Nov. 19, 1929. C. E. JOHNSON 1,736,159

PISTON RING ROUGH GRINDER

Filed March 6, 1928 6 Sheets-Sheet 1

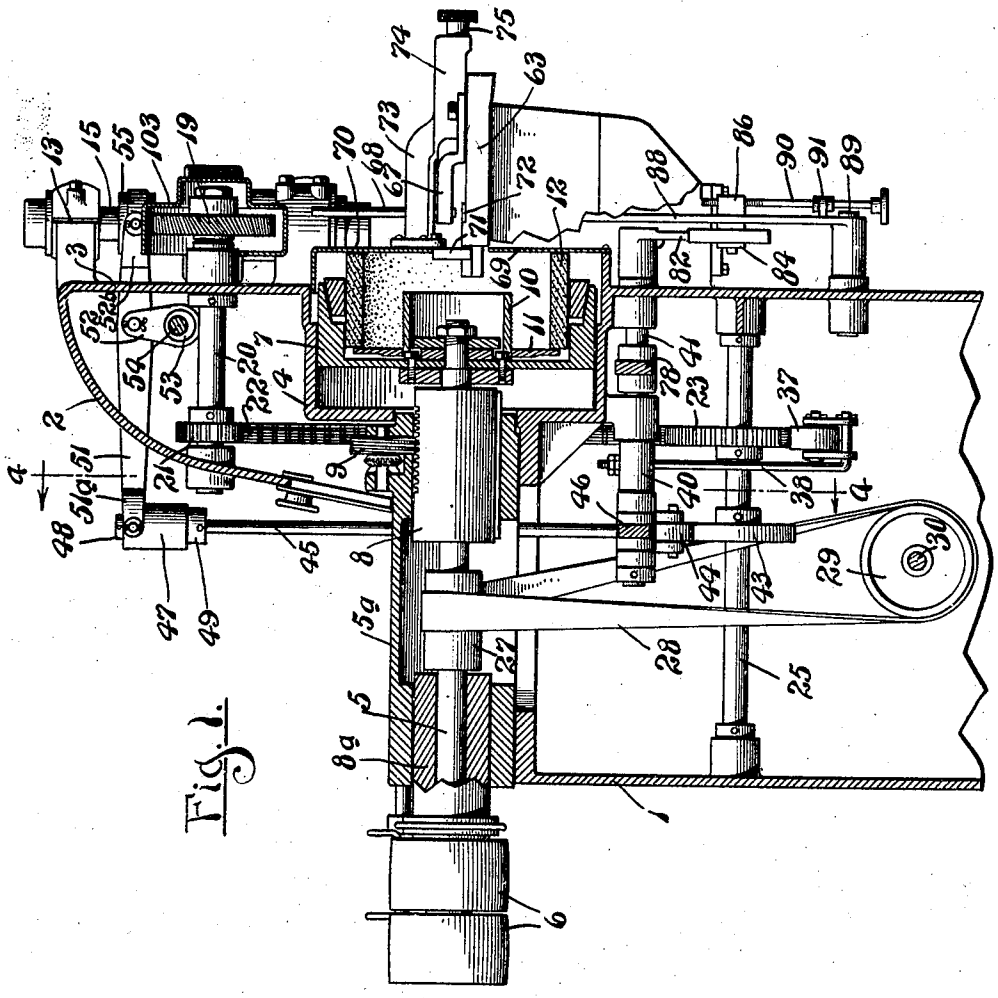

Fig. 1.

Inventor
Charles E. Johnson
By Livernash and
Van Antwerp
Attorneys

Nov. 19, 1929. C. E. JOHNSON 1,736,159

PISTON RING ROUGH GRINDER

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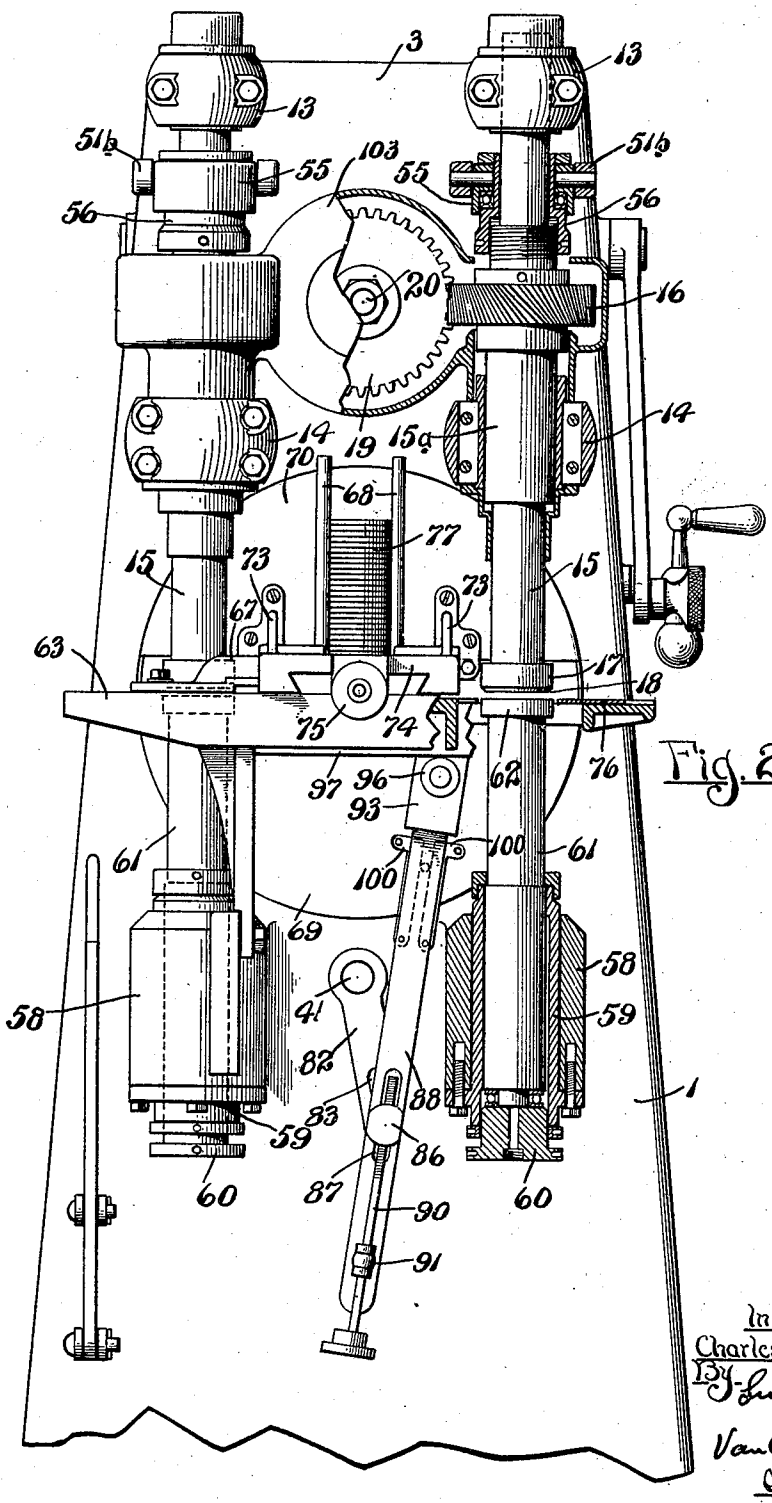

