

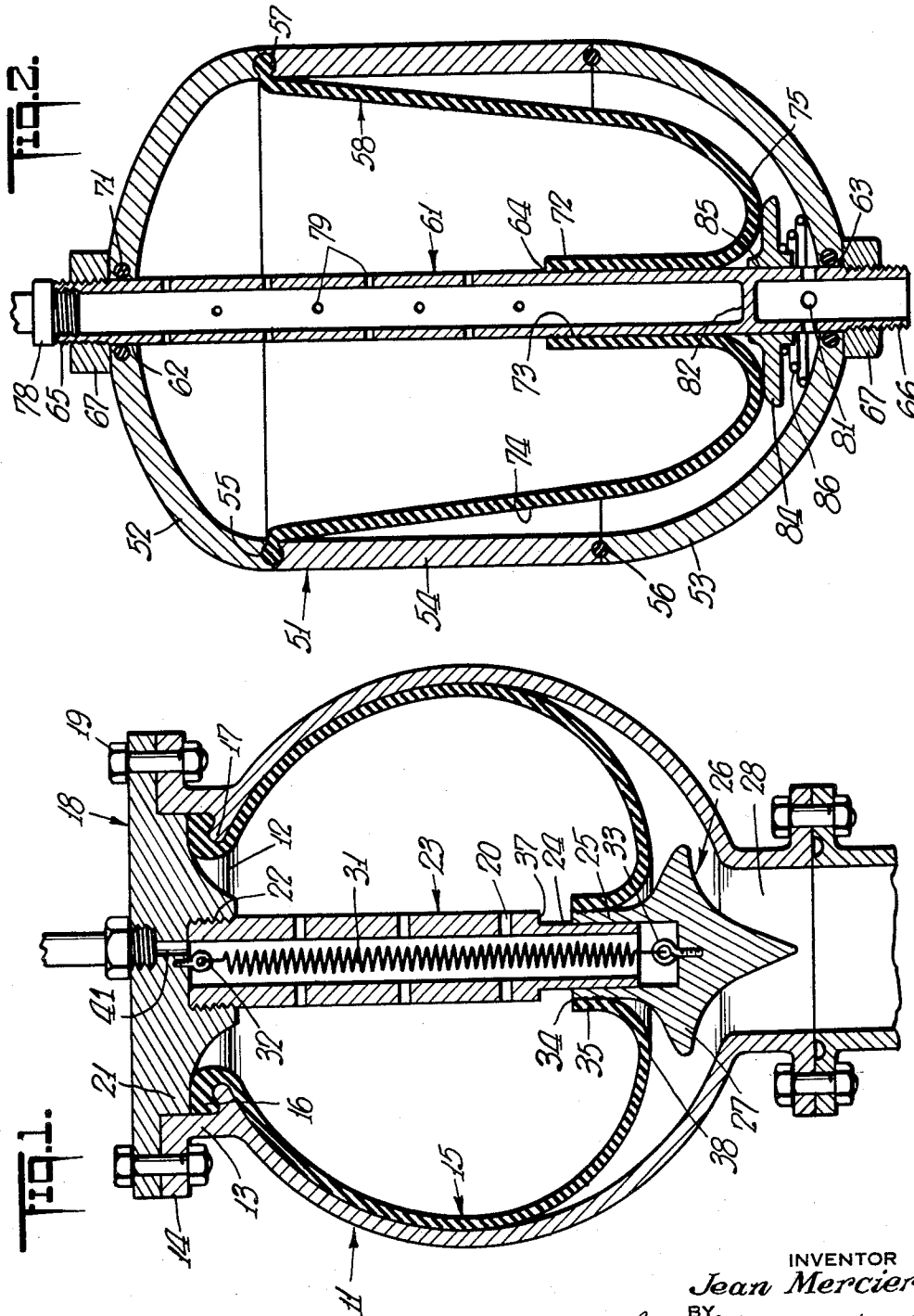
June 23, 1964

J. MERCIER
PRESSURE DEVICE

3,138,176

Original Filed March 14, 1955

2 Sheets-Sheet 1



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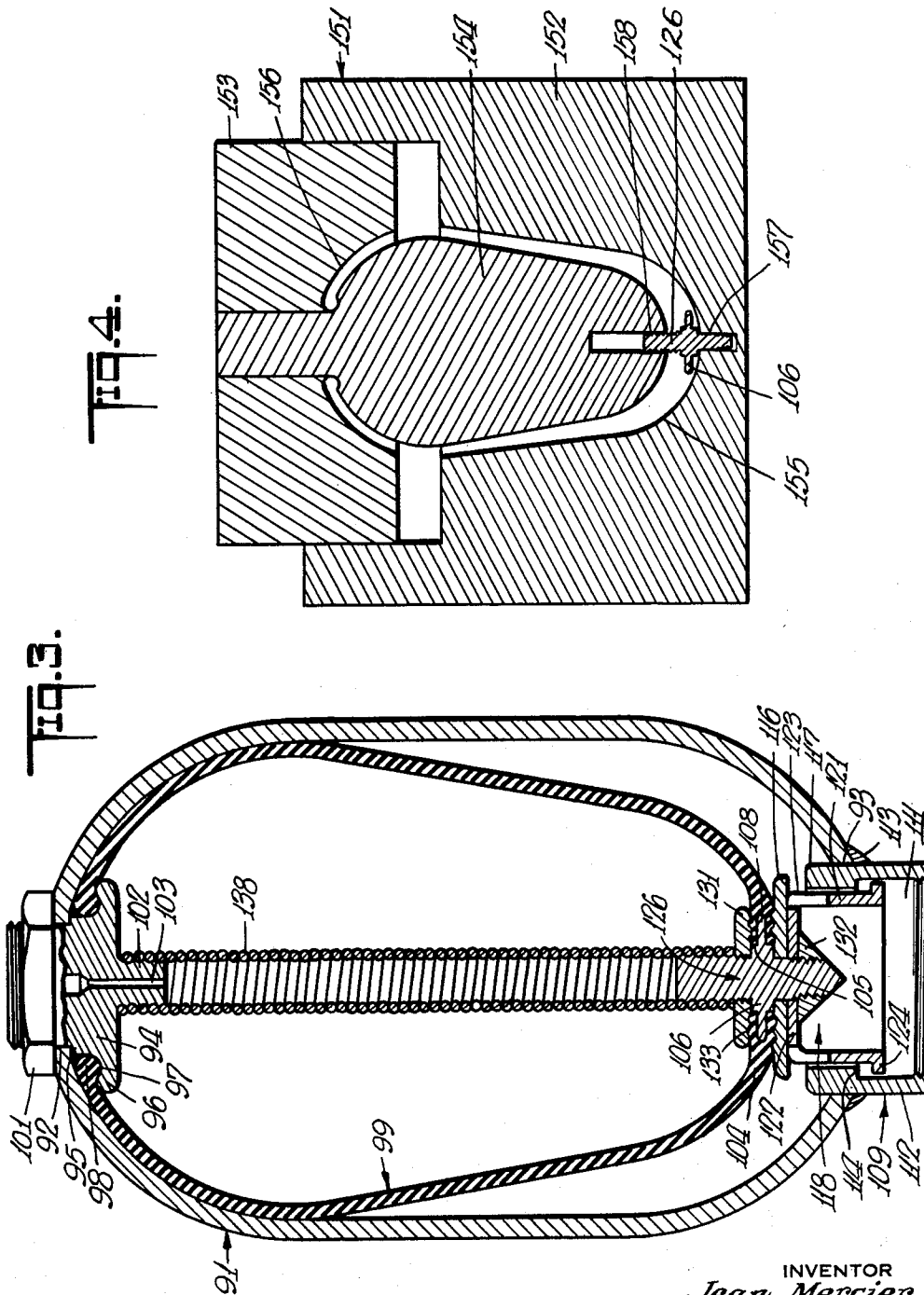
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PRESSURE DEVICE

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Original application Mar. 14, 1955, Ser. No. 494,139, now Patent No. 2,947,326, dated Aug. 2, 1960. Divided and this application July 12, 1960, Ser. No. 42,378 5 Claims. (Cl. 138—30)

This invention relates to the art of pressure devices, more particularly to the type known as pressure accumulators.

