

[54] **FEED MECHANISM FOR MACHINE TOOL**

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[57] **ABSTRACT**

In the feed handle mechanism of a machine tool, a handle and a worm wheel are rotatably mounted on the handle shaft. A worm with an operating means at one end engages the worm wheel. The worm wheel is mutually rotatably fitted with a notched plate for transmitting the rotation. The space in the notch holds a rolling body which only transmits the rotation of the worm wheel to the rotation-transmitting plate. The notch also holds the transmitting member extending from the above mentioned handle and the transmitting member extending from the above mentioned handle shaft on both sides of the above mentioned rolling body.

[56] **References Cited**

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4 Claims, 2 Drawing Figures

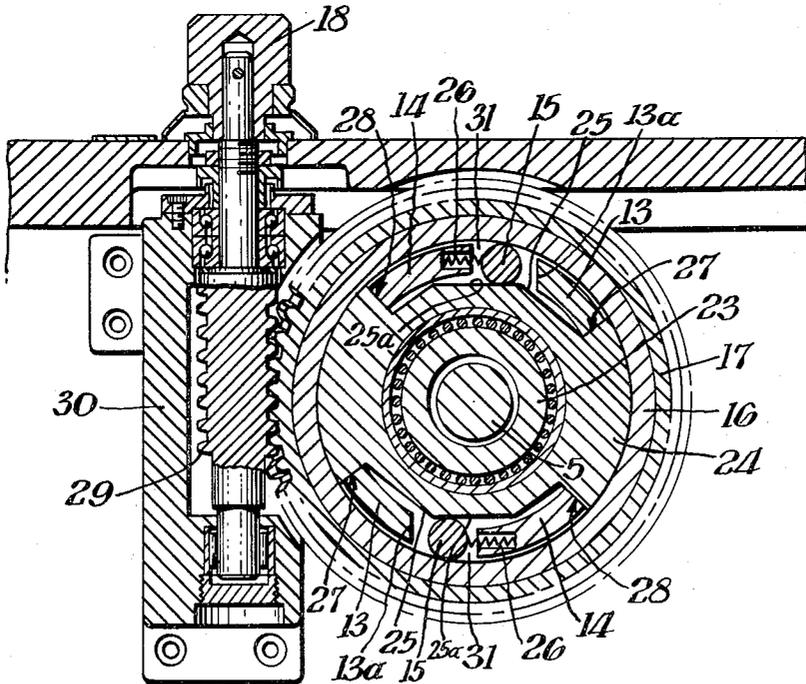


Fig. 1.

