D. F. DOMIZI.

MACHINE FOR FINISHING THE LATERAL EDGES OF PISTON RINGS.

APPLICATION FILED JAN. 20, 1912.

1,139,650.

Patented May 18, 1915.

7 SHEETS—SHEET 1.

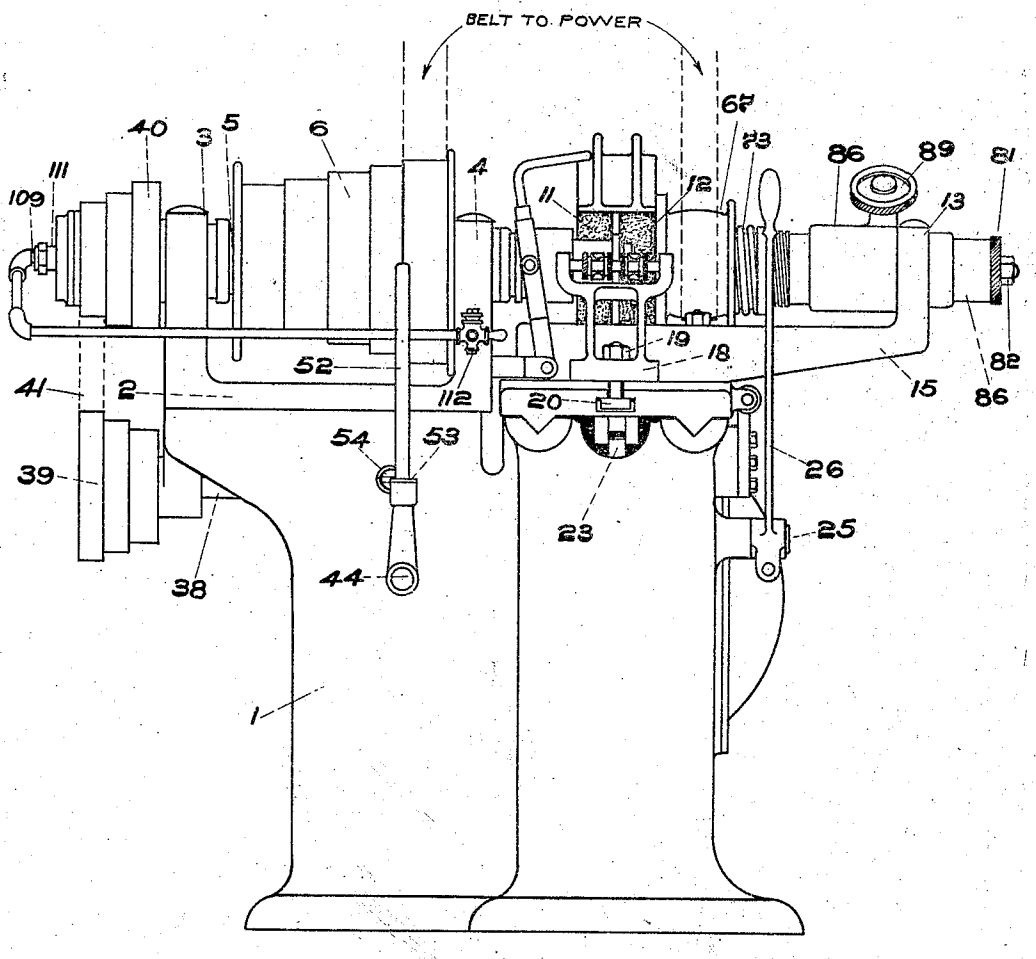


FIG. 1.

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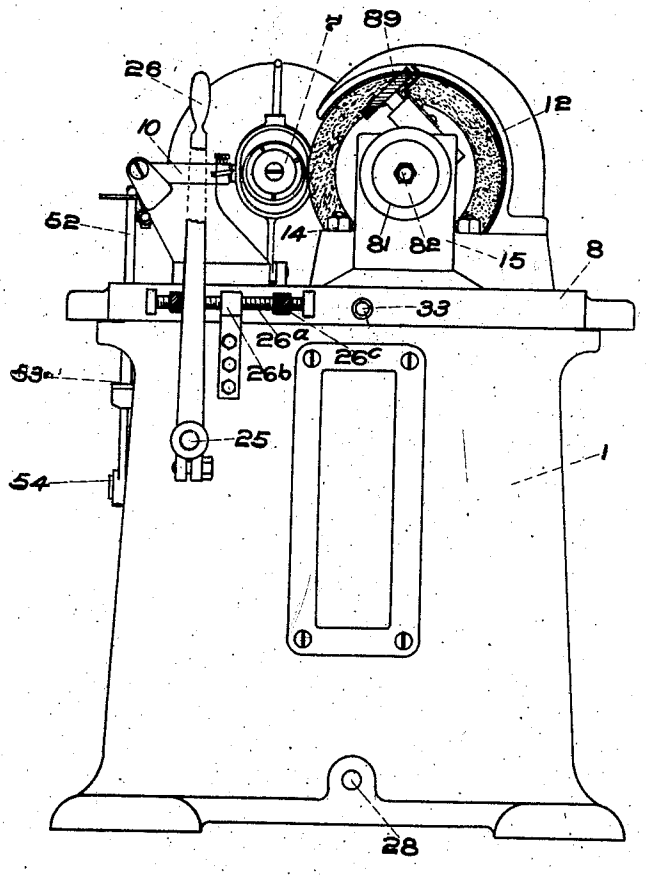


FIG. 2.

