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HYDRAULIC ACCUMULATOR

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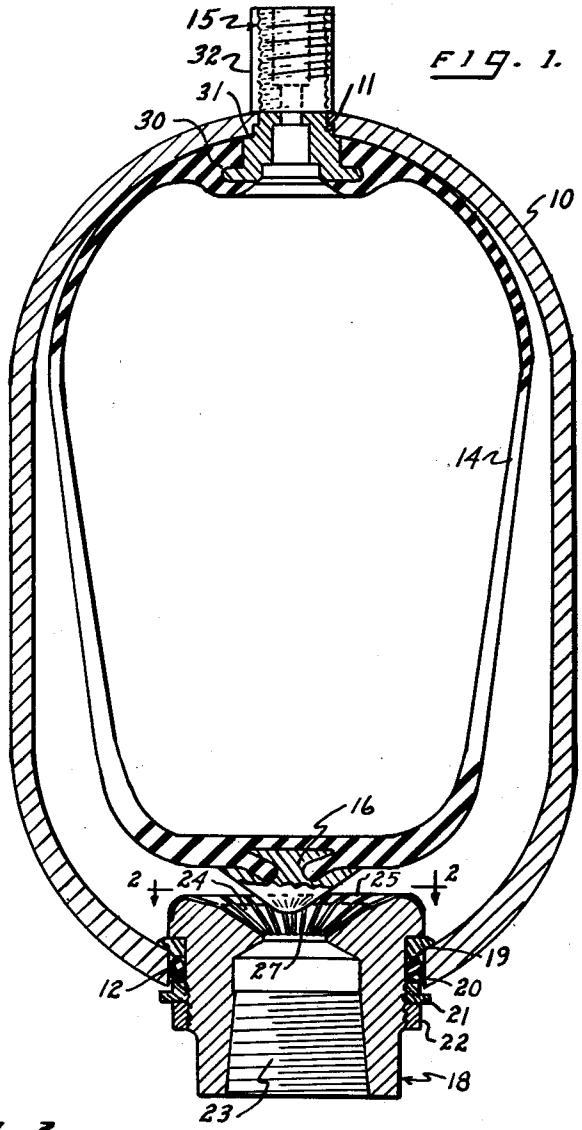


FIG. 1.

FIG. 2.

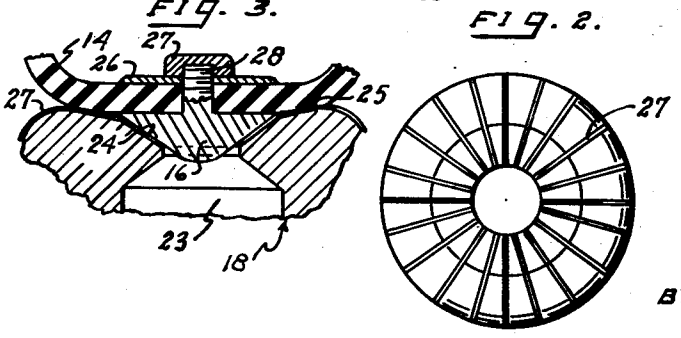


FIG. 3.

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HYDRAULIC ACCUMULATOR

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3 Claims. (Cl. 138—30)

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This invention relates to hydraulic accumulators and more particularly to the design of the oil discharge port in the accumulator and the deformable bag that is contained within the accumulator.

In hydraulic accumulators employing compressed air or a gas within a bladder as an energy storage mechanism, a fluid is stored at a pressure greater than the air pressure charged within the bladder. In use the fluid will be discharged from the accumulator by the energy storage mechanism. In such accumulators the compressed air storage mechanism may be a diaphragm or it may be a deformable bag. With a deformable bag there is a very undesirable tendency for the bag to force itself or cause the extrusion of the rubber of the bag through the fluid exhaust port after the fluid has been discharged, this condition causes damage or failure of the bag in use. Various modifications have been attempted to prevent damage to the bag, such as inserting a strainer in the fluid port and such strainer being provided with a plurality of very fine apertures to minimize the tendency of the rubber to extrude therethrough. However, this undesirable tendency produces a strain on the portion of the bag nearest to the oil port and a great number of the deformable bags in use do rupture at this particular point.

An object of this invention is to provide a means to prevent the extrusion of the deformable bag of the accumulator through the fluid discharge port when the fluid in the accumulator has been discharged.

Another object of this invention is to provide a means to protect the portion of the deformable bag of the accumulator that is normally under an excessive strain when bearing on the fluid discharge port when the fluid has been discharged from the accumulator.

A still further object of this invention is to provide a means integral with a deformable bag in combination with the fluid discharge port to insure the centering and guiding of the portion of the bag that should normally seal off the fluid discharge port when the fluid has been exhausted in the accumulator.