Fig. 2.

Inventor
Charles E. Johnson
By Livernace and Van Antwerp
Attorneys

Nov. 19, 1929. C. E. JOHNSON 1,736,159

PISTON RING ROUGH GRINDER

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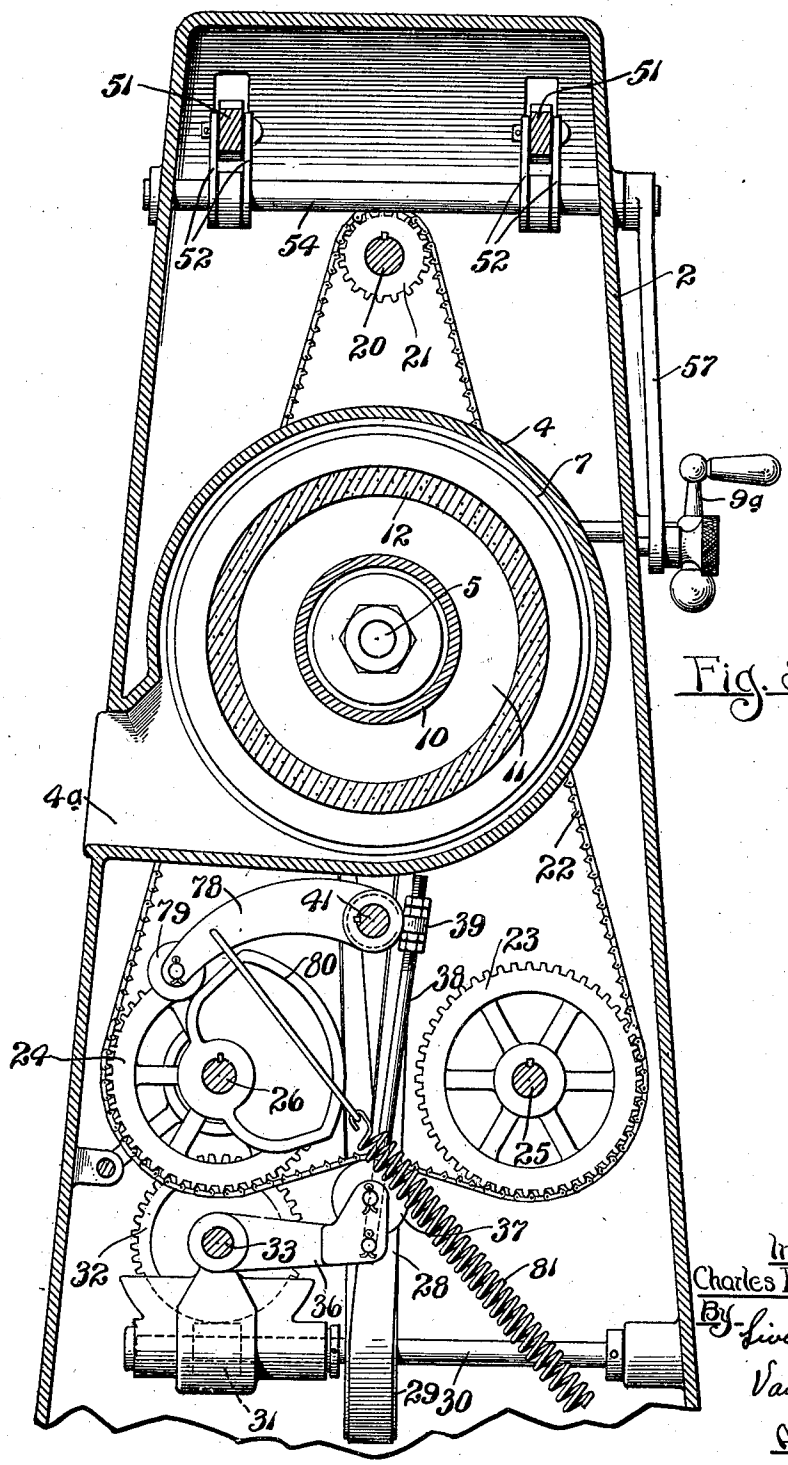

Fig. 3.

