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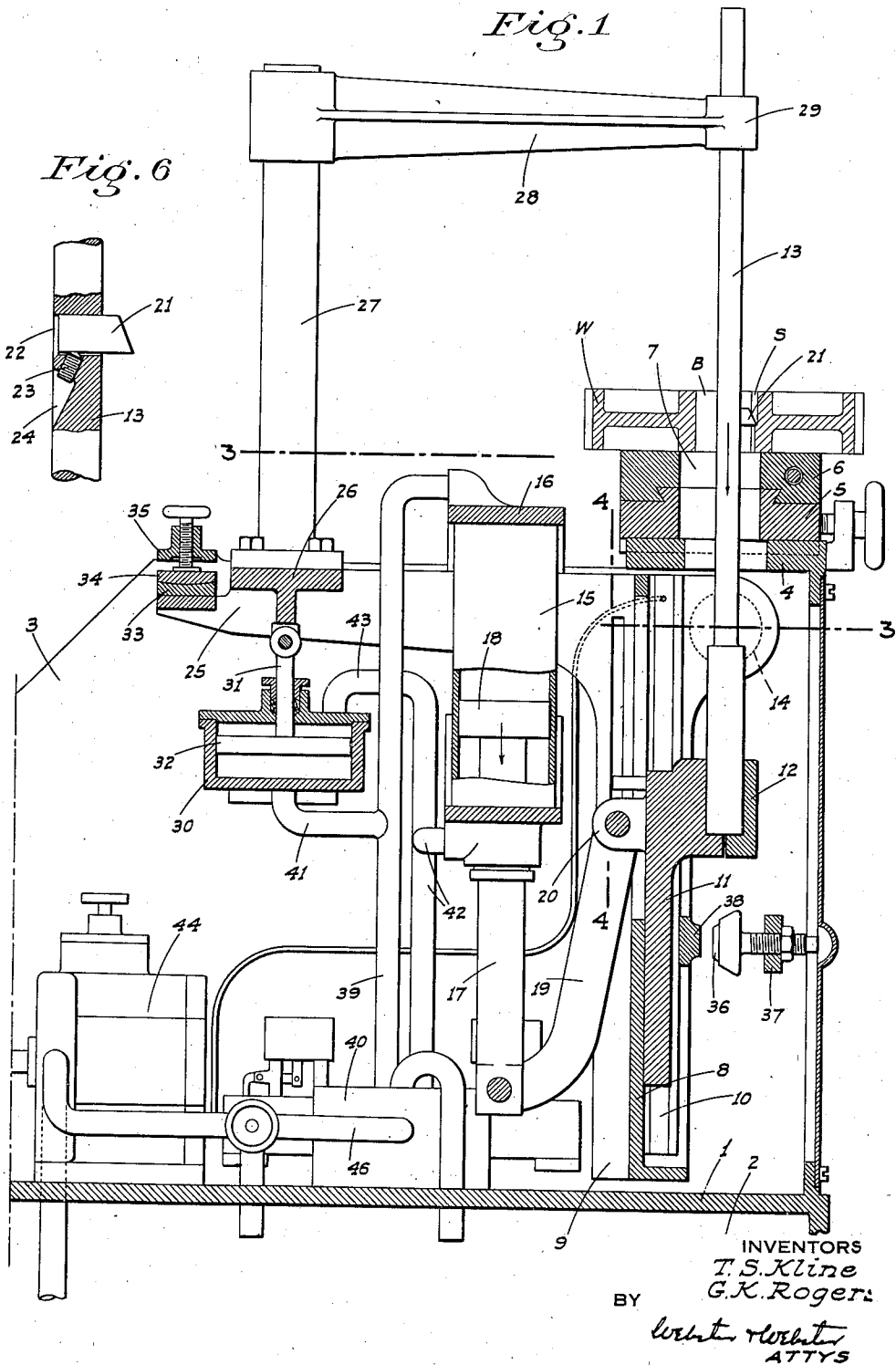
T. S. KLINE ET AL

