ENTEZARI/	Date Considered	12/11/2015

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

¹ See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. ² Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). ³ For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. ⁴ Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. ⁵ Applicant is to place a check mark here if English language translation is attached.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /M.M.E/

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number	14162157 - GAU: 2665 14162157
	Filing Date	2014-01-23
	First Named Inventor	Chester O.D. Thompson
	Art Unit	2665
	Examiner Name	Michelle M. Entezari
	Attorney Docket Number	16223-00274

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

☐ That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

☐ See attached certification statement.

☒ The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☒ A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Mark J. Masterson/	Date (YYYY-MM-DD)	2015-10-29
Name/Print	Mark J. Masterson	Registration Number	71886

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these records.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Doc code: IDS

PTO/SB/08a (01-10)

Doc description: Information Disclosure Statement (IDS) Filed

Approved for use through 07/31/2012. OMB 0851-0031

U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		14162157
	Filing Date		2014-01-23
	First Named Inventor	Chester O.D. Thompson	
	Art Unit	2665	
	Examiner Name	Michelle M. Entezari	
	Attorney Docket Number	16223-00274	

U.S. PATENTS						Remove
Examiner Initial*	Cite No	Patent Number	Kind Code ¹	Issue Date	Name of Patentee or Applicant of cited Document	Pages, Columns, Lines where Relevant Passages or Relevant Figures Appear
	1	2430924		1947-11-18	Fowle et al.	
	2	2386816		1945-10-16	Scholz	
	3	2329269		1943-09-14	Jacobi	
	4	2325541		1943-07-27	Poole	
	5	2274012		1942-02-24	Swayze et al.	
	6	2176106		1939-10-17	Segal	
	7	2148668		1939-02-28	Yoskowitz et al.	
	8	2114597		1938-04-19	Goddard	

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /M.M.E/

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number	14162157 - GAU: 2665 14162157
	Filing Date	2014-01-23
	First Named Inventor	Chester O.D. Thompson
	Art Unit	2665
	Examiner Name	Michelle M. Entezari
	Attorney Docket Number	16223-00274

	9	21050099		1938-01-11	Schuyler	
	10	2098728		1937-11-09	McPhee	
	11	2038949		1936-04-28	Mintz	
	12	2032820		1936-03-03	Turrell	
	13	1991151		1935-02-12	Hansen	
	14	1978628		1934-10-30	Hansen	
	15	1961516		1934-06-05	Hansen	
	16	1948260		1934-02-20	Fowler	
	17	1923164		1933-08-22	Roos	
	18	1889461		1932-11-29	Hansen	
	19	1848046		1932-03-01	Caron	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		14162157 - GAU: 2665 14162157
	Filing Date		2014-01-23
	First Named Inventor	Chester O.D. Thompson	
	Art Unit	2665	
	Examiner Name	Michelle M. Entezari	
	Attorney Docket Number	16223-00274	

	20	1775921		1930-09-16	Williams	
	21	1752668		1930-04-01	Johnson	
	22	1750218		1930-03-11	Falk	
	23	1702488		1929-02-19	Baird	
	24	1674291		1928-06-19	Malone	
	25	1656295		1928-01-17	Schechter	
	26	1628637		1927-05-10	Shaw	
	27	1440459		1923-01-02	Greff	
	28	1390958		1921-09-13	Hulbert	
	29	1367280		1921-02-01	Reiges	
	30	1218653		1917-03-13	Heldrich	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		14162157 - GAU: 2665 14162157	
	Filing Date		2014-01-23	
	First Named Inventor		Chester O.D. Thompson	
	Art Unit		2665	
	Examiner Name		Michelle M. Entezari	
	Attorney Docket Number		16223-00274	

	31	1135676		1915-04-13	Engelbert	
	32	1081472		1913-12-16	Tucker	
	33	1059545		1913-04-22	Kunze	
	34	0943806		1909-12-21	Billings	
	35	0466044		1891-12-29	Jacobs	
	36	0288300		1883-11-13	Borowsky	
	37	0040480		1863-03-03	Hill	
	38	7890878		2011-02-15	Bass, et al.	

If you wish to add additional U.S. Patent citation information please click the Add button.

Add

U.S.PATENT APPLICATION PUBLICATIONS

Remove

Examiner Initial*	Cite No	Publication Number	Kind Code ¹	Publication Date	Name of Patentee or Applicant of cited Document	Pages, Columns, Lines where Relevant Passages or Relevant Figures Appear
	1	20110262240		2011-10-27	Mutch et al.	

EFS Web 2.1.17 ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /M.M.E/

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		14162157 - GAU: 2665 14162157	
	Filing Date		2014-01-23	
	First Named Inventor	Chester O.D. Thompson		
	Art Unit	2665		
	Examiner Name	Michelle M. Entezari		
	Attorney Docket Number	16223-00274		

	2	20090180664		2009-07-16	Efstathiades et al.	
	3	20090074528		2009-03-19	Hadad	
	4	20080252551		2008-10-16	Kubo et al.	
	5	20070234614		2007-10-11	Tarter et al.	
	6	20070224008		2007-09-27	Bass et al.	
	7	20060147289		2006-07-06	Gimelfarb et al.	
	8	20060003676		2006-01-05	Bernard et al.	
	9	20050216120		2005-09-29	Rosenberg et al.	
	10	20050000052		2005-01-06	Byles	
	11	20040253067		2004-12-16	Bosch	
	12	20040095380		2004-05-20	Bass et al.	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number	14162157 - GAU: 2665 14162157
	Filing Date	2014-01-23
	First Named Inventor	Chester O.D. Thompson
	Art Unit	2665
	Examiner Name	Michelle M. Entezari
	Attorney Docket Number	16223-00274

	13	20040036595		2004-02-26	Kenny et al.	
	14	20040024486		2004-02-05	Almblad et al.	
	15	20030205070		2003-11-06	Chaum	
	16	20030154135		2003-08-14	Covington et al.	
	17	20030145499		2003-08-07	Tarter et al.	
	18	20020191849		2002-12-19	Campbell et al.	
	19	20020168241		2002-11-14	David et al.	
	20	20020031251		2002-03-14	Campbell et al.	
	21	20010056385		2001-12-27	Timms et al.	
	22	20010033781		2001-10-25	Wills et al.	
	23	20080145163		2008-06-19	Freeman, et al.	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		14162157 - GAU: 2665	
	Filing Date		2014-01-23	
	First Named Inventor	Chester O.D. Thompson		
	Art Unit	2665		
	Examiner Name	Michelle M. Entezari		
	Attorney Docket Number	16223-00274		

If you wish to add additional U.S. Published Application citation information please click the Add button. **Add**

FOREIGN PATENT DOCUMENTS								Remove
Examiner Initial*	Cite No	Foreign Document Number ³	Country Code ²	Kind Code ⁴	Publication Date	Name of Patentee or Applicant of cited Document	Pages, Columns, Lines where Relevant Passages or Relevant Figures Appear	T ⁵
	1							☐

If you wish to add additional Foreign Patent Document citation information please click the Add button. **Add**

NON-PATENT LITERATURE DOCUMENTS			Remove
Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T ⁵
	1		☐

If you wish to add additional non-patent literature document citation information please click the Add button. **Add**

EXAMINER SIGNATURE			
Examiner Signature	/MICHELLE M ENTEZARI/		Date Considered 12/11/2015

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

¹ See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. ² Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). ³ For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. ⁴ Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. ⁵ Applicant is to place a check mark here if English language translation is attached.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number	14162157 - GAU: 2665 14162157
	Filing Date	2014-01-23
	First Named Inventor	Chester O.D. Thompson
	Art Unit	2665
	Examiner Name	Michelle M. Entezari
	Attorney Docket Number	16223-00274

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

☐ That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

☐ See attached certification statement.

