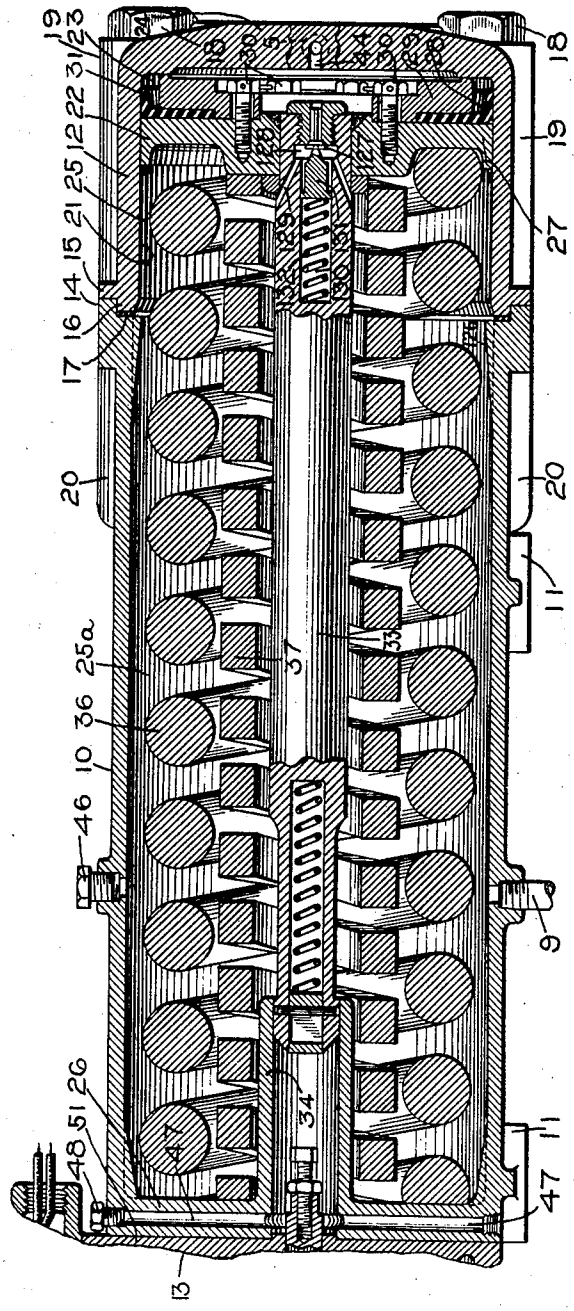
May 2, 1944. R. J. BUSH 2,347,932

ACCUMULATOR

Original Filed April 28, 1942 2 Sheets-Sheet 1

Fig.1



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ACCUMULATOR

Original Filed April 28, 1942 2 Sheets-Sheet 2

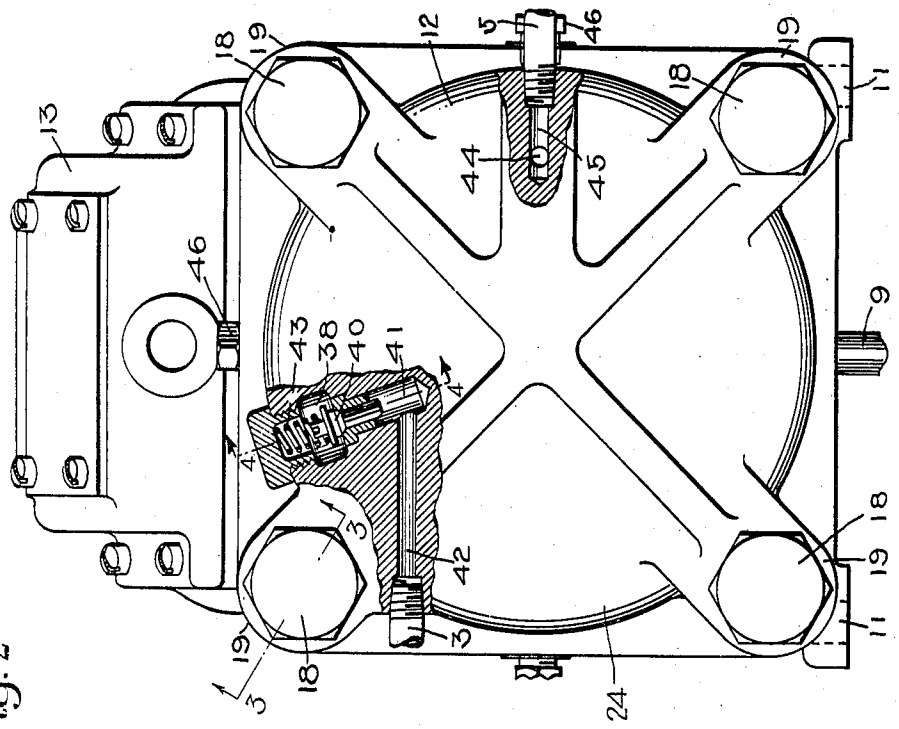


Fig. 2

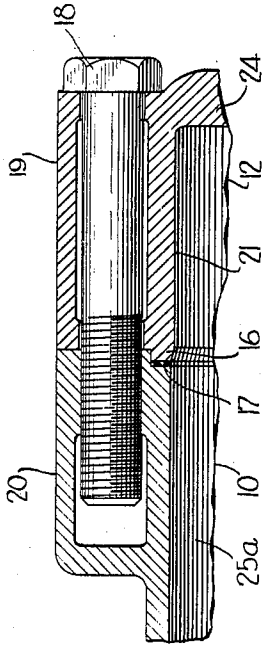


Fig. 3

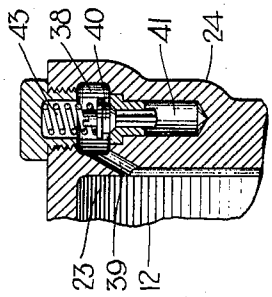


Fig. 4

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Patented May 2, 1944 2,347,932

UNITED STATES PATENT OFFICE

2,347,932

ACCUMULATOR

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Original application April 28, 1942, Serial No. 440,823. Divided and this application December 30, 1942, Serial No. 470,560

8 Claims. (Cl. 138—31)

This invention relates to accumulators and more particularly to the hydraulic type for storing liquid under pressure, the present application being a division of my copending application Serial No. 440,823, filed April 28, 1942.

The principal object of the invention is the provision of an improved accumulator of the above type.

In the accompanying drawings; Fig. 1 is a sectional view taken longitudinally through the improved accumulator; Fig. 2 is a view mainly in elevation of the right hand end of the accumulator as viewed in Fig. 1; and Figs. 3 and 4 are sectional views taken respectively on the lines 3—3 and 4—4 in Fig. 2.

Description

