

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 IPR2022-01201
Patent No. 8,644,619

DECLARATION OF SCOTT BASHAM

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LIST OF EXHIBITS

Exhibit	Description
Ex. 1001	U.S. Patent No. 8,644,619 (“the ’619 patent”)
Ex. 1002	Prosecution History of U.S. Patent No. 8,644,619
Ex. 1003	Declaration of Scott Basham
Ex. 1004	Curriculum Vitae of Scott Basham
Ex. 1005	U.S. Patent No. 6,064,747 to Wills et al. (“ <i>Wills</i> ”)
Ex. 1006	U.S. Patent App. Pub. No. 2007/0224008 to Bass et al. (“ <i>Bass</i> ”)
Ex. 1007	U.S. Patent App. Pub. No. 2007/0233298 to Heide et al. (“ <i>Heide</i> ”)
Ex. 1008	U.S. Patent No. 9,514,385
Ex. 1009	U.S. Patent No. 9,934,448
Ex. 1010	U.S. Patent No. 11,227,181
Ex. 1011	Prosecution History of U.S. Patent App. Serial No. 15/920,955

I, Scott Basham, of Chandler, Arizona, declare that:

I. INTRODUCTION

1. My name is Scott Basham, and I have been retained by counsel for Petitioner The Hillman Group (“Petitioner”) as an expert witness to provide assistance regarding U.S. Patent No. 8,644,619 (“the ’619 Patent”). Specifically, I have been asked to consider the validity of claims 1-8, 10-14, and 19-22 of the ’619 Patent (the “challenged claims”) in view of prior art, anticipation and obviousness considerations, and the understanding of a person of ordinary skill in the art at the time of the invention (“POSA”) as it relates to the ’619 Patent. I have personal knowledge of the facts and opinions set forth in this declaration and believe them to be true. If called upon to do so, I would testify competently thereto.

2. I am being compensated for my time at my standard consulting rate. I am also being reimbursed for expenses that I incur during the course of this work. My compensation is not contingent upon the results of my study, the substance of my opinions, or the outcome of any proceeding involving the challenged claims. I have no financial interest in the outcome of this matter or on the pending litigation between Petitioner and Patent Owner.

3. My analysis here is based on my years of education, research and experience, as well as my investigation and study of relevant materials, including those cited herein.

4. I may rely upon these materials, my knowledge and experience, and/or additional materials to rebut arguments raised by the Patent Owner. Further, I may also consider additional documents and information in forming any necessary opinions, including documents that may not yet have been provided to me.

5. My analysis of the materials in this proceeding is ongoing and I will continue to review any new material as it is provided. This declaration represents only those opinions I have formed to date. I reserve the right to revise, supplement, and/or amend my opinions stated herein based on new information and on my continuing analysis of the materials already provided.

II. BACKGROUND AND QUALIFICATIONS

6. I am an expert in the field of key duplication equipment. I believe that I am well qualified to serve as a technical expert in this matter based upon my qualifications, discussed in detail below. A copy of my curriculum vitae is provided as Ex. 1004.

7. Based on my education and work experience, I am knowledgeable about the subject matter of the '619 patent and the related prior art. Specifically, my qualifications as an expert in the field of key duplication equipment, and other similar machines, stem from my nearly twenty-two years of work experience at The Hillman Group, Inc. ("Hillman") and my prior employment working in electrical and mechanical control systems, as well as my education in electronic engineering

technology. I am a co-inventor of ten patents pertaining to key duplication and related technologies.

8. I received a B.S. in Electronic Engineering Technology from the DeVry Institute of Technology in 1985. From then to 1987, I was employed as an engineer and production manager at Sensor Technology, where I designed microprocessor-based controllers for industrial process control. Then, from 1988 to 1994, I worked as an engineering manager at DH Instruments, where I designed, among other thing, high accuracy pressure controllers, flow meters, and standards; microprocessor-based instruments; and analog interface circuitry. From 1994 to 1998, I was employed at Kroy Incorporated as an electronic engineer, where I worked to develop thermal printers and related hardware and software. My work at Sensor Technology, DH Instruments, and Kroy Incorporated all involved the development of mechanical and electrical control systems employing many of the techniques applicable to key duplication machines.

9. In 1998, I joined Hillman as a manufacturing engineer. In that role, I worked to design and implement machines for engraving metal tags for pets. This work drew on my experience in mechanical and electrical control systems. Further, the design of these machines required consideration of challenges that would arise again for key duplication, including mechanical solutions for supporting and/or stabilizing the tag in the machine.

10. From 2000 to 2014, I worked as the Director of Engineering at Hillman.

In this role, I guided product innovation, design, and improvement for not only tag engraving machines but also key duplication machines. In this role, I developed a comprehensive knowledge of key duplication technology, including the various considerations at play, the technological challenges faced, and the solutions to these technological challenges. For example, I became familiar with the wide variation in keys. I designed the machines at Hillman to work with numerous types of keys, including keys of differing materials or paints, single-sided keys, double-sided keys, shoulder-gage keys, tip-gage keys, and rubberized keys. In designing these machines, I also accounted for variations in keys made by different manufacturers as well as the variations in keys that result from wear and tear, such as bending, warping, breakage, and/or alteration in the blade and/or milling, that results from use. In my work, I designed key duplication machines to address these variations by recognizing how the key duplication machines would need to account for them.

11. The key duplication machines I designed and implemented at Hillman employed various techniques for key identification, that is, the process by which an appropriate key blank is selected to duplicate a master key. I worked to design and implement machines that employed both mechanical and optical techniques for extracting key information from master keys, including techniques for using cameras, mirrors, shields, lasers, LEDs, drawers, doors, and clamps. Many techniques I used

involved the extraction of information about millings on master keys, including the size, shape, depth, and length of the millings, as this information was valuable in identifying a key blank with which to duplicate a master key. In designing key identification systems, I sought to accommodate the variations among master keys, such as by ensuring a selected imaging technique would work with keys of different materials or altered by wear and tear. The machines I designed and implemented while working at Hillman included both machines in which the master key was laid upon a surface and machines in which the master key was secured using a clamp.

12. The key duplication machines I designed and implemented while working at Hillman also employed various techniques for key cutting, that is, the process by which a key blank, once identified, is cut to duplicate the master key. In this work, I drew on my prior experience in mechanical and electrical control signals to design systems.

13. I retired from Hillman in 2020 and am no longer an employee at Hillman. Since my retirement, I have been engaged in consulting and contracting with several companies, including work involving industrial controls for a recreational vehicle company and work involving automotive keys and transponders. I have also spent time remodeling homes and working on my golf game. I was retained by counsel for Petitioner in this matter in 2022.

III. LEVEL OF ORDINARY SKILL IN THE ART

14. In rendering the opinions set forth in this declaration, I was asked to consider the patent claims and the prior art through the eyes of a person of ordinary skill in the art (“POSA”) at the time of the alleged invention, which I understand is asserted to be as early as May 1, 2009. I understand that determining the ordinary skill in the art includes looking, among other considerations, at (i) the type of problems encountered in the art; (ii) prior art solutions to those problems; (iii) rapidity with which innovations are made; (iv) sophistication of the technology; and (v) educational level of active workers in the field. I understand that a POSA is not a specific real individual, but rather is a hypothetical individual having the qualities reflected by the factors above. I understand that a POSA would also have knowledge from the teachings of the prior art, including the art cited below.

15. Taking these factors into consideration, on or before May 1, 2009, a POSA of the ’619 Patent would have had a degree in engineering and three years of experience in key duplication equipment. This level of skill is approximate, and more experience would compensate for less formal education, and vice versa. For example, an individual having no degree in engineering, but ten years of key duplication experience would qualify as a POSA. Moreover, a person with no key duplication experience but a masters or doctorate in engineering may also qualify as a POSA. The experience in the field of key duplication equipment may include

experience with various types of key duplication equipment, including vending machines. Additional education could substitute for professional experience and vice versa.

16. Before May 1, 2009, my level of skill in the art was at least that of a POSA. I am qualified to provide opinions concerning what a POSA would have known and understood at that time, and my analysis and conclusions herein are from the perspective of a POSA as of that date.

IV. MATERIALS CONSIDERED AND RELIED UPON

17. In reaching the conclusions described in this declaration, I have relied on the documents and materials cited herein as well as those identified in this declaration, including the '619 Patent, the prosecution history of the '619 Patent, and prior art references cited herein. These materials comprise patents, related documents, and printed publications. Each of these materials is a type of document that experts in my field would have reasonably relied upon when forming their opinions.

18. In quoting the cited references, all emphasis is added unless otherwise noted.

19. I have also relied on my education, training, research, knowledge, and personal and professional experience in the relevant technologies and systems that were already in use prior to, and within the timeframe of the earliest asserted

invention date of the claimed subject matter in the '619 Patent, which is May 1, 2009.

- Ex. 1001:** U.S. Patent No. 8,644,619 (“the ’619 patent”)
- Ex. 1002:** Prosecution History of U.S. Patent No. 8,644,619
- Ex. 1005:** U.S. Patent No. 6,064,747 to Wills et al. (“Wills”)
- Ex. 1006:** U.S. Patent App. Pub. No. 2007/0224008 to Bass et al. (“Bass”)
- Ex. 1007:** U.S. Patent App. Pub. No. 2007/0233298 to Heide et al. (“Heide”)
- Ex. 1008:** U.S. Patent No. 9,514,385
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- Ex. 1010:** U.S. Patent No. 11,227,181
- Ex. 1011:** Prosecution History of U.S. Patent App. Serial No. 15/920,955

V. LEGAL STANDARDS

20. I am not a lawyer. My understanding of the legal standards to apply in reaching the conclusions in this declaration is based on discussions with counsel for Petitioner and my reading of the documents submitted in this proceeding. In preparing this declaration, I have tried to faithfully apply these legal standards to the challenged claims.

A. Claim Construction

21. I have been instructed that the terms appearing in the '619 patent should be interpreted in view of the claim language itself, the specification, the prosecution history of the patent, and any relevant extrinsic evidence. The words of a claim are generally given their ordinary and customary meaning, which is the meaning that the term would have to a POSA at the time of the invention, which I have assumed here is May 1, 2009. While claim limitations cannot be read in from the specification, the specification is the single best guide to the meaning of a disputed term. I have

followed these principles in reviewing the claims of the '619 patent and forming the opinions set forth in this declaration.

22. I understand that there is a special category of claim terms, known as “means-plus-function” terms, that recite a structural component solely in terms of the function it performs. In other words, a patent claim may recite a structural element that is essentially a placeholder word (for example, the word “means”) presented in terms of the function it performs (e.g., a claim reciting a “means for [function]”). I have been told that construing means-plus-function terms involves two steps: (1) identifying the claimed function, and (2) determining what structure, if any, disclosed in the specification corresponds to that claimed function.

B. Anticipation

23. I have been told that under 35 U.S.C. § 102, a patent claim is invalid if its subject matter was patented or described in a printed publication before the effective filing date of the claimed invention. I have been told that this is referred to as invalidity by anticipation. I have been told that a patent claim is anticipated under § 102 if a single prior art reference discloses all limitations of the claimed invention.

C. Obviousness

24. I understand that the existence of each and every element of the claimed invention in a prior art does not necessarily prove obviousness and that most, if not all, inventions rely on building blocks of prior art. But I have been told that under 35

U.S.C. § 103, a patent claim may be obvious if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a POSA to which said subject matter pertains. I have been told that a proper obviousness analysis requires the following:

- a. Determine the scope and content of the prior art;
- b. Ascertain the differences between the prior art and the claims at issue;
- c. Resolve the level of ordinary skill in the pertinent art; and
- d. Consider evidence of secondary indicia of non-obviousness (if available).

25. I have been told that the relevant time for considering whether a claim would have been obvious to a POSA is the time of invention. For my obviousness analysis, counsel for Petitioner instructed me to assume that the date of invention for the challenged claims is May 1, 2009, the filing date of the earliest provisional patent application to which the '619 patent claims priority. My opinions would not change if I assumed a later date of invention.

26. I have been told that a reference may be modified or combined with other references, or with a POSA's own knowledge, if the person would have found the modification or combination obvious. I have also been told that a POSA is presumed to know all the relevant prior art, and the obviousness analysis may take into account the inferences and creative steps that a POSA would employ.

27. I have been told that whether a prior art reference renders a patent claim obvious is determined from the perspective of a POSA. I have also been told that, while there is no requirement that the prior art contain an express suggestion to combine known elements to achieve the claimed invention, and while a suggestion to combine known elements to achieve the claimed invention may come from the prior art as a whole or individually and may consider the inferences and creative steps a POSA would employ, as filtered through the knowledge of one skilled in the art, obviousness grounds cannot be sustained by mere conclusory statements and must include some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness.

28. I have been told that there is no rigid rule that a reference or combination of references must contain a “teaching, suggestion, or motivation” to combine references. However, I also have been told that the “teaching, suggestion, or motivation” test can be used in establishing a rationale for combining elements of the prior art. I have also been told to be aware of distortions caused by hindsight bias, and that reading into the prior art the teachings of the invention at issue is improper.

VI. OVERVIEW OF PRIOR ART

A. Wills

29. U.S. Patent No. 6,064,747 (Ex. 1005) (“*Wills*”) issued May 16, 2000. I understand *Wills* constitutes prior art under at least pre-AIA 35 U.S.C. §§ 102(a),

102(b), and/or 102(e).

30. *Wills* describes 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.” *Id.*, 1:13-14. *Wills*’ key regenerating machine is configured to “identify[] the type of key blank onto which the master key is to be reproduced.” *Id.*, 1:48-49.

31. A master key is illustrated in Figure 7A. *Wills*, 5:22-24. As shown, the master key includes a blade “BD” in which is formed a milling “ML,” which *Wills* describes as “a longitudinally-extending groove ... in the blade.” *Id.*, 5:56-59.

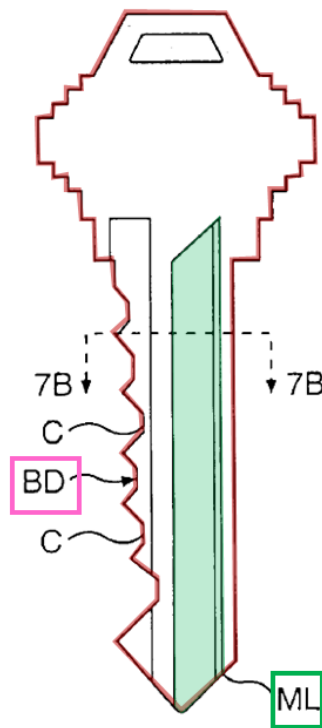


FIG. 7A

32. 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.

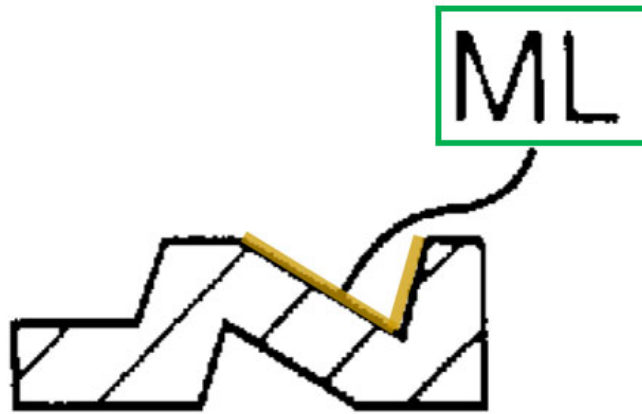


FIG. 7B

Wills, Figure 7B (annotated).

33. *Wills*' machine is illustrated in Figure 9. As shown, the **master key** is placed in the machine, and a “**laser line generator 39**” is used to generate a light beam “LB” incident on the **master key** and, in particular, on the **milling** in the **blade** of the **master key**. *Wills*, 11:44-55. A “**camera 28**” captures an image “that is the result of the light beam interfacing with the surface of the **master key**.” *Id.*, 11:59-

63. The image is captured “along a viewing axis V,” as shown in Figure 9, that “stri[k]es the side of the **key**[.]” *Id.*, 11:67-12:3. As shown, the viewing axis V is at an **angle** relative to the **master key**.

