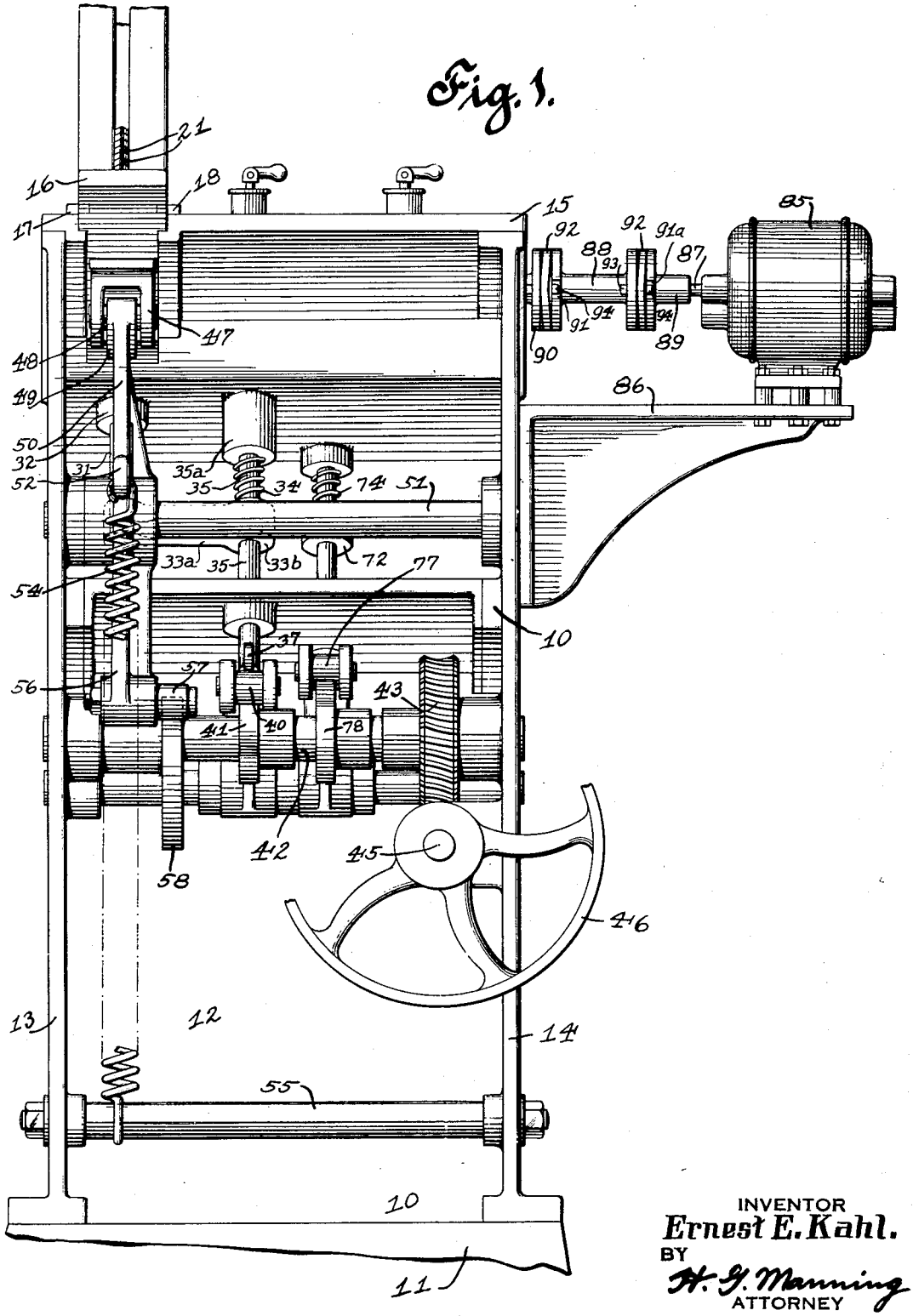
Jan. 30, 1934. E. E. KAHL 1,945,276

KEY MILLING MACHINE

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Fig. 1.



