July 31, 1945. P. H. HUTCHINSON 2,380,761

GRINDING MACHINE

Filed Sept. 29, 1944 2 Sheets-Sheet 1

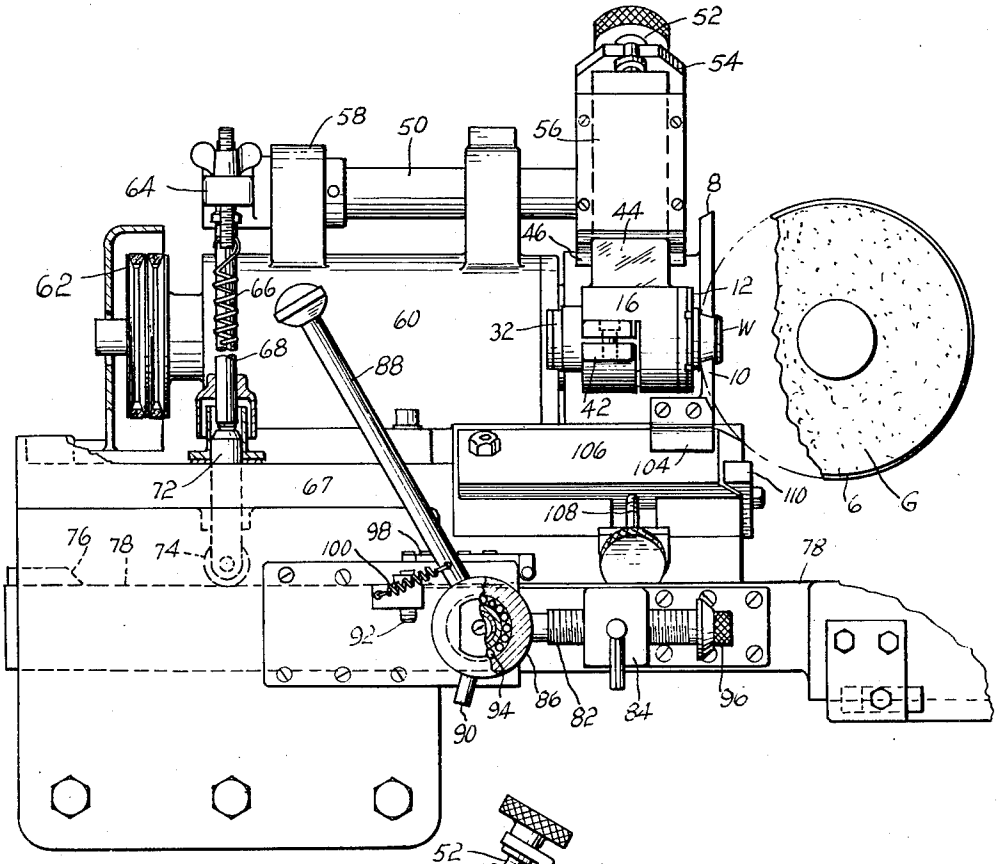



Fig. 1

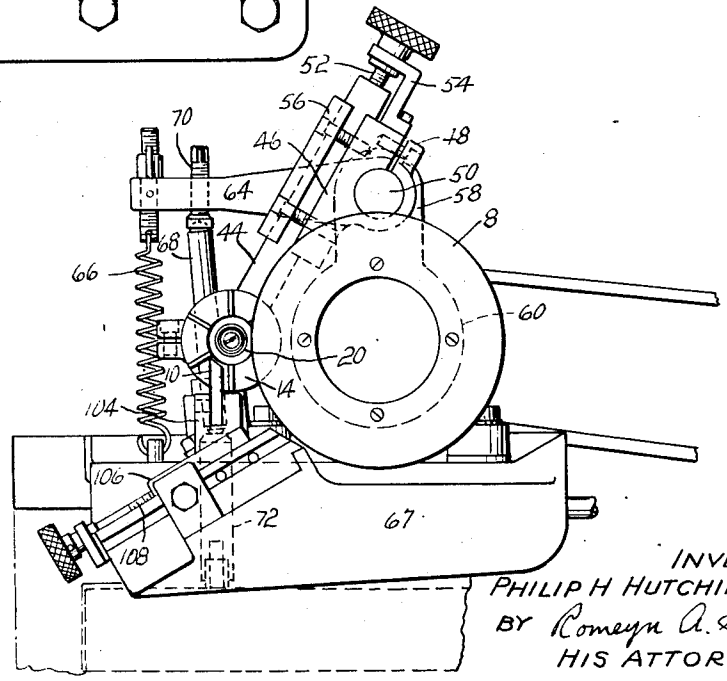



Fig. 2

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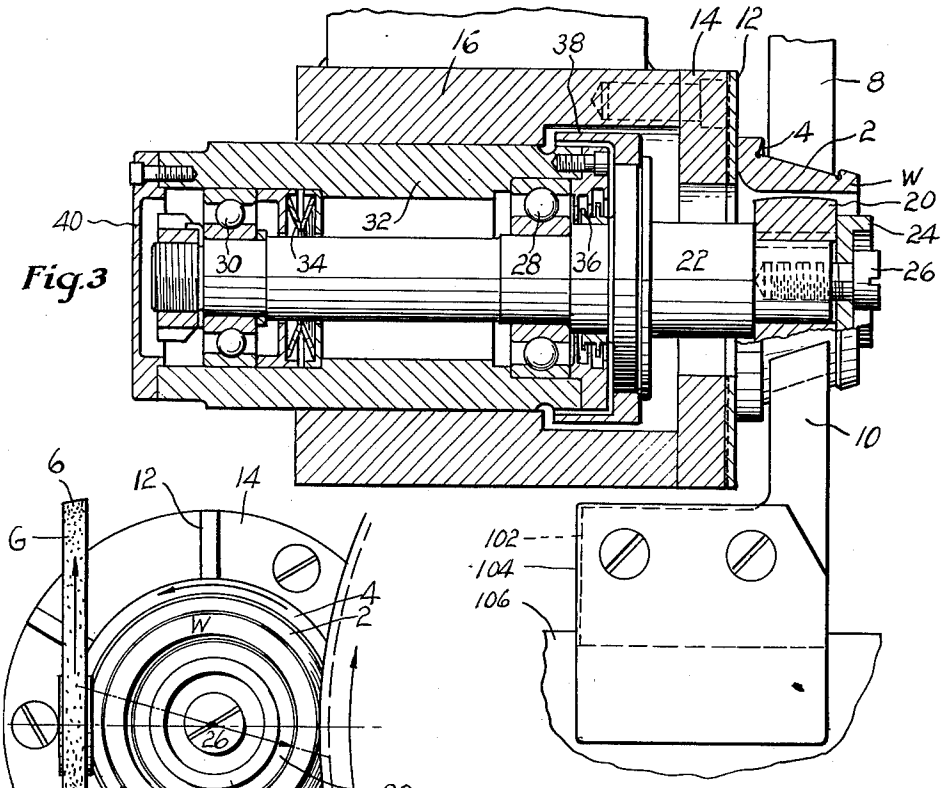



Fig.3




Fig.4

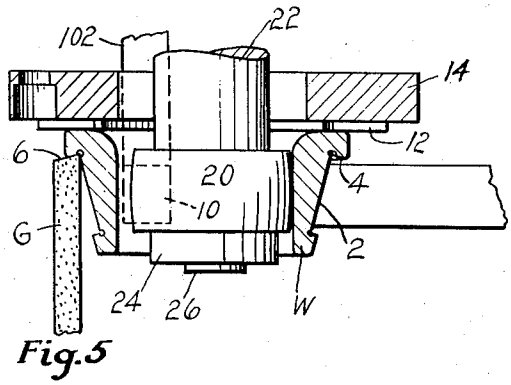



Fig.5

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# UNITED STATES PATENT OFFICE

2,380,761

## GRINDING MACHINE

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Application September 29, 1944, Serial No. 556,370

11 Claims. (Cl. 51—103)

This invention relates to grinding machines and comprises all of the features of novelty herein disclosed. An object of the invention is to provide an improved machine for grinding an outwardly projecting flange on a work piece, especially an overhanging conical face on the flange of an inner race ring for tapered roller bearings. Another object is to provide improved means for supporting and rotating the piece so that the flange may be accurately ground in predetermined relation to previously finished surfaces on the piece. Another object is to provide improved means to grind a conical surface in concentric relation to another surface on a circular work piece and to locate the ground surface at a predetermined position axially of the work piece.

To these ends and also to improve generally upon machines of this character, the invention consists in the various matters hereinafter described and claimed. In its broader aspects, the invention is not necessarily limited to the specific construction selected for illustrative purposes in the accompanying drawings in which

Fig. 1 is a front elevation of the machine, some parts being broken away and some being sectioned.

Fig. 2 is an end elevation, the work and the grinding wheel being omitted.

Fig. 3 is an enlarged vertical section of a pressure roller mounting and associated parts.

Fig. 4 is an enlarged end view of the work supporting and rotating means.

