Nov. 17, 1953 M. P. BERGER 2,659,391

PNEUMATIC ACCUMULATOR

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Fig. 1.

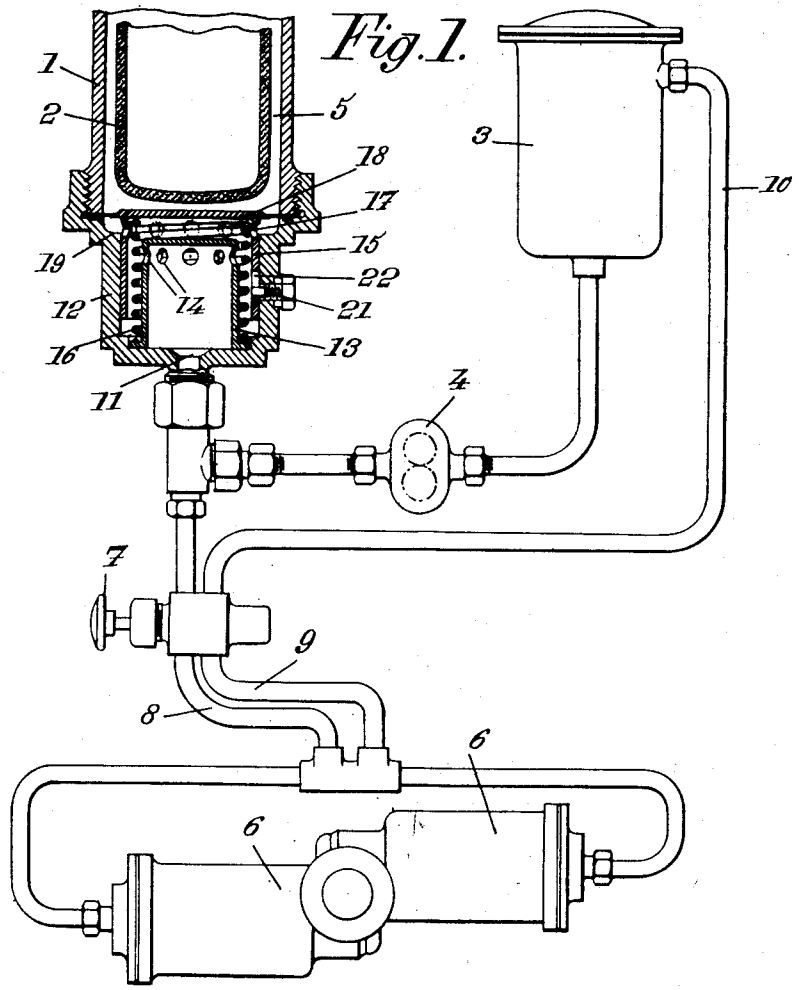
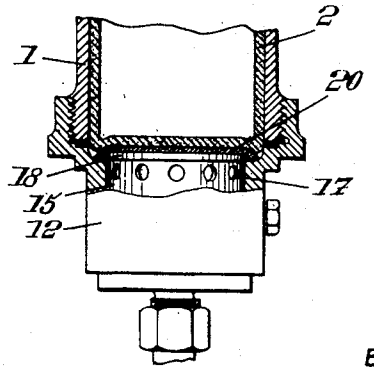


Fig. 2.



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Fig. 3.

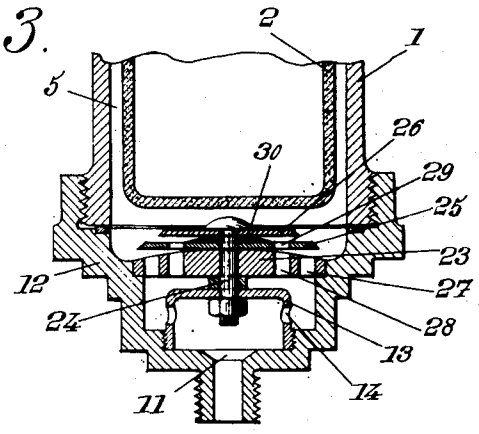


Fig. 4.

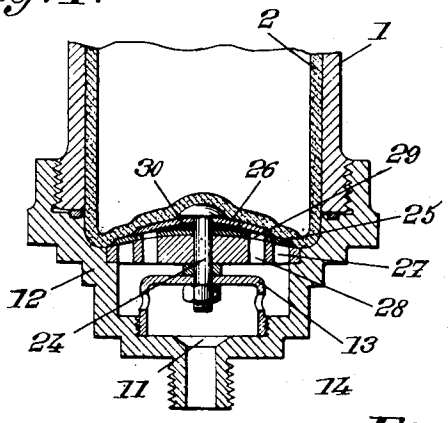


Fig. 6.