Inventor
Charles E. Johnson
By Livingston & Van Antwerp
Attorneys

Nov. 19, 1929. C. E. JOHNSON 1,736,159

PISTON RING ROUGH GRINDER

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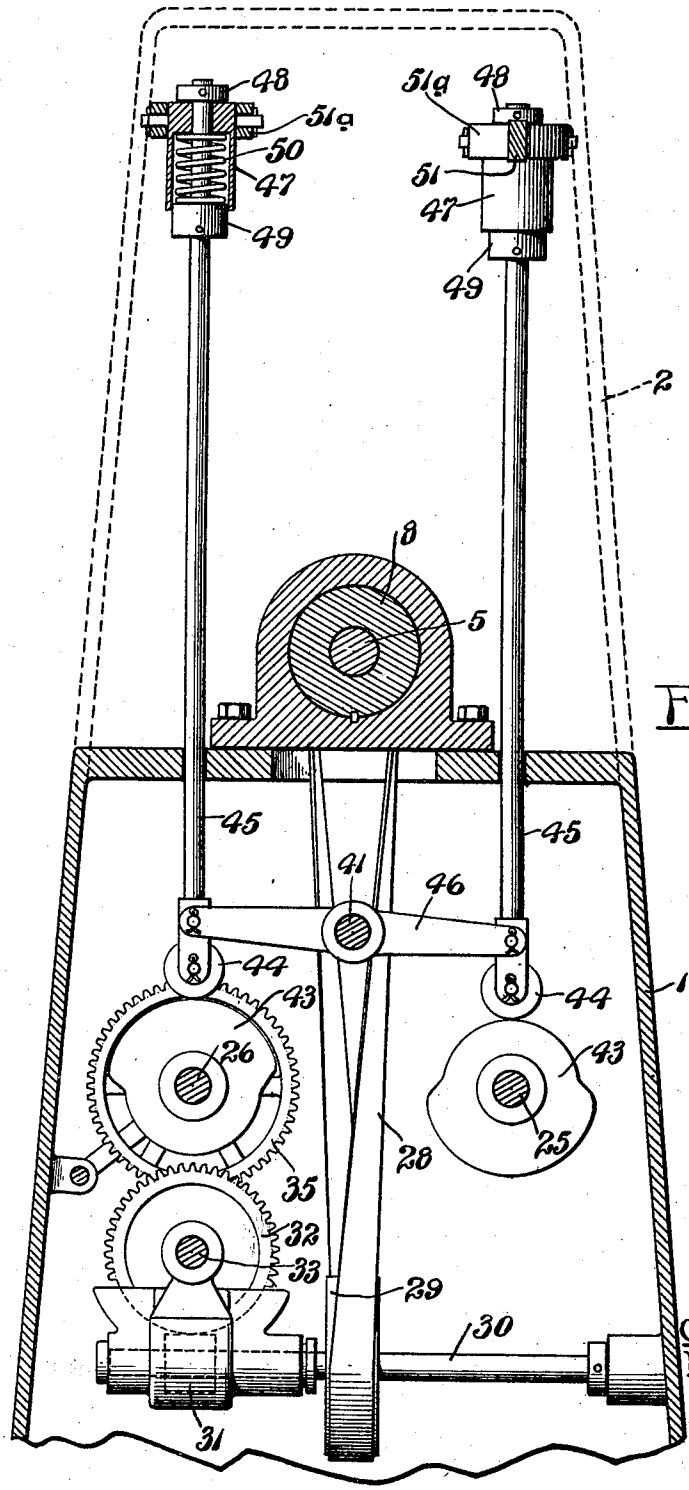

Fig. 4.

Inventor
Charles E. Johnson
By Lawrence and Van Antwerp
Attorneys

Nov. 19, 1929. C. E. JOHNSON 1,736,159

PISTON RING ROUGH GRINDER

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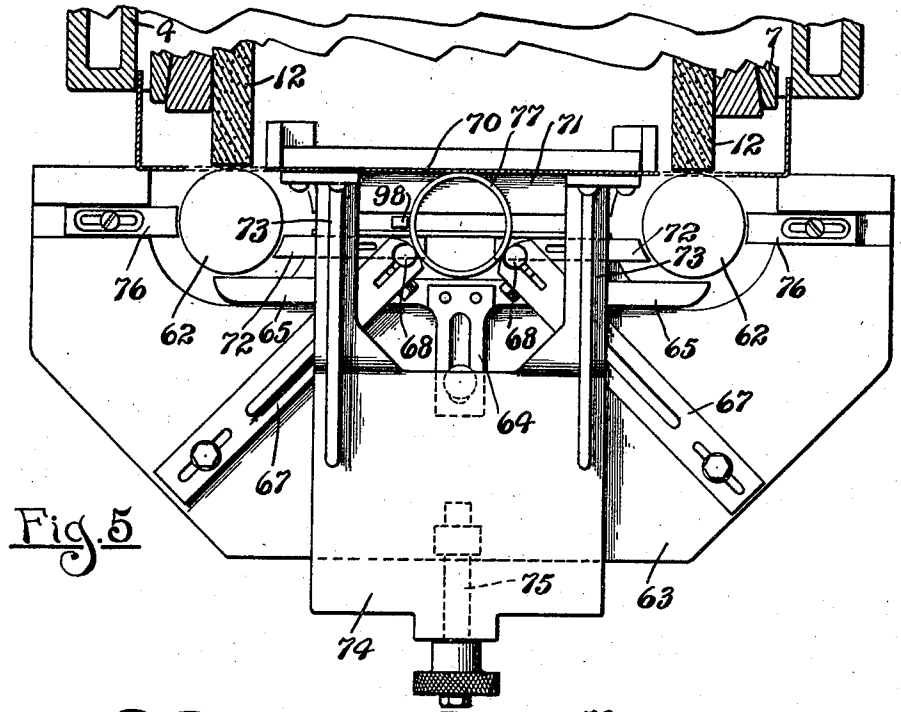

Fig. 5

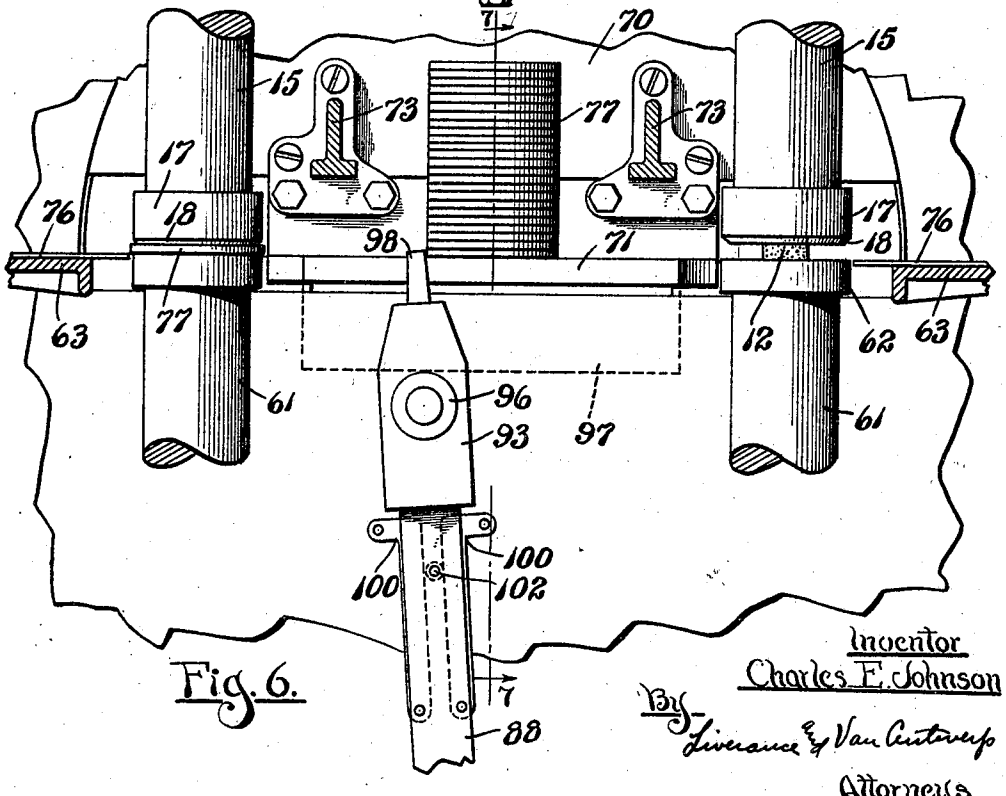

Fig. 6.

