United States Patent

Smith

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[54] **LIQUID PRESSURE ACCUMULATOR SYSTEMS**

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[52] **U.S. Cl.** **138/30**

[51] **Int. Cl.** **F16l 55/04**

[58] **Field of Search** 137/517, 525, 525.3; 138/26, 138/30

[56] **References Cited**

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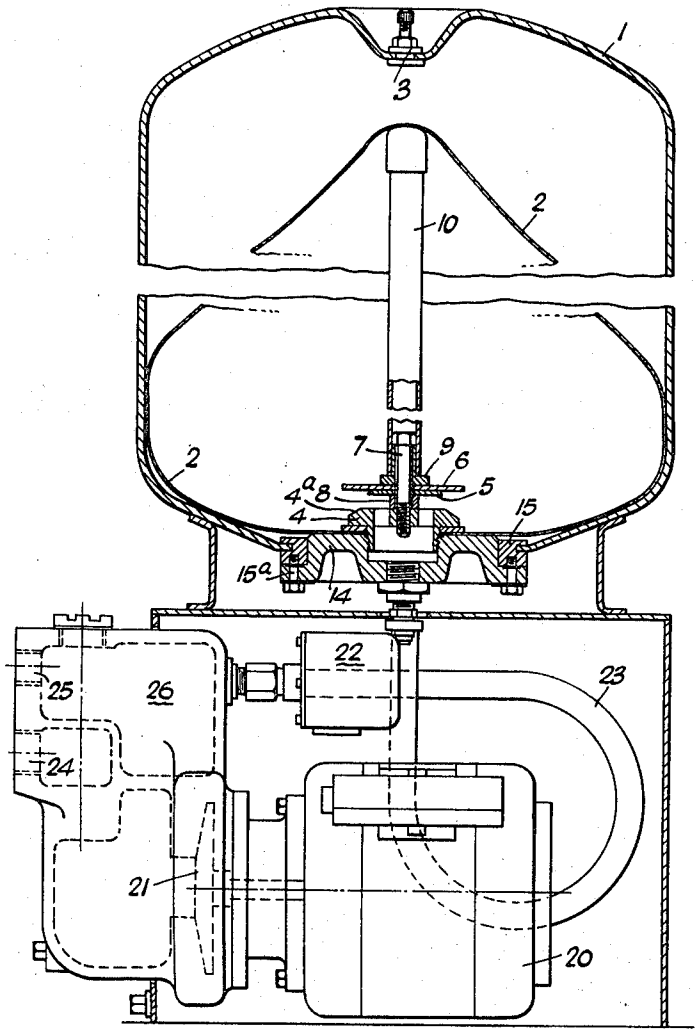
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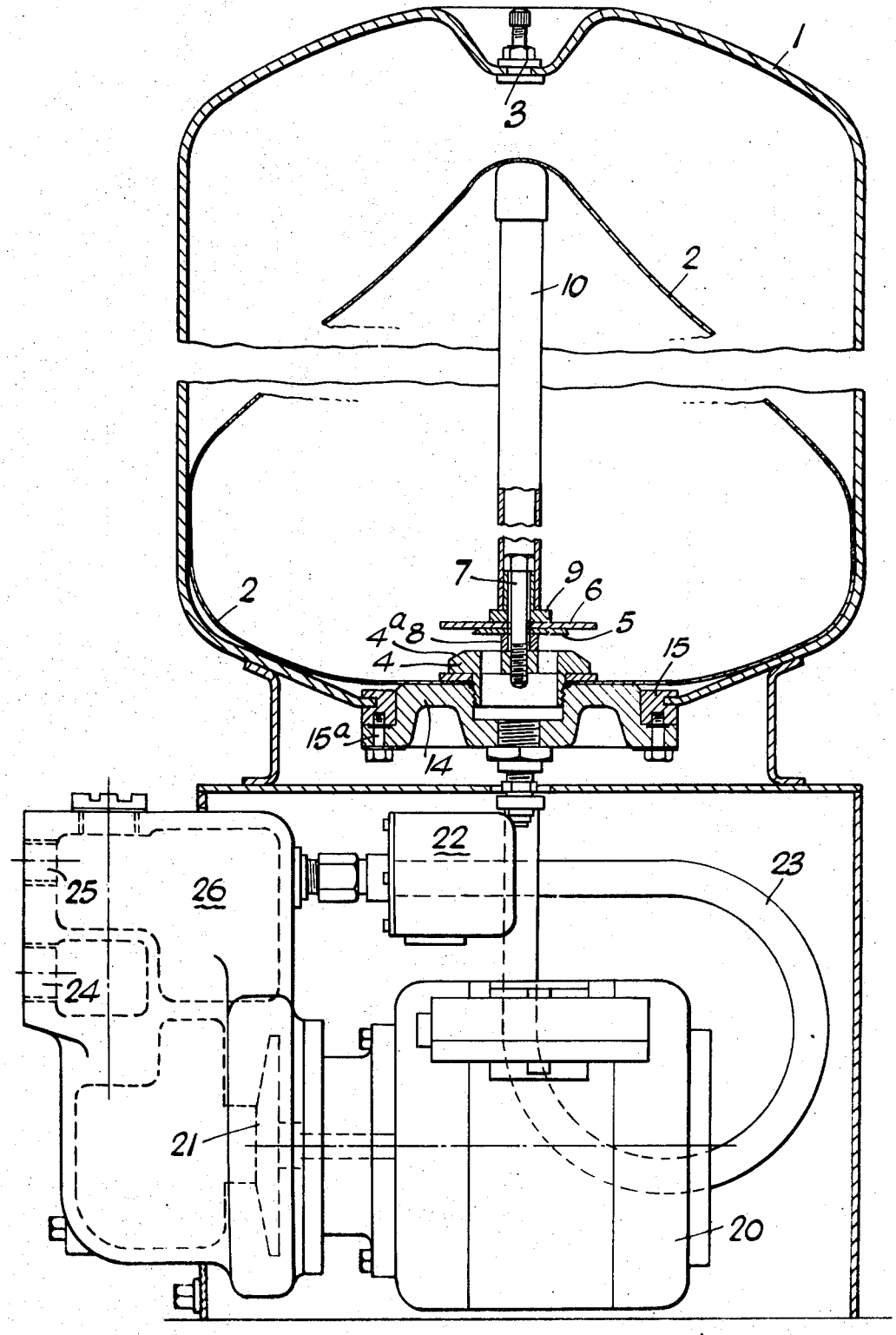
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[57] **ABSTRACT**