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HYDRAULIC KEY SEATER

Filed Jan. 31, 1944

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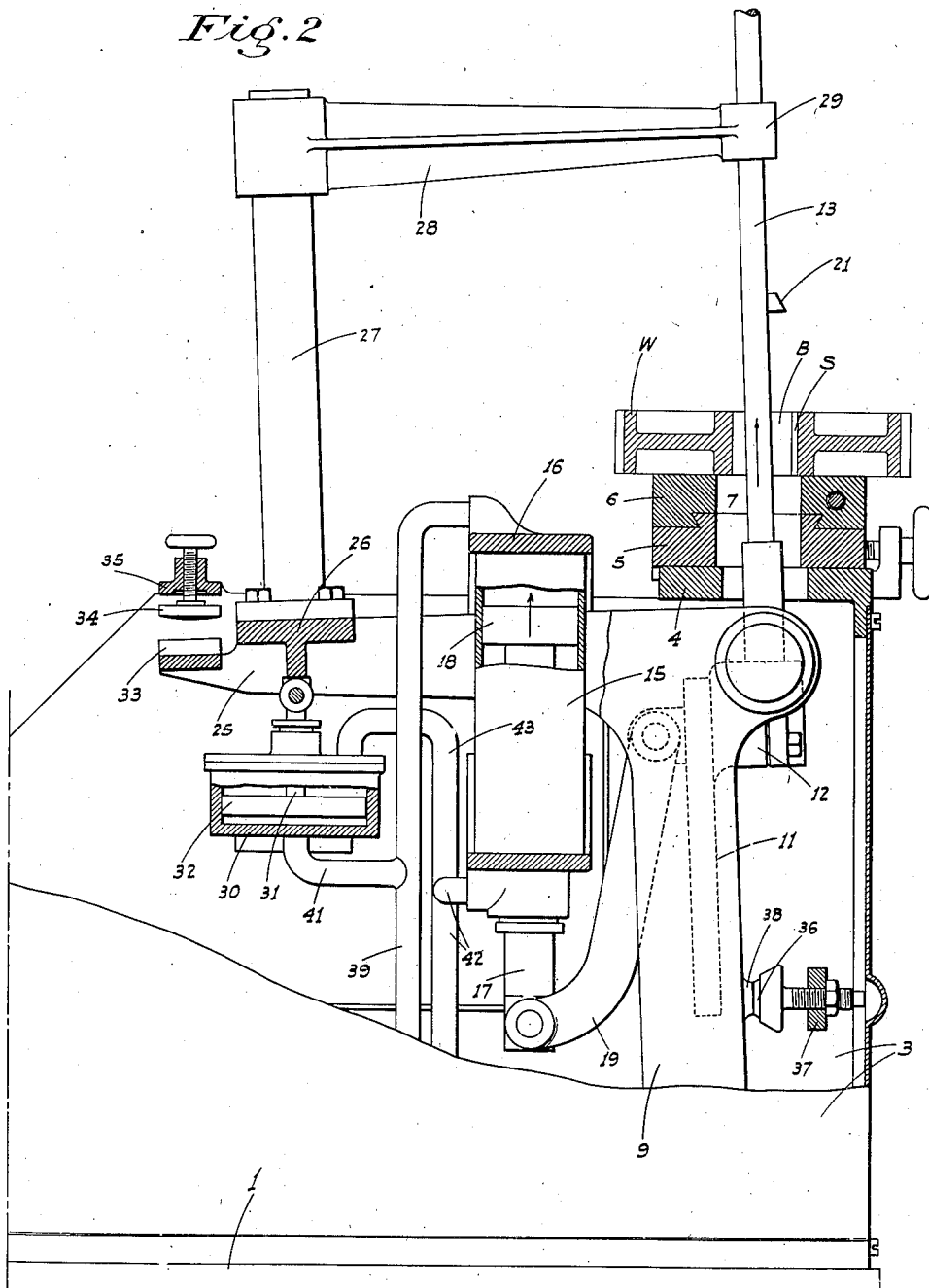
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Fig. 2



