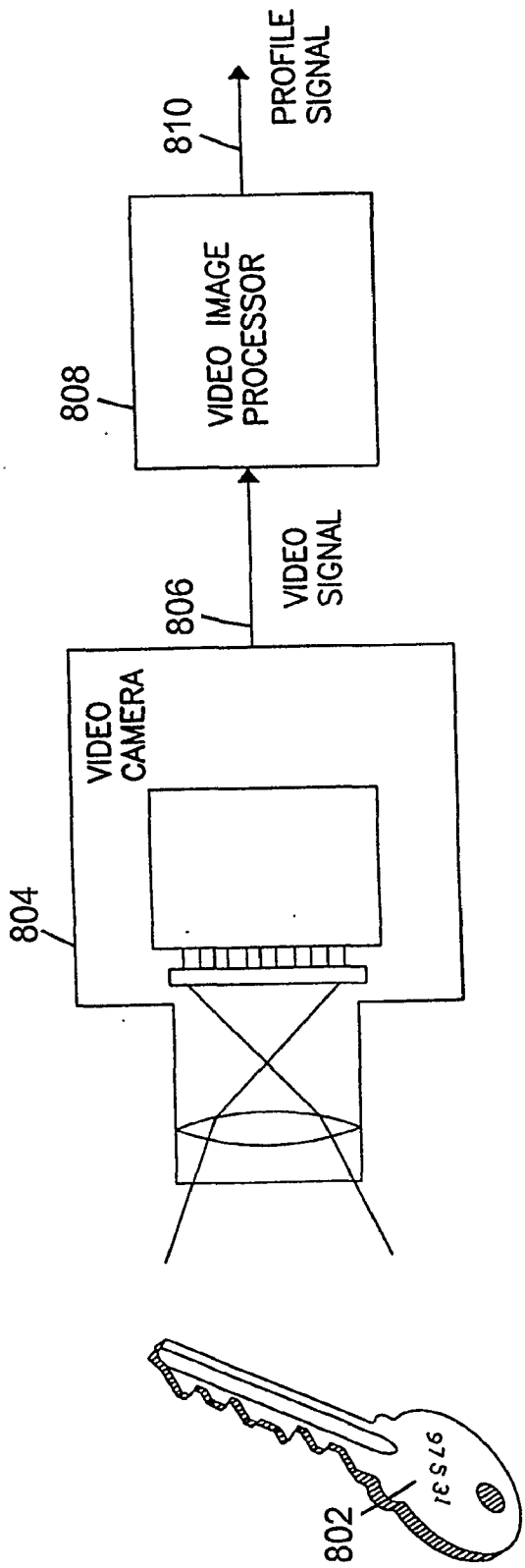


Fig. 8

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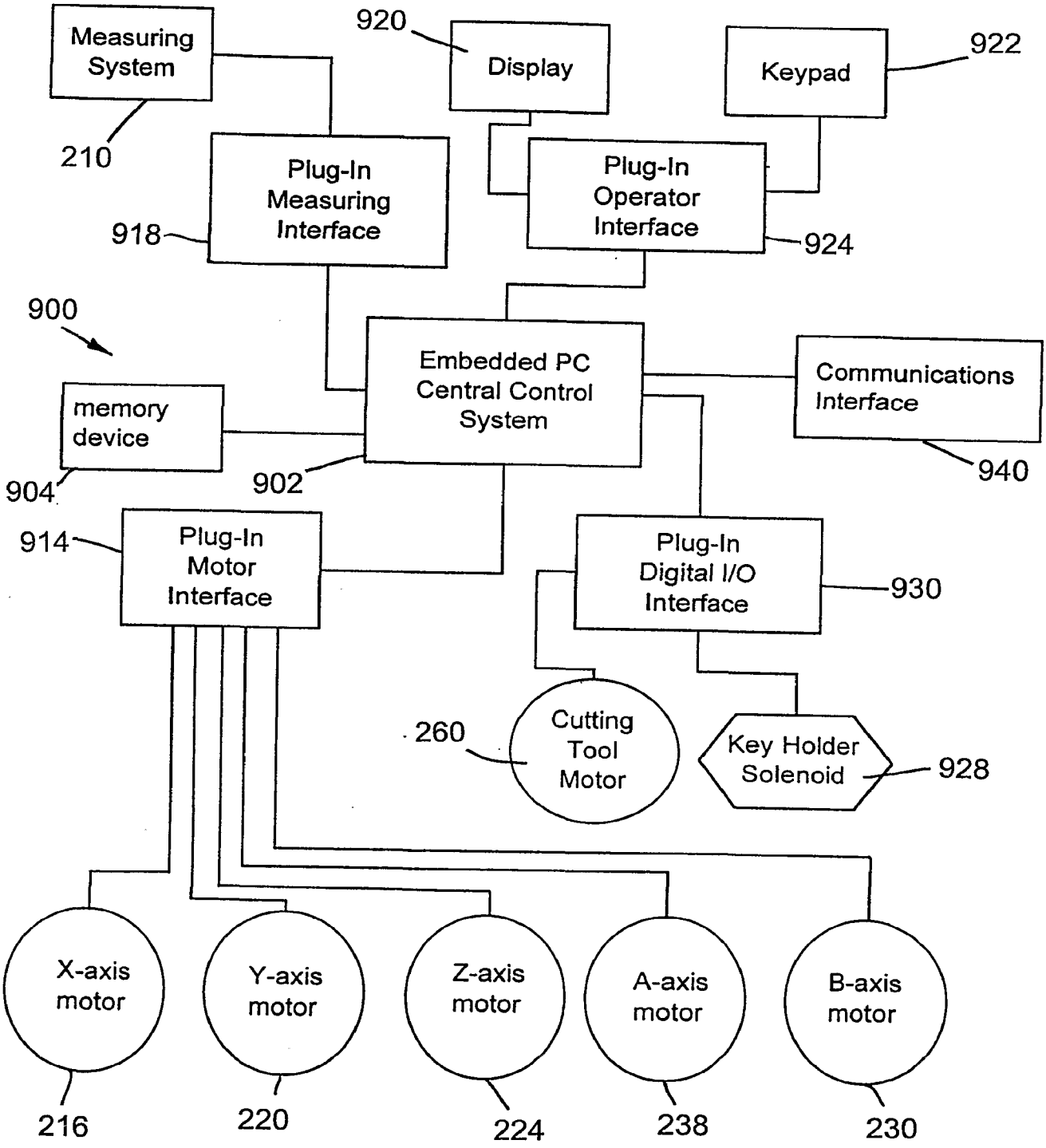


Fig. 9

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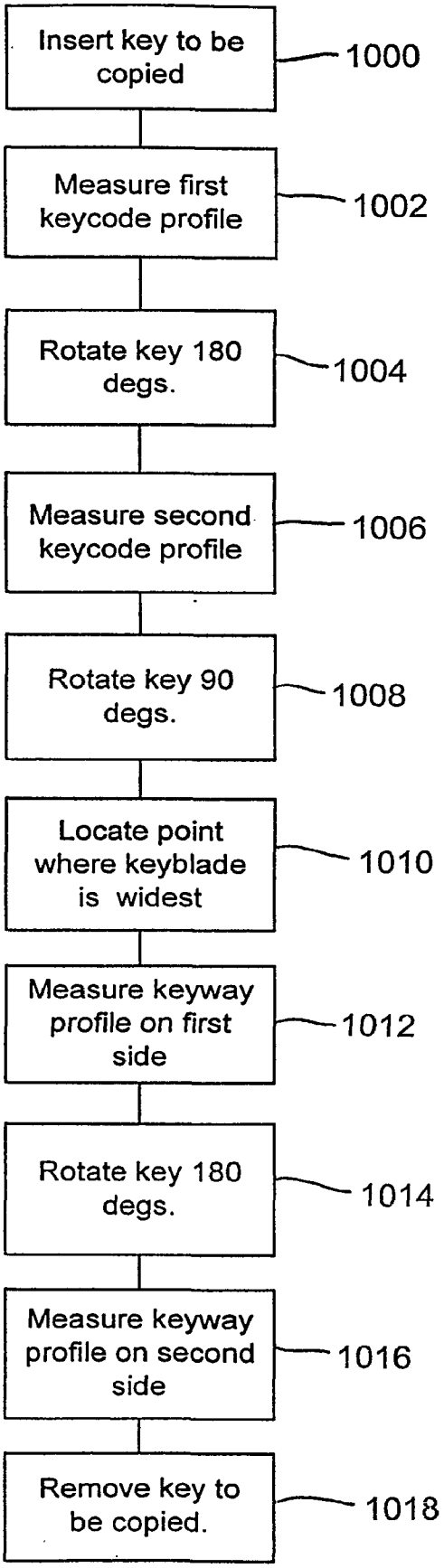


Fig. 10

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Fig. 11

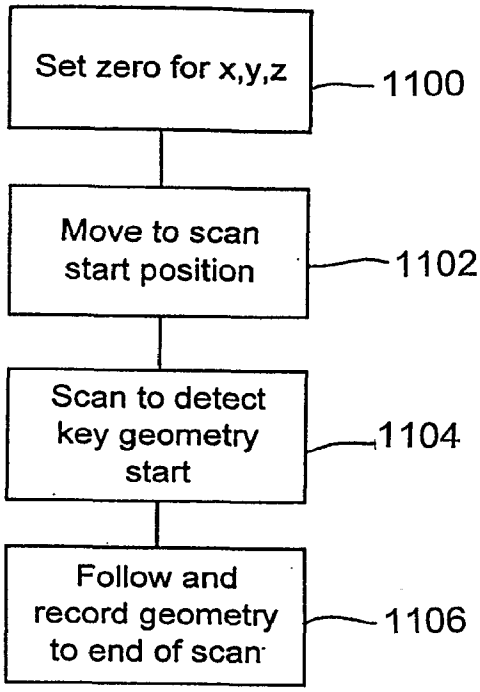
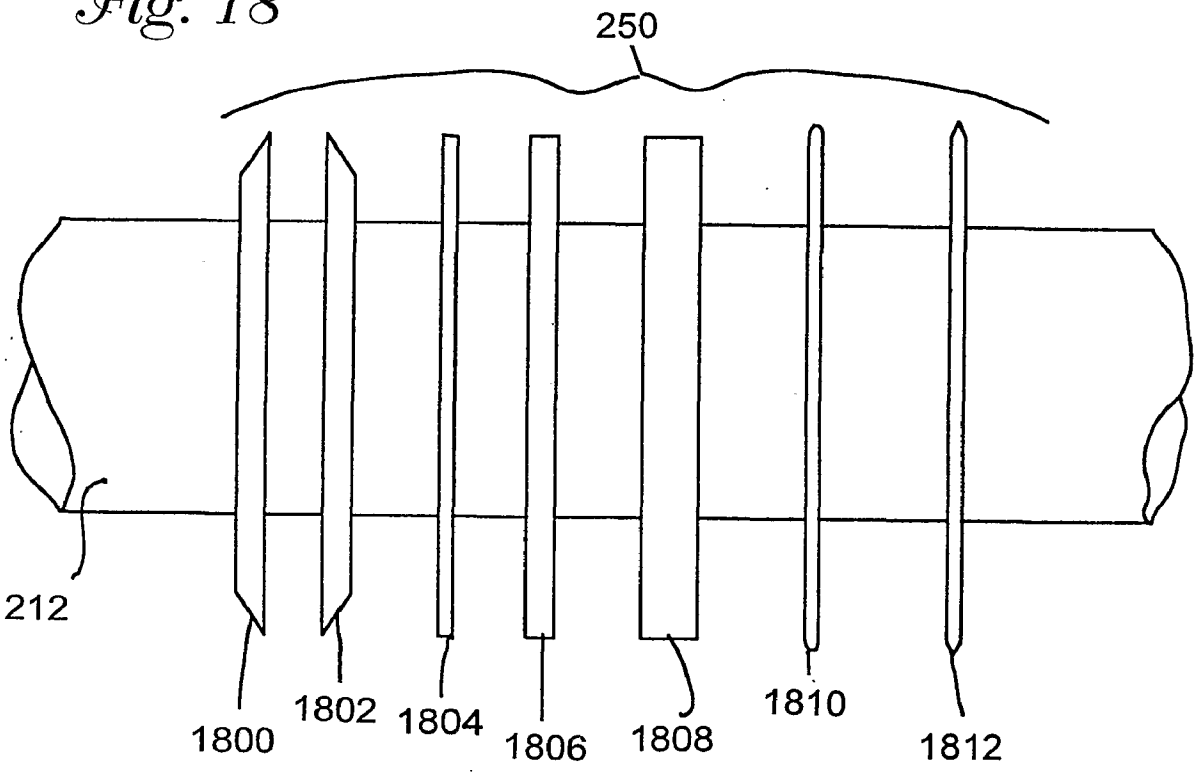


Fig. 18



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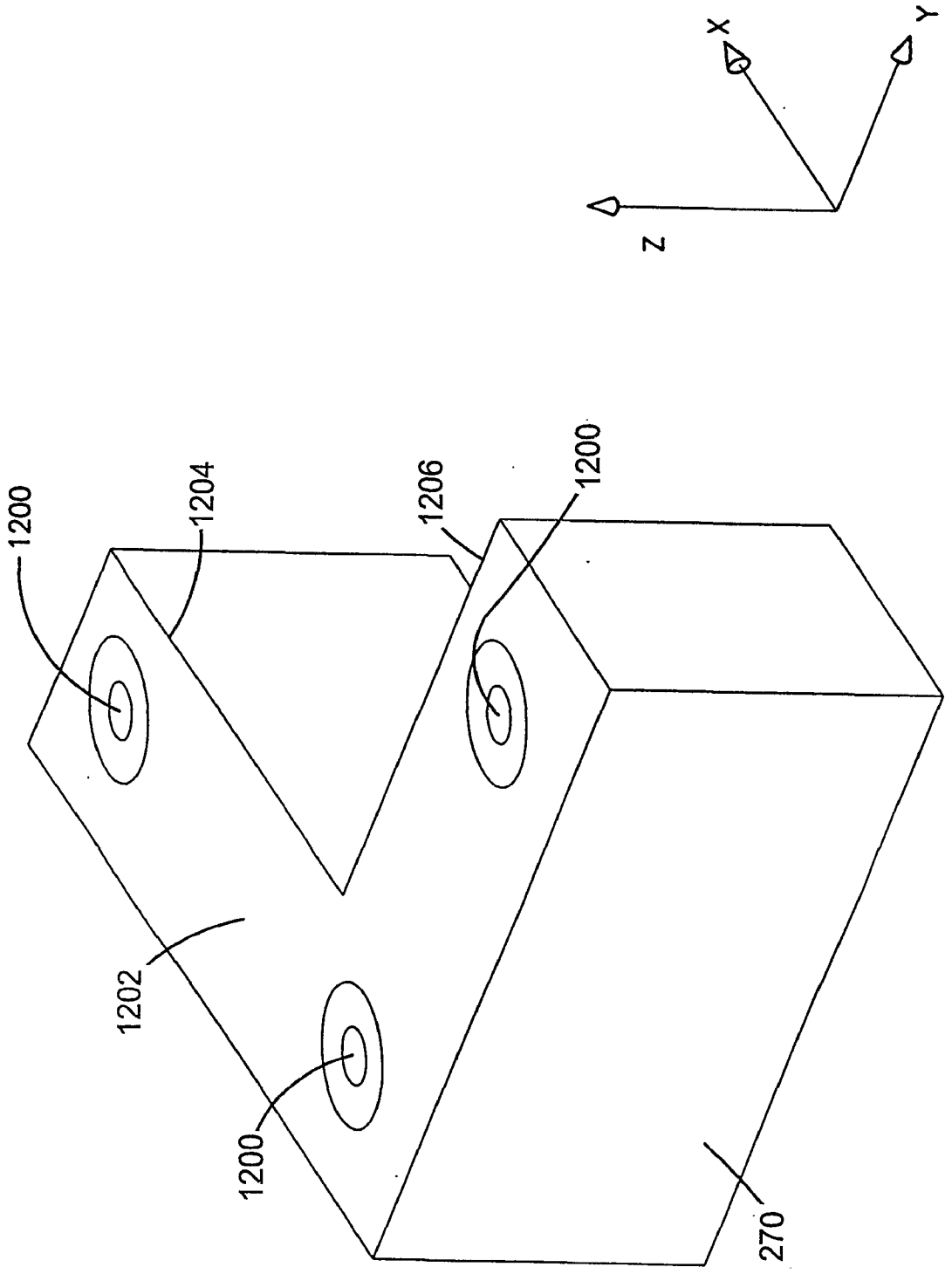


Fig. 12

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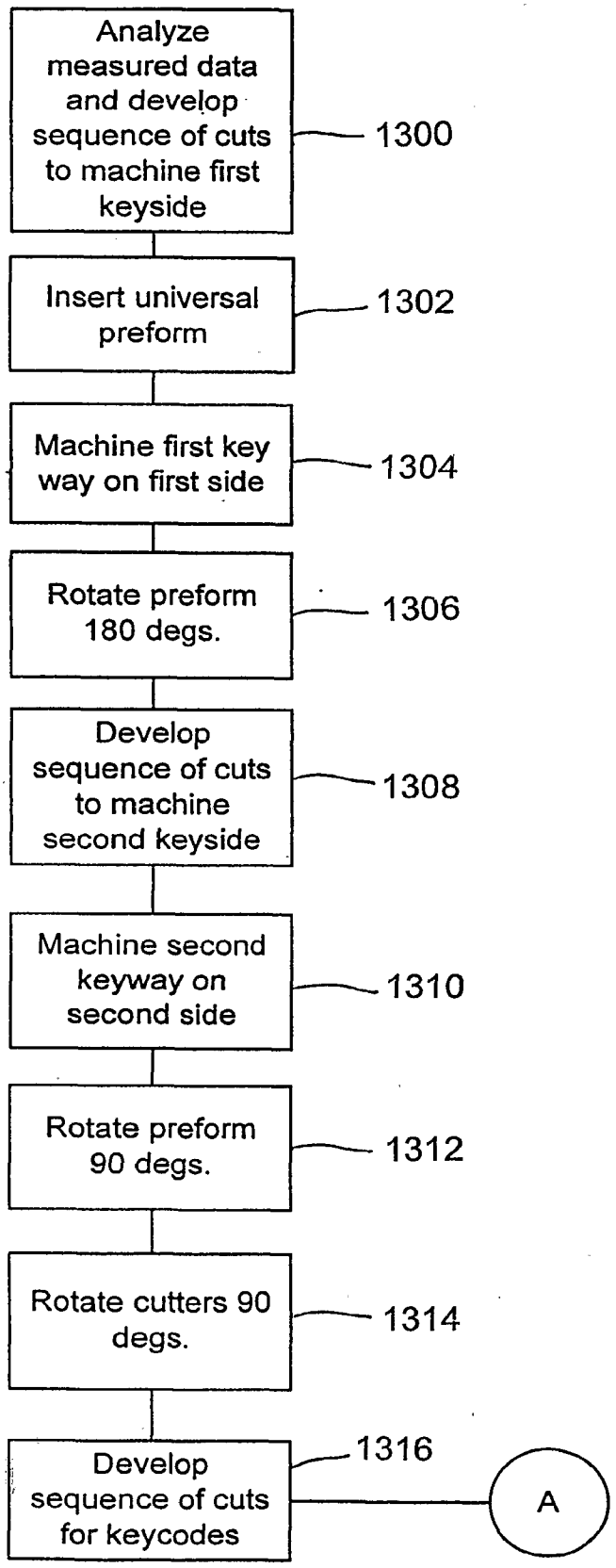


Fig. 13

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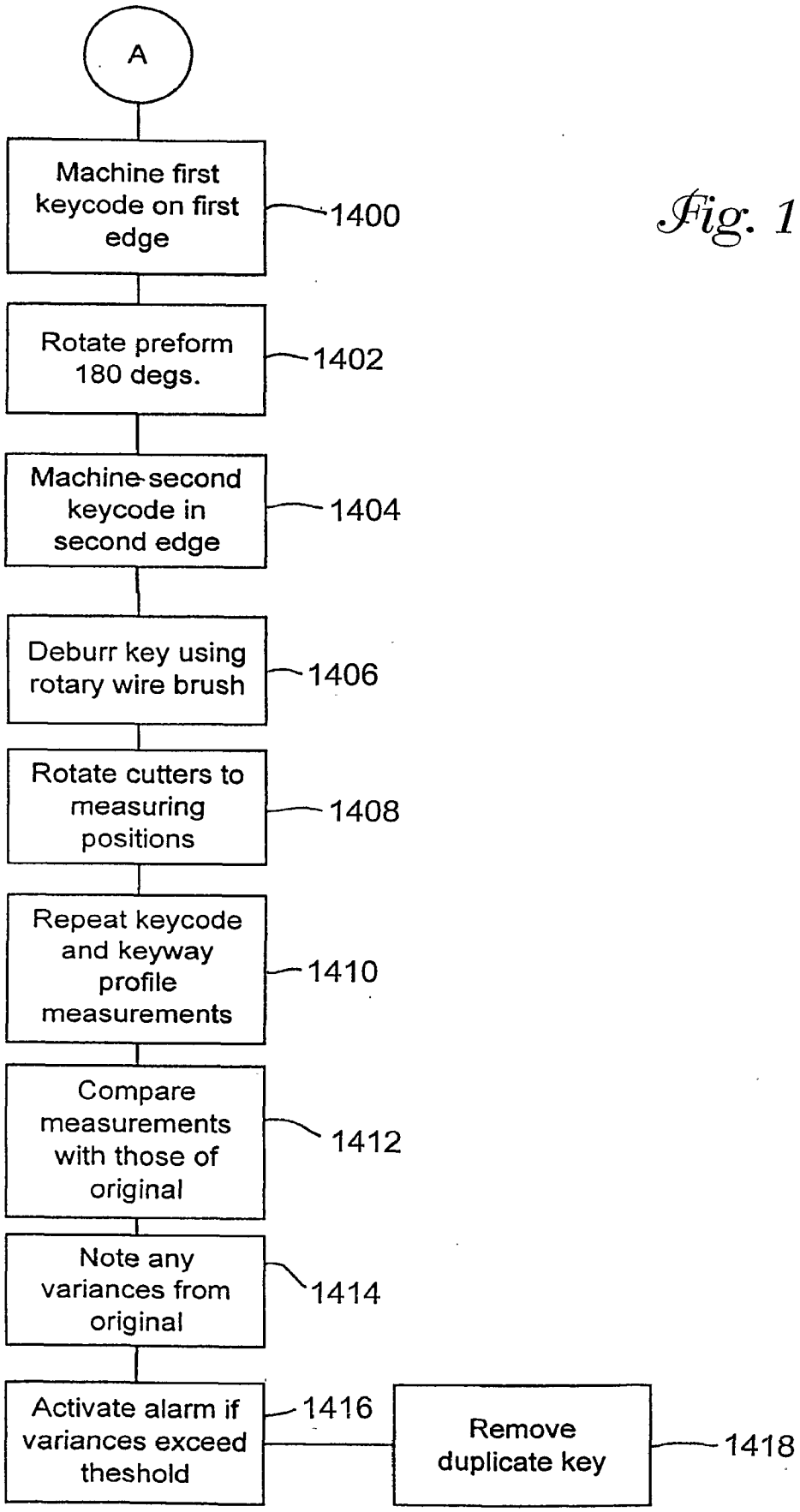
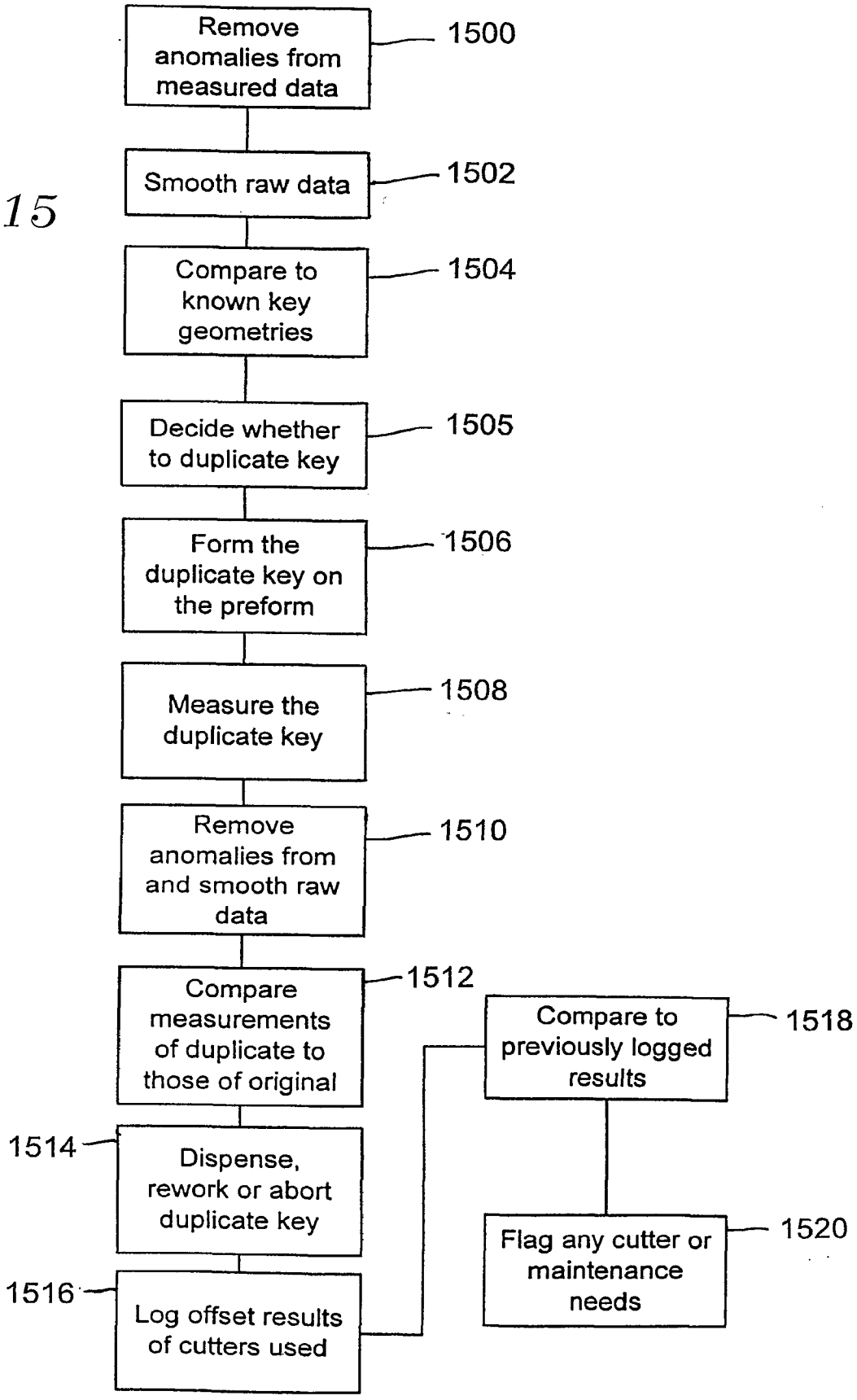

A
Machine first keycode on first edge
1400
Rotate preform 180 degs.
1402
Machine second keycode in second edge
1404
Deburr key using rotary wire brush
1406
Rotate cutters to measuring positions
1408
Repeat keycode and keyway profile measurements
1410
Compare measurements with those of original
1412
Note any variances from original
1414
Activate alarm if variances exceed theshold
1416
Remove duplicate key
1418

Fig. 14

Fig. 15



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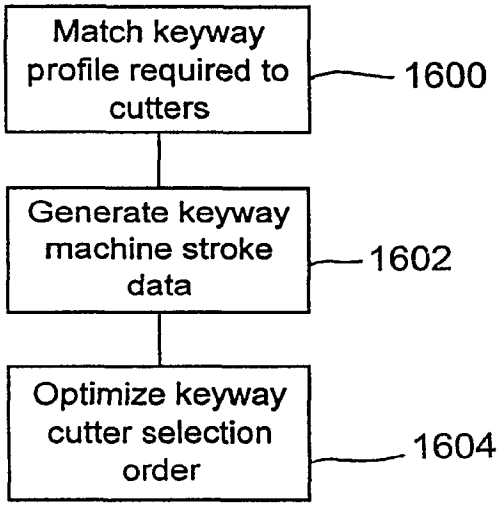


Fig. 16

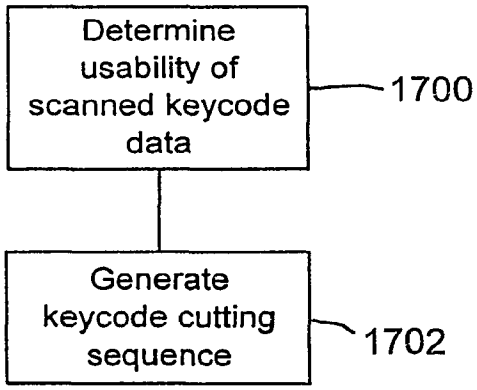


Fig. 17

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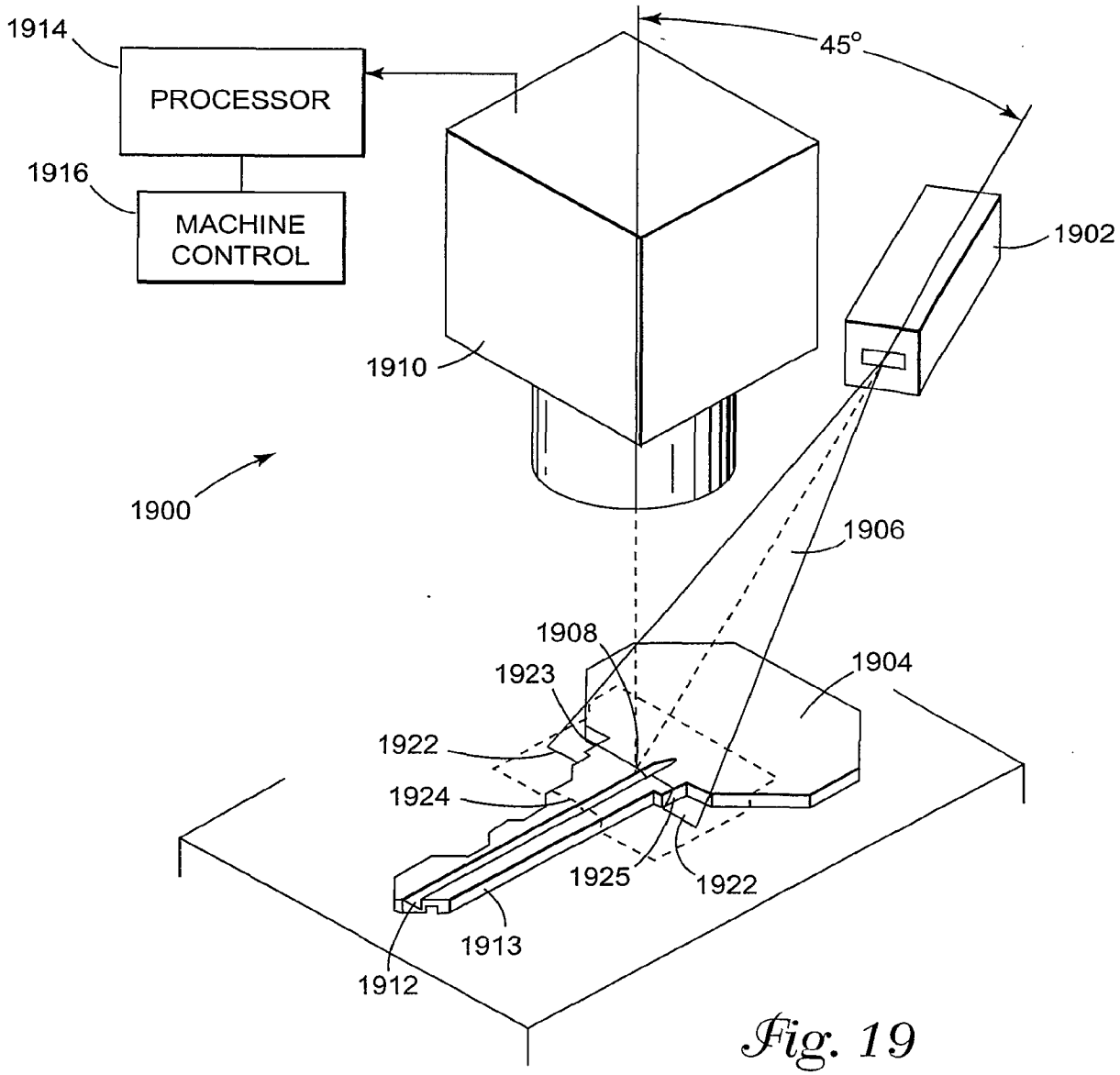

1914
PROCESSOR
1916
MACHINE CONTROL
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Fig. 19

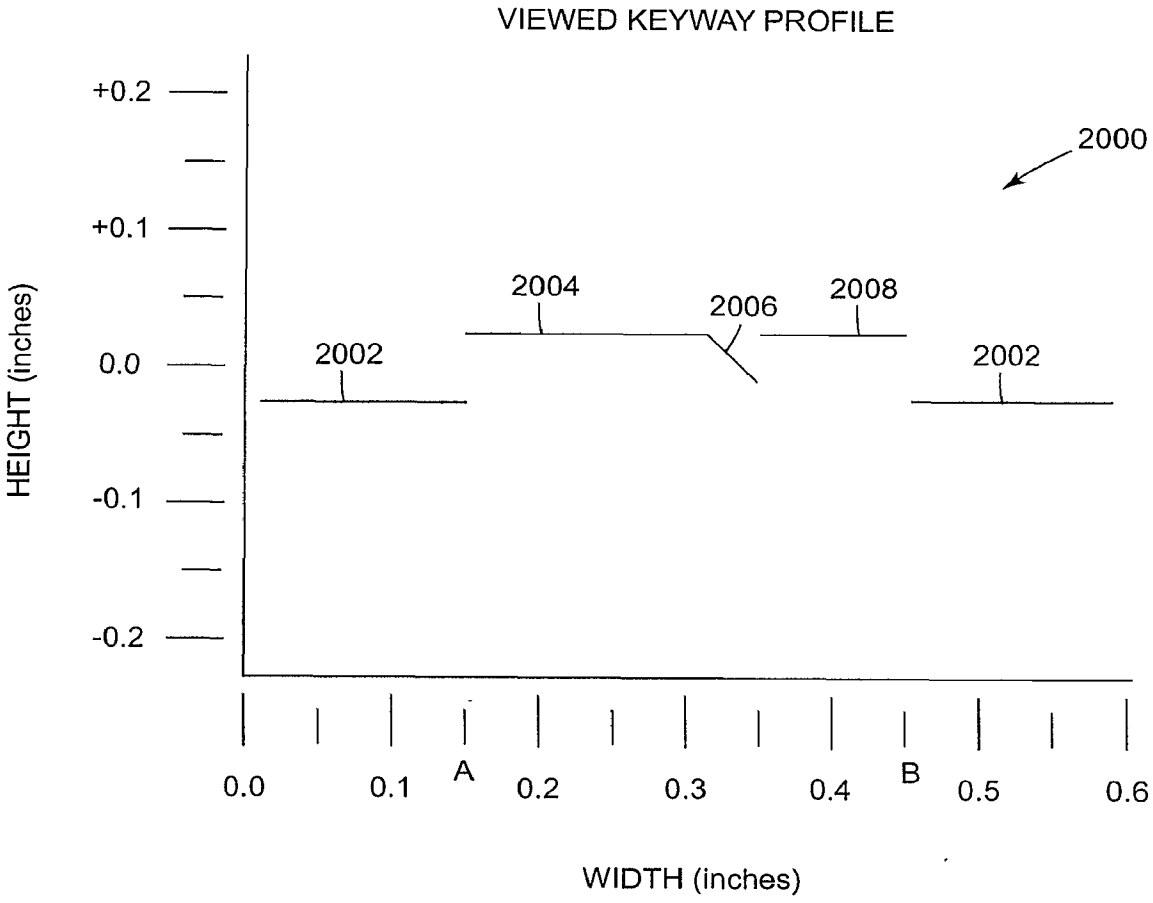
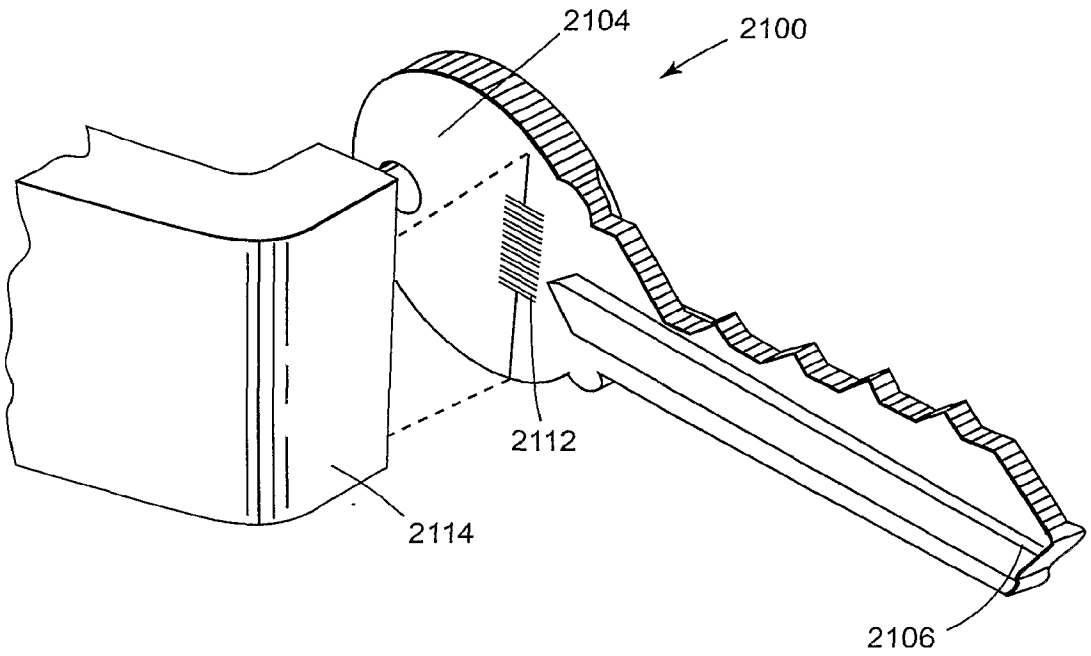


Fig. 20

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Fig. 21



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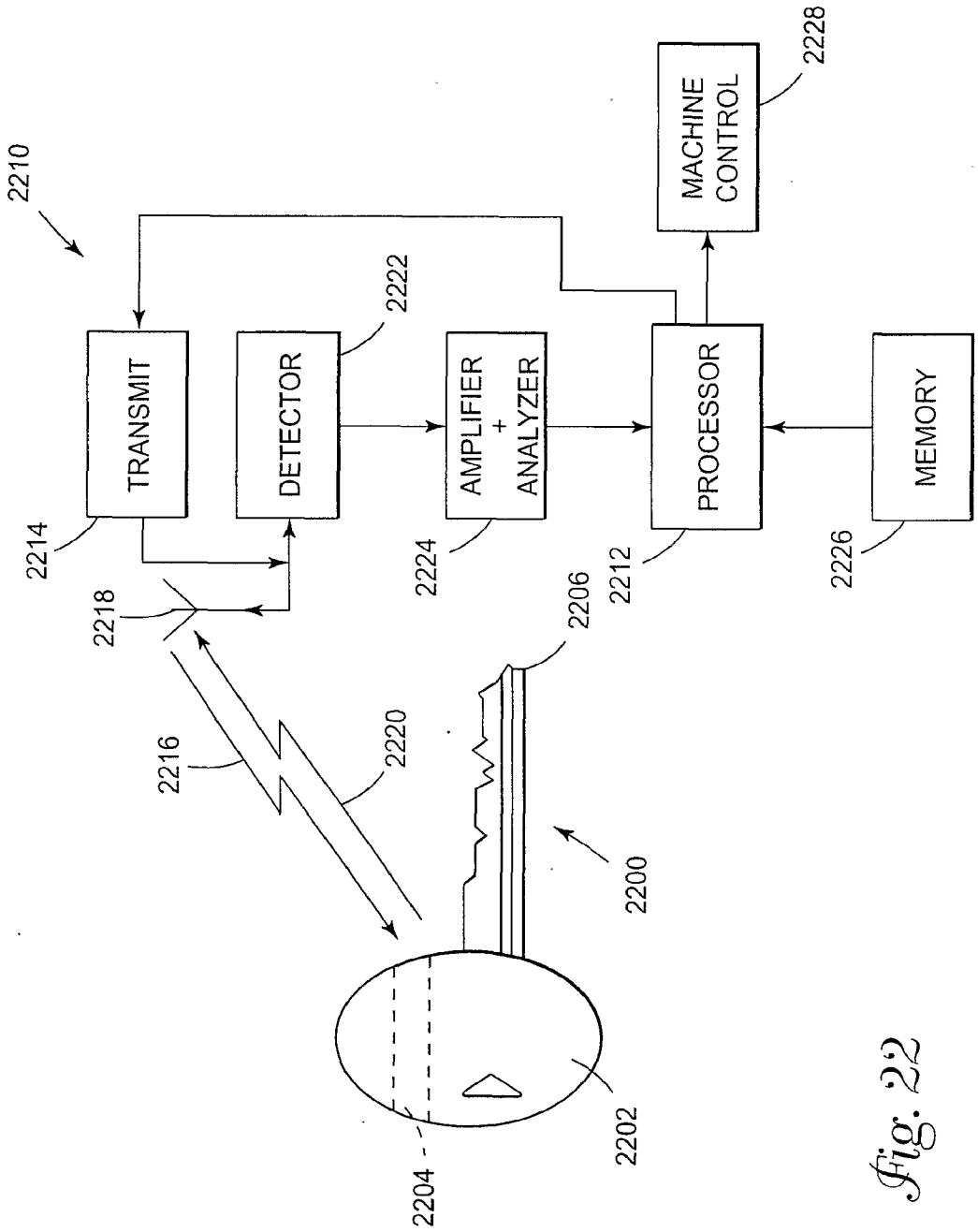


Fig. 22

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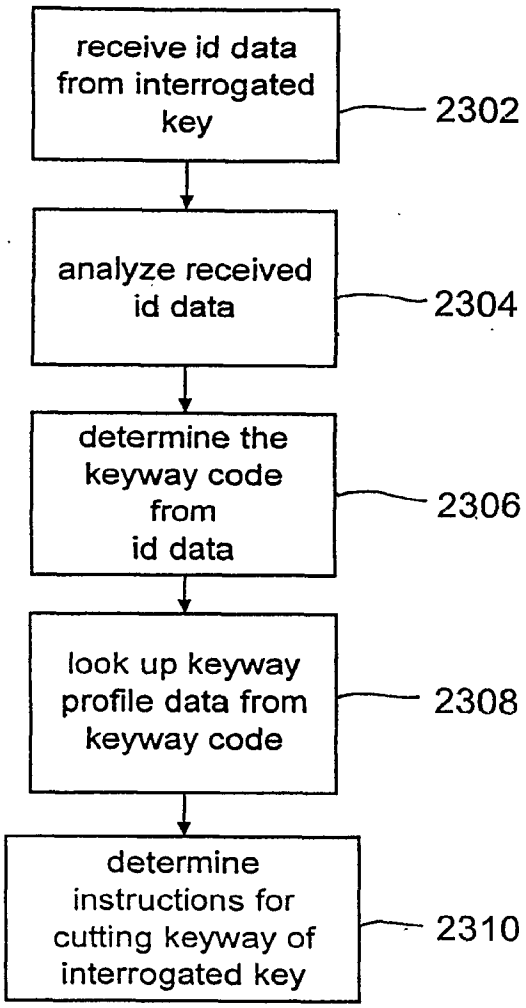


Fig. 23

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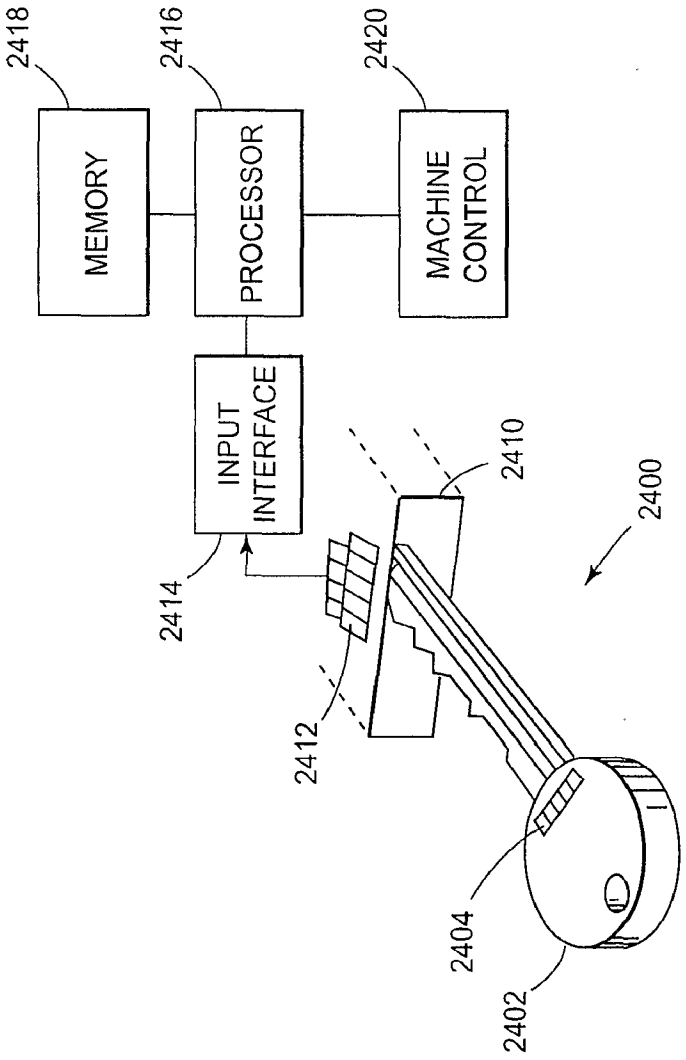


Fig. 24

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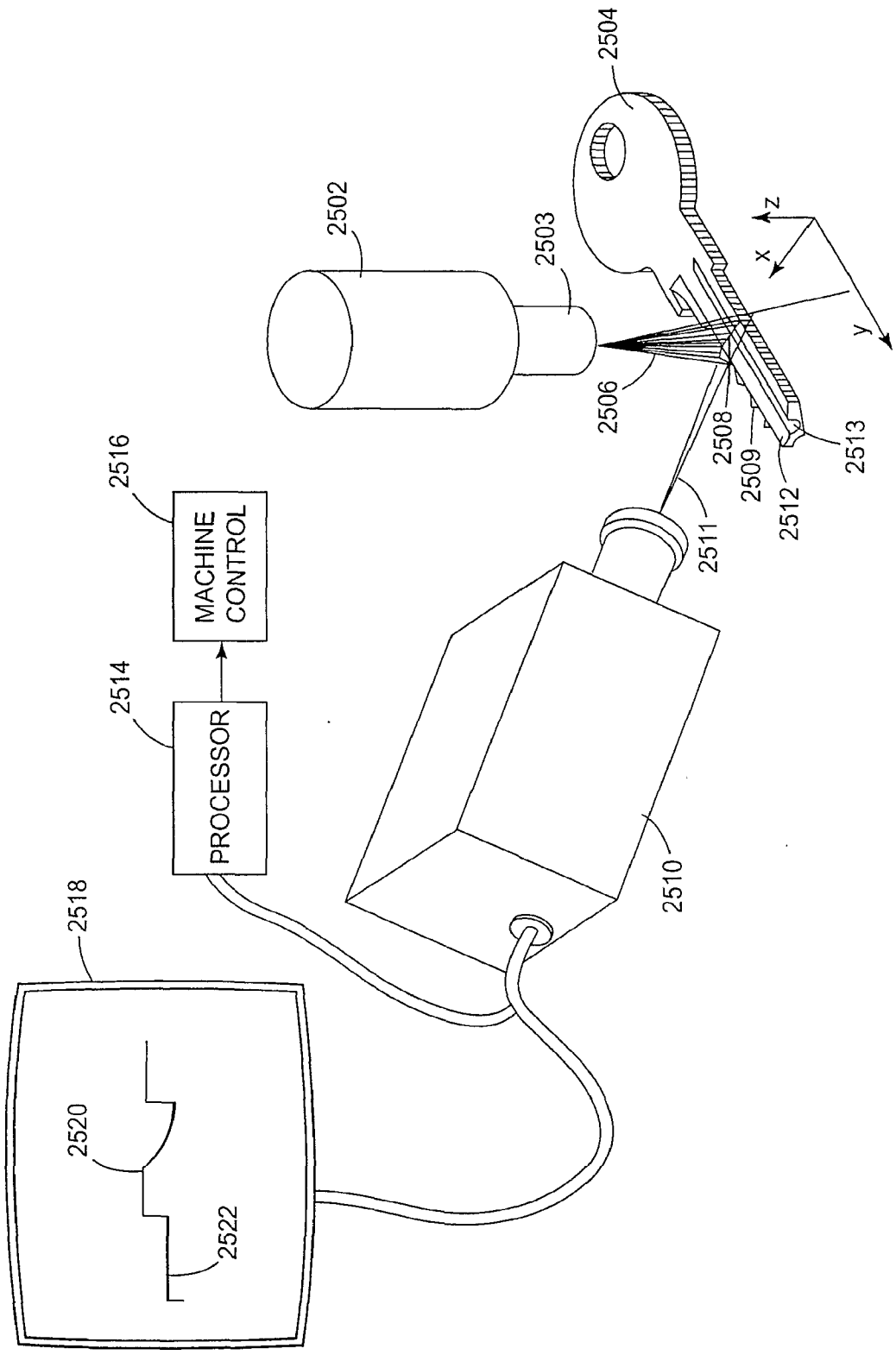


Fig. 25

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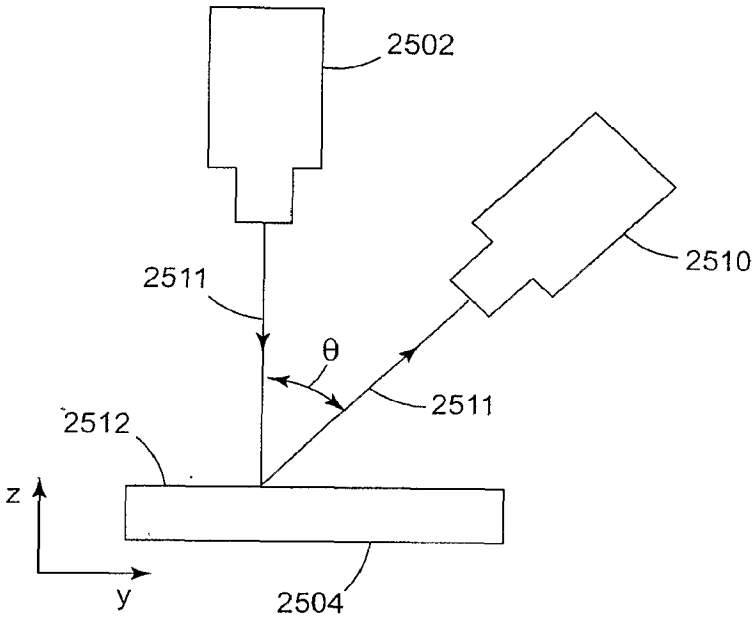


Fig. 26

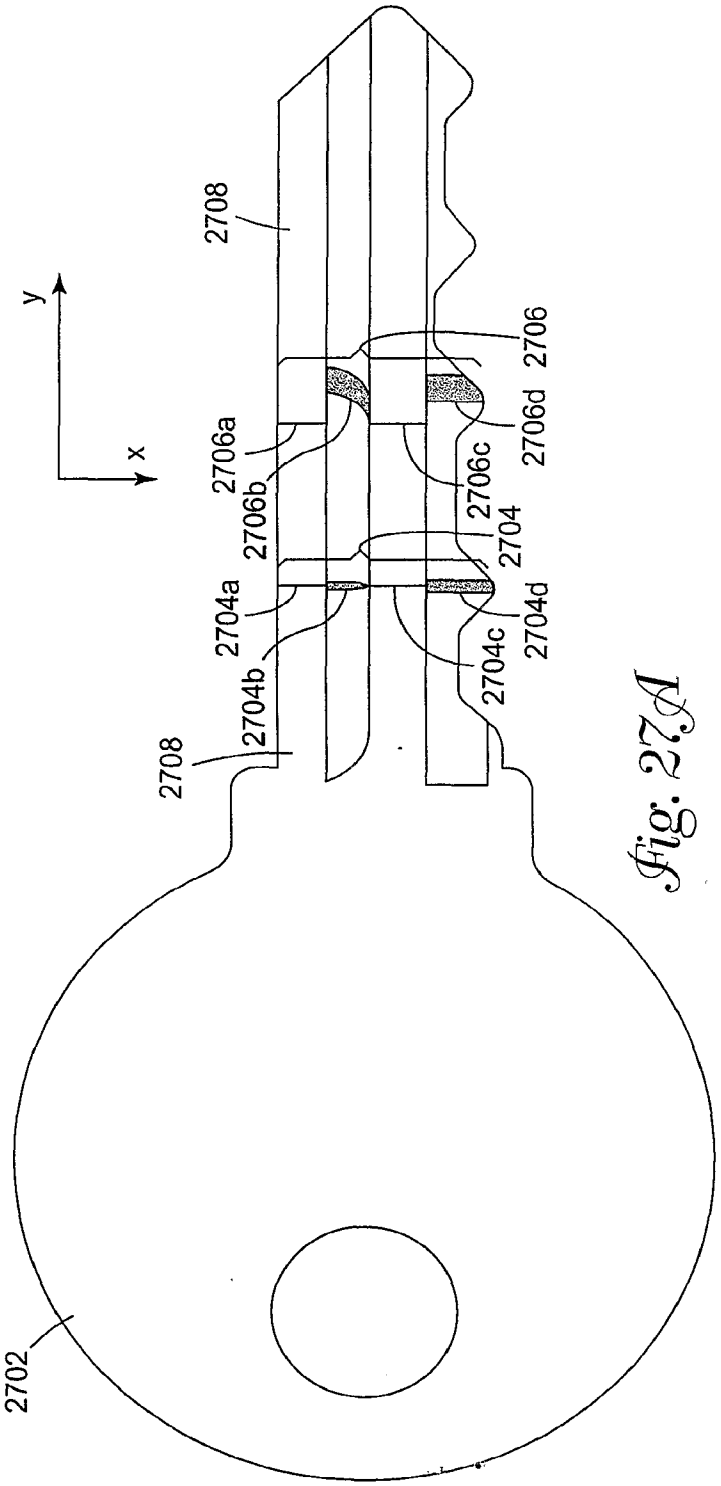


Fig. 27A

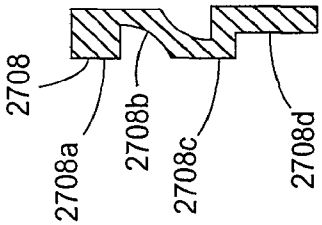


Fig. 27B

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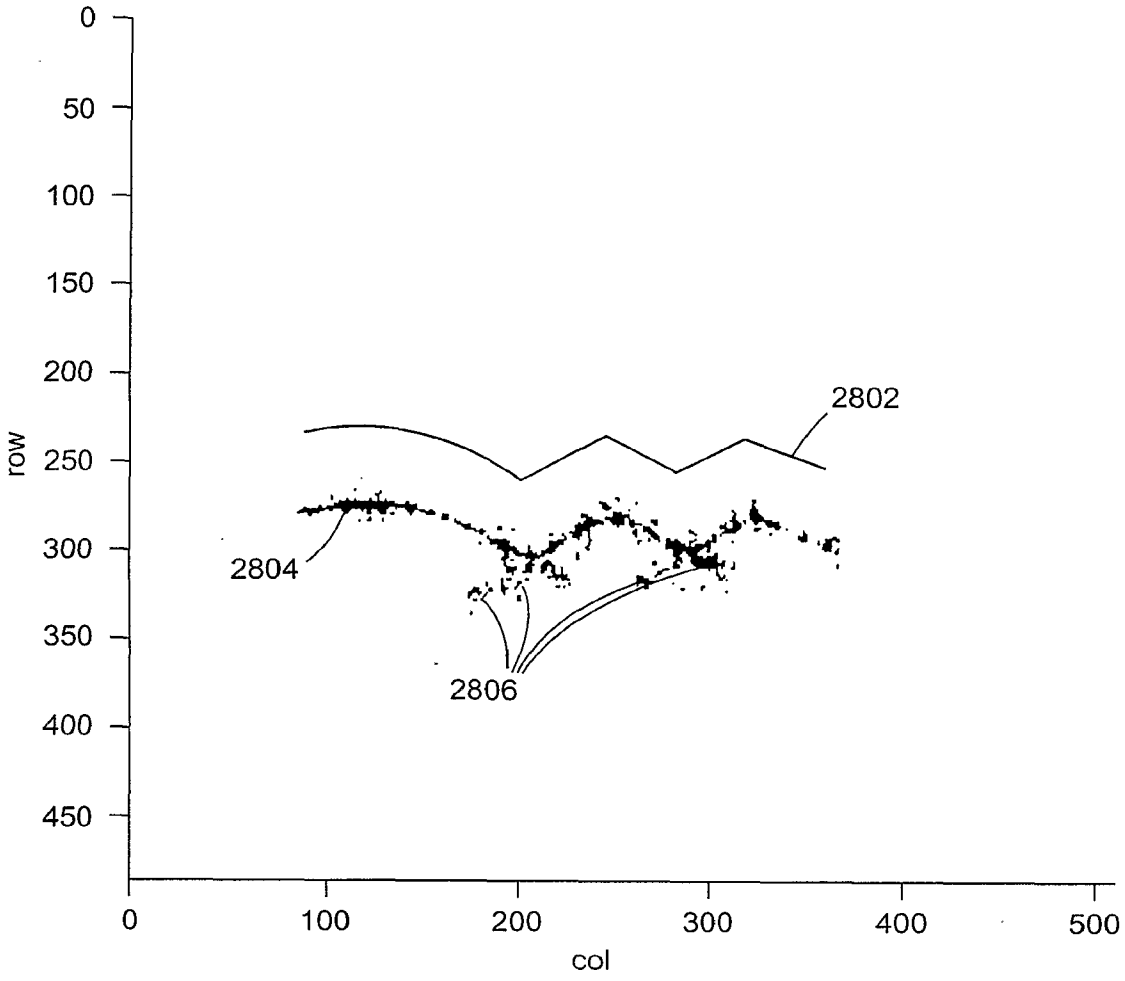


Fig. 28

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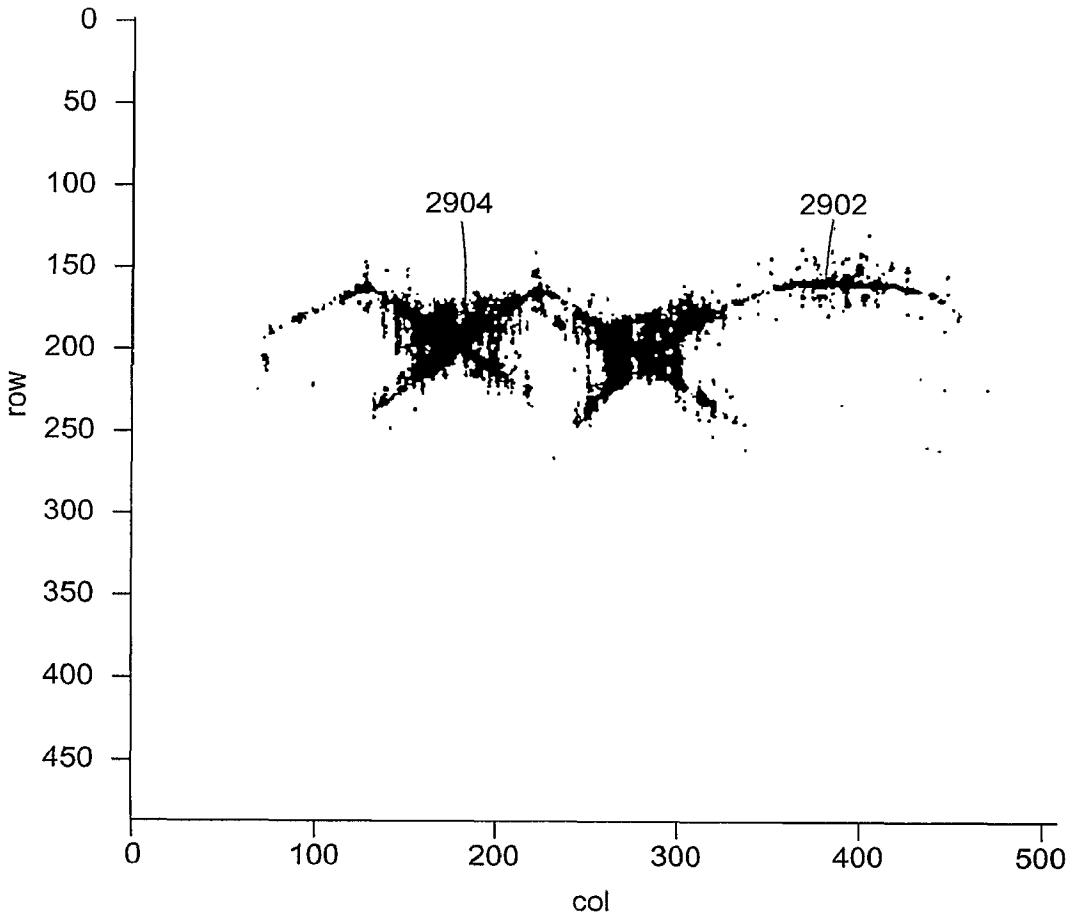


Fig. 29

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INTERNATIONAL SEARCH REPORT

rnational Application No
rcT/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

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
4 May 2001	11/05/2001

Name and mailing address of the ISA	Authorized officer
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	De Gussem, J

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INTERNATIONAL SEARCH REPORT

national Application No
rcT/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

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INTERNATIONAL SEARCH REPORT

Information on patent family members

rnational Application No
rCT/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	

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(11) International Publication Number: **WO 96/19309**

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(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).