Witnesses

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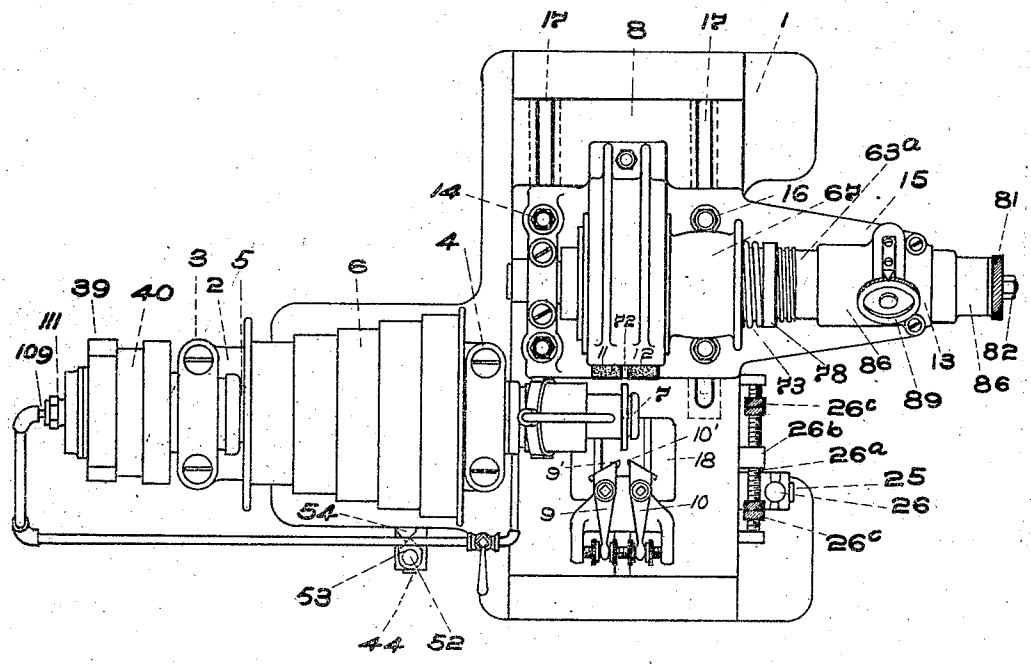


FIG. 3.

Witnesses

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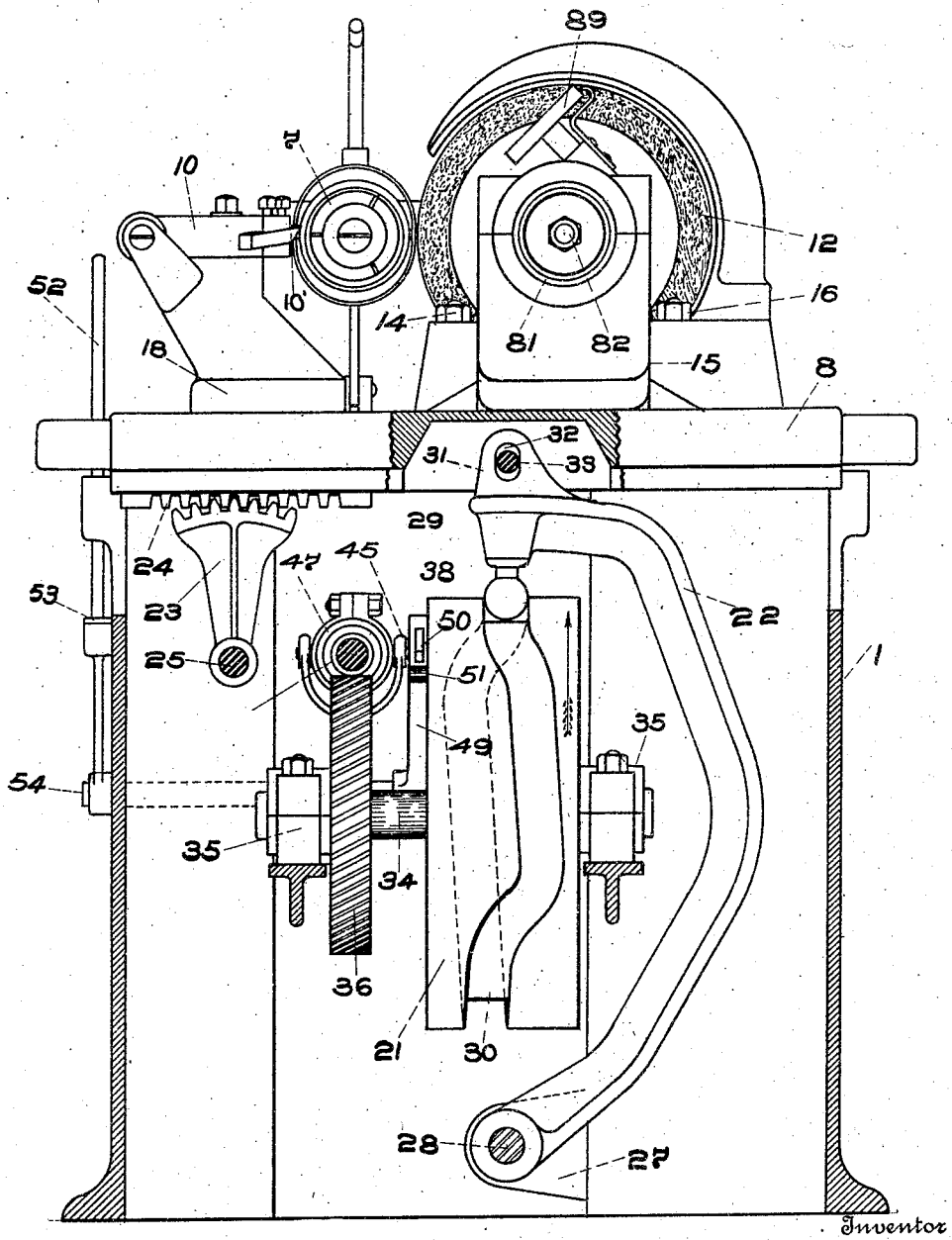
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7 SHEETS—SHEET 4.



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FIG. 4.

