June 29, 1937. F. H. MUSSLER 2,085,685

CROSS-FEEDING TOOL SLIDE

Filed Nov. 27, 1935 3 Sheets-Sheet 1

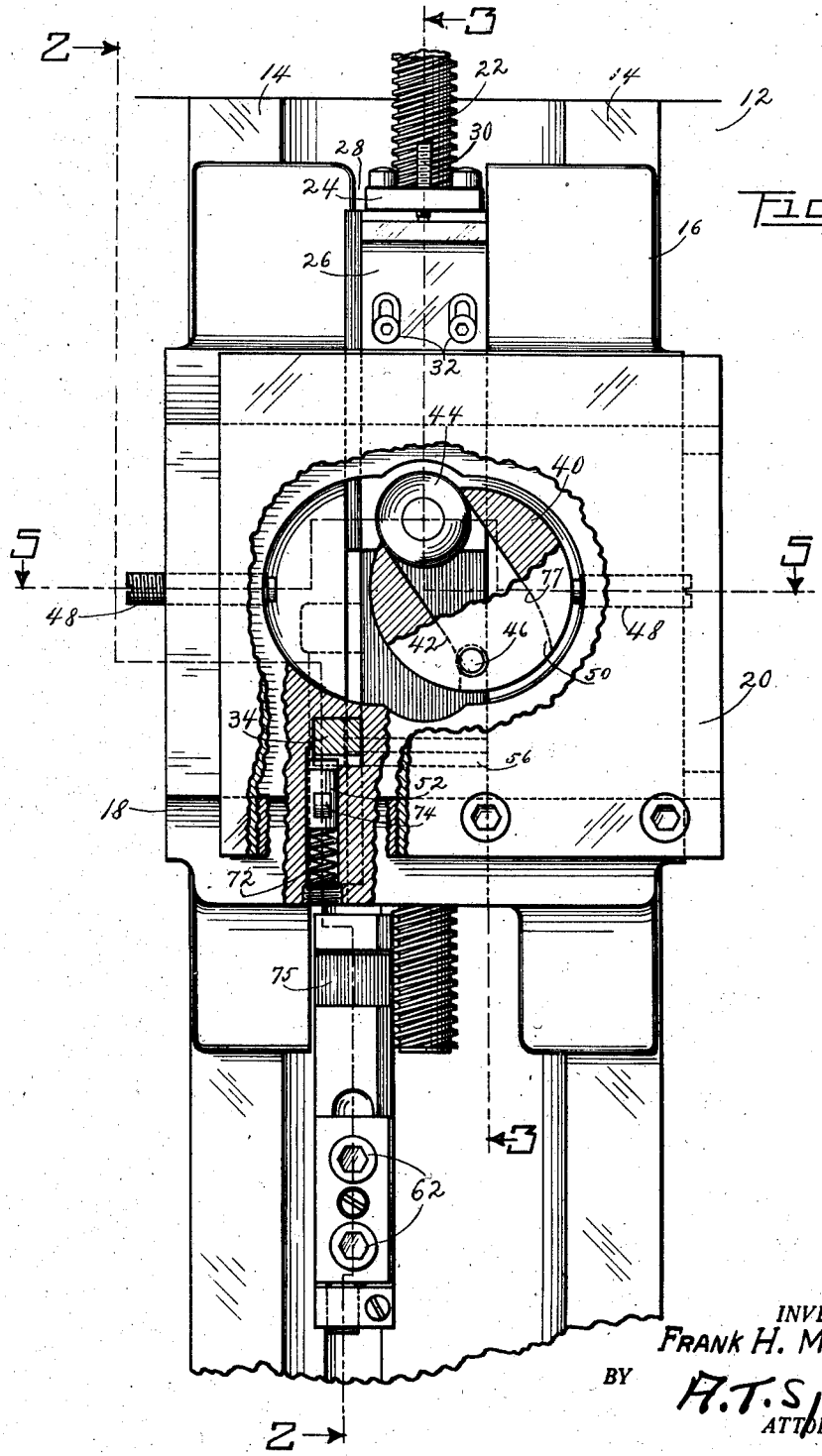


Fig 1

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