May 21, 1957 E. D. DAMMERT 2,792,673

TOOL SHARPENING MACHINE

Filed May 12, 1955 4 Sheets-Sheet 1

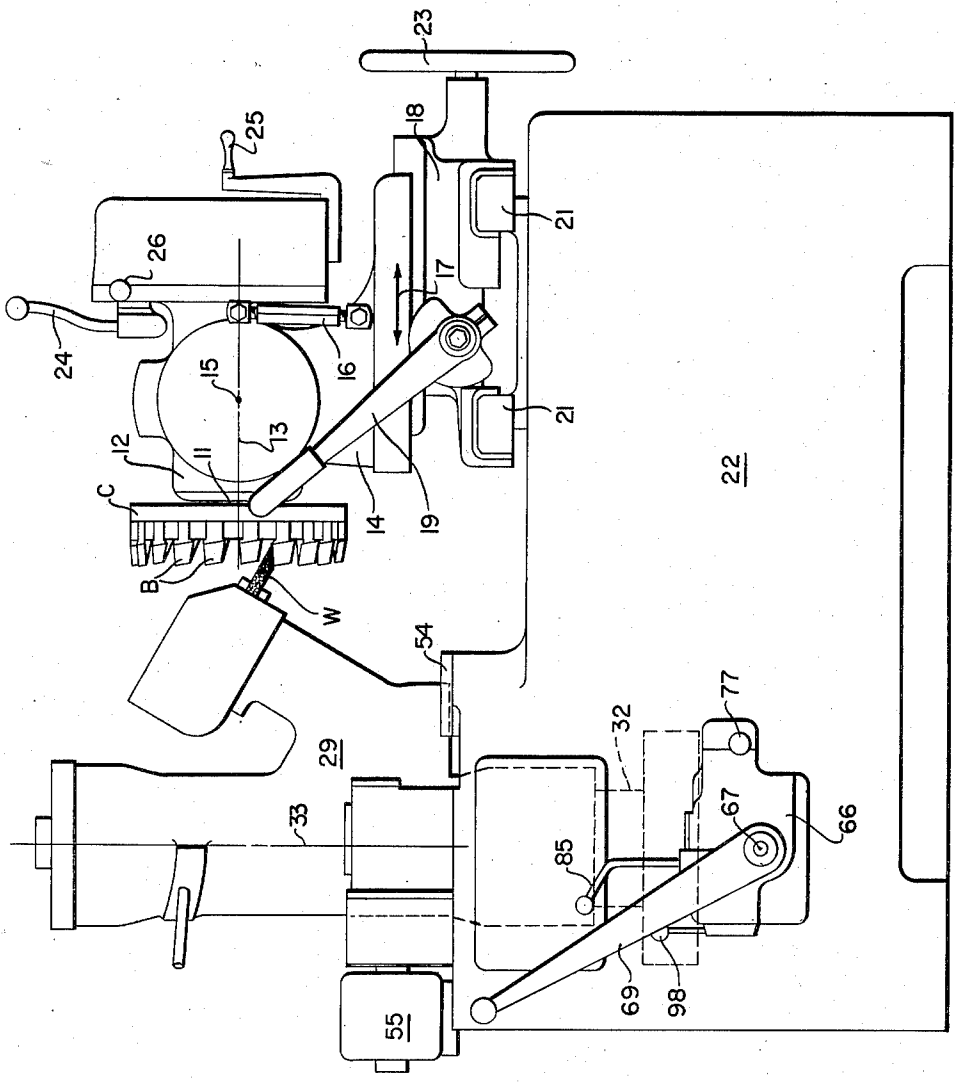


