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F. G. SMITH

3,517,682

INFLATION MEANS

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FIG. 1

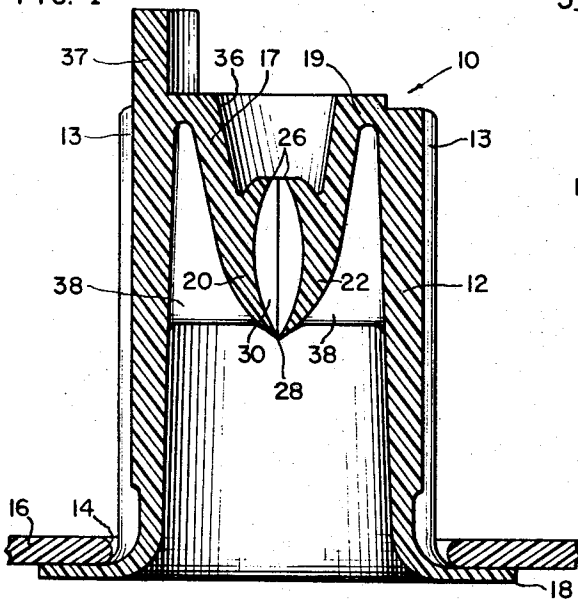


FIG. 2

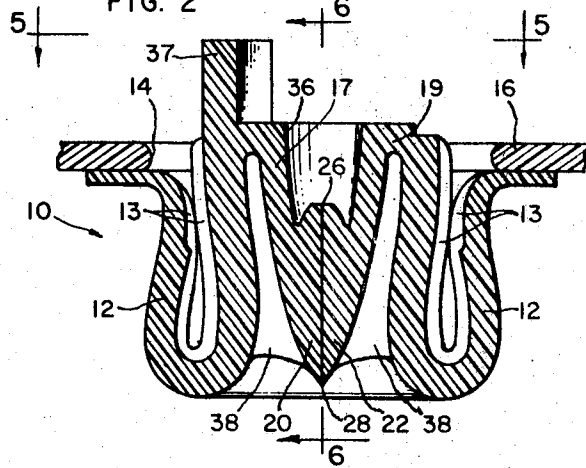


FIG. 6

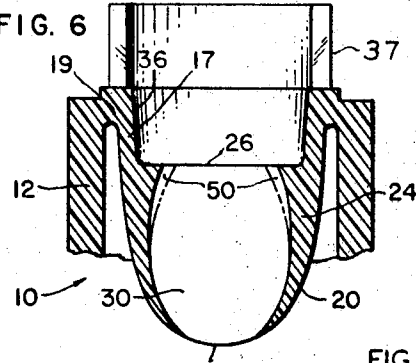


FIG. 3

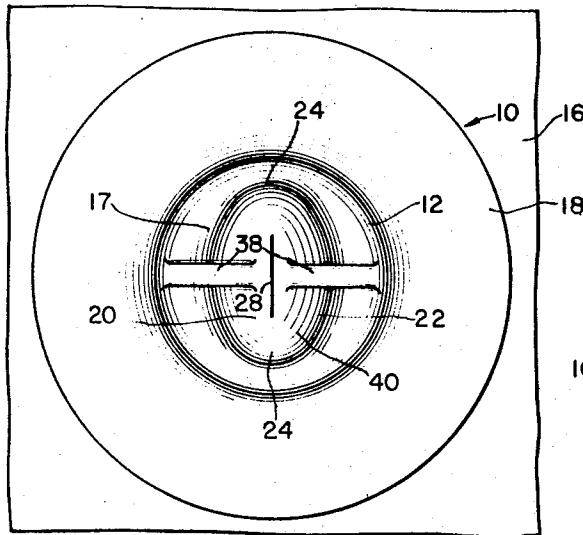


FIG. 7

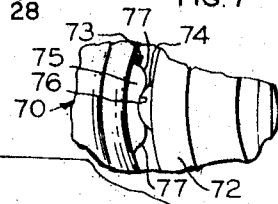


FIG. 5

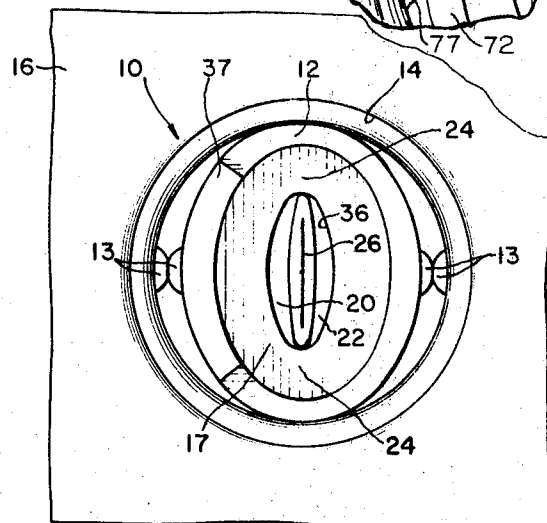
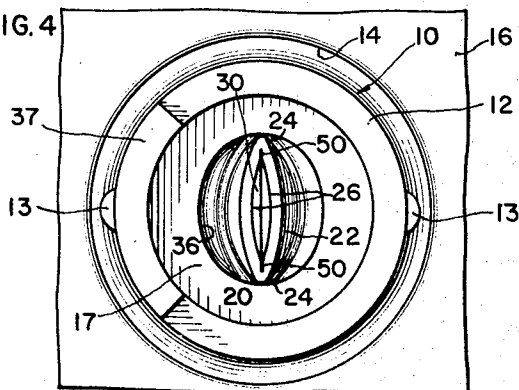


FIG. 4



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INFLATION MEANS

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19 Claims

ABSTRACT OF THE DISCLOSURE

An inflation means for introducing air into an inflatable article comprising an elastic inflation tube extending from the inflatable article. The inflation tube includes therewithin an inner tubular skirt carrying a pair of suction cup valve elements providing an air passageway therebetween except when the valve elements are pressed together. A relatively stiff strut or web joins the substantial center of the back of each suction cup to the wall of the inflation tube so that pressure applied to the sides of the inflation tube forces the suction cups together to close off the air passage. The central back of each suction cup is otherwise substantially free of connection to the inflation tube so the suction cup may freely collapse into engagement with the other suction cup. The portion of the inflation tube including the suction cup valve means is insertable within the inflatable article and within a lower portion of the inflation tube which joins the inflatable article. The inflation tube has external ribs lying in the same plane as the struts. When the inflation tube is inserted into the article, the ribs abut each other to press the suction cups tightly together. The pressure exerted by the ribs is conveyed through the struts to maintain the suction cups in their engaged relation.

BACKGROUND OF THE INVENTION

