Jan. 27, 1953 G. O. GRIDLEY 2,626,451

STOCK FEED MECHANISM

Filed Dec. 20, 1947 2 SHEETS—SHEET 1

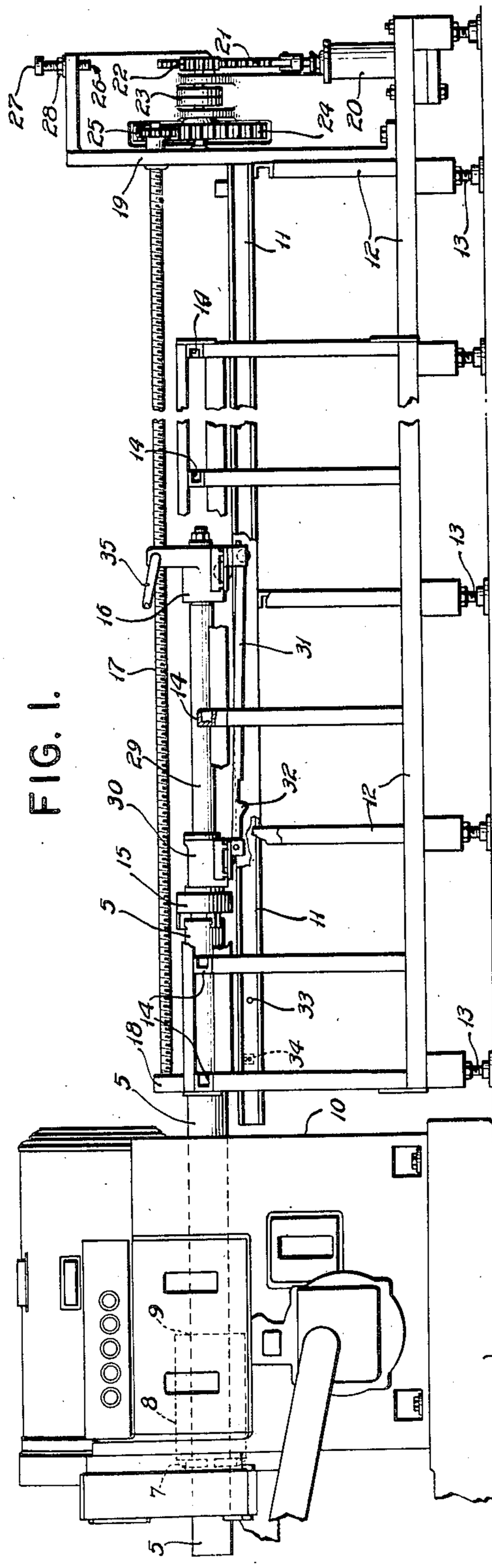

FIG. 1.

