Nov. 5, 1929. F. W. SHUELL 1,734,920

HOT WATER SYSTEM

Filed July 12, 1926

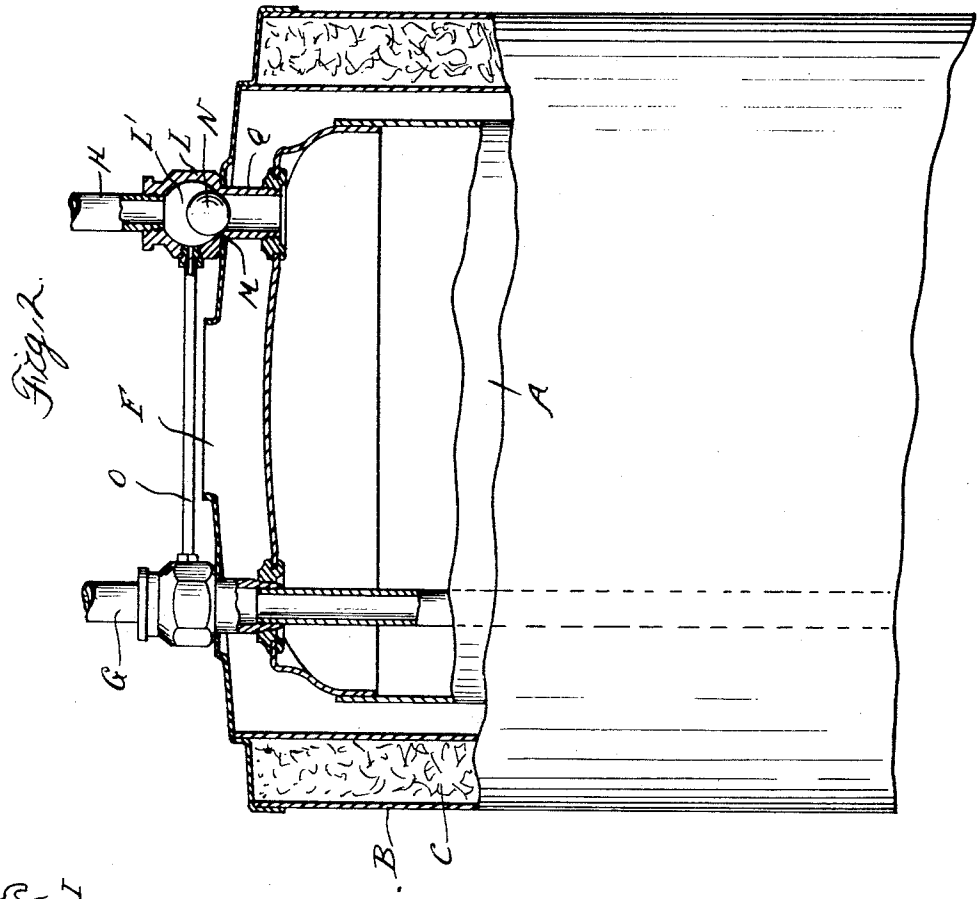


Fig. 2.

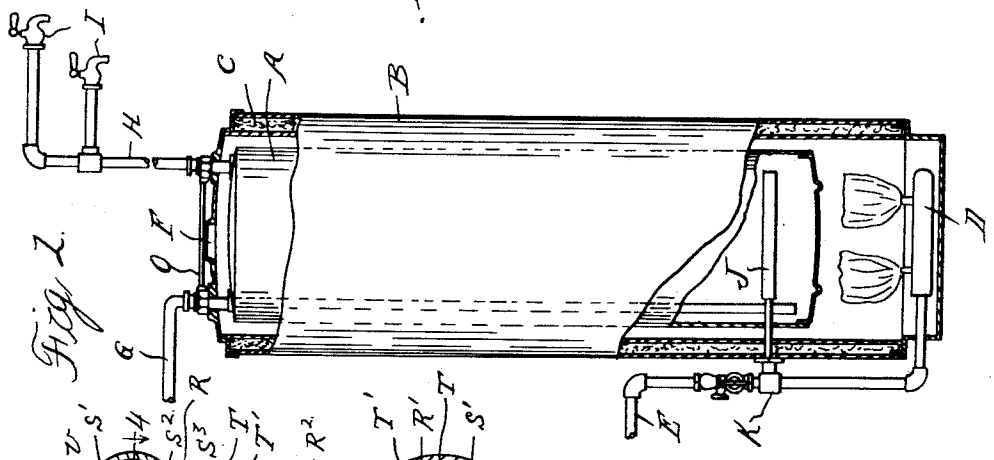


Fig. 1.

