Dec. 7, 1971 L. D. CARLO ETAL 3,625,111

KEY DUPLICATING MACHINE

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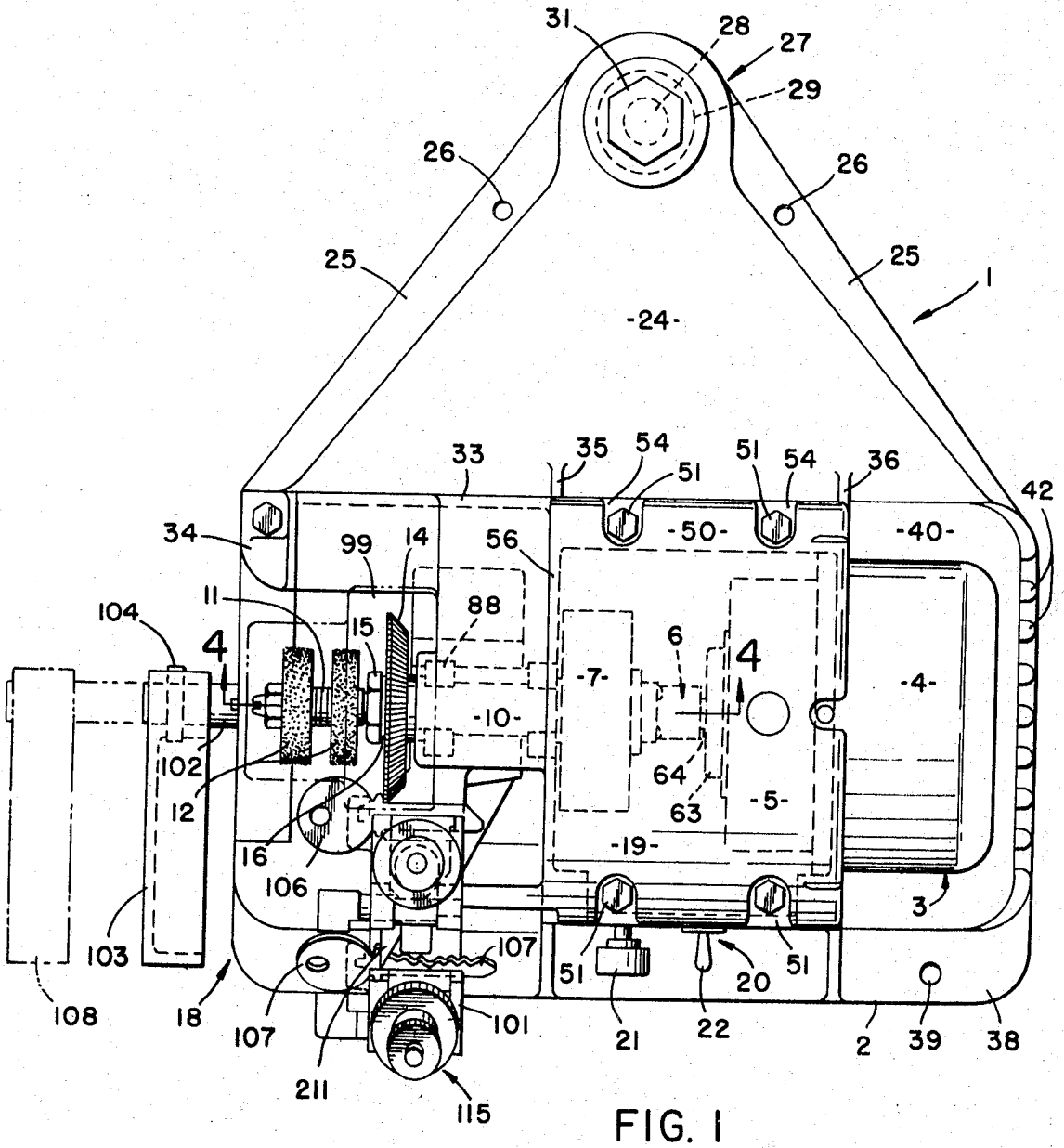


FIG. 1

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KEY DUPLICATING MACHINE

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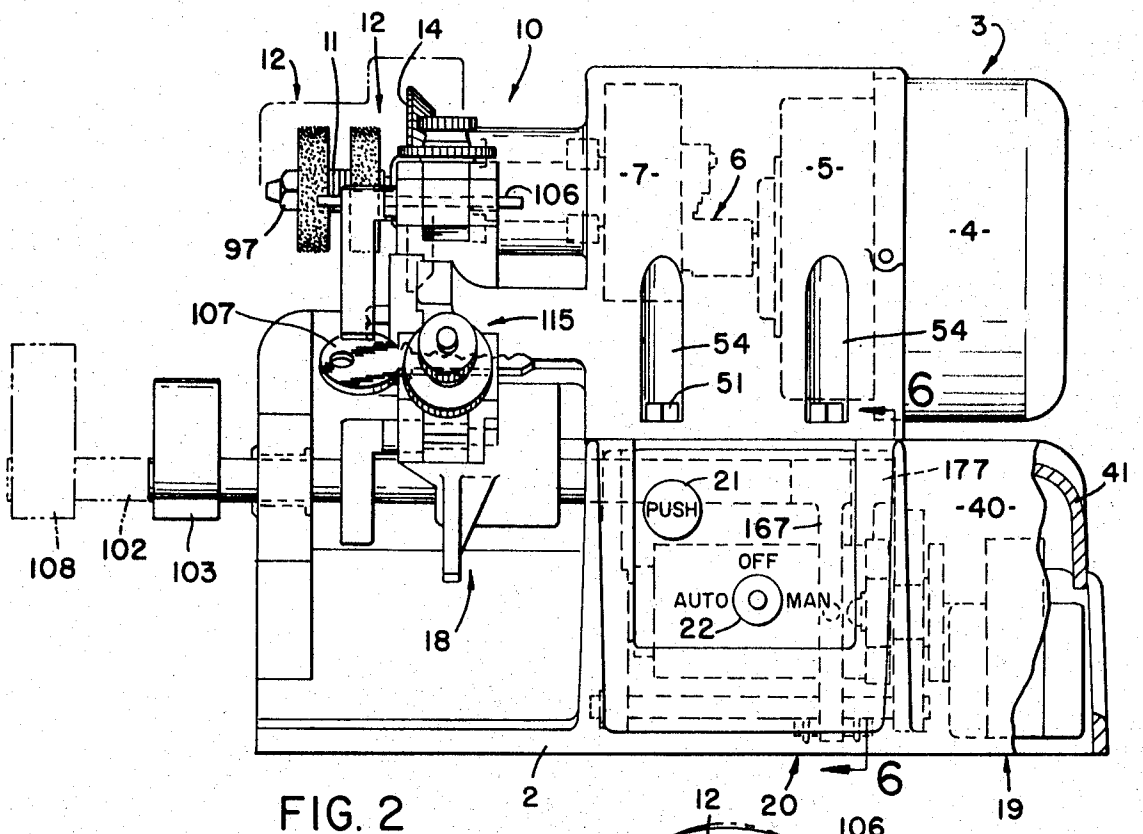


