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C. F. KRALL

3,503,109

METHOD AND APPARATUS FOR FORMING FLANGE BEARINGS

Filed June 15, 1967

2 Sheets-Sheet 1

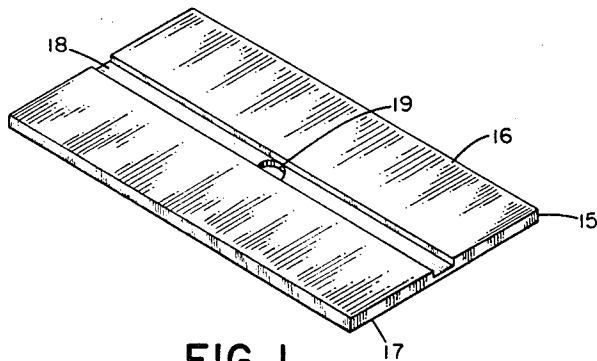


FIG. 1

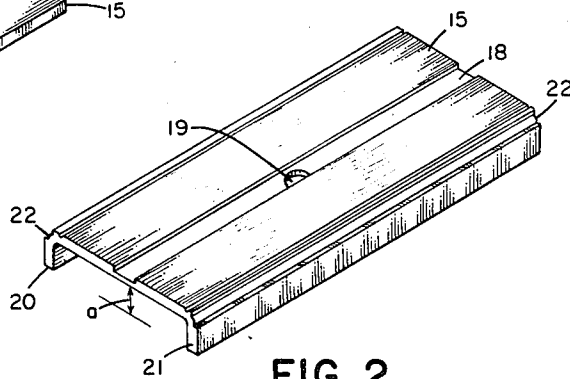


FIG. 2

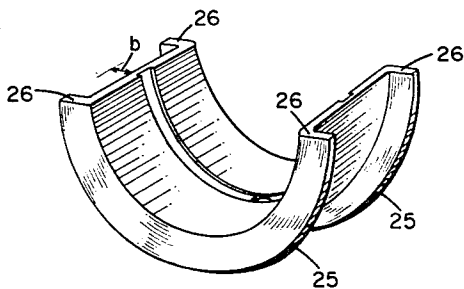


FIG. 3

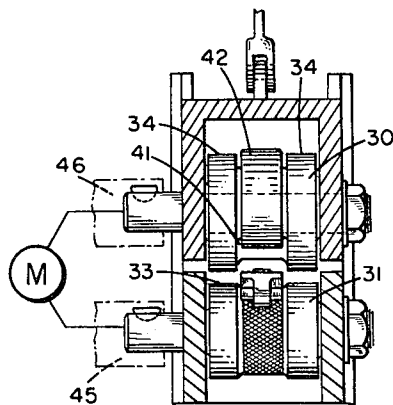


FIG. 5

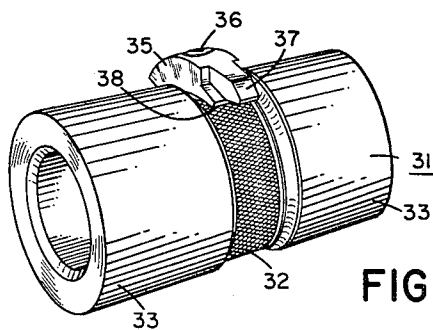


FIG. 4

INVENTOR.  
CHARLES F. KRALL

BY

*Eber J. Hyde*

ATTORNEY

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C. F. KRALL

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METHOD AND APPARATUS FOR FORMING FLANGE BEARINGS

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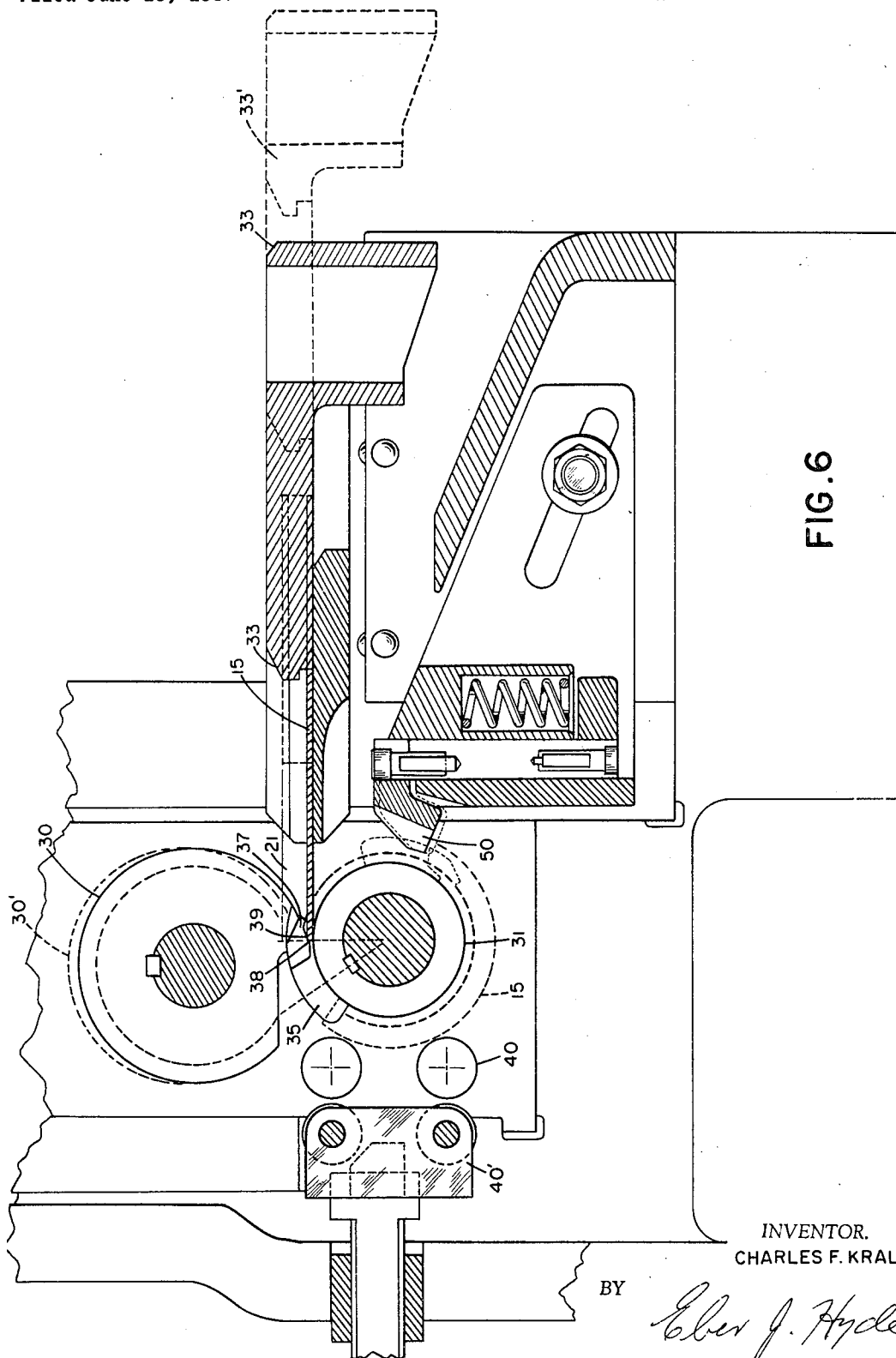


FIG. 6

INVENTOR.  
CHARLES F. KRALL

BY

*Robert J. Hyde*

ATTORNEY

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## METHOD AND APPARATUS FOR FORMING FLANGE BEARINGS

Charles F. Krall, Willowick, Ohio, assignor to Clevite Corporation, a corporation of Ohio

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6 Claims

### ABSTRACT OF THE DISCLOSURE

The apparatus herein disclosed comprises a pair of die rollers for rolling flange bearings from flanged metal strip, wherein one of the rollers is knurled and driven to draw the strip through the rollers with the aid of a pusher device, and back up roll means couple the strip to the knurled roller. In the method disclosed herein the channel shaped flat strip has an initial length substantially equal to the arcuate length of the finished bearing, and it is bent in the die rollers to stretch the outer flange edges and simultaneously to compress the flange height so that upon completion of the forming operation the four flange end faces, which become the parting line of the bearing, lie substantially in a common plane. The oil hole and the oil groove may be in the strip before the bending operation.