In Gassaway Pat. 2,734,308, assigned to the assignee of the present invention, there is disclosed and claimed an essentially cylindrical inflation means comprising an inflation tube attached to an inflatable article such as a beach ball, or the bladder of a football, basketball or the like. The inflation tube including a valve means can be urged reentrantly within the inflatable article in order to avoid the undesired protrusion of the inflation means during use of the article. The inflation means includes valve means comprising a pair of suction cup closure elements wherein positive action is required to close the valve means. To produce closure, the side of the inflation tube is grasped, e.g. between thumb and forefinger, whereby to force the suction cups into mutually engaged relation. Positive action is also required to disengage the suction cups whereby to open the valve means. In order to open the valve means, pressure is exerted on the inflation tube at right angles from the location required for closure, or adjacent the lateral peripheral edges of the suction cups.

The suction cups desirably retain an engaged relationship for an extended period of time, especially when the valve means is inserted reentrantly within the inflatable article. However, the suction cups are supported within the inflation tube with the back sides of the suction cups being joined to the inflation tube by a substantially continuous annular support means immediately behind the suction cups. The at-rest configuration of the inflation tube and the means supporting the suction cups is primarily circular, bringing about stresses which may sometimes cause leakage and opening of the valve means.

SUMMARY OF THE INVENTION

In accordance with the present invention, an inflation means includes an elastic inflation tube and an inner skirt carrying at its inner end suction cup valve means. Relatively stiff struts or webs join the substantial center of the back of the suction cups to the wall of the inflation tube, but the central back of the suction cup on either lateral side of the strut or web is substantially unrestrained by support means. The suction cup may therefore more easily assume and maintain a flattened or engaged relation with the other suction cup.