☒ The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☒ A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Mark J. Masterson/	Date (YYYY-MM-DD)	2015-10-29
Name/Print	Mark J. Masterson	Registration Number	71886

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these records.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Search Notes 	Application/Control No. 14162157	Applicant(s)/Patent Under Reexamination THOMPSON ET AL.
	Examiner MICHELLE ENTEZARI	Art Unit 2665

CPC- SEARCHED		
Symbol	Date	Examiner
B23C2235/24	4/18/14	Entezari
B23C2235/28	4/18/14	Entezari
B23C2235/41	4/18/14	Entezari
B23C2235/44	4/18/14	Entezari
b23q33/00	4/18/14	Entezari
g06k2209/401	4/18/14	Entezari
g06k2209/40 (keyword limited)	4/18/14	Entezari
y10s83/917 (keyword limited)	4/18/14	Entezari

CPC COMBINATION SETS - SEARCHED		
Symbol	Date	Examiner

US CLASSIFICATION SEARCHED			
Class	Subclass	Date	Examiner
382	203, 205, 209, 110, 141, 305 (keyword limited)	4/18/14	Entezari
409	81-83 (keyword limited)	4/18/14	Entezari

SEARCH NOTES		
Search Notes	Date	Examiner
see EAST search, includes INV	4/18/14-4/21/14	Entezari
see updated EAST search	6/15/15	Entezari
see updated EAST search, includes IDS	12/11/15	Entezari

INTERFERENCE SEARCH			
US Class/ CPC Symbol	US Subclass / CPC Group	Date	Examiner

<i>Index of Claims</i> 	Application/Control No. 14162157	Applicant(s)/Patent Under Reexamination THOMPSON ET AL.
	Examiner MICHELLE ENTEZARI	Art Unit 2665

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

☐ Claims renumbered in the same order as presented by applicant
 ☐ CPA
 ☐ T.D.
 ☐ R.1.47

CLAIM		DATE									
Final	Original	04/21/2014	11/07/2014	06/15/2015	12/11/2015						
	1	✓	✓	✓	✓						
	2	✓	✓	✓	✓						
	3	✓	✓	✓	✓						
	4	✓	✓	✓	✓						
	5	✓	✓	✓	✓						
	6	✓	✓	✓	✓						
	7	✓	✓	✓	✓						
	8	✓	✓	✓	✓						
	9	✓	✓	✓	✓						
	10	✓	✓	✓	✓						
	11	✓	✓	✓	✓						
	12	✓	✓	✓	✓						
	13	✓	✓	-	✓						
	14	✓	✓	✓	✓						
	15	✓	O	O	O						
	16	✓	✓	✓	✓						
	17	✓	✓	✓	✓						
	18	✓	✓	✓	✓						
	19	✓	✓	✓	✓						
	20	✓	✓	✓	✓						
	21	✓	✓	✓	✓						
	22	✓	✓	✓	✓						
	23	✓	✓	✓	✓						
	24	✓	✓	✓	✓						
	25			✓	✓						
	26			✓	✓						
	27			✓	✓						

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	268	("0040480" "0288300" "0466044" "0943806" "1059545" "1081472" "1135676" "1218653" "1367280" "1390958" "1440459" "1628637" "1656295" "1674291" "1702488" "1750218" "1752668" "1775921" "1848046" "1889461" "1923164" "1948260" "1961516" "1978628" "1991151" "20010033781" "20010056385" "20020031251" "20020168241" "20020191849" "20030145499" "20030154135" "20030205070" "20040024486" "20040036595" "20040095380" "20040253067" "20050000052" "20050216120" "20060003676" "20060147289" "20070224008" "20070234614" "20080145163" "20080252551" "20090074528" "20090180664" "20110262240" "2032820" "2038949" "2098728" "21050099" "2114597" "2148668" "2176106" "2274012" "2325541" "2329269" "2386816" "2430924" "7890878" "2445041" "2499124" "2556577" "2582012" "2605294" "2622485" "2645978" "2707335" "2728251" "2860884" "2929177" "2940183" "3053149" "3094039" "3138999" "3172969" "3245149" "3257908" "3259022" "3276328" "32856596" "3286597" "3305100" "3323420" "3388619" "3418882" "3424056" "3429207" "3430535" "3440906" "3442174" "3457831" "3466747" "3496636" "3499366" "3599147" "3602092" "3625111" "3633451" "3651573" "3656402" "3675536" "3682041" "3707999" "3722341" "3769865" "3773360" "3792639" "3795174" "3796130" "3807276" "3810416" "3826555" "3848235" "3865011" "3870895" "3880047" "3884121" "3902382" "3919589" "3919920" "3945298" "3955179" "3956968" "3978764" "3981214" "4012991" "4019415" "4023464" "4051748" "4062261" "4088060" "4090303" "4092806" "4105340" "4117763" "4121292" "4132151" "4143582" "4166949" "4171161" "4172632" "4188163" "4223791" "4233746" "4251173" "4256423" "4281379"	US-PGPUB; USPAT	NEAR	OFF	2015/12/11 03:35

		"4283859"	"4294096"	"4300042"				
		"4300170"	"4300836"	"4301373"				
		"4354780"	"4359299"	"4373414"				
		"4426179"	"4432142"	"4433487"				
		"4437150"	"4453432"	"4468994"				
		"4472056"	"4479673"	"4521142"				
		"4525908"	"4526498"	"4541760"				
		"4545569"	"4551046"	"4553844"				
		"4557488"	"4558215"	"4562759"				
		"4592683"	"4601185"	"4614465"				
		"4625107"	"4638567"	"4652738"				
		"4647028"	"4648585"	"4651604"				
		"4652765"	"4653104"	"4656590"				
		"4657448"	"4666351"	"4671711"				
		"4677835"	"4679331"	"4687389"				
		"4697300"	"4710808"	"4717294"				
		"4741652"	"4767110"	"4780032"				
		"4783829"	"4803371"	"4805224"				
		"4809341"	"4821200"	"4821393"				
		"4839913"	"4845764"	"4848116"				
		"4853866"	"4868559"	"4898504"				
		"4899391"	"4909892"	"4929129"				
		"4929843"	"4941335"	"4969782"				
		"4971489"	"4993291"	"4998349"				
		"5029459"	"5043144"	"5056204"				
		"5058940"	"5083759"	"5088864"				
		"5094538"	"5096346"	"5111056"				
		"5119190"	"5122018"	"5127532"				
		"5128531"	"5130064"	"5139246"				
		"5144561"	"5146689"	"5165315"				
		"5167171"	"5171112"	"5192469"				
		"5201203"	"5229619"	"5244321"				
		"5255199"	"5259708"	"5271698"				
		"5293687"	"5307151"	"5308360"				
		"5311286"	"5311756"	"5311758"				
		"5314274"	"5330168"	"5351409"				
		"5360299"	"5363463"	"5365812"				
		"5382784"	"5393967"	"5416591"				
		"5429202"	"5441369"	"5443339"				
		"5485399"	"5496138"	"5497888"				
		"5503785").PN.						
L2	89	("5515903"	"5538374"	"5543103"	US- PGPUB; USPAT	NEAR	OFF	2015/12/11 03:35
		"5545367"	"5552992"	"5555176"				
		"5556240"	"5583443"	"5592728"				
		"5594652"	"5607267"	"5617323"				
		"5630332"	"5660509"	"5671523"				
		"5676504"	"5677522"	"5711643"				
		"5739766"	"5764156"	"5771176"				
		"5807042"	"5855836"	"5886775"				
		"5906365"	"5908273"	"5926388"				
		"5940229"	"5964554"	"5966457"				
		"5982491"	"5984597"	"5997224"				
		"5997795"	"6053677"	"6059495"				
		"6064747"	"6065911"	"6082580"				
		"6094953"	"6152662"	"6175638"				
		"6179531"	"6185311"	"6186711"				
		"6243960"	"6321430"	"6406227"				
		"6415931"	"6449381"	"6478515"				
		"6543972"	"6588995"	"6602030"				
		"6612142"	"6641339"	"6647308"				
		"6687565"	"6711557"	"6801829"				
		"6817814"	"6836553"	"6839449"				
		"6839451"	"6895100"	"6959862"				
		"6965911"	"7010498"	"7111894"				

EAST Search History

"7114436"	"7114894"	"7163364"					
"7214011"	"7484446"	"7643685"					
"7891919"	"7918629"	"8128322"					
"8532809"	"8585029"	"8634655"					
"8644619"	"D251365"	"D257758"					
"D348393"	"D455104"	"RE35518"					
"Re26848"	"Re27665")	.PN.					

EAST Search History (Interference)

< This search history is empty >

12/ 11/ 2015 3:38:01 AM
C:\ Users\ mentezari\ Documents\ EAST\ Workspaces\ 14_162_157.wsp

UNITED STATES PATENT AND TRADEMARK OFFICE
COMMISSIONER FOR PATENTS
P.O.BOX 1450
ALEXANDRIA VA 22313-1451

PRESORTED
FIRST-CLASS MAIL
U.S. POSTAGE PAID
POSTEDIGITAL
NNNNN

MCDONALD HOPKINS LLC
600 Superior Avenue, East
Suite 2100
CLEVELAND, OH 44114-2653



**Courtesy Reminder for
Application Serial No: 14/162,157**

Attorney Docket No: 16223-00274

Customer Number: 33772

Date of Electronic Notification: 12/17/2015

This is a courtesy reminder that new correspondence is available for this application. If you have not done so already, please review the correspondence. The official date of notification of the outgoing correspondence will be indicated on the form PTOL-90 accompanying the correspondence.

