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F. MÜLLER.

FEEDING MECHANISM FOR MACHINE TOOLS.

APPLICATION FILED SEPT. 23, 1904.

Fig. 1

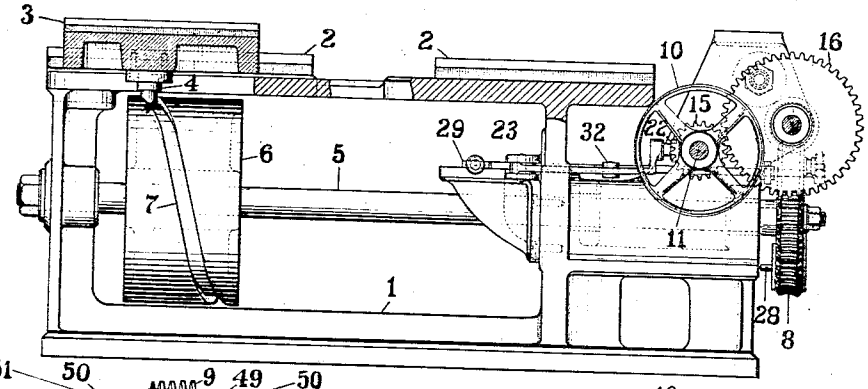


Fig. 4

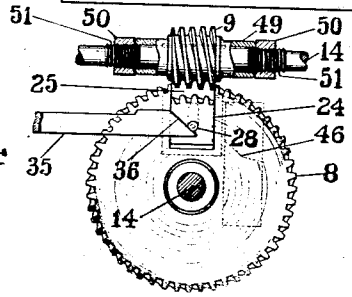
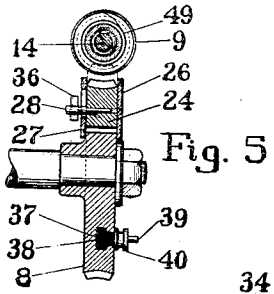


Fig. 5



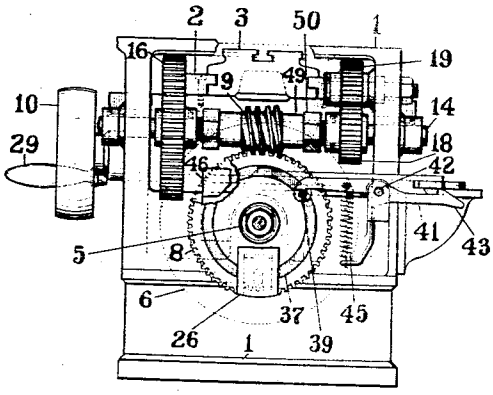


Fig. 2

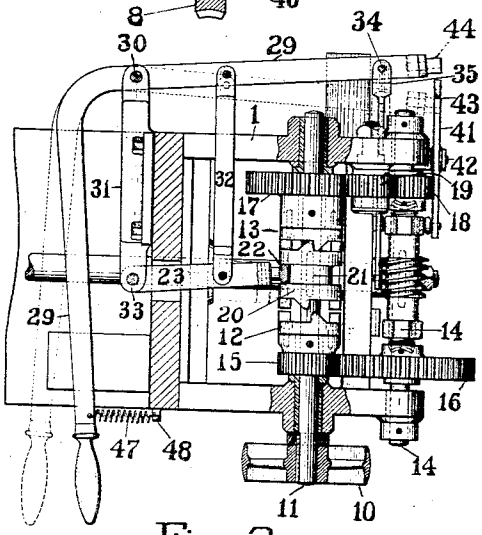


Fig. 3

WITNESSES:

H. A. Kornemann.

B. H. Marsh.

INVENTOR

Friedrich Müller

BY

Henry J. Miller

ATTORNEY

UNITED STATES PATENT OFFICE.

FRIEDERICH MÜLLER, OF ELIZABETH, NEW JERSEY.

FEEDING MECHANISM FOR MACHINE-TOOLS.

No. 831,974. Specification of Letters Patent. Patented Sept. 25, 1906.

Application filed September 23, 1904. Serial No. 225,617.

