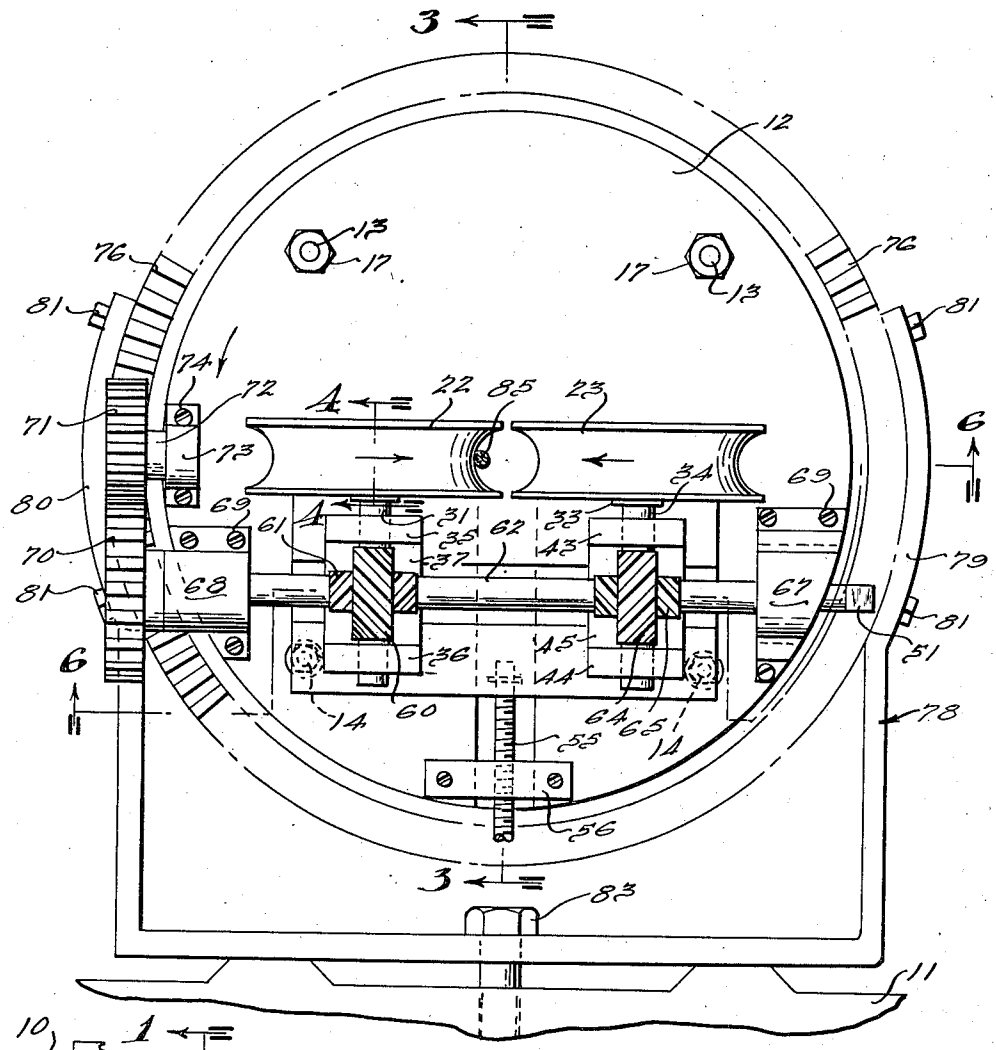
July 6, 1948. H. A. THORNGREN 2,444,793

APPARATUS FOR GRINDING THE SURFACES OF GROOVED ROLLS

Filed April 26, 1945 2 Sheets-Sheet 1



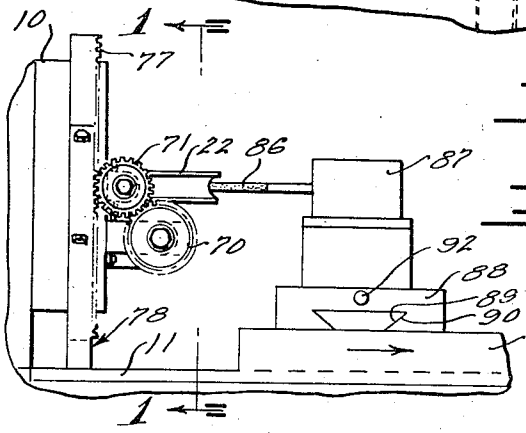


Fig. 1.

Fig. 2.

