

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

THE HILLMAN GROUP, INC.,
Petitioner

v.

HY-KO PRODUCTS COMPANY LLC,
Patent Owner

Case IPR2023-00075
Patent No. 9,514,385

PETITION FOR *INTER PARTES* REVIEW

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Ex. 1002	Prosecution History of U.S. Patent No. 9,514,385
Ex. 1003	Declaration of Scott Basham
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Ex. 1005	U.S. Patent No. 6,064,747 to Wills et al. (“ <i>Wills</i> ”)
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Ex. 1013	U.S. Patent No. 4,899,391 to Cimino et al. (“ <i>Cimino</i> ”)
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I. PRELIMINARY STATEMENT

Petitioner, The Hillman Group, Inc., requests *inter partes* review of U.S. Patent No. 9,514,385 (Ex. 1001), assigned to Hy-Ko Products Company LLC, and cancellation of claims 1-7, 9-11, 13-18, and 20-26.

The '385 patent claims recite a “key identification system,” including “an imaging system” that uses one or more mirrors “to capture an image of a tip of a master key” that “includes a contour,” and “determine[s] characteristics of said contour” of the master key to identify a key blank. '385 patent, 10:49-64, 12:14-29, 12:34-49. During prosecution, the examiner allowed these claims only after Applicant amended them to recite at least one view of the master key is “substantially a tip end view.” Ex. 1002, 184, 187, 1145; '385 patent, 10:61-62, 12:23-24, 12:40-41. But as the prior art demonstrates, it was well known before May 1, 2009 (the '385 patent's earliest possible priority date) to use mirrors to obtain images, including a tip end image, of a master key. Similarly, it was well known to identify key blanks using characteristics of a contour of a master key groove determined from such images. As explained below, *Wills* in combination with *Cimino*, *Shirley*, *Bass*, and/or *Heide* renders obvious each of the challenged claims.

II. OVERVIEW OF PRIOR ART

A. Wills

U.S. Patent No. 6,064,747 (Ex. 1005) (“*Wills*”) issued May 16, 2000 and

constitutes prior art under pre-AIA 35 U.S.C. §§ 102(a), 102(b), and/or 102(e).

Wills discloses a “key regenerating machine in which [a] master key is optically analyzed” and “the appropriate key blank determined.” *Wills*, 1:7-10. According to *Wills*, by 2000 already “[i]t [was] well known in the art to duplicate keys, referred to as master keys, onto a key blank.” *Wills*, 1:13-14. *Wills*’s machine is configured to “identify[] the type of key blank onto which the master key is to be reproduced.” *Wills*, 1:48-49.

Figure 7A of *Wills* illustrates a master key including a milling “ML,” which *Wills* calls “a longitudinally-extending groove.” *Id.*, 5:22-24, 5:56-59.

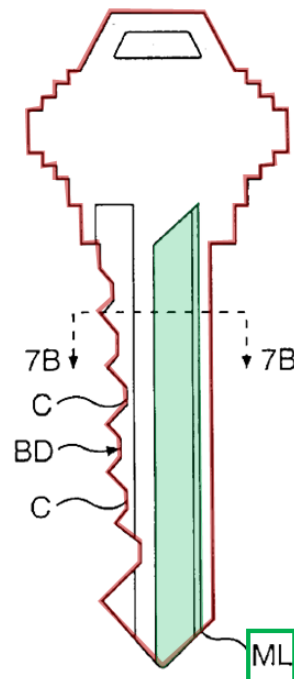


FIG. 7A

Wills, Figure 7A (annotated); Basham, ¶31.

The **milling** has particular “**surface information**,” such as a “**depth**,” shown in Figure 7B, illustrating a cross-section of Figure 7A. *Wills*, 5:25-28, 5:61-65, 11:59-63.

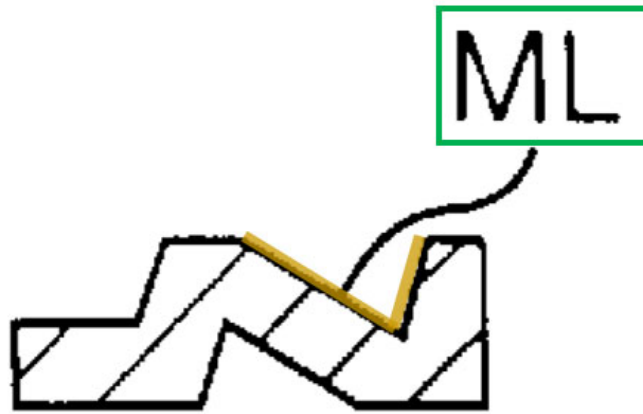


FIG. 7B

Wills, Figure 7B (annotated); Basham, ¶32.

The **master key** is placed in *Wills*’s machine, and a “laser line generator 39” is used to generate a light beam “LB” incident on the **milling** in a blade of the **master key**. *Id.*, 11:44-55, Figure 8.

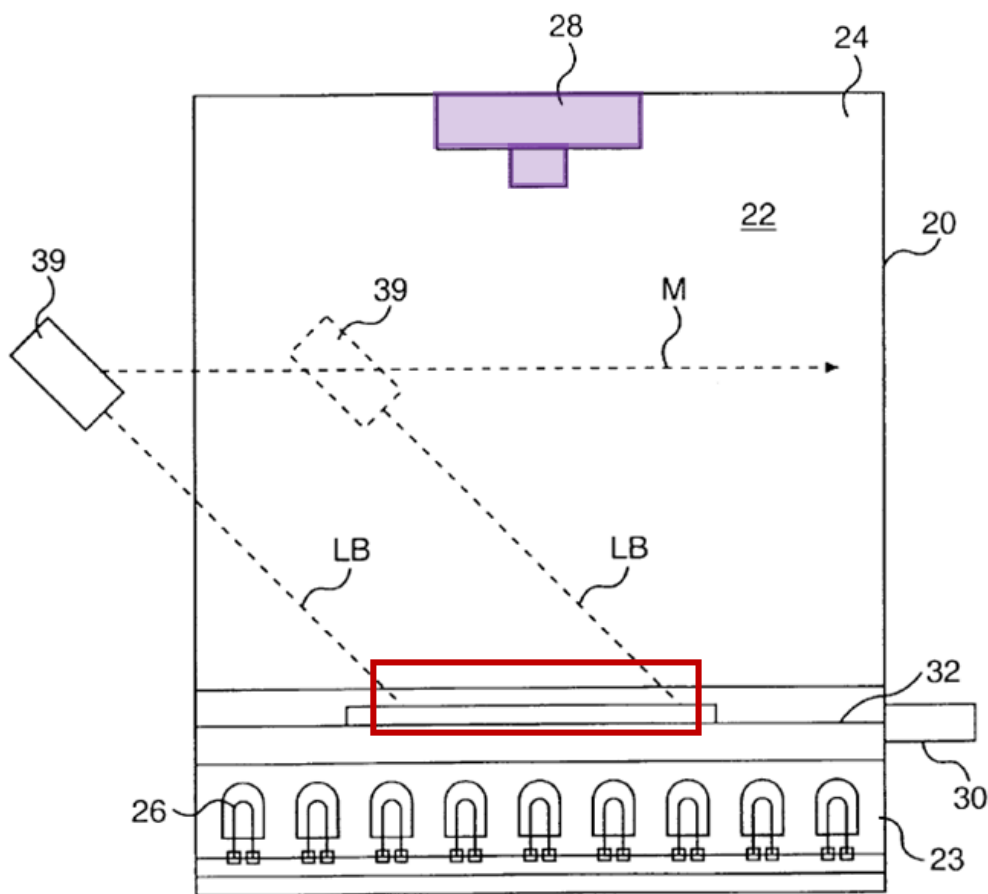


FIG. 8

Wills, Figure 8 (annotated); Basham, ¶33.

The image captured by *Wills*'s camera 28 “is the result of the light beam interfacing with the surface of the master key shown in FIG. 7A, specifically the

surface shown in FIG. 7B¹.” *Id.*, 11:59-63, Figure 7D. The image includes “surface information” of the master key, including the “depth of [the] milling” in the blade.

Id., 5:61-65, 13:1-3.

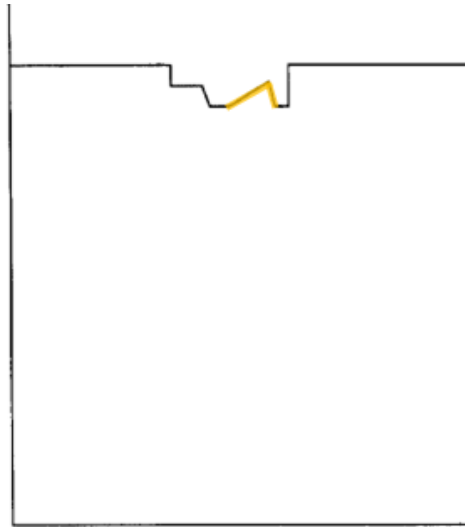


FIG. 7D

Wills, Figure 7D (cropped and annotated); Basham, ¶35.

Wills explains that “[a]s the light beam LB is swept along the length of the [master] key, illustrated by the second laser line generator 39 in phantom lines, a

¹ Figure 7B, which is a “cross-sectional view of Figure 7A taken along line 7B—7B,” and Figure 7D, which shows “[t]he intersection of the light beam line and the key surface,” are vertically flipped relative to one another, as seen by vertically flipping and superimposing Figure 7B on Figure 7D. *Wills*, 3:11-12, 13:-3; Basham, ¶34.

series of two-dimensional slices is generated,” and these “slices are stacked to form the entire three-dimensional representation of the key.” *Id.*, 15:40-50. This three-dimensional image includes the “depth of [the] milling across the [master] key.” *Id.*, 13:1-2.

Wills discloses that identifying a key blank or “reference key” includes “analyzing the surface information of the master key, specifically the milling.” *Id.*, 11:36-39. *Wills*’s machine includes a “computer subsystem,” including “means for obtaining surface information 2375.” *Id.*, 31:56-32:7, Figure 23.

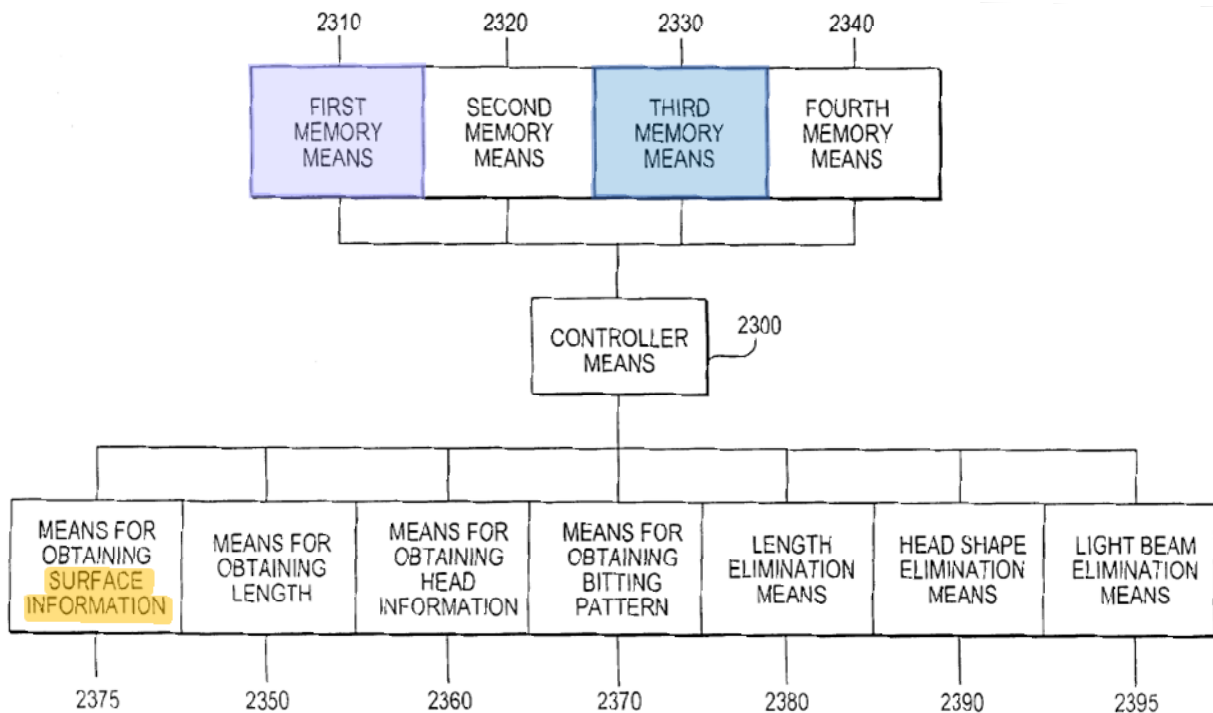


FIG. 23

Wills, Figure 23 (annotated); Basham, ¶37.

As *Wills* explains, “light beam image data represent[ing] the milling of the

master key” of Figure 7A is “stored in the third memory means 2330” in Figure 23.

Wills, 32:12-14, 37:10-15. From this data, *Wills*’s machine “extracts **depth measurements**” for the milling of the **master key**. *Wills*, 37:16-19; *see also id.*, 37:20-39:1 (discussing pseudocode for extracting **depth measurements**).

Wills’s computer subsystem stores “surface information of each of the reference keys” in a “first memory means 2310,” which includes, for each reference key, “**depth measurements across the width of the [reference] key.**” *Id.*, 31:56-61, 32:57-61; *see also id.*, 15:2-5 (“The memory means also stores information about the light beam LB interfacing with each of the reference keys[.]”).

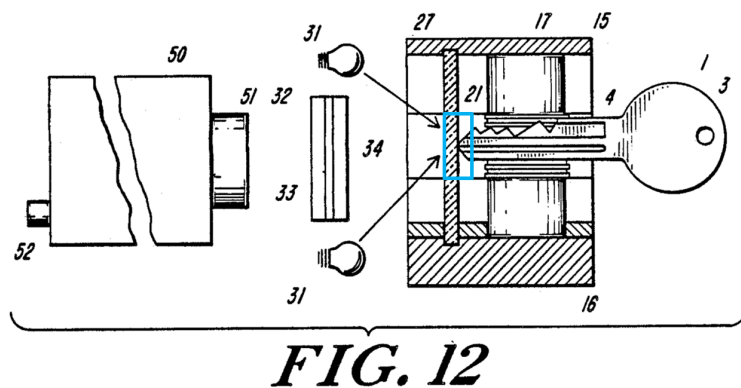
To identify a reference key for the **master key**, a “light beam elimination means” of *Wills*’s computer subsystem compares the **depth measurements** for the **master key** with the **depth measurements for the reference keys** and generates a ranking from the most likely match among the reference keys to the least likely match. *Id.*, 15:6-19; *see also id.*, Figures 31 (calculating a “surface score” for the reference keys) and 32 (factoring the “surface score” into the “overall score” and ranking keys by overall score). *Wills* describes “translating” the **image** data for the **master key** “to a predetermined reference position and orientation, independent of the position at which the **key** is placed in” the machine. *Id.*, 9:35-38. Thus, *Wills*’s machine “does not require the **master key** to be precisely aligned to operate

efficiently.” *Id.*, 7:29-31.

B. Cimino

U.S. Patent No. 4,899,391 (Ex. 1013) (“*Cimino*”) issued February 6, 1990 and constitutes prior art under pre-AIA 35 U.S.C. §§ 102(a), 102(b), and/or 102(e).

Cimino, like *Wills*, discloses a “system for identifying and matching key blanks when duplicating an original key.” *Cimino*, Abstract. *Cimino*’s system includes “a key holder subsystem 10, a lensing subsystem 30, a video subsystem 50, a digitizing subsystem 70, a computer subsystem 90, and an output subsystem 110.” *Id.*, 3:3-7. Like *Wills*, “key 1 to be duplicated” is inserted into the key holder 10” of *Cimino*’s machine. *Id.*, 3:7-8. As illustrated in Figure 12, below, *Cimino*’s “lensing subsystem 30 illuminates the front 2 of the key 1 forming a cross-sectional image 35 thereof.” *Id.*, 3:8-10. The “video subsystem 50 converts the image 35 into an electrical signal which the digitizing subsystem 70 converts into a digital image.” *Id.*, 3:10-12.



Cimino, Figure 12 (annotated); Basham, ¶42.

Cimino explains the “output of the lensing subsystem 30 is an end-on cross-section image 35 of the front 2 of the key 1.” *Id.*, 4:18-20. Figure 14 of *Cimino*, below, illustrates an exemplary end-on cross-section image 35 (e.g., tip end image) of a master key.



FIG. 14

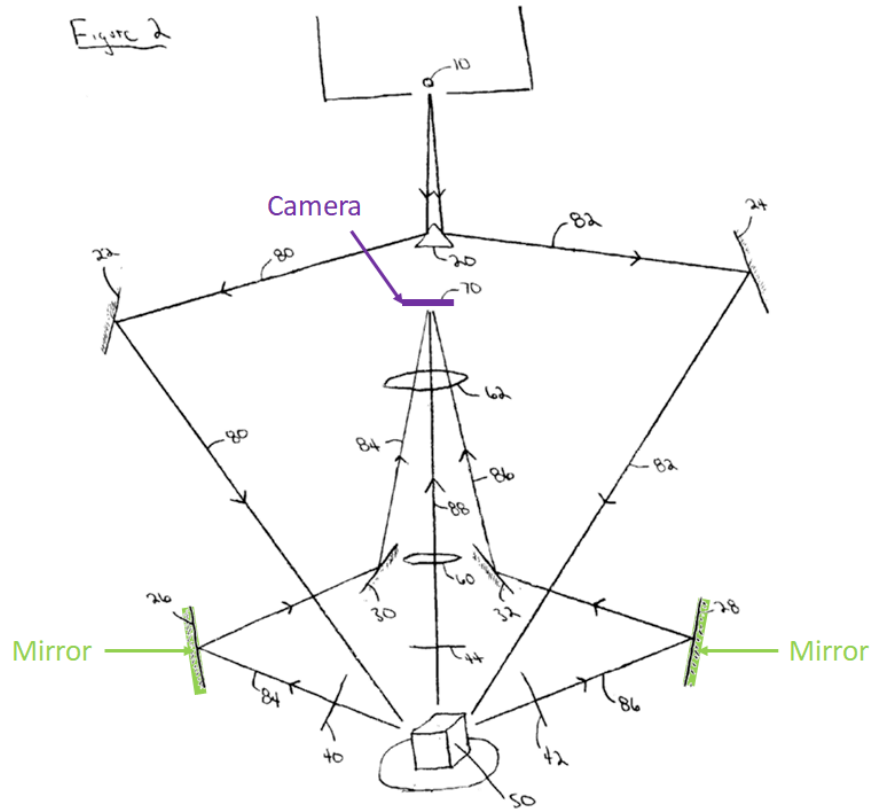
Cimino, Figure 14 (annotated); Basham, ¶43.

C. Shirley

U.S. Patent Application Publication No. 2003/0072011 (Ex. 1014) (“*Shirley*”) published April 17, 2003 and constitutes prior art under pre-AIA 35 U.S.C. §§ 102(a), 102(b), and/or 102(e).

Shirley describes a “method and apparatus for combining multiple views of an object.” *Shirley*, Abstract. As illustrated in Figure 2, below, *Shirley* discloses an “image 88 formed by radiation reflected from a ... surface of the object 50 is focused on detector 70.” *Id.*, ¶[0025]. *Shirley* further discloses an “image 84 formed by radiation reflected from the first surface of the object 50 is directed to a second mirror 26,” which is then directed to detector 70. *Id.*, ¶[0024]. *Shirley* similarly discloses an “image 86 formed by radiation reflected from the second

surface of the object 50 is directed to a **fifth mirror 28**,” which is then directed to **detector 70**. *Id.*, ¶[0025].