To all whom it may concern:

Be it known that I, FRIEDERICH MÜLLER, a citizen of the United States, residing at Elizabeth, in the county of Union and State of New Jersey, have invented certain new and useful Improvements in Feeding Mechanism for Machine-Tools, of which the following is a specification, reference being had therein to the accompanying drawings.

This invention relates to an improvement more particularly in that class of machine-tools employing a worm and worm-wheel for producing relative feeding movements between the work and the tool proper; and the invention has for its object to provide a simple and effective means of controlling the action of the feeding mechanism through such worm and worm-wheel.

The invention consists, primarily, in a worm, means for rotating it in opposite directions, a feed-shaft, a worm-wheel applied to said feed-shaft in mesh with said worm and having a radially-movable toothed peripheral section, and means for shifting said toothed peripheral section into and out of operative relation with said worm.

It also includes certain specific mechanism for controlling the motion of said worm and for shifting the toothed peripheral section of the worm-wheel into and out of operative position.

In the annexed drawings my present improvement is shown as applied to the milling-machine forming the subject of my pending United States application, Serial No. 210,024, filed May 27, 1904.

Figure 1 is a side elevation, partly in section, of the bed of the milling-machine provided with the present improvement; and Fig. 2 is an end elevation of the same. Fig. 3 is a plan view, partly in section, of the end of the machine shown in Fig. 2. Fig. 4 is a side view, and Fig. 5 an edge view, of the worm and worm-wheel detached from the other portions of the machine.

The machine is shown with a bed 1, provided upon the upper side with two guideways 2, one of which is shown surmounted by a sliding carriage 3, having a depending stud 4. The feed-shaft 5 is journaled at opposite ends in the bed 1 and carries beneath the carriage 3 a cam-cylinder 6 with groove 7, entered by the stud 4 of the said carriage, and is provided at the opposite extremity with the worm-wheel 8, meshing with the worm 9.

The power for driving the feeding mechanism is communicated through the pulley 10, mounted upon the shaft 11, carrying the loose clutch-collars 12 and 13, the former of which is connected with the worm-shaft 14 by means of the intermeshing gears 15 and 16 and the latter of which clutch-collars is connected with the said worm-shaft by means of the gears 17 and 18 upon their respective shafts and the intermediate gear 19, intermeshing with said gears. Intermediate the clutch-collars 12 and 13 is disposed a sliding clutch-collar 20, splined to the shaft 11 and provided with an annular groove 21, entered by the spherical end of a pin 22, carried by the shift-lever 23. The sliding clutch-collar 20 is provided with the usual teeth upon each end, which are adapted to interlock alternately with corresponding teeth upon adjacent ends of the loose collars 12 and 13. The gears 15 and 16 and the gears 17, 18, and 19 are so arranged and proportioned that when the sliding collar 20 is in engagement with the collar 12 the worm-shaft 14 will be rotated forwardly at a comparatively slow speed to produce a feeding movement of the work-supporting carriage 3, while the shifting of the clutch-collar 22 out of engagement with the collar 12 and into engagement with the collar 13 causes the rotation of the worm-shaft 14 in the reverse direction and at a greatly-increased speed to effect the return movement of the work-holding member after an operation of the tool upon the work in a well-known manner.

The worm-wheel 8 is provided with a radially-movable section consisting of a block 24, fitted in a radial slot or guideway 25 of the worm-wheel and provided upon its outer edge with a series of worm-teeth complemental to the peripheral teeth upon the body of the worm-wheel, such block being held from lateral displacement by means of the cheek-plates 26 and 27, the latter of which is provided with a slot through which extends a lateral pin 28, carried by the block 24.

An angular starting-lever 29, pivoted at 30 to a fixed bracket 31 upon the bed 1, has its outer end portion connected, by means of a link 32, with the shift-lever 23 pivoted at 33 to the said bracket 31, and to the outer end of said starting-lever is pivoted at 34 a reciprocating cam-rod 35, the beveled head 36 of which is adapted to engage the pin 28 to raise the toothed portion of the block 24 into

engagement with the worm 9 when the machine is started.