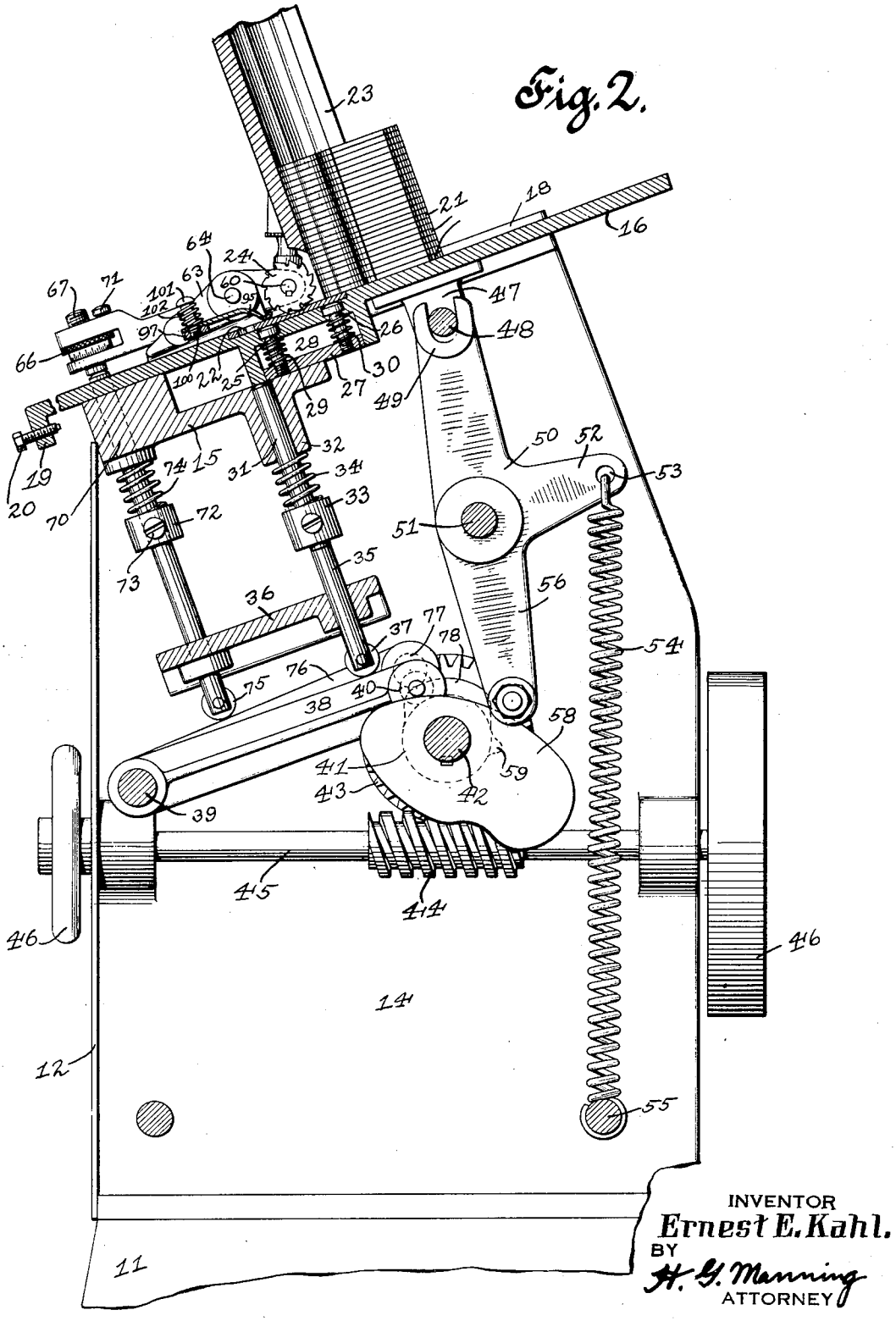
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Fig. 2.



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KEY MILLING MACHINE

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Fig.6.

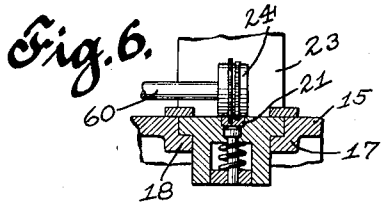


Fig.3.

Fig.4.

