Feb. 27, 1940. M. H. ARMS ET AL 2,191,930

WORK FEEDING MECHANISM

Filed Jan. 28, 1938 5 Sheets-Sheet 1

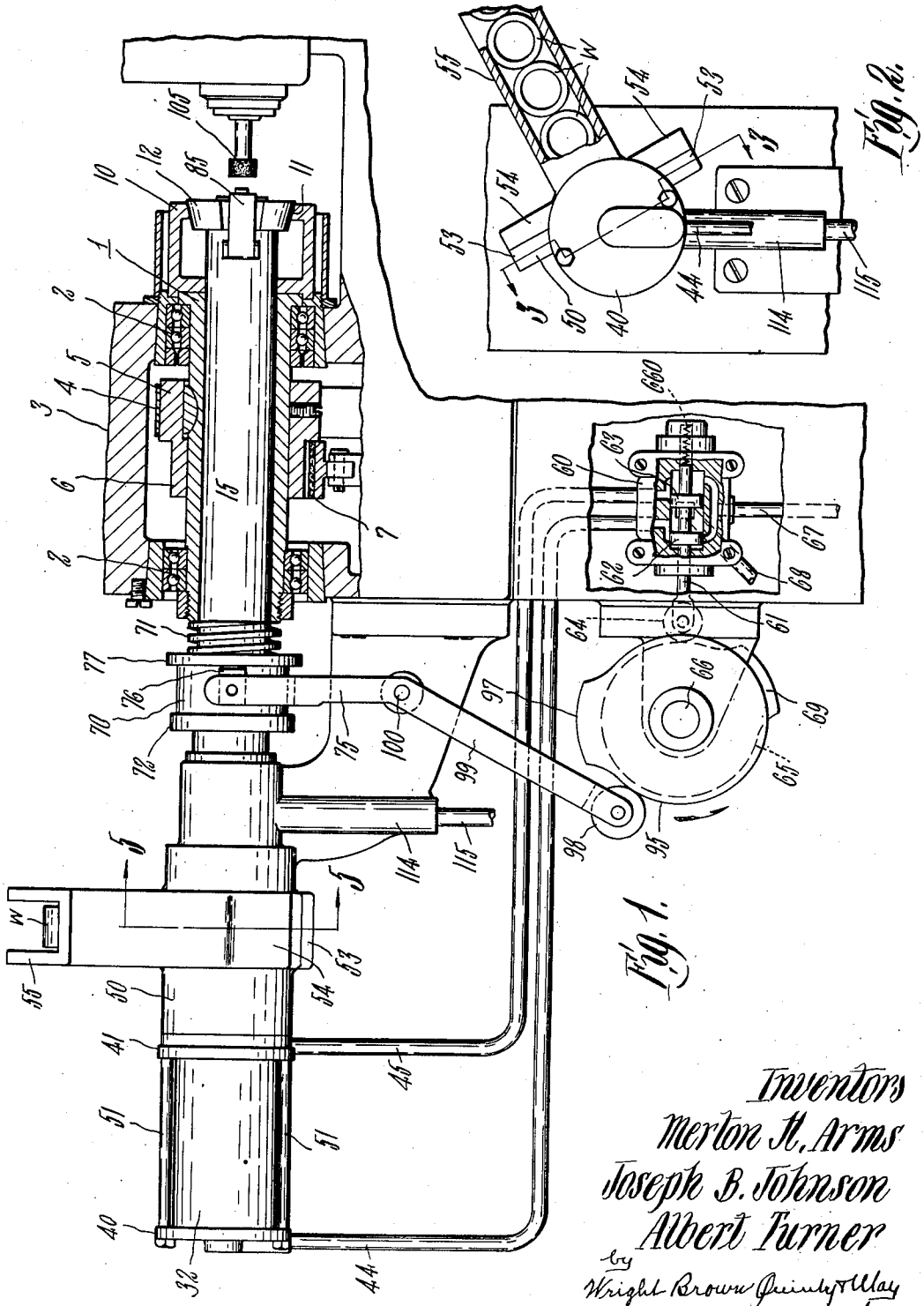


Fig. 1.

Fig. 2.

Inventors
Merton H. Arms
Joseph B. Johnson
Albert Turner
by
Wright Brown Quinby & May
Attys.

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WORK FEEDING MECHANISM

Filed Jan. 28, 1938 5 Sheets-Sheet 2

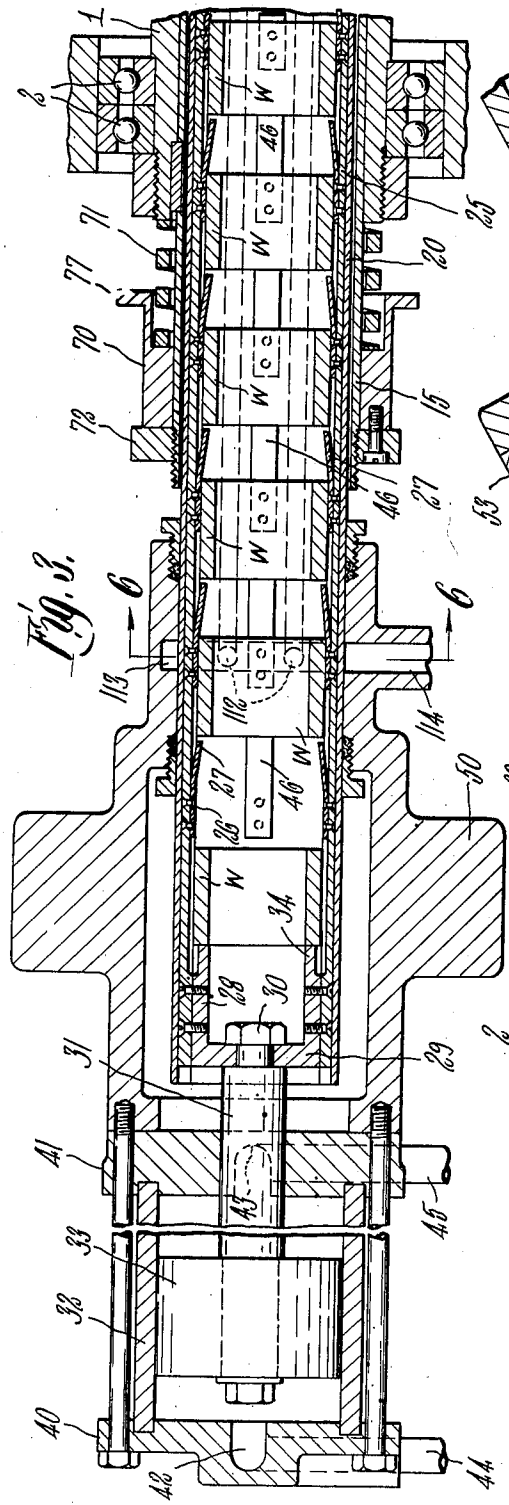


Fig. 3.