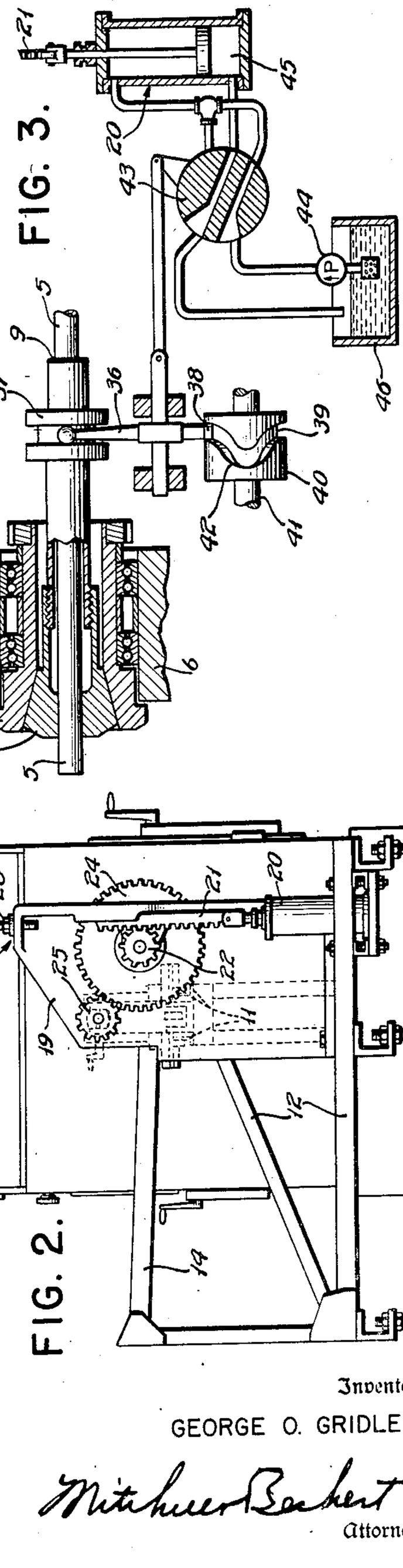

FIG. 3.

FIG. 2.

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FIG. 5.

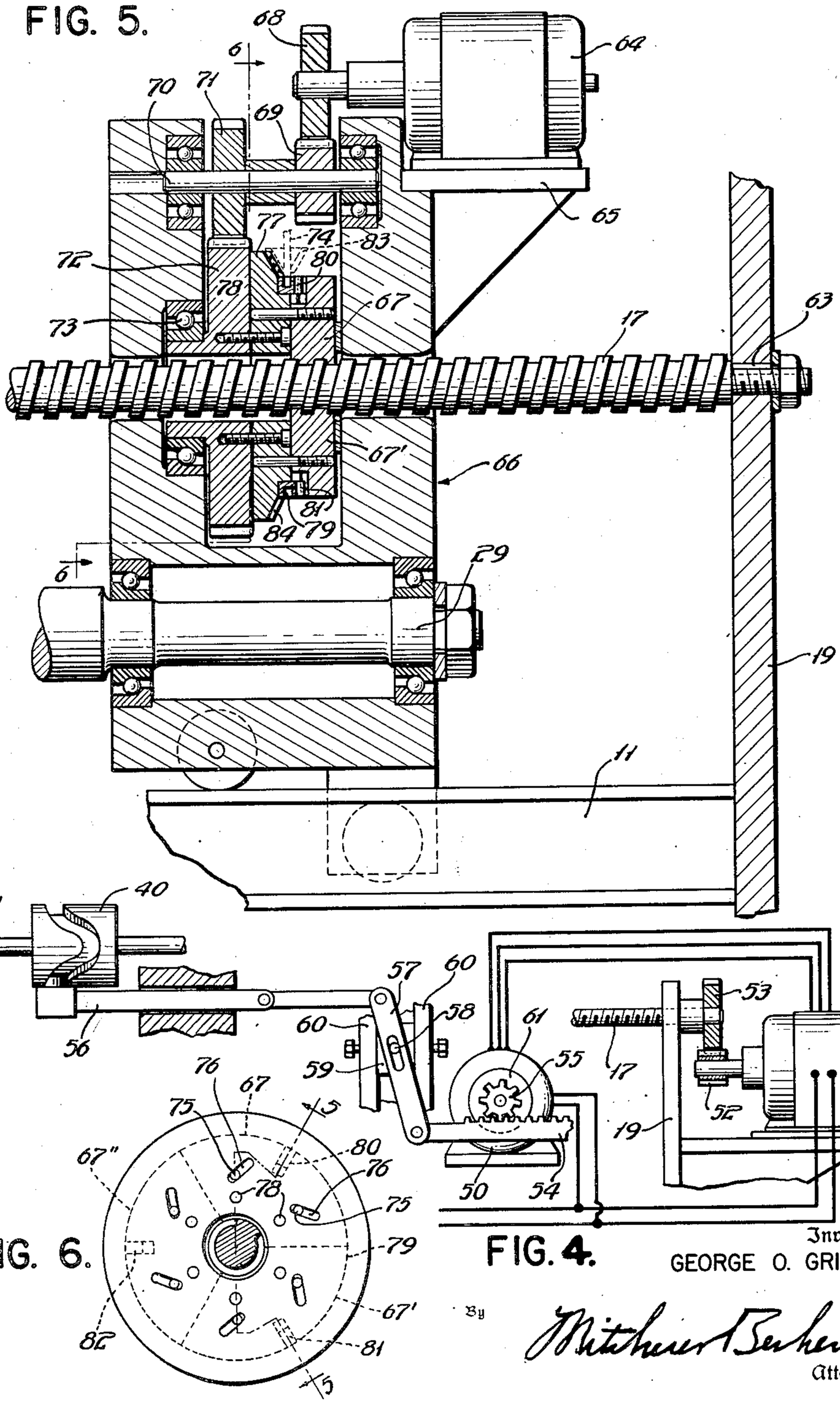

FIG. 6.