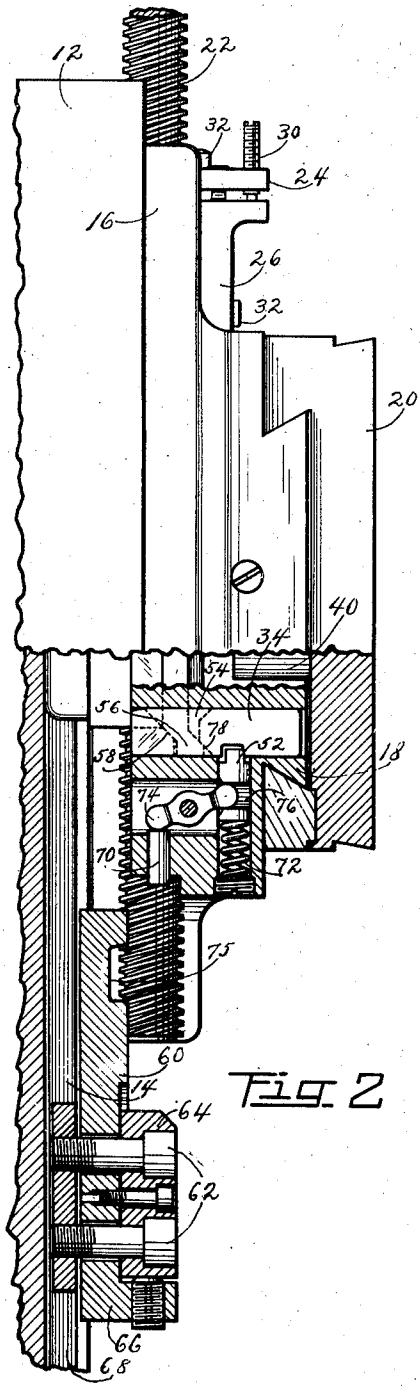


Fig. 2

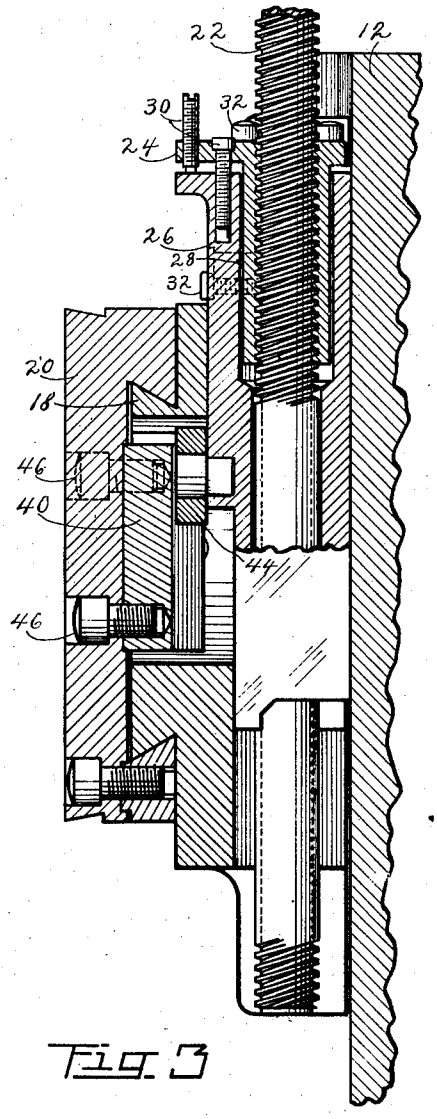


Fig. 3

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Filed Nov. 27, 1935 3 Sheets-Sheet 3