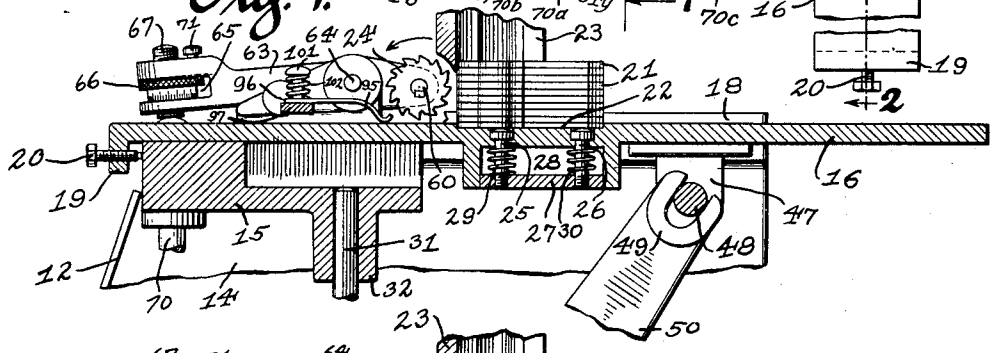
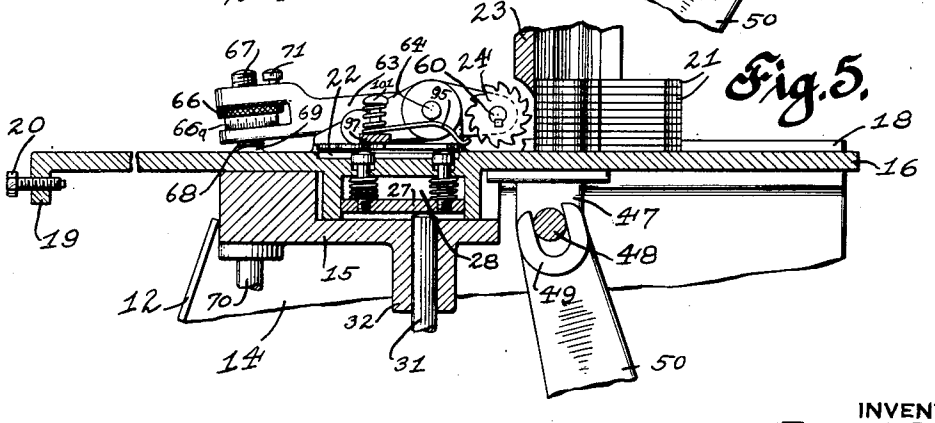


Fig.5.



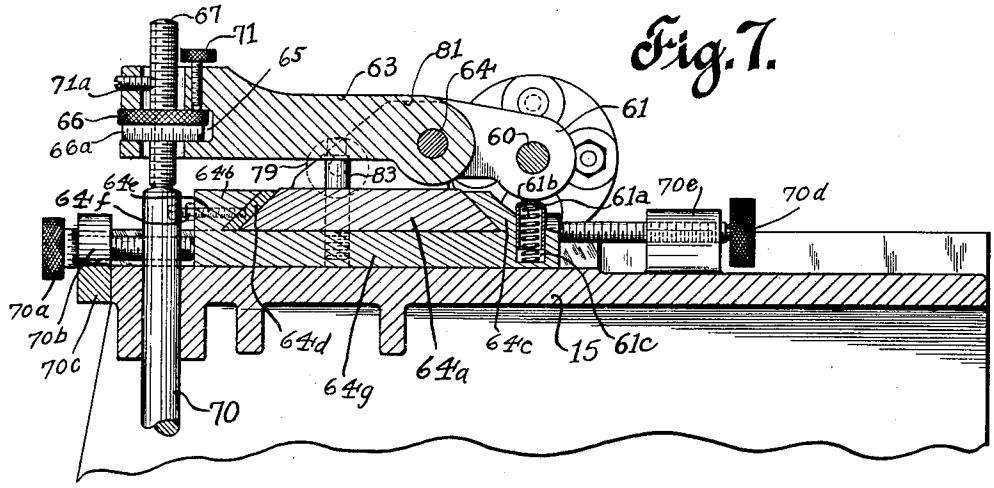
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KEY MILLING MACHINE

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Fig. 7.



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UNITED STATES PATENT OFFICE

1,945,276

KEY MILLING MACHINE

Ernest E. Kahl, New Britain, Conn., assignor to The B. Jahn Manufacturing Company, New Britain, Conn., a corporation of Connecticut

Application November 6, 1930. Serial No. 493,803

14 Claims. (Cl. 90—21)

This invention relates to automatic milling machines, and more particularly to a key-milling machine employing a rotary cutter for forming longitudinal slots in the face of the key.

One object of this invention is to provide a milling machine of the above nature in which the rotary cutter is mounted upon a shaft journaled in the end of a cam-actuated lever whereby the height of said cutter may be controlled at all points of the cutting stroke.