Inventor
Charles E. Johnson
By Livingston & Van Antwerp
Attorneys

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PISTON RING ROUGH GRINDER

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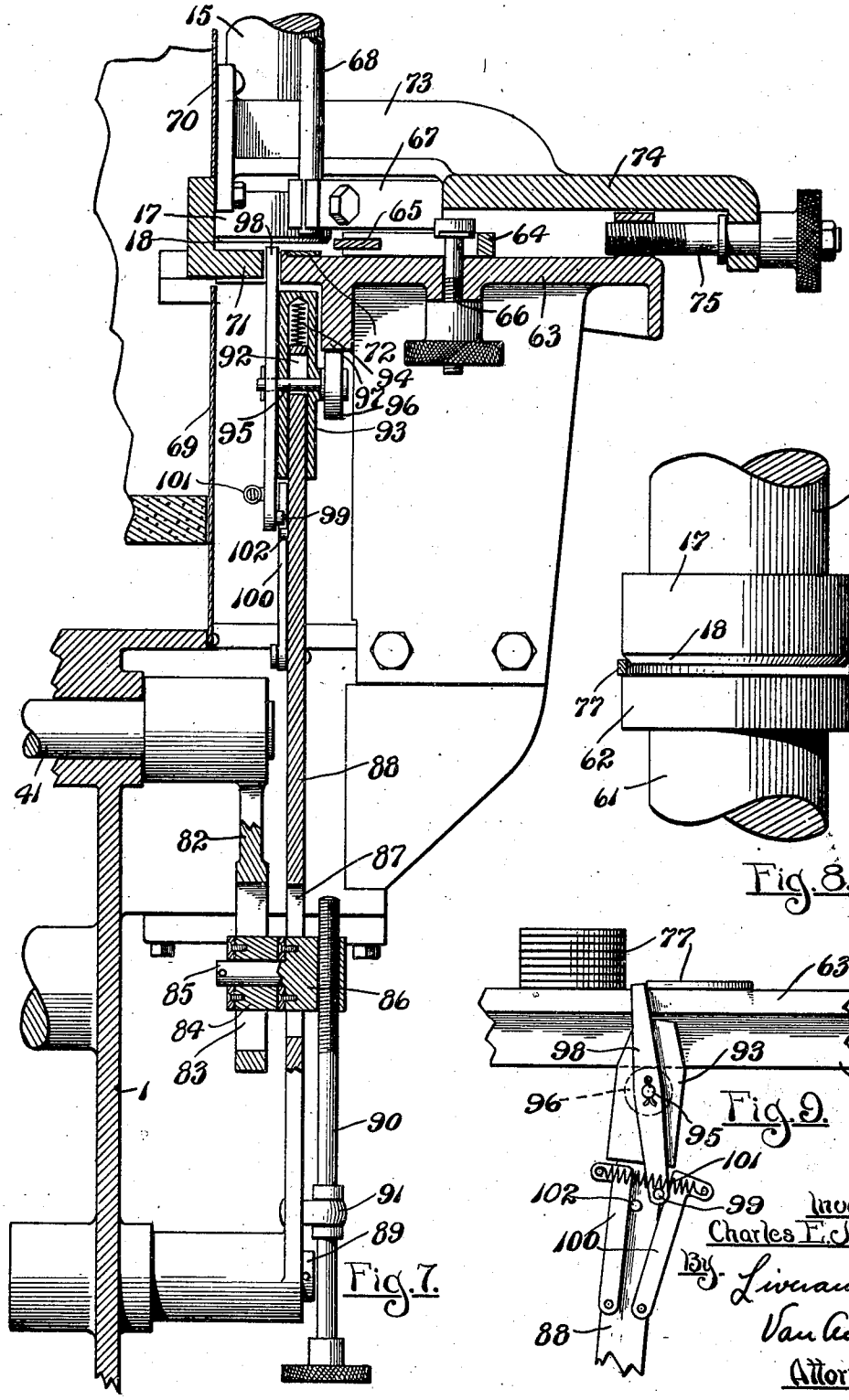

Fig. 7.

Fig. 8.

Fig. 9.

Inventor
Charles E. Johnson
By Livingston and Van Antwerp
Attorneys

Patented Nov. 19, 1929 1,736,159

UNITED STATES PATENT OFFICE

CHARLES E. JOHNSON, OF NORTH MUSKEGON, MICHIGAN, ASSIGNOR TO PISTON RING COMPANY, OF MUSKEGON HEIGHTS, MICHIGAN, A CORPORATION OF MICHIGAN

PISTON-RING ROUGH GRINDER

Application filed March 6, 1928. Serial No. 259,401.

This invention relates to a piston ring rough grinding machine.

In the modern practice of manufacturing piston rings individual ring castings are used, which castings as they come from the molds have scale and many times small projections at their outer surfaces. The processes of machining the piston rings involves several machine operations, one of which is that of roughly grinding off the scale and projections at the outer curved surface of the ring.

I have heretofore disclosed a method of machining out of round piston ring castings, in my Patent No. 1,405,517, issued February 7, 1922, and this method is still followed for finishing of the ring castings at their outer curved surfaces after the rough grinding thereof, as performed by the mechanism about to be described, has been done.

The ring castings, accordingly, are of the out of round type, that is, made from a pattern circular in the first instance then parted at one side and a segment inserted between the ends of the ring pattern at the parting thereof causing the same to spring apart and provide a ring pattern of what has been termed out-of-round form.

The present invention is therefore directed to a machine for rough grinding the outer curved surfaces of ring castings of this out-of-round form so as to remove the scale and projections from the castings and to also remove excess of metal and reduce the ring castings after such operation to substantially uniform thickness.