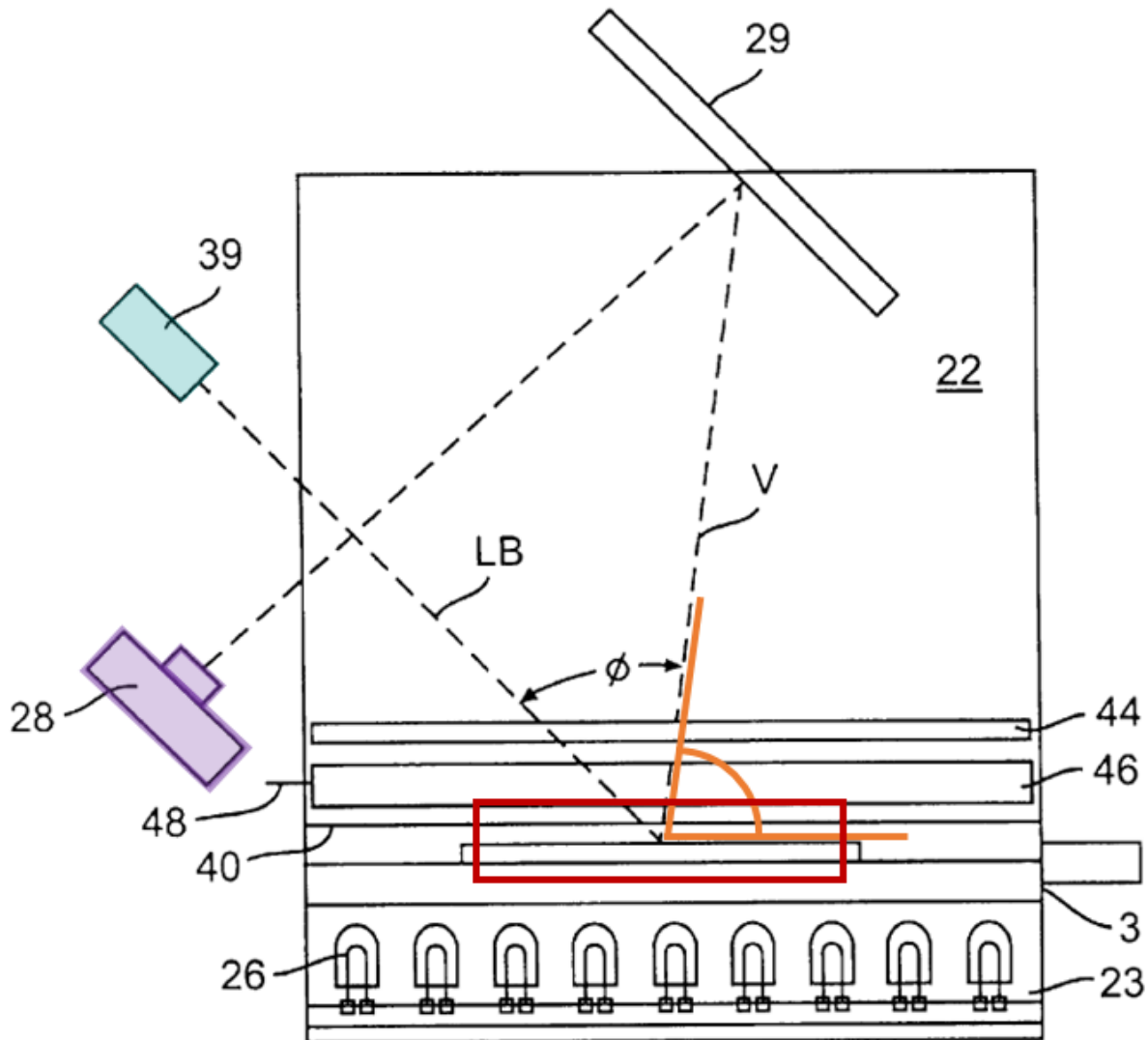
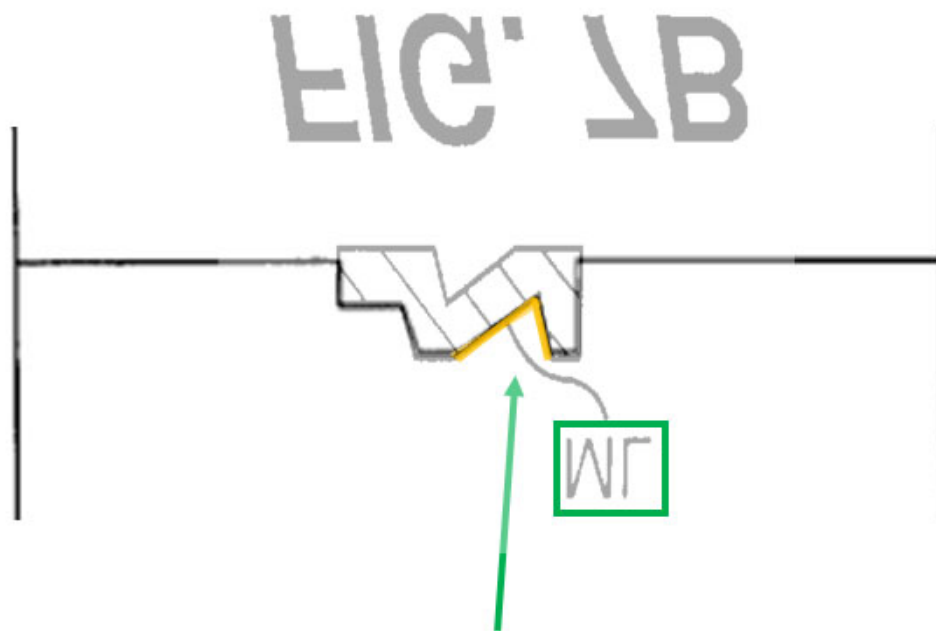


FIG. 9

Wills, Figure 9 (annotated).

34. As Figure 7D illustrates, the image captured by the **camera** “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. 7B.” *Wills*, 11:59-63. In particular, Figure 7B, which is a “*cross-sectional view of FIG. 7A taken along line 7B—7B,*” and Figure 7D, which is a “*top plan view of a light beam, such as a laser, interfacing with the master key of FIG. 7A,*” are vertically flipped relative to one another, as may be seen by vertically flipping Figure 7B and superimposing it on Figure 7D, as shown below. *Id.*, 3:11-12, 3:16-17.



Wills, Figure 7D (cropped) and
Figure 7B (vertically flipped and superimposed on Figure 7D)

35. As shown, the image captured by the camera includes the “surface information” of the master key, including the “depth of [the] milling” in the blade. *Wills*, 13:1-3.

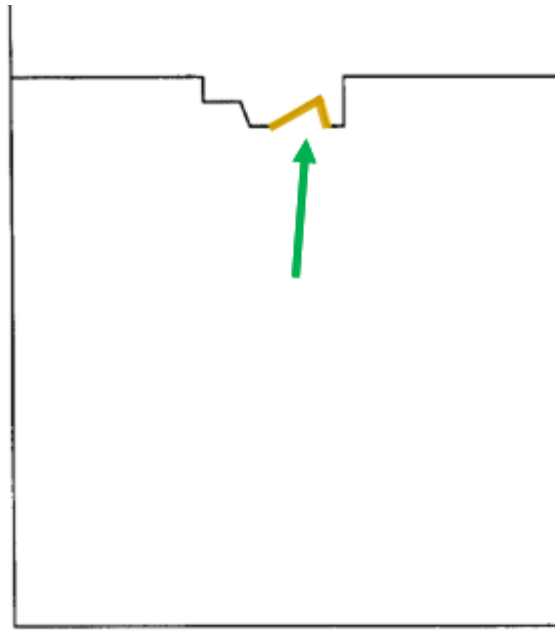


FIG. 7D

Wills, Figure 7D (cropped and annotated).

36. While Figure 7D shows only a “two-dimensional slice[]” of the master key, *Wills* envisions capturing “an entire three-dimensional surface image of the [master] key” by capturing two-dimensional slices “along the length of the key.” *Wills*, 15:34-42. As *Wills* explains with reference to Figure 8, “[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 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.

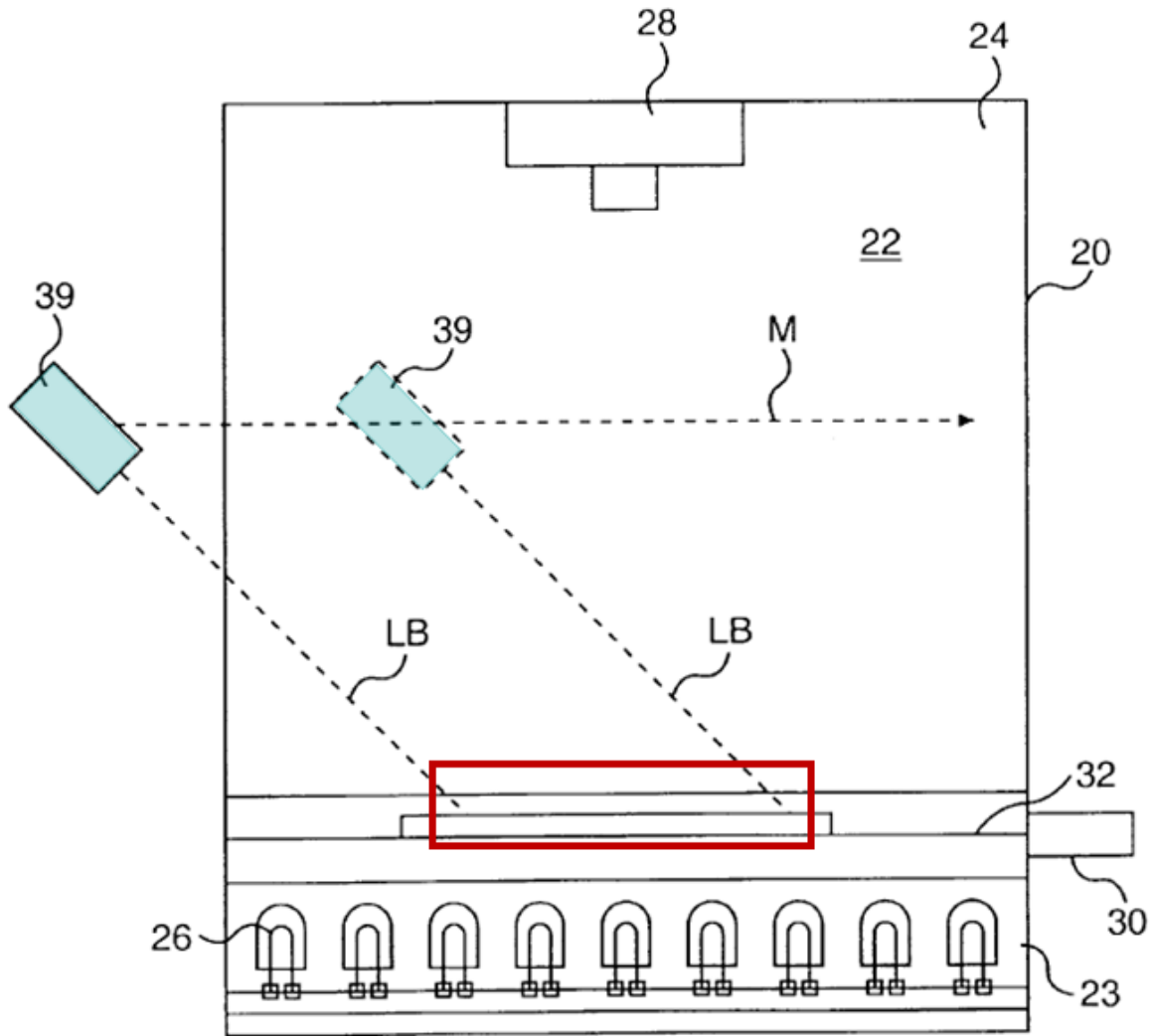


FIG. 8

Wills, Figure 8 (annotated).

37. According to *Wills*, one aspect of identifying a key blank, also called a “reference key” in *Wills*, is “analyzing the **surface information** of the master key, specifically the **milling**.” *Wills*, 11:36-39. To this end, *Wills*’ machine further includes a “computer subsystem,” as illustrated in Figure 23, that includes “means

for obtaining **surface information 2375**,” as shown. *Id.*, 31:67-32:2.

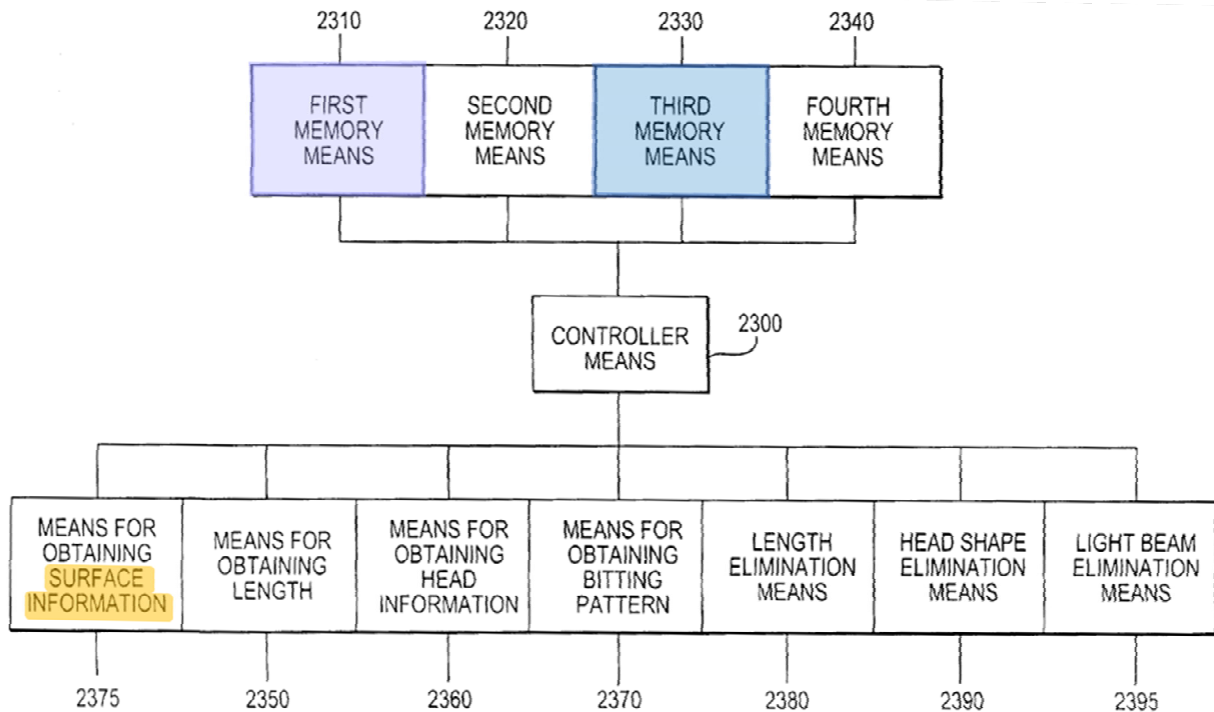


FIG. 23

Wills, Figure 23 (annotated).

38. As *Wills* explains, “light beam **image** data represent[ing] the result of the light beam interfacing with the surface of the **master key** shown in FIG. 7A, specifically the surface shown in FIG. 7B” is “stored in the third memory means 2330” in Figure 23. *Wills*, 37:11-15. From the light beam **image** data, *Wills* explains, *Wills*’ machine “extracts **depth measurements**” for the **milling** of the **master key**. *Id.*, 37:16-19; see also *id.*, 37:20-39:1 (discussing pseudocode for extracting **depth measurements**).

39. *Wills*’ computer subsystem also stores “surface information of each of

the reference keys” in a “first memory means 2310,” as shown, which includes, for each reference key, “depth measurements across the width of the [reference] key.” *Wills*, 31:56-51; *see also id.*, 15:2-5 (“The memory means also stores information about the light beam LB interfacing with each of the reference keys[.]”).

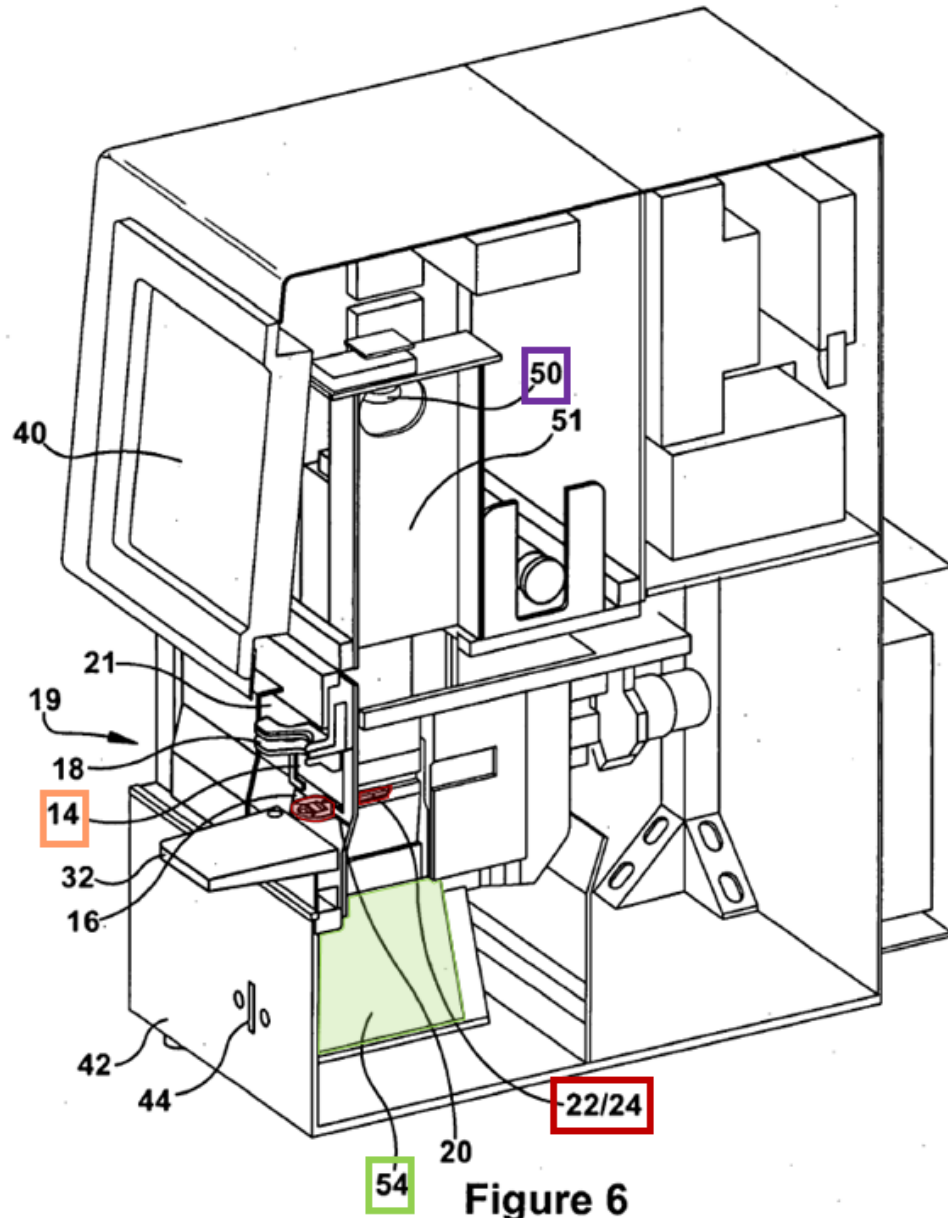
40. To identify a reference key for the master key, a “light beam elimination means 2395” of *Wills*’ computer subsystem compares the depth measurements for the master key with the depth measurements for the reference keys and, from the comparison, generates a “ranking ... from the most likely match” among the reference keys “to the least likely match.” *Wills*, 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).

