July 30, 1940. R. W. YOUNG 2,209,711

PISTON RING GRINDING MACHINE

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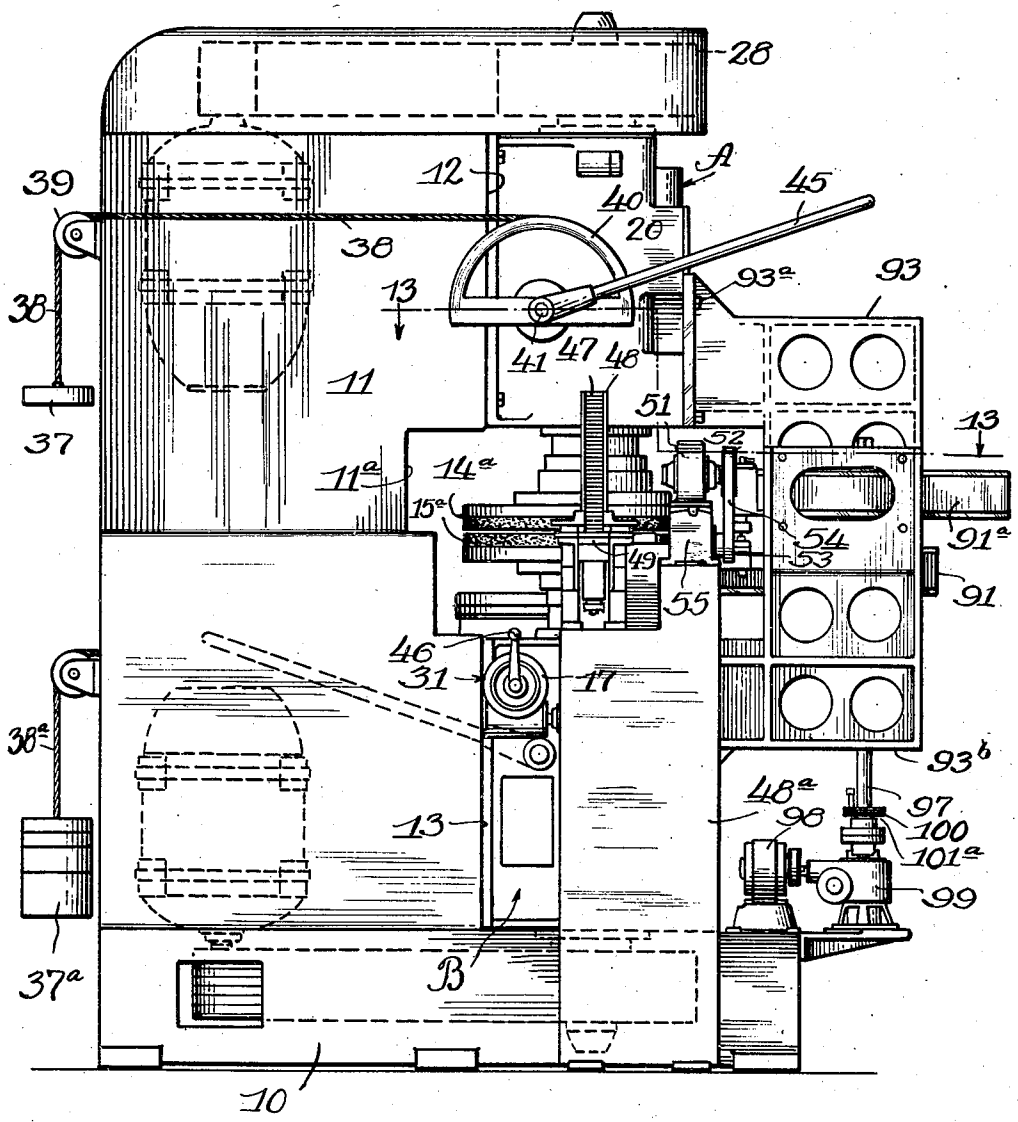


Fig. 1

Witness:
Chas. L. Howard

Inventor
Ralph Waldo Young
by Field Mehlhope Hecht & Poole Attys

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PISTON RING GRINDING MACHINE

Filed June 15, 1938 9 Sheets-Sheet 2

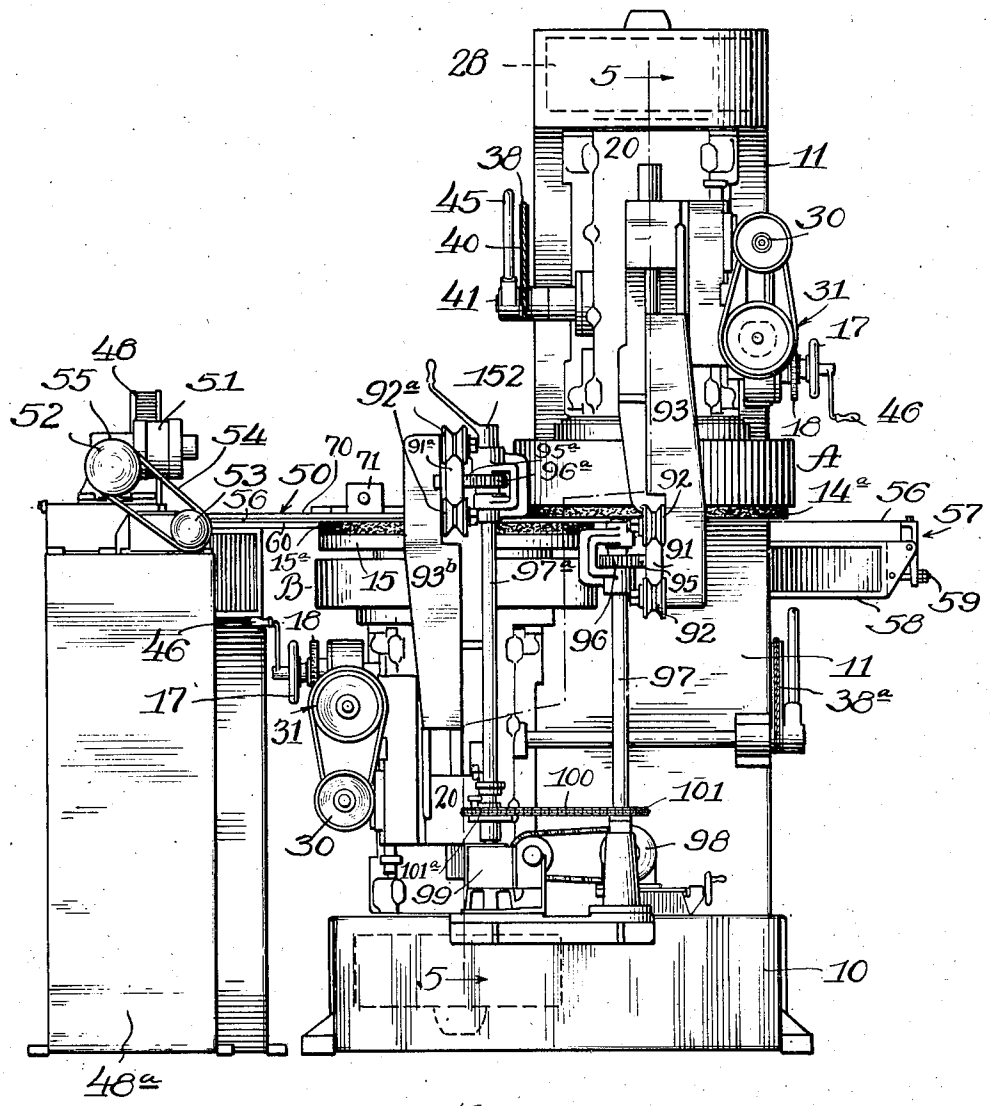


Fig. 2

Witness:
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July 30, 1940. R. W. YOUNG 2,209,711

