

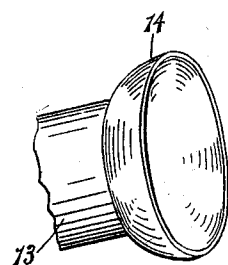
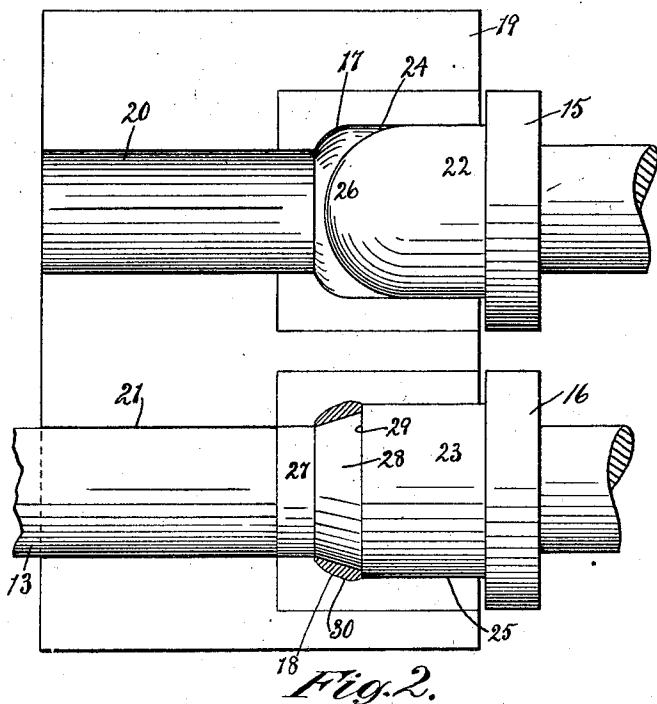
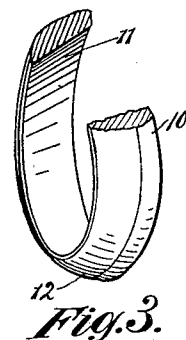
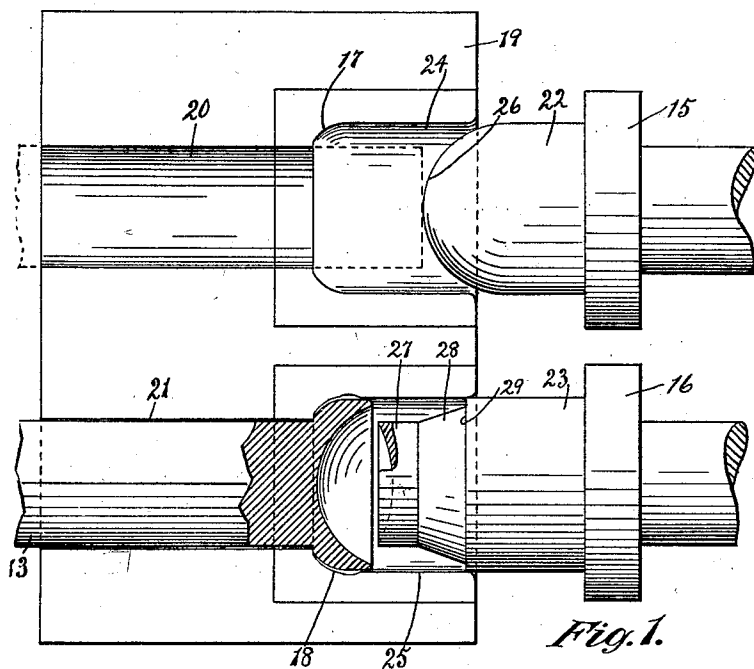
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1,452,535

C. F. SULTEMEYER

MANUFACTURE OF BEARING RINGS

Original Filed June 23, 1919



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## UNITED STATES PATENT OFFICE.

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## MANUFACTURE OF BEARING RINGS.

Original application filed June 23, 1919, Serial No. 306,058. Divided and this application filed August 7, 1920. Serial No. 401,987.

*To all whom it may concern:*

Be it known that I, CHARLES F. SULTEMEYER, a citizen of the United States, and resident of Oak Park, county of Cook, and State of Illinois, have invented certain new and useful Improvements in the Manufacture of Bearing Rings, of which the following is a specification, and which are illustrated in the accompanying drawings, forming a part thereof.

The invention relates to the production of annular machine wearing parts such as the rings between which the balls or rollers of antifriction bearings are confined. The object of the invention is an improved method of manufacture and a superior product, both of which are disclosed in my allowed application for patent on forging dies, Serial No. 306,058 filed June 23, 1919, now Patent No. 1,355,434, dated October 12, 1920, and of which this application is a division.

Bearing rings of the type indicated are frequently required to resist wear and shocks under heavy loads. Those formed from high carbon steel or steel alloy hardened throughout by heat treatment, have accordingly been preferred. Owing to the difficulty of machining high carbon steels and the waste of material resulting therefrom, the manufacture of these bearing rings, whether cut from solid or tubular stock, has been enormously expensive and the machined rings lack the required density to permit of their being successfully hardened to the most desirable degree.

The present invention therefore contemplates forging the rings to substantially finished dimensions without waste of material and in a manner calculated to produce a density of material and freedom from strains suitable for quenching without fracture. For this purpose the forging dies forming the subject of my said allowed application for patent may be employed. Bearing rings superior to any heretofore produced are thus obtained at a cost which compares favorably with that of rings formed from mild steel and having only a case hardened surface.