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Fig. 3

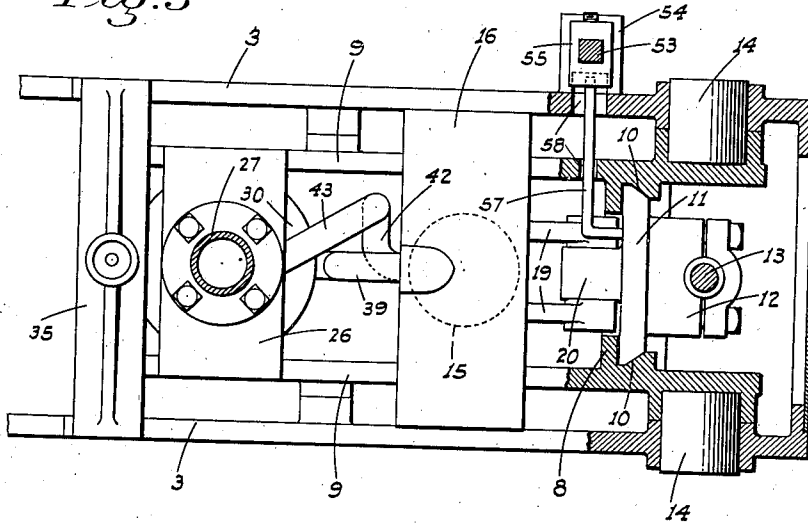


Fig. 4

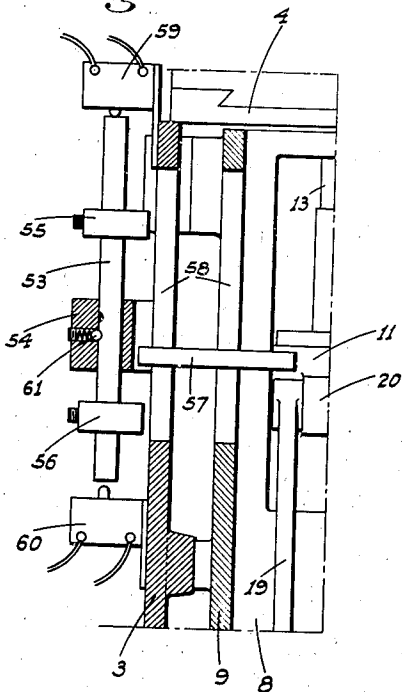
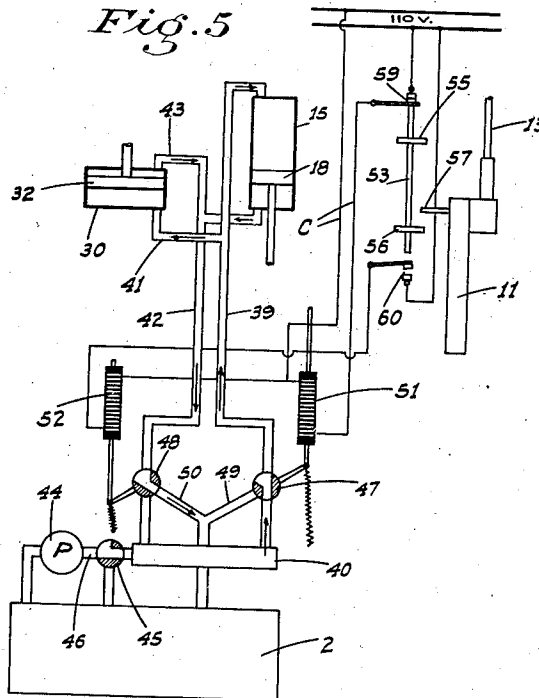


Fig. 5



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HYDRAULIC KEY SEATER

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15 Claims. (Cl. 90—43)

This invention relates to machine tools, and particularly to a keyway cutter or key seater.

One object of the invention is to provide a tool of this type provided with a reciprocating tool holding bar, and a means for controlling the movement of the bar so that with advancing movement thereof the tool cuts the keyway, while with the retracting movement of the bar the tool is automatically and first moved clear of the cut just made so that no possible marring of the cut by the retracting tool is possible.

Another object is to construct the tool so that the bar may be set to make a straight or taper key seat as may be desired, without interfering with the clearing of the tool from the cut during the retractive stroke, and without the necessity of making the work supporting table adjustable.

