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C. SMITH
COMBINATION RELIEF VALVE

Filed March 20, 1922

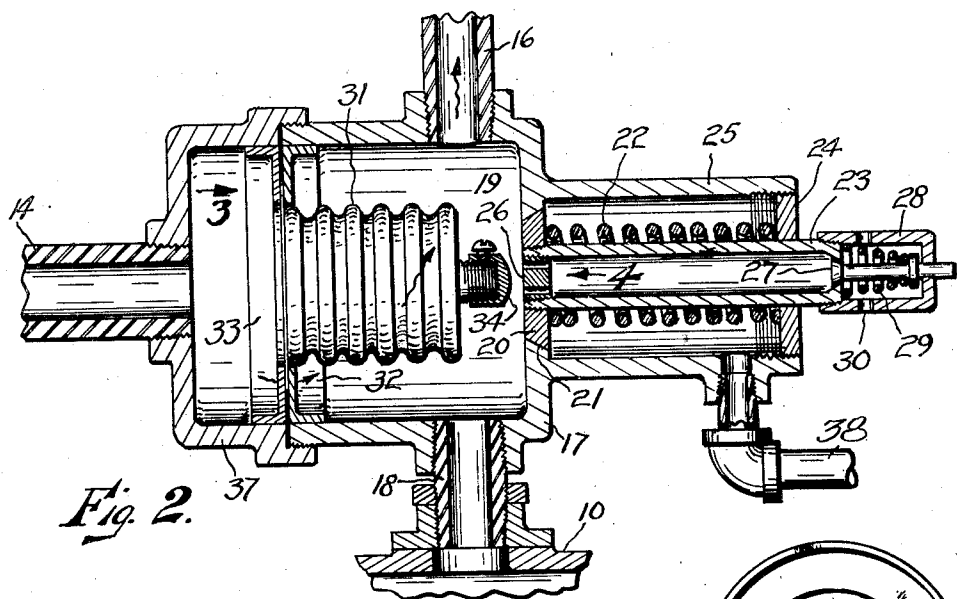


Fig. 2.

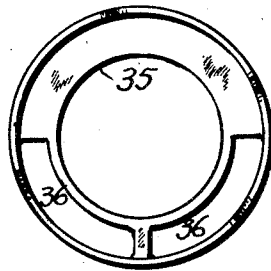


Fig. 3.



Fig. 4.

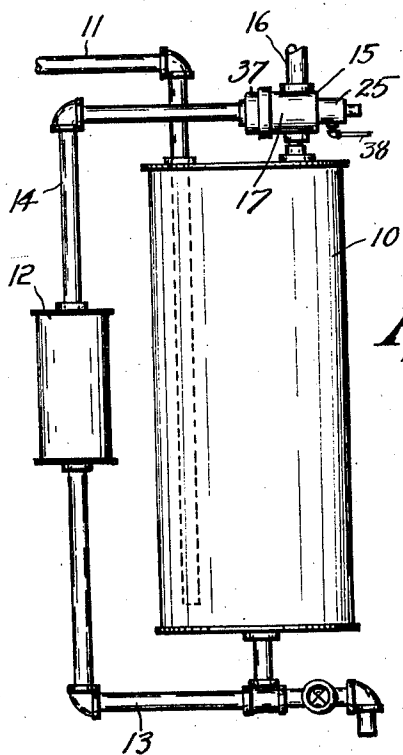


Fig. 1

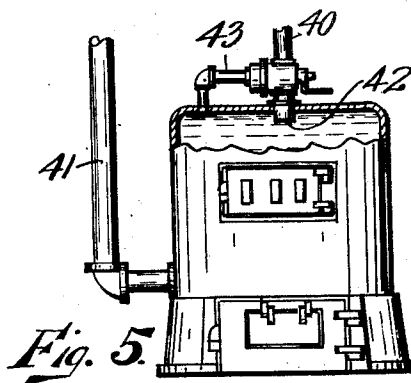


Fig. 5.

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COMBINATION RELIEF VALVE.

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This invention relates to a combination relief valve for use in connection with hot water supply systems and hot water heating systems.

