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AIR CHARGER FOR WATER SYSTEMS

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Fig. 1.

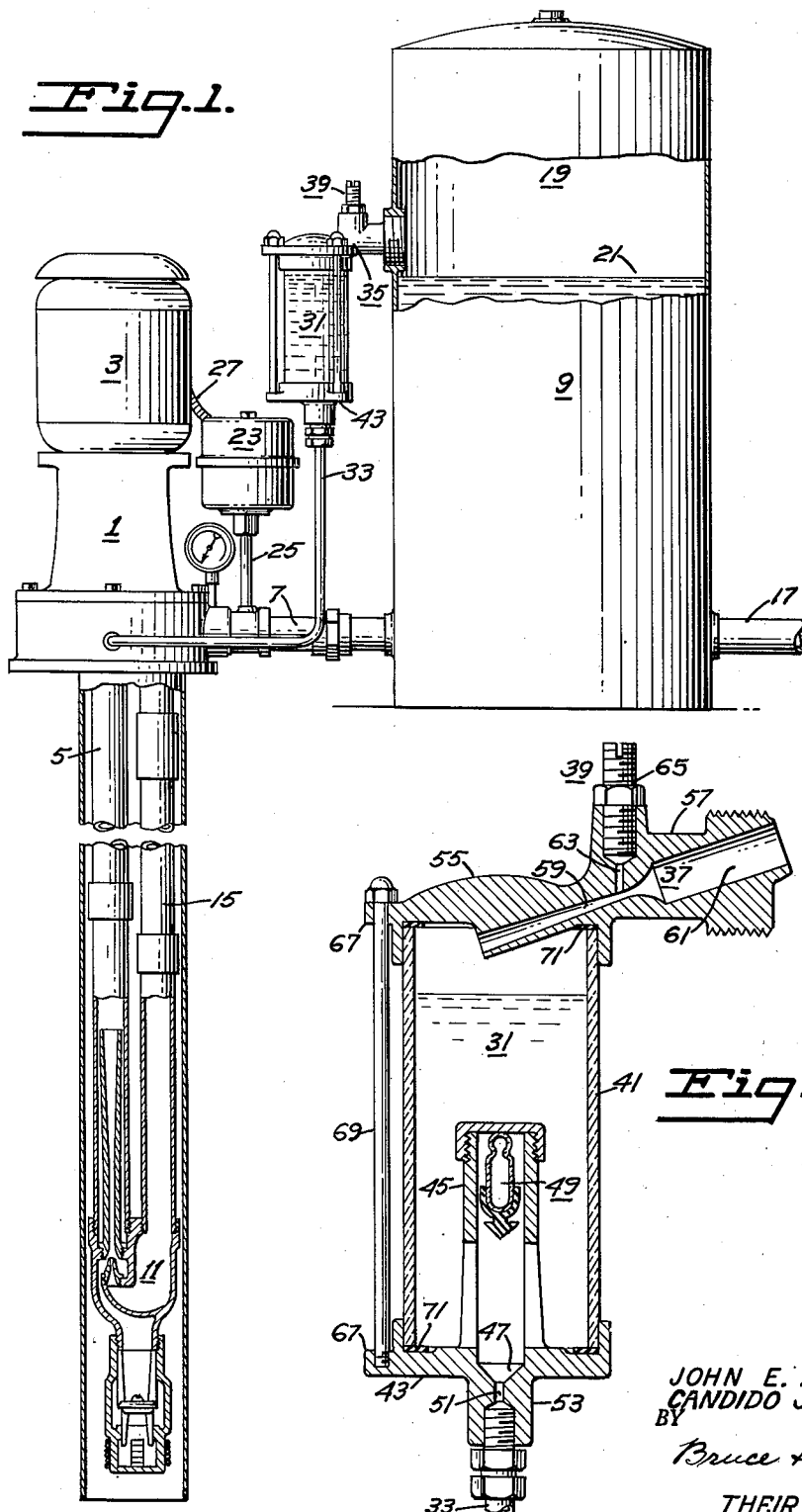


Fig. 2.

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AIR CHARGER FOR WATER SYSTEMS

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10 Claims. (Cl. 103—6)

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Our invention relates to water systems and more particularly to a pump pressure system and air charger for use in such system.

