No. 673,842. Patented May 7, 1901.

T. M. MURPHY.

PRESSURE TANK.

(Application filed Aug. 18, 1900.)

(No Model.)

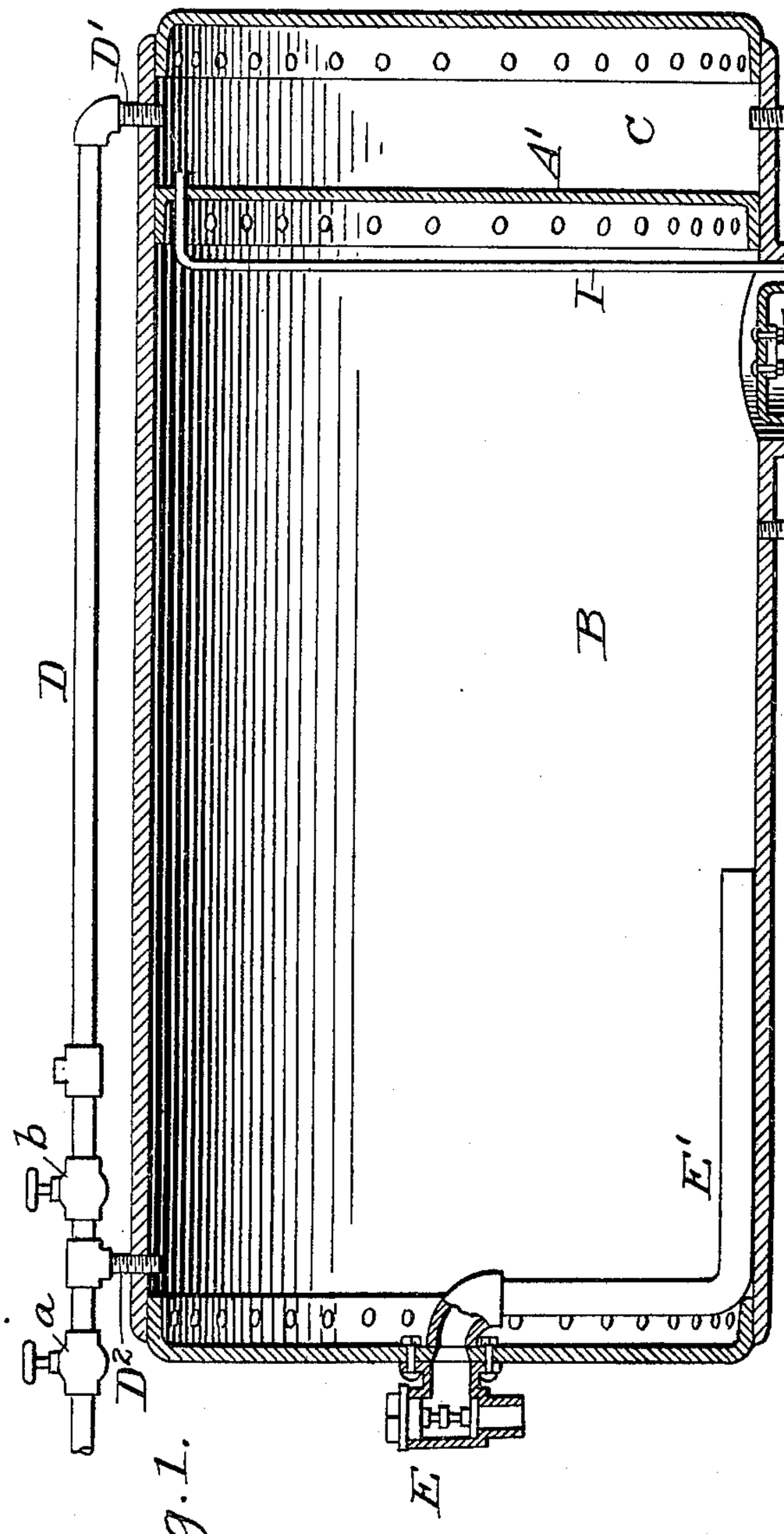

Fig. 1.

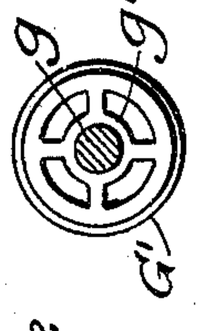

Fig. 3.