An email notification regarding the correspondence was sent to the following email address(es) associated with your customer number:

ipmailbox@mcdonaldhopkins.com

To view your correspondence online or update your email addresses, please visit us anytime at <https://sportal.uspto.gov/secure/myportal/privatepair>. If you have any questions, please email the Electronic Business Center (EBC) at EBC@uspto.gov or call 1-866-217-9197.

Doc code: RCEX

PTO/SB/30EFS (07-14)

Doc description: Request for Continued Examination (RCE)

Approved for use through 07/31/2016. OMB 0651-0031

U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

REQUEST FOR CONTINUED EXAMINATION(RCE)TRANSMITTAL **(Submitted Only via EFS-Web)**

Application Number	14162157	Filing Date	2014-01-23	Docket Number (if applicable)	16223-00274	Art Unit	2665
First Named Inventor	CHESTER O.D. THOMPSON			Examiner Name	MICHELLE M. ENTEZARI		

This is a Request for Continued Examination (RCE) under 37 CFR 1.114 of the above-identified application.

Request for Continued Examination (RCE) practice under 37 CFR 1.114 does not apply to any utility or plant application filed prior to June 8, 1995, to any international application that does not comply with the requirements of 35 U.S.C. 371, or to any design application. The Instruction Sheet for this form is located at WWW.USPTO.GOV.

SUBMISSION REQUIRED UNDER 37 CFR 1.114

Note: If the RCE is proper, any previously filed unentered amendments and amendments enclosed with the RCE will be entered in the order in which they were filed unless applicant instructs otherwise. If applicant does not wish to have any previously filed unentered amendment(s) entered, applicant must request non-entry of such amendment(s).

☐ Previously submitted. If a final Office action is outstanding, any amendments filed after the final Office action may be considered as a submission even if this box is not checked.

☐ Consider the arguments in the Appeal Brief or Reply Brief previously filed on _____

☐ Other _____

☒ Enclosed

☒ Amendment/Reply

☐ Information Disclosure Statement (IDS)

☐ Affidavit(s)/ Declaration(s)

☐ Other _____

MISCELLANEOUS

☐ Suspension of action on the above-identified application is requested under 37 CFR 1.103(c) for a period of months _____
 (Period of suspension shall not exceed 3 months; Fee under 37 CFR 1.17(i) required)

☐ Other _____

FEES

The RCE fee under 37 CFR 1.17(e) is required by 37 CFR 1.114 when the RCE is filed.

☒ The Director is hereby authorized to charge any underpayment of fees, or credit any overpayments, to
 Deposit Account No 130265

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT REQUIRED

☒ Patent Practitioner Signature

Applicant Signature

Doc code: RCEX

Doc description: Request for Continued Examination (RCE)

PTO/SB/30EFS (07-14)

Approved for use through 07/31/2016. OMB 0651-0031

U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Signature of Registered U.S. Patent Practitioner			
Signature	Mark J. Masterson/	Date (YYYY-MM-DD)	2016-06-17
Name	Mark J. Masterson	Registration Number	71886

This collection of information is required by 37 CFR 1.114. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450.

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these records.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

PATENT APPLICATION

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application: Chester O.D. Thompson et al. Art Unit: 2665
Serial No.: 14/162,157 Examiner: Michelle M. Entezari
Filing Date: January 23, 2014 Docket No.: 16223-00274
Title: KEY BLANK IDENTIFICATION SYSTEM WITH GROOVE SCANNING

Mail Stop RCE
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

TRANSMITTAL FOR REQUEST FOR CONTINUED EXAMINATION

Enclosed please find a second Request for Continued Examination (RCE) under 37 CFR 1.114 for the above-identified application. Applicant requests that the USPTO charge our deposit account no. 13-0265 \$850.00 for the fee. In the event additional fees are deemed to be due, please charge our Deposit Account No. 13-0265.

Respectfully submitted,

Date: June 17, 2016

/Mark J. Masterson/
Mark J. Masterson
Reg. No. 71,886
McDonald Hopkins LLC
600 Superior Avenue, E.
Suite 2100
Cleveland, OH 44114-2653
(216) 348-5427

PATENT APPLICATION

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application: Chester O.D. Thompson et al. Art Unit: 2665
Serial No.: 14/162,157 Examiner: Michelle M. Entezari
Filing Date: January 23, 2014 Docket No.: 16223-00274
Title: KEY BLANK IDENTIFICATION SYSTEM WITH GROOVE SCANNING

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

RESPONSE TO OFFICE ACTION

Applicants acknowledge receipt of the December 17, 2015 Office Action. As this response is electronically filed on June 17, 2016, along with a request for a three-month extension and the appropriate fee, Applicants believe no additional fees are due. However, if any additional fees are required for this Response, please charge such fees to our Deposit Account No. 13-0265.

CLAIMS

What is claimed is:

1. (Previously Presented) A key identification system comprising:

an imaging system including a camera configured to capture an image of the tip of a master key, wherein said image includes a contour;

a logic configured to analyze said captured image to determine characteristics of said contour and compare said characteristics with characteristics of known key blanks to determine the likelihood of a match between said master key and a known key blank; and

one or more mirrors positioned to allow said camera to capture two or more views of the master key wherein said characteristics of said contour are determined based on image data from at least said two or more views of said master key wherein at least one said view is substantially a tip end view, and wherein said logic calculates the geometry of the contour based on data from at least said two or more views of said master key.
2. (Original) The key identification system of claim 1, wherein said logic includes a database containing data related to characteristics of grooves of known key blanks.
3. (Original) The key identification system of claim 1, wherein said imaging system includes a reflecting device.
4. (Previously Presented) The key identification system of claim 3, wherein said imaging system includes a light.
5. (Original) The key identification system of claim 4, wherein said light is directed toward said reflecting device.
6. (Original) The key identification system of claim 5, wherein said light includes a shield

to direct light away from said master key.

7. (Original) The key identification system of claim 1, wherein said captured image is a digital image.

8. (Original) The key identification system of claim 1, wherein said captured image comprises a silhouette of said tip of said master key.

9. (Original) The key identification system of claim 1, wherein said logic accounts for rolling of said master key with respect to said imaging system to determine characteristics of said contour.

10. (Original) The key identification system of claim 1, wherein said logic accounts for tilting of said master key with respect to said imaging system to determine characteristics of said contour.

11. (Original) The key identification system of claim 1, wherein said logic accounts for tipping of said master key with respect to said imaging system to determine characteristics of said contour.

12. (Original) The key identification system of claim 1, wherein said captured image comprises a silhouette of the blade of said master key.

13. (Canceled)

14. (Previously Presented) The key identification system of claim 1, wherein said logic calculates the geometry of the contour as seen from a view of the tip parallel to the blade based on data from at least said two or more views of said master key.

15. (Previously Presented) The key identification system of claim 1, wherein said logic calculates the geometry of the contour as though the tip were squarely cut based on data from at least said two or more views of said master key.

16. (Original) The key identification system of claim 1 further comprising a key holder configured to hold said master key.
17. (Original) The key identification system of claim 16, wherein said key holder includes a lower support.
18. (Original) The key identification system of claim 16, wherein said key holder includes an upper door.
19. (Original) The key identification system of claim 16, wherein said key holder includes a clamp.
20. (Original) The key identification system of claim 1, wherein one of said views of said master key includes a view from above the master key blade of a groove in the bottom of said blade.
21. (Previously Presented) The key identification system of claim 1, wherein one of said views of said master key includes a view from an angle between perpendicular and parallel to the blade of said master key and not including perpendicular or parallel to the blade of said master key.
22. (Previously Presented) The key identification system of claim 1, wherein the captured image of said tip includes a contour of a groove in said master key.
23. (Previously Presented) The key identification system of claim 1, wherein the logic is configured to shift data related to said characteristics of said contour to compare with said known key blank characteristics.
24. (Original) The key identification system of claim 1, wherein said logic includes a tolerance range for each characteristic of said master key to determine whether a master key passes or fails to match a known key blank.

25. (Previously Presented) A key identification system comprising:

an imaging system including a camera in a first position configured to directly capture at least one image of one side of a master key, wherein said image includes a contour;

at least one mirror positioned to allow said camera to capture at least one image of a second side of a master key from a second position wherein the second position is from a different angle than the first position, wherein the image from the second angle is substantially a tip end view; and

a logic configured to analyze said captured images to determine characteristics of said contour and compare said characteristics with characteristics of known key blanks to determine the likelihood of a match between said master key and a known key blank.

26. (Previously Presented) The key identification system of claim 25, wherein the at least one mirror is configured to allow the camera to capture one image with multiple views of the master key from different angles.

