March 30, 1937. A. B. EINIG 2,075,104

METHOD OF AND MACHINE FOR GRINDING OR LAPPING BEARING ROLLS

Filed Feb. 6, 1935 2 Sheets-Sheet 1

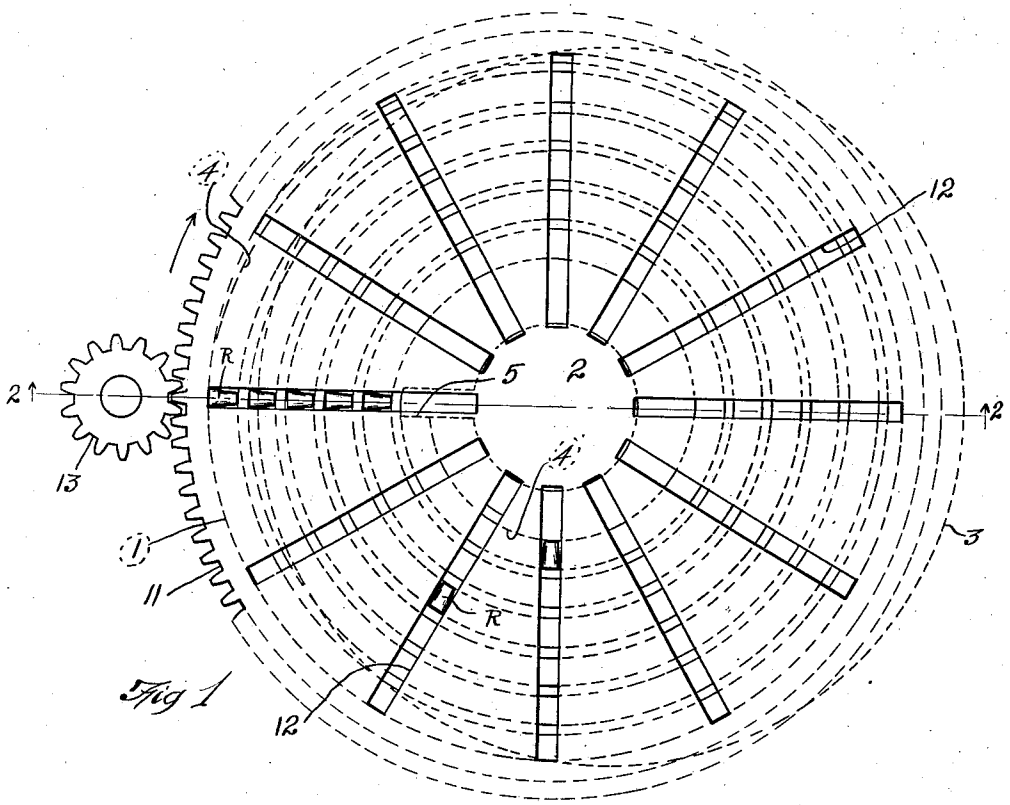


Fig 1

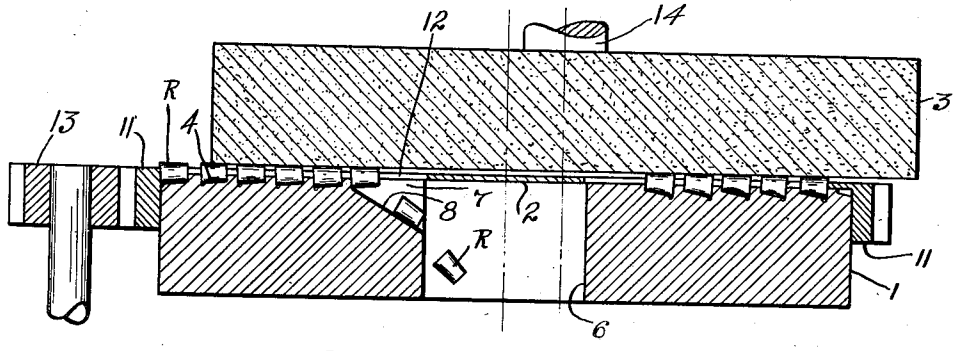


Fig. 2

INVENTOR.
Alvin B. Einig
BY
Fay, Oberlin & Fay
ATTORNEYS.

