Oct. 30, 1928. 1,689,784

F. R. KLAUS

PROCESS OF FORMING ANNULAR PLATES

Filed Dec. 15, 1924 2 Sheets-Sheet 1

Fig. 1.

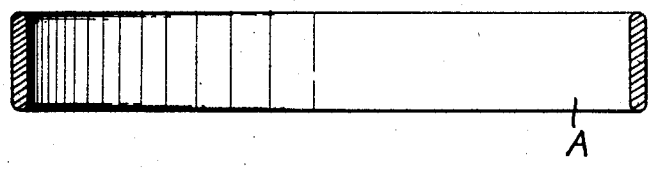


Fig. 2.

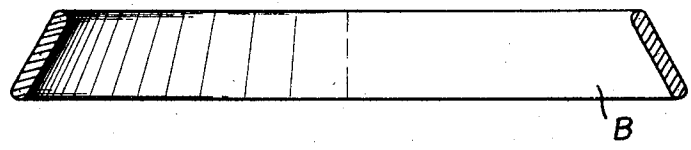


Fig. 3.



Inventor

F. R. Klaus

Lloyd L Evans

By

Attorney

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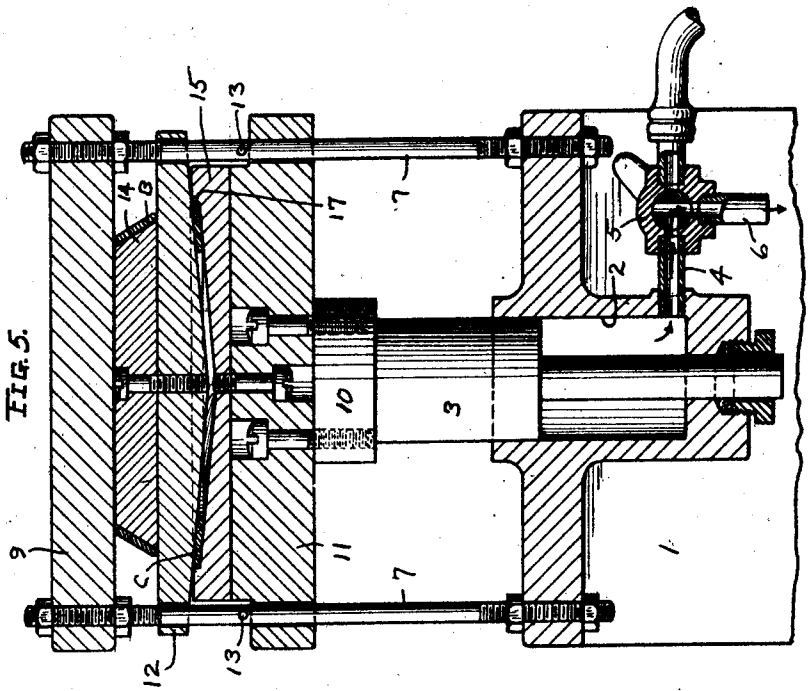


FIG. 5.

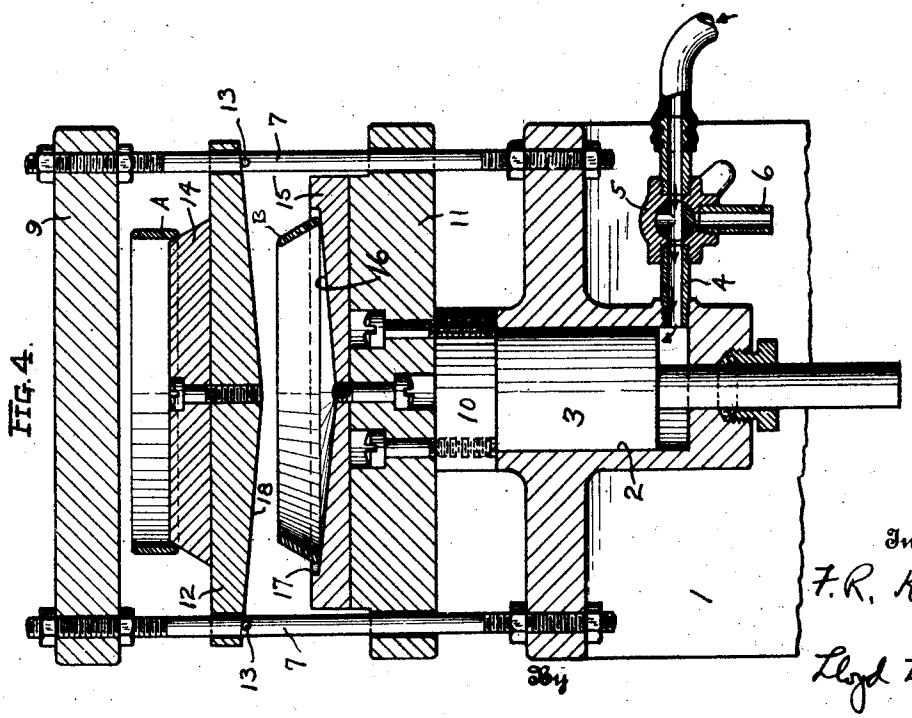


FIG. 4.