FIG. 2

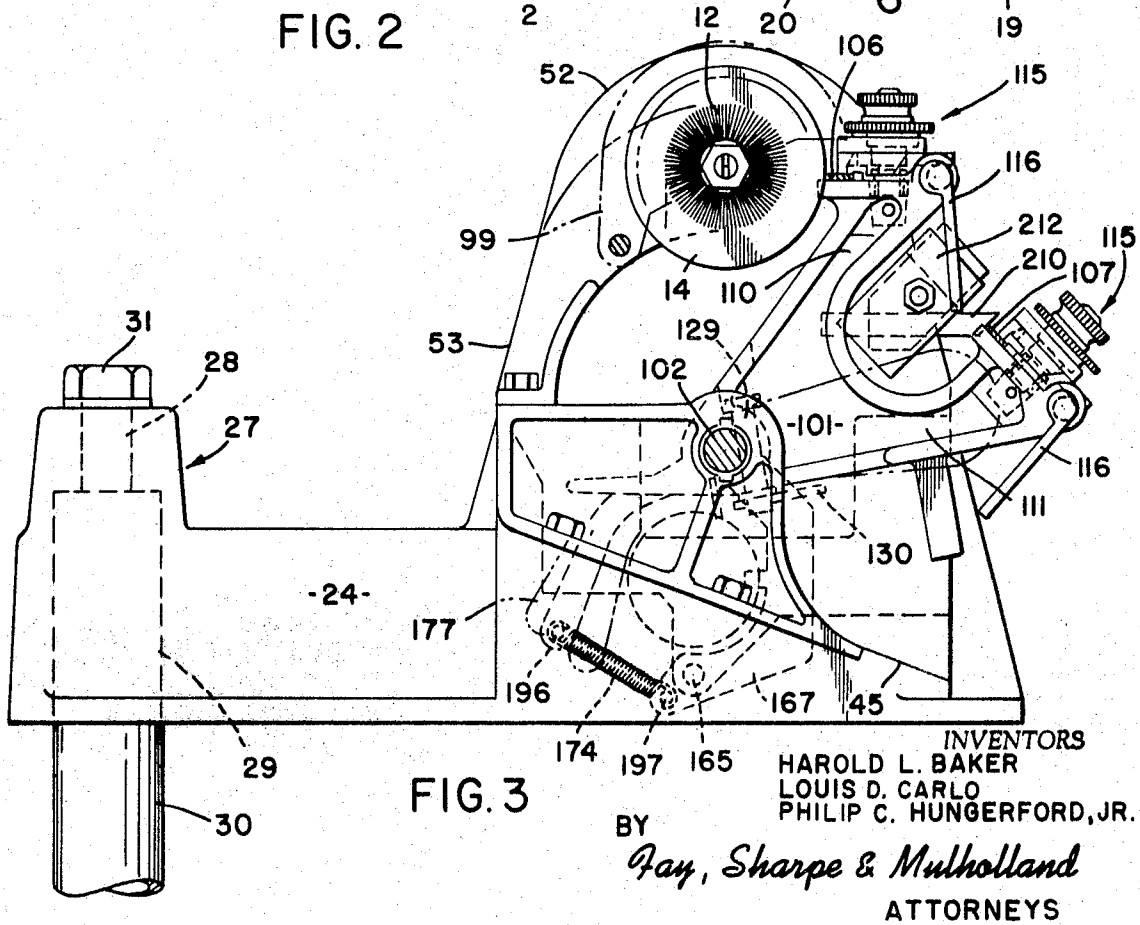


FIG. 3

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KEY DUPLICATING MACHINE

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FIG. 4

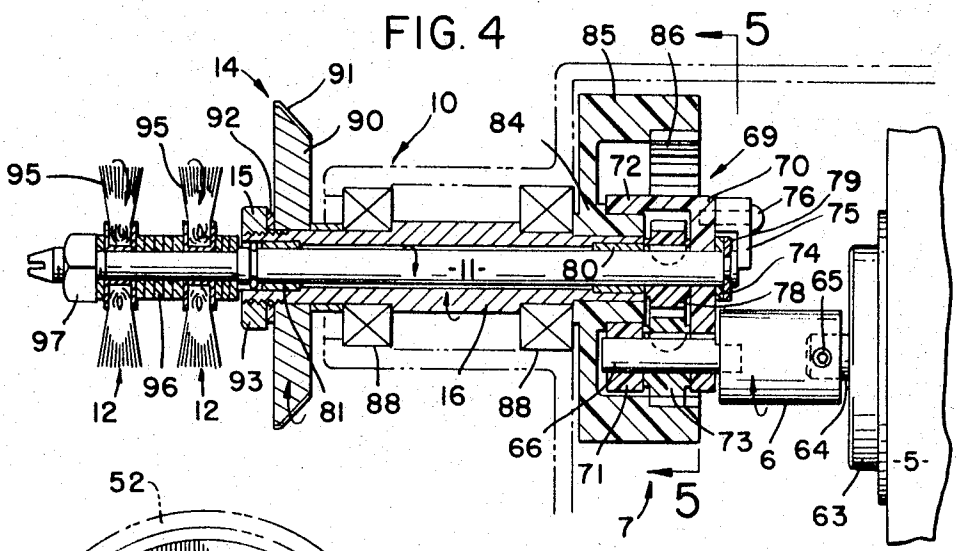
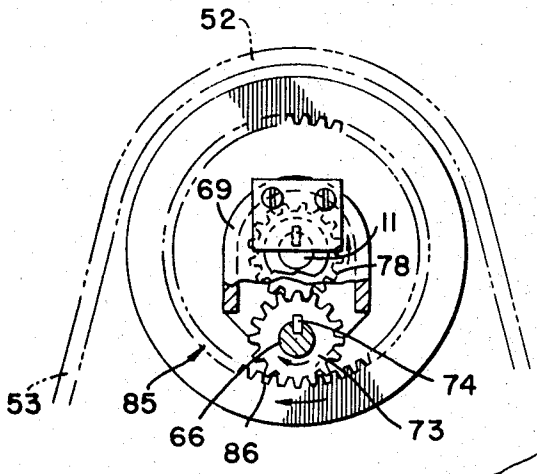


