April 14, 1970 C. F. CARLSTROM 3,505,718

ONE-PIECE SHEET METAL HOLLOW BALL FOR BALL VALVES

Filed Jan. 15, 1968 2 Sheets-Sheet 1

Fig. 1

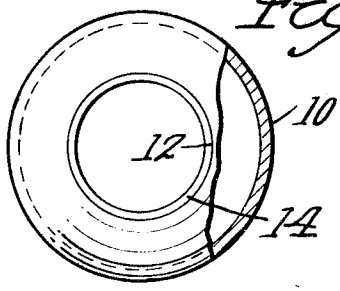


Fig. 2

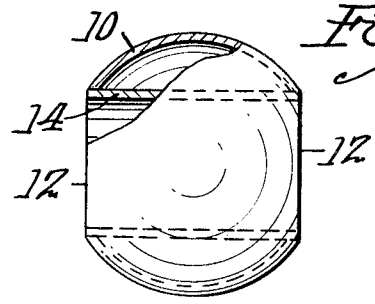


Fig. 3

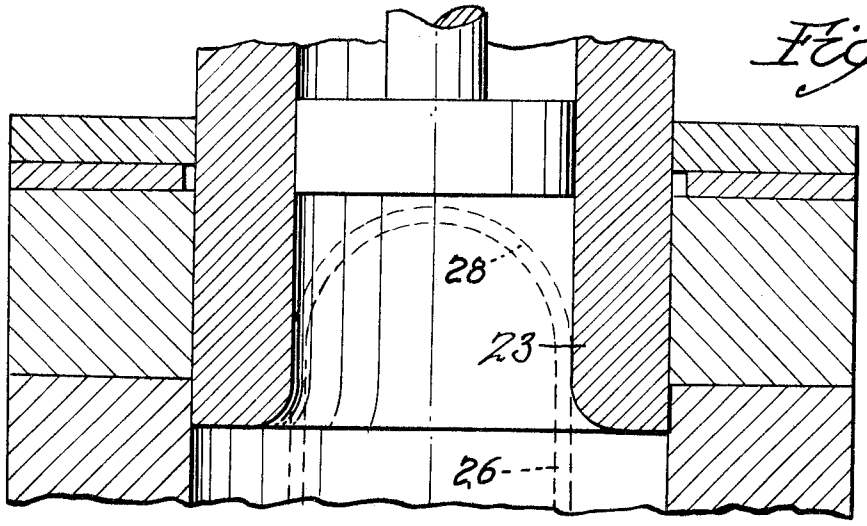
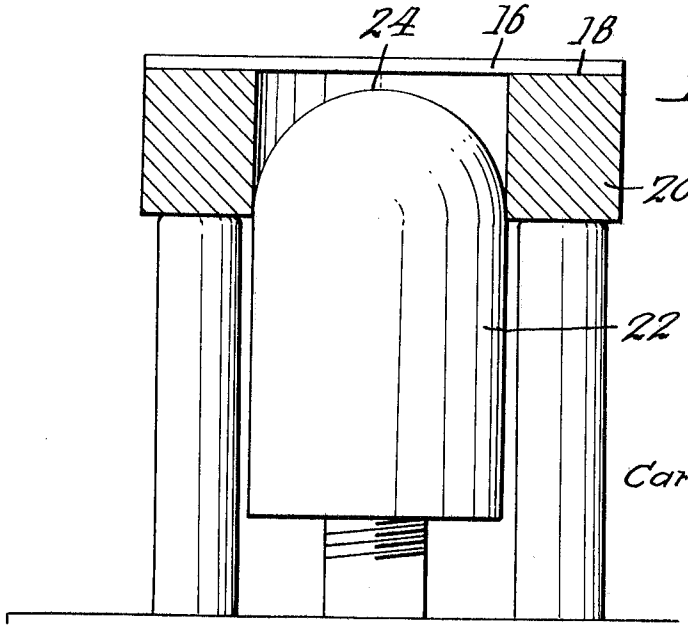