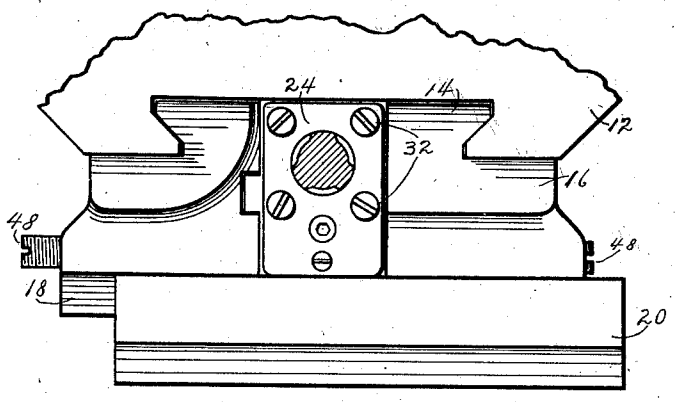


Fig. 4

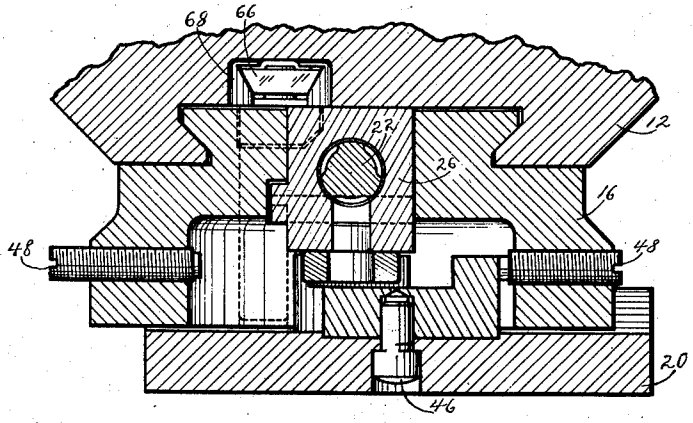


Fig. 5

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UNITED STATES PATENT OFFICE

2,085,685

CROSS-FEEDING TOOL SLIDE

Frank H. Musser, Stratford, Conn., assignor to The Bullard Company, a corporation of Connecticut

Application November 27, 1935, Serial No. 51,726

11 Claims. (Cl. 82—21)

This invention relates to cross-feeding tool slides and the like and to operating mechanism therefor adapted to impart a plurality of movements to the device in the performance of machining operations.

Mechanism embodying the present invention may be employed in combination with various types of machine tools and other mechanism and in a typical application thereof may be used in combination with multiple operation machine tools in the same general relation as described in the patent to E. P. Bullard Jr., No. 1,382,339, dated June 21, 1921. However, the invention may also be used in other relations and combinations and may be embodied in other types of machine tools or mechanism as necessary or desirable to carry out any of a great variety of operations.

One of the objects of the present invention is to provide means for driving a device such as a tool slide to impart thereto a constant unidirectional movement or a succession of different movements thereto in each of a plurality of paths.

Another object of the invention is to provide common means for successively moving a saddle and a tool slide carried by the saddle through different paths and to provide a dwell for such movement prior to the termination of the movements of the driving mechanism.

Another object of the invention is to provide saddle and cross-slide mechanisms particularly designed for cooperation with and drive from a screw feed shaft.

A still further object of the invention is to provide a structure including a cross-feeding mechanism automatically operable at a predetermined point in the feeding action and including a positive stop and a dwell operable at the termination of movement either of the saddle and slide together or of the slide after the saddle comes to rest.

These and other objects and features of the present invention will appear from the following description of a typical embodiment thereof in which reference is made to the accompanying figures of the drawings, wherein:

Figure 1 is an elevation of a typical form of the invention as seen from the front with parts of the mechanism broken away;

Figure 2 is a view of the form of the invention shown in Figure 1 as seen from the side with parts thereof shown in sections, taken on the lines 2—2 of Figure 1;

Figure 3 is a vertical sectional view of the construction of Figure 1 taken on the line 3—3 thereof;

Figure 4 is a plan view of the construction of Figure 1; and

Figure 5 is a horizontal sectional view of the form of the invention shown in Figure 1 taken on the line 5—5 thereof.