FIG. 5



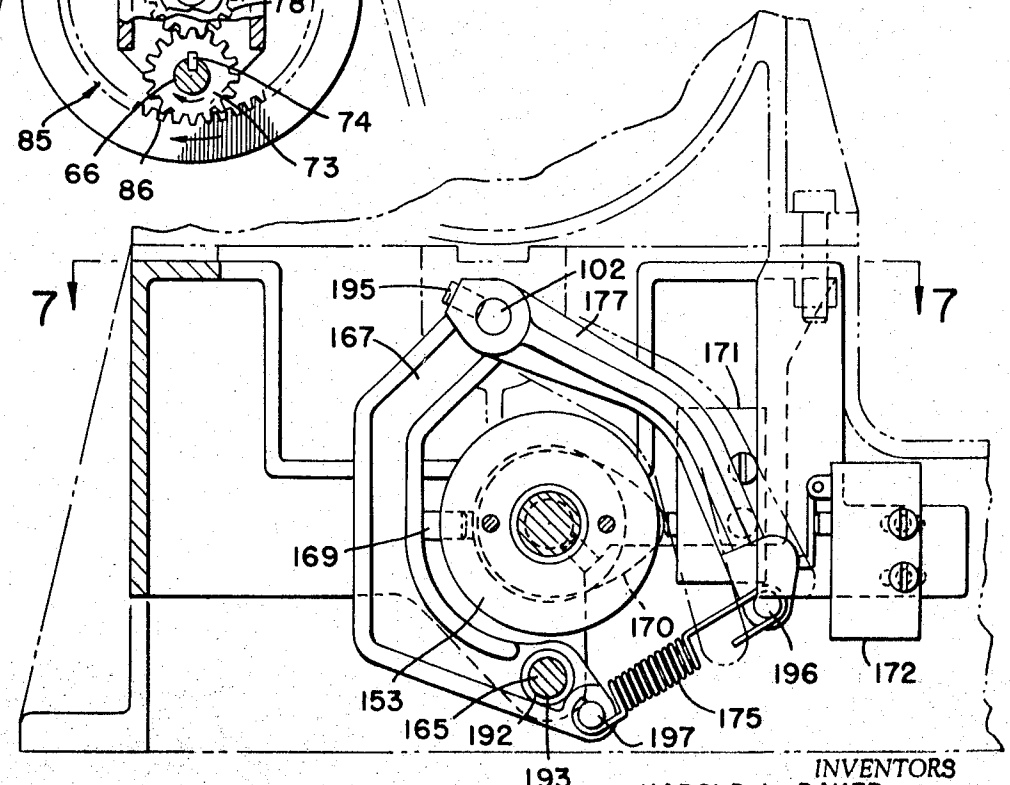


FIG. 6

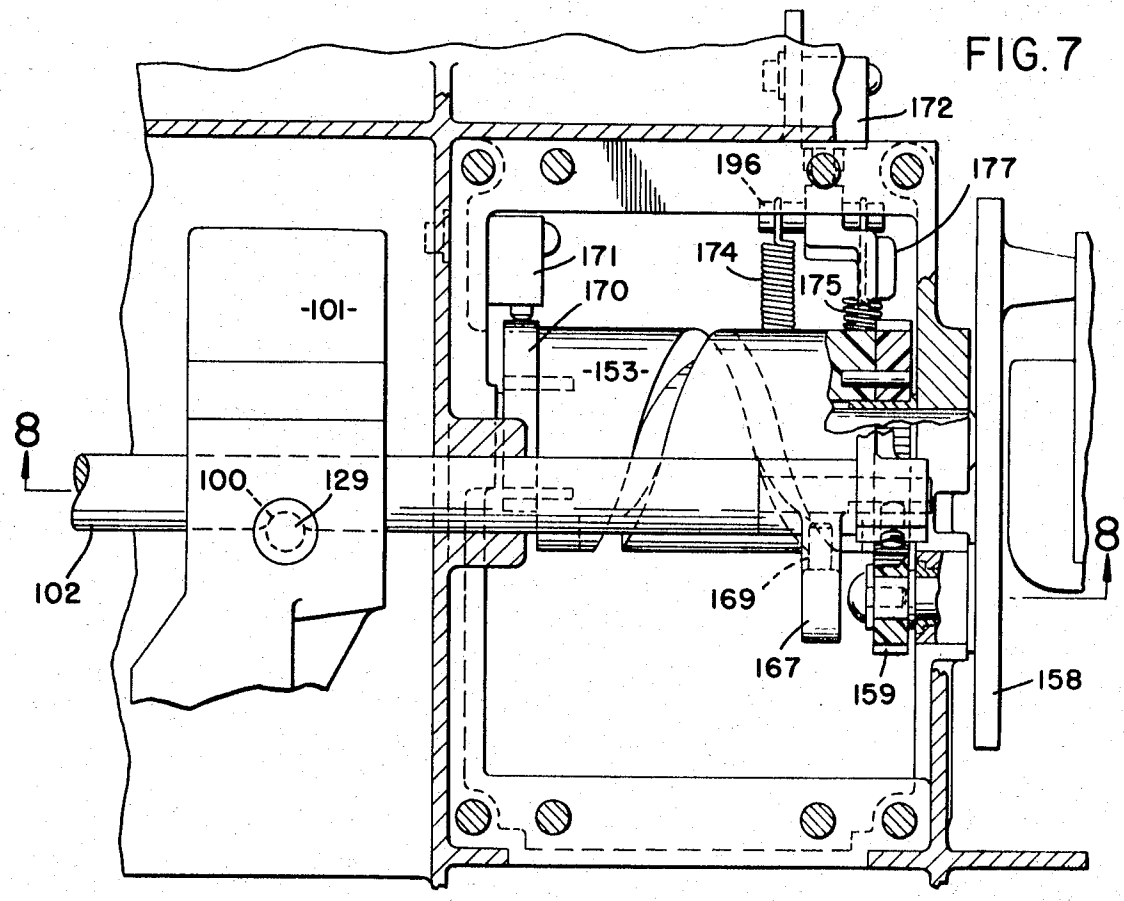
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KEY DUPLICATING MACHINE