FIG. 1

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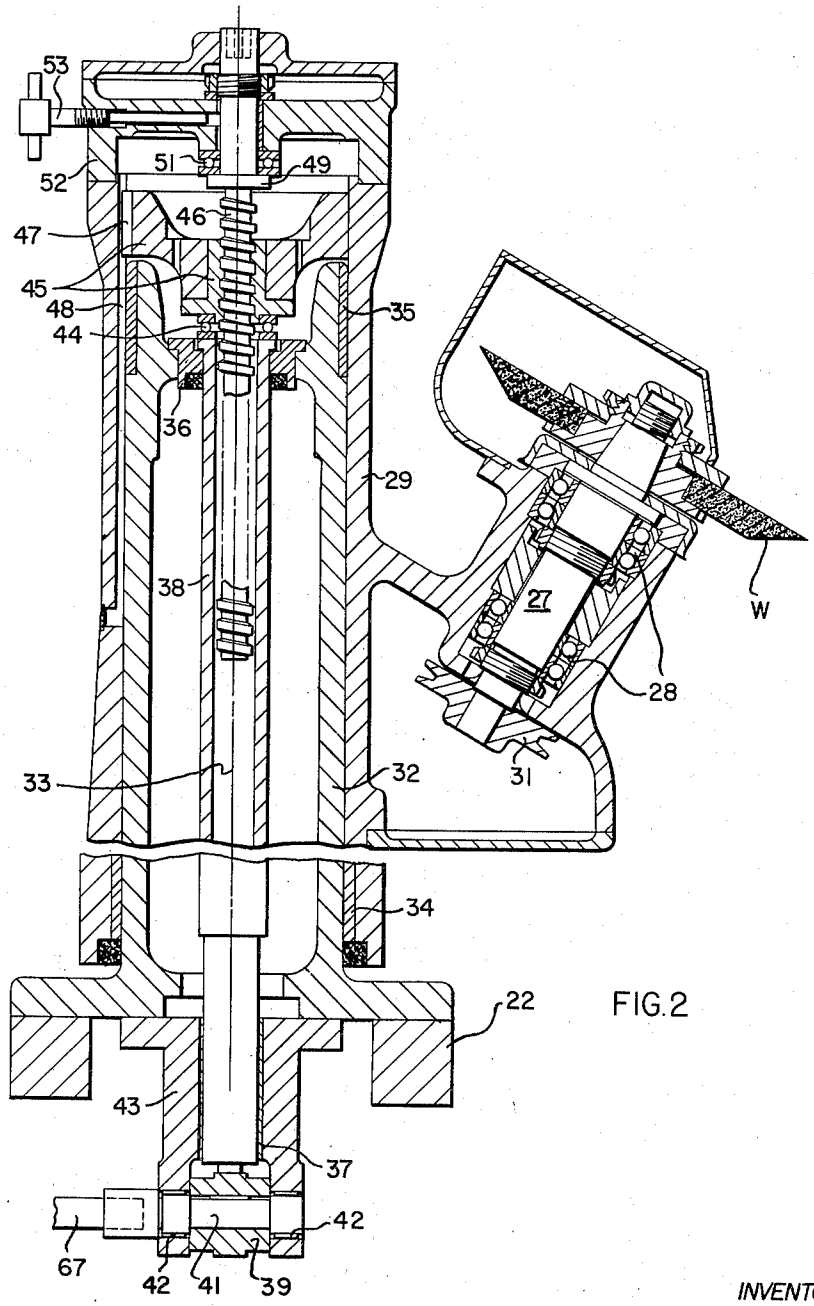