Fig. 5 is a horizontal section of Fig. 4.

The illustrated work piece W is an inner race ring for tapered roller bearings wherein a conical raceway 2 lies between outwardly extending flanges. The overhanging or internal conical face 4 of the larger flange is the surface to be ground and grinding is effected by the conical edge 6 of a grinding wheel G whose central plane is parallel to the work axis and fed in this plane. The conical raceway 2 is previously finished ground and the larger end face of the piece is finished flat, these finished surfaces being utilized to locate the piece accurately for the grinding operation on the flange.

A regulating wheel 8 having a conicel flange engages the conical raceway 2 at one side of the piece while beneath the piece and somewhat to the other side is a work blade 10 whose upper surface is flat but inclined in two directions as indicated in Figs. 3 and 4 to have line contact with the finished raceway 2. The flat end face of the piece engages a series of radial ribs 12 of hardened material brazed in radial grooves on a ring 14 fastened by screws to a housing 16. The ribs accurately locate the piece endwise while the grinding wheel is fed against the face 4 until the face is ground to a definite distance from the finished end of the piece. The accurate location of the face 4 is important because it engages the ends of the bearing rollers and guides them.

To hold the work in contact with the regulating wheel for controlled rotation, a crowned pressure idler roll 20 is yieldably urged against the cylindrical bore of the piece. The roll is crowned so that it will have only point contact with the bore and thus have no tendency to displace the piece from its predetermined location as determined by the previously finished faces. The roll is keyed to a rotary spindle 22 and is clamped against a shoulder by a cupped washer 24 which is fastened by a screw 26. The spindle is journalled by ball bearings 28 and 30 in a housing 32, the outer race ring of the bearing 30 being slidable and urged axially by spring washers 34. A labyrinth seal 36 and a guard 38 protect the bearing 28 while a cap 40 protects the bearing 30.

The housing 32 is secured in the housing 16 by a split portion 42 on the latter as shown in Fig. 1. The outer housing is welded to or otherwise formed on the lower end of an arm 44 which is slidable endwise in a guide block 46 which has a split portion 48 clamped to a rock shaft 50. The arm is slid to adjusted position by a screw 52 journalled in a bracket 54 on the block 46, the arm being clamped by a clamping plate 56 in such a position that the idler roll 20 will engage the bore of the work slightly below the horizontal as indicated by the arrow in Fig. 4. The direction of applied pressure is such that most of the pressure comes on the conical regulating wheel 8 and very little on the blade 10. The pressure reacts on the conical raceway 2 to press the work against the ribs 12.

The rock shaft 50 is journalled in lugs 58 carried by a housing 60 in which the spindle of the regulating wheel is journalled, this spindle being driven by a belt pulley 62. One end of the rock shaft has a forwardly projecting arm 64 connected by a spring 66 to the work head base 67. The tension of the spring can be adjusted by a screw to regulate the pressure of the idler roll 20 against the work. This pressure can be relieved to release the work and lift it from its supports by a ball-ended strut or rod 68 engaging a socket in a screw 70 and a socket in a vertical plunger 72, the latter having a cam roller 74 adapted to be engaged by a cam 76 on a sliding table 78

when the latter, which carries the grinding wheel, retreats to an inoperative position. The table is actuated in both directions by an air cylinder not shown and extends under the usual bridge which supports the work head on the frame of the machine.

When the table is advanced to bring the grinding wheel towards the work, an adjusting screw 82 clamped in a block 84 on the table engages an eccentric cam 86 which is thereafter turned manually clockwise by a handle 88 until a stop pin 90 on the cam engages a fixed stop screw 92. The cam turns on roller bearings 94 and its bore is eccentric to the exterior so that a gradual advance of the table occurs as the cam is turned and as the table and grinding wheel are urged forwardly. Compensation for wear of the grinding wheel can be effected by turning the screw 82 by a knurled head 96 having a dial. The handle 88 is urged counterclockwise against a stop 98 by a spring 100 when the table again retreats, thus to set the cam for feeding of the grinding wheel against the next piece.

The work blade 10 has a horizontal base 102 clamped by screws in a vertical slot of a plate 104 welded to an inclined slide 106 which is adjusted on an incline by a screw 108 and secured in adjusted position by a clamp 110. This adjustment enables work pieces of different diameters to be located at the desired level, the axis of the piece preferably being in the horizontal plane which includes the axis of the grinding wheel and the axis of the regulating wheel.