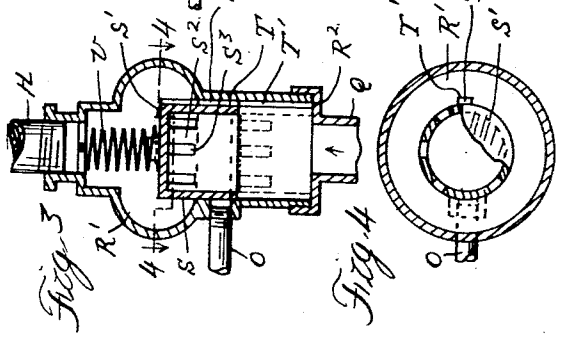


Fig. 3




Fig. 4

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# UNITED STATES PATENT OFFICE

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## HOT-WATER SYSTEM

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The invention relates to fluid distributing systems such as hot water systems and the like and consists essentially in a construction which permits the distributed liquid to be conserved when the system contains defective or leaking shut off valves. The invention is particularly adapted for use with hot water heating systems of the type which always maintain a supply of heated liquid and have an automatically regulated burner depending for its operation on the amount of liquid withdrawn from the tank. In the accompanying drawings such a system is illustrated but it is to be clearly understood that the invention is not necessarily limited to a heating system nor to the particular type of heater shown.

In the drawings:

Figure 1 illustrates a hot water system to which my invention may be applied.

Figure 2 is a longitudinal section through the top of the storage tank showing the preferred embodiment of my invention.

Figure 3 is a longitudinal section through a valve of modified construction.

Figure 4 is a transverse section on the line 4—4 of Figure 3.

One of the types of water heaters that is now extensively used consists of a thermostatically regulated gas burner which normally maintains a storage tank full of hot water by means of a pilot light and is responsive to the demand of the distributing system so that upon withdrawal of hot water from the tank it is automatically replenished by the increased supply of fuel to the burner. In such heaters when the delivery faucets are tightly closed and no water is withdrawn from the tank, the amount of gas supplied to the burner for maintaining the temperature of the storage tank is very small and the cost of operation of the system is low.

In practical use, however, it is difficult to maintain the delivery faucets tightly closed for the valves soon get out of order and permit leakage to a greater or less extent. Since this leakage goes on continuously usually for long periods of time the total amount of heat lost is surprisingly large and this heat must all be replaced by the burning of additional fuel thus increasing the cost of operation of the heater.

My invention is designed to prevent waste of hot water with defective distributing systems by providing a construction wherein the hot water from the storage tank is delivered to the faucets only when there is a predetermined normal demand and any demand below this amount will deliver only cold water to the discharge faucet. Thus my invention prevents the wastage of hot water due to small leakage in the distributing system.

Referring now more particularly to the preferred embodiment of my invention as illustrated in the drawings, A represents the storage tank arranged within a surrounding casing B preferably provided with insulating material C. D represents a gas burner located directly below the storage tank A and supplied with fuel through the gas inlet conduit E. The products of combustion from the burner pass upwardly between the side walls of the tank and the insulated outer shell finally emerging through a vent F at the top of the heater. G represents the cold water inlet conduit which as shown enters through the top of the storage tank and extends downwardly therein into the lower portion thereof. H represents the hot water delivery conduit connected to the top of the storage tank and leading to one or more delivery faucets I arranged in any suitable location. For controlling the supply of fuel to the burner D there is a thermostat J extending into the storage tank and arranged to operate a valve K in the gas line E in the well known manner. The arrangement is preferably such that the burner D maintains a small pilot light when the storage tank A is full of heated water and the burner is automatically turned up when the supply of hot water is diminished due to the withdrawal through the delivery conduit H.