FIG.2

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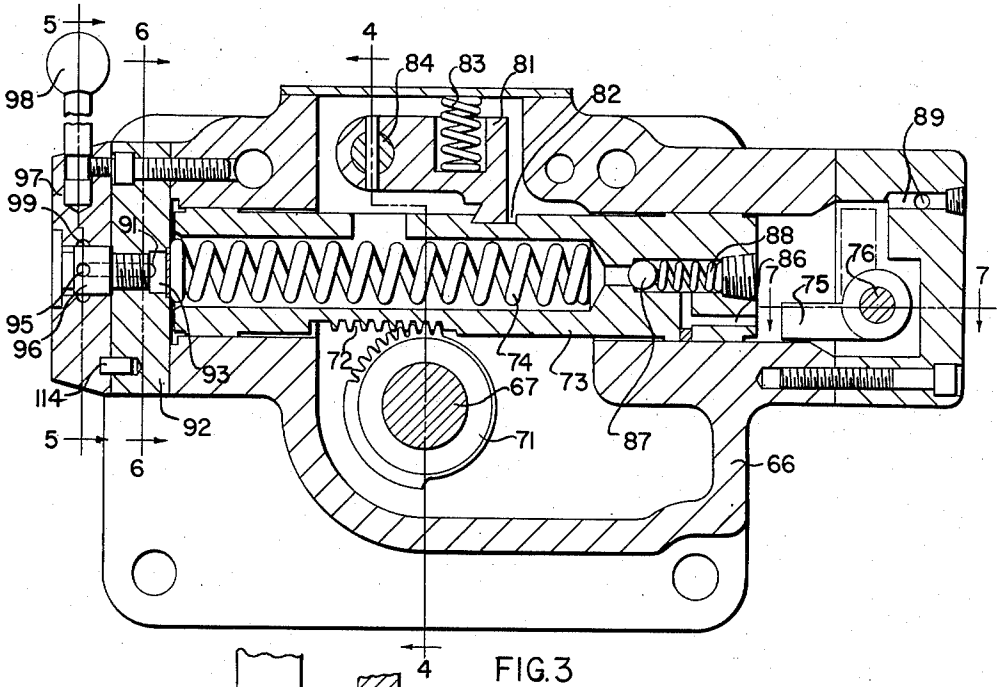


FIG. 3

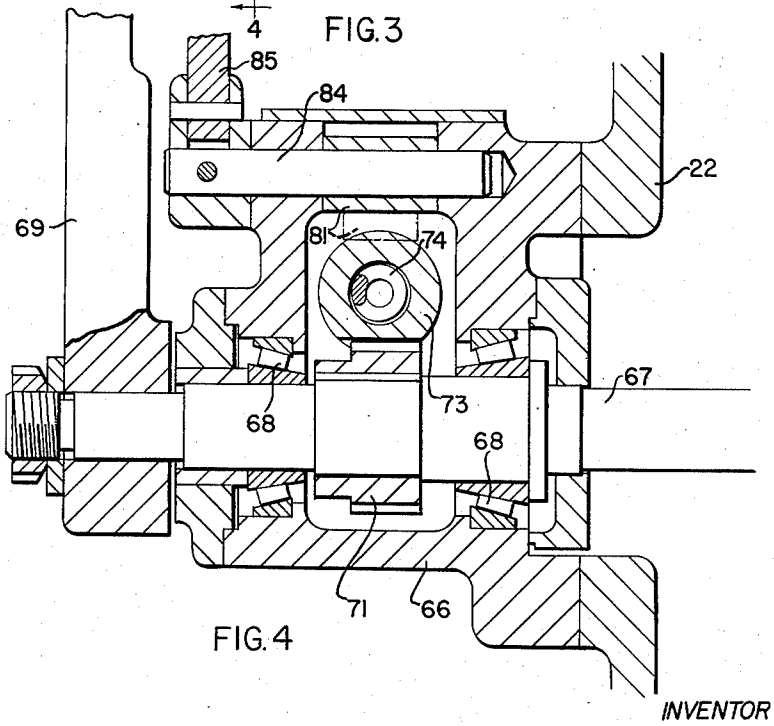


FIG. 4

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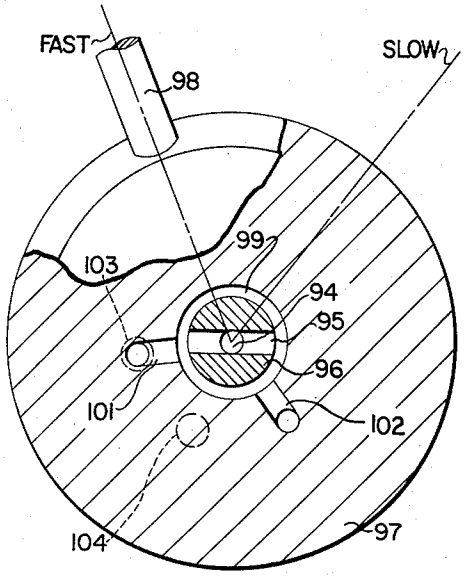