Fig. 4



Inventor
Carl F. Carlstrom

Charles R. Day

By Attorney

April 14, 1970 C. F. CARLSTROM 3,505,718

ONE-PIECE SHEET METAL HOLLOW BALL FOR BALL VALVES

Filed Jan. 15, 1968 2 Sheets-Sheet 2

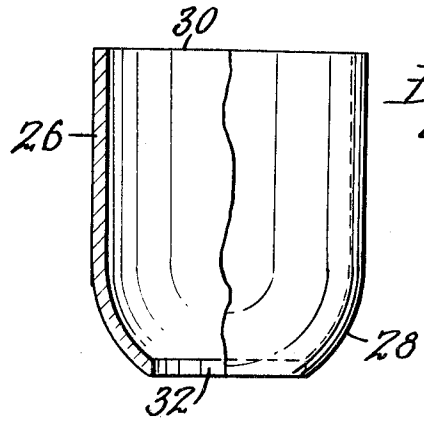


Fig. 5

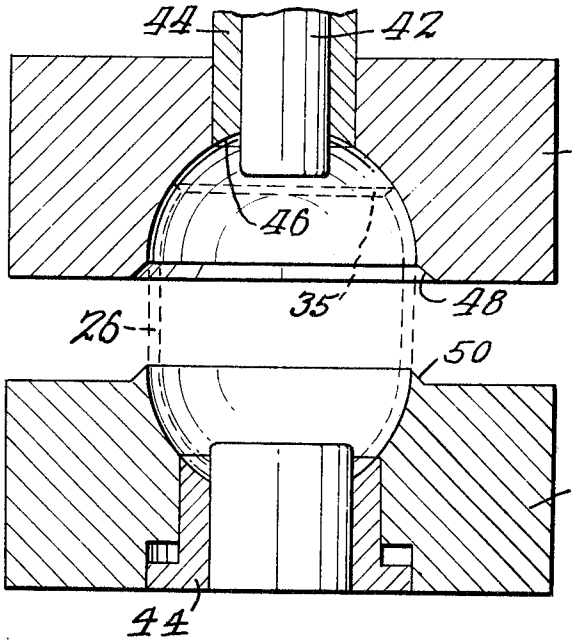
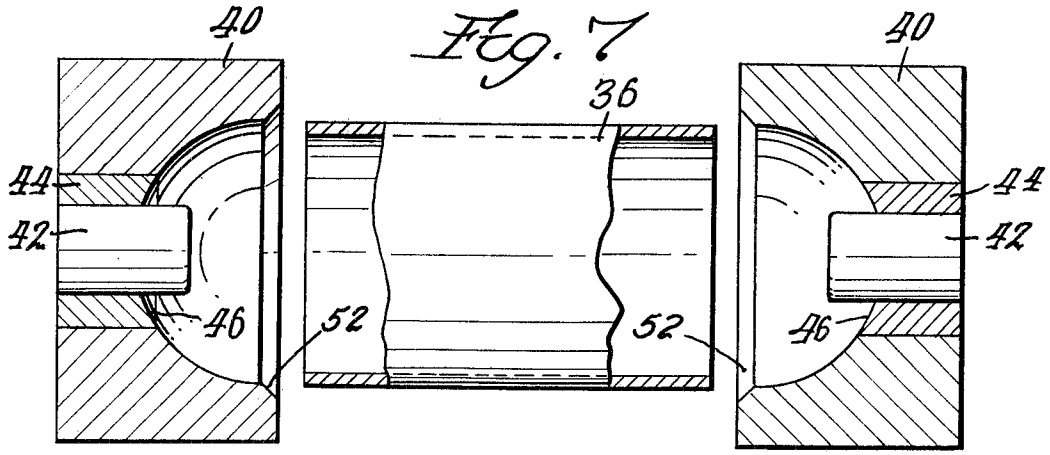