A further object is to provide a tool of this type in which the movement of the bar is hydraulically actuated, and in which the movement of the hydraulic fluid may be either electrically or mechanically controlled upon the bar reaching its limit of movement in opposite directions, so that the bar will be reciprocated continuously and automatically as long as desired.

Another object is to provide means incorporated with the control means to enable the length of the stroke of the tool bar to be altered as the work may require.

The objects we accomplish by means of such structure and relative arrangement of parts as will fully appear by a perusal of the following specification and claims.

In the drawings similar characters of reference indicate corresponding parts in the several views:

Figure 1 is a sectional elevation of our improved key seater, showing the tool bar moving on a cutting stroke.

Figure 2 is a side elevation partly in section on the key seater, showing the tool bar moving on its retractive stroke.

Figure 3 is a fragmentary sectional plan on the line 3—3 of Fig. 1.

Figure 4 is a fragmentary transverse section on the line 4—4 of Fig. 1.

Figure 5 is a diagram showing the control system of the key seater.

Figure 6 is a fragmentary sectional elevation of the tool bar showing the mounting of the tool.

Referring now more particularly to the characters of reference on the drawings, the machine comprises a base 1 which includes a reservoir 2 for oil therebelow. Projecting upwardly from the

base are rigidly spaced side frame plates 3, bridged on top at the front end by a bed 4 which supports a slide 5, which in turn supports a cross slide 6, the latter forming the work supporting table. The bed and slides are provided with center openings 7.

Disposed below the bed 4 is a depending auxiliary frame 8 which includes spaced side plates 9, this frame being formed with vertical parallel guideways 10 for a slide 11. This slide is provided at the top with a boss 12 projecting forwardly and under the opening 7. This boss forms a clamping support for the base portion of an upstanding, preferably cylindrical, tool holding bar 13 which projects upwardly through openings 7 to a point a considerable distance above the table 6. The frame 8 is pivoted adjacent its upper forward end on the main frame plates 3 by trunnions 14 so that said frame 8 can swing about a center relatively close to the bed 4.

Back of the auxiliary frame 8, a vertical hydraulic cylinder 15 is supported from the plates 3 centrally therebetween by means of brackets 16. The piston rod 17 depends from the piston 18 of said cylinder and at its lower end is connected by an upwardly projecting link 19 with a boss 20 on the back of the slide 11. As the piston rod descends therefore the slide 11 and tool holding bar are lowered, the lowermost point of movement of the slide being such that the tool 21 mounted on the bar is then below the level of the work supporting table 6, and hence below any work piece W mounted on said table.

The tool 21 is mounted in a diametral slot 22 in the bar 13 in a forwardly facing direction, and is removably clamped in the slot by a set screw 23 projecting upwardly from below the tool and accessible from a socket 24 open to the back of the bar from below the slot 22, as shown in Fig. 6.

Projecting rearwardly from the side plates 9 of the auxiliary frame 8 at the top are arms 25, which project between the cylinder 15 and the plates 3 and are connected at their rear end by a cross web 26. A post 27 projects upwardly from the cross web and supports a forwardly extending arm 28 which has a guide sleeve 29 at its forward end through which the tool bar 13 slides, the tool 21 being of course below the sleeve at all times.

Mounted in fixed connection with the frame plates 3 below the web 26 is a hydraulic cylinder 30, much shorter than the cylinder 15 but of greater cross sectional area. The piston rod 31 projects upwardly from the piston 32 of cylinder 30, and is operatively connected to the web. Up-

ward movement of the piston rod and consequently the arms 25 are adjustably limited by suitable stop means, here shown as being a pad 33, rigid with the arms 25 at their rear end and engaged by a cooperating pad 34 adjustably suspended from a cross bar 35 supported from the plates 3. Downward swinging of arms 25 and the accompanying forward swinging of the auxiliary frame 8 and parts mounted thereon, is adjustably limited by a horizontally adjustable cushion stop 36 projecting rearwardly from the cross bar 37 on the plates 3 in front of the frame 8 and below boss 12, and engageable with a pad 38 on said frame.