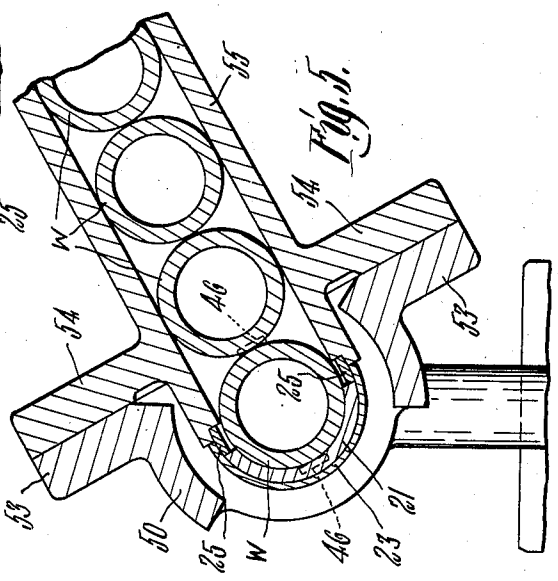


Fig. 5.

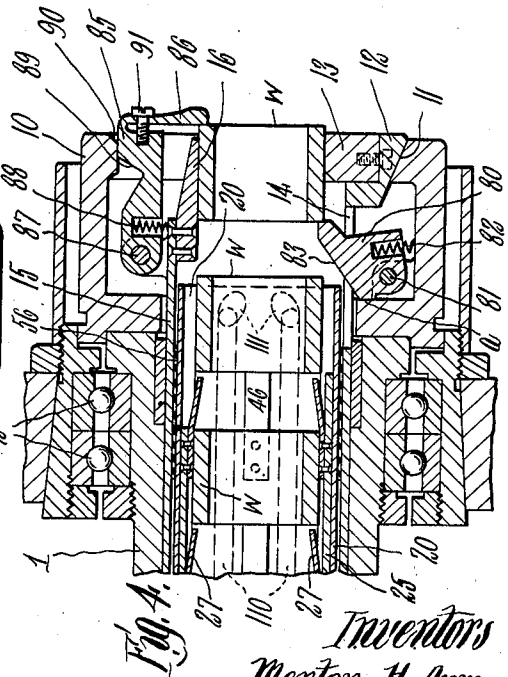


Fig. 4.

Inventors
Merton H. Arms
Joseph B. Johnson
Albert Turner
by Wright Brown Quinby & May
Attys.

Feb. 27, 1940. M. H. ARMS ET AL 2,191,930

WORK FEEDING MECHANISM

Filed Jan. 28, 1938 5 Sheets-Sheet 3

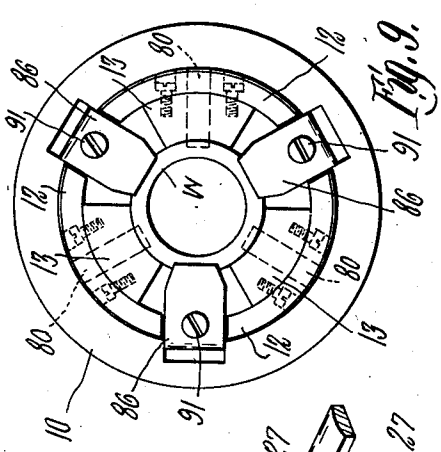


Fig. 9.

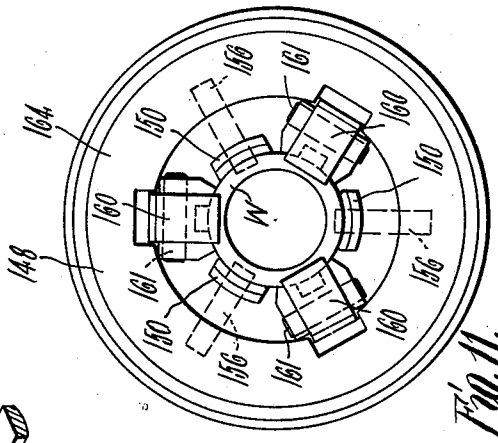


Fig. 11.

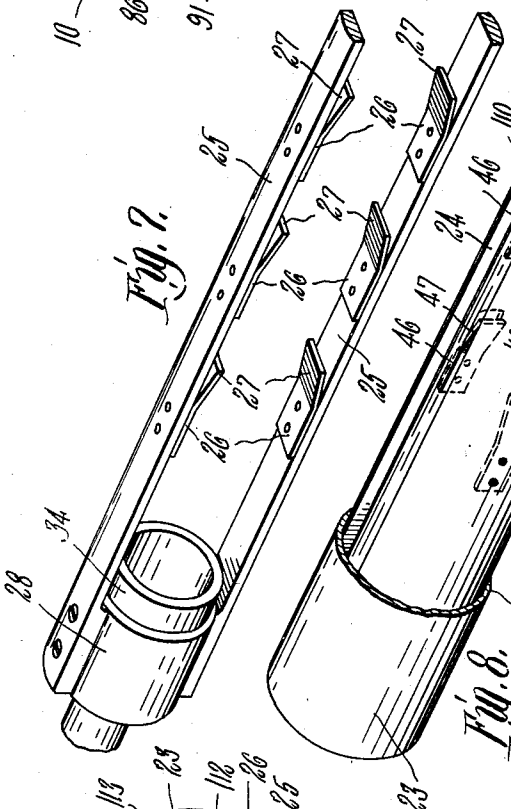


Fig. 7.