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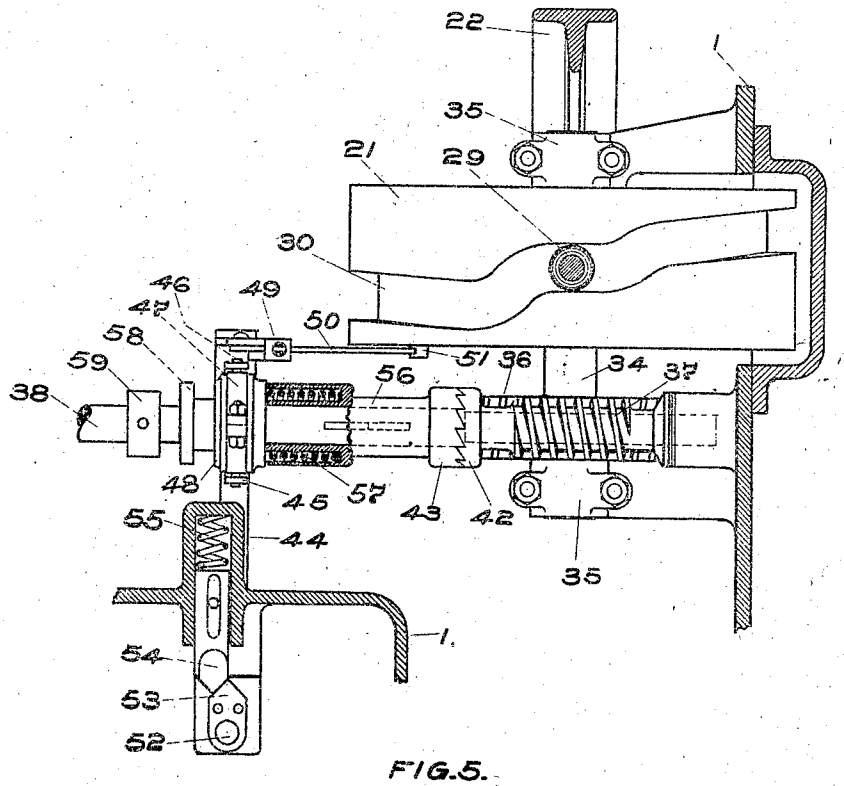


FIG. 5.

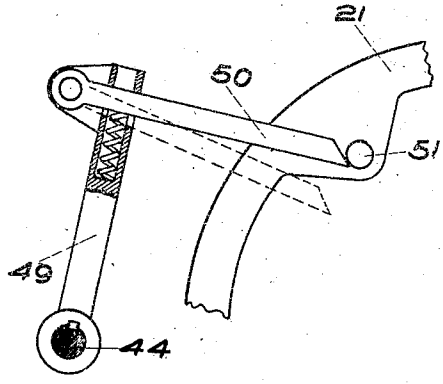


FIG. 6.

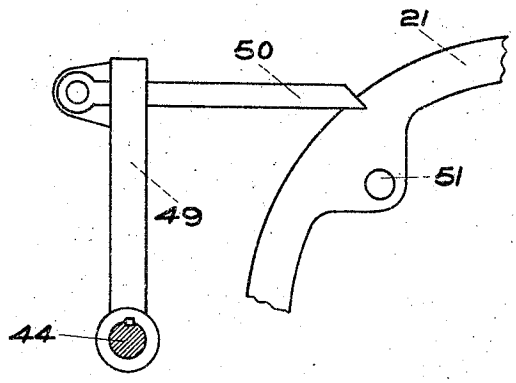


FIG. 7.

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MACHINE FOR FINISHING THE LATERAL EDGES OF PISTON RINGS.

APPLICATION FILED JAN. 20, 1912.

1,139,650. Patented May 18, 1915.

7 SHEETS—SHEET 6.

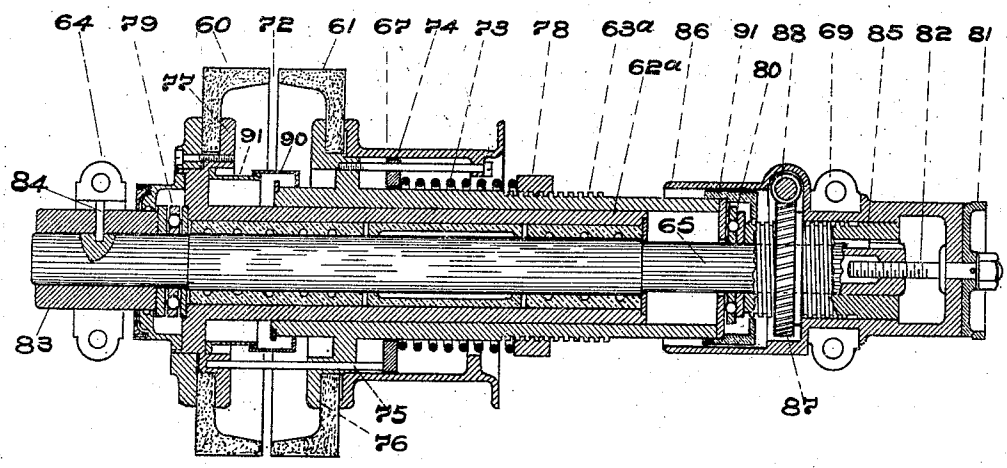


FIG. 8.