It is an object and purpose of the present invention to provide an automatic machine for attaining the ends stated, in which machine it is necessary for the attendant merely to keep the machine supplied with ring castings. The invention consists of many novel constructions, and combinations and arrangements of parts for effectively attaining this end and to provide a machine capable of large quantity production and in which a single feeding means alternately directs the ring castings to two distinct holding devices which grip the out of round ring castings and distort them to practically circular form, holding and rotating the same during the time that the grinding operation is being performed and, thereafter, automatically releasing said ring castings to make way for succeeding castings on which the grinding operation is to be performed.

An understanding of the invention and the preferred structural embodiment thereof may be had from the following description taken in connection with the accompanying drawings, in which,

Fig. 1 is a vertical section from front to rear of the upper part of a machine for rough grinding out of round piston ring castings.

Fig. 2 is a front elevation thereof with various parts broken away and shown in section for better disclosure.

Fig. 3 is a fragmentary vertical section parallel to the front of the machine, the plane of the section being through the grinding wheel near the front side of said machine.

Fig. 4 is a fragmentary vertical section through said machine substantially on the plane of line 4—4 of Fig. 1.

Fig. 5 is a fragmentary horizontal section and plan view looking down upon the ring holding table of the machine.

Fig. 6 is a front elevation of the construction illustrated in Fig. 5.

Fig. 7 is a fragmentary enlarged vertical section through said machine, substantially on the plane of line 7—7 of Fig. 5.

Fig. 8 is a fragmentary enlarged detail illustrating a ring casting held by rotating clamping heads and being ground by the grinding wheel, and

Fig. 9 is a fragmentary rear elevation of the feeding device for taking the rings one at a time from a quantity of rings and alternately feeding the same to opposite clamping heads.

Like reference characters refer to like parts in the different figures of the drawings.

In the construction of the machine, a main supporting casting 1 for the mechanism is provided, above which is a second casting or housing having a rear side 2 and a front vertical side 3 in which, at its lower part, a cylindrical housing 4 for the grinding wheel and its support is provided, as shown in Fig. 1. A shaft 5 extends through a housing 5ª there-

for mounted at the upper side of the main supporting casting 1, and is adapted to be belt driven being equipped with the usual loose and fixed pulley, both indicated at 6, from which the belt may be shifted, one to the other, as is common. The shaft extends forward into the cylindrical housing 4 previously described, and at its front end carries a cylindrical member 7 in which the grinding wheel is adapted to be detachably mounted. Shaft 5 is rotatably mounted in bearings 8 and 8ª which are slidable lengthwise of the housing member 5ª and which may be adjusted through any adjustable manually operable means, indicated at 9 as a rack and screw adjustment, the rack being on the bearing 8 and the screw cooperating therewith. This permits a limited longitudinal adjustment of the shaft 5 and of the grinding wheel carrier 7 at the front end thereof. The member 7 is of cup form and within it a cylinder 10 threaded at its outer side is secured concentric with the outer walls of said member. A back plate 11 threads on to the cylindrical member 10 and against said back plate the grinding wheel 12, at its rear end, bears. The wheel is clamped in place in any desired manner which, as it forms no part of the present invention, is not specifically described. The grinding wheel 12 is in the form of a cylinder open at both ends. It is evident that the position of the plate 11 governs the position of the outer end of the grinding wheel and for a final adjustment thereof the manually operated screw 9 engaging with the rack on the bearing 8 may be used.

The structure so far as described is not new as it is well known in the grinding machine art. I have applied to this grinding machine the mechanism which converts it into an automatic out-of-round piston ring casting rough grinder and which will now be described.

On the front face 3 of the upper housing two pairs of brackets 13 and 14 are mounted and secured, the same extending forward a short distance. One bracket 13 and one bracket 14 is located at each side of the machine in direct vertical alignment. A spindle 15 is rotatably mounted in bearings in each pair of said brackets 13 and 14. The spindle has an enlarged section 15ª between its ends on which a spiral gear 16 is secured. Each spindle at its lower end is provided with a cylindrical head 17 which, at its lower side, is formed with a conical ring engaging surface 18 the purpose of which will hereafter appear. There are two of the spiral gears 16, one located at each side of the central vertical plane of the machine. Both spiral gears 16 are in engagement with a single gear 19 mounted at the front end of a shaft 20 which extends into and through the upper housing member, having suitable bearings where it passes through the walls 2 and 3 thereof.

A sprocket wheel 21 is keyed to the shaft 20. An endless sprocket chain 22 passes around the wheel 21 (see Fig. 3) and also around two other sprocket wheels 23 and 24 keyed, respectively, to two shafts 25 and 26 which are located in the same horizontal plane and are spaced apart from each other as shown in Fig. 3.

A driving pulley 27 (see Fig. 1) is carried on the main drive shaft 5. An endless belt 28 passes around the pulley 27 and also around a wheel 29 fixed to a shaft 30 mounted below and transverse of the two shafts 25 and 26, as shown in Fig. 3. Shaft 30 carries a worm 31, indicated in dotted lines in Fig. 3, which meshing with the worm wheel 32 on the shaft 33, drives said shaft and through a gear 34 fixed to said shaft 33 meshing with another gear 35 fixed on the shaft 26 drives the shaft 26 and thereupon drives the chain 22 so that both spindles 15 rotate continuously thereover in opposite directions at the same rate of speed.

The sprocket chain 22 is supplied with a suitable tightener which includes an arm 36 loosely mounted at one end on the shaft 33 and carrying a roller 37 at its free end to bear against the chain. A rod 38 is connected with the free end of the arm 36 and at its upper end passes through a lug 39 projecting from a collar 40 loosely mounted on a shaft 41 located above, between and parallel to the two shafts 25 and 26. The shaft 41, as will later appear, serves other functions in the machine but is made use of as a means to mount the collar 40 of the belt tightening construction.

Two cams 43 are mounted on the two shafts 25 and 26 in the same vertical plane. These cams are identical in form but one is reversed as to position with respect to the other. That is, referring to Fig. 4, the larger diameter portion of the cam on shaft 26 is above the shaft while at the same time the same larger portion of the cam on the shaft 25 is below and in a position directly opposed to the cam on the shaft 26, as shown. A roller 44 mounted at the lower end of the vertical rod 45 bears against each cam. The lower end portions of the two rods 45 are connected by a rocker arm 46 which is loosely mounted at its middle on the shaft 41.