Fig. 8.

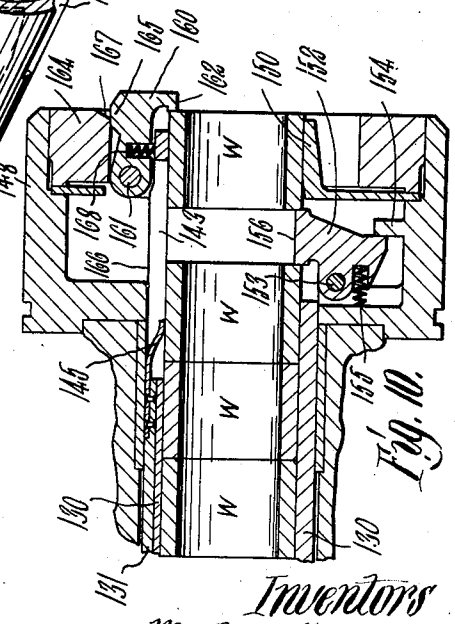


Fig. 10.

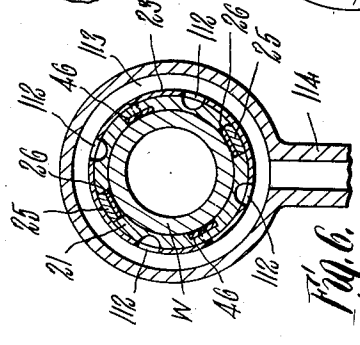


Fig. 6.

Inventors
Merton H. Arms
Joseph B. Johnson
Albert Turner
by
Wright Brown Quinby & May
Attys.

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WORK FEEDING MECHANISM

Filed Jan. 28, 1938 5 Sheets-Sheet 4

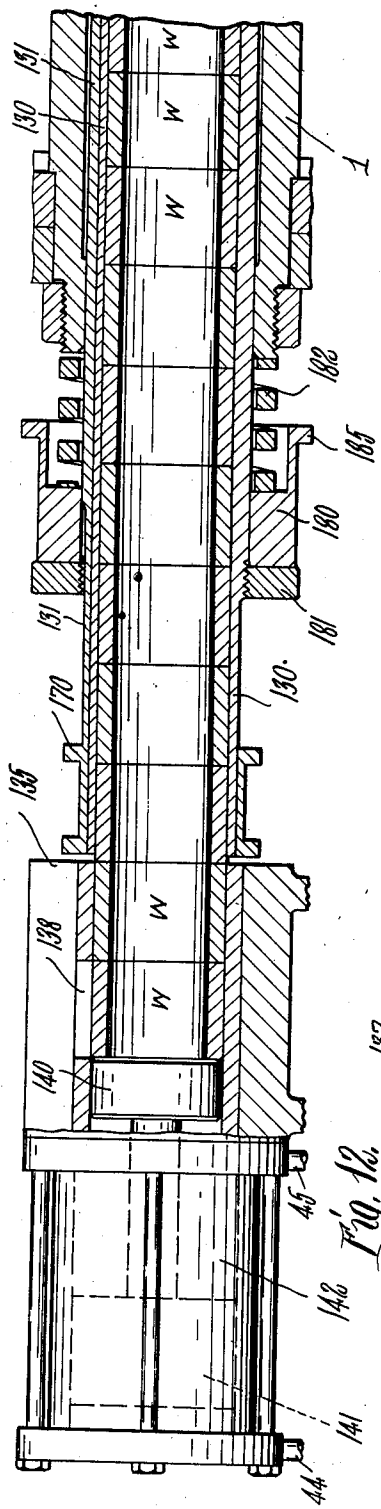


Fig. 12.

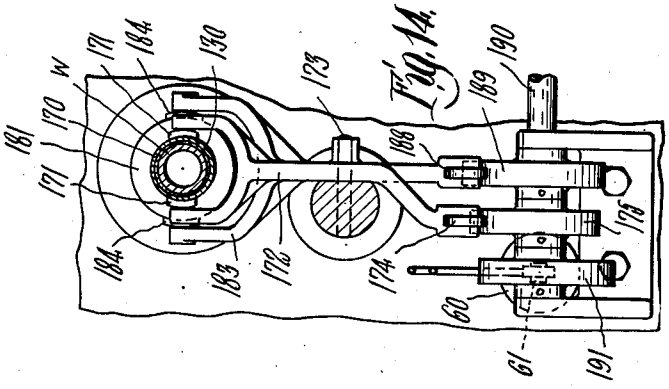


Fig. 14.

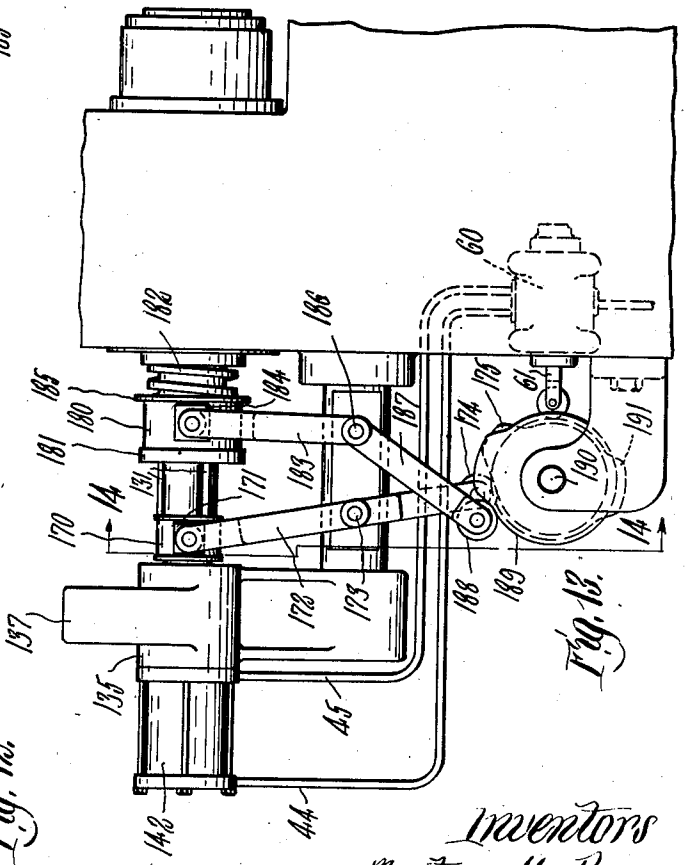


Fig. 13.