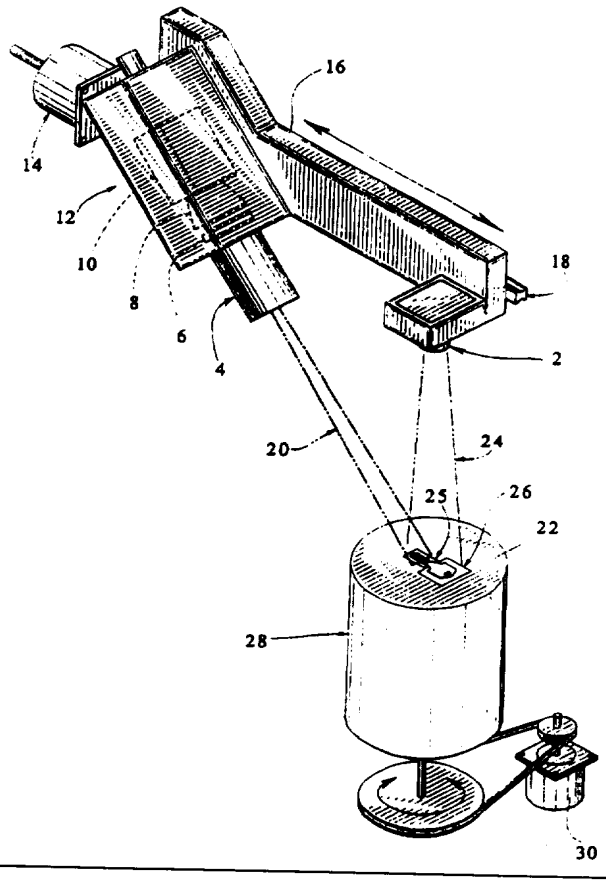
(81) Designated States: AU, CA, JP, KP, US, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).

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.



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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

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.

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 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 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 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 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

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

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

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 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 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 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 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 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

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 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 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 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 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 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

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

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

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.

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.

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

a critical advantage. It is no harder to use than a photocopy machine - no greater level of complexity is required.

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 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 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 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 a correct key blank may be identified.

Moreover, after extracting essential attribute information which is then compared with known key

manufacturer's information stored in memory, an appropriate key blank in a robotically accessible inventory is selected, cut, deburred, and automatically dispensed.

BRIEF DESCRIPTION OF THE DRAWINGS

Preferred embodiments of the invention are described hereinafter with reference to the accompanying drawing wherein:

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;

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;

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;

FIG. 4 is a cut-away perspective view of a preferred embodiment of the rotatable object key

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

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;

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;

FIG. 13 is a side elevation view of a preferred embodiment of a rotatable cutting wheel and associated anvils for cutting a key blank;

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;

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;

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;

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

extracting attributes of an object key while leaving the object key independent of constraint and then extracting attributes of an object key.

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 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 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 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.

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 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 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 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

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

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. 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

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

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

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 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 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 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 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 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

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

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

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: 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.

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 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.

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 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

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 backlighted 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

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 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 (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 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. 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, 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.

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 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 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 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 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 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.

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

determined manufacturer's keys as determined from the previous match.

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, 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 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" 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.

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

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

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

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.

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 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

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

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.

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.

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 slidingly 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

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.

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 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 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 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 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 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

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, 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: 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 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.

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.

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;

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

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

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

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

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; aa. positioning the key blank for cutting; and ab. cutting key cut features into the key blank to create a new key.

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 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 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 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

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

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 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 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 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.

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 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

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.

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 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 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 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 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.

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.

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 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 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 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 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

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.

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 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 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 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 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

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

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

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.

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

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

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

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. 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 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.) 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 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 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

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

to support the key blank against the upwardly extending lips of the key effector.

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 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, 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 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 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

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 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 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 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 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 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

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.

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.

As shown in FIG. 6, the means for clamping comprises a clamp 74, connected to a second actuable 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

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

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 actuable means 68 to cause the key effector to withdraw

the corresponding key blank 78 from a holding means, actuating a second actuable means 70 to secure the corresponding key blank 78 with a clamping means, actuating at least one subbase motor drive for the 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 actuable means to release the clamping means, 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 actuable means (68 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 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 89 in operative association with a corresponding key blank 78 in response to an identifying signal, actuating the first actuable means 68 to horizontally move the rod 85 axially to position the upwardly

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 actuable means 68 to horizontally draw in the rod 85 axially to withdraw the corresponding key blank 78 from a holding means, actuating the second actuable 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 actuable 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

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.

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.

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 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. 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 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

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

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. 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 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 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 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 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.

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 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 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 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 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 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

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 holographic 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 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

embodiments of the invention.

What is claimed as being new and desired to be protected is a follows:

1. A key making apparatus comprising:

a 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 means for extracting attributes of an object key.

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:

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.

4. The key making apparatus of claim 2, wherein the non-contact means for extracting laterally exposed attributes of an object key comprises:

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

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. The key making apparatus of claim 3, wherein the non-contact means for extracting attributes of an object key comprises:

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 an object key positioned on said transparent section and producing an output signal; and

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:

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

pass light through the transparent section of the supporting means and project an image of the object key positioned thereon;

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;

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 projected on to the object key by a light stripe generator.

7. The key making apparatus of claim 3, wherein the non-fixturing means for establishing an operative positional relationship comprises:

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 pass light through the transparent section of the supporting means and project an image of the object key positioned thereon;

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;

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 projected on to the object key by a light stripe generator.

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;

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.

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 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; and

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 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 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;

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,

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.

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:

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:

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,

whereby, the laterally protected attributes of the object key can be extracted.

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

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.

16. The key making apparatus of claim 4, 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

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.

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

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.

22. 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 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 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 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.

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

object key,

whereby, a corresponding key blank matching the outer shape of a known manufacturer's key may be determined.

24. The key making apparatus of claim 14, wherein the means for identifying attributes of an object key comprises:

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 attributes of the object key resulting from at least one light stripe being projected obliquely on to the blade thereof; 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 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 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 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.

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 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 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 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 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.

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.

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.

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.

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

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

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 slidingly 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

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

b. extracting laterally protected attributes of an object key independent of physical contact.

38. A method for automatically making keys which comprises:

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;

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.

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;

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;

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

key by a light stripe generator;

e. producing an output signal corresponding to said determination; and

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.

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:

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;

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;

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

the light received no longer exceeds a minimum threshold, indicating that the blade of said object key is disposed flatly on the blade section.

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;

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 corresponding to said 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 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

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;

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 said 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 said object key is disposed flatly on the blade section.

43. A method for automatically making keys which comprises:

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;

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

signals from a master pattern memory, said master code signals defining traits of a master pixel pattern of a selected 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 signals from the result of the recognition of the pixel pattern of the object key.

44. A method for automatically making keys which comprises:

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;

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 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

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.

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 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 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 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 signals from the result of the recognition of the pixel pattern of the object key.

46. A method for automatically making keys which comprises:

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;

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;

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

g. identifying laterally exposed attributes of the object key responsive to the integrated output signal.

48. A method for automatically making keys which comprises:

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;

e. gathering together the plurality of object images and producing an integrated object image;

f. recognizing a pixel pattern from said 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 said 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 exposed attributes 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.

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;

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;

e. gathering together the plurality of object images and producing an integrated object image;

f. recognizing a pixel pattern from said 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 said 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, 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.

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;

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;

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;

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

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

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;

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

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.

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;

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

f. dispensing said new key.

53. A method for automatically making keys which 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 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 said 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 said 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 said 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 said object key is disposed flatly on the blade section;

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;

m. recognizing a pixel pattern from said 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 said recognition, said 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,

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

laterally protected attributes of the selected manufacturer's key;

v. 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;

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 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 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 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;

aa. positioning said key blank for cutting; and

ab. cutting key cut features into said key blank to create a new key.

54. A method for automatically making keys which comprises:

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.

55. A method for automatically making keys which comprises:

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 actuable means to cause the key effector to withdraw the corresponding key blank from a holding means;

c. actuating a second actuable means to secure the corresponding key blank with a clamping means;

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

key blank in operative association with the means for cutting to cut a new key;

f. actuating the second actuable means to release the clamping means; and

g. actuating at least one subbase motor drive to position the new key for dispensing.

56. A method for automatically making keys which comprises:

a. receiving at least one object image of an object key;

b. recognizing a pixel pattern from said object image;

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;

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;

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

the object key;

g. receiving at least one object image of the illuminated object key and producing a memory signal; and

h. storing said memory signal.

57. A method for automatically making keys which 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 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;

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, 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

said 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 said first memory signal.

58. A method for automatically making keys which 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 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;

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,

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

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:

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 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 illuminated object key and producing a memory signal; and

p. storing said memory signal.

59. A method for automatically making keys which comprises:

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;

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;

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;

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,

whereby, a corresponding selected manufacturer's key and a corresponding key blank responsive to the first identifying signal may be determined; and

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

of the pixel pattern from said object image of the 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 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:

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 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.

60. A method for automatically making keys which 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 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;

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,

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 disposed on the transparent section, thereby

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

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;

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 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; 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.

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 corresponding key blank in response to an identifying signal;

b. actuating a first actuable means to horizontally move the rod axially to position the

upwardly extending pin at a spaced distance below and in alignment with a hole in the handle of the corresponding key blank;

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 actuable means to horizontally draw in the rod axially to withdraw the corresponding key blank from a holding means;

e. actuating a second actuable means to secure the corresponding key blank with a clamping means;

f. actuating a means for cutting;

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 actuable means to release the clamping means; and

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 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.

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.

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.

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.

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.

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 corresponding key blank.

70. The key making apparatus of claim 69, wherein the means for storing a plurality of key blanks comprises:

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,

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 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,

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 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 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

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:

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

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,

said passage being suitably sized to allow a key blank to be withdrawn horizontally therethrough and having an overhead door disposed thereon,

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

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.

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 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,

(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 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 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,

the bottom wall of each of the collar members 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 to limit lateral movement of same,

a recess forming an opening in its upper 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 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 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 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,

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;

(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 slidingly move axially therein;

(4) the top of said upwardly extending pin extending higher than the top of normally exposed spring biased blocks;

(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,

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,

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,

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,

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 actuable 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.

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

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 actuable means to raise the clamp and the first actuable 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 actuable means to raise the clamp and the first actuable 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.

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

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; and

e. a means for aligning an object key with a horizontal plane comprising:

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;

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;

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,

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

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-

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

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.

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

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.

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,

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.

91. A key making apparatus comprising a means for

grasping a key blank having a blade while leaving the blade free of constraint for cutting.

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.

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.

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.

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.

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

while leaving the opposite side of the blade free of constraint.

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.

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.

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 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:

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

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.

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;

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

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.

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;

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

blade free of constraint;

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 leaving the opposite side of said blade free of constraint.

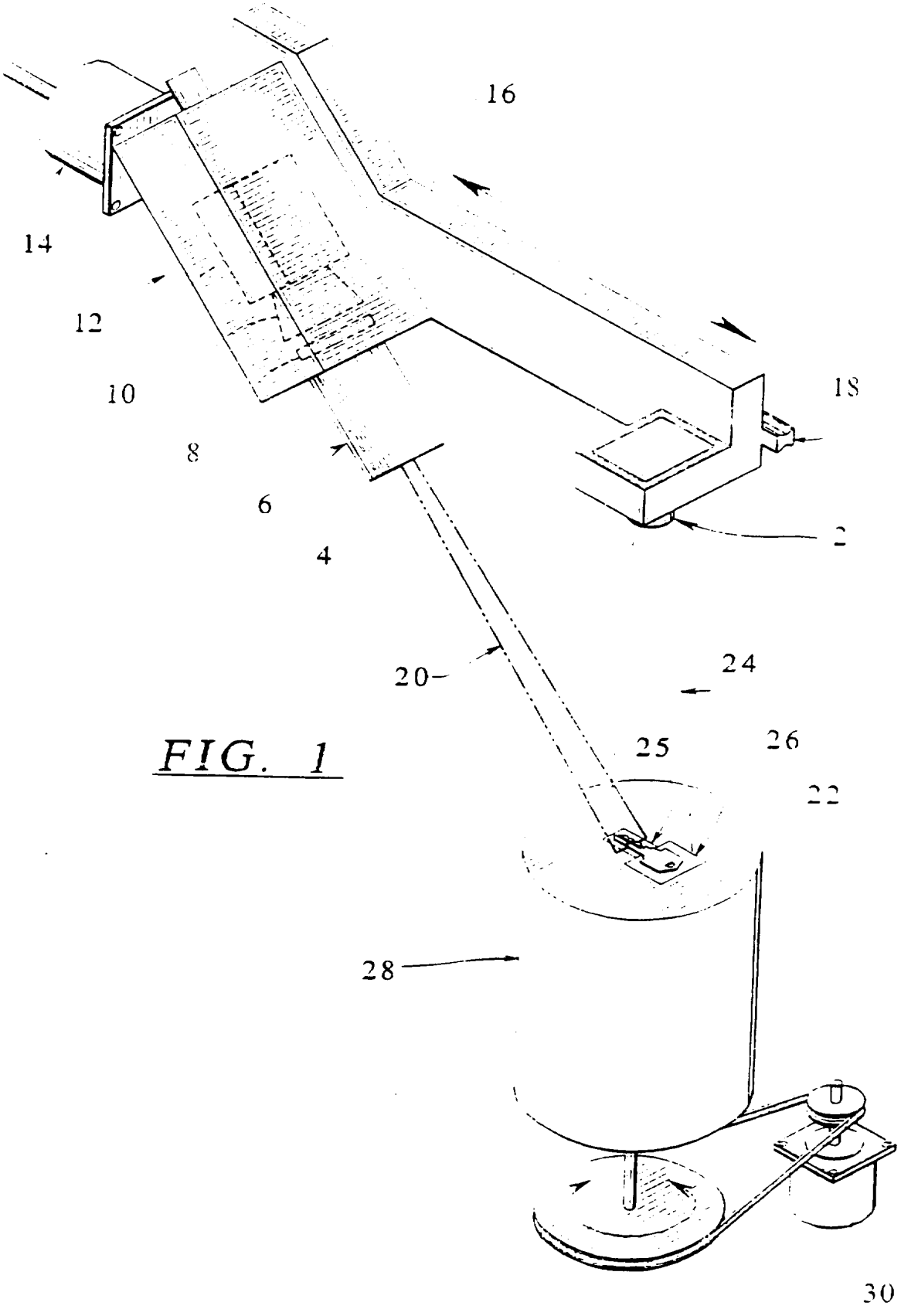


FIG. 1

FIG. 2

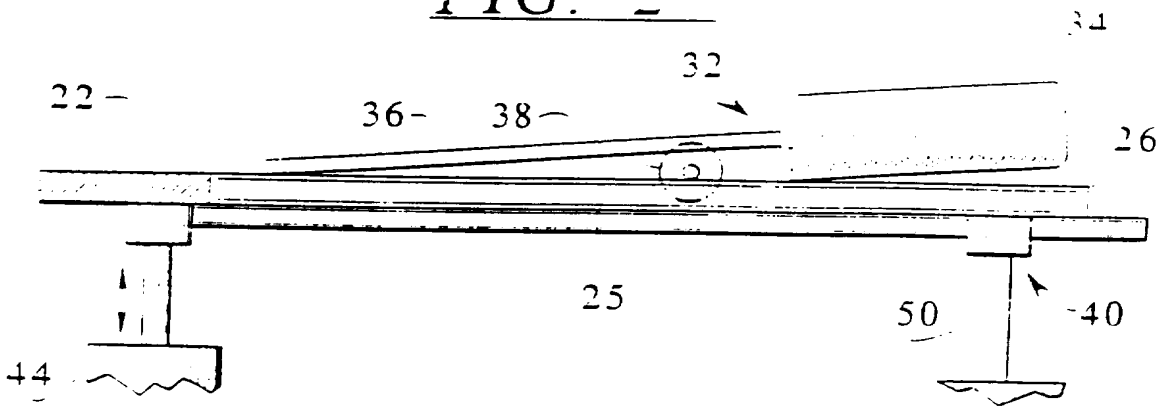


FIG. 3

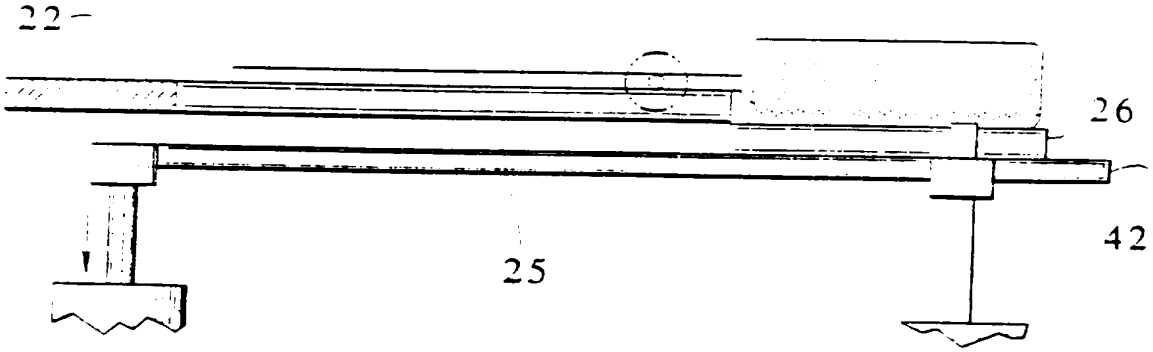


FIG. 19A

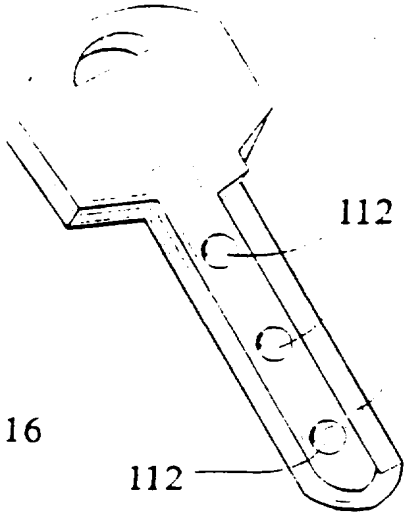


FIG. 19B

FIG. 19

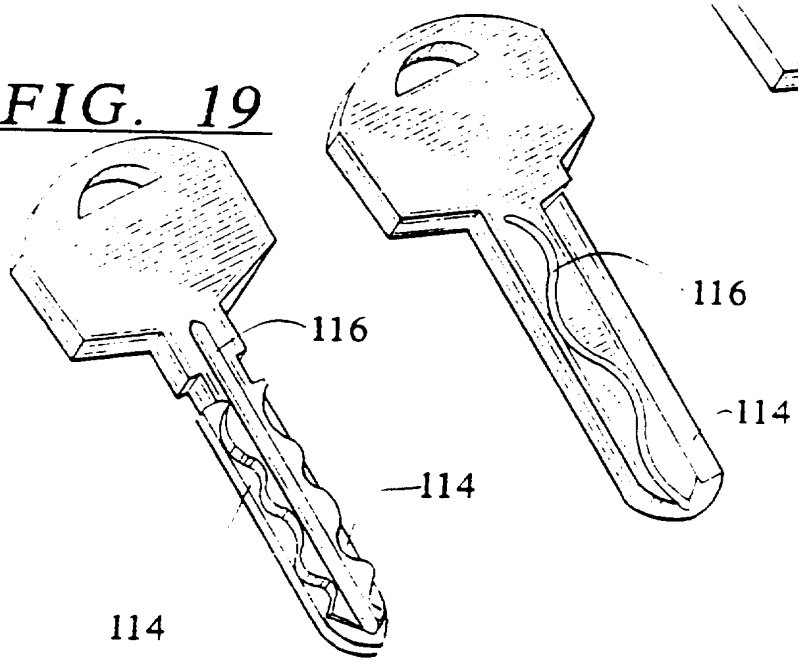
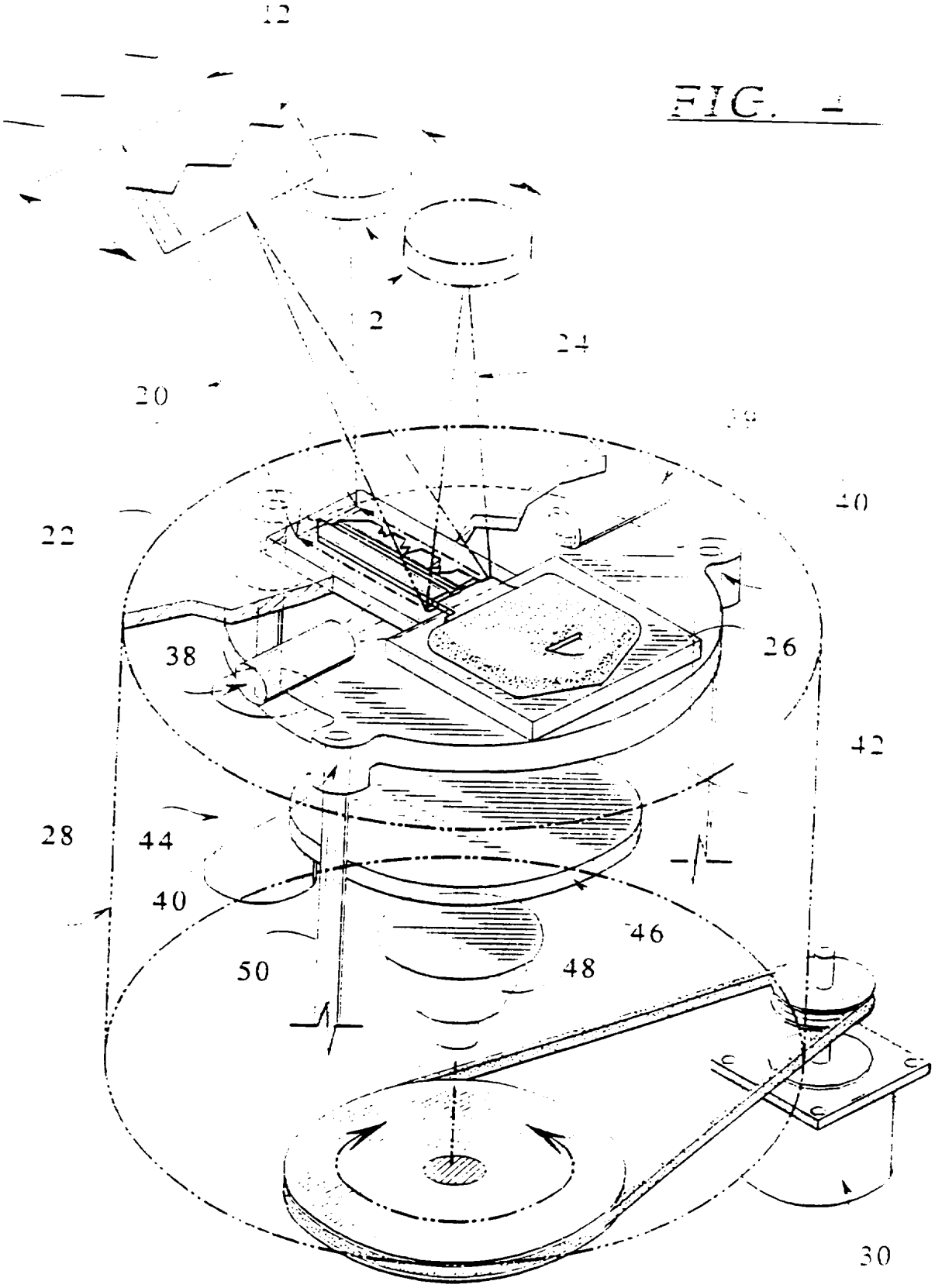


FIG. 1



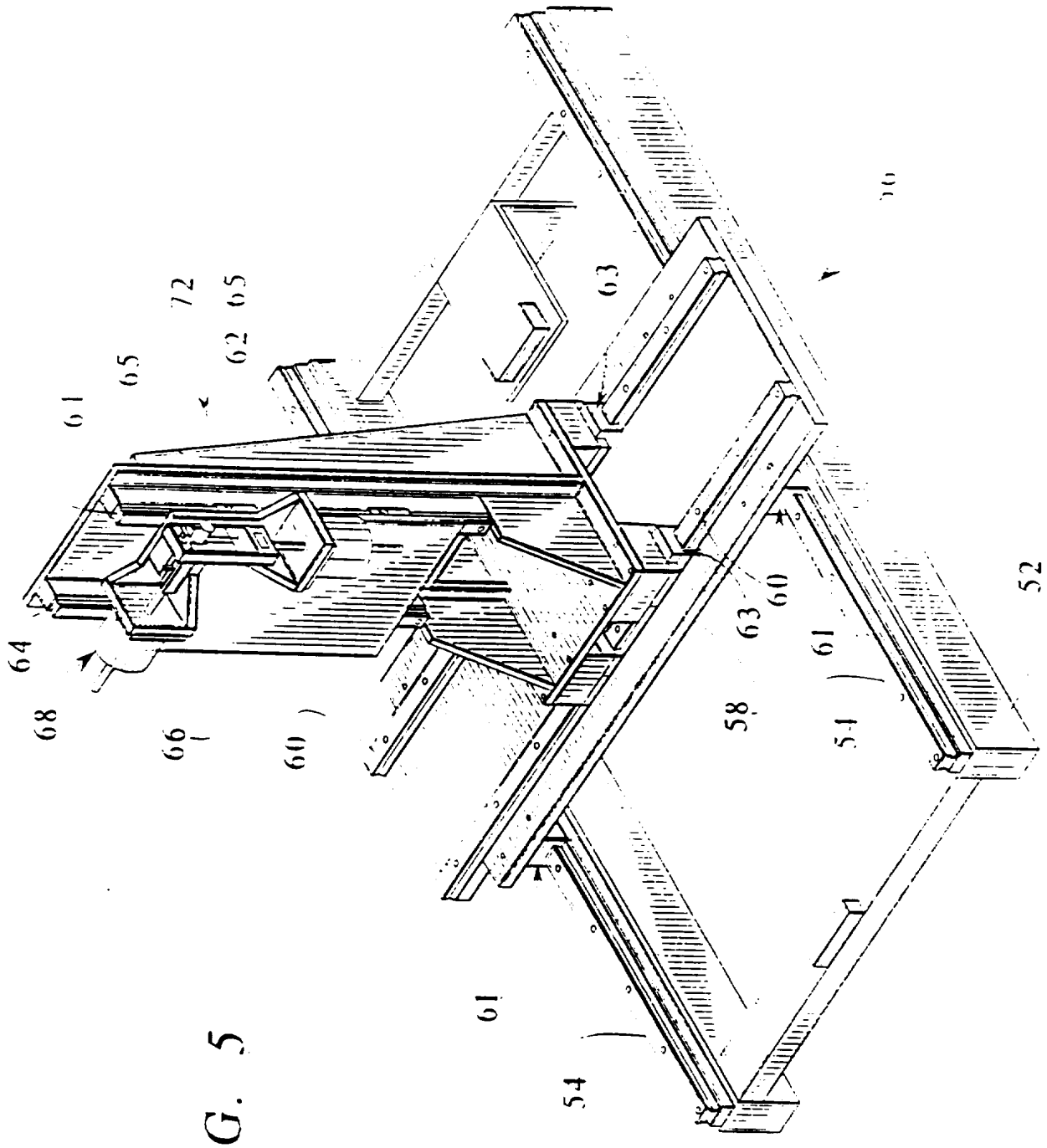


FIG. 5

FIG. 6

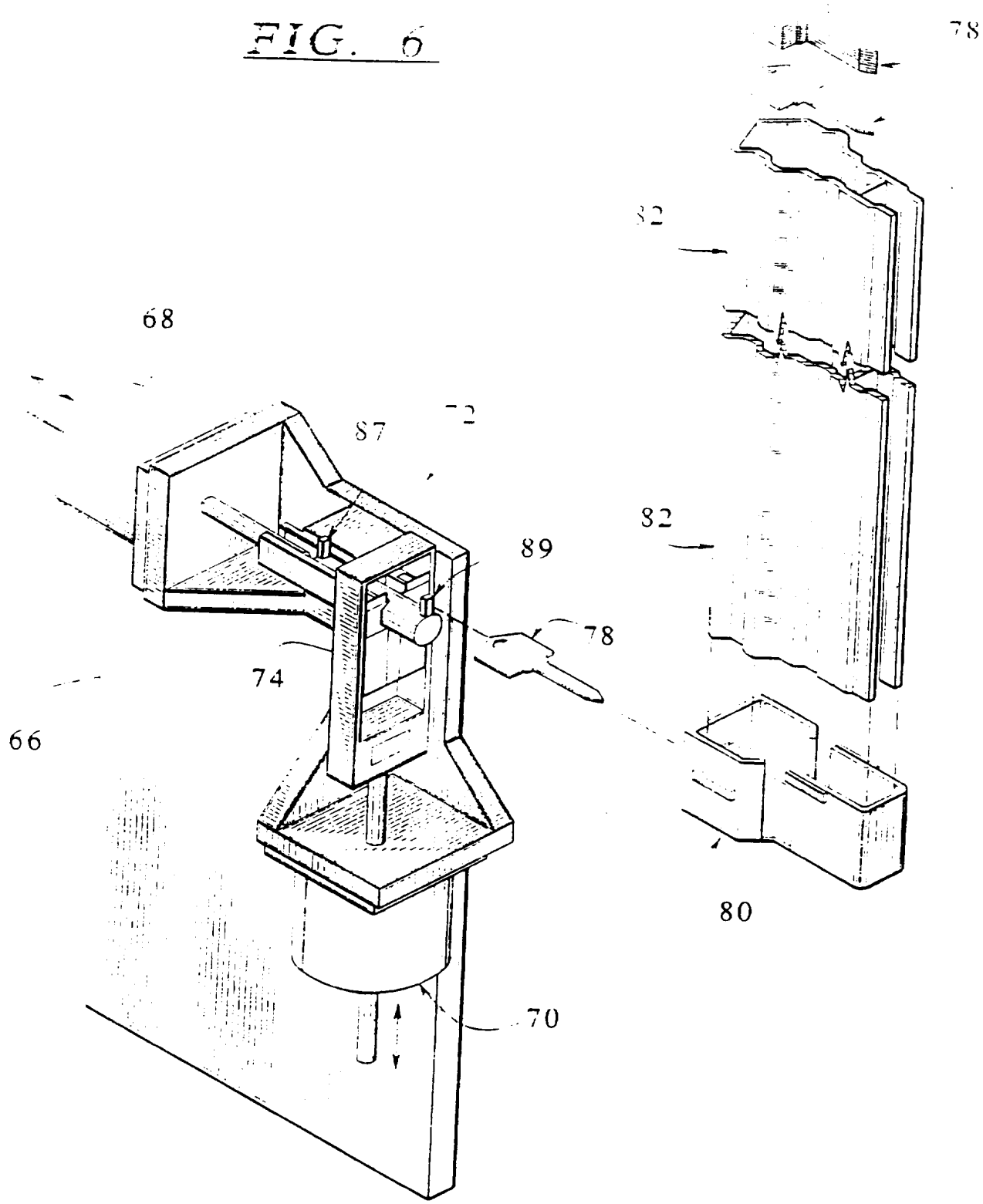


FIG. 9

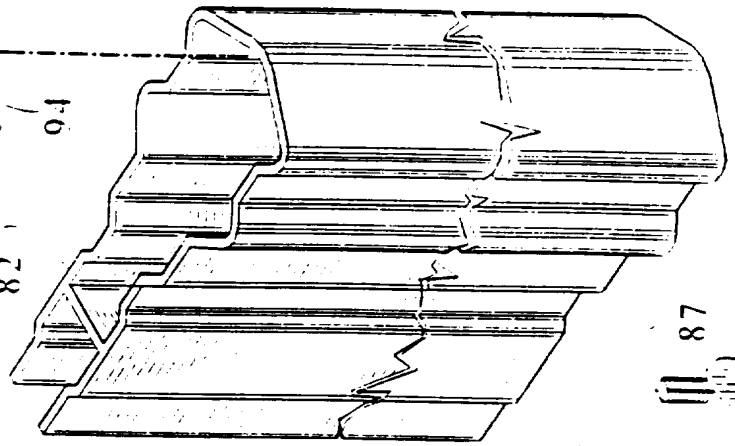


FIG. 8

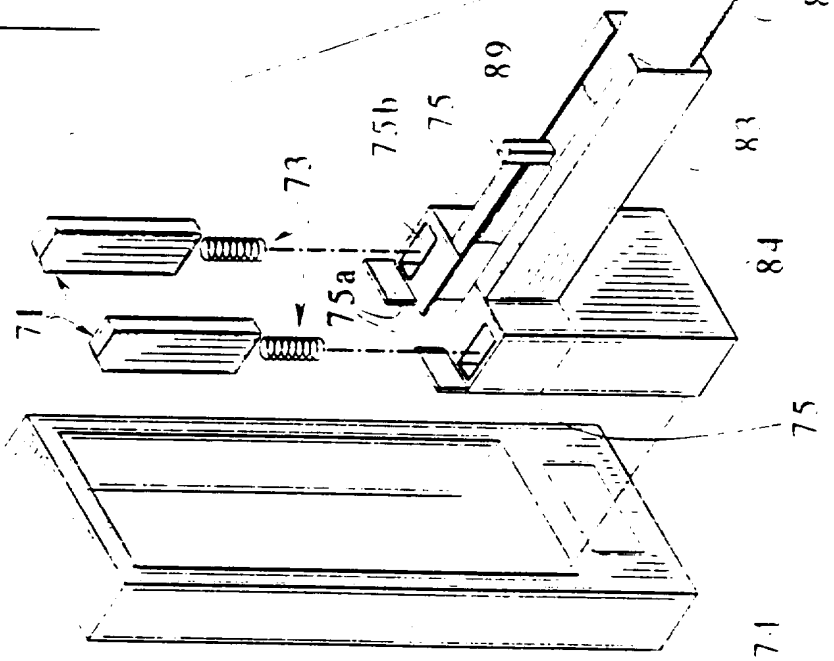
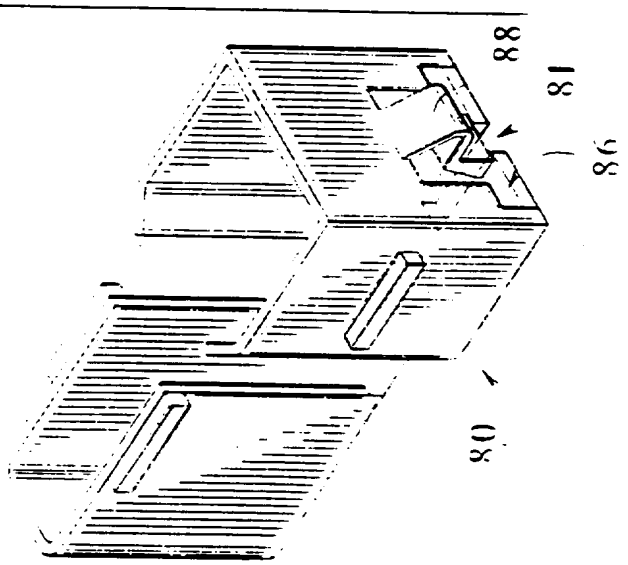


FIG. 7



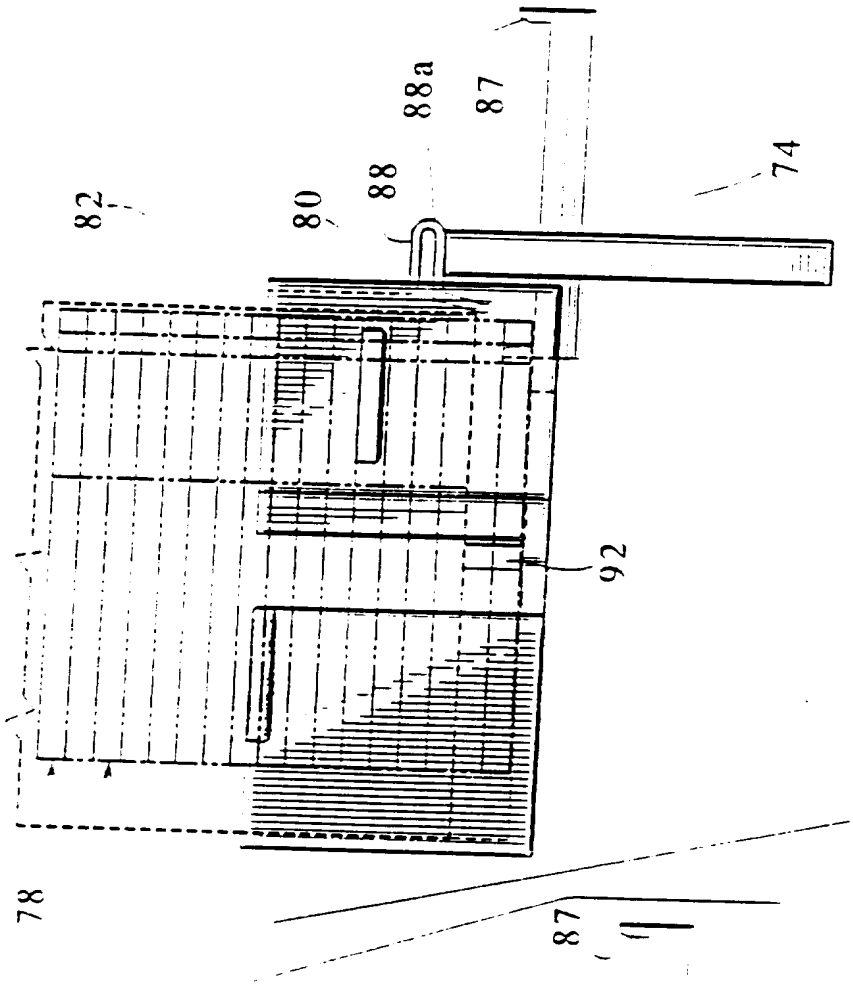


FIG. 11

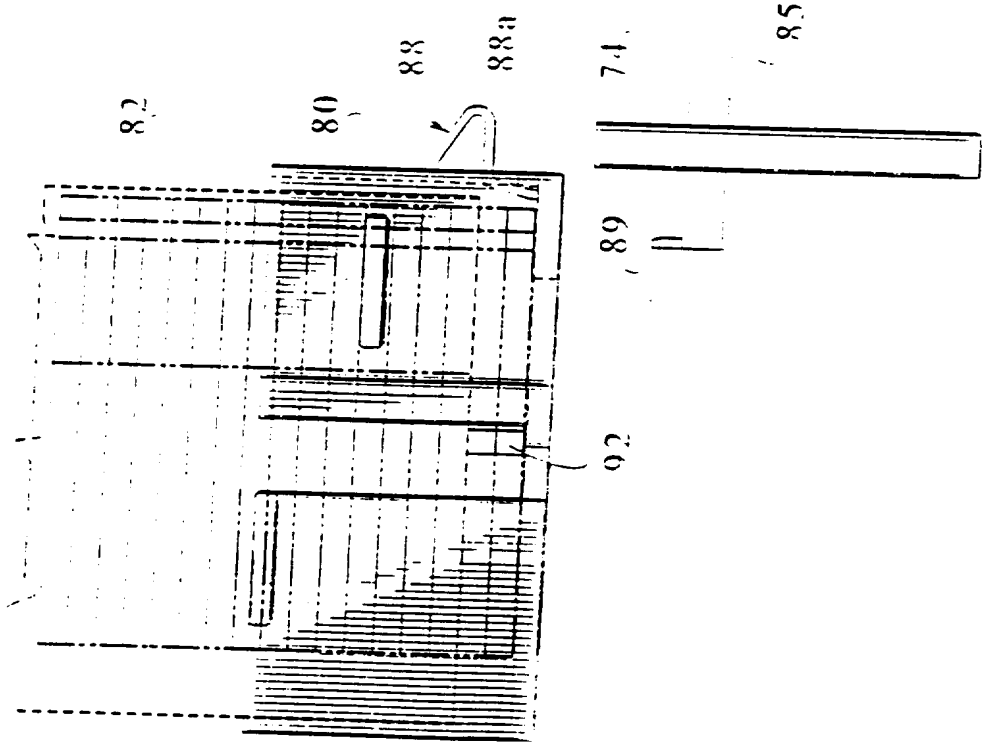


FIG. 10

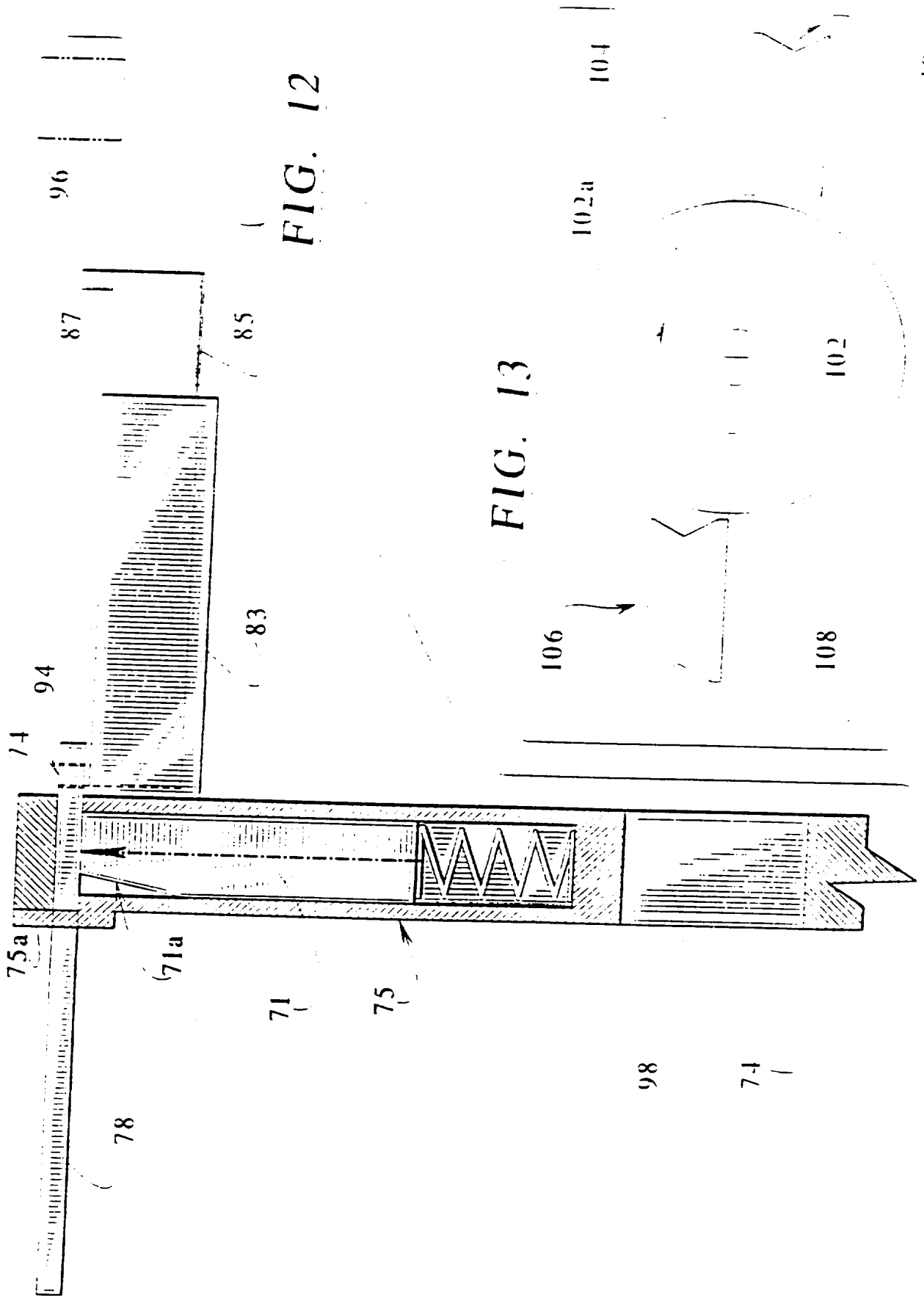
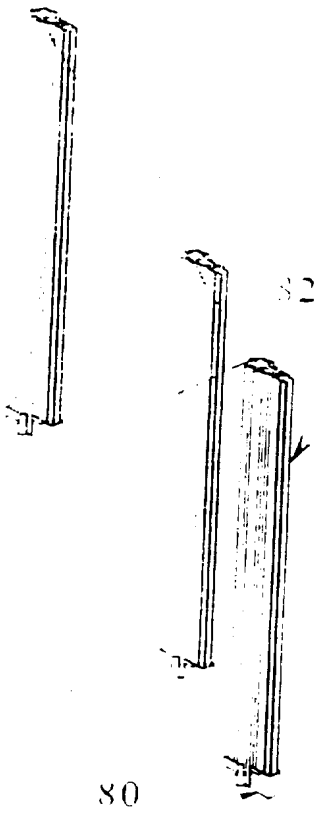


