S. I. PHELPS.

ELECTRIC WATER HEATER.

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1,399,515. **Patented Dec. 6, 1921.**

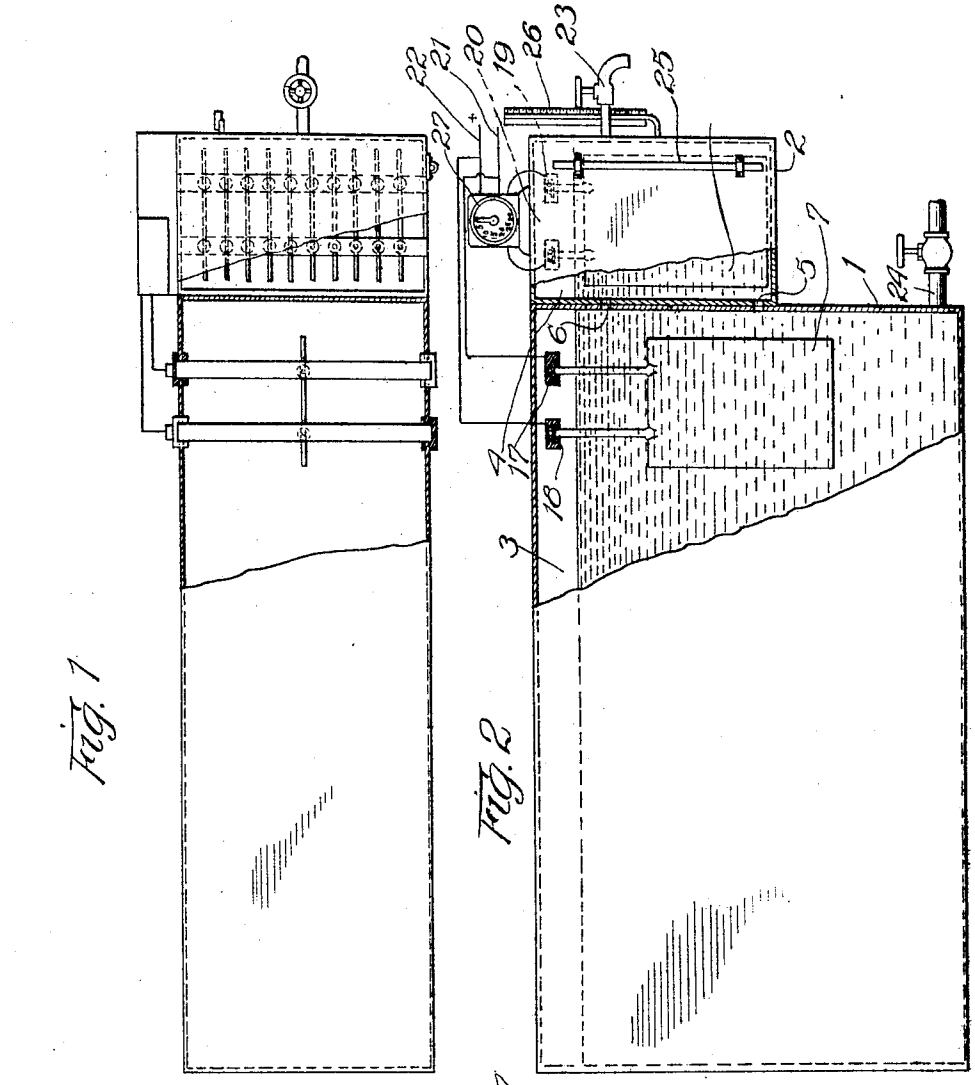

Fig. 1

Fig. 2

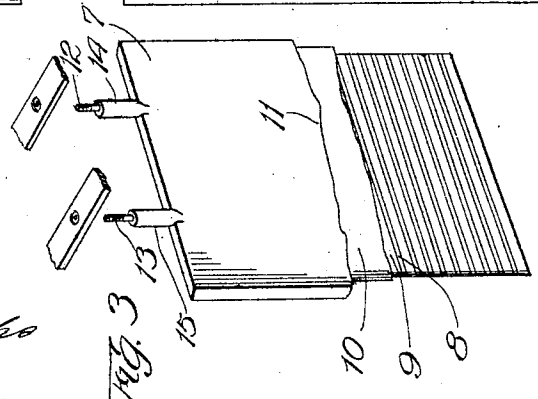

Fig. 3

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ELECTRIC WATER-HEATER.