A further object is to provide a milling machine of the above nature in which the cutter shaft is connected by a flexible coupling with a stationary motor-driven shaft.

A further object is to provide a key-milling or key-"warding" machine of the above nature in which the keys are carried in a recess of an inclined plate slidable in the bed of the machine.

A further object is to provide a machine of the above nature in which the key-holding nest plate has a depending stop member adapted to engage the machine body to limit the length of the stroke thereof and accurately aline the key recess with the key magazine.

A further object is to provide an improved form of cam-and-lever operated key ejecting mechanism.

A further object is to provide an improved form of bell-crank lever mechanism for reciprocating the nest plate under the rotary cutter.

A further object is to provide a machine of the above nature which will be relatively simple in construction, inexpensive to manufacture, easy to install and adjust, compact, and very efficient and durable in use.

With these and other objects in view there has been illustrated on the accompanying drawings one form in which the invention may be conveniently embodied in practice.

In the drawings:

Fig. 1 represents a rear view of the key-milling machine, showing the interior operating mechanism.

Fig. 2 is a side sectional view of the machine taken along the line 2—2 of Fig. 3.

Fig. 3 is a top view of the same.

Figs. 4 and 5 are fragmentary sectional views of a portion of the mechanism showing the inclined nest plate in its extreme upper "key-receiving" and lower "key-ejecting" positions respectively.

Fig. 6 is a fragmentary sectional view of the milling cutter, nest plate, and ejecting mechanism, the section being taken along the line 6—6 of Fig. 3, looking in the direction of the arrows.

Fig. 7 is a sectional view taken along the line 7—7 of Fig. 3.

Referring now to the drawings in which like reference numerals denote corresponding parts throughout the several views, the numeral 10 indicates the main frame of the machine and the numeral 11 the base upon which the frame is mounted. The frame 10, which is open at the rear, consists of a front wall 12, side walls 13 and 14, and an inclined top wall 15. The top wall 15 is adapted to support a key-holding nest plate 16 mounted to slide in a pair of opposed guiding jaws 17 and 18 formed in said top wall 15.

Key reciprocating nest plate

The nest plate 16 is provided at its lower forward end with a depending stop flange 19 carrying an adjusting screw 20, the point of which is adapted to engage the lower front end of the top wall 15. In order to support a key 21 during the milling operation, the nest plate 16 is provided with a key-shaped recess or nest 22 in the top face thereof. The keys 21 are adapted to be fed down into said nest 22 successively from an upwardly-extending magazine 23.

Ejecting mechanism

In order to eject the key 21 from the nest or recess 22 in the plate 16 at the conclusion of the cutting stroke after the key 21 has been moved downwardly past a rotary milling cutter 24, provision is made of an ejecting mechanism comprising a pair of headed rods 25 and 26 having their lower ends screwed into a movable bottom plate 27 which is slidably housed within a rectangular socket 28 formed in said nest plate 16 underneath the nest 22 thereof. The rods 25 and 26 are surrounded by coiled springs 29 and 30, whereby when the nest plate 16 is in its lower position, as shown in Fig. 5, the bottom plate 27 will lie in alinement with the upper end of a downwardly extending ejector rod 31 mounted to reciprocate in a sleeve 32 depending from said top wall 15, said rod 31 carrying an enlarged adjustable yoke 33.

The yoke 33 is provided with a laterally extending arm 33*a* enlarged at its inner extremity 33*b* and rigidly connected to a rod 35, the upper end of which is slidably guided by a depending socket 35*a*. The enlarged head 33*b* is pressed downwardly by a spring 34. The lower end of said rod 35 has a roller 37 mounted thereon for engaging the upper surface of a lever 38 pivoted upon a tie bolt 39 adjacent the front wall

12 of the machine (see Fig. 2). The upper end of the lever 38 has a roller 40 journaled thereon which is adapted to engage a cam 41 keyed or otherwise secured in non-rotative relation upon a cam shaft 42.

The cam shaft 42 is adapted to receive continuous rotary motion by means of a worm gear 43 rigidly mounted on said shaft and which meshes with a worm 44 on a main shaft 45 carrying a pulley 46 adapted to be driven by a belt, not shown. The opposite end of the shaft 45 is provided with a hand wheel 46 for convenience in adjusting the machine before the power is turned on.