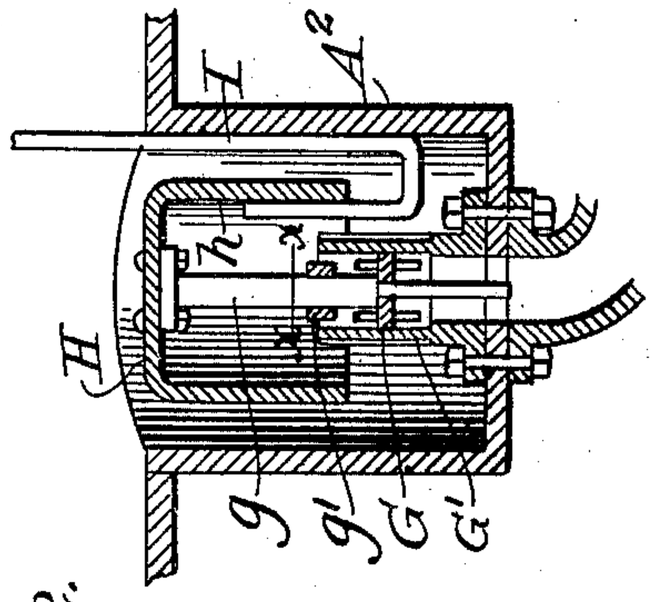

Fig. 2.

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THOMAS M. MURPHY, OF ST. LOUIS, MISSOURI.

PRESSURE-TANK.

SPECIFICATION forming part of Letters Patent No. 673,842, dated May 7, 1901.

Application filed August 18, 1900. Serial No. 27,264. (No model.)

To all whom it may concern:

Be it known that I, THOMAS M. MURPHY, a citizen of the United States of America, and a resident of the city of St. Louis, State of Missouri, have invented certain new and useful Improvements in Pressure-Tanks, of which the following is a specification.

This invention refers to an improvement in pressure-tanks containing air and water or other similar gas and fluid, the fluid being under the air or gas pressure, so that it may be delivered from the pressure-tank with a considerable degree of force, which degree may of course vary and be regulated as may be desired.

The object of my present improvements is to provide an efficient apparatus wherein water or other liquid may be stored under pressure, either for the purpose of enabling it to be transported from point to point and then redelivered by its storage-pressure for various purposes or may be placed in storage under pressure for a great variety of other purposes, the enumeration of which is unnecessary here.

The invention consists, essentially, in two connected chambers or reservoirs, one of which contains air or other gas and the other water or other liquid, the air having a pressure upon the water and there being in the bottom of the water-chamber an automatically-operated outlet-valve which closes before the water has been completely exhausted from the chamber, so as to provide a water seal at the bottom thereof; and the invention also consists in the construction, arrangement, and combination of parts and in numerous details thereof, substantially as will be hereinafter more fully described and then particularly pointed out in the appended claims.

In the accompanying drawings, illustrating my invention, Figure 1 is a longitudinal sectional elevation of my improved pressure-tank. Fig. 2 is an enlarged sectional detail view of the outlet-valve at the bottom of the tank and its accompanying parts. Fig. 3 is a plan view of the bearing for the stem of said outlet-valve.

Like letters of reference designate like parts in the different figures.

In the present example of my invention A denotes a main tank of any suitable size and shape. This is divided by means of the partition A′ into two compartments or chambers, one of which, B, I term the "water chamber or reservoir" and the other, C, the "air chamber or reservoir." The air-reservoir is preferably the smaller one of the two. These chambers B and C communicate with each other by means of an outside pipe, tube, conduit, or other channel D, situated, preferably, on top of the main tank A, said pipe D having a connection D′, which enters the air-reservoir C, and another connection D^2, which enters the water-reservoir B. The tube D is provided with a valve *a*, situated near one end, which is open to the atmosphere except when closed by said valve, and the pipe D is also provided with another valve *b*, located therein between the two connections D′ and D^2, and consequently situated at a point between the two reservoirs B and C. It must distinctly be understood that the arrangement and combination of parts which I have just described is merely an example of one way in which said parts may be arranged. It is conceivable that the two reservoirs may be arranged and related in a variety of ways. They do not need to be both in one tank separated by a partition, but they may be in separate tanks. Their relative size may vary greatly. The mode of connecting them together by a passage may also vary within very wide limits. The connecting-pipe may be long or short, small or large, and arranged to enter the two tanks at a preferred point. Therefore so far as these parts are concerned it is only necessary that there should be two tanks or chambers, one to receive water and the other to contain air. These tanks are connected together by a passage-way through which the air may pass from one tank or reservoir to the other. This passage will of course ordinarily be equipped with a valve for closing or opening the passage. Also the passage will have one end open to the atmosphere and provided with a valve. Through this open end atmospheric air may pass into the chambers when the valve is open. Having thus indicated, broadly, the way in which these tanks and their connections may be constructed and combined, it is left to those skilled in the art to select the preferred mode of arranging the parts when the invention is applied to actual practice.