FIG. 4.

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2,626,451

STOCK FEED MECHANISM

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Application December 20, 1947, Serial No. 793,015

14 Claims. (Cl. 29—59)

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My invention relates to stock-feeding mechanisms for machines such as automatic lathes.

It is an object of the invention to provide an improved device of the character indicated.

It is another object to provide an improved stock-feed mechanism which may not require a stock stop on the machine to be fed and which may, therefore, permit utilization of a greater working area on the machine.

It is also an object to provide improved stock-feeding means wherein the extent of feed may be precisely controlled solely by the stock-feeding mechanism and wherein there may be a more efficient consumption of stock.

It is a further object to provide a stock-feeding mechanism which may advance usable stock into a machine of the character indicated with substantially equal increments of feed, regardless of the extent to which the stock has been consumed.

It is still another object to provide improved means for supporting stock in a feeding mechanism of the character indicated.

It is a general object to meet the above objects with a mechanism that is inherently simple, that is not likely to get out of order, and that will be relatively easy to service.

Other objects and various further features of the invention will be pointed out or will occur to those skilled in the art from a reading of the following specification in conjunction with the accompanying drawings. In said drawings, which show, for illustrative purposes only, a preferred form of the invention:

Fig. 1 is a partly broken-away side view in elevation of a stock-feeding mechanism incorporating features of the invention, shown applied to the feeding of stock to an automatic lathe;

Fig. 2 is a right-end view of the assembly of Fig. 1;

Fig. 3 is a schematic representation of cooperative elements of the system of Fig. 1;

Fig. 4 is a fragmentary schematic representation of a modified stock-feeding mechanism according to the invention;

Fig. 5 is an enlarged fragmentary sectional view to show a further modification of the invention, the section being developed more or less along the line 5—5 of Fig. 6;

Fig. 6 is a sectional view taken partly in the plane 6—6 of Fig. 5.

Briefly stated, my invention contemplates an improved stock-feeding mechanism for advancing stock by preselected feed increments into a lathe-type machine, such as an internally fed automatic lathe. The stock-feed mechanism includes pusher means in threaded engagement with a longitudinally extending lead screw, and the known feed increments are obtained by known rotation of the lead screw or of a nut or the like relatively to the lead screw. The feed means may include any suitable motor with drive connections to assure equal successive feed increments. The limiting rotational advance for the lead screw or for the nut may be preselected, so that the exact amount of feed for the stock may be preselected. The pusher means is preferably chucked to the stock, so that stopping the lead screw or the nut may bring the stock to an abrupt stop when the feeding limit has been reached, thus avoiding the need for a stock stop on the machine which is being fed.

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Referring to the drawings, my invention (in Figs. 1, 2, and 3) is shown in application to a stock-feeding mechanism for feeding bar or tubular stock 5 into the rear of an internally fed automatic lathe 6. In the lathe 6, the stock 5 is clamped in position by a collet 7 supported in a spindle 8. The rear end 9 of the collet-and-spindle assembly 7—8 happens to be well forward of the rear end 10 of the lathe 6.

In accordance with a feature of the invention, I provide a stock-feeding mechanism for feeding the stock 5 without requiring the use of a stock stop on the machine 6, thus providing additional space for tools in the working area of the lathe 6. The stock-feeding mechanism is shown to include longitudinally extending ways or rails 11 on a framework 12 that may be raised and lowered, as by floor jacks 13, in order to provide proper alignment of the ways 11 with respect to the axis of spindle 8. In the form shown, the framework 12 includes inclined bracket means 14 on one side of the machine so that a plurality of bars of stock may be held in reverse, in position to be loaded consecutively into the stock-feeding mechanism for consumption in the lathe 6.

