Oct. 15, 1946. A. R. SPICACCI 2,409,320

GRINDING OF ROLLERS

Filed March 30, 1944

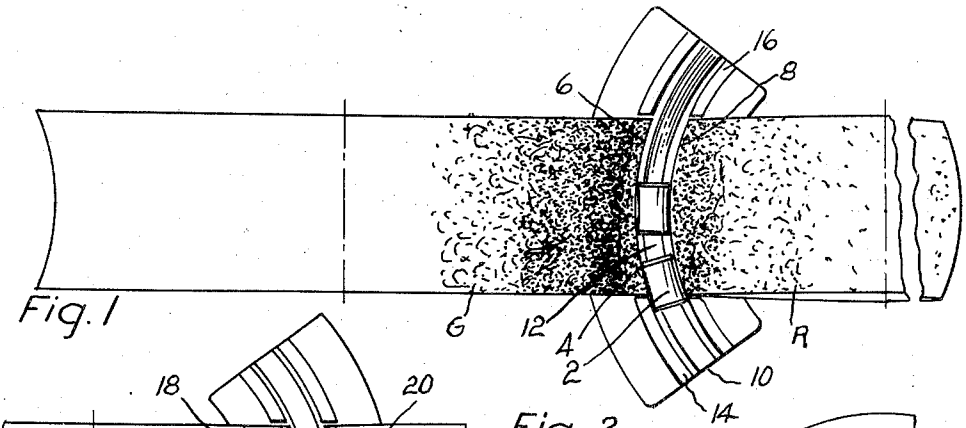

Fig. 1

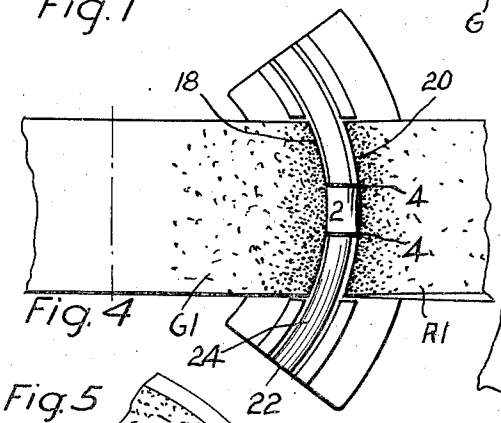

Fig. 4

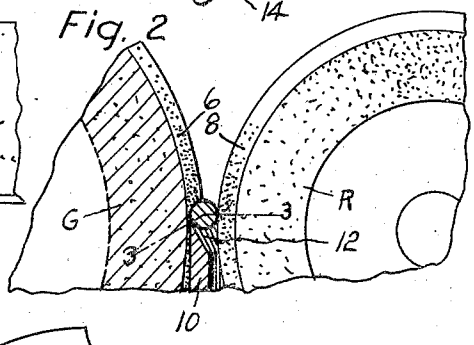

Fig. 2

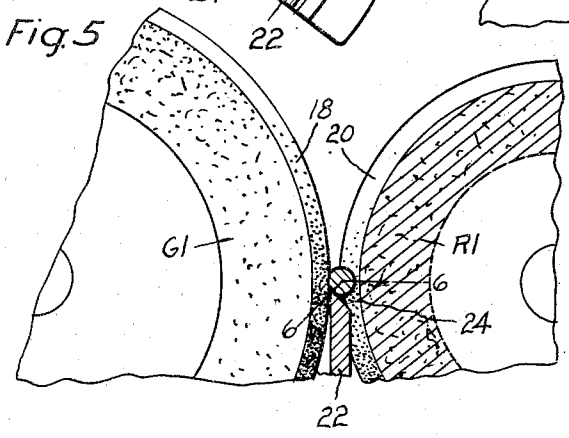

Fig. 5

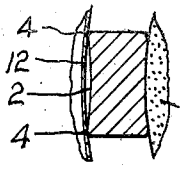

Fig. 3

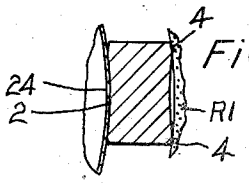

Fig. 6

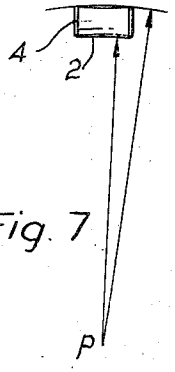

Fig. 7

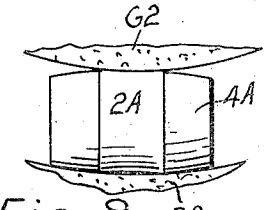

Fig. 8

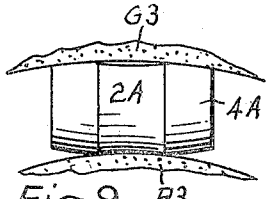

Fig. 9

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GRINDING OF ROLLERS

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Application March 30, 1944, Serial No. 528,713

16 Claims. (Cl. 51—103)

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This invention relates to the grinding of rollers, especially antifriction bearing rollers that are longitudinally profiled and have their peripheral portions formed as surfaces of revolution. An object of the invention is to provide an improved method and an improved apparatus for producing such profiled rollers with special reference to reducing the cost. Another object is to provide an improved method of producing rollers that are longitudinally concave along the middle portions of their lengths and have their end portions tapered.

