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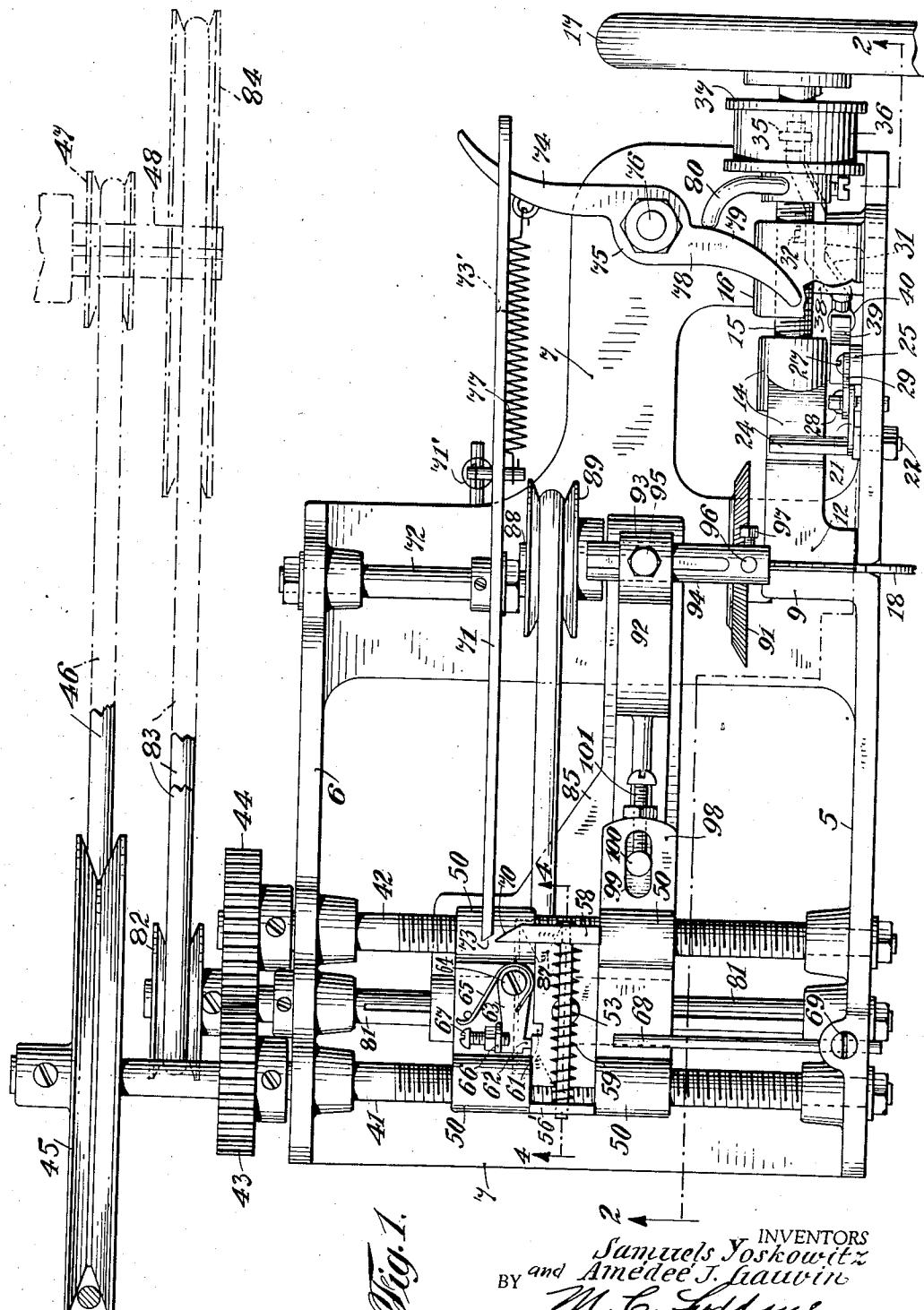
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## KEY DUPLICATING MECHANISM