The inflation tube may be reentrantly introduced into the interior of the inflatable article, and has external ribs or thickened portions lying in the same plane as the struts. With the inflation tube in the reentrant position, the ribs folded on each other exert pressure against the struts to hold the suction cups in engaged relation. As mentioned, the suction cups are free to assume and maintain the flattened engaged relation and also the surrounding inflation tube may more readily assume an oblong or elliptical configuration. It is found that the ribs are effective to hold the vacuum cups flat against each other indefinitely, and also serve to flatten the suction cups against each other when the tube is pushed into the article.

It is accordingly an object of the present invention to provide improved inflation means including a valve means of simple construction which can be maintained in engaged relationship for an extended period of time.

It is another object of the present invention to provide improved inflation means including valve means having improved means for closing the valve means.

It is a further object of the present invention to provide improved inflation means for an inflatable article, which inflation means is reentrantly insertable within the article and has valve means closed by presser means of the inflation means.

The subject matter which I regard as my invention is particularly pointed out and distinctly claimed in the concluding portion of this specification. The invention, however, both as to organization and method of operation, together with further advantages and objects thereof, may best be understood by reference to the following description taken in connection with the accompanying drawings wherein like reference characters refer to like elements.

DRAWINGS

FIG. 1 is a cross section of an inflation means in accordance with the present invention in a first position of said inflation means;

FIG. 2 is a cross section of an inflation means in accordance with the present invention in a second or reentrant position of said inflation means;

FIG. 3 is a bottom view of the inflation means according to the present invention when in the position illustrated in FIG. 1;

FIG. 4 is a top view of the inflation means according to the present invention when in the position illustrated in FIG. 1;

FIG. 5 is a top view taken along line 5—5 of FIG. 2;

FIG. 6 is a vertical section taken along line 6—6 of FIG. 2; and

FIG. 7 is a top view of inflation means forming an alternate embodiment of the invention.

DETAILED DESCRIPTION

Referring to the drawings, an inflation means 10 forming one embodiment of the invention comprises an outer inflation tube 12 having a pair of external ribs 13 extending therealong. The inflation means according to the present invention may be formed or molded from elastic

thermoplastic resin or rubber or similar elastic material. The inflation tube extends through an aperture 14 in inflatable article 16, and the inflation means is provided with a flange 18 which is cemented or vulcanized to the inside wall of the inflatable article 16 so as to form an air-tight sealed joint therebetween. Alternatively, the inflation means may be formed integrally with the inflatable article.

An inner tubular or skirt member 17 joined integrally with the outer end of the tube 12 by an annular junction portion 19 supports at its lower end mated closure members in the form of elastic collapsible concave-faced suction cups 20 and 22 arranged in face-to-face relationship within the inflation tube. Suction cup valve apparatus of the present general type is set forth and claimed in Gassaway Pats. 2,802,608, 2,674,064 and 2,623,663, all assigned to the assignee of the present invention, as well as in the aforementioned Pat. 2,754,308. The suction cups have their lateral peripheral margins or edges 24 arranged in sealed abutment with one another and these peripheral margins are preferably integral with each other. However, the central portions of the outer end peripheral margins 26 are normally spaced apart a slight distance, as illustrated in FIG. 4. The margins 26 and inner end margins 28 are movable laterally apart as by application of a slight side pressure to define an air passage 30 therebetween. One of the lips 28 may have embedded fully therein a magnet or magnet particles and the other lip have paramagnetic particles or members fully embedded therein. The lips 26 may be similarly constructed. The passage 30 normally is slightly open except at the inner end and the passage may be increased in cross sectional size by applying pressure to the inflation tube, for example, in the plane of the lateral peripheral margins 24.

The peripheral margins of the two suction cups coincide to a degree whereby force applied between the backs of the suction cups will cause flattening or engagement thereof to close the passage 30 to the flow of air. It will be realized that the suction cups 20 and 22, when collapsed against one another, will squeeze the air from the passage intermediate their faces. With the air thus eliminated, air pressure acts upon the rear or back faces of the suction cups and tends to maintain them in abutment position. In practice, the collapse of the suction cups into full engagement requires positive or conscious effort applied to the sides of the inflation tube. In similar manner, once the valve is closed, a positive or conscious effort is applied to break the vacuum between the suction cups and open the valve. It should also be noted that the air pressure acting on the suction cups from below is the greater-than-atmospheric pressure within the inflatable article and aids in keeping the valve closed when the article is inflated.