1,399,515. Specification of Letters Patent. Patented Dec. 6, 1921.

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To all whom it may concern:

Be it known that I, SEBRING I. PHELPS, a citizen of the United States of America, and a resident of Wilmette, county of Cook, and State of Illinois, have invented certain new and useful Improvements in Electric Water-Heaters, of which the following is a specification.

The main objects of this invention are to provide an improved electric water heater; to provide a receptacle or tank having an improved construction and relative arrangement of two of more separate but intercommunicating water-heating compartments; to provide an improved construction of electric heating elements for use in heating the water in said compartments; and to provide an improved arrangement of said heating elements in said compartments.

An illustrative embodiment of this invention is shown in the accompanying drawings, in which—

Figure 1 is a plan, more or less diagrammatic, of an improved electric water heater constructed in accordance with this invention, some of the exterior parts being broken away so as to more clearly illustrate the construction and arrangement of interior parts.

Fig. 2 is a side elevation of that which is shown in Fig. 1, the exterior parts thereof being also broken away to more clearly illustrate the arrangement of interior parts.

Fig. 3 is an enlarged perspective view of one of the improved electric heating elements which is used in a device constructed in accordance with this invention.

The fundamental idea of this invention is to provide a construction wherein a continuously operated electrical heating device of comparatively low heating capacity is used to bring the water in the entire receptacle to, and keep it at, a certain moderate temperature, for example, in the neighborhood of 100° F., and provide an intermittently operated electrical heating device of comparatively high heating capacity for further heating a small portion of the water so as to quickly raise the temperature to a much higher degree, for example, in the neighborhood of 200° F. The effective and economical accomplishment of this purpose, so far as time and cost of electric current respectively are concerned, involves the use of a specially constructed electric heating device providing a large area of heating surface made up of a number of separately constructed heating elements each of a comparatively low heating capacity, so arranged that the water is brought into intimate contact therewith during the heating operation and rapidly heated by the cumulative action of said several elements.

The specific embodiment of this invention as herein illustrated comprises a receptacle consisting of tanks 1 and 2 providing compartments 3 and 4 of relatively different sizes within each of which is arranged the electric heating devices more fully hereinafter described.

In the drawings, the tanks 1 and 2 are of rectangular construction and are separately formed, the smaller one, 2, being arranged on the exterior and at one end near the top of the larger tank 1. However, these tanks may be made of other shapes and the smaller tank may be arranged within the larger if so desired. The main object in this respect is to have the compartments 3 and 4 practically separate, with the exception of the communication provided by the openings 5 and 6 arranged near the bottom and top respectively of the smaller compartment 4. These openings might be termed inlet and outlet openings with reference to the compartment 4, inasmuch as the circulation of the water caused by the higher temperatures in the compartment 4 would cause the water to flow out through the opening 6 into the compartment 3, and from the compartment 3 into the compartment 4 through the opening 5, especially if water were not being drawn from the compartment 4 during the heating of the water in said compartment. On the other hand, the water might flow through both openings 5 and 6 when the water was being drawn from the compartment 4 concurrently with the heating thereof.

The electric heating elements 7 which make up the heating devices for this invention are constructed substantially in accordance with the form shown in Fig. 3. Each of the elements 7 comprises a length of resistance wire or ribbon 8 wound upon an insulating core 9 which is covered with other insulating material 10 and encased in a metal envelop 11 which is sealed so as to make it thoroughly water-tight. The ends of the resistance material 8 are connected to binding posts 12 and 13 which extend outwardly from one edge of the element, the same being encased in and in-

sulated from the supporting stems 14 and 15. The resistance material is of such size and length that it operates at a rather low amperage so as to lessen the danger of disintegration or deterioration which frequently occurs where resistance material operates at a high amperage when seeking to obtain the greatest possible heating capacity out of the material.

By means of the binding posts 12 and 13, the heating elements are electrically connected to and suspended from conductor bars 17 and 18 or 19 and 20 arranged in the compartments 3 and 4 respectively. The conductor bars 17, 18, 19, and 20 extend across the top of the respective tanks 1 and 2 above the water line and are thoroughly insulated from and connected to conductors 21 and 22 leading to a source of electricity. A switch, herein shown in the form of a time switch 27, is interposed in the connection between the bars 19 and 20 and the conductors 21 and 22, by which the supply of electric current to the heating device in the compartment 4 is controlled.