B. Bass

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

42. *Bass*, like *Wills*, describes a machine for duplicating master keys. *Bass*, [0009]. As in *Wills*, 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. As in *Wills*, where the master key is placed into the machine on a “supporting means,” *Wills*, 7:4-8, in *Bass*’ machine the master key is placed into

the machine on a “base 16,” as shown. *Bass*, [0047], [0050]. In addition, *Bass*’ machine employs a “door clamp 14,” as shown.



Bass, Figure 6 (annotated).

C. Heide

43. U.S. Patent App. Pub. No. 2007/0233298 (Ex. 1007) (“*Heide*”) published October 4, 2007. I understand *Heide* constitutes prior art under at least

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

44. *Heide* describes a “three-dimensional object” akin to the “three-dimensional image” captured by *Wills*’ machine. *Heide*, Abstract; *Wills*, 15:34-42. And just 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].

VII. THE ’619 PATENT

45. The ’619 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. ’619 patent, 2:22-29. A master key is illustrated in Figure 1. As shown, the “**master key** 10” includes a “**blade** 18” in which a “**groove** 11” is formed. ’619 patent, 3:46-50. A “**tip** 14” of the **master key** is shown as well. *Id.*, 5:6-7.

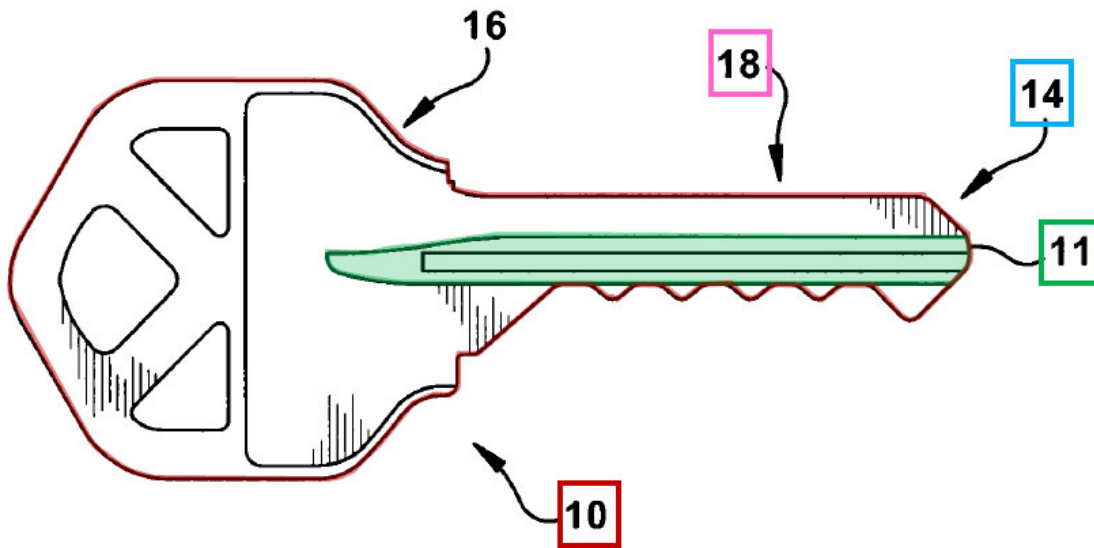
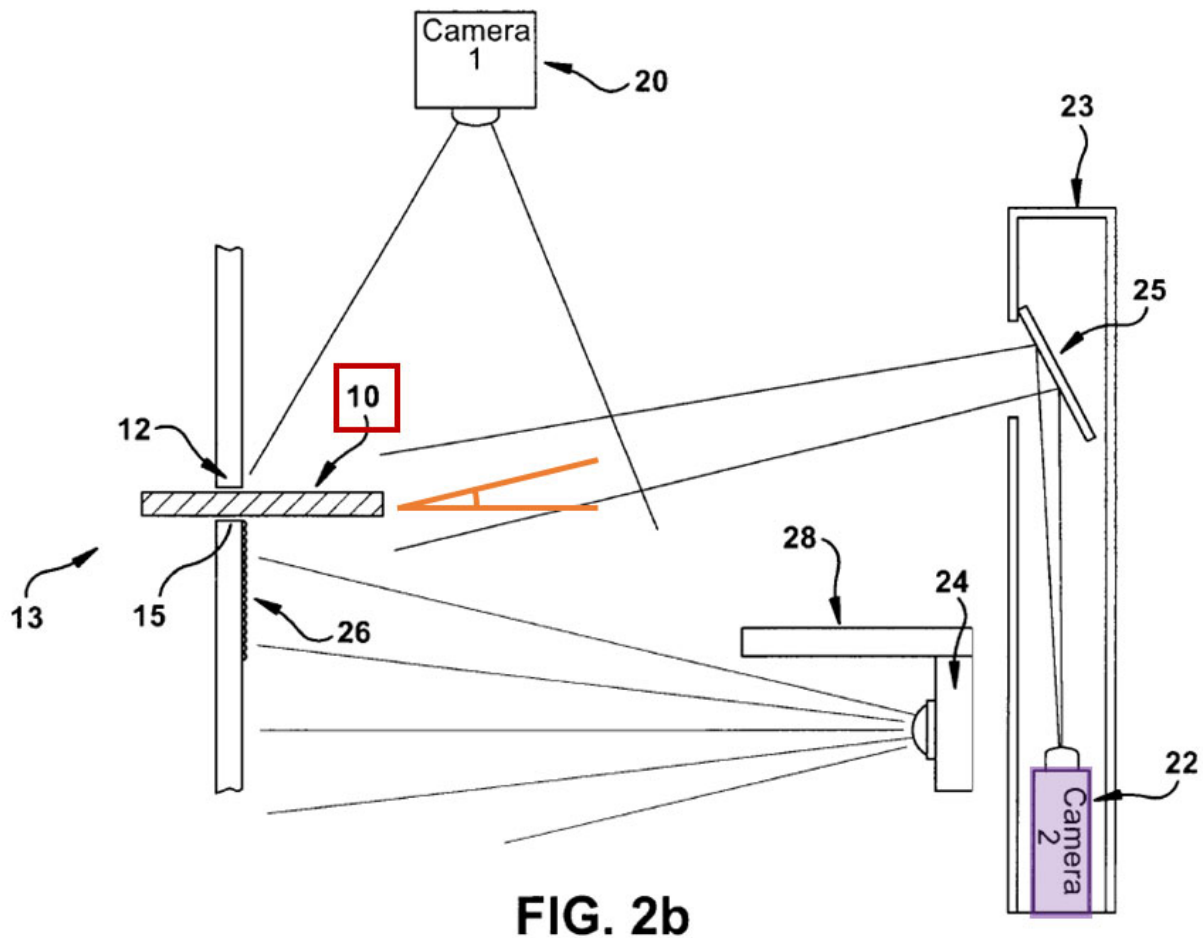


FIG. 1

'619 patent, Figure 1 (annotated).

46. An embodiment of the key identification system of the '619 patent is illustrated in Figure 2b. As shown, the system includes “an **imaging system**,” shown as a camera, “configured to capture an image of the **tip** of [the] **master key**.” '619 patent, 10:29-31.



'619 patent, Figure 2b (annotated).

47. The **imaging system** is configured to capture the image “at an **angle** between perpendicular and parallel to the **blade** of [the] **master key** and not including perpendicular or parallel to the **blade** of [the] **master key**.” ’619 patent , 10:31-33. As Figure 2b shows, the image “at an **angle** between perpendicular and parallel to the **blade** of [the] **master key**” is obtained through the use of a “mirror 25 directed toward the **key 10 tip**,” such that the “angle of incidence upon the **key 10**” is not perpendicular or parallel to the **blade** of the **master key**. *Id.*, 6:57-67.

48. The image captured by the **imaging system** “includes a contour of a **groove** in [the] **master key**,” and the key identification system uses a “logic” to “analyze [the] captured image to determine characteristics” of [the] **groove** based on [the] contour.” ’619 patent , 10:34-38. The logic “compare[s] [the] characteristics of [the] **groove** with groove characteristics of known key blanks to determine the likelihood of a match between [the] **master key** and a known key blank.” *Id.*, 10:38-41.

VIII. CLAIM CONSTRUCTION

49. I have applied the above-mentioned legal standard of claim construction here. As noted above, I understand that there is a special category of claim terms, known as “means-plus-function” terms, that recite a structural component solely in terms of the function it performs. I have been told that construing means-plus-function terms involves two steps: (1) identifying the claimed function, and (2) determining what structure, if any, disclosed in the specification corresponds to that claimed function.

50. Claim 1 of the ’619 patent recites “a logic configured to analyze said captured image to determine characteristics of said groove based on said contour and further to compare said characteristics of said groove with groove characteristics of known key blanks to determine the likelihood of a match between said master key and a known key blank.” ’619 patent, 10:36-42. In my opinion, to the extent the

Board determines the claimed “logic” should be construed as a means-plus-function term, the function of the “logic” in the ’619 patent is “analyz[ing] said captured image to determine characteristics of said groove based on said contour and further to compare said characteristics of said groove with groove characteristics of known key blanks to determine the likelihood of a match between said master key and a known key blank[.]” The corresponding structure is described in the ’619 patent at 4:12-27, which states:

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

51. Based on these teachings of the patent, it is my opinion that a POSA would have understood that the disclosed structure for performing this function encompasses, among other things, software programs stored on a hard disk.

IX. THE CHALLENGED CLAIMS ARE UNPATENTABLE

52. As described below, it is my opinion that *Wills* anticipates and/or would have rendered obvious claims 1–6, 8, 10, 12, 14, and 19–20; that *Wills* and *Bass* would have rendered obvious claims 7 and 21–22; and that *Wills* and *Heide* would have rendered obvious claims 11 and 13.

A. Grounds 1 and 2: *Wills* Would Have Anticipated and/or Rendered Obvious Claims 1-6, 8, 10, 12, 14, 19-20

1. Claim 1

53. *Wills* anticipates and/or renders obvious claim 1.

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

54. *Wills* describes “[a] key identification system.” *Wills* describes 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** configured to capture an **image** of the **tip** of a **master key** at 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**, wherein said captured **image** of said **tip** includes a **contour** of a **groove** in said **master key**; and

55. *Wills* anticipates and/or renders obvious “an **imaging system** configured to capture an **image** of the **tip** of a **master key** at 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**” because *Wills*’ machine includes a **camera**

configured to capture an image of the tip of a master key at a range of angles, including an angle between perpendicular and parallel to the blade of the master key and not including perpendicular or parallel to the blade of the master key.

56. *Wills* describes a “master key” that includes a “tip” and a “blade.” As *Wills* explains with reference to Figure 1A, “the keys discussed [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. “More specifically,” *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.

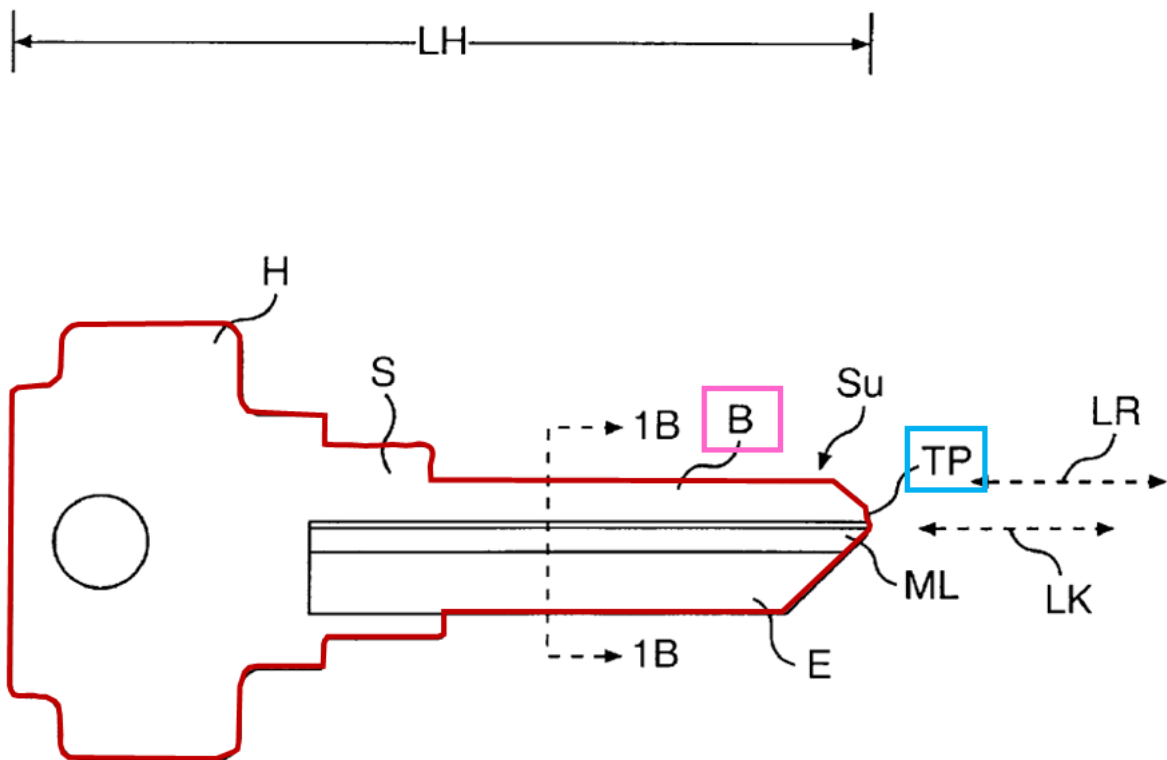


FIG. 1A

Wills, Figure 1A (annotated).

57. *Wills*' machine includes an "imaging system configured to capture an image of the tip of the master key." *Wills*' machine, including a "camera 28," is shown in Figure 9. *Wills*, 7:39-41. *Wills*' camera is "configured to capture an image of the tip of a master key," because *Wills*' camera is used to capture "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.

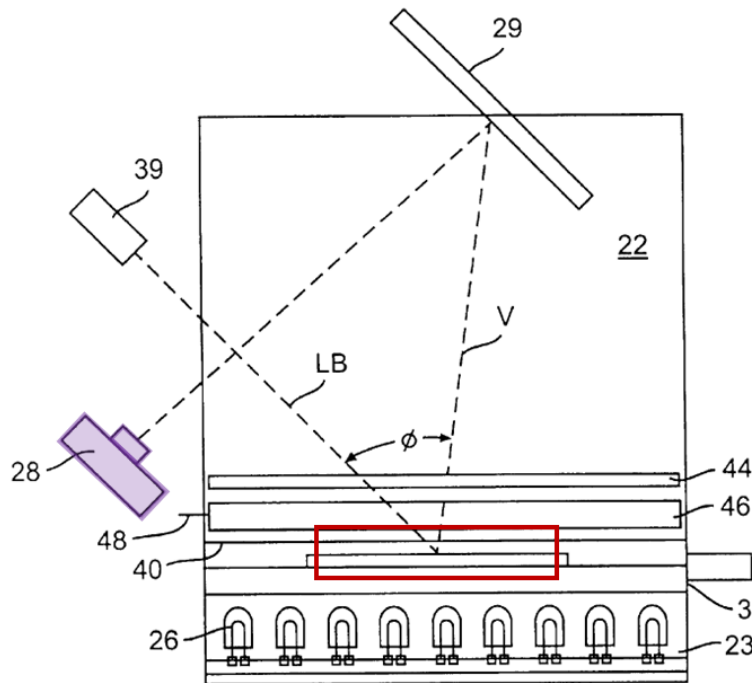


FIG. 9

Wills, Figure 9 (annotated).

58. In particular, as *Wills* explains with reference to Figure 8, "[a]s [a] 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. Because *Wills* describes capturing the two-dimensional slices “along the length of the key,” which includes the tip, *Wills*, 5:11-15, a POSA would have understood from *Wills* that *Wills*’ machine captures “an image of the tip of the master key” in two ways: (i) a two-dimensional slice captured at the tip of the master key or (ii) the resulting three-dimensional representation, which would include the tip of the master key. Regarding (i), a POSA would have understood that *Wills*’ two-dimensional slices “along the length of the key” include a two-dimensional slice captured at the tip of the master key because the “length of the key” includes the tip. *Id.*, 5:11-15. Because this two-dimensional slice captured at the tip of the master key includes the tip, a POSA would have understood, it is “an image of the tip of the master key.” Regarding (ii), when the two-dimensional slice captured at the tip of the master key is stacked with the other two-dimensional slices to form the three-dimensional representation, a POSA would have understood, the three-dimensional representation likewise includes the tip and, accordingly, is “an image of the tip of the master key.” In this manner, *Wills*’ camera is an “imaging system configured to capture an image of the tip of the master key.”