The stock-feeding mechanism includes pusher means having a chuck 15 at the forward end graspingly to engage the rear end of stock 5, and a supporting carriage member 16 is guided by the ways 11 and locked against axial displacement with respect to the chuck 15. In the form of Figs. 1–3, a longitudinally extending lead screw 17 is journalled in end standards 18—19 of the frame 12 and is threaded to the carriage member 16. Feed increments may be imparted as by incremental rotation of the lead screw 17. It will be understood that whatever the rotation of lead screw 17 there may be a corresponding

advance of the stock 5, and when a chuck 15 is employed that there need be no "overshooting" of the stock 5, once the lead-screw feed has stopped.

In the form shown, the feed means for the lead screw 17 includes a hydraulic cylinder 20 with a piston driving a rack 21. The rack 21 meshes with a pinion 22 which, through a one-way-engaging clutch 23, drives a gear 24. The gear 24 in turn meshes with another pinion 25, which may be keyed to the lead screw 17. The clutch 22 is preferably arranged so as to engage the lead screw 17 to the pinion 22 for the upward stroke of rack 21, and for the return or downward stroke of rack 21 the clutch 23 may merely free-wheel or overrun. In order to provide substantial changes in feed increments imparted by the hydraulic actuating means 20 to the feed carriage 16, the gear 24 and pinion 25 may be change gears readily removable from their respective shafts, as will be clear. For relatively fine adjustment of the selected feed advances, adjustable abutment means 26 may be provided to intercept the rack 21 in its feeding or upward stroke. In the form shown, the adjustment means 26 is a simple screw, which may have a hand-operated knob 27 and a lock nut 28 to secure a given adjustment.

As indicated above, the machine 6 happens to be of such a design that there is a substantial distance between the back end 9 of the collet 7 and the back end 10 of the machine. I prefer, therefore, that the pusher means which is slidable on the guides 11 be of the extensible variety, such as that shown in more detail in my co-pending application Serial No. 793,016, filed December 20, 1947. In accordance with such a pusher system, the chuck 15 is carried at the forward end of a pusher bar 29, which may be supportingly journalled for rotation in a forward carriage 30, located (as by latch means) preferably as close as practicable to the rear end of the stock 5. The fit between carriage 30 and the bar 29 is preferably a sliding one, that is, the bar 29 may move with respect to the forward or support carriage 30 to extend the pusher means beyond the stock-feeding frame and into the machine 6. Feeding forces may be applied to the pusher means rearwardly of the forward carriage 30; and, in the form shown, since the rear carriage 16 is longitudinally locked to the pusher means, the rear carriage 16 may receive the feed forces for the pusher means.

In the form shown, the carriage 30 is detachably latched with respect to the pusher means by means of a spacer bar 31 which serves to maintain the carriages 16—30 in maximum spaced relation as long as both carriages are traveling along the ways 11. Upon approach to the forward end of the ways 11, a projection 32 on the spacer bar 31 may engage a transversely extending rod or other tripping means 33 to release latch means between carriages 16—30. In the form shown, a latch between bar 31 and the rear carriage 16 is disengaged when projection 32 strikes the tripping means 33. For subsequent feeding increments, therefore, it will be understood that the rear or pusher carriage 16 may continue to push the chuck 15 and hence the stock 5 beyond the end of the frame of the stock-feeding mechanism and, if desired, up to the rear end of the collet 7, so that the stock 5 may be fully consumed, insofar as it is usable. A stop 34 at the forward end of the ways 11 may positively arrest forward travel of the carriage 30 during the process of extending the pusher means, as will be understood.

When the piece of stock 5 has been fully consumed as possible, that is, with the two carriages 16—30 close together at the forward end of the frame 12, and (if suitably designed) with the feed chuck 15 as far as the jaws of collet 7, the threaded engagement between carriage 16 and the lead screw 17 may be released, as by operating a handle 35 to open a split nut or other means (not shown) which serves to engage members 16—17. With the lead screw 17 thus disengaged, the two carriages and other parts of the pusher means may be readily retracted. It will be understood that a suitable shut-off device including, say, a part carried by the carriage 16 may be employed to shut-off or to disable the feed mechanism when the unconsumed remainder of stock 5 is no longer usable.