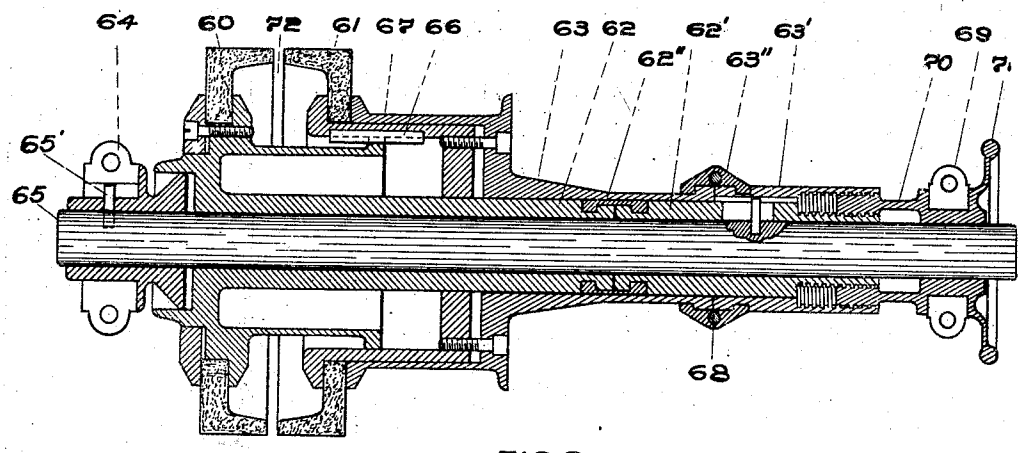


FIG. 9.

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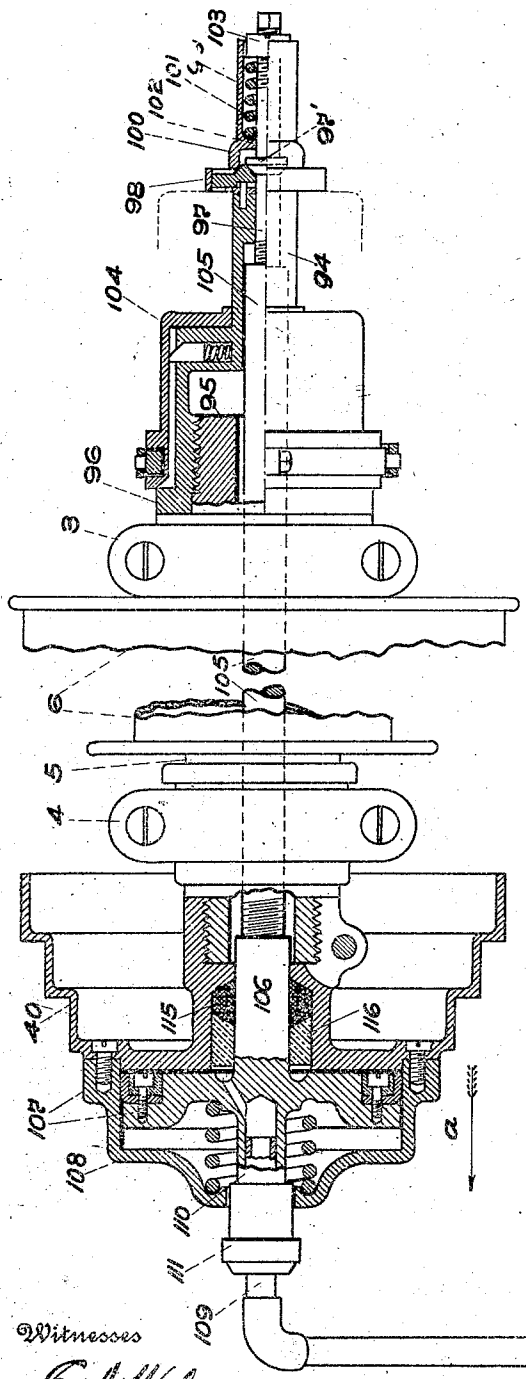
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APPLICATION FILED JAN. 20, 1912.

1,139,650.

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7 SHEETS—SHEET 7.



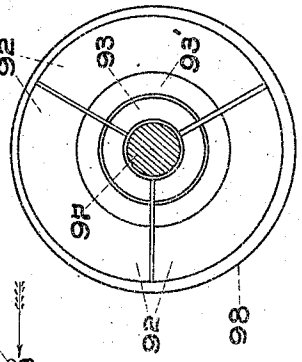


FIG. 11.

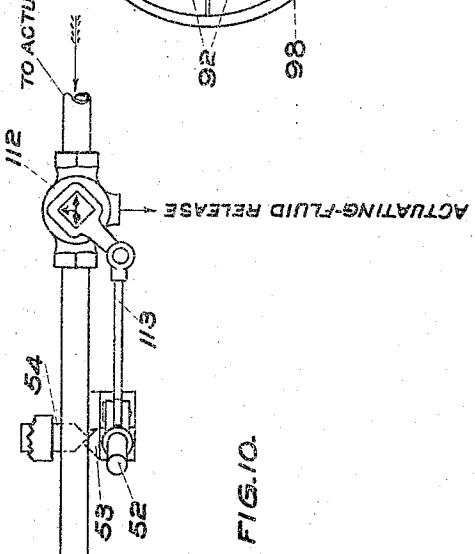


FIG. 10.

Witnesses

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UNITED STATES PATENT OFFICE.

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MACHINE FOR FINISHING THE LATERAL EDGES OF PISTON-RINGS.

1,139,650. Specification of Letters Patent. Patented May 18, 1915.

Application filed January 20, 1913. Serial No. 742,504.

To all whom it may concern:

Be it known that I, DAVID F. DOMIZI, citizen of the United States, residing at Franklin, in the county of Venango and State of Pennsylvania, have invented certain new and useful Improvements in Machines for Finishing the Lateral Edges of Piston-Rings, of which the following is a specification.

The object, construction and operation of my machine for finishing the lateral edges of piston rings, are herein set forth with sufficient clearness to enable those skilled in the art to which it appertains, to make and use the same.

The object of my invention is to provide a machine by means of which the lateral edges of snap rings for pistons of various kinds of motors, engines, pneumatic and hydraulic machinery, etc., may be finished cheaply, quickly and accurately.