Nest plate reciprocating mechanism

In order to cause the nest plate 16 to slide up and down in its inclined passage in the top wall 15 of the frame 10, said nest plate is provided with a depending yoke 47 carrying a horizontal pin 48 which is adapted to be embraced by a U-shaped upper section 49 of a T-shaped bell-crank lever 50 pivoted to a tie-bolt 51 extending between the side walls 13 and 14. The lever 50 is provided adjacent its midsection with a rearwardly and upwardly inclined arm 52 having an eye 53 for receiving a vertical elongated coiled spring 54, the bottom end of said spring being fastened to a horizontal tie bolt 55 extending between said side frames 14 and 15 and located just above the base 11 of the machine (see Figs. 1 and 2).

The lever 50 is provided with a lower arm 56 carrying a roller 57 in alinement with an oval-shaped cam 58 mounted on the cam shaft 42, whereby the desired reciprocating motion is imparted to the nest plate 16. The cam 58 is so shaped that the nest plate will be moved successively to bring the key recess or nest 22 underneath the stack of keys 21 in the magazine 23, the depth of said recess being such that only one key will be withdrawn from underneath said stack. The nest plate 16 will then slide down in the guideways 17 and 18 until the upper surface of said key has been milled as shown in Fig. 2, and bringing the plate 16 from the position shown in Fig. 4 to the position shown in Fig. 5. At this time a lug 59 on the cam 41 will come into action raising the ejecting rod 31 and forcing the bottom plate 27 upwardly against the springs 29 and 30. The rods 25 and 26 will thus be caused to eject the milled key 21 from the nest 22 permitting it to slide by gravity forwardly down the inclined nest plate 16 and to be caught in a suitable receptacle, not shown.

Cutting mechanism

The rotary milling cutter 24 is adapted to be secured on a cutter shaft 60 journaled in a pair of bearings 61 and 62 carried by a bifurcated lever 63 fulcrumed on a shaft 64 supported by upstanding lugs 81 and 82 integral with a plate 64*a* mounted to slide laterally in dovetailed guideways 64*b* and 64*c* within which the plate 64*a* is adjustably held by a gib 64*d*, a pair of set screws 64*e*, and a pair of lock nuts 64*f*. The bearings 61 are adapted to be pressed upwardly at all times by a pair of cup-shaped plungers 61*a* located in a circular hole 61*c* in the plate 64*g* below the shaft 60 and having coiled springs 64*b*.

By means of this construction the cutter height will be maintained accurately as determined by the micrometer adjustment on the front of the rocker lever 63.

The lateral guideways 64*b* and 64*c* form part of a plate 64*g* slidable in dovetailed longitudinal guideways 64*h* and 64*j* integral with the top wall 16. The forward portion of the lever 63 is provided with a slot 65 for receiving a knurled micrometer nut 66 having a graduated circumference 66*a* surrounding an adjusting screw 67, the lower end 68 of which is adapted to engage the upper end 69 of a cutter-operating rod 70, permitting the depth of the milled slot to be readily adjusted.

In order to adjust the plate 64*g* in a longitudinal direction, provision is made of a knurled micrometer adjusting screw 70*a* mounted in an upstanding ear 70*b* of a horizontal strip 70*c* at the front of the top wall 15 and a knurled screw 70*d* carried in a boss 70*e* on the rear part of said top plate 15.

Small set screws 71 and 71*a* are also provided on the front end of the lever 63 immediately behind and in front of the screw 67 for locking the knurled nut 66 and screw 67 in adjusted position. The rod 70 extends downwardly through the top wall 15 and is provided intermediate its ends with a collar 72 having a set screw 73 passing therethrough for adjusting the tension in a coiled spring 74 located above said collar. The lower end of the rod 70 is provided with a roller 75 adapted to lie in contact with the lever 76 pivoted on the tie bolt 39 and having a roller 77 on its upper edge. The roller 77 is adapted to engage at all times with a cam 78 carried by the cam shaft 42.

The shape of the cams 58 and 78 are so arranged that the cam 78 will cause the front end of the lever 63 to be raised for depressing the shaft 60 to lower the cutter 24 after the key has first been brought beneath it, the key remaining stationary during the downward motion of the cutter. The nest plate will then move slowly past the revolving cutter causing parallel slots to be milled in the key which will be then moved beyond the cutter into ejecting position.