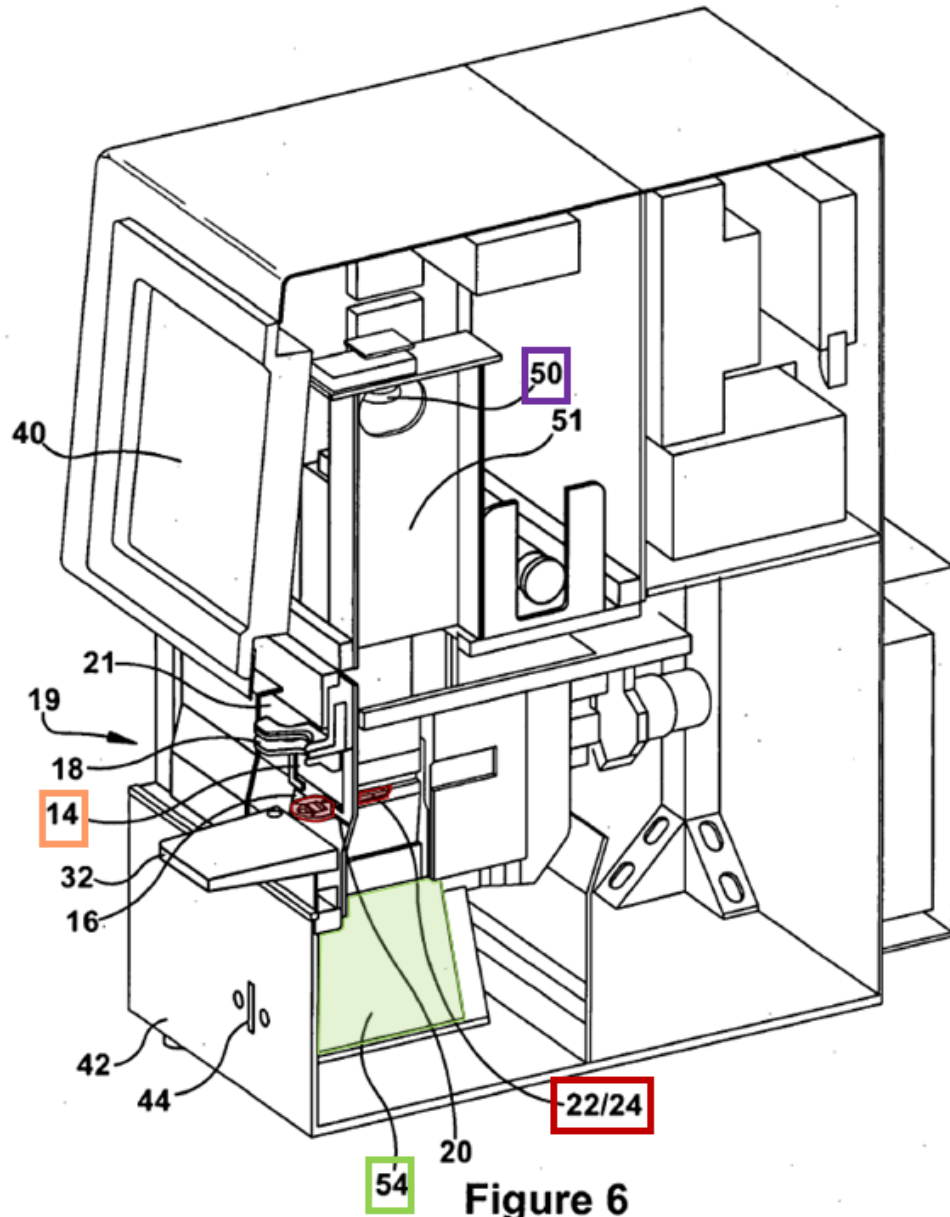
Shirley, Figure 2 (annotated); Basham, ¶46.

D. Bass

U.S. Patent Publication No. 2007/0224008 (Ex. 1006) (“*Bass*”) published September 27, 2007, and constitutes prior art under pre-AIA 35 U.S.C. §§ 102(a), 102(b), and/or 102(e).

Bass, like *Wills*, describes a machine for duplicating master keys. *Bass*, ¶[0009]. The **master key** of *Bass* is placed in the machine, and a **camera**, together with a **reflecting plate**, is used to capture an image of the **master key**, as shown in

Figure 6. Like *Wills*, where the **master key** is placed on a “supporting means,” *Wills*, 7:4-8, in *Bass*’s machine the **master key** is placed on a “base 16.” *Bass*, ¶¶[0047], [0050]. *Bass*’s machine also employs a “**door clamp 14.**” *Id.*, ¶[0047].



Bass, Figure 6 (annotated); Basham, ¶48.

E. Heide

U.S. Patent Publication No. 2007/0233298 (Ex. 1007) (“*Heide*”) published

October 4, 2007 and constitutes prior art under pre-AIA 35 U.S.C. §§ 102(a), 102(b), and/or 102(e).

Heide describes a “three-dimensional object” like the “three-dimensional surface image” captured by *Wills*’s machine. *Heide*, Abstract; *Wills*, 15:34-42. As *Wills* envisions “convert[ing]” its three-dimensional image by “rotating to a predetermined reference position and orientation,” *Wills*, 9:35-38, *Heide* teaches “rotat[ing]” its three-dimensional image “relative to one or more ... axes” to arrive at an “optimal spatial orientation,” *Heide*, ¶¶[0037]-[0038].

F. *Wills, Cimino, Shirley, Bass, and Heide* Are Analogous Art to the ’385 Patent

Wills, Cimino, and Bass “[are] from the same field of endeavor” as the patent, key duplication. *Unwired Planet, LLC v. Google Inc.*, 841 F.3d 995, 1000–01 (Fed. Cir. 2016); Basham, ¶51. See, e.g., *Wills*, 1:6-10; *Cimino*, Title; *Bass*, Title. Moreover, *Wills, Cimino, Shirley, Bass, and Heide* are reasonably pertinent to “one of the particular problems dealt with by the inventor.” *Unwired Planet*, 841 F.3d at 1000–01. *Wills, Cimino, and Bass* are pertinent to identifying an appropriate key blank to duplicate a master key. Basham, ¶51. Compare ’385 patent, 1:18-21, with, *Wills*, 1:6-10; *Cimino*, 1:5-6, 1:37-58; *Bass*, ¶[0008]. *Shirley* is pertinent to imaging an object from different angles. Basham, ¶51. Compare ’385 patent, 4:10-20, with, *Shirley*, Abstract, ¶¶[0024]-[0027]. *Heide* is pertinent to imaging an object and converting the image to a particular orientation.

Basham, ¶51. Compare '385 patent, 7:17-29, with, Heide, Abstract, ¶[0004].

III. THE '385 PATENT

The '385 patent describes a “key identification system” that “capture[s] an image of a master key” and uses “logic to analyze the image” to identify a key blank for use in duplicating the key. '385 patent, 2:28-30. Figure 1 illustrates a “master key 10,” including a “tip 14” and “blade 18” in which a “groove 11” is formed. *Id.*, 3:54-56; 5:10-13.

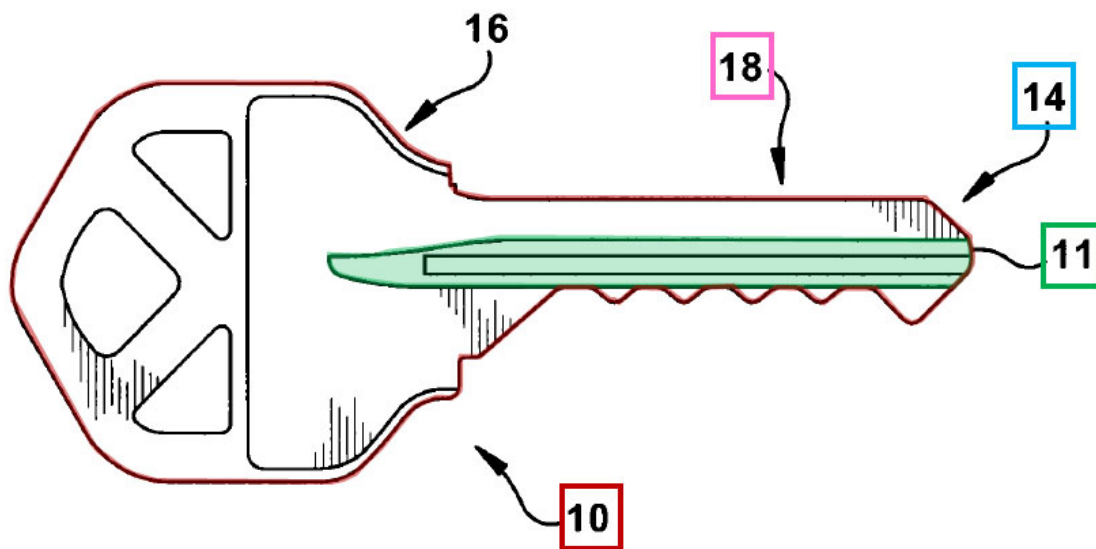


FIG. 1

'385 patent, Figure 1 (annotated); Basham, ¶52.

Figure 2a of the '385 patent illustrates “an imaging system” including a

camera “configured to capture an image of the tip of [the] master key.” *Id.*, 10:49-51.

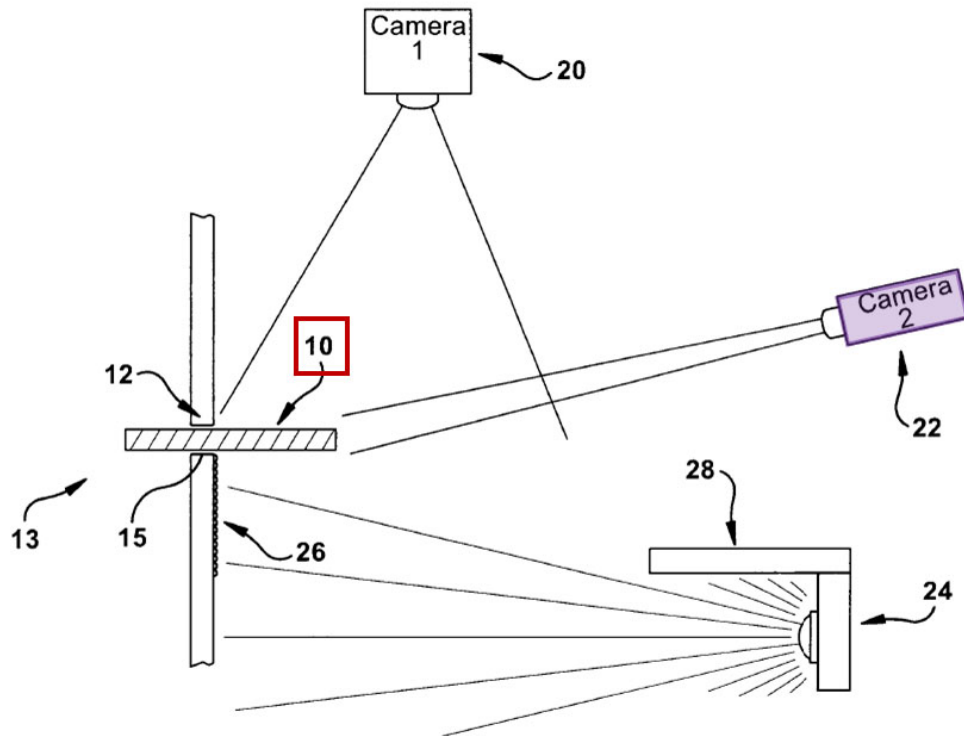


FIG. 2a

'385 patent, Figure 2a (annotated); Basham, ¶53.

The image captured by the camera “includes a contour,” and the key identification system uses a “logic” to “analyze [the] captured image to determine characteristics of [the] contour[,] ... based on image data from at least ... two or more views of said master key wherein at least one said view is substantially a tip end view.” '385 patent, 10:52-63. The logic also “compare[s] [the] characteristics with characteristics of known key blanks to determine the likelihood of a match between [the] master key and a known key blank.” *Id.*, 10:54-56.

IV. LEVEL OF ORDINARY SKILL IN THE ART

The level of ordinary skill in the art may be reflected by the prior art of record. *See Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001). A person of ordinary skill in the art (“POSA”) at the time of the alleged invention would have had a degree in engineering and three years of experience in various types of key duplication equipment, including vending machines. Basham, ¶15. This level of skill is approximate, and more experience would compensate for less formal education, and vice versa. *Id.* For example, an individual having no degree in engineering, but ten years of key duplication experience would qualify as a POSA. *Id.* So would a person with a masters or doctorate in engineering but with no key duplication experience. Additional education could substitute for professional experience and vice versa. *Id.*

V. CLAIM CONSTRUCTION

The Board construes claims in accordance with 37 C.F.R. § 42.200(b) and *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005) (en banc). Claims need only be construed to the extent necessary to resolve a controversy. *Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.*, 868 F.3d 1013, 1017 (Fed. Cir. 2017). No terms (including the term addressed below) need construction because the claims encompass the prior-art mappings under any construction consistent with *Phillips*.

Claim 1 recites “a logic configured to analyze said captured image to determine characteristics of said contour and compare said characteristics with characteristics of known key blanks to determine the likelihood of a match between said master key and a known key blank ... wherein said logic calculates the geometry of the contour based on data from at least said two or more views of said master key.” ’385 patent, 10:52-56, 10:62-64. The claimed “logic” should not be construed as a means-plus-function term under pre-AIA 35 U.S.C. § 112, ¶6, at least because the term does not recite a “means,” creating a presumption that means-plus-function claiming does not apply, and no evidence of record overcomes that presumption. *Williamson v. Citrix Online, LLC*, 792 F.3d 1339, 1348-49 (Fed. Cir. 2015). Further, the term “logic” itself connotes sufficiently definite structure to a POSA. *Id.* at 1349, 1351; *see also TecSec, Inc. v. IBM*, 731 F.3d 1336, 1348 (Fed. Cir. 2013); *Analog Devices, Inc. v. Xilinx, Inc.*, IPR2020-01597, Paper 12 at 17-18 (P.T.A.B. April 8, 2021) (describing “logic” as a “hardware structure”). To the extent the term “logic” could encompass a variety of possible structures, that alone does not warrant construing the term under § 112. *See, e.g., Mass. Inst. of Tech. v. Abacus Software*, 462 F.3d 1344, 1356 (Fed. Cir. 2006).

The claimed “logic” need not be construed. *Nidec*, 868 F.3d at 1017. If the Board determines the claimed “logic” should be construed as a means-plus-

function term, the function of the “logic” is “analyz[ing] said captured image to determine characteristics of said contour and compare said characteristics with characteristics of known key blanks to determine the likelihood of a match between said master key and a known key blank . . . wherein said logic calculates the geometry of the contour based on data from at least said two or more views of said master key,” as recited in claim 1. ’385 patent, 10:52-56, 10:62-64. Likewise, claims 2, 9-11, 13, 14, 22, 23, 24, and 26 recite addition functions of the claimed “logic.” *Id.*, 11:20-27, 11:31-38, 12:10-29, 12:45-48. The corresponding structure is described in the ’385 patent at 4:22-38. As explained below, *Wills* discloses or renders obvious the claimed “logic,” even if construed.

VI. STATEMENT OF PRECISE RELIEF REQUESTED FOR EACH CLAIM CHALLENGED

Hillman requests review under the following grounds:

Ground	References	Basis	Claims
1	<i>Wills, Cimino, and Shirley</i>	§ 103	1-5, 7, 10, 13-16, and 20-26
2	<i>Wills, Cimino, Shirley, and Bass</i>	§ 103	6, 17, 18
3	<i>Wills, Cimino, Shirley, and Heide</i>	§ 103	9, 11

VII. THE CHALLENGED CLAIMS ARE UNPATENTABLE

Wills in combination with *Cimino, Shirley, Bass, and/or Heide* renders obvious the challenged claims. Basham, ¶58.

A. Ground 1: *Wills*, *Cimino*, and *Shirley* Render Obvious Claims 1-5, 7, 10, 13-16, and 20-26

1. Claim 1

Wills in view of *Cimino* and *Shirley* renders obvious claim 1. Basham, ¶59.

a. 1[p] A key identification system comprising:

If this preamble is limiting, *Wills* discloses it. Basham, ¶60. *Wills* discloses a “key regenerating machine in which [a] master key is optically analyzed [and] the appropriate key blank determined.” *Wills*, 1:7-11.

b. 1[a] an imaging system including a camera configured to capture an image of the tip of a master key, wherein said image includes a contour;

Wills discloses this element. *Wills* discloses a machine “including a camera configured to capture an image of the tip of a master key.” Basham, ¶63; *Wills*’s image includes surface information, including a depth, of a milling in the master key. Basham, ¶¶61-70.

Wills discloses a “master key,” including a “tip.” The keys in *Wills* each have “a head H [and] a length LH that is the combination of the head H and a blade B.” *Wills*, 5:11-13, Figure 1A. *Wills* explains, “the length LH of the key extends from the tip TP of the blade B to the top of the head H.” *Id.*, 5:13-15.

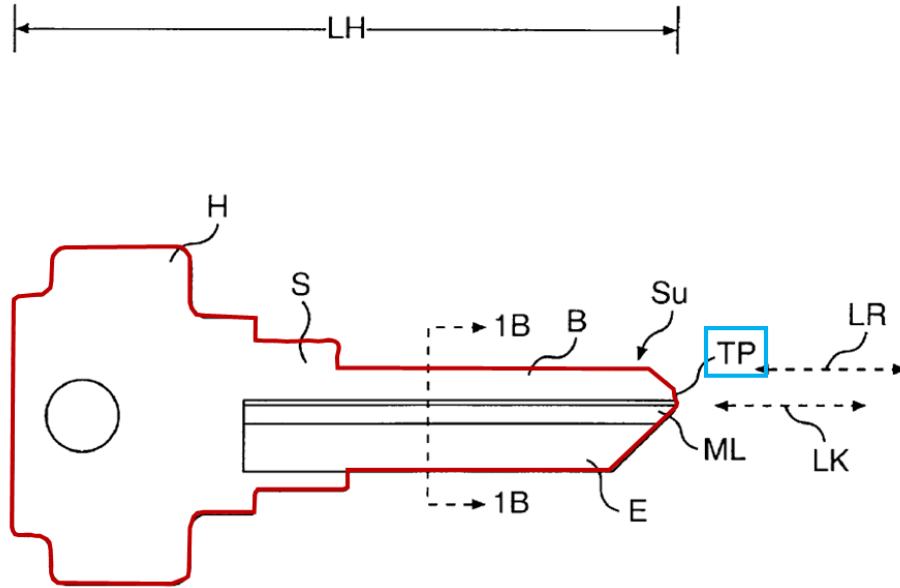


FIG. 1A

Wills, Figure 1A (annotated); Basham, ¶62.

Figure 8, below, shows an example embodiment of *Wills*'s machine, including a “camera 28.” *Wills*, 7:39-41. *Wills*'s camera captures an image of the tip of a master key because *Wills*'s camera captures “an entire three-dimensional surface image of the [master] key” by capturing two-dimensional slices “along the length of the key,” which includes the tip. *Id.*, 15:34-42.

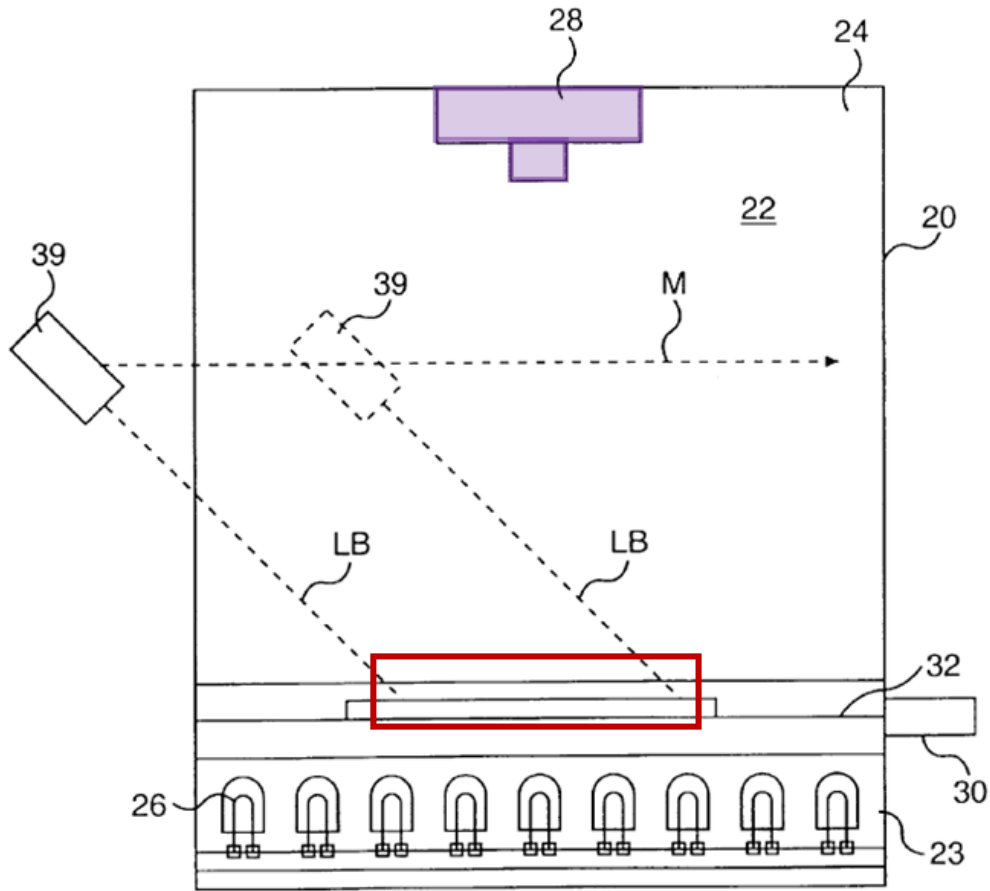


FIG. 8

Wills, Figure 8 (annotated); Basham, ¶63.

Wills discloses “[a]s light beam LB is swept along the length of the [master] key, illustrated by the second laser line generator 39 in phantom lines, a series of two-dimensional slices is generated,” and these “slices are stacked to form the entire three-dimensional representation of the key.” *Wills*, 15:40-50. A POSA would understand that either (i) a two-dimensional slice captured at the tip or (ii) the three-dimensional representation, which includes the tip of the master key,

is “an image of the tip of [the] master key.” Basham, ¶64.

Wills also discloses that the “image includes a contour” because the captured image in *Wills*—whether the two-dimensional slice or the three-dimensional representation of the master key—includes surface information, including a depth, of a milling in the master key. Basham, ¶65. *Wills*’s master key includes the blade, labeled “BD,” that includes the milling, labeled “ML,” which *Wills* describes as “a longitudinally-extending groove” in the blade.” *Wills*, 5:22-24, 5:56-59, Figure 7A.