An oil supply pipe 39 extends from an oil pressure chamber 40 to the top of cylinder 15, with a branch 41 to the bottom of cylinder 30. An oil supply pipe 42 similarly extends from chamber 40 to the bottom of cylinder 15, with a branch 43 to the top of cylinder 30. A motor driven pump 44 is mounted on the base 1, the pump drawing from reservoir 2 and feeding to chamber 40, there being a bypass or relief valve 45 in the line 46 between the pump and chamber to return oil as pumped to the reservoir if desired.

Valves 47 and 48 are interposed in pipes 39 and 42, respectively; the valve 47 controlling the flow from the chamber 40 through the pipe 39 and alternately from the pipe 39 to a pipe 49 leading to the reservoir 2. The valve 48 similarly controls the flow from the chamber 40 through the pipe 42 and alternately from said pipe 42 back to the reservoir 2 through a pipe 50, as shown in Fig. 5.

The valves are controlled by solenoids 51 and 52, respectively, which are alternately energized by the reciprocating movement of the slide 11 in opposite directions, by the following means:

Mounted on the outside of one plate 3 is a vertical rod 53 guided for limited vertical movement in a sleeve 54 fixed on said plate. This rod has adjustable stop collars 55 and 56, respectively, above and below the sleeve. A finger 57 is mounted on the slide 11 and projects laterally through slots 58 in the adjacent plates 9 and 3 and disposed between the collars, as shown in Fig. 4. A normally open switch 59 is mounted above the rod 53, to be closed thereby upon upward movement of said rod and interposed in the circuit C of the solenoid 51.

Another normally open switch 60 is mounted below the rod 53, to be closed upon downward movement of the rod and interposed in the circuit of the solenoid 52.

In operation, assuming that the tool 21 is making a key seat S in the bore B of the work W, and is on a downward cutting stroke, as shown in Fig. 1, the switch 59 is closed by the previous upward movement of rod 53 and remains closed due to the use of a yielding stop 61 holding said rod against downward movement. The solenoid 51 is then energized, turning the valve 47 so that oil flows from the chamber 40 through the pipes 39 and 41 to the top of cylinder 15 and the bottom of cylinder 30, respectively. The slide 11 and tool bar are thus not only forced down but the arms 25 of the auxiliary frame are forced up against the stop 34, as shown in Fig. 1. If the stop 34 is set so that the slide 11 and bar 13 are then perpendicular, a straight keyway will be cut in the work, but if the stop is adjusted so that the bar 13 then leans in one direction or the other, a taper keyway will be cut.

When the slide 11 approaches the bottom limit of its stroke as determined by the adjusted setting of the collar 56, the finger 57 engages said

collar and forces the rod 53 down. This causes the switch 60 to be closed and allows the switch 59 to open. The solenoid 51 thus becomes deenergized and the solenoid 52 is energized. The valve 47 is therefore shifted to establish communication between the pipes 39 and 49, while the valve 48 is shifted to establish communication between the pressure chamber 40 and the pipe 42, by which oil is fed to the bottom of the cylinder 15 and the top of the cylinder 30. The position of the valves as above described of course allows the oil from above piston 18 and below piston 32, respectively, to drain back to the reservoir. The piston 32 will thus be lowered to pull the arms 25 down, while the piston 18 will be forced up so as to lift the slide 11. Due to the relatively large size of the cylinder 30, this functions to swing the arms before any appreciable upward movement of slide 11 takes place.

The tool bar is thus tilted to the position shown in Fig. 2, so as to back the tool away from the cut in the key seat, so that when the bar 13 moves up, the tool is pulled clear of the cut right from the start. As soon as the slide reaches the top limit of its movement, as determined by the setting of collar 55, the position of valves 47 and 48 is again reversed, to cause the slide 11 to be lowered and the arms 25 to be swung up, restricting the tool bar to a perpendicular or operating position before any actual cutting takes place.

From the foregoing description it will be readily seen that we have produced such a device as substantially fulfills the objects of the invention, as defined by the appended claims.

