J. H. HALLBERG.

ELECTRIC WATER HEATER.

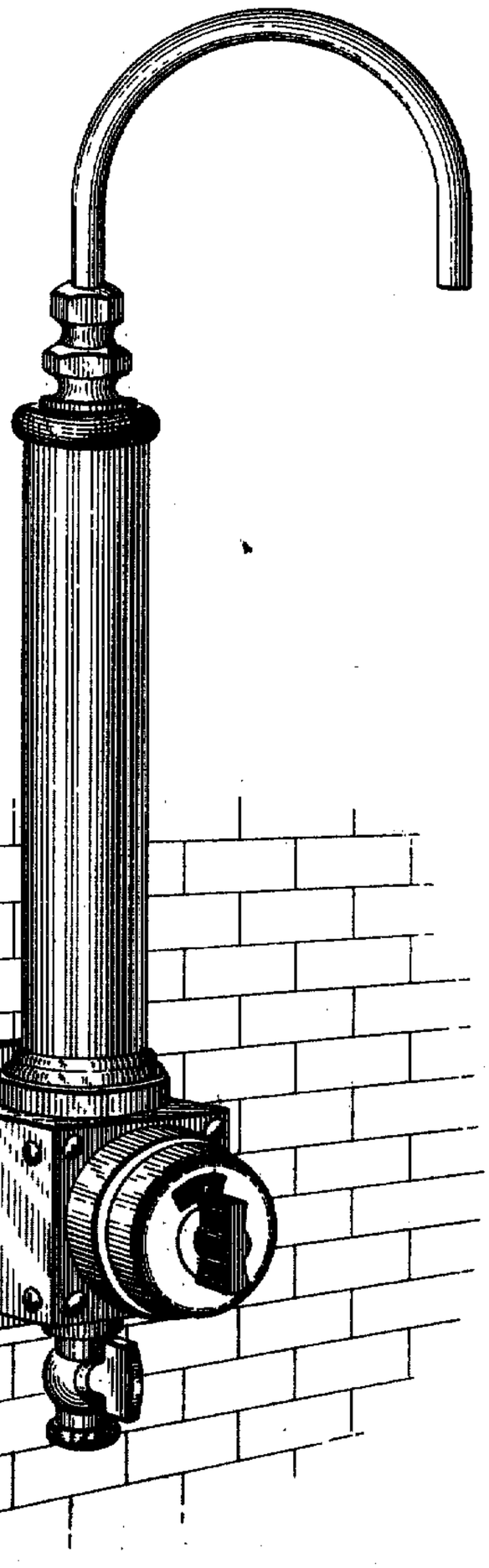
APPLICATION FILED JAN. 31, 1908.

997,670.

Patented July 11, 1911.

2 SHEETS—SHEET 1.

Fig. 1



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2 SHEETS—SHEET 2.