PISTON RING GRINDING MACHINE

Filed June 15, 1938 9 Sheets-Sheet 3

Fig. 3

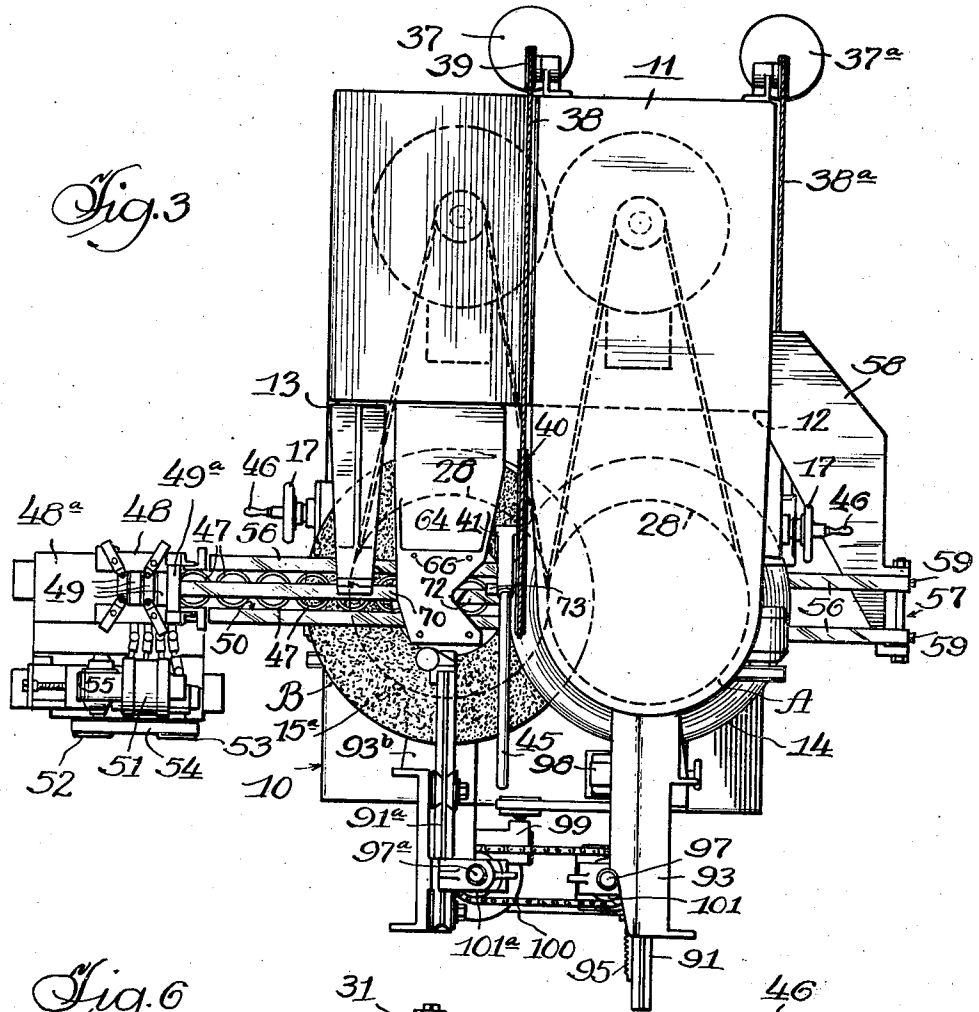
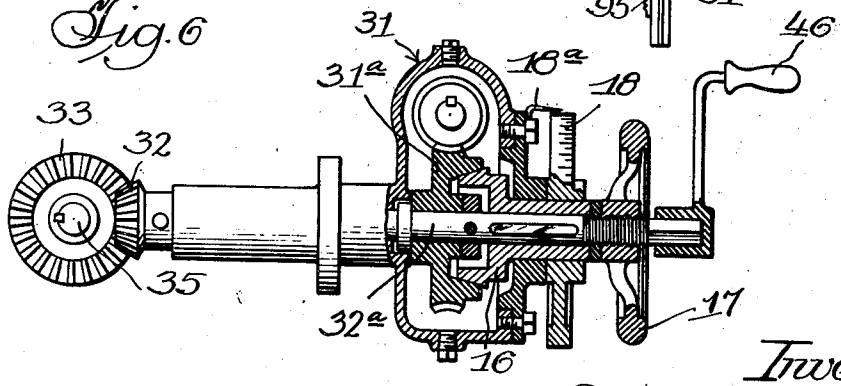


Fig. 6



Witness:
Chas. L. Touse.

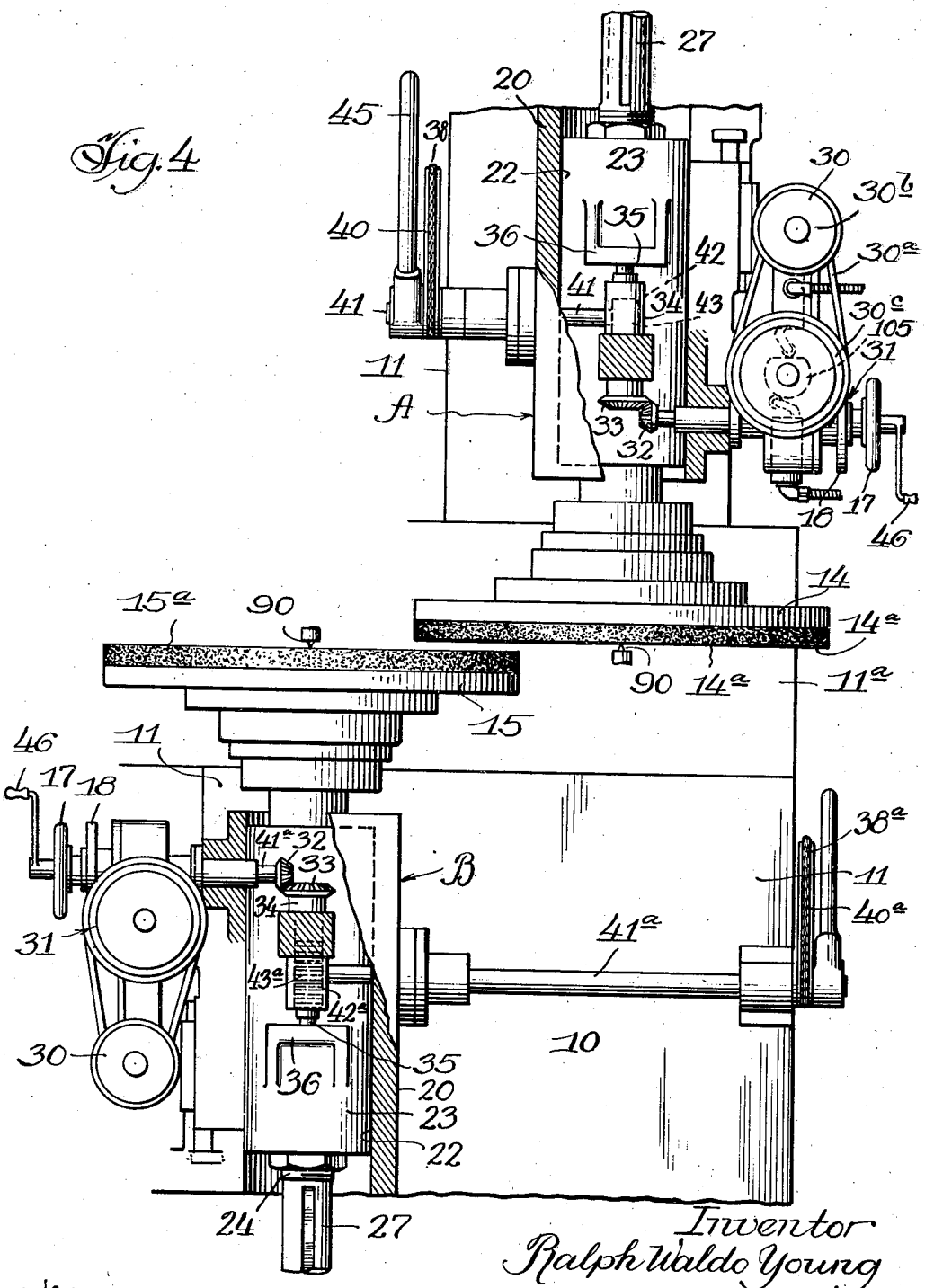
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July 30, 1940. R. W. YOUNG 2,209,711

