

May 29, 1934.

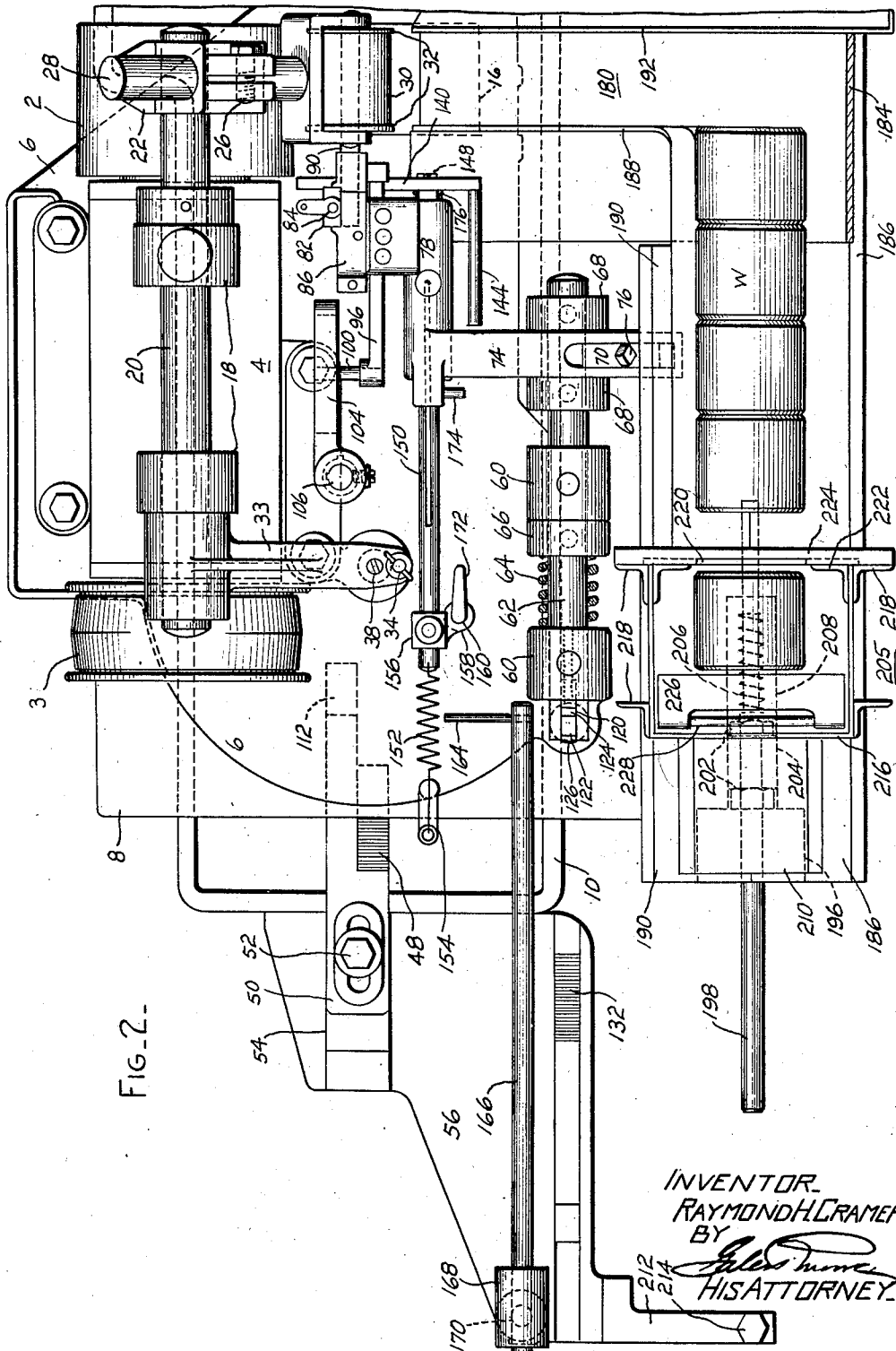
R. H. CRAMER

1,960,730

GRINDING MACHINE

Filed March 26, 1931

3 Sheets-Sheet 2



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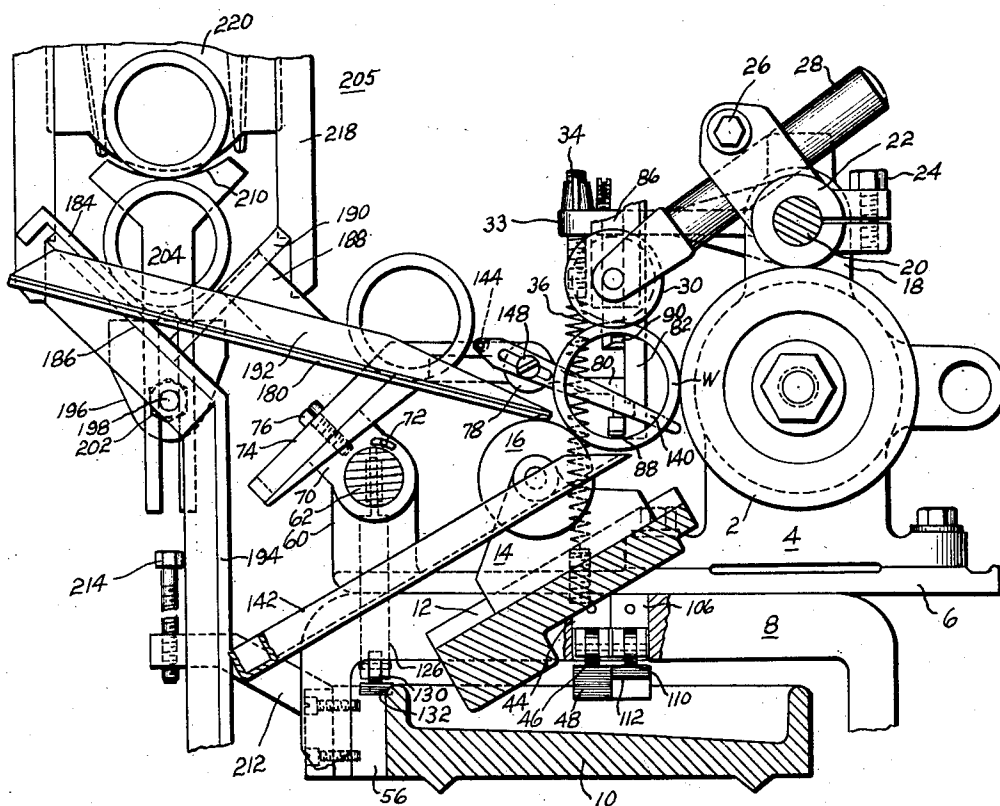


FIG. 3.

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UNITED STATES PATENT OFFICE

1,960,730

GRINDING MACHINE

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Application March 26, 1931, Serial No. 525,374

35 Claims. (Cl. 61—103)

This invention relates to grinding machines and comprises all the features of novelty herein disclosed. An object of the invention is to provide an improved machine for automatically grinding a series of circular articles to a predetermined diameter. Another object is to provide an improved internal grinding machine. Another object is to provide improved mechanism for feeding articles to a grinding machine, more especially an internal grinding machine of the chuckless type. Still another object is to provide an improved chuckless grinding machine.

To these ends and also to improve generally upon machines of this character, the invention consists in the various matters hereinafter described and claimed. In its broader aspects, the invention is not necessarily limited to the specific construction selected for illustrative purposes in the accompanying drawings in which

Fig. 1 is a perspective view of the machine with some parts broken away.

Fig. 2 is a plan view.

Fig. 3 is an end view with some parts omitted and some in section.

A work-piece W, such as a sleeve to be internally ground, is supported and rotated by a series of wheels, one wheel 2 being driven by a belt pulley 3 to control rotation of the work. The wheel shaft is journaled in a head 4 bolted to a base plate 6 rigidly mounted on a bridge 8 attached to a main frame. The frame slidably supports a table or carriage 10 which reciprocates horizontally below the bridge. The carriage supports a grinding wheel G which enters the bore of the work-piece W and has any suitable cross feeding means (not shown) to feed the wheel directly towards the backing or control wheel 2. A lateral extension of the base plate 6 is provided with inclined ways 12 for a slide 14 which rotatably carries a work-supporting idler wheel 16. Upwardly projecting lugs 18 on the head 4 support a rock shaft 20 carrying a bracket 22 clamped to the shaft by a clamping screw 24. The bracket is split and provided with a clamping screw 26 to adjustably support an arm 28 which is forked at its forward end. The fork rotatably carries a pressure idler wheel 30 which has end flanges 32 to prevent endwise movement of the work during grinding.

