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E. J. SVENSON
ACCUMULATOR STRUCTURE
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Fig. 1.

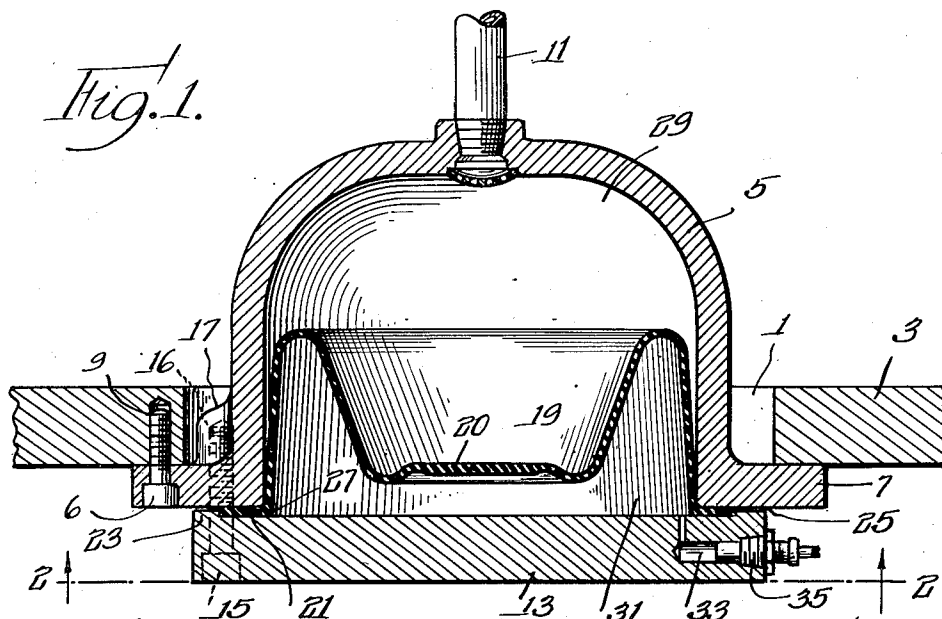


Fig. 2.

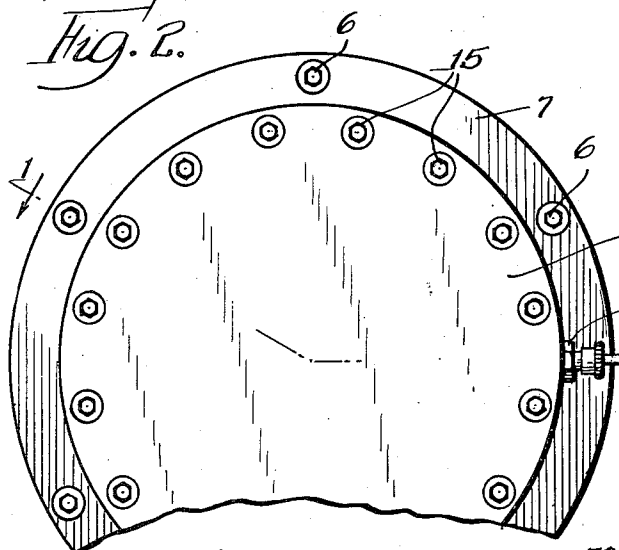


Fig. 3.

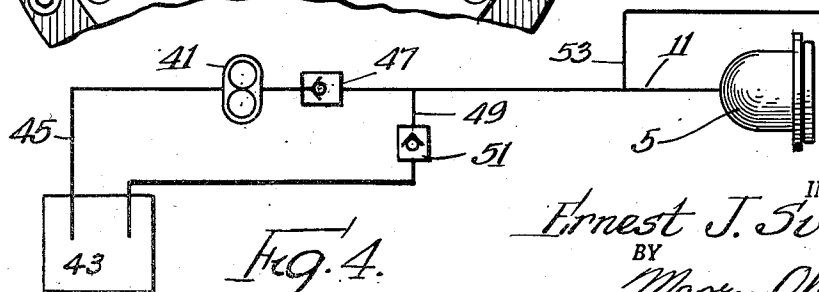
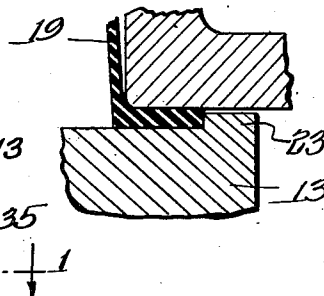


Fig. 4.