Inventors
Merton H. Arms
Joseph B. Johnson
Albert Turner
by Wright Brown Quinby & May
Attys.

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WORK FEEDING MECHANISM

Filed Jan. 28, 1938 5 Sheets-Sheet 5

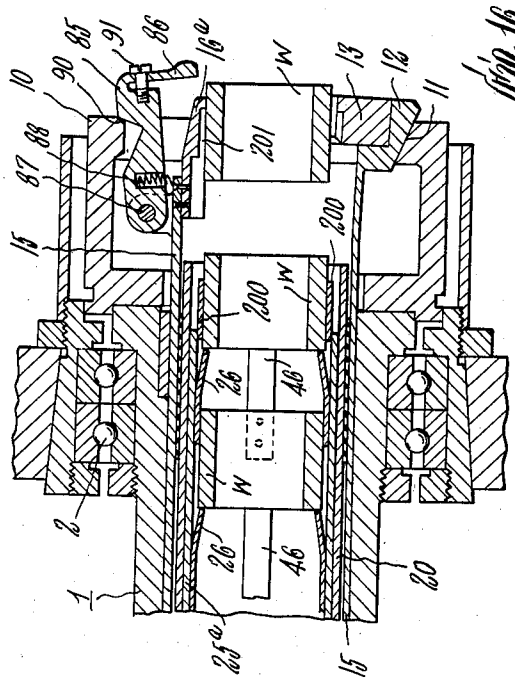


Fig. 16.

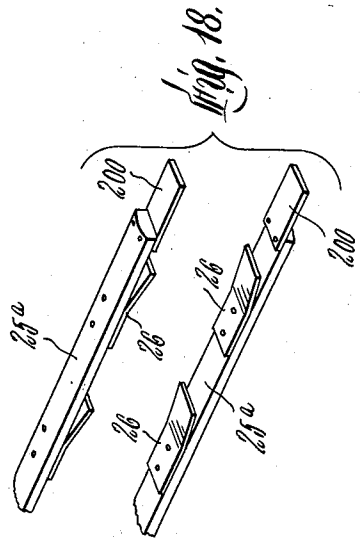


Fig. 18.

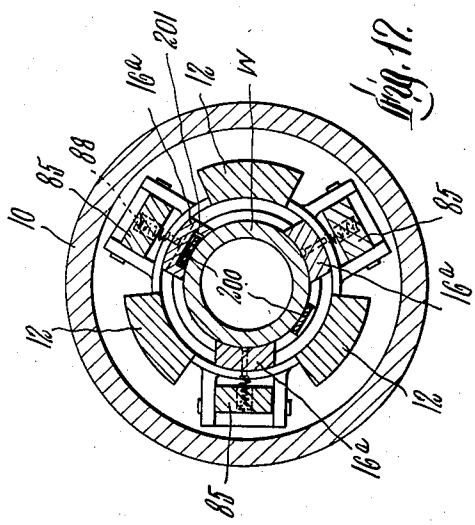


Fig. 17.

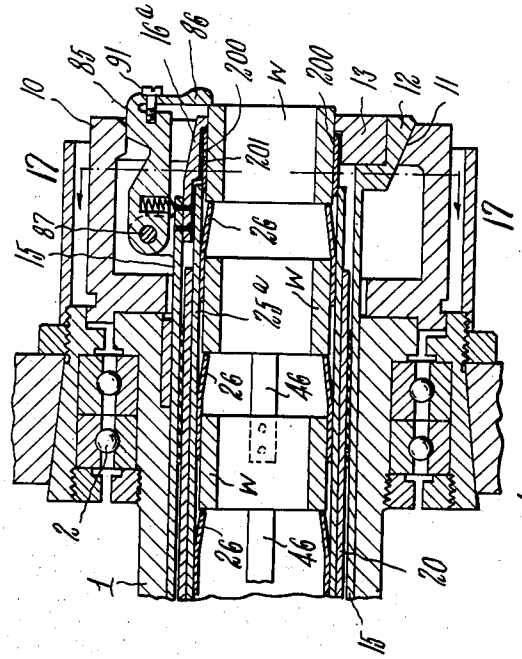


Fig. 15.

Inventors
Merton H. Arms
Joseph B. Johnson
Albert Turner
by Wright Brown Quinby & May
Attys.

Patented Feb. 27, 1940 2,191,930

UNITED STATES PATENT OFFICE

2,191,930

WORK FEEDING MECHANISM

Merton H. Arms, Joseph B. Johnson, and Albert Turner, Springfield, Vt., assignors to Bryant Chucking Grinder Company, Springfield, Vt., a corporation of Vermont

Application January 28, 1938, Serial No. 187,462

24 Claims. (Cl. 51—215)

This invention relates to the feeding of work to be operated upon and more particularly to the feeding of individual work pieces, and has for an object to provide means for the feeding of such pieces through a hollow spindle and into a chuck adapted to grip the work pieces as they are fed into it and to release them after the desired work has been done thereon.

The invention further relates to a chuck construction especially designed for cooperation with the work feeding means.

For a more complete understanding of this invention, reference may be had to the accompanying drawings in which

Figure 1 is a fragmentary view partly in side elevation and partly in section of an internal grinding machine illustrating one embodiment of this invention.

Figure 2 is a left end elevation of a portion of the mechanism shown in Figure 1.