FIG. 12

FIG. 13



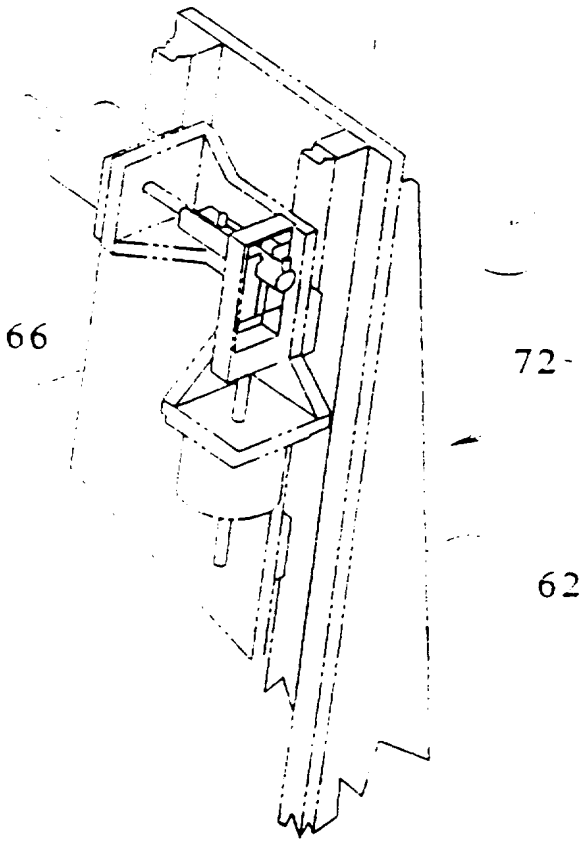


FIG. 14

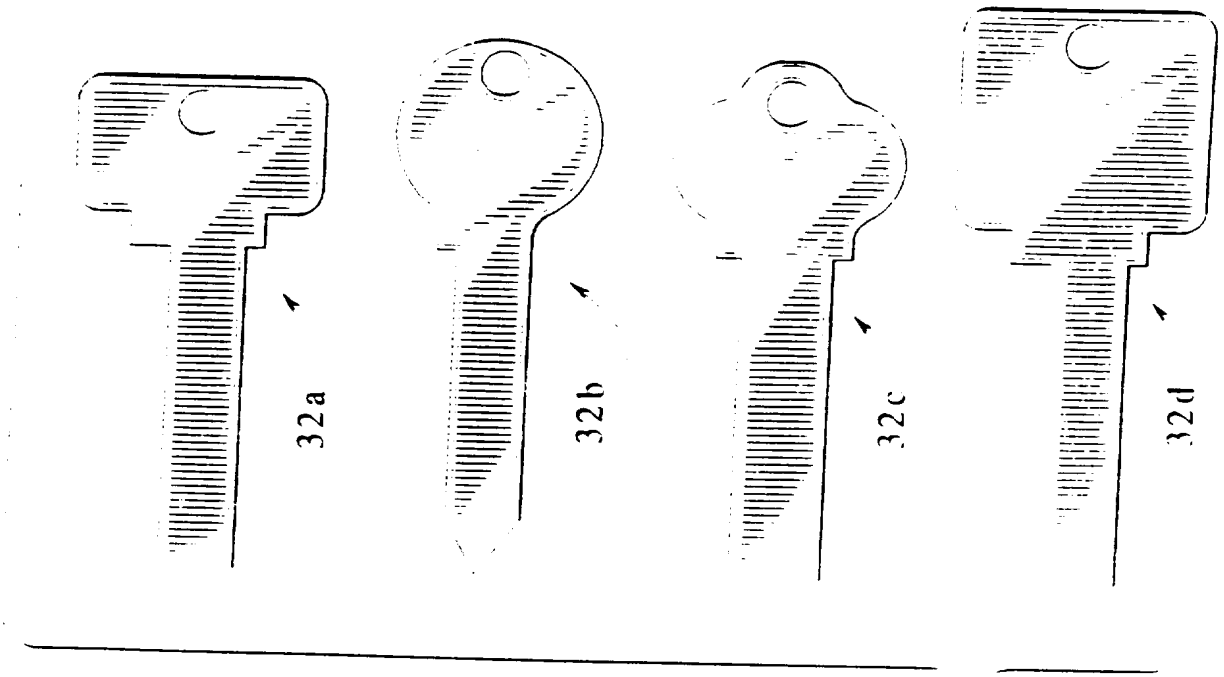


FIG. 15

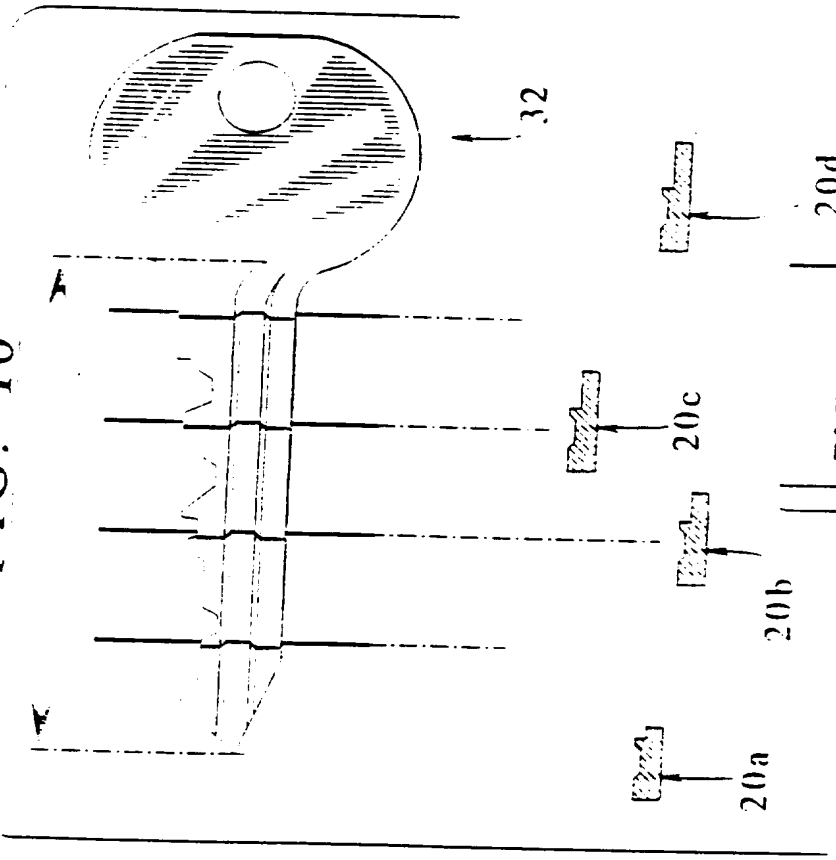


FIG. 16

FIG. 17A
FIG. 17B
FIG. 17C

FIG. 17

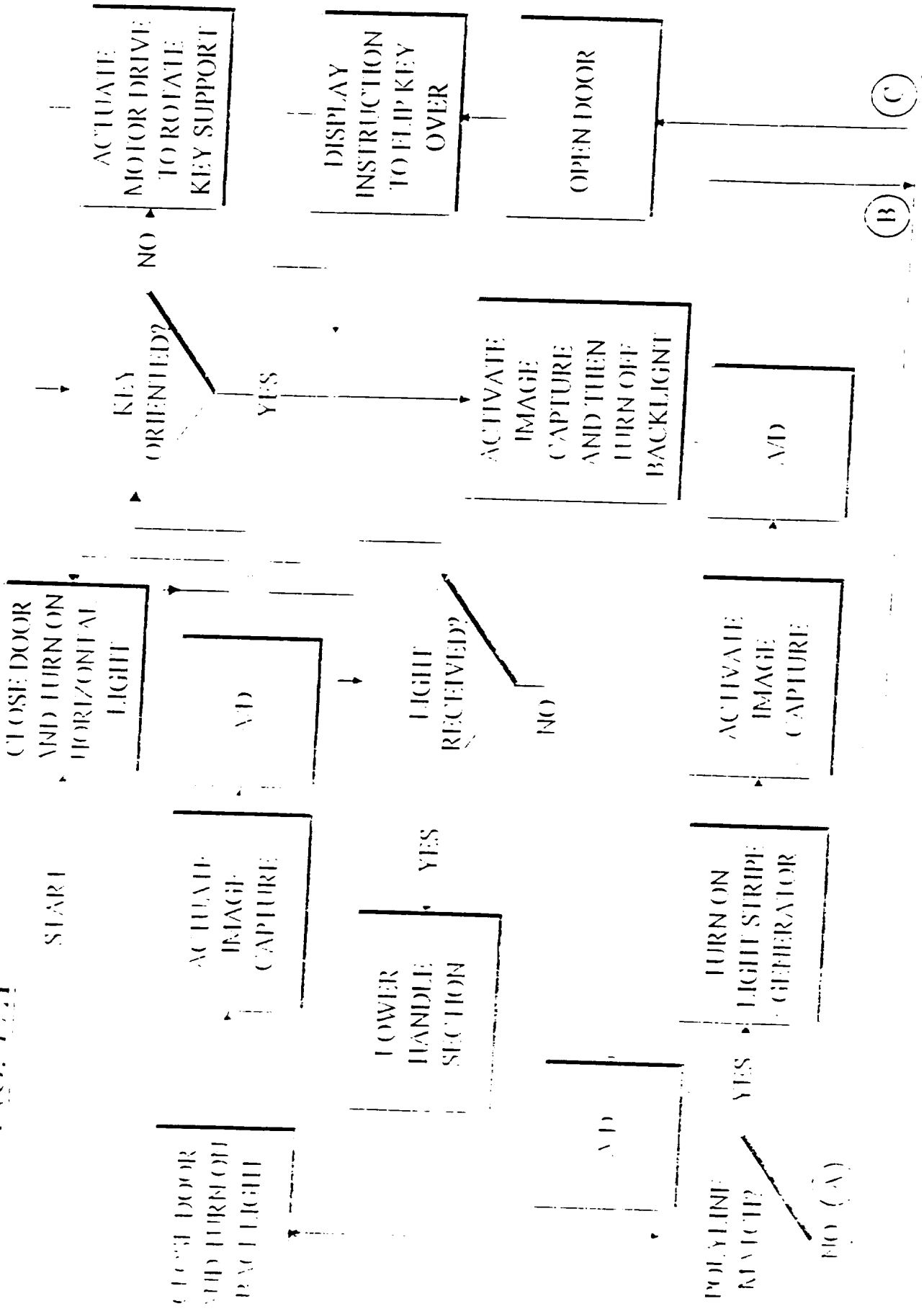

START
CLOSE DOOR AND TURN ON DOOR/CONTACT LIGHT
KEY ORIENTED?
NO
YES
ACTUATE MOTOR DRIVE TO ROTATE KEY SUPPORT
DISPLAY INSTRUCTION TO FLIP KEY OVER
OPEN DOOR
C
B
ACTUATE IMAGE CAPTURE AND THEN TURN OFF BACKLIGHT
A/D
A/D
LIGHT RECEIVED?
NO
ACTUATE IMAGE CAPTURE
ACTUATE IMAGE CAPTURE
A/D
POWER HANDLE SECTION
YES
TURN ON LIGHT STRIP GENERATOR
A/D
CLOSE DOOR AND TURN OFF BACKLIGHT
POLYLINE REVOLUTE?
YES
NO (A)

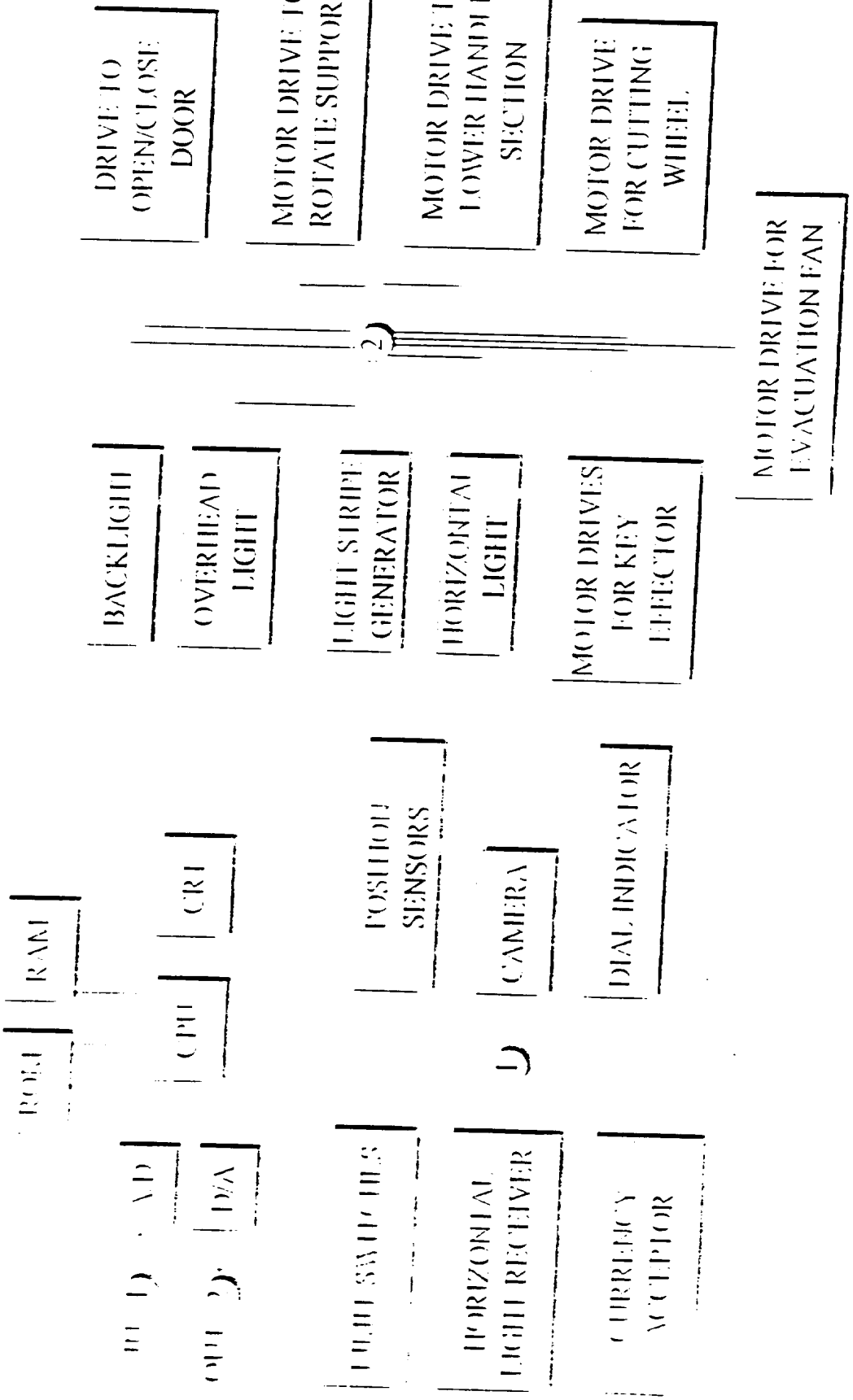
FIG. 17A

(B)
(C)
YES
NO
IS THERE KEY INFORMATION ON OTHER SIDE OF KEY?
DOES LIGHT STRIPE IMAGE MATCH LIGHT STRIPE MEMORY ASSOCIATED WITH PREVIOUS MATCH?
NO
YES
HAS MONEY BEEN DEPOSITED?
DO KEY CUT FEATURES CORRESPOND WITH KEY CUT CODES ASSOCIATED WITH PREVIOUS MATCH?
NO
YES
DISPLAY INSTRUCTIONS
ACTIVATE IMAGE CAPTURE
STORE IN MEMORY
ACTUATE MOTOR DRIVES TO POSITION KEY BLANK ASSOCIATED WITH PREVIOUS MATCH
ACTUATE MOTOR DRIVES TO WITHDRAW KEY BLANK
TURN ON OVERHEAD LIGHT
DISPLAY INSTRUCTIONS
OPEN DOOR

FIG. 17C

TRACE CUT OR CUT OEM KEY CUT CODES
TRACE
OEM
ACTUATE MOTOR DRIVES TO POSITION KEY BLANK FOR CUTTING
ACTUATE MOTOR DRIVES TO POSITION CUT KEY FOR DEBURRING
COMPUTE POSITION OF KEY BLANK FOR CUTTING
ACTUATE MOTOR DRIVES FOR CUTTING WHEEL
ACTUATE MOTOR DRIVES TO RELEASE CLAMP AND POSITION CUT KEY FOR DISPENSING
MEASURE KEY BLANK POSITION
DISPENSE KEY & DISPLAY & DEPRESS TOOLS AND OPEN DOOR
ACTUATE MOTOR DRIVE FOR POSITIONING KEY BLANK ON DEAD INDICATOR
ACTUATE MOTOR DRIVES TO RELEASE CLAMP TO SECURE KEY BLANK

FIG. 18


DRIVE TO OPEN/CLOSE DOOR
MOTOR DRIVE TO ROTATE SUPPORT
MOTOR DRIVE TO LOWER HANDLE SECTION
MOTOR DRIVE FOR CUTTING WHEEL
MOTOR DRIVE FOR EVACUATION FAN
BACKLIGHT
OVERHEAD LIGHT
LIGHT STRIPE GENERATOR
HORIZONTAL LIGHT
MOTOR DRIVES FOR KEY EJECTOR
ROM
RAM
CPU
CRT
POSITION SENSORS
CAMERA
DIAL INDICATOR
HORIZONTAL LIGHT RECEIVER

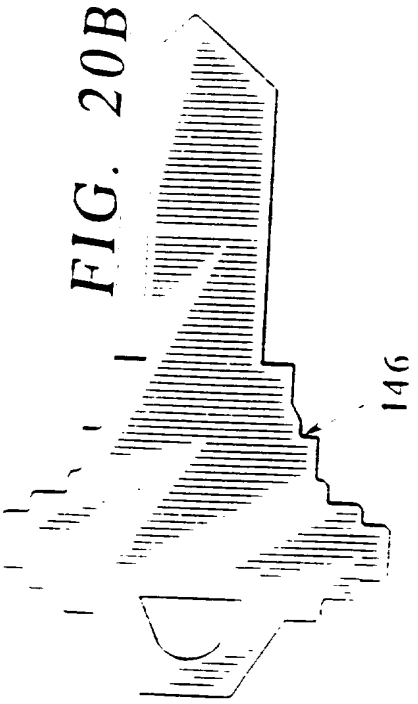


FIG. 20B



FIG. 20C

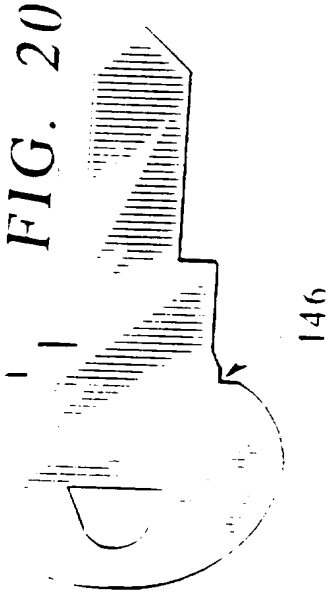


FIG. 20D

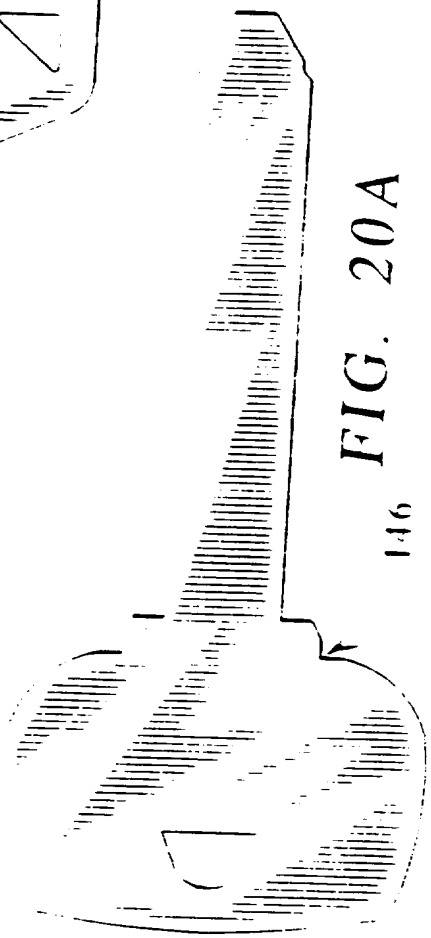


FIG. 20A

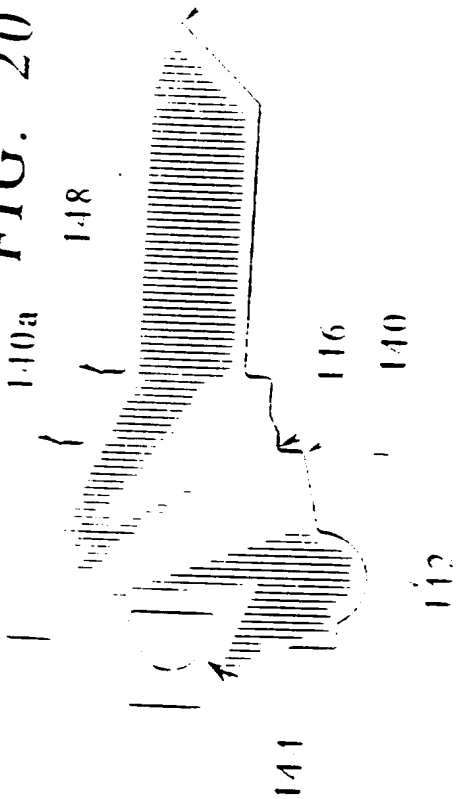


FIG. 20

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.

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Date of the actual completion of the international search
07 APRIL 1995

Date of mailing of the international search report
05 MAY 1995

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A1

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(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).

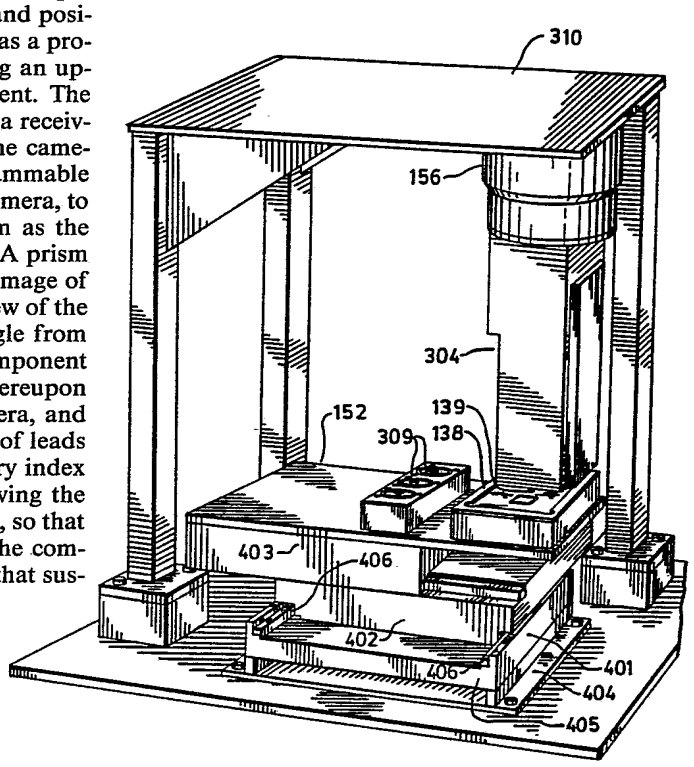
(81) Designated States: AT (European patent), BE (European patent), CA, CH (European patent), DE (European patent), DK (European patent), ES (European patent), FR (European patent), GB (European patent), GR (European patent), IT (European patent), LU (European patent), NL (European patent), SE (European patent), US.

Published
With international search report.

(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.



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VISION SYSTEM FOR INSPECTION OF ELECTRONIC COMPONENTS

TECHNICAL 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 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 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 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 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 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 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 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 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 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.

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 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 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

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;

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 ±.00005 cm. (±.000020 inches). Calibration is carried out automatically under software control. 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:

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 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 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 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 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 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 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.

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 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 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 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 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;

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;

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;

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;

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;

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

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

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:

(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

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

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

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 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 by a personal computer such as an AT-compatible controller:

(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.

(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 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. 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 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 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, 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).

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 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 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 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 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 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 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 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 inspection system provides. An additional benefit of a

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. 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 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 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 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 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 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 "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 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 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 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 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 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, 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 20 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 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 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 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.

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 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:

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;

said at least one camera being rotatably mounted about a vertical axis on a programmable rotary index table;

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 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

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 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 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.

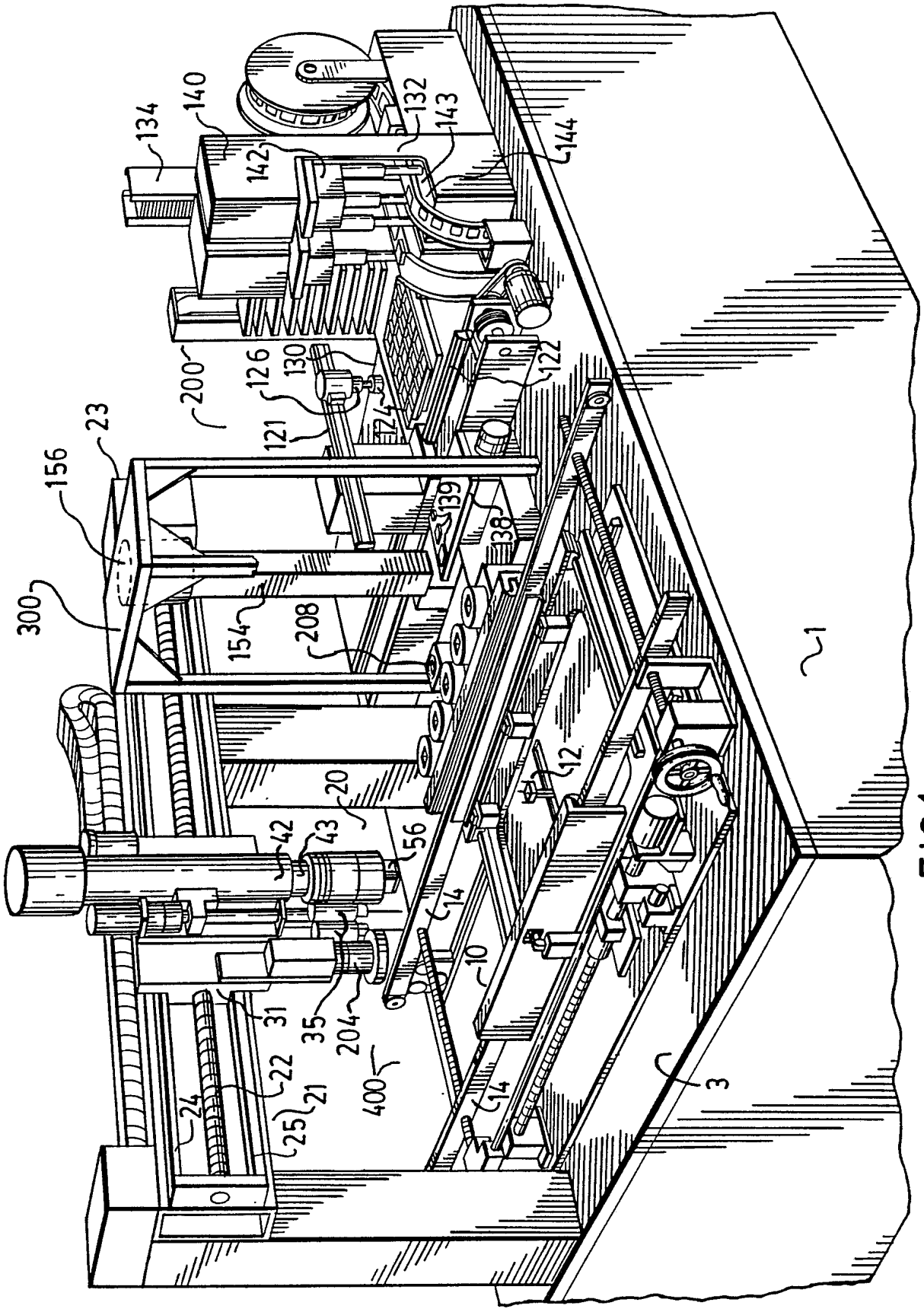

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FIG.1.

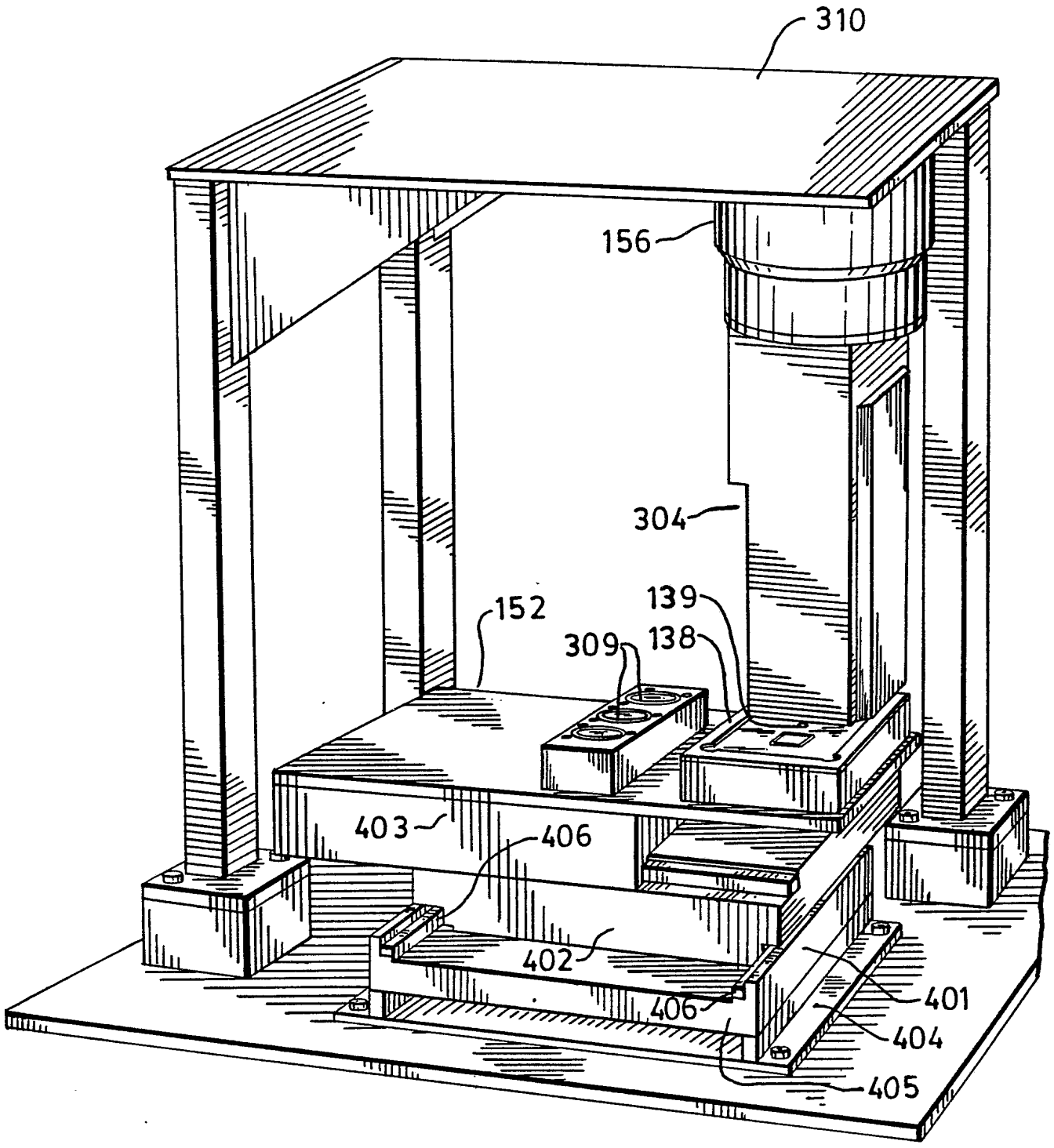


FIG.2.

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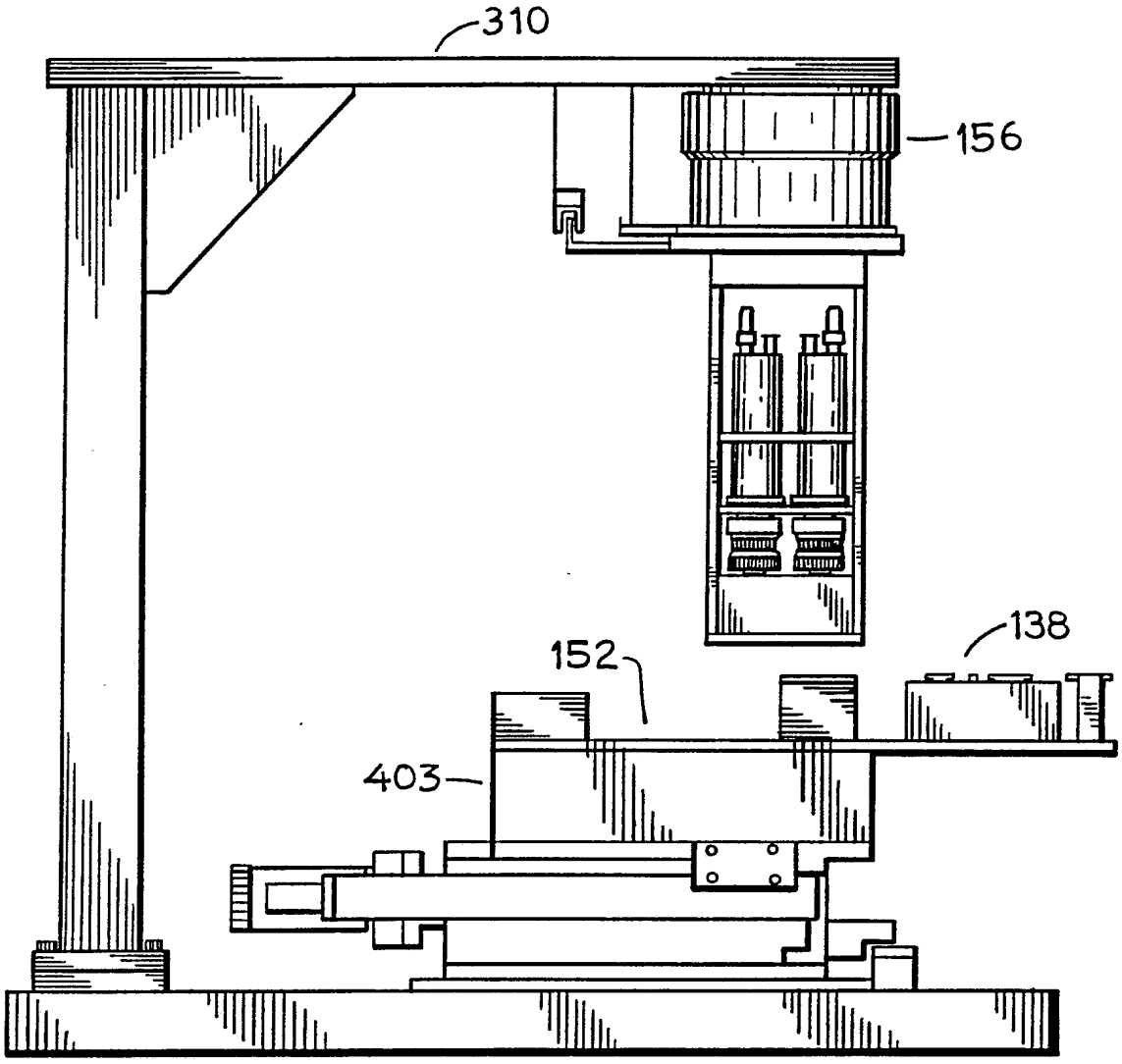


FIG.3.

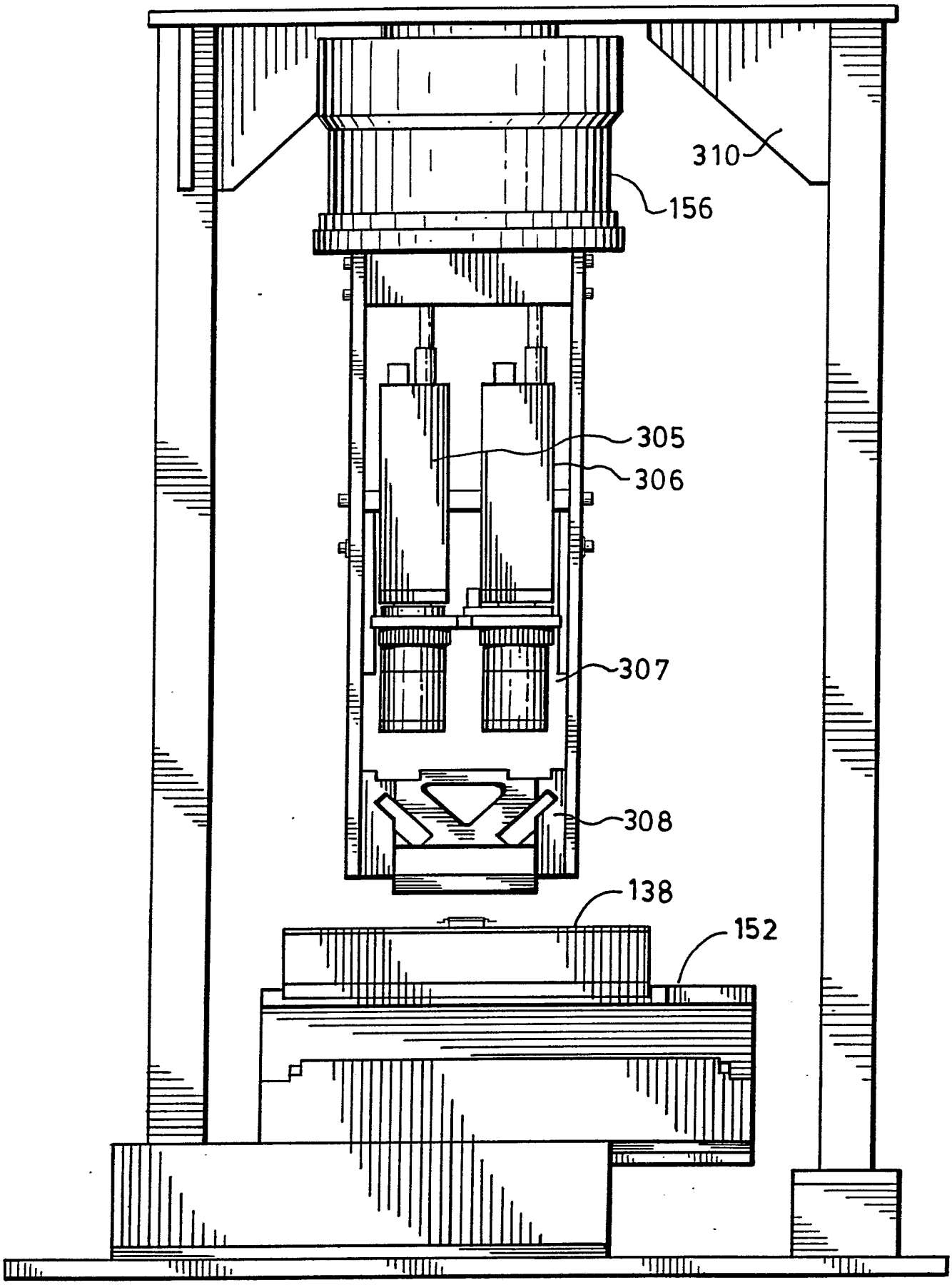


FIG.4.

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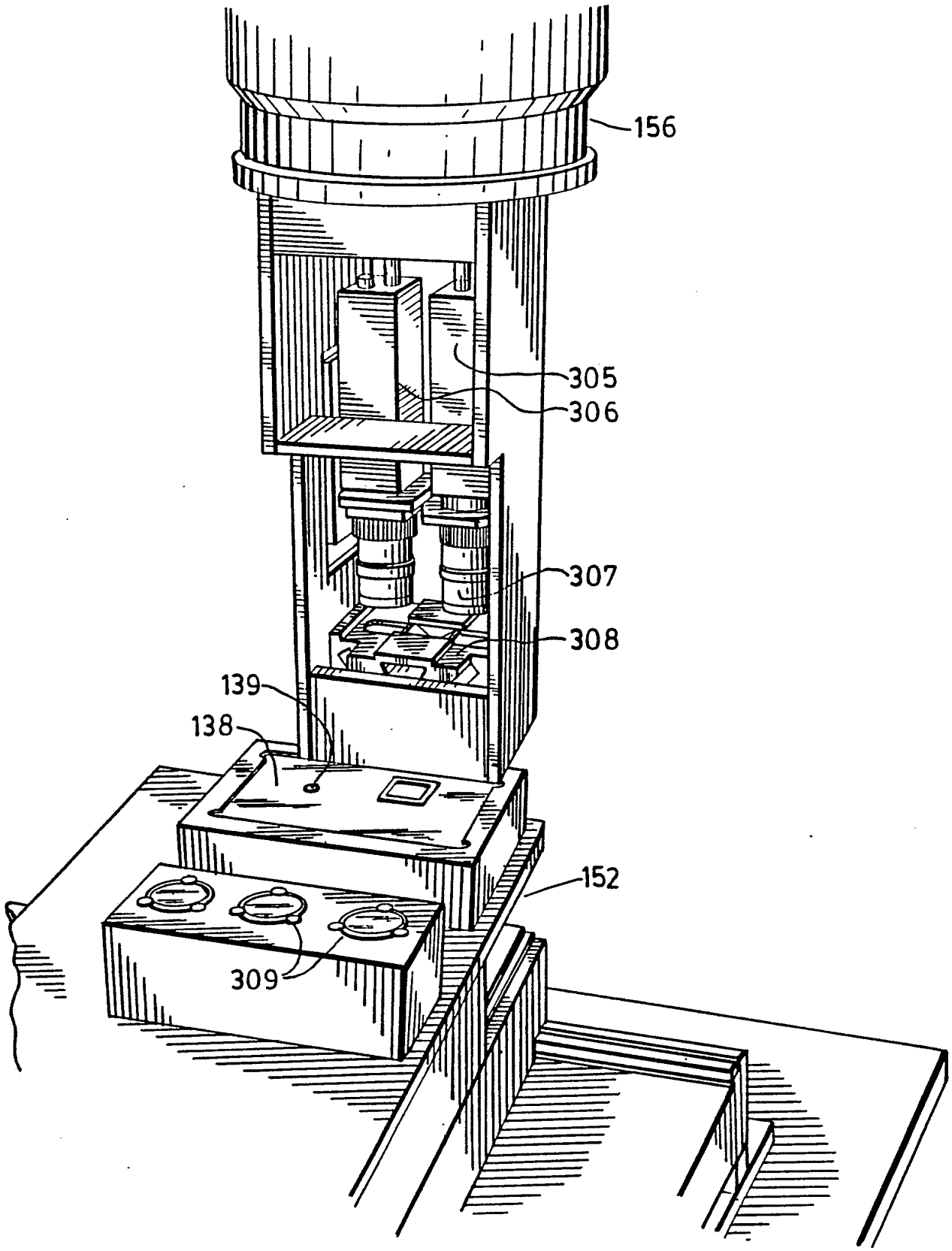


FIG.5.

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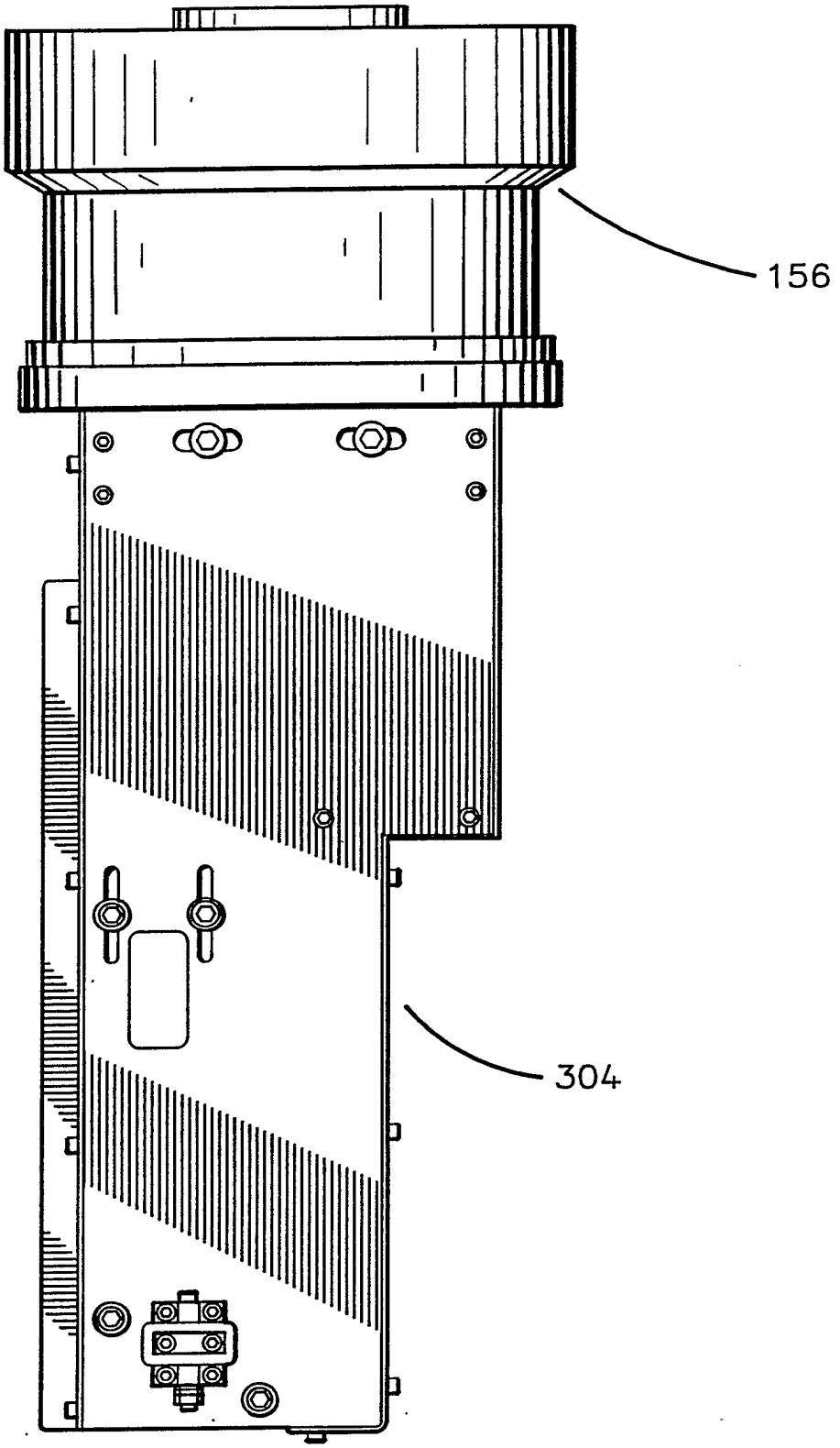


FIG.6.

SUBSTITUTE SHEET

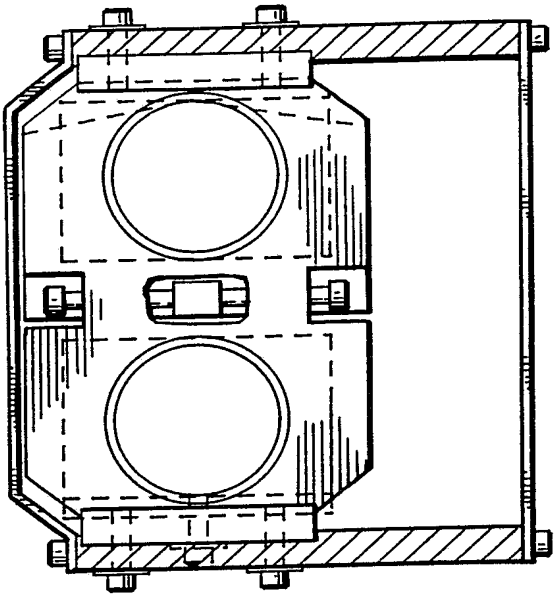


FIG.7.

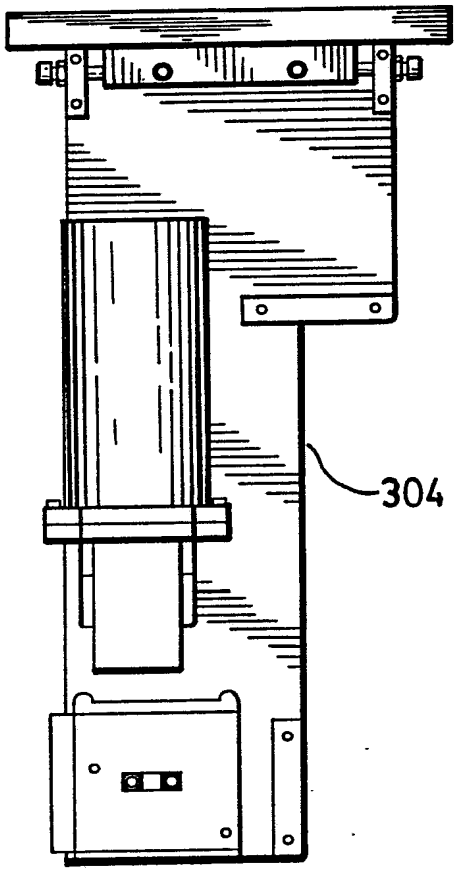


FIG.8.

Hillman Exhibit 1002
Page 0846

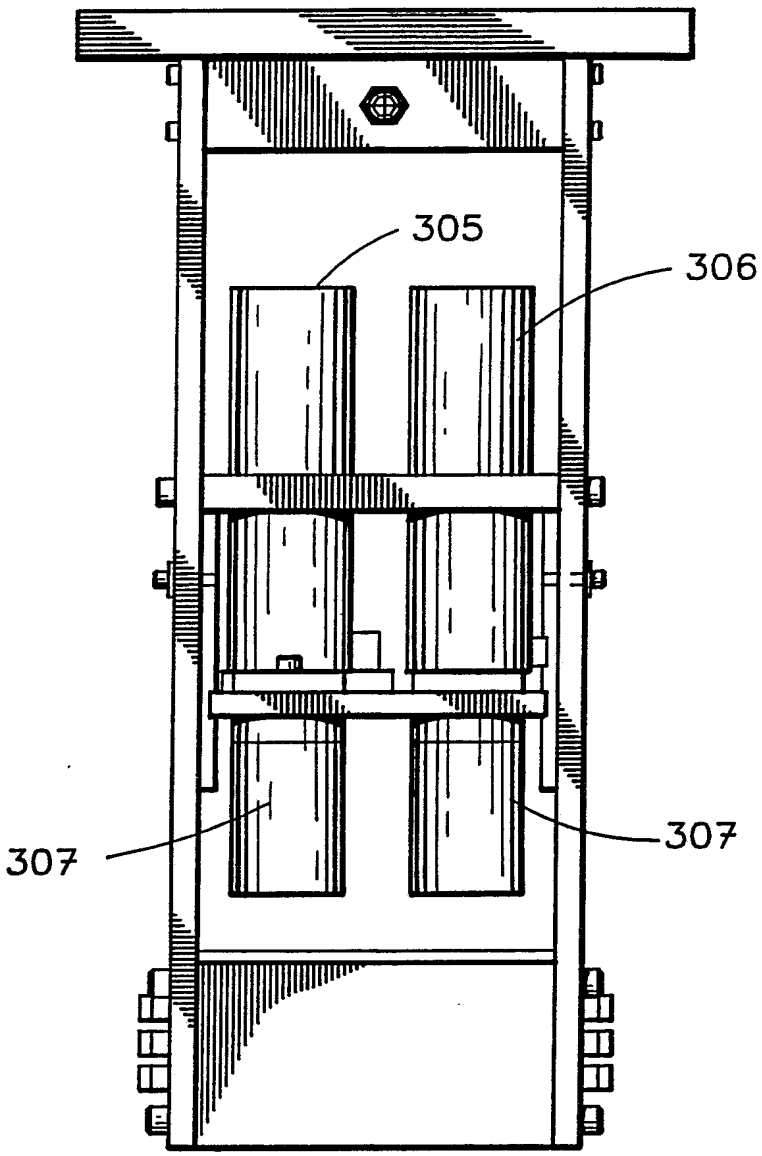


FIG.9.

Hillman Exhibit 1002
Page 0847

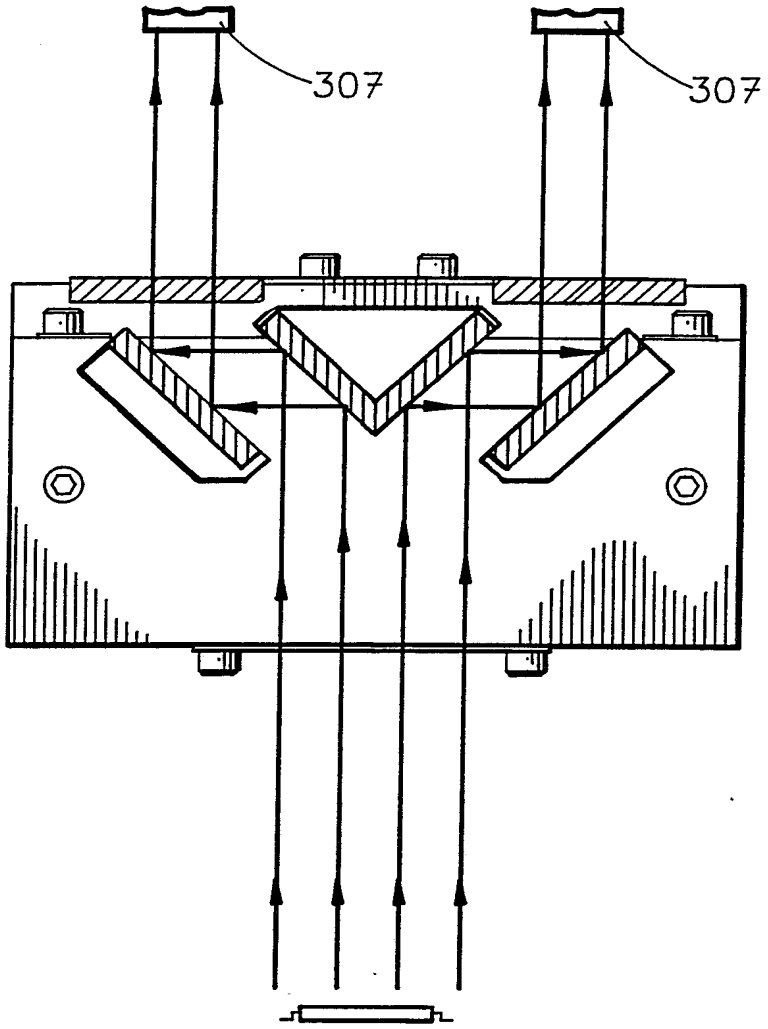


FIG. 10.

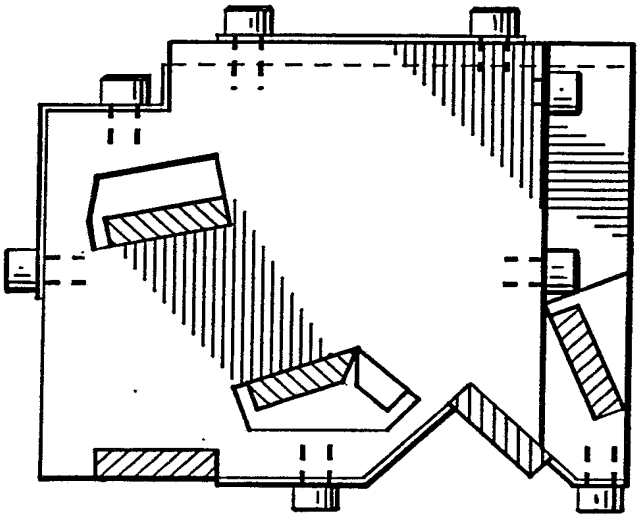


FIG. 11.