In the construction illustrated, a screw feed shaft is employed to provide the drive and, threadedly engaged therewith, is a collar fixed against rotation so as to move longitudinally of the screw upon rotation thereof. The collar is adapted to be latched to or move a limited amount with respect to a tool slide saddle, the latching being releasable upon engagement of the saddle with a positive stop for limiting the downward movement thereof. The collar and its dependent structure is permanently engaged in a cam slide carried by the tool slide which, in turn, is mounted on the saddle, thus when the collar is released from the saddle and moves with respect thereto, the slide will be moved because of the engagement between collar and cam.

An important feature of the invention, in addition to the latching and releasing means, the stop and the general structural features, is the configuration of the cam path such that just before the termination of the feeding action, the slide will come to rest, thus providing a dwell, so that in a mechanism where tool feed and work spindle rotation are inter-dependent the tool may come to rest prior to the stopping of the spindle thus providing for one or more rotations of the work under the tool after the tool has finished feeding but prior to its retraction.

Referring to the figures of the drawings, a column or base 12 of the machine is formed with suitable ways 14 along which a carriage or saddle 16 is slidable. The outer face of the saddle is provided with similar ways 18 which may be disposed at any desired angle with respect to the saddle and which receive and guide a tool slide or other element 20 in the movement thereof with respect to the saddle 16. As shown in the earlier patent, the saddle ways 18 may be formed on a separate piece adjustably bolted to the saddle so as to vary the angular relation of movements between saddle and tool slide.

Movement of the saddle and slide is effected by means of a feed screw 22 preferably extending lengthwise of the machine within the way 14 and engaged by an internally threaded sleeve, or collar, 24 adjustably secured to an operating member 26 slidable within a channel 28 in the front face of the saddle. The position of the sleeve with respect to the operating member may be varied by adjustment of a screw 30, while

the sleeve and member are retained in their adjusted positions by screws 32. Latching mechanism, including a slidable bolt 34 carried by the saddle, serves to connect the operating member to the saddle for moving the same during the initial movement of the saddle but is releasable to permit the operating member to continue its movement for actuating the tool slide after movement of the saddle has been interrupted.

The tool slide 20 carried by the saddle is recessed on its inner face to receive a cam block 40 formed with a cam surface, or slot, 42 positioned to be engaged by a cam follower in the form of a cooperating roller 44 carried by the operating member 26 for moving the tool slide with reference to the saddle along the ways 18. The cam block shown is circular in form and secured to the tool slide in predetermined position by retaining screws 46, adjustment of which may be had to vary the relative movement of slide with respect to operator.

The shape of the cam surface 42 and the position thereof with respect to the path of movement of the roller 44 on operating member 26 determines the character, amount, and speed of movement of the tool slide with respect to the saddle while the direction of movement of the slide is determined by the angular relation of the ways 18 on the saddle along which the tool slide is moved. As shown, the surface 42 of the cam block may be straight throughout the greater part thereof with the lower end 50 curved to provide a "dwell" in the movement of the slide at the end of its stroke. However, the cam surface may be given any other suitable form or shape to vary the character or speed of movement of the tool slide or device with respect to the saddle or a work piece. It will also be evident that the tool slide or device may be caused to move either to the right or to the left from the central position shown in Figure 1 by positioning the cam block so that the cam surface 42 thereof is suitably inclined with respect to the path of movement of the roller 44.

With the elements formed and arranged as described, it will be evident that the ways 18 and cam block 40 can be suitably formed or adjusted to vary the direction and character of movement of the tool slide with respect to the saddle so as to perform any desired machining or other operation and these movements may be made to conform to requirements in any particular installation to obtain the best results therein.

