

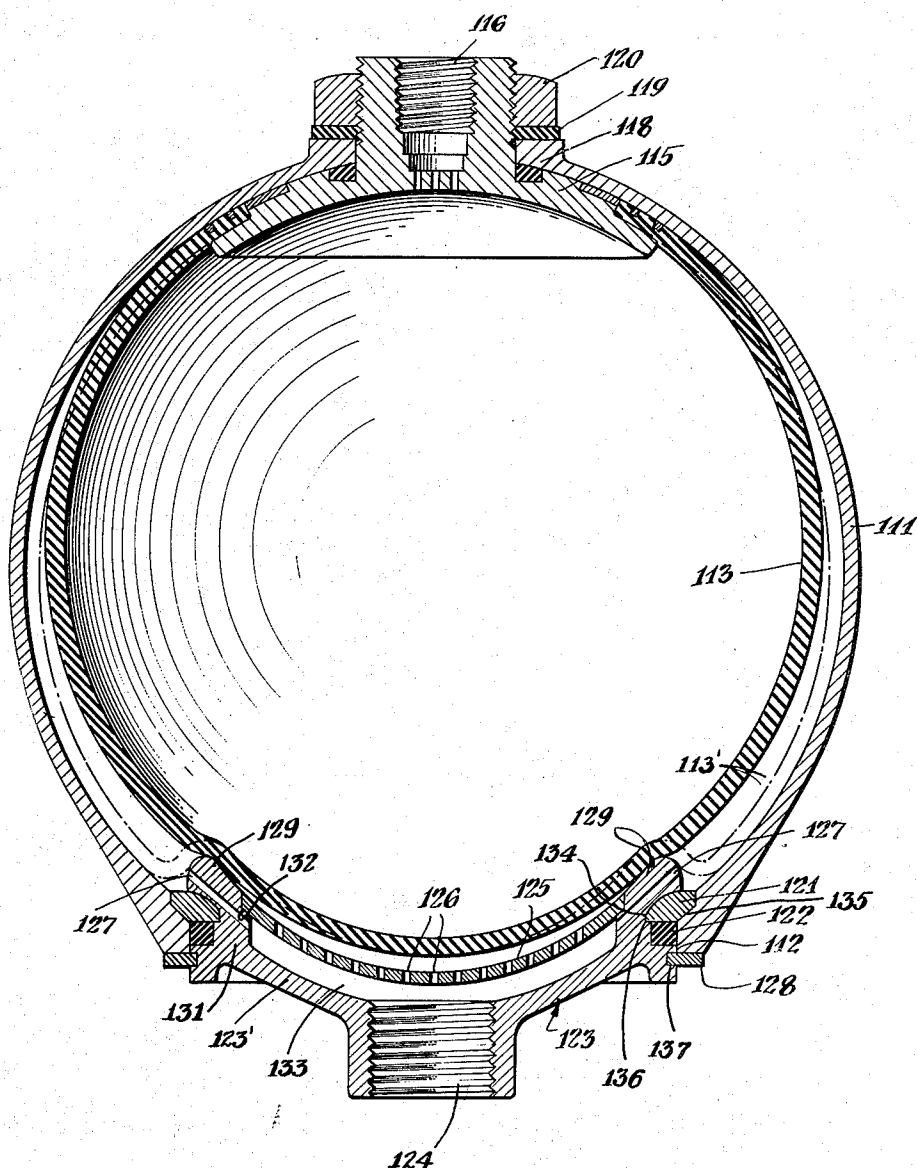
May 1, 1951

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2,550,892

PRESSURE ACCUMULATOR

Filed Jan. 26, 1944



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UNITED STATES PATENT OFFICE

2,550,892

PRESSURE ACCUMULATOR

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Application January 26, 1944, Serial No. 519,782

1 Claim. (Cl. 138—30)

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This invention relates to pressure accumulators. Pressure accumulators are used for supplying fluid under pressure to various machines. Thus, they are used for supplying water, oil, or other liquid or a gas under pressure to hydraulic presses or gasoline to certain airplane motors. The principle upon which the accumulators function is the compression of a supply of fluid against a buffer of air or other fluid, so that as one fluid is withdrawn during use, the buffer fluid, usually gas, expands and thus makes possible the delivery of a substantial quantity of the fluid before the buffer falls in pressure to the minimum pressure allowable upon the fluid being withdrawn.

