

Feb. 18, 1969

KAZUO SUGIMURA ET AL

3,428,091

ACCUMULATOR

Filed Nov. 10, 1966

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FIG. 1.

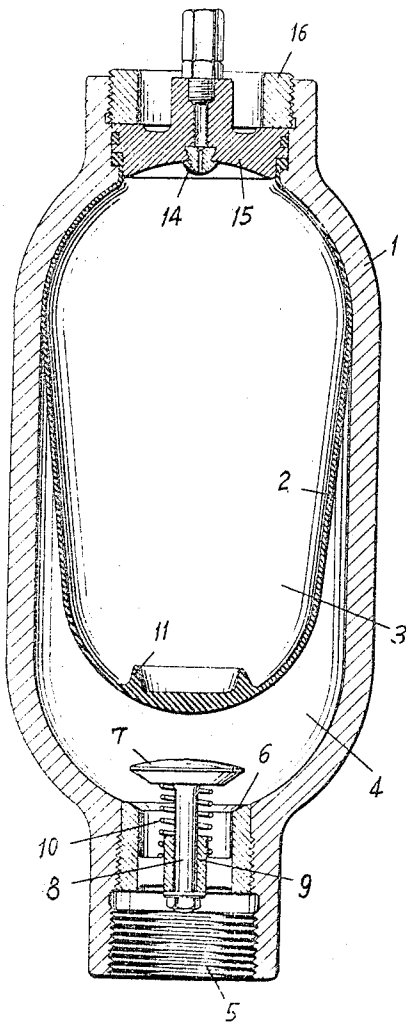
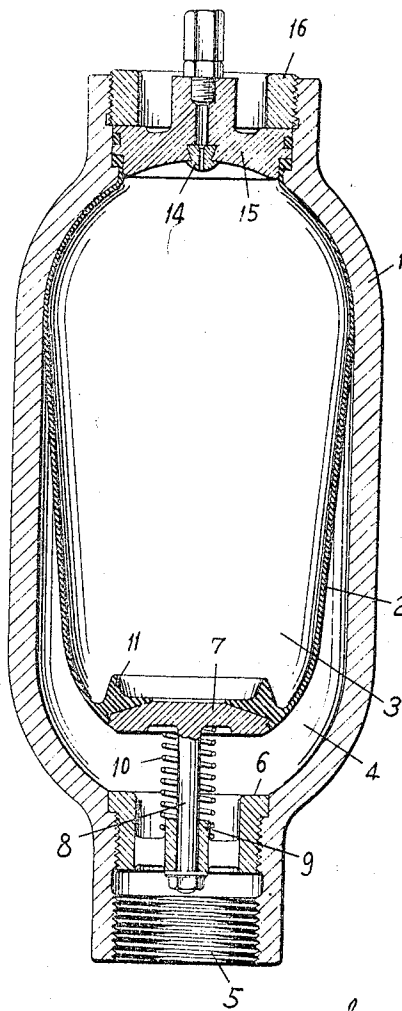


FIG. 2.



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FIG. 3.

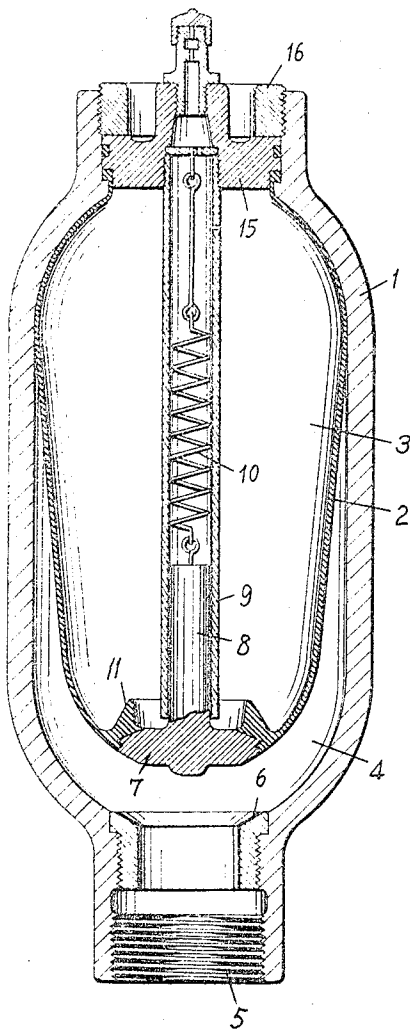


FIG. 4.