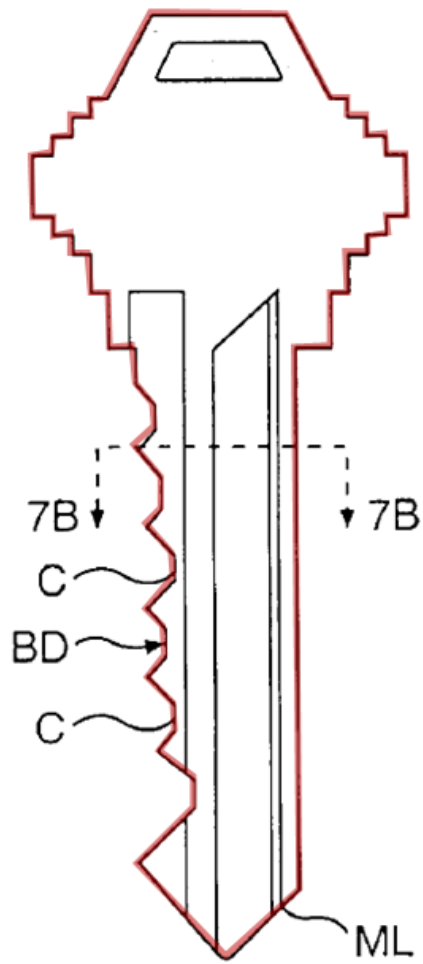


FIG. 7A

Wills, Figure 7A (annotated); Basham, ¶66.

The milling, or groove, of the **master key** has “**surface information**,” such as a “**depth**,” as shown in Figure 7B, illustrating a cross-section of Figure 7A along line 7B–7B. *Wills*, 5:61-65, 11:59-63.

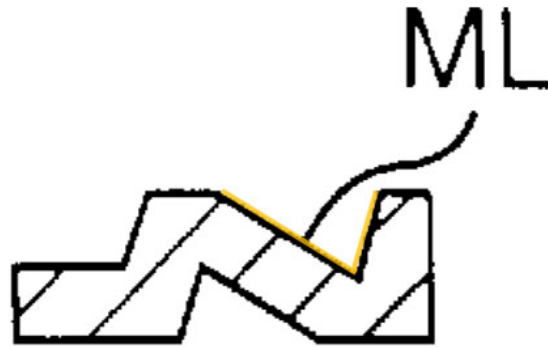


FIG. 7B

Wills, Figure 7B (annotated); Basham, ¶67

A POSA would have understood the **surface information**, such as the **depth**, of the milling of *Wills*’s **master key** to be a “a **contour**” of the **master key**. Basham, ¶68. The **contour** of the **master key** in the ’385 patent, like the **surface information** of the **master key** in *Wills*, is a physical geometry of a groove in the **master key**. *Id.*; ’385 patent, 5:37-38, Figure 3; *see also id.*, Figure 6 (showing “**contour** data related to **contours** of the groove” in Figure 3), Figure 7 (showing calculated “groove **contours**”), 4:64-66 (describing “[c]haracteristics of the grooves,” including “the size, location, angle, and other geometric parameters of a given groove”), 5:41-43 (describing “groove geometry”).

The two-dimensional slice captured by the camera, in Figure 7D, “is the result of the light beam interfacing with the surface of the master key shown in Figure 7A, specifically the surface shown in Figure 7B,” which, as shown above, includes the surface information, such as the depth, of the milling. *Wills*, 11:59-63. As Figure 7D shows, the two-dimensional slice captured by the camera likewise includes the surface information of the master key, including the “depth of [the] milling.” *Id.*, 13:1-3; Basham, ¶69. While Figure 7D, corresponding to “the surface shown in Figure 7B,” illustrates a two-dimensional slice along line 7B–7B in Figure A, *Wills*, 3:11-12, a POSA would have understood, the two-dimensional slices taken “along the length of the key” would include a two-dimensional slice captured at the tip of the master key, which like the slice taken along line 7B–7B, would include surface information of the master key, including the “depth of [the] milling.” Basham, ¶69. Moreover, a POSA would have recognized that the three-dimensional representation in *Wills* would likewise include the surface information, such as the depth, of the milling, because that representation is formed by “stack[ing]” the two-dimensional slices—each including surface information for the slice—captured “along the length of the key,” including at the tip. *Id.*; *Wills*, 15:40-47.

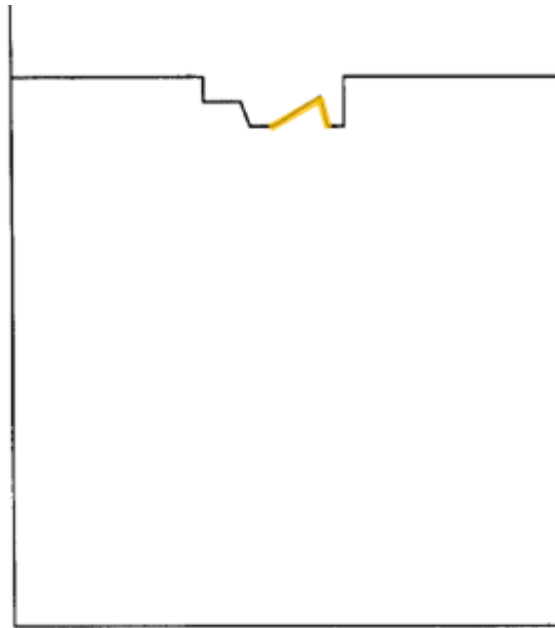


FIG. 7D

Wills, Figure 7D (cropped and annotated); Basham, ¶69.

- c. 1[b] a logic configured to analyze said captured **image** to determine **characteristics** of said **contour** and compare said **characteristics** with **characteristics of known key blanks** to determine the likelihood of a match between said **master key** and a known key blank; and

Wills discloses this element. Basham, ¶¶71-77. *Wills* discloses “analyzing the surface information of the master key, specifically the milling,” to identify a reference key for the master key. *Wills*, 11:36-39. *Wills*’s machine includes a “computer subsystem,” as illustrated in Figure 23, that includes “means for obtaining surface information 2375.” *Id.*, 31:44-47, 32:1-2.

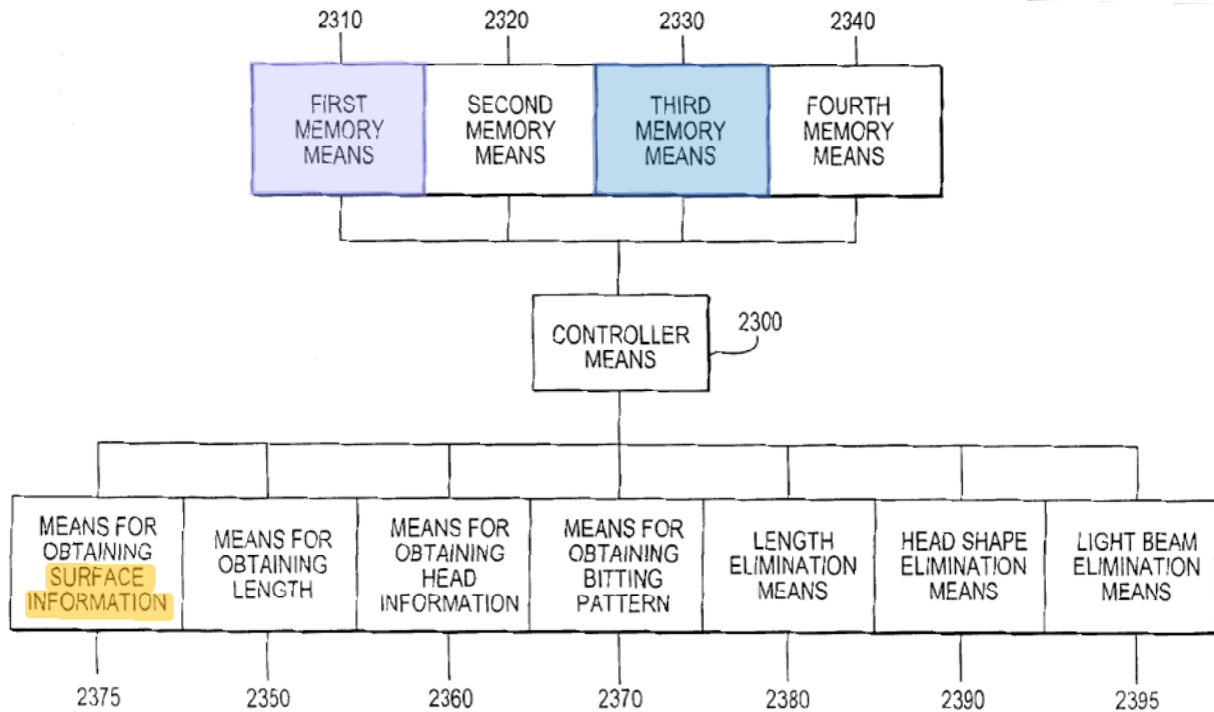


FIG. 23

Wills, Figure 23 (annotated); Basham, ¶72.

As explained for claim 1[a], *Wills*’s **image**—whether a **two-dimensional slice** or the **three-dimensional representation** formed by stacking the two-dimensional slices—includes **surface information**, including a **depth**, of the milling in the **master key**. *Wills* explains that data corresponding to this **image** is “stored in the third memory means 2330.” *Wills*, 37:11-15, Figure 23. From the **image** data, *Wills* explains, the means for obtaining **surface information** “extracts **depth measurements**” for the milling in the **master key**. *Wills*, 37:16-19; *see also id.*, 37:20-39:1 (discussing pseudocode for extracting **depth measurements**). A POSA would have understood the **depth measurements** extracted by *Wills*’s computer

subsystem to be “characteristics of said contour” because the depth measurements are measurements of the milling and reflect the surface information, including the depth, captured in the image. Basham, ¶73.

Wills’s computer subsystem is configured to compare the depth measurements of the milling with depth measurements of reference keys to determine a likelihood of a match between the master key and each reference key. Basham, ¶74. *Wills*’s computer subsystem stores “surface information of each of the reference keys” in a “first memory means 2310.” *Wills*, 31:56-61, Figure 23. This “surface information of each of the reference keys” includes, for each reference key, “depth measurements across the width of the [reference] key.” *Id.*, 32:57-61; *see also id.*, 15:2-5 (“The memory means also stores information about the light beam LB interfacing with each of the reference keys[.]”).

To identify a reference key for the master key, a “light beam elimination means 2395” of *Wills*’s computer subsystem compares the depth measurements for the master key with the depth measurements for the reference keys and, from the comparison, generates a “ranking ... from the most likely match” to the master key among the reference keys “to the least likely match.” *Id.*, 15:6-19, Figures 31 (calculating a “surface score” for the reference keys) and 32 (factoring the “surface score” into the “overall score” and ranking keys by overall score).

A POSA would have understood *Wills*’s computer subsystem to disclose the

claimed “logic,” because *Wills*’s computer subsystem is consistent with how the “logic” is described in the ’385 patent. Basham, ¶77. For example, the ’385 patent provides that the “logic” may take the form of “a memory device containing instructions.” ’385 patent, 4:21-38. Similarly, *Wills* describes implementing its computer subsystem using “programs to operate the computer subsystem 16” that “are stored on a hard disk 17,” as shown in Figure 5. *Wills*, 6:17-18.

To the extent the Board determines the claimed “logic” should be construed as a means-plus-function term under § 112, *supra* Section **Error! Reference source not found.**, as explained above and as explained in the remainder of this Petition, *Wills* discloses the functions of “logic” as recited in the challenged claims of the ’385 patent. Basham, ¶¶56-57, 77, 107, 109, 119, 129, 135, 156, 160, 173, 188, 219, 227. And the corresponding structure, described in the ’385 patent at 4:21-38, includes “a memory device containing instructions,” which *Wills* teaches, as explained above. Basham, ¶¶56, 77.

- d. 1[c] one or more **mirrors** positioned to allow said camera to capture two or more views of the **master key** wherein said **characteristics** of said **contour** are determined based on **image data** from at least said two or more views of said **master key** wherein at least one said view is substantially a tip end view, and wherein said logic calculates the geometry of the **contour** based on data from at least said two or more views of said **master key**.

Wills in view of *Cimino* and *Shirley* teaches this element. Basham, ¶¶78-107.

Wills discloses “one or more **mirrors** positioned to allow said camera to capture two or more views of the **master key**.” *Wills*’s machine employs a “**mirror 29**” that “reflects the image [of the **master key**] to the **camera 28**” to be captured. *Wills*, 7:47-48, Figure 9.

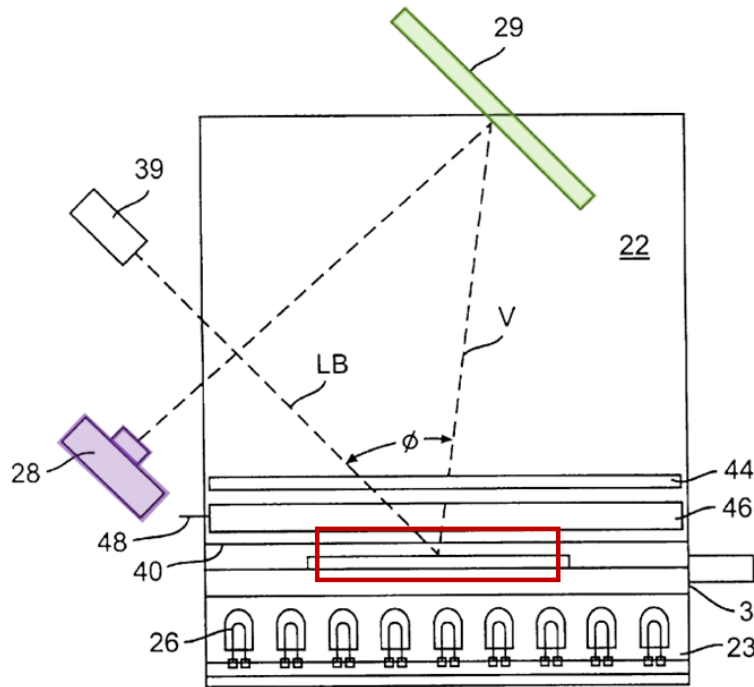


FIG. 9

Wills, Figure 9 (annotated); Basham, ¶78.

Wills discloses “capturing two or more views of the master key” using the one or more mirrors in two ways: (i) capturing images of **two-dimensional slices** of the **master key**; and (ii) capturing images of both sides of the **master key**. Basham, ¶¶79-82.

Regarding (i), as explained for claim 1[a], *Wills* describes capturing **images**

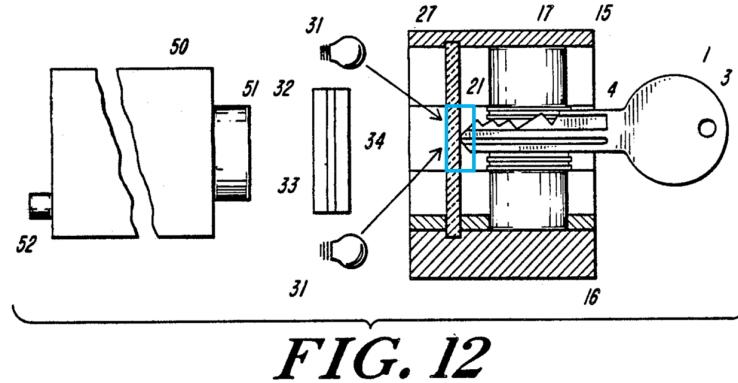
in the form of **two-dimensional slices** “along the length of the **key**.” *Wills*, 15:34-50. Although *Wills* describes this relative to the Figure 8 embodiment, which does not include a mirror, a POSA would have understood that such **two-dimensional slices** would be obtained using a **mirror** as disclosed in *Wills*’s Figure 9 embodiment by moving laser line generator 39 along the length of the **master key**. *Wills*, 12:51-52 (“It is also contemplated that the laser line generator 39 could be moved along an axis.”); Basham, ¶81. *Wills* explains that “**camera 28** can be mounted vertically over the drawer 30 if the focal length is appropriate for the dimensions of the machine 10” **or** an alternative embodiment (e.g., of Figure 9) “uses a **mirror 29** to accommodate the focal length for the CCD **camera 28** ... to minimize the size of machine 10.” *Wills*, 7:44-48. Thus, *Wills* discloses obtaining two or more views (e.g., **two-dimensional slices** or images along a length) of the **master key** using a **mirror** to reflect the image of the **master key** to **camera 28**. Basham, ¶81.

Regarding (ii), *Wills* discloses, in some embodiments, the machine “prompts the operator to remove the **master key** from the [machine] and flip it over so that the milling on the reverse side can be scanned and used in the identification process.” *Wills*, 15:26-30; Basham, ¶82. A POSA would have understood that to scan the milling on the reverse side, *Wills*’s **camera** would also capture **two-dimensional slices** of the reverse side using “**mirror 29**,” in the same manner as

described above. Basham, ¶82. The images of both sides of *Wills*'s **key** represent two or more views of the **master key** as seen by the **camera**. *Id.*

Wills also discloses “at least one said view is substantially a tip end view.” As explained, *Wills* describes capturing **images** in the form of **two-dimensional slices** “along the length of the **key**.” A POSA would understand that a two-dimensional slice captured at the **tip end** of *Wills*'s **master key**, would represent substantially a **tip end** view of the **master key** as seen by the **camera**. Basham, ¶83.

To the extent *Wills* does not explicitly teach or suggest substantially a **tip end** view, *Cimino* teaches this. Like *Wills*, *Cimino* discloses a “system for identifying and matching key blanks when duplicating an original key.” *Cimino*, Abstract. *Cimino*'s system includes “a key holder subsystem 10, a lensing subsystem 30, a video subsystem 50, a digitizing subsystem 70, a computer subsystem 90, and an output subsystem 110.” *Id.*, 3:3-7. *Cimino*'s “lensing subsystem 30 illuminates the front 2 of the key 1 forming a cross-sectional image 35 thereof” and “video subsystem 50 converts the image 35 into an electrical signal which the digitizing subsystem 70 converts into a digital image.” *Id.*, 3:8-12, Figure 12.



Cimino, Figure 12 (annotated); Basham, ¶ 84.

Cimino explains the “output of the lensing subsystem 30 is an end-on cross-section image 35 [e.g., **tip end** image] of the front 2 of the **key 1**” as illustrated in Figure 14. *Id.*, 4:18-20.



FIG. 14

Cimino, Figure 14 (annotated); Basham, ¶85.

A POSA would have been motivated and found it obvious to modify *Wills*’s machine to obtain a substantially **tip end** view of the **master key** as taught by *Cimino*. Basham, ¶86. A POSA would have understood the tip end view “provides the distinctive features,” which may be used to distinguish between different types of key blanks. *Cimino*, 2:55-56; Basham, ¶86. A POSA would have also understood that a two-dimensional slice in *Wills* may not accurately represent the

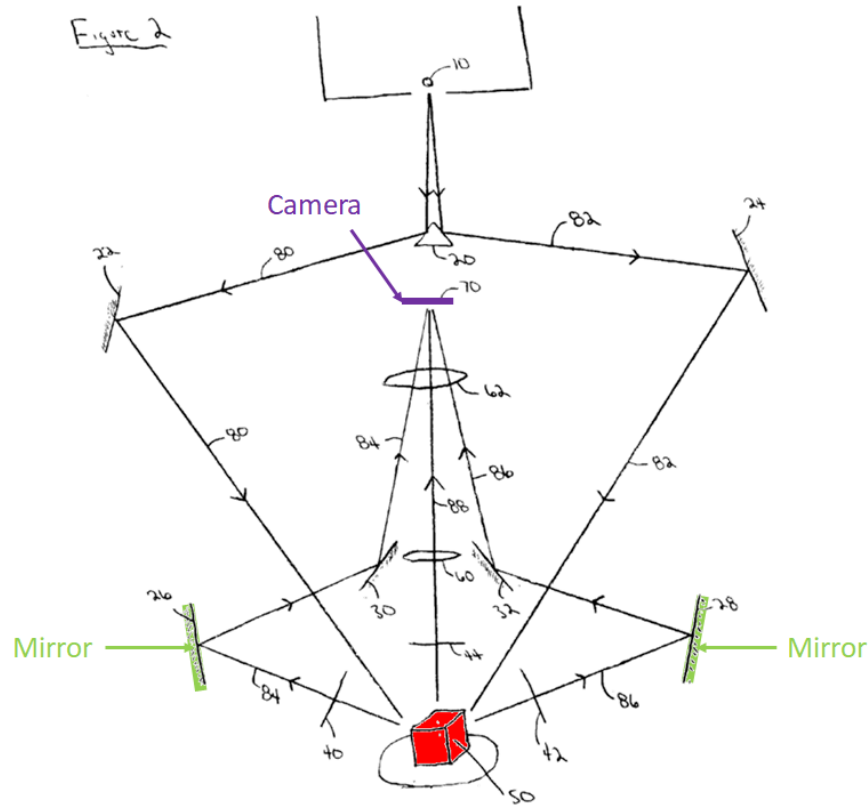
groove geometry of the **master key**, for example, when the groove includes debris, is damaged, or when the **master key** is bent at the location of that slice. *Id.* A POSA would have recognized that in such cases, an image showing the **tip end** view of the **master key** taught by *Cimino* would provide a more accurate representation of the geometrical characteristics of the groove of the **master key**. *Id.* Further, a POSA would have recognized that comparing the **tip end** view taught by *Cimino* with tip end views of known key blanks would have allowed *Wills's* machine to confirm whether a correct key blank was identified by *Wills's* logic using the two-dimensional image slices. *Id.*, ¶88.