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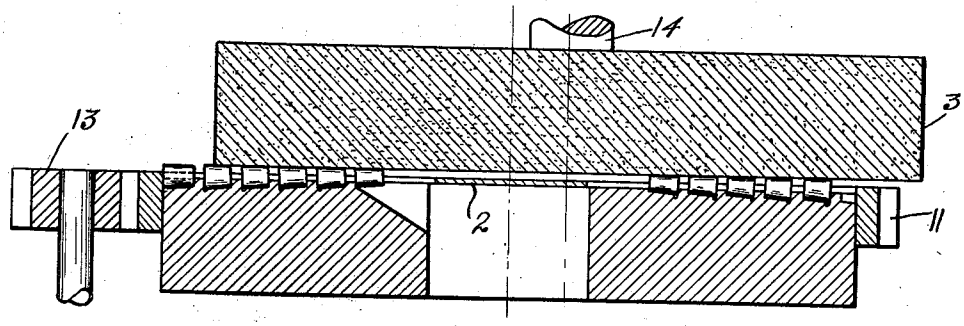


Fig. 6

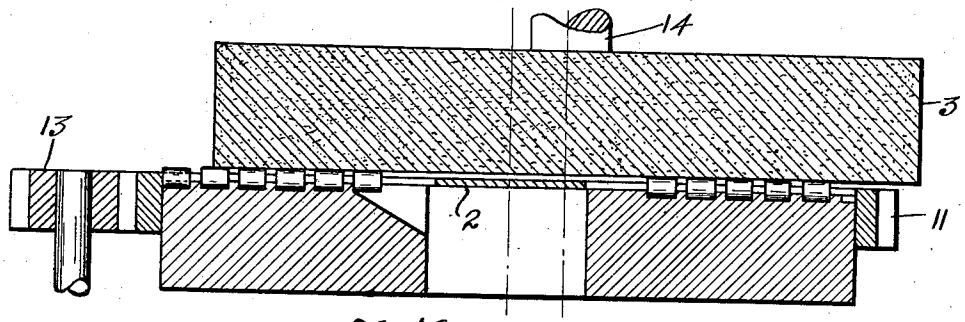


Fig. 7

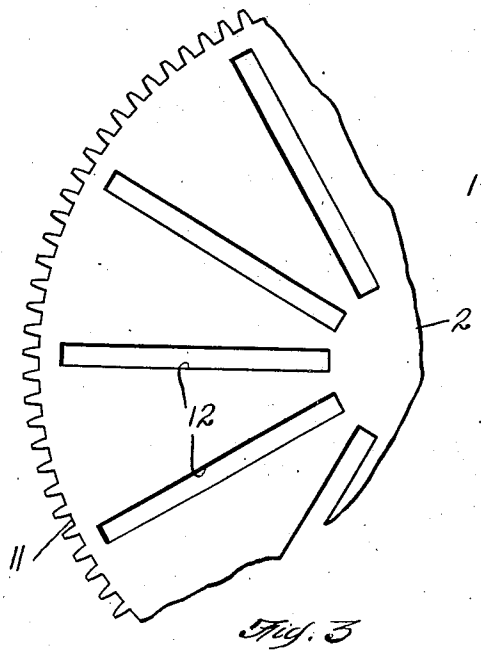


Fig. 3

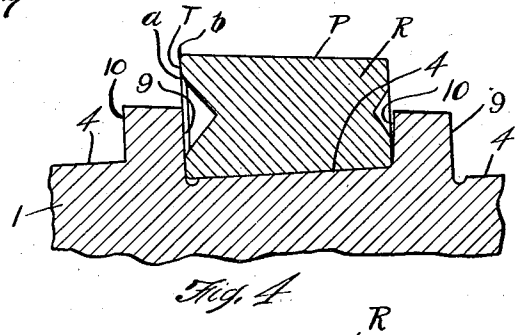


Fig. 4

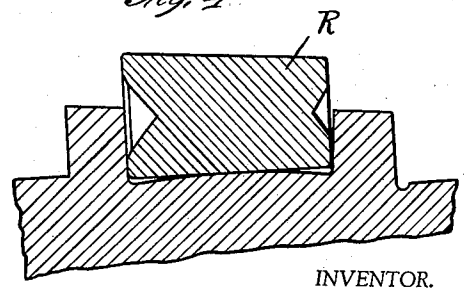


Fig. 5

INVENTOR.
Alvin B. Einig

BY

Dorff, Oberlin & Gray
ATTORNEYS.