Figures 3 and 4 is a section to a larger scale on line 3—3 of Figure 2, Figure 4 showing the chuck.

Figure 5 is a section to a larger scale on line 5—5 of Figure 1.

Figure 6 is a section on line 6—6 of Figure 3.

Figure 7 is a perspective view of the work-engaging portion of the feed mechanism.

Figure 8 is a fragmentary perspective view of the stock tube.

Figure 9 is a front elevation of the chuck.

Figure 10 is a view similar to Figure 4, but showing a modified construction.

Figure 11 is a front end elevation of the mechanism shown in Figure 10.

Figure 12 is a view similar to Figure 3, but showing the modified construction of Figures 10 and 11.

Figure 13 is a fragmentary side elevation of an internal grinder provided with the work feeding mechanism of Figures 10 to 12.

Figure 14 is a detail section on line 14—14 of Figure 13.

Figure 15 is a view similar to Figure 4, but illustrating a modified construction and showing the chuck closed.

Figure 16 is a view similar to Figure 15, but showing the chuck open.

Figure 17 is a section on line 17—17 of Figure 15.

Figure 18 is a fragmentary perspective view of the feed bars used in the construction of Figures 15 to 17, inclusive.

Referring first to the construction shown in Figures 1 to 9, inclusive, at 1 is indicated a hollow work spindle, which is journaled in bearings at 2 in a portion 3 of the machine. The spindle may be rotated by any suitable means, as, for example, by a belt 4 passing about a pulley 5 keyed to the spindle, and, as shown, provided with a brake drum extension 6 for receiving a brake shoe 7 by which the rotation of the spindle may be stopped quickly when desired. The spindle 1 carries at one end a chuck 10. This chuck has a tapered internal face 11 with which cooperate jaws 12 having work-engaging blocks 13. These jaws 12 are carried at the outer ends of spring fingers 14 projecting from the forward end of a sleeve 15 axially slidable within the spindle 1 so that as the sleeve 15 is moved to the left, as viewed in Figure 4, the clamping blocks 13 are brought toward the axis of the spindle, thus to firmly clamp the work. By moving the sleeve to the right the blocks 13 spring outwardly and release the work. The sleeve 15 has attached to its free end shoes, such as 16a, which are positioned to guide the work in between the clamping jaws 13 so that work pieces may be fed into the chuck from within the hollow spindle.

The work consists of individual pieces as W, which are slidable within a tube 20, which, as shown best in Figure 8, may comprise a pair of inner and outer sleeves 21 and 23. The inner sleeve 21 is slotted, as at 24 (see Figure 8) and within these slots ride feed bars 25 which are shown detached in Figure 7. Each of these bars is provided with a series of spring stock-engaging fingers 26 which are secured to the bars at intervals, with free ends, as 27, projecting inwardly toward the axis of the spindle and positioned to engage between successive spaced apart work pieces W within the inner sleeve 21, as shown in Figure 3. The outer sleeve 23 is continuous and holds the bars 25 from outward movement. At their rear ends the bars 25 are secured to a tubular actuating part 28 which has a closed end 29 in which is secured, as by a nut 30, the forward end of a work feeding plunger 31. This plunger extends into a fluid pressure cylinder 32 where there is fixed thereto a piston 33 slidable within the cylinder. The member 28 is provided with a forward extending portion of reduced diameter, as at 34, which may engage the rear end of the last work piece W within the tube 20. It will be noted that the member 28 with the feed bars 25 is slidable within the inner sleeve 21.

The heads 40 and 41 for the cylinder 32 are provided with fluid pressure ports 42 and 43, respectively, with which communicate fluid pressure pipes 44 and 45 by which fluid under pressure may be admitted or exhausted to cause re-

ciprocation of the piston 33 and the work feeding fingers 25 to feed the work pieces forwardly within the tube 20 on each inward movement, these work pieces being spaced apart as shown. The inner sleeve 21 is shown as provided with spring fingers 46 having free ends 47 projecting inwardly, yet yieldable to permit the stock pieces W to be fed therepast toward the chuck, and springing back behind each work piece as it passes by and preventing return movement of the work pieces during the retraction of the feed bars 25.

The heads 40 and 41 of the cylinder 32 are secured together and to a stationary member 50 within which the rear end of the tube 20 extends, as by bolts 51, and this member 50, as shown best in Figure 5, is provided with a pair of flanges 53 to which may be secured a flange 54 of a work-holding upwardly inclined chute 55. The work pieces, which are shown as ring members, may be fed into the upper end of the chute 55 from which they may fall through a slot into the rear end portion of the tube 20 into the position shown in Figure 3 directly in front of the feeding member 28 by which they may be fed forward into the tube 20. As shown herein, the tube 20 is non-rotatable, being secured to the member 50, its forward end extending into the spindle 1 and opening adjacent to the back of the chuck 10, the sleeve 15 being journaled thereon through an interposed rubber sleeve 56. Fluid under pressure is supplied and exhausted with reference to the opposite ends of the cylinder 32 through the pipes 44 and 45 by means of a valve 60 (see Figure 1), the stem 61 of which is provided with the heads 62 and 63 and whose outer end carries a cam roller 64 for cooperation with a cam 65 secured to a shaft 66. The follower roll 64 is held up against its cam as by means of a spring 660 bearing against the inner end of the valve stem 61. Fluid under pressure is supplied to the valve through the pipe 67 and is discharged therefrom through a pipe 68. In the position shown in Figure 1, fluid under pressure is admitted from the inlet pipe 67 past the head 63 and into the pipe 45 so as to hold the piston 33 in its retracted position, but when the high spot 69 of the cam 65 contacts with the follower roll 64, the valve stem is moved to its opposite position where fluid under pressure is supplied to the pipe 44 and discharged from the pipe 45, thus causing the piston with the feed fingers to be moved in feeding direction.

