July 21, 1936. C. T. FUETTERER 2,048,606

FEEDING DEVICE

Filed Aug. 16, 1932

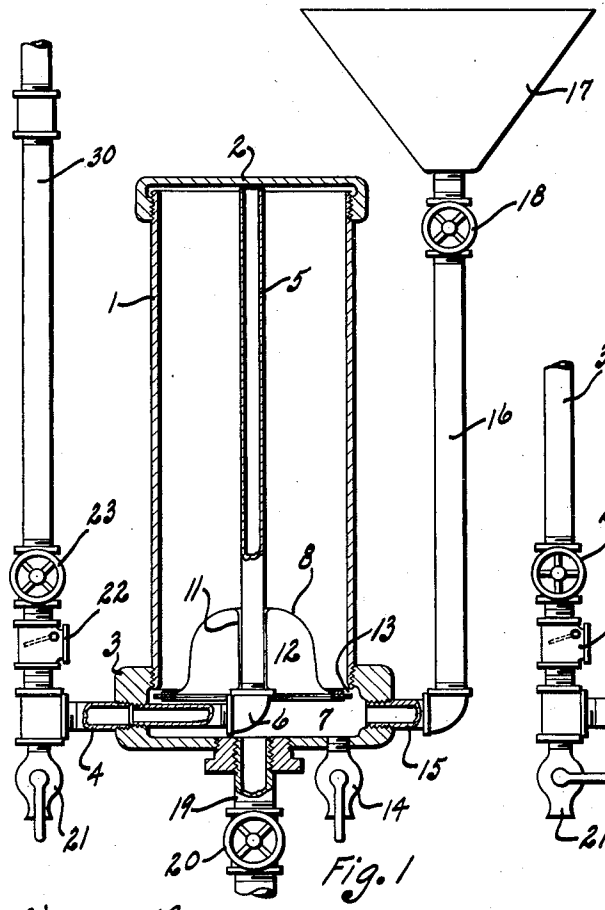


Fig. 1

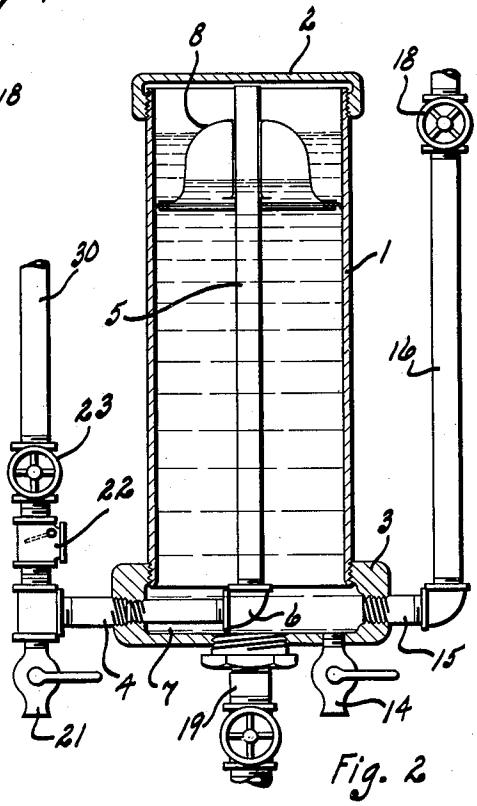


Fig. 2

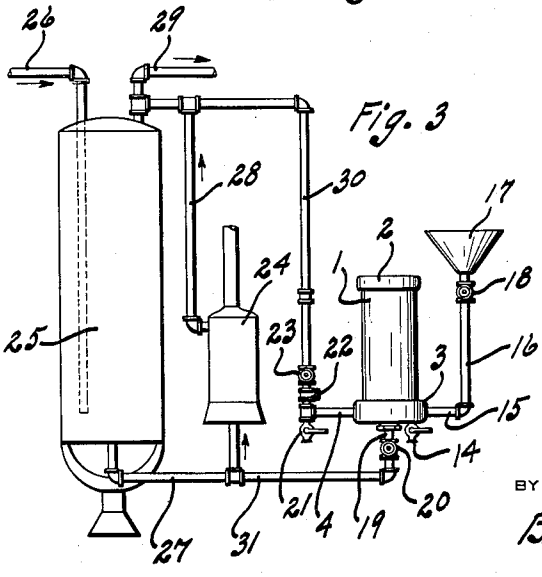


Fig. 3

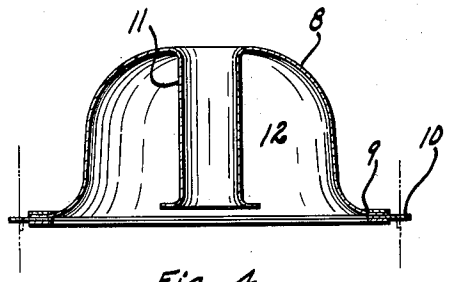


Fig. 4

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FEEDING DEVICE

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9 Claims. (Cl. 210—38)

This invention relates to chemical feeding devices and contemplates a device for feeding a water-softening chemical solution to the water to be softened.

More particularly the objects of the invention are to provide a simple, inexpensive and novel device of this character, to associate the same in a novel manner with water-heating means, and to provide that the feeding of the chemical compound shall be automatically responsive to the heating of the water.

The exact nature of this invention together with further objects and advantages thereof will be apparent from the following description taken in connection with the accompanying drawing, in which Fig. 1 is an elevation view of an embodiment of the device, parts being broken away to show details of construction, and the parts being illustrated as positioned before introduction of the chemical charge; Fig. 2 is a view similar to Fig. 1 but illustrating the parts as positioned after introduction of the charge and before feeding thereof to the water commences; Fig. 3 is a diagrammatic view in elevation showing the relation of the parts in the water system; and Fig. 4 is an enlarged detail in section of one of the parts employed.

With reference now to the drawing, 1 is a vertically disposed hollow cylinder having closures at its ends shown as comprising a cap 2 closing its upper end and a head 3 closing its lower end.

The cylinder 1 has an external connection near its lower extremity as at 4, shown as directed through the side of the head 3 and leading to a riser 5, so that communication with the hollow of the cylinder from the connection 4 is by way of piping 6 in the hollow 7 of the head 3, thence upwardly by way of the riser 5 and to the top of the latter which is adjacent the upper cylinder cap 2.