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FIG. 7



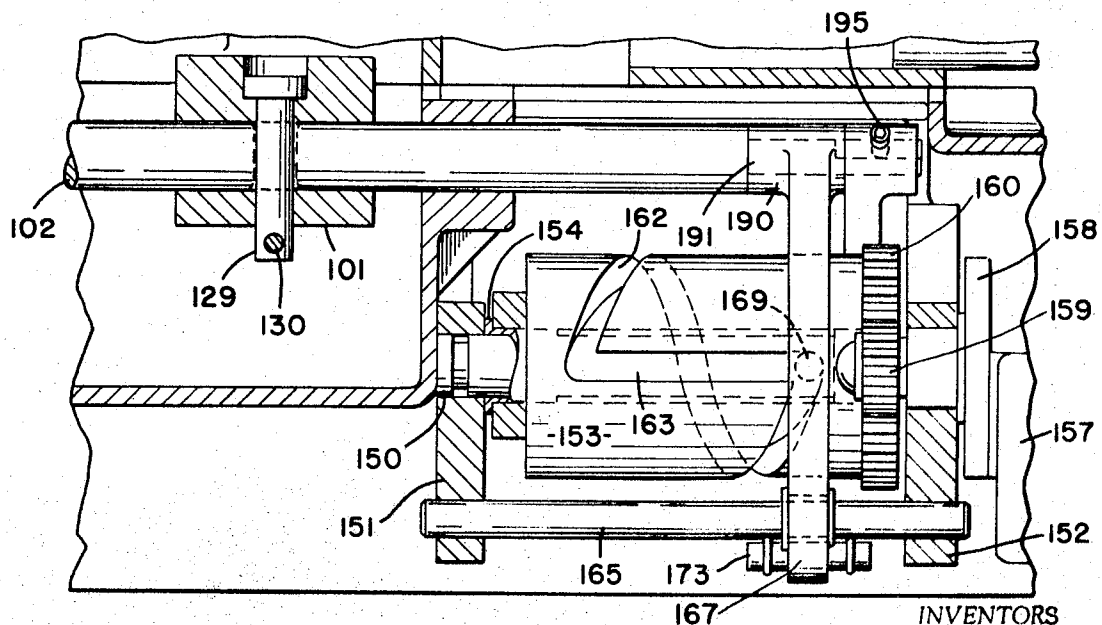


FIG. 8

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KEY DUPLICATING MACHINE

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FIG. 9

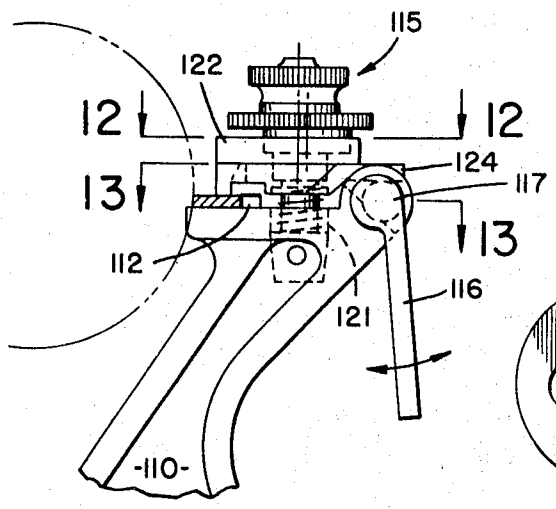
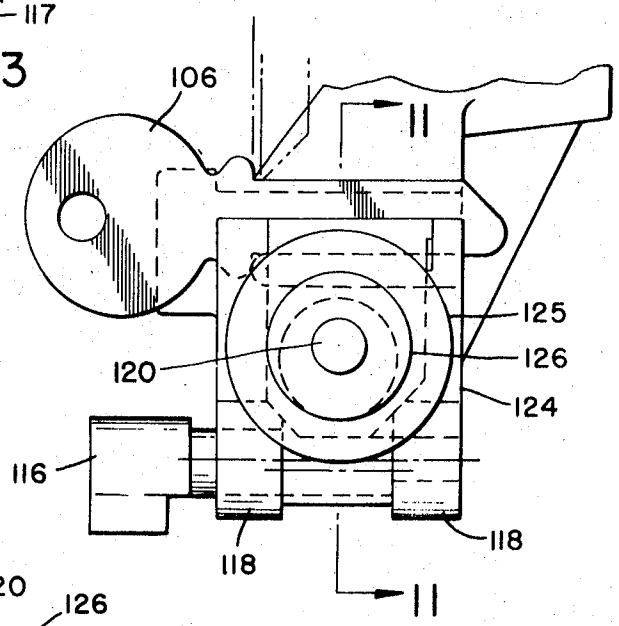


FIG. 10



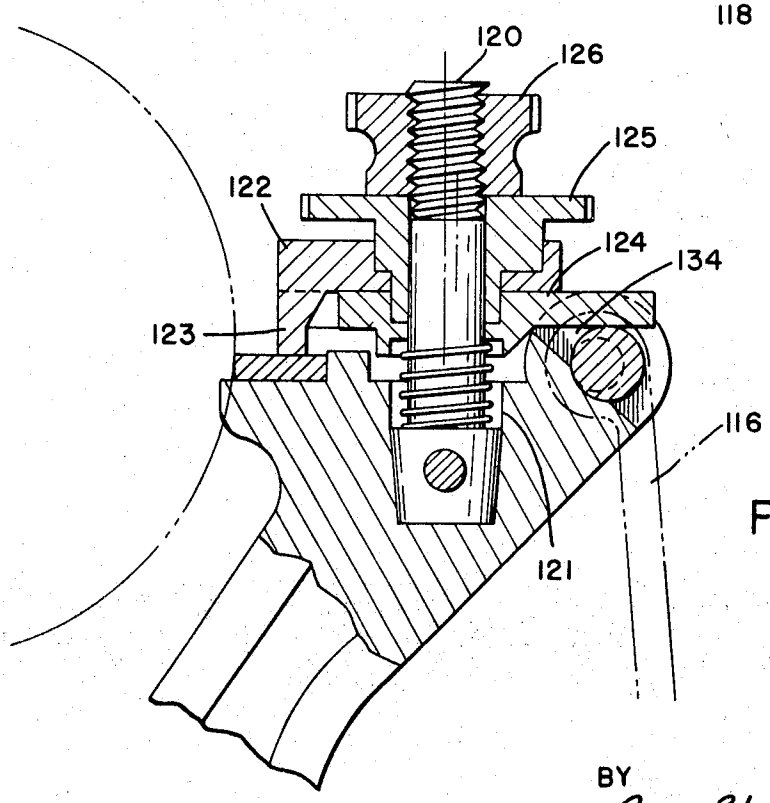


FIG. 11

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KEY DUPLICATING MACHINE

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FIG. 12

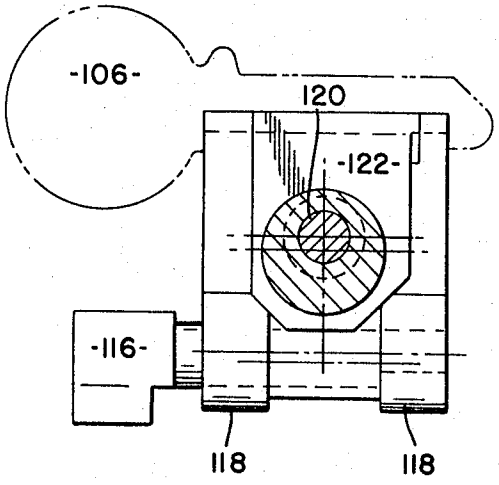
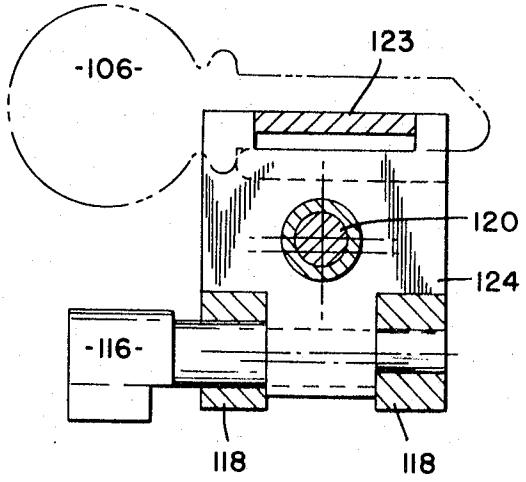


FIG. 13



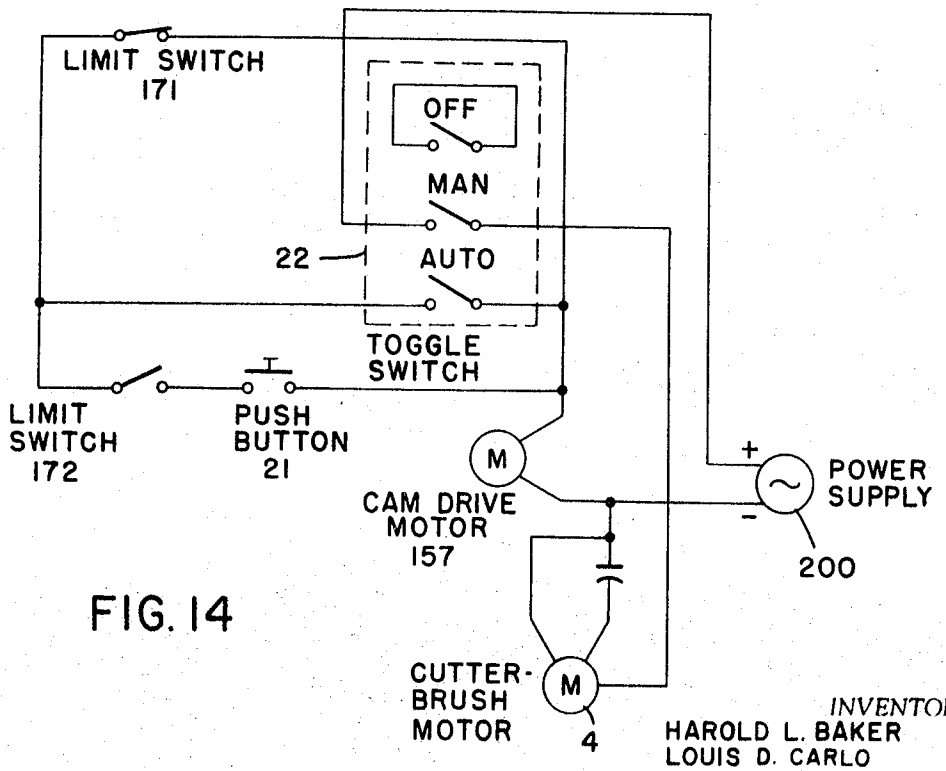


FIG. 14

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United States Patent Office 3,625,111 Patented Dec. 7, 1971