In operation, the hydraulic actuating means 20 may be timed to operate upon actuation of the collet means 7. In the form schematically shown, the collet means 7 is of the draw-back variety in which an actuating fork 36 engages spool 37 to pull it back for a clamping position of the collet 7 and to push it forward for a releasing position of the collet 7. The fork 36 may support a cam-follower roll 38 to follow the slot 39 in a drum cam 40 on the main camshaft 41 of the machine 6. For the instant depicted in Fig. 3, it will be understood that the collet is in its normal pulled-back position, clamping the stock 5, as while turning operations are proceeding. Upon completion of the turning (e. g. at cutoff), the cam-follower roll 38 may strike the rise 42 of the cam slot 39 to release the jaws of the collet 7 and to make the stock 5 slidable within the collet 7. This shift of fork 36 is shown to shift a reversing valve 43 so as to direct pressure fluid (pressurized by pump 44) to the head end 45 of the actuating cylinder 20. The feeding stroke may become immediately effective, to an extent determined by the setting of the adjustment means 26. When the cam 40 advances to draw the collet 7 back into a clamping position, the feeding stroke will have been completed, and the valve 43 may be shifted back into the normal position shown. In this normal position, pressurized fluid is conducted to the tail end of cylinder 20 while fluid to the head end is exhausted to the sump 46, thus resetting the rack 21 for the next feed cycle, due to the overrunning feature of clutch 23.

In Fig. 4, I show a modification of the invention wherein electric rather than hydraulic means are employed for advancing the lead screw 17 in known and successively equal feed increments. To assure equality of successive increments, I employ a feed-back system or servomechanism which may utilize a generator unit 50 and a motor unit 51. For simplicity, the servomechanism has been schematically indicated as a synchro system, but it will be understood that the mechanism may include servo-amplifier and control-transformer means (not shown). The term servomechanism will thus be understood to include any motion-transmission system which does not rely on mechanical connections between the generator unit (input) and the motor unit(output).

In the schematic form shown, the motor unit 51 is geared through a pinion 52 and gear 53 directly to the lead screw 17, and the generator 50 is operated upon reciprocation of a rack 54, driving a pinion 55. The rack 54 may be recip-

rocated in timed relation with operation of the collet-actuating means of the lathe 6, by employment of cam-follower means 56 for a cam 57, which may be on the same camshaft 41 as the collet-actuating cam 40 (Fig. 3). In the form shown, the cam follower 56 is connected through a reverse link 57 to the rack 50, and the pivot 58 for the link 57 is displaceable, as by adjustably setting a block 59 in suitable guides 60. It will be understood that the effect of adjustment of the block 59 in its guides 60 may be to shorten or to lengthen the stroke of rack 54 relatively to the stroke of the cam-follower means 56, and that the incremental feed imparted to the pusher means by the motor 51 may be correspondingly adjusted. Since it is desired that the feed imparted to the pusher means be in one direction only for each cycle of the cam 57, a one-way engaging clutch 61 may be interposed between the pinion 55 and the generator unit 50, so as to assure only a one-way operation of the generator unit 50 and hence only a one-way operation of the lead screw 17.

In the further embodiment shown in Figs. 5 and 6, the lead screw 17 is held fixed against rotation, as by key means 63 locking the lead screw 17 to the end frame standard 19. Feed increments may then be obtained by rotatably driving a part of the pusher means in threaded engagement with the lead screw 17. In the form shown, an electric servo or synchro system similar to that described for Fig. 4 may be employed in what may be termed a rotating-nut system (Figs. 5 and 6). In the latter arrangement, I show the motor unit 64 of the feedback system mounted on a bracket 65 carried by the rear carriage 66 (corresponding to the rear carriage 16 of Fig. 1) of the pusher means. The motor unit 64 may be electrically connected to the generator unit 50 of Fig. 4, as will be clear.