While this specification sets forth in detail the present and preferred construction of the device, still in practice such deviations from such detail may be resorted to as do not form a departure from the spirit of the invention, as defined by the appended claims.

Having thus described our invention, what we claim as new and useful and desire to secure by Letters Patent is:

1. A key seating machine comprising a frame having a fixed work supporting table thereon, said table having an opening therethrough, a slide below the table mounted in connection with the frame for vertical movement, a tool holding bar projecting upwardly from the slide and through the table opening, a vertically disposed hydraulic cylinder supported from the frame behind the slide, a piston rod depending from the cylinder and connected to the slide, fluid conduits leading to opposite ends of the cylinder, and means controlled by slide movement upon arrival of the slide at opposite ends of a stroke of predetermined length to control flow of fluid through the conduits to and from opposite ends of the cylinders alternately.

2. A structure as in claim 1, in which said means comprises valves in the conduits, electric devices for actuating the valves, a vertical rod slidably mounted on the frame, vertically spaced collars on the rod, a finger rigid with the slide and projecting between the collars to alternately engage the same and move the rod, circuits for said devices, and normally open switches in said circuits disposed so that one switch will be closed by rod movement in one direction while the other switch will be closed by rod movement in the opposite direction.

3. A key seating machine comprising a frame having a fixed work supporting table thereon, said table having an opening therethrough, a slide below the table, an auxiliary frame in which the

slide is mounted for vertical movement, means pivoting the auxiliary frame on the first named frame immediately below the table and opening therein, a tool holding bar fixed on and projecting upwardly from the slide and through the opening, a tool mounted in the bar and projecting from one side thereof in a plane at right angles to the axis of the pivot of the auxiliary frame, means to reciprocate the slide through a stroke of predetermined length, and means functioning upon arrival of the slide at the bottom of its stroke to tilt the auxiliary frame in a direction to retract the tool relative to its path of downward movement before upward movement of the slide begins, and functioning to restore the auxiliary frame to its initial position upon arrival of the slide at the end of its upward movement.

4. A machine as in claim 3 with means to adjust the initial position of the slide relative to the perpendicular without affecting the subsequent tilting of the slide.

5. A machine as in claim 3, with a bar rigid with and upstanding from the auxiliary frame in bypassing relation to the table, and a guide sleeve for the tool bar fixed in connection with the upper end of the post.

6. A key seating machine comprising a frame having a fixed work supporting table thereon, said table having an opening therethrough, a slide below the table, an auxiliary frame in which the slide is mounted for vertical movement, means pivoting the auxiliary frame on the first named frame immediately below the table and opening therein, a tool holding bar fixed on and projecting upwardly from the slide and through the opening, a tool mounted in the bar and projecting from one side thereof in a plane at right angles to the axis of the pivot of the auxiliary frame, means to reciprocate the slide through a stroke of predetermined length and including a hydraulic cylinder mounted on the first named frame and having a piston rod connected to the slide, another hydraulic cylinder mounted on the first named frame and having a piston rod connected to the auxiliary frame to tilt the same from a normal position in a direction away to retract the tool from a cutting position upon movement of said piston rod in one direction, a fluid-pressure conduit unit connected to one end of the first named cylinder and to one end of the second named cylinder in such relation that the slide will be moved up and the auxiliary frame tilted upon a flow of fluid into said conduit unit, another conduit unit connected to the other ends of the cylinders so that the slide will be moved down and the auxiliary frame restored to its initial position upon a flow of fluid into said other conduit unit, and means actuated upon arrival of the slide at the lower end upper ends of a stroke of predetermined length to control the flow of fluid into said first named and other conduit units respectively.

7. A structure as in claim 6, in which said last named means includes means to alter the length of the stroke of the slide.

8. A structure as in claim 6, in which said last named cylinder is of greater cross sectional area than the first named cylinder.