The heating device for the compartment 3 is preferably made up of one of the heating elements 7 submerged in the water adjacent to the openings 5 and 6. The heating device for the compartment 4 is made up of a plurality of the heating elements 7 arranged in uniform and comparatively closely spaced parallel relation throughout the length of the compartment 4. The size of the heating elements used in the compartments 3 and 4 may vary, but those in the compartment 4 are preferably of nearly the same width and height as the width and depth respectively of the compartment. Such an arrangement of heating elements of this kind in the compartment 4 provides a large heating area with which the water in the compartment comes into intimate contact, each heating element operating at a comparatively low heating capacity, the cumulative effect of which is to produce a heating device in said smaller compartment of relatively high heating capacity as compared with the single heating element in the compartment 3.

This arrangement of heating elements possesses the additional advantage that each element is independent to the extent that if the winding or resistance material fuses or burns out, it in no way interferes with the continued operation of the other elements. Moreover, the individual elements may be quickly removed for repair or replacement.

The heated water is taken off from the top of the compartment 4 as indicated by the faucet 23, with the result that the water warmed in the compartment 3 by the heating element 7 passes through the opening 5, and possibly the opening 6 also, into the compartment 4 and into intimate contact with the surfaces of the heating element 7 arranged therein, where it is quickly brought to the desired temperature before passing out through the faucet 23. Water is supplied to the compartment 3 through an inlet 24 connected to the bottom of the tank 1. This arrangement for drawing off water and replenishing the same is wholly diagrammatic. It is to be understood that various means may be used to control this matter, some of which might be dependent upon the switching on and off of the current to the heating device in the compartment 4.

The tank 2 may be provided with a water gage 25 for indicating the level of the water therein, and a thermometer 26 for indicating the temperature of the water.

The device herein illustrated may be operated in several ways, the three most important and practical of which are briefly as follows:

In the first place, one manner of operation is to have the heater 7 in the compartment 3 operating continuously so as to keep the temperature of the water at a moderate degree, for example, in the neighborhood of 100° F. When hot water is needed for a particular purpose, the switch 27 would be turned so as to supply current to the heating device in the compartment 4 and allow it to operate for such a length of time as will insure the water in the entire receptacle being brought up to the desired temperature. The water could then be drawn off through the faucet 23 or other outlet provided for that purpose, and fresh water supplied through the inlet 24.

A second method would be similar to the first, except that when hot water is required, the faucet 23 would be opened at the same time the current was turned on to the heating device in the compartment 4. As the water flowed out through the faucet 23, it would have to flow through the compartment 4 and come in intimate contact with the heating element 7, which would cause the water to be raised to a temperature considerably above that to which it had been raised by the continued operation of the heater 7 in the compartment 3.

A third manner of operation would differ from the first in that there would be no preheating of the water by the heater in the compartment 3. When hot water is needed, current to the heating device in the compartment 4 is turned on, and the heating device allowed to operate until the temperature of the water in the entire receptacle is high enough for use.

Although but one specific embodiment of this invention has been herein shown and described, it will be understood that numerous details of the construction shown may be altered or omitted without departing from the spirit of this invention as defined by the following claims.

I claim:

1. An electric water heater comprising a receptable having two compartments of relatively different sizes practically separate but communicating with each other through small specially arranged openings, an electric heating device of comparatively low heating capacity in the larger of said compartments, and a second electric heating device of relatively high heating capacity in the smaller of said compartments, said first-mentioned heating device being adapted to raise the temperature of the water to a moderate degree and said second-mentioned heating device being adapted to raise the temperature of the water to a higher degree as said water circulates through said openings from said larger compartment to said smaller compartment.

2. An electric water heater comprising a receptacle having two compartments of relatively different sizes practically separate but communicating with each other through small specially arranged openings, an electric heating element submerged in the larger compartment, and a plurality of similar electric heating elements submerged in the smaller compartment, said one heating element being adapted to raise the temperature of the water in said larger compartment to a moderate degree, and said other heating elements being adapted to raise the temperature of the water in said smaller compartment to a higher degree as it flows through said openings from said larger compartment to said smaller compartment.