A POSA would have also recognized that the **tip end** view of *Cimino* would simultaneously provide both the top and bottom views of the milling on the **master key**. Basham, ¶87. This would eliminate the need to manually flip the **master key** to obtain images of both sides, helping to further automate *Wills's* machine, reducing the time required to identify a key blank. *Id.* A POSA would, therefore, have been motivated to modify *Wills's* machine to additionally obtain a **tip end** view of the **master key** as taught by *Cimino* to realize the advantages of improved automation, accurate **contour** geometry determination, and/or the ability to confirm that the correct key blank has been identified by *Wills's* machine. *Id.*, ¶¶87-88.

A POSA would have found such a modification obvious because it would have involved nothing more than the use of a known technique—obtaining a **tip**

end view of the master key taught by *Cimino*—to improve a similar device—*Wills*’s key regenerating machine—in the same way, namely, by providing an additional image for use in determining a key blank corresponding to a master key. Basham, ¶89.

Wills and *Shirley* teach obtaining a tip end view using a mirror. *Shirley* discloses an “image 84 formed by radiation reflected from the first surface of the object 50 is directed to a second mirror 26, which transmits the radiation to a third mirror 30 [that] directs the image 84 to the detector 70.” *Id.* ¶[0024]. *Shirley* discloses that its “detector 70 is typically a CCD.” *Id.*, ¶[0022]. A POSA would have understood that *Shirley*’s CCD (e.g., charge coupled device) is a camera. Basham, ¶90. *Shirley* also discloses an “image 86 formed by radiation reflected from a second surface of the object 50 is directed to a fifth mirror 28, which transmits the radiation to a sixth mirror 32 [that] directs image 86 to the detector 70.” *Id.*, ¶[0025]. As illustrated in Figure 2, below, *Shirley*’s detector 70 obtains images of different sides of object 50 using mirrors 26 and 28.



Shirley, Figure 2 (annotated); Basham, ¶90.

A POSA would have understood from *Shirley* that if **object 50** were a **key** with the tip end pointing towards **mirror 26**, **detector 70** (e.g., **camera**) of *Shirley* would have obtained an image of a **tip end** view of **object 50** (e.g., **key**) using a **mirror** (e.g., **mirror 26**). Basham, ¶91. A POSA would also have been motivated and found it obvious to further modify *Will's* machine as modified by *Cimino* to include one or more mirrors as taught by *Shirley* to obtain images of the **tip end** of a **master key**. *Id.* Doing so would have eliminated the need to relocate *Will's* camera to obtain the **tip end** image, to use a different camera (e.g., a camera pointing at the **tip end** as taught by *Cimino*), and/or to move the position of the

master key relative to the camera to obtain the different images. *Id.* A POSA would have recognized that eliminating the need for camera relocation, additional cameras, or key movement would have simplified the construction of *Wills's* machine, and helped to reduce the size of *Wills's* machine. *Id.*; *Wills*, 7:45-50. Accordingly, a POSA would have been motivated to implement the one or more mirrors taught by *Shirley* in *Wills's* machine as modified by *Cimino* to capture an image of the **tip end view** of the **master key**. Basham, ¶91.

A POSA would have found such a modification obvious because it would have involved nothing more than the use of a known technique—*Shirley's* mirror—to improve a similar device—*Wills's* key regenerating machine modified by *Cimino*—in the same way, namely, by allowing *Wills's* camera to capture images representing views of different sides of a **master key**. Basham, ¶92.

Given the similarities between *Wills's* and *Cimino's* machines, modifying *Wills's* machine to additionally obtain a tip end image as taught by *Cimino* would have been within the skill of the POSA and yielded nothing more than predictable results. *Id.*, ¶93. Likewise, given that use of mirrors was well-known in the art, adding a mirror taught by *Shirley* in *Wills's* machine as modified by *Cimino* to obtain the tip end image would also have been within the skill of the POSA and yielded nothing more than predictable results. *Id.* A POSA thus would have had a reasonable expectation of success in making these modifications. *Id.*

Wills discloses determining “characteristics of said contour based on image data from at least two or more views of said master key” in two ways: (i) by determining depth measurements of the groove contour based on two or more two-dimensional slices captured of the master key; and (ii) by extracting depth measurements of the groove contour based on images of both sides of the master key. Basham, ¶¶94-96.

Regarding (i), as explained for claim 1[b], *Wills* describes using the “means for obtaining surface information” of its computer subsystem to “extract[] depth measurements” for the master key from the image data. *Wills*, 31:44-47, 32:1-2, 37:11-19; *id.*, 37:20-39:1 (discussing pseudocode for extracting depth measurements). Each two-dimensional slice is a “view[] of said master key” because each is taken “along the length of the key.” *Wills*, 15:34-50, Figure 8. *Wills* describes determining the depth measurements for “each lengthwise slice of the key”—that is, each two-dimensional slice by “loop[ing] through each slice.” *Wills*, 38:22-24, 38:39-39:9 (pseudocode step [4310], stating “Loop through each slice lengthwise ...”); Basham, ¶95. Moreover, because *Wills* discloses determining depth measurements by looping through multiple two-dimensional slices, *Wills* discloses determining characteristics of said contour based on image data from at least two or more views of said master key. *Id.*

Regarding (ii), *Wills* discloses that, in some embodiments, the machine

“prompts the operator to remove the **master key** from the [machine] and flip it over so that the milling on the reverse side can be scanned and used in the identification process.” *Wills*, 15:26-30. *Wills* explains that the reverse side would be scanned when “one side milling comparison” is insufficient to identify a reference key. *Id.*, 15:30-33. A POSA would have understood *Wills* as disclosing that the **groove geometry** of the reverse side of the **master key** would be used to identify a key blank if the **groove geometry** of the top side of the **master key** alone was insufficient to do so. Basham, ¶96. A POSA would have further understood that to determine the **groove geometry** of the reverse side of the **master key**, *Wills*’s computer subsystem would likewise analyze captured images of the “reverse side” of the **master key** to determine **depth measurements** of the milling on the “reverse side” of the **master key** based on the **surface information**. *Id.*

Wills also discloses “calculat[ing] the geometry of the **contour** based on” this “data from at least said two or more views of said **master key**” because *Wills* envisions its computer subsystem (the claimed “logic”) determining these **depth measurements** of the **surface information**—either for the two-dimensional slices that make up the three-dimensional image or for images of both sides of the **master key**, as explained above. Basham, ¶¶97-103.

As explained for claim 1[a], *Wills*’s camera obtains the two-dimensional images by illuminating the **master key** using a light beam LB. *Wills*, 15:40-50.

Wills discloses that its “light beam LB is energized and directed onto a selected portion of the master key at an angle θ .” *Id.*, 12:32-34. *Wills* recognizes “the light beam LB is inclined at an angle θ less than ninety degrees (90°)” to the blade of the master key, with the result that “the point of intersection with the key surface will vary in the direction of the length of the key ($\Delta\ell$), which is a function of the depth (Δd) of the milling pattern at that point,” namely, $\Delta d = (\Delta\ell)(\tan \theta)$. *Wills*, 12:55-65.

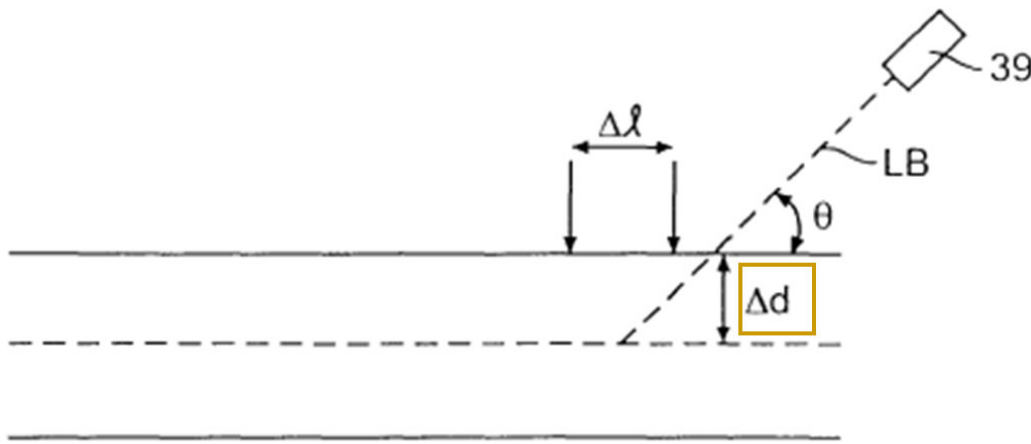
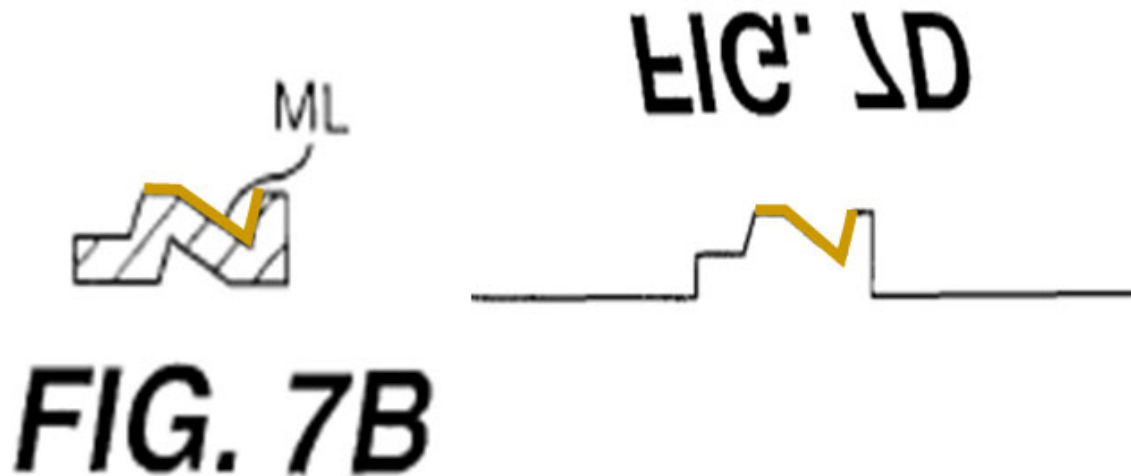


FIG. 10A

Wills, Figure 10A (annotated); Basham, ¶100.

Accordingly, “[t]he intersection of the light beam line and the key surface are extracted to determine depth of milling across the key, which is shown in a simplified form in FIG[. 7D.” *Wills*, 13:1-3. Moreover, as explained for claim 1[a], the “intersection of the light beam line and the key surface” corresponds to the cross-section of the master key. *Wills*, Figs. 7B, 7D; Basham, ¶102.



Wills, Figure 7B (annotated) and Figure 7D (cropped, vertically flipped, and annotated); Basham, ¶102.

A POSA would have understood from the above comparison that by calculating the **depth** of the milling, *Wills* discloses calculating “the geometry of the **contour**” of the milling in the **master key**. Basham, ¶103. The geometry of the **contour** in the ’385 patent, like the **depth** of the milling in *Wills*, is a geometry of the groove. *Id.*; ’385 patent, 5:37-38, Figure 3; *see also id.*, Figure 6 (showing “**contour** data related to **contours** of the groove” in Figure 3), Figure 7 (showing calculated “groove **contours**”); 4:64-66 (describing “geometric parameters of a given groove” including “size, location, angle, and other”), 5:64 (describing “groove geometry”).

It would have also been obvious for the modified *Wills* logic to determine characteristics of the contour and calculate the geometry of the contour based on

data from a **tip end** image taught by *Cimino* and as obtained using mirrors taught by *Shirley*. Basham, ¶¶104-106. *Wills* discloses determining dimensions such as length, and width using a silhouette image by indexing pixels of that image. *Wills*, 34:46-35:5 (“[C]alculating the length of the key from the head to tip and ... calculat[ing] the width of the key at specified intervals.”); *see also id.*, 35:6-37:8. A POSA would have found it obvious to use similar techniques to extract **depth measurements** of the groove from the **tip end image** obtained by *Wills*’s machine as modified by *Cimino*. Basham, ¶105; *see also Bass*, ¶¶[0060]-[0062], [0065]. A POSA would have been motivated to do so because as discussed above the tip end image may provide a more accurate representation of the groove **contour**. Basham, ¶105. A POSA, thus, would have found it obvious for the modified *Wills* logic to determine characteristics of the contour and calculate the geometry of the **contour** based on the two-dimensional slices, based on images of both sides of the **master key**, and/or using the tip end image as taught by *Cimino* and *Shirley*, and would have had a reasonable expectation of success in doing so. *Id.*, ¶¶105-106.

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

Wills discloses this additional feature because *Wills* describes the computer subsystem (the claimed “logic”) storing the “surface information” for the reference keys, which includes, the **depth measurements of the reference keys**, in “a memory

means such as a database.” *Wills*, 32:49-59 (“The surface information consists of depth measurements across the width of the key.”); *see also id.*, 33:37-34:35.

Basham, ¶¶108-109.

3. Claim 3: The key identification system of claim 1, wherein said imaging system includes a reflecting device.

Wills discloses this additional feature because *Wills*’s machine employs a “mirror 29” that “reflects the image [of the master key] to the camera 28.” *Wills*, 7:47-48, Figure 9; Basham, ¶110.

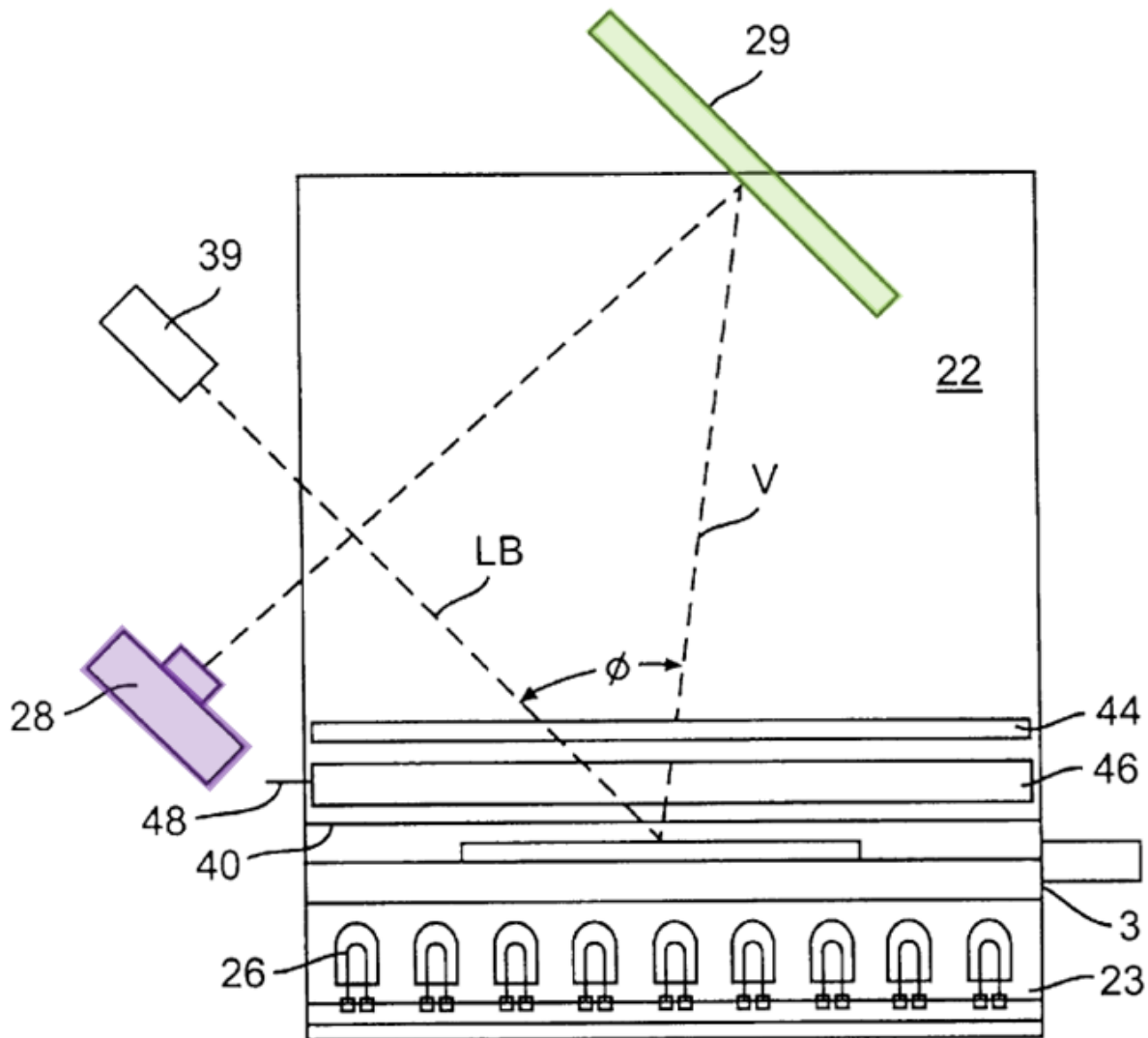


FIG. 9

Wills, Figure 9 (annotated); Basham, ¶110.

4. **Claim 4: The key identification system of claim 1, wherein said *imaging system* includes a *light*.**

Wills discloses this additional feature because *Wills*'s machine employs a "*light emitting means*." *Wills*, 11:48-63, Figure 9; Basham, ¶¶111-112.

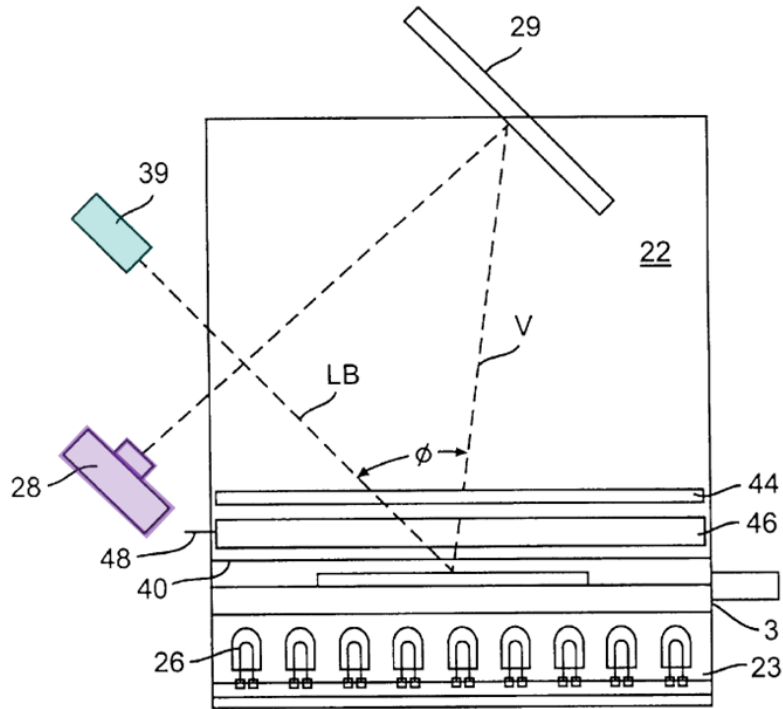


FIG. 9

Wills, Figure 9 (annotated); Basham, ¶111.

Alternatively, *Wills* discloses this additional feature because *Wills*'s machine employs an “array of LEDs 26.” *Wills*, 6:65-7:3, Figure 9; Basham, ¶112.

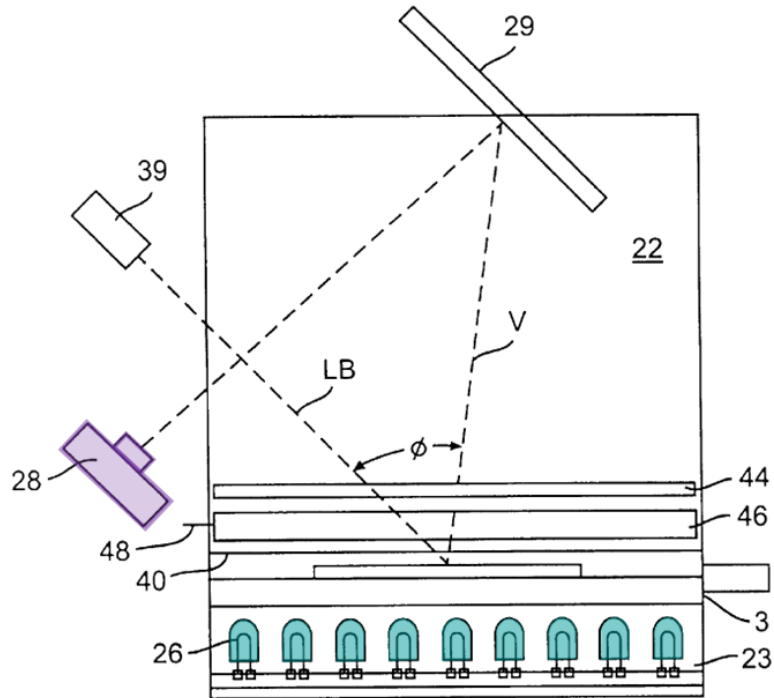


FIG. 9

Wills, Figure 9 (annotated); Basham, ¶112.