The cylinder is provided with a free or floating piston or diaphragm 8 forming a movable partition by which the cylinder cavity is divided into two compartments of varying volume, one above and the other below the piston. This piston has a flange part 9 with a flexible sealing washer 10 extending therefrom to maintain a substantial seal against the cylinder wall. The piston is dome-shaped as indicated having a neck 11 to fit about the riser 5, and forming an annular cavity 12 thereabout.

The cavity 7 of the lower cylinder head 3 is enlarged beyond the diameter of the cylinder 1, so that when the piston 8 is at the lower extremity of its travel the sealing 10 is below the end of the cylinder, and an annular opening 13 is thus provided communicating between the cylinder space above the piston and the cavity 7 therebelow. The effect is thus one of a port controlled by the piston. Lowering movement of the piston is limited by engagement of its neck 11 with the bend of the piping 6. A petcock 14 is provided on the head 3 to relieve the cavity 7. A chemical inlet connection to the cavity is provided, as indicated by the side connection 15 on the head 3, leading upwardly by way of pipe 16 to a chemical-receiving funnel or hopper 17. A shut-off valve 18 is provided to control communication between the funnel and the cavity 7.

The head 3 is also provided with an outlet connection 19, downwardly directed from the cavity 7 and valved as at 20.

The piping associated with the inlet connection 4 includes thereadjacent a petcock 21, a check valve 22 and a shut-off valve 23. The arrangement of the check valve 22 is such that flow may be had to the connection 4 subject to opening of the valve 23, but reverse flow is prevented.

The device is associated with a water-heating system as indicated Fig. 3 wherein appears the water heater 24 and hot water tank 25. The usual piping for such combination is shown and includes cold water inlet piping 26 leading to the tank 25, a cold water connection 27 leading from the bottom of the tank to the bottom of the heater 24, a hot water connection 28 leading from the top of the heater to the top of the tank and a hot water outlet connection 29 leading from the top of both heater and tank. The heater and tank are thus in parallel relation between the cold water inlet 26 and the hot water outlet 29 of the system.