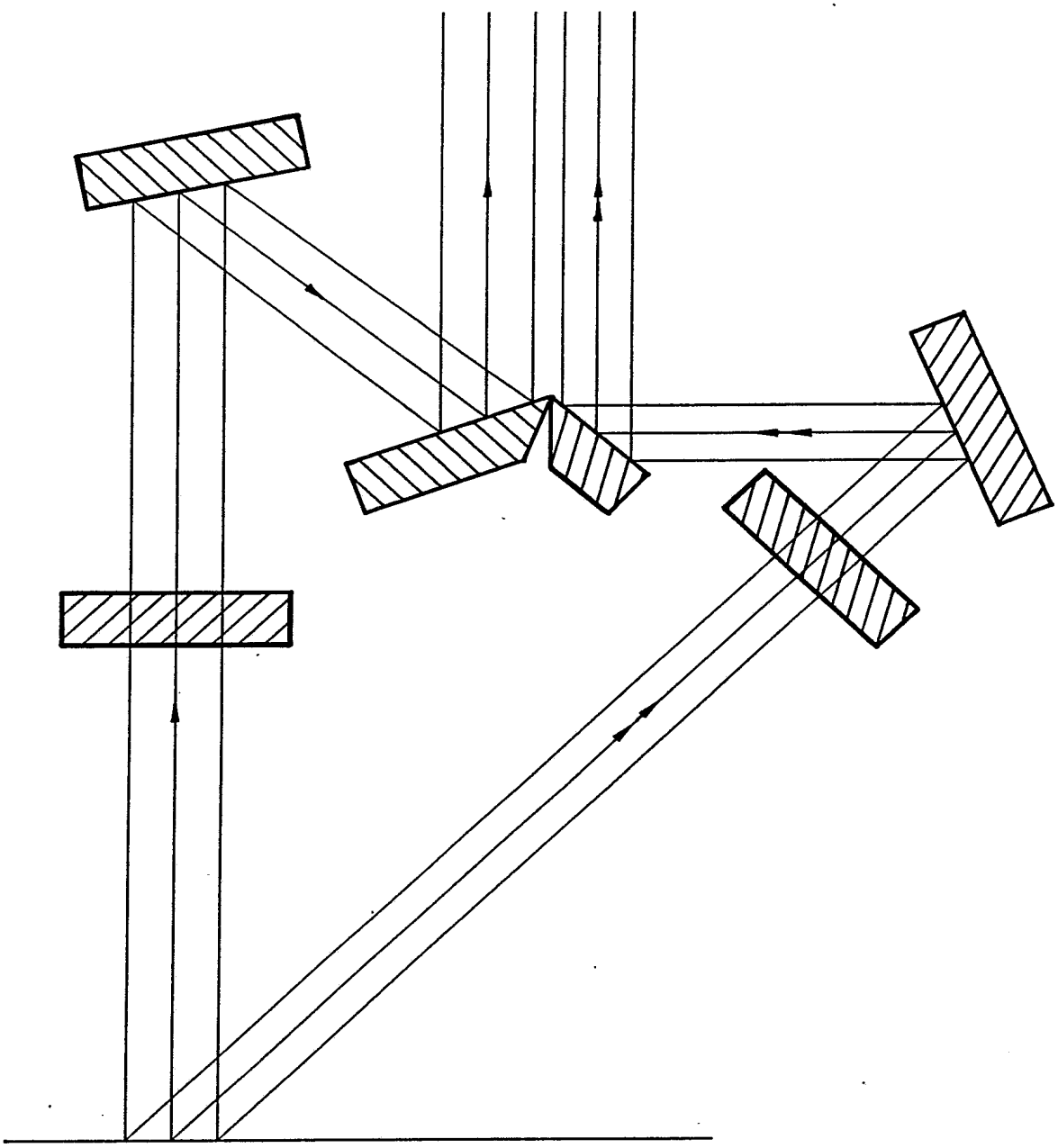


FIG. 12.

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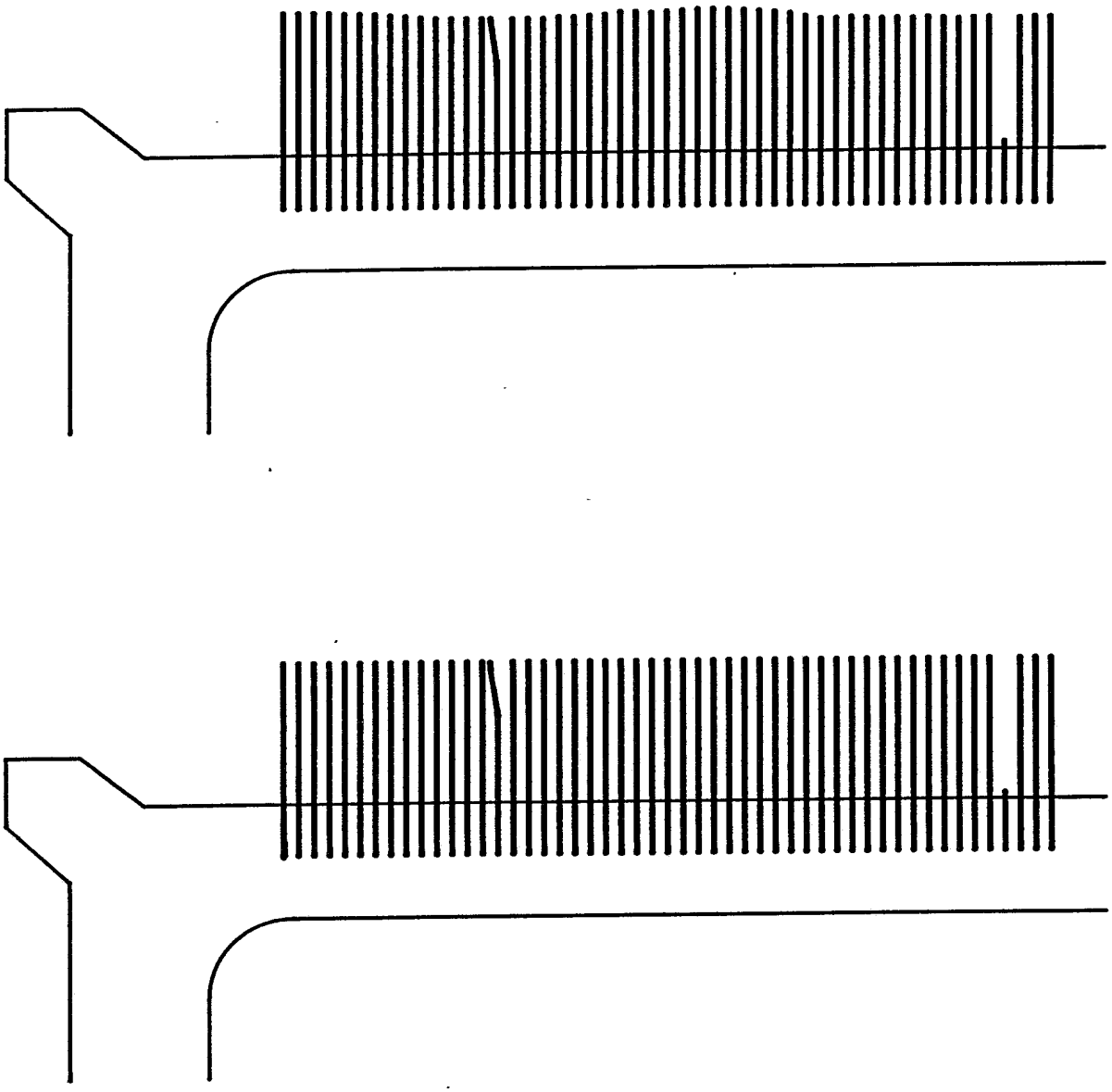


FIG. 13.

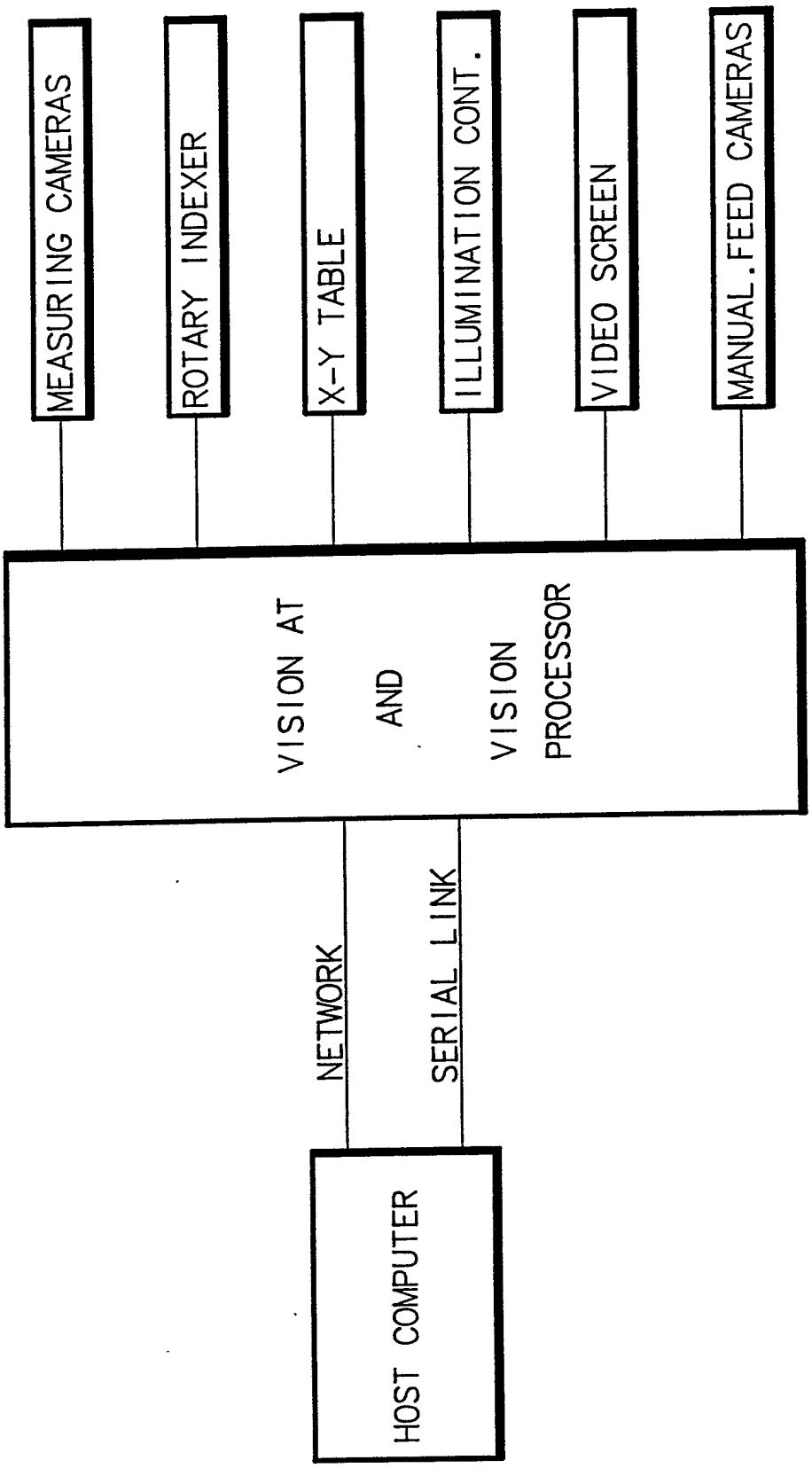

MEASURING CAMERAS
ROTARY INDEXER
X-Y TABLE
ILLUMINATION CONT.
VIDEO SCREEN
MANUAL.FEED CAMERAS
VISION AT AND VISION PROCESSOR
NETWORK
SERIAL LINK
HOST COMPUTER

FIG. 14.

INTERNATIONAL SEARCH REPORT

International Application No PCT/CA 91/00055

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

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 [8]

III. DOCUMENTS CONSIDERED TO BE RELEVANT [9]

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]

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IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
13th May 1991	19 JUN 1991
International Searching Authority	**Signature of Authorized Officer**
EUROPEAN PATENT OFFICE	MISS T. TAZELAAR

Form PCT/ISA/210 (second sheet) (January 1985)

ANNEX TO THE INTERNATIONAL SEARCH REPORT ON INTERNATIONAL PATENT APPLICATION NO. CA 9100055 SA 44719

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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

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

PCT WORLD INTELLECTUAL PROPERTY ORGANIZATION
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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).

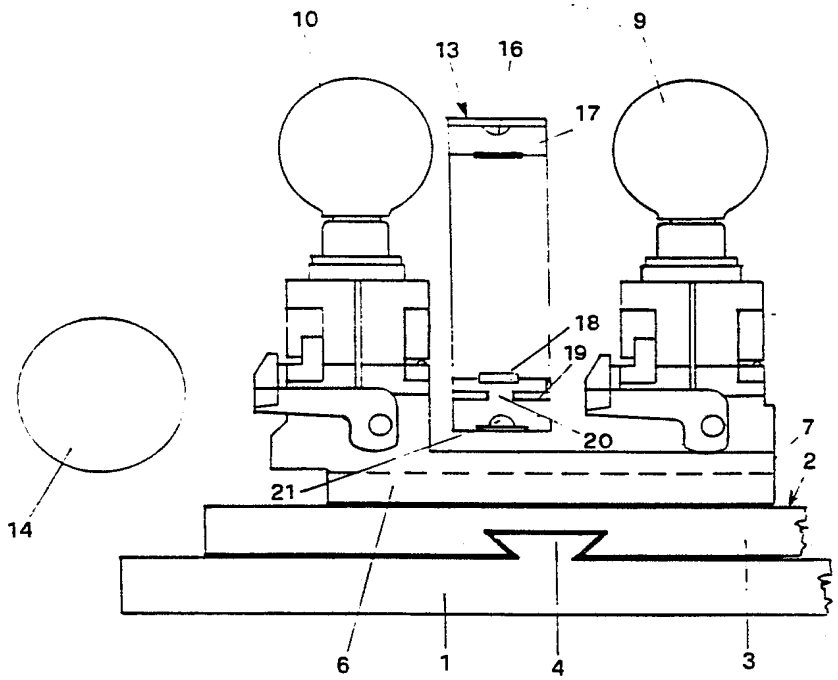
(72) Inventor; and
(75) Inventor/Applicant *(for US only) :* FADEL, Paolo [IT/IT]; Via Manzoni, I-31048 S. Biagio di Callalta (IT).

(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
With international search report.

(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).

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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 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 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 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 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

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 which 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

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

- 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 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,

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.

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

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 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.

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.

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 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

- a screen 19 disposed at a distance from said lens 18 greater than double focal length thereof. The screen 19 is contructed 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

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 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 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 orignal key 11 in the clamp 9 and the blank key to be cut 10 in the clamp 12, the machine is powered.

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 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

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

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.

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 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 addition the succesion 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

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, is of low cost and at the same time is of high sensitivity and operating precision.

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 (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 correspoding 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).

2. 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 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

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 the 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

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 (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 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).

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),
- 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

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 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.

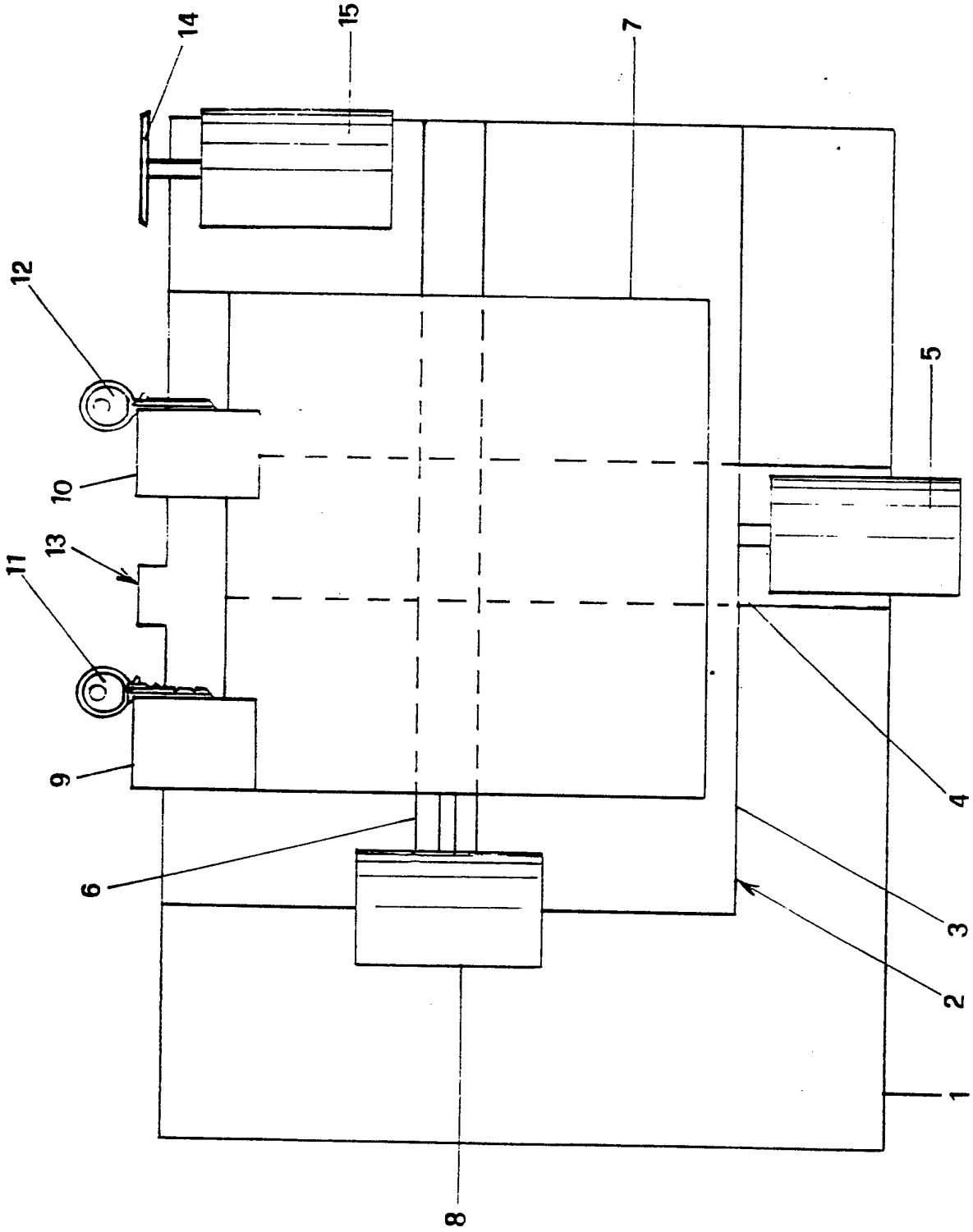
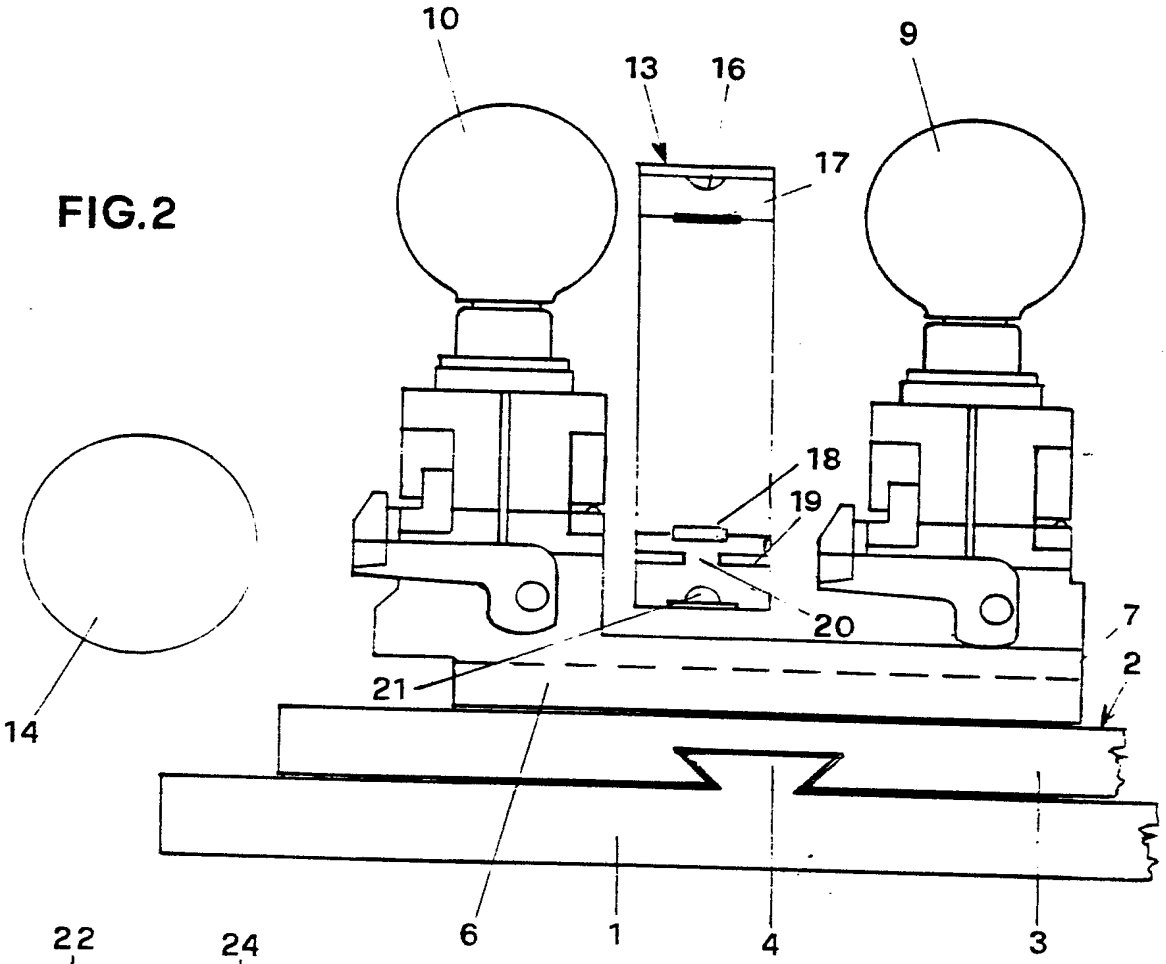


FIG.1

FIG.2



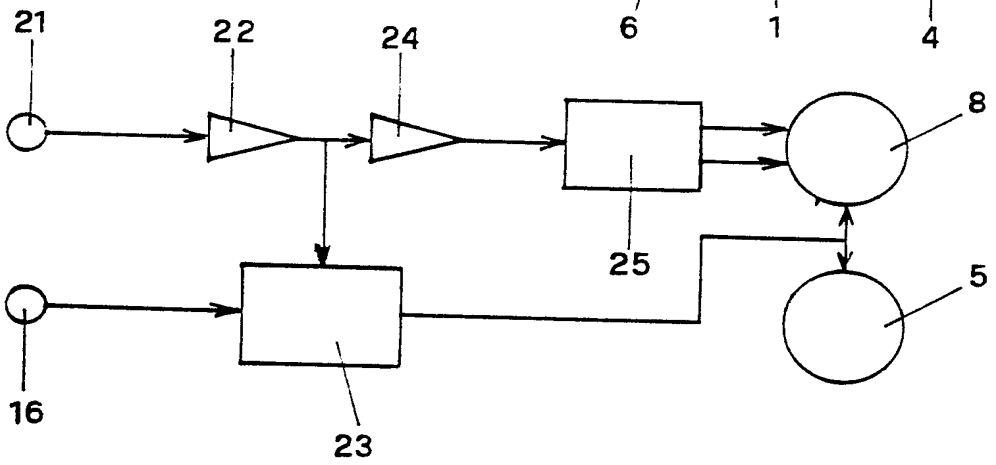


FIG.3

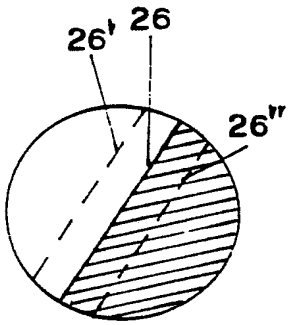


FIG.4

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 RELEVANT[9]

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

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IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
12 JANUARY 1990	31. 02. 90
International Searching Authority	**Signature of Authorized Officer**
EUROPEAN PATENT OFFICE	MOYLE J.F.

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ANNEX TO THE INTERNATIONAL SEARCH REPORT ON INTERNATIONAL PATENT APPLICATION NO.

PCT/EP 89/01157

SA 31626

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
GB-A-2006426	02-05-79	JP-A- 54033101	10-03-79
		DE-A,C 2833974	01-03-79
		US-A- 4498109	05-02-85
		US-A- 4300170	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	18-01-85
		JP-A- 60076906	01-05-85

EPO FORM P0479

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**

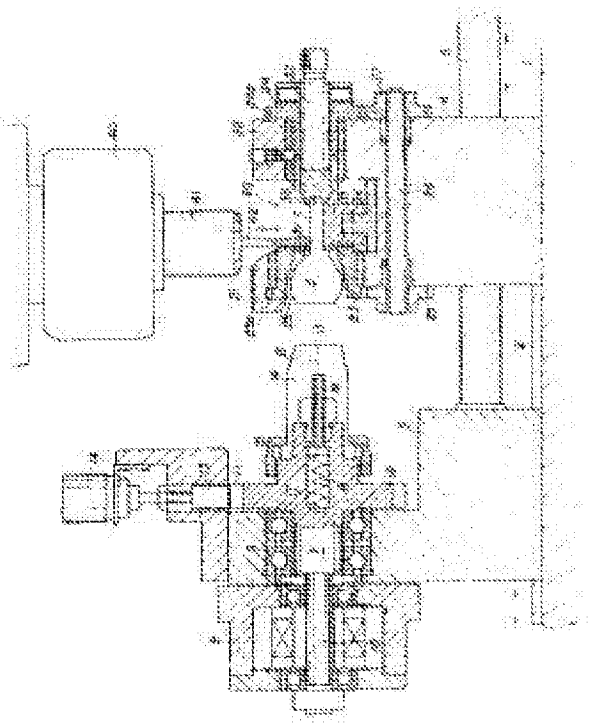
Application number: JP19830072358 19830425

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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.



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⑤4鍵の加工装置

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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、かつ互いに接離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、かつ互いに連動して回転する第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》

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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，ｉ…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っては、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の加工にあっては、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。

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《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の一側にはパルスモータ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と係合するピン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によって出没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の先端側へと出没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。

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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鍵孔テープに表わし、この鍵孔テープを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

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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ー部１６ａが、凹部２９の内周に形成されたテーパー部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、該当する深さの孔開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、前述と同様にして、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開け加工

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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、鍵エレメントdを抜き取り、新たな鍵エレメント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。

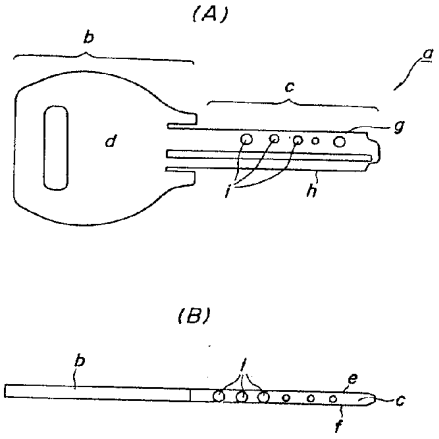
なお、前記実施例では、第1，第2の各支持ブロック3，4上にそれぞれスピンドル7，押圧子16，第1，第2の回転体23，24を一列に配置し、1本ずつ鍵加工を行なうように構成したが、各支持ブロック3，4上に同様な機構を並列に複数列設ければ、同時に多数本の鍵加工を行なうことができることは勿論である。

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

第1図



特許出願人

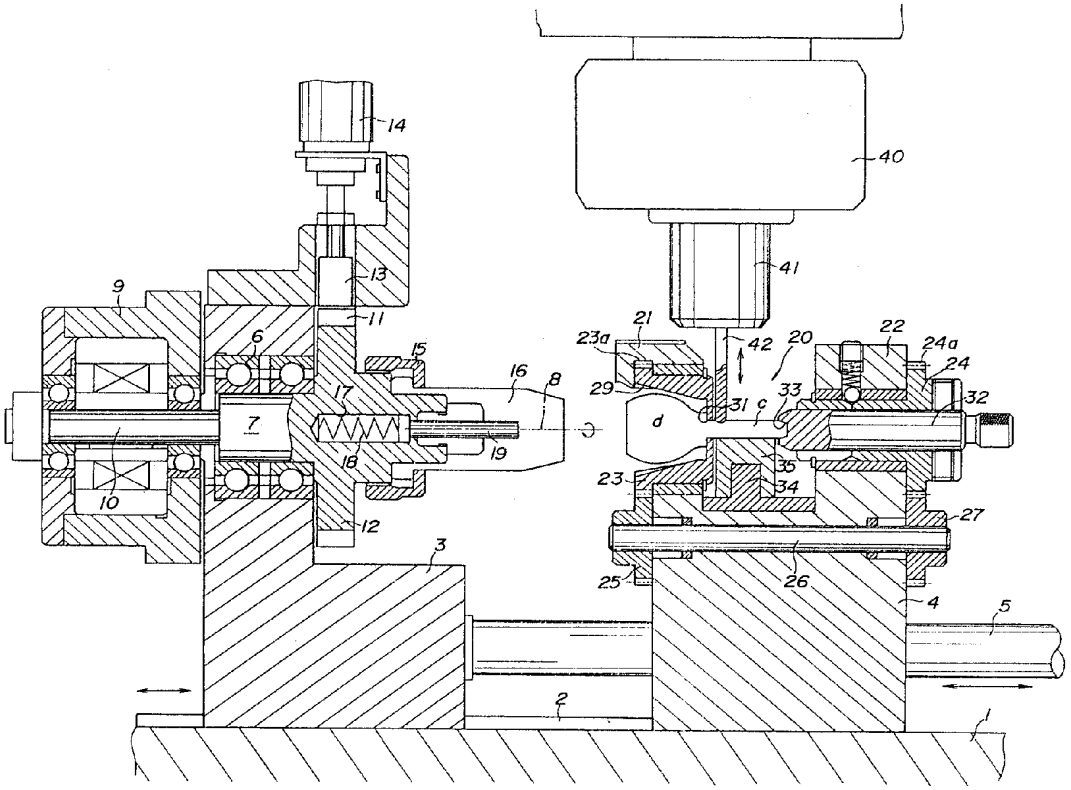
津上特機株式会社

代理人

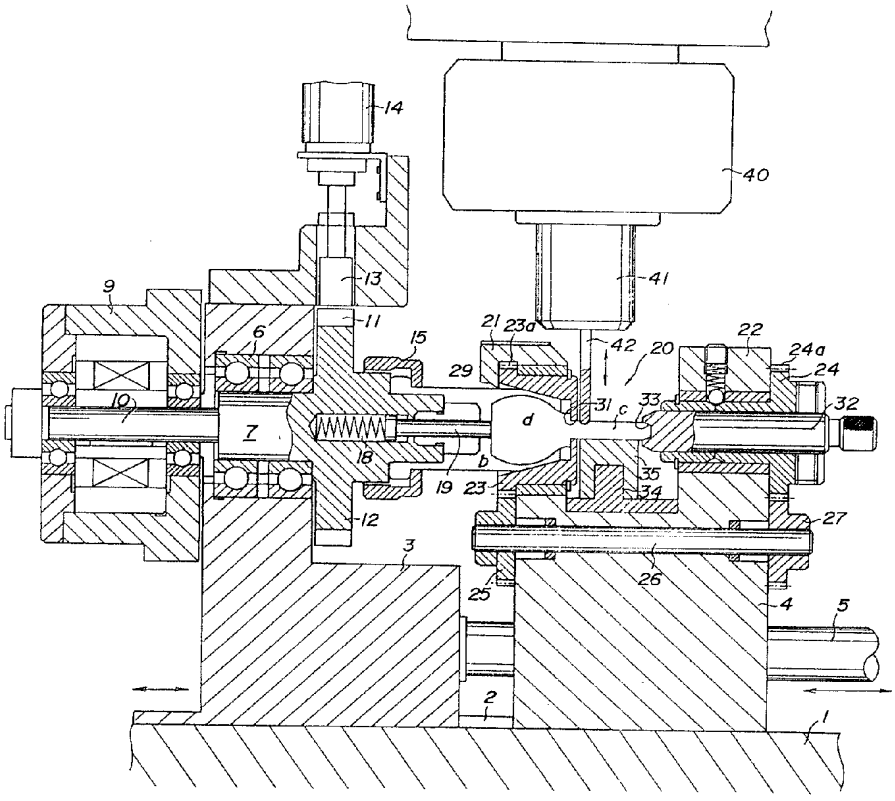
弁理士　和田成則

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第 2 図

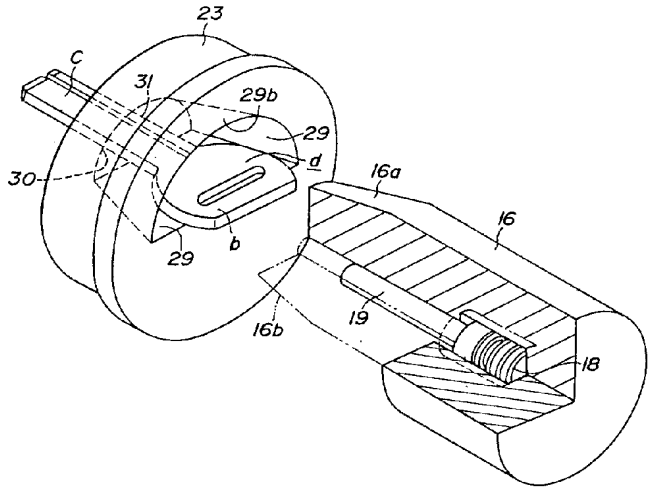


第 3 図

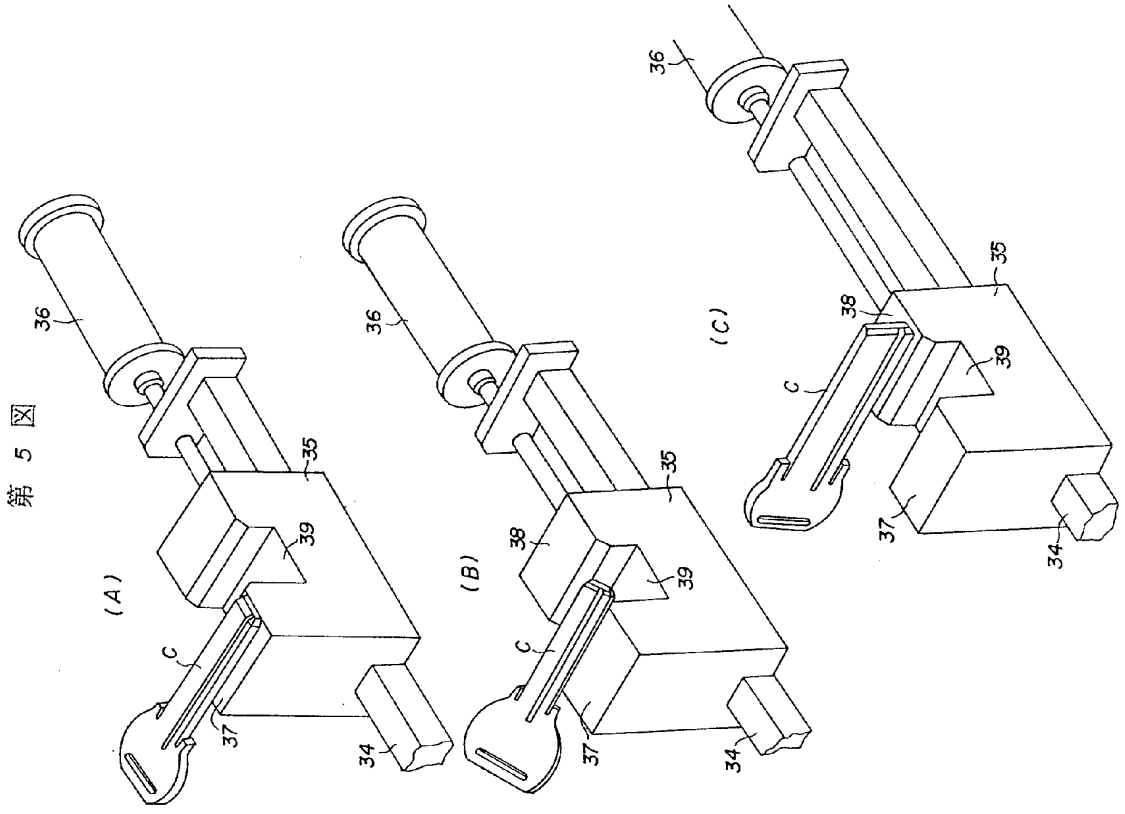


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第 4 図



第 5 図



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[Continued on next page]

(54) **Title**: KEY DUPLICATION MACHINE

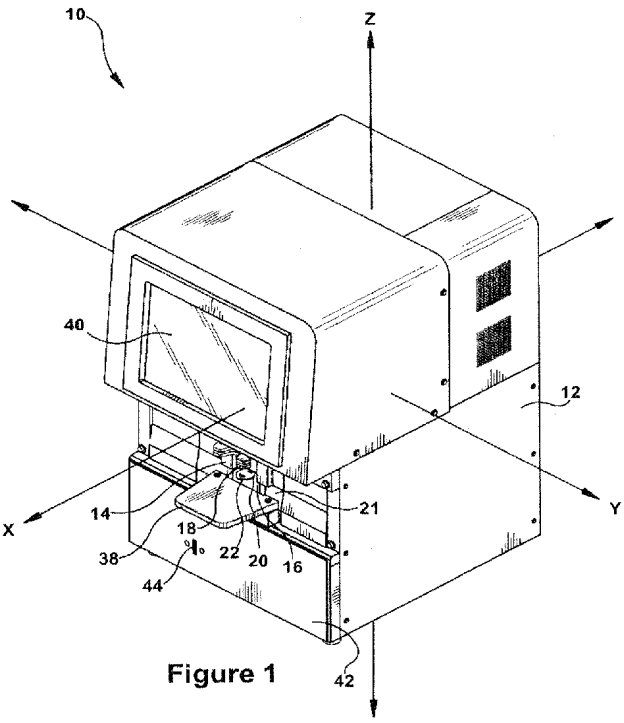


Figure 1

(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.

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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

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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

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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;

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[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;

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[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;

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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

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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

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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 though 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

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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

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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

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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**.

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[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 maser 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**

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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

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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

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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.

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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

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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**

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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**

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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.

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[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.

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[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.

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[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

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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.

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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.

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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.

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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.

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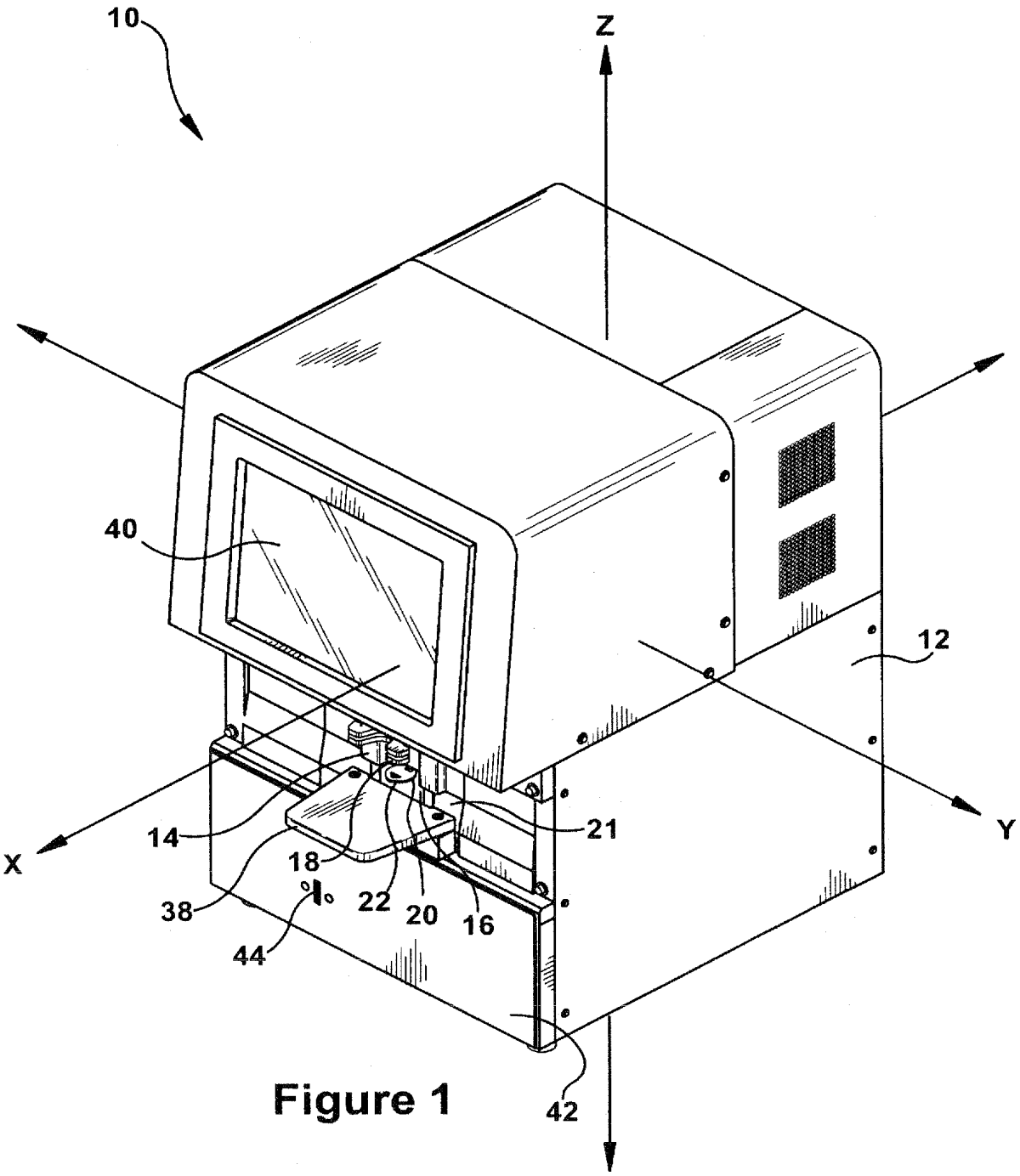