27. (Previously Presented) A key identification system comprising:

an imaging system including a camera configured to capture an image of a master key, the image includes a first view and a second view;

a first mirror positioned at a first position to allow said camera to capture the first view of the master key wherein the first view is a substantial tip end view, at least one second mirror positioned at a second position to allow said camera to capture a second view of the master key, wherein the first view is from a different angle than the second view; and

a logic configured to analyze said captured image to determine characteristics of said contour and compare said characteristics with characteristics of known key blanks to determine the likelihood of a match between said master key and a known key blank.

REMARKS

In the December 17, 2015 Office Action, claims 1-8, 12, 14, 16-20, and 24-27 stand rejected under 35 U.S.C. 103 as unpatentable over U.S. Publication No. 20020191849 to Campbell et al. (“Campbell”) in view of U.S. Patent Publication No. 20100059484 to Inoue et al. (“Inoue”) in view of U.S. Patent Publication No. 20100110380 to Allred et al. (“Allred”).

Claim 9 stands rejected under 35 U.S.C. 103 as unpatentable over Campbell, Inoue, and Allred in further view of U.S. Patent No. 7,643,685 to Miller et al. (“Miller”).

Claims 10, 11, and 22 stand rejected under 35 U.S.C. 103 as unpatentable over Campbell, Inoue, and Allred in further view of U.S. Patent No. 6,065,911 to Almblad (“Almblad”).

Claim 23 stands rejected under 35 U.S.C. 103 as unpatentable over Campbell, Inoue, and Allred in further view of U.S. Publication No 20060147289 to Gimelfarb et al. (“Gimelfarb”).

Claim 15 stands objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

The following remarks address each of these issues and place the present application in condition for allowance.

I. Campbell Does Not Teach to Provide A Tip End View of A Master Key

The Office Action relies on the combination of Campbell with Inoue and Allred to reject the recited features of Independent claims 1, 25, and 27. The Office Action states that Campbell indicates taking an image of a whole key ([0055]), therefore, Campbell discloses taking at least a tip end view.

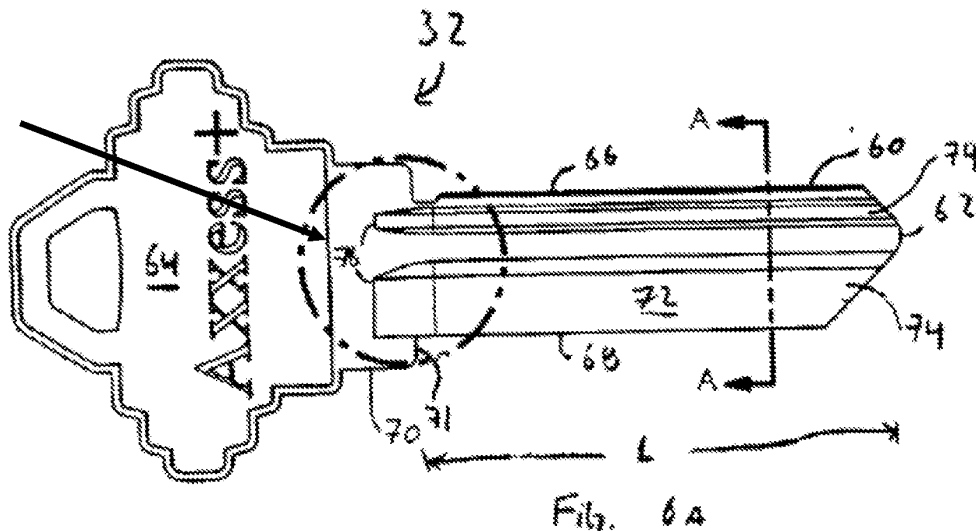
Applicants respectfully traverses this conclusion. In particular, paragraph [0055] of

Campbell merely states that:

The dual receiver embodiment can provide for a more compact key identification system. Because the viewing area of the two receivers can be combined to form a complete image of the master key, the distance between the master key and the two receivers can be reduced to less than that required by a single receiver to capture the entire image of the master key. Thus, the height of the identification system may be reduced by employing an additional receiver.

Paragraph [0055] of Campbell.

However, Campbell actually describes only taking a side view image of a key while the key is placed on a lamination surface. In particular, Campbell is directed to capturing images of the key that exhibits views of a milling exit shape 76 that exist on the side of the key by the head 64. See Figures 6a, 7a, 8a, and 11a-11d. See milling exit shape 76 within the circled area from Figure 6A of Campbell below:



The milling exit pattern 76 is described to be formed on the shoulder area 70 and head 64. See paragraph [0037]. The milling exit shape 76 is identified by a viewpoint that could only be taken from a side view or image of the key as the milling exit shape 76 is positioned between the blade 72 and head 64 of a key.

Further, Campbell careful to point out the specific orientation of the receiver 28 relative to the luminous surfaces 26 and the master key 32 as to prevent “hot spots” or glare. See paragraph [0039]. The figures and descriptions of Campbell specifically describe and illustrate that an image taken of the master key is from the side only. Further, the description of the method for determining or ranking a key blank match indicate that the images of the master key could only be images taken from the side. It is not practical to capture views of a milling exit shape 76, head or shoulder of a master key 32 from a tip end view as claimed.

Therefore, Campbell does not teach a key identification system configured to capture a substantial tip end view as recited by the claims. Inuoe and Allred fail make up for the deficiencies of Campbell. Thus, it is respectfully submitted that claim 1 and claims 2-12, and 14-24 dependent therefrom as well as claims 25 and 27 are now in condition for allowance.

II. Campbell Cannot be Combined with Inuoe As It Would Fail to Function in Accordance with it's Intended Purpose

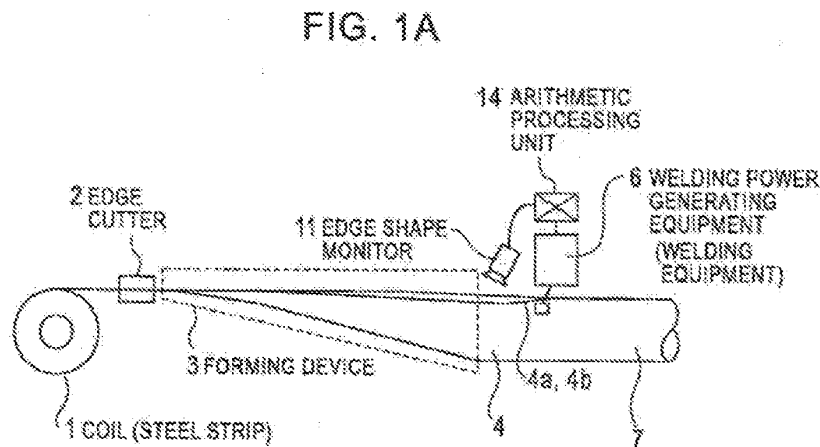
The Office Action relies on the combination of Campbell with Inuoe and Allred to reject the recited features of Independent claims 1, 25, and 27. Applicant respectfully submits that the combination of Campbell with Inuoe would frustrate of purpose of the system described by Campbell.

MPEP § 2143.01(V) states “[i]f proposed modification would render the prior art invention being modified unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification. *In re Gordon*, 733 F.2d 900, 221 USPQ 1125 (Fed. Cir. 1984). If the proposed modification or combination of the prior art would change the principle of operation of the prior art invention being modified, then the teachings of the

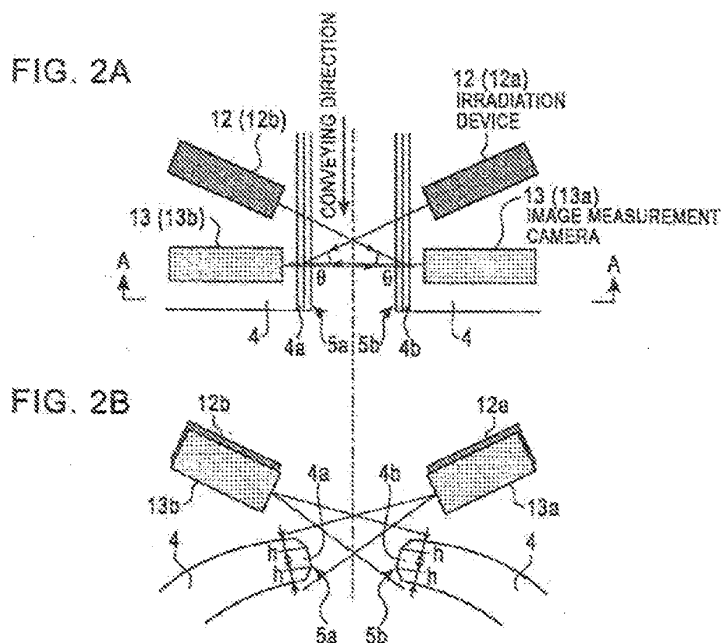
references are not sufficient to render the claims *prima facie* obvious. *In re Ratti*, 270 F.2d 810, 123 USPQ 349 (CCPA 1959)

In the present case, the Office Action relies on Campbell for teaching a key identification system with an imaging system including a camera for taking an image of the tip of a master key. The Office Action relies on Inoue to teach capturing two or more views of the master key wherein said characteristics of said contour are determined based on image data from at least said two or more views of said master key, and wherein said logic calculates the geometry of the contour based on data from at least two or more views of said master key.