In the wall of the water-chamber at one or

more points is a filling valve or valves E, through which water is introduced into the water-chamber, there being within the water-chamber a curved pipe E′, running from the valve E downwardly to a point at the extreme bottom of the water-chamber, as is clearly shown in the drawings, so that the delivery of the water into the chamber may be at the extreme bottom, thereby enabling the delivery to be at a point below the level of the quantity of water which always remains in the water-chamber in order to furnish a water seal in cases where the outlet-valve is directly in the bottom of the tank, and hence will prevent the escape of air through the filling-valve whenever the water within the tank falls to a low level. This filling-valve is intended to be connected with a water hydrant or plug by means of a hose or tube during the operation of filling the water-chamber. It will be evident that as the water-chamber B fills with water in consequence of its delivery thereinto through the valve E, if the valve *a* be closed and the valve *b* be open the air within said chamber will be compressed into the air-chamber C through the connecting-passage, and thus a degree of pressure will be created within the air-chamber which will at least be equal to the same degree of pressure as that of the water-pressure which exists in the water-main which supplies water to the filling-valve.

In the bottom of the water-chamber is an automatically-operated outlet-valve controlling the exit of water from the water-chamber into the delivery-pipe F. This automatic outlet-valve may be a float or it may have any other preferred construction. It may vary widely in the way in which it is made to serve its purpose. It seems essential, however, that it should be so constructed with a float or otherwise that it may be kept constantly open when the water-chamber is full of water and will only close when the water-level within the water-chamber drops to within a short distance of the bottom, the closure taking place before quite all the water has been exhausted from the water-chamber, so that there may thus at all times be sufficient water or liquid left in the water-chamber to cover all the inlet and outlet openings therein and make a close and tight water seal against the escape of any air from the water-chamber. This explanation applies to cases where the outlet-valve is located directly in the bottom of the tank. This automatic outlet-valve may be located directly in the bottom of the water-chamber, or a depressed extension A^2 may be formed in the under side of said chamber especially adapted to receive the outlet-valve, said extension A^2 being of proper shape and size for the purpose and serving to permit the water-level to drop lower within the chamber than would be possible if the outlet-valve were located directly in the bottom wall of said chamber.

I have here represented a particular form of automatic outlet-valve which is preferred for many purposes, although I do not, of course, by any means intend to be restricted to it alone. It is one kind of float-valve and it is made buoyant by an air-chamber attached to the valve-stem. G denotes the valve proper, and *g* the valve-stem. This stem is supported by a bearing *g′*, and the valve G works vertically in a barrel G′, having slotted sides, which permit the water to pass thereinto and below valve G when the latter is lifted off its seat. Attached to the upper end of this valve-stem is an inverted cylindrical or cup-shaped part H, which is open at its lower end and which consequently has an air-chamber *h* within it. The opening of the valve G by lifting it from its seat permits water to pass from the water-chamber B downward into the delivery-pipe F, which pipe is supplied with a hand-valve *f*, so that water can be drawn off therethrough whenever desired. When the valve G seats itself firmly upon its seat, then water cannot pass downwardly into the pipe F.

I designates an air-pipe which enters the upper end of the air-chamber C and extends therefrom to the air-chamber *h*, belonging to the automatic outlet-valve, which air-chamber it enters, substantially as shown, the end of said pipe being corrugated or bent, so that it can extend upward into said air-chamber *h* from beneath, and thus permit the air-chamber to have a play up and down without disturbing the position of this air-pipe I. This pipe I serves to supply an additional amount of air to the air-chamber *h* from the main air-tank C and keep said valve normally raised and compensate for the pressure of water within the water-tank. It will be found to serve a useful purpose in this connection by keeping a large and better supply of air in the cylinder H, and thus increasing the buoyancy of the automatic valve.

J denotes a pipe extending from the bottom wall of the water-chamber B to the water-pipe F. This pipe J is provided with a hand-valve *j*. It is used for the purpose of permitting the water under the pressure which it possesses when within the water-chamber to pass downward into the water-supply pipe at a point beneath the automatic outlet-valve. It is only used in rare instances when required for the purpose of causing a strong pressure to be brought to bear upon the under side of the outlet-valve to release the latter from its seat should it by any possibility adhere by suction too closely thereto and refuse to rise under the buoyant action of the water as exerted ordinarily upon its float mechanism. I have therefore supplied this pipe J simply to guard against a possibility of inaction in the outlet-valve, arising out of certain conditions which under some circumstances it might not be possible to avoid. Furthermore, it will be observed that the bottom of the air-reservoir C

is provided with an outlet-cock K, which would be useful for the purpose of cleaning out said chamber.

