April 6, 1926. 1,579,876

H. LUTZ

PROCESS AND APPARATUS FOR GRINDING ROLLERS

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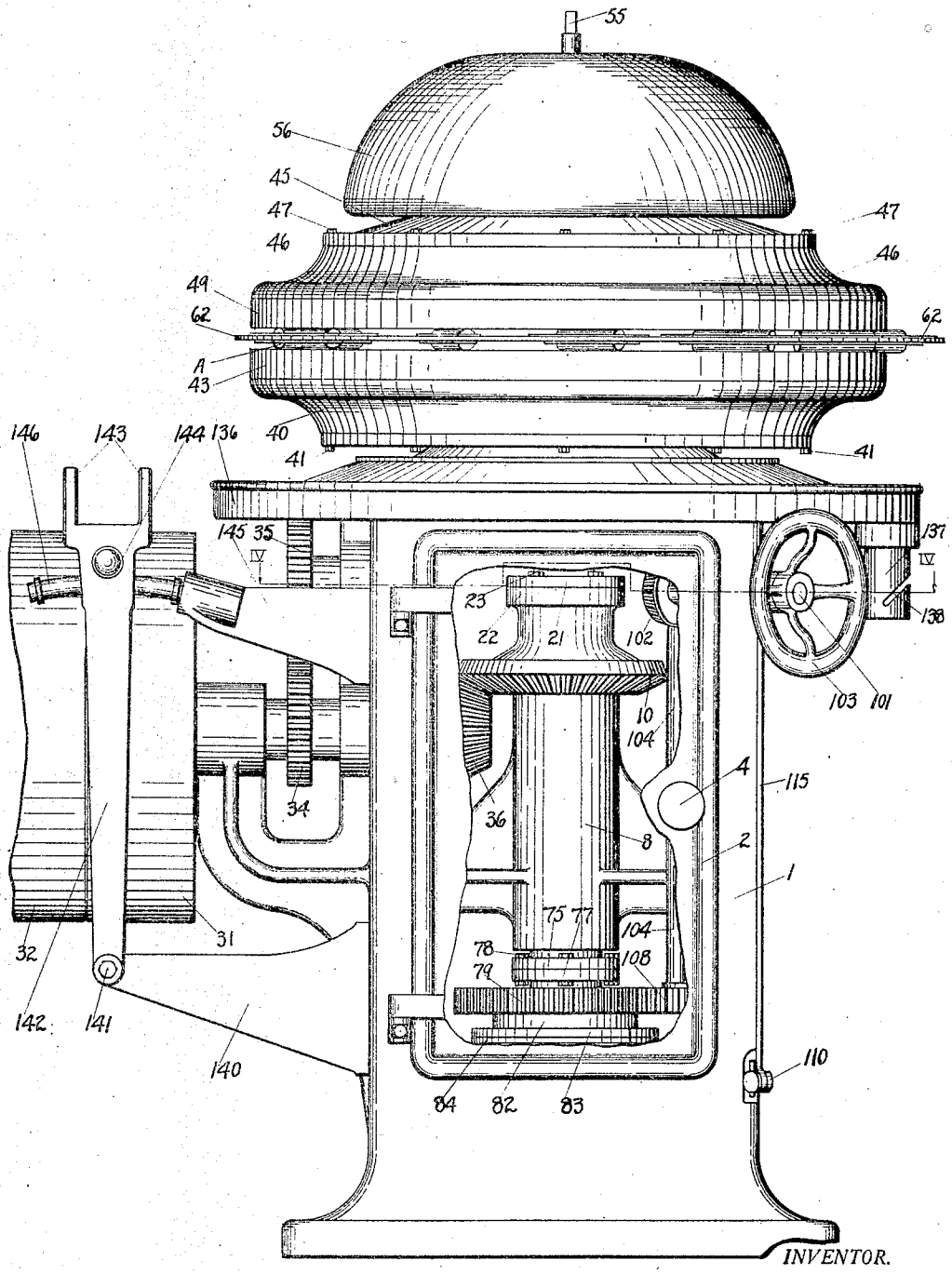


FIG. I.

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PROCESS AND APPARATUS FOR GRINDING ROLLERS

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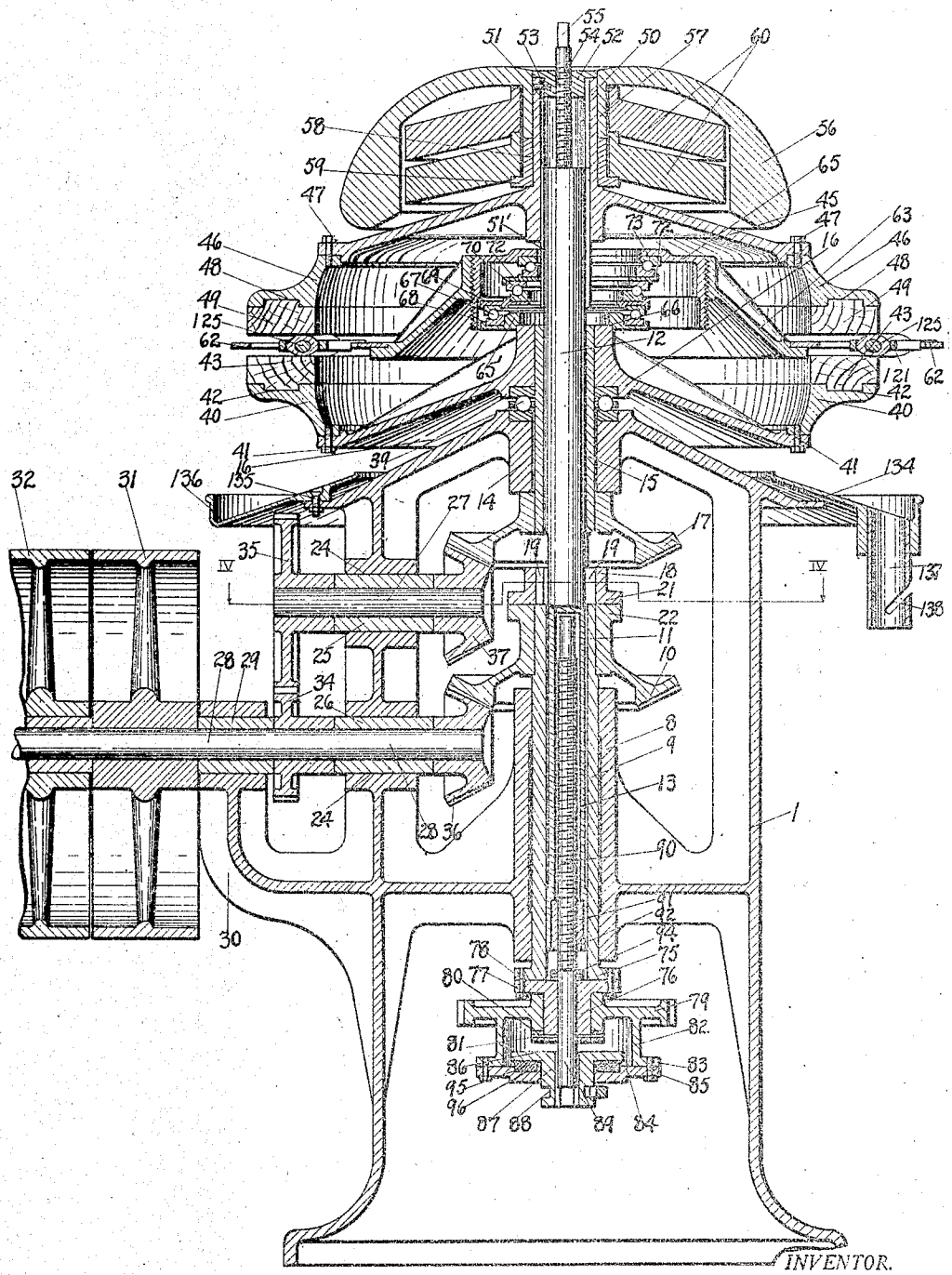


FIG. II.

