

April 27, 1937.

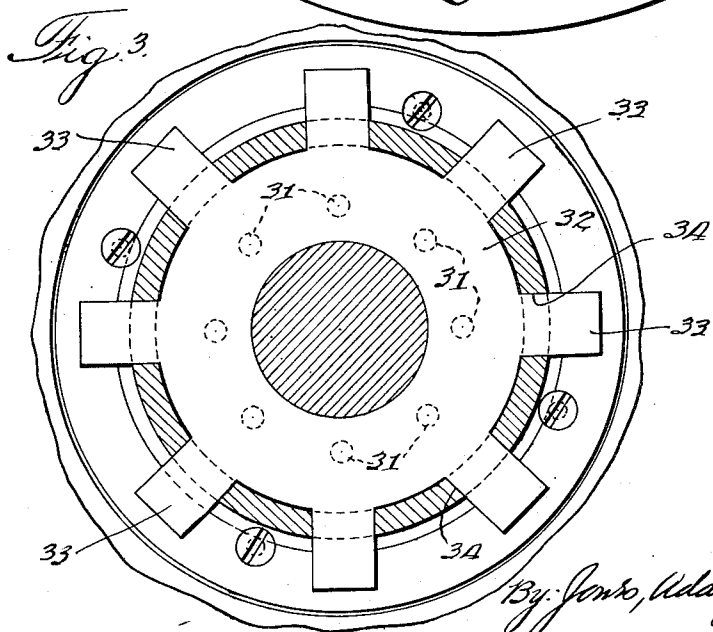
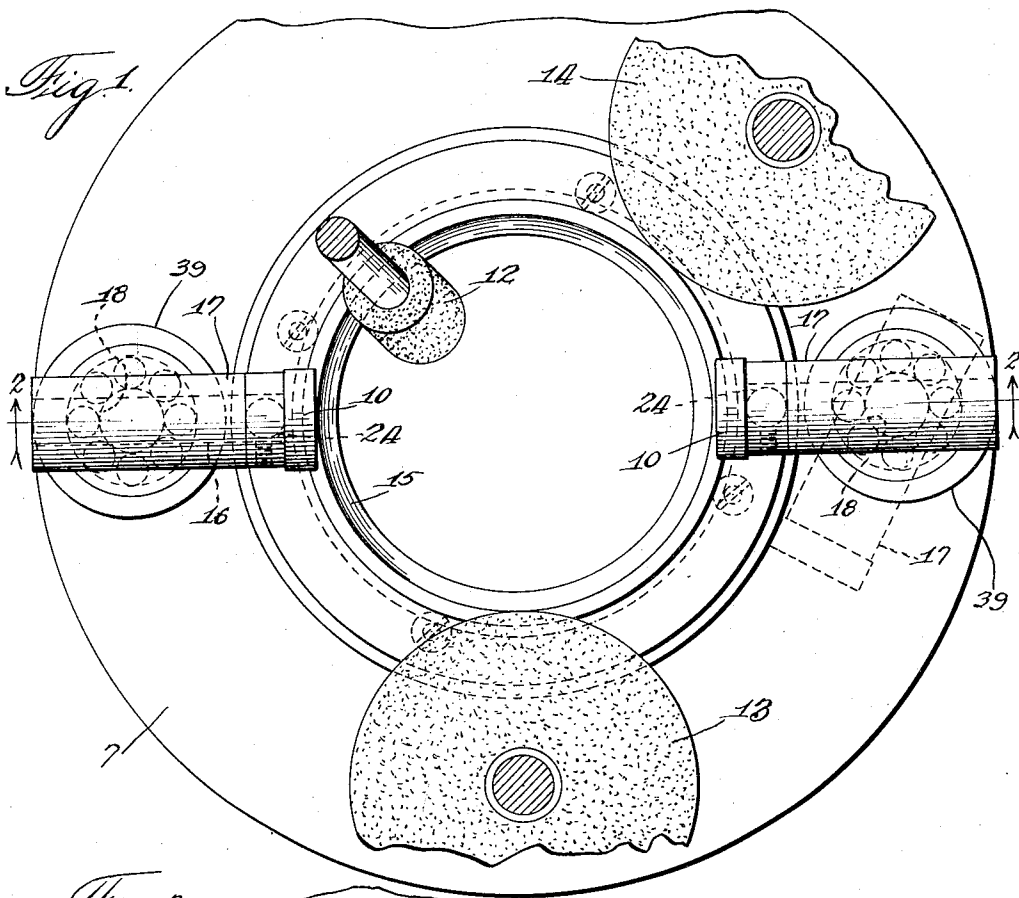
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2,078,416