There is now no uniformity of practice in this line of work, as nearly every manufacturer engaged therein has some particular method of his own, but it is generally conceded that there is a want to be filled in the way of a machine that will do this work quickly, cheaply and with the degree of accuracy that is demanded, especially in the line of high speed motors for automobiles, motor boats, aviation craft, etc.

It is generally conceded that, in order to secure a properly finished surface upon a ring, the final finish must be imparted thereto by grinding, but in finishing the lateral edges, much difficulty has been experienced in attaining the proper accuracy of width, as heretofore the machining or tooling of the ring has been done upon one of a number of machines, and by various operatives, and the final grinding upon another machine. Under these circumstances, the quality of the machining was likely to vary, the tool-marks being coarse, in some instances, and much finer in others, owing to various circumstances, such as the shape of the tool, amount of feed, the speed of the machine and the skill of the operative; and these variations left different amounts of stock upon the ring, to be removed by grinding, hence much care and skill was necessary, to secure the final desired results. Rechucking the ring, for the various operations, also added to the difficulty.

With my machine, on the other hand, the cutting tools may be accurately adjusted, so that all that is required of the grinding mechanism is, to remove the tool marks, no rechucking is required, and, under the eye of a single operative, the work has been changed from one of vexation and uncertain results, to one of ease, accuracy and extreme uniformity of product.

One form of construction whereby I attain the above object, is clearly illustrated in the drawings, which form a part hereof, the various figures of which are as follows:—

Figure 1 is a front elevation of my machine; Fig. 2 is a left end elevation; Fig. 3 is a plan view; Fig. 4 is an end view, with the bed shown in section, to expose the operative mechanism to view; Figs. 5, 6, and 7 are details of cam, clutch and clutch-operating mechanism used in my machine; Fig. 8 is a central, longitudinal section of the grinding mechanism, and the preferred form of mandrel for the same; Fig. 9 is a central, longitudinal section of the grinding mechanism, showing a modified form of mandrel construction; Fig. 10 is a plan view, partly in section, of the live spindle or head stock of my machine, showing one form of chuck which may be employed; Fig. 11 is a face view of the chuck jaws, showing the expanding plunger or mandrel in section.

The same reference characters are applied to identical parts in all the views.

The drawings illustrate one form of construction, whereby my inventive idea may be mechanically expressed, but said drawings are illustrative merely, and are not intended to limit my invention to the precise form of embodiment shown, the scope of my inventive idea being a machine which will simultaneously finish both lateral edges of an annulus, while the same is being revolved.

The construction shown in the drawings is substantially as follows:—

Mounted upon a suitable bed 1, is a head-stock 2, having suitable bearings 3, 4, for the reception of a live spindle 5, that is provided with means for revolving same, which may be a cone pulley 6. Upon the inner end of said live spindle 5, is mounted a chuck 7, that is suitable for chucking piston rings by the internal engagement thereof, and in such a manner that the lateral faces thereof can be simultaneously operated upon and finished. The chuck which I prefer to use

for this purpose, is the one shown and described in a certain application for Letters-Patent of the United States for chuck for piston rings, No. 622,579, filed by me on the 21st day of April, 1911. I have, however, shown a modified form of chuck in Figs. 10 and 11, which may be used, and will presently be described.

Also mounted upon the bed 1, and longitudinally movable thereon, is a saddle 8, to which are affixed appliances for finishing the lateral edges of the piston rings. One of said appliances consists of a suitable gage tool, composed of two tool holders 9 and 10, each provided with a cutter 9′ and 10′ respectively, adapted to roughly finished the piston ring, and bring the same to an approximately definite and accurate width. Such a gage tool is fully shown and described in a certain Letters-Patent of the United States, No. 1,098,026, issued to me on the 26th day of May 1914, though any other suitable device could be used in place of the one shown, if desired.

As will be fully understood by a reference to said Letters Patent, the holders 9 and 10 are adjustable by means of the collars 9″ and 10″, as shown in the drawings forming a portion of said Letters Patent, for the purpose of varying the width of space between the adjacent cutting edges of tools 9′ and 10′, when such variation is desired.

The other of said appliances may be any suitable device for simultaneously grinding the two lateral edges of a ring, composed of two abrasive wheels 11 and 12, designated in Figs. 8 and 9 as 60 and 61, mounted upon a suitable mandrel, for which bearing 13 and 14 are formed upon a bracket or housing 15. A more detailed illustration of such grinding wheels as I prefer to use, and the arrangement of same, is shown in Figs. 8 and 9, and will presently be described.

Housing 15 is attached to saddle 8 by means of bolts 16, the heads of which are inserted in the T slots 17 in the saddle, and this arrangement permits the adjustment of said housing longitudinally of said saddle, whereby the machine is adapted for operation upon rings of various diameters.

Gage-tools 9 and 10 are mounted upon a stand 18, which is secured to saddle 8 by means of a bolt 19 that occupies a T slot 20, whereby adjustment of said tools longitudinally of said saddle 8 is provided for, and said adjustment is also for the purpose of adapting my machine for operating upon rings of considerable variation in diameter.

Saddle 8 is longitudinally movable upon bed 1, and may be moved therein, either automatically, by means of the cam-wheel 21 and lever 22, or by means of the sector 23, through its engagement with rack 24. Sector 22 is secured upon shaft 25, which has a lever 28 attached thereto for operating same. Said movement of saddle 8 is for the purpose of moving or feeding the cutting and grinding tools into operative contact with the ring.

When the saddle 8 is to be manually operated, pin 33 is removed to free the saddle from the action of lever 22, and for the purpose of limiting the movement of the saddle in either direction, when so manually operated, I provide a stop, which consists of a screw-threaded rod 26^a, attached at either end to the saddle, and passes loosely through an eye-bracket 26^b, attached to bed 1. A pair of lock nuts 26^c, adapted to contact with said eye-bracket, is placed upon rod 26^a, upon either side of bracket 26^b, and by adjusting said nuts relatively to said bracket, the movement of the saddle will be thereby limited, so that the cutting and grinding devices will be limited in their operative travel and caused to stop at the proper point.

