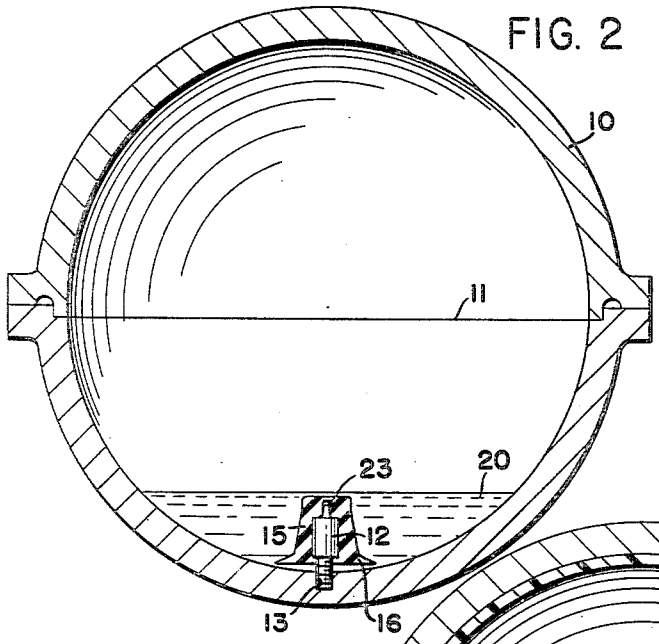
May 3, 1960 J. C. CHUPA 2,935,320

INFLATABLE VALVED ARTICLE

Filed May 12, 1954

FIG. 2



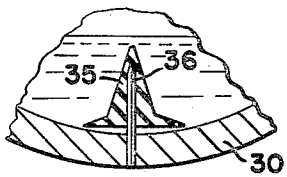
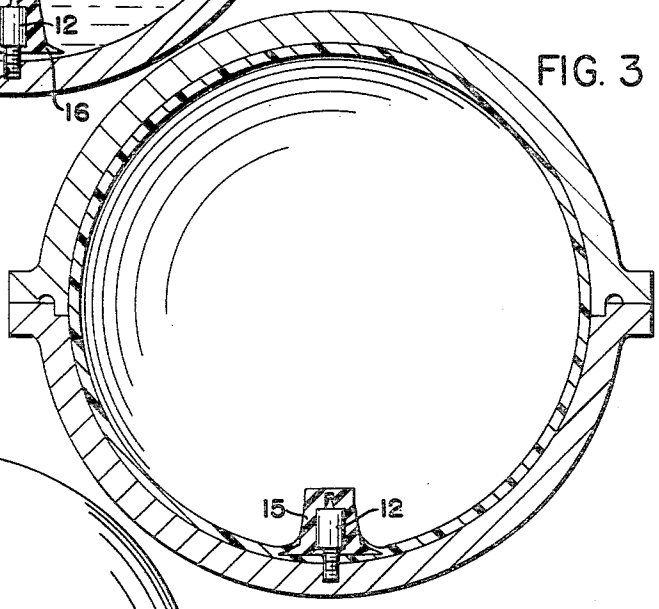


FIG. 2a

FIG. 3



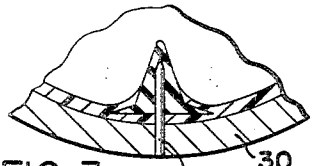


FIG. 3a

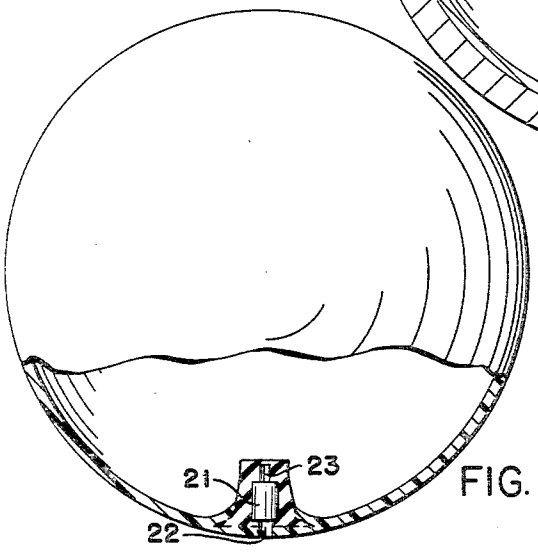


FIG. 1

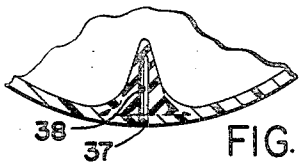


FIG. 1a

INVENTOR.
JOHN C. CHUPA

BY
Ely, Frye & Hamilton
ATTORNEYS

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INFLATABLE VALVED ARTICLE

John C. Chupa, Sandusky, Ohio, assignor to The Barr Rubber Products Company, Sandusky, Ohio, a corporation of Ohio

Application May 12, 1954, Serial No. 429,161

3 Claims. (Cl. 273—58)

The present invention relates to inflatable balls or similar inflatable objects which are provided with a valve structure opening through one portion of the wall of the inflatable object.