As conducive to an understanding of the invention, it is noted that where such accumulators are of large size requiring a relatively long bladder between the two fluids under pressure contained therein, when the bladder is compressed during operation, it is likely to rub against the side wall of the accumulator container with possibility of rupture of the bladder and failure of the accumulator. In addition, when such elongated bladder is compressed, it may form a sharp fold which is also likely to cause rupture of the bladder.

In the formation of such an elongated bladder, where a long core member is used during the molding process, it is likely to shift radially at its free end with respect to the mold recess with the result that a portion of the bladder wall will be thinner than the adjacent portion, providing a weak area that is likely to rupture when the bladder is in use.

Where a rod is used that extends through the base of the mold into the core to guide the latter, and the resultant opening in the completed bladder is filled with a plug of bladder material, the resultant plugged opening provides a region of weakness which, when subjected to strain, is likely to break down with resultant rupture of the bladder.

It is accordingly among the objects of the invention to provide a pressure accumulator of the type having a relatively long bladder therein, in which the bladder is precluded from rubbing against the side wall of the container and is not likely to form sharp folds, thereby preventing rupture of said bladder with resultant failure of the accumulator.

Another object is to provide an elongated bladder having an axial opening in the bottom thereof, with an insert therein which in use of the bladder, will not be subjected to undue stress or strain with resultant likelihood of breakdown in the region of such insert.

This application is a division of copending application Serial No. 494,139, filed March 14, 1955 now Patent No. 2,947,326.

According to the invention, these objects are accomplished by the arrangement and combination of elements hereinafter described and particularly recited in the claims.

In the accompanying drawings in which are shown one or more of various possible embodiments of the several features of the invention,

FIG. 1 is a longitudinal sectional view of one embodiment of the invention,

FIG. 2 is a view similar to FIG. 1 of another embodiment thereof,

FIG. 3 is a view similar to FIG. 1 of still another embodiment, and

FIG. 4 is a longitudinal sectional view of a mold for forming the bladder of the embodiment of FIG. 3.

Referring now to the drawings, the accumulator shown in FIG. 1 comprises a container 11, illustratively substantially spherical, and of strong rigid material capable of withstanding high pressures.

The container 11 has an opening 12 providing access to the interior thereof and a cylindrical member 13 of diameter greater than that of opening 12 encompasses the

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latter, said cylindrical member preferably being formed integral with said container and having an outwardly extending lateral flange 14 at its outer end.

Positioned in container 11 is a partition 15 which may be of material having little elongation such as nylon, but preferably is of rubber, natural or synthetic capable of expansion. The partition 15 is illustratively in the form of a bladder and has an enlarged mouth, the rim portion 16 of which is normally seated on the annular shoulder 17 defined between the periphery of opening 12 and the cylindrical member 13.

Although the rim portion 16 of the bladder 15 may be retained on shoulder 17 in any suitable manner, in the embodiment shown in FIG. 1, a cover plate 18 is provided of diameter substantially equal to that of flange 14, and secured thereto as by bolts 19.

The cover plate 18 has a cylindrical portion 21 of reduced diameter on its undersurface which fits into the cylindrical member 13, the thickness of said portion 21 being such that when the cover plate is affixed to said flange 14, the rim portion 16 of the bladder 15 will be securely clamped against shoulder 17.

The cylindrical portion 21 has a threaded axial recess 22 in which is screwed one end of a sleeve 23 perforated as at 20 along its length, said sleeve extending axially toward the opposed end of the container 11 and being of reduced outer diameter at its free end 24.

Slidably mounted on said free end 24 is the sleeve portion 25 of a valve member 26, the latter having a substantially conical valve head conformation 27 of diameter greater than that of sleeve 25, which is designed to seat at its periphery against the inner surface of container 11 about a port 28 therein.