It will, of course, be necessary that the chuck be open when the feed action takes place in order that the work piece next adjacent to the chuck may be fed thereinto. This is accomplished, as shown, by the axial motion of a spool 70 normally spring pressed to its left hand position by the coil spring 71 bearing against its right hand end and against the adjacent end of the spindle 1. This spool 70 is secured as by its flange 72 threaded thereon to the rear end of the chuck sleeve 15, and while it rotates with the spindle, it may be moved axially by means of a fork 75 having shoes 76 which may be engaged back of the spool flange 77. Rocking of the fork 75 in clockwise direction, as viewed in Figure 1, causes the sleeve 15 to be pushed forwardly, thus releasing the clamping jaws 13 and permitting the stock piece next to the chuck to be pushed thereinto, this, in turn shoving out at the forward end the piece previously in position within the chuck.

The work piece, which is moved into the chuck, passes by stop member 80, one of which is shown in Figure 4. Each member 80 is pivoted, as at 81, to the chuck member 10 and is normally spring pressed by the spring 82 into position with its inner rear end engaging with the chuck body at *a* and back of the rear face of the work piece W within the chuck, but it may be depressed by the engagement of the work piece W on its rearward inclined face 83 so as to permit the work piece to pass freely therepast. As soon as the work piece passes beyond it, it is pushed into stopping position by its spring 82. On the subsequent rearward motion of the sleeve 15 to close the chuck the work which has just been fed thereinto is clamped in position by the jaws 12 carrying the blocks 13 after it has been pushed back against the stops 80 by spring fingers 86 on the clamping jaws 85. These jaws 85 are fulcrumed as at 87 on the forward end of the sleeve 15 and are normally urged outwardly as by springs 88 reacting between them and the end portion of the sleeve 15. They are provided with inclined faces 89 cooperating with inclined faces 90 on the chuck 10 so that as the sleeve 15 is drawn backwardly to close the chuck, the fingers 85 are closed. The extent of the pressure of the spring fingers 86 against the forward face of the work piece may be adjusted as by means of the screws 91 which extend through holes in the spring fingers 86 and are threaded into the members 85. When the chuck opens, these fingers 86 are removed from their normal positions in which they would prevent the discharge of work from the chuck.

The actuation of the fork 75 to free the work or to permit the spring 71 to clamp the work is produced by a cam 95, also carried by the shaft 66 and which is provided with a hump 97. When this hump engages the cam follower roll 98 journaled on the arm 99 of the fork 75, this fork is swung about its pivot 100 in a direction to release the chuck, whereupon the shift of the valve stem 61 is effected to accomplish the feed of the stock.

In Figure 1 the grinding wheel 105 for operating on the work pieces which are successively presented into the chuck is illustrated, this grinding wheel being driven by any suitable means (not shown).

Another feature of the present invention is the introduction of coolant to the work piece as it is being operated upon, through the hollow spindle. For this purpose the sleeve 21 is shown as provided with longitudinal grooves 110 in its outer face which lead to ports 111 (see Figure 4) passing therethrough adjacent to the forward end of the sleeve. These grooves 110 are closed off on their outer faces by the sleeve 23 so that coolant passages are formed through the tube 20 comprising the sleeves 21 and 23 and the sleeve 23 is provided with holes 112 therethrough communicating with the rear end portions of the grooves 110 as shown in Figures 3 and 6. The member 50 is also provided with an annular internal groove 113 with which the openings 112 register, this passage 113 being extended on one side to form the bore of an inlet pipe 114 through which coolant may be introduced, as through the supply pipe 115 shown in Figure 1.

In Figures 10 to 14 a modification is shown in which the work pieces are fed to the chuck in contacting relationship with each other, instead of in spaced relationship as in the construction previously described. In this modification the work pieces W are fed through the sleeve 130, which is provided with longitudinal external

grooves for the guided passage of feed bars 131. The sleeve 130 rotates with the spindle 1 and terminates at its rear end outwardly of the stationary member 135. This member 135 corresponds generally, in function, to the member 50 in the mechanism previously described, having the chute 137 through which stock may be supplied through a slot 138 (see Figure 12) into alinement with the work pieces within the sleeve 130. Within this member 135 they are contacted by the feeding plunger 140 actuated by the piston 141 in the fluid pressure cylinder 142.

The feed bars 131 have secured thereto at their forward ends resilient feed fingers 145 (see Figure 10) which extend through slots 143 of the sleeve or tube 130 and engage only the last work piece back of the chuck 148. This chuck 148 is somewhat similar to the chuck 10 previously described. It is provided with guide fingers 150 between which the work piece may be guided and supported while in the chuck, and the work pieces are fed into the chuck successively past the stop dogs 152. Each stop dog is pivoted as at 153 and is spring pressed against a stop 154 as by means of a spring 155. When resting against the stop 154 a portion 156 of each dog extends in between the work piece in the chuck and the next work piece to be fed thereinto. In this position, also, clamping dogs such as 160 pivoted at 161 have their inner ends at 162 pressed against the forward face of the work piece then in the chuck as by engagement of the blocks 164 against portions 165 of these clamp dogs. These clamp dogs are secured to the extensions 166 of the sleeve 130 and this sleeve is arranged to be pulled rearwardly to bring the dogs 160 down into locking position and to pull them back against the forward face of the work piece. On inward motion of the sleeve 130, the portion 165 of each of the locking dogs may ride outwardly across an inclined face 167 of the block 164, thus permitting these dogs to release the work under the action of their releasing springs 168. The sleeve 130 may be reciprocated to thus clamp or release the work.