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2 Sheets-Sheet 2

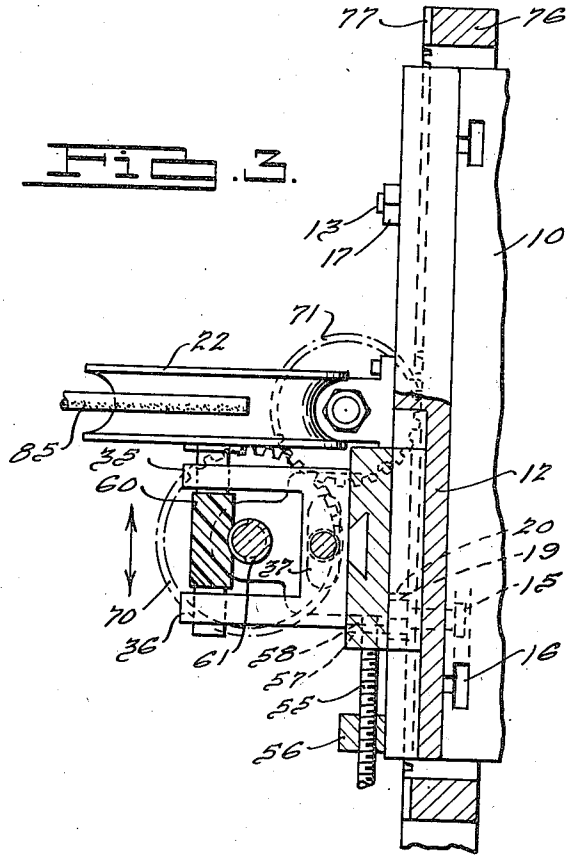

FIG. 3.

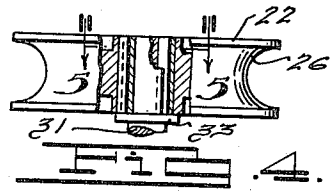

FIG. 4.

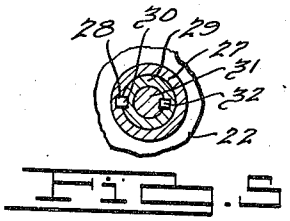

FIG. 5.

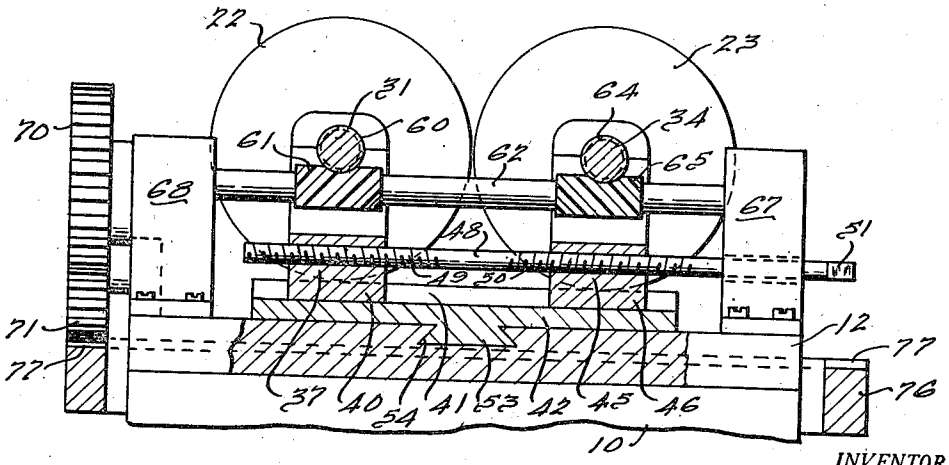

FIG. 6.

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APPARATUS FOR GRINDING THE SURFACES OF GROOVED ROLLS

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Application April 26, 1945, Serial No. 590,338

10 Claims. (Cl. 51—105)

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The invention relates to a rotary grinding mechanism and it has particular relation to a mechanism for grinding the surfaces of grooved rolls.

In the manufacture of tubing or a similar product, the tubing is passed between pairs of rolls having grooves which jointly form an opening through which the tubing travels. Necessarily, if precision is to be obtained, the rolls must be accurately formed or shaped, and the rolls of each pair must have mating contours. In actual practice heretofore, in so far as known, these rolls have been individually shaped and ground, and therefore, precision depends upon individual attention given to each roll. It follows that if either of a pair of rolls varied from the other, their surfaces would not be truly mating in character. Furthermore, a great amount of time and work is involved in grinding the rolls individually and the operation is extremely costly especially if any degree of precision is to be obtained.