In using an apparatus of this character the air and water reservoirs are charged with air in any desired manner and of any desired pressure. Ordinarily it will suffice to simply open the valves *a* and *b* and allow both chambers to fill with air at atmospheric pressure. Of course, if desired, air may be forced into the chambers at a higher pressure than atmospheric pressure; but it will be left to the discretion of the user of the apparatus. Both chambers having been filled, valve *a* will be closed. Water may now be admitted through the filling-valve E. As the water flows into the water-chamber the air will be compressed therein and will pass through the connecting-pipe D into the air-chamber till by the time the water-chamber is substantially filled the air in the chamber will have the same degree of pressure which exists in the water-main or other water-supply, and then obviously no more water can enter the water-chamber, because it will be clearly seen that when the air in the air-chamber has been compressed, so as to counteract the force of the incoming water, no more water can enter. As before stated, the initial charge of air is usually of atmospheric pressure only, and when such a charge is employed it will be found that the water-chamber may be practically filled with water before the air-pressure within the air-chamber will counteract the force of the incoming water, so as to prevent more from entering. The initial charge, however, can be so proportioned relatively to the pressure in the water-main from which the tank is to be filled that the pressure in the main and that in the tank will balance when the water is within two or three inches or so of the roof of the water-chamber, so as not to allow the water to rise into the connecting-pipe or pass into the air-chamber. If the pressure within the main be the greater, the charge of air within the air-chamber may be increased, and if the charge of air be greater some air may be allowed to escape by opening the valve *a* until the water rises to the required height in the water-chamber. This mode of proportioning the pressures and regulating the equilibrium and opposing forces is only necessary when the apparatus is first being charged for work, because the same regulating amount of pressure is retained after a degree of pressure of the air upon the water in the water-tank has once been secured equivalent to that in the water-main.

I will now explain how the water under pressure is discharged from the apparatus.

The action of the water within the water-chamber upon the automatic outlet-valve will be to float the float mechanism thereof, and consequently open the valve. The water within the water-chamber will fill the extension A^2, and will consequently be beneath the open-ended cylinder H, and will cause the compression of air within the chamber *h*. The lower edge of the cylinder H will be submerged and will be kept so, and the water will act to lift the cylinder H, the quantity of air therein assisting in giving it buoyancy, so that the normal condition of the outlet-valve will be open so long as there is enough water within the water-chamber to float the float mechanism of said outlet-valve. The water which is drawn off, therefore, from the pipe F by means of a hose or in any other suitable manner for any desired purpose will issue therefrom under a pressure equal to that of the ordinary water-main, which pressure is imparted thereto by means of the air-storage with the air-chamber, which acts through the communicating passages between the two chambers upon the water which is within the water-chamber and causes it to pass out therefrom under a strong head. When the water drops to a low level in the water-chamber and there is no longer sufficient water to keep the valve G open, said valve will close, but there still will be enough water left around the cylinder H to form a water seal to prevent any outlet of air. There will always be enough water left in the water-chamber not only to seal the outlet valve, but also, when said outlet-valve is directly in the bottom of the tank, to seal the inlet-valve by covering the inner end of the pipe E′. Any leakage of air that may take place at any time from the chamber *h* will be abundantly supplied through the air-pipe I, and said pipe, as has already been explained, will serve to assist in adding more or less air from time to time from the air-chamber to the chamber *h*, and thus keep a sufficient quantity of air within said chamber *h* and promote the buoyancy of the float H.

It will be manifest that after the apparatus has once been charged with air no further air charge will be necessary. There will thereafter take place an alternate compression and expansion of the same body of air consequent upon the intermittent filling and emptying of the water-tank with water. Herein lies an important method not heretofore known or employed in any pressure-tank of any kind which I am familiar with, consisting in the constant use of the initial atmospheric-air charge, which is alternately compressed and expanded by hydraulic means. It is, in fact, a hydropneumatic-pressure tank, whereby water under a strong pressure is supplied for use for various purposes. In speaking of the actual use of a pressure-tank of this character it is sufficient to state that in many industries where water is used in a multitude of different plans for water distribution it is necessary to transport a bulk of water from point to point and use it at the latter point under the same or a higher degree than that under which it was taken from the supply-point, or it is necessary to store water in a main from the reservoir, so that it can be supplied under pressure for various uses, and

these functions are exercised most efficiently by means of a hydropneumatic water-tank substantially of the character herein described.