Fig. 2

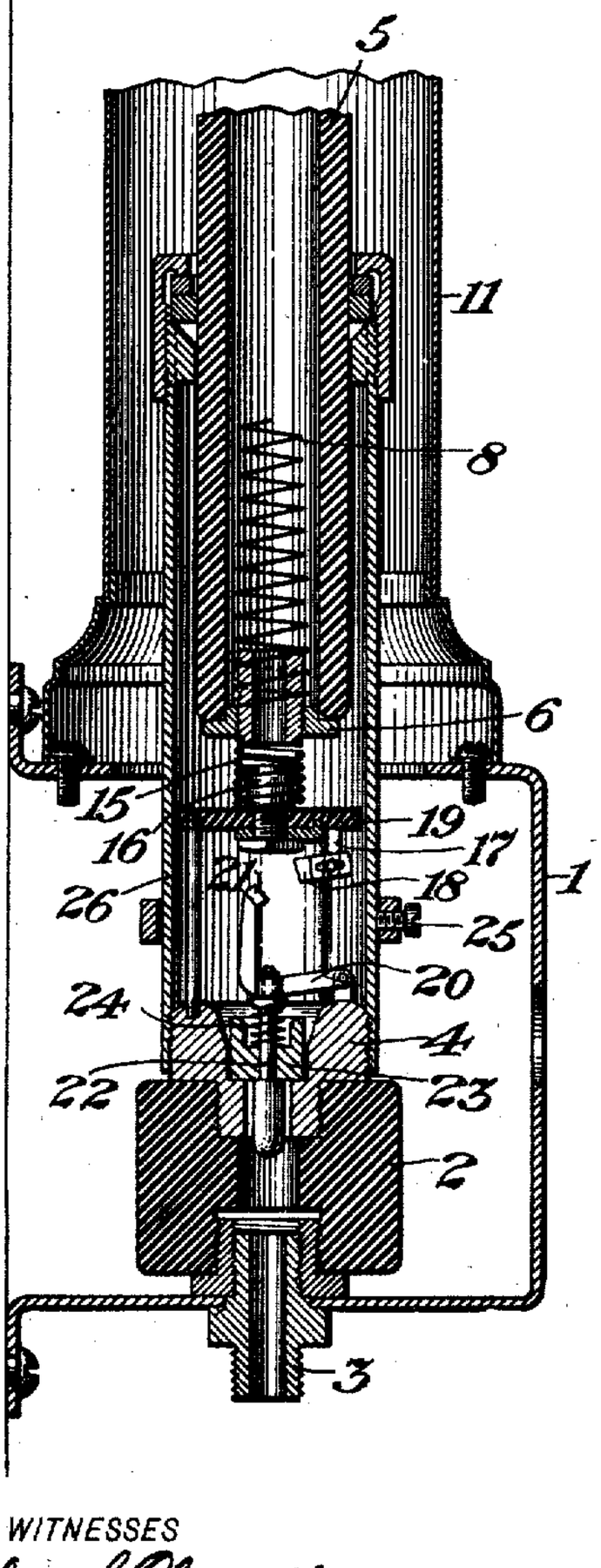
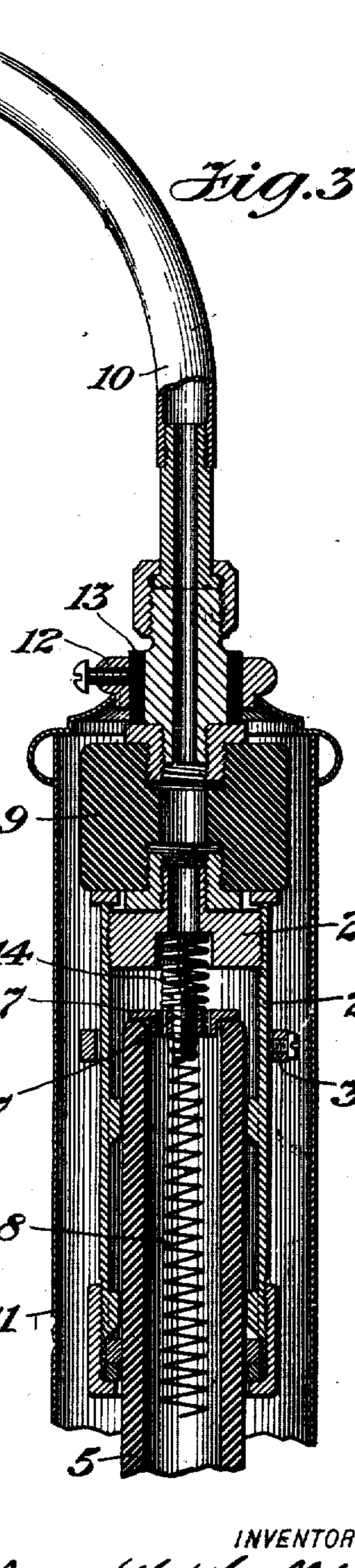


Fig. 3



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ELECTRIC WATER-HEATER.