The feed fingers 131 may be actuated to feed the last work piece in the sleeve 130 into the chuck. For this purpose they have fixed to their rear ends a spool 170 between the flanges of which ride follower blocks 171 on a fork 172. This fork 172 is fulcrumed as at 173 and carries at its opposite end a cam follower roll 174 riding on an edge cam 175. The sleeve 130 is actuated to open and close the chuck by motion of a spool 180 having its rear flange member 181 secured as by threading to the sleeve 130. This spool 180 is normally held retracted to hold the work clamped by the chuck and held back against the dogs 156 by means of a spring 182 (see Figures 12 and 13) and it is moved inwardly to release the work from the chuck so that a succeeding work piece may be fed thereinto and the work piece in position discharged from the chuck by the feeding motion of the feed bars 131. This is done by the rocking of a fork 183 having shoes 184 which may be engaged with the spool flange 185. This fork 183 is fulcrumed at 186 and its arm 187 carries a cam follower roll 188 which rides on the edge cam 189. The two cams 175 and 189 are carried by the shaft 190 which carries a third edge cam 191 which actuates the valve plunger 61 of the valve 60, as heretofore described, to produce the fluid pressure feeding action of the work pieces within the sleeve or tube 130. Thus, after the chuck has been opened the feed fingers 145 are actuated to feed the last work piece in tube 130 into the chuck, dislodging the work piece previously therein, the dogs 156 yielding to permit the passage of the work pieces in this direction. This feeding motion of the fingers 145 effects only the last work piece in the sleeve 130 and spaces it from the next work piece sufficient to permit the dogs 156 to spring in between. Thereafter the closing movement of the chuck clamps the work piece therein against the stop dogs 156 in the position shown in Figure 10.

In Figures 15 to 18 is shown a further modification in which the work pieces are fed spaced apart, as in the structure shown in Figures 1 to 9, but in this modified construction no stops such as 80 of Figure 4 are employed. The work feed bars such as 25*a* are each extended and provided with a spring 200 forwardly of their feed fingers 26. These springs may ride in grooves 201 in the inner faces of the shoes 16*a* carried by the sleeve 15, as shown in Figure 15, when the work is in fed position, and they may be retracted to engage the next work piece as shown in Figure 16 ready for a succeeding feeding motion of the bars 25*a*. In the latter position of the parts the sleeve 15 has been moved forwardly to permit the jaws 85 to be released from the work by the springs 88. A succeeding feed motion of the bars 25*a* then pushes the next piece to be machined into the chuck, pushing out the finished piece, and then instead of retracting all the way they will be retracted only sufficiently for the springs 200 to retract the work piece in the chuck enough for the jaws 85 and the fingers 86 to swing in without the fingers striking on the periphery rather than on the outer end of the work piece in the chuck. The work piece is then held between the jaws and the ends of the forward feed fingers 26 as shown in Figure 15, the feed fingers then acting as stops in place of the stops 80 of Figure 4, and preferably remaining in stopped position and pressing the work piece forwardly by fluid pressure exerted on the feed piston 33 during the operations on the work piece held in the chuck. Thereafter the feed bars are retracted to the positions shown in Figure 16 preparatory to the succeeding feeding action. The cam for controlling the fluid pressure valve 60 will, of course, be modified in contour to produce this different cycle of motions of the feed bars.

From the foregoing description of certain embodiments of this invention, it should be evident to those skilled in the art that various further changes and modifications may be made without departing from the spirit or scope of this invention as defined by the appended claims.

We claim:

1. In combination, a hollow spindle, a chuck at one end of said spindle, means within said spindle for feeding individual work pieces through said spindle and into said chuck, means for actuating said feeding means intermittently means for opening and closing said chuck in timed relation to the feeding of said work pieces, and means for feeding coolant through said spindle to said chuck.

2. In combination, a rotary spindle, a stationary tube within said spindle comprising a sleeve, a chuck carried at one end of said spindle, said sleeve having longitudinally arranged slots therein, work-feeding bars slidable in said slots, work-engaging fingers carried by said bars for engaging work pieces within said tube, means to open and close said chuck, and means actuated in time with said opening and closing means for

reciprocating said bars to feed work pieces through said tube into said chuck.

3. In combination, a rotary spindle, a stationary tube within said spindle comprising a pair of concentric sleeves, a chuck carried at one end of said spindle, the inner of said sleeves having longitudinally arranged slots therein, work-feeding bars slidable in said slots, work-engaging fingers carried by said bars for engaging work pieces within said tube, means to open and close said chuck, and means actuated in time with said opening and closing means for reciprocating said bars to feed work pieces through said tube into said chuck, said sleeves also forming between them one or more passages for coolant to be delivered to a work piece held by said chuck.

4. In combination, a rotary spindle, a stationary tube within said spindle comprising a sleeve, a chuck carried at one end of said spindle, said sleeve having longitudinally arranged slots therein, work-feeding bars slidable in said slots, work-engaging spring fingers carried by said bars for engaging work pieces within said tube for feeding said work pieces by reciprocation of said bars, means for preventing backward motion of said work pieces when said bars are retracted, means to open and close said chuck, and means actuated in time with said opening and closing means reciprocating said bars to feed work pieces through said tube into said chuck.

5. In combination, a rotary hollow spindle, a tube within said spindle, a chuck carried by said spindle and having work-gripping jaws, and means preventing the discharge of work from said chuck, said tube being positioned at the entrance to said chuck, means for feeding work pieces one by one within said tube toward said chuck, and means for opening said jaws and releasing said preventing means to cause the feeding of said pieces sccessively into said chuck to discharge from said chuck the piece previously fed thereinto, and for positioning said preventing means and closing said jaws to grip the work piece last fed into said chuck.

6. In combination, a rotary hollow spindle, a stationary tube within said spindle, a chuck carried by said spindle and having work-gripping jaws, and means preventing the discharge of work from said chuck, said tube being positioned at the entrance to said chuck, means for feeding work pieces one by one within said tube toward said chuck, and means for opening said jaws and releasing said preventing means to cause the feeding of said pieces successively into said chuck to discharge from said chuck the piece previously fed thereinto, and for positioning said preventing means and closing said jaws to grip the work piece last fed into said chuck.

7. In combination, a rotary hollow spindle, a stationary tube within said spindle, a chuck carried by said spindle and having work-gripping jaws, and means preventing the discharge of work from said chuck, said tube being positioned at the entrance to said chuck, means for feeding work pieces one by one within said tube toward said chuck, a sleeve between said tube and spindle movable axially for opening said jaws and releasing said preventing means to cause the feeding of such pieces successively into said chuck to cause discharge from said chuck of the piece previously fed thereinto, and for closing said jaws and positioning said preventing means to grip the work piece last fed into said chuck, and means for moving said sleeve and said feeding means in proper timed relation.