One object of the present invention is to provide an apparatus for grinding a pair of mating rolls which enables obtaining the precision and mating characteristics required in a simple, inexpensive, and efficient manner.

Another object of the invention is to provide an improved apparatus for grinding a pair of rolls simultaneously to the end that the surfaces on both rolls will be ground in the same operation by a single grinding wheel.

Another object of the invention is to provide an apparatus such as indicated which enables quickly placing the wheels in position for resurfacing or grinding and then quickly removing them after the grinding operation.

Another object of the invention is to provide an apparatus such as indicated which is adjustable so the rolls may be properly centered and also so that rolls of different sizes and curvature may be readily resurfaced or ground.

Another object of the invention is to provide an apparatus for the purpose indicated which may be readily attached to an ordinary lathe so that it may be made available at a reduced cost and also so that it may be more widely used without requiring special machine setups.

Other objects of the invention will become apparent from the following specification, from the drawings relating thereto, and from the claims hereinafter set forth.

For a better understanding of the invention, reference may be had to the drawings wherein:

Figure 1 is a front or end view of apparatus or mechanism constructed according to one form of

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the invention as seen along the line 1—1 of Fig. 2;

Fig. 2 is a side elevational view of the mechanism;

Fig. 3 is a cross-sectional view taken substantially along the line 3—3 of Fig. 1;

Fig. 4 is a cross-sectonal view taken substantially along the line 4—4 of Fig. 1;

Fig. 5 is a cross-sectional view taken substantially along the line 5—5 of Fig. 4; and,

Fig. 6 is a cross-sectional view taken substantially along the line 6—6 of Fig. 1.

Referring to Figs. 1 and 3, the mechanism is shown in conjunction with a lathe, and for the purpose of simplicity only the face plate and bed of the lathe are shown as indicated respectively at 10 and 11. The apparatus principally is mounted on a circular plate 12 which is fastened to the face plate by means of upper bolts 13 and lower bolts 14. These bolts have rectangular heads 15 at one end which fit in radial slots 16 of the character usually provided on the face plate of a lathe. The upper bolts 13 have nuts 17 on their outer ends which clamp the two plates together, but the lower bolts are shorter and the nuts on these bolts indicated at 19 are located in circular openings 20 in the plate 12 so that neither the ends of the bolts nor the nuts thereon at the lower side of the plate project above the outer surface of the plate. These plates are assembled so that they are concentric and it will be noted that they have substantially the same radius so that their outer peripheries are flush.

It has been mentioned previously that the apparatus is provided for the purpose of grinding a pair of rolls, and these rolls are indicated at 22 and 23, respectively. The roll 22, as best shown by Figs. 4 and 5, has a grooved periphery indicated at 26 and an inner hub 27 provided with a keyway 28. The hub is adapted to be drivingly connected to a sleeve 29 having a key 30 fitting the keyway 28, and the hub 27 in turn is drivingly connected to a shaft 31 by means of a key 32. For locating the roll axially, a shoulder 33 may be provided on the shaft, and the roll is pressed on until it reaches the shoulder. The roll 23 is of the same character and is mounted on a shaft 34 extending upwardly in parallel relation to the shaft 31. It will be noted in Fig. 1 that the rolls may be readily removed by upward pressure, and in this connection it should be understood that they are mounted with sufficient tightness on the shafts that they will stay in position during revolving thereof about the axis of the lathe.

The shaft 31 is journalled in openings in legs 35 and 36 projecting outwardly from a block 37,

and this block, as best shown by Fig. 6, has a dovetail 40 which is slidable in a dovetail slot 41 formed in a second block 42. Similarly, the shaft 34 is journalled in legs 43 and 44 projecting outwardly from a block 45 which also has a dovetail 46 slidable in the slot 41. The slot and dovetails are directed perpendicularly to the axis of the shafts 31 and 34, and consequently the shafts and rolls may be adjusted towards and from each other in a direction perpendicular to their axes.

For the purpose of adjusting the blocks 40 and 45 in the manner stated, a screw 48 is provided with threaded portions 49 and 50 which are opposite in character, and these two threaded portions are respectively threaded through the blocks. Rotation of the screw 48, therefore, will cause the blocks to move towards each other or away from each other, depending upon direction of rotation. The outer end of this screw indicated at 51 may be square or polygonal to facilitate adjustment or turning of the screw, and if desired, suitable means may be provided for holding the screw in any adjusted position.

