May 23, 1944. J. W. WHITE 2,349,322

ACCUMULATOR

Filed Oct. 2, 1942

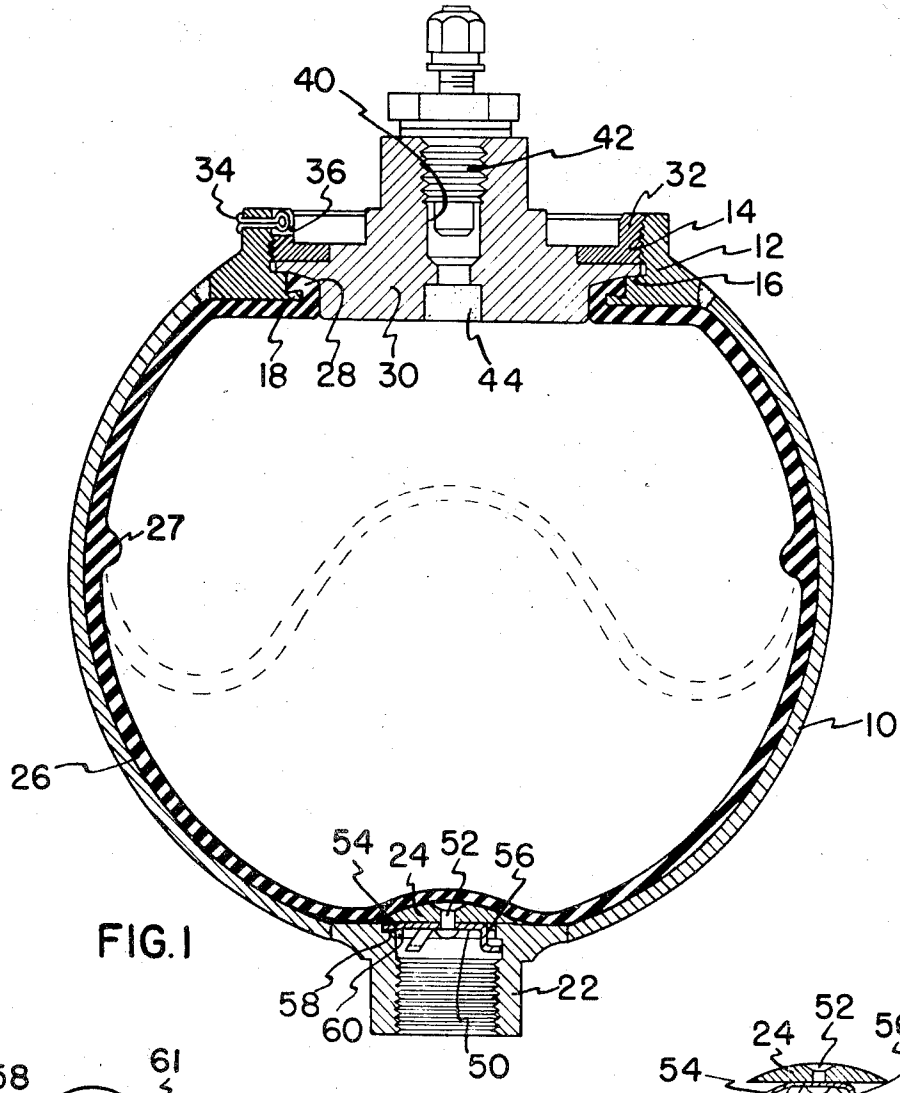


FIG. 1

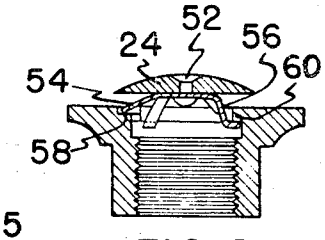


FIG. 2

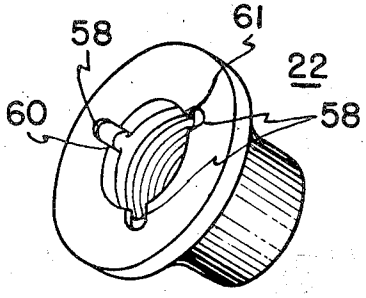


FIG. 3



FIG. 5

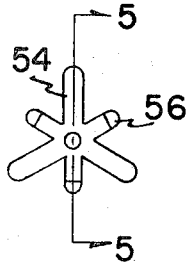


FIG. 4

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ACCUMULATOR

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2 Claims. (Cl. 138—30)

This invention relates to accumulators, and more particularly to means for covering the hydraulic opening of an air biased hydraulic accumulator of the flexible partition type, to prevent injury to the partition.