The invention is particularly applicable to inflatable objects designed to be inflated through use of an inflating needle. However, the invention may also be employed where other inflating methods are contemplated, as will become clear below.

An object of the invention is to provide a rugged, durable inflatable object which is inexpensive to manufacture and which has a valve means which is simple and foolproof in operation.

A further object of the invention is to provide a self-sealing valve which has an unusually long service life and which is particularly easy to use because of the provision of a lubricant-sealant valve material as disclosed below.

These and other objects and advantages of the invention will be more clearly understood from a reading of the following specification and the accompanying drawings in which:

Figure 1 is a partially broken-away view of an inflatable ball made according to the present invention.

Figure 1*a* is a view similar to the broken-away portion of Figure 1, showing another inflatable ball made according to the invention and employing an alternative form of valve;

Figure 2 is a cross-sectional view of a mold set-up employed in producing the ball shown in Figure 1;

Figure 2*a* is a partial cross-sectional view of a mold set-up employed in producing the ball shown in Figure 1*a*;

Figure 3 is a view similar to Figure 2 but at a later stage of manufacture;

Figure 3*a* is a view similar to Figure 2*a* but at a later stage of manufacture.

Shown in Figure 2 is a mold fabricated preferably from aluminum. The illustrated mold is spherical in shape in order to produce balls, but it will be apparent that a variety of other shapes may be formed. The parting line of the mold is shown at **11**. In the wall of one of the mold halves, a mounting pin or peg **12** is provided, the peg **12** being fixed to the mold wall in any suitable manner. In Figure 2 the peg **12** is shown as threadedly mounted in a tapped hole **13** formed in the wall of the mold.

A valve body **15** is mounted on the peg **12** within the mold **10**, as shown in Figure 2. This valve body may be conventional in shape, being adapted to receive a valve plug which is pressed into the seat formed by the peg **12** after fabrication of the molded article. The outer end or skirt **16** of the valve body is slightly spaced from the mold wall; for a ball of conventional size, this space may be about 1/16 inch.

In practicising the present invention, a suitable synthetic plastisol is preferably employed as the molding material. One formulation which has been found suitable for molding articles of the type described is set forth below:

	Parts by weight
High molecular weight polyvinyl chloride in form of a fine white powder, specific gravity approx. 1.4	60
Polyvinylchloride acetate copolymer, 96% + vinyl chloride, less than 4% vinyl acetate	13⅓
Triethylene glycol di-(2-ethyl hexoate)	13⅓
Dioctyl phthalate	13⅓
Cadmium naphthenate dissolved in plasticizer type carrier, approx. 1:1 (stabilizer)	2
Titanox (color)	3

The mix **20** may be deposited in the mold **10** as shown in Figure 2. The mold is then rotated around several axes of rotation in order to cause the mix to be distributed evenly around the inside surface of the mold. The amount of mix provided in the mold is sufficient to cause the wall thickness of the distributed mix to exceed the spacing between the outer end of the valve body and the mold wall. Thus, as shown in Figure 3, the outer wall-adjoining end of the valve body is surrounded by the wall of distributed mix.

The rotating mold is then heated to a temperature of about 165° C., the resin being thereby caused to gel and fuse in the conformation of the mold. Final heat of fusion is not necessarily applied during rotation of the mold, although generally it is most expedient to continue mold rotation during both gelling and fusing. The cast article is then stripped from the mold and allowed to cool. The conformation of the final cast product is shown in Figure 1. A resilient plug **21** is forced through the orifice or opening **22** and is received within the inner seat of the valve body formed by the peg **12**.

The valve body **15** is preferably also formed as a plastisol which has been pre-molded to shape prior to the above described operations. The nature of these plastisols is such that at least partial fusion between the valve body and the article wall will occur when the mold **10** is heated in order to set the article wall.

The plug **21** may also comprise a pre-cast plastisol element. The valve structure is adapted to receive an inflating needle through the orifice **22**, the needle puncturing the plug **21** and passing down through a further needle guide passage **23** and through the inner end of the valve body to communicate directly with the interior of the ball when the ball is being inflated. When the needle is withdrawn, the soft plug **21** expands inwardly to close off the passageway made by the needle.

It will be seen that the manner of using this self-sealing valve is somewhat similar to the use of conventional self-sealing valves which employ a soft plug and are adapted to be inflated with an inflating needle. Such valves of the prior art have been relatively short-lived because the valve plug soon loses its life and does not completely seal the valve. Furthermore, such prior art products have been very difficult to use in that the compressed plug is very difficult to puncture manually, even when a sharp needle is employed. These valves were frequently poorly bonded or adhered to the wall of the cast body, and the exposed edge of the cemented or welded juncture was particularly subject to wear and failure.