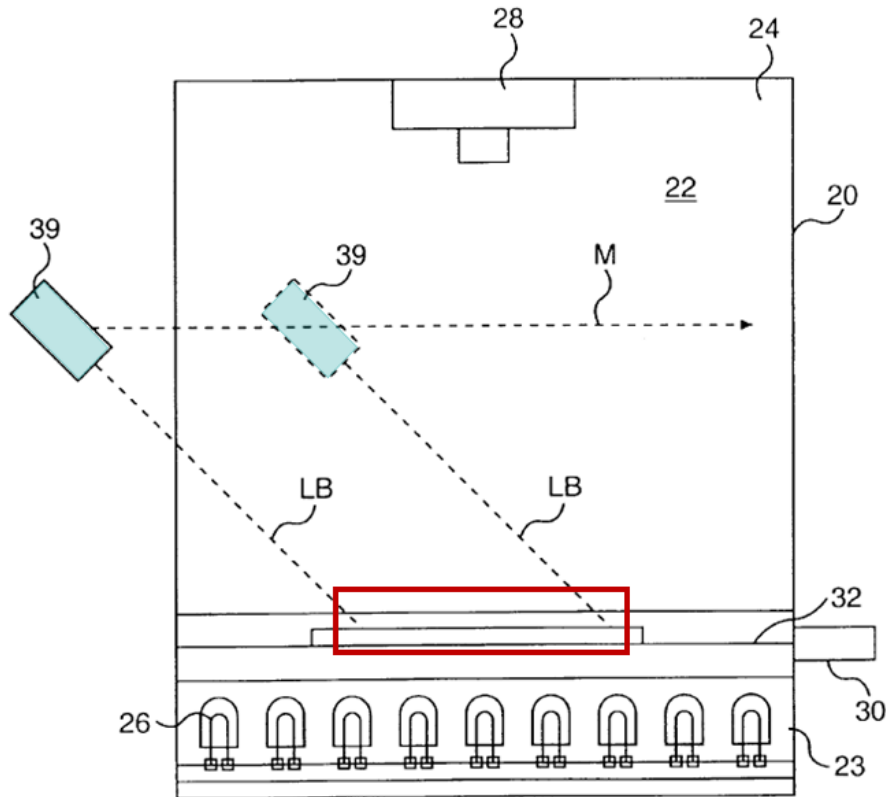


FIG. 8

Wills, Figure 8 (annotated).

59. *Wills* also discloses and/or would have rendered obvious that the image of the tip of the master key captured by its camera is captured “at 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.” As Figure 9 shows, the image captured by *Wills*’ camera is an image of “the side of the master key ... along a viewing axis V.” *Wills*, 11:67-12:1. *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 and not including perpendicular or parallel to the side of the master key.

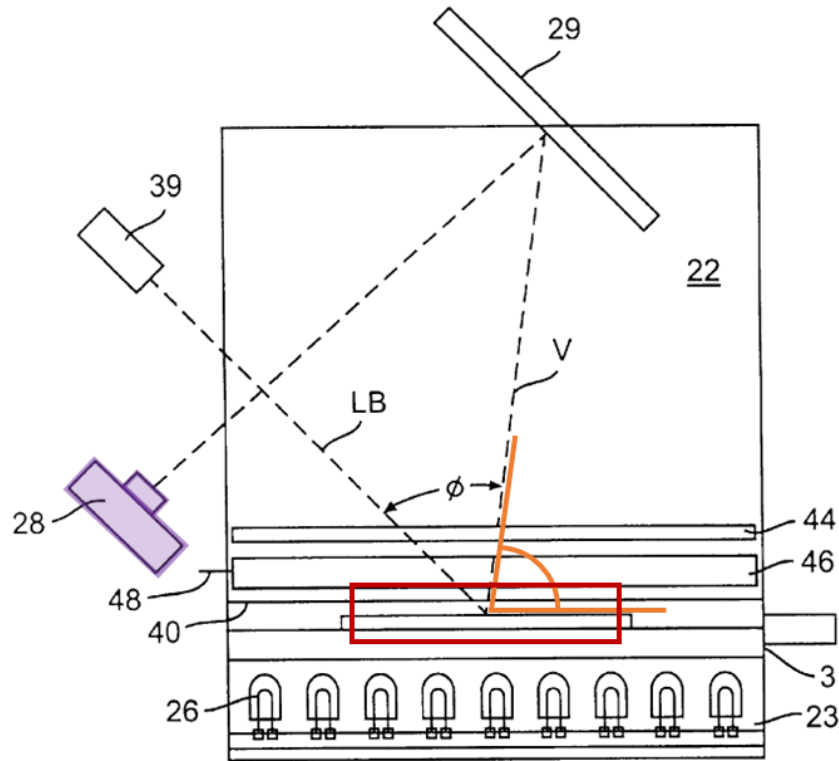


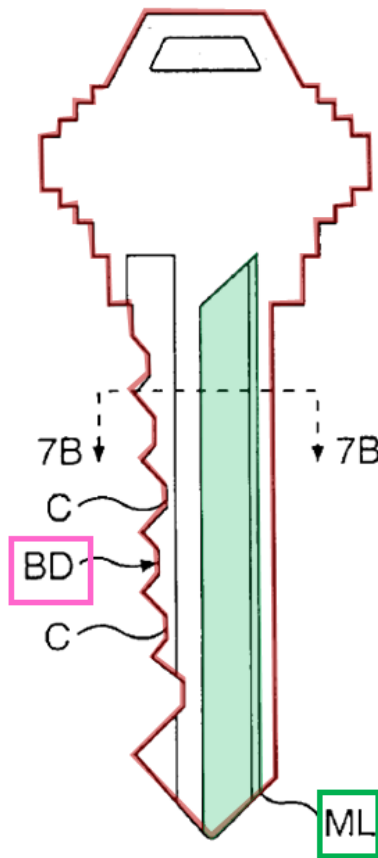
FIG. 9

Wills, Figure 9 (annotated).

60. In particular, as one example, *Wills* proposes that an angle at which the laser beam LB (shown in Figure 9 below) strikes the master key be “ten to eighty degrees (10-80°)” relative to the side of the master key, and that the angle Φ between the laser beam LB and the viewing axis V be, for example, “at sixty degrees (60°).” *Wills*, 12:12-25. Thus, as illustrated below, *Wills* contemplates an embodiment in which, for example, the angle at which the laser beam LB strikes the master key is

50° relative to the side of the master key, and the angle Φ between the laser beam LB and the viewing axis V is 60°, such that the angle between the viewing axis V and the side of the master key is 70°. *Id.*

61. A POSA would have recognized from *Wills* that the side of the 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.” As Figure 7A shows, the blade “BD” of the master key in *Wills* is co-planar with one side of the master key, and the blade includes a milling “ML”. *Wills*, 5:11-24, 5:56-59. It is this side of the master key—that is, the side including the co-planar blade and its milling—with which the light beam interfaces to capture the image.



62. As *Wills* explains, the machine includes a “drawer,” and “one side of the **master key** is disposed” on the “bottom” of the “drawer.” *Wills*, 7:5-8, 11:44-46. The other side of the **master key** faces upward, such that “the light beam LB interfaces with the side of the **master key**.” *Id.*, 11:46-49. In particular, as Figures 7B and 7D show, the light beam interfaces with the **milling** in the **blade**, as the captured **image** reflects.

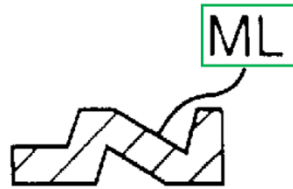


FIG. 7B

Wills, Figure 7B (annotated).

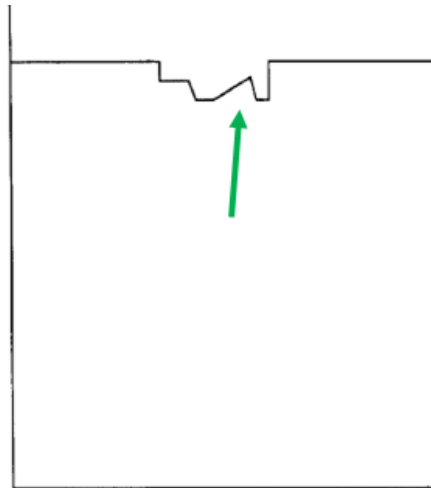


FIG. 7D

Wills, Figure 7D (cropped and annotated).

63. Because a POSA would thus have understood from *Wills* that the **image** is captured at an **angle** between perpendicular and parallel to the side of the **master key** and not including perpendicular or parallel to the side of the **master key**, and would further have understood from *Wills* that the side of the **master key** captured in the **image** is co-planar with the **blade** of the **master key**, a POSA would have

understood from *Wills* that the image is captured “at 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**.”

64. 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 and/or would have rendered obvious that this **angle** is “between perpendicular and parallel to the [side] of said **master key** and not including perpendicular or parallel to the [side] of said **master key**.”

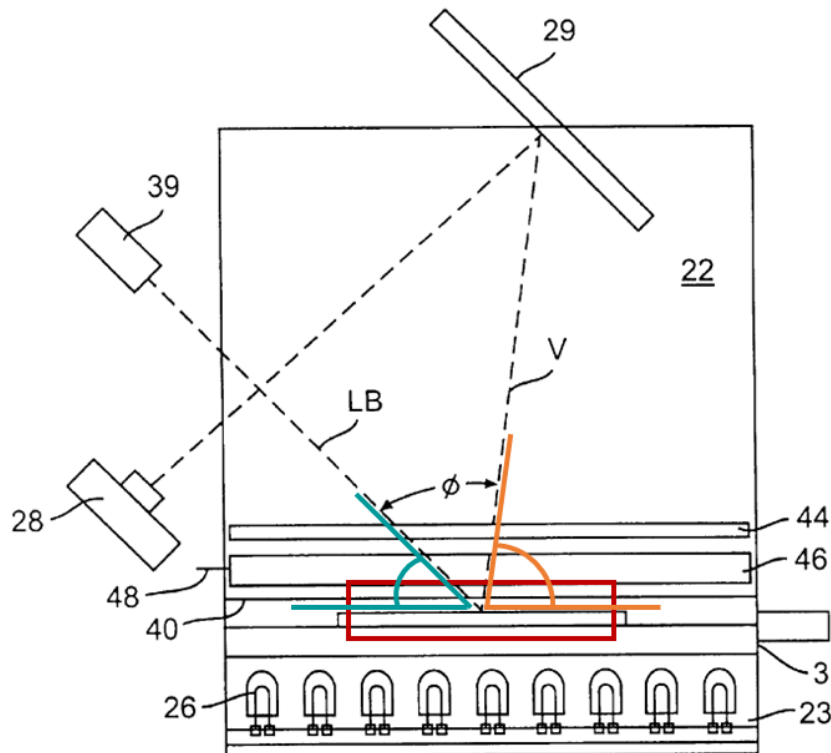


FIG. 9

Wills, Figure 9 (annotated).

65. I have been told that a claimed range is anticipated if one of the values in the range is in the prior art. Here, at least one angle of *Wills* is in the range “between perpendicular and parallel to the [side] of said **master key** and not including perpendicular or parallel to the [side] of said **master key**” as disclosed by *Wills*, as shown above. Thus, in my opinion, *Wills* discloses this.

66. I have also been told that where a range is disclosed in the prior art, and the claimed invention falls within that range, there is a presumption of obviousness. I understand that this presumption is only overcome where (1) the prior art teaches away from the claimed invention or (2) there are new and unexpected results relative to the prior art. In my opinion, *Wills* renders the claimed angle obvious, because the claimed angle falls within the range disclosed by *Wills* and neither of (1) or (2) is present here.

67. Regarding (1), *Wills* not only does not teach away from “an **angle** between perpendicular and parallel to the **blade** of said **master key** and not including perpendicular or parallel to said **blade** of the **master key**,” *Wills* recognizes the value of such an angle for the viewing axis V. In particular, *Wills* recognizes that placing the camera somewhere other than directly overhead the key (which would result in a viewing axis V “perpendicular ... to the **blade** of said **master key**”) can require a larger machine to accommodate the focal length of the camera. *Wills*, 7:39-50. For

this reason, *Wills* proposes employing the “mirror 29” shown in Figure 9, “to minimize the size of the machine[.]” *Id.* Notably, *Wills*’ configuration employing the mirror is consistent with one way that the “imaging system” and the “angle” are described in the ’619 patent. For example, the ’619 patent envisions an embodiment in which, as in *Wills*, a camera and a mirror are used together “to allow a single camera at a remote position to capture multiple angles of the master key, including angles of the tip 14.” ’619 patent, 5:27-34.

68. Regarding (2), capturing the image at “an angle between perpendicular and parallel to the blade of said master key and not including perpendicular or parallel to said blade of the master key” does not create any “new and unexpected results” not recognized by *Wills*. Rather, *Wills*, like the ’619 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 ’619 patent, 5:1-5 (“Neither overhead scanning of the groove 11 nor parallel scanning of the groove 11 provide sufficient contrast between the groove 11 and the rest of the key 10 to effectively determine certain parameters of the groove 11.”).

69. Thus, a POSA would have understood *Wills* to describe a range of angles for the viewing axis V that includes the “angle between perpendicular and

parallel to the **blade** of the **master key** and not including perpendicular or parallel to the **blade** of the **master key**,” and in my opinion this range discloses and/or would have rendered obvious “an **angle** between perpendicular and parallel to the **blade** of said **master key** and not including perpendicular or parallel to said **blade** of the **master key**.”

70. Finally, *Wills* also describes that the “captured **image** of said **tip** includes a **contour** of a **groove** in said **master key**” because the captured **image** in *Wills*—whether the **two-dimensional slice** captured at the **tip** of the **master key** or the resulting **three-dimensional representation**, both of which would include the **tip** of the **master key**—includes **surface information**, including a **depth**, of the **milling** in the **master key**.

71. As Figure 7A shows, *Wills*’ **master key** includes the **blade** in which is formed the **milling**, which *Wills* describes as “a longitudinally-extending **groove** ... in the **blade**.” *Wills*, 5:22-24, 5:56-59. From this, a POSA would have understood *Wills*’ “**milling**” to be a “**groove**,” as claimed.

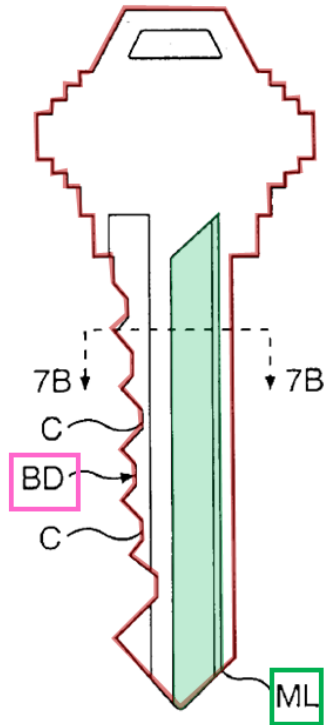


FIG. 7A

72. 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.

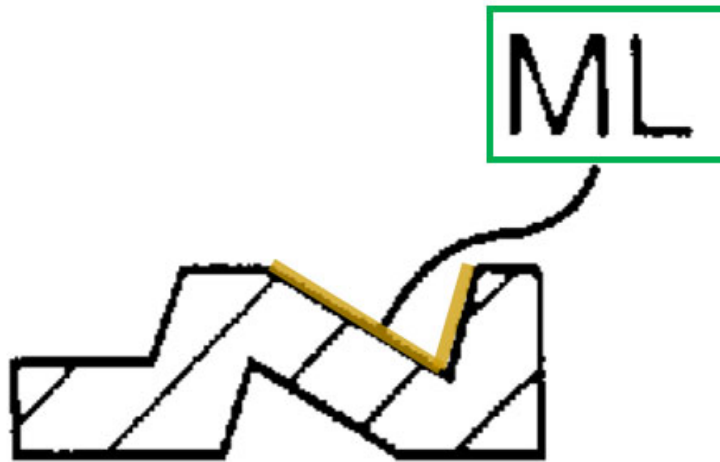


FIG. 7B

Wills, Figure 7B (annotated).

73. In my opinion, a POSA would have understood the **surface information**, such as the **depth**, of the **milling** of *Wills*' **master key** to be “a **contour** of a **groove** in said **master key**.” This is because, as Figure 3 of the '619 patent shows, the **contour** of the **groove** in the '619 patent, like the **surface information** of the **milling** in *Wills*, is a physical geometry of the **groove**. '619 patent, 5:23-24; *see also id.*, Figure 6 (showing “**contour** data related to **contours** of the **groove**” in Figure 3), Figure 7 (showing calculated “**groove contours**”), 4:51-54 (describing “[c]haracteristics of

the **grooves**,” including “the size, location, angle, and other geometric parameters of a given **groove**”), 5:27-29 (describing “**groove geometry**”).

74. The **image** captured in *Wills* includes the **surface information**, such as the **depth**, of the **milling** in the **master key**. The **two-dimensional slice** captured by the **camera**, shown in Figure 7D, “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. 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. While Figure 7D, which corresponds to “the surface shown in FIG. 7B,” illustrates a **two-dimensional slice** taken along the line 7B–7B in Figure A, *Wills*, 3:11-12, a POSA would have understood from *Wills* that, among the two-dimensional slices taken “along the length of the **key**” would be the **two-dimensional slice** captured at the **tip** of the **master key**, and the **two-dimensional slice** captured at the **tip** would, like the **two-dimensional slice** taken along the line 7B–7B, include the **surface information** of the **master key**, including the “**depth of [the] milling**.” Indeed, each of *Wills*’ two-dimensional slices taken at a position along the length of the **master key** where the **milling** is present would include the **surface information** of the **master key**, including the “**depth of [the] milling**” at that position. 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**, as the **three-dimensional representation** is simply formed by “stack[ing]” the two-dimensional slices—each including **surface information** for the slice—captured “along the length of the key.” *Id.*, 15:40-47.

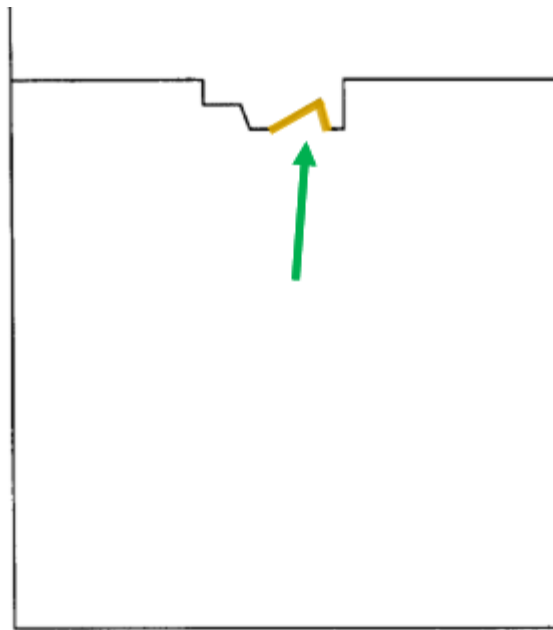


FIG. 7D

Wills, Figure 7D (cropped and annotated).