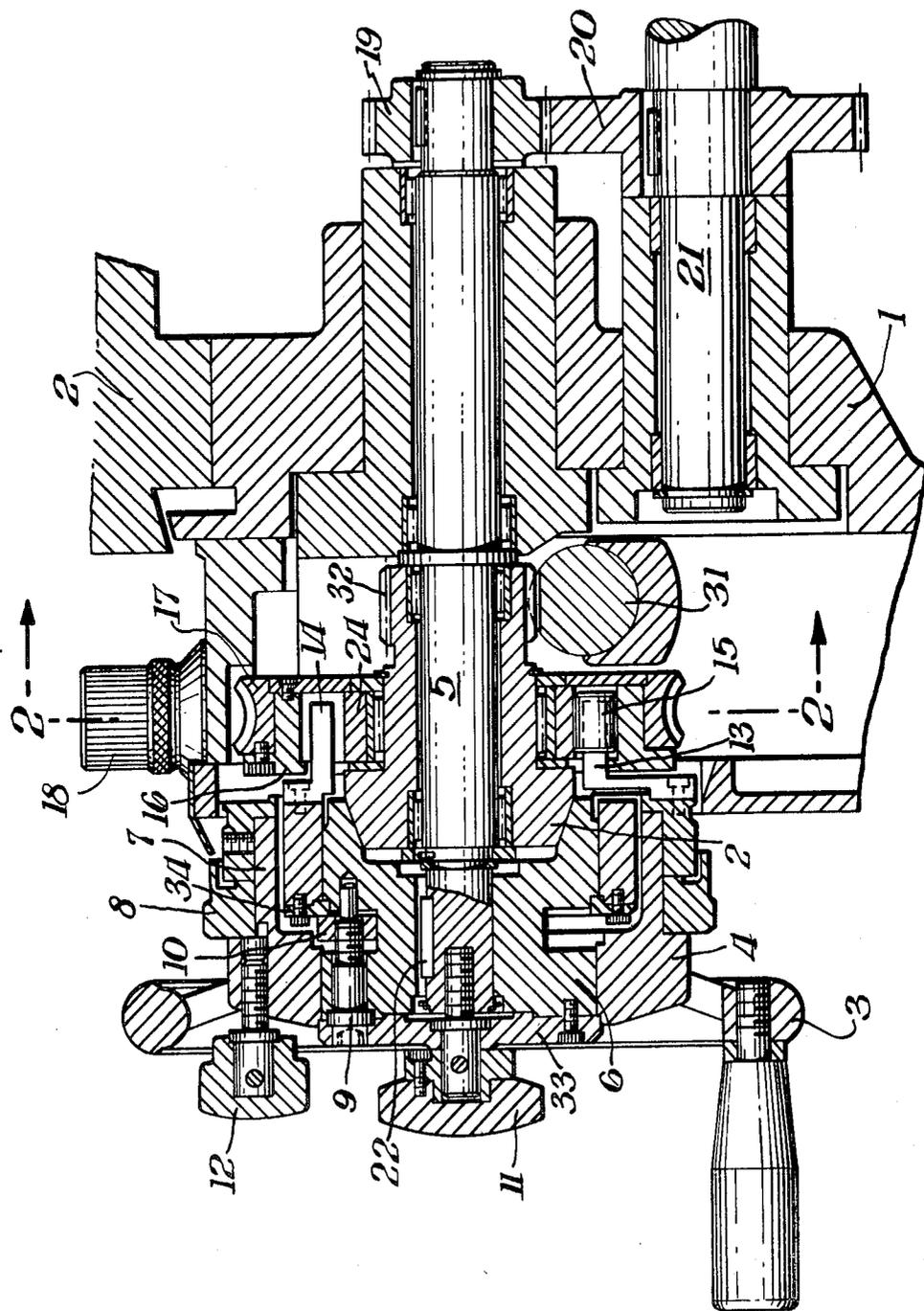
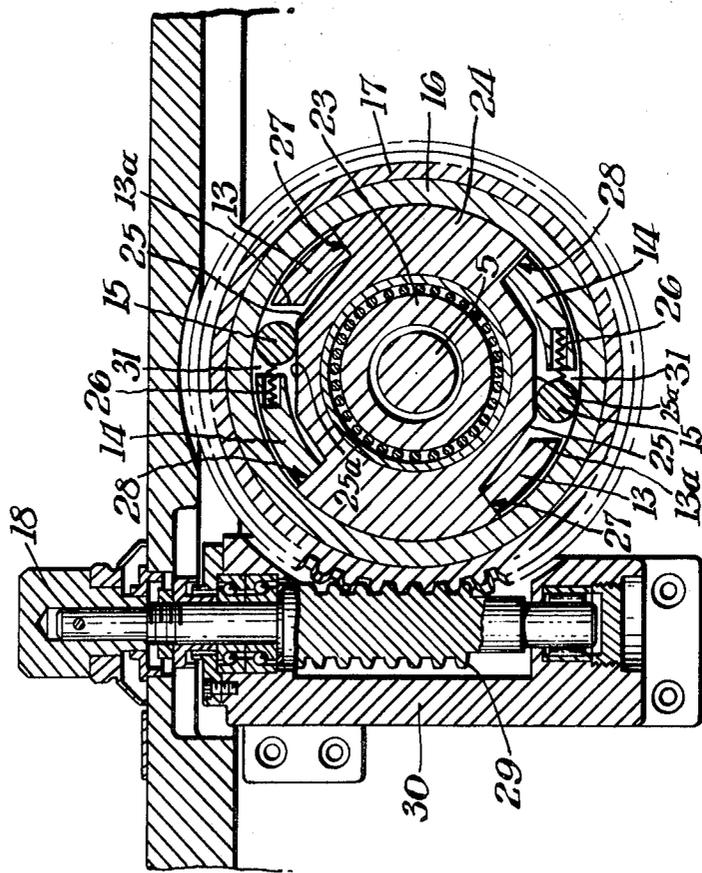


Fig. 2.



FEED MECHANISM FOR MACHINE TOOL

BACKGROUND OF THE INVENTION

Most of the conventional feed handle mechanisms lack a fine feed device. Fine feed is usually executed on the "hand feel" of a long experience operator working the feed. It is therefore practically impossible to make an extremely delicate infeed. Even with special mechanisms equipped with fine feed devices work efficiency has not been satisfactory because the handle shaft and the fine feed device must be disconnected for the purpose of switching from coarse feed to fine feed or quickly reverting the handle.