The construction of the cam mechanism, whereby saddle 8 is automatically actuated, consists of said lever 22, which is pivoted at its lower end to the bracket 27 by means of a pin 28. The upper end of said lever is provided with a cam-lug 29, that projects into the groove 30 of the cam-wheel. An upwardly projecting saddle-lug 31 is formed on the upper end of lever 22, in which a slot 32 is formed, and through which a removable or disengageable pin 33 passes and operably connects lever 22 to said saddle.

Wheel 21 is mounted upon a shaft 34, for which bearings 35 are provided, and is revolved by means of the following mechanism:—Rigidly affixed to shaft 34 is a worm-wheel 36, with which meshes a worm 37, adapted to drive said wheel. Worm 37 is revolubly mounted upon shaft 38, which projects through the bed 1, and is provided upon its outer end with a cone pulley 39, which may be driven from pulley 40 by means of a belt 41. Pulley 40 is keyed to the live spindle 5. Motion is transmitted to worm 37 by means of a clutch,—see Fig. 5—one member 42 of which is formed upon one end of said worm, and the other member 43 thereof is slidably and non-revolubly mounted upon shaft 38. Means is provided for automatically disengaging the clutch, at the completion of the operation upon each ring,—which is accomplished during one revolution of wheel 21,—and said means, shown especially in Figs. 5, 6 and 7, are as follows:—A shaft 44 passes through the bed 1, and to the same is attached and keyed an actuating yoke 45, which engages the pins 46 of the collar 47, in which the clutch-hub 48 revolves. Also keyed to the inner end of shaft 44 is an arm 49, to the upper end of which is attached a dog or pawl 50, which extends over into close proximity to the lateral face of wheel 21, and the free end thereof is so positioned, when the clutch is en-

gaged, that it encroaches upon the path of a pin 51, projecting from said wheel as shown in Fig. 6. When said pin comes into contact with the end of pawl 50, it causes lever 49 to move toward the vertical position, and this movement causes shaft 44 to turn slightly. Said shaft 44 projects through bed 1 and to its outer end is affixed and keyed the hand-lever 52. To said lever is attached a pointed latch-block 53 that bears against a yieldable, pointed detent 54, which is held in the position shown in Fig. 5 by a suitable spring 55. When arm 49 has been moved sufficiently toward the vertical position to cause the point of latch-block 53 to pass the point of the detent 54, the outward thrust of said detent, impinging upon the inclined face of block 53, causes arm 49 to move to the substantially vertical position shown in Fig. 7. This also actuates yoke 45, and causes the disengagement of the clutch-members 42 and 43, and, in order to secure a quick and positive disengagement of said clutch-members, I provide the following details for causing such actuation. Clutch member 43 is extended in the form of a sleeve 56, in which is a chamber for the reception of a spiral spring 57.

One end of said spring bears against the clutch-hub 48, which is slidable upon said sleeve 56. When hub 48 starts to move in the disengaging direction, spring 57 causes the clutch-member 43 to remain in the engaged position until hub 48 bears against collar 58, which is firmly secured to sleeve 56; at this instant the quick movement above set forth, caused by the members 53 and 54, takes place, and collar 58 is caused to move quickly into contact with collar 59, and during this quick movement, a disengagement of the clutch-members is caused, which causes the worm 37 and the parts actuated thereby, to cease operating. When the re-engagement of clutch-members 42 and 43 is desired, this is manually accomplished, by means of the hand-lever 52.

It will be readily understood that the clutch may be both manually engaged and disengaged, when so desired. It will also be readily understood that other mechanism could be employed for causing the automatic disengagement of said clutch. That shown in the drawings is merely illustrative of one way in which it may be accomplished, and I do not wish to be understood as limiting myself thereto.

The construction of the grinding mechanism for this machine is substantially the same as that set forth in my application for Letters-Patent of the United States, for a machine for grinding the lateral edges of piston rings, filed on the 20th day of January, 1912, Serial No. 672,503. With the construction here shown, however, certain modifications of said grinding mechanism are desirable, which pertain to the lateral and relative adjustment of the grinding wheels. These modifications are clearly shown in Figs. 8 and 9, which I will now describe in detail.

Fig. 8 shows the preferred form of construction, but inasmuch as the form shown in Fig. 9 is the simpler form, this will be first described, and an understanding of this form will aid in a more ready understanding of Fig 8.

Two abrasive wheels 60 and 61, designated in figures other than in 8 and 9, as 11 and 12, and between the juxtaposed faces of which, the grinding is done, are adjustably mounted side by side upon a compound mandrel, consisting of the longitudinally movable sleeve 62, to which wheel 60 is secured, and a longitudinally movable sleeve 63, to which wheel 61 is secured. Said wheels and sleeves are caused to revolve in unison upon shaft 65, which is non-revolubly secured in the bearing 64, by means of a pin 65′. Relative revolubility between sleeve 62 and 63 is prevented by the spline 66. Sleeve 63 is formed into a belt-pulley 67 for the reception of a driving belt.

In this form of construction, I provide for the simultaneous, relative adjustment of both abrasive wheels, in the following manner:—Sleeve 62 is revolubly connected to an adjusting-sleeve 62′, by means of a split collar 62″. The outer end of sleeve 62′ is reduced somewhat in diameter, and said reduced portion is externally screw-threaded. Sleeve 63 is revolubly connected to an adjusting-sleeve 63′ by means of a split collar 63″, the parts of which are secured together by means of bolts or screws 68. Sleeve 63 is internally screw-threaded with a thread that is reverse to that of the external thread upon sleeve 62′,—that is, one is a right-hand thread, the other a left-hand thread. Passing revolubly through the bearing 69, is a sleeve 70, whose inner end is externally and internally threaded. Said threads are relatively reverse, to fit the threads upon sleeve 62′ and 63′. The outer end of sleeve 70 is formed into a hand-wheel 71, suitable for revolving same, and when sleeve 70 is revolved, sleeves 63′, 63 and wheel 61 move in one direction, and sleeves 62′, 62 and wheel 60 move in the opposite direction, thus varying the width of the gap 72, between said wheels.