However, Inoue is actually directed to a method of welding steel pipe. See Figure 1A of Inoue:



Here, steel is processed from a coil into a cylindrical pipe. The edge shape monitor 11 uses image measurement cameras 13a, 13b and irradiation devices 12a, 12b to capture the images of the ends of pipe that are to be welded together while the steel material is moving along the conveying direction. See Figure 2A and 2B below:



The devices 12a, 12b, 13a, 13b measure groove heights h to adjust the welding electric power from the welding power generating equipment. See paragraph [0055]-[0057]. In particular, Inoue states that the optimum welding electric power is calculated on the basis for the measurement result of the groove height h and a measurement result of a quality of oxide at the welded portion. See paragraph [0057].

The system of Inuoe could not be combined with Campbell for at least three reasons.

First, Campbell teaches specifically, “there is a need for improved key identification system that (1) has a reduced number of moving parts. See Paragraph [0011] (emphasis added). Clearly, Campbell’s system identified that there was a problem with moving parts in prior key identification systems and attempted to provide a solution that reduces the amount of moving parts. Inuoe includes a substantial amount of moving parts as the steel work piece that is being imaged is moving along a conveyor direction. This alone would certainly deter one skilled in the art of key duplication from combining Inuoe to Campbell.

Second, if a user attempting to scan a master key in the Campbell housing were moving the master key while it is being scanned, the resulting image is likely to be blurry. The resulting blurry image would most likely be insufficient to identify a potential matching key blank. Key scanning devices require a level of precision to allow the specific shapes of the master key to be identified and processed. The devices of Inuoe are not subject to such strict precision. Thus, the resulting system would produce blurry images unsuitable for its intended purpose (ie. to identify a matching key blank).

Third, Campbell requires backlighting to properly image the key and Inuoe's system is configured such that backlighting of the pipe is not provided or practical. More particularly, the housing 22 of Campbell requires the key 32 to be positioned on or over the first luminous surface. The light emitted from the first luminous surface will back light the master key 32 to outline the profile of the master key and reveal the shape and size of the head and shoulder of the key. See Campbell paragraph [0044]. In Inuoe, the measurement cameras 13a, 13b and irradiation devices 12a, 12b are aligned along a common direction relative to each other and edge of the steal pipe. See Figure 2A and 2B. The angle of the devices 12a, 12b, 13a, 13b are configured merely to determine the height h along the pipe and backlighting is not practical or available. Without backlighting, Campbell would be unable to produce an image that would reveal the outline profile of the master key.

For at least these reasons, one skilled in the art would not look to combine Inuoe with Campbell to teach the subject matter of independent claims 1, 25 and 27 as the combination would ultimately cause Campbell to fail to work in accordance with its intended purpose. Thus, it is respectfully submitted that claim 1 and claims 2-12, and 14-24 dependent therefrom as well as claims 25 and 27 are now in condition for allowance.

Insufficient Rationale

The Office Action rejected the claims as obvious in view of various prior art references but failed to include a proper explanation in support of the rejections. The MPEP § 2143 states that “[t]he key to supporting any rejection under 35 U.S.C. 103 is the clear articulation of the reason(s) why the claimed invention would have been obvious. The Supreme Court in KSR noted that the analysis supporting a rejection under 35 U.S.C. 103 should be made explicit” (emphasis added). According to MPEP § 2143, rationales that may support a conclusion of obviousness include:

- (A) Combining prior art elements according to known methods to yield predictable results;
- (B) Simple substitution of one known element for another to obtain predictable results;
- (C) Use of known technique to improve similar devices (methods, or products) in the same way;
- (D) Applying a known technique to a known device (method, or product) ready for improvement to yield predictable results;
- (E) "Obvious to try" - choosing from a finite number of identified, predictable solutions, with a reasonable expectation of success;
- (F) Known work in one field of endeavor may prompt variations of it for use in either the same field or a different one based on design incentives or other market forces if the variations are predictable to one of ordinary skill in the art;
- (G) Some teaching, suggestion, or motivation in the prior art that would have led one of ordinary skill to modify the prior art reference or to combine prior art reference teachings to arrive at the claimed invention.

While the above is not an all-inclusive list, the MPEP requires that some rationale be provided in order to support a conclusion of obviousness. In this case, not only has the Office Action failed to present one or more of the above-listed rationales, the Office Action has failed to present any type of rationale. In particular, the rejection lacks a clear articulation of the reasons why these features would allegedly have been obvious and, therefore, the rejection cannot be supported per the requirements set forth by the United States Supreme Court in the

KSR decision. Thus, it is respectfully submitted that the rejection is improper and must be withdrawn. Further, because the Office Action failed to establish a prima facie case of obviousness, any rejection in a subsequent Office Action providing adequate reasoning(s) would be presented for the first time on the record, and, as such, a subsequent Office Action cannot be made final.

CONCLUSION

In light of the foregoing, Applicants submit that the application is now in condition for allowance. If the Examiner has any questions pertaining to the above, then the undersigned attorney would welcome a phone call to provide any further clarification or a formal interview.

Respectfully submitted,

Date: June 17, 2016

/Mark J. Masterson/
Mark J. Masterson
Reg. No. 71,886
McDonald Hopkins LLC
600 Superior Avenue, E.
Suite 2100
Cleveland, OH 44114-2653
216-348-5427

Electronic Patent Application Fee Transmittal				
Application Number:		14162157		
Filing Date:		23-Jan-2014		
Title of Invention:		KEY BLANK IDENTIFICATION SYSTEM WITH GROOVE SCANNING		
First Named Inventor/Applicant Name:		Chester O.D. Thompson		
Filer:		Mark Jason Masterson/danielle mueller		
Attorney Docket Number:		16223-00274		
Filed as Small Entity				
Filing Fees for Utility under 35 USC 111(a)				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Extension - 3 months with \$0 paid	2253	1	700	700
Miscellaneous:				
RCE- 2nd and Subsequent Request	2820	1	850	850
Total in USD (\$)				1550

Electronic Acknowledgement Receipt	
EFS ID:	26101248
Application Number:	14162157
International Application Number:	
Confirmation Number:	5914
Title of Invention:	KEY BLANK IDENTIFICATION SYSTEM WITH GROOVE SCANNING
First Named Inventor/Applicant Name:	Chester O.D. Thompson
Customer Number:	33772
Filer:	Mark Jason Masterson/danielle mueller
Filer Authorized By:	Mark Jason Masterson
Attorney Docket Number:	16223-00274
Receipt Date:	17-JUN-2016
Filing Date:	23-JAN-2014
Time Stamp:	15:28:52
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	\$1550
RAM confirmation Number	2046
Deposit Account	130265
Authorized User	MUELLER, DANIELLE
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:	

File Listing:					
Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Request for Continued Examination (RCE)	6179742.pdf	1363798	no	3
			5d1a00da888406198b9621db8c67ca87dd0283bf		
Warnings:					
Information:					
2		6180891.pdf	876265	yes	14
			0ee135e0f75d6119b4204a7d899e18dc30bfffbb		
	Multipart Description/PDF files in .zip description				
	Document Description		Start	End	
	Request for Continued Examination (RCE)		1	1	
	Amendment Submitted/Entered with Filing of CPA/RCE		2	2	
	Claims		3	6	
	Applicant Arguments/Remarks Made in an Amendment		7	14	
Warnings:					
Information:					
3	Fee Worksheet (SB06)	fee-info.pdf	32481	no	2
			46d01bd5f12e366e997641ca1056b85153e5f990		
Warnings:					
Information:					
Total Files Size (in bytes):			2272544		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

PATENT APPLICATION FEE DETERMINATION RECORD				Application or Docket Number		Filing Date		☐ To be Mailed	
Substitute for Form PTO-875				14/162,157		01/23/2014			
ENTITY: ☐ LARGE ☒ SMALL ☐ MICRO									
APPLICATION AS FILED – PART I									
(Column 1)		(Column 2)							
FOR	NUMBER FILED	NUMBER EXTRA		RATE (\$)		FEE (\$)			
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A		N/A					
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A		N/A					
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A		N/A					
TOTAL CLAIMS (37 CFR 1.16(j))	minus 20 =	*		X \$ =					
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*		X \$ =					
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$310 (\$155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).								
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))									
* If the difference in column 1 is less than zero, enter "0" in column 2.				TOTAL					
APPLICATION AS AMENDED – PART II									
(Column 1)		(Column 2)		(Column 3)					
AMENDMENT	06/17/2016	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE (\$)		ADDITIONAL FEE (\$)	
	Total (37 CFR 1.16(i))	* 26	Minus	** 26	= 0	X \$40 =		0	
	Independent (37 CFR 1.16(h))	* 3	Minus	***3	= 0	X \$210 =		0	
	☐ Application Size Fee (37 CFR 1.16(s))								
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))								
						TOTAL ADD'L FEE		0	
(Column 1)		(Column 2)		(Column 3)					
AMENDMENT		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE (\$)		ADDITIONAL FEE (\$)	
	Total (37 CFR 1.16(i))	*	Minus	**	=	X \$ =			
	Independent (37 CFR 1.16(h))	*	Minus	***	=	X \$ =			
	☐ Application Size Fee (37 CFR 1.16(s))								
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))								
						TOTAL ADD'L FEE			
* If the entry in column 1 is less than the entry in column 2, write "0" in column 3. ** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20". *** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3". The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.									