Inventor
F. R. Klaus
By Lloyd L Evans
Attorney

Patented Oct. 30, 1928. 1,689,784

UNITED STATES PATENT OFFICE.

FRED R. KLAUS, OF WARREN, OHIO, ASSIGNOR TO THE AMERICAN WELDING AND MANUFACTURING COMPANY, OF WARREN, OHIO, A CORPORATION OF OHIO.

PROCESS OF FORMING ANNULAR PLATES.

Application filed December 15, 1924. Serial No. 755,924.

The present invention relates to a method and apparatus for forming flat or substantially flat metal rings from rings or bands of cylindrical or substantially cylindrical form, the invention being particularly applicable to the production of retaining rings used in connection with automobile wheel rims although obviously not limited to the production of this particular article.

It is an object of the present invention to provide a method by which a metal ring or annulus can be produced by simple press operations at a very low cost. A further object is to provide a press capable of performing the operations necessary to convert a cylindrical ring into a flat ring or a ring having a substantially flat flange.

With the above and other objects in view the invention may be said to comprise the method and apparatus, illustrated in the accompanying drawings, hereinafter described and particularly set forth in the appended claims together with such variations and modifications thereof as is apparent to one skilled in the art to which the invention appertains.

Reference should be had to the accompanying drawings forming a part of this specification in which Fig. 1 is a sectional view showing the blank in the form of a cylindrical metal band from which the flat ring is formed.

Fig. 2 is a sectional view showing the blank after the first operation.

Fig. 3 is a sectional view showing the flat ring after the second and final operation.

Fig. 4 is a vertical axial section through the double press showing the dies in open position, a cylindrical blank between the upper pair of dies and a partially formed blank between the lower pair of dies.

Fig. 5 is a section similar to Fig. 4 showing the press members in closed position.

Referring to the accompanying drawings Figs. 1, 2 and 3 show the cylindrical blank A, the partially formed conical blank B and the substantially flat ring C which is the final product. The blank A is a substantially cylindrical band which may be formed in any desired manner, as by rolling a flat strip of the desired cross sectional dimensions to cylindrical form and welding the ends together. The cross sectional shape of the stock from which the band is formed may vary considerably depending on the cross section dimensions desired in the final product.

My invention is applicable to bands or annular members substantially cylindrical in form where it is desired to turn a portion or flange of the band which is substantially parallel to the axis thereof to a considerable angle such as 90° so that the flange extends substantially at right angles to the axis of the axis of the cylinder.

In order to illustrate my invention I have shown by way of example a cylindrical band A in which the entire band is rotated so that it lies substantially at right angles to the axis.

The cylindrical blank A is converted into the flat ring C in two press operations, the blank A being forced into conical form shown in Fig. 2 by means of a cone shaped plunger die which is forced into the cylindrical blank A and the flat ring C being formed from the conical blank B by a second press operation in which the conical blank B is flattened between a second pair of suitably formed dies.

Fig. 4 and 5 show a hydraulic press designed to perform the two forming operations simultaneously upon two different rings. The press has a fixed base 1 at the center of which there is provided a cylinder 2 with a vertically movable piston 3, the cylindrical 2 being connected to a source of fluid under pressure by an inlet pipe 4 and controlled by a suitable valve 5 by which the cylinder may be connected either to the inlet pipe 4 or to an exhaust pipe 6.

A series of vertical tie rods 7 are rigidly attached to the base 1 and extend upwardly therefrom, the rods 7 having rigidly secured thereon at their upper ends a bed plate 9. The piston 3 has an enlarged head 10 at its upper end which rests upon the base 1 when the piston is in its lowermost position and attached to the head 10 is a plate 11 which has openings through which the tie rods 7 extend, the plate 11 being movable with the piston 3 and slidable on the tie rods 7. Slidably mounted on the tie rods 7 between the fixed and movable plates 9 and 11 is an intermediate plate 12 the downward movement of which is limited by stop pins 13 on the rods 7. The intermediate plate 12 has rigidly secured to the upper side thereof a

frustro conical die 14 which tapers upwardly and is of such size that its smaller end will just enter within an edge of the cylindrical blank A, the pins 13 being so positioned that when the piston 3 is lowered there is room enough between the upper fixed plate 8 and the the die 14 for insertion of one of the cylindrical blanks A.

The plate 11 carried by the piston 3 has a die 15 secured upon its upper face and this die 15 is formed with a recess 16 of somewhat greater diameter than the larger end of the conical blank B the bottom of the recess 16 being conical and tapering downwardly at a small angle from the circumferential shoulder 17 to the center of the recess. The bottom 18 of the intermediate plate 12 is conical in form tapering downwardly to the center thereof at the same angle as the bottom of the recess 16. The pins 13 are so located that when the piston 3 is in its lowermost position the plate 12 is supported at a sufficient distance above the die 15 to permit a blank B to be inserted in the recess 16 of the die.