PISTON RING GRINDING MACHINE

Filed June 15, 1938 9 Sheets-Sheet 4

Fig. 4



Witness:
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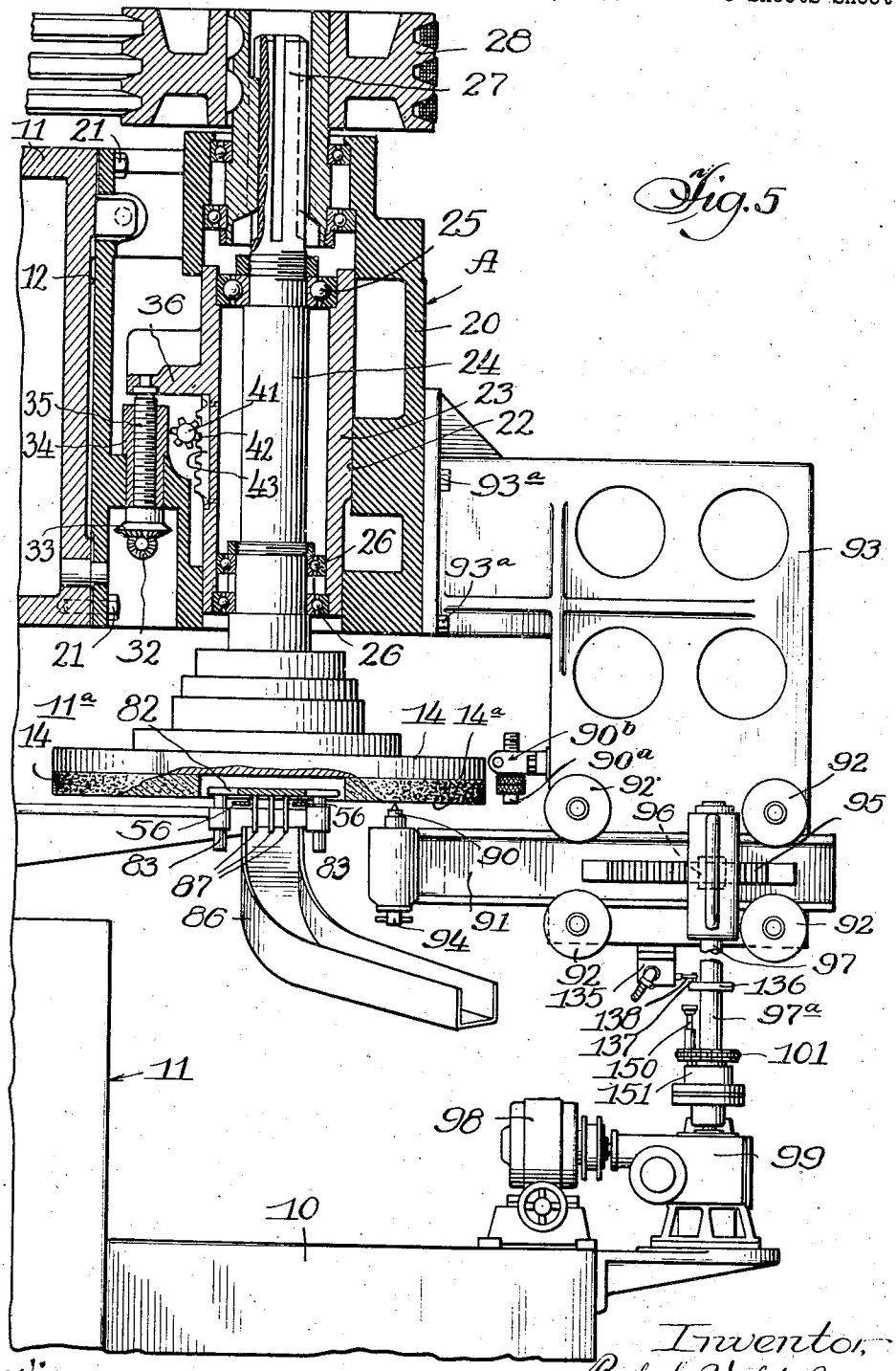
Offield Mehlhope Scott & Poole Attys.

July 30, 1940. R. W. YOUNG 2,209,711

PISTON RING GRINDING MACHINE

Filed June 15, 1938 9 Sheets-Sheet 5

Fig. 5



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July 30, 1940. R. W. YOUNG 2,209,711

PISTON RING GRINDING MACHINE

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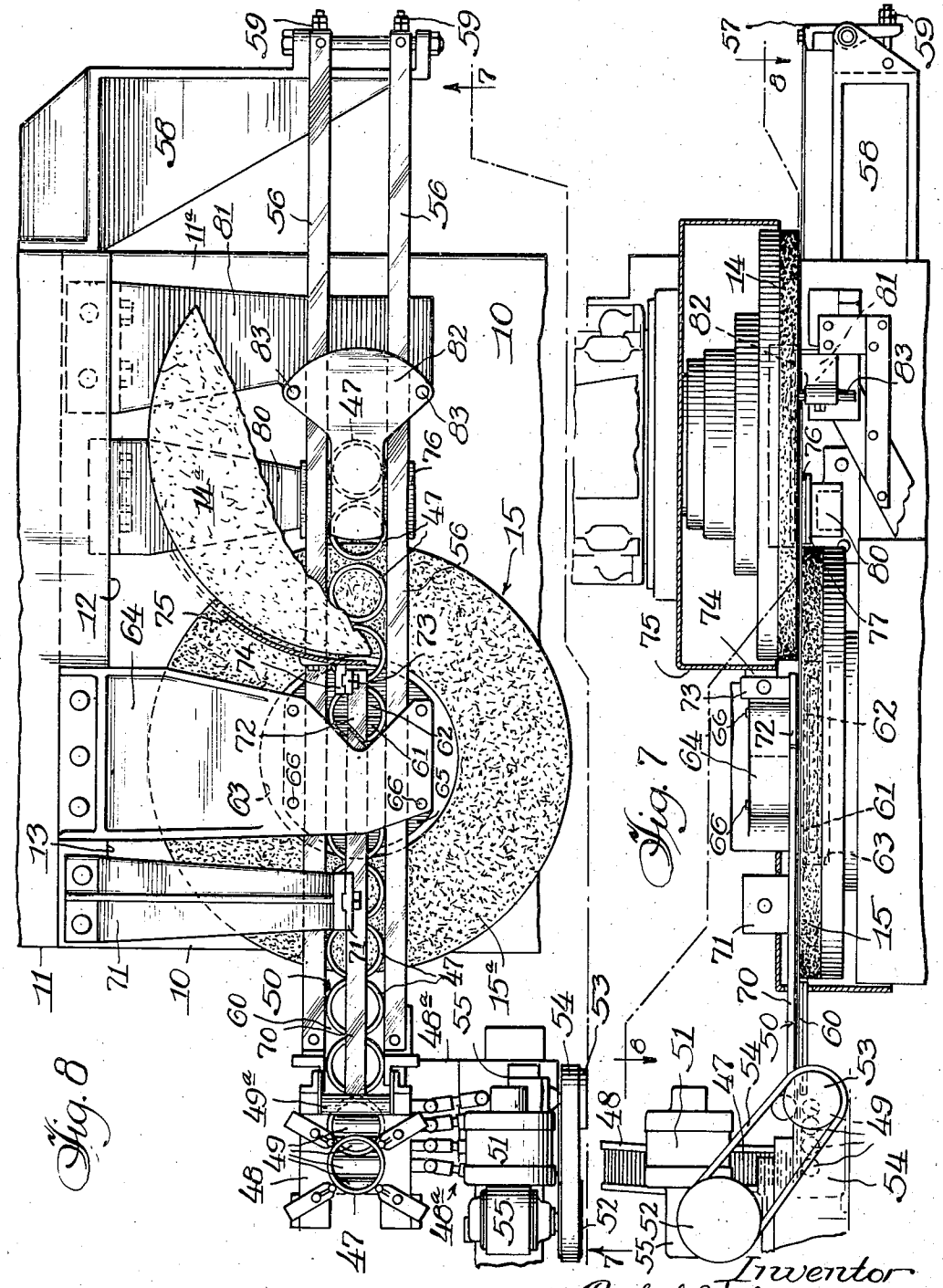