The valve member 26 is normally retained in open position with respect to port 28 by suitable resilient means which may comprise a coil spring 31 positioned in sleeve 23 and affixed at one end as at 32 to cover plate 18 and at its other end as at 33 to the valve member 26.

The bladder 15 which in extended position substantially fills the container 11, has an axial opening 34 through which extends the sleeve portion 25 of valve member 26, the portion 35 of the bladder 15 adjacent opening 34 being securely affixed to sleeve 24 as by bonding.

The bladder is of size that when the sleeve member 25 of valve member 26 is urged by spring 31 against the shoulder 37 formed by reduced end 24 of sleeve 23, the bladder will be inwardly bent adjacent opening 34, i.e., it will hang in the container with the end 38 thereof below the portion 35 affixed to sleeve 25.

In operation of the accumulator, the bladder 15 may first be charged with gas under pressure through a passageway 41 in cover plate 18, leading into perforated sleeve 23 and after the bladder is so charged, the passageway 41 is sealed by a suitable valve. A fluid such as oil, under pressure greater than that of the gas in bladder 15 is forced through port 28 into the container. As a result the bladder will be deformed and the gas therein further compressed.

By reason of the sleeve 23 extending through the bladder 15, when the latter is compressed, it will be retained in the center of the container 11 so that it will not rub against the wall thereof with resultant wear and possibility of rupture and will not form sharp folds which are also likely to cause rupture of the bladder.

When a valve (not shown) controlling port 28 is opened, the compressed gas in bladder 15 will cause the latter to expand forcing oil out of the container through the open port 28.

With continued expansion of the bladder 15, the lower portion 38 thereof will press against valve head 27 urging the latter downwardly against the tension of coil spring 31 until it seats on the periphery of port 28 to

close the latter. As a result, flow of oil from the container will cease and by reason of the closing of port 28, no extrusion therefrom of the bladder 15 will occur.

As the spring 31 normally retains the portion of sleeve 25 to which the portion 35 of bladder 15 is affixed above the level of the lower portion 38 of the bladder, as the bladder expands, the stress against the region of affixation of said portion 35 to sleeve 25 will be axially with respect to said sleeve 25 rather than radially. Consequently the force tending to break the bond between portion 35 and sleeve 25 will be at a minimum with resultant long life of the unit.

It is also to be noted that as the relative movement between sleeve 25 of valve member 26 and end 24 of sleeve 23 occurs at a region not exposed to the liquid forced into the container, no wear will occur to the contacting portions of sleeve 25 and end 24 and hence abrasive liquid could be used in the container.

In the embodiment shown in FIG. 2, the pressure accumulator comprises a container 51 illustratively formed from a plurality of sections including a pair of cup-shaped shells 52 and 53 and an intermediate cylindrical member 54, the rims of said shells and said member each having an annular depression 55 therein.

Positioned between the adjacent rim of shell 53 and member 54 is an annular sealing member 56 and positioned between the adjacent rims of shell 52 and member 54, is the enlarged periphery 57 of a deformable partition 58, illustratively a bladder which is preferably of natural or synthetic rubber.

The adjacent rims of shell 52 and member 54 and of shell 53 and member 54 are clamped against the periphery 57 of bladder 58 and the sealing member 55, respectively, by means of a central, perforated sleeve 61 which extends longitudinally through axial openings 62, 63 in the juxtaposed shells 52, 53 and through an axial opening 64 in bladder 58.

The protruding ends 65 and 66 of the sleeve 61 are desirably threaded to receive nuts 67 which, when tightened, will move the shells 52, 53 and member 54 together so that the rims thereof clamp the periphery 57 of bladder 58 and sealing member 56 to provide a dependable seal at such rims. Desirably, suitable sealing rings 71 are provided in each of the openings 62, 63 to prevent leakage between such openings and the sleeve 61.