The idler wheel 30 is lifted automatically to allow a work-piece to be inserted or removed and yieldably presses the work against the other wheels during grinding. An actuating arm 33 is fixed to one end of the shaft 20 and carries an adjusting screw 34 connected to an anchor on the

base plate by a coil spring 36. A lifting rod 38 is adjustably secured to the arm 33, its lower end having a cupped enlargement 40 resting on a ball 42 carried in a recess at the upper end of a plunger 44. The plunger is vertically guided in aligned holes in the base plate 6 and bridge 8 and carries a cam roller 46 in the path of a cam 48 on a slotted cam plate 50. The cam plate is secured by a screw 52 in a groove 54 of an extension 56 bolted to one end of the carriage 10. Whenever the carriage retreats to the right to a retracted position to carry the grinding wheel out of the work, at the conclusion of grinding, the cam 48 engages the cam roller 46 and lifts the rod 38. This rocks the shaft 20 and lifts the pressure idler wheel 30 from the work a sufficient distance to allow a new piece to roll in between the pressure wheel and the supporting idler wheel 16. The ball 42 permits the lifting rod to have a slight tilting movement without cramping.

The front of the base plate 6 has guide lugs 60 one of which has a key for a sliding shaft 62. The shaft is pressed in one direction by a coil spring 64 interposed between one of the guide lugs 60 and a collar 66 on the shaft. Two collars 68 are pinned to the shaft on opposite sides of a bracket 70 which has a limited rocking movement on the shaft. Rocking is limited by a pin 72 entering an arcuate slot in the bracket from one of the collars 68. A slotted arm 74 is adjustably secured to the bracket 70 by a clamping screw 76. The arm projects rearwardly, its middle portion having a hollow boss or enlargement 78 from which projects a gauge supporting extension 80. The extension is fastened at its rear end to a vertical bracket 82 having a screw 84 for vertically adjusting a gauge housing 86. Projecting laterally from the bracket 82 is a gauge-supporting feeler 88 which rests on the inner wall of the work-piece W. The feeler supports the gauge on the work in a floating manner, the entire gauge mechanism being free for a slight angular movement with the arm around a center at the sliding shaft 62. The angular movement permits the feeler to be lifted from the work or lowered against it, as will appear, while the sliding of the shaft 62 permits the feeler to be withdrawn from the work. These movements precede ejection of the work.

Diametrically opposite the gauge supporting feeler 88 is an upper feeler 90 having a vertical slide bar 91 slidable in the gauge housing, the relative movement of the two feelers being shown by an indicator 92. The movement of the feeler 90 also controls successively a number of electric circuits not essential to the present invention. It

is sufficient to note that the first circuits may control an increase in the stroke of the carriage to traverse the grinding wheel across a dressing tool or diamond, the final circuit controlling the retreat of the carriage to a retracted position at the conclusion of grinding. Such carriage movements are now well known in the art of internal grinding.

Pivoted to the front of the gauge housing at 94 is a lever 96 having its shorter arm overlying a stud 98 which projects through a slot in the gauge housing from the vertical slide bar 91. The longer arm of the lever carries a pin 100 which projects loosely into a slot 102 in an arm 104 fastened to the upper end of a vertical plunger 106. The plunger is guided vertically in an opening of the base plate and carries a cam roll 110 arranged in the path of a cam 112 formed on the above described cam plate 50 in advance of the cam 48 and having a shorter incline than the cam 48. When the carriage retreats at the conclusion of grinding, the cam 112 engages the cam roller 110 and lifts the plunger 106. The lever 96 is thereby rocked clockwise, depressing the stud 98 and the upper feeler 90 to free the latter from the work; then, when the stud 98 reaches the bottom of its slot, the lever is locked against swinging and is lifted bodily and with it the gauge housing and the lower feeler 88. Next comes a sliding of the gauge mechanism to the left and away from the work.

The slidable shaft 62 has a slot 120 at one end in which is journaled a cam roller 122. A tapered cam surface 124 on a vertical plunger 126 is arranged to engage the roller and move the shaft to the left. The plunger 126 is guided in aligned openings of the base plate and bridge and carries a cam roller 130 in the path of a cam 132 fastened in a groove of the extension 56. The cam is set a greater distance from its plunger than the cam 112 so that, after the feelers are separated, the shaft 62 will be forced to the left a short distance to move the gauge mechanism away from the work. The pressure idler wheel 30 is lifted as above described after, or simultaneously with, the separation of the feelers and the machine is then ready to eject the work and receive a new piece.