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2,075,104

METHOD OF AND MACHINE FOR GRINDING OR LAPPING BEARING ROLLS

Alvin B. Einig, Cleveland Heights, Ohio, assignor to The Motch & Merryweather Machinery Company, Cleveland, Ohio, a corporation of Ohio

Application February 6, 1935, Serial No. 5,272

9 Claims. (Cl. 51—278)

This invention relates, as indicated, to methods of and machines for grinding or lapping rolls, but has reference more particularly to methods of and machines for continuously and simultaneously grinding or lapping the body and thrust end of tapered or straight rolls of the character employed in roller bearings.

It has heretofore been the practice in grinding or lapping tapered bearing rolls to grind or lap the body or peripheral surface of the rolls by one operation and the thrust end of the rolls by another operation, these operations being performed in separate or independent machines. In addition to the inaccuracies frequently resulting from the treatment of the rolls in separate machines, the cost of the grinding or lapping operations has always been high due to the excessive handling of the rolls incidental to their transfer from one machine to the other.

The present invention accordingly has as its primary object a material reduction in the cost of the grinding or lapping operations in the manufacture of bearing rolls, a reduction in the capital investment in machines or devices for performing these operations, and the production of rolls conforming in a high degree with established standards of uniformity and precision.

To the accomplishment of the foregoing and related ends, said invention, then, consists of the means hereinafter fully described and particularly pointed out in the claims, the annexed drawings and the following description setting forth in detail certain means and one mode of carrying out the invention, such disclosed means and mode illustrating, however, but one of various ways in which the principle of the invention may be used.

In said annexed drawings:—

Fig. 1 is a plan view of a machine for continuously and simultaneously grinding or lapping the body and thrust end of tapered rolls of the character usually employed in tapered roller bearings, the outline of the grinding or lapping wheel or disk being indicated by dotted lines;

Fig. 2 is a cross-sectional view of the machine, taken on the line 2—2 of Fig. 1;

Fig. 3 is a plan view of a fragment of the roll carrier;

Fig. 4 is a view, on an enlarged scale, of a portion of Fig. 2;

Fig. 5 is a view similar to Fig. 4, but showing a roll support or roll race, the spiral track of which is provided with a crowned bottom;

Fig. 6 is a view similar to Fig. 4, but showing a roll support with a modified form of track; and

Fig. 7 is a view similar to Fig. 4, but showing a support adapted for use in grinding or lapping cylindrical rolls.

Referring more particularly to Figs. 1 to 4, inclusive, it will be seen that the machine comprises a circular roll support or race 1, a roll carrier 2 and a grinding or lapping wheel or disk 3.

The roll support 1 is stationary and may be made of metal, an abrasive composition, bakelite, or other suitable material. It is provided in its upper surface with a spiral track 4, the track beginning at the extreme left of the support as viewed in Figs. 1 and 2 and proceeding in a clockwise direction to a point 5, which is spaced a considerable distance from the center of the support. The support 1 is provided with a central opening 6. A chute 7 having an inclined bottom 8 extends from a point adjacent the inner end 5 of the spiral track to the opening 6, this chute receiving the finished rolls and discharging them into a suitable receptacle (not shown) which is disposed below the opening 6.

As clearly shown in Fig. 4, the track 4 is inclined at such an angle to the horizontal that the upper peripheral surface P of the roll R, which in the case is shown as a tapered roll, always lies in a horizontal plane which is parallel with the lower surface of the grinding or lapping wheel 3. The radially outward sidewall 9 of the track 4 is inclined so as to form an angle with the track which is the same as the angle between the thrust end T and the peripheral surface P of the roll R. The radially inward sidewall 10 of the track may be vertical or inclined in such a way as to leave sufficient clearance between it and the smaller inner end of the roll R to prevent binding of the rolls in the course of their movement along the track.