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PROCESS AND APPARATUS FOR GRINDING ROLLERS

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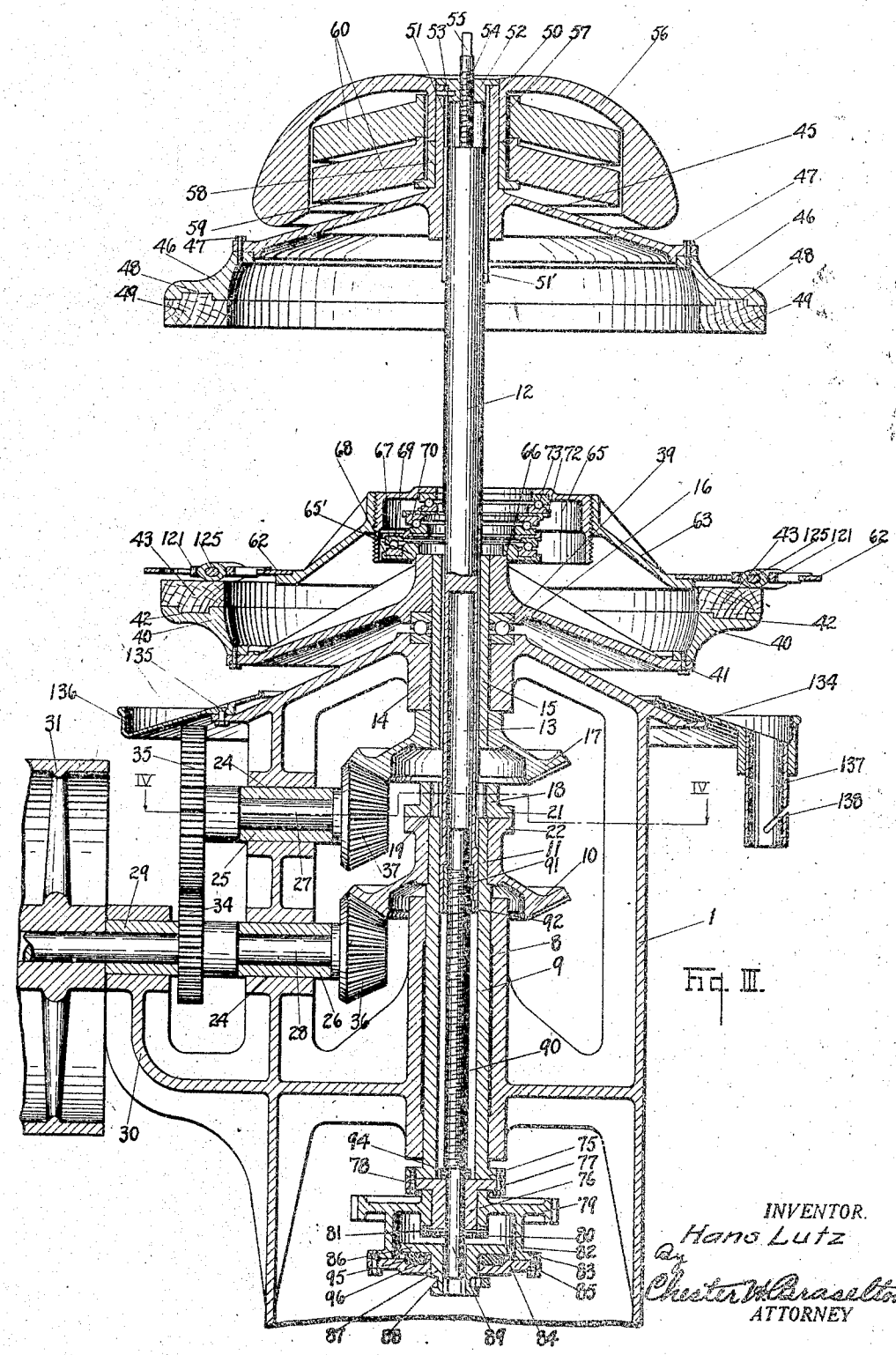


Fig. III.

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PROCESS AND APPARATUS FOR GRINDING ROLLERS

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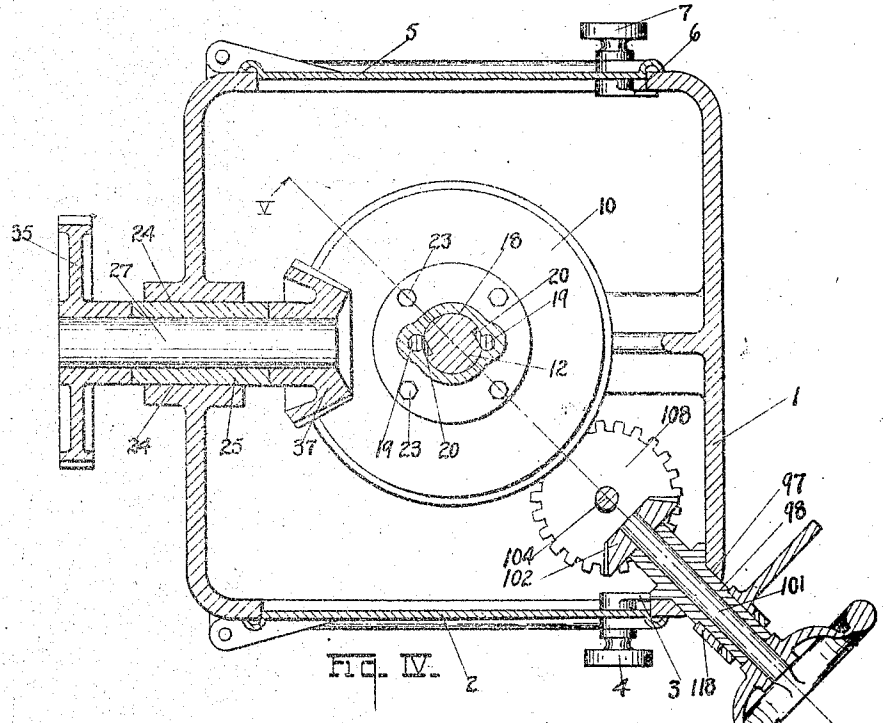


Fig. IV.