The inner end peripheral margins 28 of the suction cups are preferably initially joined during the manufacture of the inflation means by a thin imperforate membrane which is rupturable by pressure subsequently applied externally to the sides of the inflation tube, for example in the direction of lateral peripheral margins 24. The membrane may be made quite thin when the inflation means is initially molded or otherwise formed with the molding core forming the interior faces of the cups being withdrawn between the margins 26. When the inflation means is to be used, or, often when the core forming the passage 30 is withdrawn, the membrane is ruptured and thereafter aids in forming a perfectly matching closure at inner peripheral end margins 28.

The inner tubular member 17 is suitably somewhat oblong or elliptical in cross section as best shown in FIG. 4, and blends at its lower extremity into the back and outer side edge of each suction cup 20 and 22. The elliptical cross section of member 17 has its long or major axis in the direction of lateral margins 24 and the walls of the member 17 are much thicker adjacent the central portions of the suction cups than at the side edges of the suction cups. The inside of member 17 provides an outer aperture 36 for the inflation tube. The outer end of the

inflation tube 12 is provided with a pull tab 37 serving as a handle for manipulating the inflation tube as herein-after described.

According to an important feature of the present invention, the inflation means is provided with relatively stiff strut means comprising a fin or web 38 joining the substantial center of the back of each suction cup to the wall of the inflation tube. This web may be formed of the same material as the rest of the inflation means but is suitably planar and stiff, and extends along the approximate center lines of the backs of each suction cup to the directly opposite inner wall of the tube 12 of the inflation means so as to perpendicularly join the latter. The back of the suction cup on either lateral side of the web 38 is free of annular connection to the inflation tube as indicated at 40 in FIG. 3 so that the suction cup is unrestrained and quite free to collapse into a flattened position when compressed against the opposite suction cup. The webs 38 suitably extend not only directly from the back of the suction cups to the wall of the tube 12, but they also suitably extend along the tube 12 to the annular member 17 and annular portion 19. The webs desirably also extend inwardly to near the inner peripheral margins 28 of the suction cups as best shown in FIG. 2.

The ribs 13 and webs 38 in effect stiffen and make thicker the adjacent portions of the inflation tube 12. As indicated in FIG. 2, the inflation tube 12 is insertable re-entrantly within the interior of the inflatable article 16. In this position, the major portion of the length of the tube 12 is doubled within itself in the inflatable article and the ribs are folded on themselves to press the cups flatly together through the webs 38. The ribs and webs all lie in the same plane and the ribs force and maintain the suction cups 20 and 22 flatly together. As herein-before indicated, since there is no annular support behind suction cups 20 and 22, the suction cups are freer to assume and maintain a flattened engaged position and can therefore retain the suction therebetween for a more extended period of time. It is noted in this connection that the aperture 36 is of somewhat elliptical configuration when viewed from the end of the member 17 as in FIG. 4. As best shown in FIGS. 4 and 5, outer end portions 50 of the margins or lips 26 of the cups 20 and 22 are formed by joining these portions of the cups integrally together with somewhat thin webs or membranes during molding and then slicing the webs apart as a molding core forming the inner surfaces of the cups is withdrawn from between the cups. The core has a thin shank portion extending between the portions of the margins 26 between the end portions 50, and has knife-edged shoulders which slice the webs to form the end portions as the core is withdrawn.

In operation, the inflation tube 12 is first extended to the position illustrated in FIG. 1, if necessary, by grasping tab 37 and pulling the inflation tube outwardly. The tube 12 is held between the thumb and forefinger and pressed, if desired, to further open the suction cups and breath is forced into outer aperture 36. When the breath is exhaled into the inflation tube, the tube is compressed. Then, between breaths, the inflation tube is released to permit the suction cups 20 and 22 to move toward one another. The sequence is repeated to the extent desired to inflate the article, and the tube then is pressed endwise into the article to its reentrant position. As the tube is so moved, the ribs 13 are folded on themselves and press the suction cups flatly together through the ribs 13. The laterally outer portion of the tube is stretched when the laterally inward portion of the tube is pressed thereinto and the tension of this stretching presses the folded ribs laterally inwardly and holds them in these positions holding the cups tightly together. The ruptured membrane at the inner peripheral margins 28 helps maintain accurate closure between the inner ends of the suction cups. Moreover, air pressure within the inflatable article helps maintain the cups in closed relation inasmuch as

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this pressure communicates to the inner end and back of the suction cups on either lateral side of the aforementioned strut means or webs.