Among the objects of our invention are:

(1) To provide a novel and improved air charger for water systems and the like;

(2) To provide a novel and improved air charger for a water system of the type involving a pump and pressure tank, such air charger being capable of functioning in spite of the existence of atmospheric or greater pressure at the intake side of the pump;

(3) To provide a novel and improved air charger which may be readily installed and serviced;

(4) To provide a novel and improved pump pressure system capable of air charging a pressure tank regardless of the pressure existing at the intake side of the pump during its operation;

(5) To provide a novel and improved air charger which also serves to maintain air cushion volume within desired limits.

Additional objects of our invention will be brought out in the following description of a preferred embodiment of the same taken in conjunction with the accompanying drawings wherein—

Figure 1 is a view partly in section depicting our invention as embodied in a pump pressure system;

Figure 2 is an enlarged view in section of an important feature of the present invention.

The pump pressure system illustrated conventionally involves a pump 1 driven by a motor 3 and having a suction line 5 extending downwardly from the intake side of the pump to a point below the water level in a well, and a discharge line 7 from the output side of the pump to a pressure tank 9. For deep well installations, a booster pump 11 is normally included at some intermediate point in the suction line.

Such booster pump may take the form of an injector pump, in which a venturi is disposed in the main flow path of water in the suction line and a nozzle, positioned for discharge into one end of said venturi, is fed from the output side of the pump by way of a pressure line 15.

In a pressure system of the type described and illustrated, water to be consumed, is drawn off from the tank through a pipe line 17 under pressure of an air cushion 19 above the water level 21 in said tank.

A pressure switch 23 having a pressure connection 25 to the water in the tank, controls a switch circuit 27 to the driving motor of the pump, and is adjusted to close such circuit when tank pressure drops to a predetermined minimum value and open the circuit when the pressure has been

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built back up to a predetermined maximum value. Thus the pressure switch causes intermittent operation of the pump for such periods as are necessary to bring the air cushion pressure up to the desired maximum value, each time it falls to such predetermined minimum value.

Any partial loss of air from the air cushion, reduces the air cushion volume at any given pressure and accordingly increases the frequency of such pump operation. This necessarily lowers the efficiency of the system and increases the possibility of damage to the working parts of the system, particularly the electrical components thereof.

The function of an air charger is to replenish any loss of air from the air cushion to maintain a desired air cushion volume.

In the embodiment of the invention illustrated in the drawings, the air charger comprises a container 31 having a valve controlled flow connection 33 from its lower end to the intake side of the pump and a flow connection 35 from the upper end of the container to the pressure tank at a point slightly above normal liquid level and within the fluctuating range of liquid level attributable to loss of air from the tank.

Such connection includes an aspirator 37 which controls a check valve 39 to the atmosphere that is adapted to be opened in response to flow of water through the aspirator. Such opening of the valve is intended to admit air into the air charger container so long as water flows through the aspirator.

More specifically, and in the preferred form illustrated in the drawings, such container includes a cylindrical wall 41 preferably of transparent material such as glass, closed at its lower end by a casting 43 formed with an integral upstanding valve cage or guide 45 surrounding a valve seat 47 and adapted to house a float valve 49. Such valve seat constitutes the upper terminus of a passage 51 through a depending pipe fitting 53 formed as an integral part of the casting.

At its upper end, the glass cylinder is capped by a closure casting 55 having a lateral extension 57 externally threaded for connection to a suitable threaded opening in the wall of the pressure tank.

Integrally formed in the closure casting is an aspirator in the shape of a venturi 59 having its input end in flow connection with a passage 61 through the threaded lateral extension, and its discharge end opening into the container. The venturi and connecting passage preferably lie on a common axis which inclines upwardly from the container to the pressure tank.

At the point of maximum constriction of the

venturi, a duct 63 connects the venturi with an outer internally threaded recess which is adapted to receive a check valve assembly 65, preferably one of the Schrader valve type.

The upper and lower castings are each provided with aligned perforated ears 67 to receive clamping bolts 69 for sealing such castings to the glass cylinder, and gaskets 71 of sealing material such as rubber, cork or suitable composition, disposed at the ends of the glass cylinder will facilitate such sealing.

When air has been lost from the air cushion in the pressure tank, then during operating periods of the pump, the water in the tank must rise to a higher level in order to develop the maximum operating pressure in the tank as determined by the pressure switch, and when such pressure has been reached, it becomes apparent that the air cushion will be substantially less in volume than previously. It is under these conditions that air must be added to the pressure tank in order to re-establish the normal air cushion volume.