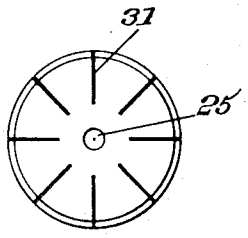
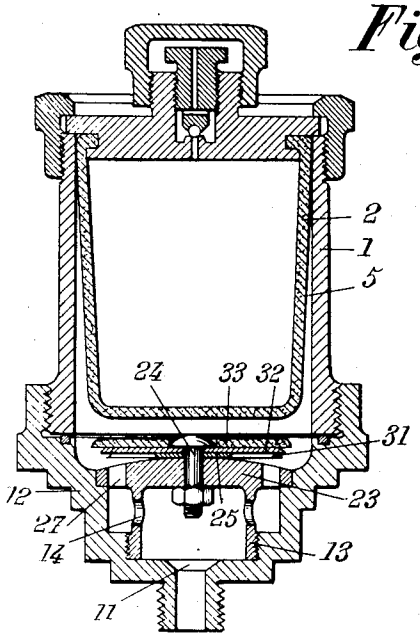


Fig. 5.



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Fig. 7.

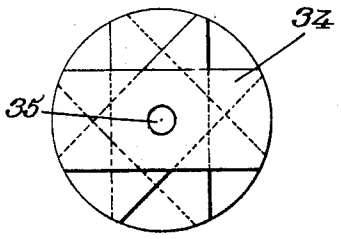


Fig. 10.

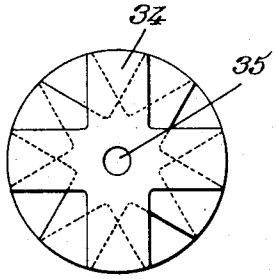


Fig. 8.

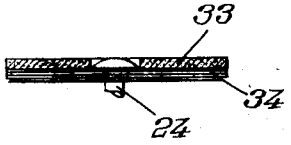


Fig. 11.

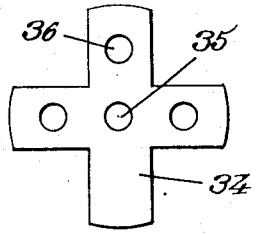


Fig. 9.

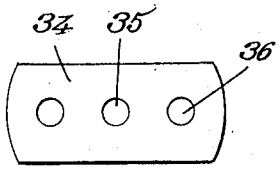
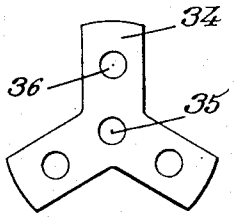


Fig. 12



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PNEUMATIC ACCUMULATOR

Maurice Pierre Berger, Paris, France

Application July 2, 1947, Serial No. 758,682

Claims priority, application France July 2, 1946

2 Claims. (Cl. 138—30)

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The present invention relates to pressure accumulators and similar apparatus of the kind in which pressure is exerted on the power transmitting gaseous or liquid fluid by means of a source of energy constituted by a gaseous fluid under pressure and separated from said power transmitting fluid by a deformable partition for instance as described in my French Patent No. 842,835 filed August 31, 1938.

The chief object of my invention is to provide an apparatus of this kind which is better adapted to meet the requirements of practice than those used for the same purpose up to the present time.

Preferred embodiments of my invention will be hereinafter described with reference to the accompanying drawings, given merely by way of example and in which:

Fig. 1 is a diagrammatic elevation, with portions in section, of a combination engine starter and compressed air accumulator according to my invention, for supplying liquid under pressure to operate said starter;

Fig. 2 is a part view analogous to Fig. 1, and showing elements thereof in another position.

Figs. 3 and 4 show, similarly to Fig. 2, in two different working positions, an accumulator made according to another embodiment of my invention.

Fig. 5 similarly shows an accumulator made according to a modification.

Fig. 6 is a separate plan view of one of the parts of the accumulator of Figs. 3 to 5.

Figs. 7 and 8 show, respectively in plan and sectional views, a portion of a cut off valve to be included in an apparatus of this kind and made according to another embodiment of my invention.

Fig. 9 is a plan view of a modified element of this device according to the invention.

Fig. 10 is a plan view analogous to that of Fig. 7 of a further modified device.

Figs. 11 and 12 are respective plan views of one of the elements of the device of Fig. 10, in still further modified forms.

