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COMBINATION WATER HEATER AND SOFTENER

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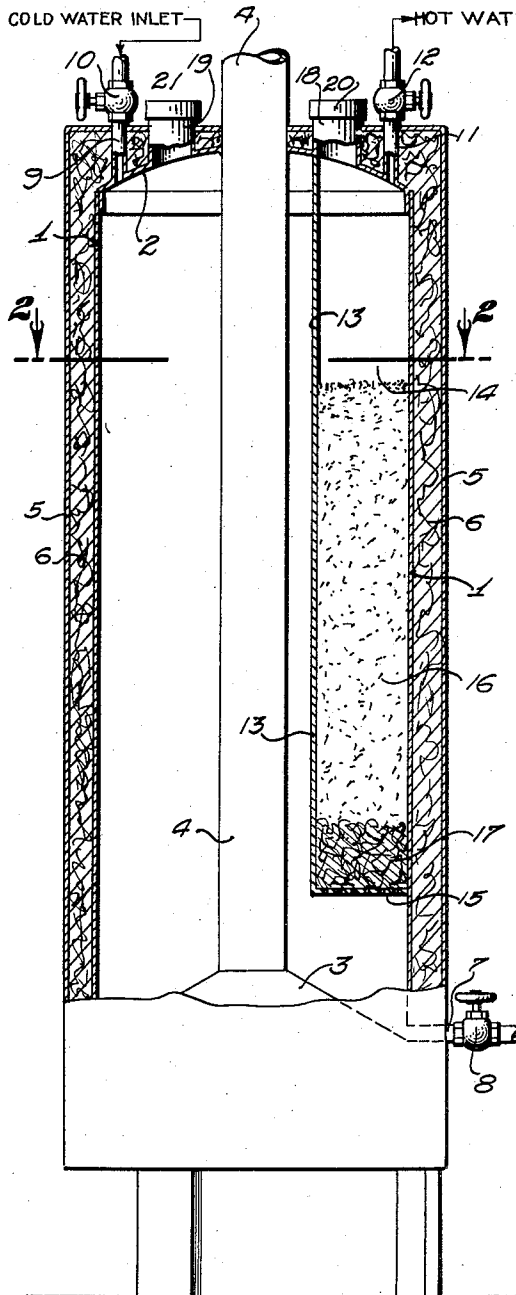


FIG. 1

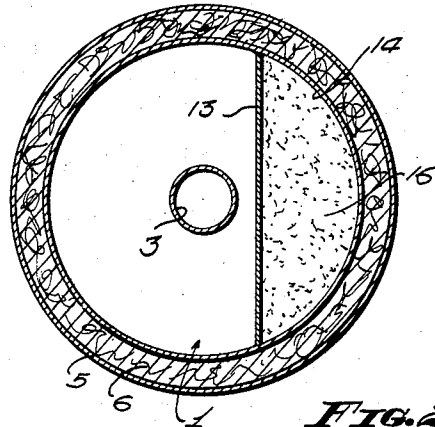


FIG. 2

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COMBINATION WATER HEATER AND SOFTENER

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3 Claims. (Cl. 210—175)

My invention relates to combined water heaters and softeners, and included in the objects of my invention are:

First, to provide an apparatus of this class wherein a compartment is formed in a water heater and filled with a cation exchange type of water softener.

Second, to provide an apparatus of this class wherein the quantity of cation exchange material required to treat the water is materially reduced.

Third, to provide an apparatus of this class wherein the time required to regenerate the cation exchange material is materially reduced.

Fourth, to provide a combined water heater and water softener which may be manufactured at a cost not materially exceeding the cost of a conventional water heater.

With the above and other objects in view, as may appear hereinafter, reference is directed to the accompanying drawings in which:

Figure 1 is a substantially diagrammatical, partial sectional, partial elevational view of a combined water heater and softener incorporating my invention; and

Figure 2 is a transverse sectional view through 2—2 of Figure 1.

My combined water heater and softener includes a tank 1 having a closed top 2 and a bottom 3 forming the upper side of a heating chamber located below the water heater tank. A central flue 4 extends upwardly through the tank.

The tank 1 is surrounded by a jacket 5, and between the jacket and tank is placed insulation 6. At its lower end the tank is provided with a drain 7 controlled by a valve 8. At its upper side the tank is provided with a cold water inlet 9 controlled by a valve 10, and a hot water outlet 11 which may, if desired, be provided with a valve 12.