8. In combination, a hollow spindle, a chuck on said spindle, means movable axially of said spindle for opening and closing said chuck, fluid pressure actuated means for feeding articles successively through said spindle into and then through said chuck while said chuck is open, a valve for controlling said feeding means, a rotary shaft, and means actuated by the rotation of said shaft for actuating said opening and closing means and for controlling said valve.

9. In combination, a hollow spindle, a chuck carried by said spindle, a tube within said spindle and having longitudinal guide grooves therein, bars slidable in said grooves, work-engaging fingers carried by said bars for engaging and moving work pieces in said tube axially thereof and into said chuck, chuck-opening and closing means, and means for actuating said opening and closing means and said bars in proper timed relation.

10. In combination, a hollow rotary spindle, a chuck carried by said spindle, a stationary tube within said spindle and having longitudinal guide grooves therein, bars slidable in said grooves, work-engaging fingers carried by said bars for engaging and moving work pieces in said tube axially thereof and into said chuck, chuck-opening and closing means, and means for actuating said opening and closing means and said bars in proper timed relation.

11. In combination, a chuck, stop means normally limiting one extent of motion axially of said chuck of a work piece carried thereby, means to feed work pieces successively into said chuck, means for engagement with said work piece so fed in position to hold said work piece against said stop means, and means for mounting said stop means to yield to permit the passage of work pieces into said chuck therepast.

12. In combination, a hollow spindle, a chuck on said spindle, means for opening and closing said chuck, means for feeding work pieces in successive spaced relation through said spindle and into said chuck while said chuck is open, a stock stop, and means for interposing said stop in the space between a work piece in said chuck and the next following work piece in said spindle after each feeding action.

13. In combination, a hollow spindle, a chuck on said spindle, means for opening and closing said chuck, means for feeding work pieces in successive spaced relation through said spindle and into said chuck while said chuck is open, a stock stop, means for interposing said stop in the space between a work piece in said chuck and the next following work piece in said spindle after each feeding action, and means for clamping the work piece against said stop.

14. In combination, a hollow spindle, a chuck on said spindle, means for opening and closing said chuck, means for feeding work pieces in abutting relation step by step through said spindle toward said chuck, means for advancing the work piece adjacent to said chuck an amount greater than the extent of said step by step feed into said chuck when said chuck is open to space said piece from the next adjacent piece, a stop, and means for interposing said stop in said space after each feeding action.

15. In combination, a hollow spindle, a chuck on said spindle, means for opening and closing said chuck, means for feeding work pieces in abutting relation step by step through said spindle toward said chuck, means for advancing the work piece adjacent to said chuck an amount

greater than the extent of said step by step feed into said chuck when said chuck is open to space said piece from the next adjacent piece, a stop, means for interposing said stop in said space after each feeding action, and means effective to clamp the work piece in said chuck against said stop.

16. In combination, a hollow spindle, a chuck carried by said spindle, a tube within said spindle having one end portion positioned adjacent to said chuck, means to open and close said chuck, means for feeding work pieces step by step and in contact with each other through said tube toward said chuck, and means engaging each work piece on its emergence from said portion and feeding it by a further amount into said chuck.

17. In combination, a hollow spindle, a chuck carried by said spindle, a tube within said spindle having one end portion positioned adjacent to said chuck, means to open and close said chuck, means for feeding work pieces step by step and in contact with each other through said tube toward said chuck, a member positioned within said spindle and outside of said tube and having means for engagement with a work piece on its emergence from said portion, and means acting while said chuck is open and after each step by step feeding movement of work pieces within said tube to actuate said member to move the work piece projecting from said portion into said chuck.

18. In combination, a chuck having work-clamping jaws and stop means for limiting the axial motion of work backward in said chuck, and means actuable to feed in an individual work piece from the back of said chuck and to hold said work piece against said stop means.

19. In combination, a chuck having work-clamping jaws and spring stop fingers carried by said jaws for engagement with the front end face of a work piece held by said chuck, and means actuable to feed a work piece into said chuck from the back and to hold it against said stop fingers.

20. In combination, a chuck having an internal tapered face, a plurality of work-engaging jaws engaging said face and movable axially of said chuck to grip and release the work therebetween, said jaws having fingers positioned to engage on the forward face of a work piece carried by said jaws, and means actuable to feed work pieces successively into the back of said chuck while said jaws are open, discharging the work piece previously in position, said feeding means presenting stop portions to a work piece fed into said chuck against which said piece is pressed by said fingers as said jaws are moved axially of said chuck into work-gripping positions.

21. In combination, a hollow spindle, a chuck at one end of said spindle, means for feeding a plurality of work pieces in said spindle simultaneously toward said chuck and that one next back of said chuck into said chuck in spaced relation to the next following work piece in said spindle, means for opening and closing said chuck in timed relation to the feeding of said work pieces and means engageable with the back face of the work piece in said chuck for holding said work piece against backward movement.

22. In combination, a hollow spindle, a chuck at one end of said spindle, means for feeding a plurality of work pieces in said spindle simultaneously toward said chuck and that one next back of said chuck into said chuck in spaced relation to the next following work piece in said spindle, means for opening and closing said chuck in timed relation to the feeding of said work pieces, and a work stop moving into and out of position back of the work piece in said chuck in said space.

23. In combination, a hollow spindle, a chuck at one end of said spindle, means having parts engageable with each of such work pieces for feeding each of a plurality of work pieces in spaced apart relation through said spindle and the adjacent one in said spindle into said chuck, and means for opening and closing said chuck in timed relation to the feeding of work pieces.

24. In combination, a hollow spindle, a chuck at one end of said spindle, means for feeding each of a plurality of work pieces in spaced relation through said spindle and the adjacent one in said spindle into said chuck, means for opening and closing said chuck in timed relation to the feeding of said work pieces, and means engageable with the back face of the work piece in said chuck for holding it against backward thrust.

MERTON H. ARMS.
JOSEPH B. JOHNSON.
ALBERT TURNER.