The rods 45 extend through the upper side of the main supporting casting 1 and nearly to the upper end of the upper housing. Each rod passes through an inverted cup 47 and is equipped with a collar 48 above the upper end of said cup (see Fig. 4). Each rod also has a second collar 49 located at the lower end of said cup and of a size to freely enter the same with a coiled spring 50 disposed between the collar 49 and the closed end of the cup, as shown. A rocking lever 51

has a yoke 51ª at its rear end pivotally connected to each of the cup members 47. The two rocking levers 51 extend forward through the front and rear sides 3 and 2 of the upper housing and within said housing are mounted each on a pair of links 52 which extend downwardly from the levers and at their lower ends are carried on eccentric 53 in turn mounted on a shaft 54 which extends between and through the sides of the upper housing member.

The end of each lever 51 is formed with a second yoke 51ᵇ (see Fig. 2) which connects with a collar 55 around the upper end of a member 56 having a permanently threaded connection with the upper end of the enlarged intermediate section 15ª of each spindle 15. It is evident according that when the machine is being operated there is an alternate raising and lowering of the two rods 45 with a consequent rocking of levers 51 and an alternate raising and lowering of the spindles 15, and that when one spindle 15 is lifted the other spindle is lowered. It is also evident that by turning the shaft 54 through a hand lever at its outer end the limits of travel of the lower head 17 may be governed; that is, the lower side of the head may be brought to a certain definite position with respect to a cooperating head below it, which will hereafter be described, and between which heads the ring casting is clamped while it is being ground.

At the front side of the lower supporting casting 1, two sleeves 58 are cast in which bushings 59 are secured, each at its lower end being closed by an adjustable plug 60. A shaft or spindle 61 is mounted for rotation in each bushing 59 and at its lower end has a thrust bearing against the plug 60. Each shaft 61 at its upper end is equipped with a head 62 having a flat horizontal upper side. The spindles 15 and 61 are in direct vertical axial alignment and the head 62 at the upper end of each spindle 61 is directly below a head 17 at the lower end of an upper spindle 15. The upper side of each head 62 always remains in the same horizontal plane.

A table 63 extends horizontally forward from the machines, its upper side being in substantially the same plane with the upper side of the head 62. It is supported by brackets which extend downwardly and are secured to the front of the main supporting casting 1. On the upper side of the table and centrally thereof a slotted bar 64 is located and at its rear end carries a blade or flat bar 65 located in front of and slightly above said heads 62 and extending from one to the other (see Fig. 5). The bar 64 may be adjusted to many different positions and held in any position to which adjusted through the clamping bolt 66, the bolt extending through the slot of member 64 and through the table 63 and having a clamping nut at its lower end.

There is also mounted at the upper side of the table 63, two bars 67 one at each side of the member 64 and diverging outwardly and away therefrom. These bars are also slotted that they may be longitudinally adjusted and each at its inner end portion bends upwardly so as to lie, at such inner end portion, a distance above the plane of the table and to pass over the bar or blade 65. Each bar 67 at its inner end carries a vertically positioned rod 68 as shown.

A sheet metal plate 69 is permanently secured at the front of the housing 4 and extends upwardly so as to cover the lower portion of the grinding wheel 12. A second sheet metal plate 70 covers the upper portion of the grinding wheel 12 and the upper portion of the open end of the housing 4 and at its lower edge has an angle bar 71 permanently secured, the upper side of which is in the same plane with fingers 72, one of which is secured at each side of the table 63 and extend one toward each head 62, the upper sides of the fingers 72 and of the heads 62 being in the same plane. These fingers 72 may be adjusted in or out so as to bring the same at their outer ends close to the heads 62. It will be evident, referring to Fig. 6, that at the ends of the angle bar 71 openings are left between the upper and lower edges of the sheet metal plates 69 and 70, and that the grinding wheel 12 rotates back of said openings.

The plate 70 and the angle bar 71 are carried at the rear ends of two spaced arms 73 which are cast integral with a member 74 slidably mounted on the table 63 for inward or outward adjustment, which is effected by the screws 75 as shown in Fig. 7. There is also at each outer end of the table a finger 76 adjustably mounted for longitudinal adjustment so that the inner ends thereof may come closely to the heads 62. These fingers also lie in the same horizontal plane with the heads 62.

A quantity of ring castings 77 are placed one over the other on the horizontal leg of the angle member 71 in front of the plate 70 and between said plate and the two rods 68, the lowermost of said rings at its front extending over and bearing upon the fingers 72, thereby crossing a slot between the front edge of the angle member 71 and the rear edge of the table 63. It will be evident that the lowest ring casting of the column of ring castings is in a position to be fed to either one or the other of the head 62 on the lower spindles 61. Furthermore ring castings of different sizes may be readily placed in the machine by properly adjusting the bars 64 and 67 and the member 74, and when a ring casting of a different size is to be ground the spindles 61, or at least their heads 62, must be changed to correspond. It is for this

reason that the fingers 72 and 76 and the bar 64 are made adjustable, also the plate 70 and angle bar 71, so that different diameter heads 62 may be used in the same machine and different sizes of ring castings treated.

The shaft 41 in the operation of the machine is rocked back and forth. An arm 78 (see Fig. 3) is secured to the shaft and extends over shaft 26 at its free end carrying a roller 79 which rides on a cam 80 fixed to said shaft 26. With the rotation of shaft 26 shaft 41 is rocked back and forth as is evident.

The shaft 41 at its front end and at the front of the machine carries an arm 82 having a longitudinal slot 83 therein. A roller 84 is located in the slot mounted on a pin 85 projecting rearwardly from a block 86 which in turn extends through a slot 87 in a bar 88 pivotally mounted at its lower end on a stud 89 as shown in Fig. 7. An adjusting screw 90 threads at its upper end through the block 86 and passes through an eye 91 fastened to and projecting from the lower end of the bar 88, said rod 90 having fixed collars, one above and the other below the eye 91. It is evident that the block 86 with the roller carried thereby may be adjusted to different positions within limits prescribed by the length of the slots 83 and 87. The bar 88 extends upwardly and at its upper end has a relatively short longitudinal slot 92 cut therein. The upper end of the bar 88 is received in a housing member 93 with a spring 94 between the upper end of bar 88 and the upper closed end of the housing. Rod 95 extends through the sides of the housing and through the slot 22 and at its front end is equipped with a roller 96 which rides against the under side of a rail 97 integral with and extending downwardly from the table 63, (see Fig. 7).