SUMMARY OF THE INVENTION

The general object of the present invention is to provide a highly improved feed handle mechanism which eliminates the need for mechanical switching between coarse feed and fine feed.

Another object of the present invention is to provide simplified mechanical switching between fine and coarse feeds without disturbing the manual feed device.

In accordance with the present invention a feed handle mechanism for a machine tool comprises a shaft with a handle rotatably mounted to the shaft. A rotation-transmitting plate is rotatably mounted about the shaft, and a hollow worm wheel rotates about the rotation-transmitting plate. A worm in engagement with the worm wheel is driven by a knob connected thereto. The rotation-transmitting plate has at least one recess on its periphery with a cam surface in the recess. A roller is located between the inner wall of the hollow worm wheel and the cam surface of the recess, and the roller divides the recess into two chambers. A first member is drivingly connected to the handle and received in one of the two chambers, while a second member is drivingly connected to the handle shaft and received in the other of the chambers. A spring device disposed between the second member and the roller wedges the roller between the inner wall of the worm wheel and the cam surface. The first member is adapted to transmit rotation of the handle in one direction to the handle shaft through the rotation-transmitting plate and the second member. The roller is adapted to transmit rotation of the worm wheel in the one direction through rotation of the worm to the rotation-transmitting plate by wedged engagement thereof between the inner wall of the worm wheel and the cam surface of the recess. Also, the first member is adapted to transmit rotation of the handle in a direction opposite to the one direction to the handle shaft through the roller and the second member.

BRIEF DESCRIPTION OF THE DRAWING

Novel features and advantages of the present invention in addition to those mentioned above will become apparent to those skilled in the art from a reading of the following detailed description in conjunction with the accompanying drawing wherein:

FIG. 1 is a longitudinal sectional view of a feed mechanism according to the present invention; and

FIG. 2 is a cross sectional view taken along line 2—2 of FIG. 1.

DETAILED DESCRIPTION OF THE INVENTION

Referring in more particularity to the drawing, FIG. 1 illustrates a bed 1 with a sliding table 2 freely slidable on the bed adapted to support a workpiece (not shown). A manual feed handle 3 is fitted on the front of the bed 1. A movable clutch 6 arranged for manual-automatic switching is located on the inside of the boss 4 of the handle 3. The movable clutch 6 is axially slidably keyed to a handle shaft 5 at 22. The handle shaft is rotatably mounted in the bed 2. A manual switch knob 11 is fastened to the end of the shaft 5, and rotation of the knob 11 causes the movable clutch 6 to shift to the right or left along the handle shaft 5 via a contact member 33.

A stationary clutch 23 opposite the movable clutch 6 is rotatably mounted to the shaft 5. The stationary clutch 23 and the movable clutch 6 are brought into intimate engagement with one another when the movable clutch 6 is shifted to the right, as viewed in FIG. 1, by manipulation of the switch knob 11. A pinion 32 is formed at the rear of the stationary clutch 23. The pinion meshes with the rack piston 31 of an automatic feed cylinder. Accordingly, when the automatic feed cylinder is operated, the stationary clutch 23 is rotated by the rack piston 31 and its associated pinion 32. Such rotation is transmitted via the movable clutch 6 to the handle shaft 5, and further from a gear 19 fitted to the end of the shaft 5 to a gear 20 at the end of a second shaft 21. The second shaft 21 is mounted parallel to the handle shaft 5 and is connected to a feed screw (not shown) which effects the infeed of a grinder table, as is well known in the art.