A still further object of this invention is to provide a fluid discharge port in an accumulator with means of draining the fluid that may be trapped within the accumulator due to the closing of the discharge port by the accumulator bag.

A still further object of this invention is to provide a fluid discharge port in an accumulator in the form of a poppet valve seat in combination

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with a poppet valve that is affixed to the deformable bag within the accumulator and in which the poppet valve seats on the fluid port to seal the accumulator when the fluid has been discharged therefrom.

A still further object of this invention is to provide a deformable bag in an accumulator in which the air port end is affixed to the accumulator at one end thereof and in which a protective plug of material harder than the deformable bag is affixed to the opposed end of the bag.

Another object of this invention is the means to restrict the deformable portions of the bag to an area about the bag lying between the two ends thereof.

A still further object of this invention is to provide means associated with the bag in combination with means associated with the shell to retain the closing position of the bag in perfect alignment with the fluid port when the fluid is fully discharged from the accumulator.

Other objects of this invention will be apparent by reference to the accompanying description and the drawing in which:

Fig. 1 illustrates a cross sectional view of the accumulator,

Fig. 2 illustrates a plan view of the fluid port taken on line 2—2 of Fig. 1, and

Fig. 3 illustrates another means of securing the protective button to the deformable bag.

Referring to Fig. 1, there is illustrated an accumulator shell 10 having two apertures 11 and 12 at opposed ends thereof and in which a deformable bag 14 is mounted. The deformable bag having an air port 15 at one end thereof and a re-enforcing or protective button 16 at the other end thereof. The bag is mounted within the accumulator by passing through the aperture 12 of the shell 10 and passing the air valve 15 through the aperture 11 and threadably securing and locking the air valve 15 in place, as indicated in Fig. 1. An oil port plug 18 is mounted through aperture 12 and a split ring 19 is compressed and passed through the aperture 12 and then spread into the position illustrated in Fig. 1 to lock the plug 18 within the accumulator shell, as illustrated. A seal 20 is positioned in the aperture 12 and a lock ring 21 is threadably secured about the plug 18 to force the seal 20 into a tight relationship with the aperture 12 and the periphery of the plug 18. The ring 21 may be locked in place by a lock nut 22. The plug 18 is provided with the usual threaded port 23 and on the interior of the shell the face of the plug 18 comprises two concave shaped portions 24 and 25 in

which the smaller concave shaped portion is formed to mate with the cone shaped exterior of the protective button or plug 16, while the larger concave portion 25 is provided with a different pitch primarily to act as a guiding surface for the plug in causing the plug 16 in the event it bears on any portion of the surface 25 to slide toward the portion 24 and find its alignment and seating with the portion 24. The faces 24 and 25 of the plug 18 may be provided with a plurality of small grooves 27 that extend from the outer periphery of the face 25 of the plug 18 into the port 23 at the inner end of the face 24. Thus, when the plug 16 is seated against the face 24, any fluid that may be trapped in the lower portion of the accumulator may be forced therefrom by the action of the accumulator bag wall in its expansion. The fluid travelling along the grooves 27 and out through the port 23. In Fig. 2, one arrangement of the grooves 27 is illustrated but other arrangements in which a lesser number of grooves may be provided may be used just as effectively. However, it is assumed that a plurality of very fine grooves would be preferable to a fewer number of larger grooves as the fine grooves do not permit the rubber or deformable material of the bag to be extruded and thus completely close these grooves. Referring to Fig. 3, a portion of the lower end of the deformable bag 14 is illustrated and in this particular modification the button 16 is mounted and affixed to the bag 14 by means of a threaded extension 28 which is passed through a washer 26 on the interior of the bag and secured to a threaded lug 27. Thus, the bag 14 is securely held between the button 16 and the washer 26. It is further noted in Fig. 3, that when the button 16 has been seated on the face 24 of the outlet plug 18 the outer surface of the deformable bag 14 will bear on the surface 25 of the plug 18. Thus, without the grooves 27 fluid would be trapped within the accumulator shell, but with a plurality of the grooves 27 and, especially with a plurality of fine grooves that prevent the extrusion of the deformable material of the bag into these grooves, the fluid trapped therein may escape along the grooves 27 and out the fluid port 23. It may be further noted in Fig. 3 that when the button 16 co-acts with the face 24 of the plug 18 to give a positive sealing action the seal will not be entirely dependent upon a tight fit between the face of the button 16 and the face 24 of the plug 18 but, in addition, the portion of the deformable bag 14 that is pressed firmly against the face 25 will provide an even better sealing action to insure a positive seal. Of course, in this instance, the grooves 27 would not be provided. However, in most of the usual uses of an accumulator the grooves 27 are desirable to allow drainage of any trapped fluid. When the grooves 27 are provided and all trapped fluid is drained from the accumulator the efficiency of the device in operation is far better as all of the available content of the device may be utilized.