5. **Claim 5: The key identification system of claim 4, wherein said light is directed toward said reflecting device.**

Wills discloses this additional feature because, as Figure 9 shows, the light is “directed toward” the mirror when reflected off the master key and before being captured by the camera. Basham, ¶113.

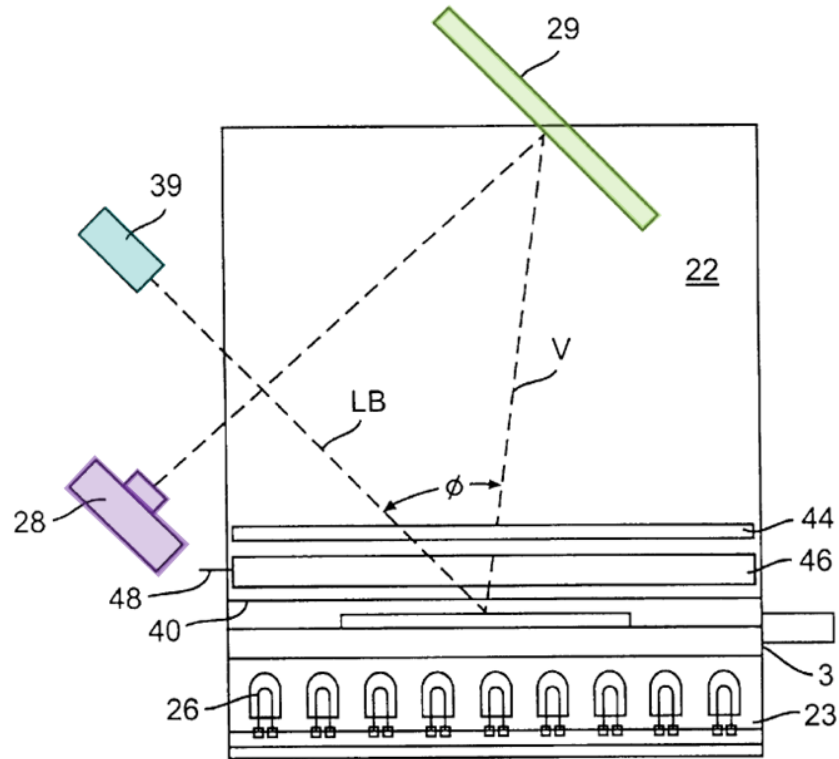


FIG. 9

Wills, Figure 9 (annotated); Basham, ¶113.

Alternatively, as *Wills*'s Figure 9 shows, the array of LEDs is "directed toward" the mirror. Basham, ¶114.

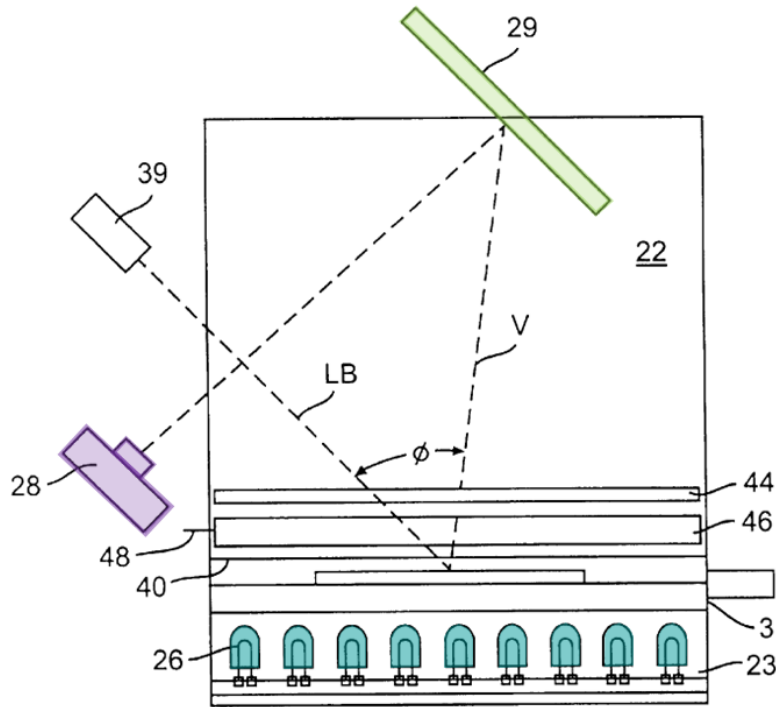


FIG. 9

Wills, Figure 9 (annotated); Basham, ¶114.

6. Claim 7: The key identification system of claim 1, wherein said captured **image is a digital image.**

Wills discloses this additional feature because *Wills*'s camera "captures the **image** of the master key and converts it into an electrical signal, which [a] digitizing means, or digitizing subsystem, converts into a digital image." *Wills*, 8:10-13; *see also id.*, 8:46-54 (describing using "digitizing means," "digitizing subsystem," and a "digital camera" for "the image of the light beam interfacing with the ... master key"), 12:40 ("the **image** of the light beam LB is captured and digitized"); 14:66-15:2 ("the digitized image of the light beam LB"). A POSA would have understood that the **two-dimensional slices** captured along the length

of the key and the **three-dimensional representation** formed by stacking those slices are “digital image[s].” Basham, ¶115.

7. **Claim 10: The key identification system of claim 1, wherein said logic accounts for tilting of said **master key** with respect to said imaging system to determine **characteristics** of said **contour**.**

Wills discloses this additional feature. Basham, ¶¶116-119. A POSA would have understood “tilting” in the ’385 patent to encompass in-plane movement of the **master key**. Basham, ¶117; ’385 patent, 7:18-20 (“With reference to FIG. 14, the key may be tilted or yawed in a plane perpendicular to the orientation of the outline camera 20.”). The ’385 patent accounts for tilting so that “[t]he **key**[] is not constrained to a particular orientation or position.” ’385 patent, 7:17-18.

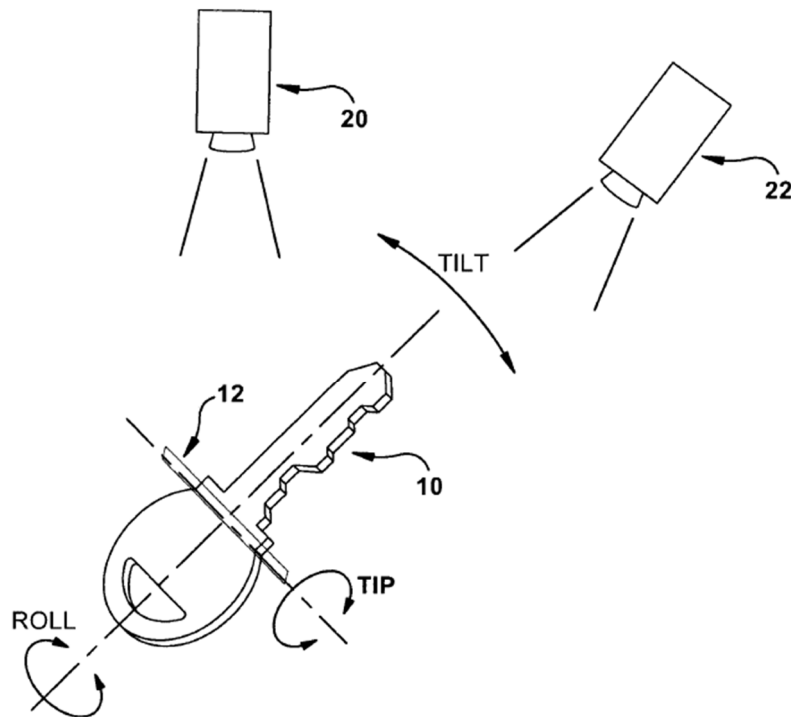


FIG. 14

'385 patent, Figure 14.

Similarly, *Wills* discloses “[t]he image” of the **master key** “is converted by translating ... to a predetermined reference position and orientation, independent of the position at which the key is placed in” the machine. *Wills*, 9:35-38. A POSA would have understood *Wills*’s “translating” as describing in-plane movement of the **master key** corresponding to the claimed “tilting.” Basham, ¶118. *Wills* explains this translating allows the “key information” of the **master key**, including the extracted **depth measurements**, to be “standardized to be comparable to” the reference key information. *Wills*, 9:38-43. Thus, *Wills*’s machine, like the

'385 patent, "does not require the master key to be precisely aligned to operate efficiently." *Id.*, 7:29-31; Basham, ¶118.

8. Claim 13: The key identification system of claim 1, wherein said logic calculates the geometry of the contour as seen from a view of the tip parallel to the blade based on data from at least said two or more views of said master key.

Wills in view of *Cimino* and *Shirley* teaches this additional feature. Basham, ¶¶120-129. As explained for claim 1[c], *Wills* discloses "said logic calculates the geometry of the contour ... based on image data from at least said two or more views of said master key." *Id.*, ¶120. As also explained for claim 1[c], *Wills* discloses that at least one two-dimensional slice taken at the tip end of the master key represents a view of the tip parallel to the blade. *Id.* And as explained there, *Wills*'s logic calculates "the geometry of the contour based on" the tip end image (e.g., two-dimensional slice at the tip). *Id.*, ¶121-125; *Wills*, 12:55-65. Thus, *Wills* discloses the features of this claim because *Wills* discloses its computer subsystem determining depth measurements of the surface information based on (i) at least two or more of the two-dimensional slices that make up the three-dimensional image or (ii) on images captured of both sides of the master key, and *Wills* further discloses calculating, from those captured images, the depth of the milling in the master key as seen from a view of the tip parallel to the blade. Basham, ¶126.

Further, as explained for claim 1[c], a POSA would have found it obvious to capture a tip end view as taught by *Cimino*, using one or more mirrors as taught by

Shirley in *Wills*'s machine. Basham, ¶¶127-128. A POSA would have understood that the **tip end** view would represent a view of the **tip** parallel to the **blade**. *Id.*, ¶127. Further, as explained for claim 1[c], a POSA would have found it obvious to use the techniques described in *Wills* for determining dimensions to calculate the geometry of the **contour** from the **tip end** image as taught by *Cimino*. *Id.*, ¶128. As also explained for claim 1[c], a POSA would have been motivated to do so to realize the advantages of improved automation, accurate **contour** geometry determination, and/or the ability to confirm the **contour** geometry or the identified key blank, using the **tip end** view that represents a view of the **tip** parallel to the **blade**. *Id.*

9. Claim 14: The key identification system of claim 1, wherein said logic calculates the geometry of the **contour as though the **tip** were squarely cut based on data from at least said two or more views of said **master key**.**

As explained for claims 1[c], *Wills* discloses its computer subsystem (the claimed “logic”) “calculates the geometry of the **contour** based on data from at least said two or more views of said **master key**” because *Wills* envisions determining these **depth measurements** of the **surface information** for the two-dimensional slices that make up the three-dimensional image. Basham, ¶¶130-135. *Wills*'s computer subsystem “calculates the geometry of the **contour** as though the **tip** were squarely cut” because at least one of the two-dimensional slices, taken along the length of the **master key**, is taken “as though the **tip** were squarely cut.”

Basham, ¶130.

Because in *Wills* the two-dimensional slices are captured “along the length of the **key**,” *Wills*, 15:34-42, a POSA would have recognized at least one of those slices would be at a position where the **tip** has not yet begun to taper, that is, “as though the **tip** were squarely cut.” Basham, ¶131. Such a position is illustrated by the **dotted line** added to Figure 1A of *Wills*, below. *Id.* A POSA would have recognized that calculating the geometry of the **contour** at such a position avoids impact of the tapering on the “**characteristics** of said **contour**.” *Id.* Accordingly, *Wills* discloses the features of claim 14 because *Wills* discloses calculating the geometry using such a two-dimensional slice. *Id.*, ¶¶131-132.

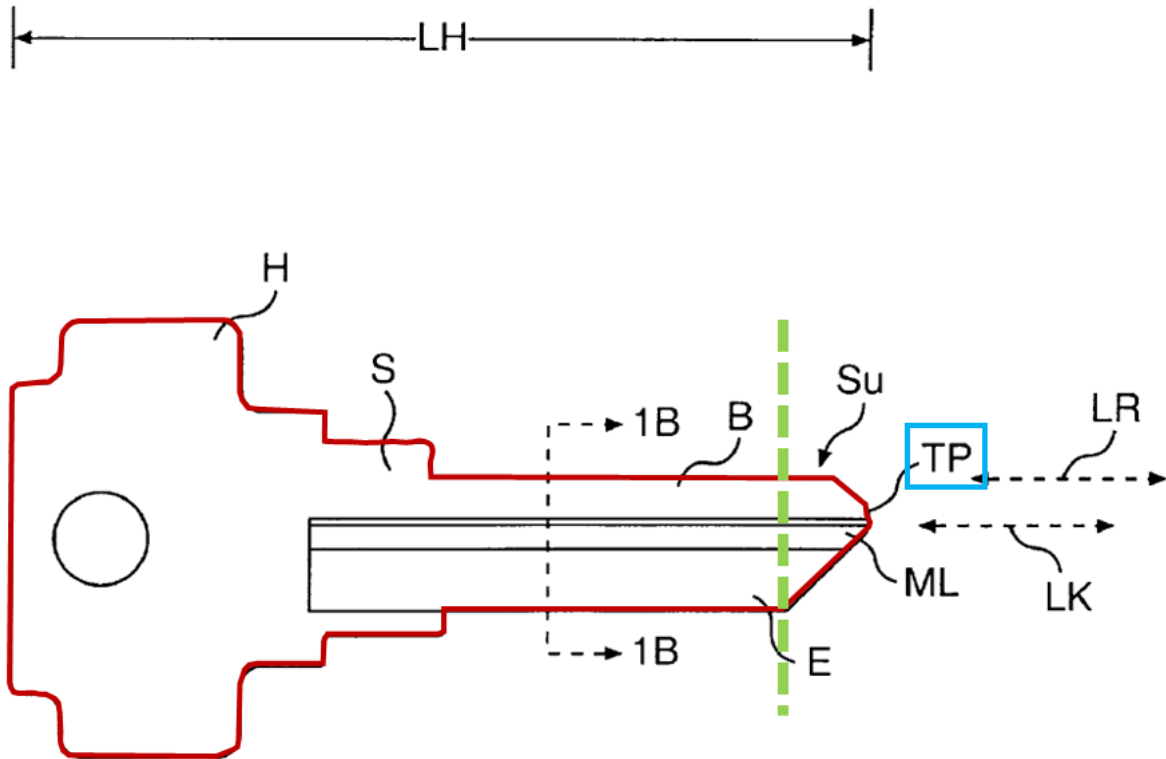


FIG. 1A

Wills, Figure 1A (annotated); Basham, ¶131.

As explained for claim 1[c], a POSA would have found it obvious to capture a **tip end** view as taught by *Cimino*, using one or more mirrors as taught by *Shirley* in *Wills*'s machine. Basham, ¶134. A POSA would have understood that the **tip end** view would represent a view of the master key as though it were squarely cut. *Id.* Further, as explained for claim 1[c], a POSA would have found it obvious to use the techniques described in *Wills* for determining dimensions to determine depth information from the tip end image as taught by *Cimino*. *Id.* A POSA would

have been motivated to do so to realize the advantages of improved automation, accurate **contour** geometry determination, and/or the ability to confirm the **contour** geometry or the identified key blank, using the view of the **tip** parallel to the **blade**.

Id.

10. Claim 15: The key identification system of claim 1 further comprising a key holder configured to hold said **master key.**

Wills discloses this additional feature because *Wills*'s machine includes a "supporting means," namely a "drawer 30," having "a bottom 32 against which one side of the **master key** is disposed." *Wills*, 7:4-8; 11:44-46 ("the **master key** remains on the supporting means, specifically on the drawer 30" during the surface information analysis). *Wills*'s drawer is consistent with the "key holder" as described in the '385 patent, namely, as "any device capable of holding or supporting a master key." '385 patent, 3:67-4:1; Basham, ¶136.

11. Claim 16: The key identification system of claim 15, wherein said key holder includes a lower support.

Wills discloses this additional feature because *Wills*'s "supporting means" for the **master key** has "a bottom 32 against which one side of the **master key** is disposed." *Wills*, 7:4-8; 11:44-46; Basham, ¶137. The bottom 32 of *Wills* corresponds to the claimed "lower support." *Id.*

12. **Claim 20:** The key identification system of claim 1, wherein one of said views of said **master key** includes a view from an **angle** between perpendicular and parallel to the **blade** of said **master key** and not including perpendicular or parallel to the **blade** of said **master key**.

Wills teaches this additional feature. *Wills*'s machine captures an image of [the] **master key** at a range of angles, including the claimed "**angle**." Basham, ¶¶138-149.

Wills's machine captures an image of "the side of the **master key** ... along a viewing axis V." *Wills*, 11:66-12:1, Figure 9. *Wills* envisions a range of angles for the viewing axis V, including an **angle** between perpendicular and parallel to the side of the **master key**. Basham, ¶139.

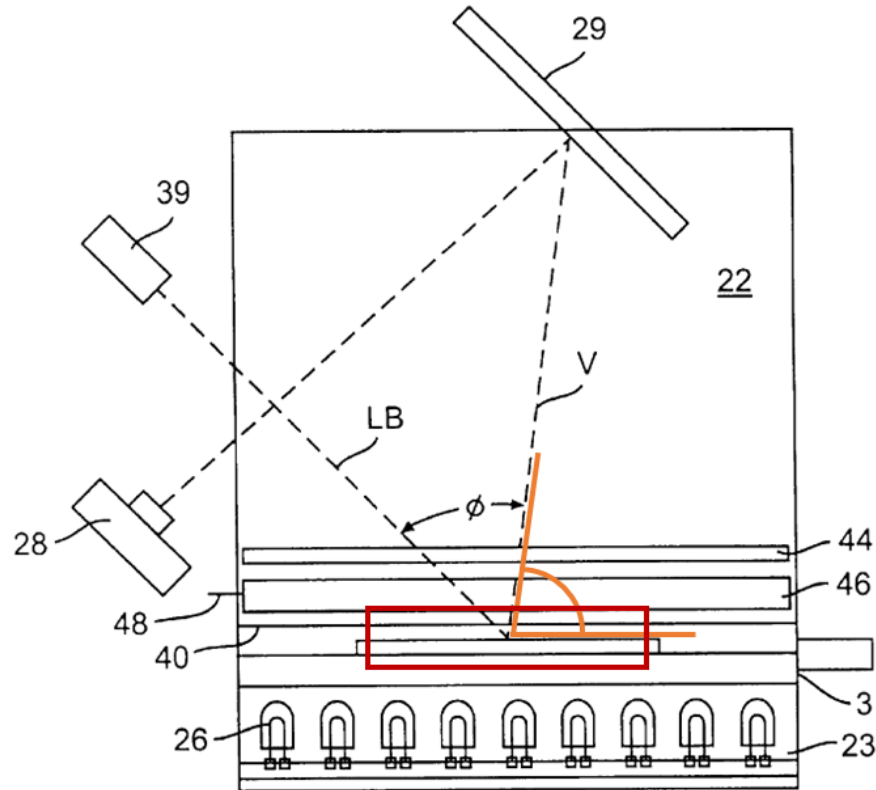


FIG. 9

Wills, Figure 9 (annotated); Basham, ¶139.

Wills discloses laser beam LB strikes the master key at an angle “ten to eighty degrees (10° - 80°)” relative to the side “of the master key,” and angle Φ between the laser beam LB and the viewing axis V is “sixty degrees (60°).” *Wills*, 12:12-25, Figure 9. Thus, as illustrated below, *Wills* contemplates, for example, an angle of 50° relative to the side of the master key at which the laser beam LB strikes the master key, and an angle Φ of 60° , such that the angle between the viewing axis V and the side of the master key is 70° . *Id.*; Basham, ¶140. A POSA would have recognized that the side of *Wills*’s master key is co-planar with “the

blade of the master key,” such that the angle between the viewing axis V and the side of the master key is likewise the angle between the viewing axis V and “the blade of the master key.” Basham, ¶¶141-142; *see, e.g., Wills*, Figures 7A, 7B, 7D; 5:11-24, 5:56-59, 7:5-8, 11:44-49. Because the 70° angle between the viewing axis V and the blade of the master key is between perpendicular (90°) and parallel (0°) to the blade of the master key, a POSA would have understood that *Wills* discloses or renders obvious that this angle is “between [and not including] perpendicular and parallel to the [side] of said master key.” Basham, ¶¶143-144. *Titanium Metals Corp. v. Banner*, 778 F.2d 775, 782 (Fed. Cir. 1985) (A claimed range is anticipated “if one of [the values in the range] is in the prior art.”); Basham, ¶145.