As shown best in FIG. 2, a transmitting disc 24 is freely mounted on the periphery of the stationary clutch 23. A rotatable cylinder 16 integrated with a worm wheel 17 is fitted around the disc 24. Symmetrically cut recesses 25, 25 having contact surfaces 27, 27 and 28, 28 are located on part of the periphery of the disc 24. These recesses and the inside wall of the rotatable cylinder 16 enclose spaces 31, 31 which house transmitting members 13, 13 that extend from the boss 4 of the handle 3. Moreover, the space 31, 31 house transmitting members 14, 14 that extend from a rotation-transmitting cylinder 7 fitted to the outside of the movable clutch 6 and in contact with the surfaces 28, 28 of the recesses 25, 25. The gaps 31, 31 between the transmitting members 13, 13 and 14, 14 are occupied by rollers 15, 15 held in wedged engagement between the inside wall of the rotatable cylinder 16 and cam surfaces 25a, 25a of the recesses. Compression springs 26, 26 projecting from the sides of the transmitting members 14, 14 hold the rollers in wedged engagement. Accordingly, when the rotatable cylinder 16 is turned clockwise, the rotation-transmitting disc 24 is also rotated clockwise by the wedged engagement of the rollers 15, 15. The rollers 15, 15 are in predetermined spaced relationship with the surfaces 13a, 13a of the transmitting members 13, 13, and as explained more fully below, this relationship performs the fine feed of micron order when the transmitting members 13, 13 are held in contact with the surfaces 27, 27 of the recesses 25, 25. A contact plate 34 is fitted on the circumferential surface of the rotation-transmitting cylinder 7 outside the movable clutch 6. One part of the contact plate 34 adjoins the side surface of the movable clutch 6. A switching device 9 parallel to the handle shaft 5 is provided around the movable clutch 6, and the switching device engages a pressing piece 10. Under the pressure of the switching device 9 the pressing piece 10 presses the contact plate 34 on the side of the rotation-transmitting cylinder 7 to thereby solidly connect the rotation-transmitting cylinder 7 to the movable clutch 6. Alternatively, the pressing piece may solidly connect the handle 3 to the movable clutch 6 when the switching device 9 shifts the pressing piece to the left, as viewed in FIG. 1.

A scale ring 8 is rotatably fitted on the outside of the boss 4 of the handle 3. A knob 12 is provided for locking the scale ring 8 to the handle. Additionally, the worm wheel 17 integrated with the rotation cylinder 16 meshes with a worm 29 rotatably mounted in a bearing 30. A fine feed dial 18 is fixed at one end of the worm 29, and the fine feed device comprises the worm 29 and the worm wheel 17.

The feed handle mechanism of the present invention functions in the following manner. For the purpose of switching to manual operation, the movable clutch 6 is first disengaged from the stationary clutch 23 through operation of the switching knob 11. In the drawing, the clutches 6, 23 are in their automatic condition of being in contact with one another. The pressing piece 10 is moved against the contact plate 34 to lock the rotation-transmitting cylinder 7 to the movable clutch 6. In this condition, when the handle 3 is turned to the right, the transmitting members 13, 13 that extend from the boss 4 of the handle 3 bear against the contact

surfaces 27, 27 of the rotation-transmitting disc 24. The rotation-transmitting disc 24 being rotatably supported by the stationary clutch 23 is then turned clockwise, as viewed in FIG. 2. This rotation of the transmitting disc 24 causes the transmitting members 14, 14 bearing against the contact surfaces 28, 28 to rotate in the same direction. Rotation of the transmitting members 14, 14 is transmitted from the rotation-transmitting cylinder 7 via the movable clutch 6, the handle shaft 5, and the gears 19, 20 to the second shaft 21. Rotation of the second shaft 21 is transmitted to a feed screw (not shown) to thereby cause a coarse feed of the grinding table. As the grinding table moves forward and the workpiece is finished close to the final dimensions, the handle 3 is no longer capable of making the final micron order fine feed.

For the purpose of accomplishing the fine feed, the fine feed dial 18 is turned so as to rotate the worm 29. The worm wheel 17 in meshing engagement with the worm 29 is then turned in a clockwise direction (FIG. 2) to thereby rotate the cylinder 16 fixed to the worm wheel. Clockwise rotation of the cylinder 16 is transmitted to the disc 24 by wedged engagement of the rollers 15, 15 between the inside wall of the rotatable cylinder 16 and the cam surfaces 25a, 25a of the recesses 25, 25. Rotation of the disc 24 is transmitted to the members 14, 14 bearing against the contact surfaces 28, 28. Also, rotation of the members 14, 14 is transmitted from the cylinder 7 via the movable clutch 6, the handle shaft 5, and the gears 19, 20 to the second shaft 21. The second shaft drives the feed screw to thereby cause a fine feed of the grinder table.

For the purpose of quick reversion of the handle, the handle 3 is reversed to thereby turn the members 13, 13 in a counterclockwise direction. The surfaces 13a, 13a press against the rollers 15, 15 and overcome the wedged engagement of the rollers 15, 15 and the force of the compression springs 26, 26 to push the rollers toward the transmitting members 14, 14. Meanwhile, counterclockwise rotation of the transmitting member 13 is transmitted via the rollers 15, 15 to the members 14, 14. Thus, the rotation-transmitting disc 24 turns in the same direction together with the transmitting members 14, 14. Rotation of the members 14 is transmitted from the rotation-transmitting cylinder 7 via the movable clutch 6, the handle shaft 5, and the gears 19, 20 to the second shaft 21. The second shaft operates the feed screw to thereby effect quick reversion of the grinder table.