To convert the cylindrical blank A into the flat ring C the blank is acted upon successively between the dies 14 and 9 and 15 and 12. The blank A is first placed upon the conical die 14 as shown in Fig. 4, pressure is admitted to the cylinder 2 to move the piston 3 upwardly, raising the plate 11 into engagement with the intermediate plate 12 and carrying the plate 12 upwardly until the blank A engages with the flat bottom of the fixed plate 9, whereupon the conical plunger die 14 is forced into the cylindrical blank A which stretches the same and rotates the flange partially toward the axis of the ring so that the part acted on by the die assumes a conical form as shown at B. The blank B formed by the operation above described is then placed upon the die 15 and pressed between the die 15 and the conical bottom 18 of the intermediate plate 12. The depth of the shoulder 17 at the edge of the recess 16 in the die 15 is substantially equal to the thickness of the metal band so that when the parts of the die are brought together the band is forced down against the conical bottom of the recess 16 as shown in Fig. 5. The band is thus bent slightly past the flat position but, upon release of the dies, the inherent resiliency of the metal will cause it to spring back to flat shape, the angle of the conical faces 16 and 18 being just sufficient to take care of the spring of the metal. The press is designed to act simultaneously upon blanks A and B and after each operation thereof a finished ring is taken from the die 15, a partially formed blank B is transferred from the upper die 14 to the lower die 15 and a new blank A inserted upon the die 14.

It will be obvious that it is possible to rotate the flange which is substantially parallel to the axis of the cylinder more or less than 90°, as desired. Also the faces 16 and 18 of the dies may be of such angle as to cause the band when it is removed from the dies to have the desired shape. In working with resilient metal, such as steel, it is usually necessary to have the faces 16 and 18 of the die at an angle which will cause the metal to be turned further than that desired for the finished ring so that allowance is made for it to spring back to the desired shape.

It will be seen, however, that as the flange is rotated from a position longitudinal with respect to the axis of the annular band to a position transverse with respect to said axis the annular center of the cross section of the metal of the flange which is rotated remains at substantially a constant distance away from the axis. That is, the outer portion of the flange that is being rotated with respect to the axis is actually expanded or enlarged, while the inner portion of the flange is compressed and made smaller in diameter. This does not mean, however, that the thickness of the flange is changed as this can be controlled by the shape of the dies and the pressure used, so that when the flange is turned transversely with respect to the axis it can be of substantially the same thickness it was originally.

It is to be understood, however, that my invention may be used in connection with cylindrical bands of various shapes in which it is desired to turn or rotate a part or all of the band at an angle to the axis.

In case it is desired to rotate a relatively thick or wide flange of the band, this may be done in more than the two operations necessary to give the band the desired final shape.

Furthermore, it is to be understood that the particular forms of apparatus shown and described, and the particular procedure set forth, are presented for purposes of explanation and illustration and that various modifications of said apparatus and procedure can be made without departing from my invention as defined in the appended claims.

What I claim is:

1. The method of changing the plane of an annular body disposed longitudinally with respect to the axis thereof to a substantially transverse position with respect to said axis, which comprises pressing the annular body between one or more sets of cooperative dies and rotating the flange while keeping the median line of the body as it is being rotated at substantially the same radial distance from said axis.

2. The method of forming a substantially flat metal ring from a substantially cylindrical band, which comprises forcing a tapering die into the band to expand the same to conical form, flattening the conical

ring so formed, and holding the median line of the ring to a given diameter during the flattening operation.

3. The method of forming a substantially flat metal ring from a substantially cylindrical band, which comprises pressing the band to conical form and subsequently pressing the band between dies while keeping the median line of the band at substantially the same radial distance from the axis of the band.

4. The method of forming a substantially flat annular ring from a substantially cylindrical band, which comprises pressing the band to conical form between suitable dies, flattening the band and pressing same past a position transverse to the axis of the band to a reversely conical form and allowing the same to spring back to a substantially flat shape.

5. The method of forming a substantially flat annular ring from a substantially cylindrical band, which comprises expanding the band to conical form by the action of a tapered plunger die, subsequently subjecting the same to pressure between flattening dies engaging opposite edges of the band, and restraining the outward movement of the outer edge thereof to hold the median line of the ring to a given diameter.

6. The method of changing the plane of an annular body disposed longitudinally with respect to the axis thereof to a substantially transverse position with respect to said axis, which comprises pressing the annular body between one or more sets of cooperative conical dies until the flange has been rotated toward said axis more than the desired final position of the body, and allowing the body to spring back to final position.

7. The method of forming an apertured disc that consists in forming an annular cylindrical band, pressing the band to conical form, flattening the conical form to apertured disc form while confining the outer edge portion thereof during a portion of the process in order to provide an apertured disc of substantially the same mean diameter as the mean diameter of the annular cylindrical band.

8. The method of forming an annular apertured disc that consists in forming an endless annular band of cylindrical form, pressing the band to conical form, partially flattening the conical form axially, confining the outer edge portion of the partially flattened conical body to prevent further increase in peripheral diameter, and reversing the concavity of the disc to impose reversed strains in the metal, and releasing said disc.

In testimony whereof, I hereunto affix my signature.

FRED R. KLAUS.