Figure 1

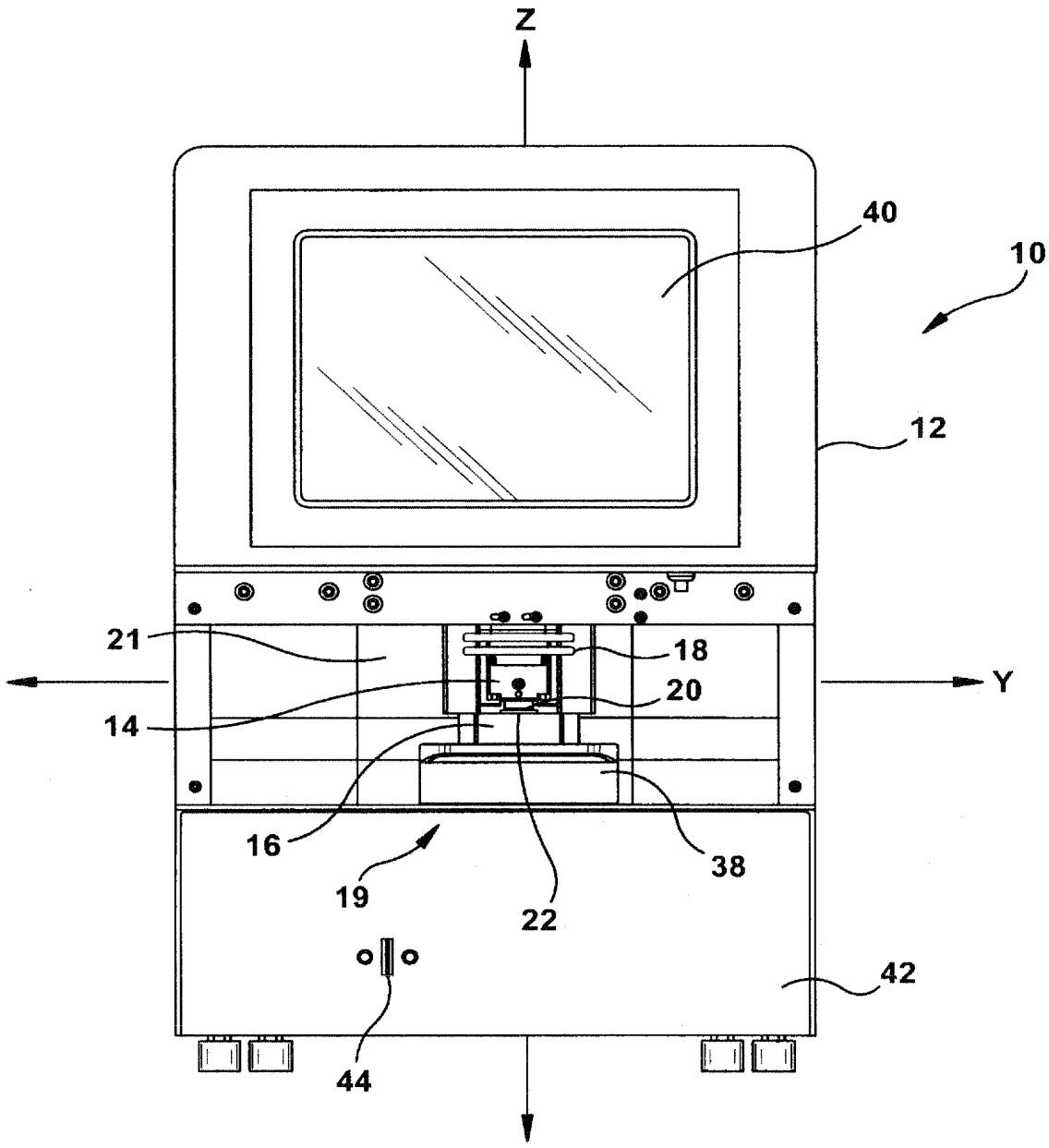


Figure 2

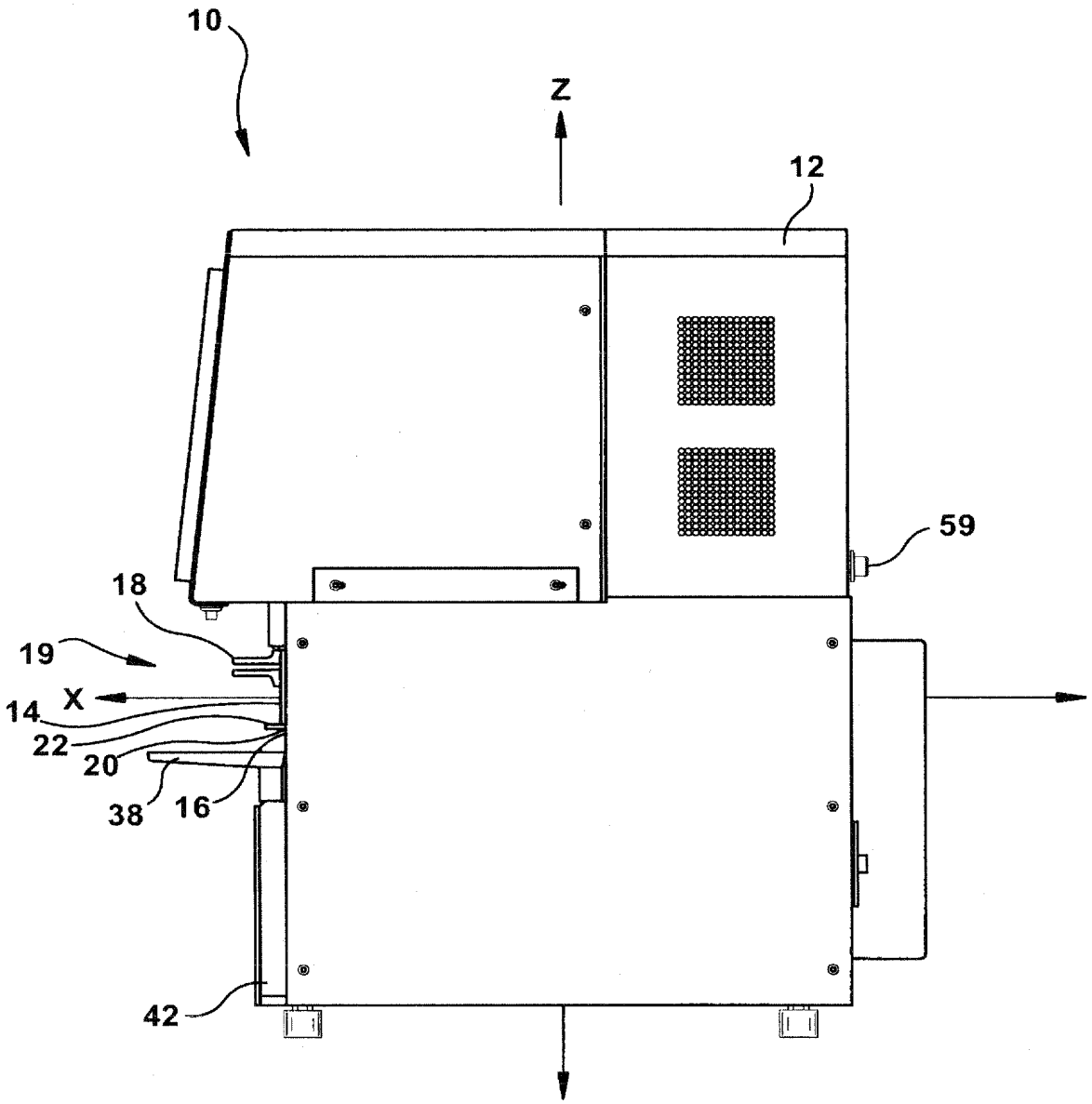


Figure 3

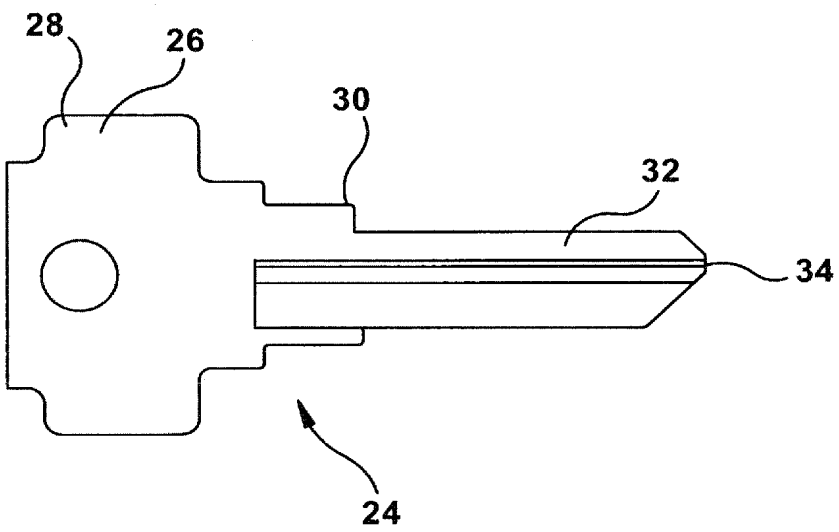


Figure 4b

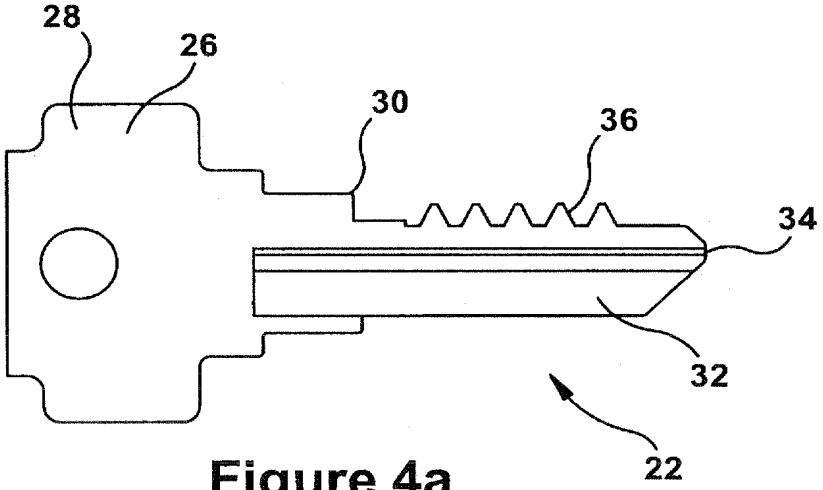


Figure 4a

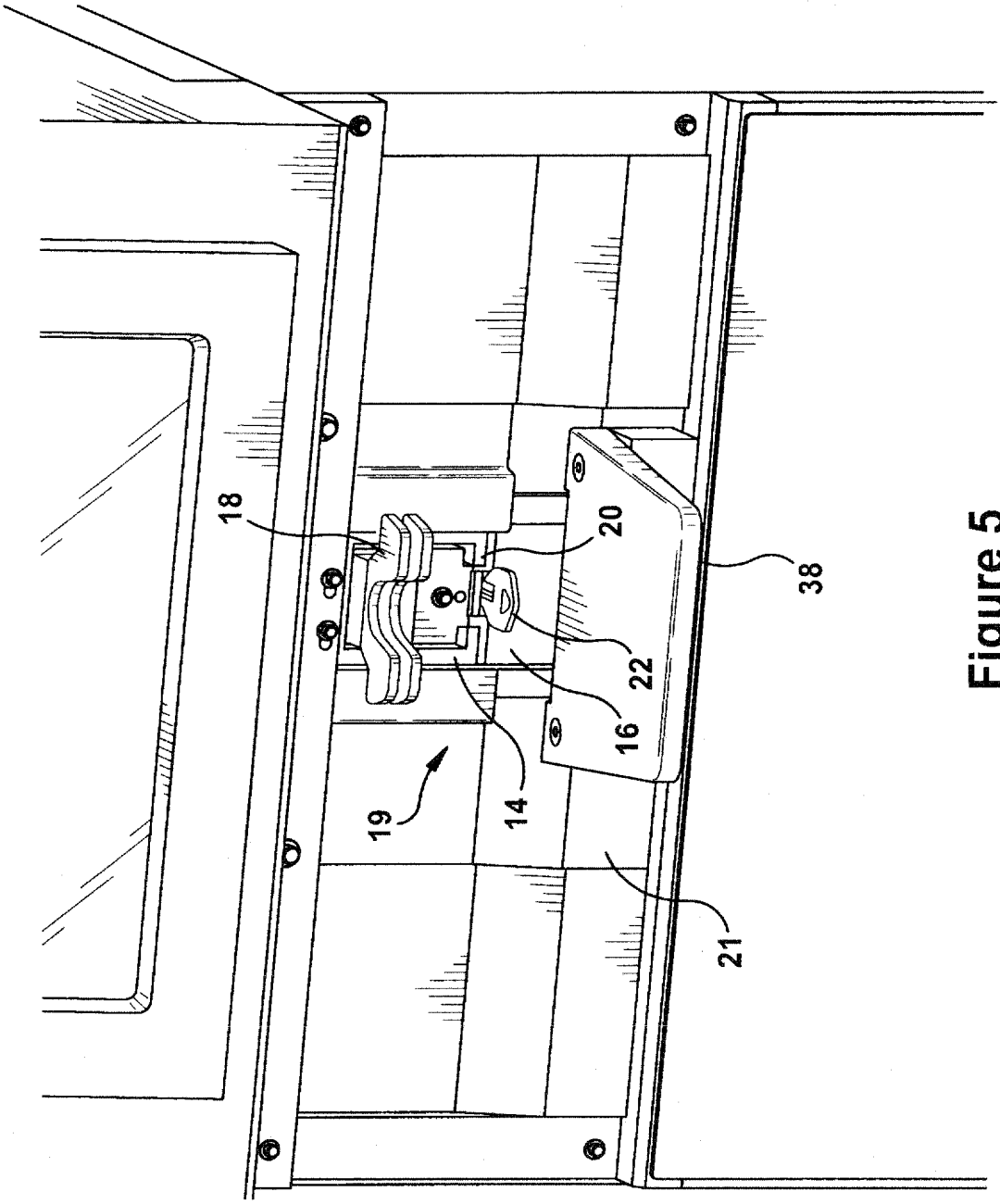


Figure 5

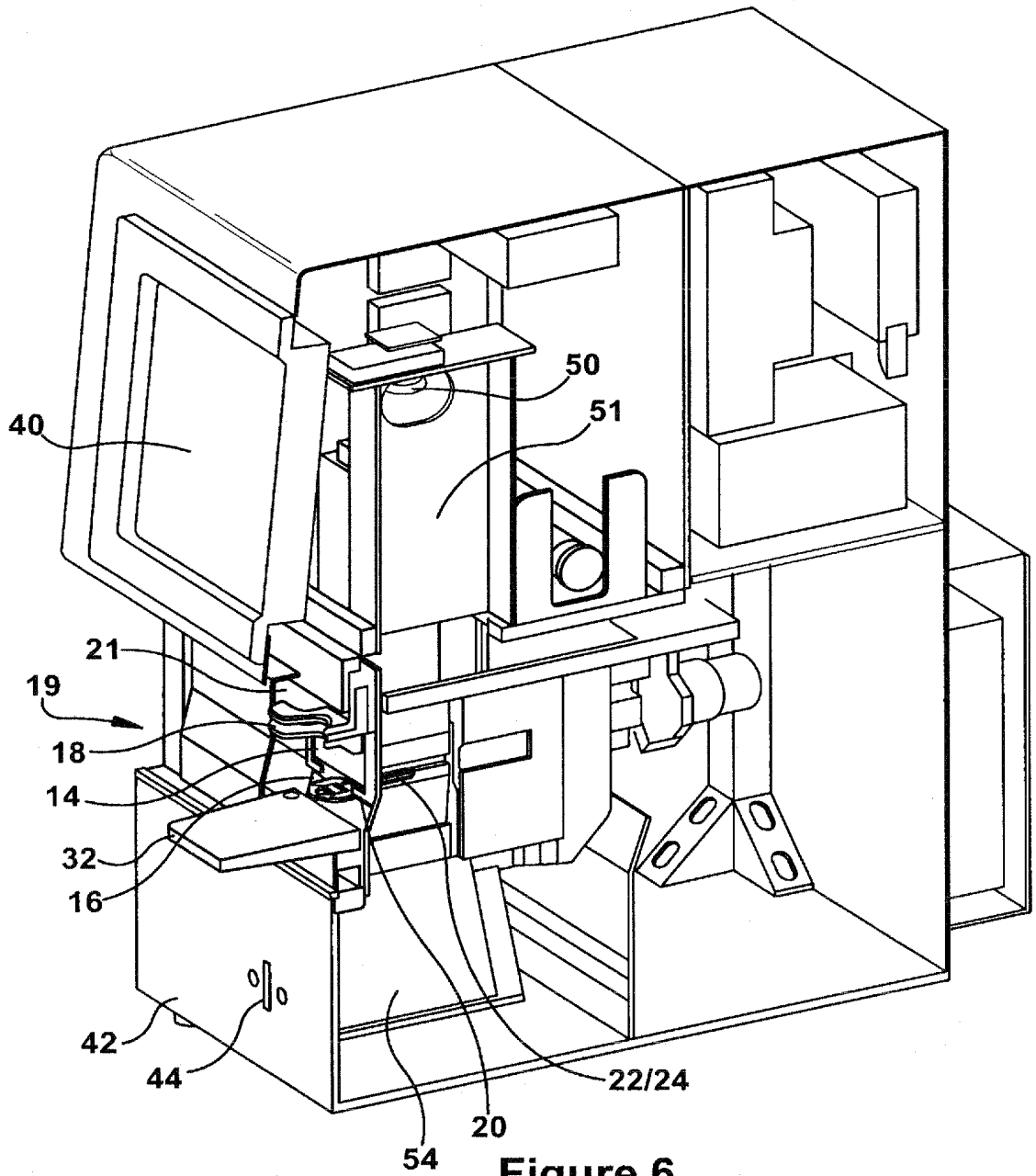


Figure 6

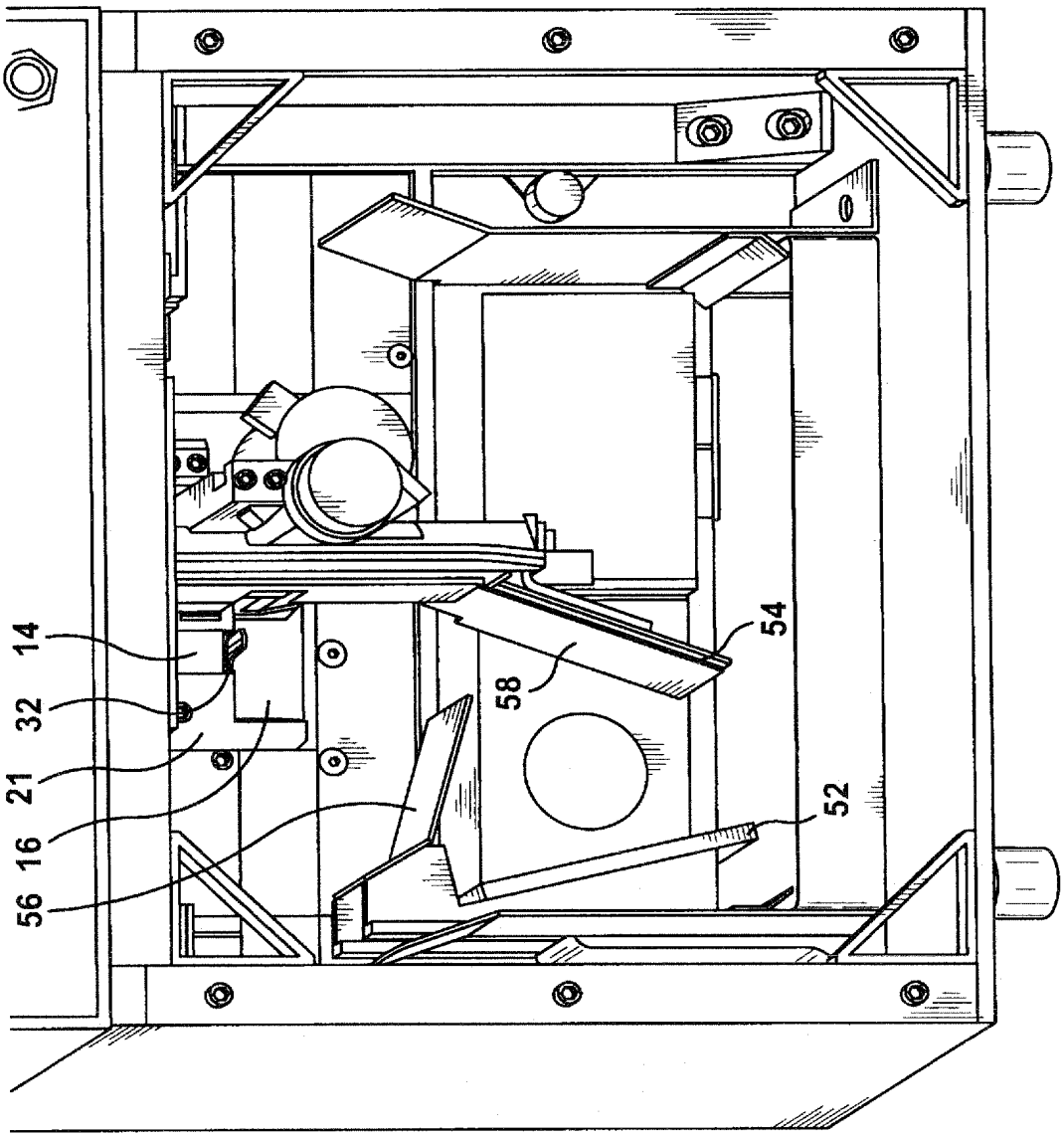


Figure 7

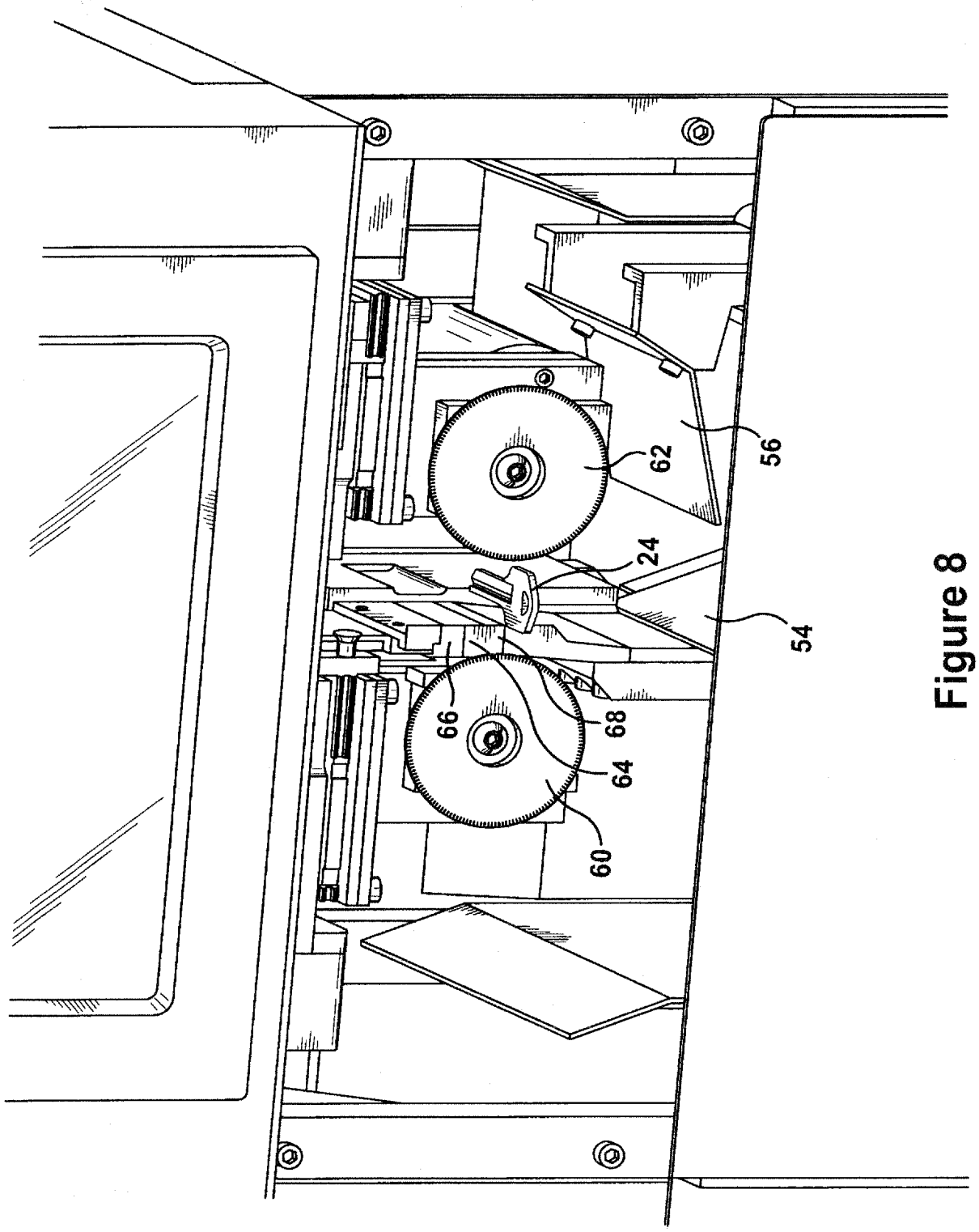


Figure 8

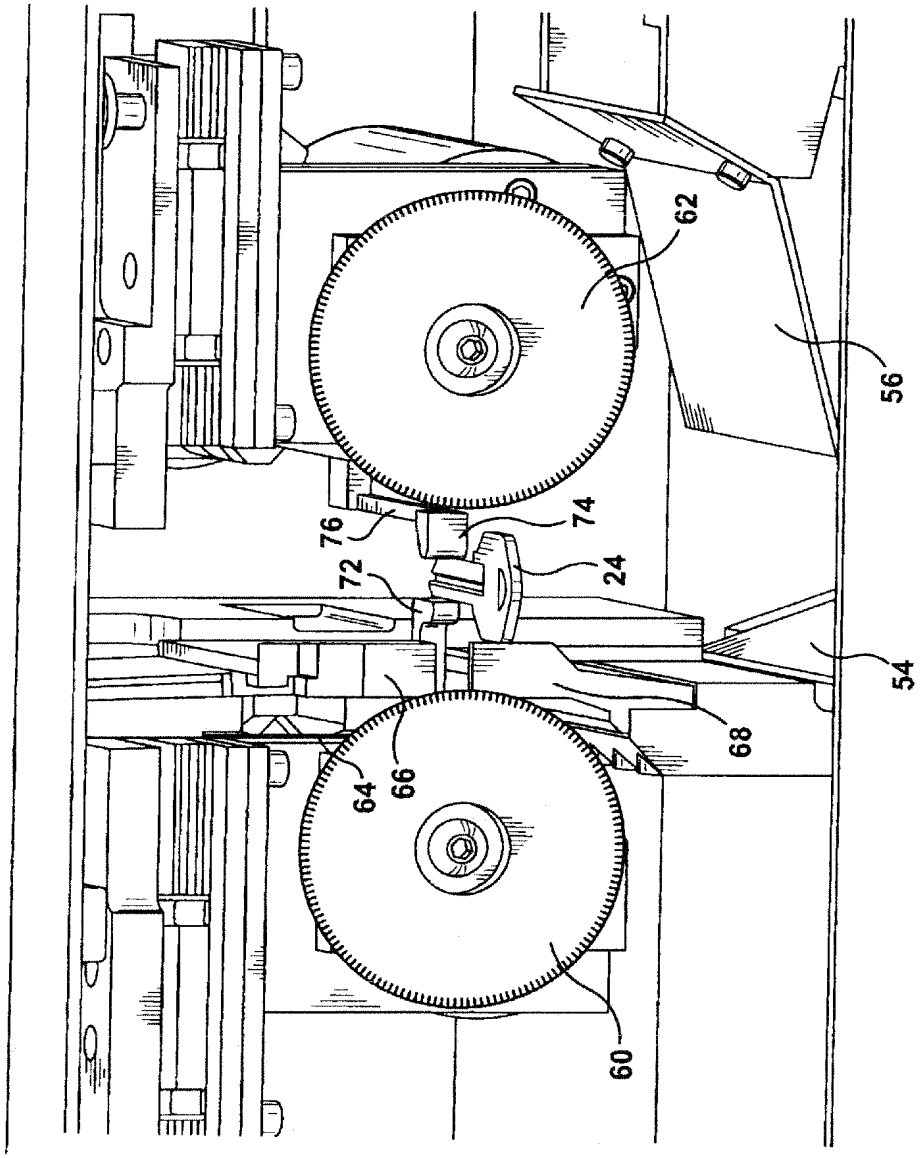


Figure 9

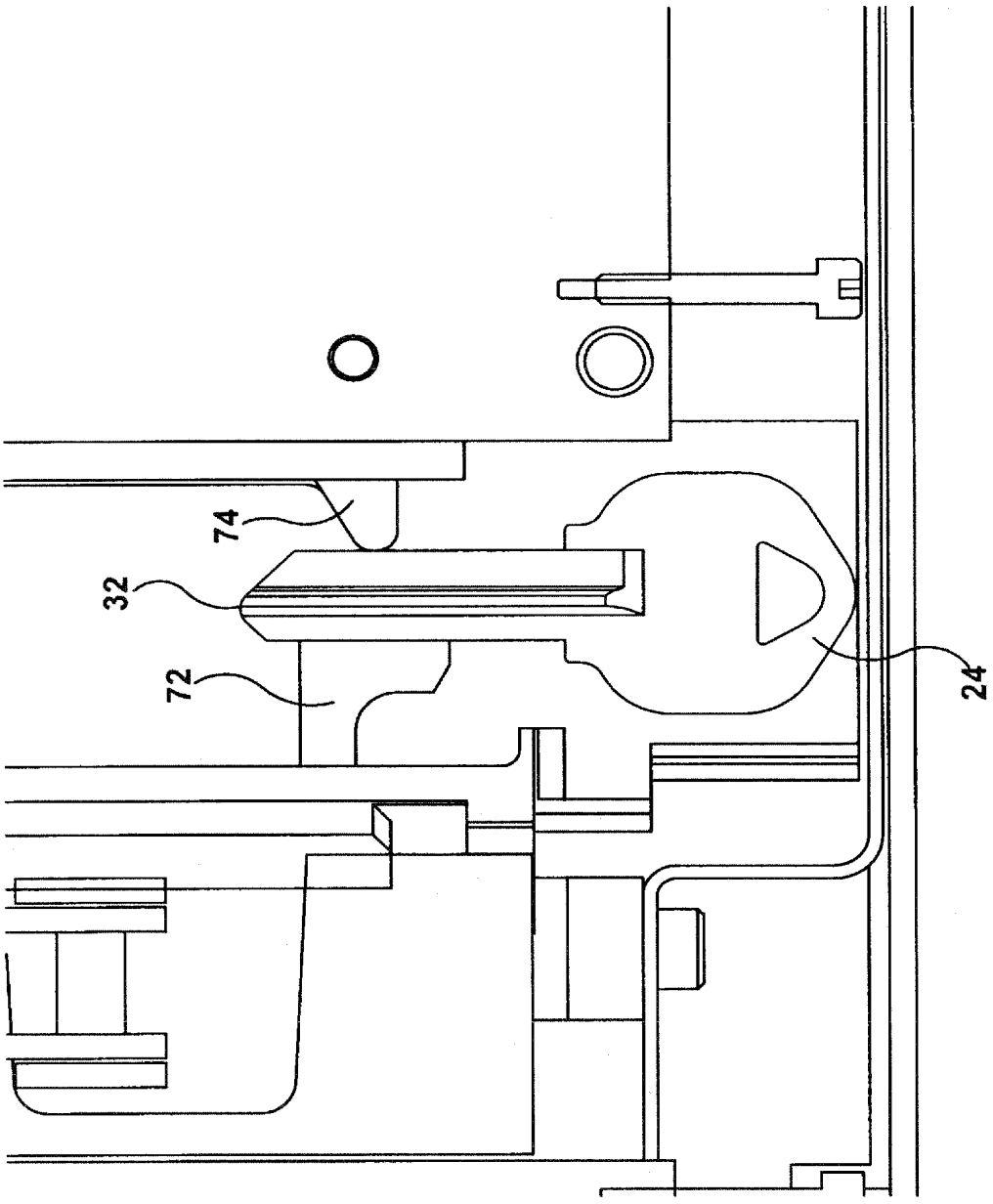


Figure 10

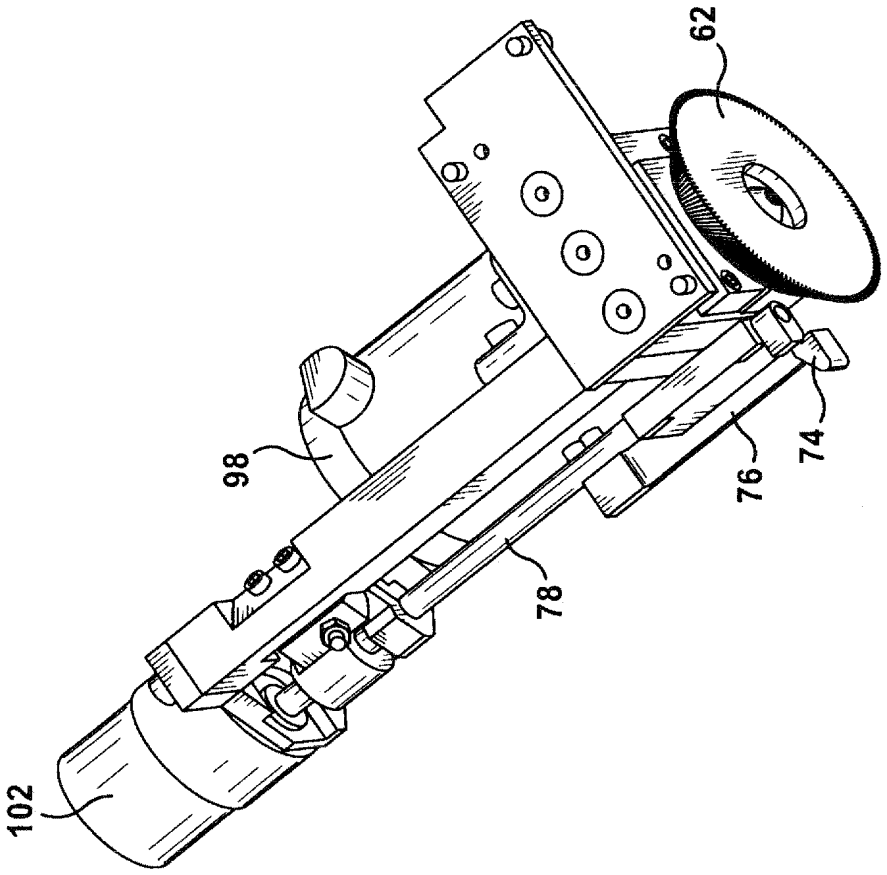


Figure 11

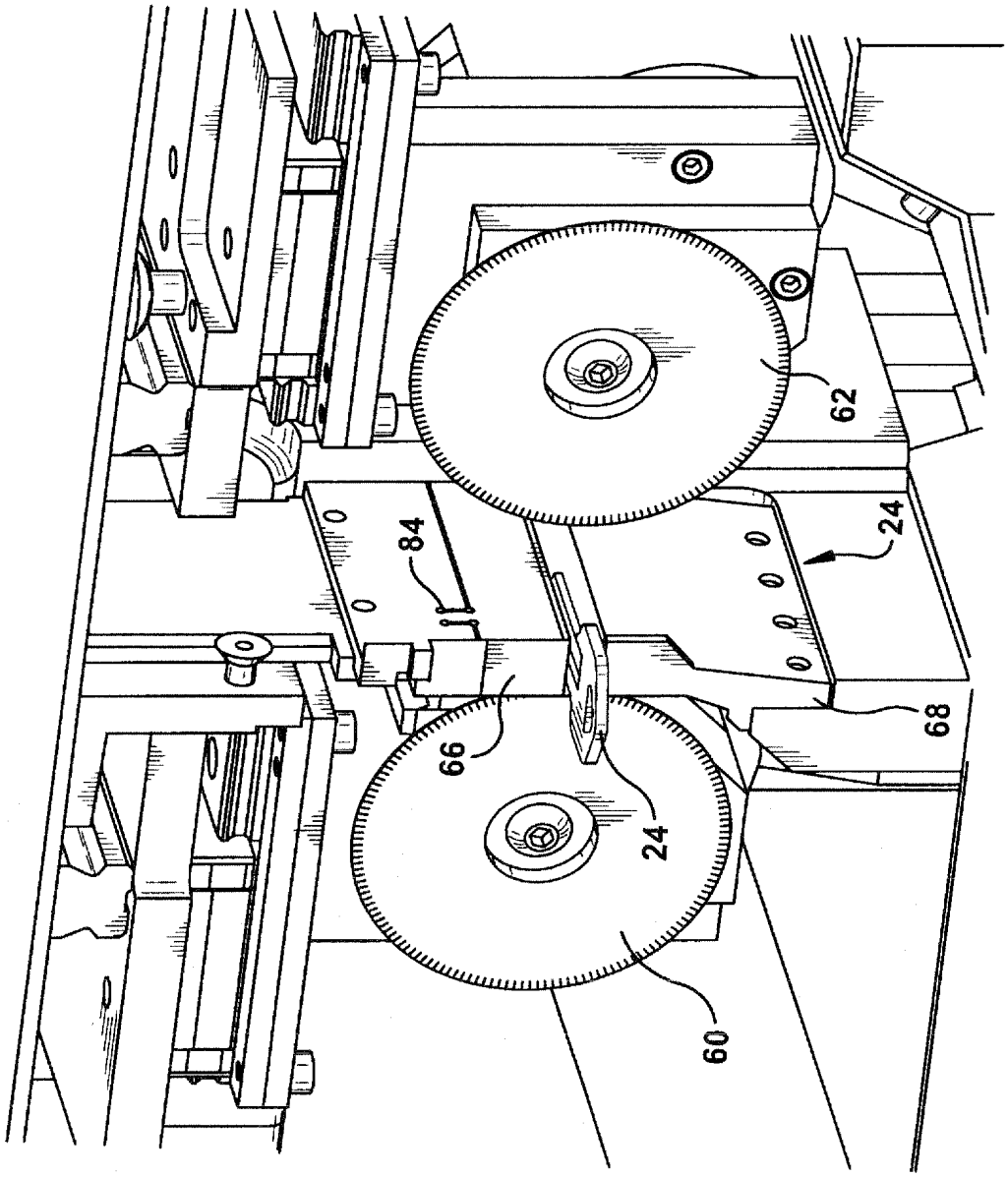


Figure 12

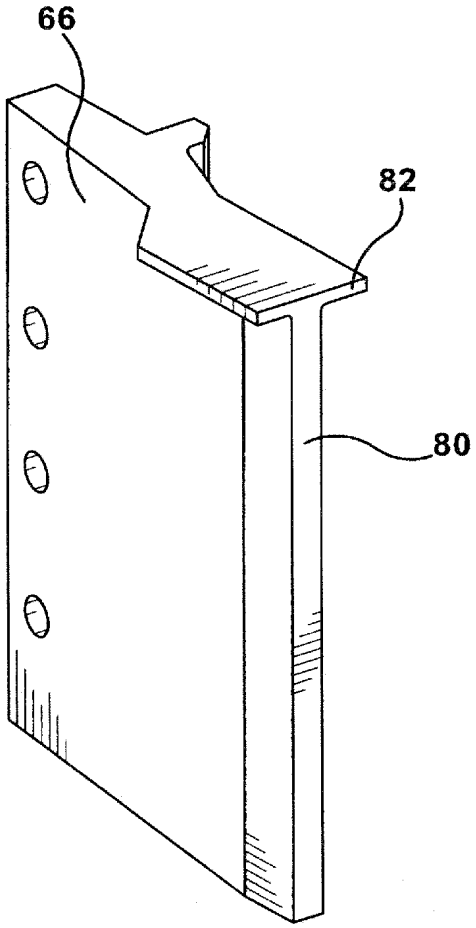


Figure 13

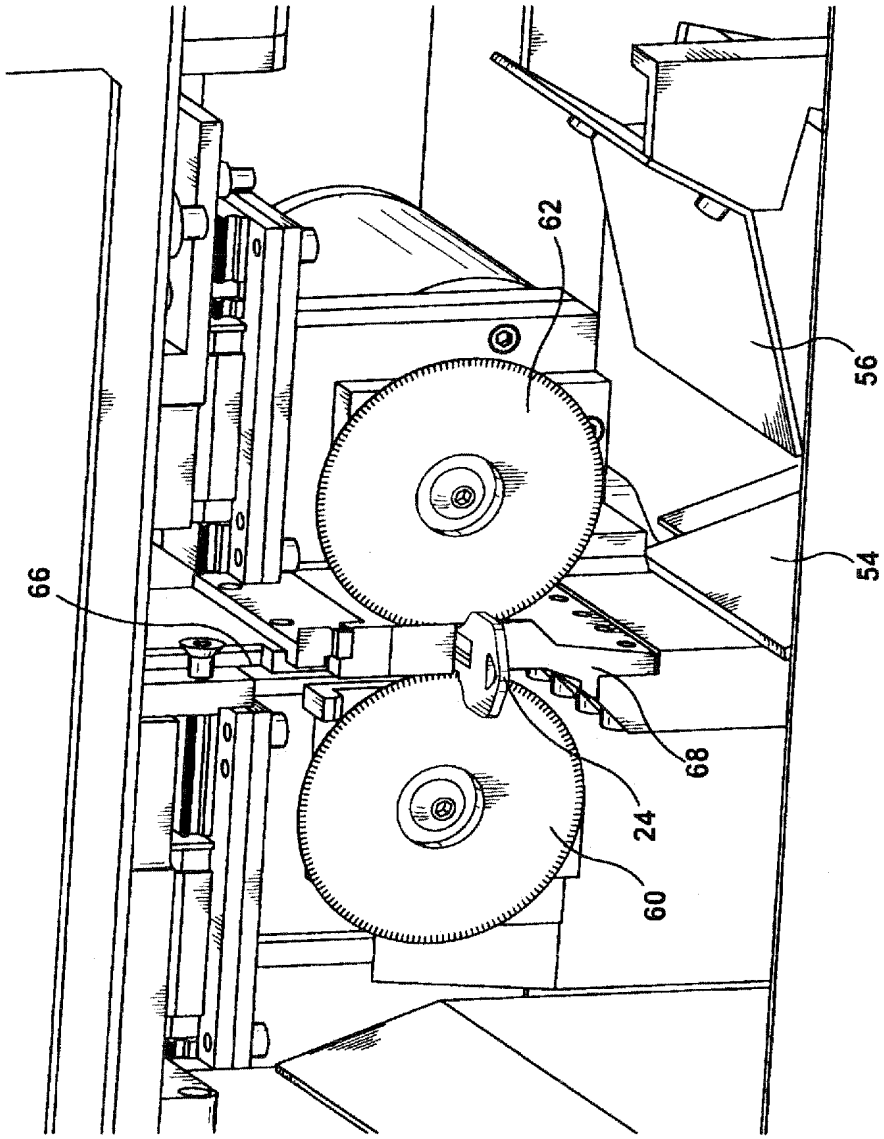


Figure 14

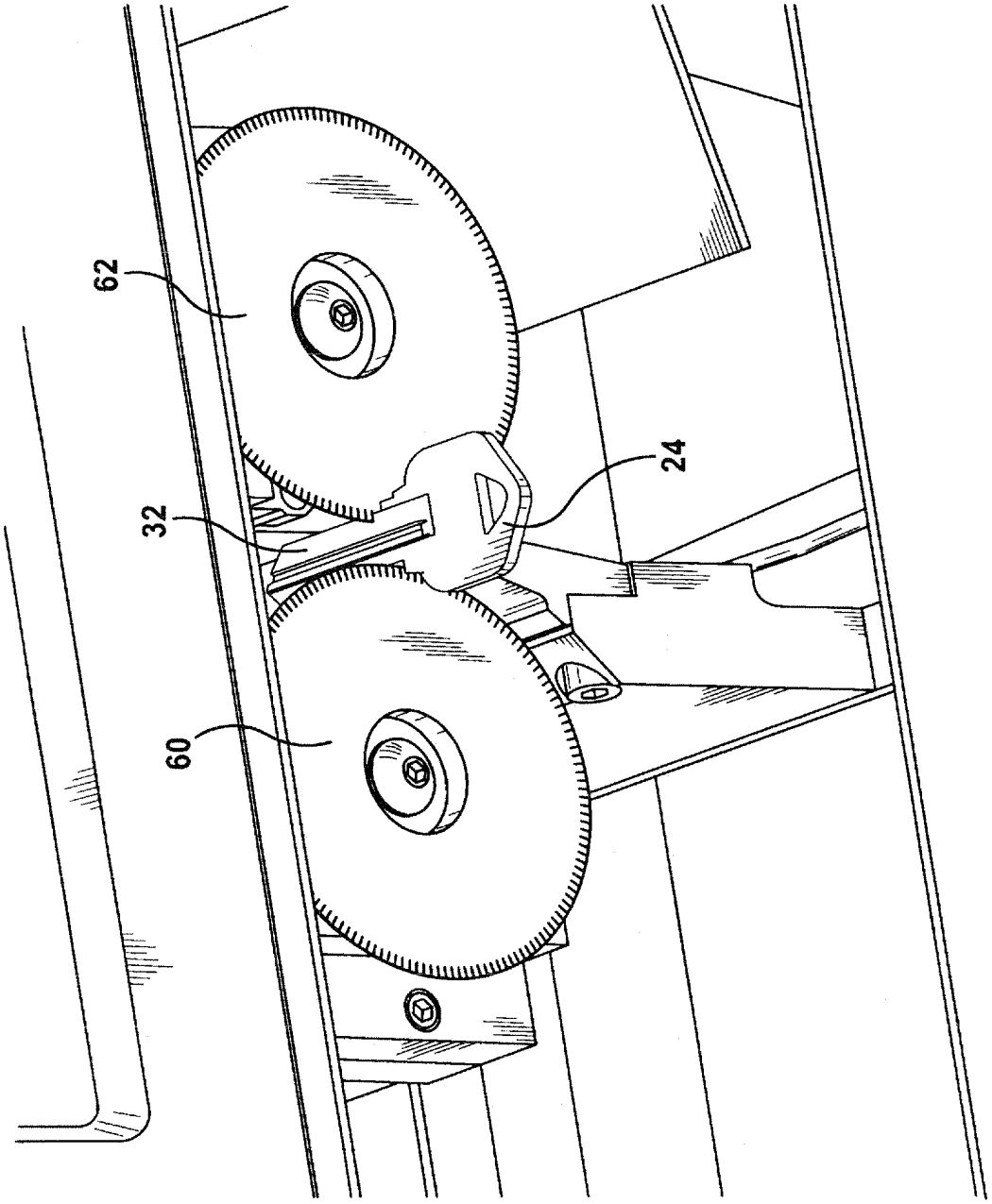


Figure 15

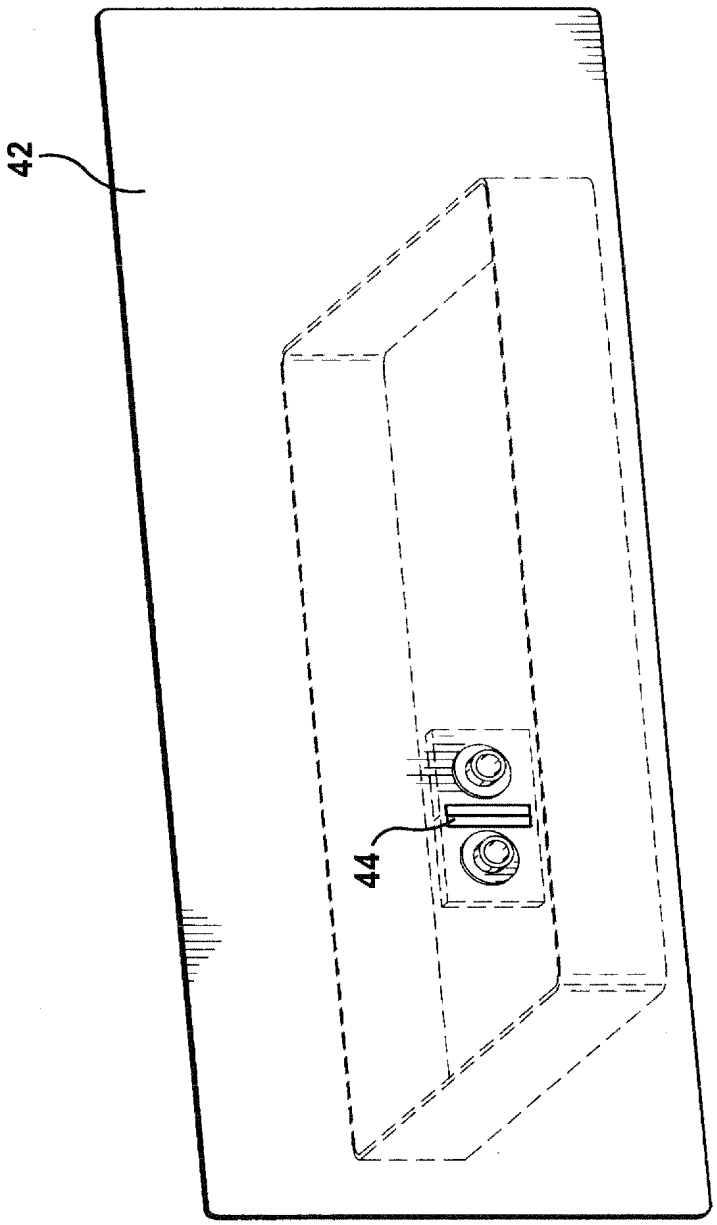


Figure 16

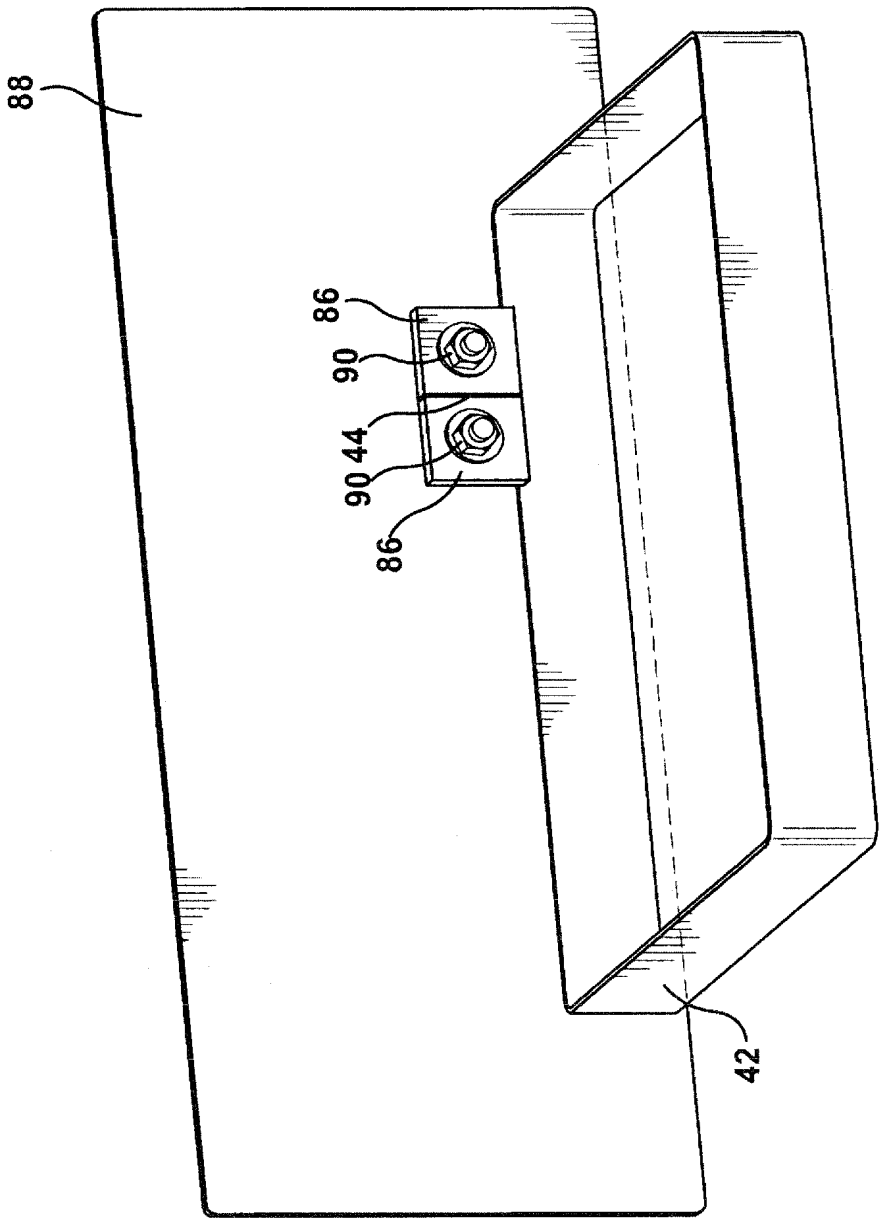


Figure 17

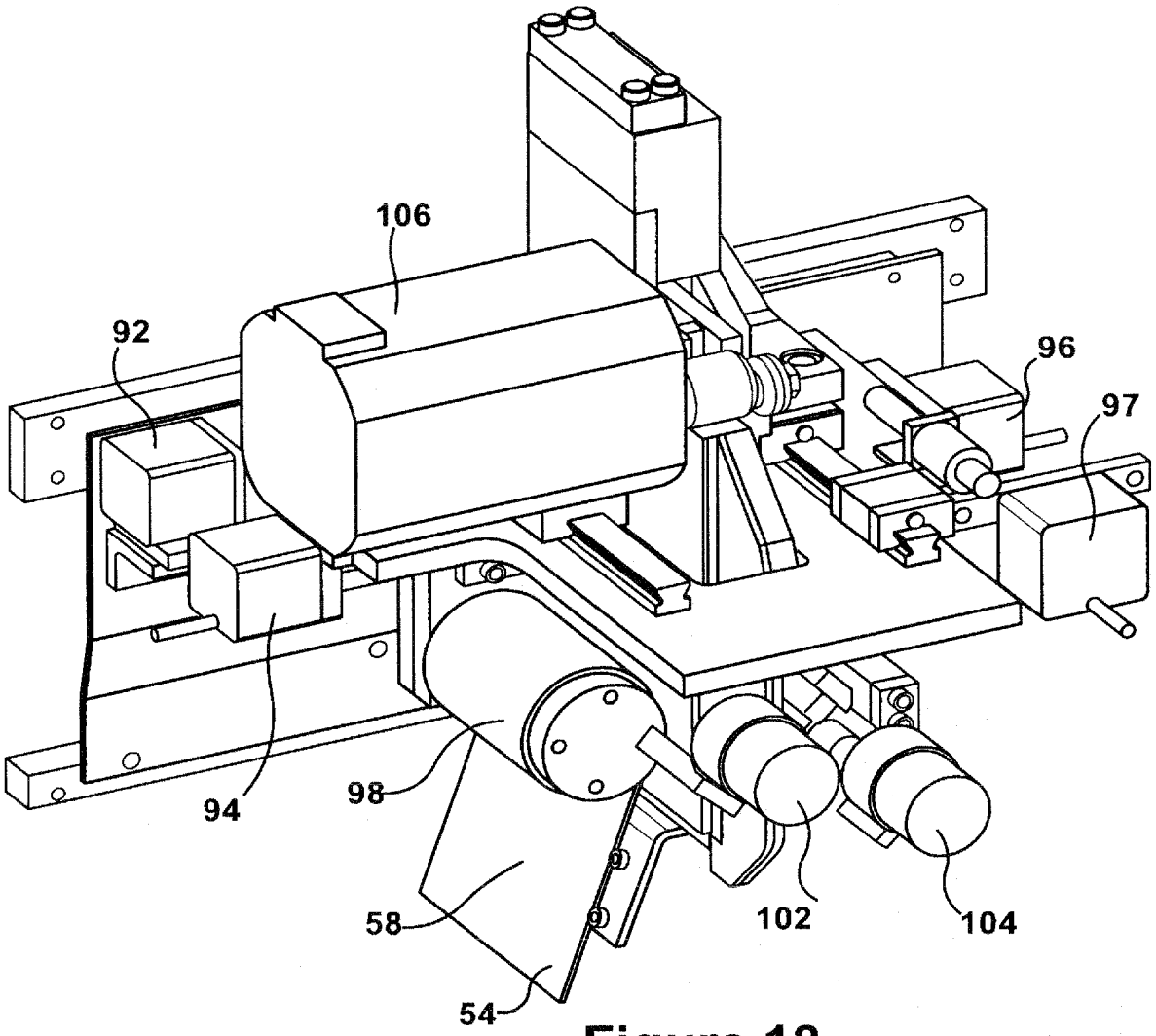


Figure 18

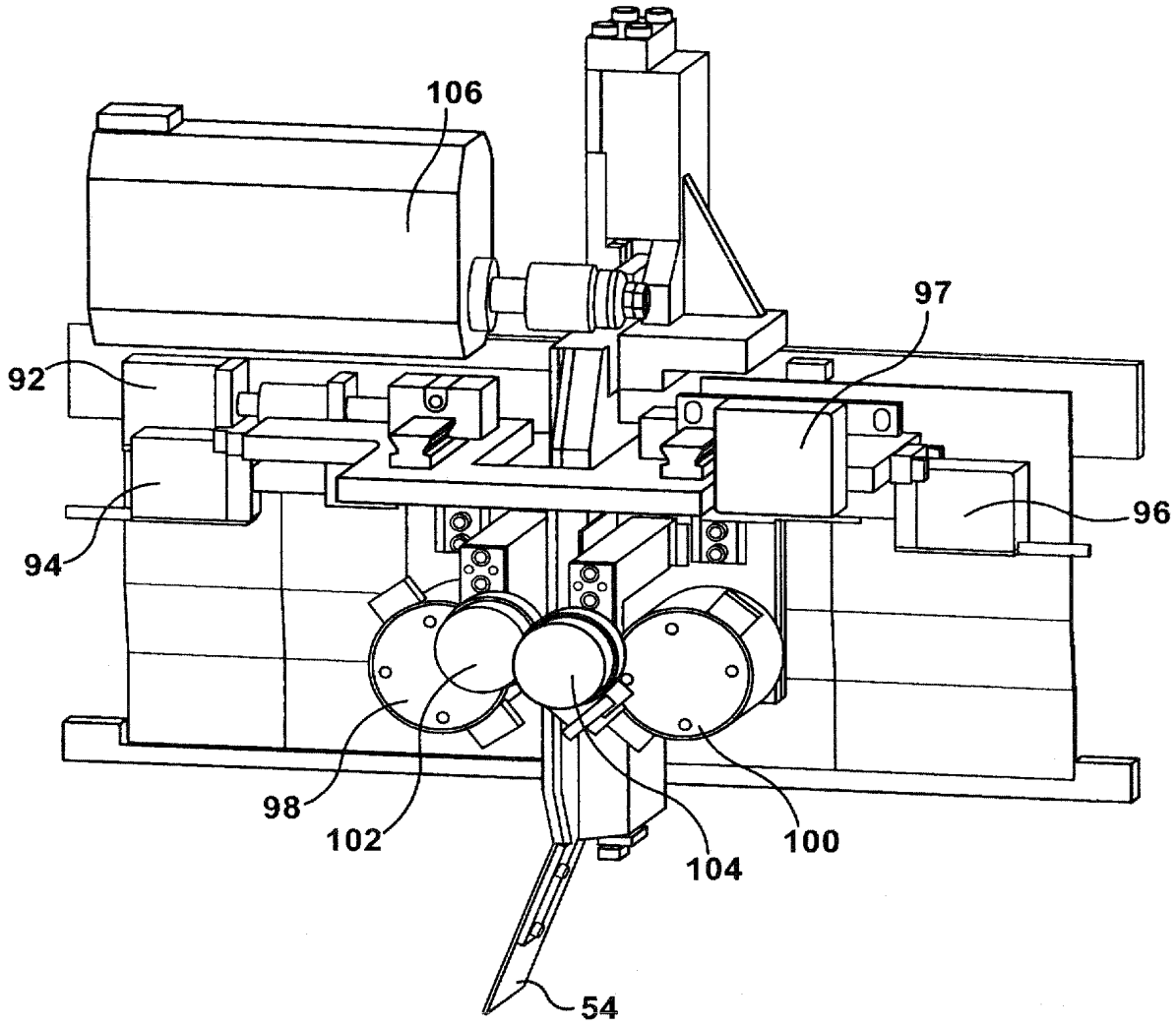


Figure 19

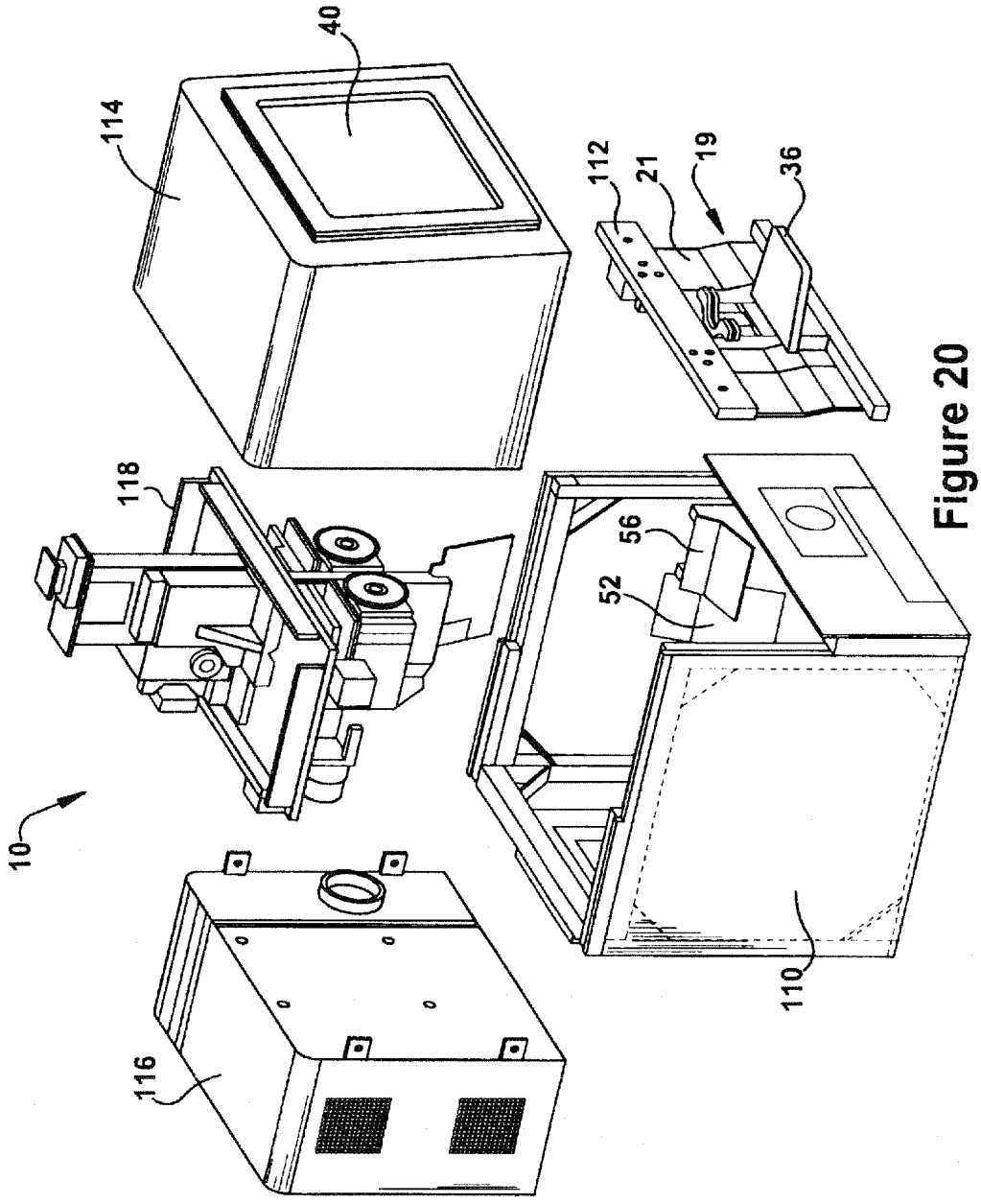


Figure 20

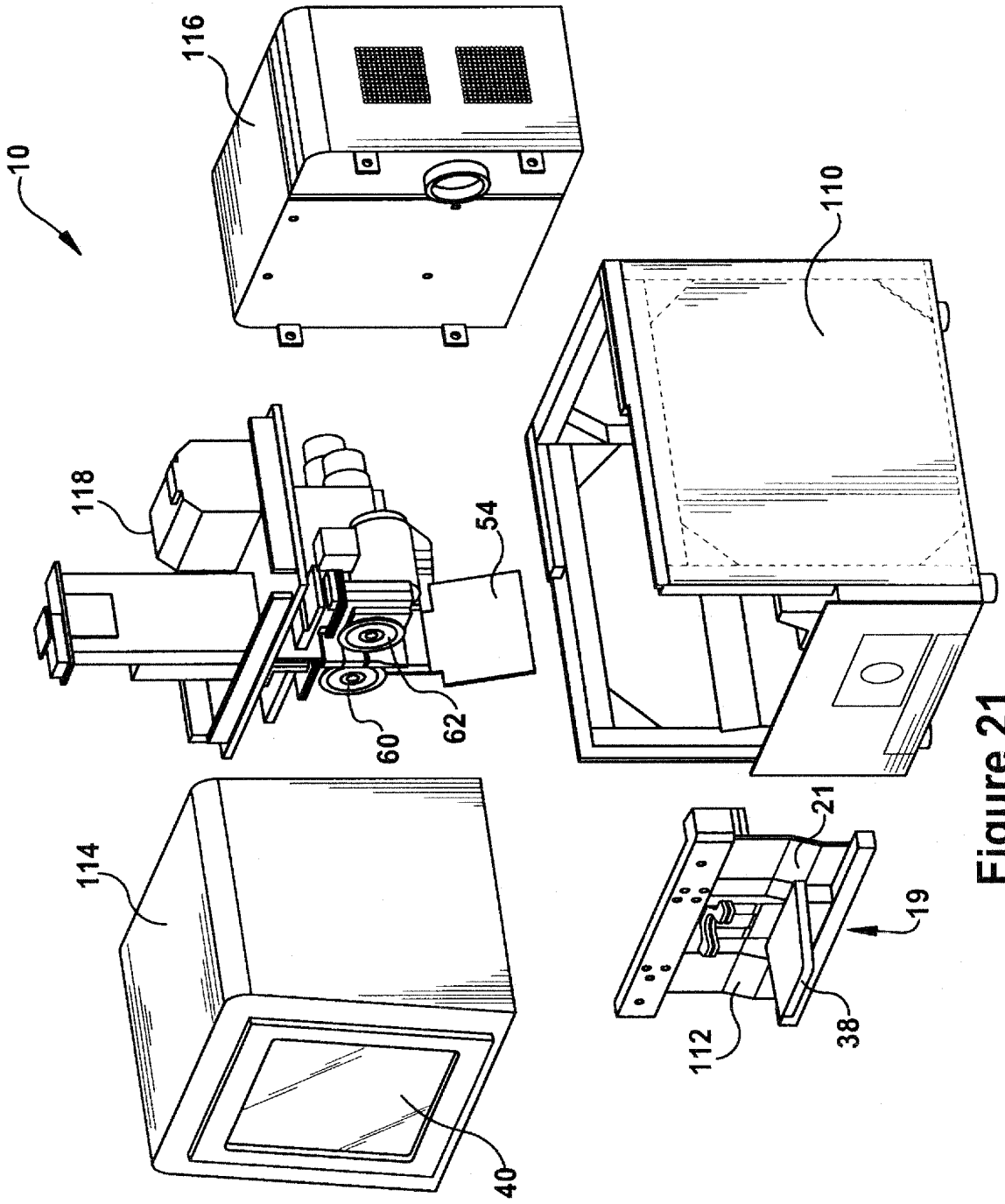


Figure 21

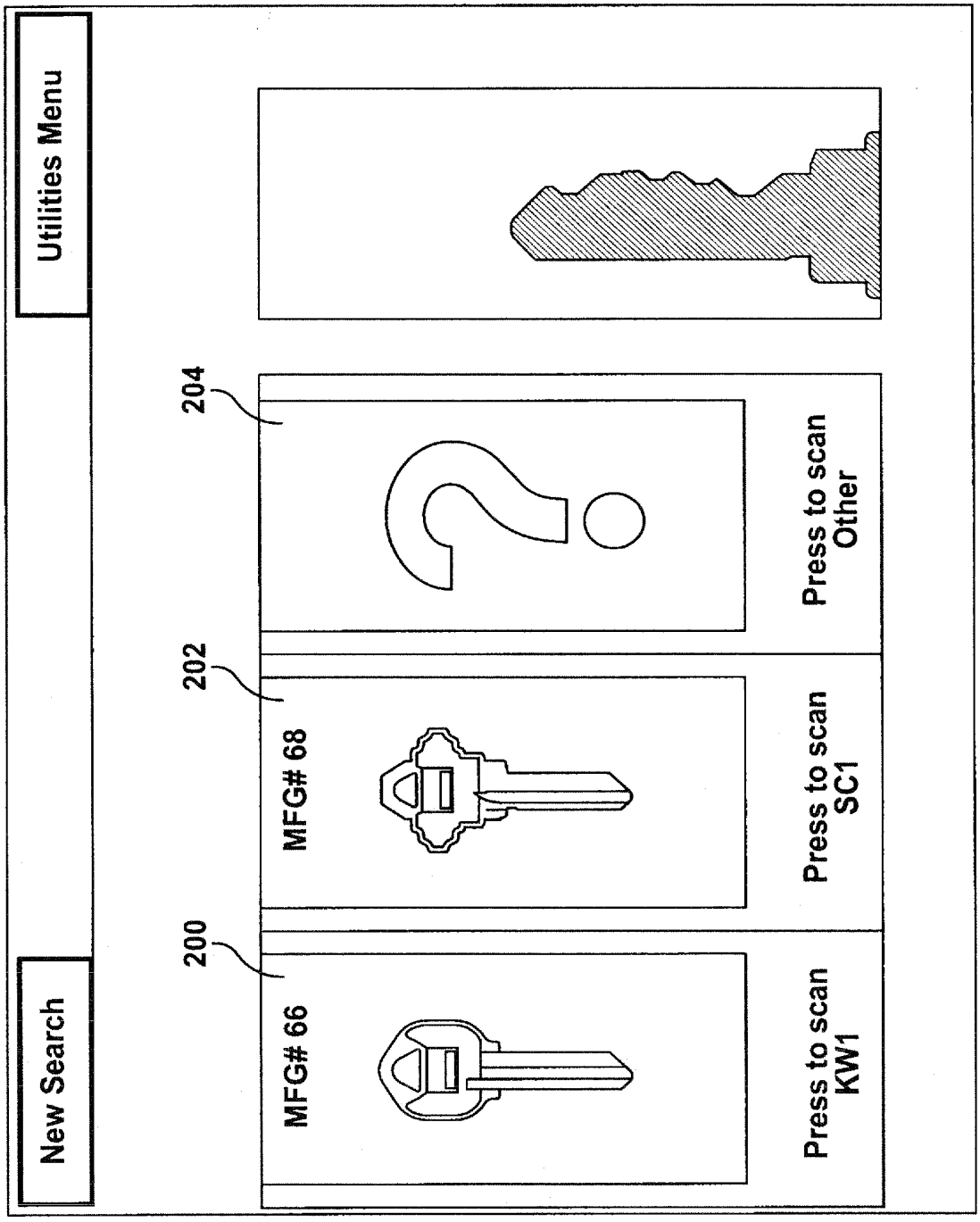

Utilities Menu
New Search
200
MFG# 66
Press to scan KW1
202
MFG# 68
Press to scan SC1
204
Press to scan Other
No Selections Made