In applying my invention to the construction as thus far described I preferably provide a check valve in the delivery conduit H adjacent the top of the heater. As shown this check valve comprises a valve body L having a spherical recess L′ therein and provided with a valve seat M for normally re-

ceiving a ball N. The ball is normally held on its seat by gravity and remains seated until the demand from the delivery conduit H is sufficiently great to provide a pressure that will overcome the weight of the ball and cause the same to rise within the spherical chamber L'. O is a by-pass tube extending between the cold water inlet pipe G and the valve casing L. The tube is of much smaller capacity than the conduit Q leading from the storage tank to the valve casing and is adapted to by pass a limited supply of cold water into the outer conduit H. Thus when the demand of the delivery conduit H is low the pressure is insufficient to raise the check valve from its seat and the demand is therefore supplied solely by the fluid passing through the by-pass tube O. When, however, the demand of the delivery conduit is greater the by-pass tube is unable to furnish sufficient fluid to supply the demand and consequently the pressure upon the check valve causes the ball to rise from its seat and permit hot water to be supplied to the delivery conduit.

With the construction described above it will be observed that when the demand of the delivery conduit is sufficient to raise the check valve the fluid can be supplied to the outer faucets from two sources, namely, the by-pass tube supplying cold water and the connection Q supplying hot water. Thus the temperature of the mixture issuing from the delivery faucet is slightly lower than the temperature of the water in the storage tank but due to the difference in capacity between the two supply sources the lowering of the temperature is so slight as to be immaterial in the practical operation of the device. It will also be understood that by properly proportioning the capacities of these tubes as well as the weight of the ball N it is possible to provide a construction which will prevent the passage of hot water into the delivery conduit when the demand is below any predetermined value that may be selected. In practice these factors are preferably so chosen that the valve will remain seated at any demands which would be occasioned due to leakage in the delivery line because of improperly seated valves in the delivery faucets.

While the foregoing description shows a specific embodiment of my invention it will be obvious that other constructions may be employed for accomplishing the same results and it is to be understood that my invention is not limited to the particular form of check valve described above, neither is my invention necessarily limited to the use of the above described apparatus in connection with hot water systems for it will be apparent that the invention might advantageously be employed in other systems wherein it is desired to conserve one fluid by the introduction of a second fluid into the delivery line when the demand is below a predetermined amount.

In Figures 3 and 4 I have illustrated a slightly modified form of valve construction in such a manner as to shut off the supply from the auxiliary conduit under normal demands from the system. In this case the valve casing R is cylindrical and is provided with an enlargement at $R^1$ above the by-pass conduit O and annular shoulders $R^2$ below said conduit. The valve S is also cylindrical having an imperforate top surface $S^1$ and a hollow interior $S^2$ open at the bottom. The valve has a series of port openings $S^3$ in its cylindrical sides which, however, are normally closed when the valve engages the shoulders $R^2$ by reason of the close fit of the valve. Within the cylindrical casing T is a guiding member projecting from the valve and engaging a groove $T^1$ in the casing to prevent rotation of the valve and U is a spring normally retaining the valve in its lower position with the by-pass O connecting with the casing above the valve. The portion of the cylindrical sides of the valve in alignment with the by-pass tube O is imperforate so as to form a shut off for said tube when the valve is in raised position.

By regulating the weight of the valve S and the tension of the spring U, the device may be designed to remain seated under low demands of the delivery conduit thus permitting the fluid from the by-pass to entirely supply the demand. Whenever the demand is above a certain predetermined value the pressure from the conduit Q raises the valve into the enlargement $R^1$ thus shutting off the supply from the by-pass and permitting the fluid from the conduit Q to pass outwardly through port openings $S^3$ which are sufficiently large to accommodate the maximum demand of the delivery conduit.

What I claim as my invention is:

1. In a fluid distributing system, the combination with a fluid supply, of means for changing the temperature of said fluid so connected to said fluid supply as to be constantly under pressure, a delivery conduit, a by pass conduit between said fluid supply and delivery conduit and means for preventing withdrawal of the fluid from said temperature changing means when the demand of said delivery conduit is below a predetermined amount, and means being automatically operated to permit said withdrawal at higher demands.