The present invention relates to a method of and apparatus for forming semi-cylindrical, flanged, sleeve bearings, and constitutes an improvement upon the method and apparatus shown in U.S. Patent No. 2,737,707, issued to Hightet and Wilcox, assigned to the same assignee as the present invention.

In the Hightet-Wilcox method the oil hole and the oil groove were not in the flat strip prior to bending, because the strip was pulled through the forming apparatus. The forces involved in pulling the strip may be sufficient to cause the strip to stretch slightly at an oil hole, thereby spoiling the piece. Also, in the Hightet-Wilcox method the arcuate piece (FIG. 3) had to be trimmed at both ends, thereby requiring that the flat strip (FIG. 1) be substantially longer than the arcuate length of the bearing to be formed.

One aspect of the invention is the provision of apparatus for forming arcuate flange bearings from a metal strip which has a flat base portion and a pair of flanges extending away therefrom a given flange distance terminating in outer flange edges. A first roller which has a knurled circumferential area engages the flat base portion of the strip, and the roller has a lip portion under which the leading edge of the strip is positioned to hold the leading edge against the knurled area. A second roller which is complementary to the first roller is positioned opposite the first roller and engages the outer edges of the strip flanges. The top roll also engages the back of the flat base portion. The first roller is driven in a direction to feed the strip between the rollers, the knurled area gripping the base portion thereof to feed it through. As the strip passes through the rollers back-up rollers engage it to hold it in close contact with the knurled area, and the flange height is reduced uniformly throughout the length of the metal strip.

In another aspect of the invention there is formed a flat strip of metal with a base portion and with a pair of upstanding flanges along the edges thereof. The length of the base portion is substantially equal to the arcuate length of the barrel portion of the finished bearing. The strip is bent, with the flanges on the outside of the arc and with bearing metal facing inwardly therefrom to form

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the barrel of the bearing, by rolling it between die rollers which arcuately stretch the outer edges of the flanges and simultaneously compress the flanges to reduce their height.

It is an object of the invention to provide apparatus for roll forming flange bearings wherein one of the rolls grips the strip to be formed and rotates it through the die rollers by torsional forces rather than by a tensional force.

A further object of the invention is to provide a method of forming flange bearings wherein the metal strip to be formed into a bearing is substantially the same length as the arcuate length of the finished bearing, thereby to obviate an expensive trimming operation, and to obviate scrap metal from both ends of the metal strip.

Still another object of the invention is to provide a method for roll forming flange bearings wherein expensive bearing stock is conserved and wherein several time consuming operations are eliminated.

Another object of the invention is to provide a method for roll forming flange bearings wherein the oil hole and the oil groove may be premachined into the strip while it is in its flat state, rather than after it has been formed into a semicylindrical shape.

For a better understanding of the present invention, together with other and further objects thereof, reference is had to the following description taken in connection with the accompanying drawings, and its scope will be pointed out in the appended claims.

FIGURE 1 shows a flat strip of metal stock from which a flange bearing is made;

FIGURE 2 shows the strip after the edges have been broached and bent to form flange edges;

FIGURE 3 shows the flange strip after it has been rolled into a semi-cylindrical bearing shell;

FIGURE 4 is an isometric view of one of the die rollers of the forming apparatus;

FIGURE 5 is an end view of the rolling apparatus in its "open" position and in which the roller shown in FIGURE 4 is in the lower position; and

FIGURE 6 is a sectional side view showing the apparatus of the invention in its "closed" position.

With reference to FIGURES 1 to 3 there is shown in FIGURE 1 a bearing blank 15 comprising a short strip of metal on one face of which there is cast, clad or sintered bearing material 16. The backing may be steel 17 or the like. In contrast to the Hightet-Wilcox method an oil groove 18 may be formed in the bearing metal portion 16 of the blank, and an oil hole 19 may be drilled or punched through the metal backing 17 at the location of the oil groove 18. Also in contrast to the Hightet-Wilcox method, the length of the strip 15 is exactly the same as the arcuate length of the barrel of the finished bearing, thereby eliminating a trimming operation and waste of strip material.