Filed Dec. 2, 1936

3 Sheets-Sheet 1



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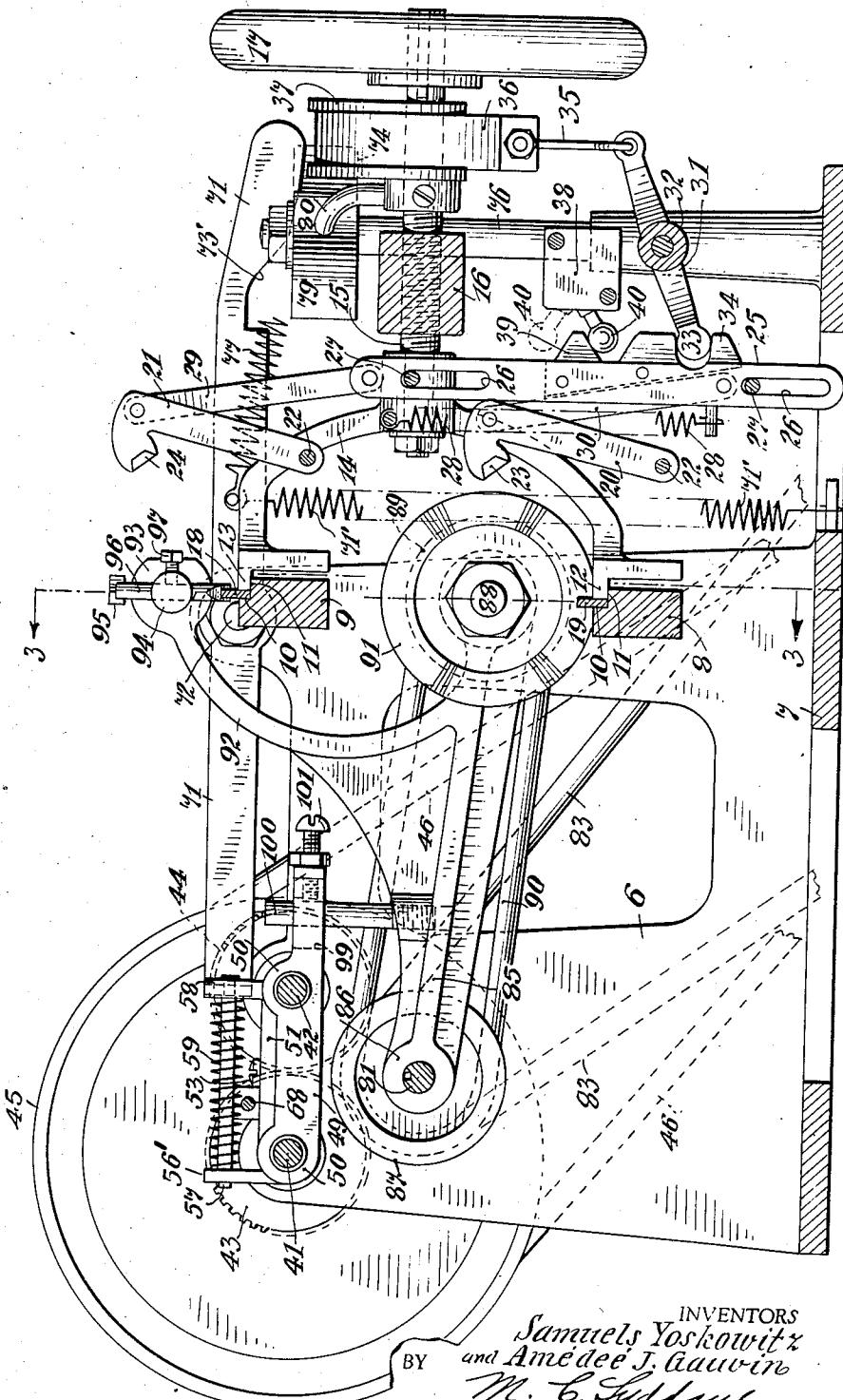
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KEY DUPLICATING MECHANISM