GRINDING APPARATUS

Filed Feb. 6, 1936

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

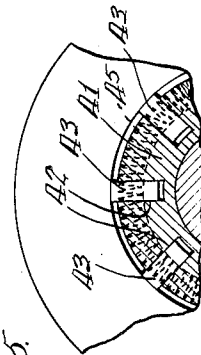
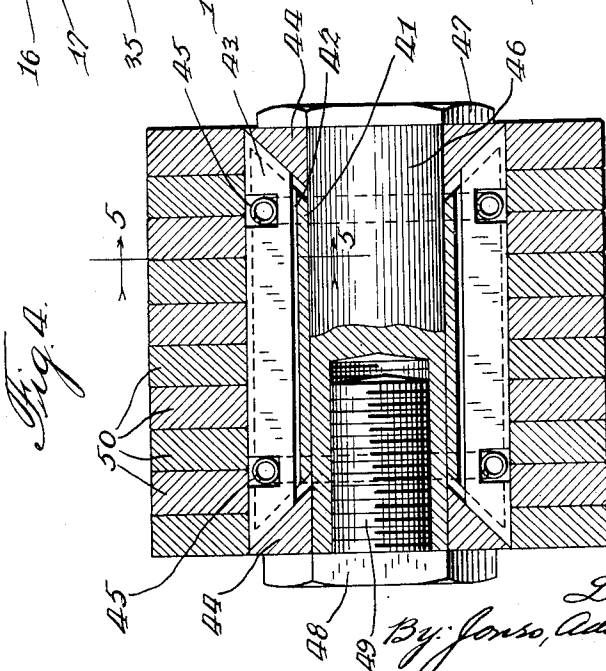
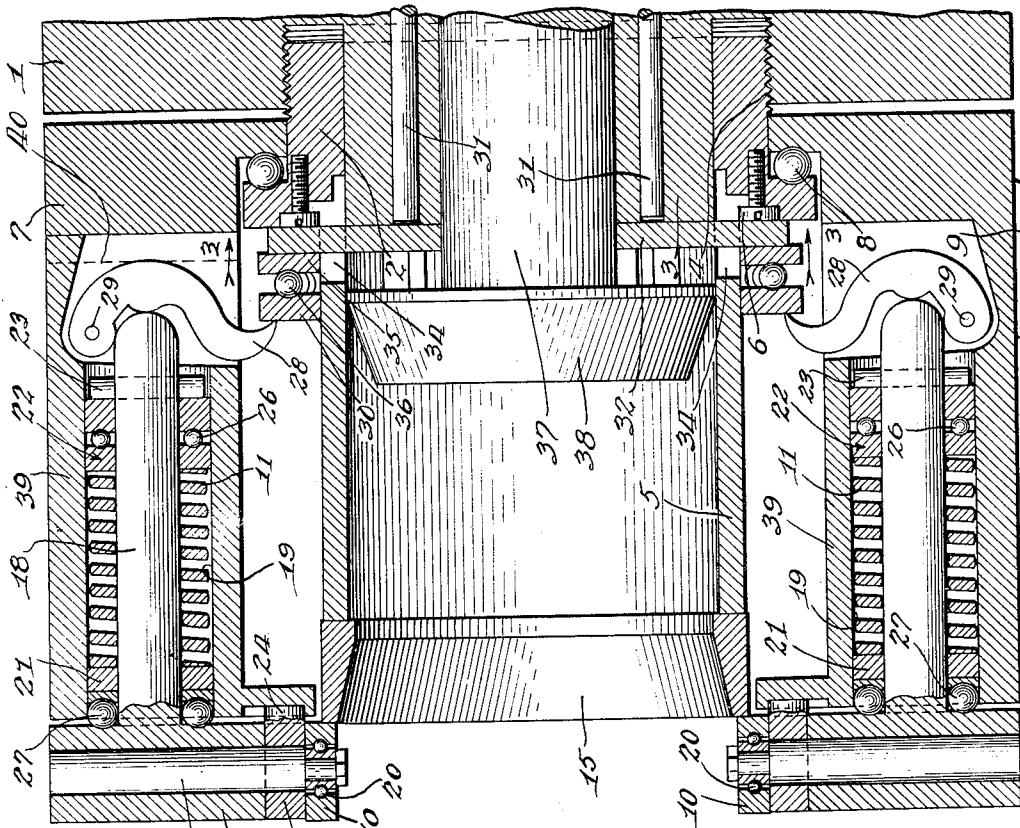


Fig. 5.