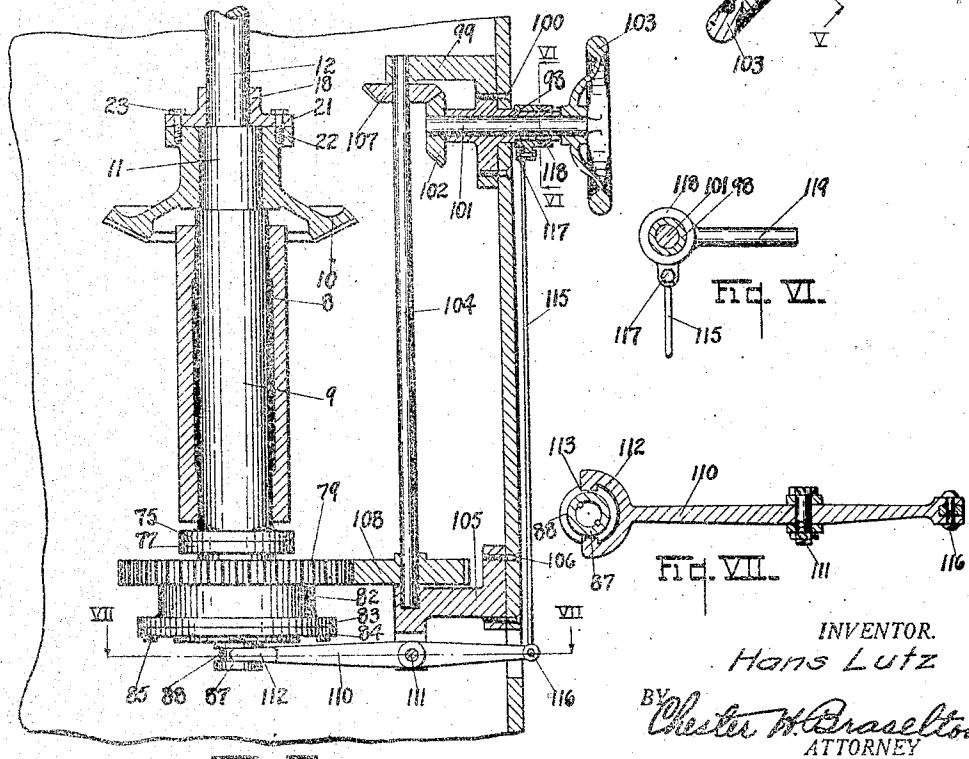


Fig. VI.

Fig. VII.

Fig. V.

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PROCESS AND APPARATUS FOR GRINDING ROLLERS

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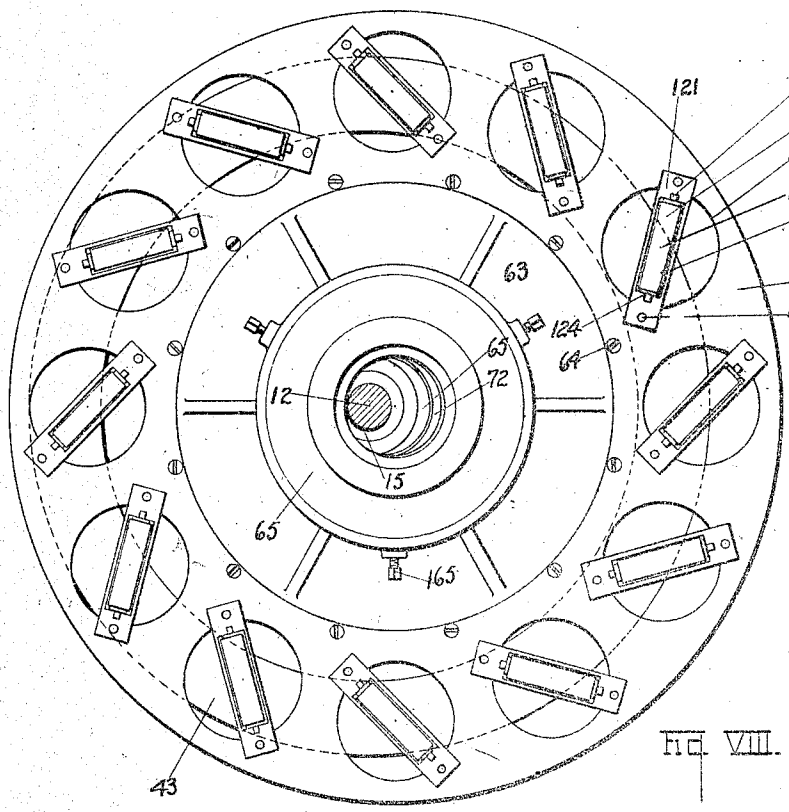


Fig. VIII.

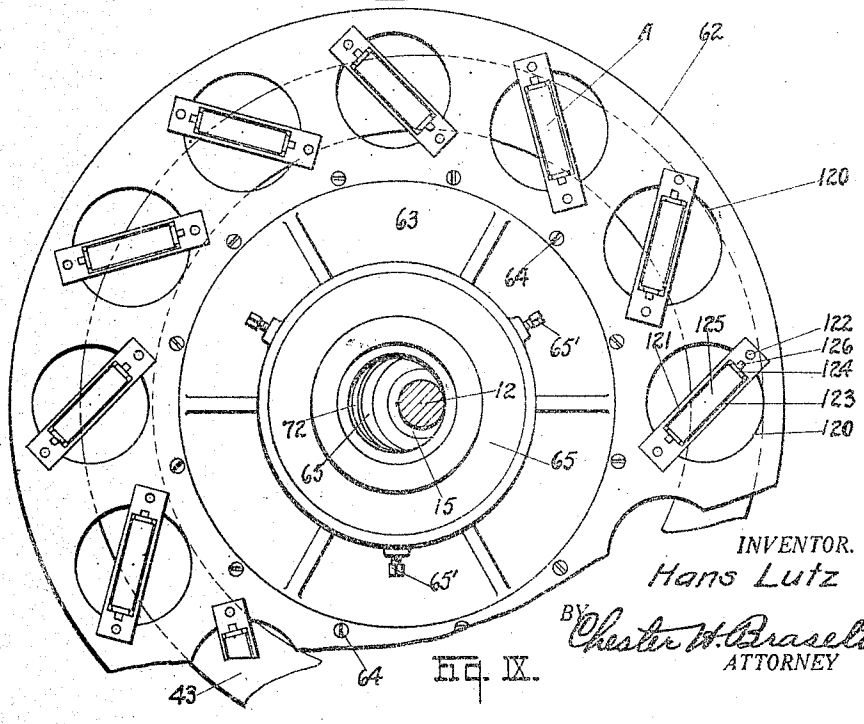


Fig. IX.

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PROCESS AND APPARATUS FOR GRINDING ROLLERS

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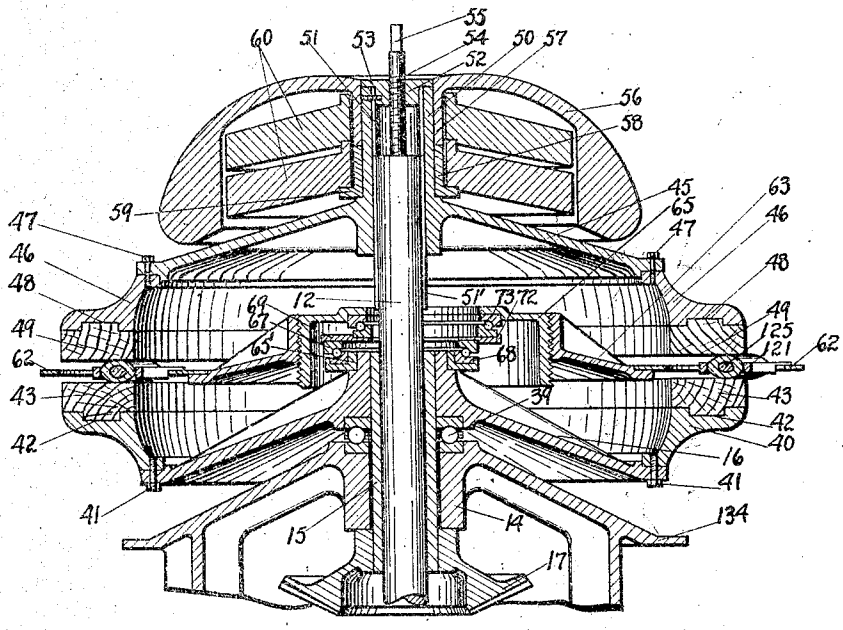


FIG. XIII.

