

S. G. CRANE.
ELECTRIC WATER HEATER.

APPLICATION FILED JULY 19, 1920. RENEWED JULY 13, 1922.

1,437,384.

Patented Nov. 28, 1922.

2 SHEETS—SHEET 1.

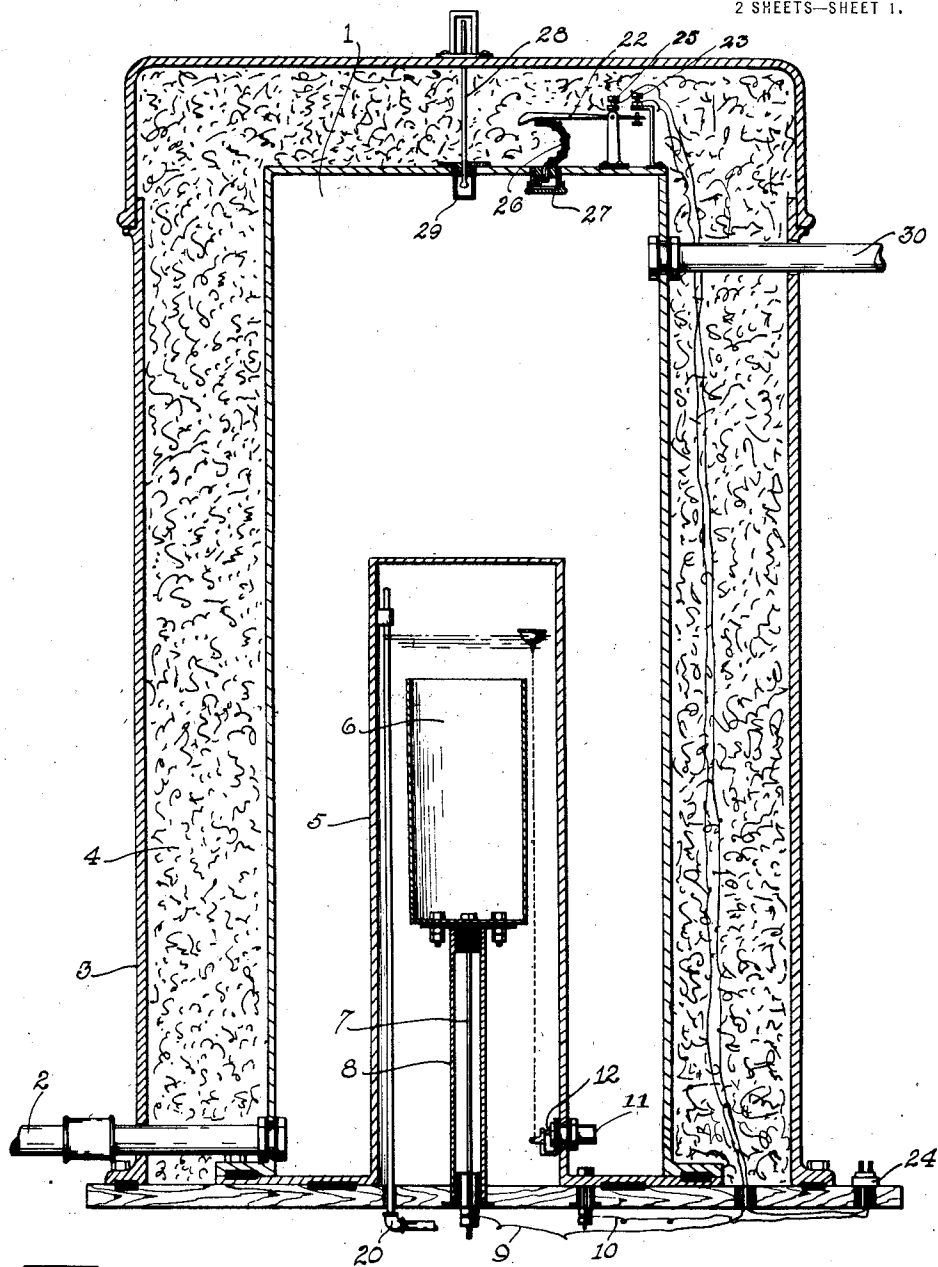


Fig. 1

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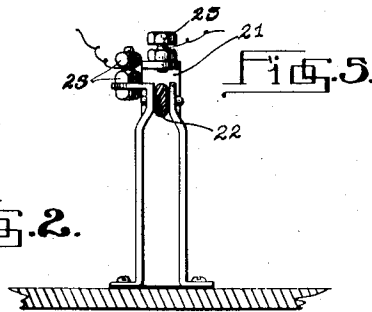
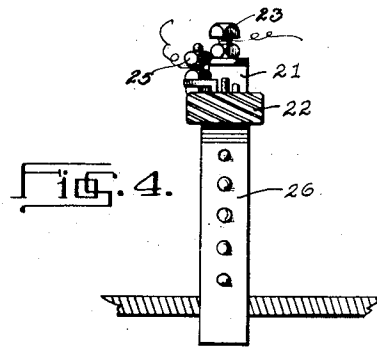
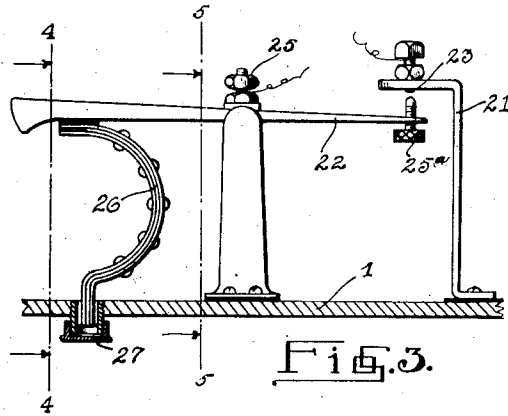
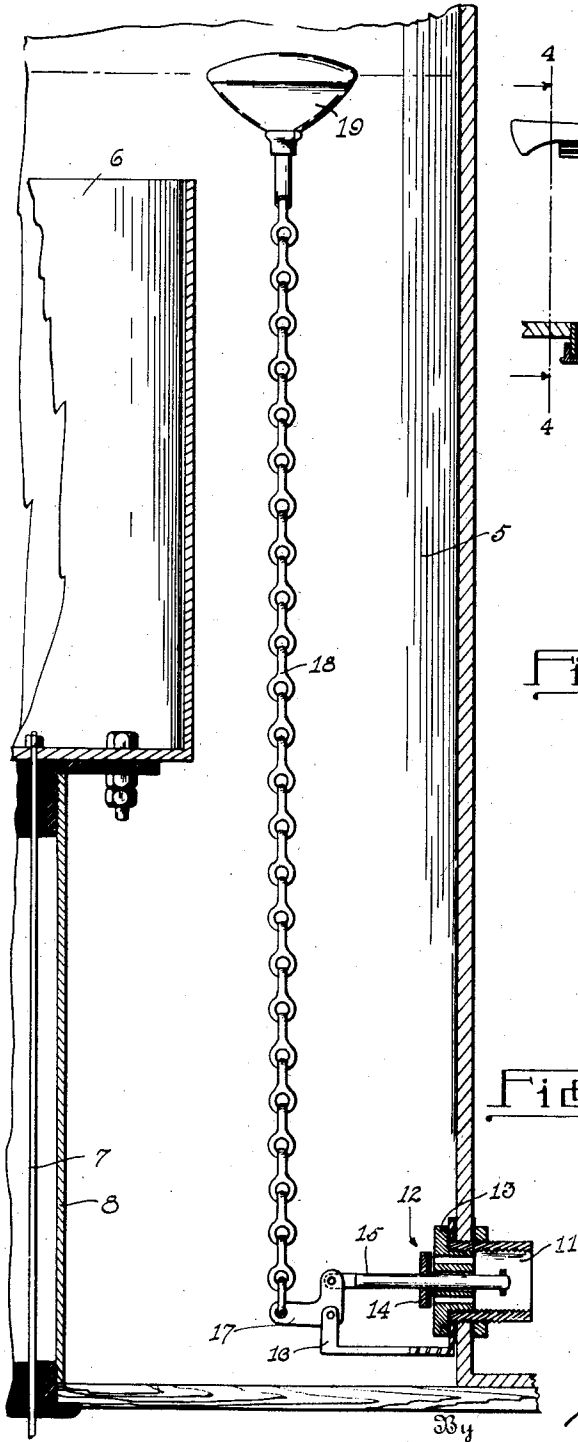
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UNITED STATES PATENT OFFICE.

SAMUEL G. CRANE, OF TOLEDO, OHIO.

ELECTRIC WATER HEATER.

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To all whom it may concern:

Be it known that I, SAMUEL G. CRANE, a citizen of the United States, residing at Toledo, in the county of Lucas and State of Ohio, have invented certain new and useful Improvements in Electric Water Heaters, of which the following is a specification.