What I claim is—

1. The combination of the water-chamber, an air-chamber, a communicating passage between them, an inlet-valve on the water-chamber, means for delivering the water from the said valve to the bottom of the water-tank, a buoyant cylindrical outlet-valve, and means operated automatically by the liquid to keep the said valve normally open and to close it when the liquid has nearly exhausted so as to preserve a water seal.

2. The combination of a fluid-reservoir, an air or gas reservoir, a communicating passage between them, a filling-valve on the fluid-reservoir, means for delivering the water from said valve to the bottom of the water-tank, a buoyant cylindrical outlet-valve in the bottom of said reservoir, and means operated automatically by the fluid to keep the outlet-valve normally open and to close it when the liquid is nearly exhausted so as to preserve a water seal, substantially as described.

3. The combination of a fluid-chamber, of an air or gas chamber, a communicating passage between them having one end open to the atmosphere, a valve in the open end of said passage, an inlet-valve in the fluid-chamber provided with a pipe which introduces its supply at the bottom of the chamber and an outlet-valve in the bottom of the said chamber, and means operated automatically by the liquid to keep the outlet-valve normally open and to close it when the liquid is nearly exhausted so as to preserve a water seal, substantially as described.

4. The combination of a fluid-reservoir, an air or gas reservoir, and communicating passage between them, having one end open to the atmosphere, a valve in the open end of the passage, another valve therein at a point between the two reservoirs, a filling-valve in the fluid-reservoir, an outlet-valve likewise therein, and means operated automatically by the liquid to keep the valve normally open and to close it when the liquid is nearly exhausted so as to preserve a water seal, substantially as specified.

5. The combination of a water-reservoir, an air-reservoir, a communicating passage between them, an air-inlet provided with a valve, a valve in the communicating passage between the two reservoirs, a filling-valve in the water-chamber provided with a pipe which introduces its water-supply at the bottom of the water-chamber and an outlet-valve in the bottom of the water-chamber, together with means operated automatically by the liquid to keep the outlet-valve normally open and to close it when the liquid is nearly exhausted so as to provide a water seal in the bottom of the water-chamber, substantially as described.

6. The combination of a water-chamber, an air-chamber, a communicating passage between them, a valve for the admission of air to the chambers, a valve for controlling the passage between the two chambers, an inlet-valve on the water-chamber and an outlet-valve in the bottom of the said chamber having an air-chamber, which operates as a float for the outlet-valve to keep it normally open and to permit it to close when the liquid is nearly exhausted so as to preserve a water seal in the bottom of the chamber, substantially as described.

7. The combination of the water-chamber, an air-chamber, a valve-provided passage between them, an inlet-valve on the water-chamber and an outlet-valve in the bottom of said chamber having an inverted air-chamber which is open at its lower end, and which acts as a float in the liquid to keep the outlet-valve normally open, and close it before the water has been completely exhausted from the water-chamber so as to provide a water seal, substantially as described.

8. The combination of the water-chamber, an air-chamber, a valve-provided passage between them, a filling-valve on the water-chamber, an outlet-valve in the bottom of said chamber having an air-receptacle and an air-pipe running from the main air-chamber to said receptacle, substantially as described.

9. The combination of the water and air chambers, with a valve-provided passage between them, an inlet-valve on the water-chamber and an outlet-valve on the bottom of the same chamber, which closes before the water-supply has been completely exhausted so as to form a water seal together with the outlet-pipe, and a valve-provided pipe for admitting water under pressure at a point below the water-outlet valve, substantially as described.

10. The combination of the water and air chambers, with a communicating passage between them provided with valves, one of which communicates with the atmosphere and the other located between the chambers, inlet and outlet valves in the water-chamber, said outlet-valve being provided with a float which is automatically operated by the fluid to keep the outlet-valve normally open and to close it when the liquid is nearly exhausted.

11. The combination of a fluid-reservoir, of air or gas reservoir, and communicating passages between them, a filling-valve on the fluid-reservoir, an outlet-valve in the bottom of said reservoir, a float attached to said valve automatically operated by the fluid to keep the valve normally open and to close it when the liquid is nearly exhausted so as to preserve a water seal, and means for supplying the float with air to compensate for any leakage therefrom.

Signed at the city of St. Louis, Missouri, this 7th day of July, 1900.

THOMAS M. MURPHY.

Witnesses:

WILLIAM RATICAN,

ALBERT H. MURPHY.