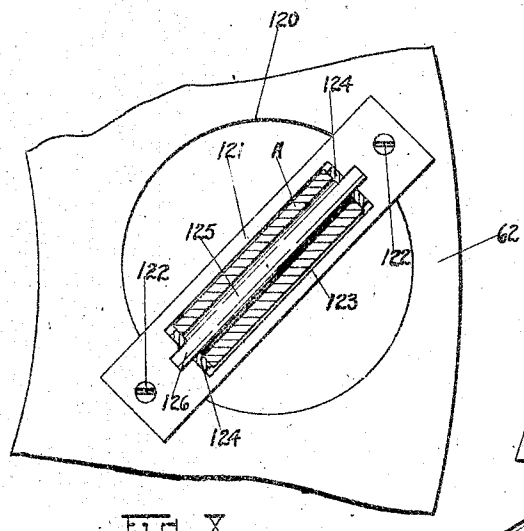


FIG. X.

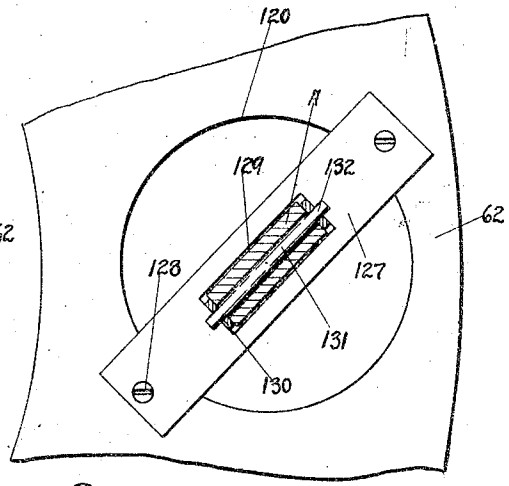


FIG. XI.

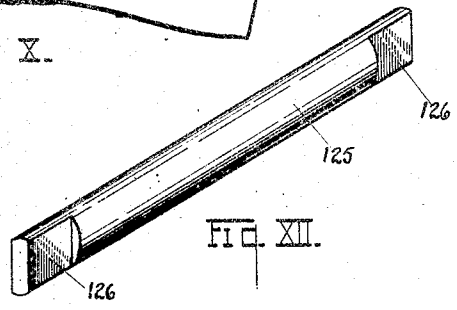


FIG. XII.

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Patented Apr. 6, 1926. 1,579,876

UNITED STATES PATENT OFFICE.

HANS LUTZ, OF ELMIRA, NEW YORK, ASSIGNOR TO THE WILLYS-MORROW COMPANY, OF ELMIRA, NEW YORK, A CORPORATION OF OHIO.

PROCESS AND APPARATUS FOR GRINDING ROLLERS.

Application filed May 29, 1919. Serial No. 300,712.

To all whom it may concern:

Be it known that I, HANS LUTZ, a citizen of the United States, residing at Elmira, county of Chemung, State of New York, have invented certain new and useful Improvements in Processes and Apparatus for Grinding Rollers, of which I declare the following to be a full, clear, and exact description.

This invention relates to an improved process and apparatus for grinding rollers, particularly rollers adapted to be employed in connection with roller bearings.

One object of the invention is to provide an improved process for grinding rollers, whereby the exterior surface of the rollers are readily ground in such a manner as to produce a substantially uniform exterior surface of cylindrical form, all parts of which are symmetrical with respect to the axis of the roller.

A further object of the invention is to provide an improved apparatus of the character described, which is of simple construction and efficient in operation.

A further object of the invention is to provide a pair of grinding surfaces rotatable in opposite directions relative to each other and at different speeds operable to properly grind the exterior surfaces of the bearing rollers.

A further object of this invention is to provide a mechanism for grinding rollers comprising an upper and lower grinding surface and a work supporting member interposed there-between mounted in such a manner as to be capable of movement in a path eccentric to the paths of movement of the grinding members.

Further objects of the invention relate to the provision of improved instrumentalities and devices for securing a proper operation of the various mechanisms employed.

Further objects of the invention relate to economies of manufacture and details of construction, as will hereinafter appear from the detailed description to follow.

The objects of the invention are accomplished in one instance by the devices and means described in the following specification, but it is evident that the same may be varied widely without departing from the scope of the invention, as pointed out in the appended claims.

A structure constituting one embodiment of the invention which may be the preferred, is illustrated in the accompanying drawings forming a part hereof, in which:

Fig. I is a side elevational view of the roller grinding mechanism, having a portion of the casing broken away in order to better illustrate the position of the operating parts.

Fig. II is a vertical-sectional view of the apparatus, illustrating the relative position of the operating mechanism during the grinding operation.

Fig. III is a vertical-sectional view of the apparatus, illustrating the position of the upper grinding member when raised vertically from its operative position for the purpose of permitting the removal and replacement of the rollers to be ground.

Fig. IV is a horizontal, sectional view, taken along the line IV—IV of Figs. II and III, and illustrating the position of the raising and lowering mechanism with respect to the remaining parts of the structure.

Fig. V is a vertical sectional view, taken along the line V—V of Fig. IV, and illustrating more in detail the mechanism for raising and lowering the vertical shaft, and the upper grinding member secured thereto.

Fig. VI is a detail sectional-view taken along the line VI—VI of Fig. V, and illustrating the manner of mounting the clutch actuating rocker arm.

Fig. VII is a horizontal sectional view, taken along the line VII—VII of Fig. V, and illustrating the manner of mounting the rocking lever.

Fig. VIII is a top, plan view of the rotatable work supporting member, illustrating the position of the same with respect to the lower grinding member at one point in its rotative movement.

Fig. IX is a top, plan view of the work supporting member, illustrating its position with respect to the lower grinding member at a different period in the rotative movement of the work supporting member.

Fig. X is a detail horizontal, view, par-

tially in section, illustrating the manner of rotatably supporting one of the rollers upon the work supporting member.

Fig. XI is a detail view, partially in section, illustrating a form of support for mounting a smaller sized bearing roller upon the work supporting member.

Fig. XII is a perspective view of one of the rods employed for supporting a bearing roller upon the work supporting member.

Fig. XIII is a vertical sectional view, similar to that illustrated in Fig. II, and showing a slightly modified form of supporting bearings for the work supporting member.

By the use of the means employed up to this time in the production of bearing rollers, it has been extremely difficult and costly to produce bearing rollers which would satisfy the exacting demands of the trade for devices of this character.

The grinding of the exterior surfaces of the rollers to give them a true cylindrical form requires the utmost care in order to produce rollers having the required precision and uniformity of bearing surfaces, and it is only by the most careful and skillful work that it is possible to make rollers capable of carrying the required loads. It has been found that by giving the rollers a rotative movement during the operation of grinding the exterior surface thereof between a pair of grinding members, and by simultaneously imparting to the rollers movement in a direction at an angle to the path of movement of the grinding surfaces during the grinding operation, the uniformity of the finished product is increased to a considerable degree, while the speed of production is at the same time greatly increased. By mounting the work supporting member in such a manner as to permit the same to move independently of the upper and lower grinding members, and in a direction eccentric to the paths of movement of the grinding members, the rollers carried thereby are rotated during the grinding operation, and at the same time given a sliding movement in a direction at an angle to the path of movement of the grinding members in such a manner as to produce a uniform and perfectly cylindrical exterior surface throughout the entire length of each bearing member, and the operation of the several parts of the mechanism is by this arrangement rendered automatic, and uniformity of the finished product is assured.

Referring to the drawings, similar reference characters designate corresponding parts throughout the several views, and the sectional views are taken looking in the direction of the small arrows at the ends of the section lines.

