Dec. 14, 1965 F. J. SABO 3,223,004

CUP-SHAPED ARTICLES

Original Filed Nov. 29, 1957 2 Sheets-Sheet 1

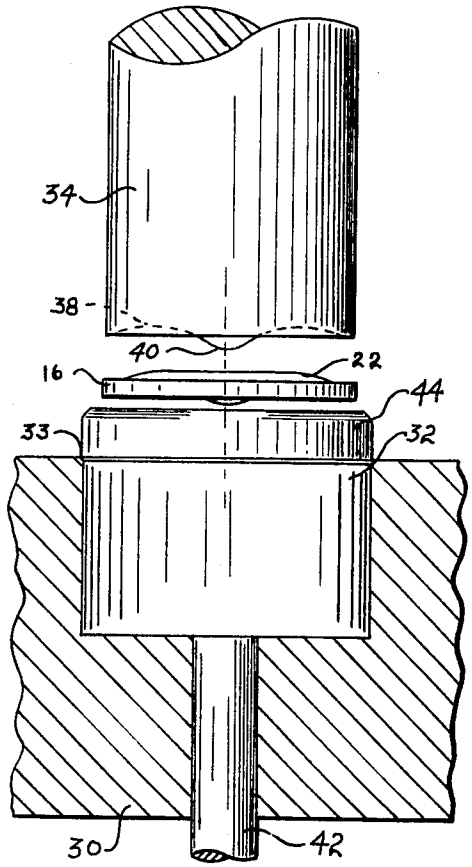


FIG. 6

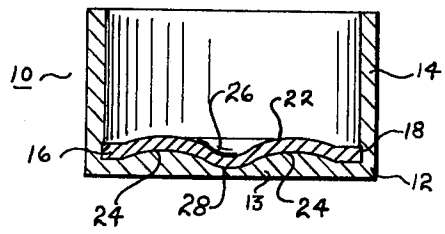
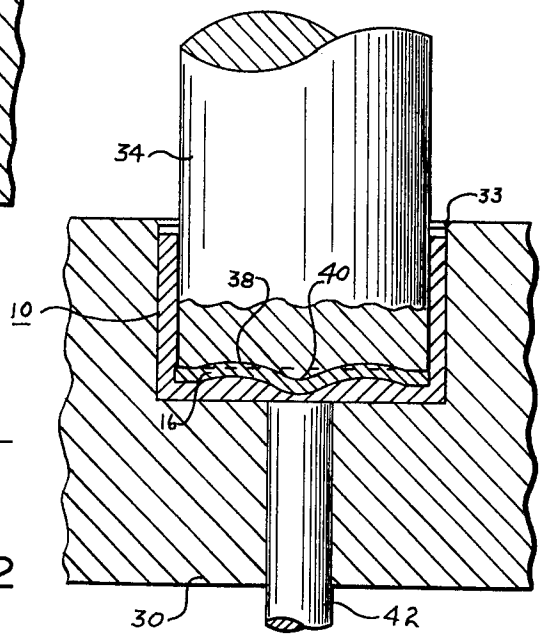