The feeding device is associated generally in a third parallel circuit. The inlet connection 4 by way of the valves 22 and 23 has connection by piping 30 with the hot water outlet 28 from the heater. The outlet connection 19 by way of the valve 20 has connection through piping 31 with the cold water inlet of the heater.

Operation will be as follows, commencing with the parts as indicated Fig. 1, the petcocks 14 and 21 and the valve 18 being open and the valves 20 and 23 being closed. The piston 8 being at the bottom of its stroke and the petcock 14 being open, the cavity of the cylinder 1 is completely drained and empty. Likewise the riser 5 and its associated piping up to the valve 22 is drained by way of the petcock 21. The petcock 14 is next closed, and the chemical solution introduced by way of the funnel 17. The valve 18 being

open, the solution flows down into the cavity 7 and rises in the cylinder. Water may similarly be introduced if dilution is prescribed. Flow into the cavity 7 raises the piston 8, closing the annular passage 13, the piston being caused to float upwardly by the buoyancy of air trapped in its cavity 12. The buoyant capacity of this cavity is preferably substantially sufficient to balance the weight of the piston. Some of the liquid may rise above the packing 10 of the piston before the latter completely closes the port 13 but this will be in negligible amount and of no consequence.

As the piston 8 rises, the petcock 21 being open, air is driven off therethrough from above the piston, by way of the riser 5. The piston therefore rises responsive solely to the liquid level of the chemical solution introduced.

After introduction of the chemical charge the valve 18 and petcock 21 are closed. The valve 20 is next opened. Since above the piston there is only air at atmospheric pressure, and below the piston there is connection with the water line under the pressure of the water supply to the system, the piston will now rise further, compressing the air above it until attainment of an equilibrium of pressure on opposite sides of the piston. Cold water flows into the cylinder below the piston by way of the connection 19 as the piston thus rises.

The valve 20 is next nearly closed, being left open only a slight amount dependent upon the rate of feed desired. The valve 20 is thereafter to act as a needle valve.

The valve 23 is then opened, providing communication from the hot water end of the heater to the riser 5. Since the air above the piston is already at the pressure of the cold water end of the cylinder 1 no appreciable piston motion will immediately follow the opening of the valve 23.

The device is now charged and ready to feed the chemical to the water, the parts being as indicated in Fig. 2. This feed takes place automatically in the following manner. As the heater 24 is operated, owing to thermo-siphon effect of the water heated pressure in the hot water line 28 and consequently in the line 30 becomes greater than pressure in the cold water line 27 and consequently in the line 31. Thus in the cylinder 1 pressure above the piston 8 becomes greater than that below the piston 8, causing the piston to lower. There will always be air in the upper end of the cylinder since as the piston is displaced downwardly by water entering above it through the riser 5, this water will follow upon the piston and the air will not be displaced in the cylinder.

As the piston lowers the chemical solution therebelow is forced past the valve 20 and into the cold water end of the heater. The more the heater is operated and the more thermo-siphon effect upon the water therein, the more chemical will be fed to the cold water end of the heater. If the heater be shut down and the system cool, the piston 8 will not rise in the cylinder 1, because of the check valve 22; but will be lowered further upon the heater resuming its operation for the reasons already described. The piston is thus inched downwardly forcing the chemical solution into the water, with a progressive motion responsive to the operation of the heater. Since the heater operation is in turn responsive to hot water demand, the hot water delivered by the system is automatically treated with chemical in a fixed proportional amount.

After the piston progresses downwardly to open the port 13, the feeding will continue as before until the chemical in the cavity 7 is displaced by water entering through the port.