As the carriage retreats, an ejector finger 140 is pushed against the work and slides it endwise from the supporting wheels into an inclined discharge chute 142 down which the finished piece rolls to the front of the machine. The ejector finger projects rearwardly between the feelers, its front end carrying a stop bar 144 which momentarily arrests an incoming piece. The finger 140 is slotted and adjustably secured by a set screw 148 to the end of an ejector rod 150 which is guided in the hollow boss or enlargement 78 and is normally urged to a retracted position by a coil spring 152 attached to a bent stud 154 on the base plate 6. A clamping block 156 is fastened in adjusted position on the rod 150 by a set screw and has a hollow casing 158 housing a catch pin 160 which is pressed down by a coil spring 162 engaging a collar on the pin. A finger 164 projects rearwardly from a long rod 166 which is adjustably clamped in a sleeve 168 on a standard 170 rising from the carriage extension 56. When the carriage retreats to the right, the finger 164 picks up or engages the catch pin 160 and slides the ejector rod 150 to operate the ejector finger. The ejector is released when a cam 172 on the bent upper end of the catch pin strikes a stud 174 on the enlargement 78. This lifts the catch pin so that it is free to ride back over the finger 164 when

the coil spring 152 retracts the ejector rod. When the table returns, the finger 164 engages an incline on the catch pin to get beyond the latter. A short coil spring 176 cushions the ejector finger 140.

An inclined entrance chute 180 has its rear end slotted and arranged substantially tangentially with respect to the supporting idler wheel 16 so that the work will roll freely down the chute and over the wheel 16 into contact with the control wheel 2 when the pressure idler wheel 30 is lifted. Such rolling piece is temporarily arrested, however, by the stop bar 144 when the ejector is advanced to slide a finished piece into the discharge chute. The entrance chute has the front end 184 of its bottom wall bent upwardly into a groove in the front side wall 186 of a V-bottom feed chute which extends horizontally, in an elevated position, at the front of the machine. The entrance chute 180 has a side wall 188 whose front end is bent laterally and extended into a groove of the rear side wall 190 of the feed chute. Another side wall 192 of the entrance chute is formed by an angle iron adjustably mounted on the bottom wall. Work-pieces are guided in end-to-end relation by the feed chute which is supported in elevated position by angle brackets 194 on the front of the machine. The feed chute has its middle portion cut away in the isometric view to reveal the mechanism beyond and below it.

At its left end, the feed chute has a depending lug 196 bored to guide a feed rod 198 which has a second sliding support in an opening in one of the angle brackets 194. A pair of spaced nuts 202 are threaded on the feed rod to secure in adjusted position a vertically slotted pusher bar 204 which pushes the work-pieces along the feed chute from a piled-up position in a magazine 205. A coil spring 206, interposed between one of the angle brackets 194 and one of the nuts 202, presses the pusher bar to retracted position, the bar being guided in a narrow slot 208 at the bottom of the feed chute. The pusher bar is advanced from a position at the left of the magazine to a position beneath it. This pushes the lowermost piece from the magazine, the remaining pieces being supported by a concave seat 210 at the top of the pusher bar. In the isometric view, the bar is shown out of position with respect to its operating means to illustrate its supporting function after advance. Advance is effected during the retreat of the carriage, a bent bracket 212 on the left end of the carriage extension 56 supporting a screw 214 which strikes the outer end of the feed rod 198.

The magazine 205 comprises a U-shaped plate 216 connected to vertical angle irons 218 which are supported on the feed chute. The U-shaped plate 216 encloses three sides of the magazine, the remaining side being closed by a vertically adjustable gate 220 guided by a pair of inner angle irons 222 and by recessed cross bars 224 which connect two of the supporting angle irons 218. Vertical adjustment of the gate 220 and of the pusher bar adapt the feeder for work of different diameters. The magazine also has a contractible lining composed of side plates 226 pivoted at the top to hinge pins 228, the approach of the lower ends of the side plates adapting the magazine for smaller work.