For the purpose of automatic operation, the pressing piece 10 and the contact plate 34 are separated from one another through operation of the switching device 9. The piece 10 is then pressed against the boss 4 of the handle 3, and the automatic-manual switch knob is operated to bring the tapered surfaces of the clutches 6, 23 into engagement with one another. The automatic feed cylinder can then be operated to move the rack piston 31 longitudinally to thereby produce an infeed of the grinder table.

As described above, the present invention provides switching from manual coarse feed to fine feed without disconnecting the handle shaft from the fine feed device. Also, quick reversion of the handle is possible without such disconnection.

What is claimed is:

1. A feed mechanism for a machine tool comprising a shaft, a handle rotatably mounted about the shaft, a rotation-transmitting plate rotatably mounted about the shaft, a hollow worm wheel rotatably mounted on the rotation-transmitting plate, a worm in engagement with the worm wheel, a knob connected to drive the worm, the rotation-transmitting plate having on its peripheral surface at least one recess provided with a cam surface thereon, a roller located between the inner wall of the hollow worm wheel and the cam surface of the

recess forming two chambers between the inner wall of the worm wheel and the recess of the rotation-transmitting plate, a first member drivingly connected to the handle and received in one of the two chambers, a second member drivingly connected to the handle shaft and received in the other of the chambers, and spring means disposed between the second member and the roller to wedge the roller between the inner wall of the worm wheel and the cam surface whereby the first member is adapted to transmit rotation of the handle in one direction to the handle shaft through the rotation-transmitting plate and the second member, the roller is adapted to transmit rotation of the worm wheel in the one direction by means of rotation of the worm to the rotation-transmitting plate by wedged engagement thereof between the inner wall of the worm wheel and the cam surface of the recess, and the first member is adapted to transmit rotation of the handle in a direction opposite to the one direction to the handle shaft through the roller and the second member.

2. A feed mechanism as in claim 1 wherein the first member is in predetermined spaced relationship with the roller when the first member transmits the rotation of the handle in the one direction to the handle shaft.

3. A feed handle mechanism for a machine tool comprising a bed, a handle shaft rotatably mounted in the bed, a movable clutch slidably but non-rotatably mounted on the handle shaft and having a tapered surface at one end thereof, a handle rotatably mounted on the movable clutch, a stationary clutch rotatably mounted on the handle shaft and having a tapered surface at one end thereof associated with the tapered surface of the movable clutch and a gear at the other end of the stationary clutch, means for shifting the movable clutch axially relative to the handle shaft for selective engagement between the tapered surfaces, a hydraulic cylinder including a piston rod with a rack in engagement with the gear of the stationary clutch, a rotation-transmitting plate rotatably mounted on the stationary clutch, a hollow worm wheel rotatably mounted on the rotation-transmitting plate, a worm in engagement with the worm wheel, a knob connected to drive the worm, the rotation-transmitting plate having on its peripheral surface at least one recess provided with a cam surface thereon, a roller located between the inner wall of the hollow worm wheel and the cam surface of the recess forming two chambers between the inner wall of the worm wheel and the recess of the rotation-transmitting plate, a first member drivingly connected to the handle and received in one of the two chambers, a cylindrical member rotatably mounted on the movable clutch, a second member drivingly connected to the cylindrical member and received in the other of the chambers, means for selectively clamping the cylindrical member to the movable clutch for rotation therewith, and spring means disposed between the second member and the roller to wedge the roller between the inner wall of the worm wheel and the cam surface whereby the first member is adapted to transmit rotation of the handle in one direction to the handle shaft through the rotation-transmitting plate and the second member, the roller is adapted to transmit rotation of the worm wheel in the one direction by means of rotation of the worm to the rotation-transmitting plate by wedged engagement thereof between the inner wall of the worm wheel and the cam surface of the recess, and the first member is adapted to transmit rotation of the handle in a direction opposite to the one direction to the handle shaft through the roller and the second member.

4. A feed handle mechanism as in claim 3 wherein the first member is in predetermined spaced relationship with the roller when the first member transmits the rotation of the handle in the one direction to the handle shaft.

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