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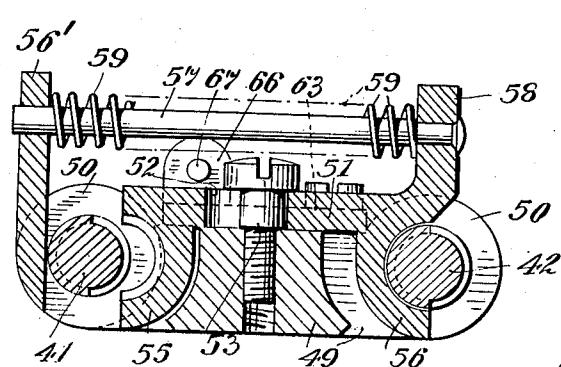
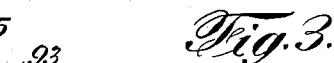
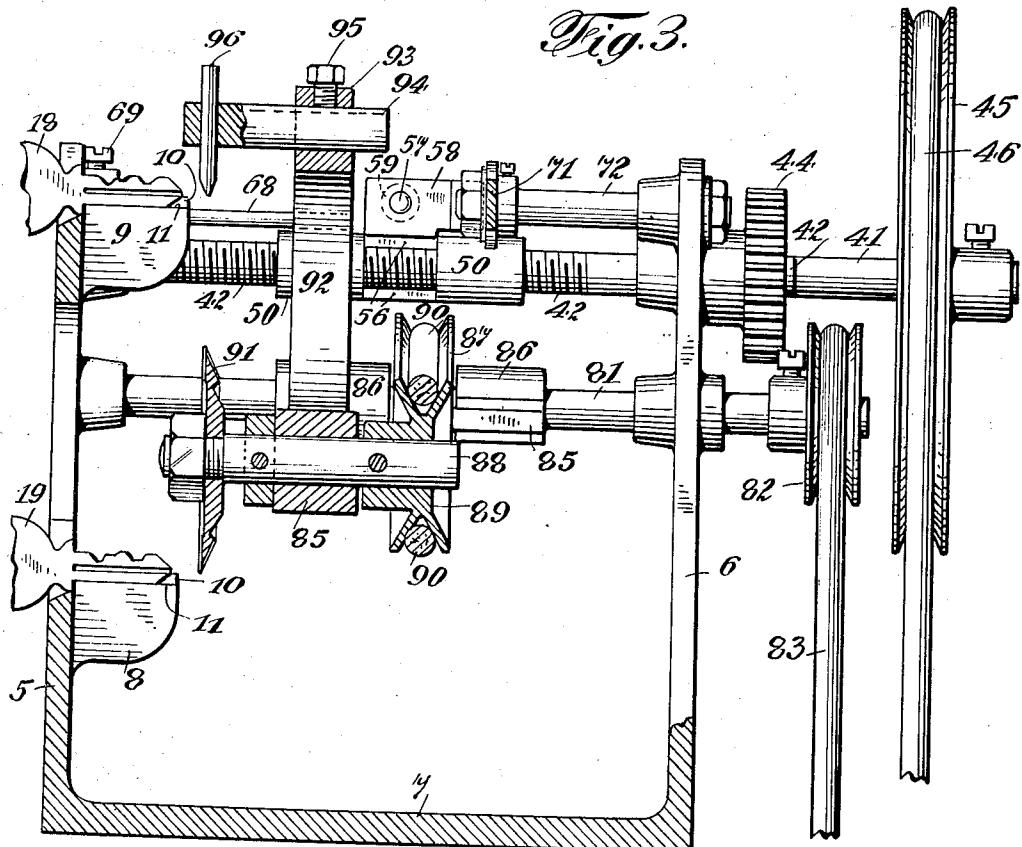
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## KEY DUPLICATING MECHANISM

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3 Sheets-Sheet 3



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## UNITED STATES PATENT OFFICE

2,148,668

## KEY DUPLICATING MECHANISM

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12 Claims. (Cl. 90—13.05)

This invention relates to key duplicating mechanism, and has for its general object and purpose to provide a machine for accurately cutting key blanks of the Yale type in accordance with the pattern of the patron's key.

More particularly, it is an object of our invention to provide an automatic machine for this purpose in which the rotation of the cutting wheel as well as its longitudinal travel with respect to the key blank is effected by means of a single motor.

Another object of the invention resides in the provision of simple and effective manually controlled means for securely clamping the patron's key and the key blank in proper positions and for also opening and closing the motor control switch.