The block 42 has a dovetail 53 which is slidable in a dovetail slot 54 in the plate 12. This dovetail and slot are directed parallel to the shafts 31 and 34 so that the rolls may be adjusted in the direction of their axes. Adjustment of the block 42 is effected by means of a screw 55, shown by Figs. 1 and 3, which is threaded through a boss 56 on the plate 12. This screw projects upwardly into the block 42 and has a collar 57 on its upper end located in a slot 58 in the block. From this it follows that rotation of the screw will move the block 42 and all parts carried thereby, vertically in one direction or the other depending upon direction of movement desired.

The shaft 31 is provided with a worm 60 meshing with a worm 61 on a drive shaft 62 extending between the legs 35 and 36, and similarly, the shaft 34 has a worm 64 meshing with a worm 65 on the drive shaft. The drive shaft 62 is journalled at its ends in bearings indicated generally at 67 and 68, and these bearings may be fastened to the plate 12 by screws 69. It may be mentioned in connection with such bearings that they may involve roller or plain cylindrical bearings, and that the shaft 62 will be held against endwise movement during its rotation by any suitable thrust means. Likewise, the shafts 31 and 34 may be journalled in the legs 35 and 36, and 43 and 44, respectively, by suitable bearings which will hold the shafts against axial movement while permitting their rotation.

One end of the shaft 62 has a pinion 70 drivingly connected thereto and this pinion meshes with a second pinion 71 mounted on a short stub shaft 72 journalled in a bearing 73 fastened by screws 74 to the plate 12. The pinion 71 is in mesh with a ring gear 76 which encircles the face plate 10 of the lathe and the plate 12 fastened thereto, and the teeth indicated at 77 are on the front side of the ring. The ring is held in a stationary position by means of a bracket 78 having oppositely disposed arcuate leg portions 79 and 80 fitting opposed portions of the gear and which are fastened solidly thereto by bolts 81. This bracket is held on the bed 11 of the lathe by one or more bolts 83.

Grinding of the grooved surfaces of the rolls is accomplished by a grinding wheel 85 which is mounted on a shaft 86. This shaft and grinding wheel may be driven by any suitable means such as by an electric motor 87 or other power drive, and it may be mounted on the lathe in any suitable manner. As shown by Fig. 2, the motor 87 is shown on a cross slide 88 having a dovetail 89 which is slidable in a slot 90 formed on a saddle 91. This saddle is slidable on the ways of the lathe bed and is adjustable therealong in the usual manner such as by an adjusting screw. The cross slide 88 is adjustable along the slot 90 and a screw 92 may be used for adjusting the slide. Hence, the motor may be moved longitudinally and transversely of the lathe.

In operation, the lathe is rotated at a relatively slow speed and this causes rotation of the rolls and all parts carried by plate 12. During this rotation, the pinion 71 is driven through its engagement with the stationary ring gear 76 and rotation of the pinion 71 in turn causes the two rolls to be driven slowly about their own axes in the directions shown by the arrows in Fig. 1. It follows that the rolls are driven about their own axes at the same time that they are revolving about the axis of the lathe. With the grinding wheel in position between the rolls and in contact with the surface on either roll, rotation of the rolls about their own axes and simultaneous revolving thereof about the axis of the lathe, will effect grinding of the complete surface of the roll as the operation continues. It is evident that the curvature of both the roll surfaces will correspond exactly to each other since they are passing the same grinding wheel and are rotating about the same axis. As a result, both rolls will have the same surface contour. When the operation is completed, it is a simple matter to withdraw the grinding wheel and remove the rolls from the shafts.

It is evident that rolls of different sizes and different contours may be ground by making adjustments such as have been described and shown. By moving the rolls farther apart, and shifting the grinding wheel farther away from the axis of the lathe, the surface of the rolls may be ground with a larger radius and vice versa, by bringing the rolls close together they may be ground with a smaller radius. As shown, the rolls are sufficiently close together that the two grooves practically form a complete circle for a tube which in practice passes between the rolls.

The plate 12 may be readily mounted on the face plate of any lathe, and the ring gear 76 and its bracket 78 likewise may be easily mounted and placed on the bed of the lathe. This completes the mounting for supporting the rolls and driving them, and it is only necessary to place the rolls in position and make the necessary adjustments. The grinding wheel is mounted separately and may be easily fastened to the cross slide or if desired, it could be fastened on the lathe in other ways. In any event mounting of the entire apparatus is a simple matter and operation thereof is likewise simple and not complicated.

Although only one form of the invention has been illustrated and described in detail, it will be apparent to those skilled in the art that various modifications may be made without departing from the scope of the claims.