Figure 22

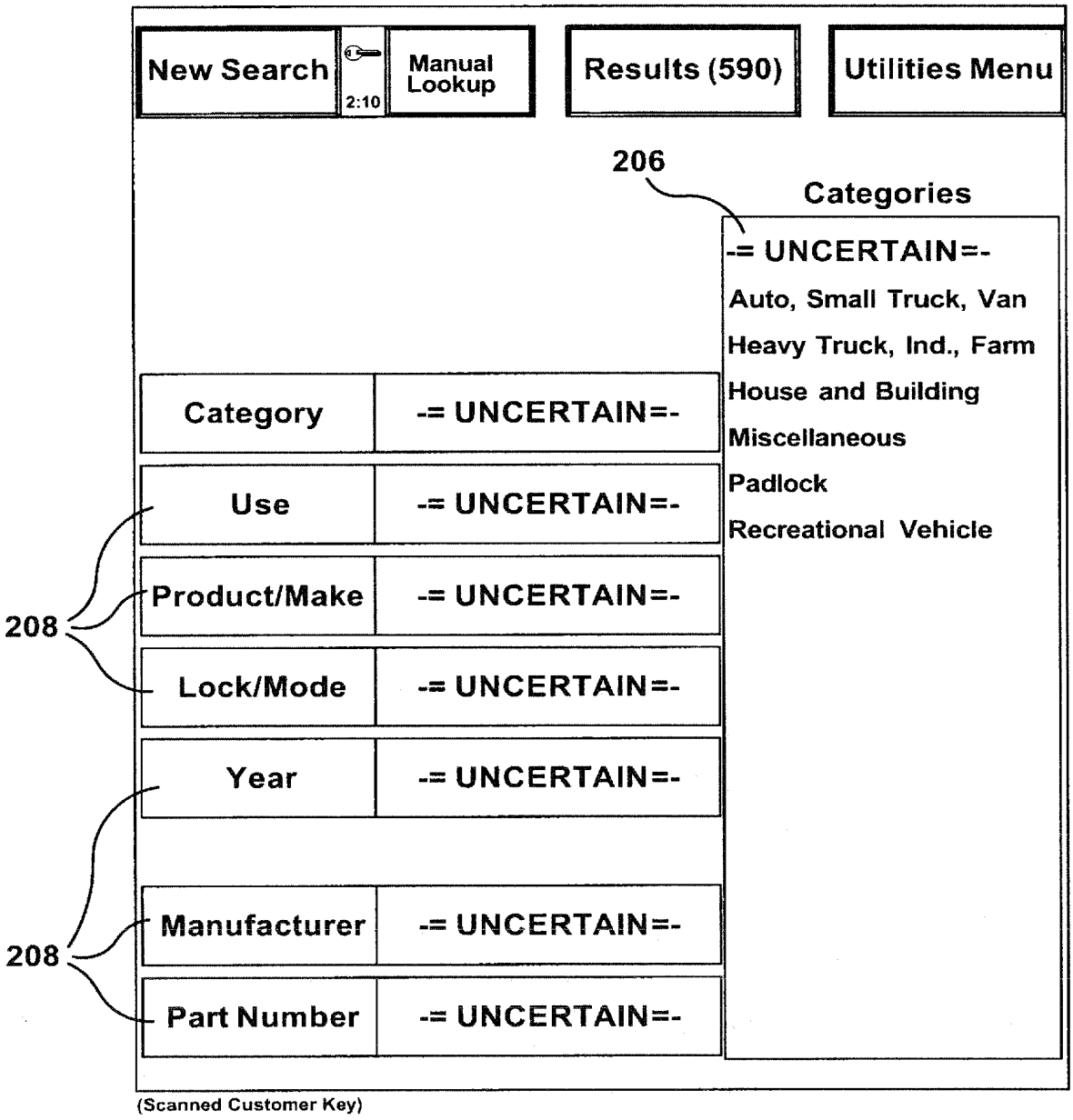

New Search
2:10
Manual Lookup
Results (590)
Utilities Menu
206
Categories
-= UNCERTAIN=-
Auto, Small Truck, Van
Heavy Truck, Ind., Farm
House and Building
Miscellaneous
Padlock
Recreational Vehicle
Category
-= UNCERTAIN=-
Use
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(Scanned Customer Key)

Figure 23

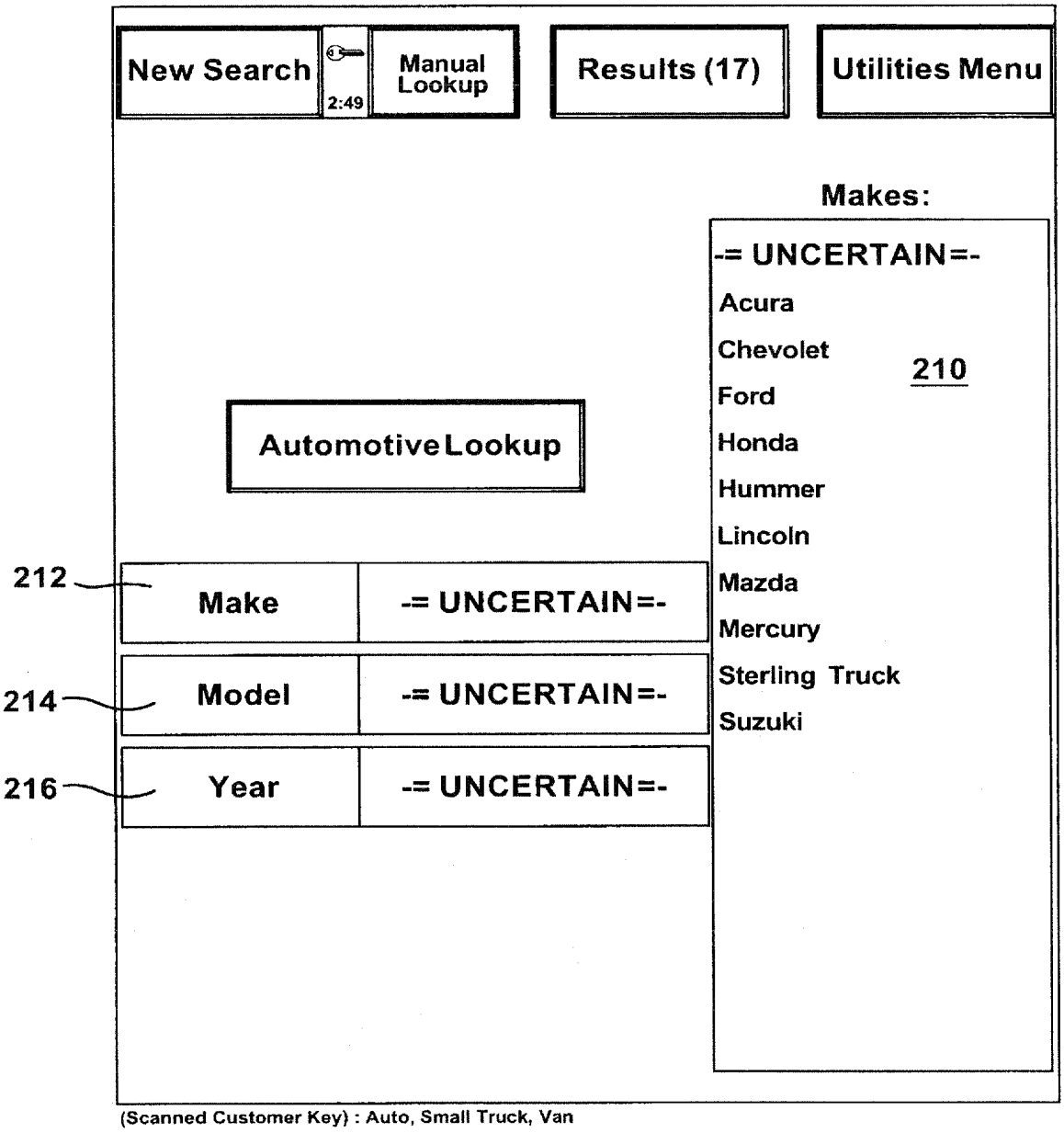

New Search
2:49
Manual Lookup
Results (17)
Utilities Menu
Makes:
-= UNCERTAIN=-
Acura
Chevolet
Ford
Honda
Hummer
Lincoln
Mazda
Mercury
Sterling Truck
Suzuki
210
Automotive Lookup
212
Make
-= UNCERTAIN=-
214
Model
-= UNCERTAIN=-
216
Year
-= UNCERTAIN=-
(Scanned Customer Key) : Auto, Small Truck, Van

Figure 24

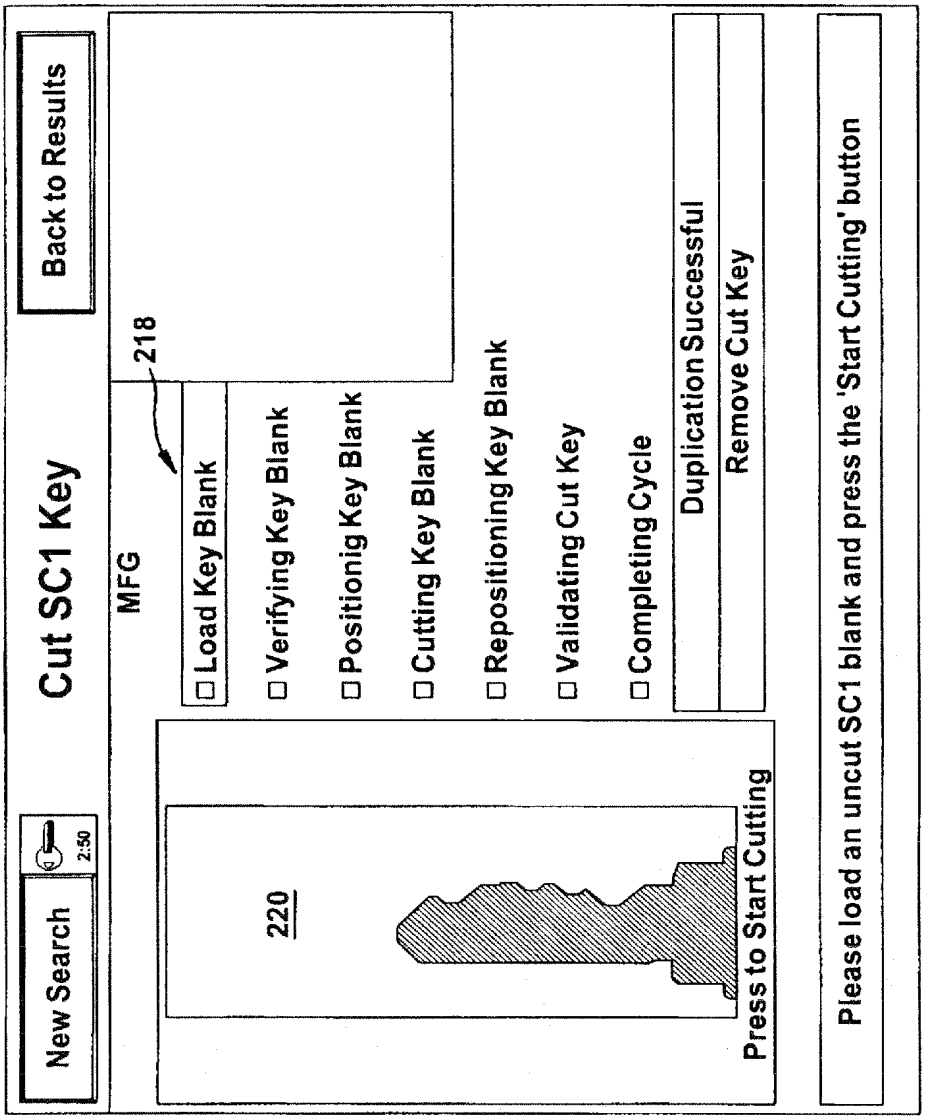

New Search
2:50
Cut SC1 Key
Back to Results
MFG
218
Load Key Blank
Verifying Key Blank
Positionig Key Blank
Cutting Key Blank
Repositioning Key Blank
Validating Cut Key
Completing Cycle
Duplication Successful
Remove Cut Key
220
Press to Start Cutting
Please load an uncut SC1 blank and press the 'Start Cutting' button

Figure 25

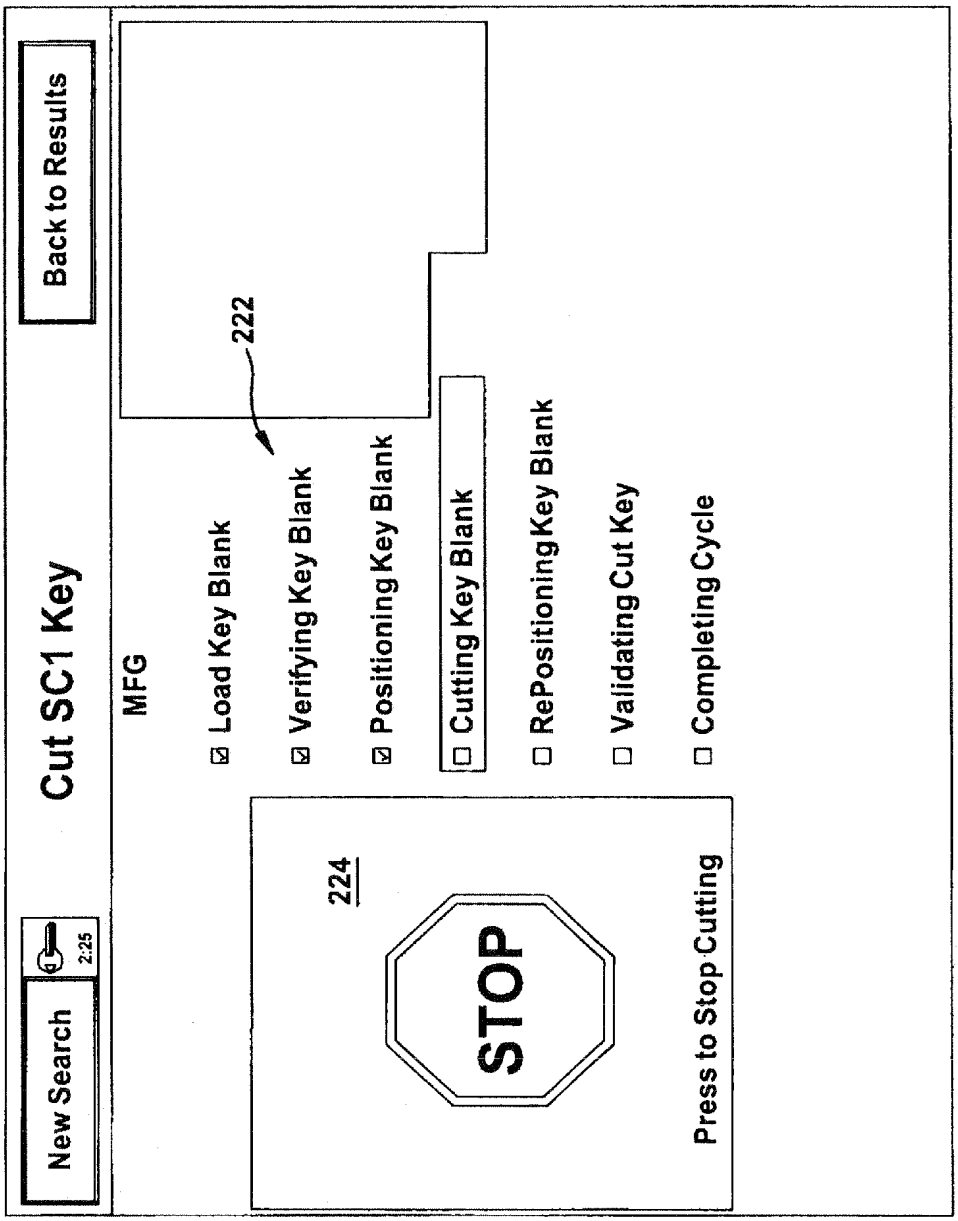

New Search
2:25
Cut SC1 Key
Back to Results
MFG
222
Load Key Blank
Verifying Key Blank
Positioning Key Blank
Cutting Key Blank
RePositioning Key Blank
Validating Cut Key
Completing Cycle
224
STOP
Press to Stop Cutting

Figure 26

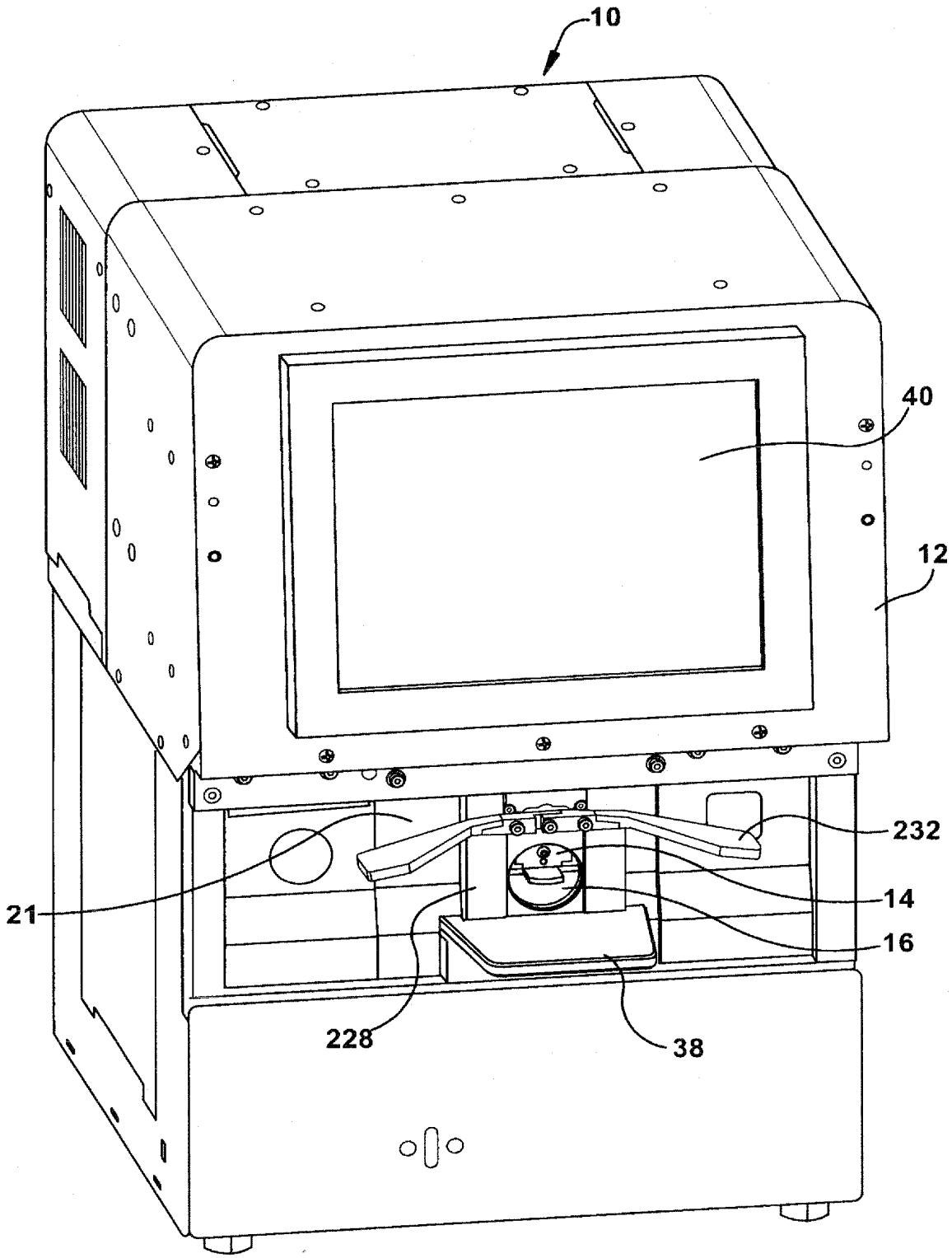


Figure 27

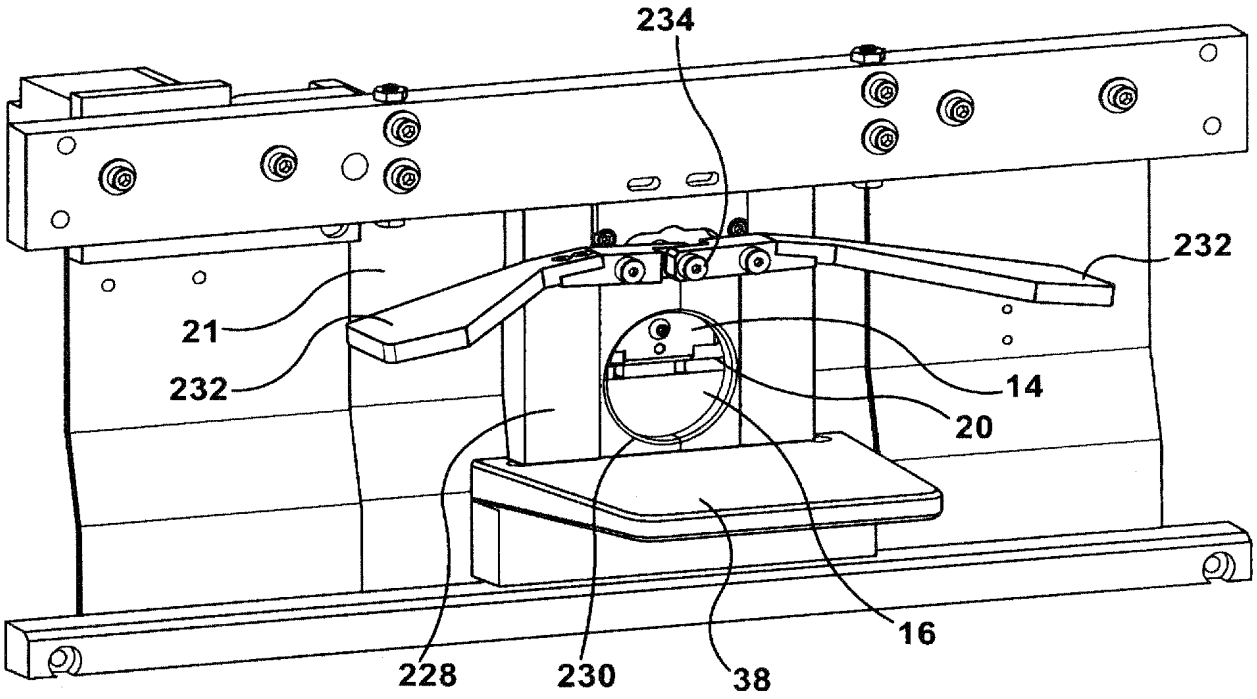


Figure 28

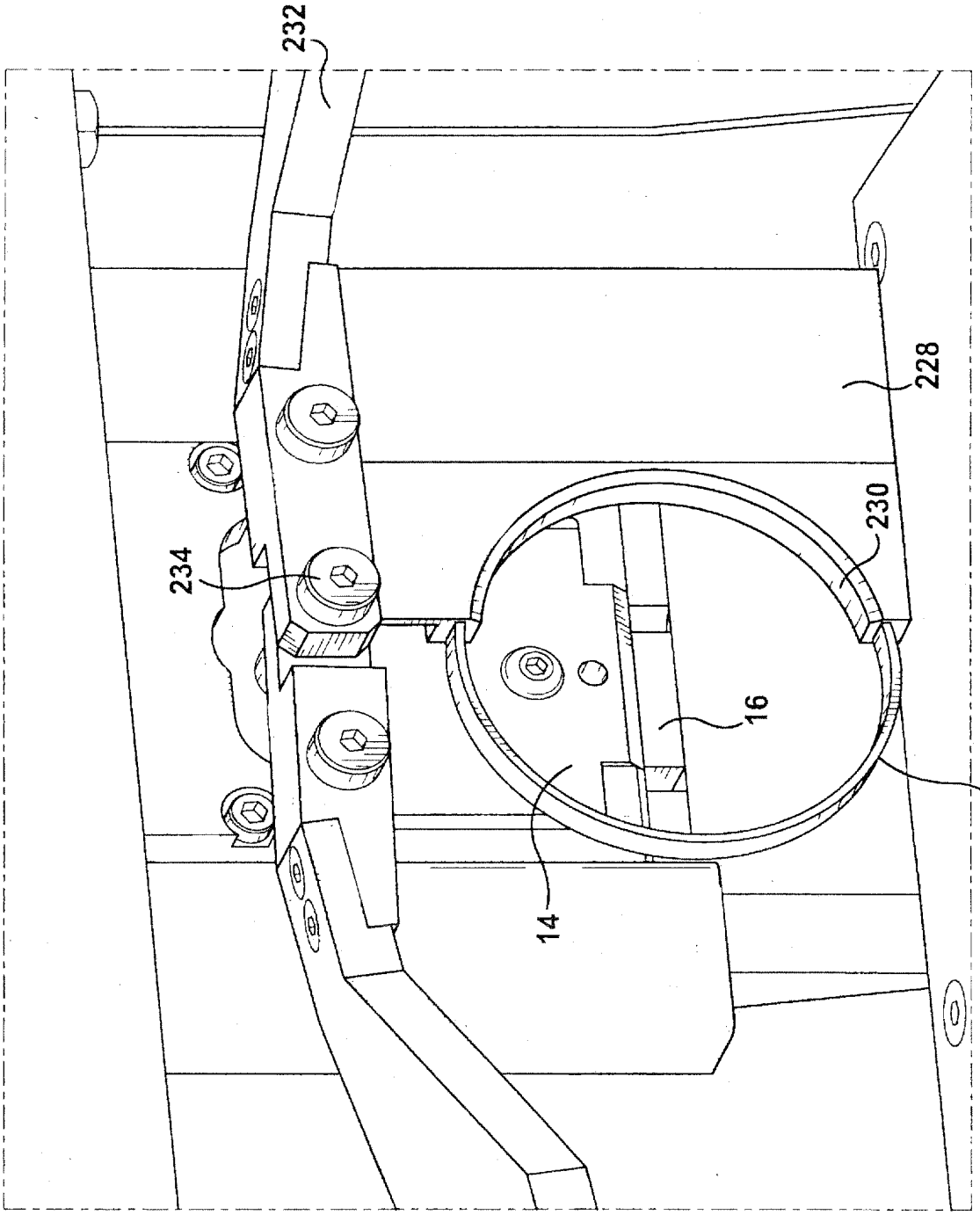


Figure 29

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	Date of mailing of the international search report
08 July 2011	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)

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY
(Chapter I of the Patent Cooperation Treaty)

(PCT Rule 44*bis*)

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 *(day/month/year)* 29 April 2011 (29.04.2011)	Priority date *(day/month/year)* 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:

☒	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 44*bis*.3(c) and 93*bis*.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 44*bis* .2).

	Date of issuance of this report 16 July 2013 (16.07.2013)
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/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 43*bis*.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.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/US2011/034564	29 April 2011	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 43*bis*.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 66.1*bis*(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	Date of completion of this opinion	Authorized officer:
Mail Stop PCT, Attn: ISA/US Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-3201	08 July 2011	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:

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US2011/034564

Box No. V **Reasoned statement under Rule 43*bis*.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).

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 15Claim 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

From the INTERNATIONAL SEARCHING AUTHORITY

To: DAVID CUPAR
C/O MCDONALD HOPKINS LLC
600 SUPERIOR AVENUE, E. STE. 2100
CLEVELAND, OH 44114

PCT

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 90*bis*.1 and 90*bis*.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	Authorized officer Blaine R. Copenheaver PCT Helpdesk: 571-272-4300
Facsimile No. 571-273-3201	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 43.6*bis*(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.

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
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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	Date of mailing of the international search report
08 July 2011	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 43*bis*.1)

Date of mailing *(day/month/year)*	15 JUL 2011

Applicant's or agent's file reference	FOR FURTHER ACTION
16223-00178P	See paragraph 2 below

International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/US2011/034564	29 April 2011	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 43*bis*.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 66.1*bis*(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	Date of completion of this opinion	Authorized officer:
Mail Stop PCT, Attn: ISA/US Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-3201	08 July 2011	Blaine R. Copenheaver PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774

Form PCT/ISA/237 (cover sheet) (July 2009)

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 43*bis*.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).

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 15Claim 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 44*bis*)

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 *(day/month/year)* 03 May 2010 (03.05.2010)	Priority date *(day/month/year)* 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:

☒	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 44*bis*.3(c) and 93*bis*.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 44*bis* .2).

	Date of issuance of this report 01 November 2011 (01.11.2011)
The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland Facsimile No. +41 22 338 82 70	Authorized officer Lingfei Bai e-mail: pt02.pct@wipo.int

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 43*bis*.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.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/US2010/033414	03 May 2010	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 43*bis*.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 66.1*bis*(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	Date of completion of this opinion	Authorized officer:
Mail Stop PCT, Attn: ISA/US Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-3201	05 August 2010	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/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 43*bis*.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

1. Statement

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: [Clm. 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); [Clm. 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); [Clm. 3] wherein said imaging system includes a camera (50, as stated on Page 4, Par. (0056)); [Clm. 4] wherein said imaging system includes a reflecting device (reflector plate (54)); [Clm. 5] wherein said imaging system includes a light (lighting panel (52)); [Clm. 6] wherein said light is directed toward said reflecting device (as stated on Page 4, Par. (0057), lines 6-8); [Clm. 7] wherein said light includes a shield (blocking plate (56)); [Clm. 8] wherein said captured image is a digital image (as stated on Page 4, Par. (0056)); [Clm. 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); [Clm. 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); [Clm. 15] an overhead camera positioned above and approximately perpendicular to said master key (as stated on Page 4, Par. (0055), lines 12-16); [Clm. 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); [Clm. 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)); [Clm. 19] a key holder (retention mechanism, (19) as shown in Fig. 2, 3 and 6)) configured to hold said master key (22); [Clm. 20] wherein said key holder includes a lower support (base, (16) as shown in Fig. 1-3); [Clm. 21] wherein said key holder includes an upper door (door clamp (14) as shown in Fig. 1-3); and [Clm. 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: [Clm. 1] wherein the imaging system captures an image at an angle between perpendicular and parallel to the blade of said master key; [Clm. 7] a shield to direct light away from said master key; [Clm. 10] wherein said characteristics of said groove include the geometric shape of said groove; [Clm. 14] a mirror positioned to reflect an image of said master key to be captured by said camera; [Clm. 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: [Clm. 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 (θ, 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; [Clm. 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); [Clm. 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; [Clm. 18] wherein said logic calculates the geometry of the groove contour as though the tip were squarely cut based on data (wherein the bitting 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.

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.

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 43.6*bis*(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	Date of mailing of the international search report
05 August 2010	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

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 43*bis*.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.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/US2010/033414	03 May 2010	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 43*bis*.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 66.1*bis*(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	Date of completion of this opinion	Authorized officer:
Mail Stop PCT, Attn: ISA/US Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-3201	05 August 2010	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/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 43*bis*.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

1. Statement

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: [Clm. 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); [Clm. 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); [Clm. 3] wherein said imaging system includes a camera (50, as stated on Page 4, Par. (0056)); [Clm. 4] wherein said imaging system includes a reflecting device (reflector plate (54)); [Clm. 5] wherein said imaging system includes a light (lighting panel (52)); [Clm. 6] wherein said light is directed toward said reflecting device (as stated on Page 4, Par. (0057), lines 6-8); [Clm. 7] wherein said light includes a shield (blocking plate (56)); [Clm. 8] wherein said captured image is a digital image (as stated on Page 4, Par. (0056)); [Clm. 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); [Clm. 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); [Clm. 15] an overhead camera positioned above and approximately perpendicular to said master key (as stated on Page 4, Par. (0055), lines 12-16); [Clm. 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); [Clm. 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)); [Clm. 19] a key holder (retention mechanism, (19) as shown in Fig. 2, 3 and 6)) configured to hold said master key (22); [Clm. 20] wherein said key holder includes a lower support (base, (16) as shown in Fig. 1-3); [Clm. 21] wherein said key holder includes an upper door (door clamp (14) as shown in Fig. 1-3); and [Clm. 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: [Clm. 1] wherein the imaging system captures an image at an angle between perpendicular and parallel to the blade of said master key; [Clm. 7] a shield to direct light away from said master key; [Clm. 10] wherein said characteristics of said groove include the geometric shape of said groove; [Clm. 14] a mirror positioned to reflect an image of said master key to be captured by said camera; [Clm. 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: [Clm. 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 (θ, 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; [Clm. 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); [Clm. 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; [Clm. 18] wherein said logic calculates the geometry of the groove contour as though the tip were squarely cut based on data (wherein the bitting 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.

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.

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter I of the Patent Cooperation Treaty)

(PCT Rule 44*bis*)

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 *(day/month/year)* 23 January 2007 (23.01.2007)	Priority date *(day/month/year)* 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:

☒	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 44*bis*.3(c) and 93*bis*.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 44*bis* .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 43*bis*.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.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/US 07/02015	23 January 2007 (23.01.2007)	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 43*bis*.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 66.1*bis*(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	Date of completion of this opinion	Authorized officer:
Mail Stop PCT, Attn: ISA/US Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-3201	11 August 2007 (11.08.2007)	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 43*bis*.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 ln 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 ln 1-27, Fig 8) of at least a portion of the master key, a logic (video image processor 808; col 8 ln 1-13) for determining a key pattern (key code 700; col 6 ln 21-22, col 7 ln 6-20, Fig 7a, 7b) of the master key from the optical image of master key, a clamping assembly (key holder 204; col 3 ln 66 to col 4 ln 4, Fig 2) for clamping a key blank (blank preform 246; col 3 ln 57-65) and a first cutting member (key-code cutter 252; col 4 ln 44-50, Fig 4) for cutting a key pattern (key-code; col 4 ln 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 ln 51-56) cut into the key blank (blank preform 246; col 4 ln 51-56) is a duplication of the key pattern of master key (original key 202; col 3 ln 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 ln 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 ln 51-56) of master key (original key 202; col 3 ln 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 ln 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 ln 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 ln 66 to col 4 ln 4, Fig 2) further comprises, a first clamping member (x-translation stage 214, y-translation stage 218, key holder 204; col 3 ln 66 to col 4 ln 14, Fig 2) having a first clamping surface (x-translation stage 214) defining a width (x-direction; col 3 ln 66 to col 4 ln 14) and a second clamping member (y-translation stage 218; col 3 ln 66 to col 4 ln 14) having a second clamping surface (upper surface of y-translation stage 218) defining a width (y-direction; col 3 ln 66 to col 4 ln 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 ln 36-44, Fig 1A) defining a width where the width of the first clamping member (key holder 204; col 3 ln 66 to col 4 ln 4, Fig 2) and the width of the second clamping member (col 13 ln 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 ln 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 ln 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 ln 66 to col 4 ln 14, Fig 2) a retention plate (tip holder 248; col 12 ln 29-39) and a biasing member (key holder solenoid 928; col 9 ln 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 ln 66 to col 4 ln 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.

Hillman Exhibit 1002
Page 0971

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.

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

To: Risto Pribisich
Mcdonald Hopkins LLC
600 Superior Avenue, E.
Suite 2100
Cleveland, OH 44114

PCT

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 90*bis*.1 and 90*bis*.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 *(day/month/year)* 23 January 2007 (23.01.2007)	(Earliest) Priority Date *(day/month/year)* 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 43.6*bis*(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.

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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	Date of mailing of the international search report
11 August 2007 (11.08.2007)	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

Form PCT/ISA/210 (second sheet) (April 2007)

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 43*bis*.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.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/US 07/02015	23 January 2007 (23.01.2007)	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 43*bis*.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 66.1*bis*(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.

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Name and mailing address of the ISA/US	Date of completion of this opinion	Authorized officer:
Mail Stop PCT, Attn: ISA/US Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-3201	11 August 2007 (11.08.2007)	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 43*bis*.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 ln 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 ln 1-27, Fig 8) of at least a portion of the master key, a logic (video image processor 808; col 8 ln 1-13) for determining a key pattern (key code 700; col 6 ln 21-22, col 7 ln 6-20, Fig 7a, 7b) of the master key from the optical image of master key, a clamping assembly (key holder 204; col 3 ln 66 to col 4 ln 4, Fig 2) for clamping a key blank (blank preform 246; col 3 ln 57-65) and a first cutting member (key-code cutter 252; col 4 ln 44-50, Fig 4) for cutting a key pattern (key-code; col 4 ln 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 ln 51-56) cut into the key blank (blank preform 246; col 4 ln 51-56) is a duplication of the key pattern of master key (original key 202; col 3 ln 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 ln 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 ln 51-56) of master key (original key 202; col 3 ln 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 ln 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 ln 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 ln 66 to col 4 ln 4, Fig 2) further comprises, a first clamping member (x-translation stage 214, y-translation stage 218, key holder 204; col 3 ln 66 to col 4 ln 14, Fig 2) having a first clamping surface (x-translation stage 214) defining a width (x-direction; col 3 ln 66 to col 4 ln 14) and a second clamping member (y-translation stage 218; col 3 ln 66 to col 4 ln 14) having a second clamping surface (upper surface of y-translation stage 218) defining a width (y-direction; col 3 ln 66 to col 4 ln 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 ln 36-44, Fig 1A) defining a width where the width of the first clamping member (key holder 204; col 3 ln 66 to col 4 ln 4, Fig 2) and the width of the second clamping member (col 13 ln 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 ln 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 ln 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 ln 66 to col 4 ln 14, Fig 2) a retention plate (tip holder 248; col 12 ln 29-39) and a biasing member (key holder solenoid 928; col 9 ln 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 ln 66 to col 4 ln 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.

Hillman Exhibit 1002
Page 0979

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.

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.

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/may 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.

Hillman Exhibit 1002
Page 0982

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 66.1*bis*(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 43*bis*.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.

Hillman Exhibit 1002
Page 0983

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY
(Chapter I of the Patent Cooperation Treaty)

(PCT Rule 44*bis*)

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 *(day/month/year)* 03 May 2010 (03.05.2010)	Priority date *(day/month/year)* 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:

☒	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 44*bis*.3(c) and 93*bis*.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 44*bis* .2).

	Date of issuance of this report 01 November 2011 (01.11.2011)
The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland Facsimile No. +41 22 338 82 70	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 43*bis*.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.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/US 10/33421	03 May 2010 (03.05.2010)	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 43*bis*.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 66.1*bis*(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	Date of completion of this opinion	Authorized officer:
Mail Stop PCT, Attn: ISA/US Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-3201	22 July 2010 (22.07.2010)	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 AUTHORITY

International 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 43*bis*.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 bitting information from a master key (para [0043]); and a logic configured to analyze said bitting information to determine characteristics of said bittings of said master key and further to compare said characteristics of said bittings with bitting 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 bitting 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 bitting 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 bitting characteristics of known key blanks includes a set of bitting 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 bitting characteristics of known key blanks includes a set of bitting centers associated with a given key blank (para [0061]).

Regarding claim 14, Bass teaches that said logic compares the depth of the master key bitting 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 bitting flat widths of the master key bitting at each spacing point to said set of bitting 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 bitting flat widths of said master key at each spacing point and said set of bitting flat widths for said given key blank (inherent to a comparison logic; para [0060]).

Regarding claim 18, Bass teaches that said logic compares the bitting centers of the master key bitting to said set of bitting 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 bitting centers of said master key and said set of bitting 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 bitting depth, a bitting flat width, and a bitting 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 *(day/month/year)* 03 May 2010 (03.05.2010)	(Earliest) Priority Date *(day/month/year)* 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 43.6*bis*(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.

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 bitting
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	Date of mailing of the international search report
21 July 2010 (21.07.2010)	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

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

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter I of the Patent Cooperation Treaty)

(PCT Rule 44*bis*)

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 *(day/month/year)* 29 April 2011 (29.04.2011)	Priority date *(day/month/year)* 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:

☒	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 44*bis*.3(c) and 93*bis*.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 44*bis* .2).

	Date of issuance of this report 16 July 2013 (16.07.2013)
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/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 43*bis*.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.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/US2011/034564	29 April 2011	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 43*bis*.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 66.1*bis*(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	Date of completion of this opinion	Authorized officer:
Mail Stop PCT, Attn: ISA/US Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-3201	08 July 2011	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:

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US2011/034564

Box No. V **Reasoned statement under Rule 43*bis*.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).

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 15Claim 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.

Electronic Acknowledgement Receipt

EFS ID:	26978323
Application Number:	15262787
International Application Number:	
Confirmation Number:	1955
Title of Invention:	KEY DUPLICATION MACHINE
First Named Inventor/Applicant Name:	Michael A. Bass
Customer Number:	33772
Filer:	Mark Jason Masterson/danielle mueller
Filer Authorized By:	Mark Jason Masterson
Attorney Docket Number:	16223-00310
Receipt Date:	20-SEP-2016
Filing Date:	
Time Stamp:	14:24:42
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	Information Disclosure Statement (IDS) Form (SB08)	6329134.pdf	621103 3f30d42007022092b1e531eb9968de3d097cfb12	no	36

Warnings:

Information:					
2	Information Disclosure Statement (IDS) Form (SB08)	6329129.pdf	613870 f1febad599d9b9042afd7091f26400d3bdb64eec	no	10
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3	Foreign Reference	6156472.pdf	1411612 81106a18c8f4a6cfbe63fcbcf058178504f6f5a0	no	37
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4	Foreign Reference	6156471.pdf	138056 0b82e13458d0af3c5d6dac1eb2488be60b43f09f	no	3
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7	Foreign Reference	6156476.pdf	549495 85d11bca80985a113be16ba84257d0679a98ca0e	no	12
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9	Foreign Reference	6156477.pdf	695089 386420b08aeff67d79c8f0dce23e67216c31a7d9	no	18
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16	Foreign Reference	6156478.pdf	2243965 41e543aa0c10c1373c7e2a91b6000f30d59944b8	no	62
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22	Foreign Reference	6156480.pdf	1534823 03ddfb5c72a7f935a0e5995597721be9e587c14c	no	38
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23	Foreign Reference	6156473.pdf	523303 71ddbedf63f70665ccd5398621e8ba7f0b77fba2	no	19
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25	Other Reference-Patent/App/Search documents	6156536.pdf	1743329 2c1a84371304c3ded397f170f1c478376a7dc0ee	no	15
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Information:					
26	Other Reference-Patent/App/Search documents	6156535.pdf	149462 13035205c4af7f3e851b3c8fa31ebb97a82e9841	no	14
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27	Other Reference-Patent/App/Search documents	6156534.pdf	803908 65ba6318ab5fcb08b144364b1b411c8af4a9b682	no	24
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28	Other Reference-Patent/App/Search documents	6156533.pdf	544108 cf1242cdc410db00edfc91d7e877a2969a69d26c	no	16
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29	Other Reference-Patent/App/Search documents	6156808.pdf	95520 9c2211b4af6402e4abd9e197fc3e9dbf0eac4caa	no	3
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30	Other Reference-Patent/App/Search documents	6156807.pdf	103638 fa6d6e6dbe8bec63e3a8c6eb4eb45bd50d2952bb	no	4
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31	Other Reference-Patent/App/Search documents	6156806.pdf	316244 0cc4b29cee9afeb7a17df234b9cc71791e47077e	no	5
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32	Other Reference-Patent/App/Search documents	6156805.pdf	108176 aa0fa47e0c2392a69b97c51273861fbe8a2ca509	no	1
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34	Other Reference-Patent/App/Search documents	6156816.pdf	310169 56ed5ddf60f56d65ac4f5fe89c5e29113cac132c	no	4
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36	Other Reference-Patent/App/Search documents	6156814.pdf	309162 67cfcf124133a70afa00693913ae65eff1968c89	no	6
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38	Other Reference-Patent/App/Search documents	6156879.pdf	358194 ece2beead207dbb3bfc556d7a013bf848ccea7a9	no	5
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39	Other Reference-Patent/App/Search documents	6156877.pdf	443300 83222a53489ff1eb6883e9c3c5bfd79be8334851	no	6
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45	Other Reference-Patent/App/Search documents	6156991.pdf	360095 dcb66384aa4283b89a4775f2a35afd4fd096de69	no	6
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49	Non Patent Literature	6157045.pdf	1381624 f6002fe50be06d4b799e856bd533cc41fef4d113	no	2
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50	Non Patent Literature	6157044.pdf	1319544 612d8279fc29a43583d00d97aa8099437211f24d	no	2
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51	Non Patent Literature	6157026.pdf	399618 78b7c9f9d7280196e5a0295c4bb913e13fc150cf	no	6
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52	Non Patent Literature	6157025.pdf	8467545 76c2cb44963b03e0c1e9329084754a25931b1e30	no	164
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56	Non Patent Literature	6157021.pdf	1605514 2ae81ff74070730b6bf101db864e471e3421cef5	no	37
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57	Non Patent Literature	6157065.pdf	47645 e951a3e15d7982b1398317888e1813a862ddc132	no	3
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58	Non Patent Literature	6157080.pdf	256471 5a6c7225e770f5f8d34db8cdf977ce210ea49196	no	6

Warnings:	
Information:	
Total Files Size (in bytes):	70611749

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 FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number: 15/262,787

APPLICATION AS FILED - PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA	SMALL ENTITY RATE($)	SMALL ENTITY FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY FEE($)
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), (i), 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(i))	29 minus 20 =	* 9	x 40 =	360	OR		
INDEPENDENT CLAIMS (37 CFR 1.16(h))	3 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			
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL	1090		TOTAL	

APPLICATION AS AMENDED - PART II

		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE($)	SMALL ENTITY ADDITIONAL FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE($)
AMENDMENT A	Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
	Application Size Fee (37 CFR 1.16(s))									
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE($)	ADDITIONAL FEE($)		RATE($)	ADDITIONAL FEE($)
AMENDMENT B	Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
	Application Size Fee (37 CFR 1.16(s))									
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	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.

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APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY.DOCKET.NO	TOT CLAIMS	IND CLAIMS
15/262,787	09/12/2016	3722	1090	16223-00310	29	3

CONFIRMATION NO. 1955

FILING RECEIPT

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

OC000000085966409

Date Mailed: 09/23/2016

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)

Michael A. Bass, Chagrin Falls, OH;
William R. Mutch, North Ridgeville, OH;
Richard W. Ryai SR., North Royalton, OH;
Chester O.D. Thompson, Painesville, OH;
Robert E. Drake, Willoughby Hills, OH;
Randall A. Porras, Avon, OH;

Applicant(s)

Hy-Ko Products Company, Northfield, OH;

Power of Attorney: None

Domestic Priority data as claimed by applicant

This application is a CON of 14/629,814 02/24/2015
which is a CON of 13/015,982 01/28/2011 PAT 8985918
which is a CON of 13/006,714 01/14/2011 PAT 8128322
which is a CON of 11/656,925 01/23/2007 PAT 7891919
which claims benefit of 60/761,293 01/23/2006

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.

Permission to Access Application via Priority Document Exchange: No

Permission to Access Search Results: No

Applicant may provide or rescind an authorization for access using Form PTO/SB/39 or Form PTO/SB/69 as appropriate.

If Required, Foreign Filing License Granted: 09/21/2016
The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 15/262,787**
Projected Publication Date: 12/29/2016
Non-Publication Request: No
Early Publication Request: No
**** SMALL ENTITY ****
Title

KEY DUPLICATION MACHINE

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 AssetsControl, 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).

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

MAILED
SEP 29 2016
OFFICE OF PETITIONS

Doc Code: TRACK1.GRANT

Decision Granting Request for Prioritized Examination (Track I or After RCE)	Application No.: 15/262,787

1. THE REQUEST FILED September 12, 2016 IS **GRANTED.**

The above-identified application has met the requirements for prioritized examination

A. ☒ for an original nonprovisional application (Track I).
B. ☐ for an application undergoing continued examination (RCE).

2. **The above-identified application will undergo prioritized examination.** The application will be accorded special status throughout its entire course of prosecution until one of the following occurs:

A. filing a **petition for extension of time** to extend the time period for filing a reply;

B. filing an **amendment to amend the application to contain more than four independent claims, more than thirty total claims**, or a multiple dependent claim;

C. filing a **request for continued examination**;

D. filing a notice of appeal;

E. filing a request for suspension of action;

F. mailing of a notice of allowance;

G. mailing of a final Office action;

H. completion of examination as defined in 37 CFR 41.102; or

I. abandonment of the application.

Telephone inquiries with regard to this decision should be directed to Brian W. Brown at 571-272-5338.

/Brian W. Brown/
[*Signature*]

Petitions Examiner, Office of Petitions
(Title)

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
15/262,787	09/12/2016	Michael A. Bass	16223-00310	1955

33772 7590 12/02/2016

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

EXAMINER
HOWELL, DANIEL W

ART UNIT	PAPER NUMBER
3722	

NOTIFICATION DATE	DELIVERY MODE
12/02/2016	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

Office Action Summary	Application No. 15/262,787	Applicant(s) BASS ET AL.	
	Examiner DANIEL HOWELL	Art Unit 3722	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 _____.

☐ 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) *1-29* 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) *1-29* is/are rejected.

8)☐ Claim(s) _____ 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: _____.

1. The present application is being examined under the pre-AIA first to invent provisions.

2. It is noted that the subject matter of at least claim 1 of Burkett et al 2014/0377027 is very close to the subject matter of claims 1 and 12 of the present application, and claim 23 of the present application is very close to the subject matter of claim 14 of Burkett et al. Burkett et al '027 does not appear on either of the IDSs submitted by Applicant. Applicant is reminded of their duty to disclose information material to patentability as per 37 CFR 1. 56.