To these ends and also to improve generally upon apparatus and methods 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 apparatus and steps selected for illustrative purposes in the accompanying drawing in which—

Fig. 1 is a plan view of one apparatus showing the first grinding step.

Fig. 2 is a central cross section of Fig. 1 except that the convex wheel is in side elevation.

Fig. 3 is a section of the blade and roller on the line 3—3 of Fig. 2, enlarged.

Fig. 4 is a plan view of an apparatus used in the final grinding step.

Fig. 5 is a central cross section of Fig. 4 except the convex wheel is in side elevation.

Fig. 6 is a section of the blade and roller on the line 6—6 of Fig. 5, enlarged.

Fig. 7 is a diagram showing the relation of the roller curves.

Figs. 8 and 9 are views similar to portions of Figs. 4 and 1 indicating a modification of the process steps.

Fig. 7 shows one of the rollers to be produced, the greater portion 2 of its periphery being a concave surface of revolution generated by revolving a circular arc about the roller axis and the ends 4 being short convex surfaces of revolution, the centers of all generating arcs being at the same point P. The portions 4 are in effect short tapers or chamfers and are not only beneficial in breaking what would otherwise be sharp corners but they have an important advantage in the process of production. The roller will ordinarily be first roughly shaped as by dies in a heading machine to approximately the desired form and then ground to accurate size and shape in a series of steps. The step following the heading is the grinding of the convexly curved ends in a centerless grinding machine having a grinding wheel G provided with a concave peripheral surface 6

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and an opposed regulating wheel R provided with a convex peripheral surface 8, the two surfaces being equidistant at their points of nearest approach and providing an arcuate throat through which the work is urged endwise by a slight skewing of the regulating wheel.

In the grinding throat is a blade 10 which is curved to follow the curve of the wheels. The upper concave work supporting surface 12 of the curved blade is steeply inclined and is extended upwardly very close to the grinding wheel. When the roller is between the wheels, the central concave portion 2 conforms to the regulating wheel and the end portions 4 engage the grinding wheel and are convexly ground. The roller is supported on the concave blade surface 12 by its two convex end portions 4 which have substantially arcuate lines of contact with the blade surface 12 as best shown in Fig. 3. The arcuate lines of support exist because the surface 12 on the curved blade is extended so close to the wheel surface that it has nearly the same concave contour as the wheel and is substantially a cylindrical surface of revolution. Suitable entrance guides 14 are provided to lead the roller into the grinding throat and suitable exit guides 16 to lead the rollers out.

After the rollers have had one or more passes through the grinding throat to produce accurate convex end portions 4, they are passed one or more times through a second centerless grinder to grind the concave portions 2 as indicated in Figs. 4, 5 and 6. In these figures, the grinding wheel G1 has a convex peripheral surface 18 and the regulating wheel R1 has a concave peripheral surface 20 equidistant therefrom at the grinding throat. A curved blade 22 with an inclined top surface 24 extended close to the grinding wheel supports the roller by contact with the concave surface 2. As best shown in Fig. 6, this is substantially an arcuate line of contact along the entire surface 2 because the blade surface where it engages the surface 2 is near the grinding wheel and has very nearly the same convex contour as the grinding wheel. The work supporting surface is substantially a cylindrical surface of revolution. The regulating wheel R1 conforms to the accurately ground end portions 4 at two spaced locations and controls rotation of the rollers. These convex end portions are not only useful in providing good supports for the roller against the regulating wheel but they are beneficial in breaking the corners of the rollers which would otherwise be sharp and dig into the wheel or into the antifriction bearing raceway

in use. Suitable entrance guides and exit guides are provided. The rollers are passed through the second centerless grinder one or more times as required to produce the accurate surfaces 2 which engage raceways in practice. In the first pass through the second grinder, the rollers may be guided thereto directly from the exit side of the first grinder.

Figs. 8 and 9 show a modification of the process. The rollers are similar to those in the preceding figures but the convex end portions 4A are much longer in proportion to the length of the roll and constitute surfaces adapted to engage the raceway of a bearing ring. After the rough rolls are shaped as in a heading machine, the concave central portions 2A are ground against a convex grinding wheel G2 as indicated in Fig. 8, a blade support similar to the surface 24 in Figs. 4 and 5 being used and the convex end portions 4A engaging a concave regulating wheel R2. Then the rolls are passed through a second centerless grinder as in Fig. 9 to grind the convex end portions 4A against a concave grinding wheel G3, a blade support similar to that in Figs. 1 and 2 being used and the concave portion 2A of the roll engaging a convex regulating wheel R3.