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

NOTICE OF ALLOWANCE AND FEE(S) DUE

33772 7590 07/27/2016
MCDONALD HOPKINS LLC
600 Superior Avenue, East
Suite 2100
CLEVELAND, OH 44114-2653

EXAMINER

ENTEZARI, MICHELLE M

ART UNIT

PAPER NUMBER

2665

DATE MAILED: 07/27/2016

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/162,157	01/23/2014	Chester O.D. Thompson	16223-00274	5914

TITLE OF INVENTION: KEY BLANK IDENTIFICATION SYSTEM WITH GROOVE SCANNING

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	SMALL	\$480	\$0	\$0	\$480	10/27/2016

THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED. THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.

THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE DOES NOT REFLECT A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE IN THIS APPLICATION. IF AN ISSUE FEE HAS PREVIOUSLY BEEN PAID IN THIS APPLICATION (AS SHOWN ABOVE), THE RETURN OF PART B OF THIS FORM WILL BE CONSIDERED A REQUEST TO REAPPLY THE PREVIOUSLY PAID ISSUE FEE TOWARD THE ISSUE FEE NOW DUE.

HOW TO REPLY TO THIS NOTICE:

I. Review the ENTITY STATUS shown above. If the ENTITY STATUS is shown as SMALL or MICRO, verify whether entitlement to that entity status still applies.

If the ENTITY STATUS is the same as shown above, pay the TOTAL FEE(S) DUE shown above.

If the ENTITY STATUS is changed from that shown above, on PART B - FEE(S) TRANSMITTAL, complete section number 5 titled "Change in Entity Status (from status indicated above)".

For purposes of this notice, small entity fees are 1/2 the amount of undiscounted fees, and micro entity fees are 1/2 the amount of small entity fees.

II. PART B - FEE(S) TRANSMITTAL, or its equivalent, must be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed and an extra copy of the form should be submitted. If an equivalent of Part B is filed, a request to reapply a previously paid issue fee must be clearly made, and delays in processing may occur due to the difficulty in recognizing the paper as an equivalent of Part B.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

IMPORTANT REMINDER: Utility patents issuing on applications filed on or after Dec. 12, 1980 may require payment of maintenance fees. It is patentee's responsibility to ensure timely payment of maintenance fees when due.

PART B - FEE(S) TRANSMITTAL

**Complete and send this form, together with applicable fee(s), to: Mail Mail Stop ISSUE FEE
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450
or Fax (571)-273-2885**

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

33772 7590 07/27/2016
MCDONALD HOPKINS LLC
600 Superior Avenue, East
Suite 2100
CLEVELAND, OH 44114-2653

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

(Depositor's name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/162,157	01/23/2014	Chester O.D. Thompson	16223-00274	5914

TITLE OF INVENTION: KEY BLANK IDENTIFICATION SYSTEM WITH GROOVE SCANNING

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	SMALL	\$480	\$0	\$0	\$480	10/27/2016

EXAMINER	ART UNIT	CLASS-SUBCLASS
ENTEZARI, MICHELLE M	2665	382-209000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

- ☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.
- ☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list

- (1) The names of up to 3 registered patent attorneys or agents OR, alternatively, 1 _____
- (2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed. 2 _____
- 3 _____

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE

(B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent): ☐ Individual ☐ Corporation or other private group entity ☐ Government

4a. The following fee(s) are submitted:

- ☐ Issue Fee
- ☐ Publication Fee (No small entity discount permitted)
- ☐ Advance Order - # of Copies _____

4b. Payment of Fee(s): (Please first reapply any previously paid issue fee shown above)

- ☐ A check is enclosed.
- ☐ Payment by credit card. Form PTO-2038 is attached.
- ☐ The director is hereby authorized to charge the required fee(s), any deficiency, or credits any overpayment, to Deposit Account Number _____ (enclose an extra copy of this form).

5. Change in Entity Status (from status indicated above)

- ☐ Applicant certifying micro entity status. See 37 CFR 1.29
- ☐ Applicant asserting small entity status. See 37 CFR 1.27
- ☐ Applicant changing to regular undiscounted fee status.

NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.

NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.

NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature _____ Date _____

Typed or printed name _____ Registration No. _____



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/162,157	01/23/2014	Chester O.D. Thompson	16223-00274	5914

33772	7590	07/27/2016
MCDONALD HOPKINS LLC		
600 Superior Avenue, East		
Suite 2100		
CLEVELAND, OH 44114-2653		

EXAMINER	
ENTEZARI, MICHELLE M	

ART UNIT	PAPER NUMBER
2665	

DATE MAILED: 07/27/2016

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b) (Applications filed on or after May 29, 2000)

The Office has discontinued providing a Patent Term Adjustment (PTA) calculation with the Notice of Allowance.

Section 1(h)(2) of the AIA Technical Corrections Act amended 35 U.S.C. 154(b)(3)(B)(i) to eliminate the requirement that the Office provide a patent term adjustment determination with the notice of allowance. See Revisions to Patent Term Adjustment, 78 Fed. Reg. 19416, 19417 (Apr. 1, 2013). Therefore, the Office is no longer providing an initial patent term adjustment determination with the notice of allowance. The Office will continue to provide a patent term adjustment determination with the Issue Notification Letter that is mailed to applicant approximately three weeks prior to the issue date of the patent, and will include the patent term adjustment on the patent. Any request for reconsideration of the patent term adjustment determination (or reinstatement of patent term adjustment) should follow the process outlined in 37 CFR 1.705.

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.

OMB Clearance and PRA Burden Statement for PTOL-85 Part B

The Paperwork Reduction Act (PRA) of 1995 requires Federal agencies to obtain Office of Management and Budget approval before requesting most types of information from the public. When OMB approves an agency request to collect information from the public, OMB (i) provides a valid OMB Control Number and expiration date for the agency to display on the instrument that will be used to collect the information and (ii) requires the agency to inform the public about the OMB Control Number's legal significance in accordance with 5 CFR 1320.5(b).

The information collected by PTOL-85 Part B is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450. Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Notice of Allowability	Application No. 14/162,157	Applicant(s) THOMPSON ET AL.	
	Examiner MICHELLE ENTEZARI	Art Unit 2665	AIA (First Inventor to File) Status No

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to 6/17/16.
☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.
2. ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.
3. ☒ The allowed claim(s) is/are 1-12 and 14-27. As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov.
4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

Certified copies:

- a) ☐ All b) ☐ Some *c) ☐ None of the:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

* Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.

THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.
Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).
6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☒ Notice of References Cited (PTO-892)	5. ☐ Examiner's Amendment/Comment
2. ☐ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date _____	6. ☒ Examiner's Statement of Reasons for Allowance
3. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material	7. ☐ Other _____.
4. ☐ Interview Summary (PTO-413), Paper No./Mail Date _____.	

/MICHELLE ENTEZARI/
Primary Examiner, Art Unit 2665

DETAILED ACTION

Notice of Pre-AIA or AIA Status

1. The present application is being examined under the pre-AIA first to invent provisions.

Continued Examination Under 37 CFR 1.114

2. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on June 17, 2016 has been entered.

Response to Amendment

3. Claims 1-12 and 14-27 are pending. Claims 1-12 and 14-27 are original or previously presented. Claim 13 is cancelled.

Response to Arguments

4. Applicant's arguments, see pages 7-14, filed June 17, 2016 with respect to the prior art rejections of claims 1-12, 14 and 16-27 have been fully considered and are persuasive. The prior art rejections of claims 1-12, 14 and 16-27 have been withdrawn.