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UNITED STATES PATENT OFFICE

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GRINDING APPARATUS

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Application February 6, 1936, Serial No. 62,671

8 Claims. (Cl. 51-217)

My invention relates to grinding apparatus.

One of the objects of my invention is to provide an improved apparatus for grinding articles having annular surfaces, the apparatus having provisions for holding the article in place as it is rotated in such a manner that the face of the article which is engaged by the clamping device may be ground.

A further object is to provide an improved apparatus for grinding articles, in which a plurality of annular surfaces may be simultaneously ground.

A further object of my invention is to provide improved means for releasing the clamping rollers from the article being ground.

Further objects and advantages of the invention will be apparent from the description and claims.

In the drawings, in which an embodiment of my invention is illustrated,

Figure 1 is an end view showing the three grinding cutters in operation;

Fig. 2 is a horizontal section on the line 2-2 of Figure 1;

Fig. 3 is a section on the line 3-3 of Fig. 2;

Fig. 4 is an axial section showing an expandible mandrel for centering a plurality of annular articles, the inside and outside surfaces of which are to be ground; and

Fig. 5 is a section on the line 5-5 of Fig. 4.

Referring to the drawings in detail, the construction shown comprises a rotatable power-driven face plate 1, an annular anvil-supporting member 2 surrounding the annular hub portion 3 of the face plate and having a threaded connection at 4 with the face plate, a cylindrical anvil or work-support 5, secured to the anvil-supporting member 2 by means of a plurality of screws 6, the heads of which engage a flange on the anvil and the shanks of which are threaded into the anvil support, a clamp-carrying head 7 having a swivel anti-friction connection with the anvil support, by means of the ball bearing construction 8, the clamp-carrying head being held against rotation in any suitable manner as by means of a lug 9 engaging some stationary part of the apparatus, and a plurality of clamping rollers 10 (two being shown) carried by the clamping head 7 and pressed into engagement with the annular article to be ground by means of coil compression springs 11.

With this construction, it will be seen that three annular surfaces may be simultaneously ground by means of the three grinding cutters 12, 13, and 14 shown, these grinding cutters

being driven at suitable speeds and moved in the desired manner by means well known in this art. The small grinding cutter 12, with the inclined axis, grinds the conical inner surface of the annular article 15 which, for instance, may be a raceway for a cone bearing. The flat face of the cutter 13 grinds the flat face or edge of the article 15 which is engaged by the clamping rollers 10 and the cylindrical surface of the grinding cutter 14 operates on the outside cylindrical surface of the article being ground. The principal feature of construction which enables this method of grinding to be accomplished is the provision of the roller clamps 10, the rollers of which are driven by contact with the article being ground.

Each of these clamping rollers 10 may be rotatably mounted on a shaft 16, which shaft in turn is mounted in a sleeve 17 having a guide pin 18 extending therefrom which is mounted for longitudinal movement in a cylindrical pocket 19 in the clamp-supporting head 7. If desired, anti-friction bearings 20 may be provided for the clamping rollers. Each roller is spring pressed into clamping engagement with the article being ground by means of the coil compression spring 11, one end of which bears against a fixed abutment 21 in the pocket 19 in the clamp-carrying head and the other end of which bears against an anti-friction bearing construction 22 which is held against endwise movement on the guide pin 18 by means of a pin 23 extending through an opening in the guide pin 18. When the clamping roller 10 is in clamping position, the guide pin is held against swivel movement in the clamp-carrying head 7 by means of a projection 24 on a collar 25 secured to the shaft 16, which projection engages a recess in the clamp-carrying head. However, when it is desired to release the clamping rollers from clamping engagement with the article being ground, the guide pins 18 may be simultaneously pushed to the left (as viewed in Fig. 2) against action of the coil compression springs 11, thus releasing the rollers 10 from clamping engagement with the article being ground and also enabling the rollers to be swung out of the way of the article being ground by a swiveling motion of the guide pins to the dotted-line position shown at the right in Fig. 1, the positioning projections 24 at this time being disengaged from the positioning recesses in the clamp-carrying head. In order to facilitate this swiveling movement of the guide pins, anti-friction bearings may be provided, as indicated at 26 and 27.