In the form shown, rotary drive is imparted to a nut member having three jaws or elements 67—67'—67'' in threaded engagement with the lead screw 17, and this drive is taken from a gear 68 on the motor 64, to a pinion 69 on an idler shaft 70 carrying a further gear 71. The gear 71, in turn, drives a gear 72, which may be journalled in thrust-receiving antifriction bearing means 73 on the axis of the lead screw. The jaw or nut elements 67—67'—67'' may be carried by the gear 72.

In order that the pusher means may be readily retracted from the advanced position, as when restocking the feeding mechanism, the nut means 67—67'—67'' may be readily retractable from threaded engagement with the lead screw 17, and a simple insertion and twisting of a drill-chuck key 74 may serve to release the nut elements. In the form shown, each of the elements 67—67'—67'' carries a pair of longitudinally extending stud pins, as in the case of the pins 75 for the nut element 67. The pins 75 each engage camming slots 76 in a plate 77 fixed as by screws 78 to the gear 72. A ring 79 is slidingly supported against a shoulder on the plate 77, and radial key means 80—81—82 between the ring 79 and each of the nut or jaw members 67—67'—67'' serves for the proper angular spacing of these jaw members. The drill-chuck key 74 may be inserted in one of a number of radial holes in the ring 79 so that its bevel pinion 83 may engage a mating bevel-gear face 84 on the plate 77. It will be clear that rotation of the key 74 may cause relative rotation of all three nut elements 67—67'—67'' with respect to the plate 77 and hence with respect to the gear 72, and that by virtue of the cam slots 76 this relative rotation may cause engagement or not with the lead screw 17.

I prefer that the nut elements 67—67'—67'' be so designed that when clamped into threaded engagement with the lead screw 17 they abut each other before binding upon the lead screw. By properly selecting the camming sense of the slots 76 with respect to the threaded direction of lead screw 17, the nut elements 67—67'—67'' may be caused to assume and hence to hold the threaded engagement with the lead screw when rotational feed increments are applied by way of the gear 72. In such case, no locking means would be required during feeding, and the key 74 may serve primarily for a manual release of the threaded engagement with the lead screw 17, as will be clear.

It will be clear that I have described relatively simple stock-feeding mechanisms which may provide means for eliminating the stock-stop on a lathe or the like machine and which, therefore, may provide additional working area for the more efficient use of tools. At the same time, my mechanisms will be understood to provide positive accurate feed increments regardless of the unconsumed usable remainder of the stock 5 to be fed. There may be relatively little back-lash in the engagement between carriage 16 and lead screw 17, and whatever the back-lash the momentum of the stock 5 is always in the same direction so as to assure stoppage in the same feed-out position.

While I have described my invention in detail for the preferred form shown, it will be understood that modifications may be made within the scope of the invention as defined in the appended claims.

I claim:

1. In combination, a lathe-type machine with an internally fed spindle journalled therein, and a stock-feeding mechanism including longitudinally extending pusher means with chucking means to engage stock at the forward end thereof, a longitudinally extending lead screw in engagement with said pusher means, feed means including one-way-engaging clutch means rotating said lead screw, and frame-based positive-stop means constantly removed from the area of stock in said machine and in stopping relation with said lead screw for arresting rotation of said lead screw, whereby no stock-stop means need be employed on said machine and yet there may be accurate feed-out increments for the stock being fed.

2. The combination of claim 1, in which a carriage is provided to support said pusher means, said carriage being longitudinally movable with respect to said machine and detachably latched to said pusher means, for the purpose described.

3. In a stock-feeding mechanism of the character indicated, longitudinally extending pusher means including a chuck to grasp stock to be fed, a longitudinally extending lead screw in threaded engagement with said pusher means, feed means including reciprocating means and one-way engaging clutch means connecting said reciprocating means to said lead screw for advancing said lead screw with successive increments, and adjustably fixed means for selectively positively limiting the stroke of said reciprocating means, whereby the stock may be positively fed and stopped for equal feed-out distances with successive feeding operations.