Fig. 6

Fig. 7



United States Patent Office 3,505,718 Patented Apr. 14, 1970

3,505,718

ONE-PIECE SHEET METAL HOLLOW BALL FOR BALL VALVES

Carl F. Carlstrom, Shrewsbury, Mass., assignor to General Industries, Inc., Worcester, Mass., a corporation of Massachusetts

Filed Jan. 15, 1968, Ser. No. 697,727
Int. Cl. B21d 53/00
U.S. Cl. 29—157.1 3 Claims

ABSTRACT OF THE DISCLOSURE

This invention relates to a new and improved ball for ball valves, and it comprises a single piece of sheet metal formed into a hollow ball perfectly smooth at the exterior thereof and forming a very inexpensive and lightweight ball for ball valves. This ball can be provided with a flow passage sleeve or it can be used in some instances without.

The sheet metal blank from which the hollow ball is made may be a flat sheet of suitable metal or it may be in the form of a single piece of tubing open at both ends.

This invention relates to a one-piece hollow ball for use as a ball valve and in the present case the invention resides in part in the fact that the same comprises originally a single piece of sheet metal which may be either in the form of a flat piece of metal of suitable type or a single piece of tubing open at both ends.

The prior art in this case is represented by U.S. Patent 3,246,873 dated Apr. 19, 1966 and U.S. Patent 3,339,259 dated Sept. 5, 1967, which show how a somewhat similar hollow ball for a ball valve may be made of two pieces of metal. The present invention is an improvement over these patents because a ball of equal and even greater utility and efficiency may be made by following the present invention to form a ball of a single piece of sheet metal, either from a flat blank, or from a tube.

The manner in which the new ball is made of the one-piece of sheet material is to form the same as by for instance drawing down a flat blank so that a tubular member is formed having a crown at one end, the other end being open, punching a hole centrally of the crown, thereafter bending in the open end of the drawn-down tubular member to a semi-spherical condition, and then punching this area centrally in order to form a second hole comparable to the aforesaid hole, at the opposite side of the now formed ball.

In the case of a tube, the ends thereof are gradually turned in by appropirate dies until the ball is formed and then the ends, i.e., opposite sides of the ball, are punched to form the flow openings for the ball.

If desired or found necessary, sleeves may be welded into the ends of the hollow ball made by either method so as to form a straight cylindrical flow passage but in many cases such a sleeve is not necessary.

Other objects and advantages of the invention will appear hereinafter.

Reference is to be had to the accompanying drawings in which:

FIG. 1 is a view in elevation illustrating a ball made according to the present invention, part being broken away and in section;

FIG. 2 is a view in elevation looking in the direction of arrow 2 in FIG. 1, part being in section;

FIG. 3 illustrates a die part used in the drawing step from a flat sheet of material, and shows the step blank in dotted lines;

FIG. 4 is a section of the other die part used to form the step blank;

FIG. 5 illustrates the step blank, part being in section;

FIG. 6 is a section of the finish dies, and

FIG. 7 illustrates the manufacture of the ball from tubular material, parts being in section.

As shown in FIGS. 1 and 2, the one-piece hollow ball **10** of the present invention comprises what would be a perfectly spherical hollow ball having a relatively thin outside wall except for openings at each side thereof as **12**. The openings **12** are for the passage of the material controlled by the valve. If desired, a sleeve as indicated at **14** may be applied to this ball but in many cases the sleeve is not necessary as the flow may be even, although directly through the ball, when the valve is open, even through no flow passage sleeve is present.

In order to form this ball from flat sheet material **16**, FIG. 4, the latter may be set or cut on an annular surface **18** on a tool part **20**. An appropriate die may be utilized for the deep drawing operation as for instance, an elongated punch such as at **22**, having a hemispherical end **24**. The flat sheet **16** is drawn into a step blank of tubular form conforming to the exterior surface of the die **22** in the female die **23**, FIG. 3. This die corresponds to and complements the die parts **20** and **22**, and the latter are moved relative to die part **23** to accomplish the result stated. This step blank then appears as in dotted lines, FIG. 3, and as shown in FIG. 5, comprising an elongated tubular member **26** having a semispherical crown **28** and an open circular end at **30**. A central opening **32** is punched out in the crown.