By connecting the charger to the pressure tank at a point just slightly above the normal liquid level in the tank when air cushion volume is also normal, the subsequent rise in liquid level permitted by loss of air cushion volume, will cause the liquid to rise above the point of connection of the air charger.

During an operating period of the pump, a differential pressure is developed between the pump output side and the input side of the pump with the pressure at the output side greater. The contents of the air charger container will accordingly be drawn out therefrom to the intake side of the pump, and as a result, the contents of the pressure tank exposed to the air charger container will be drawn through the venturi or aspirator into the container, and will continue to be so drawn into the air charger container until either the air charger valve 49 seats or the pump operation is halted. When the intake to the container ceases by reason of the valve 49 seating, such seating of the valve precludes any air which may have been drawn into the container from getting through to the intake side of the pump.

Should the air cushion volume be normal at the time the pump starts functioning, air from the air cushion will be drawn through the venturi into the air charger container, but such rush of air through the aspirator will have no effect on the check valve and consequently no air will be drawn into the system from the atmosphere by way of such check valve.

Upon completion of the operating period of the pump, pressure conditions throughout the system will become equalized, and in the process of equalizing, water from the pressure tank will be forced in reverse through the pump and back into the air charger container until the liquid level in both the air charger container and the pressure tank are in a common plane. Air previously drawn into the air charger container from the tank will thereupon be forced back into the tank. The only change in the system resulting from that particular operation of the pump would be the pumping of sufficient water into the pressure tank to restore pressure conditions to the maximum operating value.

On the other hand, should the water level in the tank be above the connection from the air charger container at the time a pump cycle of operation is initiated, the air charger container at that moment will be full of water, and in response to withdrawal of such water by operation of the

pump, a flow of water from the pressure tank into the air charger container will result. Such flow of water through the aspirator will create a region of sub-atmospheric pressure at the point of maximum constriction of the Venturi passage and cause the check valve to open and admit air into the air charger container. As the air thus admitted to the air charger container builds up in volume, the pressure exerted upon it by the inflowing water becomes greater and greater and some of the air may at that time be forced into the pressure tank through the inflowing stream of water, in the form of bubbles while the remainder of the air so drawn into the air charger container will find its way into the pressure tank during the interim in which equalization of pressure takes place following the termination of the pump operating cycle.

The bubbling of air into the tank under the aforementioned conditions is materially aided by the inclination of the aspirator passage to the tank.

Inasmuch as the admission of air into the air charger container from the atmosphere is entirely a function of the aspirator, it becomes readily apparent that the air charger will function in spite of the fact that atmospheric or greater pressure may exist at the intake side of the pump, and therefore the present invention becomes applicable in pump pressure systems of the deep well type where atmospheric or greater pressures do exist at the intake side of the pump during operation of the pump. From the above description of our invention, it is apparent that the same fulfills all the objects previously recited therefor. While we have disclosed our invention in its preferred embodiment, and in considerable detail, the same is subject to alteration and modification without departing from its fundamental principles of operation. Accordingly, we do not desire to be limited in our protection to such details, except as may be necessitated by the appended claims.

We claim:

1. An air charger for a water system of the type having a pump and a pressure tank, comprising a container including an upper portion and a bottom having a valve controlled passage therethrough, and means in the upper portion of said container having a liquid flow passage therethrough terminating in but a single external coupling connection and including a venturi in said passage with a valve connection to atmosphere for taking air into itself and directing it into said container in response to flow of liquid through said passage and included venturi, said liquid flow passage means constituting the sole liquid flow passage means into the upper portion of said container.

2. An air charger for a water system of the type having a pump and a pressure tank, comprising a container including a bottom having a passage therethrough terminating in a pipe connection at its outer end and a valve seat at its inner end, a valve in said container adapted to seat on said valve seat, a closure at the upper end of said container, said closure including a lateral extension having a communicating passage therethrough terminating in but a single external coupling connection and including a venturi in said passage with a valve connection to atmosphere for taking air into itself and directing it into said container in response to flow of liquid through said passage and included venturi, said liquid flow passage means constituting the sole liquid flow

passage means into the upper portion of said container.