An important feature of our invention is an improved means for supporting the cutting wheel for bodily vertical movement together with a carriage for longitudinally moving said supporting means and wheel, and means for automatically reversing the movement of said carriage.

It is a further general object of our invention to provide a key duplicating machine as above characterized which is comparatively simple in its construction, may be produced at reasonable cost, and will reliably function in practical operation.

With the above and other objects in view, the invention consists in the novel key duplicating mechanism, and in the form, construction and relative arrangement of its several parts, as will be hereinafter more fully described, illustrated in the accompanying drawings and subsequently incorporated in the subjoined claims.

In the drawings wherein we have illustrated one simple and practical embodiment of our invention and in which similar reference characters designate corresponding parts throughout the several views

Fig. 1 is a top plan view, the casing or housing being omitted, and showing the traveling carriage approaching the limit of its rearward movement.

Fig. 2 is a vertical sectional view taken substantially on the line 2—2 of Fig. 1.

Fig. 3 is a transverse sectional view taken on the line 3—3 of Fig. 2 and

Fig. 4 is a detail sectional view on an enlarged scale taken substantially on the line 4—4 of Fig. 1.

Referring in detail to the drawings, the parts of the mechanism are suitably mounted or supported in a frame which embodies front and rear

vertical walls 5 and 6 respectively, and a suitably formed base 7, connecting said vertical walls at their lower ends.

Upon the rear side of the front wall 5, and in vertically spaced relation, inwardly projecting lugs or brackets 8 and 9, respectively, are suitably secured or integrally formed with said frame wall. Each of these brackets at its upper end and at one side thereof, is cut away or recessed to provide a longitudinally extending shoulder 10 and a horizontal supporting seat 11 for the lower and upper clamping jaws 12 and 13 respectively.

The clamping jaws 12 and 13 are carried by the lower and upper ends of a vertically positioned bar 14, which at its center, is rigidly connected in any preferred manner with one end of the adjusting screw 15, which is threaded in the supporting bearing 16 on the rear side of the frame wall 5. To the other end of said feed screw, a suitable hand wheel 17 is secured whereby said screw is operated to adjust the clamping jaws 12 and 13.

The patron's key, indicated at 18, is vertically positioned against the shoulder 10 of the upper bracket 9 while the key blank to be cut, indicated at 19, is similarly positioned against the shoulder 10 of the lower bracket 8. In order to hold the key 18 and the blank 19 in erect positions, projecting above the upper surface of the brackets 8 and 9, prior to engagement of the clamping jaws 12 and 13 therewith, we provide the levers 20 and 21 respectively, vertically spaced apart and fulcrumed at their lower ends, as at 22, upon the frame wall 5. These levers at their other ends terminate in laterally projecting clamping heads 23 and 24 respectively.

A vertically movable bar 25 has spaced longitudinal slots 26 which receive guide studs 27 fixed to the frame wall 5, said bar being yieldingly urged upwardly by the coil spring 28. A link 29 pivotally connects the bar 25 at its upper end to the free end of the lever 21 while the corresponding end of the lever 20 is connected by a similar link 30 to said bar 25 near its lower end.

The bar 25 is actuated to position the clamping heads of levers 20 and 21 in proper relation to the brackets 8 and 9 so that they will engage the upper edges of the key blank and patron's key respectively, by means of the lever 31. This lever is fulcrumed intermediate of its ends, as at 32, upon the frame wall 5 and has a spherical terminal 33 at one end loosely engaged in a socket or recess formed in the lateral projection 34 on the bar 25. The other end of this lever is connected by link 35 with a strap 36 engaged with the ec-

centric 37 on the feed screw 15. By means of this eccentric, when the feed screw is operated, bar 25 moves upwardly, and through the link connections 29 and 30 positions the clamping heads of levers 20 and 21 to engage the upper edges of the patron's key and key blank respectively, when they are positioned upon the supporting brackets, in contact with the shoulders 10 thereof.

10 Simultaneously, with the operation above described, the control switch, indicated generally at 38, for the operating motor of the key cutting mechanism, is opened. In spaced relation to the upper end of the projection 34, on bar 25, said bar 15 is provided with a lug 39. The terminal end 40 of the switch lever is positioned between said lug and the projection 34 so that in the upward movement of the bar 25 the switch lever is engaged by the upper end of projection 34, and 20 moved to its open position, while in the downward movement of said bar lug 39 engages said switch lever and moves the same to closed position.