9. A key seating machine comprising a frame having a fixed work supporting table thereon, said table having an opening therethrough, a slide below the table, an auxiliary frame in which the slide is mounted for vertical movement, means pivoting the auxiliary frame on the first named frame immediately below the table and opening

therein, a tool holding bar fixed on and projecting upwardly from the slide and through the opening, a tool mounted in the bar and projecting from one side thereof in a plane at right angles to the axis of the pivot of the auxiliary frame, means to reciprocate the slide through a stroke of predetermined length and including a vertical hydraulic cylinder mounted on the first named frame beyond the slide on the side of the pivot axis opposite said one side of the bar, a piston rod depending from the cylinder, a link connecting said rod and slide, an arm rigid with the auxiliary slide and projecting in a direction opposite to said one side of the bar, another hydraulic cylinder mounted on the first named frame below said arm, a piston rod upstanding from said other cylinder and connected to the arm, and a fluid conduit unit connected to the bottom of the first named cylinder and the top of the other cylinder, another fluid conduit unit connected to the top of the first named cylinder and the bottom of the other cylinder, and means actuated upon arrival of the slide at the lower and upper ends of a stroke of predetermined length to control the flow of fluid into said first named and other conduit units respectively.

10. A structure as in claim 9, with adjustable stop means between the auxiliary frame and first named frame acting to limit upward movement of the arm by upward movement of the piston rod of said other cylinder and determining the normal position of the slide and tool bar relative to the perpendicular.

11. A machine for cutting key seats comprising a fixed frame and a work supporting table, an auxiliary frame pivoted for rocking movement relative to the fixed frame, a seat cutter mounted on the auxiliary frame for reciprocating movement adjacent work on the table, a double acting hydraulic cylinder operatively connected to the cutter for imparting reciprocatory movement thereto, a double acting hydraulic cylinder operatively connected to the auxiliary frame for imparting rocking movement thereto, means to admit fluid pressure to one end of the first named cylinder to drive the cutter through its cutting stroke and to simultaneously admit like pressure to one end of the second cylinder to rock the auxiliary frame in a direction to hold the cutter to the work during such cutting stroke, means to reverse the fluid pressure to the opposite ends respectively of the cylinders whereby to effect the return stroke of the cutter and to simultaneously rock the auxiliary frame in a direction to retract the cutter from the work during such return stroke.

12. A machine for cutting key seats comprising a fixed frame and a work supporting table, an auxiliary frame pivoted for rocking movement relative to the fixed frame, a slide mounted for reciprocatory movement in the auxiliary frame, a tool rod fixed to the slide and adapted with the movement of the slide to have reciprocatory movement adjacent work on the table, a post fixed to and projecting from one end of the auxiliary frame spaced from the slide, a projecting arm on the post, a guide sleeve on the outer end of the arm, the outer end of the tool rod being slidably disposed in said sleeve, means to operate the slide to reciprocate the tool rod first through a cutting stroke and then through a return stroke, and means to simultaneously first rock the auxiliary frame to cause the post and arm to urge the tool rod in a direction to hold the cutter against the work during the cutting

stroke and to then rock the auxiliary frame in the opposite direction to pull the rod and cutter away from the work on the return stroke of the tool rod.

13. A machine for cutting key seats comprising a work holding table, a cutter arranged for reciprocatory movement adjacent work on the table, means to effect such reciprocatory movement, such means including a double acting hydraulic cylinder operatively connected with the cutter, a source of fluid under pressure, a conduit leading from said source to each end of the cylinder respectively, a two way valve in each conduit, a solenoid operatively connected with each valve to operate the valves to alternately place the conduits in communication with the fluid pressure, and means to alternately energize the solenoids, such means including electric circuits connected therewith, a normally open switch in each circuit, a slidable rod between the switches, 20

means interposed between the reciprocating cutter and the rod to impart movement to the rod alternately in different directions, whereby when the cutter reaches its limit of movement in one direction the rod will engage and close one switch and when the cutter reaches its limit of movement in the opposite direction the rod will engage and close the other switch.

14. A device as in claim 13, and means to hold the rod stationary in switch closing position during travel of the cutter.

15. A device as in claim 13, and means to hold the rod stationary in switch closing position during travel of the cutter, such means including a sleeve through which the rod travels and yielding stops interposed between the sleeve and rod and spaced apart substantially the distance of the length of travel of the rod.

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