Fig. 8

Fig. 7

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July 30, 1940. R. W. YOUNG 2,209,711

PISTON RING GRINDING MACHINE

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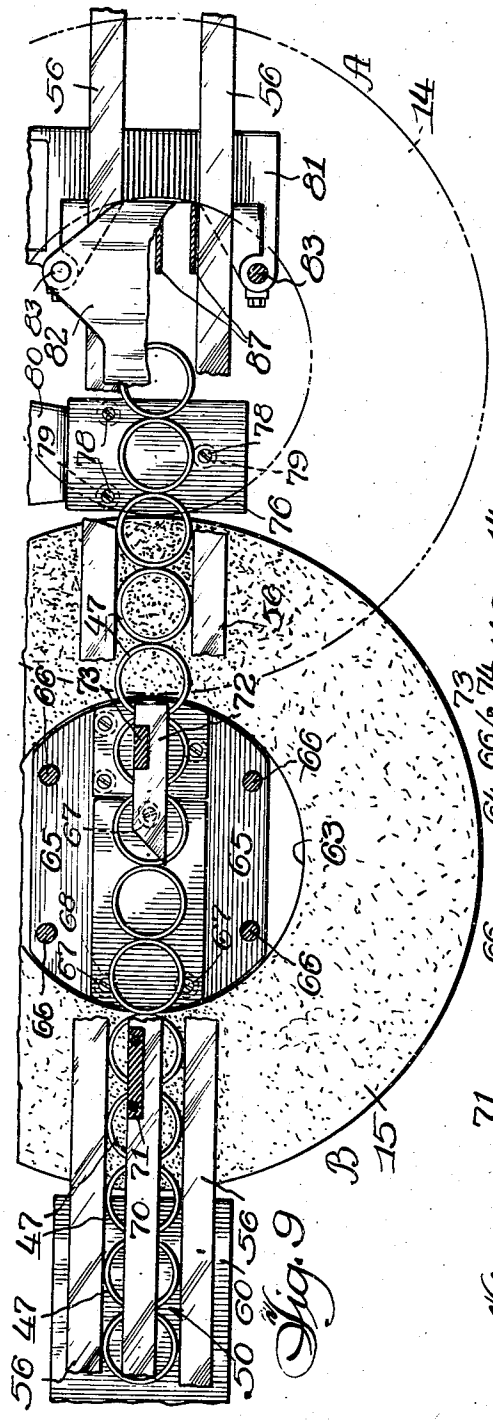


Fig. 9

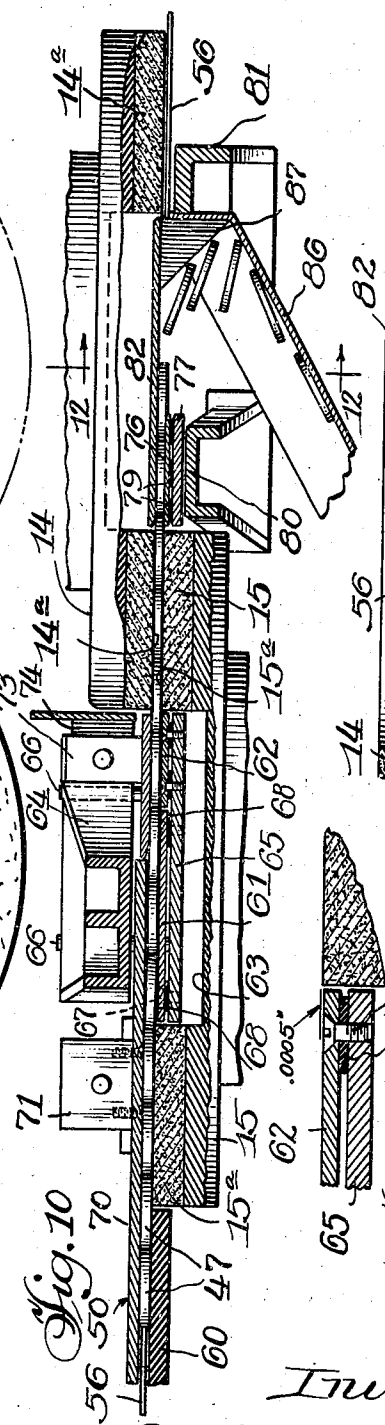


Fig. 10

Fig. 11

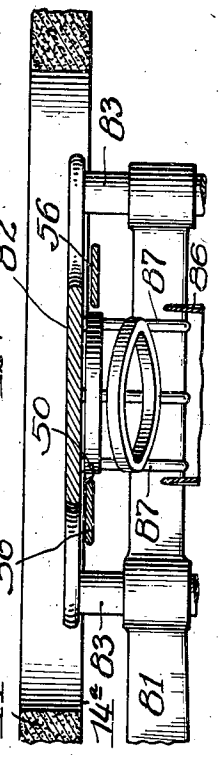


Fig. 12

Witness:
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July 30, 1940. R. W. YOUNG 2,209,711

PISTON RING GRINDING MACHINE

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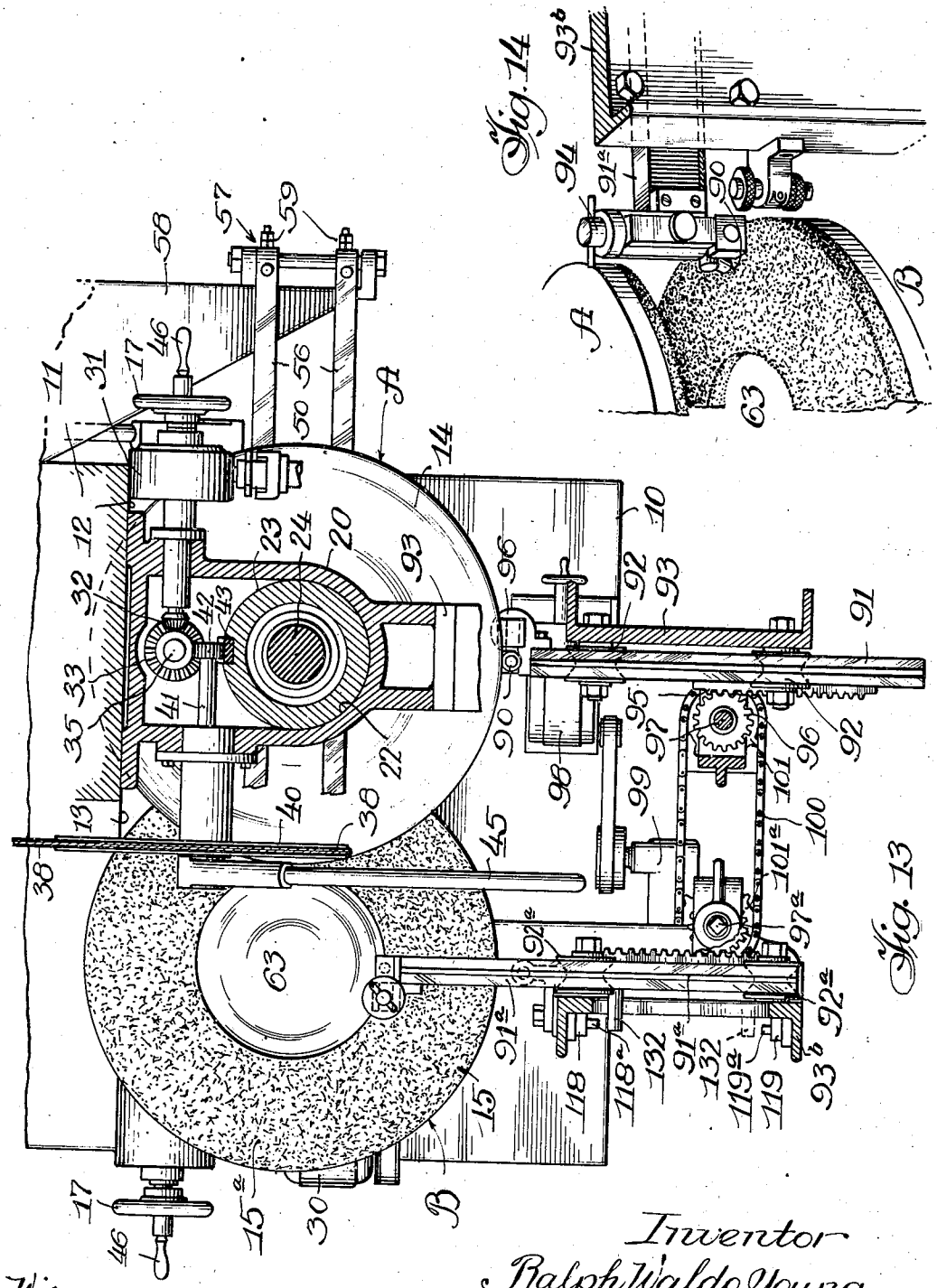