3. An electric water heater, comprising a tank, a plurality of electric heating elements each of comparatively low heating capacity submerged in said compartment, and electrical conductors connecting said heating elements in shunt relation with each other, said plurality of heating elements providing a comparatively large heating area in intimate contact with the water in said compartment.

4. An electric water heater, comprising a tank, a plurality of flat electric heating elements each of comparatively low heating capacity submerged in said compartment and closely spaced in parallel relation throughout the length of said compartment, and electrical conductors connecting said heating elements in shunt relation with each other, said plurality of heating elements providing a comparatively large heating area in intimate contact with the water in said compartment.

5. An electric water heater, comprising a tank, a plurality of flat electric heating elements each of comparatively low heating capacity submerged in said compartment, said elements being rectangular-shaped, with the width and length nearly equal respectively to the width and depth of said compartment, and electrical conductors connecting said heating elements in shunt relation with each other, said plurality of heating elements providing a comparatively large heating area in intimate contact with the water in said compartment.

6. An electric water heater comprising a tank, a pair of insulated conductor bars extending across said tank and rigidly secured in place above the level of the water, and a plurality of flat rectangular-shaped electric heating elements, each of comparatively low heating capacity, electrically connected in shunt relation to and suspended in parallel relation from said bars so as to be completely submerged in the water in said tank, said plurality of heating elements providing a comparatively large heating area in intimate contact with the water in said compartment.

7. An electric water heater comprising a receptacle having two compartments of relatively different sizes practically separate but communicating with each other through small specially arranged openings, a flat rectangular-shaped heating element of comparatively low heating capacity submerged in the water in the larger of said compartments, and a plurality of similar electric heating elements arranged side by side in spaced relation and submerged in the water in the smaller of said compartments, said one heating element being adapted to raise the temperature of the water in said larger compartment to a moderate degree, and said other heating elements being adapted to raise the temperature of the water in said smaller compartment to a higher degree as it flows through said openings from said larger compartment to said smaller compartment.

8. An electric water heater comprising a receptacle having two compartments of relatively different sizes practically separate but communicating with each other through an opening located near the bottom of the smaller compartment, and a second opening near the top thereof, a flat rectangular-shaped heating element of comparatively low heating capacity submerged in the water in the larger of said compartments adjacent to said openings, and a plurality of similar electric heating elements arranged side by side in spaced relation and submerged in the water in the smaller of said compartments, said one heating element being adapted to raise the temperature of the water in said larger compartment to a moderate degree, and said other heating elements being adapted to raise the temperature of the water in said smaller compartments to a higher degree as it flows through said opnings from said larger compartment to said smaller compartment.

9. An electric water heater comprising a

receptacle having two compartments of relatively different sizes practically separate but communicating with each other through small specially arranged openings, an electric heating device in the smaller of said compartments, comprising a plurality of separately constructed heating elements each having a comparatively low heating capacity.

10. An electric water heater comprising a receptacle having two compartments of relatively different sizes practically separate but communicating with each other through small specially arranged openings, an electric heating device in the smaller of said compartments, comprising a plurality of flat rectangular-shaped separately constructed heating elements each having a comparatively low heating capacity, the width and length of the heating elements being nearly the same as the width and depth respectively of said compartment.

11. An electric water heater, comprising a receptacle and two separate heating devices arranged within the water compartment, one of said heating devices being of a relatively low heating capacity and being adapted to be used to raise the temperature of water in said receptacle to a moderate degree, the other of said heating devices being of comparatively high heating capacity and being adapted to raise the temperature of the water in said receptacle to a higher degree.

12. An electric heater, comprising a receptacle and two separate heating devices arranged therein, one of said heating devices being of a comparatively low heating capacity and being adapted to operate practically continuously so as to be used to raise the temperature of the water in said receptacle to a moderate degree, the other of said heating devices being of comparatively high heating capacity and being adapted to operate intermittently so as to raise the temperature of the water in said receptacle to a higher degree.

13. An electric heater, comprising a receptacle and two separate heating devices arranged therein, one of said heating devices being in the form of a single flat rectangular heating element of comparatively low heating capacity adapted to operate practically continuously so as to raise the temperature of water in said receptacle to a moderate degree, the other said heating device comprising a plurality of similar heating elements adapted to operate in unison intermittently so as to raise the temperature of water in said receptacle to a higher degree.

Signed at Chicago this 17th day of January, 1920.

SEBRING I. PHELPS.