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3,234,775

APPARATUS FOR FORMING A WORK PIECE INTO AN INNER PORTION
AND AN OUTER REMAINDER HAVING A PREDETERMINED
VOLUMETRIC RELATIONSHIP TO THE INNER PORTION

Filed Dec. 26, 1961

2 Sheets-Sheet 1

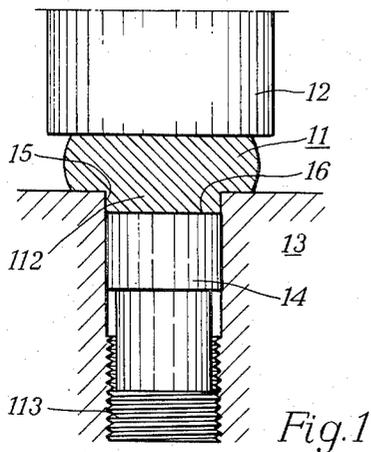


Fig. 1

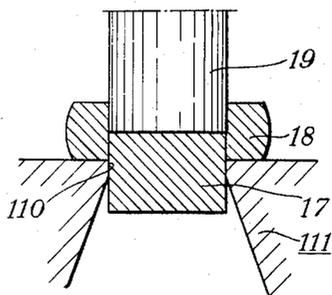


Fig. 2

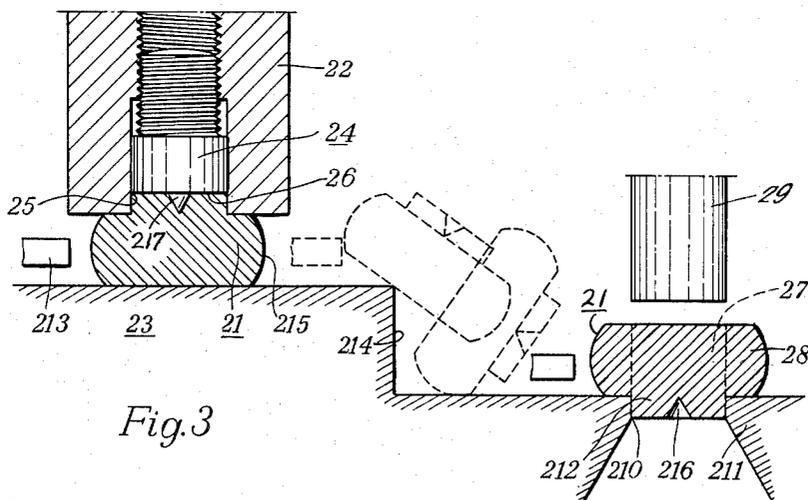


Fig. 3

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2 Sheets-Sheet 2

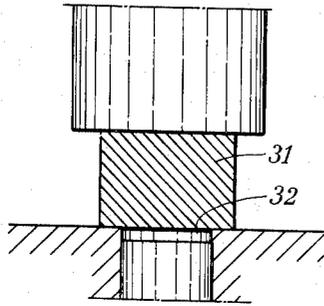


Fig. 4

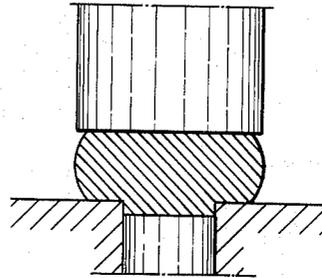


Fig. 5

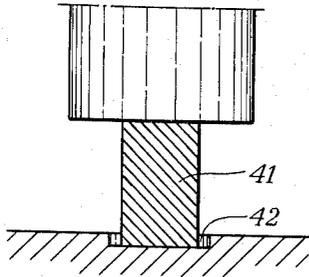


Fig. 6

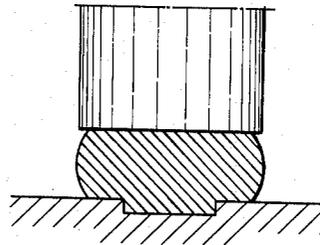


Fig. 7

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APPARATUS FOR FORMING A WORK PIECE INTO AN INNER PORTION AND AN OUTER REMAINDER HAVING A PREDETERMINED VOLUMETRIC RELATIONSHIP TO THE INNER PORTION

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2 Claims. (Cl. 72-343)

The present invention relates broadly to forming a work piece into a central portion and an outer remainder. The present invention relates more specifically to a new and improved method and apparatus for obtaining a predetermined apportionment of material between the central portion and the annular remainder of a disc-like blank when removing the central portion.