In order to effect the simultaneous release of the clamping rollers from clamping engagement with the article being ground, a plurality of cam levers 28 are provided, one for each of the guide pins, pivotally mounted at 29 in the clamp-carrying head and simultaneously released by means of a clamp-releasing collar 30 engaging the free ends of these cam levers. This clamp-releasing collar is moved to effect the clamp-releasing action by means of a plurality of pins 31 (eight being shown), slidably mounted in the hub portion 3 of the face plate and bearing on a spider member 32 (Figs. 2 and 3) having a plurality of arms 33 which extend through notches 34 in the inner edge of the anvil 5 into engagement with a ring 35 which has a swivel connection with the clamp-releasing ring 30 by means of the ball bearing construction 36.

In order to center the annular article 15, which is to be ground, a centering device may be provided having a cylindrical shank 37 slidably mounted in the face plate and having a conical centering head 38 which may be moved to the left as viewed in Fig. 2 to bring the conical surface of this centering head into engagement with the inner circular edge of the article 15 being ground to center this article properly on the work-supporting anvil 5. When the article has been properly centered and when the roller clamps are in position, the centering head may be withdrawn to the position shown in Fig. 2 to enable the grinding cutters to have free access to the various surfaces to be ground. Any suitable means (not shown) may be provided for actuating the clamp-releasing pins 31 and the centering head 38.

In using the apparatus, the clamping rollers 10 are swung to the dotted-line position of Fig. 1, which will enable the article to be ground to be placed in position on the anvil, the clamping rollers are then swung into position to engage the outer face of the article being ground, the centering head 38 is operated to properly center the article to be ground with respect to the anvil, the centering head is then withdrawn, and the apparatus is then put in operation to rotate the face plate 1, anvil 5 and the article 15 clamped against the anvil, the clamp-carrying head 7 being held against rotation by means of the holding lug 9. As the article to be ground rotates, it causes the clamping rollers 10 to rotate, but as the clamping head itself does not rotate it leaves the grinding cutters 12, 13, and 14 free to operate on all three surfaces of the article to be ground. This enables pillars 39 of different heights to be used with the clamp-carrying head, to take care of various types of work. If desired, the hollow pillars 39, in which the pins 18 are mounted, may be detachably secured to the clamp-carrying head 7 by any suitable means, such as a dovetail joint, at 40 (Fig. 2).

In Fig. 4 is shown an expansible mandrel, by means of which a plurality of annular articles may be centered and placed in the grinding apparatus in such a manner that both the outside diameters and the inside diameters of the articles may be simultaneously ground. This expansible mandrel may comprise a blade-carrying sleeve 41 having a plurality of radially-extending grooves 42 therein, a plurality of expanding blades 43, one in each groove, each blade having its ends beveled for cooperation with the conical expanding rings 44, a pair of circular coil tension springs 45, tending to draw the blades 43 inwardly, a clamping pin 46 having a head 47 en-

gaging one of the clamping rings 44 and having an internally threaded recess, and a clamping screw, the head 48 of which engages the other clamping ring 44 and the shank 49 of which is threaded into the internally threaded recess. Using this expanding mandrel, the clamping screw is loosened to permit the expanding blades 43 to move inwardly under the action of the circular springs 45, the annular articles 50 to be ground are slipped over the mandrel, and the screw is then tightened up to draw the conical rings 44 toward each other and force the beveled expansion blades 43 out into engagement with the inner surfaces of the articles to be ground. The assembly is then placed in position in the clamping head 7, an anvil of a suitable length and construction being provided for engagement with the innermost article to be ground. The clamping rollers 10 are then swung into position and brought into clamping engagement with the outermost one of the articles to be ground. The clamping screw is then loosened to enable the mandrel to contract and to be withdrawn from the assembly of articles to be ground, leaving this assembly in place in the grinding apparatus. This leaves the assembly of articles to be ground in such position that both the inside diameters and the outside diameters may be simultaneously ground by means of suitably positioned inner and outer grinding cutters.

While magnetic chucks are sometimes used for holding articles of magnetic material for the grinding operation, such chucks are of course useless for holding articles of non-magnetic material. It will be seen that with my improved apparatus, articles of non-magnetic material may be held in place on the anvil and ground. It is obvious that pneumatic or hydraulic pressure might be used for holding the clamping rollers 10 against the work instead of the coil compression springs 11 shown.