A liquid pressure tank is provided for storing liquid under pressure for use in domestic or commercial reticulated supply of the type having an impervious bladder dividing the tank into an air chamber and a liquid chamber, a constant amount of air being maintained in the chamber under pressure. A liquid pump and pressure switch system is provided for maintaining liquid in the chamber between preset pressure limits, and the tank includes a liquid outlet control comprising a seat member and a resilient disc member mounted in spaced relation from the seat and arranged to be deformed around the seat when contacted by the bladder mounted therearound to at least partially close the outlet and prevent rupturing of the bladder when liquid is substantially exhausted from the tank.

1 Claim, 1 Drawing Figure





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LIQUID PRESSURE ACCUMULATOR SYSTEMS

This invention relates to liquid pressure tanks in which a liquid such as water is stored under pressure for use in domestic or commercial supplies. Thus one important application of pressure tanks is in rural districts where a pressurized water supply is not generally available and where it is necessary particularly for cleaning purposes or the like on primary or industrial premises. Pressure tanks for domestic home use also have appeal where only a low pressure water supply is available.

The present invention will refer specifically to the supply of water, however it will be understood that the tank can be arranged to supply most fluids in a pressurized form.

The pressure tank is of the type in which a reserve supply of water is held under pressure. The tank is divided into two areas by a flexible bladder; one area containing water and the other compressed air. Water is arranged to be pumped into the tank against the pressure of air exerted on the bladder so that the column of air is displaced or compressed. Once a predetermined pressure has been reached the pump is automatically stopped.

In a practical installation the tank is connected to a home water supply so that upon opening of a tap in the home pressurized water is drawn off from the tank, when the pressure falls to a predetermined minimum the pump is restarted and the tank is replenished until maximum pressure is again reached.

The major problems associated with this apparatus lie in attaining trouble free operation of the bladder which must be substantially air impervious and have good resiliency. Furthermore problems are associated with the construction of the water outlet of the tank whereby the bladder will not be ruptured by pressure of air impinging thereon in the area of the water outlet when the water tank is empty. Various constructions of outlet valves have been proposed in the prior art for the purpose of retaining some residual water in the tank to prevent such rupture, however these valves have not proved completely satisfactory in practice in that, due to their inherent construction, full flow of pressure liquid from the tank at times of maximum demand is reduced and also such valves tend to close prematurely before the complete storage of water has been used. Another undesirable effect of such valves is that outgoing liquid is inclined to "hammer" during high volume flow. The noise caused thereby is a disadvantage particularly in domestic installations.

It is a principal object of this invention to provide a fluid pressure accumulator tank incorporating an improved liquid outlet control means which allows full liquid flow during normal operation substantially noiselessly while providing adequate protection against bladder rupture at the outlet in the event of liquid being exhausted from said bladder.

According to the present invention there is provided a pressure fluid accumulator tank including a hollow housing, a bladder secured within and dividing said housing into an air chamber and a liquid chamber, two ports in said housing one of each communicating with each chamber for admission of air under pressure to said air chamber and liquid under pressure to said liquid chamber respectively, the amount of air maintained in said air chamber being substantially constant when in use whereby as the quantity of liquid in said liquid chamber varies said diaphragm is arranged to move between two positions within said housing representing minimum liquid pressure and maximum liquid pressure, wherein said liquid port is controlled by means including a seat secured in the housing and a resilient discal element mounted on said seat and spaced therefrom, said discal element being arranged to be engaged and deformed toward said seat by said bladder when said liquid is substantially exhausted from the tank to at least partially close said port and thereby prevent rupture of said bladder.