FIG. 3

FIG. 7



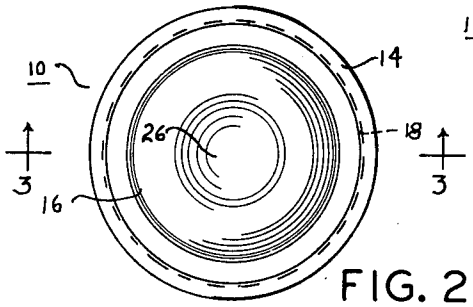


FIG. 2

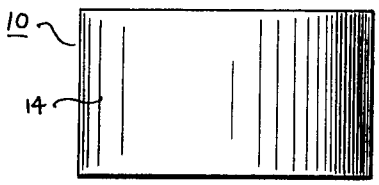


FIG. 1

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CUP-SHAPED ARTICLES

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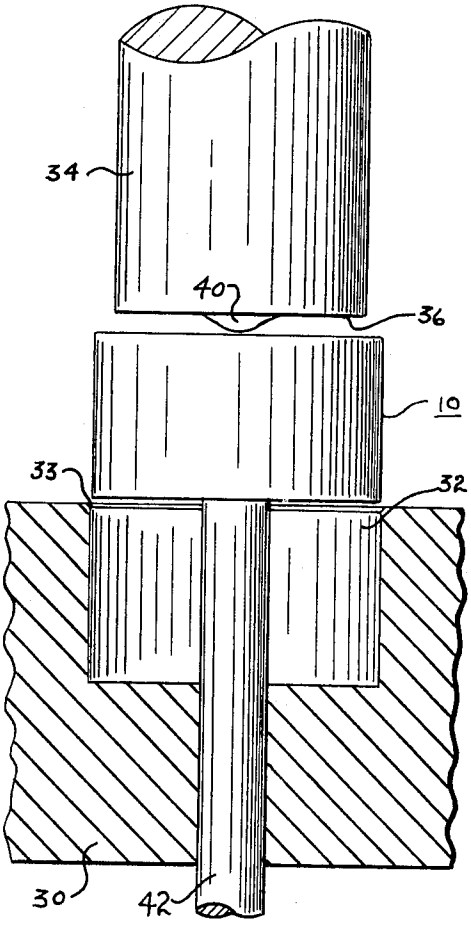


FIG. 8

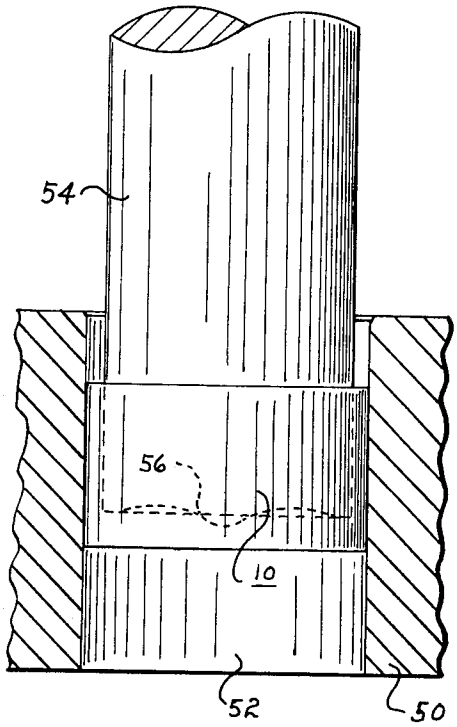


FIG. 9

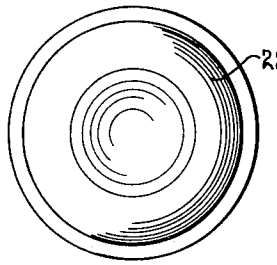


FIG. 4

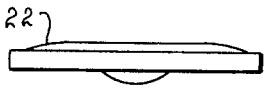


FIG. 5

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United States Patent Office 3,223,004 Patented Dec. 14, 1965

3,223,004

CUP-SHAPED ARTICLES

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Original application Nov. 29, 1957, Ser. No. 699,665. Divided and this application Aug. 20, 1958, Ser. No. 756,151

9 Claims. (Cl. 92—222)

This application is a division of my copending application Serial No. 699,665 filed November 29, 1957.

The present invention relates to cup-shaped articles and to blanks for forming the same.

One of the principal objects of the present invention is to provide cup-shaped articles which are formed of two different materials, such as two different metals, or alloys, and which are light in weight and strong and sturdy in construction.

Another object of the invention is to provide a cup-shaped article constructed of one metal, such as aluminum alloy, and having an insert of another metal, such as steel, firmly seated in and secured to the bottom of the article.

Another object of the invention is to provide an aluminum cup-shaped piston having a steel disc-shaped insert seated on the internal side of the closed end and forming the point of contact between the piston and a rod or member for transmitting motion to or from the piston.

Still another object is to provide a duplex metal piston which is so designed and constructed that it can readily be fabricated on conventional or standard presses with a minimum number of operations and with relatively simple punch and die designs.