The class of accumulators to which the present invention relates is that in which a flexible bag contains, for example, a buffer gas and a liquid containing compartment surrounds the bag. The accumulator is provided with a valve or other means for introducing gas within the bag and a port through which the liquid is pumped during the stage of accumulating a supply of the liquid under pressure and through which the liquid is withdrawn during its use.

In accumulators of this type there have arisen difficulties due to the closing of the outlet port or ports before all of the liquid at a pressure above that required can be withdrawn, injury to the expandible bag by contact with the device for closing the main liquid port or with other rough part of the apparatus, and inconvenience of obtaining access to the inside of the accumulator when it is desired to remove, repair or adjust inner parts of the assembly.

The present invention comprises a pressure accumulator having a plug with an annular passage or a plurality of primary liquid passageways in communication with the main port for liquid, the said plug being of such shape of surface, on the side adjacent to the buffer gas bag, as to be non-conforming with the outer surface of the bag. As a result of this non-conformance of shape, the bag as it expands on withdrawal of the accumulated liquid under pressure, closes the primary passageways serially and does not close the last of them until the liquid that is to be delivered has passed substantially completely through them.

The flexible bag, when no stress is exerted inwardly upon it, has a shape similar to the inside of the shell, allowance being made for the protuberance formed by the plug with a clearance between the bag and the shell of 2 mm. or so in which space a soft cushion of oil may be trapped.

The said cushion of oil enables the bag when

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unfolding to take its developed form with a minimum of friction on the shell wall.

While unfolding the bag must not close the oil ports but must leave open an exit for the oil. After several months of operation the bag, then slightly deformed, may trap some oil in places more or less distant from the oil ports; when, however, all the oil surrounding the oil ports is expelled the pressure in the bag becomes greater than the pressure of the surrounding oil. The bag then would tend to take a spheroidal shape, but the plug prevents it from doing so and the bag, pressing hard on the plug, receives a corresponding reaction which tends to push it in the general direction opposite to the plug.

As the oil ports are preferably situated in recesses, it will be seen that the previously trapped oil is expelled through the oil ports. Thus the invention solves the problem of the expulsion of the maximum possible amount of oil with a minimum stress and fatigue of the bag.

The invention will be illustrated by detailed description in connection with the attached drawing in which the single figure is a sectional view of the accumulator of the present invention.

Referring now to the drawing, the pressure accumulator comprises a container or pressure chamber 111 preferably of strong rigid material such as steel, cast aluminum or the like, capable of withstanding high pressure. The container may be spherical or cylindro-spherical as desired and has a collapsible and expandible bag 113 therein which preferably is of resilient material such as rubber or synthetic plastic of like physical characteristics and which in distended, but substantially unstretched condition is smaller than the cavity of the container. The container 111 and the bag 113 define therebetween a space 113' to receive the pressure accumulator liquid, the space 113' becoming very large as the bladder is collapsed and the contained gas therein is compressed by liquid forced through the opening 124 in closure plug 123.

Thus, if the pressure upon the gas in bag 113 is made 1500 pounds per square inch by pumping liquid into the space 113', and the volume of the gas in bag 113 is reduced to approximately 1/100 of the volume of the gas at normal atmospheric pressure, the volume of such space 113' for receiving the liquid forced therein is increased by an amount corresponding to the compression and decrease of volume of the gas in the bag 113.

The closure plug 123 comprises a bottom plate 123' having an upstanding rim 131 at the periphery thereof and unitary therewith and a con-

cave cover plate 125 is seated on an annular shoulder 132 in the inner wall of said rim 131 and rigidly affixed thereto. A portion of rim 131 extends above said cover plate to form an upstanding member or flange 129 which will be more fully described hereinafter.