2. In a fluid distributing system the combination with a fluid supply conduit, of a storage tank so connected to said fluid supply conduit as to be constantly under pressure, a delivery conduit from said tank, a by-pass conduit between said fluid supply conduit and said delivery conduit, and means for automatically regulating the admission of fluid from said tank to said delivery conduit dependent upon the demand of said delivery conduit.

3. In a fluid distributing system, the combination with a fluid storage tank and a fluid supply conduit so connected to said tank as to maintain the same constantly under pressure, of means for heating the fluid in said tank, a delivery conduit leading from said tank, a by pass tube connecting said conduits exterior of said tank, and means adapted to prevent withdrawal of hot water from said delivery conduit when a demand of the latter is below a predetermined amount.

4. In a fluid distributing system, the combination with a fluid storage tank, of a fluid supply conduit constantly under pressure extending within said tank through the top portion thereof and so connected to said tank as to maintain the same under constant pressure, means for heating the fluid in said tank, a delivery conduit extending from the top of said tank, an auxiliary supply conduit connecting said supply and delivery conduit adjacent the top of said tank, and means for automatically regulating the admission of fluid from said tank to said delivery conduit dependent upon the demand of said delivery conduit.

5. In a fluid distributing system, the combination with a source of hot water constantly under pressure and a source of cold water, of a delivery conduit connected to the hot water source, regulable means for withdrawing the water from said delivery conduit, means adapted to prevent the withdrawal of hot water from said delivery conduit when the demand of the latter is below a predetermined amount, and a by-pass tube connecting said cold water supply and said delivery conduit, adapted to supply fluid to said delivery conduit when the demand is below said predetermined demand.

6. In a fluid distributing system, the combination with a fluid supply conduit, of a storage tank so connected to said fluid supply conduit as to be constantly under pressure, a delivery conduit from said tank, means for automatically regulating the admission of fluid from said tank to said delivery conduit dependent upon the demand of said delivery conduit, and a by-pass conduit between said fluid supply conduit and delivery conduit adapted to supply fluid to said delivery conduit when the demand is below that of the aforesaid demand.

7. In a fluid distributing system, the combination with a fluid supply, of means for changing the temperature of said fluid so connected to said fluid supply as to be constantly under pressure, a delivery conduit, a by-pass conduit between said fluid supply and delivery conduit and means for preventing withdrawal of the fluid from said temperature changing means when the demand of said delivery conduit is below a predetermined amount, the inlet end of said by-pass conduit being positioned in advance of said temperature changing means and the discharge end thereof being located beyond said second mentioned means.

8. In a fluid distributing system, the combination with a main fluid supply, of means for changing the temperature of said fluid so connected to said fluid supply as to be constantly under pressure, a delivery conduit, a valve casing between said conduits having an enlarged chamber therein, a normally closed check valve within said valve casing, an auxiliary fluid supply conduit placing said main supply conduit in communication with said valve casing, said valve preventing withdrawal of the fluid from said temperature changing means when the demand is below a predetermined amount, but permitting said withdrawal at higher demands.

9. In a fluid distributing system, the combination with a main fluid supply, of means for changing the temperature of said fluid so connected to said fluid supply as to be constantly under pressure, a delivery conduit, a valve casing between said conduits beyond said temperature changing means, said valve casing having an enlarged chamber therein, a ball check valve normally seated by gravity in said casing, said enlarged chamber being of sufficient capacity to permit the passage of the full supply of fluid from said main conduit when said check valve is raised from its seat, and a by-pass tube of smaller capacity than said main conduit and having an inlet communicating with said main conduit in advance of said temperature changing means, said by-pass tube having an outlet communicating with said valve casing above said valve.

10. In a fluid distributing system, the combination with a fluid storage tank, of a fluid supply conduit constantly under pressure extending within said tank through the top portion thereof and so connected to said tank as to maintain the same constantly under pressure, means for heating the fluid in said tank, a delivery conduit extending from the top of said tank, a valve casing in said delivery conduit, a normally closed check valve within said valve casing for automatically regulating the admission of fluid from said tank to said delivery conduit dependent upon the demand of said delivery conduit, and an auxiliary supply conduit connecting said supply conduit with said valve casing above said valve.

In testimony whereof I affix my signature.

FRANK W. SHUELL.