The rod 95 at its rear end, after passing through the housing 93, also passes through a feed finger 98 substantially midway between the ends thereof thereby serving to pivotally mount said finger. The finger at its lower end carries a pin 99 which extends toward the rear side of the bar 88 and lies between two members 100 which are pivotally connected at their lower ends to the rear side of the bar 88 and extend upwardly toward the housing, being connected at their upper ends and drawn toward each other by a coiled spring 101, as shown in Fig. 9. A pin 102 extends from the rear side of the bar 88 between the two members 100 and limits the travel of one in one direction, and the other in the opposite direction.

In the operation of the machine, with a plurality of ring castings 77 located as described, bar 88 is oscillated back and forth about the stud 89 and the feed finger 98 engages against a side of the lowermost ring casting 77 in the column of castings whereupon said lowermost casting is moved to one of the heads 62. During the movement of the feed finger 98 its upper end traverses a horizontal plane by reason of the roller 96 riding against the horizontal lower edge of the rail 97. And there is no fear that the feed finger will engage with any more than one of the rings. The ring which is being fed to a head 62 reaches said head when the clamping head 17 immediately above is in elevated position or in the position shown at the right in Fig. 6. In moving to the head 62 it is guided by the bar or blade 65 and the back or vertical flange of the angle member 71 and rides over the horizontal flange of said angle bar and over one of the fingers 72.

When the ring casting has been deposited on the head 62 there follows immediately thereafter a lowering of the spindle 15 to bring the conical surface 18 of the upper head 17 at the lower end of said spindle into contact with the inner edges of the ring casting as shown in Fig. 8. The spring 60 associated with the operating mechanism for the spindle 15 which has been lowered is a strong spring but can compress a limited amount or sufficient to take care of the minor variations in the width of any one size of ring castings. The pressure exerted by the two heads against the opposite sides of the ring and with the conical face 18 entering into the ring casting at its upper end, causes the ring casting to be distorted to circular form.

The head 17 as soon as it engages with and clamps a ring casting against the head 62 below, immediately causes the ring casting as well as the head 62 and its spindle 61 to rotate and the casting is rotated and at the same time the front end of the cylindrical grinding wheel 12 engages with the outer curved surface of the casting, removing the outer scale and any projections of metal or sand which may be on the casting. Due to the alternate operation of the spindles 15 in their raising and lowering, one spindle is in upper position and an opening is made between its head 17 and the head 62 below to receive a ring casting, while at the opposite side of the machine a ring casting is held by the two other heads 17 and 62 and is being ground at its outer curved surface. There is thus provided a doubling of the quantity production of the machine using only one feeding means to feed the rings alternately to one side or the other of the machine.

It is evident that the stroke of the bar 88 may be adjusted and controlled by the adjusting screw 90 for different sizes of rings in order to stop the feed finger 98 at a proper position when a ring has been delivered to a head 62. It is further evident that when the feed finger 98 engages against a side of the lowermost ring of the column of ring castings there is a yielding of the finger and a stretching of the spring 101 which eliminates the possibility of breakage or injury to the machine from too abrupt engagement of the

fingers with a ring casting and starting such casting in motion.

The construction described is very practical and useful and has proved its value in use. There are many variations in structural detail which may be resorted to in embodying the invention I have made. I, accordingly, do not wish to be limited to the specific structure illustrated in the drawings and described herein but consider myself entitled to all forms of structure which come within the scope of the appended claims defining the invention.

I claim:

1. In a machine of the class described, means for supporting and guiding a quantity of continuous ring castings located in a column one above the other, means for feeding the lowermost of said rings laterally at periodic intervals into a holding means, holding means in which said ring castings are adapted to be clamped and held when fed thereto, means for rotating said holding means, and means for grinding the outer curved surface of said ring castings, while the same are held and rotated and means for removing the ring from said holding means.

2. In a machine of the class described, a vertical spindle having a head at its upper end, a second vertical spindle located in axial alignment with the first spindle having a head at its lower end, means for driving the second spindle to rotate the same, means for periodically raising and lowering said second spindle, means for periodically feeding a ring casting to and between said heads when the vertical spindle has been elevated to an upper position, said ring casting being clamped between the heads when the second spindle is carried to its lower position, and means for machining the outer curved surface of said ring casting while it is clamped between said heads.

3. In a machine of the class described, a rotatably mounted head having a horizontal upper face, a second rotatably mounted head located over the first head and in alignment therewith, means for periodically moving said second head away from the first head and thereafter moving it toward said first head, holding it for an interval and then moving it away therefrom, a horizontal table on which a quantity of ring castings one over the other are adapted to be placed and held, feeding means for periodically feeding a ring casting from said column of castings on to the first head when the two heads are separated, said ring casting being clamped between the heads when the second head is moved toward said first head, and a rotatably mounted grinding wheel positioned to grind the outer curved surface of said casting when it is clamped between said heads.

4. In a machine of the class described, a horizontal table on which a quantity of continuous ring castings may be held in a vertical column one over the other, holding means mounted to turn about a vertical axis in which a ring casting is adapted to be clamped and held, means for feeding the ring castings to said holding means at periodic intervals, means for releasing said holding means at intermediate intervals, means for driving the holding means to rotate the same and to rotate said ring casting when held therein, and means for machining the ring castings at their outer curved sides during the period that they are held by said holding means.

5. In a machine of the class described, a rotatably mounted two-part separable holding means for individual piston ring castings mounted to turn about a vertical axis, means included in the construction of said holding means for securely clamping a piston ring casting and holding it in a horizontal plane, means for rotating the holding means about a vertical axis, means for periodically separating and then bringing the parts for said holding means together, a horizontal table on which ring castings may be located in a vertical column one over the other, means for periodically feeding the lowermost ring casting of said column of castings to said holding means at the time of separation of the parts thereof, and means for machining the outer curved sides of a casting while held and rotated by said holding means.

6. In a machine of the class described, holding means mounted to turn about a vertical axis in which individual ring castings are adapted to be clamped, means for rotating said holding means about said vertical axis, means for feeding ring castings individually to the holding means at periodic intervals, means included in the holding means to engage with a ring casting to clamp and securely hold said casting in the holding means whereby it will rotate therewith, and means for grinding the ring castings at their outer curved sides while held in the holding means and rotated therewith.