The roll carrier 2 is mounted on the support 1 and is provided at its outer edge with a ring gear 11 formed integrally therewith and embracing the peripheral surface of the support. The carrier is provided with a multiplicity of radial slots 12 which are all of the same length and extend from the inner periphery of the ring gear 11 to a point adjacent the opening 6 in the roll support. The carrier is adapted to be driven in the direction indicated by the arrow in Fig. 1, as by means of a pinion 13 in mesh with the ring gear 11 and which pinion is adapted to be driven by a motor (not shown).

The grinding or lapping wheel or disk 3, which is formed of a suitable abrasive material is mounted on a shaft 14, whereby it may be driven in the same direction as the roll carrier. The

wheel 3, however, rotates about an axis which is offset or spaced from the axes of the roll support and roll carrier.

Previous to the grinding or lapping operations, and in cases where the roll support 1 is not made of an abrasive material, the track sidewall 9 of the work support is charged with an abrasive substance in paste or other suitable form.

The various parts are then arranged as shown in Figs. 1 and 2 and the roll carrier and wheel 3 caused to rotate, the speed of rotation of the carrier being less than that of the abrasive wheel.

Due to the fact that the axis of the abrasive wheel 3 is offset from the axes of the roll support and carrier, a portion of the left side of the carrier is at all times exposed. This permits the rolls to be ground or lapped to be deposited, one at a time, in the successive slots 12 at the extreme outer ends thereof. It will be understood, however, that it is not necessary that the axis of the abrasive wheel 3 be offset from the axes of the roll support and carrier, and the abrasive wheel may in fact be coaxial with the latter. In this case, the roll support and carrier will be of larger diameter than the abrasive wheel so as to leave the marginal portion of the carrier exposed sufficiently to receive the rolls.

In the course of the rotation of the roll carrier, the rolls are caused to traverse the spiral track, and this traversing movement combined with the action of the abrasive wheel, results in a continuous and simultaneous grinding or lapping of the peripheral surfaces of the rolls R and the thrust end surfaces T thereof. The rolls R roll, but do not slide on the bottom of the track. Consequently, the track does not exert an abrading action on the peripheral surfaces of the rolls, and the work support, for this reason, may be made of an abrasive material.

The rolling action of the rolls on the track results in a sliding of the surfaces T of the rolls on the sidewall 9. At the same time, the sidewall of the track forces the rolls toward the center of the roll support, and thereby exerts a pressure on the surfaces T. Since, as before stated, the sidewall 9 of the track is charged with an abrasive, the result of the aforesaid sliding action and pressure is that abrasion of the thrust end surfaces of the rolls takes place.

At the same time the peripheral surface of the roll is continuously ground by the abrasive wheel 3, the abrasive action resulting principally from the difference in speed of rotation of the peripheral surface of the roll and the abrasive wheel, which difference results from and depends upon the difference in speed of rotation of the work carrier and the abrasive wheel. This abrasive action on the body or peripheral surface of the roll is augmented by virtue of the fact that the roll in the course of its movement from the outer to the inner end of the slot 12 in which it is disposed crosses the lower surface of the abrasive wheel, and also by virtue of the fact that the abrasive wheel, since it rotates about an axis offset from that of the roll carrier, exerts a shearing action on the roll.

It will be further noted that the axial orientation or position of the rolls, in the course of their traverse of the track, is being continuously and automatically changed. This, taken with the fact that the track is at all times filled with a large number of rolls, all of which are being lapped at the same time, results in the production of rolls which are highly accurate as to size, roundness and straightness.

When the rolls reach the inner end of the spiral track, they fall by gravity into the chute 7, dropping into a suitable receptacle which is provided therefor below the opening 6 in the roll support.

Owing to the fact that the radius of curvature of the side wall 9 of the track decreases as the track approaches the center of the roll support, this method of grinding or lapping is especially adapted for tapered roller bearings of the Timken type, in which the thrust ends T are slightly inclined with respect to the axis of the roll. In such case the inclination or taper of the thrust end of the roll is developed by a progressive action, that is to say, the lapping action will begin at the point designated *a* and progress towards the point designated *b* as the roll approaches the inner end of the track, the points of contact between the sidewall 9 and the thrust end of the roll in effect moving radially outwardly from the axis of the roll.