Fig. 13

Fig. 14

Witness:
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July 30, 1940. R. W. YOUNG 2,209,711

PISTON RING GRINDING MACHINE

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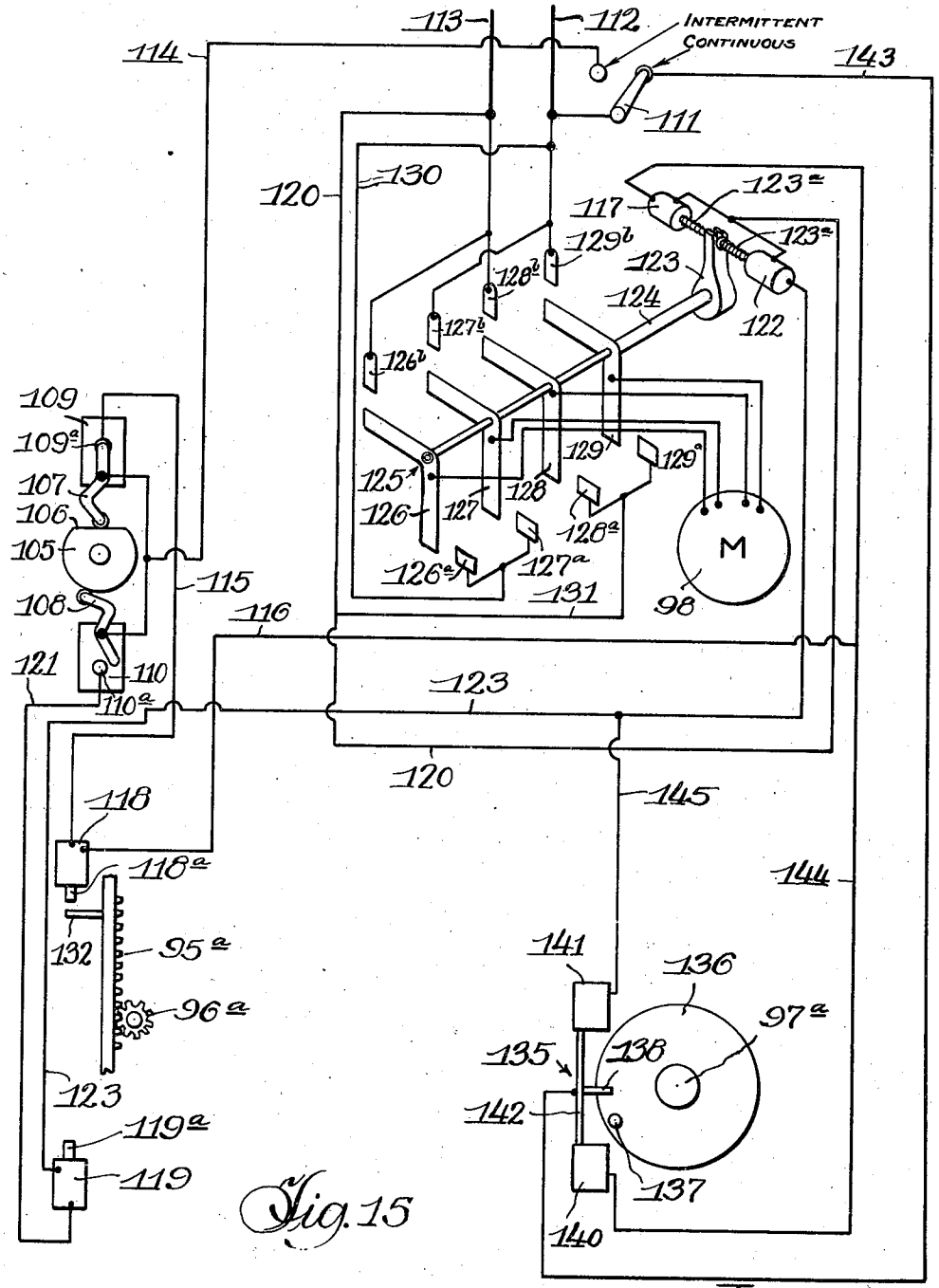


Fig. 15

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Patented July 30, 1940 2,209,711

UNITED STATES PATENT OFFICE

2,209,711

PISTON RING GRINDING MACHINE

Ralph Waldo Young, Beloit, Wis., assignor to Charles H. Besly & Company, Chicago, Ill., a corporation of Illinois

Application June 15, 1938, Serial No. 213,767

3 Claims. (Cl. 51—112)

This invention relates to improvements in double spindle grinding machines of the type particularly adapted for finishing the top and bottom surfaces of piston rings and similar flat pieces, although not necessarily limited to such use.

Among the objects of the invention is to provide a machine of the character described wherein piston rings are continuously fed between the two opposed grinding wheels and ground or finished to a predetermined uniform thickness within exceptional limits of precision.

A further object of the invention is to provide improved means for feeding the grinding wheels toward each other to compensate for wear, together with means for automatically dressing the grinding surfaces so as to maintain the wheels in proper working relation with each other as well as to maintain their grinding surfaces in proper cutting condition.

Other features and objects of the invention will appear from time to time as the following description proceeds.

The invention may best be understood by reference to the accompanying drawings, in which

Fig. 1 is a front view of a machine constructed in accordance with my invention, and with the grinding wheel hoods removed.

Fig. 2 is a side view of the machine shown in Fig. 1.

Fig. 3 is a plan view of the machine.

Fig. 4 is an enlarged side view of the machine, but with parts omitted to show the general arrangement of the two grinding wheels and the means for feeding them toward each other to compensate for wear.

Fig. 5 is an enlarged detail section taken generally on line 5—5 of Fig. 2, and showing portions of the compensating feed mechanism and the dressing mechanism for the upper wheel.

Fig. 6 is an enlarged detail section of the compensating feed clutch and index wheel.

Fig. 7 is an enlarged detail section taken generally along the piston ring feed guideway, and showing the grinding wheels in side elevation.

Fig. 8 is a detail section taken generally on line 8—8 of Fig. 7.

Fig. 9 is a view somewhat similar to Fig. 8, but drawn to a somewhat larger scale and with parts of the piston ring guide supports broken away to show the feed guideway in greater detail.

Fig. 10 is a detail section taken longitudinally of the piston ring feed guideway shown in Fig. 9, and showing the grinding wheels in section.

Fig. 11 is an enlarged detail view of the front platen for supporting the rings as they enter the grinding zone.

Fig. 12 is an enlarged detail section taken on line 12—12 of Fig. 10.

Fig. 13 is a horizontal detail section taken generally on line 13—13 of Fig. 1, with parts removed to show details of the wheel dressing mechanism.

Fig. 14 is a perspective detail view of one of the dressing tools and adjustable gauge stool for the dresser point.