One of the principal objects of the invention is the provision of an economical, safe, and wholly automatic electric water heater which is adapted to be operated in connection with the ordinary city water supply and to use the ordinary city current.

Another object is the provision of an electric water heater of this type employed as a water resistance medium, having automatic means for replenishing the resistance medium as it is depleted by evaporation and electrolysis.

Another object is the provision of means for regulating the conductivity of the resistance medium.

Still another object is the provision of improved thermostatic means for regulating the flow of current.

Other objects and advantage will be apparent from the following description, in which reference is had to the accompanying drawings illustrating a preferred embodiment of my invention and wherein similar reference numerals designate similar parts throughout the several views.

In the drawings:—

Figure 1 is a vertical sectional view through a heating apparatus embodying my invention;

Figure 2 is an enlarged fragmentary sectional view showing the automatic means for replenishing the resistance medium;

Figure 3 is a front elevation of a thermostatic switch employed for controlling the current;

Figure 4 is a vertical sectional view taken substantially on the line 4—4 of Figure 3; and

Figure 5 is a vertical sectional view taken substantially on the line 5—5 of Figure 3.

Referring to the drawings in detail, the water to be heated is contained in a tank 1 which is connected by means of an open inlet pipe 2 to the source of water supply. Surrounding the tank 1 and spaced therefrom is a shell 3, the space between the shell 3 and tank 1 being filled with mineral wool or other material 4 to form a jacket sub-

stantially non-conductive of heat. Centrally located within the lower end of the tank 1 is a chamber 5 adapted to contain water, and supported within the chamber 5 at some distance from its bottom is a cup-shaped electrode 6. The electrode 6 is connected, by means of a rod 7 extending downwardly through an insulated supporting tube 8, to a wire 9 leading from one pole of the source of current, while the wall of the chamber 5 is connected to a wire 10 leading to the other pole of the source of current.

The interior of the chamber 5 is connected by means of a pipe 11 to the water supply, the pipe 11 being fitted with a float-controlled valve 12 by means of which the depth of the water in the chamber 5 is regulated. The valve 12 comprises a perforated plug 13 threaded into the end of the pipe 11 which enters the chamber 5 and a valve head 14 fixed upon a valve stem 15 slidably mounted in the plug 13. Secured upon the pipe 11 within the chamber 5 is a bracket 16 upon which is pivoted a bell-crank lever 17, one arm of which is connected to the valve stem 15, while its other arm is connected by means of a chain 18 to a float 19 adapted to be supported by the water within the chamber 5. As will be apparent from an inspection of Figure 2, the valve 12 is automatically closed when the water in the chamber 5 reaches a level slightly above the top of the cup-shaped electrode 6.

The conductivity of water varies according to the kinds and percentages of materials which it holds in solution, pure water being for all practical purposes a non-conductor. The cup-shaped electrode 6 which is submerged in the water used as a resistance medium forms a convenient receptacle for salts or other materials which affect the conductivity of water when held in solution. Since the percentage of soluble material required is very small, the cup-shaped receptacle 6 may be partially filled with salts of very slight solubility when the apparatus is installed and this charge of soluble substances will last almost indefinitely.

When the current is switched on, it passes through the water within the chamber 5 from the wall of the chamber to the electrode 6, or vice versa, according to its direction, and, due to the resistance which it offers to the passage of the current, con-

siderable heat is liberated, which readily passes through the walls of the chamber and raises the temperature of the surrounding water in the tank 1. As the water in the chamber 5 is heated it is to some extent evaporated even though it remain below the boiling point, and, at times, the water within the chamber 5 is also rapidly decomposed by electrolytic action, the hydrogen and oxygen being liberated. The products of decomposition and evaporation rise into the upper end of the chamber 5, from which they are discharged through a pipe 20 connecting at its lower end with a waste pipe of the usual systems of plumbing employed in houses. As the water within the chamber 5 is decomposed and evaporated, its level tends to fall, thereby lowering the float 19 and slackening the chain 18, which allows the valve 12 to open and admit fresh water from the water supply. The resistance medium is thus automatically replenished. If the current employed be alternating, the loss from electrolytic decomposition will, of course, be very much less, but the loss from evaporation will be practically the same.

In order to control the flow of heating current, I have interposed in the wire 9 a thermostatic switch, which is shown in detail in Figure 3. The switch proper consists of a stationary member 21 and a pivoted lever 22, the member 21 having a contact 23 electrically connected to one of the poles of a plug 24, while the lever 22 has a contact 25 electrically connected to the rod 7, so that when the switch is closed the current may pass from the plug 24 through the switch, the rod 7, the electrode 6, the resistance medium, the wall of the chamber 5, the wire 10, and thence to the other pole of the plug, the plug 24 being, of course, adapted to be suitably connected with the source of current.