I claim:

1. In apparatus for grinding rolls having their middle portions of longitudinally concave profile and their end portions convexly curved, a grinding wheel having a concave profile adapted to grind the convex end portions of the rolls, a regulating wheel having a convex profile conforming to the concave profile of the rolls to control rotation, and a work supporting surface constituting a surface of revolution having a concave profile engaging and substantially conforming to the profile of the convex end portions.

2. In apparatus for grinding rolls having their middle portions of longitudinally concave profile and their end portions convexly curved, a grinding wheel having a concave profile adapted to grind the convex end portions of the rolls, a regulating wheel having a convex profile conforming to the concave profile of the rolls to control rotation, and a curved blade having a concave work supporting surface engaging the profile of the convex end portions adjacent to the grinding wheel and having substantially the same concave curvature as the grinding wheel.

3. In apparatus for grinding rolls having their middle portions of longitudinally concave profile and their end portions convexly curved, a grinding wheel having a convex profile adapted to grind the concave profile of the rolls, a regulating wheel having a concave profile conforming to the convex end portions to control rotation of the rolls, and a work supporting surface having a convex profile engaging and substantially conforming to the concave profile of the rolls.

4. In apparatus for grinding rolls having their middle portions of longitudinally concave profile and their end portions convexly curved, a grinding wheel having a convex profile adapted to grind the concave profile of the rolls, a regulating wheel having a concave profile conforming to the convex end portions to control rotation of the rolls, and a curved blade having a convex work supporting surface engaging the concave profile of the rolls adjacent to the grinding wheel and having substantially the same convex curvature as the grinding wheel.

5. In apparatus for grinding rolls having their middle portions of longitudinally concave profile and their end portions convexly curved, a grinding wheel and an opposed regulating wheel, one of the wheels having a convex profile to conform to the concave profile of the rolls and the other wheel having a concave profile to conform to the convex end portions of the rolls, and a work support close up to the grinding wheel and having its work supporting surface formed as a surface of revolution having substantially the same profile as the grinding wheel.

6. The method of producing rolls, which consists in first forming a roll having its middle portion of concave profile and its end portions tapered, and passing the formed roll into a centerless grinder to grind the tapered end portions while supporting the roll for controlled rotation by its concave profile.

7. The method of producing rolls, which consists in first forming a roll having a central concave profile and tapered end portions, and passing the formed roll into a centerless grinder to grind the tapered end portions while utilizing both the concave profile and the tapered end portions to support the roll for rotation.

8. The method of producing rolls, which consists in first forming a roll having a central concave profile and tapered end portions, and passing the formed roll into a centerless grinder to grind the tapered end portions while rotatably supporting the roll on its concave profile opposite to the grinding wheel and on its tapered end portions adjacent to the grinding wheel.

9. The method of producing rolls, which consists in first forming a roll having its middle portion of concave profile and its end portions of convex profile, and passing the formed roll into a centerless grinder to grind one kind of profile while rotatably supporting the roll on the same kind of profile adjacent to the grinding wheel and on the other kind of profile opposite to the grinding wheel.

10. The method of producing rolls having their middle portions of longitudinally concave profile and their end portions tapered, which consists in first grinding the tapered end portions, and centerless grinding the concave profile while supporting the rolls for controlled rotation on the previously ground end portions.

11. The method of producing rolls having their middle portions of longitudinally concave profile and their end portions tapered, which consists in first grinding the tapered end portions, and passing the rolls into a centerless grinder to grind the concave profile while utilizing both the tapered end portions and the concave profile to support the roll for rotation.

12. The method of producing rolls having their middle portions of longitudinally concave profile and their end portions tapered, which consists in first forming the end portions to convexly curved profile, and passing the rolls into a centerless grinder to grind the concave profile while rotatably supporting the rolls on their tapered end portions opposite to the grinding wheel and on their concave profile adjacent to the grinding wheel.

13. The process of producing rolls having their middle portions of longitudinally concave profile, which consists in first grinding the end portions of the rolls to convexly curved profile, and then centerless grinding the concave profile by a correspondingly curved grinding wheel while utilizing the curved end portions to support the rolls against a regulating wheel which conforms to the curved end portions.

14. The method of producing rolls, which consists in first forming a roll having its middle portion of concave profile and its end portions of convex profile, passing the roll through a centerless grinder to grind the convex end portions, and passing the rolls through a second centerless grinder to grind the concave profile while supporting the roll for controlled rotation upon the ground end portions.

15. The method of producing rolls, which consists in first forming a roll having a central concave profile and tapered end portions, passing the roll through a centerless grinder to grind the end portions while supporting the roll for rotation by its concave profile and by its end portions, and passing the roll through a second centerless grinder to grind the concave profile while supporting the roll for rotation by its ground end portions and its concave profile.

16. The method of producing a roll having a central concave profile and tapered end portions, which consists in first passing the roll through a centerless grinder to grind the tapered end portions while supporting the roll for rotation opposite to the grinding wheel by its concave profile and adjacent to the wheel by its tapered end portions, and passing the roll through a second centerless grinder to grind the concave profile while supporting the roll for rotation opposite to the grinding wheel by its tapered end portions, and supporting the roll adjacent to the wheel by its concave profile.

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