Another object of the invention is to provide a blank for use in forming by a single extrusion operation cup-shaped articles having a disc-shaped insert in the bottom thereof.

Additional objects and advantages will become apparent from the following description and accompanying drawings, wherein:

FIGURE 1 is a side elevational view of a cup-shaped article of duplex metal formed by my fabricating process;

FIGURE 2 is a top plan view of the cup-shaped article shown in FIGURE 1;

FIGURE 3 is a vertical cross sectional view of the cup-shaped article shown in FIGURES 1 and 2, taken on line 3—3 of FIGURE 2;

FIGURE 4 is a top plan view of a blank used in the forming of the cup-shaped articles shown in the preceding figures;

FIGURE 5 is a side elevational view of the blank shown in FIGURE 4;

FIGURE 6 is a fragmentary vertical cross sectional view of the die and plunger employed in forming the present cup-shaped article, showing the plunger withdrawn from the die and the blanks from which the article is formed in position for the forming operation;

FIGURE 7 is a fragmentary vertical cross sectional view of the die and plunger shown in FIGURE 6, showing a cup-shaped article in cross section at the completion of the forming operation with the plunger at the end of its forming stroke;

FIGURE 8 is a fragmentary vertical cross sectional view of the die and plunger shown in FIGURES 6 and 7, showing the plunger withdrawn from the die and the newly formed cup-shaped article being ejected from the die; and

FIGURE 9 is a fragmentary vertical cross sectional view of a sizing die and elevational view of a plunger, showing a cup-shaped article being worked to final dimensions.

Referring more specifically to the drawings, numeral 10 designates generally the present cup-shaped article, 12 the cup-shaped portion of the article having cylindrical side walls 14 and disc-shaped end member 13 joined integrally to the lower end of the side walls. A disc-shaped metal insert 16 is seated in the bottom of cup-shaped portion 12 and is secured therein by the marginal portion of the insert extending into a shallow annular groove 18 at the bottom of the internal surface of the side walls. The cup-shaped article shown in the drawings is intended primarily for use as a piston, such as those used for operating the shoes of a hydraulic brake system for automobiles, trucks and similar vehicles. The size of the piston may vary from one size or type of vehicle to another, but the general construction of the present piston consisting of cup-shaped portion 12 and insert 16 remains the same.

The particular shape of insert 16 is important in the construction and use of the cup-shaped article and also in the fabricating operation. The insert is generally disc-shaped with an annular concentric rib or ridge 22 on the upper surface spaced from the edge of the insert and a corresponding annular concentric groove 24 on the lower surface. The center portion of the insert is concave on the upper surface and convex on the lower surface, forming a distinct recess 26 in the upper surface and a protrusion 28 on the lower surface. The annular rib and protrusion impart substantial strength to the insert so that a relatively thin insert can be used to give substantial strength to the end of the cup-shaped portion 12. In addition to the added strength given to the end structure of the cup-shaped article, this insert forms a contact member for the piston rod of a brake shoe operating mechanism and, being of harder and more durable material than the remainder of the piston, greatly increases the life of the piston. While various materials may be used in the construction of the present article, in one embodiment cup-shaped portion 12 is made of aluminum and insert 16 is made of steel. This combination of materials provides a light weight article with a relatively thin yet strong end portion.

The steps of my process for fabricating the present cup-shaped article and the equipment used in carrying out this process are illustrated in FIGURES 6 through 9, the process being claimed in the parent application. The die consists of a heavy metal plate 30 having a die cavity 32 of substantially the size and shape of the outside configuration of the article, terminating at the upper surface in an outwardly extending beveled edge 33. The die plate is mounted rigidly in a press with the cavity facing upwardly as shown and a reciprocable cylindrical plunger 34 is mounted in the press thereabove in axial alignment with the cavity. The plunger moves to and from the die between the positions shown in FIGURES 6 and 7. The lower face 36 of the plunger has the same configuration as the upper face of insert 16, i.e., an annular concentric groove 38 and a centrally located protrusion 40 for interlocking with annular rib 22 and recess 26 respectively. The press used in the present fabricating operation is a standard press of the type used in conventional impact extrusion operations and includes a knockout pin 42 for ejecting the formed article from the die cavity as shown in FIGURE 8.