3. An air charger for a water system of the type having a pump and a pressure tank, comprising a container including a hollow cylinder, a closure at the lower end thereof, said closure having a passage therethrough terminating in a pipe connection at its outer end and a valve seat at its inner end, a valve in said container adapted to seat on said valve seat, a closure at the upper end of said cylinder, said closure including a lateral extension having a communicating passage therethrough terminating in but a single external coupling connection and including a venturi and a duct from its point of maximum constriction to a threaded recess, and a check valve mounted in said threaded recess and exposed to the atmosphere, said lateral extension passage constituting the sole liquid flow passage through said closure.

4. An air charger for a water system of the type having a pump and a pressure tank, comprising a container including a hollow cylinder, a closure at the lower end thereof, said closure having a passage therethrough terminating in a pipe connection at its outer end and a valve seat at its inner end, a valve in said container adapted to seat on said valve seat, a closure at the upper end of said cylinder, said closure including a lateral extension adapted for connection to such pressure tank, an aspirator in said closure for providing communication between said pressure tank and said container, said aspirator being directed upwardly from said container and including a venturi and a duct from its point of maximum constriction to a threaded recess, and a check valve mounted in said threaded recess and exposed to the atmosphere.

5. A pump system comprising a pump having an intake side and a discharge side, a tank, means flow connecting said pump on its discharge side with said tank, a container, a flow connection from the lower end of said container to the intake side of said pump and including a normally open valve in the presence of liquid, a flow connection from the upper end of said container to said tank at substantially the desired normal liquid level therein and open to liquid flow from said tank to said container, a check valve exposed to the atmosphere, and air pump means responsive to flow of liquid through said normal liquid level flow connection from said tank to said container for opening said check valve and admitting air to said container.

6. A pump system comprising a pump having an intake side and a discharge side, a tank, means flow connecting said pump with said tank, a container, a flow connection from one end of said container to the intake side of said pump and including a normally open valve in the presence of liquid, a flow connection from the other end of said container to said tank at substantially the desired normal liquid level therein and open to liquid flow from said tank to said container, a valve exposed to the atmosphere, and air pump means responsive to flow of liquid through said normal liquid level flow connection from said tank to said container for opening said valve and admitting air to said container.

7. A pump system comprising a pump having an intake side and a discharge side, a tank, means flow connecting said pump on its discharge side with said tank, a container, a flow connection from the lower end of said container to the intake side of said pump and including a normally open valve in the presence of liquid, a flow con-

nection from the upper end of said container to said tank at a point slightly above normal liquid level in said tank, a check valve exposed to the atmosphere, and air pump means in said latter flow connection and responsive to flow of liquid therethrough, said air pump means including an aspirator having a duct from its region of maximum constriction to said check valve.

8. A pump system comprising a pump having an intake side and a discharge side, a tank, means flow connecting said pump on its discharge side with said tank, a container, a flow connection from the lower end of said container to a point in said system at lower pressure than at the discharge side of said pump during operation of said pump and including a normally open valve in the presence of liquid, a flow connection from the upper end of said container to said tank at substantially normal liquid level in said tank, a check valve exposed to the atmosphere, and air pump means in said latter flow connection and responsive to flow of liquid therethrough, said air pump means including an aspirator having a duct from its region of maximum constriction to said check valve.

9. A pump system comprising a pump having an intake side and a discharge side, a tank, means flow connecting said pump with said tank, a container, a flow connection from the lower end of said container to a point in said system at lower pressure than in the flow connection between said pump and said tank during operation of said pump and including a normally open valve in the presence of liquid, a flow connection from the upper end of said container to said tank at substantially normal liquid level in said tank, a check valve exposed to the atmosphere, and air pump means in said latter flow connection and responsive to flow of liquid therethrough, said air pump means including an aspirator having a duct from its region of maximum constriction to said check valve.

10. A pump system comprising a pump having an intake side and a discharge side, a tank, means flow connecting said pump to said tank, a container, a flow connection from the lower end of said container to a point in said system at lower pressure than at the discharge side of said pump during operation of said pump and including a normally open valve in the presence of liquid, a flow connection from said container to said tank at substantially normal liquid level in said tank and open to liquid flow from said tank to said container, a normally closed valve exposed to atmosphere, and air pump means responsive to flow of liquid from said tank to said container through said normal liquid level flow connection for opening said valve and admitting air to said container.

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