The improved accumulator comprises a relatively long, central, cup-shaped mounting or base portion 10 having suitable mounting lugs 11, a relatively short liquid reservoir or cylinder portion 12 also cup-shaped and disposed at the open end of the central portion 10 in coaxial relation, and a motor control portion 13 mounted on and carried by the closed or opposite end of the central portion 10. The motor control portion 13 is fully disclosed in the parent application and forms no part of this divisional application.

The adjacent open ends of the portions 10 and 12 are provided with external annular ribs 14 and 15, respectively, which engage each other. The internal surface of the rib 14 defines a recess into which projects a tongue 16 provided on the end of the reservoir portion 12 and interposed between this tongue and the bottom of the recess is a gasket 17 which, when the parts 10 and 12 are secured together in the manner hereinafter described, is compressed to produce a seal which will prevent seepage of oil through the joint between the two parts. The two parts 10 and 12 of the accumulator are rigidly secured together with the ribs 14 and 15 in contact with each other by means of a plurality of cap screws 18 which are equally spaced from each other around said parts and which extend through suitable bores provided in bosses 19 on the reservoir portion 12 and have screw-threaded engagement in aligned bosses 20 provided on the adjacent end of the central portion 10. This metal to metal contact between the ribs 14 and 15 serves to limit the pressure to which the sealing gasket can be subjected to by the parts 10 and 12 thereby guarding the gasket against damage.