By way of illustration, I have reproduced in Fig. 1 a system of the kind described in my above mentioned prior patent, which comprises:

a. The accumulator proper, constituted by a fluidtight container 1 inside which is mounted a deformable bag or partition 2 (of rubber or another material) containing a reserve of compressed air or in communication with an external source of compressed air;

b. A reservoir 3 of power transmitting liquid, in combination with a pump 4 capable, through

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a suitable automatic control (operated for instance when the pressure, due to expansion of said bag 2, has dropped down to a given minimum in container 1) of delivering this liquid under pressure into said container, where it occupies the annular space 5 between the wall and bag 2, said liquid being thus constantly subjected to the action of the pressure in said bag; and

c. Starters 6 (or any other apparatus to be controlled), including for instance two cylinders with pistons therein adapted to move under the action of the power transmitting liquid pressure, when this liquid is allowed by means of a valve 7 to enter said cylinders, the pistons acting for instance on racks in mesh with a pinion fixed on the shaft to be started.

8 and 9 are an inlet conduit and an exhaust conduit respectively, the return of liquid to the reservoir 3 taking place through pipe 10.

In a system of this kind, it may happen that, when a starting operation requires an important and quick flow of fluid, the wall of deformable bag 2, upon expanding and moving toward the liquid outlet orifice 11, blocks this orifice or the cut-off valve associated therewith. This will tend to happen under the effect of the liquid stream suction due to the high local velocity of the liquid streamlines as they flow past the cut-off valve.

In order to obviate these drawbacks, I interpose, in the accumulator, between the deformable bag and the outlet orifice, means for limiting the velocity of the liquid streams, in particular by causing expansion to take place in a chamber of suitable dimensions, into which the liquid can be admitted through one or several orifices of sufficient total section.

For instance, as shown by Fig. 1, I provide at the end of the accumulator, preferably inside the removable end piece or chamber 12, a bell-shaped casing 13 of sufficiently large diameter and into which the liquid flows laterally through a multiplicity of holes such as 14.

If a cut off valve is provided between the chamber in which this casing 13 is positioned and the chamber in which deformable wall 2 is arranged, the suction effect will be reduced to a minimum on the one hand due to the plurality of said holes 14, on the other hand, due to the fact that the direction of the liquid streams through these holes is transverse to the axis of the apparatus.

The cut off valve is advantageously constituted by a bell-shaped piece 15 of large diameter, which surrounds casing 13 and is subjected to the action

of a return spring 16, said piece 15 being provided with passage holes 17 in sufficient number and laterally disposed. This valve includes a plate 18 that fits laterally upon a seat 19, so as to constitute for deformable wall 2, when the latter expands to the maximum degree, a support free from projections capable of injuring it.

It will be seen that:

On the one hand, bell 13, with its lateral openings 14 of relatively large total section, prevents any suction capable of causing valve 15 to be unduly closed,

On the other hand, valve 15, being of large diameter, does not risk causing a suction of deformable wall 2, and

Finally, said wall 2, at the end of its expansion, rests upon a support of suitable shape preventing injury thereof (account being taken of the very high stresses applied thereto, which may, for instance, average 150 kgs. per sq. cm.).

Fig. 2 shows the position assumed by deformable wall 2 in this last case. Advantageously and as shown by this figure, the valve is covered with a pad or rubber or another flexible material such as 20, projecting therearound.

The device may further include means for limiting displacements of valve 15 toward the accumulator, such as a screw with a projection 21 cooperating with a slot 22 provided in the valve wall. This screw will be tightened on a fluidtight pad so as to prevent leakage.

Figs. 3 and 4 illustrate another embodiment, according to which the valve is constituted by flexible discs cooperating with a multiplicity of orifices so as to close them when deformable wall 2 is expanded to the maximum.

According to this feature, above bell-shaped casing 13 there is provided a disc 23 (which may be fixed to this casing at 24), having a convex curved face toward bag 2 and cooperating with one or several deformable plates (of metal, or rubber, or any other plastic material), such as 25, 26, with orifices 27, 28 provided in said disc, and other orifices 29 in at least one of said plates, the whole being arranged in such manner that said orifices are closed when the plates are deformed so as to be applied upon said curved face of disc 23.

Of course, the same result might eventually be obtained with a flat disc and curved plates, or with a disc and plates both of curved shape, but with different curvatures.

The use of a multiplicity of plates permits of reducing the closing displacement of the outer edge of each of said plates to some tenths of a millimeter, while keeping sufficient sections of flow, as wide as possible in order to reduce the velocity of the liquid and to avoid suction of the plates before the liquid is wholly emptied.

A portion of this liquid therefore passes between curved disc 23 and big plate 25, then through holes 27.