The above described mechanism is arranged at 25 one end of the machine frame. At the opposite end thereof spaced feed screws 41 and 42 respectively, are journaled in the frame walls 5 and 6 and are adapted to be rotated in relatively opposite directions by the cog gears 43 and 44. 30 The screw 41 extends beyond the gear 43 and has a belt wheel 45 secured thereto and connected by driving belt 46 with the relatively small belt wheel 47 on the shaft of a driving motor, indicated at 48. Of course it will be understood, that any 35 other conventional means for transmitting power from the motor to the feed screw 41 may be employed.

A carriage to be reciprocated by the screws 41 and 42 includes a body section 49 provided at its 40 opposite ends and at each side thereof with the bearings 50 having smooth bores within which the feed screws 41 and 42 freely rotate. Upon this body section 49 of the carriage and centrally thereof a transversely shiftable section 51 is 45 mounted, said carriage section having a slot 52 receiving the guide screw 53 which is threaded at its lower end in the body section 49 of the carriage. The carriage section 51 at its opposite ends is formed with the half-nuts 55 and 56 respectively, which are adapted to engage with the 50 respective feed screws 41 and 42.

The carriage body at one side thereof and between the spaced bearings 50 is formed with an upstanding arm 56' having an opening therein 55 through which one end of a rod 57 is freely movable. The other end of this rod is fixed in a similar arm 58 extending upwardly from one end of the carriage section 51. A coiled expansion spring 59 surrounds the rod 57 and bears at its 60 opposite ends against the arms 56' and 58. It will therefore be understood that this spring acts to yieldingly hold the carriage section 51 in a normal position with the half-nut 56 in meshing engagement with the threads of the feed screw 65 42 as seen in Fig. 4 of the drawings.

The shiftable carriage section 51, in one edge thereof, is provided with a rectangular notch or recess 61 to receive a lug 62 on the free end of a dog 63 which is pivoted at its other end as at 64 70 upon the body section of the carriage. A suitable spring 65 urges the dog 63 in one direction to yieldingly hold its lug 62 in contact against the longitudinal edge of the shiftable carriage section 51. The free end of the dog 63 is further 75 provided on one edge thereof with an upwardly

projecting lug 66 in which a set screw 67 is adjustably mounted.

A transversely extending rod 68 is adjustably fixed at one of its ends by the set screw 69 in the frame wall 5. This rod is in alignment with the set screw 67 and is adapted to contact with the end of said screw at the limit of the traveling movement of the carriage in the forward direction towards the frame plate 5 to thereby actuate the dog 63 and disengage its lug 62 from the 10 notch 61.

The arm 58 at its upper end is formed with a projecting part terminating in a beveled or inclined face 70. A lever 71 is fulcrumed immediate of its ends upon supporting rod 72 mounted in the frame plate 6, and one end of this lever 73 is beveled similarly to the beveled surface 70 of the projecting part of the arm 58 and is disposed in the path of movement of said arm when in operative position.

As herein shown the lever 71 at its opposite end and in the lower edge thereof is formed with a cam surface 73'. A spring 71' normally urges the rear end of this lever downwardly and holds said cam surface 73' in engagement with the rearwardly projecting arm 74 of an oscillatable member 75 mounted on the upper end of a pedestal 76 rising from the frame base. A spring 77 connected at one of its ends with lever 71 and at its other end with the arm 74 normally acts to position said arm in contact with the low end of the cam surface 73' so that under the action of the spring 71', the other end of the lever 71 will be elevated out of the path of movement of the surface 70.

The member 75 also has a forwardly projecting arm 78 which is provided with a convex cam surface 79 engaged by the end of a curved finger 80 suitably fixed upon the screw 15.