3. The following is a quotation of the first paragraph of 35 U.S.C. 112(a):

> (a) IN GENERAL.—The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same, and shall set forth the best mode contemplated by the inventor or joint inventor of carrying out the invention.

The following is a quotation of the first paragraph of pre-AIA 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same, and shall set forth the best mode contemplated by the inventor of carrying out his invention.

4. Claims 1-29 are rejected under 35 U.S.C. 112(a) or 35 U.S.C. 112 (pre-AIA), first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor or a joint inventor, or for pre-AIA the inventor(s), at the time the application was filed, had possession of the claimed invention. There are two parts to this rejection. First, the specification as originally filed does not disclose the concept of identifying keys while the key cutting system is cutting keys as set forth in each of claims 1, 12, and 23. This is a new matter rejection. Second, the device set forth in the specification is incapable of performing that limitation of claims 1, 12, and 23.

5. Regarding the new matter rejection, and noting that the present application is a Continuation, there simply isn't *anything* in the entire specification which discusses identifying keys while the key cutting system is cutting keys.

6. Regarding the second part of this rejection, several paragraphs throughout the specification regarding the slot 20 will first be pointed out. 1) Paragraphs [0046 and 0047] discuss a door clamp 14 and slot 20 to secure a master key 22 or key blank 24. 2) Paragraph [0050] states that the slot 20 is on a panel 21, and the panel 21 may slide left or right between an imagining zone and a cutting zone. 3) Paragraph [0055] discusses placing the master key or key blank in the slot 20 such that it is in the imaging zone. The next several paragraphs discuss capturing the image of the master key. 4) Paragraph [0064] then discusses removing the master key 24 from the slot 20 and then placing the key blank 24 in the slot 20, and that the key blank may be validated. 5) As discussed in paragraphs [0072-0073], the key blank in slot 20 in panel 21 is moved to the left from the imaging zone to the key cutting zone, where the key blank may be clamped by members 66, 68. 6) Paragraphs [0075-0076] discusses commencement of the cutting operation. Note that the key blank is still in slot 20 in panel 21 at this time. 7) Paragraph [0078] states that the key blank is now newly-cut, and that it "remains secured by the retention mechanism 19." The panel 21 is moved to the right, back to the imaging zone. 8) Paragraph [0079] discusses lifting the door clamp 14 and removing the newly-cut key from the slot 20.

7. Putting this all together, *the machine has only one slot 20 for holding both the master key and the key blank*. Thus, when the slot 20 having a key blank is moved to the key cutter, there is no access for a key blank to be placed at the identification system. It's impossible for this machine to image another key while a key is being cut, as there isn't a second access hole to

place a master key at the imaging system while the key blank is being cut. The device as disclosed is incapable of identifying a master key while cutting a key blank.

8. Claims 1-29 are rejected under 35 U.S.C. 112(b) or 35 U.S.C. 112 (pre-AIA), second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which the inventor or a joint inventor, or for pre-AIA the applicant regards as the invention. As discussed above, the device is incapable of identifying a master key while cutting a key blank, as the machine does not have a second access hole to image the master key while the key blank is held in slot 20. Slot 20 is the only location where a master key or key blank can have access to the imaging zone and key cutting zone.

9. Without sanctioning the new matter discussed above, for purposes of the art rejection below, the claims will be given a filing date of 9-12-16.

10. The following is a quotation of the appropriate paragraphs of pre-AIA 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

11. Claim(s) 1-8, 10-19, 21-29 is/are rejected under pre-AIA 35 U.S.C. 102(b) as being anticipated by Burkett et al (2014/0377027). See paragraph [0010] for a concise statement of how Burkett et al works. Paragraph [0019] discloses separate slots 102 for the master and blank. The master is IDed at 112, and the blank is cut at 114. Various types of ID modules are discussed in [0020]. Processors and memory are discussed at [0023-0026, 0035, 0051]. [0038-0039, 0050] discusses a network and kiosks.

12. Any inquiry concerning the content of this communication from the examiner should be directed to Daniel Howell, whose telephone number is 571-272-4478. The examiner's office hours are typically about 10 am until 6:30 pm, Monday through Friday. The examiner's supervisor, Sunil K. Singh, may be reached at 571-272-3460.

In order to reduce pendency and avoid potential delays, Group 3720 is encouraging FAXing of responses to Office actions directly into the Group at FAX number to 571-273-8300. This practice may be used for filing papers not requiring a fee. It may also be used for filing papers which require a fee by applicants who authorize charges to a USPTO deposit account. Please identify Examiner Daniel Howell of Art Unit 3722 at the top of your cover sheet.

/DANIEL HOWELL/
Primary Examiner, Art Unit 3722

Notice of References Cited	Application/Control No. 15/262,787	Applicant(s)/Patent Under Reexamination BASS ET AL.	
	Examiner DANIEL HOWELL	Art Unit 3722	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-2014/0377027 A1	12-2014	Burkett; Michael Wilson	B23C3/35	409/83
	B	US-				
	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	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.

PTO/SB/08a (01-10)
Approved for use through 07/31/2012. OMB 0651-0031
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	15262787
Filing Date	2016-09-12
First Named Inventor	Michael A. Bass
Art Unit	3722
Examiner Name	
Attorney Docket Number	16223-00310

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. /D.H./

Receipt date: 09/20/2016	Application Number	15262787	15262787 - GAU: 3722
INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Filing Date	2016-09-12	
(Not for submission under 37 CFR 1.99)	First Named Inventor	Michael A. Bass	
	Art Unit	3722	
	Examiner Name		
	Attorney Docket Number	16223-00310	

	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	

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /D.H./

Receipt date: 09/20/2016	Application Number	15262787	15262787 - GAU: 3722
INFORMATION DISCLOSURE STATEMENT BY APPLICANT (**Not for submission under 37 CFR 1.99)**	Filing Date	2016-09-12	
	First Named Inventor	Michael A. Bass	
	Art Unit	3722	
	Examiner Name		
	Attorney Docket Number	16223-00310	

	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	

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /D.H./

Receipt date: 09/20/2016	Application Number	15262787 15262787 - GAU: 3722
INFORMATION DISCLOSURE STATEMENT BY APPLICANT (**Not for submission under 37 CFR 1.99)**	Filing Date	2016-09-12
	First Named Inventor	Michael A. Bass
	Art Unit	3722
	Examiner Name	
	Attorney Docket Number	16223-00310

	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.	
	39	3358561		1967-12-19	Roxburgh, et al.	
	40	5517299		1996-05-14	Teratani, et al.	
	41	8287215		2012-10-16	Freeman et al.	

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /D.H./

Receipt date: 09/20/2016	Application Number	15262787	15262787 - GAU: 3722
INFORMATION DISCLOSURE STATEMENT BY APPLICANT (**Not for submission under 37 CFR 1.99)**	Filing Date	2016-09-12	
	First Named Inventor	Michael A. Bass	
	Art Unit	3722	
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	1	20110262240		2011-10-27	Mutch et al.	
	2	20090180664		2009-07-16	Efstathiades et al.	
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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).

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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)	2016-09-20
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.**

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First Named Inventor	Michael A. Bass
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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
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	24	6711557		2004-03-23	Palaniappan	
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	29	6602030		2003-08-05	Markbreit	
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	Attorney Docket Number	16223-00310

	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.	☐

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

EXAMINER SIGNATURE

Examiner Signature	/Daniel Howell/	Date Considered	11/27/2016

*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. /D.H./

Receipt date: 09/20/2016	Application Number	15262787 15262787 - GAU: 3722
INFORMATION DISCLOSURE STATEMENT BY APPLICANT (**Not for submission under 37 CFR 1.99**)	Filing Date	2016-09-12
	First Named Inventor	Michael A. Bass
	Art Unit	3722
	Examiner Name	
	Attorney Docket Number	16223-00310

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)	2016-09-20
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.**

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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.

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Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	15262787	BASS ET AL.
	Examiner	Art Unit
	DANIEL HOWELL	3722

CPC- SEARCHED		
Symbol	Date	Examiner
B23C 3/35, 355; 2235/12, 24, 32, 41		
Y10T 409/300952, 301008, 301064	11-27-16	DH

CPC COMBINATION SETS - SEARCHED		
Symbol	Date	Examiner

US CLASSIFICATION SEARCHED			
Class	Subclass	Date	Examiner

SEARCH NOTES		
Search Notes	Date	Examiner

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

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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
15/262,787	09/12/2016	Michael A. Bass	16223-00310

CONFIRMATION NO. 1955

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

PUBLICATION NOTICE

OC000000088176290

Title:KEY DUPLICATION MACHINE

Publication No.US-2016-0375503-A1
Publication Date:12/29/2016

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 (571) 272-3150 or (800) 972-6382, by facsimile at (571) 273-3250, by mail addressed to the United States Patent and Trademark Office, Office of Public Records, Alexandria, VA 22313-1450 or via the Internet.

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PATENT APPLICATION

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application:	Michael A. Bass, et al.	Art Unit:	3722
Serial No.:	15/262,787	Examiner:	Howell, Daniel W
Filing Date:	September 12, 2016	Docket No.:	16223-00310

Title: KEY DUPLICATION MACHINE

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

RESPONSE TO OFFICE ACTION

Applicants acknowledge receipt of the December 2, 2016 Office Action. This response is electronically filed on March 2, 2017 and 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.

Electronic Acknowledgement Receipt

EFS ID:	28510375
Application Number:	15262787
International Application Number:	
Confirmation Number:	1955
Title of Invention:	KEY DUPLICATION MACHINE
First Named Inventor/Applicant Name:	Michael A. Bass
Customer Number:	33772
Filer:	Mark Jason Masterson/Rebecca Shofar
Filer Authorized By:	Mark Jason Masterson
Attorney Docket Number:	16223-00310
Receipt Date:	02-MAR-2017
Filing Date:	12-SEP-2016
Time Stamp:	09:39:52
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		6619876.pdf	117536 55cb967461d5f2aa75c866da1a6e977f7dbb296e	yes	10

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Applicant Arguments/Remarks Made in an Amendment	7	10
	Claims	2	6
	Amendment/Req. Reconsideration-After Non-Final Reject	1	1
Warnings:			
Information:			
	Total Files Size (in bytes):	117536	

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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.

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REMARKS

The December 2, 2016 Office Action identifies the following issues:

- Claims 1-29 stand rejected under 35 U.S.C. §112(a), or 35 U.S.C. §112(pre-AIA), first paragraph as failing to comply with the written description requirement;
- Claims 1-29 stand rejected under 35 U.S.C. §112(b), or 35 U.S.C. §112(pre-AIA), second paragraph as being indefinite for failing to claim the subject matter regarded as the invention;
- Claims 1-8, 10-19, 21-29 stand rejected under 35 U.S.C. §102(b) as being anticipated by Burkett et al (20143/0377027).

Claims 1 and 12 are amended. Claims 23-29 are canceled.

Preliminary Statement

The Office Action indicated that the Burkett reference was not submitted in an IDS. However, Applicants respectfully submit that the Burkett reference is not prior art to the instant application as its priority date is June 24, 2013 and the priority date of the instant application is January 23, 2006. Further, as will be explained below, Applicants submit that the subject matter recited by the claims is sufficiently disclosed by the application as filed by the identified priority date and that no new matter has been added.

Claim Rejections – 35 USC 112(a) or first paragraph

Claims 1-29 have been rejected as failing to comply with the written description requirement. Claims 1 and 12 have been amended and claims 23-29 have been canceled. Claim 1 recites:

An integrated key duplication machine, comprising:

an optical key blank identification system to identify keys; and

a key cutting system for cutting keys,

wherein the key blank identification system is configured to operate individually ~~identify keys while~~ from the key cutting system ~~is cutting keys~~ wherein the key blank identification system and the key cutting system may interact and share information.

Claim 12 recites:

A plurality of key duplication systems, comprising:

at least one key blank identification system for identifying key blanks; and

at least one key cutting system for cutting keys,

wherein the key blank identification system is configured to operate individually ~~identify keys while~~ from the key cutting system ~~is cutting keys~~ wherein the key blank identification system and the key cutting system may interact and share information.

Applicants respectfully traverse the written description rejection as paragraph [0044] particularly states, "[i]n 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." See Paragraph [0044]. This statement also exists in Col. 3, lines 13-17 of the parent patent application US 7,891,919 which the present application claims priority.

Further, in paragraph [0065] of the instant application, patent application 10/633,966 (US Patent No. 7,890,878) is incorporated by reference and states the following at Col. 11, line 55 to Col. 12, line 21, regarding the key identification system and key cutting devices:

> The key identification system utilizes a general computing platform to provide the database storage and computation, graphical user interface (GUI) for the operator, the display rack controller, and any and all other components which need the assistance of a general

> computing platform. All of the components of KIDS may exist on a single computing machine or on a plurality of computing machines with no requirements on the various implementations in which they may interact and share information. For example, a single general computing device such as personal computer may maintain the database and run the display rack control while a series of personal digital assistants act as operator interfaces to collect inputs, and then transmits the pertinent information via a wireless; network with the database result being reflected by the lighted display rack, in conjunction with an appropriate notation for the specific user, which is physically connected to the personal computer (the result could also be transmitted back to the particular user's personal digital assistant). This example in no way limits or restricts the plurality of methods that this system may be implemented or networked, including inclusive hand-held devices and systems coupled to key-cutting devices. Significantly, the interchangeability of various consumer-oriented computing devices permits widespread implementation of the invention in a variety of environments, including situations where such devices are presently available, in addition to other situations where KIDS would be provided as a new, stand-alone installation (such as in an integrated kiosk). This interchangeability should also minimize expenses, while at the same time providing a known platform of operation that is familiar to the user (and/or proprietor of the establishment in which the KIDS is installed).

(emphasis added) Col. 11, line 55 to Col. 12, line 21 of US Patent No. 7,890,878.

These passages identify that the key identification system and the key cutting system may be used individually and may interact and share information as recited by the claims. Therefore, no new matter has been added to the instant application by way of the claimed features and that the device(s) identified by the specification are capable of performing the limitations of claims 1-22. Thus, for at least the reasons identified above, it is respectfully submitted that the claims sufficiently comply with the written description requirement and that this rejection be withdrawn.

Claim Rejections – 35 USC 112(b) or second paragraph

Claims 1-29 have been rejected as indefinite. Claims 1 and 12 have been amended to clarify the claimed subject matter in accordance with the identified supported written description

noted above. Claims 23-29 have been canceled. The features of the claims are sufficiently definite and supported by the specification.

Further, Applicants request that the 9-12-16 date accorded this application be withdrawn as the enforced priority date as the actual priority date of this application should be January 23, 2006.

Thus, for the reasons identified above, it is respectfully submitted that this rejection be withdrawn.

Claim Rejections – 35 USC 102

The Office Action rejected claims 1-29 as being disclosed by Burkett. However, Burkett is not 102 prior art as its priority date is from 2013 and the instant application has a priority date of January 23, 2006. Burkett is not sufficient to disclose the subject matter recited by the instant claims. Thus, it is respectfully submitted that this rejection be withdrawn.

CONCLUSION

In light of the foregoing, Applicants submit that the application is now in condition for allowance and earnestly solicits a notice of 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 2, 2017

/Mark J. Masterson/

Mark J. Masterson
Reg. No. 71,886
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216-348-5400

CLAIMS

1. (Currently Amended) An integrated key duplication machine, comprising:

an optical key blank identification system to identify keys; and

a key cutting system for cutting keys,

wherein the key blank identification system is configured to operate individually ~~identify keys while~~ from the key cutting system ~~is cutting keys~~ wherein the key blank identification system and the key cutting system may interact and share information.

2. (Original) The integrated key duplication machine of claim 1 wherein the key blank identification system includes an optical imaging device, a database and a logic wherein said optical imaging device captures an image of a master key, said logic identifies features of the master key, and said logic compares said features of the master key with data in a database.

3. (Original) The integrated key duplication machine of claim 2 wherein said data in said database relates to key blanks.

4. (Original) The integrated key duplication machine of claim 2 wherein said data in said database relates to physical dimensions of key blanks.

5. (Original) The integrated key duplication machine of claim 2 wherein said logic aids in determining a proper key blank for the master key.

6. (Original) The integrated key duplication machine of claim 5 wherein said logic aids in selecting the proper key blank.

7. (Original) The integrated key duplication machine of claim 6 wherein said optical imaging device captures an image of the key blank at an imaging position and said logic validates said key blank.

8. (Original) The integrated key duplication machine of claim 1 wherein the key cutting system includes a retention mechanism, and at least one cutting member.

9. (Original) The integrated key duplication machine of claim 8 wherein the retention mechanism and said at least one cutting member further comprises a reflector plate wherein the lighting panel emits light that is reflected off the reflector plate and directed towards said master key.

10. (Original) The integrated key duplication machine of claim 2 wherein said master key is imaged and compared with a plurality of key blanks to aid in determining an appropriate key blank while utilizing the image to provide key pattern information to be cut into a key blank.

11. (Original) The integrated key duplication machine of claim 10, wherein said key blank identification system and said key cutting system are within a single apparatus.

12. (Currently Amended) A plurality of key duplication systems, comprising:

at least one key blank identification system for identifying key blanks; and

at least one key cutting system for cutting keys,

wherein the key blank identification system is configured to operate individually ~~identify keys while~~ from the key cutting system ~~is cutting keys~~ wherein the key blank identification system and the key cutting system may interact and share information.

13. (Original) The integrated key duplication machine of claim 12 wherein the at least one key blank identification system includes an optical imaging device, a database and a logic

wherein said optical imaging device captures an image of a master key, said logic identifies features of the master key and compares said features of the master key with data in a database.

14. (Original) The integrated key duplication machine of claim 13 wherein said data in said database relates to key blanks.

15. (Original) The integrated key duplication machine of claim 13 wherein said data in said database relates to physical dimensions of key blanks.

16. (Original) The integrated key duplication machine of claim 13 wherein said logic aids in determining a proper key blank for the master key.

17. (Original) The integrated key duplication machine of claim 16 wherein said logic aids in selecting the proper key blank.

18. (Original) The integrated key duplication machine of claim 17 wherein said optical imaging device captures an image of the key blank at an imaging position and said logic validates said key blank.

19. (Original) The integrated key duplication machine of claim 12 wherein said at least one key cutting system includes a retention mechanism, and at least one cutting member.

20. (Original) The integrated key duplication machine of claim 19 wherein the retention mechanism and said at least one cutting member further comprising a reflector plate wherein the lighting panel emits light that is reflected off the reflector plate and directed towards said master key.

21. (Original) The integrated key duplication machine of claim 13 wherein said master key is imaged and compared with a plurality of key blanks to aid in determining an

appropriate key blank while utilizing the image to provide key pattern information to be cut into a key blank.

22. (Original) The integrated key duplication machine of claim 21, wherein said key blank identification system and said key cutting system are within a single apparatus.

23. - 29. (Canceled) ~~A method of duplicating keys, comprising:~~

~~identifying a key blank corresponding to a first master key using a key duplication machine, wherein identifying the key blank comprises capturing an image of the first master key, and comparing features of the first master key with data in a database corresponding to known key blanks;~~

~~cutting a key pattern into the identified key blank, the key pattern corresponding to the key pattern of the first master key;~~

~~while the key pattern is being cut into the identified key blank, identifying a key blank corresponding to a second master key, wherein identifying the key blank comprises capturing an image of a second master key, and comparing features of the second master key with data in a database corresponding to known key blanks.~~

~~24. (Original) The method of claim 23 wherein the steps of identifying a key blank and cutting said key pattern are performed on a single key duplication machine.~~

~~25. (Original) The method of claim 23 wherein the steps of identifying a key blank and cutting said key pattern are performed on a plurality of key duplication machines.~~

~~26. (Original) The method of claim 25 wherein the plurality of key duplication machines communicate over a network.~~

~~27. (Original) The method of claim 26 wherein said network includes at least one integrated kiosk.~~

~~28. (Original) The method of claim 27 wherein said network includes at least one personal computer.~~

~~29. (Original) The method of claim 23 further comprising storing information associated with a plurality of key blanks on said database..~~

PTO/SB/06 (09-11)
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U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 15/262,787	Filing Date 09/12/2016	☐ To be Mailed

ENTITY: ☐ LARGE ☒ SMALL ☐ MICRO

APPLICATION AS FILED – PART I

FOR	(Column 1) NUMBER FILED	(Column 2) 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

AMENDMENT **03/02/2017**

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)
Total (37 CFR 1.16(i))	* 22	Minus	** 29	= 0	X $40 =	0
Independent (37 CFR 1.16(h))	* 2	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

AMENDMENT

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) 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.

SLIE
DESHONNE T. MARTINO

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
15/262,787	09/12/2016	Michael A. Bass	16223-00310	1955

33772 7590 06/16/2017

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

EXAMINER
HOWELL, DANIEL W

ART UNIT	PAPER NUMBER
3722	

NOTIFICATION DATE	DELIVERY MODE
06/16/2017	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

Office Action Summary	Application No. 15/262,787	Applicant(s) BASS ET AL.	
	Examiner DANIEL HOWELL	Art Unit 3722	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 *3-2-17*.

☐ 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) *1-22* 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) *1-22* is/are rejected.

8)☐ Claim(s) _____ 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: _____.

1. The present application is being examined under the pre-AIA first to invent provisions.

2. Regarding page 8 of Applicant's arguments of 3-2-17, it is paragraph *[0064]* that discusses patent application *10/633933*, not 10/633966.

3. In the event the determination of the status of the application as subject to AIA 35 U.S.C. 102 and 103 (or as subject to pre-AIA 35 U.S.C. 102 and 103) is incorrect, any correction of the statutory basis for the rejection will not be considered a new ground of rejection if the prior art relied upon, and the rationale supporting the rejection, would be the same under either status.

4. Claims 9 and 20 are rejected under 35 U.S.C. 112(b) or 35 U.S.C. 112 (pre-AIA), second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which the inventor or a joint inventor, or for pre-AIA the applicant regards as the invention. On line 3 of claims 9 and 20, the first "the" needs to be changed to "a," as the lighting panel does not have antecedent basis.

5. The following is a quotation of the appropriate paragraphs of pre-AIA 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

6. Claim(s) 1-8, 10-19, and 21-22 is/are rejected under pre-AIA 35 U.S.C. 102(b) as being anticipated by Campbell et al (6839451). Column 5, lines 28+ through column 9, line 21, discuss an optical key blank identification system. Column 9, line 22, through column 10, line 33, discuss the computer system for operating the identification system. Column 11, line 10, through column 16, line 37, discuss the process of identifying the proper key blank. Lines 38-51 of column 16 disclose that the identification system "may be used in conjunction with a key

cutting machine," including performing the function of determining the key cut codes for the key to be made by the key cutter machine. Note the discussion of transmission of the codes by direct connection or over a network, which permits the interacting and sharing of information. The key blank identification system may "operate individually from the key cutting system" as it performs a different function than the key cutting machine. Additionally, the key identification system could be used to simply identify and store the key blank information, which also constitutes operating individually. Regarding claims 8 and 19, a cutter and a clamp to retain the key blank are inherent within a key cutting machine, as the cutting machine cannot operate without a cutter, and a clamp must hold the key blank against movement when the cutter contacts the key blank. Regarding claims 11 and 22, the combination of the key blank identification system and key cutting machine of column 16, lines 38-51, are considered to be a "single apparatus."

7. Claims 9 and 20 would be allowable if rewritten to overcome the rejection(s) under 35 U.S.C. 112(b) or 35 U.S.C. 112 (pre-AIA), 2nd paragraph, set forth in this Office action and to include all of the limitations of the base claim and any intervening claims.

8. Applicant's arguments filed 3-2-17 have been fully considered but they are not persuasive. The scopes of the independent claims have been changed by the amendment, such that it was necessary to apply new art in the rejection.

9. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). 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 date of this final action.

10. Any inquiry concerning the content of this communication from the examiner should be directed to Daniel Howell, whose telephone number is 571-272-4478. The examiner's office hours are typically about 10 am until 6:30 pm, Monday through Friday. The examiner's supervisor, Sunil K. Singh, may be reached at 571-272-3460.

In order to reduce pendency and avoid potential delays, Group 3720 is encouraging FAXing of responses to Office actions directly into the Group at FAX number to 571-273-8300. This practice may be used for filing papers not requiring a fee. It may also be used for filing papers which require a fee by applicants who authorize charges to a USPTO deposit account. Please identify Examiner Daniel Howell of Art Unit 3722 at the top of your cover sheet.

/DANIEL HOWELL/
Primary Examiner, Art Unit 3722

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	15262787	BASS ET AL.
	Examiner	Art Unit
	DANIEL HOWELL	3722

CPC- SEARCHED		
Symbol	Date	Examiner
B23C 3/35, 355; 2235/12, 24, 32, 41		
Y10T 409/300952, 301008, 301064	11-27-16	DH
search updated	6-10-17	DH

CPC COMBINATION SETS - SEARCHED		
Symbol	Date	Examiner

US CLASSIFICATION SEARCHED			
Class	Subclass	Date	Examiner

SEARCH NOTES		
Search Notes	Date	Examiner

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

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.

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

Application Number	15/262,787	Filing Date	2016-09-12	Docket Number (if applicable)	16223-00310	Art Unit	3722
First Named Inventor	Michael A. Bass			Examiner Name	Daniel W. Howell		

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 Petition for Extension of Time

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

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)	2017-11-16
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.

Electronic Patent Application Fee Transmittal

Application Number:	15262787
Filing Date:	12-Sep-2016
Title of Invention:	KEY DUPLICATION MACHINE
First Named Inventor/Applicant Name:	Michael A. Bass
Filer:	Mark Jason Masterson/Rebecca Shofar
Attorney Docket Number:	16223-00310

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 - 2 months with $0 paid	2252	1	300	300
Miscellaneous:				
RCE- 1st Request	2801	1	600	600
		Total in USD ($)		**900**

Electronic Acknowledgement Receipt

EFS ID:	30969446
Application Number:	15262787
International Application Number:	
Confirmation Number:	1955
Title of Invention:	KEY DUPLICATION MACHINE
First Named Inventor/Applicant Name:	Michael A. Bass
Customer Number:	33772
Filer:	Mark Jason Masterson/Rebecca Shofar
Filer Authorized By:	Mark Jason Masterson
Attorney Docket Number:	16223-00310
Receipt Date:	16-NOV-2017
Filing Date:	12-SEP-2016
Time Stamp:	12:48:06
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	DA
Payment was successfully received in RAM	$900
RAM confirmation Number	111617INTEFSW00015351130265
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		7080578.pdf	299307 876c0fa4d3db60b87ba22b00a1d057f83b9990a1	yes	10
	Multipart Description/PDF files in .zip description				
	Document Description		**Start**	**End**	
	Amendment Submitted/Entered with Filing of CPA/RCE		1	2	
	Claims		3	6	
	Applicant Arguments/Remarks Made in an Amendment		7	10	
Warnings:					
Information:					
2	Request for Continued Examination (RCE)	7080295.pdf	1349894 a8ff52a2d4a20cb6d6e0699323be9e7a6fd8fe00	no	3
Warnings:					
Information:					
3	Fee Worksheet (SB06)	fee-info.pdf	32504 437a662da1cca004a5b0960f5669bafa8abe6a09	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	1681705		

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: Michael A. Bass, et al. Art Unit: 3722

Serial No.: 15/262,787 Examiner: Howell, Daniel W

Filing Date: September 12, 2016 Docket No.: 16223-00310

Title: KEY DUPLICATION MACHINE

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

TRANSMITTAL FOR REQUEST FOR CONTINUED EXAMINATION

Enclosed please find a 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: November 16, 2017

/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:	Michael A. Bass, et al.	Art Unit:	3722
Serial No.:	15/262,787	Examiner:	Howell, Daniel W
Filing Date:	September 12, 2016	Docket No.:	16223-00310

Title: KEY DUPLICATION MACHINE

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

RESPONSE TO FINAL OFFICE ACTION

Applicants acknowledge receipt of the June 16, 2017 Office Action. This response is electronically filed on November 16, 2017, along with a petition for a two month extension as well as a Request for Continued Examination (RCE), and 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

1. (Currently Amended) An integrated key duplication machine, comprising:

an optical key blank identification system to identify keys; and

a key cutting system for cutting keys, wherein the key cutting system includes a retention mechanism panel and at least one cutting member, wherein the retention mechanism panel includes a slot to receive a blade of a key to be retained by the retention mechanism panel and cut by said at least one cutting member;

wherein the optical key blank identification system is configured to operate individually from the key cutting system wherein the optical key blank identification system and the key cutting system may interact and share information.

2. (Original) The integrated key duplication machine of claim 1 wherein the key blank identification system includes an optical imaging device, a database and a logic wherein said optical imaging device captures an image of a master key, said logic identifies features of the master key, and said logic compares said features of the master key with data in a database.

3. (Original) The integrated key duplication machine of claim 2 wherein said data in said database relates to key blanks.

4. (Original) The integrated key duplication machine of claim 2 wherein said data in said database relates to physical dimensions of key blanks.

5. (Original) The integrated key duplication machine of claim 2 wherein said logic aids in determining a proper key blank for the master key.

6. (Original) The integrated key duplication machine of claim 5 wherein said logic aids in selecting the proper key blank.

7. (Original) The integrated key duplication machine of claim 6 wherein said optical imaging device captures an image of the key blank at an imaging position and said logic validates said key blank.

8. (Canceled) ~~The integrated key duplication machine of claim 1 wherein the key cutting system includes a retention mechanism, and at least one cutting member~~.

9. (Original) The integrated key duplication machine of claim 8 wherein the retention mechanism and said at least one cutting member further comprises a reflector plate wherein the lighting panel emits light that is reflected off the reflector plate and directed towards said master key.

10. (Original) The integrated key duplication machine of claim 2 wherein said master key is imaged and compared with a plurality of key blanks to aid in determining an appropriate key blank while utilizing the image to provide key pattern information to be cut into a key blank.

11. (Original) The integrated key duplication machine of claim 10, wherein said key blank identification system and said key cutting system are within a single apparatus.

12. (Currently Amended) A plurality of key duplication systems, comprising:

at least one key blank identification system for identifying key blanks wherein the at least one key blank identification system includes a retention mechanism that includes a slot for receiving a blade of a master key such that an image of the blade of the master key may be captured; and

at least one key cutting system for cutting keys,

wherein the key blank identification system is configured to operate individually from the key cutting system wherein the key blank identification system and the key cutting system may interact and share information.

13. (Original) The integrated key duplication machine of claim 12 wherein the at least one key blank identification system includes an optical imaging device, a database and a logic wherein said optical imaging device captures an image of a master key, said logic identifies features of the master key and compares said features of the master key with data in a database.

14. (Original) The integrated key duplication machine of claim 13 wherein said data in said database relates to key blanks.

15. (Original) The integrated key duplication machine of claim 13 wherein said data in said database relates to physical dimensions of key blanks.

16. (Original) The integrated key duplication machine of claim 13 wherein said logic aids in determining a proper key blank for the master key.

17. (Original) The integrated key duplication machine of claim 16 wherein said logic aids in selecting the proper key blank.

18. (Original) The integrated key duplication machine of claim 17 wherein said optical imaging device captures an image of the key blank at an imaging position and said logic validates said key blank.

19. (Original) The integrated key duplication machine of claim 12 wherein said at least one key cutting system includes a retention mechanism, and at least one cutting member.

20. (Original) The integrated key duplication machine of claim 19 wherein the retention mechanism and said at least one cutting member further comprising a reflector plate wherein the lighting panel emits light that is reflected off the reflector plate and directed towards said master key.

21. (Original) The integrated key duplication machine of claim 13 wherein said master key is imaged and compared with a plurality of key blanks to aid in determining an appropriate key blank while utilizing the image to provide key pattern information to be cut into a key blank.

22. (Original) The integrated key duplication machine of claim 21, wherein said key blank identification system and said key cutting system are within a single apparatus.

23. - 29. (Canceled)

REMARKS

The June 16, 2017 Office Action identifies the following issues:

- Claims 9 and 20 stand rejected under 35 U.S.C. §112(b), or 35 U.S.C. §112(pre-AIA), second paragraph as being indefinite for failing to claim the subject matter regarded as the invention;
- Claims 1-8, 10-19, and 21-22 stand rejected under 35 U.S.C. §102(b) as being anticipated by Campbell et al (6839451).
- Claims 9 and 20 are identified as allowable if rewritten to overcome the rejections set forth and to include all of the limitations of the base claim and any intervening claims.

Claim Rejections – 35 USC 112(b) or second paragraph

Claims 9 and 20 have been rejected as indefinite. Claims 9 and 20 have been amended to clarify the claimed subject matter in accordance with the identified supported written description noted above.

Thus, for the reasons identified above, it is respectfully submitted that this rejection be withdrawn.

Claim Rejections – 35 USC 102

The Office Action rejected claims 1-8, 10-19, and 21-22 as being disclosed by Campbell. **A. Claim 1**

The independent claim 1 has been amended as follows:

Claim 1.An integrated key duplication machine, comprising:
an optical key blank identification system to identify keys; and
a key cutting system for cutting keys, wherein the key cutting system includes a retention mechanism panel and at least one cutting member, wherein the retention mechanism panel includes a slot to receive a blade of a key to be retained by the retention mechanism and cut by said at least one cutting member;
wherein the optical key blank identification system is configured to operate individually from the key cutting system wherein the optical key blank identification system and the key cutting system may interact and share information.

Notably, independent claim 1 has been amended to recite a retention mechanism panel that includes a slot to receive a blade of a key to be retained by the retention mechanism panel and cut by said at least one cutting member.

Support for this amendment exists at least in the specification at paragraphs [0065]-[0066] and Figures 8 and 9 wherein no new matter is added. Claim 8 is now canceled.

Campbell was cited to disclose an optical key blank identification system that may be used in conjunction with a key cutting machine per column 16, lines 38-40. However, Campbell is silent regarding the configuration of key cutting machines and fails to disclose an optical key blank identification system that may be used in conjunction with a key cutting machine that includes a retention mechanism panel that includes a slot for receiving the blade of a key as now claimed.

Thus, Campbell does not disclose each of the features recited by claim 1. Applicants respectfully submit that claim 1 and claims 2-7, and 9-12 dependent thereon are now in condition for allowance.

B. Claim 12

The independent claim 12 has been amended as follows:

Claim 12. A plurality of key duplication systems, comprising:

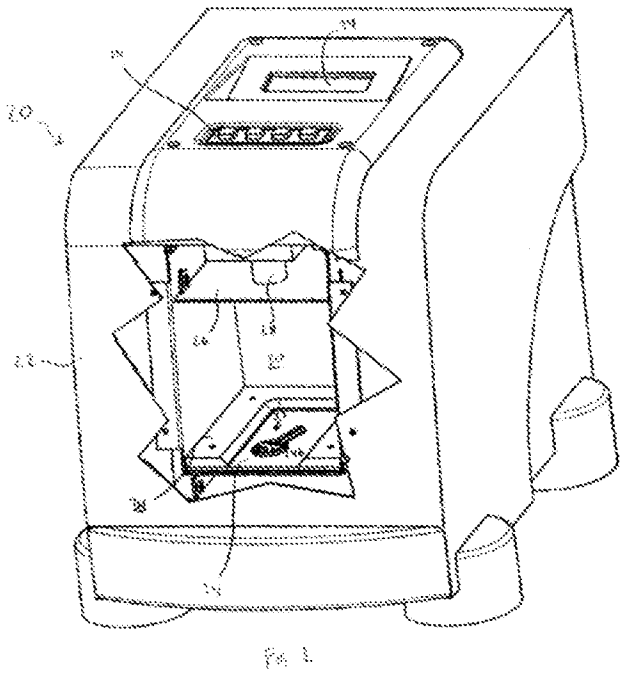
at least one key blank identification system for identifying key blanks <u>wherein the at least one key blank identification system includes a retention mechanism that includes a slot for receiving a blade of a master key such that an image of the blade of the master key may be captured</u>; and

at least one key cutting system for cutting keys,

wherein the key blank identification system is configured to operate individually from the key cutting system wherein the key blank identification system and the key cutting system may interact and share information.

Notably, independent claim 12 has been amended to recite at least one key blank identification system includes a retention mechanism that includes a slot for receiving a blade of a master key such that an image of the blade of the master key may be captured. Support for this amendment exists at least in the specification at paragraph [0055] and Figures 5 and 6 wherein no new matter is added.

Campbell was cited to disclose an optical key blank identification system that may be used in conjunction with a key cutting machine per column 16, lines 38-40. However, Campbell discloses a key identification system 20 having a first luminous surface 24 and a second luminous surface 26 disposed within a housing 22 wherein the housing substantially encloses the first and second luminous surfaces 24 and 26 to provide a light tight environment in which a master key 32 may be examined. See col. 5, lines 28-35 and Figure 1 below:



Campbell requires that the entire key be placed within the housing. Thus, Campbell fails to disclose a system that includes a retention mechanism with a slot to secure a blade of a master key such that an image of the blade of the master key may be captured as now recited by claim 12.

Applicants respectfully submit that independent claim 12 and claims 13-21 dependent thereon are now in condition for allowance.

CONCLUSION

In light of the foregoing, Applicants submit that the application is now in condition for allowance and earnestly solicits a notice of 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: November 16, 2017

/Mark J. Masterson/

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216-348-5400

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
15/262,787	09/12/2016	Michael A. Bass	16223-00310	1955

33772 7590 12/18/2017

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EXAMINER
HOWELL, DANIEL W

ART UNIT	PAPER NUMBER
3722	

NOTIFICATION DATE	DELIVERY MODE
12/18/2017	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

Office Action Summary	Application No. 15/262,787	Applicant(s) BASS ET AL.	
	Examiner DANIEL HOWELL	Art Unit 3722	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 *11-16-17*.

☐ 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) *1-7 and 9-22* 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) *1-7, 9-22* is/are rejected.

8)☐ Claim(s) _____ 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: _____.

1. The present application is being examined under the pre-AIA first to invent provisions.

2. While Yanovsky has been used in the rejection of claim 12, it noted that Willis et al 6064747 could have been used in its place.

3. Claims 9 and 20 are rejected under 35 U.S.C. 112(b) or 35 U.S.C. 112 (pre-AIA), second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which the inventor or a joint inventor, or for pre-AIA the applicant regards as the invention. On line 3 of claims 9 and 20, the first "the" needs to be changed to "a," as the lighting panel does not have antecedent basis. It is noted that the response of 11-16-17 states that these issues have been addressed, but clearly no change was made. Additionally, claim 9 now improperly depends from canceled claim 8.

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, 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 negatived by the manner in which the invention was made.

5. Claim 1-7, 10 and 11 is/are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Campbell et al (6839451) in view of Weiner et al (3442174). In Campbell et al, column 5, lines 28+ through column 9, line 21, discuss an optical key blank identification system. Column 9, line 22, through column 10, line 33, discuss the computer system for operating the identification system. Column 11, line 10, through column 16, line 37, discuss the process of identifying the proper key blank. Lines 38-51 of column 16 disclose that the identification system "may be used in conjunction with a key cutting machine," including performing the function of determining the key cut codes for the key to be made by the key

cutter machine. Note the discussion of transmission of the codes by direct connection or over a network, which permits the interacting and sharing of information. The key blank identification system may "operate individually from the key cutting system" as it performs a different function than the key cutting machine. Additionally, the key identification system could be used to simply identify and store the key blank information, which also constitutes operating individually. Campbell et al does not explicitly disclose a retention system for the key cutting machine. Figures 1-3 of Weiner et al show a retention system having a slot 104' in a panel and a vise 11 adjacent that slot 104' for retention of the key blank 4' adjacent a cutting wheel 20. See also column 3 of Weiner et al. It is considered to have been obvious to have provided the key cutting machine mentioned by Campbell et al with this key retention system as shown by Weiner et al in order to hold the key blank while it is being cut. Regarding claim 11, the combination of the key blank identification system and key cutting machine of column 16, lines 38-51, are considered to be a "single apparatus."

6. Claims 12-19 and 21-22 is/are rejected under pre-AIA 35 U.S.C. 102(b) as being anticipated by Campbell et al (6839451) in view of Yanovsky (6175638). In Campbell et al, column 5, lines 28+ through column 9, line 21, discuss an optical key blank identification system. Column 9, line 22, through column 10, line 33, discuss the computer system for operating the identification system. Column 11, line 10, through column 16, line 37, discuss the process of identifying the proper key blank. Lines 38-51 of column 16 disclose that the identification system "may be used in conjunction with a key cutting machine," including performing the function of determining the key cut codes for the key to be made by the key cutter machine. Note the discussion of transmission of the codes by direct connection or over a

network, which permits the interacting and sharing of information. The key blank identification system may "operate individually from the key cutting system" as it performs a different function than the key cutting machine. Additionally, the key identification system could be used to simply identify and store the key blank information, which also constitutes operating individually. As discussed at column 10, lines 49-55, the master key 32 is placed on surface 24 and a door of housing 22 is shut. There are other ways of presenting a key for identification of its profile. Figures 3-6 of Yanovsky show an analogous image acquisition system 20, 25, 24, 26, a panel 21 having a slot 22, and positioning elements 23a, 23b. It is considered to have been obvious to have provided Campbell et al with the key retention system as shown by Yanovsky as this is a simple substitution of one known element for another in order to obtain a predictable result of holding a key while its profile is being determined. Regarding claim 19, a cutter and a clamp to retain the key blank are inherent within a key cutting machine, as the cutting machine cannot operate without a cutter, and a clamp must hold the key blank against movement when the cutter contacts the key blank. Regarding claim 22, the combination of the key blank identification system and key cutting machine of column 16, lines 38-51, are considered to be a "single apparatus."

7. Claims 9 and 20 would be allowable if rewritten to overcome the rejection(s) under 35 U.S.C. 112(b) or 35 U.S.C. 112 (pre-AIA), 2nd paragraph, set forth in this Office action and to include all of the limitations of the base claim and any intervening claims.

8. Any inquiry concerning the content of this communication from the examiner should be directed to Daniel Howell, whose telephone number is 571-272-4478. The examiner's office hours are typically about 10 am until 6:30 pm, Monday through Friday. The examiner's supervisor, Sunil K. Singh, may be reached at 571-272-3460.

In order to reduce pendency and avoid potential delays, Group 3720 is encouraging FAXing of responses to Office actions directly into the Group at FAX number to 571-273-8300.

This practice may be used for filing papers not requiring a fee. It may also be used for filing papers which require a fee by applicants who authorize charges to a USPTO deposit account. Please identify Examiner Daniel Howell of Art Unit 3722 at the top of your cover sheet.

/DANIEL HOWELL/
Primary Examiner, Art Unit 3722

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	40	(US-20080267514-$ or US-20040024486-$ or US-20070003388-$ or US-20110262240-$ or US-20140377027-$ or US-20160375501-$).did. or (US-4143582-$ or US-4899391-$ or US-8239924-$ or US-6185311-$ or US-8626331-$ or US-6839451-$ or US-6839449-$ or US-6836553-$ or US-6647308-$ or US-6406227-$ or US-5908273-$ or US-5127532-$ or US-5517299-$ or US-7890878-$ or US-6588995-$ or US-6152662-$ or US-6175638-$ or US-6064747-$ or US-5128531-$ or US-5807042-$ or US-6065911-$ or US-6543972-$ or US-6895100-$ or US-6687565-$ or US-8128322-$ or US-7891919-$).did. or (US-9308590-$ or US-8985918-$).did. or (DE-102005027102-$ or WO-9906938-$ or EP-53730-$).did. or (JP-63311109-$ or JP-63311108-$).did. or (FR-2489535-$).did.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2017/12/09 14:46
L2	5	(("8239924") or ("6185311") or ("8626331") or ("8059883") or ("6839451")).PN.	US-PGPUB; USPAT	OR	OFF	2017/12/09 14:50
L3	119	(US-8682468-$ or US-7890878-$ or US-6801829-$ or US-3442174-$).did. or (us-20130331976-$ or US-20090074528-$ or US-20080145163-$ or US-20070224008-$ or US-20070212180-$ or US-20070003388-$ or US-20060051173-$ or US-20060212398-$ or US-20040253067-$ or US-20020022901-$ or US-20010033781-$ or US-20040095380-$ or US-20040024486-$ or US-20020191849-$).did. or (us-8634951-$ or US-7891919-$ or US-7077607-$ or US-6895100-$ or US-6687565-$ or us-6839451-$ or US-6588995-$ or US-6543972-$ or US-6406227-$ or US-6179531-$ or US-6175638-$ or US-6152662-$ or US-6065911-$ or US-5997224-$ or US-5908273-$ or US-5833406-$ or US-5807042-$ or US-5711643-$ or US-5676504-$ or US-5128531-$ or US-4143582-$ or US-7890878-$ or US-7849721-$ or US-7070369-$ or US-6839451-$ or US-6839449-$ or US-6836553-$ or US-6801829-$).did. or (US-6651470-$ or US-6647308-$ or US-6449381-$ or US-6185311-$ or US-6064747-$ or US-5617323-$ or US-5517299-$ or US-5351409-$ or US-5127532-$ or US-4971489-$ or US-4899391-$ or US-4638567-$ or US-4426179-$ or US-7614158-$).did. or us-6647308-$.did. or us-7890878-$.did. or (US-20150050094-$ or US-20140377027-$ or US-20140314508-$ or US-20130294857-$ or US-20120243957-$ or US-20110262240-$ or US-20060008333-	US-PGPUB; USPAT; EPO	OR	ON	2017/12/09 14:50

		$).did. or (US-8644619-$ or US-8634655-$ or US-8408851-$ or US-6839449-$ or US-6647308-$ or US-3442174-$ or US-3358561-$ or US-8979446-$ or US-8985918-$ or US-8128322-$ or US-8992145-$ or US-8532809-$ or US-5133127-$ or US-4012991-$).did. or (US-20140064598-$ or US-20140064597-$ or US-20110301738-$ or US-20110297691-$ or US-20110176881-$ or US-20110164938-$ or US-20100278438-$ or US-20100278437-$ or US-20030144759-$ or US-20020031251-$).did. or (US-9073133-$ or US-8626331-$ or US-8287215-$ or US-4090303-$).did. or (EP-133091-$ or GB-2009007-$ or EP-1339024-$ or GB-2340644-$ or WO-2005080717-$ or EP-1270851-$ or WO-2006102109-$ or WO-2006032354-$ or DE-10031713-$ or WO-2008066857-$ or EP-1468769-$ or WO-2101180-$ or EP-53730-$ or WO-9619309-$ or CH-673612-$ or WO-9523666-$ or WO-9906179-$ or GB-2150475-$ or DE-102009019640-$ or WO-2007093982-$ or EP-779120-$ or EP-1418015-$ or EP-1298574-$ or EP-1191475-$ or DE-19851815-$ or WO-9906938-$).did. or (EP-556590-$ or WO-9207677-$).did. or (wo-2005080717-$).did. or (DE-102005027102-$).did.				
L4	3	("6064747").PN.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	OFF	2017/12/09 16:04
L5	24	B23C3/35.cpc. and @py>"2016"	US-PGPUB; USPAT; FPRS	OR	ON	2017/12/09 16:22
L6	21	B23C2235/12,24,32,41.cpc. and @py>"2016"	US-PGPUB; USPAT; FPRS	OR	ON	2017/12/09 16:22
L7	18	y10T409/300952,301008,301064.cpc. and @py>"2016"	US-PGPUB; USPAT; FPRS	OR	ON	2017/12/09 16:22
L8	28	5 or 6 or 7	US-PGPUB; USPAT; FPRS	OR	ON	2017/12/09 16:23

EAST Search History (Interference)

<This search history is empty>

12/9/2017 4:23:41 PM
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Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	15262787	BASS ET AL.
	Examiner	Art Unit
	DANIEL HOWELL	3722

CPC- SEARCHED		
Symbol	Date	Examiner
B23C 3/35, 355; 2235/12, 24, 32, 41		
Y10T 409/300952, 301008, 301064	11-27-16	DH
search updated	6-10-17	DH
search updated	12-9-17	DH

CPC COMBINATION SETS - SEARCHED		
Symbol	Date	Examiner

US CLASSIFICATION SEARCHED			
Class	Subclass	Date	Examiner

* See search history printout included with this form or the SEARCH NOTES box below to determine the scope of the search.

SEARCH NOTES		
Search Notes	Date	Examiner
see EAST search printout	12-9-17	DH

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:	Michael A. Bass, et al.	Art Unit:	3722
Serial No.:	15/262,787	Examiner:	Howell, Daniel W
Filing Date:	September 12, 2016	Docket No.:	16223-00310

Title: KEY DUPLICATION MACHINE

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

RESPONSE TO FINAL OFFICE ACTION

Applicants acknowledge receipt of the December 18, 2017 Office Action. This response is electronically filed on June 18, 2018, along with a petition and fee for a three month extension. 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

1. (Previously Presented) An integrated key duplication machine, comprising:

an optical key blank identification system to identify keys; and

a key cutting system for cutting keys, wherein the key cutting system includes a retention mechanism panel and at least one cutting member, wherein the retention mechanism panel includes a slot to receive a blade of a key to be retained by the retention mechanism panel and cut by said at least one cutting member;

wherein the optical key blank identification system is configured to operate individually from the key cutting system wherein the optical key blank identification system and the key cutting system may interact and share information.

2. (Original) The integrated key duplication machine of claim 1 wherein the key blank identification system includes an optical imaging device, a database and a logic wherein said optical imaging device captures an image of a master key, said logic identifies features of the master key, and said logic compares said features of the master key with data in a database.

3. (Original) The integrated key duplication machine of claim 2 wherein said data in said database relates to key blanks.

4. (Original) The integrated key duplication machine of claim 2 wherein said data in said database relates to physical dimensions of key blanks.

5. (Original) The integrated key duplication machine of claim 2 wherein said logic aids in determining a proper key blank for the master key.

6. (Original) The integrated key duplication machine of claim 5 wherein said logic aids in selecting the proper key blank.

7. (Original) The integrated key duplication machine of claim 6 wherein said optical imaging device captures an image of the key blank at an imaging position and said logic validates said key blank.

8. (Canceled)

9. (Currently Amended) The integrated key duplication machine of ~~claim 8~~claim 1 wherein the retention mechanism and said at least one cutting member further comprises a reflector plate wherein [[the]]a lighting panel emits light that is reflected off the reflector plate and directed towards said master key.

10. (Original) The integrated key duplication machine of claim 2 wherein said master key is imaged and compared with a plurality of key blanks to aid in determining an appropriate key blank while utilizing the image to provide key pattern information to be cut into a key blank.

11. (Original) The integrated key duplication machine of claim 10, wherein said key blank identification system and said key cutting system are within a single apparatus.

12. (Previously Presented) A plurality of key duplication systems, comprising:

at least one key blank identification system for identifying key blanks wherein the at least one key blank identification system includes a retention mechanism that includes a slot for receiving a blade of a master key such that an image of the blade of the master key may be captured; and

at least one key cutting system for cutting keys,

wherein the key blank identification system is configured to operate individually from the key cutting system wherein the key blank identification system and the key cutting system may interact and share information.

13. (Currently Amended) The ~~integrated key duplication machine~~systems of claim 12 wherein the at least one key blank identification system includes an optical imaging device, a database and a logic wherein said optical imaging device captures an image of a master key, said logic identifies features of the master key and compares said features of the master key with data in a database.

14. (Currently Amended) The ~~integrated key duplication machine~~systems of claim 13 wherein said data in said database relates to key blanks.

15. (Currently Amended) The ~~integrated key duplication machine~~systems of claim 13 wherein said data in said database relates to physical dimensions of key blanks.

16. (Currently Amended) The ~~integrated key duplication machine~~systems of claim 13 wherein said logic aids in determining a proper key blank for the master key.

17. (Currently Amended) The ~~integrated key duplication machine~~systems of claim 16 wherein said logic aids in selecting the proper key blank.

18. (Currently Amended) The ~~integrated key duplication machine~~systems of claim 17 wherein said optical imaging device captures an image of the key blank at an imaging position and said logic validates said key blank.

19. (Currently Amended) The ~~integrated key duplication machine~~systems of claim 12 wherein said at least one key cutting system includes a retention mechanism, and at least one cutting member.

20. (Currently Amended) The ~~integrated key duplication machine~~system of claim 19 wherein the retention mechanism and said at least one cutting member further comprising a reflector plate wherein [[the]]a lighting panel emits light that is reflected off the reflector plate and directed towards said master key.

21. (Currently Amended) The ~~integrated key duplication machine~~systems of claim 13 wherein said master key is imaged and compared with a plurality of key blanks to aid in determining an appropriate key blank while utilizing the image to provide key pattern information to be cut into a key blank.

22. (Currently Amended) The ~~integrated key duplication machine~~systems of claim 21, wherein said key blank identification system and said key cutting system are within a single apparatus.

23. - 29. (Canceled)

30. (New) The integrated key duplication machine of claim 1 wherein said retention mechanism panel is vertically movable.

31. (New) The integrated key duplication machine of claim 1 further comprising a housing wherein said optical key blank identification system is positioned within said housing such that a portion of said key is positioned outside said housing when said blade is retained by said retention mechanism panel.

32. (New) The systems of claim 12 wherein said retention mechanism is vertically movable.

33. (New) The systems of claim 12 further comprising a housing wherein said at least one key cutting system is positioned within said housing such that a portion of said key is positioned outside said housing when said blade is retained by said retention mechanism.

34. (New) An integrated key duplication machine, comprising:

a housing having at least one slot to receive a master key or key blank;

an optical key blank identification system to identify key blanks wherein the optical key blank identification system includes a retention mechanism for receiving a blade of a master key within said housing such that an image of the blade of the master key may be captured; and

a key cutting system for cutting keys, wherein the key cutting system includes a retention mechanism and at least one cutting member within said

housing, wherein the retention mechanism receives a blade of a key blank to be cut by said at least one cutting member;

wherein the optical key blank identification system is configured to operate individually from the key cutting system wherein the optical key blank identification system and the key cutting system may interact and share information.

REMARKS

The December 18, 2017 Office Action identifies the following issues:

- Claims 9 and 20 stand rejected under 35 U.S.C. §112(b), or 35 U.S.C. §112(pre-AIA), second paragraph as being indefinite for failing to claim the subject matter regarded as the invention;
- Claims 1-7, 10 and 11 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Campbell et al (6839451) in view of Weiner (3442174).
- Claims 12-19 and 21-22 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Campbell in view of Yanovsky (6175638).
- Claims 9 and 20 are identified as allowable if rewritten to overcome the rejections set forth and to include all of the limitations of the base claim and any intervening claims.

Claim Rejections – 35 USC 112(b) or second paragraph

Claims 9 and 20 have been rejected as indefinite. Claims 9 and 20 have been amended to clarify the claimed subject matter in accordance with the identified supported written description noted above.