The strip 15 may be grooved at 22 and bent into the shape shown in FIGURE 2 to provide flanges 20, 21 along the edges thereof. The height *a* of the flanges 20, 21 formed on the strip is greater than the height *b* of the flanges in the finished bearing.

The formed strip shown in FIGURE 2 is then rolled through the machine shown in FIGURES 5 and 6 to produce the shape shown in FIGURE 3. During its passage through the roll forming machine the strip is bent into a semi-cylindrical shape of 180° of arc, and the flange height is rolled down to less than it was when in the strip form. As the strip is bent into semi-cylindrical shape the flange edges tend to stretch. Normally this cracks the bearing material 16 from the base material 17, but simultaneously with the stretching of the flanges the rolling machine reduces the flange height to provide enough metal to permit the stretching of the flanges, as explained

in the Hight-Wilcox patent. In the present process the entire length of the strip 15 is rolled and the entire length of each flange is reduced in height, thereby producing a semi-cylindrical bearing blank which utilizes every bit of the strip shown in FIGURES 1 and 2, and obviating the necessity to trim both ends of the curved bearing blank. During the forming operation sufficient metal is rolled out to the flange ends so that all four of the flange end faces 26 lie substantially in a common plane which becomes the parting line of the finished bearing.

The apparatus for forming the flanged blank is shown in FIGURES 4, 5 and 6, and comprises a pair of rollers 30, 31 which operate to bend the strip 15 into semi-circular form while simultaneously compressing the flanges. A pusher mechanism 33 feeds the strip 15 to the rolls, and additionally, in synchronism with the rotation of the rolls exerts pressure on the strip 15 to help feed the strip through the rolls. A backup roll mechanism 40 couples the strip 15 to the lower roll 31 to assure that the lower roll grips the strip and rotates it through the mechanism. To aid the lower roll 31 in gripping the strip its central circumferential area is knurled, as shown at 32. This is the area which engages the relatively soft bearing material 16 which covers the back face of the strip. Any knurl marks which may occur due to the gripping action subsequently are removed from the surface by a boring step so that the barrel of the finished bearing has a smooth surface. Also, the upper roll 30 engages the strip 15 between the flanges 20, 21 to aid in coupling the strip to the lower roller 31.

As shown in FIGURE 5 both of the rollers 30, 31 may be driven in timed relation to each other by a motor M through drive mechanisms 45, 46, and it is preferred that the rollers rotate at approximately the same peripheral speed.

In FIGURE 6 the mechanism is shown by solid lines in its operative or rolling position and is shown by dotted lines in its retracted position where it is open to receive strip 15. Also, the strip 15' is shown by dotted lines after it has been roll formed into a 180° semi-cylindrical member.

The lower roller 31 is shown in detail in FIGURE 4. It comprises the knurled central area 32 which grips the bearing material surface of the strip 15 and two spaced apart end sections 33 which roll on corresponding sections 34 of the upper roller 30 during a roll forming operation. A fixed channel stop 35 is mounted by screw 36 to the knurled portion of the roller 31, and has a lip 37 which extends outwardly in spaced relation to the knurled area 32. The stop 35 also has a surface 38 against which the leading edge 39 of the strip 15 abuts when the strip is in position to be roll formed. The channel stop 35 does not grip the leading edge of the strip 15, it merely holds it down close against the knurled area 32 so that as the roller 31 is rotated the knurls grip the surface of strip 15 and the rolling action in conjunction with the pusher 33 feeds the strip through the roll forming device. The knurled area 32 is quite broad and consequently the force driving the strip 15 between the rollers is spread over a wide area and is essentially a rotary or winding action in contrast to the prior art device which forcibly gripped the leading edge of the strip and pulled it through the roll forming machine resulting in severe deformation of the leading edge of the strip and pulled it through the roll forming machine resulting in severe deformation of the leading edge of the strip and necessitating trimming of the leading edge by a subsequent operation.