Mounted adjacent the switch upon the upper end of the tank 1 is a thermostat 26 consisting of curved metallic laminae having different coefficients of expansion and riveted together at a plurality of points in their lengths, one end of the compound member so formed being passed through an opening in the upper end of the tank and separated from the water stored therein by means of a cap 27 of copper or other material of high conductivity. The opposite end of the compound member carries an insulating plate adapted to engage an arm of the pivoted lever 22, which arm is overweighted so that it normally tends to close the switch. When the temperature of the water in the tank or reservoir 1 falls, the curvature of the compound member is increased by reason of the fact that the inner lamina contracts to a greater extent than the outer lamina. The overweighted arm of the lever 22 is thus allowed to descend

and the switch is closed so that the current passes through the resistance medium in the chamber 5 and re-heats the water in the tank or reservoir 1, thereby causing the thermostat 26 to straighten and rock the pivoted lever to reopen the switch when a desired temperature of the water in the tank 1 has been attained. By adjusting the set screws 25^a on the lever 22, variations in the temperature of the water in the tank 1 may be secured, through the consequent variations in the point to which the thermostat must straighten to open the switch.

The temperature of the water in the tank 1 may thus be kept to a substantially uniform temperature with the consumption of but little current. After the tank is first heated, the heat dissipates very slowly, and the cup-shaped electrode 6 in the chamber 5 stores hot water that replaces that given off by the water in the tank 1. When only a small quantity of water is drawn off from the tank 1, the inflowing cool water lowers the temperature of the mass only slightly, and very little additional current is needed to raise the water in the tank to its previous high temperature. The more water is drawn off from the tank 1, the more water is supplied to the central heating chamber 5 and the longer the current flows to reheat the tank, the consumption of current being governed entirely by the consumption of hot water.

A thermometer 28 extends through the upper end of the tank 1, its bulb being separated from the water within the tank by means of a cap 29 of copper or other heat-conducting material, the upper end of the thermometer extending through the shell 3 so that the temperature of the water within the tank is visibly indicated. The thermometer also forms means for indicating whether or not the apparatus is functioning properly.

An outlet pipe 30 leads from the upper end of the tank 1 to faucets, which may be conveniently positioned over sinks, etc. When water is drawn from the tank it is replaced by unheated water entering through the pipe 2. The contents of the tank are thereby cooled and the automatic switch thrown into co-operation to re-heat them.

While it will be apparent that the illustrated embodiment of my invention herein disclosed is well calculated to adequately fulfill the objects primarily stated, it is to be understood that the invention is susceptible to variation, modification and change within the spirit and scope of the subjoined claims.

Having described my invention, I claim:

1. An electric heating device comprising, in combination, a pair of electrodes, means for interposing a consumable resistance medium between said electrodes, and means

for replenishing said resistance medium substantially as it is consumed.

2. An electric heating device comprising, in combination, a pair of electrodes, means for interposing a volatile resistance medium between said electrodes, and automatic means for replenishing said resistance medium at substantially its rate of evaporation.

3. In an electric heater, in combination, a pair of electrodes, means for interposing an electrolytic resistance medium between said electrodes, and automatic means for replenishing said resistance medium substantially as it is decomposed.

4. In an electric heating device, in combination, a chamber of conducting material adapted to contain a volatile resistance medium, an electrode within said chamber, and automatic means for replenishing said volatile medium substantially as it is evaporated.

5. In an electric heating device, in combination, a chamber of conducting material adapted to contain an electrolyte, an electrode within said chamber, and automatic means for replenishing said electrolyte substantially as it is decomposed.

6. In an electric heating device, a pair of electrodes, one of said electrodes being adapted to be submerged in a liquid resistance medium which contacts the other of said electrodes and being cup-shaped to contain soluble matter for regulating the conductivity of such resistance medium.

7. In an electric heating device, in combination, a chamber of conducting material adapted to contain a liquid resistance medium, and an electrode within said chamber, said electrode forming a receptacle for soluble substances to regulate the conductivity of said resistance medium.

8. In an electric water heater, in combination, a tank for containing water to be heated, and means for heating the water so contained, comprising a pair of electrodes, a consumable resistance medium therebetween, and means for automatically replacing said resistance medium substantially as it is consumed.