Thus, for the reasons identified above, it is respectfully submitted that this rejection be withdrawn.

Claim Rejections – 35 USC 103

A. Claim 1

The Office Action rejected claims 1-7, 10 and 11 as being objected to over Campbell in view of Weiner.

Applicant respectfully traverses the combination of Campbell and Weiner as the proposed combination would not teach each and every feature recited by claim 1. Particularly, Campbell at column 16, lines 38 – 40 merely states "[t]he present invention contemplates that the disclosed key identification system may be used in

conjunction with a key cutting system where it may store key cut codes in memory 82 or send to the key cutting machine. However, Weiner discloses an old 1960s era integrated key blank dispenser and mechanical tracer cutter. This device would have no capability to receive data in the form disclosed by Campbell and it would be unable to "interact and share information" as recited by claim 1.

Moreover, the Office Action does not articulate a sufficient reason with rationale underpinnings for why anyone would combine the teachings of those references as required by KSR.

Weiner is directed to a key cutting assembly that includes a mechanical tracer machine with "longitudinally extending vises" on the master key (see column 3 line 11 -14) while the Campbell reference is an optical scanner with a loose master key laying horizontally on a transparent surface. The Office Action states "[i]t is considered to have been obvious to have provided the key cutting machine mentioned by Campbell et al with this key retention system as shown by Weiner et al in order to hold the key blank while it is being cut." (Office Action para 5.) As stated in MPEP 2142 quoting the Supreme Court in KSR: "rejections on obviousness cannot be sustained with mere conclusory statements; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness." Since there is no such explanation in the Office Action, the Examiner has not established a *prima facie* case of obviousness under KSR and the rejection cannot stand.

For at least these reasons, Campbell in view of Weiner does not teach each of the features recited by claim 1. Applicants respectfully submit that claim 1 and claims 2-7, and 9-12 dependent thereon are now in condition for allowance.

B. Claim 12

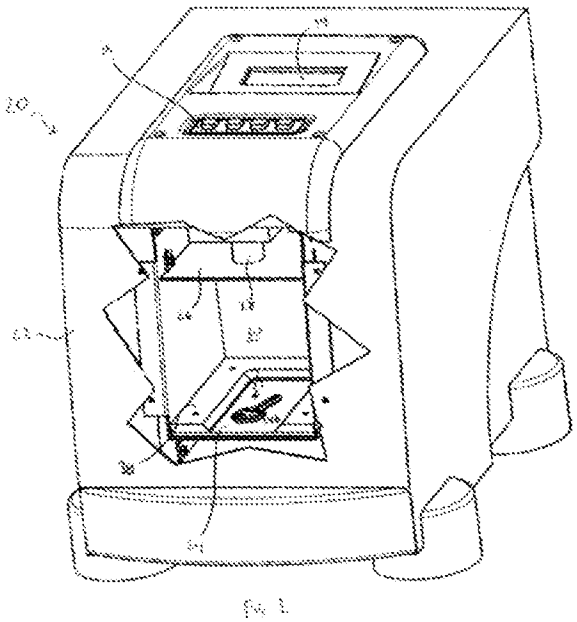
Claims 12-19 and 21-22 stand rejected as being unpatentable over Campbell in view of Yanovsky. Notably, claims 13-22 have been amended to correct antecedent basis issues.

Applicant respectfully traverses the combination of Campbell and Yanovsky to arrive at the recited features of claim 12. This is in part, because the combination of Campbell to Yanovsky would cause the resulting system to fail to work in accordance with its intended purpose.

"If references taken in combination would produce a 'seemingly inoperative device,' we have held that such references teach away from the combination and thus cannot serve as predicates for a prima facie case of obviousness." *McGinley v. Franklin Sports, Inc.*, 262 F.3d 1339, 1354 (Fed. Cir. 2001) (quoting *In re Sponnoble*, 405 F.2d 578, 587 (CCPA 1969)). "[A] reference teaches away from a combination when using it in that combination would produce an inoperative result." *In re Icon Health and Fitness, Inc.*, 496 F.3d 1374, 1382 (Fed. Cir. 2007).

Campbell was cited to disclose an optical key blank identification system that may be used in conjunction with a key cutting machine per column 16, lines 38-40. However, Campbell discloses a key identification system 20 having a first luminous surface 24 and a second luminous surface 26 disposed within a housing 22 wherein

the housing substantially encloses the first and second luminous surfaces 24 and 26 to provide a light tight environment in which a master key 32 may be examined. See col. 5, lines 28-35 and Figure 1 below:



Campbell requires that the entire key be placed within the housing to properly identify the key blank.

Yavonsky is cited for disclosing a key identification system that includes a key retention system. The office action reasons that the positioning elements 23a, 23b are a simple substitution of one known element for another in order to obtain a predictable result of holding a key while its profile is being determined. Figure 6 of Yavonksy is provided below:

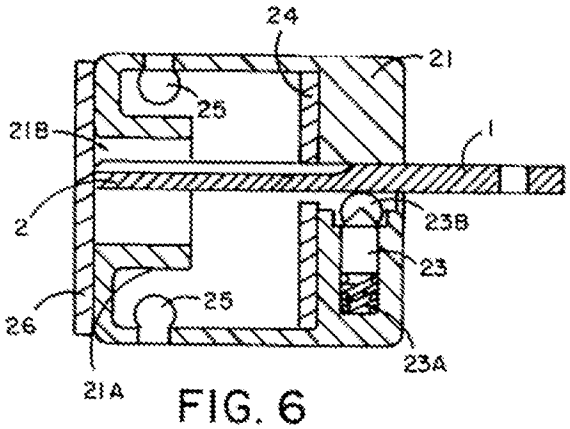


FIG. 6

(SECTIONAL CUT ALONG LINE AA WITH KEY INSERTED)

However, the proposed combination would alter the function of Campbell and, to that extent, Yanovsky teaches away from the claimed invention. The Office Action points to the generic description of a key identification system of Campbell then attempts to combine Yanovsky to provide the "retention mechanism" feature that is admittedly lacking in Campbell. However, Yanovsky's panel 21, slot 22, and positioning elements 23a, 23b would not be able to be integrated or combined with the Campbell imaging arrangement in any way without causing interruption of the receiver 28 (which is described as a high resolution digital camera - See Col. 6, Lines. 28-35). Further, Campbell's design is predicated on the luminous surfaces 24, 26 positioned within the housing 22 to "prevent unwanted light from reflecting off any internal components of the key identification system. Any unwanted light that interferes with the key identification process could reduce the accuracy of the identification process." See Col. 5, lines 30-40.

Introducing Yanovsky's panel 21, slot 22, and positioning elements 23a, 23b to any portion of the housing of Campbell would render Cambell useless since the

desired amount of uniform light would not be available, any image would be interrupted, and the various elements of Yanovsky would otherwise interfere with capturing an image of the key as desired by Campbell. The Campbell imaging arrangement would be rendered useless since a slot held key with positioning elements 23a, 23b would not allow the particular features of that key to be viewed and analyzed by Campbell's overhead camera. As such, the proposed combination would cause Campbell's assembly to fail to work in accordance with its intended purpose.

Thus, the proposed combination does not establish a *prima facie* case of obviousness. Applicants respectfully submit that claim 12 and claims 13-22 dependent thereon are now in condition for allowance.

New Claims

Claims 30-34 are newly added. Claims 30-33 ultimately depend from independent claims 1 and 12 and are in condition for allowance for at least the reasons identified above. Claim 34 is a newly added independent claim. It is directed to a system that is not disclosed by the prior art of record for at least the reasons identified herein.

CONCLUSION

In light of the foregoing, Applicants submit that the application is now in condition for allowance and earnestly solicits a notice of 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 18, 2018

/Mark J. Masterson/

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216-348-5400

Electronic Patent Application Fee Transmittal

Application Number:	15262787
Filing Date:	12-Sep-2016
Title of Invention:	KEY DUPLICATION MACHINE
First Named Inventor/Applicant Name:	Michael A. Bass
Filer:	Mark Jason Masterson/Danielle Mueller
Attorney Docket Number:	16223-00310

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 $0 paid	2253	1	700	700
Miscellaneous:				
			Total in USD ($)	**700**

Electronic Acknowledgement Receipt

EFS ID:	32922195
Application Number:	15262787
International Application Number:	
Confirmation Number:	1955
Title of Invention:	KEY DUPLICATION MACHINE
First Named Inventor/Applicant Name:	Michael A. Bass
Customer Number:	33772
Filer:	Mark Jason Masterson/Danielle Mueller
Filer Authorized By:	Mark Jason Masterson
Attorney Docket Number:	16223-00310
Receipt Date:	18-JUN-2018
Filing Date:	12-SEP-2016
Time Stamp:	12:58:49
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	DA
Payment was successfully received in RAM	$700
RAM confirmation Number	061818INTEFSW00010982130265
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		7491321.pdf	441299 12dc37a1c3a1804ad31f5bd727ea51ea4e21b8c5	yes	14
	Multipart Description/PDF files in .zip description				
	Document Description		**Start**	**End**	
	Amendment/Req. Reconsideration-After Non-Final Reject		1	1	
	Claims		2	7	
	Applicant Arguments/Remarks Made in an Amendment		8	14	
Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	30520 4ecb4b9a1b83d5bb02bd03146e09bac20f10a4c0	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	471819		

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.

PTO/SB/06 (09-11)
Approved for use through 1/31/2014. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 15/262,787	Filing Date 09/12/2016	☐ To be Mailed

ENTITY: ☐ LARGE ☒ SMALL ☐ MICRO

APPLICATION AS FILED – PART I

FOR	(Column 1) NUMBER FILED	(Column 2) 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

AMENDMENT

06/18/2018	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)
Total (37 CFR 1.16(i))	* 26	Minus	** 29	= 0	X $50 =	0
Independent (37 CFR 1.16(h))	* 3	Minus	***3	= 0	X $230 =	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

AMENDMENT

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) 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
ANGELONA JONES

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.**
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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
15/262,787	09/12/2016	Michael A. Bass	16223-00310	1955

33772 7590 10/18/2018

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

EXAMINER
HOWELL, DANIEL W

ART UNIT	PAPER NUMBER
3722	

NOTIFICATION DATE	DELIVERY MODE
10/18/2018	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

Office Action Summary	Application No. 15/262,787	Applicant(s) BASS ET AL.	
	Examiner DANIEL HOWELL	Art Unit 3722	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 *6-18-18*.

☐ 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) *1-7,9-22 and 30-34* 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) *1-7,10-19,21,22,32 and 34* is/are rejected.

8)☒ Claim(s) *9, 20, 30-31, 33* 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: _____.

1. The present application is being examined under the pre-AIA first to invent provisions.

2. In the event the determination of the status of the application as subject to AIA 35 U.S.C. 102 and 103 (or as subject to pre-AIA 35 U.S.C. 102 and 103) is incorrect, any correction of the statutory basis for the rejection will not be considered a new ground of rejection if the prior art relied upon, and the rationale supporting the rejection, would be the same under either status.

3. 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, 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 negatived by the manner in which the invention was made.

4. Claims 1-7, 10, and 11 is/are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Campbell et al (6839451) in view of Weiner et al (3442174). In Campbell et al, column 5, lines 28+ through column 9, line 21, discuss an optical key blank identification system. Column 9, line 22, through column 10, line 33, discuss the computer system for operating the identification system. Column 11, line 10, through column 16, line 37, discuss the process of identifying the proper key blank. Lines 38-51 of column 16 disclose that the identification system "may be used in conjunction with a key cutting machine," including performing the function of determining the key cut codes for the key to be made by the key cutter machine. Note the discussion of transmission of the codes by direct connection or over a network, which permits the interacting and sharing of information. The key blank identification system may "operate individually from the key cutting system" as it performs a different function than the key cutting machine. Additionally, the key identification system could be used to simply identify and store the key blank information, which also constitutes operating

individually. Campbell et al does not explicitly disclose a retention system for the key cutting machine. Figures 1-3 of Weiner et al show a retention system having a slot 104' in a panel and a vise 11 adjacent that slot 104' for retention of the key blank 4' adjacent a cutting wheel 20. See also column 3 of Weiner et al. It is considered to have been obvious to have provided the key cutting machine mentioned by Campbell et al with this key retention system as shown by Weiner et al in order to hold the key blank while it is being cut. Regarding claim 11, the combination of the key blank identification system and key cutting machine of column 16, lines 38-51, are considered to be a "single apparatus."

5. Claims 12-19, 21-22, and 32 is/are rejected under pre-AIA 35 U.S.C. 102(b) as being anticipated by Campbell et al (6839451) in view of Yanovsky (6175638). In Campbell et al, column 5, lines 28+ through column 9, line 21, discuss an optical key blank identification system. Column 9, line 22, through column 10, line 33, discuss the computer system for operating the identification system. Column 11, line 10, through column 16, line 37, discuss the process of identifying the proper key blank. Lines 38-51 of column 16 disclose that the identification system "may be used in conjunction with a key cutting machine," including performing the function of determining the key cut codes for the key to be made by the key cutter machine. Note the discussion of transmission of the codes by direct connection or over a network, which permits the interacting and sharing of information. The key blank identification system may "operate individually from the key cutting system" as it performs a different function than the key cutting machine. Additionally, the key identification system could be used to simply identify and store the key blank information, which also constitutes operating individually. As discussed at column 10, lines 49-55, the master key 32 is placed on surface 24

and a door of housing 22 is shut. There are other ways of presenting a key for identification of its profile. Figures 3-6 of Yanovsky show an analogous image acquisition system 20, 25, 24, 26, a panel 21 having a slot 22, and positioning elements 23a, 23b. Elements 23a, 23b, are vertically movable against or with the bias of a spring. It is considered to have been obvious to have provided Campbell et al with the key retention system as shown by Yanovsky as this is a simple substitution of one known element for another in order to obtain a predictable result of holding a key while its profile is being determined. Regarding claim 19, a cutter and a clamp to retain the key blank are inherent within a key cutting machine, as the cutting machine cannot operate without a cutter, and a clamp must hold the key blank against movement when the cutter contacts the key blank. Regarding claim 22, the combination of the key blank identification system and key cutting machine of column 16, lines 38-51, are considered to be a "single apparatus."

1. The following is a quotation of the first paragraph of 35 U.S.C. 112(a):

> (a) IN GENERAL.—The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same, and shall set forth the best mode contemplated by the inventor or joint inventor of carrying out the invention.

The following is a quotation of the first paragraph of pre-AIA 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same, and shall set forth the best mode contemplated by the inventor of carrying out his invention.

2. Claim 34 is rejected under 35 U.S.C. 112(a) or 35 U.S.C. 112 (pre-AIA), first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor or a joint inventor, or for pre-AIA the inventor(s), at the time the application was filed, had possession of the claimed invention. New claim 34 states

that the optical key blank identification system includes a retention mechanism. Claim 34 then sets forth a key cutting system which also includes a retention mechanism. Thus, claim 34 is setting forth two retention mechanisms, but the invention as originally disclosed has only one retention mechanism which is used for both the optical key blank identification system. It is incorrect for claim 34 to set forth two retention mechanisms, as the application as originally filed sets forth only one retention mechanism.

3. Claim 34 is rejected under 35 U.S.C. 112(b) or 35 U.S.C. 112 (pre-AIA), second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which the inventor or a joint inventor, or for pre-AIA the applicant regards as the invention. Claim 34 sets forth one retention mechanism for the identification system and a second retention mechanism for the key cutting system, but only one retention mechanism appears to have been disclosed by the specification.

4. Claims 9, 20, 30, 31, and 33 would be allowable if rewritten to overcome the rejection(s) under 35 U.S.C. 112(b) or 35 U.S.C. 112 (pre-AIA), 2nd paragraph, set forth in this Office action and to include all of the limitations of the base claim and any intervening claims.

5. Applicant's arguments filed 6-18-18 have been fully considered but they are not persuasive. Regarding the rejection of claim 1, Applicant has argued that Weiner is a 1960s vintage machine that would have no capability to receive data from Campbell. It is noted that Campbell does disclose the concept of the identification system and key cutting system interacting and sharing information. Weiner et al has solely been relied upon for its key retention system. In the last full paragraph of page 9, Applicant appears to be arguing that the retention system of Weiner can not be applied to the "optical scanner with a loose master key

laying horizontally on a transparent surface." This is not remotely what the rejection states. The rejection clearly points out that Campbell et al "does not explicitly disclose a retention system for the key cutting machine." This is referring to the structure set forth in lines 3-6 of claim 1, specifically the limitation, "the key cutting system includes *a retention system panel* and at least one cutting member, the retention mechanism panel *includes a slot to receive a blade of a key* to be retained by the retention mechanism panel and cut by said at least one cutting member." As pointed out in the rejection, Weiner shows a slot 104' in a panel and a vise 11 adjacent that slot 104' for retention of a key blank 4' adjacent a cutting wheel 20. Nothing in claim 1 sets forth any kind of clamp for the optical key blank identification system, and the rejection certainly doesn't say to provide the transparent surface of Campbell with any such clamp as shown by Weiner. Regarding claim 12, Applicant has argued that attempting to modify Campbell with Yanovsky would cause interruption of the receiver of the receiver/camera 28, and that Campbell's design is such that unwanted light would interfere with the identification process, and that the positioning elements would not allow the features of the key to be viewed. As seen from figure 6 of Yanovsky, the panel 21, slot 22, and positioning elements 23a, 23b, are all located at the head of the key, such that they would not interfere with the operation of the camera/receiver 28 of Campbell. Additionally, there's no reason to image the head of the key held by the elements 23a, 23b, as the head is where an operator would hold the key. The head of the key doesn't really include any readable information to be imaged. Applicant has referred to lines 30-40 of column 5 of Campbell to argue that the structure of Yanovsky would interfere with Campbell's desire for unwanted light. A full reading of lines 30-40 of column 5 of Campbell states that the luminous surfaces 24, 26, are enclosed by housing 22 to prevent any unwanted

light from reflecting off any internal components of the system. In other words, the housing 22 is what stops the "unwanted light." The structure of Yanovsky is not going to be the source of any unwanted light, nor will it prevent the desired amount of uniform light.

6. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). 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 date of this final action.

7. Any inquiry concerning the content of this communication from the examiner should be directed to Daniel Howell, whose telephone number is 571-272-4478. The examiner's office hours are typically about 10 am until 6:30 pm, Monday through Friday. The examiner's supervisor, Sunil K. Singh, may be reached at 571-272-3460.

In order to reduce pendency and avoid potential delays, Group 3720 is encouraging FAXing of responses to Office actions directly into the Group at FAX number to 571-273-8300. This practice may be used for filing papers not requiring a fee. It may also be used for filing papers which require a fee by applicants who authorize charges to a USPTO deposit account. Please identify Examiner Daniel Howell of Art Unit 3722 at the top of your cover sheet.

/DANIEL HOWELL/
Primary Examiner, Art Unit 3722

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	5	("6064747").PN.	US-PGPUB; USPAT; FPRS; JPO; DERWENT	OR	OFF	2018/10/12 15:27
L2	16	y10T409/300952,301008,301064.cpc. and @py>"2017"	US-PGPUB; USPAT; FPRS	OR	ON	2018/10/12 15:31
L3	26	B23C2235/12,24,32,41.cpc. and @py>"2017"	US-PGPUB; USPAT; FPRS	OR	ON	2018/10/12 15:31
L4	26	B23C3/35.cpc. and @py>"2017"	US-PGPUB; USPAT; FPRS	OR	ON	2018/10/12 15:31
L5	35	2 or 3 or 4	US-PGPUB; USPAT; FPRS	OR	ON	2018/10/12 15:32

EAST Search History (Interference)

< This search history is empty>

10/ 12/ 2018 3:34:10 PM
C:\ Users\ dhowell\ Documents\ EAST\ Workspaces\ 15262787.wsp

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	15262787	BASS ET AL.
	Examiner	Art Unit
	DANIEL HOWELL	3722

CPC- SEARCHED		
Symbol	Date	Examiner
B23C 3/35, 355; 2235/12, 24, 32, 41		
Y10T 409/300952, 301008, 301064	11-27-16	DH
search updated	6-10-17	DH
search updated	12-9-17	DH
search updated	10-12-18	DH

CPC COMBINATION SETS - SEARCHED		
Symbol	Date	Examiner

US CLASSIFICATION SEARCHED			
Class	Subclass	Date	Examiner

* See search history printout included with this form or the SEARCH NOTES box below to determine the scope of the search.

SEARCH NOTES		
Search Notes	Date	Examiner
see EAST search printout	12-9-17	DH
see EAST search printout	10-12-18	DH

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

Doc code: RCEX
Doc description: Request for Continued Examination (RCE)

PTO/SB/30EFS (02-18)
Approved for use through 11/30/2020. 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	15262787	Filing Date	2016-09-12	Docket Number (if applicable)	16223-00310	Art Unit	3722
First Named Inventor	Michael A. Bass			Examiner Name	Daniel W. Howell		

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 _____

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

PTO/SB/30EFS (02-18)
Approved for use through 11/30/2020. 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)	2019-04-18
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.

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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:	15262787
Filing Date:	12-Sep-2016
Title of Invention:	KEY DUPLICATION MACHINE
First Named Inventor/Applicant Name:	Michael A. Bass
Filer:	Mark Jason Masterson/danielle mueller
Attorney Docket Number:	16223-00310

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 $0 paid	2253	1	700	700
Miscellaneous:				
RCE- 2ND AND SUBSEQUENT REQUEST	2820	1	950	950
		Total in USD ($)		**1650**

Electronic Acknowledgement Receipt

EFS ID:	35764624
Application Number:	15262787
International Application Number:	
Confirmation Number:	1955
Title of Invention:	KEY DUPLICATION MACHINE
First Named Inventor/Applicant Name:	Michael A. Bass
Customer Number:	33772
Filer:	Mark Jason Masterson/danielle mueller
Filer Authorized By:	Mark Jason Masterson
Attorney Docket Number:	16223-00310
Receipt Date:	18-APR-2019
Filing Date:	12-SEP-2016
Time Stamp:	13:20:48
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	$1650
RAM confirmation Number	041819INTEFSW13215300
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		8043899.pdf	379628 646886751cf5cd7069dd8288901eb28107a141a0	yes	14
	Multipart Description/PDF files in .zip description				
	Document Description		**Start**	**End**	
	Amendment Submitted/Entered with Filing of CPA/RCE		1	1	
	Claims		2	7	
	Applicant Arguments/Remarks Made in an Amendment		8	14	
Warnings:					
Information:					
2	Request for Continued Examination (RCE)	8043525.pdf	1349924 dbf2f0e4c02e60b73dd8aaa439f52445bcec1310	no	3
Warnings:					
Information:					
3	Fee Worksheet (SB06)	fee-info.pdf	32462 e27c1e9d81c462196c86ef6f9d4b84a6f4b843e6	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	1762014		

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: Michael A. Bass, et al.	Art Unit: 3722
Serial No.: 15/262,787	Examiner: Howell, Daniel W
Filing Date: September 12, 2016	Docket No.: 16223-00310

Title: KEY DUPLICATION MACHINE

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

RESPONSE TO FINAL OFFICE ACTION

Applicants acknowledge receipt of the October 18, 2018 Final Office Action. This response is electronically filed on April 18, 2019, along with a petition and fee for a three month extension and a Request for Continued Examination. 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

1. (Currently Amended) An integrated key duplication machine, comprising:

an optical key blank identification system to identify keys including a housing and an imaging device wherein said imaging device is positioned within said housing such that a portion of said key is positioned outside said housing when a blade of said key is positioned within an imaging zone of said housing; and

a key cutting system for cutting keys, wherein the key cutting system includes a retention mechanism panel and at least one cutting member, wherein the retention mechanism panel includes a slot to receive a blade of a key to be retained by the retention mechanism panel and cut by said at least one cutting member;

wherein the optical key blank identification system is configured to operate individually from the key cutting system wherein the optical key blank identification system and the key cutting system may interact and share information.

2. (Currently Amended) The integrated key duplication machine of claim 1 wherein the key blank identification system includes an optical imaging device, a database and a logic wherein said optical imaging device captures an image of a master key, said logic identifies features of the master key, and said logic compares said features of the master key with data in [[a]]said database.

3. (Original) The integrated key duplication machine of claim 2 wherein said data in said database relates to key blanks.

4. (Original) The integrated key duplication machine of claim 2 wherein said data in said database relates to physical dimensions of key blanks.

5. (Original) The integrated key duplication machine of claim 2 wherein said logic aids in determining a proper key blank for the master key.

6. (Original) The integrated key duplication machine of claim 5 wherein said logic aids in selecting the proper key blank.

7. (Original) The integrated key duplication machine of claim 6 wherein said optical imaging device captures an image of the key blank at an imaging position and said logic validates said key blank.

8. (Canceled)

9. (Previously Presented) The integrated key duplication machine of claim 1 wherein the retention mechanism and said at least one cutting member further comprises a reflector plate wherein a lighting panel emits light that is reflected off the reflector plate and directed towards said master key.

10. (Original) The integrated key duplication machine of claim 2 wherein said master key is imaged and compared with a plurality of key blanks to aid in determining an appropriate key blank while utilizing the image to provide key pattern information to be cut into a key blank.

11. (Original) The integrated key duplication machine of claim 10, wherein said key blank identification system and said key cutting system are within a single apparatus.

12. (Currently Amended) A plurality of key duplication systems, comprising:

at least one key blank identification system for identifying key blanks wherein the at least one key blank identification system includes a retention mechanism that includes a slot for receiving a blade of a master key such that an image of the blade of the master key may be captured; [[and]]

at least one key cutting system for cutting keys; and

a housing wherein said at least one key cutting system is positioned within said housing such that a portion of a key blank is positioned outside said housing when a blade of said key blank is to be cut by the cutting system;

wherein the key blank identification system is configured to operate individually from the key cutting system wherein the key blank identification system and the key cutting system may interact and share information.

13. (Currently Amended) The systems of claim 12 wherein the at least one key blank identification system includes an optical imaging device, a database and a logic wherein said optical imaging device captures an image of a master key, said logic identifies features of the master key and compares said features of the master key with data in [[a]]said database.

14. (Previously Presented) The systems of claim 13 wherein said data in said database relates to key blanks.

15. (Previously Presented) The systems of claim 13 wherein said data in said database relates to physical dimensions of key blanks.

16. (Previously Presented) The systems of claim 13 wherein said logic aids in determining a proper key blank for the master key.

17. (Previously Presented) The systems of claim 16 wherein said logic aids in selecting the proper key blank.

18. (Previously Presented) The systems of claim 17 wherein said optical imaging device captures an image of the key blank at an imaging position and said logic validates said key blank.

19. (Previously Presented) The systems of claim 12 wherein said at least one key cutting system includes a retention mechanism, and at least one cutting member.

20. (Previously Presented) The system of claim 19 wherein the retention mechanism and said at least one cutting member further comprising a reflector plate wherein a lighting panel emits light that is reflected off the reflector plate and directed towards said master key.

21. (Previously Presented) The systems of claim 13 wherein said master key is imaged and compared with a plurality of key blanks to aid in determining an

appropriate key blank while utilizing the image to provide key pattern information to be cut into a key blank.

22. (Previously Presented) The systems of claim 21, wherein said key blank identification system and said key cutting system are within a single apparatus.

23. - 29. (Canceled)

30. (Previously Presented) The integrated key duplication machine of claim 1 wherein said retention mechanism panel is vertically movable.

31. (Canceled).

32. (Previously Presented) The systems of claim 12 wherein said retention mechanism is vertically movable.

33. (Canceled).

34. (Canceled).

35.(New) A key duplication system, comprising:

an optical key blank identification system to identify key blanks wherein the optical key blank identification system includes a housing having at least one slot to receive a master key or key blank; and

a key cutting system for cutting keys, wherein the key cutting system includes a retention mechanism panel and at least one cutting member, wherein the retention mechanism panel is positioned within a housing and includes a slot to

receive a blade of a key to be retained by the retention mechanism panel and cut by said at least one cutting member wherein a portion of said key is positioned outside said housing when said blade is retained by said retention mechanism panel;

wherein the optical key blank identification system is configured to operate individually from the key cutting system wherein the optical key blank identification system and the key cutting system may interact and share information.

REMARKS

The October 18, 2018 Office Action identifies the following issues:

- Claims 1-7, 10 and 11 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Campbell et al (6839451) in view of Weiner (3442174).
- Claims 12-19, 21-22, and 32 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Campbell in view of Yanovsky (6175638).
- Claim 34 stands rejected under 35 U.S.C. §112(a), or 35 U.S.C. §112(pre-AIA), first paragraph as failing to comply with the written description requirement;
- Claim 34 stands rejected under 35 U.S.C. §112(b), or 35 U.S.C. §112(pre-AIA), second paragraph being indefinite for failing to claim the subject matter regarded as the invention;
- Claims 9, 20, 30-31, and 33 are identified as allowable if rewritten to overcome the rejections set forth and to include all of the limitations of the base claim and any intervening claims.

Claim Rejections – 35 USC 103

A. Claim 1

The Office Action rejected claims 1-7, 10 and 11 as being objected to over Campbell in view of Weiner. Applicant has amended claim 1 to substantially recite most of the subject matter recited by claim 31. Notably, claim 31 was identified to include allowable subject matter and is now canceled.

Claim 1 now recites:

An integrated key duplication machine, comprising:

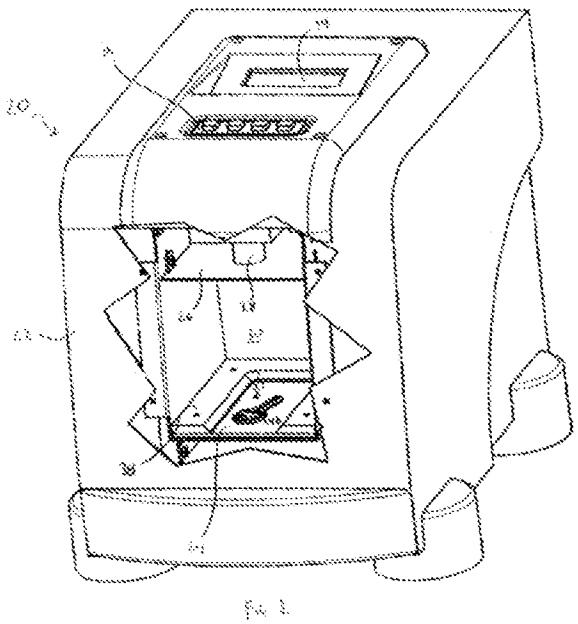
an optical key blank identification system to identify keys including a housing and an imaging device wherein said imaging device is positioned within said housing such that a portion of said key is positioned outside said housing when a blade of said key is positioned within an imaging zone of said housing; and

a key cutting system for cutting keys, wherein the key cutting system includes a retention mechanism panel and at least one cutting member, wherein the retention mechanism panel includes a slot to receive a blade of a key to be retained by the retention mechanism panel and cut by said at least one cutting member;

wherein the optical key blank identification system is configured to operate individually from the key cutting system wherein the optical key blank identification system and the key cutting system may interact and share information.

Applicant respectfully submits that the combination of Campbell and Weiner does not teach each and every feature recited by claim 1. Particularly, Campbell and Weiner to teach the combination of features as recited by claim 1 and are silent regarding "an optical key blank identification system to identify keys including a housing and an imaging device wherein said imaging device is positioned within said housing such that a portion of said key is positioned outside said housing when a blade of said key is positioned within an imaging zone of said housing" as recited by claim 1.

Notably, Campbell was cited to disclose an optical key blank identification system that may be used in conjunction with a key cutting machine per column 16, lines 38-40. However, Campbell discloses a key identification system 20 having a first luminous surface 24 and a second luminous surface 26 disposed within a housing 22 wherein the housing substantially encloses the first and second luminous surfaces 24 and 26 to provide a light tight environment in which a master key 32 may be examined. See col. 5, lines 28-35 and Figure 1 below:



Campbell requires that the entire key be placed within the housing to properly identify the key blank.

Additionally, the office action cites to Weiner for disclosing a retention system having a slot in a panel and a vise for retaining a key blank adjacent a cutting wheel. Weiner is silent regarding the newly recited subject matter and fails to overcome the deficiencies of Campbell discussed above.

As such, the combination of Campbell to Weiner fails to disclose each and every feature recited by claim 1. For at least these reasons, Applicant respectfully submits that claim 1 and claims 2-7, 9-11, and 30 dependent thereon are now in condition for allowance.

B. Claim 12

Claims 12-19, and 21-22 stand rejected as being unpatentable over Campbell in view of Yanovsky. Applicant has amended claim 12 to substantially recite most of

the subject matter recited by claim 33. Notably, claim 33 was identified to include allowable subject matter and is now canceled.

Claim 12 now recites:

A plurality of key duplication systems, comprising:

at least one key blank identification system for identifying key blanks wherein the at least one key blank identification system includes a retention mechanism that includes a slot for receiving a blade of a master key such that an image of the blade of the master key may be captured; [[and]]

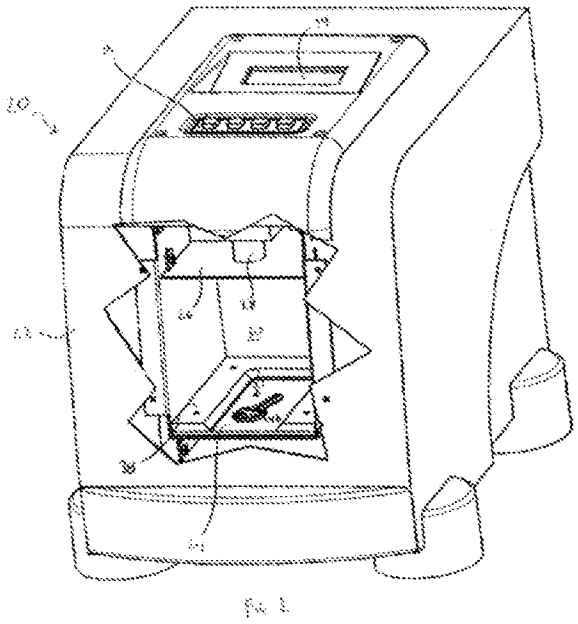
at least one key cutting system for cutting keys; and

a housing wherein said at least one key cutting system is positioned within said housing such that a portion of a key blank is positioned outside said housing when a blade of said key blank is to be cut by the cutting system;

wherein the key blank identification system is configured to operate individually from the key cutting system wherein the key blank identification system and the key cutting system may interact and share information.

Applicant respectfully suggests that the combination of Campbell and Yanovsky fails to teach the recited features of claim 12.

Campbell was cited to disclose an optical key blank identification system that may be used in conjunction with a key cutting machine per column 16, lines 38-40. However, Campbell discloses a key identification system 20 having a first luminous surface 24 and a second luminous surface 26 disposed within a housing 22 wherein the housing substantially encloses the first and second luminous surfaces 24 and 26 to provide a light tight environment in which a master key 32 may be examined. See col. 5, lines 28-35 and Figure 1 below:



Campbell requires that the entire key be placed within the housing to properly identify the key blank.

Yavonsky is cited for disclosing a key identification system that includes a key retention system. The office action reasons that the positioning elements 23a, 23b are a simple substitution of one known element for another in order to obtain a predictable result of holding a key while its profile is being determined. Figure 6 of Yavonksy is provided below:

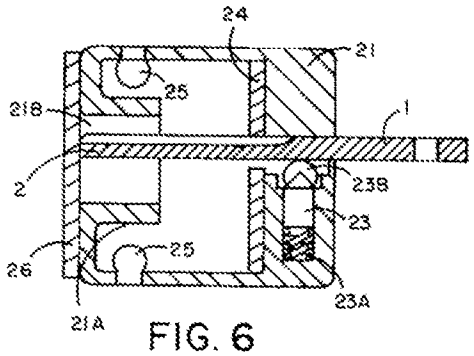


FIG. 6
(SECTIONAL CUT ALONG LINE AA WITH KEY INSERTED)

However, the proposed combination fails to disclose each and every feature as recited by claim 12. More particularly, Applicant respectfully submits that the combination of Campbell and Yavonsky are silent regarding "at least one key cutting system for cutting keys; and a housing wherein said at least one key cutting system is positioned within said housing such that a portion of a key blank is positioned outside said housing when a blade of said key blank is to be cut by the cutting system" as recited by claim 12.

As such, the combination of Campbell to Yavonsky fail to disclose each and every feature recited by claim 12. For at least these reasons, Applicant respectfully submits that claim 12 and claims 13-22 and 32 dependent thereon are now in condition for allowance.

Claim 34

Claim 34 was rejected under 35 USC 112 for various reasons. Claim 34 has now been canceled.

New Claim

Claim 35 is a newly added independent claim. It is directed to a system that is not disclosed by the prior art of record for at least the reasons identified herein.

CONCLUSION

In light of the foregoing, Applicants submit that the application is now in condition for allowance and earnestly solicits a notice of 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: April 18, 2019

/Mark J. Masterson/

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216-348-5400

PTO/SB/06 (09-11)
Approved for use through 1/31/2014. OMB 0651-0032
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 displays a valid OMB control number.

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 15/262,787	Filing Date 09/12/2016	☐ To be Mailed

ENTITY: ☐ LARGE ☑ SMALL ☐ MICRO

APPLICATION AS FILED - PART I

FOR	(Column 1) NUMBER FILED	(Column 2) 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 $40 =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*		x $210 =	
☐ 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	04/18/2019	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA		RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	* 24	Minus	** 29	= 0		x $50 =	0
	Independent (37 CFR 1.16(h))	* 3	Minus	*** 3	= 0		x $230 =	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 $0 =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=		x $0 =	
	☐ 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.	LIE
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".	/JAMES ELLIOTT/
*** 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 06/26/2019
MCDONALD HOPKINS LLC
600 Superior Avenue, East
Suite 2100
CLEVELAND, OH 44114-2653

EXAMINER	
DIAB, YASIR A	
ART UNIT	PAPER NUMBER
3722	

DATE MAILED: 06/26/2019

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
15/262,787	09/12/2016	Michael A. Bass	16223-00310	1955

TITLE OF INVENTION: KEY DUPLICATION MACHINE

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	SMALL	$500	$0.00	$0.00	$500	09/26/2019

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: Maintenance fees are due in utility patents issuing on applications filed on or after Dec. 12, 1980. It is patentee's responsibility to ensure timely payment of maintenance fees when due. More information is available at www.uspto.gov/PatentMaintenanceFees.

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), by mail or fax, or via EFS-Web.

By mail, send to: Mail Stop ISSUE FEE
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

By fax, send to: (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 06/26/2019

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 transmitted to the USPTO via EFS-Web or by facsimile to (571) 273-2885, on the date below.

(Typed or printed name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
15/262,787	09/12/2016	Michael A. Bass	16223-00310	1955

TITLE OF INVENTION: KEY DUPLICATION MACHINE

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	SMALL	$500	$0.00	$0.00	$500	09/26/2019

EXAMINER	ART UNIT	CLASS-SUBCLASS
DIAB, YASIR A	3722	409-081000

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 03-09 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 _____
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 must have been previously recorded, or filed for recordation, as set forth in 37 CFR 3.11 and 37 CFR 3.81(a). 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. Fees submitted: ❑ Issue Fee ❑ Publication Fee (if required) ❑ Advance Order - # of Copies _____

4b. Method of Payment: *(Please first reapply any previously paid fee shown above)*

❑ Electronic Payment via EFS-Web ❑ Enclosed check ❑ Non-electronic payment by credit card (Attach form PTO-2038)

❑ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment to Deposit Account No. _____

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. _____

Hillman Exhibit 1002
Page 1168

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.
15/262,787	09/12/2016	Michael A. Bass	16223-00310	1955

33772 7590 06/26/2019

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

EXAMINER	
DIAB, YASIR A	

ART UNIT	PAPER NUMBER
3722	

DATE MAILED: 06/26/2019

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 30 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, local, or foreign enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Notice of Allowability	Application No. 15/262,787	Applicant(s) Bass et al.	
	Examiner YASIR A DIAB	Art Unit 3722	AIA (FITF) 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 4/18/19.
   ☐ 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 See Continuation Sheet . 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 areply 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)
2. ☐ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date _____.
3. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material _____.
4. ☐ Interview Summary (PTO-413), Paper No./Mail Date. _____.
5. ☐ Examiner's Amendment/Comment
6. ☐ Examiner's Statement of Reasons for Allowance
7. ☐ Other _____.

/YASIR A DIAB/ Examiner, Art Unit 3722	/SUNIL K SINGH/ Supervisory Patent Examiner, Art Unit 3722

Continuation of 3. The allowed claim(s) is/are: 1-7,9-22,30,32 and 35

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	15/262,787	Bass et al.
	Examiner	**Art Unit**
	YASIR A DIAB	3722

CPC						
Symbol					**Type**	**Version**
B23C	/	3	/	35	F	2013-01-01
G06K	/	9	/	2036	I	2013-01-01
G06K	/	9	/	4661	I	2013-01-01
G06K	/	9	/	48	I	2013-01-01
G06K	/	9	/	20	I	2013-01-01
G07F	/	17	/	26	I	2013-01-01
G06Q	/	20	/	18	I	2013-01-01
Y10T	/	409	/	300952	A	2015-01-15
Y10T	/	409	/	301008	A	2015-01-15
Y10T	/	409	/	303808	A	2015-01-15
B23C	/	2235	/	32	A	2013-01-01
B23B	/	2270	/	32	A	2013-01-01
B23C	/	2235	/	08	A	2013-01-01
B23C	/	2235	/	12	A	2013-01-01
B23C	/	2235	/	41	A	2013-01-01
G06K	/	2209	/	401	A	2013-01-01

CPC Combination Sets							
Symbol					**Type**	**Set**	**Ranking**	**Version**
	/		/					

/YASIR A DIAB/ Examiner, Art Unit 3722	24 June 2019	**Total Claims Allowed:**	
(Assistant Examiner)	(Date)	24	
/SUNIL K SINGH/ Supervisory Patent Examiner, Art Unit 3722	24 June 2019	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	1

U.S. Patent and Trademark Office

Part of Paper No.: 20190624

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	15/262,787	Bass et al.
	Examiner	**Art Unit**
	YASIR A DIAB	3722

INTERNATIONAL CLASSIFICATION				
CLAIMED				
B23C	/	3	/	35

NON-CLAIMED				
	/		/	

US ORIGINAL CLASSIFICATION	
CLASS	**SUBCLASS**
409	81

CROSS REFERENCES(S)						
CLASS	**SUBCLASS (ONE SUBCLASS PER BLOCK)**					

/YASIR A DIAB/ Examiner, Art Unit 3722	24 June 2019	**Total Claims Allowed:**	
(Assistant Examiner)	(Date)	24	
/SUNIL K SINGH/ Supervisory Patent Examiner, Art Unit 3722	24 June 2019	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	1

U.S. Patent and Trademark Office — Part of Paper No.: 20190624

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	15/262,787	Bass et al.
	Examiner	**Art Unit**
	YASIR A DIAB	3722

☑ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIMS

Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
1	1	10	11	19	20										
2	2	11	12	20	21										
3	3	12	13	21	22										
4	4	13	14	22	30										
5	5	14	15	23	32										
6	6	15	16	24	35										
7	7	16	17												
8	9	17	18												
9	10	18	19												

/YASIR A DIAB/ Examiner, Art Unit 3722	24 June 2019	**Total Claims Allowed:**	
(Assistant Examiner)	(Date)	24	
/SUNIL K SINGH/ Supervisory Patent Examiner, Art Unit 3722	24 June 2019	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	1

U.S. Patent and Trademark Office

Part of Paper No.: 20190624

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	15/262,787	Bass et al.
	Examiner	Art Unit
	YASIR A DIAB	3722

CPC - Searched*		
Symbol	**Date**	**Examiner**
B23C 3/35, 355; 2235/12, 24, 32, 41		
Y10T 409/300952, 301008, 301064	11-27-16	DH
search updated	6-10-17	DH
search updated	12-9-17	DH
search updated	10-12-18	DH
Search updated	06/24/2019	YD

CPC Combination Sets - Searched*		
Symbol	**Date**	**Examiner**

US Classification - Searched*			
Class	**Subclass**	**Date**	**Examiner**

* See search history printout included with this form or the SEARCH NOTES box below to determine the scope of the search.

Search Notes		
Search Notes	**Date**	**Examiner**
see EAST search printout	12-9-17	DH
see EAST search printout	10-12-18	DH

Interference Search			
US Class/CPC Symbol	**US Subclass/CPC Group**	**Date**	**Examiner**
As searched	As searched	06/24/2019	YD

/YASIR A DIAB/ Examiner, Art Unit 3722	

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	15/262,787	Bass et al.
	Examiner	Art Unit
	YASIR A DIAB	3722

/YASIR A DIAB/ Examiner, Art Unit 3722	

Hillman Exhibit 1002
Page 1177

EAST Search History

EAST Search History (Interference)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	0	(key$1 and duplicat$3 and machin$3 and optic$3 and blank$3 and identif$7 and housing$1 and imag$3 and cut$4 and retent$3 and slot$3).clm.	US-PGPUB; USPAT	OR	OFF	2019/06/24 04:55
L2	45	(Bass-Michael).in.	US-PGPUB; USPAT	OR	OFF	2019/06/24 04:56
L3	0	(Mutch-William).in.	US-PGPUB; USPAT	OR	OFF	2019/06/24 04:56
L4	0	(Mutch-William).in.	US-PGPUB; USPAT	OR	OFF	2019/06/24 04:56
L5	2	(Ryai-Richard).in.	US-PGPUB; USPAT	OR	OFF	2019/06/24 04:57
L6	0	(Thompson-Chester).in.	US-PGPUB; USPAT	OR	OFF	2019/06/24 04:57
L7	8	(Drake-Richard).in.	US-PGPUB; USPAT	OR	OFF	2019/06/24 04:57
L8	0	(Porras-Randall).in.	US-PGPUB; USPAT	OR	OFF	2019/06/24 04:58
L9	0	(Porras-Randall).in.	US-PGPUB; USPAT	OR	OFF	2019/06/24 04:58

6/ 24/ 2019 4:58:34 AM
C:\ Users\ ydiab\ Documents\ EAST\ Workspaces\ 15262787.wsp

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	1377	B23C3/35.cpc.	US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT	OR	OFF	2019/06/24 04:44
L2	357	B23C3/355.cpc.	US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT	OR	OFF	2019/06/24 04:44
L3	209	B23C2235/12.cpc.	US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT	OR	OFF	2019/06/24 04:45
L4	83	B23C2235/24.cpc.	US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT	OR	OFF	2019/06/24 04:45
L5	117	B23C2235/32.cpc.	US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT	OR	OFF	2019/06/24 04:46
L6	261	B23C2235/41.cpc.	US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT	OR	OFF	2019/06/24 04:46
L7	660	Y10T409/300952.cpc.	US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT	OR	OFF	2019/06/24 04:46
L8	312	Y10T409/301008.cpc.	US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT	OR	OFF	2019/06/24 04:46
L9	287	Y10T409/301064.cpc.	US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT	OR	OFF	2019/06/24 04:47
L10	23	(Michael and Bass and William and Mutch and Richard and Ryai and Chester and Thompson and Robert and Drake and Randall and Porras).in.	US-PGPUB; USPAT; FPRS; EPO; JPO; DERWENT	OR	OFF	2019/06/24 04:48

6/24/2019 4:50:53 AM
C:\Users\ydiab\Documents\EAST\Workspaces\15262787.wsp

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), by mail or fax, or via EFS-Web.

By mail, send to: Mail Stop ISSUE FEE
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

By fax, send to: (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 06/26/2019

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 transmitted to the USPTO via EFS-Web or by facsimile to (571) 273-2885, on the date below.

	(Typed or printed name)
	(Signature)
EFS	(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
15/262,787	09/12/2016	Michael A. Bass	16223-00310	1955

TITLE OF INVENTION: KEY DUPLICATION MACHINE

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	SMALL	$500	$0.00	$0.00	$500	09/26/2019

EXAMINER	ART UNIT	CLASS-SUBCLASS
DIAB, YASIR A	3722	409-081000

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 03-09 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 must have been previously recorded, or filed for recordation, as set forth in 37 CFR 3.11 and 37 CFR 3.81(a). Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE: Hy-Ko Products Company

(B) RESIDENCE: (CITY and STATE OR COUNTRY): 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. Fees submitted: ☒ Issue Fee ☐ Publication Fee (if required) ☐ Advance Order - # of Copies _____

4b. Method of Payment: *(Please first reapply any previously paid fee shown above)*

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☒ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment to Deposit Account No. 130265

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 July 31, 2019

Typed or printed name Mark J. Masterson Registration No. 71886

Electronic Patent Application Fee Transmittal

Application Number:	15262787
Filing Date:	12-Sep-2016
Title of Invention:	KEY DUPLICATION MACHINE
First Named Inventor/Applicant Name:	Michael A. Bass
Filer:	Mark Jason Masterson/Danielle Mueller
Attorney Docket Number:	16223-00310

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	500	500

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension-of-Time:				
Miscellaneous:				
			Total in USD ($)	**500**

Electronic Acknowledgement Receipt

EFS ID:	36743734
Application Number:	15262787
International Application Number:	
Confirmation Number:	1955
Title of Invention:	KEY DUPLICATION MACHINE
First Named Inventor/Applicant Name:	Michael A. Bass
Customer Number:	33772
Filer:	Mark Jason Masterson/Danielle Mueller
Filer Authorized By:	Mark Jason Masterson
Attorney Docket Number:	16223-00310
Receipt Date:	31-JUL-2019
Filing Date:	12-SEP-2016
Time Stamp:	15:07:54
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	$500
RAM confirmation Number	E20197UF08091158
Deposit Account	
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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)	8247537.pdf	142145 b13961b1a4261eb5575b70e7941fc0f8cb814f23	no	1
Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	30109 3d32f8b416d9347b6a214502b38b057d97adc13d	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	172254		

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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.

Receipt date: 12/02/2016
15/262,787 - GAU: 3722
Receipt date: 09/20/2016
15262787 - GAU: 3722
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
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT
(Not for submission under 37 CFR 1.99)

Application Number	15262787
Filing Date	2016-09-12
First Named Inventor	Michael A. Bass
Art Unit	3722
Examiner Name	
Attorney Docket Number	16223-00310

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	

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Receipt date: 09/20/2016

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	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.	

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	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.	

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	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.	
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	40	6185311		2001-02-06	Yanovsky et al.	
	41	6179531		2001-01-30	Jaw	

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	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	

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	53	5982491		1999-11-09	Breyer et al.	
	54	5966457		1999-10-12	Lemelson	
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	57	5926388		1999-07-20	Kimbrough et al.	
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	59	5906365		1999-05-25	Wu	
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	63	5771176		1998-06-23	Froehlich et al.	

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	64	5764156		1998-06-09	Chaloux	
	65	5739766		1998-04-14	Chaloux	
	66	5711643		1998-01-27	Parr et al.	
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	69	5676504		1997-10-14	Mueller et al.	
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	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.	

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	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.	

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Receipt date: 09/20/2016

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Attorney Docket Number	16223-00310

	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	

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Attorney Docket Number	16223-00310

	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.	
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	105	5311286		1994-05-10	Pike	
	106	5308360		1994-05-03	Neitzke et al.	
	107	5307151		1994-04-26	Hof et al.	

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Filing Date	2016-09-12
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Art Unit	3722
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Attorney Docket Number	16223-00310

	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	

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Exs Web 2.0

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First Named Inventor	Michael A. Bass
Art Unit	3722
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	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.	

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Efs Web 2.2.6

Receipt date: 09/20/2016

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	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	

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	201	4359299		1982-11-16	Sagarian	
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	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.	☐
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	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.A.B/ /P.H./

Receipt date: 09/20/2016

INFORMATION DISCLOSURE STATEMENT BY APPLICANT
(Not for submission under 37 CFR 1.99)

Application Number	15262787 15262787 - GAU: 3722
Filing Date	2016-09-12
First Named Inventor	Michael A. Bass
Art Unit	3722
Examiner Name	
Attorney Docket Number	16223-00310

	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.	☐

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

EXAMINER SIGNATURE

/YASIR A DIAB/ 08/13/2019

Examiner Signature	/Daniel Howell/	Date Considered	11/27/2016

*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. /Y.A.D/

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /D.H./

Receipt date: 09/20/2016

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Art Unit	3722
Examiner Name	
Attorney Docket Number	16223-00310

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)	2016-09-20
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.**

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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 record s.

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.

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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.

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APPLICATION NO.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
15/262,787	09/24/2019	10421133	16223-00310	1955

33772 7590 09/04/2019

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):

Michael A. Bass, Chagrin Falls, OH;
Hy-Ko Products Company, Northfield, OH;
William R. Mutch, North Ridgeville, OH;
Richard W. Ryai SR., North Royalton, OH;
Chester O.D. Thompson, Painesville, OH;
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Randall A. Porras, Avon, 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.

AO 120 (Rev. 08/10)

TO:	REPORT ON THE FILING OR DETERMINATION OF AN ACTION REGARDING A PATENT OR TRADEMARK
Mail Stop 8 **Director of the U.S. Patent and Trademark Office** **P.O. Box 1450** **Alexandria, VA 22313-1450**	

In Compliance with 35 U.S.C. § 290 and/or 15 U.S.C. § 1116 you are hereby advised that a court action has been filed in the U.S. District Court Eastern District of Texas, Marshall Division on the following

☐ Trademarks or ☑ Patents. (☐ the patent action involves 35 U.S.C. § 292.):

DOCKET NO. 2:21-cv-197	DATE FILED 6/1/2021	U.S. DISTRICT COURT Eastern District of Texas, Marshall Division
PLAINTIFF Hy-Ko Products Company LLC		DEFENDANT The Hillman Group, Inc.

	PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1	9,656,332 B2	5/23/2017	Hy-Ko Products Company LLC
2	9,682,432 B2	6/20/2017	Hy-Ko Products Company LLC
3	9,687,920 B2	6/27/2017	Hy-Ko Products Company LLC
4	10,421,133 B2	9/24/2019	Hy-Ko Products Company LLC
5			

In the above—entitled case, the following patent(s)/ trademark(s) have been included:

DATE INCLUDED	INCLUDED BY ☐ Amendment ☐ Answer ☐ Cross Bill ☐ Other Pleading	
PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1		
2		
3		
4		
5		

In the above—entitled case, the following decision has been rendered or judgement issued:

DECISION/JUDGEMENT

CLERK	(BY) DEPUTY CLERK	DATE

Copy 1—Upon initiation of action, mail this copy to Director **Copy 3—Upon termination of action, mail this copy to Director**
Copy 2—Upon filing document adding patent(s), mail this copy to Director **Copy 4—Case file copy**