75. Thus, because *Wills*’ machine includes a **camera** configured to capture an **image** of the **tip** of a **master key** at a range of angles, including an **angle** between perpendicular and parallel to the **blade** of the **master key** and not including perpendicular or parallel to the **blade** of the **master key**, and because the captured

image in *Wills* includes surface information, including a depth, of the milling in the master key, *Wills* discloses and/or would have rendered obvious “an imaging system configured to capture an image of the tip of a master key at 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, wherein the captured image of said tip includes a contour of a groove in said master key.”

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

76. *Wills* discloses “a logic configured to analyze said captured image to determine characteristics of said groove based on said contour” because *Wills* describes a computer subsystem configured to analyze the captured image to determine depth measurements of the milling based on the surface information, including the depth.

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

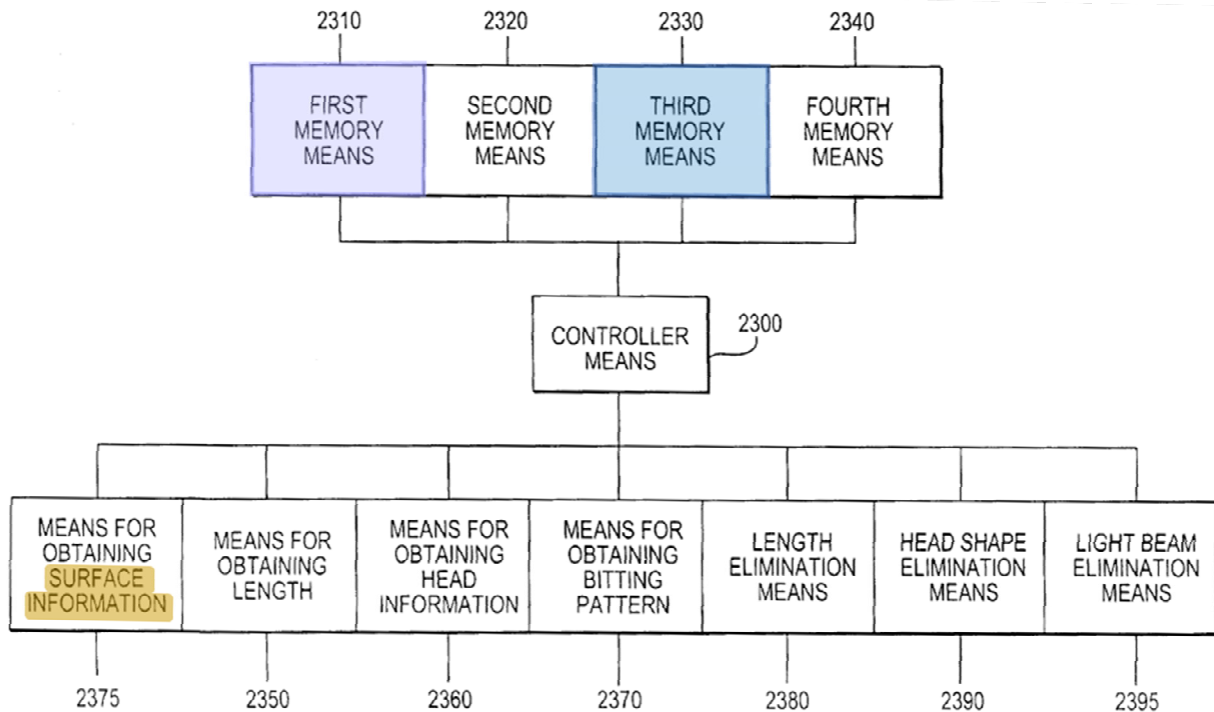


FIG. 23

Wills, Figure 23 (annotated).

78. As explained for 1[a], *Wills*' *image*—whether the *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” in Figure 23. *Wills*, 37:11-15. From the *image* data, *Wills* explains, the means for obtaining *surface information* “extracts *depth measurements*” for the *milling* in the *master key*. *Id.*, 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*' computer subsystem to be “**characteristics** of said **groove** based on said **contour**” because the **depth measurements** are measurements of the **milling** and reflect the **surface information**, including the **depth**, captured in the **image**. A POSA would have understood “**characteristics** of said **groove**” to include, among other things, measurements of the “**groove**,” like the **depth measurements** of the **milling** in *Wills*, and a POSA would have understood that such **depth measurements** are “based on said **contour**,” because the **depth measurements** are based on the **surface information**, including the **depth**.

79. *Wills* also discloses “a logic configured ... further to compare said **characteristics** of said **groove** with **groove characteristics of known key blanks** to determine the likelihood of a match between said **master key** and a known key blank” because *Wills*' computer subsystem is also 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.

80. As *Wills* explains, the computer subsystem also stores “surface information of each of the reference keys” in a “first memory means 2310,” as shown in Figure 23. *Wills*, 31:56-61. This “surface information of each of the reference keys” includes, for each reference key, “**depth measurements across the width of the [reference] key**.” *Id.*; see also *id.*, 15:2-5 (“The memory means also stores information about the light beam LB interfacing with each of the reference keys[.]”).

81. To identify a reference key for the **master key**, *Wills* explains, a “light beam elimination means 2395” of *Wills*’ 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.” *Wills*, 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).

82. In my opinion, a POSA would have understood *Wills*’ computer subsystem to disclose the claimed “logic,” because *Wills*’ computer subsystem is consistent with how the “logic” is described in the ’619 patent. For example, the ’619 patent provides that the “logic” may take the form of “a memory device containing instructions.” ’619 patent, 4:12-20. 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. In my opinion, “a memory device containing instructions” encompasses programs stored on a hard disk, as *Wills* describes. For this reason, my opinion that *Wills* discloses the claimed “logic” is the same whether or not “logic” is construed as a means-plus-function term. *See* Section VIII.

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.

83. *Wills* discloses that the “logic includes a database containing data related to **characteristics of grooves of known key blanks**” because *Wills* describes 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 (example surface information for reference keys). A POSA would have understood the **depth measurements of the reference keys** to be “**characteristics of grooves of known key blanks**” because a POSA would have understood “characteristics” to encompass “depth measurements,” and a POSA would have recognized that “depth measurements,” like the other “surface information” stored in the database in *Wills*, are characteristics of the millings, or “grooves,” of the reference keys.

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

84. *Wills* discloses that the “**imaging system** includes a camera” because *Wills*’ machine captures the image of the master key using the “**camera 28**,” as shown in Figure 9. *Wills*, 7:38-46.

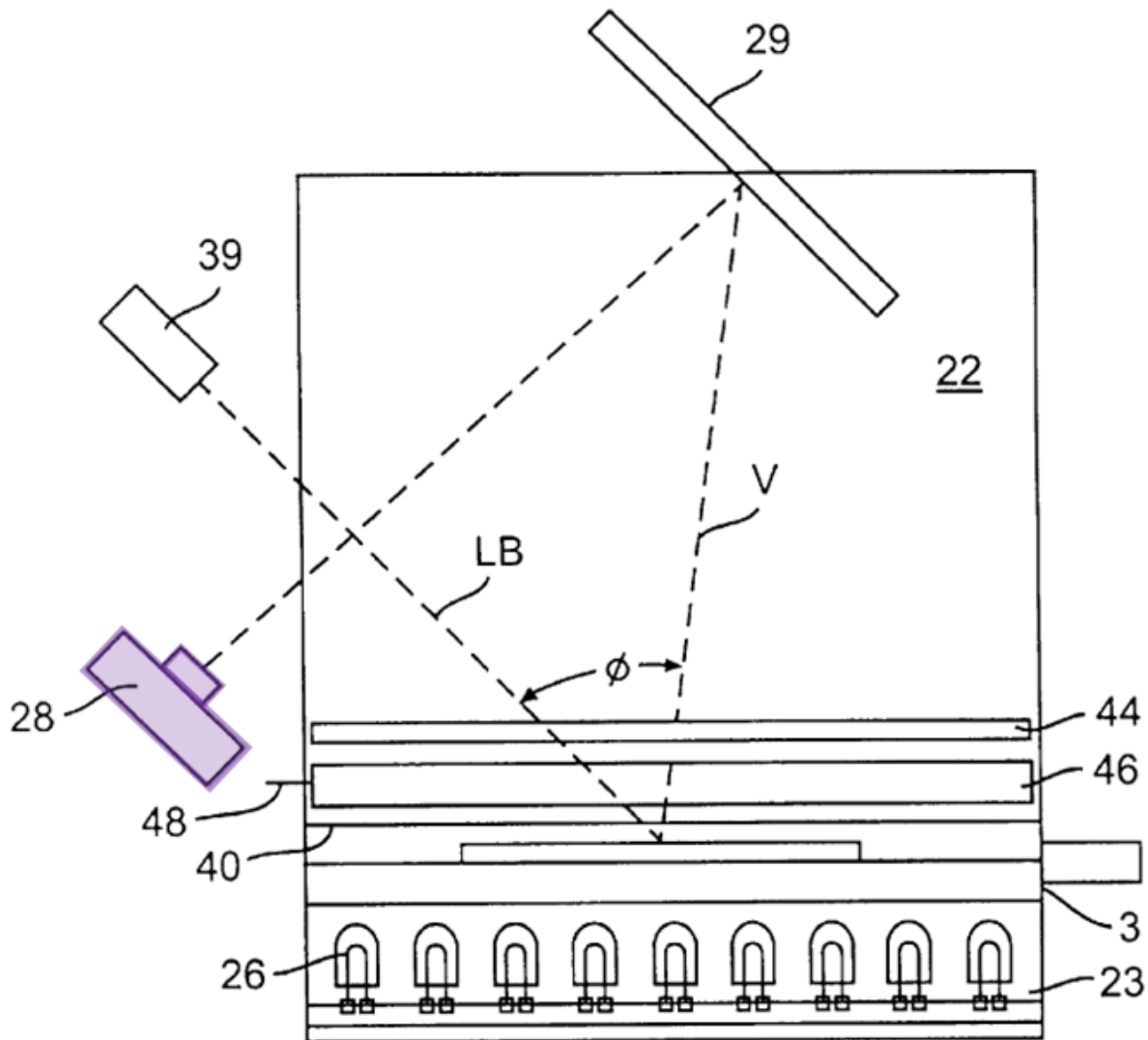


FIG. 9

Wills, Figure 9 (annotated).

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

85. *Wills* discloses that the “**imaging system** includes a **reflecting device**” because *Wills*’ machine employs a “**mirror 29**,” shown in Figure 9, that “reflects the

image [of the master key] to the camera 28.” *Wills*, 7:47-48.

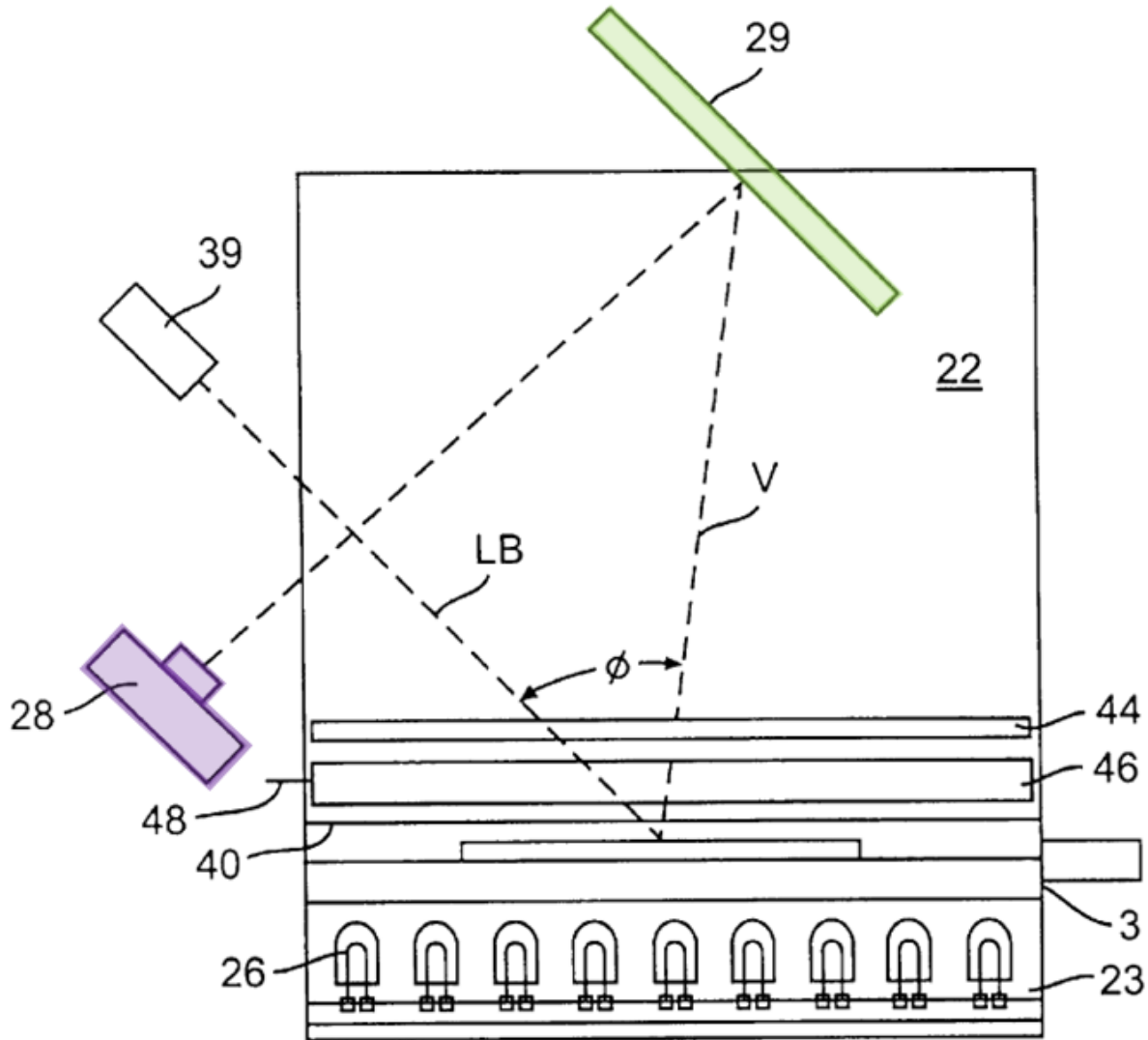


FIG. 9

Wills, Figure 9 (annotated).

5. **Claim 5:** The key identification system of claim 1, wherein said **imaging system** includes a **light**.

86. *Wills* discloses that the “**imaging system** includes a **light**” because *Wills*’

machine employs a “light emitting means,” such as a “laser line generator 39 that produces a laser beam,” as shown in Figure 9. *Wills*, 11:48-50.

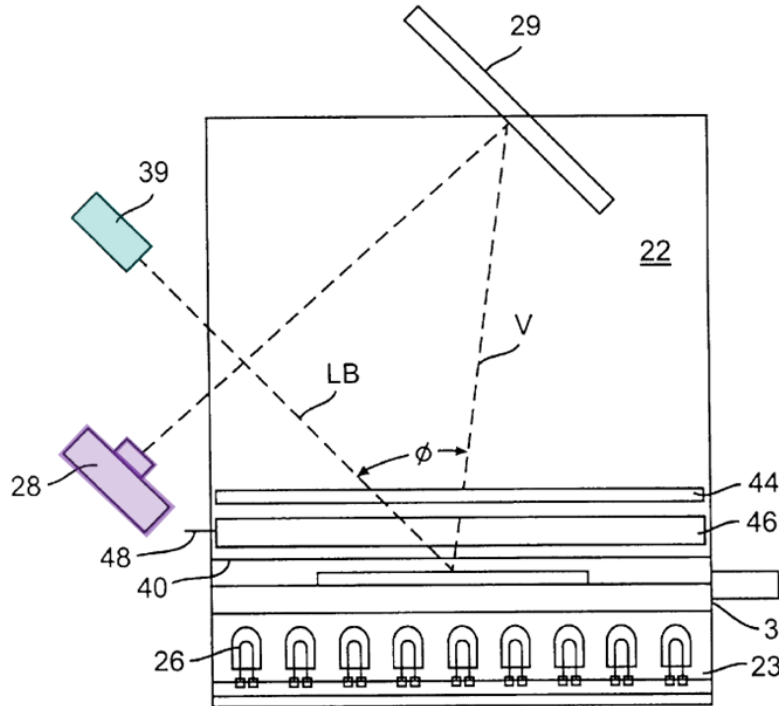


FIG. 9

Wills, Figure 9 (annotated).

87. Alternatively, *Wills* discloses that the “imaging system includes a light” because *Wills*’ machine employs an “array of LEDs 26,” as shown in Figure 9. *Wills*, 6:65-7:3. *Wills* envisions using such an “array of LEDs 26” in connection with the camera 28, as Figure 9 shows. In particular, *Wills* contemplates using the LEDs 26 and the camera 28 to capture a “profile” or “outline” of the key that, along with the surface information, is used in *Wills* to identify a reference key for the master key. *See, e.g., Id.*, 7:64-8:4, 9:25-40, Figure 24.