To deflate the article, the tab 37 is grasped and the inflation tube 12 is pulled out. The inflation tube then is pressed together at points thereon adjacent the portions 50 to move the cups 20 and 22 apart and permit the air to flow from the article into the atmosphere. It will be noted that, with the tube 12 in its extended position, the lips 26 are slightly open, vacuum between the cups is broken and deflation is effected rapidly by pressure on the tube to hold the lips 26 and 28 further open.

EMBODIMENT OF FIG. 7

An inflation means 70 is identical with the inflation means 10 except that an inflation tube 72 corresponding to the inflation tube 12, instead of having the pair of ribs 13, which are of uniform transverse cross-sectional shape throughout their lengths, has a pair of ribs 73, which have upper rib portions 74 extending about one-half of the length of the tube 72 and lower, grooved rib portions 75 forming continuations of the upper rib portions and extending about one-half of the length of the tube. When the upper portion of the tube 72 is pushed into the lower half thereof to the closed position, as shown in FIG. 7, the upper rib portions 74 move into grooves 76 in the lower, grooved rib portions 75 and are held against lateral movement by rounded, rib-like side-walls or retaining portions 77 of the grooves. The grooved rib portions 75 and the upper rib portions 74 compress the cups of the valve tightly together, the grooved rib portions being as thick as the upper rib portions. That is, the grooved rib portions 75 keep the upper rib portions 74 centered relative to the grooved rib portions and act as centering retaining members. The inflation means 70 is identical to the inflation means 10 except for the lower portions of the ribs 73 being grooved.

I claim:

1. Inflation means for introducing air into an inflatable article comprising,
 - an elastic inflation tube for extending from said inflatable article,
 - the outermost portion of said inflation tube adapted to be pushed into the innermost portion of said inflation tube,
 - valve means through which air may be received carried by said inflation tube,
 - said valve means comprising first and second mated closure elements arranged in face to face relationship, said elements providing an air passage therebetween when said valve means is open, at least the first of said closure elements comprising a first suction cup,
 - and strut means joining only a portion of the inside of said inflation tube and only a portion of the outside of the central portion of said suction cup for pressing the suction cup against the second closure element in closed relation,
 - the strut means extending along the tube,
 - said inflation tube being provided with ribs adapted to press said strut means in a closing direction when said outermost portion of said tube is pressed into said innermost portion thereof.
2. Inflation means according to claim 1 wherein said second closure element comprises a second suction cup having a peripheral margin substantially coinciding with the peripheral margin of said first suction cup when said valve means is in closed position, and a second strut means joining a location at the outside of the central back of the second suction cup to the inside of the wall of said inflation tube, with the central back of the second suction cup on either lateral side of the strut means being otherwise substantially unrestrained and free of direct connection to said inflation tube so that the suction cup may

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freely collapse to engage the first suction cup in closed relation as when urged theretoward by said second strut means.

3. Inflation means for introducing air into an inflatable article comprising:

- an elastic inflation tube extensible from said inflatable article, said inflatable tube bounding a hollow bore, said inflation tube having an inner portion for joining to said inflatable article and an outer portion,
- valve means through which air may be received,
- said valve means including first and second mated closure elements arranged in face to face relationship and having substantially coinciding peripheral margins when said valve means is closed, said closure elements defining an air passage therebetween longitudinal of said bore when said valve means is open, at least the first of said closure elements comprising a first elastic collapsible concave-faced suction cup, relatively stiff strut means extending along the cup and joining the substantial center of the back of said suction cup to the wall of said outer end portion of said tube while the central back of the suction cup on either lateral side of the strut means is otherwise substantially unrestrained and free of direct connection to said outer end portion of said tube so that said suction cup may freely collapse as movement of the wall of the outer end portion of said tube toward said suction cup urges collapse thereof toward said second element,

- and generally annular means mounting said valve means and closing off said inflation tube except for said air passage between said elements,
- said outer portion of said tube being insertable inwardly within said inner portion and said inner portion being insertable into the interior of said inflatable article,
- at least one of said inner and outer portions of said tube being thicker adjacent said strut means than at 90° therefrom so as to press through said strut means said suction cup toward its sealing position.