The reservoir portion 12 is provided interiorly with a finished or machined bore 21 in which is slidably mounted a piston 22 which separates a pressure chamber 23, defined by the inner surface of the bore, the closed end wall 24 of the reservoir portion and the piston, from a non-pressure chamber 25 at the opposite side of the piston which is open to a chamber 25a extending through the central portion 10 of the accumulator to the end wall 26 thereof. The central portion 10 of the accumulator is provided with four drain openings to the lowermost of which a pipe 9 is connected in order that any liquid which may enter chamber 25a may drain out of same. The other three openings are closed by plugs 46.

The piston 22 comprises a piston head 27 having sliding contact with the bore 21 and further comprises a flexible packing cup 28 which is secured to the face of said head adjacent the closed end wall 24 of the reservoir portion by a suitable follower 29 and cap screws 30. The packing 28 has a skirt portion 31 which encircles the follower 29 and contacts the wall of the bore 21. This skirt is adapted to be forced into sealing contact with the wall of the bore by liquid pressure effective in the pressure chamber 23 in order to prevent leakage of such liquid pressure past the piston to chamber 25a at the opposite face thereof.

The piston head 27 carries one end of a piston rod 33 which extends through chamber 25 and into chamber 25a. The opposite end of rod 33 is supported in a bore provided in a boss 34 projecting into chamber 25a centrally from the end wall 26 of the central portion 10 of the accumulator. The end wall 26 has a plurality of spaced radially extending passages 47 opening into the outer end of the bore in boss 34. The outer end of each of these passages is closed by a plug 48, except the lowermost passage which is effective to allow drainage of any oil from the bore within boss 34 which may gain access thereto from chamber 25a past the piston rod 33.

Two coil springs 36 and 37, arranged one within the other and encircling the piston rod 33 and the boss 34, extend through the chambers 25 and 25a and bear at one end against the piston head 27 and at the opposite end against the end wall 26 of the central portion 10 of the accumulator. These springs are under a chosen degree of pressure for opposing movement of the piston 22 away from the closed end wall 24 of the reservoir portion 12 of the accumulator. The initial compression of the springs is effected by the reservoir portion 12 as such portion is drawn into working relation with the central portion 10 of the accumulator by means of the cap screws 18,

in which relation the ribs 14 and 15 engage each other as above described and thereby limit the initial compression of the spring.

The closed end wall 24 of the reservoir portion 12 has a chamber 38 which is open through a port 39 to the pressure chamber 23 and also through bores 41 and 42 to a supply pipe 3 through which liquid under pressure is adapted to be forced by a pump (not shown) into chamber 23 at one side of the accumulator piston 22. The chamber 38 contains a check valve 40 arranged to permit flow of liquid from the pump to chamber 38 and accumulator piston chamber 23 but to prevent flow in the opposite direction. A spring 43 in chamber 38 acts on the check valve 40 to urge same to its seated position shown.

The end wall 24 of the reservoir portion 12 is also provided with a bore 44 open at one end to the pressure chamber 23 and at the opposite end to a bore 45 which is connected to a pipe 5 through which liquid under pressure may be drawn from the chamber 23 for use.

From the above description it will be seen that when liquid under pressure is supplied to pipe 3 it will flow past the check valve 40 into pressure chamber 23 and therein act on piston 22 in opposition to the pressure of springs 36 and 37. When the pressure of liquid in pressure chamber 23 is increased to a degree sufficient to overcome the opposing pressure of springs 36 and 37, the piston 22 will move in the direction of the left hand, as viewed in Fig. 1. When liquid is drawn from chamber 23 through pipe 5, the resultant reduction in the pressure of liquid in said chamber will allow springs 36 and 37 to move piston 22 in the direction of the right hand.

It is intended that the piston 22 will be moved in the direction of the left hand for about two-thirds, three-quarters or any other desired portion of the length of bore 21 and be then stopped by terminating the supply of liquid under pressure thereto through pipe 3 by means disclosed and described in the parent application. In case the supply of liquid under pressure to chamber 23 fails to be terminated as just described, then the piston 22 will continue movement against springs 36 and 37, but such movement will be limited by engagement of said piston while still in bore 21 with a plurality of spaced ribs or stops 126 provided in the central portion 10 adjacent the reservoir portion 12.

If the piston 22 moves into contact with stops 126 it is desirable to relieve all further liquid forced into chamber 23 and for this purpose a check valve 127 arranged in the right-hand end of piston rod 33 controls a communication between pressure chamber 23 and a chamber 28 which is open through passages 129 to chamber 25a within the central position 10. Back of the check valve 127 the piston rod 23 has a bore 130 containing a plunger 131 acting on the check valve 127 and a spring 132 acting on said plunger for urging the check valve to its closed position shown.