In order to release the operating member 26 for movement relative to the saddle so that the tool slide may be given the movement described, the slidable bolt 34 is caused to move to the left, as seen in Figure 2, upon completion of the downward movement of the saddle. The bolt is carried by the saddle and normally held against movement by a spring pressed latch 52 which, when in projected position, engages a recess in the bolt 34. The bolt is also provided with a slot 54 on the rear side, as seen in Figure 2, into which the lower end or foot 56 of the operating member 26 extends, the slot and foot being provided with cooperating inclined surfaces 58 serving upon movement of the operating member with respect to the saddle to force the bolt 34 to the left.

Release of the operating member to actuate the tool slide is effected upon completion of a predetermined movement of the saddle by means of an adjustable tripping device 60 located below the saddle and in position to positively arrest movement thereof. The tripping device is adjustably held between the vertical ways 14 on the column, or base, of the machine by bolts 62 extending through a block 64 and secured to a retaining member 66 in a recess 68.

The upper surface of block 64 is accurately located in adjusted position to engage a projecting pin 70 carried by the saddle 16 when the saddle has completed its downward movement. The pin is urged outward by the action of spring 72 acting through a pivoted member 74 carried by the saddle and positioned with one end thereof in a recess 76 in latch 52 and with the opposite end engaging the head of pin 70. When the pin is depressed or forced inwardly by engagement with the block 64 of the tripping device, the member 74 is rocked about its pivot causing the latch 52 to be retracted and the bolt 34 released for movement to the left as seen in Figure 2. The operating member 26 then continues its movement downward while the movement of the saddle is arrested. The foot 56 of the operating member therefor moves into the cam slot 54 and the cam surfaces 58 on the foot and bolt 34 cooperate to move the bolt so that it projects into a recess 75 in the upper portion of the tripping device 60 preventing upward movement of the saddle when the direction of rotation of the feed screw is reversed and before the tool slide has returned to the central or normal position shown in Figure 1.

The operating member 26 when released from the saddle moves downward causing the roller 44 to engage the cam surface 42 on the cam block 40 and actuate the tool slide. The slide is thus moved with reference to the saddle through a new path while the saddle remains in fixed position. The slide continues to move under the action of the operating member as controlled by the cam elements until the dwell terminus of the cam path is reached. Thereafter a small amount of rotation of the screw, independent of movement of the slide, is permitted to constitute the dwell referred to. The stop screws 48 in the saddle also act to positively limit the cross-movement of the slide.

Upon completion of operating movement of the tool slide and reversal of the feed screw for the traverse movement of the mechanism in the normal operation thereof, the operating member 26 is raised causing the roller 44 to engage the upper surface 77 of the slot 42 so that the slide is moved back to the central position shown in Figure 1. The foot 56 of the operating member also moves up through the cam slot 54 bringing the inclined surface 78 thereof into engagement with a similarly inclined surface on the bolt 34 forcing the bolt back to the right until the recess therein is in position to be engaged by the latch 52. At the same time the bolt is withdrawn from the recess 75 in the tripping device releasing the saddle for upward movement with the operating member. As the saddle rises with said member on continued operation of the feed screw the pin 70 is again projected and the latch 52 moved into engagement with the bolt 34 so that the saddle and operating member are secured together for movement to a raised position.

From the foregoing description of the construction and operation of the mechanism illustrated in the drawings it will be evident that the same operating member and drive means are used to move the saddle and the tool slide in different paths and that these movements take place successively and in predetermined timed relation

which is variable to adapt the mechanism for a wide range of operations and uses. Furthermore, the character and amount of movement of the tool slide or other element actuated by mechanism embodying the present invention are variable to suit the conditions presented in any particular installation.