The present valve is relatively easy to penetrate and has a long service life compared to the valves of the prior art. A particular advantage of the valve is that the plug **21** may be made from a synthetic plastisol resin with a relatively high plasticizer content which serves, on the one hand, to lubricate a penetrating needle, and, on the other hand, to render more positive the self-

sealing operation of the plug. The tendency of the plastisol to bleed toward the surface of the plug is apparently responsible in large measure for these highly desirable characteristics. An exemplary formula having the relatively high plasticizer content which it is desirable to use in making the sealing portions of the valve (in this case the plug 21) is set forth below:

	Parts by weight
High molecular weight polyvinyl chloride in form of a fine white powder, specific gravity approx. 1.4	40
Polyvinylchloride acetate copolymer, 96% + vinyl chloride, less than 4% vinyl acetate	20
Triethylene glycol di-(2-ethyl hexoate)	20
Dioctyl phthalate	20
Cadmium naphthenate dissolved in plasticizer type carrier, approx. 1:1 (stabilizer)	2
Titanox (color)	3

Thus, it will be seen that I have provided for the manufacture of a self-sealing valve which has an unusually long service life, which remains convenient to use even after long periods of shelf storage and in which the valve body is not directly exposed but rather is contained within and preferably fused with the wall of the cast article. Further, the invention reduces manufacturing costs and reduces the incidence of rejects by eliminating the necessity of separate sealing or welding or vulcanizing operations which formerly had to be performed in order to affix the valve body on the wall of the cast article.

In Figures 1*a*, 2*a* and 3*a*, I have illustrated an alternative form of the invention which also provides an article having a valve adapted to be used with an inflating needle. A mold **30** is provided similar in all respects to the mold **10**. A valve housing **35** is mounted on a needle **36** which is press-fitted into the wall of the mold **30**. The valve housing **35** is of an unconventional shape and is not adapted to contain a plug equivalent to the plug **21**. The valve housing **35** is preferably made from a synthetic plastisol resin having a relatively high plasticizer content, the formula given in connection with the plug **21** being suitable for this purpose. In all other respects, the example of the invention which is illustrated in Figures 1*a*, 2*a* and 3*a* is similar to the previous description of Figures 1, 2 and 3.

It will be seen that the valve shown in Figures 1*a*, 2*a* and 3*a* is simplified in that no plug insert is necessary. As seen in Figure 1*a*, the final product is adapted to receive an inflating needle through the orifice **37** and the passage **38**. The needle is simply inserted through the orifice and passage and penetrates the inner tip of the valve housing. When the inflating needle is withdrawn, the inner tip of the housing acts as its own self-sealing closure. Again, with the relatively high plasticizer content of the valve housing, lubrication is provided for the easy penetration of the needle and for more positive self-sealing operation of the valve. Also, in this example as in the previous example, a valve is provided which is not directly exposed but rather is contained within and fused with the wall of the cast article. It will be obvious that this feature may be provided in articles which contain valves which are not designed to be employed with an inflating needle. For example, a conventional inner tube type valve may be mounted in a housing equivalent to the housings **15** and **35**, and may be contained within and fused with the wall of the cast article in the manner disclosed above, access to the middle portion of the valve being had through an orifice equivalent to the orifices **22** and **37**, such orifice being formed by a mold pin or peg equivalent to the pins **12** and **36**.

Still other alternatives to the specifically disclosed examples of the invention will readily occur to those familiar with the manufacture of cast air-inflatable articles. Accordingly, the scope of the invention is not to be restricted to the details of the above disclosure but is to be defined by the following claims:

What is claimed is:

1. A flexible air-inflatable cast article comprising an air-envelope consisting essentially of a resin and a non-volatile plasticizer therefor, valve structure projecting within said air envelope inwardly from the wall of said air envelope, at least a portion of said valve structure consisting essentially of a resin and a non-volatile plasticizer therefor, the percentage content of plasticizer of said portion being substantially higher than the percentage content of plasticizer of said air-envelope, the outer wall-adjoining end of said valve structure being embedded in the wall of said air envelope and being at least partially fused therewith and an opening extending from the outside of said wall into the interior of said valve structure.

2. A flexible air-inflatable cast article formed as an air envelope comprising a seamless wall consisting essentially of a resin and a non-volatile plasticizer therefor, valve structure projecting within said air envelope inwardly from said wall, the outer wall-adjoining end of said valve structure being embedded in said wall and being at least partially fused therewith, said valve structure comprising a body consisting essentially of a resin and a non-volatile plasticizer therefor, the percentage content of plasticizer of said body being substantially higher than the percentage content of plasticizer of said wall, a passage extending from the outer wall-adjoining end of said body inwardly toward but not to the inner free end of said body, and an opening through the outside of said wall communicating with said passage.

3. A flexible air-inflatable cast article formed as an air envelope comprising a seamless wall consisting essentially of a resin and a non-volatile plasticizer therefor, valve structure projecting within said air envelope inwardly from said wall, the outer wall-adjoining end of said valve structure being embedded in said wall and being at least partially fused therewith, said valve structure comprising a body consisting essentially of a resin and a non-volatile plasticizer therefor, the percentage content of plasticizer of said body being substantially higher than the percentage content of plasticizer of said wall, an open passage extending from the outside of said wall inwardly through the outer wall-adjoining end of said body toward but not to the inner free end of said body.

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