March 26, 1963 KAZUO SUGIMURA 3,082,793

PROTECTING APPARATUS FOR GAS RESERVOIR OF OIL ACCUMULATOR

Filed Jan. 4, 1960

Fig. 1.

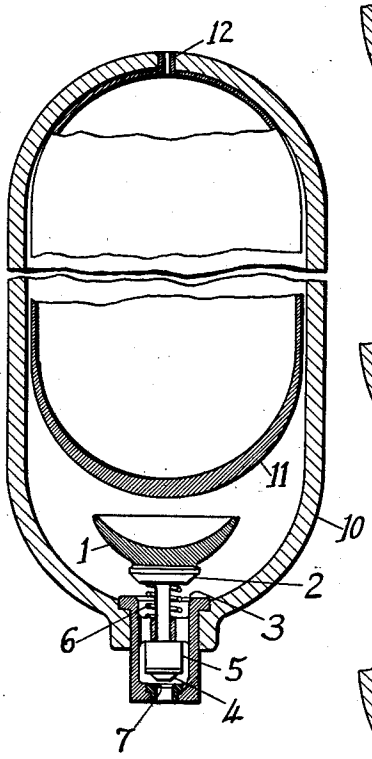


Fig. 2.

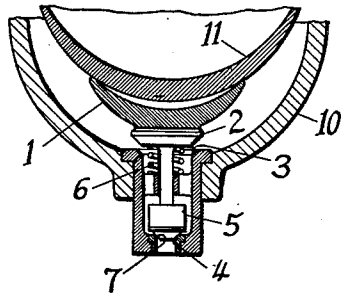


Fig. 3.

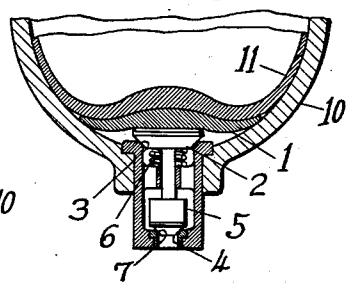
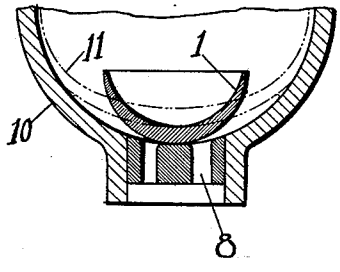


Fig. 4.



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PROTECTING APPARATUS FOR GAS RESERVOIR OF OIL ACCUMULATOR

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4 Claims. (Cl. 138—30)

This invention relates to a protective device for a gas reservoir provided in the oil bottle of a pressure oil accumulator. In this device, a cup of soft and elastic material is mounted and fixed on a discharge valve for the oil and acts as an elastic cushion, permits the oil retained in the cup to act as a lubricating cushion between the gas reservoir and the valve, and protects the gas reservoir from breakage.

FIGURE 1 is a longitudinal section of this invention with its central part broken away. FIGURES 2 and 3 are cross sectional views of an embodiment of this invention. FIGURE 4 shows a cross sectional view of another embodiment of the invention which differs from that shown in FIG. 1, FIG. 2, and FIG. 3.

The first embodiment of this invention is illustrated in FIGS. 1–3, and its operation and characteristics are explained in the following description.

FIG. 1 is a sectional view of a pressure oil accumulator, in which, an oil bottle **10** with a cylindrical barrel and semispherical ends, is provided with a gas reservoir **11** inside thereof, of nearly the same shape as the bottle.

The gas reservoir **11** is made of an oil proof, elastic synethtic rubber, and is so designed that its expansion and contraction occur due to the elongation and contraction of the reservoir along its longitudinal center line.

An apparatus for oil charging and discharging, which is provided at the bottom of the oil bottle **10**, consists of a poppet valve **2** and a check valve **4** which are connected to each other to act correlatedly by a buffer, consisting of a dashpot **5** and a coil spring **6**, in order to close the valves tightly and to absorb shocks caused by closing of the valves.

An oil cup **1**, made of soft, elastic and oil proof synthetic rubber is mounted and fixed on the poppet valve **2** to act as a cushion and a protector for the gas reservoir **11**.

The oil cup **1** is concave upwardly and its inside curvature is smaller than the outer curvature of the bottom surface of the gas reservoir **11** as shown in FIG. **1**.