Heretofore in accordance with one of the commonly used methods for apportioning the material between the central portion and the annular remainder, a generally cylindrical member is flattened a predetermined amount to provide a disc-like blank of desired height or thickness and a single punch of predetermined cross section is used to remove the central portion. In accordance with this method the relative volume of material of the central and annular portions is varied by flattening the blank to various heights before the punching operation is carried out. However this method is not suitable where it is desired to maintain the height of the annular portion constant and vary selectively the relative volumes of the annular and central portions.

In accordance with another method for proportioning the volume of material between the central and annular portions, the cylindrical member is flattened between press members to a predetermined desired height and a selected punch of predetermined diameter is chosen to punch out the central portion and to provide the desired volume of material in the annular and central portions. It is readily appreciated that while the respective volumes and height of the annular portion may be controlled by this method, it is necessary to maintain a large stock of punches of various sizes.

In accordance with the present invention, a new and improved method and apparatus are provided for obtaining a predetermined apportionment of the material between the central portion and the annular remainder of a disc-like member whereby the height of the annular portion, and relative volumes thereof and of the central portion may both be varied selectively while using a single punch. This result is obtained by flattening a generally cylindrical member between two pressing members of which at least one is provided with a chamber or recess, the volume of the latter being selectively adjustable by varying the depth thereof. Accordingly the cylindrical member may be flattened to provide a desired height of the outer portion thereof and the relative volume of the central portion with respect thereto may be selectively controlled by varying the volume of the chamber in one of said pressing members. Thereafter a punch preferably of substantially the same cross section as the recess in the pressing member is used to punch out the central portion and provide an outer annular portion of a desired relative volume and height.

The method of the present invention is especially useful in making the inner and outer race rings of a bearing assembly from a single blank. In this regard it is noted that the variation in the desired relative volumes of the inner race ring and the outer race ring may cover a wide range. When it is desired to form an outer ring of a pre-

determined height and an inner race ring having a predetermined volumetric relationship with the outer race ring from a single blank, the prior method of varying the height of the blank can very seldom be used. The present invention solves the problem of properly apportioning the volumes between the central portion of the blank and the outer ring which remains in such a manner that a minimum number of punches is required for a great number of ring sizes and volumes. Further the method and apparatus of the present invention make it possible to control selectively the height of the outer race ring.

Other objects of the present invention are set forth hereinafter and a more detailed description of the method and apparatus of the present invention are hereinafter more fully set forth and described with reference to the accompanying drawings, in which:

FIGS. 1 and 2 show apparatus and steps for forming a generally cylindrical member into an annular portion and central disc portion in accordance with the present invention;

FIG. 3 illustrates a similar method with a somewhat different form of apparatus;

FIGS. 4 and 5 illustrate the method of the present invention with a cylindrical member of a greater diameter than the diameter of the recess in one of the pressing members; and

FIGS. 6 and 7 which are similar to FIGS. 4 and 5, show the method with a cylindrical member of smaller diameter than the recess in the pressing member.

Referring now to the drawings, there is shown in FIG. 1 a pressing apparatus including a movable pressing member 12 and a stationary table 13. The pressing table 13 is provided with a generally cylindrical chamber or recess 15, the bottom of which is defined by the end face of a piston 14. The piston 14 is actuatable selectively in an axial direction in the chamber 15 by means of a screw 113 thereby providing means for varying selectively the volume of the cylindrical chamber 15.