The rear face of the worm-wheel 8 is provided with an undercut slot 37, to which is fitted a similarly-shaped head 38 of a screw-stud 39, provided with a clamp-nut 40. The screw-stud 39 is circumferentially adjustable in the slot 37, its path of movement in the rotation of the worm 8 being such as to enable it to engage the tail of a latch-lever 41, mounted upon a fixed stud 42 on the bed 1 and having its operative end formed with a hook 43, adapted to engage a tooth 44 upon the outer extremity of the angular portion of the starting-lever 29, a spring 45 being provided to maintain the latch-lever 41 normally in engagement with the starting-lever 29.

As illustrated in the drawings, the several parts of the mechanism above described are in the positions which they assume at the end of the cycle of the machine, the starting-lever 29 being shown in full lines in retracted position, with the clutch member 20 in engagement with the member 13 for effecting the backward rotation of the worm 9, the cam-rod 35 being retracted to permit the worm-wheel section 24 to drop by gravity or to be forced by engagement of the pin 28 with the stationary cam-piece 46, secured to the bed 1 inwardly toward the cam-shaft 5, so as to lie out of engagement with the actuating-worm as the worm-wheel 8 returns to initial or starting position in which the work-holding member assumes its initial position.

To throw the feeding mechanism into effective or feeding relation, the starting-lever 29 is thrown forwardly into the dotted-line position, (represented in Fig. 3,) which causes the shift-lever 23 to disengage the clutch-collar 20 from the toothed collar 13 and to couple the same with the toothed collar 12 for communicating to the worm-shaft 14 a forward-feeding movement and simultaneously advances the cam-rod 35, whose head 36 engages the pin 28 and raises the worm-wheel section 24 into engagement with the rotating worm 9, whereby the forward movement of the worm-wheel 8, cam-shaft 5, and cam 6 are initiated and the feed of the carriage 3 begun to carry the work to the tool. This feeding movement continues until the worm 8 is rotated to the point indicated in Fig. 2, when its tripping-stud 39 engages the latch-lever 41 and tilts the latter in opposition to its spring 45, and thereby releases the starting-lever 29, which returns to initial position under the action of the spring 47, interposed between the same, and a pin 48 upon the bed 1. This movement of the starting-lever causes the shifting of the clutch member 20 from engagement with the collar 12 to engagement with the collar 13 for reversal of the direction of rotation of the worm-shaft 14 and simultaneously withdraws the cam-rod 35 to remove its head 36 from the circular path of movement of the pin 28, so as to enable the toothed portion of the worm-wheel section 24 to recede from the periphery of the worm-wheel under the action of gravity or of the stationary cam 46 upon the pin 28, whereby as the worm-wheel returns to initial starting position the worm runs out of engagement with the tooth of the same, and the latter comes to rest in readiness for a succeeding operation.

Although the feed throw-out device, comprising the radially-movable worm-wheel section 24 and the cam-rod 35, operated manually to shift it into operative position and automatically to permit its return to inoperative position in respect of the body of the worm-wheel, will operate equally well whether the worm 8 rotates continuously in one direction or alternately in opposite directions, the employment of means for reversing the direction of rotation of the worm, and hence of the cam-shaft, is evidently advantageous, as it is thereby made practicable to adjust the length of feed for a given piece of work, the circumferential adjustment of the tripping-stud 39 providing for the operation of so much only of the entire length of the cam-groove 7 as is necessary to communicate the requisite relative movement between the tool and the work.

It will be observed that only a single manual actuation of the starting-lever 29 is necessary in each operation of the machine, the return of such lever to initial position being effected automatically, and the final interruption of the feed-returning movement being accomplished independently of such automatic shifting of the starting-lever.

By a reference more particularly to Figs. 2 and 4 of the drawings it will be observed that the series of worm-teeth 9 are formed upon a sleeve 49, mounted upon the worm-shaft 14 and having merely a spline-and-groove connection therewith to insure its turning with the shaft, its longitudinal position thereon being capable of adjustment by means of the internally-threaded thrust-collars 50, between which it is interposed, which are applied to the threaded portions 51 of the supporting-shaft. It will be further observed that the worm is slightly tapered from right to left.