FIG.5

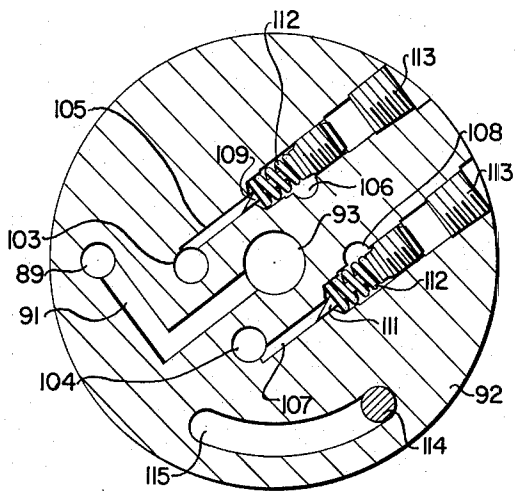


FIG.6

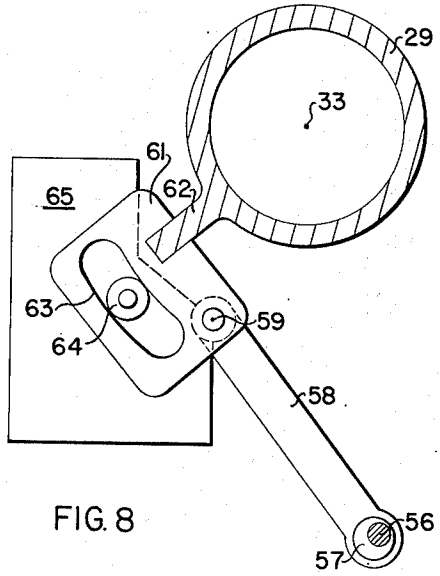


FIG. 8

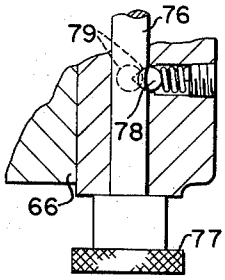


FIG.7

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United States Patent Office 2,792,673 Patented May 21, 1957

2,792,673

TOOL SHARPENING MACHINE

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Application May 12, 1955, Serial No. 507,872

10 Claims. (Cl. 51—33)

The present invention relates to a tool sharpening machine of the kind in which a rotating abrasive wheel is stroked back and forth across the tool and is fed depthwise so that on successive passes the wheel removes successive layers of stock from the tool. More particularly the present invention relates to machines of this kind in which the feed is effected manually rather than by power-operated means operating in time with the stroking motion.

The primary object of this invention is to provide in such a machine a manually operated feed mechanism in which the rate of feed will be constant and independent of the amount of force applied by the operator, and, preferably, in which both the rate of feed and the stroke of feed may be adjusted.

According to the invention the machine comprises a frame, a wheel support mounted on the frame both for a stroking motion, to carry an abrasive wheel on the support back and forth across a tool being sharpened, and for a depthwise feed motion, power-operated means to effect such stroking motion, spring-operated feed means to effect said feed motion, dashpot means to retard said feed motion, a manually operable member to effect return motion of the feed means, and a manually releasable latch to hold the feed means in returned position.

In the drawings, which illustrate a preferred embodiment of the invention:

Fig. 1 is a front elevation of the machine;

Fig. 2 is a vertical sectional view through the wheel support and adjacent parts;

Fig. 3 is a vertical sectional view through the wheel feed mechanism;

Fig. 4 is a vertical section in the offset planes indicated at 4—4 in Fig. 3;

Figs. 5 and 6 are cross-sections taken approximately in the planes 5—5 and 6—6 of Fig. 3;

Fig. 7 is a detail sectional view in the plane 7—7 of Fig. 3; and

Fig. 8 is a fragmentary plan view showing a part of the power-operated means for effecting the wheel stroking motion.