3,625,111

KEY DUPLICATING MACHINE

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Filed Oct. 6, 1969, Ser. No. 863,782
Int. Cl. B23c 1/16
U.S. Cl. 90—13.05 11 Claims

ABSTRACT OF THE DISCLOSURE

An automatic key duplicating machine which causes a key blank in a fixed position relative to a key master to traverse a rotating cutting member and one or more deburring brushes to duplicate the configuration of the key master on the key blank. Both the master and the blank are fixed relative to one another on a member forming part of carriage means which are capable of linear translatory motion with respect to the apparatus support means, the cutting member and the brushes. Means, including a cam and drive assembly, are disclosed for translating the rotational movement of a gear drive mechanism to cause the linear motion of a carriage member. The cam assembly includes a barrel cam having a continuous groove and also includes a cam follower fixed in the groove to impart the linear motion to the carriage when automatic operation is desired. The groove in the cam has a spiral portion to guide the cam follower during automatic operation of the machine and an axial portion which permits manual operation of the machine and free return of the carriage after automatic operation. Biasing means are provided to maintain the force of the keys and the carriage means against the stationary guide blade engaging the serrations on the key master and the rotating cutting member which engages the key blank. Control means are provided to select either single-cycle automatic or manual operation of the machine. The cutter assembly includes one or more counter-rotating deburring brushes mounted on an axis concentric with the axis of the cutter wheel and driven by a pinion gear from the drive gear on the cutter motor shaft so that the direction of rotation of the brush is opposite to that of the cutter wheel. The means for securing the key blank and the key master on the carriage include a novel locking member and permit easy positioning of those elements as well as strongly securing the elements against inadvertent displacement during the operation.

BACKGROUND OF THE INVENTION

This invention relates to key duplicating machines. More particularly, this machine relates to key duplicating machines which may be either manually or automatically operated. Still more particularly, this invention relates to a key duplicating machine of the kind in which the profile of a master key is duplicated on a key blank.

The prior art includes a wide variety of machines designed to produce keys which duplicate the profiles of other keys. Typically, those machines include means to fix the key blank relative to the master key and means to fix a cutting member relative to a guide. When the guide engages the master key, the cutting member engages the key blank to duplicate the profile of the key master. Generally, such machines have been manually operated, wherein the skills of the operator play an important role in determining the operability of the newly-cut key.

Problems which have confronted the operator have included difficulties in: (1) positioning the key master and the key blank in a proper relationship, (2) manipulatively insuring that a relatively constant pressure is exerted against the guide as it engages the profile of the key master so that the profile of the newly-cut key blank precisely corresponds to the master, and (3) manually deburring the newly-cut key. It may be understood that inadvertence in any one or more of the above areas of difficulty could produce an inoperable duplicate key.

In an attempt to solve these problems, the art has produced several automatic key cutting machines. An example of an automatic machine is shown in the U.S. patent to N. S. Lieptz, Pat. No. 3,286,596, issued Nov. 22, 1966. In general, such automatic key cutting machines have not been capable of both manual or automatic operation, nor have they included controls capable of permitting both types of operation. Moreover, these machines have not generally adequately solved the problem of exerting proper pressure on the guide and cutting member as the key blank engages the profile of the key master to insure that the duplicate key is true. In addition, the art has not generally included adequate means for automatically deburring the newly-cut blank, and particularly has not solved the need to obviate a separate deburring step in the cutting cycle. Accordingly, it is an object of this invention to provide a key cutting machine which is capable of both automatic and manual operation.

It is a further object of this invention to provide a key duplicating machine which includes means for placing pressure upon the guide as it engages the profile of the master key so that the newly-cut key is a true duplicate of the master.

It is a still further object of this invention to provide an automatic key duplicating machine which is automatic both as to the cutting and the deburring operation.

It is a still further object of this invention to provide an automatic key duplicating machine which includes a cam and drive assembly capable of use in either manual or automatic operation.

It is a still further object of this invention to provide control means for an automatic key duplicating machine which permits both automatic and manual operation.

It is another object of this invention to provide an automatic key cutting apparatus which includes base means and a carriage assembly capable of lateral movement with respect to the base means, the carriage means being driven by a cam and drive assembly.

It is a still further object of this invention to provide an automatic key cutting apparatus which causes a key blank in a fixed position relative to a key master to traverse a rotating cutting member and one or more deburring brushes to produce a duplicate key.

It is another object of this invention to provide improved locking means for the key members on the carriage means.

It is still another object of this invention to provide a deburring member on a shaft concentric with the shaft to which the cutting member is secured wherein the key is deburred immediately after the key is profiled.

It is still another object of this invention to provide a cam for use in an automatic key duplicating machine wherein the cam permits automatic or manual operation.

It is still another object of this invention to provide differential spring loading of the key member against the cutting member and against the deburring member.

SUMMARY OF THE INVENTION

Directed to the solutions of the shortcomings of the prior art and to achieving the aforestated and other objects, the invention includes an apparatus support means including a precast base capable of being mounted either upon a pole-like structure or upon a generally horizontal flat surface. Power drive means, including a motor, a gear box assembly, and coupling means, are

provided in a fixed relationship to the base means. The cutting means, including a first shaft connected to the gear box assembly and a deburring member mounted upon the shaft for rotation in a first direction. A cutting member is secured to a second shaft concentric with the first shaft and secured to the second shaft by an arbor nut. The cutter rotates in a direction opposite from the brushes.

The carriage means are capable of horizontal movement with respect to the base means and include a generally Y-shaped member. Improved gripping means, including means for securing a key member to a gripping surface ore provided on each arm of the Y, one for engaging the key blank, and one for engaging the master key. Guide means, including a guide member, for tracing the profile of the key master are positioned in such a manner that when the machine is operated, the cutter engages the key blank in a position which precisely corresponds to the key master. The carriage assembly is horizontally translatable on a shaft.

A cam and drive means are provided for causing the horizontal translation of the carriage means. The cam and drive means include a barrel cam having a continuous groove provided therein. When the cam follower is positioned in the spiral portion of continuous groove of the barrel cam and when the cam is rotated, the follower, secured to a member on the shaft supporting the carriage means, is caused to move linearly upon rotation of the cam. The continuous groove in the cam is also provided with an axial portion so that the carriage may be manually manipulated and also to provide free return of the carriage to its starting position.

Biasing means, including spring means secured to the member supporting the cam follower, is arranged to provide the desired loading on the carriage for various axial positions.