Another portion passes between big plate 25 and small plate 26, then through holes 29 and 28.

The total section of flow is thus as high as possible. Consequently, the bag is not sucked in, owing to the low velocities of the liquid streams, which further are transverse to the axis, as above.

The plates will be made, for instance, of spring steel of a thickness of some tenths of a millimeter, so that they can bend and subsequently come back to their initial position; but any other material giving analogous qualities might be utilized.

Concerning the shape of the curved top part of disc 23, it is advantageously chosen in correspondence with the shape that must be imparted to big plate 25, when it is applied by deformable wall 2 against said disc.

I may further provide, between plates 25 and 26, a curved disc 30, the top curvature of which corresponds to the shape assumed by small plate 26.

When the accumulator is nearly empty of liquid and is still caused to deliver liquid, deformable wall 2 comes into contact with small plate 26 which is curved and comes to stop the passage holes 29 of the big plate. Then bag 2 comes into contact with the periphery of big plate 25, causes it to curve down and brings it into contact with disc 23, thus closing holes 27. This position is shown by Fig. 4.

The passages between disc 23 and plates 25 and 26, which are not quite fluidtight (metal on metal) are closed by the rubber wall 2 which is fully applied on the whole.

I might also have only one plate, such as 25, this plate being then solid that is to say without holes such as 29.

An arrangement of this kind is shown by Fig. 5, where it has been further supposed that disc 23 is integral with bell 13.

Besides, in order to give plate 25 or plates such as above mentioned a suitable deformability, they should be provided with slits, for instance radially and near the periphery, as shown at 31 on Fig. 6.

In order to account for the fact that slits 31 may allow liquid to leak past them, said plate or plates may be covered by a solid disc, for instance of foil, such as 32 (Fig. 5).

The system may be covered by a rubber disc such as 33 (Fig. 5).

According to still another feature of my invention, in systems including one or several plates intended to be elastically deformed as above, the plates such as above described are replaced by a multiplicity of oblong elastic strips, fixed together for instance at their center, and overlapping one another.

Thus, according to a first embodiment shown by Figs. 7 and 8, I make use of rectangular strips such as 34, provided in their centers with holes 35, these strips being for instance four in number to form a complete disc.

Eventually, they may be provided with lateral holes, as shown at 36 on Fig. 9, which permits of reducing the suction effect of the liquid through the holes of supporting disc 23, by reduction of the area of the strips opposite these holes.

In this case, the angular overlapping of the successive strips may be more important, that is to say the number of strips may be greater, so that the supplementary lateral holes are closed by the strips located above them.

According to another embodiment, shown by Figs. 10 to 12, the successive strips 34 are cross- or star-shaped, being superposed in such manner that the solid portions of one star cover the intervals of the others.

The thicknesses of the successive strips, crosses or stars may be different from one another. The last strip, to wit the bottom one, applied on supporting disc 23, will be the thickest one so as better to resist the suction effect of outlet holes 27, 28, the thicknesses of the other strips decreasing to the uppermost strip, which is the thinnest one.

Of course, the crosses or strips (Figs. 11 and 12) might, as above stated with reference to Fig. 9,

be provided with supplementary holes **36**, with a greater overlapping so that all the holes or intervals between branches are well closed.

The whole may be covered, as above, with a rubber pad **33**, mounted on foil **32**, or merely glued to a disk of fabric (or again merely covered with cloth on the side of the strips).

Such a system ensures a fluidtight closing, and wholly prevents any injury of deformable wall **2**.

In a general manner, while I have, in the above description, disclosed what I deem to be practical and efficient embodiments of my invention, it should be well understood that I do not wish to be limited thereto as there might be changes made in the arrangement, disposition and form of the parts without departing from the principle of the present invention as comprehended within the scope of the accompanying claims.

What I claim is:

1. An accumulator which comprises, in combination, a container, a flexible partition dividing the inside of said container into two spaces, one of said spaces being filled with a compressible fluid under pressure, said container being provided with an orifice adapted to connect the other space with the outside, whereby said second mentioned space can admit a power transmitting fluid or discharge it through said orifice, and cut-off valve means between the portion of said second mentioned chamber adjacent to said orifice and the remainder of said space, said cut-off valve means including a valve seat provided with holes and having a convex curved face toward said partition, and a plurality of elastically flexible plates fixed at their centers to said face, said plates angularly overlapping one another to constitute a composite disc deformable in response to deformations of said partition, said plates being normally flat so as to be at a distance from said holes but to be applied thereon by said partition in the fully expanded state thereof.

2. An accumulator according to claim 1 in which said plates are in the form of elongated strips.

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