Thereafter tools shown at **34**, FIG. 6, or equivalent, are utilized to bend and flow the metal in the area at the open end **30** of the tubular member **26** to achieve a semispherical shape having a diameter co-existent with that of the crown **28**. It is preferred that any resultant opening left in this area after the bending operation, shall be less than the hole at **32**, and then properly punched to conform thereto.

This action is illustarted in part way condition in dotted lines in FIG. 6, as at **35**. If the leader **42**, which is of peg-like form and solid, is present, the edge at **35** of the step blank engages it prior to die closed condition and this causes "back pressure" to be applied to the metal. The effect is to stop the closing flow of the metal, thickening it somewhat. This action has been found to completely do away with any and all tendency of the metal to ruffle or fold.

Slidable ejection sleeves of convenient and effective construction are provided as shown at **44** to make sure the finished ball is ejected from the die parts, and these sleeves have seats shaped as at **46** to conform to the dies **34**, to form the ball.

The ball of FIGS. 1 and 2 has now been formed and by utilizing correctly designed dies, etc. there are no folds either inside or outside although the outside surface is finished in order to provide an extremely smooth surface in cooperation with the valve seat in the ball valve in which the device will be utilized, and a handle of any kind may be applied to the ball for turning it.

Referring to FIG. 7 there is shown a tubular member of sheet-like material indicated at **36**, the same having both ends open. Appropriately formed dies e.g. such as shown at **40**, **40** are then applied with force to the ends of the tubular member, the same being then bent and flowed in, similarly to the action of dies **34**, to form substantially closed portions of a spherical ball of identical diameter. The leaders **42** are the same as before described and act in the same way, to inhibit the flow of the metal and to provide openings in the ball. The ends (i.e. and sides of the ball), may be punched in the areas of these openings, or at the former openings of the tube, to provide equal sized flow openings e.g. such as at **12**, FIGS. 1 and 2. Ejection sleeves **44** are also used as before.

The tools **34** and **40** may be provided with beveled edges as at **48**, **50** and **52** to assist the work to enter the tools.

In some cases it has been found that it may be preferable to provide an interior member acting in the manner of an anvil, resisting the thrust of the tools above described. This may comprise an elastometric device of a predetermined suitable consistency, and even explosives or hydraulic pressure may be utilized for this purpose. The consideration as to use of such interior devices may depend upon the thickness of the blanks and the particular metals of which they are made.

In any event it will be seen that a virtual one-piece sheet metal ball for a ball valve is very inexpensively manufactured. These balls do not have any ruffled areas adjacent the edges of the openings **12**, as might be expected, and by finishing off the exterior surface and punching the openings **12** to correspond with each other and to the size desired for the particular valve use to which it is to be put, a very inexpensive hollow ball for a ball valve can be provided through the use of an original flat blank, as at **16** in FIG. 3 or tubular as at **36** in FIG. 7.

I claim:

1. The process of making a one-piece sheet metal ball for ball valves comprising deep drawing down a flat blank to form a step blank of generally cylindrical shape, forming a semispherical crown at one end thereof the opposite end of the step blank, formerly adjacent the edges of the flat blank, being open, forming an opening centrally of the crown, and then forcing in the rim of the open end of the step blank to a degree to form a generally spherical conformation, and simultaneously with forcing in the rim, restricting the flow of metal inwardly to a predetermined extent.

2. The process recited in claim **4** including the step of forcing in the metal of the crown while restricting the inward flow of the metal in this area.

3. The process recited in claim **1** wherein the step of restricting the flow of the metal is accomplished by positioning an obstruction in the flow of the metal.

References Cited

FOREIGN PATENTS

1,185,434 1/1965 Germany.

M. CARY NELSON, Primary Examiner

M. O. STURM, Assistant Examiner