The portion 72 of bladder 58 adjacent opening 64 therethrough is securely retained against sleeve 61 as by bonding as at 73. The dimensions of the bladder 58 and the position at which the portion 72 thereof is secured to sleeve 61 are so selected that, as shown in FIG. 2, the bladder will hang downwardly in the container and is substantially conical in cross section, the distance of the outer surface 74 of the bladder from the inner surface of the container progressively increasing from the enlarged periphery 57 thereof to the reversely bent bottom 75 thereof.

Means are provided to charge the bladder with gas, for example. For this purpose, the end 65 of sleeve 61 has a valve 78 therein and the sleeve 61 has a plurality of apertures 79 leading thereinto so that when gas under pressure is forced through valve 78, it will flow through sleeve 61 and out of apertures 79 into bladder 58.

To charge the accumulator with a fluid such as oil, the portion of sleeve 61 adjacent end 66 thereof has a plurality of apertures 81 through which the fluid forced into sleeve 61 through its end 66 may pass. The sleeve 61 has a barrier 82 therein between apertures 79 and 81 to prevent mixing of oil and gas.

Slidably mounted on sleeve 61 between bladder 58 and opening 63 in shell 53 is a valve head 84 which has a central bore 85 through which sleeve 61 extends. Resilient means 86 such as a coil spring encompassing sleeve 61 and compressed between the valve head 84 and shell 53 normally retain the valve head in open position, i.e., with the aperture 81 not covered by the wall of bore 85.

In the operation of the accumulator shown in FIG. 2, the bladder 58 is first charged with gas under pressure and the valve 78 is then closed. Oil under pressure greater than that in bladder 58 is forced through end 66 of sleeve 61 to charge the accumulator which will cause the bladder 58 to be deformed and the gas therein further compressed.

By reason of the sleeve 61 extending through the bladder 58, when the latter is compressed, it will be retained in the center of the container 51 so that it will not rub against the wall thereof with resultant rupture and will not form sharp folds which are also likely to cause rupture of the bladder.

When a valve (not shown) controlling end 66 of sleeve 61 is opened, the compressed gas in bladder 58 will cause the latter to expand forcing oil out of the container through aperture 81 and the end 66 of sleeve 61.

As the bladder expands, the portion of the outer wall 74 thereof closest to the inner surface of the container 51 will first contact such inner surface and as more and more oil is forced from the container, the wall of the bladder will progressively engage such inner surface.

As a result, no oil pockets will be formed between the bladder 58 and the wall of the container and substantially all of the oil in the container will be forced out therefrom. As the operation of the conical bladder above described is set forth in detail in Reissue Patent No. 23,437 dated December 4, 1951, it will not be further described.

With continued expansion of bladder 58, the lower portion 75 thereof will press against valve head 84, urging the latter downwardly against the tension of coil spring 86 until it seats against the shell 53 thereof closing apertures 81. As a result, flow of oil from the container will cease and by reason of the closing of aperture 81, no extrusion therefrom of bladder 58 will occur.

As the portion 72 of the bladder affixed to sleeve 61 is above the level of the lower portion 75 of the bladder, as the bladder expands, the stress against the region of affixation of said portion 72 to sleeve 61 will be axially with respect to said sleeve rather than radially. Consequently the force tending to break the bond between portion 72 and sleeve 61 will be at a minimum with resultant long life of the unit.

In the embodiment shown in FIG. 3, the pressure accumulator comprises a container 91 having axially aligned openings 92 and 93 at its opposed ends.

Mounted in opening 92 is a plug 94 having an annular shoulder 95 adapted to seat against the inner periphery of said opening. The plug 94 has a lateral flange 96 with an annular depression 97 therein to receive the thickened rim 98 of the mouth of a deformable substantial conical bladder 99. Thus when a nut 101 screwed on the threaded end of plug 94 extending beyond opening 92, is tightened, the rim 98 of the bladder will be clamped between flange 96 and the wall of the container around opening 92 securely to hold the rim in place, the shoulder 95 preventing excessive pinching of such rim.

The plug 94 desirably has an axial nipple 102 on its inner surface and a passageway 103 extends through said plug and said nipple so that gas under pressure may be forced through said passageway into said bladder to charge the latter.