As the employment of the shifting section 24 of the worm-wheel 8 obviates the necessity of shifting the worm-shaft to disengage the worm and worm-wheel, as has been common heretofore in many classes of machine-tools, the feed and worm shafts 5 and 14 are mounted in rigid bearings having no means of adjustment to compensate for wear. In the continued use of the machine the wear of the journals of the worm and cam shafts 14 and 5, respectively, causes the worm and worm-wheel to recede somewhat from each other, thereby producing a

certain degree of lost motion, which impairs the effectiveness of the feeding mechanism. By shifting the worm-sleeve 49 upon its supporting-shaft 14 by the means above described compensation is made for such wear of the parts, and the effectiveness of operation of the mechanism is to a large extent, if not wholly, restored.

Having thus set forth the nature of my invention, what I claim herein is—

1. In a machine-tool, the combination with a feed-shaft and a cam mounted thereon, of a worm-wheel mounted upon said feed-shaft and provided with a radially-movable toothed peripheral section, a worm adapted to mesh with said worm-wheel and provided with means for rotating it alternately in opposite directions, means operated initially for radially moving said worm-wheel section into engagement with said worm to initiate the rotation of the worm-wheel in one direction and to cause such section to move out of operative relation with said worm before the return of the worm-wheel to initial starting position.

2. In a machine-tool, the combination with a feed-shaft and a cam mounted thereon, of a worm-wheel mounted upon said feed-shaft and provided with a radially-movable toothed peripheral section, a worm adapted to mesh with said worm-wheel and provided with means for rotating it, manually-operated means for shifting said worm-wheel section into operative relation with said worm to initiate the actuation of said feed-shaft, and automatically-acting means for causing the retraction of said worm-wheel section out of such operative relation to produce the stoppage of said feed-shaft in initial starting position.

3. In a machine-tool, the combination with a circularly-moving feed-cam, of means for communicating to said cam a feeding movement in one direction and a return movement in the opposite direction, comprising a rotating worm, means for driving it alternately in opposite directions, a worm-wheel having a radially-movable toothed peripheral section, and means for shifting said section inwardly and outwardly to establish and interrupt the operative relation of the worm-wheel with said worm.

4. In a machine-tool, the combination with a circularly-moving feed-cam, and means for communicating to said cam a feeding movement in one direction and a return movement in the opposite direction, comprising a rotating worm with means for driving it alternately in opposite directions, a worm-wheel having a radially-movable toothed peripheral section carrying a laterally-projecting pin, and a reciprocating cam-rod adapted to engage said lateral pin for radially shifting said worm-wheel section.

5. In a machine-tool, the combination with a circularly-moving cam and a feed-shaft upon which said cam is mounted, of a worm-wheel mounted upon said feed-shaft, a worm-shaft, a worm thereon meshing with said worm-wheel, a driving-shaft, clutch-sleeves mounted loosely upon said driving-shaft and provided, respectively, with direct and reversing gear connections with said worm-shaft, a sliding clutch member also mounted upon said driving-shaft and adapted to alternately engage the said clutch-sleeves, and means, manually actuated in one direction and automatically actuated in the opposite direction, for shifting the said sliding-clutch member.

6. In a machine-tool, the combination with a cam and a feed-shaft upon which said cam is mounted, of a worm-wheel mounted upon said feed-shaft and provided with a radially-movable peripheral toothed section, a worm-shaft and a worm thereon adapted to mesh with said worm-wheel, means comprising a clutch provided with connections with said worm whereby the latter is driven alternately in opposite directions, and a common operating device for shifting said clutch and radially moving said worm-wheel section to start, reverse and cause the machine to come to rest at initial position.

7. In a machine-tool, the combination with a cam and a feed-shaft upon which said cam is mounted, of a worm-wheel mounted upon said feed-shaft and provided with a radially-movable peripheral toothed section, a worm-shaft and a worm thereon adapted to mesh with said worm-wheel, shifting means for radially moving said worm-wheel section in respect of said worm, a driving-shaft with direct and reverse connections with said worm-shaft, a clutch for controlling said direct and reverse connections of said worm-shaft with said driving-shaft, and a common operating device for said clutch and worm-wheel-section shifting means.