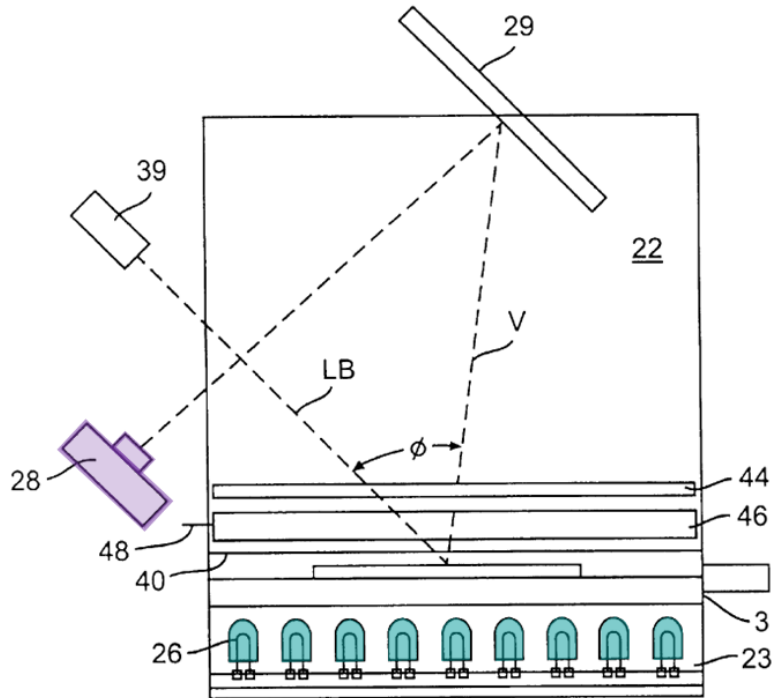


FIG. 9

Wills, Figure 9 (annotated).

- 6. Claim 6: The key identification system of claim 5, wherein said light is directed toward said reflecting device.**

88. *Wills* discloses that the “light is directed toward said reflecting device” 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.

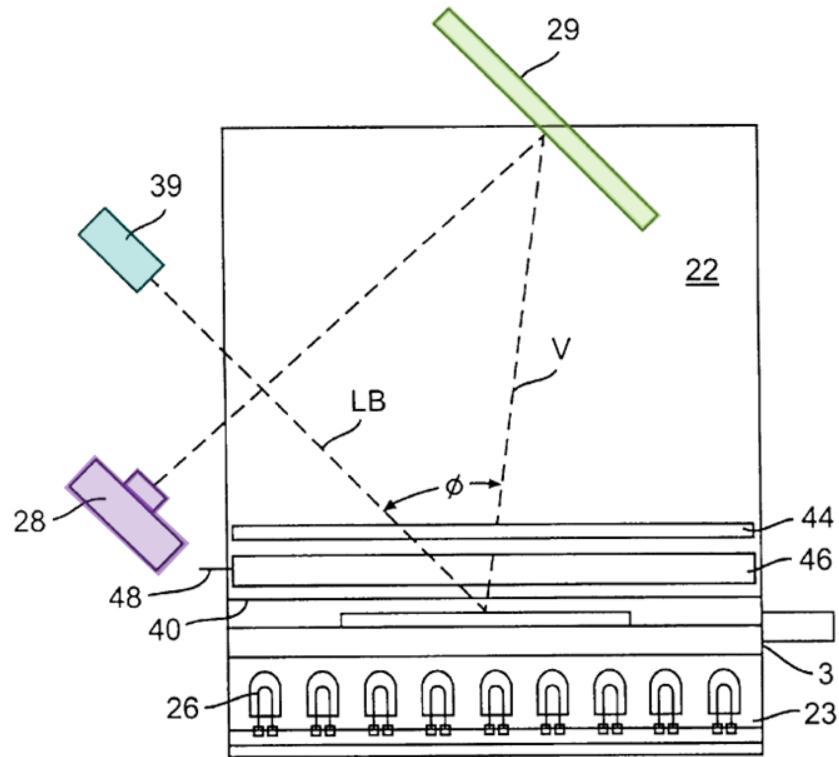


FIG. 9

Wills, Figure 9 (annotated).

89. Alternatively, *Wills* discloses that the “light is directed toward said reflecting device” because, as Figure 9 shows, the array of LEDs is “directed toward” the mirror.

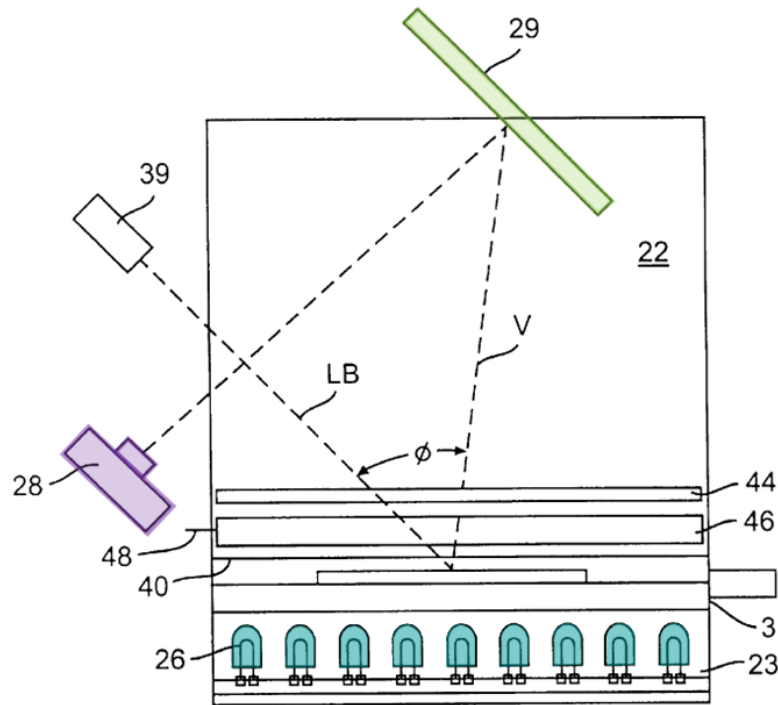


FIG. 9

7. Claim 8: The key identification system of claim 1, wherein said captured **image is a digital image.**

90. *Wills* discloses that the “captured **image** is a digital image” because *Wills* explains that the 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 the “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”). From *Wills*, a POSA would have understood that the **two-dimensional slices** captured along the length of the key are thus “digital image[s]”

and, accordingly, that the **three-dimensional representation** formed by stacking the digital two-dimensional slices is a “digital image” as well. Such digitizing of images would have been common and within the skill of a POSA, and the POSA would have recognized that such digitizing was known to allow the image to be analyzed for comparison with images of reference keys.

8. Claim 10: The key identification system of claim 1, wherein said **characteristics of said **groove** include the geometric shape of said **groove**.**

91. *Wills* discloses that the “**characteristics** of said **groove** include the geometric shape of said **groove**” because a POSA would have recognized that the **depth measurements** of the **milling** are a “shape” of the **milling**.

92. *Wills* states that the “light beam image data” of the two-dimensional slices (and, when formed by stacking the two-dimensional slices, the three-dimensional representation) “represents the result of the light beam interfacing with ... the **surface** [of the **milling**] shown in FIG. 7B.” *Wills*, 37:11-14.

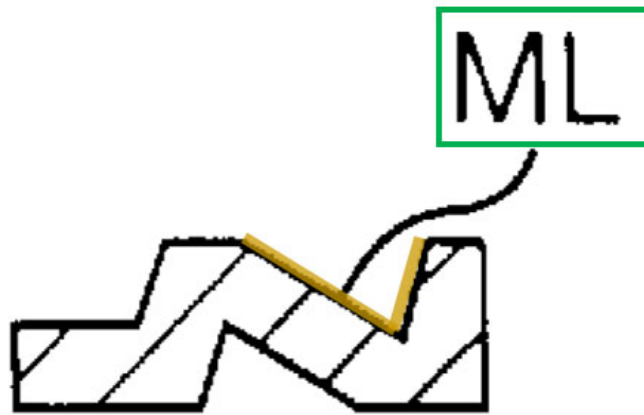


FIG. 7B

Wills, Figure 7B (annotated).

93. The **surface** of the **milling**, as shown, has a “**surface** shape” having particular **depth measurements**. *Wills*, 15:38-39 (“A light beam scan in one position gives a two-dimensional slice of the **surface** shape.”). Thus, a POSA would have recognized, in “extract[ing] [the] **depth measurements**” for the **milling**, as *Wills* describes, *Wills*’ machine extracts the “**surface** shape” of the **milling**. *Id.*, 37:16-19; *see also id.*, 37:20-39:1 (discussing pseudocode for extracting **depth measurements**). Because *Wills* thus discloses that the **depth measurements** of the **milling** are a “**surface** shape” of the **milling**, *Wills* discloses that the “**characteristics** of said **groove**

include the geometric shape of said **groove**.” A POSA would have understood “**surface** shape,” as used in *Wills*, to refer to “geometric shape,” as claimed, because a POSA would have recognized that the “**surface**” of *Wills*’ **milling** has a geometric shape, including its **depth**, as shown in Figure 7B. *See, e.g., Id.*, 11:52-55 (referring to the **milling** as “the non-planar portion of the side of the key), 14:17-19 (discussing “the geometry of the non-planar portion”).

9. Claim 12: 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 **groove**.**

94. *Wills* discloses that the “logic accounts for tilting of said **master key** with respect to said **imaging system** to determine **characteristics** of said **groove**” because *Wills*’ machine accounts for in-plane movement of the **master key** with respect to the **camera** in extracting the **depth measurements** of the **milling**.

95. A POSA would have understood “tilting” in the ’619 patent to encompass in-plane movement of the **master key**, as shown in Figure 14 below. ’619 patent, 7:2-4 (“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 ’619 patent seeks to account for tilting of the **master key** so that “[t]he **key** is not constrained to a particular orientation or position.” *Id.*, 7:1-2.

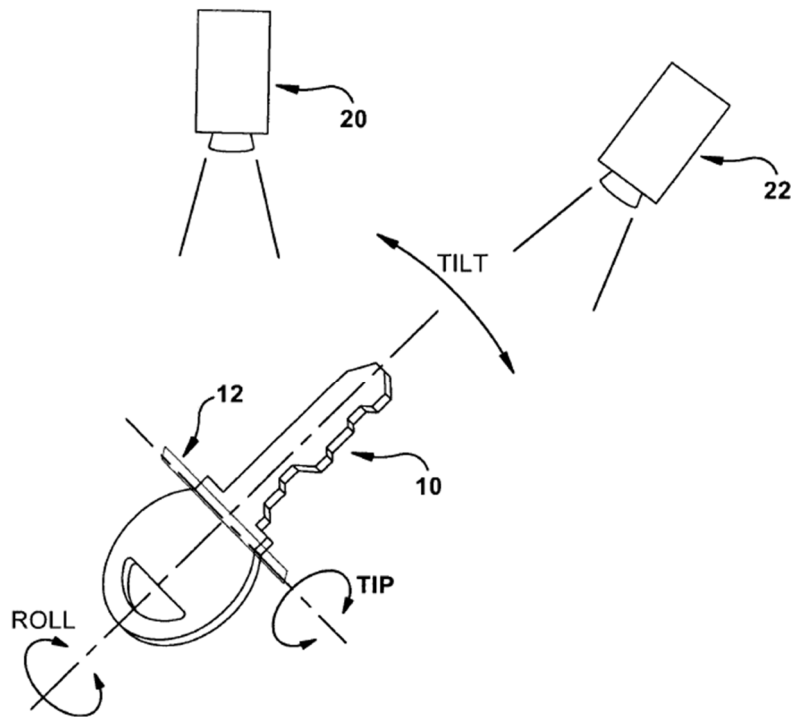


FIG. 14

'619 patent, Figure 14.

96. Similarly, in *Wills*' machine, "[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 "translating ... to a predetermined reference position and orientation" in *Wills* to describe in-plane movement of the **master key** akin to the "tilting" of the '619 patent. As *Wills* explains, this translating 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. *Id.*, 9:38-43. As a result, *Wills*' machine, like the system of the '619 patent, "does not require the master key to be precisely aligned to operate efficiently." *Id.*, 7:29-31. A POSA would have recognized that accounting for positional variations, like the "tilting" of the '619 patent, was known to facilitate comparison of the image of the master key and images of the reference keys, as *Wills* describes, especially in a machine like *Wills*' where the master key, placed in a drawer, *Wills*, 7:4-8; 11:44-46, is likely to experience in-plane movement. In my own work at Hillman, such positional variations were recognized and addressed in machines in which the master key was laid upon a surface like *Wills*' drawer.

10. Claim 14: The key identification system of claim 3 further comprising a mirror positioned to reflect an image of said master key to be captured by said camera.

97. *Wills* discloses "a mirror positioned to reflect an image of said master key to be captured by said camera" because *Wills*' machine employs a "mirror 29," shown in Figure 9, that "reflects the image [of the master key] to the camera 28" to be captured. *Wills*, 7:47-48.

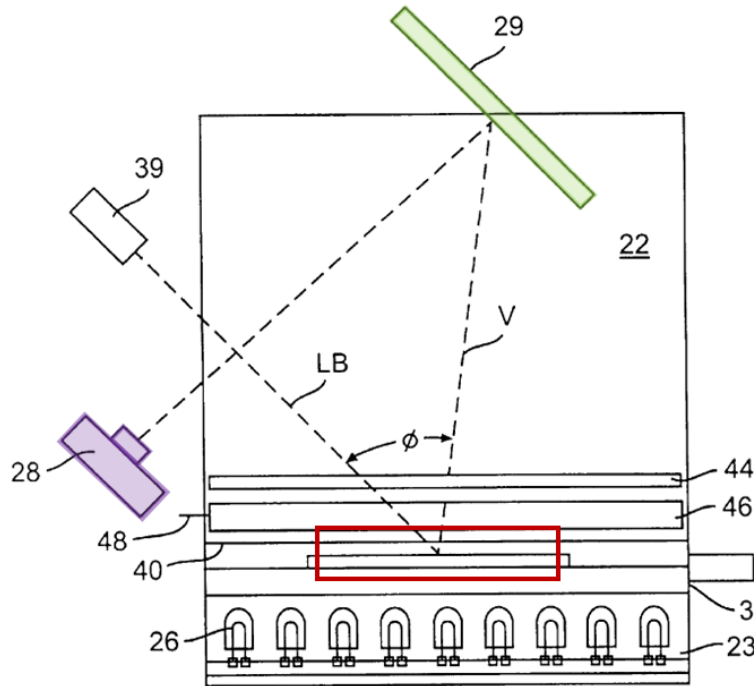


FIG. 9

Wills, Figure 9 (annotated).

11. Claim 19: The key identification system of claim 1 further comprising a key holder configured to hold said master key.

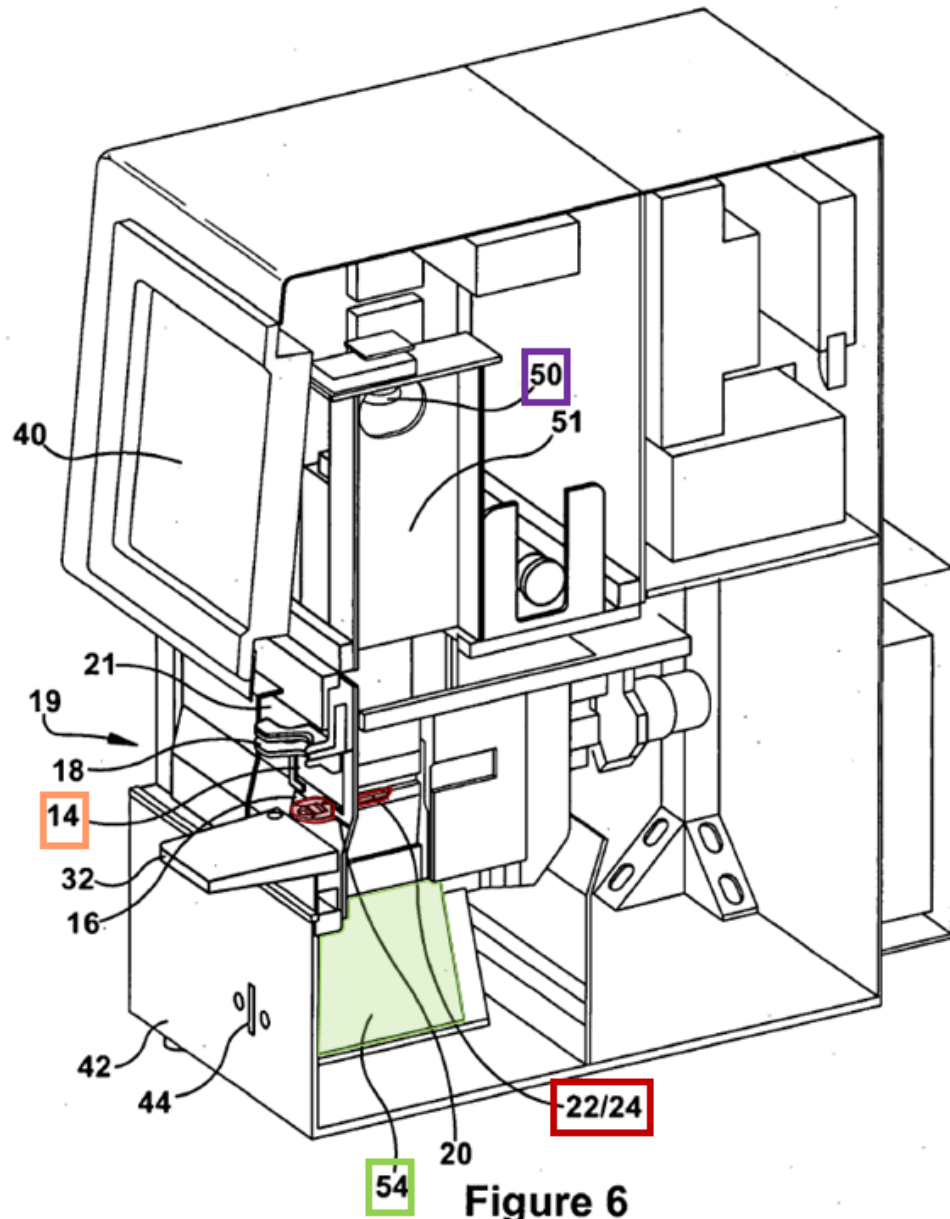
98. *Wills* discloses “a key holder configured to hold said master key” because *Wills*’ machine includes a “supporting means” for the master key, such as a “drawer 30” that has “a bottom 32 against which one side of the master key is disposed.” *Wills*, 7:4-8; 11:44-46 (“the master key remains on the supporting means, specifically on the drawer 30” during the surface information analysis”). *Wills*’ drawer is consistent with one way in which the “key holder” is described in the ’619 patent, namely, as “any device capable of holding or supporting a master key.” ’619 patent, 3:58-60.