What is claimed is:

1. In an apparatus for grinding the surfaces of grooved rolls, a support for a pair of rolls to be ground, means for rotating the support about a predetermined axis, means for mounting the rolls on the support so that they will be disposed in planes radial to said axis, means for driving the rolls about their own axes respectively while they are being revolved about the

axis of the support, and means for adjusting the rolls radially of the axis of the support.

2. In an apparatus for grinding the surfaces of grooved rolls, a support for a pair of rolls to be ground, means for rotating the support about a predetermined axis, means for mounting the rolls on the support so that they will be disposed in planes radial to said axis, means for driving the rolls about their own axes respectively while they are being revolved about the axis of the support, means for adjusting the rolls radially of the axis of the support, and means for adjusting the rolls along their own axes.

3. An apparatus for grinding the surfaces of grooved rolls comprising a plate mounted for rotation about an axis perpendicular to the plate, a pair of shafts on the plate in positions perpendicular respectively to radii of said axis, means on each of said shafts for holding a roll, means for rotating the plate, means for rotating the shafts as the plate is rotated, and means for adjusting the shafts and rolls radially of the plate axis.

4. An apparatus for grinding the surfaces of grooved rolls comprising a plate mounted for rotation about an axis perpendicular to the plate, a pair of shafts on the plate in positions perpendicular respectively to radii of said axis, means for adjustably supporting the shafts on the plate so that they are adjustable radially of said axis while being held equidistant from such axis, means for rotating the plate, means for rotating the shafts as the plate is rotating, and means on each shaft for holding one of the rolls.

5. An apparatus for grinding the surfaces of grooved rolls comprising a plate mounted for rotation about an axis passing through the plate, a pair of shafts on the plate in positions perpendicular respectively to radii of said axis, a third shaft extending transversely of the pair of shafts, drive connections between the third shaft and the pair of shafts so that the latter are driven when the third shaft is driven, a stationary ring gear concentric to the plate axis, a gear connection between the third shaft and ring gear, and means for holding a roll on each of said pair of shafts.

6. An apparatus for grinding the surfaces of grooved rolls comprising a plate mounted for rotation about an axis passing through the plate, a pair of shafts on the plate in positions perpendicular respectively to radii of said axis, a third shaft extending transversely of the pair of shafts, drive connections between the third shaft and the pair of shafts so that the latter are driven when the third shaft is driven, a stationary ring gear concentric to the plate axis, a gear connection between the third shaft and ring gear, means for holding a roll on each of said pair of shafts, and means for adjusting said pair of shafts towards or from each other.

7. In combination with a lathe, an apparatus for grinding the surfaces of grooved rolls comprising a supporting plate, means for mounting the plate on the face plate of the lathe, a pair of shafts on the supporting plate, a ring gear mounted on the bed of the lathe in concentric relation to the axis of the lathe, a third shaft on the supporting plate, gear means drivingly connecting the ring gear to the third shaft, means drivingly connecting the third shaft to said pair of shafts, and means for holding a roll on each of the pair of shafts.

8. In combination with a lathe, an apparatus for grinding the surfaces of grooved rolls comprising a supporting plate, means for mounting the plate on the face plate of the lathe, a pair of shafts on the supporting plate, a ring gear mounted on the bed of the lathe in concentric relation to the axis of the lathe, a third shaft on the supporting plate, gear means drivingly connecting the ring gear to the third shaft, means drivingly connecting the third shaft to said pair of shafts, means for holding a roll on each of the pair of shafts, means for adjusting the shafts towards or from the plate axis, and means for adjusting the shafts along their axes.

9. An apparatus for grinding the surfaces of grooved rolls comprising a supporting plate, means for mounting the plate on the face plate of a lathe so that it will turn about the lathe axis, a pair of shafts on the supporting plate disposed normal to radii of the plate axis of rotation, means for holding a roll on each shaft, a third shaft on the plate, gear means drivingly connecting the third shaft to the pair of shafts, and means for adjusting the pair of shafts towards or from the plate axis.

10. An apparatus for grinding the surfaces of grooved rolls comprising a supporting plate, means for mounting the plate on the face plate of a lathe so that it will turn about the lathe axis, a pair of shafts on the supporting plate disposed normal to radii of the plate axis of rotation, means for holding a roll on each shaft, a third shaft on the plate, gear means drivingly connecting the third shaft to the pair of shafts, means for adjusting the pair of shafts towards or from the plate axis, and means for adjusting the pair of shafts along their own axes, respectively.

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The following references are of record in the file of this patent:

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