The blanks used in the present process consist of a disc-shaped blank or slug 44 of the metal, preferably wrought, which will form the cup-shaped portion 12 of the article and a blank of the same size and shape as the final insert 16. Slug 44 is slightly larger in diameter than the cavity of the die and is preferably in the wrought form, either stamped from rolled sheet or plate material or cut from extruded material, although cast slugs can be satisfactorily used. The insert blank is stamped from sheet material and formed by the stamping operation into the configura-

tion shown in the drawings. This insert is slightly larger in diameter than the diameter of the plunger so that the marginal edge will form groove 18 during the fabricating procedure and will hold the insert firmly in place in the bottom of the article.

In carrying out the fabricating operation, with plunger 34 in its raised position and pin 42 withdrawn, as shown in FIGURE 6, metal slug 44 is first placed on the die plate 30 with its lower edge resting on annular beveled edge 33 and the preformed insert blank is placed on top of slug 44 in approximate axial alignment therewith. The press is then actuated and plunger 34 advanced rapidly downwardly, protrusion 40 first engaging the insert at recess 26, centering the insert with the plunger, and said protrusion and annular groove 38 interlocking with the recess and annular ridge 22 to hold the insert in exact alignment with the plunger throughout the extruding operation. During the downward stroke of the plunger, insert 16 in effect becomes a part of the plunger in forming the metal slug 44 into the cup-shaped portion 12. As the plunger advances downwardly into the die cavity, protrusion 40 engages the upper surface of slug 44 forcing the metal to flow outwardly from the protrusion into groove 38, expelling the air therefrom and completely filling the groove so that complete metal to metal contact is obtained and a solid duplex metal end portion of the article is formed. The metal of the slug is extruded upwardly between the marginal edge of insert 16 and the sides of the die cavity thence between the sides of the plunger and the sides of the cavity, flowing inwardly immediately above insert 16 to form groove 18 for retaining the insert firmly in place in the bottom of the article. The marginal edge of slug 44 and the partially formed cup is elongated to form the finished side walls of the article. The thickness of the end member is determined by the travel of plunger 34 into the die cavity and the thickness of the side wall 14 is determined by the spacing between plunger 34 and the walls of the cavity. After plunger 34 has reached its lowermost position shown in FIGURE 7, it is reversed and withdrawn from the die and article and pin 42 is driven upwardly to eject the article from the die cavity, in the manner shown in FIGURE 8.

While the dimensions of the cup-shaped article 10 will normally be substantially correct upon the completion of the extrusion operation just described, if close tolerances are required for the diameter, a sizing operation may be necessary. A sizing machine is shown in part in FIGURE 9, consisting of a die plate 50 having a hole 52 therethrough of the exact diameter required for the article and a reciprocable cylindrical plunger 54 for forcing the article through the hole. The die plate and plunger are mounted in a suitable press and, with the plunger in its raised or withdrawn position, the cup-shaped article 10 is placed on the plunger or in hole 52 with the hollow interior facing the plunger. The article is advanced by the plunger through the hole reforming the article to the size of the die hole and is then ejected from the hole on the lower side of the die plate. The lower or forward end 56 of plunger 54 is preferably provided with the same configuration as the forward end of plunger 34 to assist in centering and retaining the article in exact alignment with hole 52 during the sizing operation.

The present invention is not limited to pistons but may be used advantageously in any application where a strong light cup-shaped article is required. Two metals are normally used in the construction of the present cup-shaped articles; however, different combinations of various materials may be used for certain applications. For example, the insert may be metal and the cup portion plastic or the insert of one kind of plastic and the cup portion of another plastic. The article has been described and referred to in the description of the fabricating process and in the claims with reference to the position shown in FIGURES 1, 2 and 3, i.e., with the closed end at the bottom. The article, however, may be fabricated and used in any other position.