**12. Claim 20: The key identification system of claim 19,
wherein said key holder includes a lower support.**

99. *Wills* discloses that the “key holder includes a lower support” because *Wills*’ “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 (“the master key remains on the supporting means, specifically on the drawer 30” during the surface information analysis).

**B. Ground 3: *Wills* and *Bass* Would Have Rendered Obvious
Claims 7, 21, and 22**

100. *Bass*, like *Wills*, describes a machine for duplicating master keys. *Bass*, [0009]. As in *Wills*, the master key is placed in the machine, and a camera is used to capture an image of the master key, as shown in Figure 6. *Id.*, [0055]



Bass, Figure 6 (annotated).

101. As in *Wills*, where the **master key** is placed into the machine on a “supporting means,” *Wills*, 7:4-8, in *Bass*’ machine in the **master key** is placed into the machine on a “base 16,” as shown. *Bass*, [0047], [0050]. In addition, *Bass*’ machine employs a “**door clamp 14**,” as shown.

102. *Bass*' machine, like *Wills*, uses light to illuminate the master key being imaged by the camera. *Wills*, 6:65-7:3; *Bass*, [0057]. *Bass*' "lighting panel 52" is shown in Figure 7. *Bass*, [0057]. Also, just as *Wills*' machine employs a mirror, *Wills*, 7:39-50, *Bass*' system employs a "reflector plate 54," as shown, *Bass*, [0047].

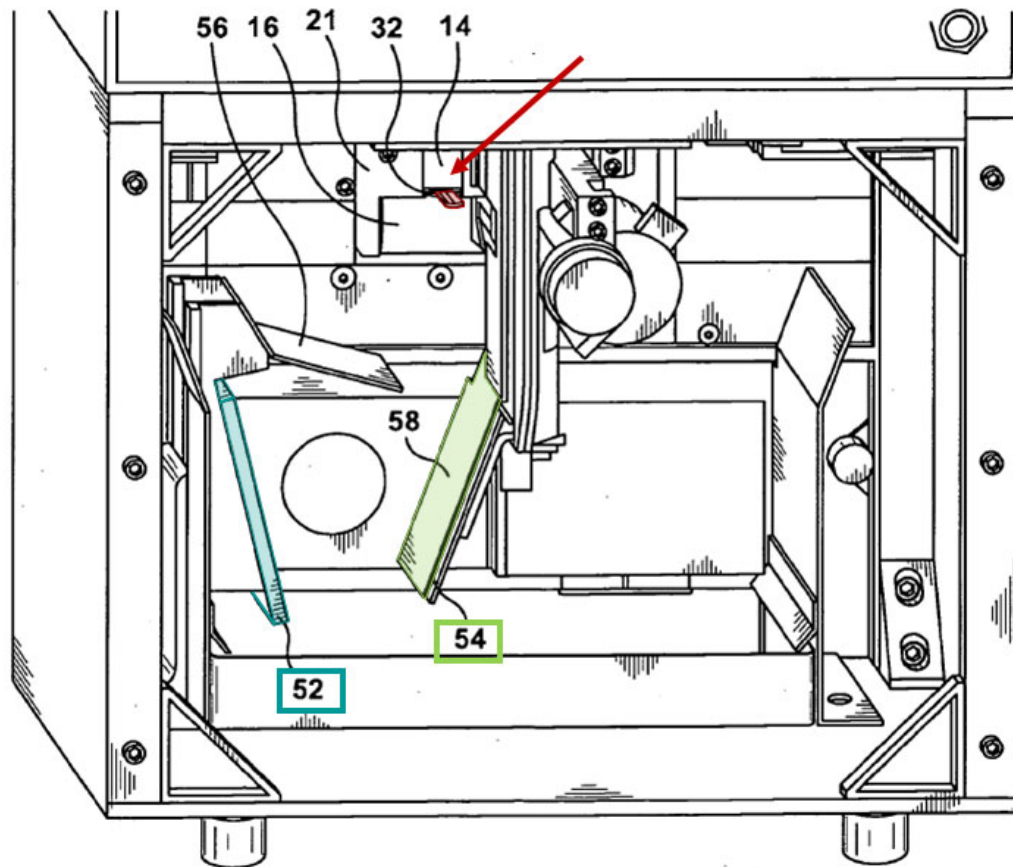


Figure 7

Bass, Figure 7 (annotated).

103. Together, *Wills* and *Bass* would have rendered obvious each of claims 7, 21, and 22, as explained below.

- 1. Claim 7: The key identification system of claim 5, wherein said light includes a shield to direct light away from said master key.**

104. *Wills* and *Bass* teach that the “light includes a shield to direct light away from said master key” because *Bass* teaches using a shield to direct light away from a master key to be imaged and, from *Bass*, a POSA would have been motivated and found it obvious to modify *Wills*’ machine to include a shield as in *Bass*.

105. As explained for claim 6, *Wills'* machine for imaging a master key includes an array of LEDs and a mirror, as shown in Figure 9. *Wills*, 6:65-7:3.

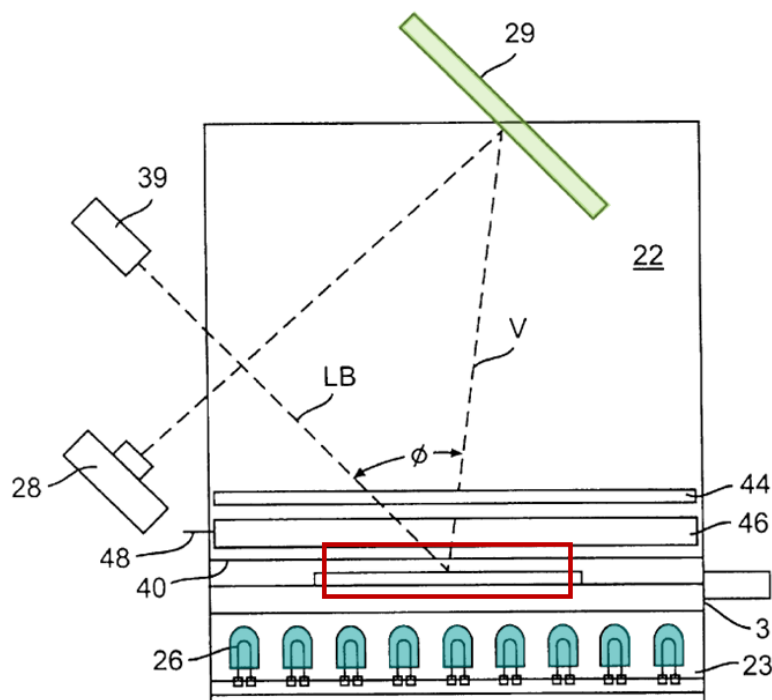


FIG. 9

Wills, Figure 9 (annotated).

106. *Bass'* machine similarly images the master key using both a “lighting

panel 52” and a “reflector plate 54,” as shown in Figure 7. *Bass*, [0057]. In addition, *Bass* recommends using a “blocking plate 56.” *Id.* As *Bass* explains, the “blocking plate 56” 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]. A POSA would have understood *Bass*’ blocking plate to be a “shield” because, just as the shield of the ’619 patent shields light from the light, *Bass*’ blocking plate blocks light from the lighting panel. Compare ’619 patent, 6:32-40 with *Bass*, [0057].

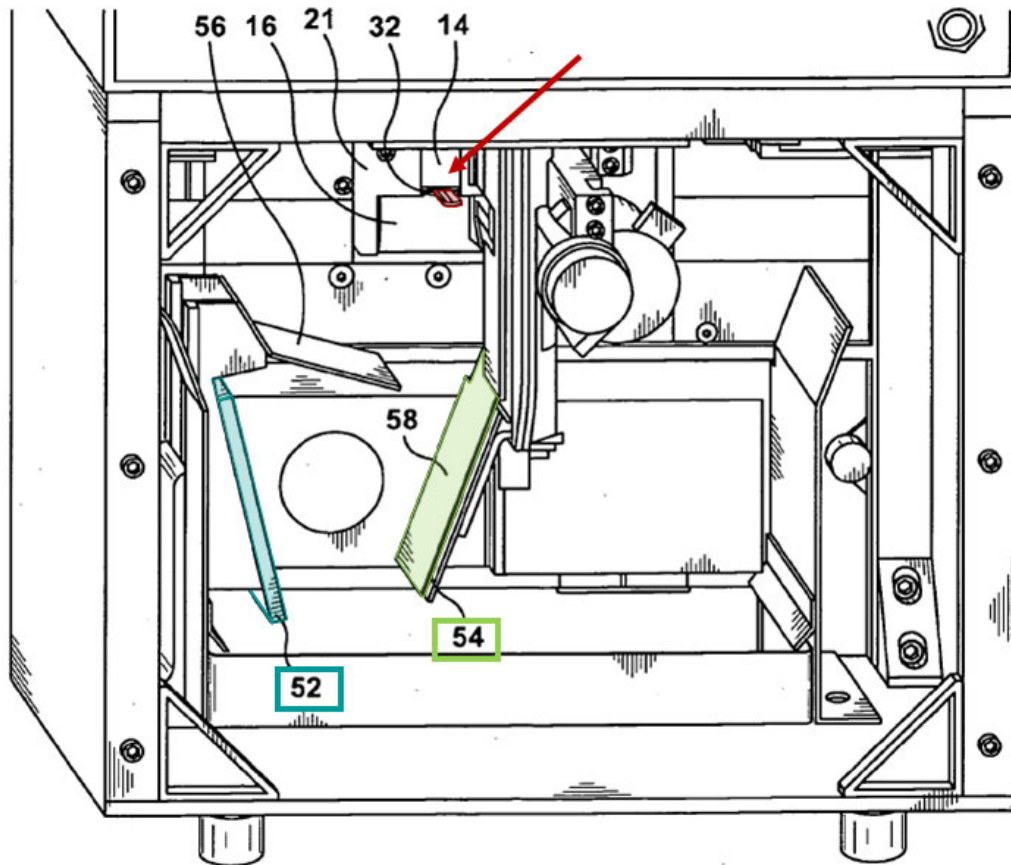


Figure 7

Bass, Figure 7 (annotated).

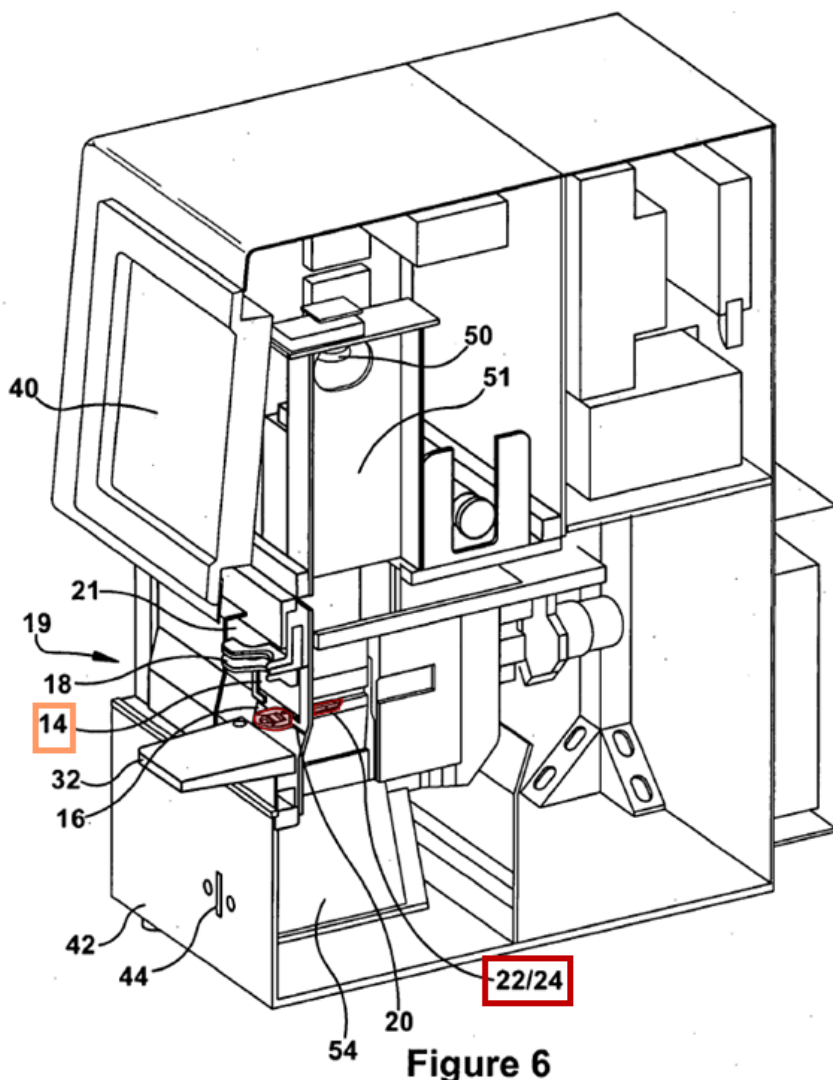
107. From *Bass*, a POSA would have been motivated and found it obvious to modify *Wills*' machine to similarly include a blocking plate for use with *Wills*' LEDs and *mirror*, in the same manner that *Bass*' blocking plate is used with *Bass*' *lighting panel* and *reflector plate*. A POSA would have been motivated by *Bass*' teaching that such a blocking plate, together with a *reflector plate* like *Wills*' *mirror*, serves "[t]o enhance an image captured by [an] optical imaging device," like *Wills*'

camera, because “the positioning of” the **mirror** and the blocking plate can be “adjusted to improve ... captured images.” *Bass*, [0057], [0059]. A POSA would have found such a modification obvious because it would have involved nothing more than the use of a known technique—*Bass*’ blocking plate in a key duplicating machine—to improve a similar device—*Wills*’ key regenerating machine—in the same way, namely, by serving to enhance an image of a **master key** captured by a camera. Given the similarities between *Wills*’ and *Bass*’ machines, such a modification would have been within the skill of the POSA and yielded nothing more than predictable results.

2. Claim 21: The key identification system of claim 20, wherein said key holder includes an **upper door.**

108. *Wills* and *Bass* teach that the “key holder includes an upper door” because *Bass* teaches supporting the **master key** using a door clamp, and, from *Bass*, a POSA would have been motivated and found it obvious to modify the supporting means of *Wills*’ machine to include a door clamp as in *Bass*.

109. 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. Similarly, in *Bass*’ machine, the **master key** is placed into the machine on a “base 16,” as shown in Figure 6, *Bass*, [0047], [0050]. In addition, as shown, *Bass*’ machine employs a “**door clamp** 14.” *Id.*



Bass, Figure 6 (annotated).

110. *Bass*' door clamp 14 and base 16 are further illustrated in Figure 5, below.

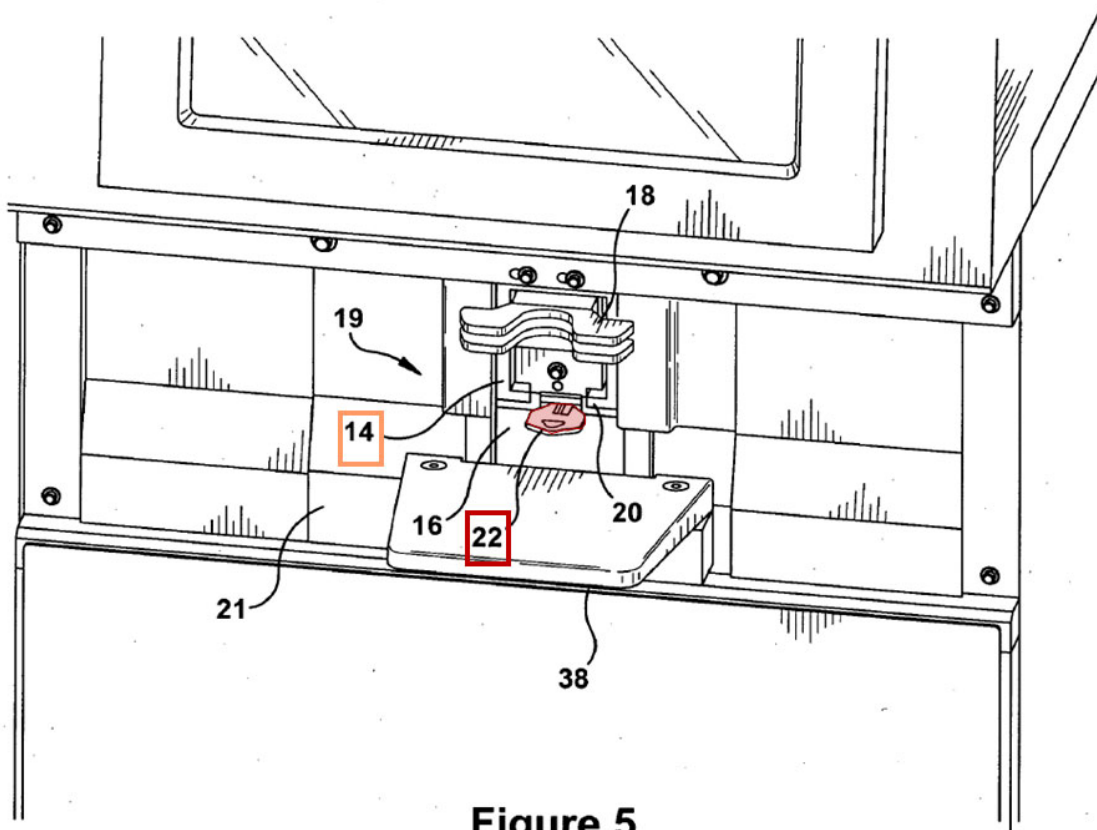


Figure 5

Bass, Figure 5 (annotated).