Assuming a work-piece is in grinding position on the supporting wheels, the carriage 10 has a short reciprocation sufficient to traverse the grinding wheel G along the bore of the work, the wheel G having also the usual intermittent 150

cross feeding movement towards the control wheel 2. As the work approaches size, as determined by the gauge, the grinding wheel has one or more limited withdrawals to dress it against a diamond and then returns to finish the piece. When the piece reaches final size, the grinding wheel and carriage retreat to a greater distance under gauge control. In this final retreat, the cam 112 comes into action on the plunger 106. The upper feeler 90 is depressed and the lower feeler 88 is elevated to clear the work. Cam 132 operates its plunger 126 to slide the shaft 62 and move the gauge feelers out of the work. Cam 48 also operates its plunger 44 to lift the pressure idler wheel. The finger 164 engages the catch pin 160 and operates the ejector to push the finished piece into the discharge chute. The screw 214 operates the pusher bar 204 which slides the line of work-pieces in the feed chute to deliver one of them from the feed chute into the inclined entrance chute 180. The new piece rolls down against the stop bar 144 and is temporarily arrested until the stud 174 trips the catch pin 160 to let the coil spring 152 retract the ejector. The new piece then rolls down to grinding position and the carriage returns to the left to begin grinding. As the carriage returns, the various cams are withdrawn so that the pressure idler wheel comes down, the gauge feelers enter the work and separate and the pusher bar is retracted from under the magazine to let the stack of pieces descend against the feed chute.

I claim:

1. In an internal grinding machine, a grinding wheel, a backing wheel, a work-supporting wheel, means for automatically feeding work of round section into grinding relation to the wheels means for holding the work from axial movement during grinding, and means for automatically moving the finished work out of grinding relation to the wheels; substantially as described.

2. In an internal grinding machine, a grinding wheel, a backing wheel opposing the grinding wheel, a work-supporting wheel, and an inclined chute arranged to guide articles of round section into supported engagement with the backing wheel and the work-supporting wheel, the chute sloping downwardly and substantially meeting the supporting wheel in tangential relation thereto; substantially as described.

3. In an internal grinding machine, a grinding wheel, a backing wheel, a work-supporting wheel, means for guiding articles of round section substantially tangentially of the work-supporting wheel and transversely of its axis, and means for ejecting the articles axially of the wheels; substantially as described.

4. In an internal grinding machine, a grinding wheel, a backing wheel, a work-supporting wheel, an inclined entrance chute arranged substantially tangent to the supporting wheel, and an inclined discharge chute at one end of the supporting wheel; substantially as described.

5. In an internal grinding machine, a grinding wheel, a backing wheel, a supporting wheel, an inclined entrance chute arranged substantially tangent to the supporting wheel, an inclined discharge chute at one end of the supporting wheel, and means for moving a work-piece axially from the supporting wheel to the discharge chute; substantially as described.

6. In an internal grinding machine, a grinding wheel, a backing wheel, a work-supporting wheel, a pressure wheel for holding work of round sec-

tion in operative relation to the other wheels, means for moving the pressure wheel bodily towards and from the work-supporting wheel, and automatic means for introducing a work-piece to grinding position in timed relation to the movement of the pressure wheel away from the work-supporting wheel; substantially as described.

7. In an internal grinding machine, a grinding wheel, a backing wheel, a work-supporting wheel, a pressure wheel for holding work of round section in operative relation to the other wheels, means for moving the pressure wheel bodily towards and from the work-supporting wheel, and an inclined entrance chute sloping downwardly towards the work-supporting wheel and substantially meeting the latter for guiding work-pieces between the work supporting wheel and the pressure wheel; substantially as described.

8. In an internal grinding machine, a grinding wheel, a backing wheel, a work-supporting member spaced from the backing wheel and having its work engaging portion lower than the work engaging portion of the backing wheel, and means for feeding work of round section by gravity over the work-supporting member and transversely of the axis of the backing wheel into contact with the backing wheel; substantially as described.

9. In an internal grinding machine, a grinding wheel, a backing wheel, a work-supporting member spaced from the backing wheel and having its work engaging portion lower than the work engaging portion of the backing wheel, a pressure wheel for holding work of round section against the backing wheel and the work-supporting member, means for moving the pressure wheel towards and from the work-supporting member, and means for introducing a work-piece between the pressure wheel and the work-supporting member when said pressure wheel is moved away from the supporting member; substantially as described.

10. In an internal grinding machine, a grinding wheel, a work-head, a carriage for one of said members to cause the grinding wheel to occupy the interior of a hollow work-piece, a gauge having a feeler, means for causing the feeler to enter the work-piece from the end opposite to the grinding wheel, and mechanism for moving said feeler radially of the work-piece into and out of contact with the inner wall thereof; substantially as described.