4. In a machine of the character indicated, collet means, collet-actuating means, a fixed longitudinally extending lead screw, pusher means including a rotatable part in threaded engagement with said lead screw, and a servomechanism including servomotor means for driving said rotatable part, and servogenerator means for said servomotor means and connected for operation in timed relation with operation of said collet operating means, said last-defined connection including one-way-engaging clutch means for unidirectional drive of said servogenerator means.

5. A machine according to claim 4, in which said servomotor means is carried with said pusher means, and in which there is a flexible connection between said servogenerator means and said servomotor means.

6. A machine according to claim 4, in which said connecting means for timing the operation of said generator means includes an adjustable element for controlling the operation of said servogenerator means, whereby the feed of said pusher means may be correspondingly adjusted.

7. In combination, a lathe-type machine including a collet and means for actuating said collet and a cam synchronized with said collet-actuating means, and a stock-feeding mechanism including longitudinally extending pusher means with chucking means to engage stock at the forward end thereof, a longitudinally extending lead screw, rotatable means carried by said pusher means and in threaded engagement with said lead screw, motor means for rotating said rotatable means, generator means for said motor means and connected for operation by said cam, the connection between said cam and said generator means including a one-way-engaging clutch, and a feed-back connection from said motor means to said generator means, whereby upon a given actuation of said generator means by said cam said pusher means may be advanced a known and corresponding amount.

8. In a stock-feeding mechanism of the character indicated, a frame including fixed elongated guide means, pusher means guided by said guide means and including a part to engage a piece of stock, lead-screw feed means including an elongated lead-screw member carried by said frame and a lead-screw engaging member carried by said pusher member, reciprocating feed means, one-way-engaging clutch means connecting said feed means to drive one of said members relatively to the other, and adjustably fixed means carried by said frame for selectively adjusting the effective stroke of said reciprocating means.

9. A stock-feeding mechanism according to claim 8, in which said pusher means includes two spaced carriages independently slidably guided by said fixed guide means and including aligned pusher-bar guide means, a pusher bar axially clamped to one of said carriages and with elongated guide means slidably supported in the pusher-bar guide means of the other of said carriages, and a positive connection between said one carriage and said feed means.

10. A combination according to claim 9, in which said one carriage includes means for selectively disengaging said lead screw therefrom.

11. The combination of claim 9 in which said other carriage and said pusher means are detachably latched, when said other carriage is near

the projecting end of said pusher means, whereby said carriage may provide best aligned support for the stock whether the rear end of the stock is completely within said machine or projecting rearwardly thereof.

12. In a stock-feeding mechanism of the character indicated, a frame including elongated guide means, pusher means guided by said guide means and including a part to engage a piece of stock, lead-screw feed means including an elongated lead-screw member carried by said frame and a lead-screw engaging member carried by said pusher member, positive direct-acting incremental feed means, a one-way-engaging clutch connecting said feed means in direct-driving relation with one of said members, and adjustably fixed positive increment-limiting means, whereby upon adjustment of said limiting means the exact feed of stock in any feeding operation may be accurately selected regardless of load variations as a length of stock is consumed.

13. In a stock-feeding mechanism of the character indicated, pusher means to engage a piece of stock to be fed, a frame, a longitudinally-extending lead screw journalled in said frame and threadedly engaged with said pusher means, feed means for said lead screw and including a fluid pressure-operated piston and a one-way engaging clutch between said piston and said lead screw, said clutch being engaged for one direction of piston movement and disengaged for the opposite direction of piston movement, whereby upon advance and retraction of said piston said lead screw may be rotated only in a feed direction, rack-and-pinion means driven by said piston and connected to drive said lead screw, and an adjustably fixed stop for said rack-and-pinion means for selectively determining a feeding stroke.

14. In combination, a lathe-type machine including a spindle with collet means and a stock-feeding mechanism to feed stock through the back end of said collet means, said stock-feeding mechanism including longitudinally extending guide means, pusher means to be guided by said guide means and including a chuck for a locking grip on a piece of stock, a member locked against axial displacement with respect to said chuck, lead-screw feed means for said member, reciprocating drive means including a one-way-engaging ratchet connecting said drive means to said member, and adjustable positive feed-increment limiting means for said drive means.

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