In the embodiment of the invention illustrated herewith, 1 designates the supporting frame of the machine, which may be formed of cast metal constructed in such a manner as to provide suitably positioned bearing portions for the reception of the various operating parts. The frame portion 1 is provided with an opening formed upon one side thereof in such a manner as to permit ready access to the various parts of the operating mechanism, these openings being normally closed by hinged cover 2 provided with a latch 3 adapted to engage with the interior of the frame adjacent the opening formed therein, the latch being operable by a knob 4 for the purpose of securing the cover member in closed position. If desired, a similar opening may be formed upon the other side of the frame oppositely positioned from that just described and provided with a hinged cover plate 5 similar in all respects to the cover 2, and adapted to be retained in closed position by means of a latch 6 which is capable of being rotated by means of a knob 7. By means of the openings thus provided, the various operating parts of the device positioned within the main portion of the frame are readily accessible at all times for the purpose of repair.

The frame portion of the machine is provided with a substantially vertically positioned bearing portion 8, within which is revolvably mounted a sleeve 9 extending beyond the end portions of the bearing 8, and having rotatably mounted thereupon at its upper extremity a beveled pinion 10. The sleeve 9 is provided at the upper end thereof with a reduced portion 11, upon which the beveled gear 10 is revolvably mounted, and which serves to retain the bevel gear 10 in position to prevent downward movement thereof with respect to the sleeve 9. Slidably and revolvably mounted within the sleeve 9, is a substantially vertical shaft 12 provided with a central opening 13 formed in one end thereof, for a purpose which will be hereinafter described. A bearing 14 is formed in the frame portion above and substantially in vertical alignment with the bearing 8 previously described, and a sleeve 15 is rotatably positioned within the bearing 14, the sleeve 15 being of sufficient length to extend both above and below the bearing 14. Keyed or otherwise firmly secured to the upper end of the sleeve 15 is a plate 16 adapted to operatively support certain of the operating mechanisms. Keyed or otherwise firmly secured in any suitable manner to the lower end portion of the sleeve 15, is a beveled gear 17 similar in all respects to the bevel gear 10 previously described. Positioned above the bevel gear 10 is a collar 18 surrounding the vertical shaft 12 and provided with oppositely positioned splines 19 adapted to extend into oppositely positioned, longitudinally extending grooves 20 formed upon op-

posite sides of the vertical shaft 12 in such a manner as to permit longitudinal movement of the shaft 12 with respect to the collar 18, while at the same time preventing rotation of the collar with respect to the shaft. The collar 18 is provided with an outwardly extending flanged portion 21 which bears against a similarly constructed outwardly extending flange 22 carried by the bevel gear 10, and these flanged portions are firmly secured together by means of bolts or other suitable fastening means 23. A pair of horizontally positioned openings 24 are provided in one side of the frame portion of the machine within which are positioned bearing sleeves 25 and 26 located in substantially the same vertical plane, and within which are mounted shafts 27 and 28 respectively. The shaft 28 extends outwardly and has a bearing in a sleeve 29 carried by an offset arm 30, which may be formed integral with the frame portion 1. Keyed or otherwise firmly secured to the outer portion of the shaft 28 is a pulley 31, which is adapted to be driven by a power belt for the purpose of driving the operating mechanism. A loose pulley 32 is mounted adjacent the pulley 31, and is loosely carried by the shaft 28 in order to provide means for disconnecting the power from the machine in the usual manner. Keyed or otherwise firmly secured to the shaft 28 is a gear 34, which meshes with a gear 35 keyed or otherwise firmly secured to the shaft 27. Keyed to the inner end of the shaft 28 is a bevel gear 36, which is adapted to mesh with the bevel gear 10 to transmit rotative movement thereto, and to the vertical shaft 12 through the collar 18. Keyed or otherwise firmly secured to the inner end of the shaft 27 is a bevel gear 37 which meshes with the bevel gear 17 for the purpose of communicating rotative movement to the sleeve 15 and the lower plate 16. It will be noted that the gear 35 is of somewhat larger diameter than the gear 34, while the bevel gears 36 and 37 are of substantially the same diameter as are the gears 10 and 17 with which they are adapted to mesh. By reason of this construction the shaft 27 together with the gear 17 actuated thereby are driven at a lower rate of speed than is the shaft 28 and the gear 10, which is carried by the shaft 28. It will, therefore, be understood that the vertical sleeve 15 is driven at a lower rate of speed than the vertical shaft 12, which results in rotating the upper and lower grinding members in opposite direction, and at different rates of speed.

The plate 16 is rotatably supported upon the upper surface of the machine frame by means of an anti-friction bearing 39, and carries a ring member 40, of substantially circular form secured to its outer edge portions by means of a plurality of screws or suitable fastening means 41. The ring member 40 is provided upon its upper face with a substantially circular groove 42 within which is positioned a substantially circular grinding ring or member 43 formed of wood or other suitable material, the upper surface thereof being treated with abrasive in such a manner as to form the same into a proper grinding surface for grinding and polishing the bearings.

An upper plate 45 is splined upon the upper end portion of the vertical shaft 12 in such a manner as to be non-rotatably secured thereto, while being attached in such a manner as to permit sliding movement of the same with respect to the vertical shaft to a sufficient extent to provide means for adjustably positioning the plate with respect to the vertical shaft. A substantially circular ring member 46 is secured to the outer edge portion of the upper plate 45 by means of a plurality of screws or other suitable fastening means 47, and the ring member is provided with a groove 48 formed upon the lower surface thereof to provide means for retaining in position a substantially circular upper grinding ring or member 49 secured to the under surface of the ring 46. The grinding ring or member 49 is similar in all respects to the member 43 previously described, and the lower surface thereof is treated with abrasive material in the manner previously described in connection with the grinding member 43 for the purpose of providing a grinding surface thereon. The plate 45 is provided with an upwardly extending sleeve portion 50 formed centrally thereof, the inner portion of said sleeve being provided with grooves 51 within which the splines 51′ formed upon the outer surface of the vertical shaft 12 are adapted to slide, thus providing means for adjusting the plate 45 longitudinally of the shaft 12 while preventing relative rotation of these members. A cap 52 is positioned in the opening formed within the sleeve 50 being secured in proper position therein by means of a key or other suitable locking means 53. The cap 52 is provided with a threaded opening formed substantially centrally thereof within which is threaded an adjusting screw 54 provided with a squared end 55 for attachment of an adjusting member thereto. A cover plate 56 is provided with a central opening, which is surrounded by a sleeve portion 57 formed in such a manner as to fit snugly upon the outer surface of the sleeve 50 and a bearing ring 58 having an outwardly extending flange 59 formed at one end thereof is adapted to fit snugly over the outer surface of the sleeve 50 and provide a bearing for the downwardly extending flange 57 formed upon the cover 56. One or more metal plates 60, each of which is provided with a central

opening, are adapted to be positioned within the cover plate 56 in such a manner as to bear against the upper surface of the annular flange 59 formed upon the sleeve 55, and thus give added weight to the upper grinding ring or member 49, in such a manner as to properly force the grinding surfaces into contact with the bearing rollers which are to be ground and polished.