11. In an internal grinding machine, a grinding wheel, a work-head, a carriage for one of said members to cause the grinding wheel to occupy the interior of a hollow work-piece, a gauge having a feeler entering the work-piece from the end opposite to the grinding wheel, and mechanism for moving the feeler both radially and axially of the work-piece; substantially as described.

12. In an internal grinding machine, a grinding wheel, a work-head, a carriage for one of said members to cause the grinding wheel to occupy the interior of a hollow work-piece, a gauge having a feeler entering the work-piece from the end opposite to the grinding wheel, and mechanism controlled by the movement of the carriage for successively causing a radial and an axial shifting movement of the feeler with respect to the work-piece; substantially as described.

13. In an internal grinding machine, a grinding wheel, a work-head, a carriage for one of said members to cause the grinding wheel to occupy the interior of a hollow work-piece, a gauge hav-

ing a pair of opposed feelers entering the work-piece and riding on the inner wall thereof, one of said feelers being movable with respect to the other in response to change in size of the work-piece, and mechanism for causing the feelers to approach each other to clear the inner wall of the work-piece; substantially as described.

14. In an internal grinding machine, a grinding wheel, a work-head, a carriage for one of said members to cause the grinding wheel to occupy the interior of a hollow work-piece, a gauge having a pair of opposed feelers entering the work-piece and riding on the inner wall thereof, one of said feelers being movable with respect to the other in response to change in size of the work-piece, and mechanism for causing the feelers to move out of the work-piece axially thereof; substantially as described.

15. In an internal grinding machine, a grinding wheel, a work-head, a carriage for one of said members to cause the grinding wheel to occupy the interior of a hollow work-piece, a gauge having a pair of opposed feelers entering the work-piece and riding on the inner wall thereof, one of said feelers being movable with respect to the other in response to change in size of the work-piece, and mechanism controlled by the movement of the carriage for causing the feelers to withdraw from the inner wall of the work-piece and move axially out of the work piece; substantially as described.

16. In an internal grinding machine, a grinding wheel, a work-head, a carriage for one of said members to cause the grinding wheel to occupy the interior of a hollow work-piece, a gauge having a feeler to enter the work-piece and ride on the inner wall thereof, means for moving the feeler out of the work-piece, and mechanism for expelling the work-piece and introducing a new work-piece to the work-head when said feeler is withdrawn; substantially as described.

17. In an internal grinding machine, a grinding wheel, a work-head, a carriage for one of said members to cause the grinding wheel to occupy the interior of a hollow work-piece, a gauge having a feeler to enter the work-piece and ride on the inner wall thereof, means for moving the feeler into and out of the work-piece, and mechanism for inserting the work-piece laterally of the work-head when the feeler is withdrawn; substantially as described.

18. In an internal grinding machine, a grinding wheel, a work-head, a carriage for one of said members to cause the grinding wheel to occupy the interior of a hollow work-piece, a gauge having a feeler to enter the work-piece and ride on the inner wall thereof, means for moving the feeler out of the work-piece when the grinding wheel and work-piece are axially separated, and means for introducing the work-piece laterally to the work-head between the grinding wheel and the feeler; substantially as described.

19. In an internal grinding machine, a grinding wheel, a work-head, a carriage for one of said members to cause the grinding wheel to occupy the interior of a hollow work-piece or to be disposed beyond the end thereof, the work-head comprising a plurality of wheels, means for moving one of the wheels to engage or to release the work, a gauge having a feeler movable towards and from the work-head to enter and leave the work-piece, and means for introducing a work-piece laterally to the work-head when the grinding wheel, feeler and work-head wheels are in

their separated relations; substantially as described.

20. In an internal grinding machine, a grinding wheel, a work-head, a gauge having a pair of opposed feelers to enter a hollow work-piece, an ejector extending between said feelers and across one end of the work-piece, and means for actuating the ejector to remove the work-piece from the work-head; substantially as described.

21. In an internal grinding machine, a grinding wheel, a work-head, a gauge having a feeler to enter a hollow work-piece, a support for the gauge, an ejector at one end of the work-piece, and a rod carried by the gauge support for actuating the ejector; substantially as described.

22. In an internal grinding machine, a grinding wheel, a work-head, a carriage for one of said members to cause the grinding wheel to occupy the interior of a hollow work-piece, the work-head comprising a backing wheel and a work-supporting wheel, an ejector at one end of the work-piece, and mechanism for actuating said ejector to slide the work-piece axially along the wheels of the work-head to a position beyond the end thereof; substantially as described.