Control means are provided to permit the machine to operate either automatically or manually. Limit switches are located so that the machine must be in a "set" position before automatic operation may be commenced. When the carriage has been returned to its starting position, the limit switch is engaged and the cam follower is in its start position. Thereupon the machine may be actuated causing the cam follower to follow the spiral groove of the rotating barrel cam. When the barrel cam has completed one revolution, the carriage has moved its desired axial distance, whereupon an eccentric on the barrel cam engages a second limit switch causing the machine to stop. A handle is provided to return the carriage to its original position.

As the carriage has been driven by the action of the cam follower in the spiral groove of the barrel cam, the cutting member has simultaneously rotated, cutting a profile in the key blank which identically matches the profile of the key master. At a point in its horizontal movement, the cutter has completed its cutting operation, but the carriage continues to move so that the oppositely rotating brushes may engage the newly-cut profile on the key blank to accomplish the deburring operation.

Other objects and advantages of this invention will be apparent in the following detailed description and from the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings:

FIG. 1 is a top plan view of the apparatus according to the invention particularly showing the cutting member and the deburring members relative to the key master and key blank secured to carriage means;

FIG. 2 is a front elevational view of the apparatus according to the invention;

FIG. 3 is a side elevational view of the apparatus according to the invention;

FIG. 4 is a cross-sectional view of the cutter means taken along line **4—4** of FIG. 1;

FIG. 5 is a cross-sectional view of the planetary gear arrangement for the cutting member and deburring member taken along line **5—5** of FIG. 4;

FIG. 6 is a view of the barrel cam, its switch-actuating eccentric and the biasing means, taken along line **6—6** of FIG. 2;

FIG. 7 is a view, partially in section, taken along line **7—7** of FIG. 6 showing the cam and drive means in greater detail;

FIG. 8 is a view, partially in section, taken along line **8—8** of FIG. 7;

FIG. 9 is a side elevational view of the securing means and an arm of the carriage for gripping a key member;

FIG. 10 is a top view of the securing means shown in FIG. 9;

FIG. 11 is a cross-sectional view taken along line **11—11** of FIG. 10;

FIG. 12 is a view taken along line **12—12** of FIG. 9;

FIG. 13 is a view taken along line **13—13** of FIG. 9; and

FIG. 14 is a schematic view of the control circuit including limit switches for the apparatus.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIG. 1 shows an overall layout of the invention including apparatus support means shown generally at **1** as including a base **2**. First power drive means for providing rotational energy to the cutting member and deburring member are shown generally at **3**, including a motor **4**, transmission means **5**, coupling means **6**, and gear means **7**, shown in dotted outline. Motor **4** is actuatable separately from the cam and drive assembly (as will be hereinafter discussed) so that the machine may be manually operated.

Cutting means, shown generally at **10** and in greater detail in FIG. 4, is depicted as comprising a shaft **11** on which deburring members **12**, such as cylindrical wire brushes, are mounted. A cutting member **14** is secured by an arbor nut **15** to a second shaft **16** for performing the cutting operations on the key blank.

Carriage means, shown generally at **18** and capable of lateral translatory movement with respect to the cutting means and deburring means, are shown in greater detail in FIGS. 6 through 8. Cam and drive means, shown generally at **19**, provide the movement for the carriage means, and are set forth in greater detail in FIGS. 7 and 8. Control means, shown generally at **20** and in greater detail in FIG. 14, include push-button **21** and toggle switch **22**. Toggle **22** controls the off, manual, and automatic operations of the machine, as will hereinafter be discussed.

Apparatus support means

In the apparatus support means, base **2** may take the form of a wide variety of configurations, but as depicted, is preferably of die-cast aluminum of such dimension as to be capable of being stem mounted, as best seen in FIG. 3, or capable of resting upon a generally horizontal work platform, as may be observed in FIG. 2.

Base **2** includes a generally triangular converging web-portion **24** merging into a pair of flanged sections **25** each having a plurality of mounting holes **26** disposed therein. The web-portion terminates in an upraised, generally cylindrical portion **27** having a bore **28** and a counterbore **29** placed therein for mounting to a stem **30** as can be seen in FIG. 3. The apparatus may be secured to stem **30** by fastening means **31**, preferably a machine bolt.

Base **2** as cast includes a bottom section **32** and a rear wall **33** extending from the left side flange portion **34** beyond a first intermediate wall **35** connected to a second intermediate wall **36**. Intermediate walls **35** and **36** are generally parallel and form a convenient division of the base into compartments suitable for housing various portions of the apparatus as well as providing a journaled member to support a portion of the cutter assembly **10**.

The base **2** also includes a front flange portion **38** having a plurality of openings **39** therethrough for placement of fastening means, such as machine screws, when the overall structure is mounted on a supporting surface.

At one side, apparatus support means **1** includes a housing **40** having an upper wall section **41** shown partially in section in FIG. 2. Wall section **41** may include openings therein as at **42** for cooling gear drive motor **43** housed therein. As previously mentioned, gear drive motor **43** may be operated either separately from or concurrently with motor **4**.

An inclined section **45**, located on the side of base **2** opposite housing **40**, is conveniently placed for the removal and disposal of chips and filings from the key as it is cut.

Power driven means and cutting means

The details of the power drive means and cutting means are best understood by references to FIGS. 1, 2, 4 and 5.

Frame means **50** for housing transmission means **5**, for example a gear reducer, coupling means **6**, and gear means **7** are secured to the apparatus support means **1** by a plurality of fastening members **51**, for example, machine screws. The upper portion **52** of frame means **50** assumes the configuration of a gentle curve (see FIGS. 2 and 3) while the lower portion **53** assumes an outward configuration of a tangent thereto. Recesses **54** are provided in lower portion **53** to accommodate fastening means **51**.

A first side wall **55** of frame **50** is cast in the form of a circular portion to accommodate the motor **4** therein. The other end wall **56** of frame means **50** has a first axially extending portion **58** having a bore **59** contained therein and first and second support structures **60** and **61** attached thereto. When assembled, bore **59** accommodates shaft **12** and the second shaft **16** of cutting means **10**.

As heretofore indicated, motor **4** is connected in a manner known to the art to a speed reducing transmission **5** having a hub **63** for supporting a shaft **64**.

In one embodiment, coupling **6** is a cylindrical member including a radial tap **65** for securing shaft **64** therein by a suitably disposed fastening means within the radial tap. A drive shaft **66** is disposed in coupling **6** in a direction axially opposite shaft **64**. Coupling **6** may include an opening having a flattened portion and complementary in shape to an end portion of shaft **66** to be secured therein.

A gear housing **69** having a first leg **70** and a second leg **71** with a cross member **72** which is generally transverse of the first leg and the second leg is provided. Shaft **66** is journaled in both the first leg **70** and second leg **71** of gear housing **69**.

A pinion gear **73** is secured to shaft **66** by key **74** secured for rotation with shaft **66**. A second pinion gear **78** is in mesh with the first pinion gear **73** and is secured near one end of shaft **11** as by a pressed fit, to cause rotation of that shaft in a first direction opposite the direction of rotation of shaft **66**. One end of shaft **11** is journaled within first leg **70** of gear housing **69** and secured thereto by means of washer **74**, retaining ring **79**, and shaft retainer **75** secured to leg **70** by fastener **76**.