In the ordinary case, however, when it is desired to lap the entire thrust end of the roll during the entire lapping action of the body or peripheral surface of the roll, the roll support will be made so large with relation to the diameter of the rolls to be lapped and the track will terminate at such a distance from the center of the support, that the change in the degree of curvature of the sidewall of the track will be so slight as to avoid the progressive lapping action referred to in the preceding paragraph.

In order to minimize the resistance to rolling of the rolls on the track, the bottom of the track may be crowned as in Fig. 5. By crowning the bottom of the track in this manner, a further advantage is secured in that the body or peripheral surface of the rolls may always be presented parallel to the lower surface of the abrasive wheel, in which case, the abrasive wheel simply finishes this surface of the rolls as it comes to the machine without correcting the taper of the rolls, as is the case where the bottom of the track is tapered to conform with the angle of taper of the rolls.

In that form of the machine shown in Fig. 6, the depth of the track decreases as it approaches the center of the work support. This permits rolls of various diameters to be ground, the rolls passing through a sizing zone, so that all of the rolls are finally ground to the same predetermined size.

In that form of the machine shown in Fig. 7, the track of the roll support is formed to receive cylindrical rolls, the peripheral surfaces and thrust ends of which are simultaneously ground or lapped in a manner similar to that described in connection with the tapered rolls. In this case, the pressure of the rolls against the sidewall of the track results from the resistance which the rolls encounter to their movement towards the center of the roll support.

Other modes of applying the principle of my invention may be employed instead of the one explained, change being made as regards the means and the steps herein disclosed, provided those stated by any of the following claims or their equivalent be employed.

I therefore particularly point out and distinctly claim as my invention:—

1. A machine for grinding or lapping bearing rolls, comprising a stationary substantially horizontally disposed roll support having a spiral

track therein of a cross-sectional contour to receive the rolls to be ground or lapped, the radially outer side wall of said track being charged with an abrasive, a rotatable roll carrier mounted on said support and adapted to cause said rolls to traverse said track, and a rotatable abrasive wheel disposed above said carrier.

2. A machine for grinding or lapping bearing rolls, comprising a stationary roll support having a spiral track therein, a rotatable roll carrier mounted on said support and adapted to cause said rolls to traverse said track, and a rotatable abrasive wheel disposed above said carrier, the axis of rotation of said wheel being laterally offset from the axis of rotation of said carrier.

3. The method which comprises lapping the pheripheral surface of a bearing roll while lapping the thrust end surface thereof progressively from a radially inward to a radially outward point on said thrust end surface.

4. A machine for grinding or lapping bearing rolls, comprising a horizontally disposed roll support having a spiral track in its upper surface of a cross-sectional contour to receive the rolls to be ground or lapped, and a rotatable abrasive wheel disposed above said support.

5. A machine for grinding or lapping bearing rolls, comprising a horizontally disposed roll support having a spiral track in its upper surface, said track having a base forming a support for the body of a roll and a side wall extending at an angle to said base and forming an abutment for the thrust end of a roll, and an abrasive wheel disposed above said support.

6. A machine for grinding or lapping bearing rolls, comprising a horizontally disposed roll support having a spiral track in its upper surface, said track having a bottom surface for revolubly supporting the body of a roll and a side wall extending at an angle to said bottom surface and forming an abutment for the thrust end of a roll, a rotatable roll carrier mounted on said support and adapted to cause said rolls to traverse said track, and a rotatable abrasive wheel disposed above said carrier.

7. A machine for grinding or lapping bearing rolls, comprising a horizontally disposed roll support having a spiral track in its upper surface, said track having a base forming a support for the body of a roll and inclined downwardly from its radially inner edge to its radially outer edge and a side wall extending at an angle to said base and forming an abutment for the thrust end of a roll, and an abrasive wheel disposed above said support.

8. A machine for grinding or lapping bearing rolls, comprising a horizontally disposed roll support having a spiral track in its upper surface of a cross-sectional contour to receive the rolls to be ground or lapped and of varying depth, and a rotatable abrasive wheel disposed above said support.

9. A machine for grinding or lapping bearing rolls, comprising a horizontally disposed roll support having a spiral track in its upper surface of a cross-sectional contour to receive the rolls to be ground or lapped and of a depth which gradually decreases from the outer to the inner end of the spiral, and a rotatable abrasive wheel disposed above said support.

ALVIN B. EINIG.