Allowable Subject Matter

5. Claims 1-12 and 14-27 are allowed.
6. The following is an examiner's statement of reasons for allowance: As noted, the cited prior art does not disclose the subject matter of the independent claims. The

closest prior art of US 8634655 B2 and US 8644619 B2 are to the same inventor, and US 20140260809 A1 has a later filing date.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to MICHELLE ENTEZARI whose telephone number is (571)270-5084. The examiner can normally be reached on M-Th, 7:30am-5pm EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Stephen R. Koziol can be reached on (571)270-1844. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/MICHELLE ENTEZARI/
Primary Examiner, Art Unit 2665

Notice of References Cited	Application/Control No. 14/162,157	Applicant(s)/Patent Under Reexamination THOMPSON ET AL.	
	Examiner MICHELLE ENTEZARI	Art Unit 2665	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	CPC Classification	US Classification
*	A	US-8,634,655 B2	01-2014	Thompson; Chester O. D.	G06K9/48	382/141
*	B	US-8,644,619 B2	02-2014	Thompson; Chester O. D.	G06T7/602	382/141
*	C	US-2014/0260809 A1	09-2014	Miller; J. Clayton	H04N5/2254	76/110
	D	US-				
	E	US-				
	F	US-				
	G	US-				
	H	US-				
	I	US-				
	J	US-				
	K	US-				
	L	US-				
	M	US-				

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	CPC Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

Search Notes 	Application/Control No. 14162157	Applicant(s)/Patent Under Reexamination THOMPSON ET AL.
	Examiner MICHELLE ENTEZARI	Art Unit 2665

CPC- SEARCHED		
Symbol	Date	Examiner
B23C2235/24	4/18/14	Entezari
B23C2235/28	4/18/14	Entezari
B23C2235/41	4/18/14	Entezari
B23C2235/44	4/18/14	Entezari
b23q33/00	4/18/14	Entezari
g06k2209/401	4/18/14	Entezari
g06k2209/40 (keyword limited)	4/18/14	Entezari
y10s83/917 (keyword limited)	4/18/14	Entezari

CPC COMBINATION SETS - SEARCHED		
Symbol	Date	Examiner

US CLASSIFICATION SEARCHED			
Class	Subclass	Date	Examiner
382	203, 205, 209, 110, 141, 305 (keyword limited)	4/18/14	Entezari
409	81-83 (keyword limited)	4/18/14	Entezari

SEARCH NOTES		
Search Notes	Date	Examiner
see EAST search, includes INV	4/18/14-4/21/14	Entezari
see updated EAST search	6/15/15	Entezari
see updated EAST search, includes IDS	12/11/15	Entezari
see updated EAST search	7/21/16	Entezari

INTERFERENCE SEARCH			
US Class/ CPC Symbol	US Subclass / CPC Group	Date	Examiner

INTERFERENCE SEARCH			
US Class/ CPC Symbol	US Subclass / CPC Group	Date	Examiner
B23C	3/35	7/21/16	Entezari
B23C2235	2235/00, 24, 28, 41, 44	7/21/16	Entezari
b23q	33/00	7/21/16	Entezari
g06k	2209/401, 40	7/21/16	Entezari
y10s	83/917 (keyword limited)	7/21/16	Entezari
g06k	9/62, 00, 20, 48 (keyword limited)	7/21/16	Entezari
g06t	7/60 (keyword limited)	7/21/16	Entezari
y10t	409/300952, 301064, 301008 (keyword limited)	7/21/16	Entezari
b23c	2235/41 (keyword limited)	7/21/16	Entezari

EAST Search History**EAST Search History (Prior Art)**

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	15	(view or angle or perspective) with mirror with (cod or imaging or camera) and key with blank	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	NEAR	ON	2016/07/21 02:51
L34	1	14/162157	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	NEAR	OFF	2016/07/21 03:36

EAST Search History (Interference)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L2	1041	382/203.ccls.	USPAT	NEAR	OFF	2016/07/21 02:58
L3	472	382/205.ccls.	USPAT	NEAR	OFF	2016/07/21 02:58
L4	1512	382/209.ccls.	USPAT	NEAR	OFF	2016/07/21 02:58
L5	297	382/110.ccls.	USPAT	NEAR	OFF	2016/07/21 02:58
L6	1669	382/141.ccls.	USPAT	NEAR	OFF	2016/07/21 02:58
L7	2120	382/305.ccls.	USPAT	NEAR	OFF	2016/07/21 02:58
L8	278	409/81-83.ccls.	USPAT	NEAR	OFF	2016/07/21 02:58
L9	250	B23C3/35.cpc.	USPAT	NEAR	OFF	2016/07/21 02:59
L10	4	B23C2235/00.cpc.	USPAT	NEAR	OFF	2016/07/21 02:59
L11	3	B23C2235/24.cpc.	USPAT	NEAR	OFF	2016/07/21 02:59
L12	7	B23C2235/28.cpc.	USPAT	NEAR	OFF	2016/07/21 02:59
L13	13	B23C2235/41.cpc.	USPAT	NEAR	OFF	2016/07/21 02:59
L14	1	B23C2235/44.cpc.	USPAT	NEAR	OFF	2016/07/21 03:00
L15	35	b23q33/00.cpc.	USPAT	NEAR	OFF	2016/07/21 03:00
L16	18	g06k2209/401.cpc.	USPAT	NEAR	OFF	2016/07/21 03:00
L17	131	g06k2209/40.cpc.	USPAT	NEAR	OFF	2016/07/21 03:00
L18	439	y10s83/917.cpc.	USPAT	NEAR	OFF	2016/07/21

						03:00
L19	2	(2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18) and (view or angle or perspective) with mirror with (cod or imaging or camera) and key with blank	USPAT	NEAR	ON	2016/07/21 03:02
L20	17	(2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18) and (view or angle or perspective) with mirror.clm.	USPAT	NEAR	ON	2016/07/21 03:02
L21	2	(9 or 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18) and (view or angle or perspective) with mirror with (cod or imaging or camera) and key with blank	USPAT	NEAR	ON	2016/07/21 03:21
L22	2	(9 or 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18) and (view or angle or perspective) with mirror.clm.	USPAT	NEAR	ON	2016/07/21 03:21
L23	635	g06k9/6202.cpc.	USPAT	NEAR	OFF	2016/07/21 03:27
L24	136	g06k9/00208.cpc.	USPAT	NEAR	OFF	2016/07/21 03:27
L25	397	g06k9/209.cpc.	USPAT	NEAR	OFF	2016/07/21 03:27
L26	449	g06k9/48.cpc.	USPAT	NEAR	OFF	2016/07/21 03:27
L27	524	g06t7/602.cpc.	USPAT	NEAR	OFF	2016/07/21 03:27
L28	187	y10t409/300952.cpc.	USPAT	NEAR	OFF	2016/07/21 03:27
L29	74	y10t409/301064.cpc.	USPAT	NEAR	OFF	2016/07/21 03:27
L30	97	y10t409/301008.cpc.	USPAT	NEAR	OFF	2016/07/21 03:28
L31	13	b23c2235/41.cpc.	USPAT	NEAR	OFF	2016/07/21 03:28
L32	20	(23 or 24 or 25 or 26 or 27 or 28 or 29 or 30 or 31) and (view or angle or perspective) with mirror.clm.	USPAT	NEAR	ON	2016/07/21 03:28
L33	0	14/162157	USPAT	NEAR	OFF	2016/07/21 03:35

7/ 21/ 2016 3:42:53 AM

C:\Users\mentezari\Documents\EAST\Workspaces\14_162_157.wsp

Issue Classification 	Application/Control No. 14162157	Applicant(s)/Patent Under Reexamination THOMPSON ET AL.	
	Examiner MICHELLE ENTEZARI	Art Unit 2665	

CPC					
Symbol				Type	Version
G06K	9	6202		F	2013-01-01
Y10T	409	300952		A	2015-01-15
Y10T	409	301064		A	2015-01-15
Y10T	409	301008		A	2015-01-15
G06K	9	00208		I	2013-01-01
G06K	9	209		I	2013-01-01
G06K	9	48		I	2013-01-01
B23C	2235	41		A	2013-01-01
G06T	7	602		I	2013-01-01

CPC Combination Sets					
Symbol	Type	Set	Ranking	Version	

NONE		Total Claims Allowed:	
		26	
(Assistant Examiner)	(Date)		
/MICHELLE ENTEZARI/ Primary Examiner.Art Unit 2665	07/21/2016	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	14

Issue Classification 	Application/Control No. 14162157	Applicant(s)/Patent Under Reexamination THOMPSON ET AL.
	Examiner MICHELLE ENTEZARI	Art Unit 2665