It will be noted, referring to Fig. 1, that the normal operation of the bag 14, in use, causes a movement of the plug 16 toward the port 15 and in such movement the bag 14 must deform to allow this progressive movement as the fluid is pumped in through the port 23. Unfortunately, the bags 14 are not always shaped in a concentric fashion to retain the bag in its movement in a concentric position up and down with the ingress or egress of fluid. Instead, due to the nature of the material of the bag, and due to certain peculiarities of the bag, because of the manner of curing and other conditions that may exist, the bag 14 takes various shapes and formations in operation. However, as a general rule the bag 14 will expel the fluid from the accumulator in a rather progressive fashion and as it reaches toward the end of its expelling stroke the lower portion of bag may meet the oil port plug in alignment therewith or entirely out of alignment therewith. In this particular invention the button 16 has two functions. The button 16 is shaped in a cone shape and the plug 18 is formed with a guiding face so that in the event the deformable bag in its expelling stroke does not move in a concentric fashion the plug 16 will meet the guiding face 25 and be moved back into a concentric position and the plug 16 will seat in perfect alignment within the face 24 of the plug 18. The other function of the plug 16 is to prevent the material of the deformable bag 14 from excessive strain or attempted extrusion during the final closing of the fluid port 23. In this particular instance, the plug 16 is designed to securely hold the bag in a fixed relation therewith and to restrict and re-enforce the particular portion of the bag that would normally be under an excessive strain during this closing operation. It is to be noted in Fig. 1 that the oil port plug 18 and especially the inner end thereof has been somewhat exaggerated in the drawing to clearly distinguish the faces 24 and 25 as well as the grooves 27, but in actual use they may be much smaller and the area on either side of the plug within the shell would be considerably less to prevent the possibility of trapping fluid in this particular area. It is apparent in Fig. 1, that the greater diameter of the plug 18 has been restricted to the diameter of the aperture 12 to permit the plug 18 to be passed through the aperture 12. However, with the locking ring 19, as provided, it is possible to vary the aperture 12 slightly to insure the passage of the plug 18 therethrough without weakening this design. It is perhaps desirable to reduce the head portion of the plug 18 as much as possible and still retain the features that are incorporated in this invention. It is also desirable to effect as large an area of the lower portion of the bag 14 with the re-enforcing button 16 as is plausible without departing from the spirit of this invention.

Referring to the air valve insert of the accumulator bag in Fig. 1, it may be noted that the rubber seal or bonding is not disturbed at 30 or further pressed in mounting and sealing the air valve 15 to the shell 10. Instead the mounting of valve 15 provides a metal to metal contact between the shoulder 31 and the cap member 32. The rubber bond of the bag 14 to the base of the valve 15 is effective over its entire bonded area during each stroke or stress of operation of the bag. The metal to metal contact insures a tight seal without extruding any of the rubber into the aperture 11.

Various changes and modifications may be made to the deformable bag at or near to the fluid outlet port and to the design of the fluid port without departing from the spirit of this invention and various changes may be made to the means of maintaining drainage for the fluid that may be trapped therein without departing from the spirit of this invention, and this invention shall be limited only by the appended claims.

What is claimed is:

1. In an accumulator comprising a shell hav-

ing two ports, one of said ports forming an air port and the other of said ports forming a liquid port, a deformable partition secured within said shell separating said two ports from each other, an air valve mounted in said air port, a liquid outlet plug mounted in said liquid port, a re-enforcing button affixed to the side of the deformable partition opposite to the air port, said liquid outlet plug having a concave shaped face on the interior of said shell, said concave face being provided with a plurality of grooves radiating from the center of said plug, said re-enforcing button being cone shaped to mate with the concave shaped face of the liquid outlet plug, and being free to move away from said liquid outlet plug with the deformation of the partition.

2. In an accumulator comprising a shell having two ports, a deformable bladder secured within said shell separating said two ports from each other, an air valve mounted in one end of said bladder and secured to one of said two ports in said shell, a liquid outlet plug having a cone shaped inner face with a central bore mounted in the other of said ports in said shell, said liquid outlet plug having the cone-shaped face that is mounted within the shell cut with a plurality of fine drain grooves which extend from the outer circumference of the plug to the central bore.

3. In an accumulator comprising a shell having two ports, a deformable bladder secured within said shell separating said two ports from each other, the deformable bladder having an air valve bonded to one end thereof to control the ingress and egress of air in the bladder and a guiding button bonded to the opposite end of said bladder, said air valve being mounted in one port of the shell, a liquid outlet plug having a concave inner face mounted in the other port of said shell, said liquid outlet plug having a shoulder on the outer periphery thereof that bears against a lock ring which in turn bears against the inside surface of the shell when the plug is mounted in the other port of the shell, means to seat said shoulder and lock ring tightly against the shell to provide a seal.

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