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ACCUMULATOR STRUCTURE

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3 Claims. (Cl. 138—30)

This invention relates to a new and improved accumulator structure and more specifically it relates to a particular arrangement of an accumulator diaphragm structure.

Accumulators, as is well known, are frequently used to smooth the flow of a liquid from a reciprocating pump, or to store up a quantity of liquid being pumped in a hydraulic system so that a pump may be used which is of a smaller capacity than the maximum demand upon the system. It would, of course, be possible to use a pump equal in capacity to the maximum demand on the system, but this is not desirable when the demand is intermittent as it so frequently is in hydraulic systems, because, as is well known, it is uneconomical to operate a large pump at or near its full capacity only a small fraction of the time. In the interests of ease and economy of installation and in economy of operation, it is desirable that a pump should be used which is operating at or near its peak capacity as much of the time as possible. Accordingly accumulators are used.

Generally accumulators have fallen into one of two classifications. In the first of these, nothing separates the liquid from the gas in the accumulator. This leads to several difficulties, among them that the gas in large or small amounts dissolves in the liquid and is carried off by it thus adulterating the liquid and making it imperative that gas be added at frequent intervals. Furthermore, it is necessary in this type of accumulator that the gas should at all times be above the liquid. If the structure is tilted to any great degree, or if the liquid is exhausted from the accumulator, the gas will be exposed directly to the liquid outlet and will blow out. To overcome this difficulty, it has been suggested that a flexible diaphragm should be interposed between the gas and the liquid. A simple, flat diaphragm of rubber or other flexible material serves to separate the two media, but as it must be stretched in addition to being constantly flexed, its life is very short. Other accumulators have been built using a diaphragm in the form of an inner tube such as is used in a common automobile tire, and in a variety of kindred shapes in which the tubing proper forms an enclosure for the gas. These are comparatively difficult and expensive to make and installation is often difficult. Furthermore, such diaphragm structures are short lived.

Accordingly, it is an object of this invention to provide an accumulator having a diaphragm so that the gas will not blow out if the structure is tilted or exhausted of liquid.

It is further an object of this invention to provide such an accumulator having a diaphragm which is not stretched and has a long life and which is simple and easy to manufacture.

A still further object of the invention is to provide an improved mounting and securing means for the flexible diaphragm of an accumulator, wherein the mounting and securing means permits free diaphragm flexibility while at the same time protecting the diaphragm and promoting the durability and long life thereof in service.

Other and further objects and advantages of the present invention will be apparent from a perusal of the following specification with reference to the accompanying drawings in which:

Figure 1 is a cross-sectional view of the accumulator structure taken on the line 1—1 of Figure 2;

Figure 2 is a bottom view of the accumulator structure taken along the line 2—2 in Figure 1 showing most

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particularly the placement of the screws and the gas valve;

Figure 3 is an enlarged fragmentary sectional view of the juncture between the diaphragm and the two parts of the housing; and

Figure 4 is a diagrammatic view of a hydraulic circuit showing the accumulator in use.

The accumulator structure may be mounted in a circular hole 1 in a frame or other support 3. The cup shaped upper portion 5 of the accumulator housing is fastened to the frame 3 by a plurality of screws 6 fitted through screw holes in flange 7 which constitutes an integral part of the upper part 5 of the housing. The screws 6 are threaded into holes 9 in the frame 3. An inlet pipe 11 is threaded into the top of the upper cup shaped portion 5 of the housing and provides for ingress and egress of the liquid. A lower flat member 13 completes the accumulator housing and is held to the upper part 5 by screws 15 which threadingly engage the upper portion of the housing in screw holes 16. Extended portions 17 are provided on the sides of the upper cup shaped portion 5 of the housing to accommodate the screws 15.

A rubber diaphragm 19 of unique construction is held between the two portions of the accumulator housing dividing the interior of said housing into two chambers. This diaphragm has a thickened central section 20 and is held by pressure on a rubber flange 21 formed integral with the remainder of the diaphragm at the periphery thereof. A shoulder 23 on the lower member 13 of the accumulator housing laterally confines the flange 21 and prevents the flange from being forced outwardly with respect to the housing. A small space 25 is left between the shoulder 23 and the flange 7 of the upper portion of the housing. This space is on the order of a few thousandths of an inch and is provided for the compensation of slight variances in thickness of the rubber flange 21 which may occur in manufacture. If this space were not provided and contact between the parts relied upon to control the clamping pressure, it is obvious that insufficient pressure would be applied to a diaphragm having a slightly thin flange 21 and excessive pressure would be applied to an overly thick flange 21, thus speeding the demise of the diaphragm. By turning the screws to a known tension while maintaining the aforementioned clearance, a predetermined pressure may at all times be applied to the flange 21 and complete flexibility is thus present at the corner 27 between the flange 21 and the main body portion of the diaphragm 19.