From FIG. 4, it may be seen that brush shaft **11** is disposed within and concentric with cutter shaft **16**. To permit free and independent counter-rotation of shaft **11** relative to cutter shaft **16**, bearing means are provided at **80** and **81** respectively.

In order to impart a rotational direction to shaft **16** which is opposite to that of shaft **11**, a gear member **83** having an intermediate axial extending portion **84** is secured to shaft **16** to cause rotation thereof, and a second axially extending portion **85** having teeth **86** is disposed thereon in mesh with the pinion **73** opposite its engagement with pinion **78**. It will be understood that for rotation of shaft **66** in a first direction, cutter shaft **11** will rotate in the opposite direction because of the mesh of the gear **78** with gear **73**. On the other hand, the rotation of cutter shaft **16** will be in the same direction as the rotation of shaft **66** because of the action of the mesh between gear **73** and teeth **86** on gear member **84**.

Additional bearings **88** are also provided to aid in the free running of the respective shafts and to impart a high degree of structural integrity to the overall apparatus.

Cutting means **14** includes a cutting member **90** having a beveled annular cutting face **91**. Member **90** is secured to shaft **16** near the end opposite the gear mechanism by a washer **92** and arbor nut **93** threadedly engaged with the end portion of shaft **16**. At the end of shaft **16**, a retaining ring **94** disposed in a groove in shaft **11** may be provided to maintain the relationship between shaft **11** and shaft **16**.

Deburring means **12** include a plurality of deburring brushes **95** secured to shaft **11** in a spaced relationship, maintained, for example, by a plurality of washers **96**. The brushes **95** and washers **96** are secured to the shaft by a clamping nut **97** having a thread direction appropriately chosen to prevent inadvertent rotational movement during the cutting or the deburring operation.

It can best be seen in FIG. 1 that cutter guard **99** is disposed in relation to cutter **90** for safety purposes.

Carriage means

Turning now to the details of carriage means **18**, a carriage member **101** is fixedly secured on a carriage shaft **102**, having an axis which is substantially co-linear with the axis of the shaft **11** in the cutter assembly. A handle **103** (see FIGS. 1 and 2) is fixedly secured to shaft **102** as by pin **104** disposed in a detent **100**.

The carriage member **101**, shaft **102** and handle **103** are capable of translatory motion laterally from the position in which the key blank **106** is ready to be cut according to the serrations in key master **107** secured by improved gripping means to carriage member **101**. Since the assembly is programmed for single-cycle operation, the extent of its linear travel is shown by the phantom outline **108** of handle **103**. Shaft handle **103** also provides a return gripping device for carriage member **101** and the shaft assembly to its original or starting position.

As may best be seen in FIG. 3, carriage member **101** is a generally Y-shaped member having arms **110** and **111** cast therewith.

Arm **110** has a gripping surface **112** disposed near its distal end for securely mounting key blank **106**. Similarly, arm **111** has a gripping surface **113** disposed near its distal end for securing a key master **107** thereon. Means shown generally at **115** are disposed on each of the arms **110** and **111** for securing the key blank **106** or the key master **107** to the respective arms. Since the means **115** on each arm are generally similar, they will only be described with respect to the securing means **115** disposed on arm **111**.

As shown in detail in FIGS. 9 through 13, securing means **115** comprise an eccentrically operated clamp arm **116** rotated about a roll pin **117** disposed between the bifurcated portions **118** of arm **110**. A stud **120** is disposed in an oversized opening **121** which is generally transversely disposed and secured in flat **113** on arm **111**.

A clamping member **122** having an inturned lip **123** is positioned adjacent intermediate clamping member **124** so that inturned lip **123** is secured adjacent key member **106** or **107**. The intermediate clamping member **124** and member **122** are disposed about and are positioned adjacent stud **120** for tightening therewith.

An eccentric member **125** is also disposed about stud **122** adjacent clamp **124** and is secured about stud **120** by a thumb screw **126**. The arrangement of elements is biased by a clamp spring **127** so that when the thumb screw **126** is released, the assembly parts between the flat **113** on arm **111** and the key cutter clamp. A key may be then inserted therebetween.

In operation, a key blank is positioned on gripping surface **112**, generally adjacent a guide member **132** dis-

posed thereon. Guide member **132** corresponds to a like member **132** disposed on the gripping surface of the other arm so that a precise positional correlation is maintained between the cutter guide and the key master as a first unit and the key blank and the cutting member as a second unit.

After precise positioning, the thumb screw **126** is hand tightened to the desired strength with clamp arm **116** in the position about ninety degrees from that shown in FIG. 9. Thereafter, arm **116** is rotated to the position shown in FIG. 9, causing the cam surface **134** located thereon to contact the undersurface of member **124** causing an increased tension in the gripping means as the members tend to be axially displaced. Openings disposed in each of the members **122**, **124** and opening **121** permit the necessary degree of lateral movement during tightening.

The carriage member **101** is secured to carriage shaft **102** by a clamping stud **129** secured thereto by a roll pin **130**.

Cam and drive means

Turning now to the detail of the carriage drive assembly, as best seen in FIGS. 7 and 8, a cam support shaft **150** is rotatably secured in cam housing **151** and **152**. A roller cam **153** is rotatably secured about cam support shaft **150** by the use of bearing means **154** and **155** disposed at opposite ends of the roller cam **153**. In a preferred embodiment, bearing means **154** and **155** are nylon inserts.

Means for rotating the roller cam **153** in a cyclic arrangement are provided and include a gear motor **157** connected to a gear drive arrangement **158** which is in turned connected to pinion gear **159**. Cam gear **160** is secured to roller cam **153** for rotation therewith and is also connected to pinion gear **159**.

Roller cam **153** is generally cylindrical in configuration and includes a continuous groove which includes a spiral portion, shown at **162**, which extends axially along the outer surface of roller cam **153**. An axially extending portion **163** of the continuous groove permits the key cutter to be used for manual operation and will provide a simplified return path for the carriage at the completion of the cycle which will be hereinafter discussed.

A carriage guide shaft **165** is also disposed between cam housing walls **151** and **152**.

A linking drive member **167** is provided which is secured to the shaft **102** near one end thereof and is secured to guide shaft **165** in such a manner that lateral translational movement of the member relative to the shaft is permitted. Member **167** includes a cam follower **169** disposed in the continuous groove in the roller cam **153**.

In operation, the key master and key blank are positioned in the carriage member as hereinbefore discussed. The apparatus is actuated and the drive member **167** is driven by the rotation of the roller cam **153** and the action of the cam follower **169** in the continuous groove thereof to its end position. An eccentric member **170** is secured to roller cam **153** at the end opposite the gear drive assembly and is positioned to actuate limit switch **171** after one complete rotation of the spiral cam **153**. A second limit switch **172**, shown in the schematic of FIG. 14, is located at a convenient position to indicate that the carriage has returned to its starting position. By the arrangement of FIG. 14, the machine will not operate unless the carriage is at the beginning of the cycle as shown in FIGS. 7 and 8.

As may be seen in FIGS. 3, 6 and 8, drive member **167** is laterally displaceable by the movement of cam follower **169** in the continuous groove of the barrel cam **153**. However, member **167** is secured against relative rotational movement at its upper end where a bore **190** rotatably receives the end portion **191** of shaft **102**. Near its lower end, member **167** includes a bore **192** which may be provided with a nylon insert **193** for free lateral movement along guide shaft **165**.