A plurality of passageways 126 are provided in cover plate 125 preferably disposed from the center to the edge thereof, and a plurality of lateral radiating ports 127 extend through said rim 131 from the interior of the container 111 to the liquid receiving and holding space 133 between the bottom plate 123' and cover plate 125.

Closure plug 123 has a peripheral groove 134 therein beneath ports 127 and a rubber gasket 122 preferably affixed to said rim beneath said groove. A snap ring 121 is seated on the beveled edge 135 of opening 112 of the container against shoulder 136 thereof and in groove 134 in the rim 131 of the plug and a peripheral slot 137 is provided at the end of rim 131 below bottom plate 123' extending outside the container to accommodate a snap ring 128, thus securely to retain the closure plug in the container.

The bag 113 is secured in the container as by means of a flange 115 rigid with the nipple 116, the latter extending through the air inlet port of the container, and secured thereto by means of a nut 120 screwed on the threaded end of the nipple, a washer 119 intervening between the nut and the rim 118 of the container providing a liquid and air tight seal.

In the assembly of the device shown in Fig. 6, the rubber bag 113 is first inserted through the opening 112. Closure plug 123 is then inserted into opening 112 and snap ring 121 is fitted into peripheral groove 134 in the rim of the closure plug and then seated on the bevelled portion 135 against shoulder 136. Snap ring 128 is then inserted into peripheral slot 137 securely to retain the closure plug in place.

To use the device shown and described herein, a fluid, preferably air, is forced under pressure into the inlet 116 leading into the rubber bag 113 until the desired pressure, which may be of the order of 1500 pounds per square inch or more, is attained. This will cause the rubber bag 113 to stretch and snugly engage the inner wall of the container. The inlet is then sealed by any suitable valve (not shown). A liquid, preferably an oil, is then forced under pressure into outlet or port 124 of the container to fill the latter.

The liquid compresses the gas in the rubber bag thus decreasing its volume, and as the liquid is generally forced into the container until a very high pressure is obtained, illustratively of the order of 5000 pounds per square inch, the rubber bag will be collapsed.

As the accumulator approaches exhaustion of liquid and the rubber bag becomes stretched and stiff, its reaction against the upstanding member or flange 129 protruding inside the container will force the bag against the pole of the container substantially opposite the upstanding member. The further expansion of the stretched and stiffened bag during continued discharge of liquid from the container will result in a higher reaction pressure of the bag against the wall area of the container opposed to said upstanding member

than against the intervening wall areas of the container.

Thus, during such expansion of the rubber bag with the expulsion of liquid from the container, as the pressure of the bag against the wall of the container becomes progressively less toward the outlet, if any liquid should remain between the rubber bag and the container wall it would tend to be squeezed from the area of maximum pressure to the area of lesser pressure. This would prevent any liquid from being trapped between the wall of the container and the rubber bag.

When the rubber bag expands to the position shown in solid lines it contacts flange 129 of closure plug 123 and cuts off openings 126 from communication with the container. However, lateral ports 127 will still remain open. Further expansion of the rubber bag to the position shown in dot and dash lines will force any liquid remaining on the plate 125 through the openings 126 therein and also seal the ports 127. With this construction substantially all the space in the container is utilized and all the available liquid therein is forced out.

It will be understood also that it is intended to cover all changes and modifications of the example of the invention herein chosen for the purpose of illustration which do not constitute departures from the spirit and scope of the invention.

What is claimed is:

In a pressure accumulator of the class containing a collapsible bag holding a buffer gas and a pressure vessel surrounding the bag and defining therewith a space to receive and hold fluid under pressure; the combination in which the pressure vessel has a closure plug with an outlet port, said plug having a flange spacing the collapsible bag wall from the pressure vessel, a perforated plate surrounded by said flange and bores through said flange communicating to the port from the space intervening between the pressure vessel and the collapsible bag.

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