7. In a machine of the class described, a support, a vertically positioned rotatably mounted shaft located at the front of said support, a head attached to said shaft at the upper end thereof, a second vertically positioned and rotatably mounted shaft located above and in alignment with the first shaft, a head at its lower end having a conical portion at the lower end thereof, means for continuously driving the second shaft, means for alternately raising and lowering said second shaft, means for periodically feeding continuous ring castings on to the first mentioned head at the time that the second shaft and its attached head are in raised position, said ring casting being clamped between the heads on downward movement of said second shaft, and a rotatably mounted grinding wheel positioned back of said heads for grind-

ing the ring casting at its outer curved surface when said ring casting is clamped between the heads.

8. In a machine of the class described, a support, a vertically mounted shaft at the front of said support, a head attached at the upper end of said shaft, a second vertically positioned shaft rotatably and slidably mounted above the first shaft, means for driving said second shaft, a head at the lower end of the second shaft having a conical surface at the lower part thereof, means for alternately raising and lowering said second shaft and attached head, a horizontal table having its upper side in the plane of the upper side of the first head, said table being adapted to carry a column of ring castings positioned one over the other, means on the table for holding and guiding the rings in position one above the other, a feeding device mounted for oscillation on said support below said table and having a feed finger at its upper end to engage against a side of the lowermost ring casting in said column of castings to move the same on to said first head at periodical intervals and at times when the heads are separated, means for oscillating said feeding mechanism and means for grinding ring castings held between said heads at its outer curved surface.

9. In a machine of the class described, a support, a horizontal table carried by said support adapted to carry a plurality of ring castings located one over the other, means for maintaining said ring castings in a vertical column, ring holding means mounted at each side of the table, means for alternately opening and closing said holding means and for opening one holding means when the other is closed, means for alternately feeding the lowermost ring castings on the table to said holding means at the times that the holding means are in open position to receive ring castings, thereafter being clamped and held when the holding means closes against the ring casting, and means for machining the outer curved surfaces of ring castings when held in said holding means.

10. In a machine of the class described, a support, a horizontal table carried by said support, said table being adapted to support a vertical column of ring castings located one over the other, guiding means for said column of ring castings to maintain the same in proper position one over the other carried on and above said table, a vertically positioned spindle mounted on said support at each side of the table, a head mounted at the upper end of each of said spindles having its upper side in the same plane with the upper side of the table, feeding means mounted below the table and engaging alternately the opposite sides of the lowermost ring castings in the column of castings to move said lowermost ring castings alternately to said heads, additional vertical spindles rotatably mounted on said support above and in alignment with the first mentioned spindles, heads at the lower ends of the additional spindles, means for driving said additional spindles, means for periodically raising and lowering said additional spindles with their attached heads, the same being raised at the times ring castings are carried to the first mentioned heads and lowered thereafter to clamp said ring castings between said heads and grinding means rotatably mounted back of said pairs of heads to grind said ring castings at their outer curved surfaces when the same are clamped between said heads.

11. In a machine of the class described, a support, a horizontal table carried by said support, a vertical spindle rotatably mounted on the support adjacent one end of the table, a head carried at the upper end of said spindle having a horizontal upper side in the same plane with the upper side of the table, a second vertically positioned spindle rotatably mounted on said support above and in alignment with the first spindle, a second head fixed to the lower end of the second spindle, means for driving said second spindle, means for periodically raising and lowering said second spindle and its attached head, a horizontal rock shaft mounted in said support below the table, a bar mounted on said support at its lower end for oscillation about a horizontal axis, an arm secured to said rock shaft at one end and connected with said bar at the other end to oscillate the bar on rocking the shaft, means to rock said shaft, and a feed finger mounted at the upper end of said bar and extending a short distance above the upper side of the table, for the purposes described.

12. A construction containing the elements in combination defined in claim 11, combined with a housing slidably mounted at the upper end of said bar on which said feed finger is carried, spring means interposed between said housing and the end of the bar normally acting to move said housing upwardly, a roller mounted on said housing, and a horizontal track attached to and depending from the table against the under side of which the roller bears to cause the upper end of the feed finger to move in a horizontal plane slightly above the upper side of the table as said bar is oscillating about its horizontal axis.

13. In a construction of the class described, a support, a horizontal table to carry a plurality of ring castings located in a vertical column one above the other, holding means for said ring castings adjacent opposite ends of the table, means for periodically separating said holding means to receive a ring casting and thereafter bringing the holding means together to clamp and hold said casting, means for rotating said holding

means, means for machining said ring castings at their outer curved sides while held and rotated by the holding means, and feeding means mounted on said support and extending a short distance above the upper side of said table and movable back and forth in a horizontal plane to engage against the outer side of the lowermost ring in said column of ring castings and move it to said holding means, alternate ring castings of the column of castings being engaged by said feeding means on opposite sides.

14. A feeding means for engaging with the lowermost casting of a vertical column of ring castings located one over the other and carried on a horizontal table comprising, a vertical bar pivotally mounted to oscillate about a horizontal axis at its lower end and located below and extending toward said table, a housing located over the upper end of said bar, said bar adjacent its upper end having a longitudinal slot therein, a shaft passing through the sides of said housing and through said slot, a roller at one end of said shaft, a spring within said housing between its upper end and the upper end of the oscillating bar, a feed finger pivotally mounted between its ends on the opposite end of said shaft, adapted at its upper end to extend slightly above the upper side of said table so as to engage with the lowermost casting of said column of ring castings, two members pivotally mounted on said bar at their lower ends and extended upwardly to the housing, a coiled spring connecting said members at their upper ends, a pin on said bar located between said members and a second pin at the lower end of said feed finger lying between said members.

15. A feed mechanism including the elements recited in combination in claim 14, said bar having a longitudinal slot therein between its ends, a rock shaft mounted on the support, means for rocking the shaft, an arm attached to the rock shaft and extending downwardly back of said bar, said arm also having a slot therein back of said last mentioned slot in said bar, a block extending through the slot in the bar, a roller rotatably mounted on said block extending into the slot of said arm, and an adjusting screw mounted on said bar and threaded through said block for the purposes described.

16. In a machine of the class described, two spaced apart holding means in each of which a ring casting is adapted to be clamped and held, a holding device for a quantity of continuous ring castings located in a vertical column one over the other, means for feeding the ring castings alternately to said holding means at periodical intervals, and means for grinding the ring castings at their outer curved sides while held by the holding means.

In testimony whereof I affix my signature.

CHARLES E. JOHNSON.