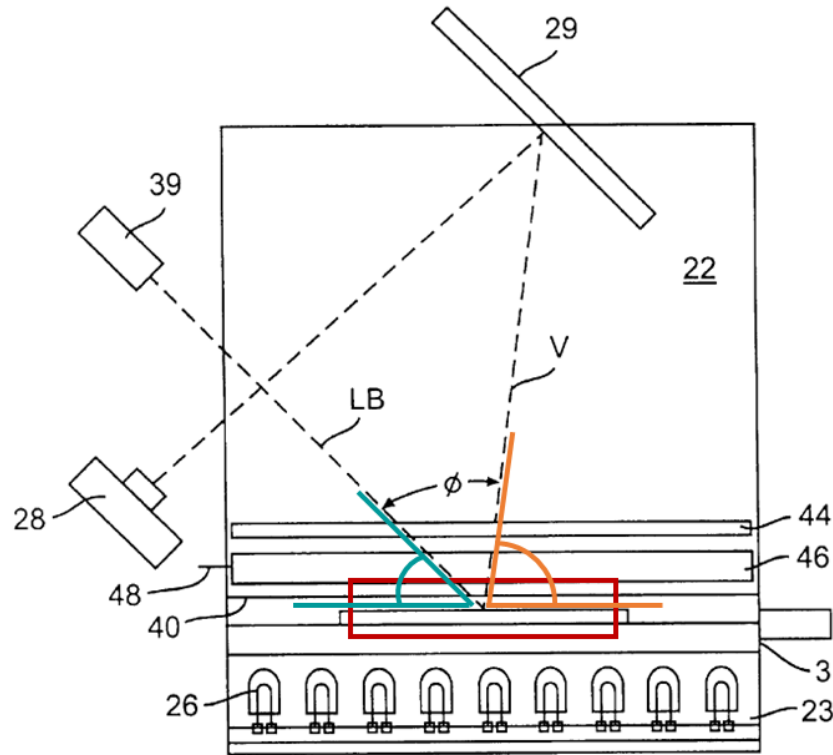


FIG. 9

Wills, Figure 9 (annotated); Basham, ¶144.

Moreover, “where there is a range disclosed in the prior art, and the claimed invention falls within that range, there is a presumption of obviousness.” *Iron Grip Barbell Co. v. USA Sports, Inc.*, 392 F.3d 1317, 1322 (Fed. Cir. 2004). This presumption is only overcome where (1) “the prior art taught away from the claimed invention” or (2) “there are new and unexpected results relative to the prior art,” *id.*, neither of which is the case here. Basham, ¶146.

Regarding (1), *Wills* does not teach away from “an **angle** between perpendicular and parallel to the **blade** of said **master key**.” Basham, ¶147. Rather

Wills recognizes the value of such an **angle**, noting placing the camera somewhere other than directly overhead the key (e.g., a viewing axis V perpendicular to the **master key blade**) can require a larger machine to accommodate the camera's focal length. *Wills*, 7:39-50; Basham, ¶147. *Wills*, therefore, proposes employing mirror 29 "to minimize the size of the machine." *Wills*, 7:47-50, Figure 9. *Wills*'s mirror configuration is consistent with how the "imaging system" and the "**angle**" are used together in the '385 patent "to allow a single camera at a remote position to capture multiple **angles** of the master key, including **angles** of the tip 14." '385 patent, 5:45-48; Basham, ¶147.

Regarding (2), capturing the image at "an **angle** between [and not including] perpendicular and parallel to the **blade** of said **master key**" does not create any "new and unexpected results" not recognized by *Wills*. Basham, ¶148. Rather, *Wills*, like the '385 patent, recognizes that the angle at which the image is captured must be selected to ensure surface information about the **master key** can be discerned. *Compare Wills*, 12:4-8 ("If the viewing axis V and the light beam LB were parallel, then the segment would appear linear and no information would be easily obtained about the surface of the key.") *with* '385 patent, 5:15-18 ("[N]either overhead scanning of the groove 11 nor parallel scanning of the groove 11 provide sufficient contrast between the groove 11 and the rest of the key 10 to effectively determine certain parameters of the groove 11."); Basham,

¶¶148-149. Thus, *Wills* teaches the features of claim 20.

13. **Claim 21: The key identification system of claim 1, wherein the captured image of said tip includes a contour of a groove in said master key.**

As explained for claim 1[a], *Wills* discloses “captur[ing] an image of the tip of a master key,” and that the “image includes a contour.” *Wills*’s master key includes the blade in which is formed the milling in the blade. *Wills*, 5:22-24, 5:56-59. The milling of the master key in Figure 7A has particular “surface information,” such as a “depth,” as shown in Figure 7B, which is a cross-section of Figure 7A. *Wills*, 5:61-65, 11:59-63.

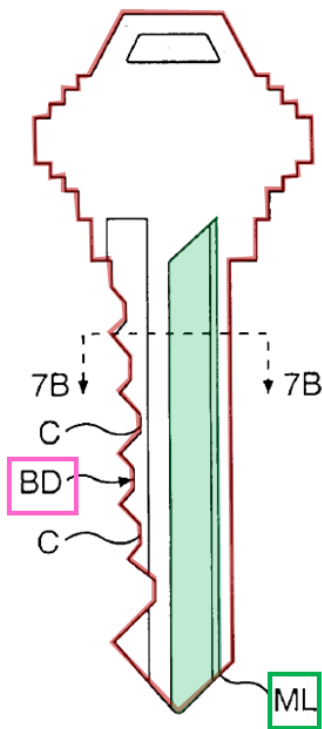


FIG. 7A

Wills, Figure 7A (annotated); Basham, ¶151.

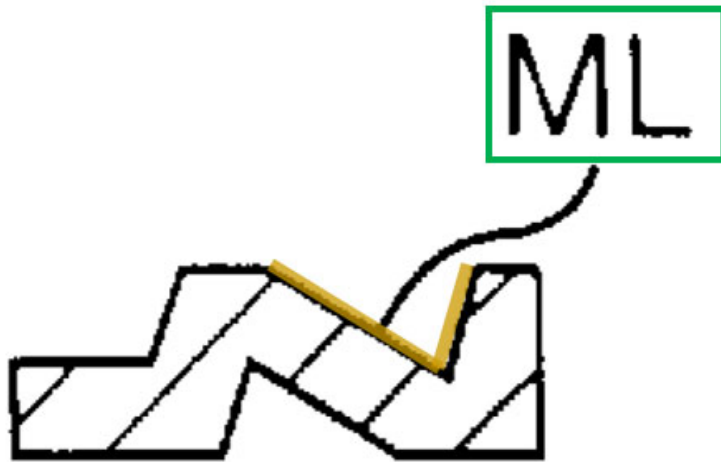


FIG. 7B

Wills, Figure 7B (annotated); Basham, ¶152.

Thus, *Wills* discloses that the “contour” in the captured image is “a contour of a groove in said master key” because the image—whether the two-dimensional slice captured at the tip of the master key or the three-dimensional representation that includes the tip—includes surface information, including a depth, of the milling in the master key. Basham, ¶¶150-152. For reasons similar to those discussed for claim 1[a], a POSA would have understood the surface information, such as the depth, of the milling of *Wills*’s master key to be a “a contour of a

groove in said master key.” Basham, ¶153.

14. **Claim 22: The key identification system of claim 1, wherein the logic is configured to shift data related to said characteristics of said contour to compare with said known key blank characteristics.**

Wills discloses this additional feature because *Wills* describes its computer subsystem (the claimed “logic”) “translating” the image data of the captured image—from which the depth measurements of the surface information are determined—to facilitate comparison with the depth measurements for the reference keys. Basham, ¶¶154-156.

In *Wills*, the captured image data is “converted” by the computer subsystem “by translating ... to a predetermined reference position and orientation, independent of the position at which the key is placed” in the machine. *Wills*, 9:35-38. A POSA would have understood such translating of the captured image data to be synonymous with “shift[ing] data related to said characteristics of said contour.” Basham, ¶155. Moreover, the depth measurements (which disclose “said characteristics of said contour,” as explained for claim 1[b]) are determined from the translated captured image data. *Id.* Further, a POSA would have understood from *Wills* that such translating is done “to compare with said known key blank characteristics” because *Wills* explains that, through such translating, “key information is standardized to be comparable to other key data in [the] memory subsystem,” which *Wills* explains includes the “depth measurements across the

width of the [reference] key.” *Id.*; *Wills*, 9:38-40, 32:58-59; *see also id.*, 15:2-5.

15. **Claim 23:** The key identification system of claim 1, wherein said logic includes a tolerance range for each **characteristic** of said **master key** to determine whether a master key passes or fails to match a known key blank.

Wills discloses this additional feature. Basham, ¶¶157-160. As explained for claim 1[b], *Wills*’s computer subsystem, shown in Figure 23, includes “means for obtaining **surface information** 2375” that “extracts **depth measurements**” for the **master key** and a “light beam elimination means 2395” that compares the **depth measurements** for the **master key** with the **depth measurements for the reference keys**. *Wills*, 31:44-47, 32:1-2, 37:16-19.

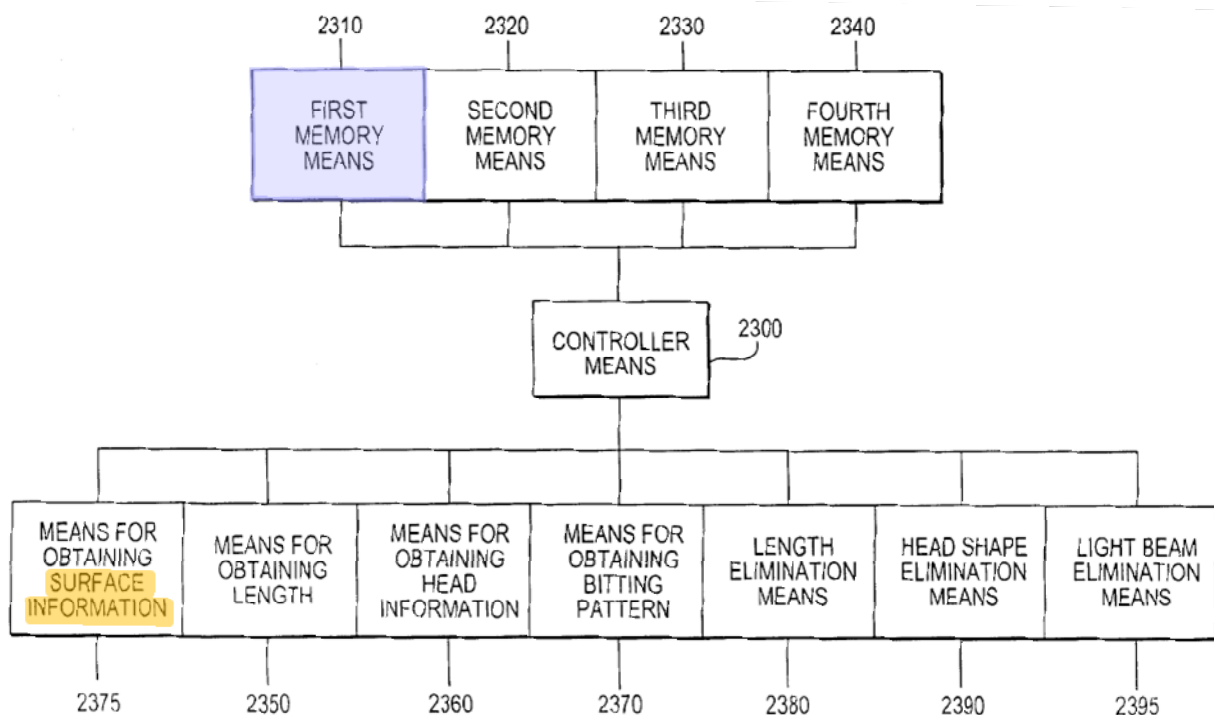


FIG. 23

Wills, Figure 23 (annotated); Basham, ¶158.

Wills explains the light beam elimination means “eliminates reference keys that deviate more than a desired value when compared with the master key.” *Wills*, 15:6-12. Because *Wills* discloses eliminating reference keys based on the “desired value” of deviation between the **depth measurements** of the **master key** and the **reference keys**, a POSA would have understood *Wills*’s “desired value” to be “a tolerance range” for the **depth measurements** that *Wills*’s machine uses “to determine whether a **master key** passes or fails to match a known **key blank**.” Basham, ¶159.

16. Claim 24

Wills in view of *Cimino* and *Shirley* renders obvious claim 24. Basham, ¶161

a. 24[p] A key identification system comprising:

If this preamble is limiting, as disclosed in claim 1[p], *Wills* discloses it.

Basham, ¶ 162.

b. 24[a] an imaging system including a **camera in a first position configured to directly capture at least one **image** of one side of a **master key**, wherein said **image** includes a **contour**;**

As discussed in claim 1[a], *Wills* discloses this limitation. Basham, ¶163.

Wills discloses “**camera** 28 can be mounted vertically over the drawer 30” (*Wills*, 7:41-42) and configured to directly (e.g., without the use of a mirror) capture at least one **image** of one side (e.g., side facing camera 28) of the **master key**. *Id.*, Figure 8.

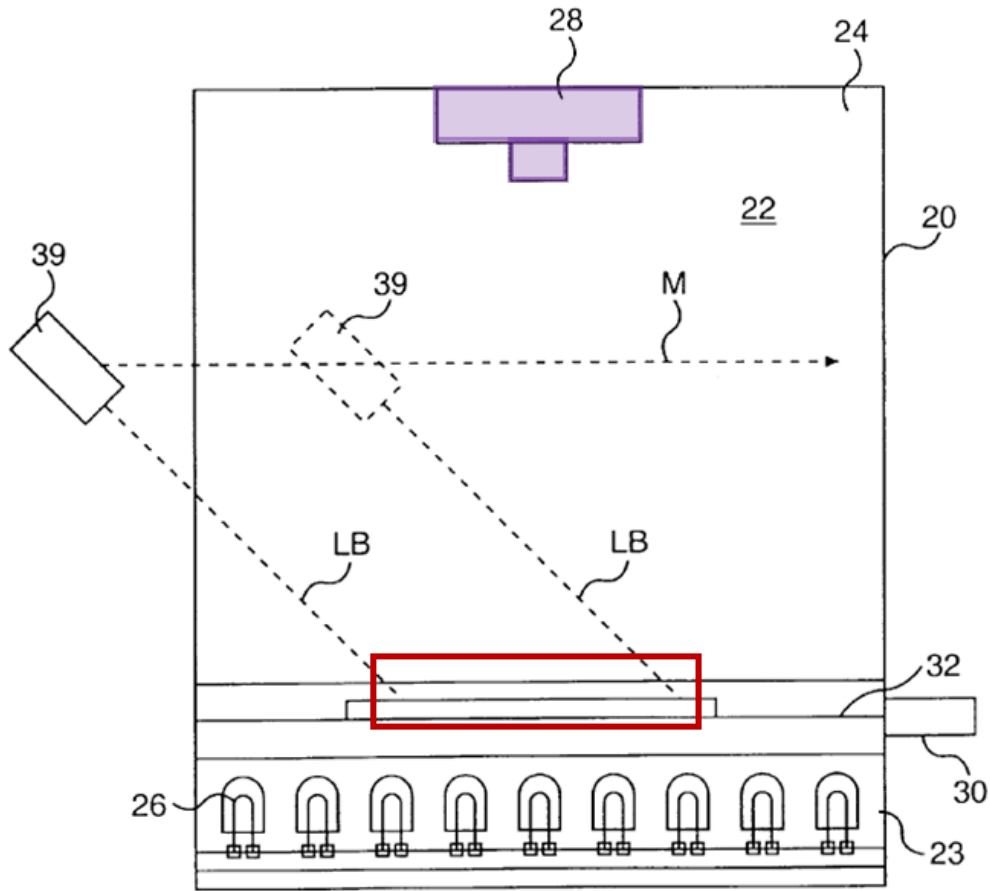


FIG. 8

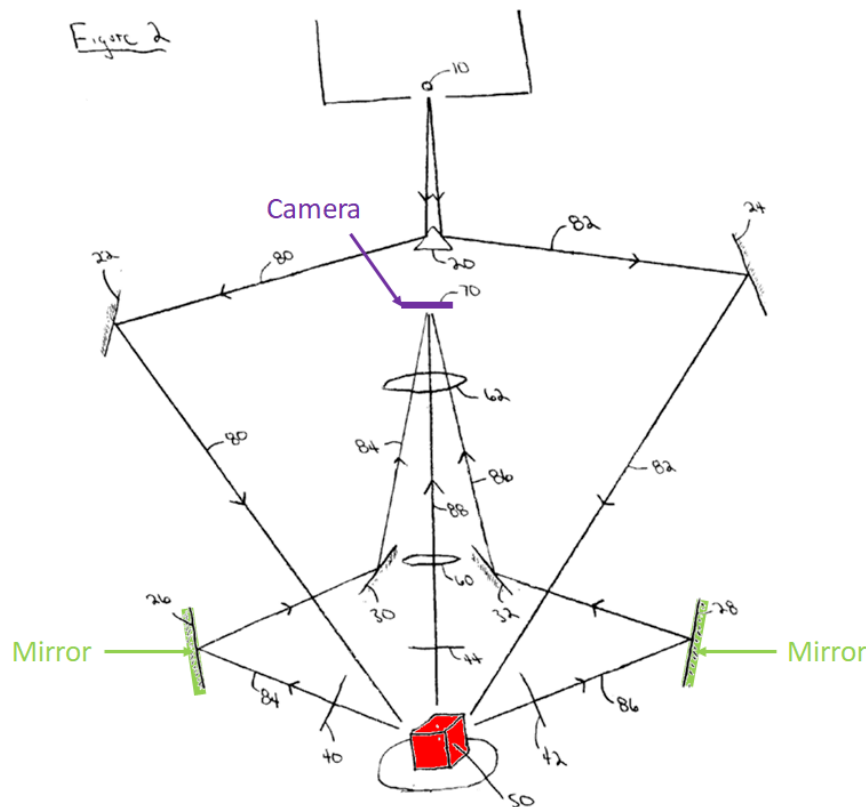
Wills, Figure 8 (annotated); Basham, ¶163.

As explained in claim 1[a], the at **captured image** includes a **contour**. Basham, ¶164.

- c. 24[b] at least one **mirror** positioned to allow said **camera** to capture at least one image of a second side of a **master key** from a second position wherein the second position is from a different angle than the first position

Wills in view of *Cimino* and *Shirley* teaches this limitation. Basham, ¶¶165-

169. As explained for claim 1[c], like *Wills*, *Shirley* discloses imaging a top side of **object 50** (e.g., image 88) directly without a mirror, using **detector 70**. *Shirley*, ¶[0025]; Basham, ¶165. As also explained there, *Shirley* discloses using **mirrors 26 or 28** to obtain an image of a left or right side, respectively, of **object 50**. *Shirley*, ¶¶[0024]-[0025]. As shown in Figure 2, below, *Shirley*'s **detector 70** obtains images of different sides of **object 50** using **mirrors 26 and 28**.



Shirley, Figure 2 (annotated); Basham, ¶166.

A POSA would have understood from *Shirley* that if **object 50** were a **key**, **detector 70** (e.g., **camera**) of *Shirley* would capture an image 88 of an upper surface of **object 50** (e.g., top side of the **key**) directly, without the use of a mirror.

Basham, ¶167. A POSA would have also understood that **detector 70** (e.g., **camera**) of *Shirley* would capture an image of a left side (e.g., **tip end**) of **object 50** using a **mirror** (e.g., **mirror 26**). *Id.*

Moreover, a POSA would have understood that the image obtained using mirror 26 would be from a different angle than the image obtained along optical path 88 in the same manner as described by the '385 patent. Basham, ¶168. The '385 patent discloses a “camera angle provides a top view of the blade 18” ('385 patent, 5:8-9) and that its “imaging system may also capture an image of the groove from the end of the tip 14 at an angle parallel to the blade 18” (*id.*, 5:10-12). Thus, the '385 patent discloses that different views (or images) of the master key are associated with different angles. Basham, ¶168. Similarly, the **detector 70** (e.g., **camera**) of *Shirley* obtains a different image (e.g., from a different angle) of **object 50** using, for example, optical path 88 as compared to an image obtained using optical path 84 via **mirror 26**.