Fig. 15 is a wiring diagram of the electrical connections for controlling the operation of the dressing mechanism.

Referring now to details of the embodiment of my invention illustrated in the drawings, the machine shown therein includes a base 10 having a main supporting column 11 rigidly mounted thereon. A pair of similar grinding wheel assemblies indicated generally at A and B are mounted on vertical saddles 12 and 13 at one side of said column, with their respective grinding wheels 14 and 15 arranged in opposed lapping relation to each other, but with their vertical axes offset laterally. Said grinding wheels have annular grinding discs or surfaces 14a and 15a, respectively, arranged so that their inner edges are tangential with the outer edge of the other annular surface at the point of maximum overlap, as is best seen in Figs. 3, 4 and 9. The central portion of said supporting column between said saddles 12 and 13 is recessed at 11a to accommodate the grinding wheels.

The two wheel assemblies A and B are substantially identical with each other, including the means for feeding their respective wheels axially toward each other so as to compensate for wear on their grinding surfaces. Accordingly a description of one of said assemblies, such as the upper unit A, will suffice for an understanding of both. Like reference characters will apply where like parts are utilized in both of said assemblies.

Referring to Figs. 4 and 5, it will be seen that the upper grinding wheel assembly A includes a casing 20 mounted at one side of the saddle 12, as by bolts 21, 21. Said casing has a bore 22 therein in which is slidably mounted a bearing support 23 having the wheel spindle 24 rotatably mounted therein as by ball bearings 25 and 26. The upper end of the spindle 24 has a splined connection at 27 with a drive pulley 28 which is rotatably supported at the upper end of the casing 20. The wear-compensating mechanism for feeding the wheel 14, spindle 24 and its bearing support 23 in a downward direction includes an electric motor 30 which operates through a multi-

ple gear reduction mechanism of any well known form, as indicated generally at 31, to drive a bevel pinion 32 meshed with bevel pinion 33 on a threaded stud 35 which passes upwardly through a sleeve 34 fixed on the casing 20 adjacent one side of the bearing support 23. The upper end of stud 35 engages a projecting lug 36 integral with the bearing support 23. With this arrangement it will be seen that the weight of the wheel 14 and its bearing support normally rests upon the upper end of the threaded stud 35 and as said stud is gradually backed away by operation of the motor 30 through its geared connections, the wheel is fed downwardly at a slow rate, sufficient to compensate for wear on its grinding surface.

Means are provided for counterbalancing the weight of the wheel and its bearing support 23, which herein consists of a counterweight 37 (see Figs. 1 and 3) located at one side of the column 11 and connected by cable 38 over pulley 39 and segment 40 to a shaft 41 passing through one side of the casing 20, and having a pinion 42 engaging a rack 43 fixed on one side of the bearing support 23. A hand lever 45 is also connected to the outer end of the shaft 41 to permit manual elevation of the wheel when desired, as for instance during adjustments of the machine.

The speed of automatic feed can be regulated mechanically in any desired manner. In the form shown herein, the drive motor 30 is connected to the gear reduction mechanism 31 by adjustable belt and pulley drive of the Reeves type, affording variations in the feeding speed as desired.

Means are also provided for disconnecting the gear drive to the bevel pinion 32 at will, and operating said bevel pinion by hand for quick vertical adjustment. Details of this mechanism are shown in Fig. 6 in which the shaft 32a carrying bevel pinion 32 is normally driven from a helical gear 31a forming part of the gear reduction mechanism 31. Said helical gear 31a is loosely mounted on the shaft 32a and is adapted to be engaged by a clutch member 16 splined on shaft 32a and movable into and out of frictional engagement with gear 31a by means of a hand wheel 17. When the clutch is disengaged, the pinion shaft 32a is free to be rotated by means of a handle 46.

An indexing wheel 18 is also fixed on the clutch member 16 and has a pointer 18a associated therewith to indicate the vertical position of adjustment of the spindle 24.

The lower wheel assembly B is substantially the same in construction as the upper assembly just described, excepting that in the case of the lower assembly, of course, the wheel is fed upwardly against gravity. Accordingly, in the case of the lower wheel assembly a counterbalancing weight 37a is provided, which is considerably heavier than the corresponding counterweight 37 of the upper wheel assembly so as to urge the wheel 15 upwardly against gravity. The counterweight 37a is connected through cable 38a and segment 40a to shaft 41a. As in the case of the upper wheel, the shaft 41a of the lower wheel assembly has a pinion 42a engaging rack 43a and tending to elevate the lower wheel 15 upwardly under control of its threaded stud 35.

The grinding wheels 14 and 15 are continuously rotated by any suitable drive means, as for instance, by electric motors suitably mounted within hollow upper and lower portions of the column 11 and connected by belts to the drive pulleys 28 on their respective drive spindles 24.

Referring now to the construction and arrangement for guiding the piston rings through the machine, special reference may be had to Figs. 7 to 12, both inclusive.

The piston rings 47 are fed laterally from the bottom of a magazine 48 mounted on a standard 48a at the front of the machine. The feeding means herein shown, consists of a plurality of rubber rollers 49, 49 all rotating in the same direction to progress the rings successively from the bottom of the magazine beneath an upper idler roller 49a into a horizontal feeding guideway indicated generally at 50. The feed rollers 49 are driven by a motor 51 through suitable gear reduction mechanism including pulleys 52, 53, belt 54 and a multiple shaft drive gearing of well known form, indicated generally at 55, details of which need not be described herein as the ring feeding mechanism forms no part of the present invention.

The piston ring guideway 50 is formed in part by a pair of parallel side bars 56 passing through the machine between the upper and lower grind wheels 14 and 15, and spaced on opposite sides of the common diameter including the axes of the two grinding wheels, as is clearly seen in Figs. 7 and 8. As shown herein, said side bars 56 consist of strips of sheet metal, anchored at one end adjacent the magazine 48 at the front of the machine, and at the opposite end to a rocking member 57 pivotally mounted on a bracket 58 projecting from the main column 11 at the rear of the machine. The two side bars 56 are maintained under tension by means of adjustable bolts 59 which control the tilted position of the rocking member 57, as clearly shown in Fig. 7.

The bottom of the guideway 50 between the feed rollers 49 and the outer edge of the lower grinding wheel 15 is formed by a platen 60 fixed with its upper face in substantially the same plane as that of the said grinding wheel. From platen 60 the rings are passed over the exposed outer periphery of the lower wheel disc and from thence across two platens 61 and 62. The latter platens are supported in fixed position within the recessed central portion 63 of the lower wheel by means of an overhanging bracket 64 extending laterally from the main column 11. As shown in Figs. 8 and 9, a bed plate 65 is rigidly suspended from the bracket 64 within the central recess 63 by vertical rods 66, 66 depending on opposite sides of the side bars 56. The two platens 61 and 62 are adjustably mounted on bed plate 65 by means of countersunk screws 67, preferably three in number, and each passing through a rubber washer 68 interposed between the bottom of the platen and the bed plate 65 (see also Fig. 10). With this arrangement, the upper surfaces of the two platens are capable of very close adjustment both vertically and planarly, relative to the surfaces of the adjacent grinding wheels so as to control the position of the rings as they are introduced into the grinding zone, as will hereinafter more fully appear.

The top of the guideway 50 between the idler roller 49a and the near edge of the upper grinding wheel 14 is closed by a hold-down bar 70 extending approximately to the axis of the lower wheel and supported by a bracket 71 also projecting from column 11. Another hold-down bar 72 forms a continuation of bar 70, but is arranged for vertical adjustment on a support 73 dovetailed in a bracket 74 fixed on the exhaust hood 75 or casing surrounding the upper wheel 14. This second hold-down bar 72 is therefore capable of careful vertical adjustment, as well as the

platen 62 immediately below it, for purposes that will presently appear. From the platen 62 and hold-down bar 72, the rings are projected through the grinding zone between the lapping surfaces 14a and 15a of the upper and lower grinding wheels, being guided and held against lateral displacement in this zone by the guide bars 56.