4. The inflation means according to claim 3 wherein said second closure element comprises a second elastic collapsible concave-faced suction cup,

- and relatively stiff strut means joining the substantial center of the back of said suction cup to the wall of said outer portion of said tube while the central back of the second suction cup on either lateral side of the strut means is otherwise substantially unrestrained and free of direct connection to said outer portion of said tube so that said second suction cup may freely collapse as movement of the wall of the outer portion of said tube towards said suction cup urges the collapse thereof towards said first element.

5. The inflation means according to claim 4 wherein said means for closing off said inflation tube except for the air passage between said elements comprises an annular member formed of elastic material joined to the backs of both said suction cups as well as to at least a portion of the lateral peripheral margin of each suction cup, said annular member extending longitudinally towards the outer end of said outer portion, being joined to said outer portion at a location outwardly removed from the position of said suction cups.

6. The inflation means according to claim 5 wherein annular ring means joins said annular member to said outer portion of said inflation tube.

7. The inflation means according to claim 5 wherein said annular member is elliptical in cross section with the major axis of the ellipse extending in the same direction as the lateral peripheral margins of the suction cups.

8. The inflation means according to claim 5 wherein said strut means is planar in a direction longitudinal of said inflation tube and also joins said annular means to said outer portion of said tube, said strut means forming

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a substantially planar web between said suction cup, said outer portion and said annular means.

9. The inflation means according to claim 4 wherein the region at the rear of said suction cup on both lateral sides of said strut means communicates to the interior of said inflatable article.

10. Inflation means according to claim 4 wherein the end peripheral margins at one end of said mated closure elements are joined by a thin imperforate membrane rupturable by pressure externally applied to the sides of said outer portion of said inflation tube for opening said valve means, said membrane when thus ruptured providing a mating closure edge at end peripheral margins of said mated closure elements.

11. The inflation means according to claim 4 wherein end peripheral margins of said mated closure elements include a thin mating ruptured membrane.

12. The inflation means according to claim 3 wherein said strut means is substantially planar and describes a plane substantially longitudinal of said outer portion of said inflation tube while being substantially perpendicular to the wall thereof directly behind said suction cup.

13. The inflation means according to claim 10 wherein said planar strut means also extends to near the inner peripheral margin of the suction cup, said strut being tapered outwardly toward the wall of said outer portion and the outer end of the inflation means.

14. In a valve device adapted to be joined to an inflatable article,

inflation tube means including an inner end, a mounting portion at the inner end adapted to be sealed to such an inflatable article, an outer end portion and an inner end portion adjacent the mounting portion and the outer end portion being movable from an inflating position extending outwardly from the mounting portion to a sealing position extending inwardly from the mounting portion,

the outer end portion of the inflation tube means forming a continuation of the inner end portion and extending outwardly from the inner end portion in an inflating position when the inner end portion is in its inflating position and positioned in a sealing position in the inner portion when the inner portion is in its sealing position,

the end portions having a pair of ribs each folded on

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itself and serving to compress the outer end portion laterally to tend to flatten the outer end portion toward a predetermined central plane when the end portions are in the sealing positions thereof,

and valve means mounted in and sealed to the outer end portion and closed by the compressing of the outer end portion when the outer end portion is in its sealing position.

15. The valve device of claim 14 wherein the valve means includes a suction cup having a suction face facing said plane.

16. The valve device of claim 15 wherein the valve device includes a pair of opposed suction cups in the outer end portion and a pair of strut portions between the backs of the cups and the portions of the tube means at which the ribs are located for transmitting compressive forces from the ribs to the cups.

17. The valve device of claim 16 including a flexible skirt member in the outer portion of the tube means and joined to the outer end portions of the cups to suspend the cups in the tube means with substantially the entire outer surfaces of the cups except the portions of the outer surfaces thereof joined to the ribs being exposed to gas from the interior of the inflatable article.

18. The valve device of claim 14 wherein one portion of each of the ribs has a socket-like portion and another portion of each of the ribs is a projection member adapted to enter the socket-like portion.

19. The valve device of claim 14 wherein each rib includes an upper projection portion and a lower grooved portion adapted to receive the projection portion.

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137—223, 525.1