I claim:

1. In a machine for grinding a projecting face on the exterior of a ring, a regulating wheel engaging the exterior of the ring on one side, a grinding wheel extending substantially parallel to the ring axis on the other side of the ring and having its periphery engaging the projecting face, an abutment engaging one end of the ring in opposition to the wheel, a blade co-operating with the regulating wheel to support the ring for rotation, and a rotatable pressure roll extending into the bore of the ring in opposition to the regulating wheel.

2. In a machine for grinding a projecting face on the exterior of a ring, means engaging the exterior of the ring to support it for rotation on its axis, a grinding wheel extending substantially parallel to the ring axis and having its periphery engaging the projecting face, a non-rotary abutment engaging one end of the ring in opposition to the wheel, and a rotatable pressure roll extending into and engaging the bore of the ring.

3. In a machine for grinding a projecting face on the exterior of a ring, a regulating wheel and a blade engaging the ring to support it for controlled rotation on its axis, a non-rotary abutment engaging one end of the ring to locate it axially, and a grinding wheel having a peripheral face adapted to have controlled approach towards the butment.

4. In a machine for grinding a projecting face on the exterior of a ring, a regulating wheel and a blade engaging the exterior of the ring for controlled rotation on its axis, a pressure roll entering the bore of the ring, an arm for swinging the pressure roll towards or from the regulating wheel, means for locating the ring axially, and a grinding wheel having a peripheral face movable against the projecting face of the ring.

5. In a machine for grinding a projecting face on the exterior of a ring, a regulating wheel and a blade engaging the exterior of the ring to support the ring for controlled rotation on its axis, an abutment engaging the end of the ring to locate it axially, a pressure roll projecing into and engaging the bore of the ring for urging the ring against the regulating wheel, and a grinding wheel having a peripheral face adapted to engage the projecting face and have controlled approach towards the abutment.

6. In a machine for grinding a projecting face on the exterior of a ring, a regulating wheel and a blade engaging the exterior of the ring to support the ring for controlled rotation on its axis, an abutment engaging the end of the ring to locate it axially, a grinding wheel having a peripheral face adapted to have controlled approach towards the abutment, a pressure roll projecting into and engaging the bore of the ring for urging the ring against the regulating wheel, and a movable carrier supporting both the abutment and the pressure roll.

7. In a machine for grinding a projecting face on the exterior of a ring, a regulating wheel and a blade engaging the exterior of the ring to support the ring for controlled rotation on its axis, an abutment engaging the end of the ring to locate it axially, a grinding wheel having a peripheral face adapted to have controlled approach towards the abutment, a hollow carrier for supporting the abutment, a pressure roll engaging the bore of the ring for urging the ring against the regulating wheel, and a spindle supporting the pressure roll and journalled for rotation in the hollow carrier.

8. In a machine for grinding a projecting face on the exterior of a ring, a regulating wheel and a blade engaging the exterior of the ring to support the ring for controlled rotation on its axis, an abutment having a plurality of ribs arranged in a plane to engage the end of the ring and locate it axially, a grinding wheel having a peripheral face adapted to have controlled approach towards the ribs, and a pressure roll extending into the bore of the ring and movable towards and from the regulating wheel.

9. In a machine for grinding an overhanging conical face projecting from the exterior of a ring, a regulating wheel and a work blade engaging the exterior of the ring to support the ring for controlled rotation on its axis, an abutment engaging the end of the ring and axially locating the ring, a pressure roll engaging the bore of the ring and pressing it against the regulating wheel, a grinding wheel having a conical periphery engaging the conical face, and means for controlling peripheral approach of the wheel towards the abutment.

10. In a machine for grinding an overhanging conical face projecting from the tapered exterior of a ring, a regulating wheel and a work blade engaging the tapered exterior of the ring to support it for controlled rotation on its axis, an abutment engaging the end of the ring and locating the ring axially, a pressure roll engaging the bore of the ring, means for urging the pressure roll in a direction to apply the major pressure of the ring against the regulating wheel with a minor pressure against the work blade, the regulating wheel and the blade having surfaces inclined with respect to the axis of the ring to cause a resultant endwise pressure of the ring against the abutment, and a grinding wheel movable parallel to the ring axis and having a conical face adapted to feed into the overhanging conical face of the ring.

11. In a machine for grinding an overhanging conical face projecting from the tapered exterior of a ring, a regulating wheel having a conical periphery engaging the tapered exterior, a blade engaging the tapered exterior and inclined laterally and longitudinally to have line contact therewith, an abutment engaging the end of the ring, a pressure roll having a crowned periphery engaging the bore of the ring and urging the ring against the regulating wheel, and a grinding wheel having a conical periphery adapted to engage and grind the conical face to a predetermined distance from the end of the ring.

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