Further modifications will be apparent to those skilled in the art and it is desired, therefore, that the invention be limited only by the prior art and the scope of the appended claims.

Having thus described my invention, what I claim and desire to secure by Letters Patent is:

1. A grinding apparatus for surfacing annular articles comprising a rotatable work support having an annular surface coaxial with the support against which surface an annular face of the article is held, means for clamping the article on the work support comprising a plurality of rollers, and mounting means for said rollers non-rotatable with the work support, the axes of which rollers intersect the axis of the work support and which rollers engage an annular surface on the article and are rotated thereby.
2. A grinding apparatus for surfacing annular articles comprising a rotatable work support having an annular surface coaxial with the support against which surface an annular face of the article is held, means for clamping the article on the work support comprising a plurality of rollers, mounting means for said rollers non-rotatable with the work support, the axes of which rollers intersect the axis of the work support and which rollers engage an annular surface on the article and are rotated thereby, and a plurality of grinding cutters for simultaneously grinding a plurality of different annular surfaces of the article.
3. A grinding apparatus for surfacing annular articles comprising a rotatable work support having an annular surface coaxial with the sup-

port against which surface an annular face of the article is held, means for clamping the article on the work support comprising a plurality of rollers, mounting means for said rollers non-rotatable with the work support, the axes of which rollers intersect the axis of the work support and which rollers engage an annular surface on the article and are rotated thereby, and a plurality of grinding cutters for simultaneously grinding a plurality of different annular surfaces of the article, one of said surfaces being the surface engaged by said rollers.

4. A grinding apparatus for surfacing annular articles comprising a rotatable work support having an annular surface coaxial with the support against which surface an annular face of the article is held, means for clamping the article on the work support comprising a plurality of rollers, mounting means for said rollers non-rotatable with the work support, the axes of which rollers intersect the axis of the work support and which rollers engage an annular surface on the article and are rotated thereby, and a plurality of grinding cutters for simultaneously grinding a plurality of different annular surfaces of the article, one of said surfaces being the outside surface of the article.

5. A grinding apparatus for surfacing annular articles comprising a rotatable work support having an annular surface coaxial with the support against which surface an annular face of the article is held, means for clamping the article on the work support comprising a plurality of rollers, mounting means for said rollers non-rotatable with the work support, the axes of which rollers intersect the axis of the work support and which rollers engage an annular surface on the article and are rotated thereby, and a plurality of grinding cutters for simultaneously grinding a plurality of different annular surfaces of the article, one of said surfaces being the inside surface of the article.

6. A grinding apparatus for surfacing annular articles comprising a rotatable work support having an annular surface coaxial with the support against which surface an annular face of the article is held, means for clamping the article on the work support comprising a plurality of rollers, mounting means for said rollers non-rotatable with the work support, the axes of which rollers intersect the axis of the work support and which rollers engage an annular sur-

face on the article and are rotated thereby, and spring means for pressing the roller against the article.

7. A grinding apparatus for surfacing annular articles comprising a rotatable work support having an annular surface coaxial with the support against which surface an annular face of the article is held, means for clamping the article on the work support comprising a plurality of rollers, mounting means for said rollers non-rotatable with the work support, the axes of which rollers intersect the axis of the work support and which rollers engage an annular surface on the article and are rotated thereby, spring means for pressing the roller against the article, and means for releasing the spring pressure on the rollers to enable the release of the article.

8. A grinding apparatus for surfacing annular articles comprising a rotatable work support having an annular surface coaxial with the support against which surface an annular face of the article is held, a clamp-carrying head with respect to which said work support has a swivel connection coaxial with the axis of rotation of the support, means for holding said clamp-carrying head against rotation, clamping means carried by said head comprising a plurality of rollers, the axes of which intersect the axis of the work support, which rollers engage an annular surface on the article and are rotated thereby, means for mounting said rollers on said clamp-carrying head, each roller-mounting means comprising a bearing member for the roller having an elongated guide member secured to said bearing member extending longitudinally of the axis of the work support and guided by said head for longitudinal movement, spring means for pressing the rollers against the article, and means for simultaneously exerting force on all of said elongated guide means to release the rollers simultaneously from clamping engagement with the article, each of said bearing members being rotatable about the axis of said elongated guide member when the roller is released to enable the rollers to be swung out of the way of the article and work support.

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Witness to mark:
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