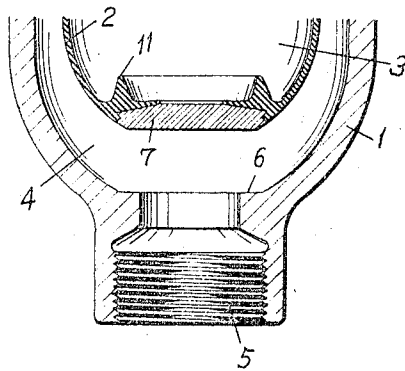


FIG. 5.

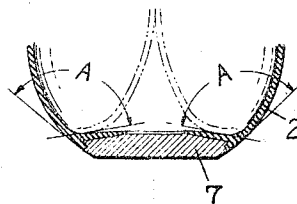
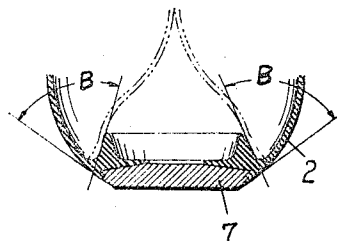


FIG. 6.



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40/81,431

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Int. Cl. F16l 55/04

4 Claims

ABSTRACT OF THE DISCLOSURE

An elastic gas bag accumulator is provided having at its bottom hemispherical end an inwardly projecting integral circular ridge for preventing the gas bag from suffering a sharp reverse bend when it collapses.

This invention relates to the improvement of the gas bag of accumulators of the pressure liquid type, which consist of a rigid cylindrical pressure liquid tank, and of an elastic and flexible cylindrical gas bag, generally called a bladder, filled with gas under a certain standard pressure, and disposed within the tank.

An object of this invention is to permit the wall of the gas bag to bend with a sufficient radius around its hemispherical or lower bottom end when the gas bag is collapsed, so as to prevent the wall from being injured due to sharp bend of the wall, and thus to elongate the useful life of the gas bag.

Other objects and the nature and advantages of the instant invention will be apparent from the following description taken in conjunction with the accompanying drawings, wherein:

FIG. 1 is a cross-sectional view through one embodiment of an accumulator in accordance with the present invention;

FIGS. 2-3 are cross-sectional views through modified forms of accumulators in accordance with the present invention;

FIG. 4 is a partial cross-sectional view through a still further modification of accumulator;

FIG. 5 is a partial cross-sectional view showing the lower end of a prior art type of gas bag; and

FIG. 6 is a partial cross-sectional view showing through the lower end of a gas bag in accordance with the present invention.

Referring to the drawings, FIG. 1 shows a first embodiment of an accumulator in accordance with the present invention. In the drawing, 1 is the pressure oil tank of rigid material, 2 is the gas bag, whose one end is hemispherical and the other open end is flanged so as to be compressed and fixed to one end of the tank 1 by a cover 15 and a ring nut 16, to form a gas bag, into which gas is charged through a gas valve 14, provided on the cover 15. A liquid port 5 is provided with a poppet valve 7 and its seat 6 to close and open the liquid port 5.

When this accumulator is installed in a pressure liquid system when the liquid pressure of the system is higher than the gas pressure within the gas bag, pressure liquid will flow into the liquid tank 1 through the liquid port 5 to be accumulated in the tank, with the gas bag being collapsed; and when the liquid pressure of the system drops lower than the gas pressure the collapsed gas bag will expand to discharge pressure liquid out of the tank through the liquid port. In the course of this expansion, the cylindrical gas bag inflates radially and longitudinally, and the gas bag will first touch and press against the cylindrical wall of the liquid tank, and then the hemispherical end will touch the valve 7 and finally push it downwardly against its seat 6, thus closing the liquid port 5.

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In the conventional gas bag, its hemispherical end is generally reinforced by making the wall of that end thicker than that of the cylindrical wall as shown in FIG. 1, or by some other suitable means, to protect the bag from being injured by the poppet valve. Due to this thickness change, when the gas bag collapses, its cylindrical wall bends along the line where the thickness changes and is folded sharply as shown in FIG. 5. Thus the bag is injured and damaged due to this sharp reverse bend. The useful life of the gas bag is thus much shortened.

To eliminate such a sharp reverse bend, the gas bag according to the present invention has a circular ridge 11, which is integrally provided within the bag, approximately at the edge of the thickened portion of the hemispherical end of the bag as shown in FIG. 1.