A work supporting member 62 of substantially circular form, is secured to a dished plate 63 by means of a plurality of screws or other suitable fastening means 64, the dished plate 63 being provided with an opening formed substantially centrally thereof and provided with internal threads in such a manner as to receive an externally threaded cup-shaped member 65 therein, the dished member 63 being capable of vertical adjustment with respect to the cup-shaped member 65 and being adapted to be retained in a plurality of adjusted positions relative thereto by means of a plurality of clamping screws 165. The work retaining member is mounted upon and rotatably supported by the lower plate 16, in a manner which will now be described. A lower bearing ring 65' is provided upon its underface with a circular groove 66 within which the upper circular portion of the plate 16 is adapted to fit in such a manner as to support the ring 65' upon the plate 16, and concentric with the axis of the vertical shaft 12. The plate 65' is provided with an anti-friction bearing 67, the lower member of which is positioned within a groove 68 formed in the upper surface of the plate 65', and located in such a manner as to be concentrically positioned with respect to the axis of the shaft 12. A bearing plate 69 is supported by the upper member of the anti-friction bearing 67 and this plate 69 is in turn provided with an anti-friction bearing 70 formed upon the upper surface thereof and positioned in such a manner as to be eccentric to the anti-friction bearing 68 and the axis of the vertical shaft 12. Positioned upon the upper surface of the anti-friction bearing 70 is a third supporting plate 72, which is in turn provided with an anti-friction bearing 73 positioned upon the upper face thereof and located eccentrically with respect to the bearings 68 and 70. The upper ring of the bearing 73 fits within a groove formed upon the underface of the cup shaped member 65 and is concentrically positioned with respect to the circular opening formed in the cup-shaped member, and also with respect to the circular work supporting member 62. The work supporting member 62 is therefore supported by the plate 16 in such a manner as to permit the same to rotate freely, and by reason of the eccentrically positioned anti-friction bearing, the work supporting member 62 together with the bearing rollers carried thereby will move in a direction eccentric to the path of movement of the grinding surfaces with which the bearing rollers contact.

The provision of the several anti-friction bearings 67, 70 and 73 each of which is mounted slightly off set from the one next below serve to increase the eccentricity of the dished plate 63 with respect to the vertical shaft 12 and the grinding members, while the amount of displacement of each of the anti-friction bearings relative to the next lower bearing is so slight as to not materially affect the stability of the support given the dished plate 63 by the bearings.

An outwardly extending annular flange 75 is formed upon the lower end portion of the sleeve 9, and the collar 76 is provided with an upwardly extending annular flange 77, which abuts against the annular flange 75 and is firmly secured thereto by means of a plurality of screws or similar fastening means 78. Rotatably mounted upon the outer surface of the collar 76 is a gear 79, which is held against removal from the collar by means of a ring 80 secured to the collar by a key 81. The gear 79 is provided with a downwardly extending cylindrical portion 82 provided with an outwardly extending flange 83 formed upon the lower end thereof. A plate 84 provided with a central opening formed therein has its edge portion secured to the outwardly extending flange 83 by means of screws or other suitable fastening means 85. A clutch member 86 is housed within the space formed by the downwardly extending cylindrical portion 82 formed upon the gear and the plate 84, and this clutch member is provided with a cylindrical portion 87 extending through the central opening formed in the plate 84 and provided upon its outer surface with an annular groove 88 for a purpose which will be hereinafter described. Slidably but non-rotatably mounted within the cylindrical portion 87 of the clutch member and extending upwardly therefrom is a shaft 89, which is rotatably mounted within the collar 76 and extends upwardly therefrom substantially concentric with the vertical shaft 12. The upper portion of the vertical shaft 89 is provided with an enlarged portion 90 having exterior threads formed thereon which are adapted to engage with an internally threaded collar 91, positioned within the central opening formed in the end of the vertical shaft 12, and non-rotatably secured to the shaft by means of a key or other suitable locking means 92. The vertical shaft 89 is held against downward movement through the collar 76 by means of a ring 94 mounted upon the upper face of the collar 76 and bearing against the shoulder formed by lower end of the enlarged portion 90 of the shaft 89. A ring 95 of leather or other suit-

able material is positioned within an annular groove 96 formed upon the upper surface of the plate 84, and located in such a manner as to serve as a friction means for engagement by the under surface of the clutch member 86. Means which will be hereinafter described is provided for drawing the clutch member 86 downwardly into close engagement with the upper surface of the ring 95 in such a manner as to cause the clutch member 86 to be rotated through rotation of the gear 79, whereby the vertical shaft 89 will be rotated, thus causing the internally threaded collar 91 carried by the vertical shaft 12 to be raised or lowered, depending upon the direction of rotation of the shaft 89, and thus raising or lowering the vertical shaft 12 since the vertical shaft is held from rotation relative to the collar 18 by means of the oppositely positioned splines 19 cooperating with the grooves 20 formed upon opposite sides of the vertical shaft 12.

A suitable opening 97 is formed in the cast frame member 1 within which is positioned a bearing sleeve 98 provided with an inwardly extending bracket portion 99, the said bearing sleeve being adapted to be held in position relative to the frame portion by means of a plurality of screws or other suitable fastening means 100. Rotatably mounted within the bearing sleeve 98 is a shaft 101 to one end of which is secured a bevel gear 102, while a hand wheel 103 is non-rotatably secured to the opposite end of the shaft. A vertical shaft 104 has its upper end portion rotatably mounted within the bracket 99 while the lower end portion thereof is rotatably mounted in and held in position by a bracket 105, which may be secured in place relative to the frame portion of the machine by means of attaching screws 106. Firmly secured to the shaft 104 in such a manner as to mesh with the gear 102 is a bevel gear 107 whereby the shaft 104 is rotated upon rotation of the hand wheel 103. Firmly secured to the lower end portion of the shaft 104 is a gear 108 meshing with the gear 79 previously described, and adapted to impart rotation thereto by reason of the rotative movement given to the shaft 104. A lever 110 is fulcrumed upon a downwardly extending portion of the bracket 105 as at 111, and the inner end portion thereof is provided with a pair of forked arms 112, provided with inwardly extending lugs 113 positioned within the groove 88 formed upon the downwardly extending cylindrical portion 87 of the clutch member 86. A link 115 is pivotally connected to the opposite end of the lever 110 as at 116 and extends upwardly therefrom being pivotally connected at 117 to a collar 118, mounted upon the bearing sleeve 98 and provided with an actuating lever 119 positioned adjacent the hand wheel 103. It will be evident from the above description that when it is desired to raise the vertical shaft 12 for the purpose of withdrawing the bearing rollers upon the completion of the grinding and polishing operation, the lever 119 is actuated thus rocking the lever 110 through the connecting rod 115, and drawing the clutch member 86 downwardly into close engagement with the clutch ring 95 and the supporting plate 84 whereby these parts are caused to operate in unison and upon the hand wheel 103 being rotated manually, rotation is imparted to the shaft 104 and through the gears 108 and 79 to the clutch member 86, thus rotating the vertical shaft 89 in such a manner as to cause the vertical shaft 12 and the upper grinding member carried thereby to be raised by reason of the internally threaded sleeve 91 traveling upon the enlarged exteriorly threaded portion 90 of the shaft 89.

The manner of mounting the bearing rollers upon the work retaining ring or member in such a manner as to permit the opposite edges thereof to be engaged by the oppositely positioned grinding surfaces is illustrated in detail in Figs. X, XI and XII, and will now be described. The work supporting ring or member 62 is provided with a plurality of circular openings 120 as illustrated in Figs. VIII and IX, the circular openings being so positioned as to lie in a path concentric with the outer edge of the ring 62, and these circular openings are preferably spaced a substantial distance from each other so as to cause a uniform grinding action to be exerted upon the several bearing rollers. It is evident that various means may be employed for supporting the rollers in position relative to the openings 120 and a simple and efficient form of supporting means is illustrated in Figs. X and XI which is capable of being readily adapted to support rollers of different lengths in proper position relative to the grinding apparatus.