111. A POSA would have understood *Bass*' door clamp to be an "upper door." Like the "upper door" of the '619 patent, which together with a "lower support" serves to "close onto the key," '619 patent, 3:59-64, *Bass* teaches that the 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].

112. From *Bass*, a POSA would have been motivated and found it obvious to modify *Wills*' machine to include a door clamp as in *Bass*, to the extent this is not disclosed in *Wills*. A POSA would have been motivated by *Bass*' teaching that the

door clamp, together with a base like the bottom of the drawer in *Wills*, “secure[s] [the] master key” by applying a “force ... sufficient to retain or hold the key ... in place.” *Bass*, [0047]. A POSA would have recognized that *Bass*’ door clamp, when implemented in *Wills*’ drawer, would have improved the ability of *Wills*’ 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. As one example, *Wills* teaches that the drawer in *Wills*’ machine must be closed by an operator after the master key has been placed in it, *Wills*, 7:54-56, which a POSA would have recognized poses a risk that the master key will shift out of place during the closing. A POSA would have recognized that “secur[ing] [the] master key” with a door clamp, as *Bass* recommends, would aid in addressing this risk. 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*’ key regenerating machine—in the same way, namely, by securing the master key by applying a force sufficient to retain or hold the key in place on a support below. It would have been within a POSA’s skill to implement a door clamp, as *Bass* recommends, that effectively secured the master key in *Wills*’ drawer without hampering operation of *Wills*’ machine. As one example, as noted in Section II, the machines I designed and implemented while I was employed at Hillman included both machines in which the master key was laid

upon a surface and machines in which the master key was secured using a clamp. It would have been within my skill to implement a **door clamp**, as *Bass* recommends, that effectively secured the **master key** in *Wills*' drawer without hampering operation of *Wills*' machine. To this end, a POSA would have taken into account possible variations in the master key, such as those resulting from manufacture and/or those resulting from wear and tear, as well as which aspects of the master key must remain visible to the camera in order for *Wills*' machine to operate as intended. These considerations are relevant in many aspects of the design of key duplication machines, and a POSA would have readily been able to recognize and address these considerations. In general, given the similarities between *Wills*' and *Bass*' machines, such a modification would have been within the skill of the POSA and yielded nothing more than predictable results.

3. Claim 22: The key identification system of claim 19, wherein said key holder includes a **clamp.**

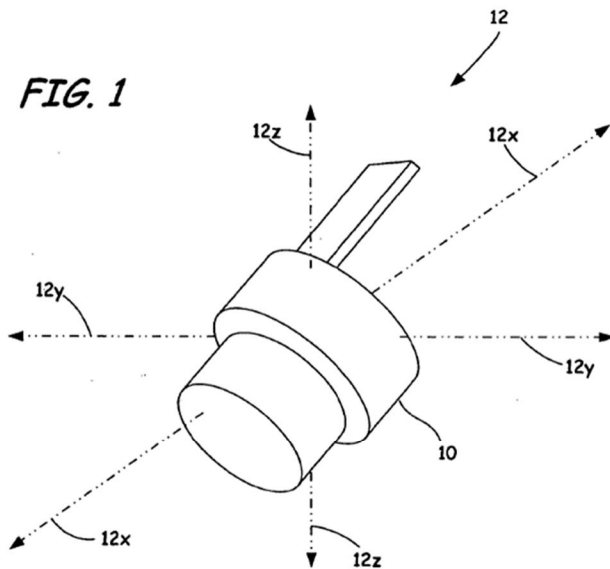
113. As explained for claim 21, a POSA would have been motivated and found it obvious to modify *Wills*' machine to include a **door clamp**, as in *Bass*, to the extent this is not disclosed in *Wills*. A POSA would have understood the **door clamp** to be a "clamp." This is because, like the "**clamp**" of the '619 patent, which is merely an alternative to the "upper door" and similarly serves together with a "lower support" to "close onto the **key**," '619 patent, 3:59-64, *Bass* teaches that the **door clamp**, together with the base, provides additional functionality to "secure [the] **master key**"

by applying a “force ... sufficient to retain or hold the **key** ... in place,” *Bass*, [0047].

C. Ground 4: *Wills* and *Heide* Would Have Rendered Obvious Claims 11 and 13

114. *Heide* describes a “three-dimensional object” akin to the “three-dimensional image” captured by *Wills*’ machine. *Heide*, Abstract; *Wills*, 15:34-42. And just 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].

115. A POSA would have recognized that rotation about the “axes” described in *Heide* corresponds to the “rolling” and “tilting” described in the ’619 patent, as a comparison of *Heide*’s Figure 1 and Figure 14 of the ’619 patent shows. In particular, a POSA would have understood rotation about *Heide*’s axis “12x” to correspond to the “rolling” of the ’619 patent. Similarly, a POSA would have understood rotation about *Heide*’s axis “12z” to correspond to the “tilting” of the ’619 patent.



Heide, Figure 1

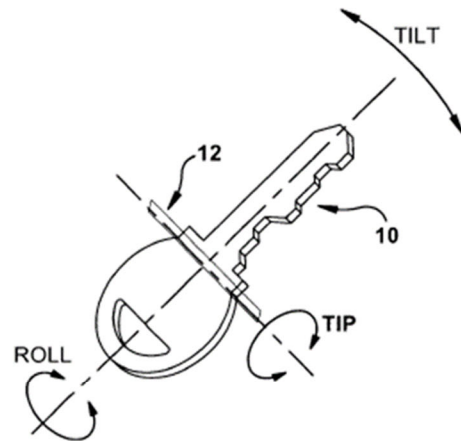


FIG. 14

'619 Patent, Figure 14

116. Together, *Wills* and *Heide* would have rendered obvious each of claims 11 and 13, as explained below.

1. **Claim 11: 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 groove.**

117. *Wills* teaches that the “logic accounts for rolling of said master key with respect to said imaging system to determine characteristics of said groove” because *Wills* envisions accounting for variations of the master key with respect to the camera in extracting the depth measurements of the milling 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

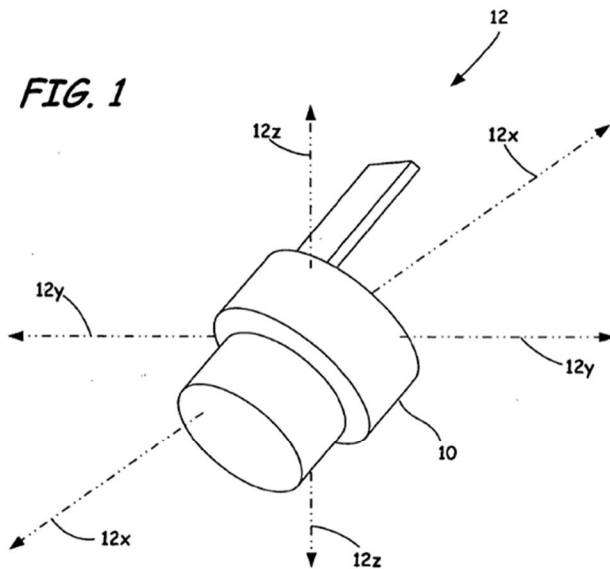
of the three axes, *Heide*, [0037]-[0038]; and, from *Heide*, a POSA would have been motivated and found it obvious to implement *Wills*' "rotating to a predetermined reference position and orientation" to be rotating along any of the three axes, including that called "rolling" in the '619 patent.

118. *Wills* envisions accounting for variations of the master key with respect to the camera in extracting the depth measurements of the milling by "rotating" the three-dimensional image captured by its camera "to a predetermined reference position and orientation." *Wills*, 9:35-38. A POSA would have recognized that a key in *Wills*' machine may 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. *See Id.*, 1:35-37 (recognizing that keys may deviate "from factory specifications" once "worn from use"). As explained in Section II, in my own work at Hillman I designed machines to work with numerous types of keys and to account for variations in keys made by different manufacturers as well as the variations in keys that result from wear and tear, such as bending, warping, breakage, and/or alteration in the blade and/or milling that results from use. In my work, I designed key duplication machines to address these variations by recognizing how the key duplication machines would need to account for them. A POSA would have

recognized the need to do the same in *Wills*' machine.

119. Indeed, as *Wills* explains, such “rotating” 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*' machine “does not require the **master key** to be precisely aligned to operate efficiently.” *Id.*, 7:29-31. This is akin to the stated purpose of the “rolling” in the '619 patent, namely, so that “[t]he **key**[] is not constrained to a particular orientation or position.” '619 patent, 7:1-2.

120. While *Wills* thus describes “rotating” the three-dimensional image, *Wills* does not expressly teach along which axes the “rotating” occurs. *Heide* teaches rotating a three-dimensional object, like the three-dimensional image in *Wills*, to an optimal spatial orientation by rotating the three-dimensional object about any of the three axes. *Heide*, [0037]-[0038].



Heide, Figure 1

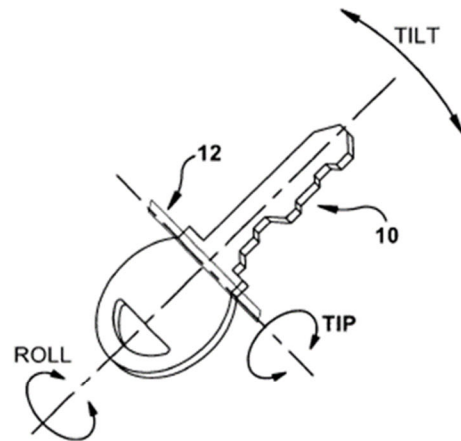


FIG. 14

'619 Patent, Figure 14

121. A POSA would have recognized that rotation about the “12x” axis described in *Heide* corresponds to the “rolling” described in the '619 patent, as a comparison of *Heide*’s Figure 1 and Figure 14 of the '619 patent shows. Such rotation about the “12x” axis of the three-dimensional object is consistent with one way that “rolling” is described in the '619 patent, namely, “rotat[ing] the master key “around the axis of the key” itself. '619 patent, 7:6-7.

122. From *Heide*, a POSA would have been motivated and found it obvious to implement *Wills*’ “rotating to a predetermined reference position and orientation” to include rotating along any of the three axes, including that called “rolling” in the '619 patent. A POSA would have been motivated by *Wills*’ stated intent to “rotat[e]” the three-dimensional image captured by its camera “to a predetermined

reference position and orientation” so that *Wills*’ machine “does not require the **master key** to be precisely aligned to operate efficiently.” *Wills*, 7:29-31, 9:35-38. A POSA would have been further motivated by *Heide*’s teaching that rotating a three-dimensional object along all three axes facilitates achieving an “optimal spatial orientation” of the three-dimensional object. *Heide*, [0037]-[0038]. A POSA would have found it obvious because implementing “rotating” along all three axes in *Wills*, as *Heide* describes, would have involved nothing more than the use of a known technique—*Heide*’s rotation of a three-dimensional object along all three axes—to improve a similar context—*Wills*’ rotation of a three-dimensional image—in the same way, namely, by facilitating conversion of the three-dimensional image to an “optimal spatial orientation.” A POSA would have recognized that accounting for positional variations, like the “rolling” of the ’619 patent, was known to facilitate comparison of the image of the **master key** and images of the reference keys, as *Wills* describes, especially in a machine like *Wills*’ where the **master key**, placed in a drawer, *Wills*, 7:4-8; 11:44-46, can be “rolled” by variations in the master key. In my own work at Hillman, such positional variations were recognized and addressed in machines in which the master key was laid upon a surface like *Wills*’ drawer.

2. **Claim 13: The key identification system of claim 1, wherein said logic accounts for tipping of said **master key** with respect to said **imaging system** to determine **characteristics** of said **groove**.**

123. *Wills* teaches that the “logic accounts for tipping of said **master key** with

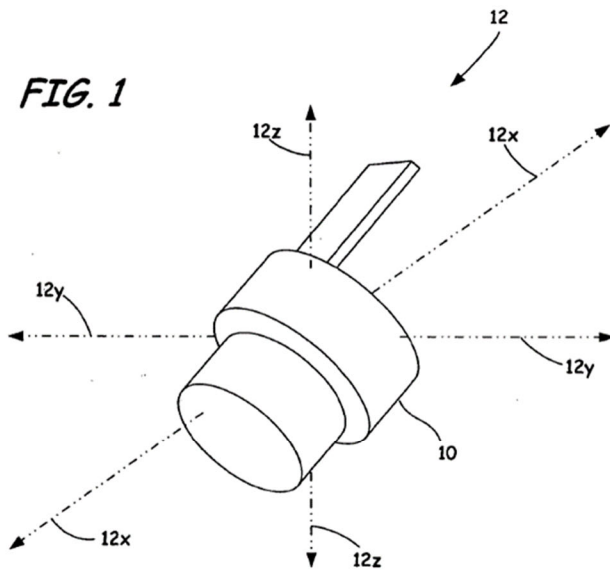
respect to said **imaging system** to determine **characteristics** of said **groove**” because *Wills* envisions accounting for variations of the **master key** with respect to the **camera** in extracting the **depth measurements** of the **milling** by “rotating” the three-dimensional image captured 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]; and, from *Heide*, a POSA would have been motivated and found it obvious to implement *Wills*’ “rotating to a predetermined reference position and orientation” to be rotating along any of the three axes, including that called “tilting” in the ’619 patent.

124. *Wills* envisions accounting for variations of the **master key** with respect to the **camera** in extracting the **depth measurements** of the **milling** by “rotating” the three-dimensional image captured by its **camera** “to a predetermined reference position and orientation.” *Wills*, 9:35-38. A POSA would have recognized that a key in *Wills*’ machine may 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. *See Id.*, 1:35-37 (recognizing that keys may deviate “from factory specifications” once “worn from use”). As explained in Section II, in

my own work at Hillman I designed machines to work with numerous types of keys and to account for variations in keys made by different manufacturers as well as the variations in keys that result from wear and tear, such as bending, warping, breakage, and/or alteration in the blade and/or milling that results from use. In my work, I designed key duplication machines to address these variations by recognizing how the key duplication machines would need to account for them. A POSA would have recognized the need to do the same in *Wills*' machine.

125. Indeed, as *Wills* explains, such “rotating” 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*' machine “does not require the **master key** to be precisely aligned to operate efficiently.” *Id.*, 7:29-31. This is akin to the stated purpose of the “tipping” in the '619 patent, namely, so that “[t]he **key**[] is not constrained to a particular orientation or position.” '619 patent, 7:1-2.

126. While *Wills* thus describes “rotating” the three-dimensional image, *Wills* does not expressly teach along which axes the “rotating” occurs. *Heide* teaches rotating a three-dimensional object, like the three-dimensional image in *Wills*, to an optimal spatial orientation by rotating the three-dimensional object about any of the three axes. *Heide*, [0037]-[0038].



Heide, Figure 1

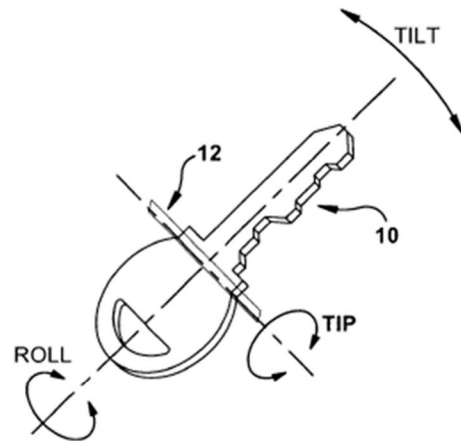


FIG. 14

'619 Patent, Figure 14

127. A POSA would have recognized that rotation about the “12y” or “12z” axis described in *Heide* corresponds to the “tipping” described in the ’619 patent, as a comparison of *Heide*’s Figure 1 and Figure 14 of the ’619 patent shows. Such rotation about the “12y” or “12z” axis of the three-dimensional object is consistent with one way that “tipping” is described in the ’619 patent, namely, “tipped up or down relative to the plane defined perpendicular to the door opening 12.” ’619 patent, 7:4-6.

128. From *Heide*, a POSA would have been motivated and found it obvious to implement *Wills*’ “rotating to a predetermined reference position and orientation” to include rotating along any of the three axes, including that called “tipping” in the ’619 patent. A POSA would have been motivated by *Wills*’ stated intent to

“rotat[e]” the three-dimensional image captured by its camera “to a predetermined reference position and orientation” so that *Wills*’ machine “does not require the master key to be precisely aligned to operate efficiently.” *Wills*, 7:29-31, 9:35-38. A POSA would have been further motivated by *Heide*’s teaching that rotating a three-dimensional object along all three axes facilitates achieving an “optimal spatial orientation” of the three-dimensional object. *Heide*, [0037]-[0038]. A POSA would have found it obvious because implementing “rotating” along all three axes in *Wills*, as *Heide* describes, would have involved nothing more than the use of a known technique—*Heide*’s rotation of a three-dimensional object along all three axes—to improve a similar context—*Wills*’ rotation of a three-dimensional image—in the same way, namely, by facilitating conversion of the three-dimensional image to an “optimal spatial orientation.” A POSA would have recognized that accounting for positional variations, like the “tipping” of the ’619 patent, was known to facilitate comparison of the image of the master key and images of the reference keys, as *Wills* describes, especially in a machine like *Wills*’ where the master key, placed in a drawer, *Wills*, 7:4-8; 11:44-46, can be “tipped” by variations in the master key. In my own work at Hillman, such positional variations were recognized and addressed in machines in which the master key was laid upon a surface like *Wills*’ drawer.

X. CONCLUSION

I declare that all statements made herein of my knowledge are true, that all statements made on information and belief are believed to be true, and that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code.

Dated: 6-27-22

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