9. In an electric water heater, in combination, a tank for containing water to be heated, and means for electrically heating the water in said tank, comprising a chamber adapted to contain an electrolyte, means for passing a current through said electrolyte, and automatic means for replenishing the electrolyte substantially as it is consumed by the passage of the current.

10. In an electric water heater, in combination, a tank for containing water to be heated, and means for heating said water, comprising a chamber of conducting material to contain an electrolyte, an electrode within said chamber, and means for replen-

ishing said electrolyte substantially as it is consumed by the passage of the current.

11. In an electric water heater, in combination, a tank for containing water to be heated, a chamber within said tank adapted to contain water to act as a resistance medium, automatic means to replenish the water in said chamber, and means whereby the passage of current through the water in said chamber is controlled by the temperature of the water in said tank.

12. In an electric water heater, in combination, a tank for containing water to be heated, a chamber within said tank for periodically receiving water from said tank to act as a resistance medium, and means whereby passage of current through the water in said chamber is controlled by the temperature of the water in said tank.

13. In an electric water heater, in combination, a tank for containing water to be heated, a chamber within said tank for periodically receiving water from said tank to act as a resistance medium, and a thermostatic switch actuated by the temperature of the water in said tank to control the passage of current through the water in said chamber.

14. In an electric water heater, in combination, a tank for containing water to be heated, a pair of electrodes, means for interposing a consumable resistance medium between said electrodes, means for replenishing said medium substantially as it is consumed, and means controlled by the temperature of the water in said tank for initiating and terminating the passage of the current through said resistance medium.

15. In an electric water heater, in combination, a tank for containing water to be heated, a chamber of conducting material, an electrode within said chamber, a pipe for admitting water from said tank into said chamber whereby it is interposed as a resistance medium between said electrode and the wall of said chamber, and a float-controlled valve in said pipe for controlling the supply of water in said chamber.

16. In an electric water heater, in combination, a reservoir for water to be heated, a heating chamber located therein, and a valve-controlled pipe for admitting water from the reservoir to said chamber.

17. In an electric water heater, in combination, a reservoir for water to be heated, a heating chamber located therein and having an opening in its wall, and a float-controlled valve adjacent said opening for admitting water from the reservoir into said chamber.

18. In an electric water heater, in combination, a reservoir for water to be heated, a heating chamber located therein and having an aperture in its wall, a valve arranged to close said aperture, and means for opening

said valve whenever the water in the heating chamber falls below any predetermined level.

19. In an electric water heater, in combination, a reservoir for water to be heated, a heating chamber located therein and having an aperture in its wall, a valve arranged to close said aperture, and a float arranged to open said valve whenever the water in the heating chamber falls below any predetermined level.

20. In an electric water heater, in combination, a reservoir for water to be heated, a heating chamber located therein, a pipe for connecting the reservoir and chamber, a valve in said pipe, and means for automatically operating said valve to maintain the water in said chamber to any desired level.

21. In an electric water heater, in combination, a reservoir for water to be heated, a heating chamber located therein, a pipe for connecting the reservoir and chamber, a valve in said pipe, and means for automatically operating said valve, including a float connected with the valve stem.

22. In an electric water heater, in combination, a reservoir for water to be heated, a heating chamber located therein, a pipe for connecting the reservoir and chamber, a valve in said pipe, and means for automatically operating said valve, including a bell-crank engaging the valve stem, and a float flexibly connected with the bell-crank.

23. In an electric water heater, in combination, a reservoir for water to be heated, a heating chamber of current conducting material, an electrode within said chamber, an electric circuit connected with said cham-

ber and electrode, and means for closing said circuit whenever the temperature of the water in the reservoir falls below a predetermined point.

24. In an electric water heater, in combination, a reservoir for water to be heated, a heating chamber of current conducting material, an electrode within the chamber, an electric circuit including said electrodes, and means for closing said circuit, including a thermostat mounted in the wall of the reservoir, and a switch arranged to be operated thereby.

25. In an electric water heater, in combination, a reservoir for water to be heated, a heating chamber of current conducting material, an electrode within the chamber, an electric circuit including said electrodes, and means for closing said circuit, including a thermostat adjacent said reservoir, a movable switch member engaged thereby, and a contact member adapted to be engaged by said switch member in certain positions of the thermostat.

26. In an electric water heater, in combination, a reservoir for water to be heated, a heating chamber of current conducting material, an electrode within the chamber, an electric circuit including said electrodes, and means for closing said circuit, including a thermostat adjacent said reservoir, a pivoted switch member having one arm in engagement with the thermostat, and a contact member adapted to be engaged by said switch member in certain positions of the thermostat.

SAMUEL G. CRANE.