8. In a machine-tool, the combination with a cam and a feed-shaft upon which said cam is mounted, of a worm-wheel mounted upon said cam-shaft and provided with a radially-movable peripheral toothed section, a worm-shaft and a worm thereon adapted to mesh with said worm-wheel, means for radially moving said worm-wheel section in respect of said worm, a driving-shaft with direct and reverse connections with said worm-shaft, a clutch for controlling said direct and reverse connections of said worm-shaft with said driving-shaft, a common starting-lever, connections between the same and the clutch and worm-wheel-section shifting devices, a spring for holding said starting-lever normally in initial position, a latch for holding said lever in operative position, and means for automatically tripping said latch to release said starting-lever.

9. In a machine-tool, the combination with

a feed-shaft and a cam mounted upon the same, of a worm-wheel mounted upon said feed-shaft and provided with a radially-movable peripheral toothed section and a circumferentially adjustable tripping-stud, a worm-shaft and a worm thereon adapted to mesh with said worm-wheel, means for radially moving said worm-wheel section in respect of said worm, a driving-shaft with direct and reverse connections with said worm-shaft, a clutch for controlling said direct and reverse connections of said worm-shaft with said driving-shaft, a common starting-lever, connections between the same and the clutch and worm-wheel-section shifting devices, a spring for holding said starting-lever normally in initial position, a latch having at one end a hook adapted to engage said starting-lever in its operative position and at the other end a tail adapted for engagement with the adjustable tripping-stud of said worm-wheel, and a spring for normally maintaining said latch-lever in operative relation with said starting-lever.

10. In a machine-tool, the combination with a feed-shaft and a cam mounted thereon, of a worm-wheel mounted upon the said feed-shaft and provided with a radially-movable toothed peripheral section, a worm-shaft, a worm of slightly-tapered form longitudinally adjustable upon said worm-shaft and adapted to mesh with said worm-wheel, means for rotating said worm-shaft alternately in opposite directions, and means operating initially in radially moving said worm-wheel section into engagement with said worm to initiate the rotation of the worm-wheel in one direction and to cause said section to move out of operative relation with said worm before the return of the worm-wheel to initial starting position.

11. In a machine-tool, the combination with a feed-shaft and a cam mounted thereon, of a worm-wheel mounted upon the said feed-shaft and provided with a radially-movable toothed peripheral section, a worm-shaft provided with a pair of longitudinally-adjustable thrust-collars, a loose sleeve interposed between said thrust-collars on said shaft and provided with slightly-tapered series of worm-teeth meshing with said worm-wheel, means for rotating said worm-shaft alternately in opposite directions, and means operating initially in radially moving said worm-wheel section into engagement with said worm to initiate the engagement of the worm-wheel in one direction and to cause said section to move out of operative relation with said worm before the return of the worm-wheel to initial starting position.

12. In a machine-tool, the combination with a circularly-moving feed-cam, of means for communicating to said cam feeding movements comprising a rotating worm, means for driving it, a worm-wheel having a radially-movable toothed peripheral section, and means for shifting said section inwardly and outwardly to establish and interrupt the operative relation of the worm-wheel with said worm.

13. In a machine-tool, the combination with a circularly-moving worm-wheel, provided with a radially-movable toothed peripheral section, and a worm adapted to mesh with said worm-wheel and provided with means for rotating it, of means operated manually for radially moving the worm-wheel section into engagement with said worm to initiate the rotation of said worm-wheel, and operated automatically to cause said section to move out of operative relation with said worm before the arrival of the worm-wheel in initial starting position.

14. In a machine-tool, the combination with the frame and a reciprocating carriage thereon, of a circularly-moving feed-cam, an operative connection between said cam and said carriage, means for communicating to said cam a feeding movement in one direction and a return movement in the opposite direction, and means operatively connected with said cam for adjusting the amount of feeding movements of said cam within the limits of a single rotation, and acting positively to prevent the rotation of said cam more than a complete rotation.

15. In a machine-tool, the combination with the frame and a reciprocating carriage thereon, of a circularly-moving feed-cam, an operative connection between said cam and said carriage, a worm-wheel connected with said cam, a worm meshing with said worm-wheel, means for rotating said worm in opposite directions, and controlling means for the worm-actuating mechanism of which one member is carried by and adjustable upon the said worm-wheel for determining the point of reversal of the movements of said feed-cam.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

FRIEDERICH MÜLLER.

Witnesses.

H. J. MILLER,

H. A. KORNEMANN.