In order to permit the cutter lever 63 to be laterally adjusted with respect to the plate 64*g*, provision is made of a pair of knurled micrometer screws 79 and 80 carried by said lugs 81 and 82. The threaded ends of the screws 79 and 80 are adapted to extend inwardly into engagement with a pair of plugs 83 and 84 upstanding from said plate 64*g* and adapted to move within transverse slots 84*a* and 84*b* in the plate 64*a*.

The cutter 24 is adapted to be driven by an electric motor 85 mounted on a side shelf 86 and having a shaft 87 mounted to rotate on a fixed axis. In order to permit the cutter shaft 60 to rise and fall under the action of the cutter operating cam 78, provision is made of a flexible coupling comprising a spool-shaped central member 88 and a pair of side collar members 89 and 90 rigidly mounted on the shafts 87 and 60 respectively. Each of the flanges of the spool-shaped member 88 is provided with a pair of opposed edge recesses 91, said recesses being adapted to be located 90 degrees away from a pair of similar recesses 91*a* in the flanges of the collar members 89 and 90.

A pair of flexible circular discs 92, such as leather, rubber, etc., are located between the ends of the spool member 88 and the flanges on the collars 89 and 90, said flexible discs 92 being secured in position as by bolts 93 and nuts 94 extending in alternate directions, the heads of said bolts being located outside of the flanges and the nuts located in the recesses 91.

In order to prevent the keys 21 from chattering during the milling process, provision is made of a downwardly convex curved spring finger 95 having a T-shaped base 96 yieldably carried by a laterally projecting plate 97 secured to the end of the top wall 15. The base 96 of the spring finger 95 is loosely mounted on a pair of pins 98 and 99 and a screw 100, the central screw 100 having a head 101 on its upper end and being surrounded by a coiled spring 102, whereby the spring finger 95 will be pressed downwardly at all times.

Operation

In operation, assuming the plates 64*a* and 64*g* to have been previously adjusted as desired, the keys or other articles 21 will be fed downwardly by gravity from the magazine 23 and successively received in the nest recess 22 of the nest plate 16. The nest plate 16 will then be caused to slide downwardly by the cam 58 and bell-crank lever 50 into milling position, the rotary cutter 24 being until then held in its uppermost position as shown in Fig. 4. The nest plate will then remain stationary for a short period and the cutter will then be lowered by the action of the cam 78 until it has reached the full depth of the slot to be milled continued rotation of the cam 58 will cause the key-holding nest plate to slide downwardly past the cutter, producing a straight slot in the key extending from a point within the key "bow" to the extremity of the "bit".

When the nest plate 16 reaches the ejecting position shown in Fig. 5, the lug 59 on the cam 41 will come into action causing the lever 38 to raise the rod 35 and eject the key from the nest recess 22, whereupon the key will slide by gravity down the nest plate 16 and drop into the receptacle, not shown.

While there has been disclosed in this specification one form in which the invention may be embodied, it is to be understood that this form is shown for the purpose of illustration only, and that the invention is not to be limited to the specific disclosure but may be modified and embodied in various other forms without departing from its spirit. In short, the invention includes all the modifications and embodiments coming within the scope of the following claims.

Having thus fully described the invention what is claimed as new and for which it is desired to secure Letters Patent is:

1. In a milling machine, a frame having a top wall, a pair of longitudinal parallel guideways in said top wall, an article-holding plate slidable in one of said guideways, a second plate adjustable in the other guideway, a transverse guideway in said second plate, a rotary cutter shaft-supporting plate in said transverse guideway, and means to adjust said second plate with respect to said article-holding plate.

2. In a milling machine, a frame having a top wall, a pair of longitudinal parallel guideways in said top wall, an article-holding plate slidable in one of said guideways, a second plate adjustable in the other guideway and having a transverse guideway, a rotary cutter shaft-supporting plate adjustable in said transverse guideway, means for reciprocating said article-holding plate, and means for automatically raising and lowering said cutter for milling said article.

3. In a milling machine, a frame having a top wall, a pair of longitudinal parallel guideways in said top wall, an article-holding plate slidable in one of said guideways, a second plate adjustable in the other guideway and having a transverse guideway, a third plate adjustable in said transverse guideway, a lever pivoted on said third plate, a rotary cutter journaled in the rear of said lever, and means for alternately raising and lowering the front of said lever to bring said cutter into and out of milling position.