The construction shown in Fig. 8 differs mainly from that shown in Fig. 9, in the fact that the grinding wheels are independently adjustable, and a separate adjusting device is provided for each. In other respects, the constructions do not differ materially, so far as my inventive idea is concerned.

The construction shown in Fig. 8 is as follows:—The grinding wheels 60 and 61 are identical in construction with those shown in Fig. 9. Wheel 60 is attached to the man-

drel-sleeve 62ª and wheel 61 is attached to the mandrel-sleeve 63ª. Shaft 65 is non-revolubly mounted in the bearings 64 and 69, but it is made longitudinally movable therein, for the purpose of laterally adjusting wheel 60 in a manner presently to appear.

The wheels 61 and 62 are held apart by means of spring 73 that bears at its inner end against a ring or annulus 74, which in turn bears against one end of a plurality of rods 75, which pass loosely through the flange 76 of the wheel 61, but are firmly attached to the flange 77 of wheel 60. The outer end of spring 73 bears against a collar 78 that is attached to sleeve 63ª by means of a screw-thread. Spring 73 is compressed to a considerable degree by means of the collar 78, and the reactive or expansive tendency of said spring is to hold sleeve 62ª firmly against the thrust-bearing 79, and sleeve 63ª firmly against the thrust-bearing 80.

The desired width of the ring being operated upon, is secured by the width of the slot 72 between the wheels, and the width of said slot is determined by the lateral adjustability of the grinding wheels.

Wheel 60 is adjusted in the following manner: Shaft 65 is longitudinally movable, as aforesaid, and is so moved by means of the hand-wheel 81, which is rigidly secured to a stem or pin 82, that screws into one end of said shaft. At the opposite end of said shaft, is affixed a collar 83, secured to the shaft by the pin 84, and the inner end of said collar 83 bears against the thrust-collar 79. When the hand-wheel 81 is moved in one direction, it draws shaft 65 toward it, and this causes a corresponding movement of wheel 60, or its movement toward wheel 61, and a diminution of the width of gap 72. When hand-wheel 81 is turned in the opposite direction, the pressure and reaction of wheel 73 causes the shaft 65 to move in the opposite direction from that above set forth, and an increase in the width of gap 72.

The means whereby wheel 61 is adjusted, consists of a sleeve 85, which is non-revoluble, and longitudinally movable within the housing 86. Said sleeve is externally screw-threaded for the reception of a nut in the form of a worm-wheel 87, which is revolved by means of a worm 88, to which a hand-wheel 89 is attached for convenience of manipulation. One end of sleeve 85 bears against sleeve 63ª, through the medium of a thrust-bearing 80, and when nut 87 is turned in one direction, said sleeves 85 and 63ª are caused to be moved,—and with them, wheel 61,—toward wheel 60, which decreases the width of gap 72. When said nut 87 is turned in the opposite direction, sleeve 85 is retracted, and the reaction of spring 73 moves sleeve 63ª and its wheel 61, so that the width of gap 72 is increased.

Suitable guards, as 90 and 91, are provided for excluding particles of abrasive matter from the working portion of the arbor.

It will be readily noted that the form of mechanism shown in Fig. 8 is capable of a much finer and more minute adjustment than that shown in Fig. 9, and for this reason, it is usually preferred, though, for some classes of work, Fig. 9 may be wholly satisfactory in this respect. I do not wish to be understood, however, as confining myself in all cases to either form of grinding mechanism here shown. Figs. 8 and 9 are shown, more for the purpose of giving an explicit description of the type of grinding mechanism well suited to the embodiment of my invention, but other mechanism, embodying the same general features set forth, could also be employed.

As previously mentioned, the form of chuck which I prefer to use with my machine, is the one shown and described in my said application Number 622,579, but I have shown a modified form of chuck in Figs. 10 and 11, which is particularly well adapted for use with small rings, of a diameter of two inches and less.

There are also some other important, modified forms of construction and arrangement, shown in Fig. 10, which I will particularly point out and describe.

The chuck here shown is provided with a plurality of sector-shaped jaws 92, the rear face of each of which is substantially plane, and upon the front face is formed a V-shaped, annular bead, having faces 93 and 93′. The rear face of said jaws is caused to bear against an arbor 94, that is attached to the front end of the live spindle 95, by means of a thimble 96. Said jaws are adapted to move bodily in a line transverse to the axial line of the spindle or arbor 94. Provision is made at the central point of said jaws for the passage of an expander-mandrel 97, upon which is a beveled, annular shoulder 97′, arranged to bear against the inner face 93′ of the jaws, in such a manner that an inward movement of said expander, by means presently to be set forth, will cause said jaws to move or expand outwardly, for the purpose of internally gripping a piston ring 98. Mandrel 97 is extended through the jaws, and upon the same is mounted a sleeve 99, which is formed at its inner end into a contractor-cup 100, the inner edge of which bears against the face 93 of the annular V upon the jaws. Within the outer end of said sleeve 99, is formed a chamber for the reception of a spiral spring 101, one end of which bears against a wall 102 of said sleeve, and the other end against a nut 103, which is screwed upon the expander-mandrel. As the mandrel 97 moves outward, the reaction of spring 101 is sufficient to

cause the contraction or retraction of jaws 92, and the release of the ring that is being operated upon. A gage 104, which is movable to the position shown in dotted lines, is employed to insure the proper positioning of the ring upon the chuck.