A modified form of insert may be used to form the cup-shaped article and still obtain some of the advantages of the structure just described. For example, ridge 22 and groove 24 may be eliminated and a disc flat on both sides, with the exception of a recess corresponding to recess 26 used in place of the one shown. This centrally located recess and a protrusion on the plunger corresponding to the one shown at numeral 40 perform the centering operation during the forming process. Other changes and modifications can be made in my cup-shaped article and process for making the article without departing from the scope of the present invention.

I claim:

1. A piston, comprising circumferentially continuous walls of aluminum forming a hollow cylindrical member, a disc-shaped member joined integrally at its entire marginal edge to said walls at one end of said cylindrical member and being thicker adjacent its edges than at its center, an annular groove in the internal surface of said side walls adjacent said disc-shaped member, and a steel disc-shaped insert in contact with the inner surface of said disc-shaped member seated at its marginal edge in said groove and having on its upper surface a central recess and an annular ridge spaced from and concentric with said central recess and having on its lower surface a central protrusion and an annular groove spaced from and concentric with said central protrusion.

2. A cup-shaped metal article, comprising circumferentially continuous walls forming a hollow cylindrical member, a disc-shaped member joined integrally to said walls at one end of said cylindrical member and being thicker adjacent its edges than at its center, an annular groove in the internal surface of said side walls adjacent said disc-shaped member, and a disc-shaped insert in contact with the inner surface of said disc-shaped member seated at its marginal edge in said groove and having on its upper surface a central recess and annular ridge spaced from and concentric with said central recess and having on its lower surface a central protrusion and an annular groove corresponding in position to said annular ridge.

3. A cup-shaped metal article, comprising circumferentially continuous walls forming a hollow cylindrical member, a disc-shaped member of greater thickness at its periphery than at its center joined integrally to said walls at one end of said cylindrical member, an annular groove in the internal surface of said side walls adjacent said disc-shaped member, and a disc-shaped insert in contact with the inner surface of said disc-shaped member seated at its marginal edge in said groove.

4. A cup-shaped metal article, comprising circumferentially continuous walls of metal forming a hollow cylindrical member, a disc-shaped member joined integrally to said walls at one end of said cylindrical member, and being thicker adjacent its edges than at its center, and a disc-shaped insert of a harder metal than said walls in contact with the inner surface of said disc-shaped member having on its upper surface a central recess and an annular ridge spaced from and concentric with said central recess and having on its lower surface a central protrusion and an annular groove corresponding in position to said annular ridge.

5. A cup-shaped article, comprising circumferentially continuous metal walls forming a hollow cylindrical member, a disc-shaped member joined integrally to said walls at one end of said cylindrical member and being thicker adjacent its edges than at its center, and a disc-shaped insert of a harder metal than said walls in contact with the inner surface of said disc-shaped member having on its upper surface a central recess and having on its lower surface a central protrusion.

6. A cup-shaped article, comprising circumferentially continuous metal walls forming a hollow cylindrical member, a disc-shaped member of greater thickness at its

periphery than at its center joined integrally to said walls at one end of said cylindrical member and being thicker adjacent its edges than at its center, and a disc-shaped insert of a harder metal than said walls in face-to-face contact throughout with the inner surface of said disc-shaped member having on its upper surface a central recess and an annular ridge spaced from and concentric with said central recess.

7. A piston comprising circumferentially continuous walls forming a hollow cylindrical member, a disc-shaped member joined integrally to said walls at one end of said cylindrical member and being thicker adjacent its edges than at its center, an annular groove in the internal surface of said side walls adjacent said disc-shaped member, and a disc-shaped insert of another material seated on and in face-to-face contact with the inner surface of said disc-shaped member, said insert extending into said annular groove and having on its upper surface an axially aligned depression and on its lower surface a central protrusion.

8. A piston comprising a cylindrical side wall and a head having on its inner surface a centrally located indentation, a surrounding ridge and an outer indentation surrounding said ridge, and a reinforcing member secured marginally in said side wall and in complete surface engagement with the indentations and ridge on said head, said reinforcing member having a centrally located indentation for centering a cooperating push rod, and a surrounding ridge and an outer indentation surrounding said ridge.

9. A piston according to claim 8 wherein the piston, including its head, is formed of aluminum and the reinforcing member is formed of steel.

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