When oil pressure in the oil circuit decreases, the gas reservoir **11** expands to discharge oil out of the bottle **10** through valves **2** and **4**, until the reservoir begins to touch the oil cup **1**; at this time the pressure of the reservoir against the cup **1** pushes down the poppet valve **2**, as shown in FIG. 2, and at last the check valve **4** is seated by movement through the dash-pot **5** to stop oil discharge out of the accumulator. In case oil leaks out of the bottle **10** through the check valve **4** due to its imperfect seal or due to some other cause, the gas reservoir expands further until it pushes the poppet valve **2** down against its valve seat **3** and closes the valve as shown in FIG. 3 to check oil leakage through these valves perfectly.

If the poppet valve were not provided with the oil cup **1**, the gas reservoir **11**, in the course of its expansion to close the valves, would bear directly upon the poppet valve **2** and force the lower surface of the reservoir strongly against the sharp edges of the projecting parts of the valve and its seat **3**. Moreover, during the course of expansion of the reservoir, the lower portion of the reservoir is apt to wrap the valve in it and become caught and nipped between the valve **2** and its seat **3**.

Thus the reservoir may easily become damaged and broken. It is clear that applicant's use of a flexible oil cup **1** mounted on the valve **2** never allows the reservoir **11** to bear directly against the valve. It acts as a soft cushion against the sharp projections of poppet valve **2** and its seat **3**, and never allows the reservoir to become caught between the valve **2** and its seat **3**. FIG. 3 shows the cup acting as a cushion from the gas reservoir at the point of extreme expansion of the latter.

In addition to this, after the gas reservoir begins to press against the oil cup as shown in FIG. 2 until it finishes its extreme expansion as shown in FIG. 3, the oil retained in the cup is pressed and squeezed gradually out along the circumference of the cup, and acts as an oil cushion so that the relative contact and sliding between the reservoir and cup will be soft and smooth, avoiding direct and frictional contact which might damage the surface of the reservoir.

The present invention yields a structure which guarantees smooth and accurate operation for long service.

The apparatus as above described is for high pressure oil.

In the case of low pressure oil, an oil cup of similar design to the oil cup previously described is applied to serve not only as a cushion, but also as a check and a poppet valve. In this case, these valves may be eliminated and a cup **1** placed inside an oil bottle **10** at its bottom above an oil discharge hole **8** as shown in FIG. 4.

In FIG. 4, chain lines show the position of the reservoir **11** in its extreme expanded position. Oil cup **1** acts as a cushion to the reservoir **11** and covers and closes the discharge hole **8** at the extreme expansion of the gas reservoir **11** serving as a check valve for oil discharge. In this case, it is clear that the oil retained in the oil cup **1** provides the same oil cushioning action as in the case of high pressure oil.

Thus this apparatus protects the gas reservoir to guarantee its long reliable service for use with low pressure oil.

I claim:

1. In an oil accumulator having an expandable gas reservoir located therein and a passageway through said accumulator at the bottom thereof for the supply and discharge of oil, a soft, non-metallic and elastic oil cup mounted between said gas reservoir and said oil passageway, said cup acting as an elastic cushion to protect the gas reservoir from direct contact with said oil passageway and to prevent the gas reservoir from being forced into the oil discharge holes by internal gas pressure, said cup being concave upwardly and retaining oil whereby oil retained in the cup acts as an oil cushion and is squeezed outwardly along the circumference of the cup when the gas reservoir expands into contact with said cup, said cup having an inside curvature smaller than the outer curvature of the bottom portion of said gas reservoir when said reservoir initially contacts said cup to thereby provide retaining means for said oil cushion.

2. In an oil accumulator in accordance with claim 1 wherein a valve is provided for opening and closing said passageway and said elastic oil cup is mounted on said valve.

3. In an oil accumulator adapted for use in a high pressure oil system having an expandable gas reservoir located therein and a passageway through said accumulator at the bottom thereof for the supply and discharge of oil, a valve mounted adjacent said passageway for opening and closing said passageway, a soft, non-metallic and elastic oil cup mounted on said valve between said gas reservoir and said oil passageway, said cup acting as an elastic cushion to protect the gas reservoir from direct contact with said valve and oil passageway and to pre-

vent said gas reservoir from being forced into said oil discharge passageway by internal gas pressure, said cup being concave upwardly and retaining oil whereby said retained oil within said cup acts as an oil cushion and is squeezed outwardly along the circumference of said cup when said gas reservoir expands into contact with said cup.

4. In an oil accumulator having an expandable gas reservoir located therein, an oil supply and discharge passageway located in the bottom of said accumulator and containing a poppet type valve therein, a soft, non-metallic and elastic cushion cup of hemispherical shape mounted on top of said poppet valve intermediate said gas reservoir and said poppet valve, said cushion cup being adapted to be widened dish-shaped elastically when said gas reservoir expands to its extreme so as to cover said valve completely thereby avoiding direct contact between said valve and said reservoir to protect the bottom of said reservoir.

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