When a gas bag provided with such a ridge is collapsed or deflated, its cylindrical wall collapses just outside of the ridge and bends over the ridge as shown in FIG. 6. It is clear that, due to the ridge 11, the bending angle B is much smaller than the bending angle A of the conventional bag, as shown in FIG. 6 and FIG. 5, and the gas bag suffers no sharp reverse bend so as to be overstressed and to be injured due to the fold. It has actually been proven that the present gas bag suffers neither injury nor cracking due to bending and that its useful life is much elongated.

A few examples of embodiments of pressure liquid accumulators equipped with the gas bag of the present invention are shown in the drawings as follows:

The first embodiment

FIG. 1 is an accumulator of conventional type equipped with the gas bag 2 of the present invention, which has a circular ridge 11, which is integrally provided approximately along the border of the cylindrical wall and the hemispherical end as above described.

In this embodiment, the poppet valve 7 is supported by its valve stem 8 in a valve guide 9 through a coil spring 10, which acts to open the valve 7.

The second embodiment

FIG. 2 shows the second embodiment, in which like reference numerals represent the same parts as in the first embodiment. The difference between the first and second embodiments is that the gas bag 2 and the poppet valve 7 are made integral, i.e., the valve 7 is cast integral into the spherical end of the gas bag 2. In this case, the ridge 11 is provided along and above the circumference of the valve within the bag.

The valve 7, being thus equipped integral with the end of the bag 2, and the valve spindle 8 being guided by the valve guide 9 along the longitudinal center line of the accumulator, the gas bag 2, in spite of its buoyancy in the liquid, is always kept straight along the center line of the oil tank 1 even if the accumulator is installed horizontally or inclined. Here it must be mentioned that in the conventional accumulators, whose poppet valve is separated from the gas bag, the gas bag is bent due to the buoyancy when the accumulator is installed inclined or horizontally, and therefore the bag touches the wall of the liquid tank, causing friction not only to damage the gas bag but also to decrease the sensibility of absorbing hydraulic shocks of the accumulator due to the frictional resistance between the bag and the liquid tank.

The third embodiment

In the third embodiment, as shown in FIG. 3, the poppet valve 7 is also integral with the gas bag 2 at its cylindrical end, and the ridge 11 is provided along and above the circumference of the valve 7, as in the second embodiment. Instead of the valve stabilizing mechanism being provided outside of the gas bag as in the second

embodiment, in this third embodiment the valve stabilizing mechanism is all located inside of the gas bag 2 as shown in FIG. 3.

A tubular valve guide 9 is rigidly fixed at one of its ends to the liquid tank cover 15 within the tank 1 along its center line. Into another end of this guide 9, the valve spindle 8 provided on the upper side of the valve 7 is slidably arranged and a tension coil spring 10 is provided within the valve guide hooked at one end to the liquid tank cover 15 and at the other end to the valve spindle 8 which acts to open the valve 7.

By this arrangement, having all the valve stabilizing mechanism located within the gas bag 2, the liquid port 5 is quite clear of any obstacles and the liquid can flow freely through the port with minimum resistance, which gives the accumulator a high sensibility both to absorb hydraulic shocks and to discharge pressure liquid promptly into the pressure liquid system.

The fourth embodiment

FIG. 4 shows the fourth embodiment wherein the poppet valve 7 which has neither a valve spindle nor a guide is integrally attached to the cylindrical end of the gas bag 2.

An accumulator according to this embodiment has the same characteristics as an accumulator of the third embodiment wherein the pressure liquid can flow freely through the liquid port.

What is claimed is:

1. An accumulator, comprising a cylindrical liquid tank having a liquid port and a cylindrical gas bag made of a flexible and elastic material and located within the said tank, said gas bag being attached to the liquid tank

at its one end and having a free hemispherical other end being at least partially thickened adjacent to said liquid port, the wall of the said gas bag being integrally provided with a circular ridge around the bottom end approximately along the border of the thickened end of and within the said gas bag.

2. An accumulator according to claim 1, wherein a poppet valve is integrally embedded in the wall of the hemispherical end of said gas bag.

3. An accumulator according to claim 2, wherein a guide is located at the liquid port of said tank and a spindle attached to said valve is slidably supported by said guide.

4. An accumulator according to claim 2, wherein a spindle is attached to the side of said valve located within said gas bag, a tubular guide fixed to said one end to said tank and located along the center line of said gas bag, said spindle being slidably supported by said guide, and a tension coil spring located within said guide connecting said spindle to said tank.

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