23. In an internal grinding machine, a grinding wheel, a work-head, a carriage for one of said members to cause the grinding wheel to occupy the interior of a hollow work-piece, the work-head comprising a backing wheel and a work-supporting wheel, an ejector at one end of the work-piece, and mechanism controlled by the movement of the carriage for operating the ejector to slide the work-piece axially along the wheels of the work head; substantially as described.

24. In an internal grinding machine, a grinding wheel, a work-head, a carriage for one of said members to cause the grinding wheel to occupy the interior of a hollow work-piece, the work-head comprising a plurality of supporting wheels, an ejector at one end of the work-piece, means for operating the ejector to slide the work-piece axially from the supporting wheels, and a bar carried by the ejector to postpone the insertion of a new work-piece; substantially as described.

25. In an internal grinding machine, a grinding wheel, a work-head, a carriage for one of said members to cause the grinding wheel to occupy the interior of a hollow work-piece, the work-head comprising a plurality of wheels, a chute leading to the work-head wheels, an ejector at one end of the work-piece, means for operating the ejector to slide the work-piece axially from the work-head wheels, and a bar carried by the ejector to arrest a new work-piece in the chute; substantially as described.

26. In a grinding machine, a grinding wheel, a work-head having a swingable work-engaging wheel, and mechanism for swinging the wheel and comprising an arm and a plunger, and a ball between the plunger and the arm; substantially as described.

27. In a grinding machine, a grinding wheel, a work-head having a pair of work-supporting wheels, each presenting to the periphery of a round work-piece a continuous, work-supporting surface of revolution which is unobstructed at the end to provide for an endwise sliding movement of the work-piece along the wheels, and a pressure wheel movable towards and from the supporting wheels and having flanges to lap the ends of the work-piece during grinding; substantially as described.

28. In a grinding machine, a grinding wheel, a

work-head having a pair of work-supporting wheels, a pressure wheel movable towards and from the others, an ejector to slide a work-piece axially along the work supporting wheels, and the pressure wheel being flanged to hold the work-piece from such axial movement during grinding; substantially as described.

29. In a grinding machine, a grinding wheel, a work-head having work engaging wheels, an inclined chute leading downwardly to said wheels to conduct work-pieces thereto, a feed chute, and a pusher for advancing work-pieces along said feed chute to the inclined chute; substantially as described.

30. In a grinding machine, a grinding wheel, a backing wheel, a work-supporting wheel, mechanism for automatically feeding articles of round section successively into operative relation to said wheels for a grinding operation and for ejecting the articles after the grinding operation, and mechanism for causing the grinding wheel and the other wheels to be separated during the feeding and ejecting operations; substantially as described.

31. In an internal grinding machine, a grinding wheel, a backing wheel opposing the pressure of the grinding wheel, a work-supporting member, and automatic mechanism for feeding work of round section transversely over the work-supporting member and substantially radially against the periphery of the backing wheel; substantially as described.

32. In an internal grinding machine, a grinding wheel, a backing wheel opposing the pressure of the grinding wheel, a work-supporting member, means for feeding work of round section transversely over the work-supporting member

and against the periphery of the backing wheel, and means for holding the work against axial movement during grinding; substantially as described.

33. In an internal grinding machine, a grinding wheel, a backing wheel, a work-supporting member, means for feeding work of round section transversely over the work-supporting member and against the periphery of the backing wheel, and means for ejecting the work lengthwise of the supporting member; substantially as described.

34. In an internal grinding machine, a grinding wheel, a work-head, a carriage for one of said members to cause the grinding wheel to occupy the interior of a hollow work-piece, a gauge having a feeler, mechanism for causing relative axial shifting movement between the feeler and the work-piece to cause the feeler to occupy the bore of the work-piece, and means for thereafter causing relative radial movement between the feeler and the work-piece to cause the feeler to contact with the wall of the bore; substantially as described.

35. In an internal grinding machine, a grinding wheel, a work-head, a carriage for one of said members to cause the grinding wheel to occupy the interior of a hollow work-piece, the work-head comprising a plurality of rotary wheels, a gauge having a feeler to enter the bore of the work-piece, and mechanism controlled by the movement of the carriage for successively causing a radial and an axial shifting movement of the feeler with respect to the work-piece; substantially as described.

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60	135
65	140
70	145
	150