4. In a milling machine, a frame having a top wall, a pair of longitudinal parallel guideways in said top wall, an article-holding plate slidable in one of said guideways, a second plate adjustable in the other guideway and having a transverse guideway, a third plate adjustable in said transverse guideway, a lever pivoted on said third plate, a rotary cutter journaled in the rear of said lever, and cam-and-lever operated means for alternately raising and lowering the front of said lever to bring said cutter into and out of milling position.

5. In a milling machine, a frame having a top wall, a pair of longitudinal parallel guideways in said top wall, an article-holding plate slidable in one of said guideways, a second plate adjustable in the other guideway and having a transverse guideway, a third plate adjustable in said transverse guideway, a lever pivoted on said third plate, a rotary cutter journaled in the rear of said lever, means for alternately raising and lowering the front of said lever to bring said cutter into and out of milling position, and means on said lever for varying the depth of cut of said cutter.

6. In a milling machine, a frame, an article-holding plate slidable longitudinally on said frame, a spring-pressed bell-crank lever in said frame for reciprocating said plate, means for ejecting said article after the milling operation, a cutter-holding shaft mounted on an axis parallel to said frame, means for rocking said shaft about its axis to bring the cutter into and out of milling position and vary the depth of cut, and cam-and-lever operated means to actuate said lever, said ejecting means, and said rocking means.

7. In a milling machine, a frame, a rotary cutter mounted on said frame, an article holding plate slidable on said frame, means for moving said plate to bring said cutter in alinement with said article at a point intermediate the ends thereof, means for holding said article stationary, means for lowering said cutter to the full depth of the slot to be milled, and means for thereafter moving said plate to cause said cutter to produce a slot extending from said intermediate point to one end of said article.

8. In a key-warding machine, a frame, a rotary cutter mounted on said frame, a key-holding plate slidable on said frame, means for sliding said plate in said frame to bring a point in the key bow under said cutter, means for automatically lowering said cutter to the full depth of cut while said key is held stationary, and means for thereafter sliding said plate to mill a slot extending from the starting position to the end of the key bit.

9. In a key-warding machine, a frame, a rotary cutter mounted on said frame, a key-holding plate slidable on said frame, means for sliding said plate in said frame to bring a point in the key bow under said cutter, means for automatically lowering said cutter to the full depth of cut while said key is held stationary, means for thereafter sliding said plate to mill a slot extending from the starting position to the end of the key

bit, and means for ejecting said key after the milling operation.

10. In a key-warding machine, a frame, a rotary cutter mounted on said frame, a key-holding plate slidable on said frame, means for sliding said plate in said frame to bring a point in the key bow under said cutter, means for automatically lowering said cutter to the full depth of cut while said key is held stationary, means for thereafter sliding said plate to mill a slot extending from the starting position to the end of the key bit, and cam-and-lever-operated means for ejecting said key after the milling operation.

11. In a milling machine, a frame, a rotary cutter mounted on a horizontal axis, an article holding plate slidable under said cutter, means for moving said plate to bring said article into milling position, means for automatically lowering said cutter to start the cut at a point intermediate the ends of said article, means for holding said article stationary while said cutter is being lowered, and means to thereafter slide said plate along said frame to mill a slot to the end of said article.

12. In a milling machine, a frame, an article holding plate slidable longitudinally in said frame, a second plate slidable transversely on said frame, a lever adjustably mounted on said second plate on an axis parallel to said frame, a rotary cutter journaled in said lever, cam-operated means for rocking said lever to raise and lower said cutter to vary the depth of cut during the cutting operation as the article passes under said cutter, and manually operated means for engaging said lever for adjusting said cutter.

13. In a milling machine, a frame, an article holding plate slidable longitudinally in said frame, a second plate slidable transversely and longitudinally on said frame, a lever adjustably mounted on said second plate on an axis parallel to said frame, a rotary cutter journaled in said lever, and cam-and-lever operated means for rocking said lever to raise and lower said cutter at right angles to the plane of said article to vary the depth of cut as the article passes under said cutter.

14. In a key-milling machine, a frame, a rotary cutter mounted on said frame, a key-holding plate, means for sliding said key-holding plate to bring the bow of said key under said cutter, means for lowering said cutter to the full depth of cut while holding said key stationary, means for thereafter cutting a slot to the end of the key bit, means on said plate for ejecting the key after the milling operation, and a resilient plate carried by said frame and overlying the path of said plate for pressing upon said key during the milling operation to prevent chattering.

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