In Fig. X there is illustrated a work supporting member 121 which is secured to the plate 62 by means of screws 122. The member 121 is provided with a longitudinal opening 123 formed therein for the purpose of permitting a portion of the bearing roller to extend beneath the plate a sufficient distance to contact with the surface of the lower grinding member 43. Positioned at opposite ends of the longitudinal opening 123 are upwardly extending slotted standards 124, which may, if desired, be formed integral with the member 121, and which are located a sufficient distance from each other to accommodate a bearing roller of the size which it is desired to grind. A bar 125 provided with flattened ends 126 is carried by the standards 124, the flattened ends 126

being adapted to fit within the slots formed in the standards in such a manner as to position the bar so that it is at all times parallel to the plane of the ring 62, thus permitting the roller A within which the bar 125 is inserted to be carried in such a manner that it will remain at all times parallel to the plane of the ring 62.

In Fig. XI of the drawings is illustrated a modified form of support for one of the rollers which comprises a supporting member 127 adapted to be secured to the ring 62 by means of screws 128, and which is provided with a longitudinally extending opening 129 for the reception of the roller A. A pair of upwardly extending slotted standards 130 are positioned at opposite ends of the opening 129 in such a manner as to carry a rod 131 provided with flattened ends 132. The supporting member and its associated parts as illustrated in Fig. XI is similar in all respects to that shown in Fig. X except for the fact that this supporting member is constructed so as to accommodate a bearing roller of smaller size than that with which the supporting member illustrated in Fig. X is adapted to be used. It is clear from the structure shown in Figs. X, XI and XII that the only change necessary to be made in adapting this device for use in connection with rollers of different sizes is to substitute supporting members of proper size for accommodating the rollers which it is desired to grind for those previously used, whereupon the process of grinding the rollers may be continued in the usual manner.

The cast frame portion 1 of the machine is provided with an outwardly extending ledge 134 near the upper end thereof to which is secured in any suitable manner as by a plurality of bolts 135 an annular trough member 136 which is adapted to catch the lubricant applied to the bearing rollers during the grinding operation and discharge the same through a spout 137 into a suitable receptacle which may be attached to the spout by having a portion thereof engaging in a slot 138 formed in the spout.

Secured to a side portion of the cast frame 1 is an offset bracket 140 to which is pivoted at 141 a control lever 142 provided with a pair of forked arms 143 adapted for engagement with the power belt, and having a hand grip 144 by which the same may be actuated for the purpose of moving the power belt from the fixed pulley to the loose pulley or vice versa as occasion may require. An outwardly extending bracket member 145 formed integral with or secured to the cast frame in any desired manner carries a segment 146 which is adapted to control the movement of the shifting lever 142 in such a manner as to control the direction of movement of the forked arms 143 for the purpose of properly actuating the power belt.

It will be evident from the above description that by means of the apparatus herein described a plurality of roller bearings may be ground and polished simultaneously, and in such a manner as to give the same a perfect cylindrical form wherein inaccuracies and imperfections in the grinding surfaces are eliminated and a uniform and perfect bearing produced. When power is applied to the pulley 31 from the driving belt the shaft 28 is rotated together with the gear 34 and the bevel pinion 36 carried thereby. As the gear 34 meshes with the gear 35 secured to the shaft 27 rotative movement is simultaneously imparted to the bevel gear 37 whereby the bevel gears 10 and 17 are simultaneously rotated in opposite directions and at different speeds. The gear 35 being of larger diameter than the gear 34, the shaft 27 will be rotated at a considerably lower rate of speed than the shaft 28, and the gears 36 and 27 being of substantially equal size the gears 10 and 17 will be rotated at different speeds thus resulting in rotating the lower grinding member 43 actuated by the gear 17 at a considerably greater speed than the upper grinding member 49 actuated by the gear 10. It is to be understood that the relative size of the gears 34 and 35 may be varied as desired thus giving one of the grinding surfaces a greater or less speed of rotation relative to the other, or if desired the gear 34 may be constructed of larger diameter than the gear 35 thus imparting to the upper grinding surface 49 a higher speed of rotation than that given to the lower grinding surface 43. It will be noted that the lower grinding member 43 is firmly secured to the upper end portion of the sleeve 15 while the bevel gear 17 is firmly attached to the lower end portion of the sleeve thus insuring rotative movement of the lower grinding members upon rotation of the gear 17. As previously pointed out the bevel gear 10 is firmly secured to the collar 18 which is in turn slidably and non-rotatably carried by the vertical shaft 12 thus causing rotative movement to be imparted to the vertical shaft 12 and to the upper grinding member 49 upon rotation of the gear 10, while permitting vertical movement of the shaft 12 relative to the gear 10 and the collar 18. Since the upper and lower grinding members are thus adapted to be rotated in opposite directions and at different speeds, and the work retaining member 62 is mounted in such a manner as to diminish to a considerable degree the frictional resistance to the rotative movement of the work retaining member, the frictional resistance between the rotating bearings and the more rapidly rotating upper grinding member will cause rotation of the work retaining member at a rate of speed depending upon the difference between the speed of

rotation of the upper and lower grinding members. By reason of the eccentric mounting of the work retaining member the rollers which are to be ground will be moved in a path eccentric to the path of movement of the upper and lower grinding members, thus causing the rollers to be forced across the grinding surfaces in an angular direction relative to the longitudinal axes of the grinding rollers. By the provision of the weights 60 which may be varied in number as may be found desirable, the upper and lower grinding members may be forced more or less firmly into contact with the opposite sides of the rollers thus increasing or decreasing the grinding action as may be found desirable. The provision of the cap 52 and the adjusting screw 54 provide means for adjusting the upper grinding member vertically with respect to the shaft 12 so as to take up any wear upon the grinding surfaces and provide means for insuring contact at all times between the surfaces of the grinding members and the rollers which are to be ground.

When it is found desirable to remove the rollers and replace them with others after the completion of the grinding operation the relative rotation of the grinding members is stopped by throwing the power belt from the pulley 31 to the loose pulley 32 by operating the control lever 142, whereupon the upper grinding member may be raised to the position illustrated in Fig. III by means of the mechanism shown in Figs. IV, V, VI and VII.

After the power has been disconnected from the grinding members the handle 119 is actuated for the purpose of rocking the lever 110 in such a manner as to force the clutch member 86 into engagement with the clutch ring 95 and thus cause the clutch member 86 to move as a unit with the gear 79. The hand wheel 103 is then rotated thereby imparting rotative movement to the shaft 104 and the gear 79 whereby the clutch member 86 is rotated together with the vertical shaft 89 non-rotatably connected thereto thus causing the vertical shaft 12 to be raised by reason of the internal threads formed upon the sleeve 91 co-operating with the threaded portion 90 of the vertical shaft 89. The shaft 12 is retained against rotative movement by reason of the oppositely positioned grooves formed therein co-operating with the oppositely positioned splines 19 carried by the collar 18. After the upper grinding member has been raised to the desired height the rollers previously treated are removed and replaced by others which are to be ground whereupon the vertical shaft 12 and the upper grinding member carried thereby are permitted to return to their original position into contact with the upper surfaces of the rollers. It will be observed that the roller supporting members 121 and 127 are positioned at an angle to the circumference of a circle passing through the centers of the small circular openings 120, thus resulting in a rotative movement of the rollers upon their axes and a slidable movement of the same in a direction at an angle to their longitudinal axes as the roller supporting plate 62 moves eccentrically to the path of movement of the grinding members.

It will be observed that Figs. II and XIII disclose modified forms of supporting bearings for the work supporting member since in Fig. II three anti-friction bearings are employed for supporting the work holding member while in Fig. XIII only two of these anti-friction bearings are used. Any desired number of these anti-friction bearings may be employed and the extent which adjacent bearings are offset from each other may be varied with the number of bearings employed so as to secure a proper degree of eccentricity of the work supporting member relative to the grinding members.