An accumulator is a device for storing hydraulic fluid under pressure. This is done by providing a pressure vessel with a yielding wall. For this purpose, a pressure vessel may be used having a yielding diaphragm against which the hydraulic fluid acts, with air or other gas under compression acting on the other side of the diaphragm. The diaphragm separates air and liquid to prevent air from being dissolved in the liquid, which air might later cause trouble. Another type is an air biased accumulator of the bladder type, in which a bladder fitted inside a pressure vessel is filled with air under compression against which hydraulic fluid acts. This type of accumulator is much lighter than the diaphragm type.

Although this invention is fully applicable to a diaphragm type accumulator, or other type using compressed gas as a biasing means, it will be described with relation to a bladder type accumulator.

One of the conditions commonly present in all accumulators is that the hydraulic fluid is completely expelled and the bladder or diaphragm rests upon the hydraulic outlet. Since bladders and diaphragms must be flexible, they are commonly made of oil resisting synthetic rubber such as neoprene. This rubber is relatively tough and in low pressure work has been fully protected by placing a perforated plate over the hydraulic opening. The more recent high pressure systems, however, employ such a high initial charge that the rubber is extruded through the small holes and the bladder is permanently damaged.

The air pressure forcing the bladder against the hydraulic opening will be the air pressure to which the bladder is initially charged. Since the accumulator's purpose is to supply hydraulic fluid under pressure when the demand exceeds the output of the system pump, this charging air pressure must be equal to the minimum pressure at which the system can satisfactorily operate. In hydraulic systems normally operating at 3,000 psi the commonly accepted minimum is 1500 psi. Thus 1500 psi is the pressure to which the accumulator must be initially charged and this full force may at times act upon the bladder or diaphragm, extruding it into hydraulic opening holes.

The present invention seeks to prevent the extrusion of the bladder through the hydraulic opening by providing the opening with a movable cover. Although covers for hydraulic openings may have been used before, the present one is designed for use in high pressure accumulators. Further, the structure of the cover plate is simple in design and well suited for mass production.

It is therefore an object of this invention to provide a cover for the hydraulic opening of an accumulator which will prevent injury to the flexible partition from contact with the opening.

Still another object is to provide a spring biased cover plate of an accumulator opening, which closes at relatively low pressure, insuring that the flexible partition will not be caught therein.

Another object is to provide an accumulator with a hydraulic cover which does not close until all liquid is expelled from the accumulator.

Other objects and advantages of the invention will be apparent in the following description and claims.

In the drawing forming a part of this specification

Figure 1 is an elevation view in full section showing a bladder type accumulator embodying the invention wherein the bladder is completely extended and pressing against the hydraulic outlet. The position of the bladder when the accumulator is partially filled with oil is shown in broken lines,

Figure 2 is a view in full section of the hydraulic outlet of the accumulator of Figure 1 showing the cover forming the invention in its normal or raised position,

Figure 3 is an isometric view of the hydraulic fitting of the accumulator of Figure 1, showing in more detail the spring slots,

Figure 4 is a plan view of the spring used with the cover to keep it normally raised, and

Figure 5 is a sectional view of the spring along the line 5—5 of Figure 4.

Referring to Figure 1, a generally spherical shell 10 has a hydraulic fitting 22 welded to the bottom and including a cover 24. Welded to the upper part of shell 10 is a collar 12. The collar 12 has a threaded opening 14, an internal annular shoulder 16 and an internal annular lip 18.

A bladder 26 of flexible material is fitted in shell 10. The bladder 26 has a preformed shape as shown in solid lines, with the lower half thinner than the upper half. The bladder has an internal bead 27, and has an external lip 23 which hooks over collar lip 18. A plug 30 is fitted in collar 14 which fits snugly against the upper end of the bladder and rests upon shoul-

der 16. An annular nut 32 is threaded within collar 12 to hold the plug 30 in place. A cotter pin 34 passes through collar 12 and fits in a slot 36 in nut 32 to lock the nut in place.

Plug 30 is centrally drilled at 40 to receive a threaded air valve unit 42. The hole 40 is enlarged at the bottom surface of plug 30 to receive an insert 44 of sintered powdered metal. The insert is composed of bronze metal sintered at just below the eutectic temperature of the alloy. The pores in the metal are less than two-thousandths of an inch and probably average about half of a thousandths of an inch. These holes are so fine that they may be considered to be an impervious wall as regards a material having the toughness of synthetic rubber at hydraulic test pressures. The air, however, has no difficulty in passing through the sintered metal. The insert 44 is necessary to protect the bladder during test when all air is excluded from the bladder and full hydraulic pressure is applied to force the bladder against the hydraulic outlet.