From the above description it will be understood that as the screw 15 is rotated to bring the jaws 12 and 13 into clamping engagement against the pattern key and key blank, the finger 80 rides upon the convex face of the arm 78 and oscillates member 78 to move the other arm 74 of said member along the high portion of the cam surface 73', and thus actuate the lever 71 to position its end 73 in the path of movement of the carriage arm 58. Therefore in the rearward movement of the carriage it will be apparent that when the beveled surface 70 engages the end 73 of lever 71, the carriage section 51 will be transversely shifted against the action of spring 59. The half-nut 56 is thus disengaged from feed screw 42 while the half-nut 55 is operatively engaged with the feed screw 41. Notch or recess 61 in the carriage section 51 is also brought into registering relation with the lug 62 of dog 63, and under the action of spring 65 said lug is engaged in said notch to thereby lock the shiftable section 51 of the carriage against return movement to its normal position.

Below the feed screws 41 and 42, a shaft 81 is journaled at its opposite ends in the frame walls 5 and 6, one end of said shaft being provided with the belt wheel 82 connected by driving belt 83 with a wheel 84 of large diameter on the motor driven shaft 48 whereby the shaft 81 will be driven at a high speed. This shaft extends loosely through the spaced bearings 86 of a frame 85. Between said bearings the belt wheel 87 is keyed upon the shaft 81 to rotate therewith and have longitudinal sliding movement with the frame 85 along said shaft. The other end of the frame 85 is formed with a suitable bearing in which shaft 75

88 is mounted, one end of said shaft having a belt wheel 89 connected by driving belt 90 to wheel 87 on shaft 81. To the other or forward end of the shaft 88 a cutter wheel 91 is secured.

This end of the frame 85 is also formed with an upwardly extending arm 92 terminating in a guide bearing 93 having a rod 94 which is adjustably fixed in said bearing by a set screw 95. The forward end of said rod carries a vertically adjustable index member 96, secured in adjusted position by set screw 97.

At one end of the body section 49 of the traveling carriage a laterally projecting arm 98 is provided, said arm having a slot 99 through which a rod 100 projects upwardly from the frame 85. A set screw 101 is adjustably mounted in the end of the arm 98 and projects longitudinally into the slot 99. By properly adjusting this set screw, with one end of which the rod 100 contacts, the depth of the cutting action of the wheel 91 may be limited. Also of course, it is understood that this rod 100 provides the connecting means between frame 85 and cutter 91 and said carriage, so that they will travel in unison longitudinally of the feed screws 41 and 42.

In the operation of the machine above described, normally the key engaging heads 23 and 24 are positioned immediately above the respective supporting brackets 8 and 9. Thus when the pattern key and the key blank are inserted and moved longitudinally upon the supporting brackets, their upper edges are engaged by the respective heads 23 and 24 so as to hold the pattern key and key blank with the shanks positioned in a vertical plane and against the shoulders 10. When the screw 15 is now operated, the clamping jaws 12 and 13 move inwardly against the pattern key and key blank to rigidly clamp the same against the shoulders 10 of the supporting brackets while at the same time the retaining or positioning members 23 and 24 are lifted to the positions shown in Fig. 2 of the drawings.

Assuming that the reciprocating carriage has reached the limit of its rearward movement and that the half-nut 55 has been locked in operative engagement with the feed screw 41 as above described, the above operation of the screw 15, which results in a downward movement of the bar 25, closes the motor switch 38. Shaft 81 is thereby driven at high speed to rotate the cutter 91 while the reciprocating carriage with the frame 85 in which the cutter shaft is mounted are slowly moved forwardly by the screw 41. The action of the cutter 91 upon the key blank 19 is controlled by the index member 96 which rides over the serrations or irregularities on the edge of the pattern key 18, the frame 85 together with the rotating cutter blade, thus oscillating vertically as said frame is reciprocated longitudinally along the shaft 81 in the travel of the carriage.

Upon reaching the forward end of the carriage travel for which rod 68 has been properly adjusted, the end of said rod engages the set screw 67 to release the member 51 of the carriage so that spring 59 returns said member to normal position, disengaging the half-nut 55 from the screw 41 and engaging the half-nut 56 with the rotating screw 42. Movement of the reciprocating carriage is thus automatically reversed and the action of the rotating cutter blade upon the key blank, under control of the index member 96, is repeated. At the end of this latter movement of the cutter, wheel 17 is turned in the proper direction to rotate screw 15 whereby the clamping

jaws 12 and 13 release the pattern key and key blank, which has now been properly cut, and at the same time returns the positioning members 23 and 24 to their normal positions and opens the switch 38 to discontinue operation of the motor.