In hot water supply systems, disastrous explosions have at times occurred and it has been found that the failure of the storage tank, while sometimes due to excessive pressure, is more frequently due to an excessive rise in temperature which softens the solder in the seams commonly found in copper storage tanks. The tank thus weakened is unable to withstand even normal pressure and separates at the soldered points or at some other point of weakness. A large volume of water at high temperature is thus liberated, and instantly and violently expands into steam with very disastrous results.

Similar accidents have occurred with hot water heating systems particularly when operated on a pressure system.

It is the object of my invention to provide means effective to permit escape of water from a hot water storage tank or from a heating system in the event of an excessive increase in either temperature or pressure therein.

It is a further object of my invention to make such provision in the form of a combination valve, which in the preferred form may also provide relief on the occurrence of a reduced pressure or vacuum in the system. This combination valve is acted upon directly by the pressure in the water supply or heating system and indirectly by an increase in temperature and the combined action of the two greatly increases the efficiency of the relief mechanism.

My invention further relates to arrangements and combinations of parts which will be hereinafter described and more particularly pointed out in the appended claims.

A preferred form of my invention is shown in the drawings in which

Fig. 1 is an elevation of parts of a hot water supply system;

Fig. 2 is a vertical sectional view of my improved combination valve;

Figs. 3 and 4 are detail elevations looking in the directions of the arrows 3 and 4 in Fig. 2; and

Fig. 5 shows my improvements embodied in a heating system.

Referring to Fig. 1, I have shown a storage tank 10, an inlet pipe 11, a water heater 12, a lower connection 13 from the bottom of the

tank 10 to the heater 12, an upper connection 14 from the heater 12 to the top of the tank 10 through my combination valve 15, and an outlet or distributing pipe 16.

My improved relief valve 15 comprises a casing 17 (Fig. 2) threaded to receive the outlet pipe 16 and also to receive a short pipe or nipple 18 connecting the casing 17 and storage tank 10. A chamber 19 within the casing 17 forms a passage between the pipes 18 and 16.

A pressure relief valve 20 is seated in a port 21 formed in the side wall of the chamber 19. A spring 22 surrounds the stem 23 of the valve 20 and is disposed between the head of the valve 20 and a disk 24 threaded into the outer end of an extension 25 of the casing 17. The disk 24 provides an abutment for the spring 22 and also an outer bearing for the valve stem 23.

The valve stem is preferably formed as a hollow sleeve provided at its inner end with a perforated plate 26 (Fig. 4), and at its outer end with a seat for a vacuum valve 27. A cap 28 is threaded to the end of the valve stem 23 and provides an outer bearing for the valve 27. A spring 29 within the cap 28 holds the valve 27 firmly seated under normal conditions and air openings 30 are provided in the side walls of the cap.

An expansion member or metal bellows thermostat 31 has its base mounted between fixed flanges 32 and 33 and is provided with an adjustable head 34 adapted to engage the valve 20 when the thermostat expands. The flanges 32 and 33 are of the form shown in Fig. 3, each flange having an opening 35 to receive the thermostat and having also segmental openings 36 in its lower portion to permit the flow of water from the connection 14 to the tank 10 or pipe 16.

The flange 32 is mounted in the casing 17 and the flange 33 is mounted in a casing cap 37 threaded on the casing 17 and receiving the end of the connection 14. A drainage pipe or opening 38 is provided for the casing extension 25.

Having thus described the construction of my improved valve, I will now outline its method of operation: During the normal operation of the supply system, the valves 20 and 27 remain closed and the water flows from the pipe 18 through the chamber 19 to the distributing pipe 16. It will be noted that the path of the water is directly past the face

of the valve 20, thus keeping the valve clear of all dirt or sediment.

If the pressure within the supply system rises above a predetermined point, the spring 22 will be overcome and the valve 20 will open, permitting water to flow through the extension 25 and out of the drainage opening 38. The pressure at which the valve opens may be adjusted by screwing the disc 24 into or out of the extension 25.

The valve stem 23 fits slightly loosely in the disc 24, the clearance being such that no leakage will commonly occur when the drain pipe is clear but permitting escape of water around the stem 23 if the drain pipe becomes clogged.