The illustrated machine is arranged especially for sharpening a tool in the form of a face mill cutter C comprising a disc-shaped cutter body from which a plurality of cutter blades B project in an axial direction, the blades being arranged in a circle about the cutter axis. The machine has a work spindle 11 journaled in a work head 12 for step-by-step indexing about the spindle axis 13 to bring the blades successively into position for having their front faces sharpened by the conical surface of an abrasive wheel W. The work head 12 is adjustable on a slide 14 about an axis 15, which intersects axis 13 at right angles, by means of a turnbuckle 16. The slide 14 is adjustable and also movable horizontally, in the direction of arrow 17, on a cross-slide 18, such movement being effected by swinging a hand lever 19 and being for the purpose of withdrawing work head 12 from the wheel W to permit indexing the cutter, and also

to provide clearance for mounting and removing the cutter. The cross-slide 18 is adjustable horizontally along ways 21 on frame 22, in a direction perpendicular to arrow 17, by turning a handwheel 23. Indexing of the cutter is effected by turning a spring-biased lever 24 to lift an index pawl from a notched index plate, not shown, which is secured to the work spindle, and by then turning the cutter spindle by means of an index handle 25, to bring another blade B of the cutter into position for sharpening. When this position is reached the index pawl drops into a notch in the index plate to again lock the spindle. The indexing mechanism and the work spindle may be advanced as a unit in work head 12, about axis 13, by turning an adjusting screw 26. This adjustment determines how far the blades B will be sharpened back in one sharpening cycle.

The abrasive wheel W, Figs. 1 and 2, is mounted on a wheel spindle 27 which is rotatable on anti-friction bearings 28 in a wheel support 29, the spindle being driven by an electric motor, not shown, which is also mounted on the support 29, the drive from the motor being through a flexible belt to a pulley 31 on the spindle. The wheel support 29 is journaled on a post 32 for oscillation about a vertical axis 33 to carry the wheel W back and forth across the surface of the tool being sharpened, in this case across the blade B shown immediately beneath the wheel; and also for feed motion along axis 33. The post 32 is secured to and forms a part of the frame 22, and the wheel support is journaled on it for the oscillation and feed motions by a bushing 34 on the wheel support and a bushing 35 on the post. Also on the post are upper and lower bushings 36 and 37 guiding a rod 38 for vertical motion. The lower end of the rod rests on a wheel feed cam 39 which is keyed to a shaft 41 that is rotatable on anti-friction bearings 42 in lower section 43 of post 32. The periphery of the cam is of spiral formation so that as shaft 41 is turned counter-clockwise, with reference to Fig. 1, the rod 38 is raised.

Supported on rod 38 on an anti-friction thrust bearing 44 is a nut 45 which is screw-threaded onto a wheel support adjusting screw 46. The nut is slidable vertically in the bore of the wheel support 29 but is held against turning therein by having a key 47 engaged in a vertical keyway 48 in the support.

The screw has a flange 49 supporting an anti-friction bearing 51 on which is supported upper section 52 of the wheel support 29. Threaded into section 52 is a lock screw 53 for the adjusting screw 46. When this lock screw is released the screw 46 may be rotated, by a wrench applied to its upper end, to raise or lower the wheel support relative to the rod 38. By this adjustment the wheel W may be brought to the desired vertical position with respect to tool C when setting up the machine. This adjustment may also be employed to compensate for wear of wheel W and to provide wheel stock when dressing of the wheel becomes necessary, such dressing preferably being effected by a dressing device, not shown, attached to pad 54 on the frame, Fig. 1.

The wheel support is oscillated about axis 33 by a motor 55, Fig. 1, which through suitable reduction gearing, not shown, rotates a vertical shaft 56, Fig. 8, journaled in the frame. On this shaft is an eccentric 57 journaled in one end of a pitman 58 whose opposite end is pivoted at 59 to a plate 61 which has a notch slidably receiving a tongue 62 on the wheel support 29. The tongue's vertical dimension is great enough that it engages in the plate 61 in any position of vertical adjustment of the wheel support. The plate has an arcuate slot 63 concentric with axis 33 and receiving a roller 64 mounted on a member 65 supported by the frame. The arrangement is such that as the eccentric 57 is rotated by motor 55, the plate 61 and wheel support 29 are os-

cillated as a unit about the axis 33 to carry the wheel W back and forth across the face of the tool being sharpened.