At the discharge end of the guideway 50 immediately adjacent the rear edge of the lower wheel 15 is mounted a receiving platen 76 adjustably mounted on a bed plate 77 by three countersunk screws 78 and intervening rubber washers 79. The bed plate 77 is supported by a bracket 80 extending from the main column 11. Similarly, a second bracket 81 supports the rear end of a hold-down plate 82 having a flared rear end portion and being vertically adjustable by means of a pair of rods 83, 83 (see Figs. 9–12) connected to said flared rear portion. The hold-down plate 82 extends a sufficient distance beyond the receiving platen 76 to permit the finished rings to drop off the latter into a discharge chute 86 supported on and depending from the bracket 81. In the form shown, a plurality of depending stripper fingers 87, 87 are formed integral with the rear edge of the hold-down plate 82, with their lower faces inclined downwardly and rearwardly, as shown in Fig. 10, to direct the finished rings 47 into the chute 86 as they are dropped off of the receiving platen 76.

Referring now to the means for dressing the surfaces 14a and 15a of grinding wheels 14 and 15 so as to maintain them at proper working distances and in proper cutting condition, reference may be had to details shown in Figs. 5, 13, 14 and 15. The dressing mechanism for both wheels is substantially identical, excepting, of course, that the dresser tools for said wheels, together with their associated parts, are mounted in inverted relation to each other. Accordingly, a description of one of said dressing tools and its associated drive mechanism will suffice for an understanding of both.

Referring to the dressing mechanism for the upper wheel 14, a diamond pointed dressing tool 90 of any well known form is adjustably mounted on a dresser bar 91 which is reciprocably mounted in a plurality of opposed guide rolls 92, 92 on a supporting bracket 93. In the form shown, said supporting bracket is mounted as by bolts 93a on the outer face of the casing 20 within which the wheel 14 is rotatably mounted, and said bracket 93 overhangs the side of said wheel opposite the main column 11 of the machine.

The guide rollers 92, 92 are arranged so that the bar 91 with its dresser tool 90 traverses the working surface 14a of the grinding wheel in a straight line extending radially of said wheel. The cutting height of the diamond tool 90 is adjusted in any suitable manner, as for instance by wing nut 94 on bar 91, the adjustment being facilitated by means of a gauge stool 90a adjustably mounted on a support 90b fixed on the inner face of the bracket 93 within the range of traversing movement of the dresser tool 90.

The dresser bar 91 is reciprocably driven by a rack 95 thereon engaged by a pinion 96 on upright drive shaft 97. As shown in Fig. 12, the drive shaft 97 is operatively connected by chain 100 and sprockets 101 and 101a with a similar drive shaft 97a of the other dresser bar 91a associated with the lower wheel 15. The arrangement is such, that one dresser bar, as for instance bar 91, is in its outermost position at the time that the other bar 91a is in its innermost position, and vice versa, and the two bars reciprocate in alternate directions with respect to each other. The two dresser bars are thus driven simultaneously from a common drive motor 98 and reduction gearing 99 mounted on the base 10.

Reciprocating movement of the two dresser bars is effected by reversing the direction of drive of the motor 98 through electric control mechanism which is illustrated in the diagram, Fig. 15. This diagram shows two alternatively operable control circuits, one of which is designed to effect reversal of the motor at the end of each stroke of the dresser tools across their respective wheel surfaces, but with a substantial time lag or period of pause at the end of each stroke. For convenience in the following description, this form of control is termed "intermittent" drive. The second circuit connection is designed to effect reversal of the motor at the end of each stroke without pause or time lag, which for convenience herein is termed "continuous" drive.

The intermittent drive circuit connections are controlled primarily from a cam member 105 suitably driven by a constant speed motor, as for instance the same drive motor 30 that is used for the compensating feed of the upper grinding wheel 14. The cam 105 has a flat surface 106 thereon adapted to be successively engaged by a pair of followers 107 and 108 on opposed contact switches 109 and 110, respectively. The control circuit connections are supplied through a switch indicated generally at 111 connected to the main circuit conductor 112. The switch 111 completes control connections for intermittent drive in one position, and for continuous drive in the other position.

The intermittent drive connections from main circuit line 112 through switch 111 include a conductor 114 leading to the followers 107 and 108 of the reversing switches 109 and 110. The fixed contact 109a of switch 109 has a conductor 115 leading to a limit switch 118 and from thence through conductor 116 to a solenoid 117, forming part of a motor-reversing switch indicated generally at 125. From solenoid 117 a conductor 120 leads to a main circuit line 113.

The fixed contact 110a of the second switch 110 is connected by conductor 121 through a limit switch 119 and conductor 123 to solenoid 122 of the motor-reversing switch 125, and from thence to the return line conductor 120. Due to the arrangement of the cam 105, the switches 109 or 110 will be alternately closed in timed relation, when the followers 107 and 108 pass along the flat portion 106 of said cam. The limit switches 118 and 119 are normally closed. The shaft 124 of reversing switch 125 is normally maintained by suitable tension means such as springs 123a in an intermediate position, and the motor connections can only be completed by energizing solenoid 117 or solenoid 122 to close one of the motor circuits. As soon as the energizing circuit of one or the other of said solenoids is broken, the switch shaft 124 is automatically returned by springs 123a to its intermediate position to shut off the motor.

The operation of the intermittent control connections just described is as follows:

Assuming that the follower 107 is on the flat portion 106 of cam 105 as shown in the diagram, a circuit will be completed through switch 109, switch 118 and solenoid 117. Energizing of the solenoid 117 throws the control arm 123 of motor reversing switch 125 in a direction to bring a series of contactor arms 126, 127, 128 and 129 on shaft 124 into engagement with contacts 126a,

127a, 128a and 129a, respectively. The contactor arms 126, 127, 128 and 129 are thus directly connected, respectively, to four motor leads arranged as in well known motor design so as to drive the motor in one direction, as for instance with two leads 126 and 127 connected through conductor 130 to the main line conductor 112, and with the other two leads 128 and 129 connected through conductors 131 and 120 to the main line conductor 113. Operation of the motor will be continued as long as the follower 107 remains on the flat portion 106 of cam 105, unless in the meantime the circuit is broken by the opening of limit switch 118, under conditions as will hereinafter be described.

When cam 105 is rotated further to raise the follower 107 of switch 109, the circuit is broken, solenoid 117 is deenergized, and the motor connections are automatically broken by switch 125 to stop the motor.

Further rotation of cam 105 will cause the follower 108 to engage the flat portion 106 so as to close another circuit through switch 110 and energize the solenoid 122. The shaft 124 of the motor-reversing switch 125 will then be rocked in the opposite direction to establish other circuit connections to the four motor leads through contacts 126b, 127b, 128b and 129b, in which case said motor leads will be alternately connected, respectively, with the two main conductors 112 and 113 in such a manner as to start the motor in the reverse direction.

The two limit switches 118 and 119 are directly responsive to the movement of said dresser bars, so as to prohibit overrun at the ends of their stroke in opposite directions. In the form shown herein, said limit switches are mounted on bracket 93b which supports dresser bar 91a, as shown in Fig. 13. The guide bar 91a has a pin 132 mounted thereon and projecting into position to engage plunger 118a or 119a of limit switches 118 and 119, respectively, and open the latter when said guide bar reaches its limits of reciprocable movement. Thus the circuit through one or the other energizing solenoids 117 or 122 will be broken to stop the motor at the end of each stroke of the dresser bars, regardless of the operation of the timing cam 105. In practice, said timing cam 105 is arranged and driven at such speed that switches 109 and 110 will be closed for at least a sufficient time to move the dresser bar the full length of its stroke, but the limit switches 118 and 119 operate automatically to prohibit overrunning of the motor in either direction.