While I have shown and described in considerable detail the specific embodiment of my invention, it is to be understood that this showing and description is illustrative only and for the purpose of rendering my invention more clear, and that I do not regard the invention as limited to the details of construction illustrated or described, nor any of them, except in so far as I have included such limitations within the terms of the following claims, in which it is my intention to claim all novelty inherent in my invention broadly as well as specifically.

What I claim as new and desire to secure by Letters Patent is:

1. The process of cylindrically grinding rollers between two rotating surfaces comprising revolving the grinding surfaces in opposite directions at different speeds, and giving the rollers a back and forth movement in a path eccentric to the axis of rotation of said surfaces.

2. The process of cylindrically grinding rollers between two concentric oppositely rotating surfaces comprising imparting to the rollers a movement toward and from the axis about which the surfaces are rotated and eccentric to the paths of the rotating surfaces.

3. The process of grinding the curved faces of rollers between rotating surfaces comprising the positioning of the rollers angularly with respect to the path of movement of the rotating surfaces, and simultaneously imparting to the rollers a circular and back and forth movement toward and from the axis about which the surfaces are rotated.

4. The process of cylindrically grinding rollers between grinding surfaces rotating

in opposite directions, comprising the imparting of a back and forth movement to the rollers in a circular direction about the axis of rotation of the grinding surfaces.

5. The process of cylindrically grinding the curved faces of a roller by rotating the roller and subjecting it to grinding action at an angle to the direction of rotation and simultaneously moving it back and forth while rotating.

6. The process of grinding a roller by simultaneously rotating the roller, moving it back and forth in a direction at an acute angle to its axis of rotation, and subjecting it to grinding action.

7. In a device of the class described, a pair of oppositely rotatable grinding members, a roller retaining ring having a portion thereof extending between the grinding surfaces and mounted to move in a direction eccentric to the path of movement of the grinding members, and rollers carried by said retaining ring and rotatably supported thereby with their axes parallel to the face of a grinding member.

8. In a roller grinding mechanism, upper and lower grinding members, movable in opposite directions relative to each other, a roller retaining ring having a portion thereof extending between the adjacent surfaces of the grinding members, and means carried by the retaining ring for rotatably supporting the rollers, with their cylindrical surfaces in contact with a grinding member.

9. In a device of the class described, upper and lower grinding elements, a work supporting member therebetween, means for rotating said upper member and means whereby the rotative movement of said upper member may be made effective to raise the same from said lower member.

10. In a device of the class described, upper and lower grinding members, means for rotating said grinding members in opposite directions, relative to each other at different speeds, and means coaxial with the grinding members for displacing one of the grinding members relative to the other.

11. In a device of the class described, upper and lower grinding members having a common axis of rotation, means for rotating said grinding members in opposite directions relative to each other, and means coaxial with the common axis of the grinding members for displacing one of the grinding members relative to the other in an axial direction.

12. In a device of the class described, upper and lower grinding members having a common axis of rotation, means for rotating said grinding members at different speeds relative to each other, and means coaxial with the common axis of the grinding members for displacing one of the grinding members relative to the other in an axial direction.

13. In a roller grinding machine, a pair of opposed relatively rotatable grinding members, an intermediate roller carrying member, means for rotatively mounting a plurality of rollers on said carrying member and means for mounting said carrying member to be freely rotatable in a path eccentric to said grinding members.

14. In a device of the class described, a grinding member rotatable about a substantially vertical axis, a member freely mounted for eccentric movement about the axis of the grinding member, means for rotatively mounting a roller in said member and means for imparting movement to said member relative to the grinding member.

15. In a device of the class described, a lower grinding member, an upper grinding member, a work supporting member having a portion extending between the grinding members, and means for mounting the work supporting member for free movement in a path eccentric to the grinding members.

16. In a device of the class described, a lower grinding member and an upper grinding member having a common axis of rotation, a work supporting member having a portion extending between the grinding members and adapted to prevent vertical displacement of the work, and means for rotating the grinding members at different speeds.

17. In a device of the class described, a substantially vertical shaft, a lower member, an upper member carried by said shaft, and means comprising a threaded member operated by said shaft for bodily raising the first named shaft and the member carried thereby.

18. In a device of the class described, a substantially vertical shaft, a lower rotatable member, the axis of rotation of which coincides with the axis of the vertical shaft, an upper member carried by said shaft, and screw threaded means carried by said shaft for automatically raising the shaft and the member carried thereby.

19. In a device of the class described, a substantially vertical shaft, a lower rotatable member the axis of rotation of which coincides with the axis of the vertical shaft, an upper member carried by said shaft, means for rotating the shaft and the lower member, and means responsive to the relative movement of the shaft and the lower member for raising the shaft and the member carried thereby.

20. In a device of the class described, a substantially vertical shaft, a lower rotatable member the axis of rotation of which coincides with the axis of the vertical shaft, an upper member carried by said shaft, a work supporting member positioned between

the upper and lower members, means for rotating the upper and lower members, and means operatively connecting said shaft and said lower member for automatically raising the shaft and the member carried thereby.

21. In a device of the class described, an upper rotatable member, a lower rotatable member, and a rotatable work supporting member positioned between the first named rotatable members and provided with bearings offset from each other whereby the supporting member is given an eccentric movement as it is rotated.

22. In a device of the class described, a substantially vertical rotatable shaft, a rotatable work supporting member, and a plurality of bearings for said supporting member concentric respectively with said shaft and with said supporting member and offset from each other in such a manner as to cause the supporting member to move eccentrically when it is rotated relative to the shaft.

23. In a device of the class described, a lower grinding element, an upper grinding element, a shaft for rotating said upper grinding element, threaded means operatively connected with said shaft for raising said upper member and a clutch device for rendering operative said threaded means.

24. In a device of the class described, a substantially vertical shaft, a rotatable work supporting member, a bearing concentric with the shaft, a second bearing offset from the first named bearing, and means for supporting the said member upon the second named bearing whereby the supporting member moves eccentrically with respect to the shaft as it is rotated.

25. In a device of the class described, a lower grinding member, upper grinding member, a shaft for each of said members, single means for rotating said shafts in opposite directions, and means for interconnecting said shafts for automatically raising said upper member.

26. In a device of the class described, a work supporting member comprising a central portion and an outer ring portion, and means carried by the ring portion for supporting a plurality of bearing rollers.

27. In a device of the class described, a work supporting member provided with a plurality of openings therein, and means extending across said openings for supporting rollers therein.

28. In a device of the class described, a work supporting member provided with a plurality of openings formed therein arranged in the path of a circle, means for mounting roller bearings in certain of the openings in such a manner that the longitudinal axis of each roller will be positioned angularly with respect to a radial line to said roller.

29. In a device of the class described, a lower grinding member, an upper grinding member, a work supporting member provided with a plurality of openings formed therein in such a manner as to be positioned between the upper and lower grinding members, and bearing rollers positioned within certain of the openings in such a manner as to contact with the upper and lower grinding members.

30. In a device of the class described, a substantially vertical shaft, means for rotating the shaft, and means for raising and lowering the shaft, and clutch means for operatively connecting the raising and lowering means with the operating mechanism therefor.

31. In a device of the class described, a substantially vertical shaft, a threaded shaft co-operating with the first named shaft for raising and lowering the same, means for rotating the threaded shaft, and clutch means for connecting the operating means for the threaded shaft thereto and disconnecting the same therefrom.

In testimony whereof, I affix my signature.

HANS LUTZ.