The mounting for the flange 21, as described, thus serves the dual purpose of preventing lateral spread of the flange while also permitting the clamping pressure upon the flange to be accurately gauged by the bolt tension to the requirements of any particular installation. In this manner a tight clamping pressure may be used, if desired, without danger of distorting the flange, and without premature deterioration thereof, while at the same time permitting a completely free flexing of the diaphragm adjacent the secured flange which further promotes the life of the structure.

The diaphragm 19 which has been spoken of as being composed of rubber could, of course, be constructed of any one of a number of the synthetic elastomers generally termed synthetic rubbers. Some of these materials are better adapted than rubber to continued flexing and are less subject to deterioration by the media contained in the accumulator.

The upper chamber 29 demarcated in the accumulator housing by the diaphragm 19 is filled with the liquid being pumped and as was before mentioned is connected to the liquid by inlet pipe 11. The lower chamber 31 formed in the housing by the diaphragm 19 is filled with gas. Whereas it is possible to fill this chamber with air, it is preferred that some inert gas such as nitrogen should be used. Nitrogen is inexpensive and does not have the deleterious effects on rubber that air has. The gas is admitted to the lower chamber 31 through a passageway 33 and a valve 35 such as is commonly used in automobile tires.

Whenever the pressure on the liquid in the chamber

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29 becomes less than that of the gas confined in chamber 31, the gas expands forcing the diaphragm 19 upwards, thus expelling the liquid through the pipe 11. As the pressure on the liquid is increased by a pump or the like, some of the liquid re-enters the chamber 29 via the pipe 11 and the diaphragm 19 is again forced down compressing the gas 31.

In Figure 4 an operating hydraulic circuit is diagrammatically illustrated, showing the accumulator in use. A pump 41 draws liquid such as oil from a reservoir 43 by means of a pipe or conduit 45, the oil being propelled through a check valve 47 and line 11 to the accumulator structure. A by-pass line 49 returns to the reservoir through an adjustable relief valve 51 by which the maximum delivery pressure of the pump and the maximum accumulator pressure may be controlled. A line 53 leads to the operated device, as shown. When the volumetric delivery of the pump exceeds the requirements of the line 53, the accumulator is charged with liquid, compressing the gas therein, as previously described. At such times when the requirements of the pipe line 53 exceed the volumetric delivery of the pump, the liquid stored within the accumulator under pressure becomes available to augment the pump delivery and supply the operating requirements of the operated device.

It is apparent that variations from the foregoing specification may be made without departing from the spirit of the invention. The invention is accordingly to be limited only as indicated by the following claims.

I claim:

1. A fluid pressure accumulator of the flexible diaphragm type and comprising a pair of casing members, one of said casing members being recessed to define with the other casing member, a chamber therebetween of predetermined size and shape, said casing members having complementary flange portions secured together, and a flexible diaphragm made in the shape of a flanged cup disposed within said chamber and dimensioned relative to said chamber to substantially prevent stretching of the diaphragm during its movements between the limits of travel defined by said casing members, said cup having the side wall thereof provided at its inner end with a gradual reversely curved portion locating the cup bottom intermediate the ends of the side wall and having the cup flange clamped between the flange portions of said casing members, the side wall of the cup projecting in one pre-

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determined direction along and juxtaposed to the wall of said recessed casing member, the other casing member preventing movement of the bottom of the cup away from said recessed casing member beyond a predetermined position such as to maintain the side wall of the cup projecting into said recessed casing member in the same said one predetermined direction and in juxtaposition with respect to the wall thereof adjacent the cup flange and having a surface portion inwardly of the cup side wall substantially flat and coplanar with its flange portion for preventing any movement of the side wall of the cup adjacent its juncture with the cup flange in a direction opposite to said predetermined direction whereby to prevent working of the cup wall at the flange juncture and effect bending of the diaphragm along the curved portion between the bottom and side wall of the cup during its movement within the limits of travel defined by said casing members.

2. A fluid pressure accumulator as defined in claim 1, wherein the diaphragm cup side wall portion and the diaphragm flange portion are substantially perpendicularly disposed relative to each other, defining a substantially right angular line of juncture therebetween.

3. A fluid pressure accumulator as defined in claim 1, wherein the reversely curved portion is extended toward the said other casing member when the diaphragm is in normal position, providing a cup within a cup, in the cup portion of the diaphragm.

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