The feed mechanism of the present invention is supported by a bracket 66, Figs. 1, 3 and 4, secured to the front wall of frame 22. In the bracket a shaft 67 is journaled on anti-friction bearings 68. The shaft is aligned with and coupled to feed cam shaft 41, to turn as a unit therewith, and has secured to its forward end a hand lever 69. Also secured to the shaft is a segmental pinion 71 meshing with a rack 72 formed on a plunger 73 which is reciprocable in a cylinder provided in the bracket, the cylinder and plunger comprising the dashpot which controls the feed rate. Disposed in a bore in the plunger is the operating spring 74 of the wheel feed mechanism, which constantly urges the plunger, to the right in Figs. 1 and 3, toward a stop 75 which limits the stroke of the plunger. The stop is mounted on a shaft 76 which is journaled in the bracket and has an operating knob 77 by which the stop 75 may be turned between the full-line and the broken line positions thereof shown in Fig. 3, this being an adjustment which provides either a short or long stroke for the plunger. As shown in Fig. 7, a spring-backed detent ball 78 engages in one or the other of two recesses 79 in shaft 76 to hold the stop 75 in the position to which it is moved.

For holding the plunger in the position thereof, shown in Fig. 3, wherein the spring 74 is fully compressed, a latch 81 is provided which seats in a latch recess 82 in the plunger. The latch is urged into the recess by a spring 83 and is pinned to a shaft 84. This shaft is journaled in the bracket 66 and has secured on its forward end a latch-release hand lever 85.

The rate of wheel feed motion, which reflects the rate of motion of plunger 73 when moved by spring 74 upon release of the latch, is controlled by the dashpot action of the plunger in its cylinder. For this purpose the interior of the bracket is filled with any suitable hydraulic fluid, and a metering passage is extended through the bracket body between the cylinder chambers at the opposite ends of the plunger. Another passage connecting these chambers extends through the plunger 73. This latter passage, designated 86, is controlled by a ball check valve 87, backed by a light spring 88. The check valve is opened by fluid displaced from the left cylinder chamber when the plunger is moved to the left; and closed when the plunger moves to the right, to thereby compel the displaced fluid to flow through the metering passage.

The metering passage includes section 89 which extends from the right end of the cylinder, Fig. 3, to a connecting section 91, in the left cylinder head 92 of the bracket, Figs. 3 and 6, which communicates with a central opening 93 in the head. It further includes the central bore 94 and radial passages 95 in a screw 96 which pivotally connects a feed-rate selector valve disc 97 to the head, the disc having an operating handle 98. The outer ends of radial passages 95 open into an annular groove 99 in the disc, and from this groove lead a pair of distributing passages 101 and 102 adapted to register respectively with ports 103 and 104 in head 92. Port 103 opens into a metering orifice 105, which discharges through port 106 into the left cylinder chamber, while port 104 opens into another metering orifice 107 which discharges through port 108 also into the left cylinder chamber.

The metering orifices 105 and 107 are partially closed by screw-adjusted metering plugs 109 and 111 each of which is locked in adjusted position by a lock spring 112. Access for adjusting the plugs 109 and 111 is had by removing screw-threaded plugs 113. A pin 114 carried by the valve disc 97 rides in an arcuate slot 115 in the head 92 and abuts the ends of the slot to determine the two limit positions of the valve. In one position the distributing passage 101 registers with port 103, while in the other the distributing passage 102 registers with port 104. The corresponding positions of handle 98 are designated "Fast" and "Slow" in Fig. 5. In correspondence with these designations the metering plugs 109 and 111 are adjusted to provide less restriction to fluid flow through orifice 105 than through orifice 108.