US ORIGINAL CLASSIFICATION						INTERNATIONAL CLASSIFICATION									
CLASS		SUBCLASS				CLAIMED					NON-CLAIMED				
						G	0	6	K	9 / 62 (2006.01.01)					
CROSS REFERENCE(S)						G	0	6	K	9 / 00 (2006.01.01)					
						G	0	6	K	9 / 20 (2006.01.01)					
CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)					G	0	6	K	9 / 48 (2006.01.01)					
						G	0	6	T	7 / 60 (2006.01.01)					
							</								

NONE		Total Claims Allowed:	
		26	
(Assistant Examiner)	(Date)		
/MICHELLE ENTEZARI/ Primary Examiner.Art Unit 2665	07/21/2016	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	14

Issue Classification 	Application/Control No. 14162157	Applicant(s)/Patent Under Reexamination THOMPSON ET AL.
	Examiner MICHELLE ENTEZARI	Art Unit 2665

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47															
Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
1	1	16	17												
2	2	17	18												
3	3	18	19												
4	4	19	20												
5	5	20	21												
6	6	21	22												
7	7	22	23												
8	8	23	24												
9	9	24	25												
10	10	25	26												
11	11	26	27												
12	12														
	13														
13	14														
14	15														
15	16														

NONE		Total Claims Allowed:	
		26	
(Assistant Examiner)	(Date)		
/MICHELLE ENTEZARI/ Primary Examiner.Art Unit 2665	07/21/2016	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	14

PART B - FEE(S) TRANSMITTAL

**Complete and send this form, together with applicable fee(s), to: Mail Mail Stop ISSUE FEE
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450
or Fax (571)-273-2885**

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

33772 7590 07/27/2016
MCDONALD HOPKINS LLC
600 Superior Avenue, East
Suite 2100
CLEVELAND, OH 44114-2653

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

(Depositor's name)
(Signature)
EFS (Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/162,157	01/23/2014	Chester O.D. Thompson	16223-00274	5914

TITLE OF INVENTION: KEY BLANK IDENTIFICATION SYSTEM WITH GROOVE SCANNING

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	SMALL	\$480	\$0	\$0	\$480	10/27/2016

EXAMINER	ART UNIT	CLASS-SUBCLASS
ENTEZARI, MICHELLE M	2665	382-209000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

- ☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.
- ☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list

- (1) The names of up to 3 registered patent attorneys or agents OR, alternatively,
- (2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

1 McDonald Hopkins LLC
2
3

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE

(B) RESIDENCE: (CITY and STATE OR COUNTRY)

HY-KO PRODUCTS COMPANY

Northfield, OH

Please check the appropriate assignee category or categories (will not be printed on the patent): ☐ Individual ☒ Corporation or other private group entity ☐ Government

4a. The following fee(s) are submitted:

- ☒ Issue Fee
- ☐ Publication Fee (No small entity discount permitted)
- ☐ Advance Order - # of Copies _____

4b. Payment of Fee(s): (Please first reapply any previously paid issue fee shown above)

- ☐ A check is enclosed.
- ☐ Payment by credit card. Form PTO-2038 is attached.
- ☒ The director is hereby authorized to charge the required fee(s), any deficiency, or credits any overpayment, to Deposit Account Number 13-0265 (enclose an extra copy of this form).

5. Change in Entity Status (from status indicated above)

- ☐ Applicant certifying micro entity status. See 37 CFR 1.29
- ☐ Applicant asserting small entity status. See 37 CFR 1.27
- ☐ Applicant changing to regular undiscounted fee status.

NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.

NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.

NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature /Mark J. Masterson/

Date October 26, 2016

Typed or printed name Mark J. Masterson

Registration No. 71,886

Electronic Patent Application Fee Transmittal				
Application Number:		14162157		
Filing Date:		23-Jan-2014		
Title of Invention:		KEY BLANK IDENTIFICATION SYSTEM WITH GROOVE SCANNING		
First Named Inventor/Applicant Name:		Chester O.D. Thompson		
Filer:		Mark Jason Masterson/Rebecca Shofar		
Attorney Docket Number:		16223-00274		
Filed as Small Entity				
Filing Fees for Utility under 35 USC 111(a)				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
UTILITY APPL ISSUE FEE	2501	1	480	480

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Extension-of-Time:				
Miscellaneous:				
Total in USD (\$)				480

Electronic Acknowledgement Receipt	
EFS ID:	27322569
Application Number:	14162157
International Application Number:	
Confirmation Number:	5914
Title of Invention:	KEY BLANK IDENTIFICATION SYSTEM WITH GROOVE SCANNING
First Named Inventor/Applicant Name:	Chester O.D. Thompson
Customer Number:	33772
Filer:	Mark Jason Masterson/Rebecca Shofar
Filer Authorized By:	Mark Jason Masterson
Attorney Docket Number:	16223-00274
Receipt Date:	26-OCT-2016
Filing Date:	23-JAN-2014
Time Stamp:	09:20:06
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	DA
Payment was successfully received in RAM	\$480
RAM confirmation Number	102616INTEFSW00011425130265
Deposit Account	
Authorized User	
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:	

File Listing:					
Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Issue Fee Payment (PTO-85B)	6392241.pdf	126747	no	1
			8edf11946c9dd676293a9e1aa3856a7c5fcd b1b7		
Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	30865	no	2
			be2eaa69d98185a31899d3146833d5f57a3 95ad2		
Warnings:					
Information:					
Total Files Size (in bytes):			157612		
This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503. <u>New Applications Under 35 U.S.C. 111</u> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application. <u>National Stage of an International Application under 35 U.S.C. 371</u> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course. <u>New International Application Filed with the USPTO as a Receiving Office</u> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.					

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		14162157 - GAU: 2665 14162157	
	Filing Date		2014-01-23	
	First Named Inventor	Chester O.D. Thompson		
	Art Unit	2665		
	Examiner Name	Michelle M. Entezari		
	Attorney Docket Number	16223-00274		

	273	3429207		1969-02-25	John	
	274	3424056		1969-01-28	Stolove et al.	
	275	3418882		1968-12-31	Brand	
	276	3388619		1968-06-18	Schreiber et al.	
	277	3323420		1967-06-06	Roxburgh	
	278	3305100		1967-02-21	Barbee	
	279	3286597		1966-11-22	Schwartz	
Change(s) applied to document, /S.H/ 8/3/2016	280	32856596		~~3286596~~ ~~1966-11-22~~	Lieptz	
	281	3276328		1966-10-04	Schreiber et al.	
	282	3259022		1966-07-05	Vietorisz	
	283	3257908		1966-06-28	Haggstrom	

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /M.M.E/

**INFORMATION DISCLOSURE
STATEMENT BY APPLICANT**
(Not for submission under 37 CFR 1.99)

Application Number	14162157
Filing Date	2014-01-23
First Named Inventor	Chester O.D. Thompson
Art Unit	2665
Examiner Name	Michelle M. Entezari
Attorney Docket Number	16223-00274

Change(s) applied to document. /S.H/ 8/3/2016	9	~~2105099~~ ~~21050099~~		1938-01-11	Schuyler	
	10	2098728		1937-11-09	McPhee	
	11	2038949		1936-04-28	Mintz	
	12	2032820		1936-03-03	Turrell	
	13	1991151		1935-02-12	Hansen	
	14	1978628		1934-10-30	Hansen	
	15	1961516		1934-06-05	Hansen	
	16	1948260		1934-02-20	Fowler	
	17	1923164		1933-08-22	Roos	
	18	1889461		1932-11-29	Hansen	
	19	1848046		1932-03-01	Caron	



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/162,157	12/06/2016	9514385	16223-00274	5914

33772 7590 11/16/2016
MCDONALD HOPKINS LLC
600 Superior Avenue, East
Suite 2100
CLEVELAND, OH 44114-2653

ISSUE NOTIFICATION

The projected patent number and issue date are specified above.

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b) (application filed on or after May 29, 2000)

The Patent Term Adjustment is 0 day(s). Any patent to issue from the above-identified application will include an indication of the adjustment on the front page.

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (<http://pair.uspto.gov>).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Application Assistance Unit (AAU) of the Office of Data Management (ODM) at (571)-272-4200.

APPLICANT(s) (Please see PAIR WEB site <http://pair.uspto.gov> for additional applicants):

HY-KO PRODUCTS COMPANY, Northfield, OH;
Chester O.D. Thompson, Painesville, OH;
William R. Mutch, North Ridgeville, OH;

The United States represents the largest, most dynamic marketplace in the world and is an unparalleled location for business investment, innovation, and commercialization of new technologies. The USA offers tremendous resources and advantages for those who invest and manufacture goods here. Through SelectUSA, our nation works to encourage and facilitate business investment. To learn more about why the USA is the best country in the world to develop technology, manufacture products, and grow your business, visit SelectUSA.gov.