In the accompanying drawings:—

Fig. 1 is an elevation of one of the elements of the said forging dies with the associated punch head, and illustrates one of the steps of the improved method, a detail

of bar stock with its end upset in the manner contemplated by the said step of the improved method being shown, partly in section;

Fig. 2 is similar to Fig. 1, but shows the parts of the forging dies in a different position and illustrates another step of the improved method;

Fig. 3 is a perspective view of a bearing ring formed by the improved process, partly broken away, and

Fig. 4 is a perspective view showing the upset end of the bar stock from which the bearing rings are produced.

For the purpose of illustrating the invention, the drawings show a simple form of roller bearing ring 10 having a smooth beveled interior wearing surface 11 and a bulging exterior 12. As the invention contemplates that the ring 10 is to be hot forged to substantially its finished dimensions from high carbon steel or steel alloy, bar stock, as 13, preferably of chrome bearing steel containing between .90 and 1.00 per cent carbon and between 1.25 and 1.40 per cent chromium is desirably employed. Furthermore, the said rings 10 may be forged without waste of material, if the size of the bar stock 13 substantially conforms with the smallest interior diameter of the rings. For producing rings of moderate size, this will customarily be the original size of the bar stock, while for producing rings of large size, it may, in some cases, be preferable to upset the end of a smaller bar to a size corresponding with the smallest interior diameter of the ring as a preliminary step to the operation herein described. The simple form of ring 10 illustrated is readily forged to its said finished dimensions by first upsetting the heated end of the bar stock 13 to form a cupped head 14 integral with the bar. This head is desirably somewhat longer than the width of the ring and of less external diameter. The head 14, while still at a temperature suitable for forging, is then punched centrally, (the part removed being of uniform size with and retained upon the end of the bar 13) expanded radially, and longitudinally compressed to the shape and finished dimensions of the ring 10. The said final longitudinal compression of the ring, following radial expansion, has been found to

be effective in securing the density of material now believed to be essential to successful hardening of the same by heat treatment.

Apparatus useful for performing the forging operations may comprise the two punch heads 15, 16, and cooperating die sockets 17, 18, the die sockets 17, 18 being preferably formed in like companion die blocks, only one of which, as 19, is shown. The punch heads 15, 16 and die blocks, as 19, will customarily be used in a forging press of well known construction (not shown) but arranged, as usual, to effect powerful simultaneous movements of the punch heads 15, 16, into the die sockets 17, 18, when the two die blocks, as 19, are closed upon the bar 13. Under these circumstances, the bar 13 will be aligned with the die sockets 17 and 18 during alternate movements of the punch heads and one of the punch heads is idle during each of said movements.

As shown, the die blocks, as 19, are formed with grooves 20 and 21, to receive the bar stock, as 13, in alternation, the groove 20 being of such size that the bar is firmly gripped between the die blocks during the engagement of the upsetting punch head 15 with the end of the bar. The groove 21, on the other hand, is of larger size to permit of the bar 13 being moved longitudinally between the die blocks by the advancing punch head 16.

To secure the required accuracy in the formation of the bearing rings, as 10, some special provision is desirably made for insuring great precision in the alignment of the punch heads 15, 16, and die blocks 17, 18. For this purpose the punch heads and die blocks, as 19, may respectively be formed with closely fitting cylindrical body portions 22, 23, and passages 24, 25 of substantial length whereby the punch heads are exactly centered as they enter the die sockets.

Upsetting the end of the bar stock, as in Fig. 4, may be accomplished by forming the punch head 15 with a blunt rounded end, as 26.

Similarly, the punch head 16 is preferably formed with a piercing projection 27, a tapering intermediate portion 28 and a forwardly facing abutment shoulder 29. The

piercing projection 27 desirably conforms in size with the size of the bar stock 13. The tapering portion 28 serves for radially expanding the ring, as 10, and for smoothing its interior surface 11, while the abutment shoulder 29 serves for the final compression of the ring in the direction of its axis. As the wall of the die socket 18 is preferably undercut, as at 30, to conform with the bulging exterior 12 of the ring, the ring is effectively held in the die socket 18 during withdrawal of the punch head 16 and its removal is only permitted by separation of the two companion die blocks, as 19.

After forging, the ring 10 will not usually require machine finishing but may be ground to remove fins and the like. The ring is then hardened throughout by suitable heat treatment, preferably comprising quenching in oil from a temperature above that of decalescence of the particular steel or steel alloy of which it is composed. Grinding and polishing of the hardened ring, principally confined to the wearing surface 11, serve to complete the ring for use as a bearing element.

The finished ring is distinguished from rings which have been machined from solid or tubular stock of similar analysis by being of increased density and greater strength. Furthermore, by its uniform hardness and texture throughout, the ring is markedly superior to bearing rings which have been produced from low carbon steel and hardened by carbonization at the surface only.

I claim as my invention:

The method of forging annular high carbon steel or steel alloy machine wearing parts to substantially finished dimensions which consists in upsetting the end of a solid bar of the selected steel, punching out the central portion of the upset end of the bar while attached to the bar, radially expanding the ring thus left between punch and die members substantially conforming in shape with the interior and exterior surfaces of the part to be produced and then compressing the ring in the direction of its axis while held between the said punch and die members.

CHARLES F. SULTEMEYER.