The construction so far described may be identical to the conventional hot water storage tank and equipped with conventional thermostat control means and a conventional gas burner, not shown, located below the tank, or the tank may be heated by a conventional electric heating element.

In the exercise of my invention the tank 1 is provided with a vertical partition 13 located at one side of the flue 4 so as to form under the hot water outlet 11 a compartment 14. The partition 13 terminates short of the bottom 3 of the tank, and the compartment is closed at its lower end by a perforated bottom 15.

The compartment 14 is partially filled with a cation exchange water softening material 16. While many of the cation exchange materials, both natural and artificial, may be used, a type known commercially as "Nalcite HCR" has been found satisfactory. This is a cation exchange resin of the non-phenolic type. It is a mono-functional, sulfonated copolymer of styrene and divinylbenzene.

A filter 17 formed of rock wool, or the like, is placed above the perforated bottom 15 of the compartment 14 so as to support the cation exchange material.

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A pair of access openings 18 and 19 provided with suitable covers 20 and 21 may be provided in the top 2 of the tank 1. The access opening 18 is located over the water softener compartment 14 and the access opening 19 is located over the main portion of the tank 1.

The access opening 18 is primarily used for the initial introduction of cation exchange material into the compartment 14 and infrequent supplemental addition of such material.

The access opening 19 is employed periodically for the introduction of rock salt for the purpose of regenerating the cation exchange material. The access opening 19 may be omitted inasmuch as the salt may be introduced through the access opening 18. However, the regenerating cycle is minimized by introduction of the salt into the heated water in the main portion of the tank 1.

Operation of my water heater and softener is as follows.

Normally, the water within the tank 1 is maintained at a suitable temperature, for example, between 140° and 180° F., by means of a thermostat, not shown. Consequently, the water within the water softening compartment is also maintained at this temperature by transfer of heat through the partition 13. When hot water is withdrawn from the outlet 11, a corresponding volume of cold water enters the inlet 9.

If the demand of the tank 1 is such as to deplete the hot water, the temperature of the cation exchange material may drop to the temperature of the incoming cold water. This periodic change in temperature of the cation exchange material apparently has a beneficial effect. This may be due to the fact that at the elevated temperatures of 140° to 180° F. the particles of the material are expanded; conversely, when the particles are subjected to cold water they contract. Thus the calcium and magnesium which deposit on the heated particles tend to flake off when the particles of the cation exchange material shrinks.

It has been found that by incorporating the cation exchange material in the hot water tank, the volume of material required to treat a given volume of water is decreased between 25% and 35%. This means that the amount of cation exchange material required is reduced to a minimum so that a compartment containing the material may be incorporated in a water heater without materially reducing the effective capacity of the heater.

The cation exchange material is regenerated in the conventional manner by adding rock salt to the water. By reason of the temperature of the water the rock salt rapidly dissolves, so that the regeneration cycle may be reduced from three-quarters of an hour, as required in the conventional domestic water softener, to only two to five minutes. Furthermore, less salt is needed. Regeneration is accomplished merely by circulating the salt water upwardly through the cation exchange material by running water from the hot water outlet until the salt water has been withdrawn.

It is advisable to drain water from the tank periodically in order to remove sediment which may have been brought in. In the draining or flushing of such sediment from the tank, there is a downward flow of water through the filter 17 so that the filter is purged at the same time the tank is drained.

It should be observed that the hot and cold water connections may be reversed, in which case the cold water enters the compartment 14 and the hot water discharges from the tank 1 through the pipe 9. This has the effect of providing more frequent changes in the temperature of the cation exchange material.

Having fully described my invention, it is to be understood that I do not wish to be limited to the details herein

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set forth, but my invention is of the full scope of the appended claims.

I claim:

1. A combined water heater and softener, comprising: a tank structure having insulated side walls, a central heating flue, and a burner compartment below said flue; a cold water connection and a hot water connection at the upper end of said tank structure; a partition extending downwardly from the upper end of said tank structure to a level near the bottom end of said tank structure and separating said inlet and outlet connections, said partition dividing said tank structure transversely into a major and a minor complementary zone; a perforated support at the bottom end of said minor zone; a charge of ion exchange material at least partially filling said minor zone, where- by water passing between said connections flows consec- 15 utively through said zones; and means affording access to said minor zone for introducing regenerating material therein.

2. A combined water heater and softener as set forth 20

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in claim 1, wherein: said cold water connection com- municates with said major zone.

3. A combined water heater and softener as set forth in claim 1, wherein: said cold water connection communi- cates with said minor zone.

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