The pressure of spring 132 on the check valve 127 is such as to maintain said valve seated at all times when the pressure of liquid in pressure chamber 23 is below that required to move the piston 22 against the springs 36 and 37 into contact with the stops 126. At substantially the time this greater degree of pressure is however attained, such pressure acting on the check valve 127 will unseat same against the spring 132 to thereby dissipate all further liquid displaced by the pump into the pressure chamber 23 from said chamber into chamber 25a from which it may drain away through pipe 9 so as to thereby prevent further increase in pressure in chamber 23 and possible damage to the device or failure of the system with which the accumulator is associated.

From the above description it will be noted that operation or movement of the piston 22 is confined to within the finished or machined bore 21 of the reservoir portion 12. The substantially aligned wall of chamber 25a in the central portion 10 of the accumulator need not therefore be machined or finished, and neither is it necessary that this wall be as thick as that of the reservoir portion 12 since it is never subjected to the bursting pressure of liquid in chamber 23. This wall need only be sufficiently rigid to support the reservoir portion 12 at one end and the motor control portion 13 at the opposite end and to also support the springs 36 and 37 against their expansive force on end wall 26. By this construction the weight and cost of the accumulator are maintained at a minimum.

It should also be noted that since the central portion 10 constitutes the mounting portion of the accumulator, the cylinder 12 and piston 22 can be removed for inspection or repairs without interference with an installation. Moreover such inspection or repairs is facilitated by the structure embodying the long cap screws 18 which allow removable or application of the cylinder 12 to and from the central portion 10 with the springs 36 and 37 in a fully expanded condition.

Having now described the invention, what I claim as new and desire to secure by Letters Patent, is:

1. A pressure accumulator comprising a cylindrical base portion one end of which is arranged for supporting one end of a spring under pressure and the interior wall of which is unfinished, a fluid accumulator cylinder removably mounted on the opposite end of said base portion and having a finished piston bore open to the interior of said base portion, a piston slidably mounted in said bore and having at the side opposite said base portion a pressure chamber for containing fluid under pressure, and a spring extending through said base portion interposed between and bearing at one end on said one end of said base portion and at the opposite end against the adjacent side of said piston for urging said piston against fluid pressure in said chamber.

2. A pressure accumulator comprising a base portion having at one end a wall, a cylinder portion mounted against the opposite end of said base portion, a piston slidably mounted in said cylinder portion, coil spring means bearing at one end against said wall and at the opposite end against one face of said piston, said piston having at its opposite face a pressure chamber for containing fluid under pressure, a plurality of bolts arranged around and carried by said cylinder portion and having screw-threaded engagement with the adjacent end of said base portion, said bolts being of such length as to provide for screw-threaded contact with said base portion with said spring means fully extended and being operative upon drawing said cylinder portion into engagement with said base portion to compress said spring means for providing a chosen degree of spring pressure on said piston.

3. A pressure accumulator comprising a base portion having a spring supporting wall, a fluid accumulator cylinder removably secured to one end of said base portion and having a piston bore open at the end adjacent said base portion, a piston slidably mounted in said bore, spring means interposed between said wall and the adjacent face of said piston, said piston having at its opposite face a pressure chamber for receiving fluid under pressure which is operative to effect movement of said piston against said spring means in the direction of said base portion, and stop means in said base portion engageable by said piston with said piston in said bore for preventing movement of said piston out of said cylinder.

4. A pressure accumulator comprising a base portion having a spring supporting wall, a fluid accumulator cylinder removably secured to one end of said base portion and having a piston bore open at the end adjacent said base portion, a piston slidably mounted in said bore, spring means interposed between said wall and the adjacent face of said piston, said piston having at its opposite face a pressure chamber for receiving fluid under pressure which is operative to effect movement of said piston against said spring means in the direction of said base portion, stop means in said base portion arranged to engage said piston to prevent movement of said piston out of said cylinder under the action of fluid pressure in said pressure chamber, and a release valve subject to pressure of fluid in said pressure chamber and operative upon an increase in such pressure to a degree substantially equal to that required for moving said piston into engagement with said stop means to open a communication from said pressure chamber for releasing fluid under pressure therefrom.