Conveniently the liquid chamber is bounded solely by said bladder and said control means. The control means is a valve like member in which the seat is frustoconical surrounding several liquid ports and the discal member is mounted on a central shaft projecting upwardly from the seat the disc being spaced a short distance from the seat. The arrangement and dimension of the disc is such that when it is deformed toward the seat it does not quite reach the seat thus leaving a small gap therebetween. Thus premature closing of the valve is obviated but the gap remaining is not big enough to enable rupturing of the bladder to occur.

Preferably the discal member is mounted on a solid circular base washer of smaller diameter to provide a measure of support therefor. The central shaft is extended above the discal member and an elongated member is mounted thereon to extend into the interior of the bladder a substantial distance to prevent complete collapse of the bladder into one end of the housing.

The invention will now be described in further detail having reference to a practical arrangement which is described in conjunction with the accompanying drawings.

The pressure tank **1** of one arrangement is of cylindrical form having curved ends one end forming part of the air chamber and having a one way valve **3** therein for charging this chamber with compressed air. The liquid chamber is conveniently comprised of a bladder **2** of suitable material secured around the outlet port **4**.

The other end of the tank housing is closed with a discal keeper plate **14** which includes the outlet port. In large high pressure tanks the diameter of said keeper plate **14** is preferably maintained relatively small and is arranged to interconnect with a ring **15** about the open end of the housing proper. The ring has studs **15***a* therein for securement of said plate thereto. The configuration of the tank lends itself to manufacture in fiber glass material or like synthetic materials.

In this figure a schematic arrangement of the motor **20** pump impeller **21** and pressure switch **22** is shown in assembly. The pump is of a Centrifugal jet, easy priming type. The pressure switch **22** is preferably adjustable and controls operation of the motor within preset liquid pressure limits.

In this arrangement liquid at low pressure is drawn in through port **24** and pumped under high pressure into chamber **26** for supply either to outlet port **25** or through hose **23** to the pressure vessel. The pressure switch **22** is arranged to disconnect the motor **20** upon the pressure within the bladder **2** reaching a preset maximum. Further supply of liquid is provided from the

tank until the pressure falls to a preset minimum whereupon the switch **22** connects said motor **20** and pumping recommences to provide further pressurized supply of liquid.

The outlet port in the keeper plate is covered from above by a circular rigid plate **5** and resilient discal member **6** mounted thereon spaced from the port. Furthermore the port is surrounded by a chamfered shoulder **4***a*. The plate **5** and discal member **6** are mounted on a central shaft **7** which is engaged in the outlet port body by a screw thread or the like. The spacer **8** provides suitable spacing of the discal member **6** from the outlet port shoulder **4***a*. Mounted atop the discal member **6** is a tube support **9** upon which an elongated tube **10** is mounted. This tube is arranged to extend a substantial distance into the bladder **2** to support the bladder when the water volume therein is substantially reduced and the bladder is in a collapsed state. It will be understood that the tube will obviate extensive crumpling of the bladder in its collapsed condition.

The shoulder **4***a* and discal member **6** when deformed do not actually meet but do present a seating surface which is contacted and sealed by said bladder during periods of low liquid level in the tank. Sealing is arranged to take place only with residual amounts of water left in the tank.

Thus it will be understood that with the combination of the bladder and the resilient discal member at the outlet port in the keeper plate, the possibility of damage to the diaphragm is minimised while full performance in flow rates can be obtained from the pressure tank.

I claim:

1. In a pressure fluid accumulator tank comprising a hollow housing, a bladder located within said housing dividing said housing into an air chamber and a liquid chamber, said housing having a first port communicating with said air chamber for the admission of air under pressure to said air chamber, said housing having a second port communicating with said liquid chamber for admitting liquid under pressure to said liquid chamber, said air chamber containing an amount of air substantially constant when in use, said bladder moving as the quantity of liquid in said liquid chamber varies between two positions within said housing representing minimum liquid pressure and maximum liquid pressure, the improvement comprising controlling means for the flow of liquid from said liquid chamber through said second port, said controlling means comprising a seat in said housing, said seat is frusto-conical in form and surrounds said second port, a resilient discal member cooperating with said seat in spaced relation therefrom, said discal member being engaged and deformed toward said seat by said bladder when said liquid is substantially exhausted from said tank, means supporting said discal member such that when said discal member is fully deformed by said bladder said member will only partially close said second port, the remainder of said second port being closed only by said bladder when the liquid is exhausted from said liquid chamber, said supporting means including a circular shaft projecting upwardly from said seat on which said discal member is mounted, a rigid central washer of smaller diameter than said discal member mounted on said shaft beneath and in contact with said discal member to provide support for said discal member and spacing means to space the washer and discal member from said seat.

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