A spring arm **177** is fixedly secured, as by securing means **195**, to an end of shaft **102** axially adjacent the end of arm **167**. As will be discussed, spring arm **177** is spring-biased relative to member **167** so that shaft **102**, and hence carriage arm **101**, rotates therewith. Thus, a tension of the key blank against the cutter and the deburring means is assured. For example, in FIG. 6 a spring tension causes arm **177** to tend to cause rotation of shaft **102** in a clockwise direction which corresponds to forcing key blank **106** more firmly against cutting member **90**.

Member **177** has a roll pin **196** generally transverse thereto and located near one end of the member. Similarly, member **167** has a roll pin **197** secured near its distal end. Spring members, having different free lengths, are shown at **174** and **175** and are secured to the roll pins **196** and **197** on the opposite side of the ends of the respective arms **177** and **167**.

It has been found convenient to use a differential biasing arrangement such as that depicted because of the differences in the radii of the deburring means and the cutting means. As the carriage means **101** traverses the cutting member, spring **175**, having the shorter free length, is greatly extended, while the extension of spring **174** beyond its free length is somewhat less. After the key blank **106** passes the cutter, the spring bias tends to rotate shaft **102** inwardly toward the deburring means **12** where the key is effectively deburred. The springs are sized so that spring **175** loses its tensioning ability while spring **174** provides a sufficient tension to achieve the deburring operation. One of the reasons that such an arrangement has been found desirable is to prevent stalling the motor and gear arrangement by excessive pressure on the deburring means.

Turning now to the details of FIG. 14, an overall power supply **200** is shown which may comprise a line plug. The circuit is arranged so that upon manual operation, only the cutter drive motor **4** is actuated. When it is desired to have automatic operation, normally-open limit switch **171** must be closed by the position of the carriage in readiness of the start cycle. Thereafter, the push-button is closed completing the circuit to actuate both the cam drive motor **157** and the cutter drive motor **4**. Upon completion of the cycle, the eccentric actuates limit switch **171** to open the circuit and shut off both motors.

As best seen in FIGS. 1 and 3, a stationary guide member **210** having a knife-like guide edge **211** is secured to the apparatus as by adjustable clamping means **212**. Edge **211** is arranged relative to the cutting edge **91** of the cutting member **90** so that, as the serrations on the key blank **107** are followed, a like serration is cut into an edge of the key blank. Thus, the pressure of the biasing arrangement maintains the force of the carriage means against the guide edge **211** and against the cutting member.

We claim:

1. A key duplicating machine comprising the combination of:

apparatus support means for providing a base for said machine;

first power drive means, including a motor and gear means, to provide a source of energy to said machine;

cutting means for providing serrations in a key blank according to the pattern of a key master;

means connected to said first power drive means for actuating said cutter means;

carriage means, including means for securing said key master relative to said key blank, said carriage means being capable of linear translatory motion with respect to said cutting means so that upon the movement of the carriage means, the cutting means causes the key blank to be cut according to the pattern of the key master;

carriage drive means; comprising a cam which includes a continuous groove and a cam follower coacting

with said continuous groove, said groove including a first portion which upon movement of said cam drives said cam follower for causing the translatory movement of said carriage means and a second portion which allows said cam follower and said carriage to be manually given translatory movement while said cam remains stationary;

stationary guide means for engaging the serrations of the key master and controlling the position of said carriage means relative to said cutting means; and,

biasing means to maintain the force of the carriage means against the cutting means.

2. The apparatus as defined in claim **1** wherein said cutting means further includes deburring means for engaging the key upon the completion of the cutting operation to deburr the newly-cut key configuration.

3. The apparatus as defined in claim **1** wherein the carriage means includes a first means for securing a master key and a second means for securing a key blank, said first means being in a fixed position with respect to said second means.

4. The apparatus as defined in claim **3** wherein said carriage means further includes means for securing said key blank and said key master to said carriage means.

5. The apparatus according to claim **11** wherein said apparatus further includes a shaft, said carriage is secured to said shaft and further includes a member fixedly secured to said shaft, said member including said cam follower, said cam follower being located in a groove on said roller cam, said member further including means for securing said biasing means thereto.

6. The apparatus according to claim **5** wherein said machine further includes limit switch means,

a switch cam secured to said roller cam so that when said machine is actuated, said switch cam engages the limit switch after one complete revolution of the roller cam, thereafter to cease operation of said machine, whereby the cutting cycle is achieved in a single rotation of the roller cam.

7. The apparatus according to claim **6** wherein the roller cam further includes gear means secured to the end of said roller cam opposite said switch cam, and

cam drive means, including a cam drive motor and gear assembly secured to a drive pinion, said drive pinion engaging said cam gear which is secured to said roller cam.

8. The apparatus according to claim **7** further including means for actuating said cam drive motor simultaneously with said power drive means for automatic operation.

9. The apparatus according to claim **6** wherein said apparatus further includes a second member secured to said carriage shaft near one end, means for securing one spring means near the opposite end of said member, said spring means bearing against the opposite end of said second member to cause rotation of the shaft and the carriage means secured thereto so that the bias caused by said spring means is transmitted to the carriage means.

10. A key duplicating machine comprising the combination of:

apparatus support means for providing a base for said machine;

first power drive means, including a motor and gear means, to provide a source of energy to said machine;

cutting means for providing serrations in a key blank according to the pattern of a key master;

means connected to said first power drive means for actuating said cutter means;

carriage means, including means for securing said key master relative to said key blank, said carriage means being capable of linear translatory motion with respect to said cutting means so that upon the movement of the carriage means, the cutting means causes the key blank to be cut according to the pattern of the key master;

carriage drive means, comprising a cam which includes a continuous groove which permits automatic and manual operation, and a cam follower coacting with said continuous groove, for causing the translatory movement of said carriage means;

stationary guide means for engaging the serrations of the key master and controlling the position of said carriage means relative to said cutting means;

biasing means to maintain the force of the carriage means against the cutting means; and,

said cutting means further including at least one rotatable deburring member mounted upon a shaft which is driven by said power drive means, and wherein said cutting means also includes a rotatable cutting member which is mounted upon a second shaft, said first shaft being concentric with said second shaft and wherein said cutting member is rotatable in a direction opposite said deburring means.

11. A key duplicating machine comprising the combination of:

apparatus support means for providing a base for said machine;

first power drive means, including a motor and gear means, to provide a source of energy to said machine;

cutting means for providing serrations in a key blank according to the pattern of a key master;

means connected to said first power drive means for actuating said cutter means;

carriage means, including means for securing said key master relative to said key blank, said carriage means being capable of linear translatory motion with respect to said cutting means so that upon the movement of the carriage means, the cutting means causes the key blank to be cut according to the pattern of the key master;

carriage drive means, comprising a cam which includes a continuous groove which permits automatic and manual operation, and a cam follower coacting with said continuous groove for causing the translatory movement of said carriage means;

stationary guide means for engaging the serrations of the key master and controlling the position of said carriage means relative to said cutting means;

biasing means to maintain the force of the carriage means against the cutting means; and,

said cam being generally cylindrical and the continuous groove of said cam comprising a first portion of said groove for traversing the periphery of said cam in a helical configuration, and a second portion of said groove for traversing the periphery of said cam in a direction generally parallel to the axis of said cam, whereby the cam may be used for both manual and automatic operation.

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