In accordance with the present invention, a generally cylindrical member is positioned in the apparatus between the pressing member 12 and piston 14 and then flattened to a cheese-shaped blank 11 as shown for example, in FIG. 1. As illustrated, the blank 11 thus formed has a depending portion 112 of a diameter substantially equal to the diameter of the chamber 15. The piston 14 may be moved upwards to eject the blank 11 from the table 13. Thereafter the depending portion 112 of the blank 11 is placed in an opening 110 of a die 111 to locate the blank for removal of the central portion 17 by means of a punch 19 as illustrated in FIG. 2. Removal of the central portion 17 leaves an outer ring 18. It is noted that in order to provide a predetermined relationship between the volume of the central portion 17 and the volume of the ring 18, it is merely necessary to vary selectively the volume of the chamber 15 through the screw 113. Further the height or thickness of the ring 18 may be controlled selectively at the same time by the pressing member 12. From the foregoing it may be seen that the present invention provides a simple and effective method and apparatus for forming a central disc portion and an annular ring having a predetermined volumetric relationship which may be varied selectively and wherein the height or thickness of the annular ring may be controlled selectively.

Another apparatus for carrying out the method of the present invention is illustrated in FIG. 3. The apparatus includes a press member 22 and a table 23 which in the present instance has a plane top. The press member 22 has a chamber or recess 25 therein and a piston 24 having a threaded shank which cooperates with interval threads in the press member 22 so that the piston 24 may be moved axially within the chamber 25.

In operation therefore, a generally cylindrical member is placed in the pressing apparatus and flattened to provide a blank 21 having an extension forming a projecting portion 212. In the present instance the piston 24 is provided with a conical portion 217 which makes an impression 216 in the blank when it is being flattened by the press member 22. After retraction of the member 22, the blank 21 is moved by means of a pusher 213 over an edge 214 of the pressing table, whereby due to its convex surface 215, the blank is turned over and advanced to a punch 29 which is aligned with an opening 210 of a die 211. As shown, the projecting portion 212 fits into the opening 210 in the die 211 whereby the punch 29 removes the central portion 27 of the blank 21. It is noted that the impression 216 in the central portion may serve to locate this portion properly during following operations, for example, during a piercing operation. Further it is noted that the volume of the central portion 27 with respect to the outer annular portion 28 may be varied selectively by adjusting the screw 24 to vary the volume of the chamber 25.

It is noted that in the above described methods, the diameter of the punches 19 and 29 are equal to the diameter of the projecting portions 17 and 27 respectively whereby the central portion thus formed is of uniform thickness. However, if desired, the punch for removing the central portion may be of a greater or less cross section than the projecting portion.

It is not necessary, of course, that the diameter of the chamber in the pressing member be the same as the diameter of the cylindrical member. For example, as shown in FIGS. 4 and 5, the diameter of the chamber 32 may be less than that of the cylindrical member 31 which is to be formed, or the diameter of the cylindrical member 41 may be less than that of the chamber 42 as illustrated in FIGS. 6 and 7.

While particular embodiments of the present invention have been illustrated and described herein, it is of course, to be understood that changes and modifications in various parts of the apparatus and in the manner and sequence of the method of the present invention may be made within the scope of the present invention and the following claims.

I claim:

1. Apparatus for forming an elongated work piece having opposite end faces into an inner portion and outer remainder having a predetermined volumetric relationship

to the inner portion comprising a pressing member having a pressing face, a pressing table having a pressing face, means mounting said pressing faces for relative movement with respect to one another, means defining a chamber in at least one of said pressing faces, means for selectively varying the volume of said chamber in said one pressing face, said work piece adapted to be positioned between said faces with the opposite end faces thereof respectively confronting said pressing faces whereby relative movement of said pressing member and table toward one another compresses said work piece axially to provide an outer remainder of predetermined thickness and an extension on one of said end faces of a size and shape equal to said chamber in said one pressing face and means for removing said inner portion from said outer remainder.

2. Apparatus for forming a generally cylindrical work piece having opposite end faces into an inner disc portion and outer annular remainder comprising a pressing member, a pressing table member, means mounting said pressing member and table member for relative movement with respect to one another, means defining a cylindrical chamber in at least one of said members, said work piece adapted to be positioned between said members with the end faces thereof confronting said pressing member and table member whereby relative movement of said pressing member and table member toward one another compresses said work piece axially to provide an outer remainder of predetermined thickness and an extension on one of said end faces of a size and shape equal to said chamber, a piston mounted in said chamber, means adjustably mounting said piston for movement axially in said chamber to vary selectively the volume thereof and said extension whereby the volumetric relationship of said disc and annular remainder may be controlled, and means for removing said disc portion from said outer annular remainder.

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