Mounted in opening 93 of the container 91 is a closure assembly 109 defining a port 111 through which a fluid under pressure, such as oil, may flow into and out of the container.

The closure assembly illustratively comprises a tubular member or sleeve 112 of diameter such that it may readily fit into opening 93. Although the tubular member 112 may be retained in position in opening 93 in any suitable manner, it desirably is welded in place as at 113.

The bore of tubular member 112 which defines the port 111, is of enlarged internal diameter at its outer

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end defining an annular shoulder 114 and such enlarged diameter portion is internally threaded to receive the correspondingly threaded end of a coupling (not shown) to which a hydraulic line may be connected.

Positioned in the container 91 is a valve head 116 of diameter greater than that of the bore in tubular member 112 and designed to seat against the inner end 117 thereof to cut off flow of fluid from the container.

Means are provided to guide the valve head 116 so that it will move axially with respect to tubular member 112. Such means desirably comprises a guide member 118 which may be substantially cup-shaped as shown and of outer diameter just slightly less than that of the smaller diameter portion of bore 111 so that it may readily slide therethrough but with substantially no transverse play. The side wall 121 of guide member 118 near its end wall 122 has a plurality of openings 123 through which fluid may flow, when valve head 116 is in open position. The guide member 118 desirably has an outwardly extending flange 124 which will abut against shoulder 114 to limit the inward movement of said guide member, and which will also impart a damping action to such inward movement as liquid is forced into the container.

Although the valve head may be affixed to the guide member in any suitable manner, in the embodiment shown, a rod 126 threaded at both ends extends through axially aligned openings in the end wall 122 of the guide member 118 and the valve head 116 and through an opening 105 in the end 104 of the bladder 99 opposed to the mouth of the latter. The rod 126 has a collar 106 desirably formed integrally therewith of substantially the same thickness as the bladder wall and an annular flange 108 preferably formed integrally with the collar extends laterally outward therefrom. The collar 106 and flange 108 are molded integrally with the bladder, said flange having a layer of bladder material on each surface thereof. Nuts 131 and 132 are screwed on the threaded ends of said rod to clamp the collar 106, the valve head 116 and the guide member 118 together.

The nut 131 and the valve head 116 at the periphery of the openings therein will abut against the collar 106 to prevent undue pinching of the bladder 104 adjacent the opening 105 therein and the opposed surface of said nut 131 and the valve head 116 have outstanding bosses 133 securely to grip the bladder to reduce lateral strain against the flange 108 which might break the bond of the bladder thereto.

The nut 132 is desirably conical, as shown, to deflect the liquid forced into the tubular member 112 so that it will flow toward openings 123 without severe impact against the underface of the end wall 122 of the guide member 118.

Resilient means are provided normally to retain the valve head in open position. Such means desirably comprises a coil spring 138 extending centrally through bladder 104 and affixed at its respective ends to nipple 102 and to rod 126. Under normal conditions with the accumulator uncharged, the spring 138 will retain the valve head in open position, the inward movement of such valve head being limited by the abutment of flange 124 against shoulder 114.

After the bladder and container are charged with gas and oil under pressure, the deformed bladder will be retained in the center of the container by the coil spring 138 so that it will not rub against the wall of such container with resultant rupture and will not form sharp folds which are also likely to cause rupture of the bladder.

When a valve (not shown) controlling port 111 is opened, the compressed gas in bladder 104 will cause the latter to expand, forcing oil out of the container through openings 123 in the guide member. As the bladder expands, by reason of its conical shape, as previously described with respect to the embodiment of FIG. 2, no oil

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pockets will be provided and substantially all the oil will be forced out of the container.

With continued expansion of the bladder, sufficient force will be exerted against valve head 116 to overcome the tension of coil spring 138 so that the valve head will seat against the end 117 of tubular member 112, stopping flow from the container and precluding extrusion of the bladder.

By reason of the bonding of the flange 108 in the opening 105 of the bladder and the clamping action of nut 131 and valve head 116, the rod 126 will remain securely affixed to the bladder without likelihood of breakage of such bond. Hence the accumulator is not likely to break down, even with long use.