The hydraulic outlet 22 could also be provided with a porous insert. The resistance to hydraulic fluid flow would be so great, however, that the flow characteristics would not be practical.

The hydraulic opening will now be described in more detail. Referring to Figure 1, a spring member 50 is held to cover 24 by a rivet 52. Spring 50 has spring arms 54 and restraining arms 56 which limit the upward spring movement of the cover 24. It will be noticed that spring members 54 rest in surface recesses 58 in fitting 22, whereas restraining members 56 hook under an inwardly projecting flange 60.

The cover plate 24 is shown in its raised or normal position in Figure 2. There it will be noted that the spring members 54 force the cover 24 upwardly until halted by hook members 56 engaging flange 60.

The spring member 50 is more clearly shown in Figures 4 and 5. There it will be noted that there are three spring arms 54 and intermediate these arms are restraining members 56. The spring as a whole may be stamped from a single piece of spring steel or bronze and later heat treated.

The details of the recesses of fitting 22 are shown in Figure 3. There it will be noted that the internal flange 60 is substantially complete. The spring recesses 58 are cut into the upper surface. It will be noted also, that the flange 60 is notched at each recess 58 as at 61. This cut may be made with the same vertical mill that cuts recesses 58.

Notch 61 permits the restraining arm 56 of spring 50 to be inserted into fitting 22. When these arms are below flange 60, the spring 50 as a whole is rotated until spring arms 54 snap into recesses 58. This locks the spring 50 from rotation, insuring that the restraining arms 56 will remain positioned at the unrelieved portions of flange 60.

In operation, air under pressure is applied at valve 42 and passes through porous insert 44 into the interior of bladder 26. The pressure is built up to about 600 psi for 1000 psi systems and is built up to 1500 psi for 3000 psi systems. The bladder at this time is tightly pressed against the walls of shell 10 and against cover 24 as shown in Figure 1. It will be noted that cover 24 is thin with a gently rounded contour meeting fitting 22 at a very flat angle. This results in very smooth contour on the bladder and eliminates abrupt bends which might crack the bladder particularly at low temperatures when the rubber is brittle.

Cover 24 meets the fitting 22 with a close fit. This is very important since rubber will be extruded through even a $\frac{1}{32}$ hole at 1500 psi.

Fitting 22 may next be connected to a hydraulic system having a pump which forces hydraulic fluid into the shell 10 against the air pressure. As the hydraulic flow increases, the lower part of bladder 26 will be pressed upwardly until the compression of the air builds up an air pressure which equals the hydraulic pressure. Thereafter the hydraulic fluid will be decreased or increased in amounts depending upon the demands of the hydraulic system and the pump supply pressure.

The action of the cover plate 24 relative to the action of the bladder 26 is important in preventing the trapping of fluid in the accumulator. As stated previously, the lower half of the bladder is thinner than the upper half, which construction, together with bead 27 causes the upper half to remain stationary while the lower half does all the flexing in accordance with liquid changes. The action of spring 50 causes the lower center part of the bladder to remain lifted off of shell 10 until all other parts of the bladder touch shell 10. This causes all the fluid to be progressively driven toward the outlet 22 before the outlet is closed by the bladder. Thus no fluid is trapped at intermediate points in the lower half, such as is possible when the bladder is allowed to cover the hole without "sequence" control. The spring permits cover 24 to close before any substantial stress is placed on the same, and a suitable pressure for this purpose is about 5 pounds.

Although this invention has been described with reference to particular embodiments thereof, it is not limited to these embodiments nor otherwise limited except by the terms of the following claims.

I claim:

1. An accumulator comprising a shell; a flexible partition therein, one side of the partition being subjected to the pressure of a compressible fluid; an opening to permit a fluid to contact the other side of the partition; and spring biased cover means secured to said shell for limited movement and normally held over said opening in spaced relation to the inner end to provide for the passage of fluid, and adapted to close over the mouth of said opening when contacted by said partition to prevent extrusion of the partition into said opening.

2. In an accumulator, a fluid opening portion having an internal flange with notches therein and surface recesses, a spring member with spring portions and restraining portions, said restraining portions being placed under said flange by inserting into the opening through the notches and the spring member as a whole rotated until the spring portions lock in the recesses, and a cover plate secured to said spring and adapted to cover said opening when the spring member is overcome.

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