It will be noted that there are two connections between the chemical container and the water heater, one to the cold water inlet of the heating means and the other to the hot water outlet thereof. The inlet is preferably at the bottom of the heater and the outlet at the top thereof, as indicated. The connection from the container to the cold water inlet of the heater is the chemical feeding connection and preferably leads from the bottom of the container as illustrated and described. The connection from the hot water outlet to the chemical container includes a U formed by the riser 5 and associated parts, whereby the effective inlet to the container is at the top of the latter yet of such nature that air cannot leave the container therethrough except under the described valve manipulation as the container is filled with chemical.

What I claim is:

1. Chemical feeding means of the class described comprising a container having a partition providing two compartments one above the other, means for connecting the upper compartment with the outlet end of water-heating means, said means including a riser leading upwardly to the upper part of said upper compartment and having associated draining means, means for connecting the lower compartment with the inlet end of said heating means, and means for introducing chemical into said lower compartment, said partition being arranged for movement responsive to the relative pressures in said compartments to vary the relative volumes thereof, and having associated float means to substantially neutralize its weight.

2. Chemical feeding means of the class described, comprising a container having a partition providing two compartments one above the other, means for connecting the upper part of the upper compartment with the outlet end of water-heating means by way of a drainable riser passage leading upwardly into said upper compartment, means for connecting the lower part of the lower compartment with the inlet end of said heating means, and means for introducing chemical into said lower compartment, said partition being arranged for movement responsive to the relative pressures in said compartments to vary the relative volumes thereof.

3. Chemical feeding means of the class described comprising a cylindrical container having a free piston providing two compartments, means for connecting the end of one compartment with the outlet end of water-heating means, means for connecting the end of the other compartment with the inlet end of said heating means, and means for introducing chemical into the latter compartment, said container having port means providing a bypass around said piston when the latter is at the end of its stroke to decrease said latter compartment volume.

4. In combination with water-heating means having a cold water inlet and a hot water outlet, a chemical container having a chemical feeding connection with said cold water inlet and a connection with said hot water outlet, said connections being so arranged that feed will be had from said container through said feeding connection responsive to thermo-siphon effect produced by

said heating means, and means in said container for preventing dilution of the chemical contents thereof from said hot water connection.

5. In combination with water-heating means having a bottom cold water inlet and a top hot water outlet, a chemical container having a bottom chemical feeding connection with said cold water inlet and a top connection with said hot water outlet, whereby feed will be had from said container through said feeding connection responsive to thermo-siphon effect produced by said heating means, said top connection including a riser leading from said hot water outlet upwardly into the top part of said container, and means for draining said riser, whereby in said feeding operation said container will have an air pocket effective between said hot water outlet and the chemical container contents.

6. In a water heating system having a closed heating circuit including a heater and a storage tank to provide accumulation of heated water by thermosiphonic flow within said circuit, whereby continuous low capacity operation of said heater may satisfy intermittent high capacity demands on said system, a chemical container connected in said system to provide an auxiliary circuit wherein said heater and container are in series relation, whereby the container contents may have displacement in the system toward the heater inlet dependent upon thermosiphonic pressure generated in said heater, the connections for said container including means automatically preventing reverse flow therein, whereby said displacement will be proportional to said heater operation rather than said intermittent demand.

7. In a water heating ssytem having a closed heating circuit including heating and storage elements, a chambered chemical container, means connecting said container with said heating element to establish the container chamber in series relation with said heating element, in a circuit which has parallel relation with the heating circuit in said system, and movable means in said container separating its chamber into two compartments in series relation in the container circuit and of relatively variable volumes responsive to operation of said heating element.

8. In a water heating system including a heater having inlet and outlet means arranged to provide upward flow through the heater, of water heated therein, a chemical container, and means connecting said container in said system to provide a closed container circuit including said heater wherein substantially the entire thermosiphonic pressure generated in said heater may be effective to displace the container contents toward the heater inlet.

9. In a water heating system including a heater having inlet and outlet means arranged to provide upward flow through the heater, of water heated therein, a chemical container, means connecting said container in said system to provide a closed container circuit including said heater wherein substantially the entire thermosiphonic pressure generated in said heater may be effective to displace the container contents toward the heater inlet, and means for controlling flow in said circuit, to control said chemical displacement, and including means for restricting flow in the described direction and means automatically preventing flow in the opposite direction.

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