By reason of the various adjustments provided for controlling the reciprocating and oscillating movement of the cutter wheel or blade, it will be apparent that our invention may be employed for accurately cutting keys of various lengths and of different detail forms. The mechanism above described, is relatively simple, and reliable in its functional operation. The particular mounting and arrangement of the several parts, as herein shown, is merely suggestive, and in order to secure greater compactness, in certain adaptations of our invention, both the form and arrangement of the several elements might be modified. Thus the key cutting mechanism may be commercially employed as a separate unit, or in combination with a key blank vending mechanism, such as that described in our pending application, Ser. No. 103,107 filed Sept. 29, 1936, and both said vending mechanism and the cutting mechanism housed in a common case or cabinet.

Also it is to be further understood that while we have herein disclosed a preferable embodiment of the novel combination and sub-combinations of elements constituting our present invention, the essential features thereof might also be exemplified in various other alternative mechanical forms and we accordingly reserve the privilege of resorting to all such legitimate changes therein as may be fairly considered to be within the spirit and scope of the appended claims.

We claim:

1. In a key duplicating machine, means for supporting a pattern key and a key blank, a vertically oscillatory frame, a rotary cutter mounted in one end of said frame to operate on the key blank, a reciprocating carriage, connecting means between the carriage and the frame whereby the latter is reciprocated to move the cutter longitudinally of the key blank, an index member carried by said frame and adapted to co-act with the pattern key, means carried by said frame for rotating the cutter, and additional motor driven means for simultaneously reciprocating said carriage and frame.

2. In a key duplicating machine, a reciprocating carriage, a frame connected with said carriage to reciprocate as a unit therewith and supported for vertical oscillating movement independently of the carriage, a cutter rotatably mounted upon said frame to operate upon a key blank, an index member carried by the frame to co-act with a pattern key, spaced feed screws for the carriage, means for rotating the feed screws in reverse directions, means for operatively connecting the carriage with the respective feed screws, and means including parts movable with the carriage and adapted to engage relatively stationary elements to disengage the last named means from one of said feed screws and engage said means with the other feed screw at the end of the traveling movement of the carriage in each direction whereby the movement of said carriage is reversed.

3. In a key duplicating machine, a reciprocating carriage, a frame, a cutter rotatably mounted upon one end of said frame to operate upon a key blank, means for rotating said cutter including a driving shaft, said frame being loosely mounted at its other end upon said shaft and supported thereby for vertical oscillation, con-

necting means between said frame and the carriage whereby the frame is moved with said carriage longitudinally along said shaft, spaced feed screws for the carriage, means for rotating said screws in reverse directions, movable members mounted on the carriage to engage the respective feed screws whereby the carriage is reciprocated, and means including coacting parts operatively controlled by said carriage at the 10 end of the movement of the carriage in each direction to effect an operative engagement of one of said members with one of the feed screws and the disengagement of the other of said members from the other feed screw, whereby the 15 movement of the carriage is reversed.

4. In a key duplicating machine, a reciprocating carriage, a frame, a cutter rotatably mounted upon one end of said frame to operate upon a key blank, means for rotating said cutter including a driving shaft, said frame being loosely mounted at its other end upon said shaft and supported thereby for vertical oscillation, connecting means between said frame and the carriage whereby the frame is moved with said 20 carriage longitudinally along said shaft, spaced feed screws for the carriage, means for rotating said screws in reverse directions, rigidly connected members mounted on the carriage and movable into and out of meshed engagement 25 with the respective feed screws, means yieldably urging said members in one direction to normally hold one of said members in meshing engagement with one of the feed screws, a stationary element coacting with a part carried by said 30 connected members at the end of the traveling movement of the carriage in one direction to move said members relative to the carriage and engage the other of said members with the other feed screw as the first named member is moved 35 out of meshing engagement with the first named feed screw, means for locking said connected members in the latter position whereby the traveling movement of the carriage is reversed, and means automatically actuating said locking 40 means at the end of the traveling movement of the carriage in the latter direction to release said screw engaging members whereby the latter are returned to normal position and the movement of the carriage is again reversed.