As previously stated, the continuous drive circuit control operates to reverse the motor at the end of its stroke in both directions without any time lag or waiting period. In the arrangement illustrated in the wiring diagram (Fig. 15), the continuous drive circuit is connected for operation from the same power leads 112 and 113 through the switch 111, so that the solenoids 117 and 122 of the motor reversing switch 125 are automatically operated through a two-way reversing switch indicated generally at 135. (See Fig. 5.) This last named switch is mounted adjacent the drive shaft 97a which operates the dresser bar 91a. Said shaft has a collar 136 mounted thereon carrying a pin 137 which is adapted to throw switch finger 138 in one direction when the dresser bar reaches its desired limit of movement in one direction, and throw said switch finger in the opposite direction when the dresser bar reaches its other limit of movement. The reversing switch 135 is of the well known snap action type in which finger 138 operates a contact member 142 adapted to selectively close switches 140 and 141.

When the switch 111 is set for continuous dressing, the power lead 112 is connected through conductor 143 to the contact member 142, and from thence either to switch 140 or 141, depending upon which direction the finger 138 has last been thrown by pin 137. When the contact member 142 closes switch 140, the circuit is completed through conductor 144, solenoid 117, conductor 120 and power lead 113 to start motor 98 in one direction. When the pin 137 is rotated into engagement with switch finger 138, the circuit through solenoid 117 will be broken and a new circuit established through switch 141, conductor 145 and solenoid 122 so as to effect reversal of the motor through the reversing switch 125.

Under most operating conditions, I find that it is usually preferable to employ intermittent dressing, with a rest period of, say, two or three minutes at the end of each stroke of the dresser bars. Due to the extremely low rate of feed of the grinding wheels usually employed in machines of this character, I find that the surfaces of the wheels are usually kept in better cutting condition with intermittent dressing, which permits sufficient feed of the wheels between successive strokes to give the dressing diamonds a substantial cutting effect on the abrading surfaces, whereas with continuous dressing the cutting tool may tend to have more of a glazing or smoothing effect on the abrading surfaces. However, under certain other operating conditions continuous dressing may be satisfactory.

Means are also provided for disengaging the dresser bars and their drive shafts 97 and 97a from the motor 98 so as to assist in various adjustments of the machine. In the form shown, the sprockets 101 and 101a are fixed on their respective drive shafts, but the sprocket 101 is provided with a vertically disposed drive pin 150 adapted to be detachably engaged in a recessed hub 151 which is directly driven from the gear reduction mechanism 99 (see Fig. 5). By lifting the pin 150 out of engagement with the hub 151, the shafts 97 and 97a are free to rotate independently of the motor. In order to assist rotation of the dresser bars manually, a hand lever 152 (see Fig. 2) is provided for detachable engagement with the upper end of drive shaft 97a. This arrangement is particularly designed for adjusting the height of the dressing tools on their gauge stools.

Among the principal features of novelty of the machine constructed as above described, is the arrangement whereby the piston rings or the like are fed between the two opposed but offset grinding wheels 14 and 15 in a straight line substantially intersecting the axes of the two wheel spindles. Thus while passing between the two grinding surfaces rotating in opposite directions, the piston rings are progressed substantially at right angles to the mean directions of rotation of the opposed wheels so that there will be a minimum tendency toward rotation of the piston rings while passing through the grinding zone.

In carrying out this feature, it will be noted that the guideway 50 is arranged at a substantially uniform level through the machine (see Figs. 7 and 9). The vertical dimension of said guideway 50 before the rings pass into the grinding zone is adjusted to accommodate the unfinished rings so that they pass over the free outer periphery of the lower wheel with only the slight

abrasive action on the under surface of the rings due to the weight of the rings resting by gravity on the grinding surface. This initial abrasive action, however, is helpful in removing dirt and minor burrs on the bottom surface of the rings before they are fed between the wheels.

It will be observed further that the grinding wheels are urged by gravity towards the work as the studs 35 are backed off mechanically by the wear-compensating drive gearing, but that said wheels are free to move away from each other under unusual operating conditions such as the accidental introduction of rings of excessive thickness or hardness. Operation of the machine is therefore much safer than would be the case with a positive mechanical feed for the grinding wheels.

The arrangement of the platens forming the bottom of the ring feeding guideway 50 and their adjustment is a further novel feature of the machine. The platen 60 at the front of lower wheel 15 is normally disposed substantially flush with the exposed upper surface of said wheel, so the rings can be moved directly onto the latter. From said surface the rings are progressed to platen 61, mounted within the recessed central portion 63 of said lower wheel 15. This platen is preferably adjusted so as to be slightly below the level of the upper surface of said lower wheel, as indicated in somewhat exaggerated form in Fig. 11. The next feed platen 62 is given an even more careful adjustment in a horizontal plane at a predetermined level below the adjacent upper grinding surface of the lower wheel, which difference in level is substantially equal to the amount of material that is to be taken off of the lower face of the piston ring in the grinding operation. In practice, I find a difference in level in the order of .0005 inch is satisfactory for this purpose. Similarly, the adjustable hold-down bar 72 immediately above the platen 62 is carefully adjusted both vertically and planarly so as to be spaced approximately the same distance above the working surface 14a of the upper disc wheel.

With the parts adjusted as above described, the piston rings are held in fairly close, vertical confinement between the platen 62 and the top bar 72 while being fed between the wheels so as to prevent tilting of the rings, or uneven grinding of their upper and lower surfaces.

The receiving platen 76 and the superimposed hold-down plate 82 are also given careful adjustment, but in this case the platen 76 is maintained at the same level as the adjacent bottom wheel 15 so that each piston ring will be discharged thereon and maintained in a horizontal plane until it has fully passed from between the wheels, as indicated in Fig. 10.

A further advantageous feature of my improved machine is the arrangement of the grinding wheels in offset relationship so as to facilitate the use of automatic dressing mechanism while the machine is in operation. It will be observed that the dresser bars 91, 91a are guided for rectilinear reciprocation so as to move their respective dressing tools in a straight line extending radially of their respective disc wheels. This feature affords an especially simple, rigid and effective mechanism that is superior to dressing mechanisms previously utilized for a similar purpose.

Although I have shown and described one particular embodiment of my invention, it will be understood that I do not wish to be limited to the exact construction shown and described, but that various changes and modifications may be made without departing from the spirit and scope of my invention as defined in the appended claims.

I claim as my invention:

1. In a grinding machine of the class described, the combination of a base, a pair of upright spindles journalled on said base with their axes in offset relationship, annular grinding discs mounted in opposed relationship on said spindles, with the inner edge of each of said discs arranged substantially tangential with the outer edge of the other disc in the zone of maximum lapping of said discs, means for successively feeding a plurality of similar work pieces disposed at one side of the lower disc, and means for guiding said work pieces across the open surface of said lower disc and then between the lapping faces of both of said discs, said guiding means including a supporting platen disposed within the lower disc and another supporting platen disposed adjacent the outer edge of said lower disc opposite said feeding means.

2. In a grinding machine of the class described, the combination of a base, a pair of upright spindles journalled on said base with their axes in offset relationship, annular grinding discs mounted in opposed relationship on said spindles, with the inner edge of each of said discs arranged substantially tangential with the outer edge of the other disc in the zone of maximum lapping of said discs, and means for feeding and guiding a plurality of similar work pieces between the lapping faces of said discs, said feeding and guiding means including a platen disposed within and below the level of the lower disc, and another platen disposed adjacent the outer edge of said lower disc and substantially in the same plane thereof and adjustable supporting means for each of said platens comprising a bracket rigid with the base, a plurality of threaded members connecting said bracket with said platen at a plurality of horizontally spaced points, and compressible elastic supporting material interposed between said bracket and said platen adjacent said threaded means.

3. In a grinding machine of the class described, the combination of a base, a pair of spindles journalled on said base with their axes in offset relationship, annular grinding discs mounted in opposed relationship on said spindles, with the inner edge of each of said discs arranged substantially tangential with the outer edge of the other disc in the zone of maximum lapping of said discs, and means for feeding and guiding a plurality of similar work pieces between the lapping faces of said discs in a direction extending generally along the radial line common to both discs, said feeding and guiding means including a pair of spaced metal bands extending between the lapped surfaces of said discs and having adjustable anchoring means at opposite ends thereof for maintaining them under tension.

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