The bladder shown in FIG. 3 may be formed by means of the mold 151 shown in FIG. 4. The mold desirably comprises a base 152, a cover member 153, and a core 154. The base and the cover member each has a recess 155 and 156 therein which, when juxtaposed, conforms to the desired substantially conical configuration of the bladder. To prevent transverse displacement of the lower end of the core with respect to the recess in the mold, an axial bore 157, 158 is provided in the base and said core in which the rod 126 may be positioned.

To form the bladder with the mold shown in FIG. 4, the rod 126 is positioned in recess 155 so that it extends into the bore 157 therein, the collar 106 resting on the periphery of said bore 157. A predetermined charge of material from which the bladder is formed is placed in the recess 155, the core 154 is then placed in the recess 155 being guided by the rod 126 which extends into the axial bore 158 in said core. The cover member 153 and the core 154 are then forced downwardly as by means of a hydraulic press. As a result, the material in recess 155 will rise to fill the space between the recess wall and the core to form the bladder which is then cured in conventional manner.

Although the mold shown in FIG. 4 has been described with respect to the fabrication of the bladder shown in FIG. 3, it is readily apparent that by suitable conformation of a mold, the sleeve 25 of valve member 26 shown in FIG. 1, or the sleeve 61 shown in FIG. 2 could be molded integrally with the associated bladder.

In the case of the embodiment of FIGS. 2 and 3, the sleeve 61 and the rod 126 would serve as a guide for the core and in the embodiment of FIG. 1 a guide member could be provided which extended from sleeve 25 into the bore in the core member.

Thus, in all of the embodiments shown, the core of the mold to make the elongated bladder is guided during the molding process and the hole in the bladder resulting from the core guiding means is sealed by an insert such as the valve member 26 of FIG. 1, the sleeve 61 of FIG. 2 or the rod 126 of FIG. 3. As such inserts are bonded in place during the molding operation, they will remain in position much more securely than if they were inserted after the bladder had been formed.

As many changes could be made in the above constructions, and many apparently widely different embodiments of this invention could be made without departing from the scope of the claims, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent of the United States is:

1. A pressure vessel comprising a container, a deformable bladder in said container of volume substantially conforming to that of said container, said bladder having a mouth, means securely clamping said mouth with respect to said container, means to charge said bladder with fluid, said bladder having an axial opening in its free end, a rigid insert affixed in said opening, said container having an opening axially aligned with said bladder, a valve

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head secured to said insert and controlling said opening, a tubular member rigidly mounted in said container and axially aligned with the opening therein, means to guide said valve head axially with respect to said opening, said means comprising a cylindrical opening in said insert into which said tubular member extends, and resilient means normally to retain said valve head in open position.

2. The combination set forth in claim 1 in which said tubular member is rigidly mounted at one end and has its other end positioned in said container and inwardly spaced from the opening thereof, the free end of said tubular member extending into the cylindrical opening in said insert.

3. The combination set forth in claim 2 in which said resilient means comprises a coil spring positioned in said tubular member, said coil spring being fixed at one end with respect to said container and fixed at its other end with respect to said valve head.

4. A pressure vessel comprising a container, a deformable bladder in said container of volume substantially conforming to that of said container, said bladder having a mouth, means securely clamping said mouth with respect to said container, means to charge said bladder with fluid, said bladder having an axial opening in its free end, a rigid insert affixed in said opening, said con-

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tainer having an opening axially aligned with said bladder, a valve head secured to said insert and controlling said opening, a tubular member mounted in said container axially aligned with the opening therein, means to guide said valve head axially with respect to said opening, said means comprising a guide member positioned in said tubular member, said valve head being secured to said guide member and resilient means normally to retain said valve head in open position.

5. The combination set forth in claim 4 in which said guide member is a cup-shaped member having an end and a side wall and of diameter such that it will slide in said tubular member with substantially no transverse play, said valve head being secured to the end wall of said guide member, said member having an opening in its side wall near the end wall thereof.

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