In the preferred use of the machine the knob 77 will be turned clockwise, in Figs. 1 and 3, before a rough sharpening operation, in order to allow the plunger 73 to have its full stroke, and the valve handle 98 will be moved to "Fast" position. Assuming that the machine is properly set up and the cutter C installed on the work spindle, the operator will swing the lever 69 counterclockwise, thereby moving the plunger 73 to the left (in Fig. 3) so that latch 81 will engage in recess 82, and cam 39 will be turned to lift the rod 38 upwardly so that the active surface of the wheel will be just slightly above the level of the cutter blade B first to be sharpened. The wheel drive motor and the wheel oscillating motor 55 are started and the lever 19 is swung to the left to advance the cutter into position for sharpening. Then the latch-release lever 85 is moved, also to the left, lifting the latch 81 and thereby freeing the plunger 73 for movement to the right by spring 74, this movement causing a clockwise turning, in Figs. 1 and 3, of pinion 71, shaft 67 and cam 39. This turning of the cam allows the wheel support 29 to lower by gravity, thereby feeding the oscillating wheel W into the blade B. The rate of such feed, of course depends upon the adjustment of metering valve plug 109 which determines the rate at which the spring 74 can cause the plunger 73 to displace fluid from the right to the left cylinder chamber. After the feed motion is completed the operator again cocks the feed mechanism by moving the lever 69 counterclockwise, this action causing cam 39 to turn to lift the wheel from the surface of blade B which has just been sharpened. He then swings lever 19 to the right to withdraw the cutter from the wheel; then actuates lever 24 and handle 25 to index the cutter for the sharpening of a successive blade B; swings the lever 19 to the left to advance the cutter to the wheel; and again actuates latch-release lever 85 to effect the feed motion. This sequence is repeated until all of the cutter blades have been rough sharpened. To finish sharpen the process is repeated after first repositioning the cutter by adjustment knob 26; turning the knob 77 counterclockwise to adjust stop 75 to shorten the feed stroke; and moving valve handle 98 to "Slow" position.

Having now described the preferred embodiment of the invention, what is claimed is:

1. A tool sharpening machine comprising a frame, a tool support on the frame, a wheel support having an abrasive wheel rotatable thereon which has a substantially conical working face, one support being movable back and forth on the frame to effect a relative stroking motion between the wheel and a tool on the tool support in a plane tangential to said working face, and one support being movable on the frame in a direction substantially perpendicular to said plane to effect relative feed and return motions between the wheel and the tool, power operated means to effect rotation of the wheel and power operated means to effect said stroking motion, spring-operated feed means to effect said feed motion while said stroking motion and wheel rotations are occurring whereby on successive strokes successive layers of stock will be ground from the tool, reduction drive means connecting said feed means to said last-mentioned one support, dash-pot means connected to said feed means to control the rate of feed motion thereof, and a manually operable member connected with said feed means to effect return motion thereof, thereby to effect return motion of said last-mentioned one support and to compress the operating spring of said feed means, and a manually releasable latch to hold said feed means and said last-mentioned support in returned position.

2. A machine according to claim 1 in which there is a means to vary the stroke of the feed motion effected by said spring-operated feed means.

3. A machine according to claim 1 in which there is

a means to vary the retarding effort of the dash-pot means, for varying the rate of the feed motion.

4. A machine according to claim 1 in which the stroking motion comprises an angular oscillation of the wheel support about an axis perpendicular to said plane and inclined at an acute angle to the axis of the wheel, and said feed and return motions comprise motions of the wheel support along the axis of the oscillation.

5. A machine according to claim 1 in which the dash-pot means includes a reciprocating plunger operatively connected to the wheel support, and the operating spring of the feed means is arranged to move the plunger to effect the feed motion.

6. A machine according to claim 1 in which the reduction drive means includes an angularly movable member for transmitting the feed motion, and the operating spring of the feed means is arranged to urge angular motion of said member in one direction.

7. A machine according to claim 6 in which said angularly movable member is a cam, the dash-pot means includes a reciprocating plunger operatively connected to the cam, and the operating spring of the feed means is arranged to move the plunger to thereby effect feed motion of the cam.

8. A machine according to claim 7 in which the manually operable member is connected to the cam and the manually releasable latch is arranged to engage the plunger at one end of the latter's stroke, for holding the feed means in returned position.

9. A machine according to claim 7 in which there is a movable stop to vary the stroke of said plunger to thereby vary the amount of said feed motion.

10. A machine according to claim 9 in which the dash-pot means includes adjustable valve means to control its retarding effort, for varying the rate of the feed motion.

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