5. A pressure accumulator comprising a base portion having a spring supporting wall, a fluid accumulator cylinder removably secured to one end of said base portion and having a piston bore open at the end adjacent said base portion, a piston slidably mounted in said bore, spring means interposed between said wall and the adjacent face of said piston, said piston having at its opposite face a pressure chamber for receiving fluid under pressure which is operative to effect movement of said piston against said spring means in the direction of said base portion, stop means provided for engagement by said piston, upon movement thereof under the action of fluid pressure supplied to a said pressure chamber, at the end of said cylinder adjacent said base portion for preventing further movement of said piston by said fluid pressure, and a release valve in said piston subject to the pressure of fluid acting in said pressure chamber and operative upon an increase in such pressure to substantially the degree required to move said piston against said stop means to open a communication for releasing fluid under pressure from said pressure chamber.

6. A pressure accumulator comprising a base portion having a spring supporting wall, a fluid accumulator cylinder having one end removably secured to said base portion and having a piston bore open at one end to said base portion and closed at the opposite end by a pressure head, a piston slidably mounted in said bore, spring means under pressure interposed between said spring supporting wall and the adjacent face of said piston, said piston having at its opposite face a pressure chamber, a communication through said pressure head for supplying fluid under pressure to said pressure chamber for moving said piston against said spring means, a check valve in said communication providing for flow of fluid under pressure in the direction of said pressure chamber and arranged to prevent flow of fluid under pressure in the opposite direction through said communication, and a passage in said pressure head open to said pressure chamber providing for flow of fluid under pressure from said pressure chamber.

7. A pressure accumulator comprising a cup-shaped base portion, a cup-shaped cylinder portion arranged with its open end adjacent the open end of said base portion, bolt means extending through said cylinder portion and base portion removably securing same together in contact with each other, a piston slidably mounted in said cylinder portion, spring means interposed between the closed end of said base portion and the adjacent side of said piston, said spring means being under pressure urging said piston in the direction of the closed end of said cylinder portion, said piston having at the opposite side a pressure chamber for receiving fluid under pressure through a communication in the closed end of said cylinder portion for moving said piston in said cylinder portion in the direction of said base portion, a check valve in the closed end of said cylinder portion controlling said communication and so arranged as to provide for flow of fluid under pressure in the direction of said pressure chamber but to prevent flow in the opposite direction, another communication in the closed end of said cylinder portion providing for flow of fluid under pressure out of said pressure chamber, said bolt means providing for connecting said cylinder portion to said base portion with said spring means fully extended and being then operative to draw said cylinder portion into engagement with said base portion and during such operation compress said spring means.

8. A pressure accumulator comprising a cup-shaped base portion, a cup-shaped cylinder portion arranged with its open end adjacent the open end of said base portion, bolt means extending through said cylinder portion and base portion removably securing same together in contact with each other, a piston slidably mounted in said cylinder portion, spring means interposed between the closed end of said base portion and the adjacent side of said piston, said spring means being under pressure urging said piston in the direction of the closed end of said cylinder portion, said piston having at the opposite side a pressure chamber for receiving fluid under pressure through a communication in the closed end of said cylinder portion for moving said piston in said cylinder portion in the direction of said base portion, a check valve in the closed end of said cylinder portion controlling said communication and so arranged as to provide for flow of fluid under pressure in the direction of said pressure chamber but to prevent flow in the opposite direction, another communication in the closed end of said cylinder portion providing for flow of fluid under pressure out of said pressure chamber, said bolt means providing for connecting said cylinder portion to said base portion with said spring means fully extended and being then operative to draw said cylinder portion into engagement with said base portion and during such operation compress said spring means, stop means associated with the open end

of said base portion arranged as to be engaged by said piston upon movement thereof under the action of fluid pressure in said pressure chamber to a position adjacent the open end of said cylinder, and a release valve in said piston subject to the pressure of fluid in said pressure chamber and arranged to operate upon an increase in such pressure to a degree which provides for movement of said piston substantially into contact with said stop means to open a vent from said pressure chamber for releasing fluid under pressure therefrom.

RANKIN J. BUSH.