As discussed for claim 1[c], a POSA would have been motivated to modify *Wills*'s machine to obtain an image showing a tip end view as taught by *Cimino*. *Id.*, ¶169. A POSA would have recognized that *Shirley*'s mirror 26 would provide a **tip end** view if **object 50** were a **key** with its tip end pointing towards mirror 26. *Id.*, ¶167. As explained for claim 1[c], a POSA would have found it obvious to further modify *Will*'s machine modified by *Cimino* to include one or more **mirrors**

taught by *Shirley* to obtain images of a **master key** from different angles (e.g., a **tip end** view) without having to relocate the **camera**, without having to use an additional camera, and/or without having to move the key to obtain the different images. *Id.*, ¶169. Given the similarities between the machines of *Wills* and *Cimino*, and because using mirrors to obtain images as taught by *Shirley* was well known in the art, such a modification would have been within the skill of the POSA and yielded nothing more than predictable results. *Id.* A POSA thus would have had a reasonable expectation of success in making the modification. *Id.*

d. 24[c] wherein the image from the second angle is substantially a **tip end view; and**

Wills in view of *Cimino* and *Shirley* teaches this limitation for the same reasons discussed in claims 1[c] and 24[b]. Basham, ¶170. For example, as discussed for claim 24[b], a POSA would recognize that if a **master key** (e.g., **object 50**) were to be placed in the optical configuration disclosed by *Shirley* so that a **tip** of the **master key** was facing, for example, **mirror 26**, then the optical path 84 disclosed by *Shirley* would provide substantially a **tip end** view of the **master key** from a second angle. *Id.*, ¶171. And, as described for claim 1[c], a POSA would have found it obvious to modify *Wills*'s machine to obtain a **tip end** view, as taught by *Cimino*, by implementing mirrors taught by *Shirley* to allow a single camera in *Wills*'s machine to obtain images representing views of a top side and **tip end** of the **master key**. *Id.* As also discussed there, a POSA would have had

a reasonable expectation of success in making the modification. *Id.*

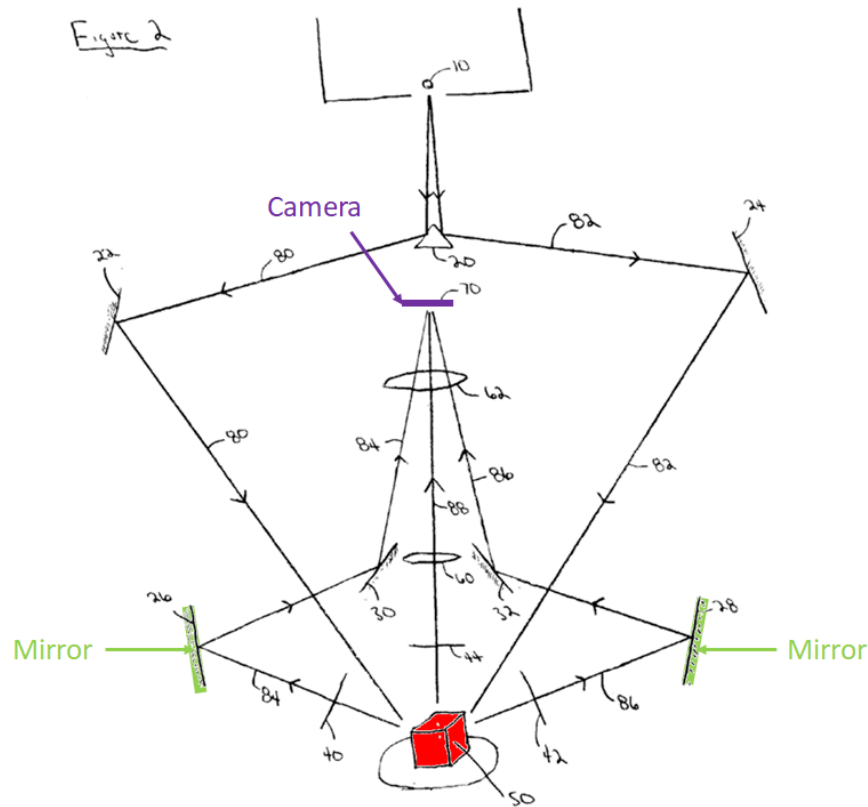
- e. 24[d] a logic configured to analyze said captured images to determine characteristics of said contour and compare said characteristics with characteristics of known key blanks to determine the likelihood of a match between said master key and a known key blank.

Wills in view of *Cimino* and *Shirley* discloses this limitation for the same reasons discussed in claims 1[b] and 1[c]. Basham, ¶172.

- 17. Claim 25: The key identification system of claim 24, wherein the at least one mirror is configured to allow the camera to capture one image with multiple views of the master key from different angles.

Wills in view of *Cimino* and of *Shirley* teaches this additional feature.

Basham, ¶¶174-178. As discussed for claim 24[b], *Shirley* discloses capturing images of an object 50 (e.g., master key) along three optical paths 84, 86, and 88 using mirrors 26 and 28. *Shirley*, ¶¶[0024]-[0026]. In particular, *Shirley*'s mirrors 26 and 28 are configured to reflect the left side and right side views, respectively, of object 50 to detector 70 (e.g., camera). *Id.*; Basham, ¶175. And as illustrated in Figure 2 of *Shirley* below, the images obtained along optical paths 84, 86, and 88 provide images that are different views (e.g., left side view along optical path 84, right side view along optical path 86, and top side view along optical path 88) of object 50.



Shirley, Figure 2 (annotated); Basham, ¶175.

A POSA would understand from *Shirley* that detector 70 would obtain a single image including a top side view, a left side view (e.g., tip end view), and/or a right side view of object 50 from different angles in the same manner as described by the '385 patent. '385 patent, 5:8-12; Basham, ¶176. Indeed, *Shirley* itself discloses obtaining a single image having different views of object 50. *Shirley* discloses using a lens such that “all three images are in focus on the detector 70 at substantially the same time.” *Shirley*, ¶[0025]. Further, *Shirley* discloses that its invention “provides a method and apparatus for combining multiple views of an object.” *Id.*, ¶ [0007].

A POSA would have recognized that such an image would provide information regarding contours on both sides of the master key in a single image instead of requiring separate images of the two sides of the master key. Basham, ¶177. A POSA would have also recognized that obtaining a **tip end** view (e.g., left side view of **object 50**) at the same time as obtaining one or more two-dimensional slices (e.g., top side view of **object 50**) as taught by *Wills* would eliminate the need to manually flip the key to obtain an image of any groove on the reverse side of the **key**. *Id.* As explained for claim 1[c], doing so would have made the process of identifying a key blank faster. *Id.* Further, a POSA would have understood that using a single image having views of both sides of the **master key** would have increased the image processing speed by reducing the number of image files that must be accessed to obtain the same information. *Id.* This in turn would have improved the speed of identification of a key blank. *Id.* A POSA would, therefore, have found it obvious to implement the optical scheme of *Shirley* in *Wills*'s machine to achieve these and other advantages as discussed for claim 1[c]. *Id.* As explained for claim 1[c], a POSA would have had a reasonable expectation of success in making this modification. *Id.*, ¶178.

18. Claim 26

Wills in view of *Cimino* and *Shirley* renders obvious claim 26. Basham, ¶179.

a. 26[p] A key identification system comprising:

If this preamble is limiting, as discussed for claim 1[p], *Wills* discloses it.

Basham, ¶ 180.

b. 26[a] an imaging system including a camera configured to capture an image of a master key, the image includes a first view and a second view;

Wills in view of *Cimino* and *Shirley* teaches this limitation. Basham, ¶¶181-183. *Wills*'s machine employs a "mirror 29," shown in Figure 9, that "reflects the image [of one side the master key] to the camera 28" to be captured. *Wills*, 7:47-48; Basham, ¶182. The image of, for example, an upper side of the master key as illustrated in Figure 9 is a first view of the master key.

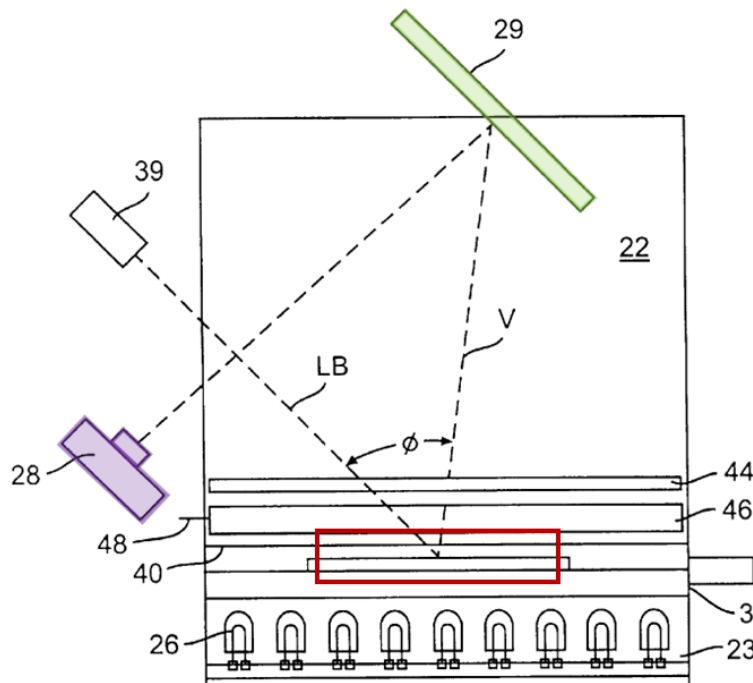


FIG. 9

Wills, Figure 9 (annotated); Basham, ¶182.

As also discussed for claims 1[c], a POSA would have been motivated to obtain a tip end view of the master key as taught by *Cimino* to realize the advantages of improved automation, accurate **contour** geometry determination, and/or the ability to confirm the **contour** geometry using the **tip end** view. Basham, ¶183. The **tip end** view is a second view of the **master key**. *Id.*

c. 26[b] a first mirror positioned at a first position to allow said camera to capture the first view of the master key

As discussed for claim 1[c], *Wills* discloses this limitation. Basham, ¶184.

As illustrated in Figure 9 of *Wills*, the first mirror (e.g., **mirror 29**) allows **camera 28** to capture the first view (e.g., one or more images of a top side) of the **master key**. *Id.*

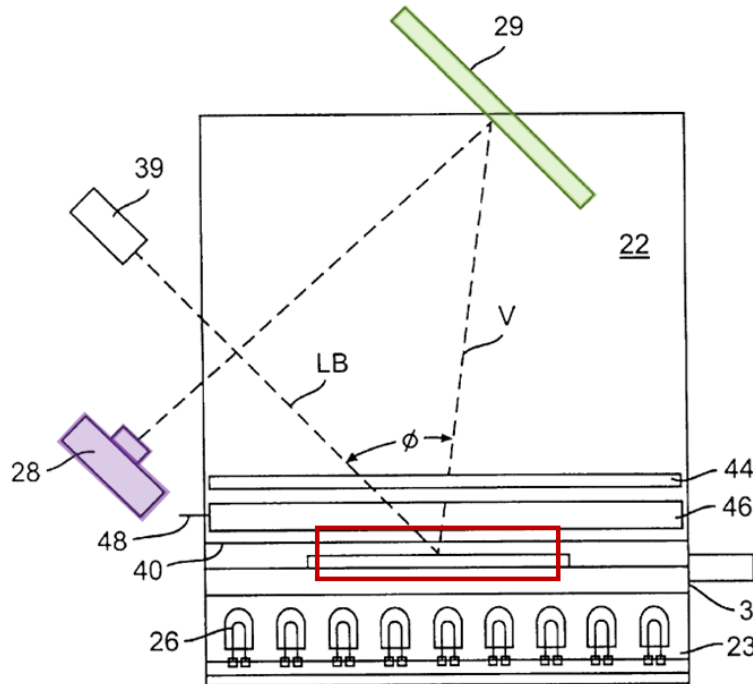


FIG. 9

Wills, Figure 9 (annotated); Basham, ¶184.

- d. 26[c] at least one second mirror positioned at a second position to allow said camera to capture a second view of the master key, wherein the first view is from a different angle than the second view,**

As discussed in claims 1[c] and 24[b], *Wills*, *Cimino*, and *Shirley* teach this limitation. Basham, ¶¶185-186. As discussed there, *Shirley* discloses using a mirror (e.g., mirror 26) to allow the camera (e.g., detector 70) to capture a second view (e.g., tip end view) as taught by *Cimino* from a different angle of object 50 (e.g., master key). *Shirley*, ¶¶[0024]-[0026]; Basham, ¶186. As explained for claim 1[c], a POSA would have found it obvious to implement at least one additional mirror as taught by *Shirley* in *Wills*'s machine to be able to obtain an image of the tip end of

the master key as taught by *Cimino* without the need to relocate *Wills*'s camera, include an additional camera, or move the master key. *Id.* As also explained there, a POSA would have had a reasonable expectation of success in making the modification. *Id.*

- e. 26[d] a logic configured to analyze said captured **image** to determine **characteristics** of said **contour** and compare said **characteristics** with **characteristics of known key blanks** to determine the likelihood of a match between said **master key** and a known key blank.

As discussed for claims 1[b] and 24[d], *Wills* discloses this limitation.

Basham, ¶187.

B. Ground 2: *Wills*, *Cimino*, *Shirley*, and *Bass* Render Obvious Claims 6, 17, and 18

- 1. **Claim 6: The key identification system of claim 5, wherein said **light** includes a shield to direct light away from said **master key**.**

Wills in view of *Cimino*, *Shirley*, and *Bass* teaches this additional feature because *Bass* teaches using a shield to direct light away from a **master key** to be imaged. Basham, ¶¶189-197.

As explained for claim 5, *Wills*'s machine for imaging a **master key** includes an array of **LEDs** and a **mirror**. *Wills*, 6:65-7:3, Figure 9; Basham, ¶194. *Wills*'s machine, modified with an additional mirror as taught by *Shirley*, to obtain a tip end view of the **master key** as taught by *Cimino* would also include this configuration of **LEDs** and a **mirror**. Basham, ¶194.

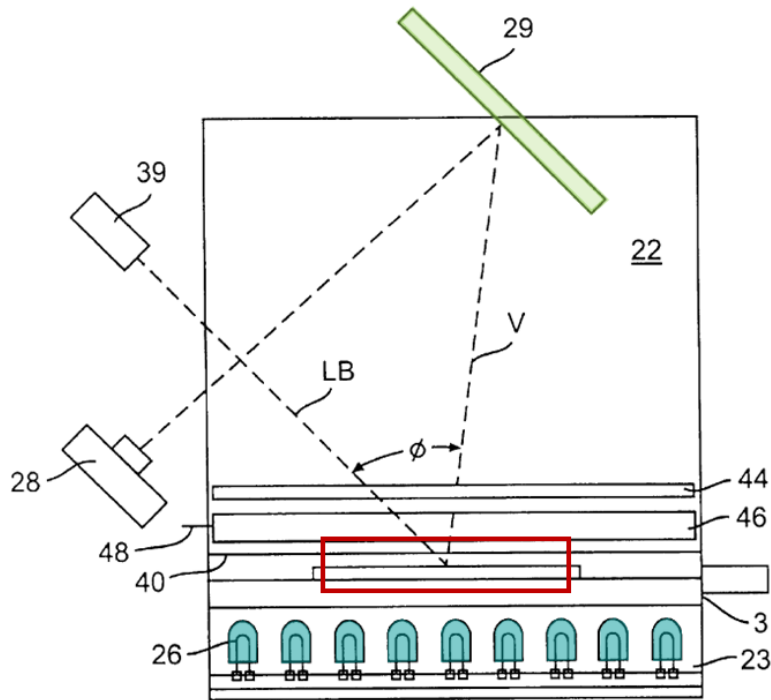


FIG. 9

Wills, Figure 9 (annotated); Basham, ¶194.

Bass's machine images the master key using a "lighting panel 52" and a "reflector plate 54." *Bass*, ¶[0057], Figure 7. *Bass* also discloses a "blocking plate 56" that serves "[t]o enhance an image captured by the optical imaging device," because "the positioning of" the reflector plate and the blocking plate can be "adjusted to improve ... captured images." *Id.*, ¶[0057], [0059]. Like the shield of the '385 patent, *Bass*'s blocking plate blocks light from the lighting panel. Basham, ¶195; compare '385 patent, 6:46-55 with *Bass*, ¶[0057].

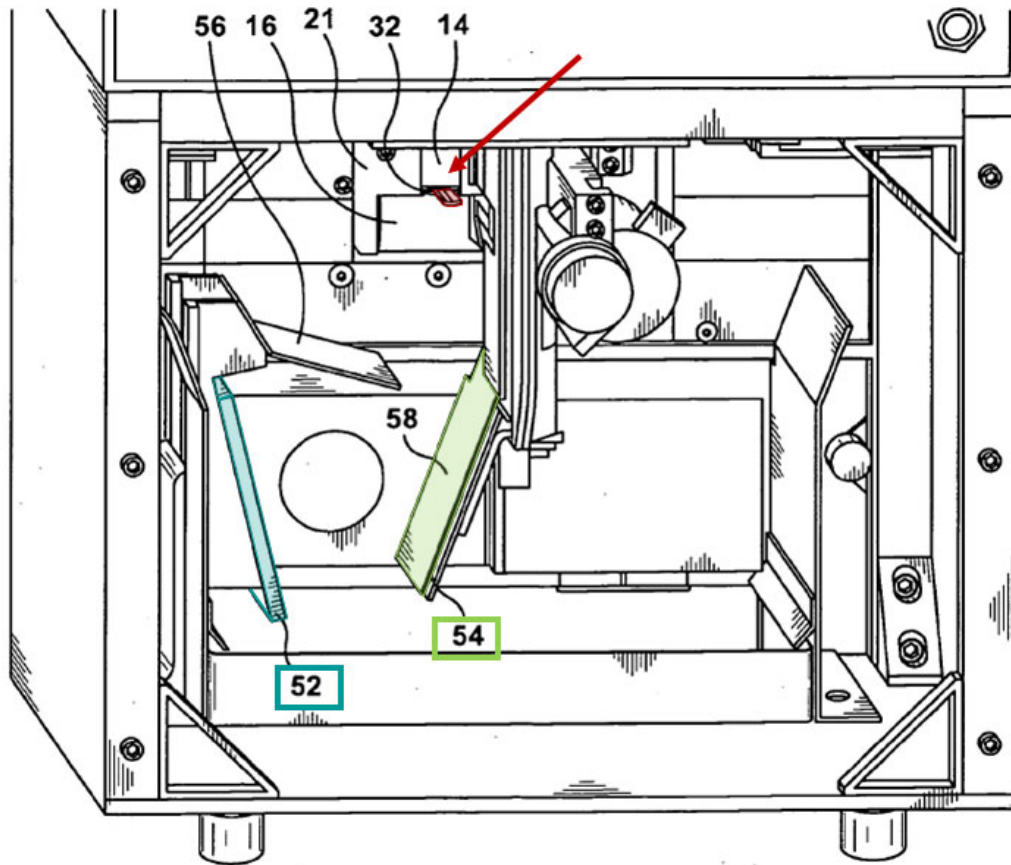


Figure 7

Bass, Figure 7 (annotated); Basham, ¶195.

A POSA would have been motivated and found it obvious to further modify *Wills*'s machine, as modified by *Cimino* and *Shirley*, to include a blocking plate as disclosed by *Bass* "[t]o enhance an image captured by [an] optical imaging device," like *Wills*'s camera. *Bass*, ¶¶[0057], [0059]; Basham, ¶196. A POSA would have found such a modification obvious because it would have involved nothing more than the use of a known technique—*Bass*'s blocking plate in a key

duplicating machine—to improve a similar device—*Wills*’s key regenerating machine as modified by *Cimino* and *Shirley*—in the same way, namely, by serving to enhance an image of a **master key** captured by a camera. *Id.* Given the similarities between *Wills*’s machine as modified by *Cimino* and *Shirley* and *Bass*’s machine, such a modification would have been within the skill of the POSA and yielded nothing more than predictable results. *Id.*, ¶¶196-197. A POSA thus would have had a reasonable expectation of success in making the modification. *Id.*, ¶196.

2. Claim 17: The key identification system of claim 15, wherein said key holder includes an **upper door.**

Wills in view of *Cimino*, *Shirley*, and *Bass* teaches this additional feature because *Bass* teaches supporting the **master key** using a **door clamp**. Basham, ¶¶198-206.

In *Wills*, the **master key** is placed into the machine on a “supporting means,” which in some embodiments includes “clear protrusions” or “a cut-out template ... into which the master key is placed.” *Wills*, 7:4-20. *Wills*’s machine, modified with an additional mirror as taught by *Shirley*, to obtain a tip end view of the **master key** as taught by *Cimino* would also include the supporting means. Basham, ¶199.

Similarly, in *Bass*’s machine, the **master key** is placed into the machine on a “base 16,” as shown in Figures 5 and 6 below. *Bass*, ¶¶[0047], [0050]. *Bass*’s machine also employs a “**door clamp** 14.” *Id.*, ¶[0047].