5. In a key duplicating machine, a frame supported at one of its ends for vertical oscillatory movement, a cutter rotatably mounted upon the other end of said frame to operate on a key blank, a reciprocating carriage mounted above 45 said frame, said carriage having a laterally extending slotted arm, a rod fixed to the frame and extending upwardly through the slot in said arm, an adjusting screw mounted on said arm and constituting a stop engaged by said 50 rod to limit downward movement of the frame and control the maximum depth of cut in the operation of said cutter, means for rotating said cutter, and means for automatically reciprocating said carriage, such reciprocating movements of the carriage being transmitted through 55 said rod to the oscillating frame.

6. In a key duplicating machine, vertically spaced supports for a pattern key and a key blank, movable members adapted to co-act with 60 the pattern key and the key blank when positioned upon the said supports to retain the key shanks on edge in a vertical plane, clamping jaws associated with the respective supports, and means for actuating said clamping jaws to rigidly clamp the pattern key and the key blank 65

on the respective supports and simultaneously move said retaining members to inoperative positions in laterally spaced relation from the respective supports.

7. In a key duplicating machine, vertically spaced supports for a pattern key and a key blank, movable members adapted to co-act with the pattern key and the blank when positioned upon the said supports to retain the key shanks on edge in a vertical plane, clamping jaws associated with the respective supports, a manually operable adjusting screw for said clamping jaws, and means connected with said retaining members and operatively controlled by said adjusting screw whereby said members are simultaneously displaced to an inoperative position in laterally spaced relation from the respective supports and said clamping jaws are moved into clamping engagement with the pattern key and key blank when the adjusting screw is turned in one direction.

8. In a key duplicating machine, vertically spaced supports for the pattern key and key blank, movable members adapted to co-act with the pattern key and the blank when positioned upon the said supports to retain the key shanks on edge in a vertical plane, clamping jaws associated with the respective supports, an adjusting screw connected with said clamping jaws, a vertically movable bar, link connections between said retaining members and said bar, and means actuated by the adjusting screw upon rotation thereof in one direction to move said bar and displace said retaining members to an inoperative position in laterally spaced relation from the supports as said jaws are simultaneously moved into clamping engagement with the pattern key and the key blank.

9. In a key duplicating machine, vertically spaced supports for a pattern key and a key blank, movable members adapted to co-act with the pattern key and the key blank when positioned upon the said supports to retain the key shanks on edge in a vertical plane, clamping jaws associated with the respective supports, a rotary motor driven cutter to operate upon the key blank, a motor control switch, an adjusting screw connected with said clamping jaws, and means actuated in the turning movement of said screw in one direction to engage the clamping jaws with the pattern key and key blank, whereby said retaining members are displaced to inoperative positions at one side of the respective supports and said motor control switch is simultaneously closed.

10. In a key duplicating machine, a frame supported at one of its ends for sliding and vertical oscillatory movement, a cutter mounted upon the other end of said frame to operate upon a key blank, means for operating said cutter, a reciprocating carriage and a common means connecting said frame with the carriage for reciprocatory movement with the latter and for limiting oscillatory movement of the frame in one direction to control the maximum depth of cut in the operation of said cutter.

11. In a key duplicating machine, a frame supported at one of its ends for sliding and vertical oscillatory movement, a cutter rotatably mounted upon the other end of said frame to operate on a key blank, means for operating said cutter, a reciprocating carriage, a member connecting the frame with the carriage whereby said frame is reciprocated, and an adjustable element coacting with said member to limit oscillatory motion of

the frame in one direction and control the maximum depth of cut in the operation of said cutter.

12. In a key duplicating machine, a frame supported at one of its ends for sliding and vertical oscillatory movement, a reciprocating carriage, a member fixed to one of said parts and movably engaging the other part to transmit reciprocating movement from the carriage to the frame, a cutter rotatably mounted upon the other end of said

frame to operate on a key blank, means for rotating said cutter, and an adjustable element coacting with said member to variably limit the oscillatory movement of the frame in one direction to control the maximum depth of cut in the 5 operation of said cutter.

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