If for any reason the pressure within the supply system is reduced substantially below atmospheric, as sometimes happens when water is drawn from the system with the supply pipe 11 closed, the air valve 27 will open inward against the pressure of the spring 29, thus permitting the entrance of sufficient air to relieve the reduced pressure within the tank 10.

If the temperature of the heated water in the system rises above a predetermined point, the thermostat 31 will expand, engaging the valve 20 and opening the valve outward against the pressure of the spring 22. The temperature at which the thermostat acts may be adjusted by setting the head 34, which is threaded to a projection on the outer end of the thermostat.

It will thus be seen that my combination relief valve effectively protects the supply system under any and all circumstances which may arise in the operation of the system.

The location of the openings 36 is important, as it causes the heated water to circulate more actively around the thermostat, as indicated by the arrows in Fig. 2. It is also very desirable to have the thermostat located in the connections between the heater 12 and the tank 10, as the water flowing through the connections 14 and 18 is usually more highly heated than the water in any other portion of the system outside of the heater 12.

If both temperature and pressure increase, the thermostatic member forcibly engages the valve and acts with the pressure thereon to open the same. Very strong opening pressure is thus available, in the event of a valve being clogged or stuck to its seat. This condition may easily be avoided by occasionally pulling outward upon the cap 28 to unseat the valve 20.

In Fig. 5, I have shown the invention applied to a hot water heating system. In this case the combination valve is placed in the regular outlet pipe 40 through which the water flows to the radiators and back through the return pipe 41. The end 42 of the pipe 40 should be extended slightly within the dome of the heater and an additional pipe 43 con-

nects the valve to the top of the heater. This gives a supplementary circulation past the thermostatic member, due to the slight difference in the elevation of the open lower ends of the pipes 40 and 43.

In this arrangement, as in that previously described, an increase of pressure is usually associated with a corresponding rise in temperature and the thermostat 31 acts with the increased water or steam pressure to open the valve 20.

In the claims the term "heating system" is used broadly to cover either hot water or other storage systems or hot water heating systems for houses or other buildings.

It will be evident that changes and modifications can be made in my invention within the spirit and scope thereof as set forth in the claims, and I do not wish to be otherwise limited to the details herein disclosed, but what I claim is:—

1. In a heating system, a relief valve constructed to open said system for an increase in either pressure or temperature in said system, and means to convey waste liquid from the heating system, said valve including a loosely fitted member past which liquid may be forced to relieve the system if the waste connection is clogged.

2. In a heating system, a storage tank, means to heat the water therein, means to open said system and allow the heated water to waste on the occurrence of an excessive rise in either temperature or pressure within said system, said system being automatically restored to normal condition after the excess in pressure or temperature has been relieved, and a supply pipe to immediately restore the wastage.

3. In a heating system, a container for heated water, a temperature controlled relief valve mounted directly on the top portion of said container and having inlet and outlet and waste openings, and inlet and outlet connections through said top portion from said container to the inlet and outlet openings of said valve, said connections being open to said container at their lower ends and one of said connections having its open lower end in said container at a lower level than the other.

4. In a heating system, temperature relief means comprising a valve casing, a bellows thermostat having supporting means at one end thereof, a contact head mounted on said bellows at the other end thereof, means to adjust said head on said bellows toward and from said valve to vary the operating temperature, a temperature relief valve in said casing and spaced from said head, a spring to seat said valve, said head adapted upon expansion of said bellows to engage said valve and open same, said valve and head being spaced apart under normal operation conditions.

5. In a heating system, a storage tank, a heater, temperature relief means comprising a valve casing, a thermostatic member therein, a valve in said casing positioned to be engaged and opened by said member, an inlet connection from said tank to said casing on one side of said thermostatic member, a distributing outlet connection from said casing on the opposite side of said thermostatic member, whereby the flow of previously heated liquid drawn from the tank will be actively circulated about said thermostatic member when said valve is open and also when said valve is closed, an additional connection from said heater to said valve casing, and means to direct the flow of heated water entering said casing from said heater to the side of said casing opposite to said distributing outlet, whereby the heated water flows past said thermostatic member and closely adjacent thereto in reaching said outlet and also flows past said member in reaching said inlet connection to the tank when the distributing outlet is closed.

In testimony whereof I have hereunto affixed my signature.

CHETWOOD SMITH.