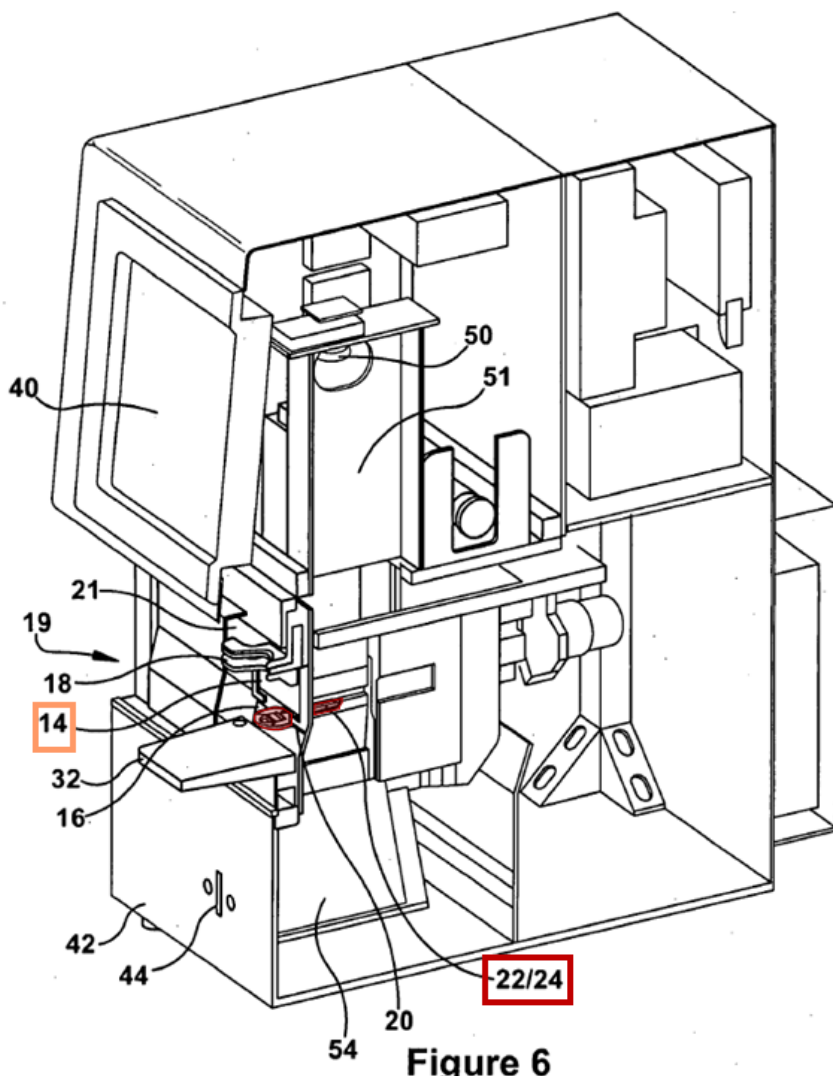


Figure 6

Bass, Figure 6 (annotated); *Basham*, ¶200.

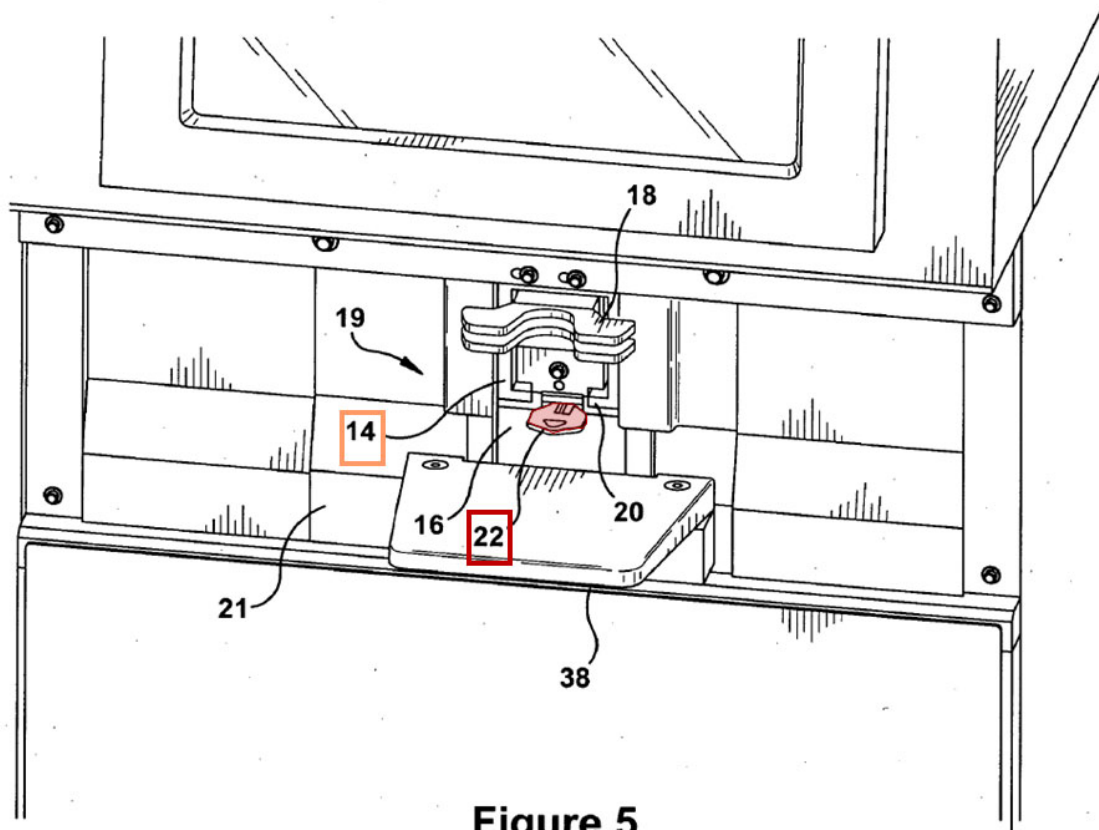


Figure 5

Bass, Figure 5 (annotated); Basham, ¶201.

Like the “upper door” of the ’385 patent, which together with a “lower support” serves to “close onto the key,” ’385 patent, 3:67-4:1, *Bass* teaches that its door clamp, together with the base, “secure[s] [the] master key” by applying a “force ... sufficient to retain or hold the key ... in place.” *Bass*, ¶[0047]; Basham, ¶202. A POSA would have been motivated and found it obvious to further modify *Wills*’s machine, as modified by *Cimino* and *Shirley*, to include a door clamp as in *Bass* to secure the master key by applying a force sufficient to retain or hold the key in place. Basham, ¶203. A POSA would have recognized that *Bass*’s door

clamp, when implemented in *Wills*’s machine as modified by *Cimino* and *Shirley*, would have improved the ability of the modified machine to hold the **master key** in place, thereby improving the accuracy of the captured image as well as the ultimate duplication of the **master key**. *Id.*, ¶¶203-206. A POSA would have found such a modification obvious because it would have involved nothing more than the use of a known technique—*Bass*’ **door clamp** in a key duplicating machine—to improve a similar device—*Wills*’s key regenerating machine as modified by *Cimino* and *Shirley*—in the same way. *Id.* Given the similarities between *Wills*’s machine as modified by *Cimino* and *Shirley* and *Bass*’s machine, such a modification would have been within the skill of the POSA and yielded nothing more than predictable results. Basham, ¶205. A POSA thus would have had a reasonable expectation of success in making the modification. *Id.*

3. Claim 18: The key identification system of claim 15, wherein said key holder includes a **clamp.**

As discussed for claim 17, a POSA would have been motivated and found it obvious to further modify *Wills*’s machine, as modified by *Cimino* and *Shirley*, to include a **door clamp**, as in *Bass*. Basham, ¶¶207-208. A POSA would have understood the **door clamp** to be a “clamp” because like the “**clamp**” of the ’385 patent, which is merely an alternative to the “upper door” and serves together with a “lower support” to “close onto the **key**,” ’385 patent, 4:1-6, *Bass*’s **door clamp**, together with the base, provides additional functionality to “secure [the]

master key.” *Bass*, ¶[0047]. *Basham*, ¶¶207-208.

C. Ground 3: *Wills*, *Cimino*, *Shirley*, and *Heide* Render Obvious Claims 9 and 11

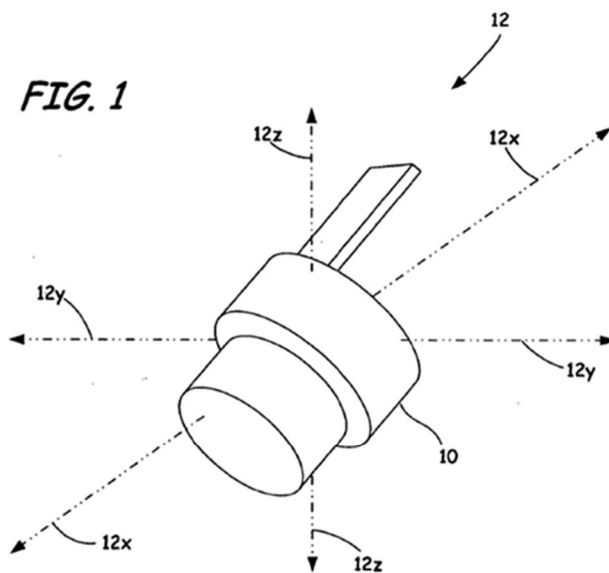
- 1. Claim 9: The key identification system of claim 1, wherein said logic accounts for rolling of said **master key** with respect to said imaging system to determine **characteristics** of said **contour**.**

Wills, *Cimino*, *Shirley*, and *Heide* teach this feature. *Basham*, ¶¶209-219.

Wills accounts for rolling of the **master key** by “rotating” the three-dimensional image captured by its **camera** “to a predetermined reference position and orientation.” *Wills*, 9:35-38; *Heide* teaches rotating a three-dimensional object to an optimal spatial orientation by rotating the three-dimensional object about any of the three axes, *Heide*, ¶¶[0037]-[0038]; *Basham*, ¶212. A POSA would have recognized that images of a key obtained in *Wills*’s machine, as modified by *Cimino* and *Shirley*, may still deviate from a predetermined reference position and orientation and require “rotating” for several reasons, including, for example, deformation of the **master key** that commonly results from use, such as bending or chipping, or aspects of the **master key**’s design, such as a rubberized head that prevents the key from lying flat. *Basham*, ¶213; *see also Wills*, 1:35-37 (recognizing that keys may deviate “[from] factory specifications” once “worn from use”). As *Wills* explains, “rotating” the three-dimensional image allows the “key information” of the **master key**, including the extracted **depth measurements**,

to be “standardized” so as “to be comparable to” the information about the reference keys. *Wills*, 9:38-43. As a result, *Wills*’s machine, modified by *Cimino* and *Shirley*, would also not “require the master key to be precisely aligned to operate efficiently.” *Id.*, 7:29-31. This matches the purpose of “rolling” in the ’385 patent, namely, that “[t]he key[] is not constrained to a particular orientation or position.” Basham, ¶214; ’385 patent, 7:17-18.

While *Wills* describes “rotating” the three-dimensional image, *Wills* does not expressly identify the rotational axes. Basham, ¶215. *Heide* teaches rotating a three-dimensional object, like the three-dimensional image in *Wills*, to an optimal spatial orientation by rotating about any of three axes. *Heide*, ¶¶[0037]-[0038].



Heide, Figure 1

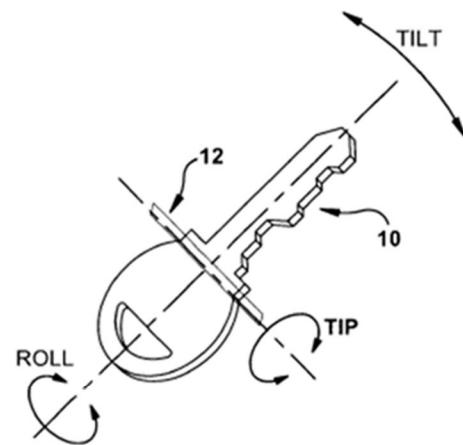


FIG. 14

’385 Patent, Figure 14

A POSA would have recognized that rotation about the “12x” axis of *Heide*

corresponds to the “rolling” described in the ’385 patent (*compare Heide*, Figure 1 with ’385 patent, Figure 14); Basham, ¶216. Such rotation about the “12x” axis of the three-dimensional object is consistent with how “rolling” is described in the ’385 patent, namely, “rotat[ing]” the master key “around the axis of the key” itself. *Id.*; ’385 patent, 7:22-23.

A POSA would have found it obvious to implement *Wills*’s “rotating to a predetermined reference position and orientation” to include rotating about the “12x” axis taught by *Heide*. Basham, ¶217. A POSA would have been motivated by *Wills*’s stated intent to “rotat[e]” the three-dimensional image captured by its camera so that *Wills*’s machine “does not require the master key to be precisely aligned to operate efficiently,” or *Heide*’s teaching that such rotation facilitates achieving an “optimal spatial orientation.” *Id.*; *Wills*, 7:29-31, 9:35-38; *Heide*, ¶¶[0037]-[0038]. A POSA would have found it obvious because implementing such rotation in *Wills*’s machine, as modified by *Cimino* and *Shirley*, would have involved nothing more than the use of a known technique—*Heide*’s rotation of a three-dimensional object along “12x” axis—to improve a similar context—*Wills*’s rotation of a three-dimensional image—in the same way, namely, by achieving “optimal spatial orientation” of the three-dimensional image. Basham, ¶¶217-218. Given *Wills* already discloses rotating its three-dimensional image, such a modification would have been within the skill of the POSA and yielded nothing

more than predictable results. *Id.*, 217 A POSA thus would have had a reasonable expectation of success in making the modification. *Id.*

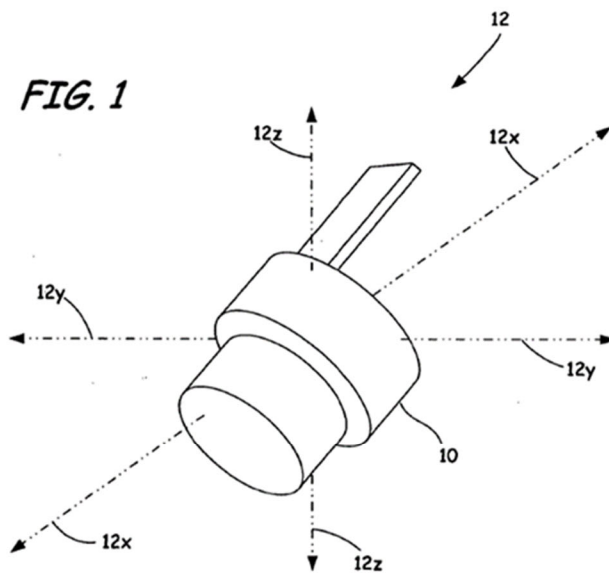
2. Claim 11: The key identification system of claim 1, wherein said logic accounts tipping of said master key with respect to said imaging system to determine characteristics of said contour.

Wills, *Cimino*, *Shirley*, and *Heide* teach this feature. Basham, ¶¶220-226.

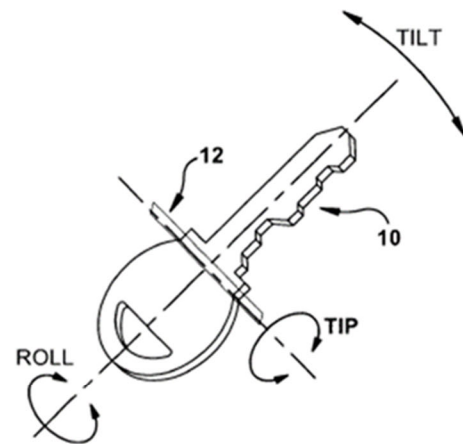
Wills accounts for variations of the master key with respect to the camera in extracting the depth measurements of the surface information by “rotating” the three-dimensional image captured by its camera “to a predetermined reference position and orientation.” *Wills*, 9:35-38; *Heide* teaches rotating a three-dimensional object to an optimal spatial orientation by rotating the three-dimensional object about any of the three axes, *Heide*, ¶¶[0037]-[0038]; Basham, ¶220. As explained for claim 9, a POSA would have recognized that the “rotating” of *Wills* would be required for a master key in *Wills*’s machine, as modified by *Cimino* and *Shirley*, to account for deformation of the master key or aspects of the master key’s design, such as a rubberized head that prevents the key from lying flat. *Wills*, 9:35-43; *see also Wills*, 1:35-37, 7:20-21; Basham, ¶221. Moreover, including the “rotating” of *Wills* would ensure that *Wills*’s machine, as modified by *Cimino* and *Shirley*, would also not “require the master key to be precisely aligned to operate efficiently.” *Wills*, 7:29-31; Basham, ¶222. This matches the purpose of the “tipping” in the ’385 patent, namely, that “[t]he key[] is not constrained to a

particular orientation or position.” ’385 patent, 7:17-18; Basham, ¶222.

While *Wills* describes “rotating” the three-dimensional image, *Wills* does not expressly teach the rotational axes. Basham, ¶154. *Heide* teaches rotating a three-dimensional object, like the three-dimensional image in *Wills*, about any of three axes. *Heide*, ¶¶[0037]-[0038].



Heide, Figure 1



’385 Patent, Figure 14

A POSA would have recognized that rotation about the “12y” or “12z” axis described in *Heide* corresponds to the “tipping” described in the ’385 patent (compare *Heide*, Figure 1 with ’385 patent, Figure 14); Basham, ¶224. Such rotation about the “12y” or “12z” axis of the three-dimensional object is consistent with how “tipping” is described in the ’385 patent, namely, “tipped up or down relative to the plane defined perpendicular to the door opening 12.” ’385 patent,

7:21-22.

For reasons similar to those discussed for claim 9, a POSA would have been motivated and found it obvious to include the rotating about the “12y” or “12z” axes of *Heide* in *Wills*’s machine, as modified by *Cimino* and *Shirley*. Basham, ¶¶225-226. As also explained there, A POSA would have had a reasonable expectation of success in making the modification. *Id.*, ¶225.

VIII. THE BOARD SHOULD NOT DENY INSTITUTION UNDER § 325(d)

The Board should not exercise its discretion to deny institution under 35 U.S.C. § 325(d). The relevant considerations for such a denial are: (1) whether the same or substantially the same art previously was presented to the Office or whether the same or substantially the same arguments previously were presented to the Office; and (2) if either condition of first part of the framework is satisfied, whether the petitioner has demonstrated that the Office erred in a manner material to the patentability of challenged claims. *Advanced Bionics, LLC v. MED-EL Elektromedizinische Geräte GmbH*, IPR2019-01469, Paper 6 (P.T.A.B Feb. 13, 2020).

Neither of the *Advanced Bionics* factors warrant denial of institution. During prosecution, the Examiner considered but did not rely on *Wills*, *Bass*, or *Cimino*. ’385 patent, 10:33-39 (incorporating *Bass* by reference); *but see* Ex. 1012, 112-114 (examiner citing a single paragraph of U.S. Patent Publication No. 2001/0033781

to Wills et al., unrelated to *Wills*, during the prosecution of the parent '619 patent for a disclosure of “determin[ing] the *likelihood* of a match between said master key and a known key blank”). As the Board has noted, “[t]he fact that [references] were of record, but not applied in any rejection by the Examiner during examination of [a] patent, provides little impetus for [the Board] to exercise [its] discretion to deny institution under § 325(d).” *Navistar, Inc. v. Fatigue Fracture Tech., LLC*, IPR2018-00853, Paper 13 at 16-17 (P.T.A.B. Sept. 12, 2018). Each of *Bass* and *Wills* was first relied on by the Office only during prosecution of U.S. Patent No. 11,227,181—the grandchild of the '385 patent—more than four years after the '385 patent issued. Ex. 1010, 162, 211. The '181 patent was allowed over *Bass* only when the claims were amended to recite “us[ing] a single camera to capture images of multiple angles of the master key ... without removing the master key from the slot”—a feature the independent claims of the '385 patent do not recite. *Id.*, 50, 79-80. *The Office never considered Heide and Shirley.*

Thus, the examiner of the '385 patent did not consider the same (or substantially the same) prior art and arguments during prosecution as presented in this Petition, and the Examiner’s failure to consider and apply references such as *Wills*, *Bass*, *Cimino*, *Heide*, and *Shirley* constitutes an error material to the patentability of the challenged claims. The Board should not exercise its discretion to deny institution under 35 U.S.C. § 325(d).

IX. MANDATORY NOTICES

A. Real Party-in-Interest

The real party-in-interest is The Hillman Group, Inc.

B. Related Matters

Petitioner is not aware of any related matters for the '385 patent. Petitioner notes the below IPRs involving U.S. Patent No. 8,644,619, the parent of the '385 patent, and U.S. Patent No. 9,934,448, the child of the '385 patent.

Case Caption	Case No.	Filing Date
<i>The Hillman Group, Inc. v. Hy-Ko Products Company LLC</i>	IPR2022-01201	June 27, 2022
<i>The Hillman Group, Inc. v. Hy-Ko Products Company LLC</i>	IPR2022-01285	July 18, 2022

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Please address all correspondence to lead counsel and back-up counsel at the addresses shown above. Petitioner also consents to electronic service by email.

X. GROUNDS FOR STANDING

Petitioner certifies that the '385 patent is available for IPR and that Petitioner is not barred or estopped from requesting IPR challenging the patent claims on the grounds identified herein.

XI. CONCLUSION

The Board should institute IPR and cancel the claims. The Office may charge any required fees to Deposit Account No. 06-0916.

Dated: October 27, 2022

Respectfully submitted,

/Joshua L. Goldberg/
Joshua L. Goldberg
Reg. No. 59,369

CERTIFICATE OF COMPLIANCE

Pursuant to 37 C.F.R. § 42.24(a)(1)(i), the undersigned hereby certifies that the foregoing PETITION FOR *INTER PARTES* REVIEW OF U.S. PATENT NO. 9,514,385 contains 13,970 words, excluding parts of this Petition exempted under § 42.24(a), as measured by the word-processing system used to prepare this paper.

Dated: October 27, 2022

/Joshua L. Goldberg/
Joshua L. Goldberg (Reg. No. 59,369)
Lead Counsel for Petitioner.

CERTIFICATE OF SERVICE

The undersigned certifies that the foregoing **Petition for *Inter Partes* Review**, the associated **Power of Attorney**, and **Exhibits 1001 through 1014** are being served on October 27, 2022, by FedEx Priority Overnight® at the following address of record for the subject patent.

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