As the strip is rolled around by roller 31 the upper roller 30 moves into its position shown by the solid lines in FIGURE 6, and the back-up rolls 40 move from the dotted position to the position shown by the solid lines, thereby to closely couple the strip 15 to the knurled roller 31, and to assure that the strip 15 is bent into an arc of 180°. Without the back-up rolls 40 the strip 15 sometimes tends to spring back slightly from its 180° arc.

During the rolling operation the flanges 20, 21 extend into grooves 41 located in the upper roller 30 between a central portion 42 and the spaced sections 34. The entire length of the strip 15 is rolled between the rollers 30, 31, and the flanges 20, 21 throughout their entire length are crushed by an amount between  $\frac{1}{16}$ " and  $\frac{3}{32}$ ".

Thereafter a stripper device 50 engages the strip 15 and forces it out from underneath the stop 35 allowing it to drop out of the roll forming machine, after which the rollers reverse and go back to their original positions to receive another strip.

While there have been described what are at present considered to be the preferred embodiments of this invention, it will be obvious to those skilled in the art that various changes and modifications may be made therein without departing from the invention, and it is aimed, therefore, in the appended claims to cover all such changes and modifications as fall within the true spirit and scope of the invention.

What is claimed is:

1. Apparatus for forming arcuate flanged bearings comprising:

a first roller for receiving a metal strip having a flat base portion and a pair of flanges extending away therefrom a given flange distance terminating in outer flange edges,

said first roller having a knurled circumferential area for contact with the base portion of said strip and a lip member secured thereto under which the end of said strip is positioned,

a second roller complementary to said first roller and opposite thereto adapted to engage the outer flange edges and to at least partially surround said flanges at said outer edges,

means for rotating said first roller to compress said base portion and said flanges between said rollers, said knurled portion of said first roller gripping said base portion of said strip and feeding the entire length of said strip between said rollers,

said rollers in the flange engaging position being separated by a distance less than the said given flange distance whereby the flange height is reduced uniformly throughout the entire length of said strip, and back-up roll means engaging said strip as it passes between said first and second rollers to hold said strip in close engagement with said first roller.

2. The method of forming a semi-cylindrical flange sleeve bearing which comprises the steps of:

forming a flat strip of metal having a bearing metal face, having a base portion with upstanding flanges along both edges thereof, and with said base portion being of a length substantially equal to the arcuate length of the barrel portion of the finished bearing,

bending the strip with the flanges on the outside of the arc and with the bearing metal face inwardly thereof to form the barrel of the bearing by rolling said strip between die rollers which arcuately stretch the outer edges of said flanges and simultaneously compress the flanges radially to form a semi-cylindrical bearing shell wherein the four end faces of the two flanges lie substantially in a common plane.

3. The method as set forth in claim 2, further characterized by perforating said flat strip of metal to form a hole therethrough, which hole becomes an oil hole in the finished bearing.

4. The method as set forth in claim 2, further characterized by machining an oil groove longitudinally of said flat strip and in the bearing metal face thereof prior to bending the strip.

5. The method as set forth in claim 4, further characterized by perforating said strip at said oil groove to form a hole therethrough prior to bending said strip, whereby in said finished bearing the hole and groove become the oil hole and the oil groove for the bearing.

6. The method of forming a semi-cylindrical flange

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sleeve bearing which comprises the steps of:

forming a flat strip of metal having a bearing metal face having a base portion with upstanding flanges along both edges thereof, and with said base portion being of a length substantially equal to the arcuate length of the barrel portion of the bearing to be finished therefrom, 5

rolling said strip between two die rollers to bend the strip with the flanges on the outside of the arc and with the bearing metal face inwardly thereof to form the barrel of the bearing, the die roller engaging the bearing metal face being knurled to grip the bearing metal face substantially throughout its entire area during the roll formation operation, 10

rotating said knurled die roller and simultaneously pushing said strip between said two idle rollers whereby the force from the knurled roller drawing the 15

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strip through the die rollers is spread throughout the entire length of the strip, said die rollers arcuately stretching the outer edges of said flanges and simultaneously compressing the flanges radially to form a semi-cylindrical bearing shell wherein the four end faces of the two flanges lie substantially in a common plane.

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THOMAS H. EAGER, Primary Examiner

U.S. Cl. X.R.

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