For the purpose of imparting the necessary longitudinal movement to the mandrel 97, to actuate the chuck-jaws as stated, I attach said mandrel 97 to a rod 105, which is attached to the stem 106 of a fluid-actuated piston 107, that is operable within the head or cylinder 108, which is attached to the pulley 40. Pulley 40 is rigidly attached to the live spindle in any suitable manner. A pipe 109, for the admission of actuating fluid, enters the piston-tube 110, through a stuffing-nut 111, and air is admitted thereto and permitted to exhaust therefrom by means of a three-way cock 112, which is automatically actuated by being connected to the lever 52 by any suitable means, such as a coupling-rod 113. When air is admitted through the pipe, it causes piston 107 to move in the outward direction,—indicated by arrow *a*,—which movement is transmitted through the medium aforesaid, to the mandrel 97, and causes the jaws 92 to move outwardly, in which movement, spring 101 is caused to contract, because of the outward or backward movement of cup 100. When cock 112 is turned to the air-escape position, spring 114 moves said piston back to the normal position shown, and the chuck contracts as above stated.

It is desirable that a stuffing-box 115 be provided for the passage of stem 106, and a suitable gland 116 be placed therein, to compress the packing, and inasmuch as the location is normally inaccessible, and cannot be reached for the purpose of adjusting said gland 116, without considerable disassembling of the surrounding structure, I arrange and adapt the gland to be automatically adjusted, by exposing the outer face or end of same to the pressure of the air that actuates piston 107. By this arrangement, the compression of the packing is always automatic and in proportion to the pressure of the air used in operating the chuck mechanism.

Throughout this specification, I have considered the machine here shown in its adaptability to finishing the lateral edges of piston rings; it is, however, fully as well adapted for finishing other annuli and like objects, and such use is equally within the scope of my invention.

The machine could also, if desired, be constructed in such a manner that the gage tools and the grinding wheels would operate upon the work at the same time.

I claim—

1. In a machine for finishing the lateral edges of piston rings, the combination with means for so holding and revolving such ring that the two lateral edges thereof may be simultaneously operated upon, of a plurality of pairs of width-reducing means, each of said pairs being adjustable as to said width, and arranged to operate upon the two edges of such ring simultaneously, and perform a step in the reduction of such ring to a predetermined width, and means moving said reducing means respectively into operative relation with said ring, alternately, in the proper sequence.

2. In a machine for finishing the lateral edges of piston rings, the combination with means for so holding and revolving such ring that the two lateral edges thereof may be simultaneously operated upon, of a plurality of width-reducing means, each adjustable as to said width, and arranged to operate upon the two edges of such ring simultaneously, and perform a step in the reduction of said ring to a predetermined width, and means automatically moving said reducing means respectively into operative relation with said ring, alternately, in the proper sequence.

3. In a machine for finishing the lateral edges of piston rings, the combination with means for holding and revolving a ring in such a manner that the lateral edges thereof may be simultaneously operated upon, of a plurality of width-reducing means, each adjustable transversely to the axial line of said holding means, and arranged to operate upon the two edges of such ring simultaneously and perform a step in the reduction of said ring to a predetermined width, and means automatically moving said reducing means respectively into operative relation with said ring alternately in the proper sequence.

4. In a machine for finishing the lateral edges of piston rings, the combination with a chuck attached to a suitably driven spindle and arranged for holding a ring in such manner that the two lateral edges thereof, may be simultaneously operated upon, of a plurality of devices, each adapted to operate upon both edges of said ring simultaneously for the purpose of reducing the width thereof, each of said devices being arranged to perform a step in the reduction of said ring to a pre-determined width, means automatically moving said devices into operative relation with said ring alternately and in the proper sequence, and means arresting the action of said moving means at the completion of such sequence.

5. In a machine for finishing the lateral edges of piston rings, the combination with a chuck attached to a driven spindle and arranged to hold a ring in such manner that the lateral edges thereof may be simultaneously operated upon, of a plurality of devices, each adapted to operate upon both

edges of said ring simultaneously for the purpose of reducing the width thereof, each of said devices being arranged to perform a step in the reduction of such ring to a pre-determined width, manually-actuated means for moving said devices into operative relation with said ring, and means limiting the extent of said movement.

6. In a machine for finishing the lateral edges of piston rings, the combination with an automatically actuated chuck attached to a driven spindle and arranged to hold a ring in such manner that the lateral edges thereof may be simultaneously operated upon, of a plurality of devices each adapted to operate upon both edges of a ring simultaneously and to perform a step in the reduction of said ring to a pre-determined width, means automatically and alternately moving said devices into the operative relation with said ring, in the proper sequence, and means arresting the action of said moving means, at the completion of said sequence.

7. In a machine for finishing the lateral edges of piston rings, the combination of a bed, a head-stock attached to said bed, a spindle in said head-stock, a chuck attached to said spindle, arranged to chuck such ring, a saddle mounted upon said bed and movable transversely to the axial line of said spindle, finishing means for said ring arranged to operate upon both edges thereof simultaneously, and means arranged to move said saddle to bring said finishing means into operative relation with said ring and to remove the same therefrom.

8. In a machine for finishing the lateral edges of piston rings, the combination of a bed, a head-stock mounted upon said bed, a spindle in said head-stock, a chuck attached to said spindle, arranged to chuck said ring by internal engagement thereof, a saddle mounted upon said bed and movable thereon in a line transverse to the axial line of said chuck, ring-finishing means attached to said saddle, arranged to operate upon both edges of said ring simultaneously, means automatically moving said saddle to bring said finishing means into operative relation to said ring and to remove the same therefrom, and means automatically arresting the action of said saddle-moving means at the completion of said removal movement.

In testimony whereof I affix my signature in presence of two witnesses.

DAVID F. DOMIZI.

Witnesses:
AGNES WHALEN,
E. R. INMAN.