In view thereof it should be understood that the form of the invention herein illustrated and described is intended to be illustrative of a typical form of elements embodying the invention but many changes and modifications may be made in the form and construction of the parts employed and in the relation thereof to the mechanism with which it is used without departing from the spirit and scope of the invention.

Having set forth the nature of my invention, what I claim is:

1. In combination with a machine tool having a base, a saddle mounted for movement on said base, a tool slide mounted for movement on said saddle, a rotatable feed screw, means movable by said feed screw for imparting movement to said saddle, a releasable connection between said means and saddle and cooperating cam elements on said means and tool slide for moving said tool slide with reference to said saddle.

2. In combination with a machine tool having a base, a saddle mounted for movement on said base, a tool slide mounted for movement on said saddle, a rotatable feed screw, means movable by said feed screw for imparting movement to said saddle, a tripping device for disconnecting said means from said saddle upon completion of a predetermined movement of the saddle and cooperating cam elements on said means and tool slide for moving said tool slide with reference to said saddle.

3. In combination with a machine tool having a base, a saddle mounted for movement on said base, a tool slide mounted for movement on said saddle, a rotatable feed screw, means movable by said feed screw for imparting movement to said saddle, a tripping device adjustably positioned in the path of movement of the saddle and engageable thereby for disconnecting said means from said saddle upon completion of a predetermined movement of the saddle and cooperating cam elements on said means and tool slide for moving said tool slide with reference to said saddle.

4. In combination with a machine tool having ways for guiding a saddle, a saddle movable along said ways, a tool slide carried by said saddle and movable thereon, an operating member releasably connected to said saddle for moving the same, a feed screw engaging the operating member to actuate the same, cooperating elements carried by the operating member and tool slide for moving the tool slide with reference to the saddle and a tripping device for releasing said operating member for movement relative to the saddle to actuate said slide.

5. In combination with a machine tool having a base, a saddle mounted for movement on said base, a tool slide mounted for movement on said saddle, means for moving said saddle, a cam element actuated by said means and a cooperating element movable with said tool slide actuated by said cam element to move said tool slide with respect to said saddle, said elements being relatively movable to alter the character of movement imparted to said tool slide.

6. In combination with a machine tool having a base, a saddle mounted for movement on said base, a tool slide mounted for movement on said saddle, means for moving said saddle, a cam element actuated by said means and a cooperating element adjustably mounted on said tool slide and presenting a surface positioned to be engaged by said cam element to move said tool slide with respect to said saddle.

7. In combination with a machine tool, a tool slide, operating means for moving said tool slide, a rotatable feed screw for actuating said means and cooperating cam elements connected to said tool slide and operating means, said elements being formed to move the tool slide at varying speeds under constant rotation of said feed screw.

8. In combination with a machine tool, a tool slide, operating means for moving said tool slide engaging a rotatable feed screw and movable longitudinally thereof and cooperating cam elements carried by said tool slide and operating means including a roller and a cam surface over which the roller is movable presenting portions located at different angles to the path of movement of the operating member to vary the speed of movement of the tool slide.

9. In a tool moving mechanism for machine tools, a tool holding slide, a reciprocal actuating member therefor, and a cam connection between said actuating member and said slide including a cam path a portion of which is arranged to permit free movement of said actuating member with respect to said slide to effect a dwell in the movement of the slide with respect to the actuating member.

10. In a tool moving mechanism for machine tools, a tool holding slide, a reciprocal actuating member, a cam follower connection between said actuating member and said slide including a cam path adapted to move the slide at an angle with respect to the movement of the actuator and including a terminal portion in line with the movement of the actuator so that said actuator may move without movement of the slide at the end of the tool feeding stroke.

11. In a tool moving mechanism for machine tools, a tool carrying slide, including a cam path, a reciprocal actuator having a follower within said path, screw means for reciprocating said actuator in response to the rotation of a feed screw and means for permitting reciprocating movement of said actuator without corresponding movement of said slide so as to provide for retaining the slide stationary during a portion of the rotation of said screw.

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