997,670. Specification of Letters Patent. Patented July 11, 1911.

Application filed January 31, 1908. Serial No. 413,552.

To all whom it may concern:

Be it known that I, JOSEF H. HALLBERG, a citizen of the United States, and resident of the city of New York, in the county of New York and State of New York, have invented certain new and useful Improvements in Electric Water-Heaters, of which the following is a specification.

This invention relates to water heaters of the electric type.

The object sought to be obtained by this invention is to provide a heater of this type which will heat the water flowing therethrough to the desired temperature in the shortest possible space of time and with the minimum consumption of current.

It has been found by a large number of experiments with apparatus of this type that the most efficient results are obtained, both as to current consumed and time required to heat water, by providing a direct contact between the water and the heating elements. In these experiments it was found that the life of the heating element depended upon the presence of the water while the current was flowing and in order to insure this condition I have provided a cut-out device which operates automatically to interrupt the current when the water ceases to flow or when the flow should be reduced to such an extent that the water in the heater would boil. This device operates automatically to accomplish the above results, it being only necessary for the operator to turn on the water at the controlling valve, as will be more fully described hereinafter.

In order to provide against the grounding of the electric circuit through the water, I have provided insulating joints between the portions of the heater which are in direct contact with the water and other portions of the device and this in connection with the fact that the resistance of the water is sufficient to prevent any flow of current therethrough avoids the difficulty above mentioned.

Where the heater is connected to the regular Edison three-wire systems, the neutral, or grounded connection, is connected to the lower part of the heater, which absolutely prevents any grounds, as there can be no difference of potential. This is also the case where the heater is used on alternating systems where one side or the neutral of the secondary circuit is grounded.

The electric water heater which I have herein shown as an illustration of one form or embodiment of my invention consists of a supporting box upon which is mounted a double pole quick break switch of standard construction and an insulating joint of special design, to the lower end of which is attached an ordinary water valve. Secured to the upper part of the insulating joint is a metal fitting within which is placed the cut-out which automatically opens and closes the electric circuit as the water is turned off and on. In the upper end of this fitting is held a porcelain tube provided with a terminal at each end. Within the porcelain tube is placed the heating element, which consists of a specially designed spiral, made of a material which will not rust or corrode, or be injured in any way by the action of the current and the presence of the water. At the upper end of the porcelain tube is another metal fitting provided with an insulating joint above it which supports the spout. One wire leads from the switch to the upper fitting on the porcelain tube and the wire from the other side of the switch leads to the lower fitting. The porcelain tube and fittings are surrounded by a brass tube.

The device can be placed anywhere where an electric circuit can be installed. The heater can also be used in combination with a water tank placed slightly above it, in which case it is not necessary to connect the heater with the water system, only connecting it to the electric wiring by means of an attachment plug and flexible cable. With this arrangement the water heater is portable and can be installed in any hotel room where it can be attached to the ordinary wash-stand.

In the drawings accompanying this specification I have shown one form of water heater embodying the features above described as an illustration of one operative embodiment of my invention.

Figure 1 is a perspective view of a water heater showing a current controlling switch of the ordinary type. Fig. 2 is an enlarged sectional side elevation of the lower portion of the heater with the controlling switch removed. Fig. 3 is an enlarged side elevation of the upper portion of the heater.

At 1 is shown a supporting box which may be secured to a wall by suitable means.

At 2 is shown an insulating joint of special

design to which an ordinary water valve may be attached by means of the coupling shown at 3. A metal fitting, such as shown at 4, is secured to the upper portion of an insulating joint 2 and carries the cut-out switch, which will be more fully described hereinafter.

A porcelain tube 5 is positioned within the heater and held in place by means of suitable supports at either end thereof, such as 6 and 7. A heating element is shown at 8. This heating element is preferably in the form of a tapered spiral secured at either end to suitable supports forming terminals to hold the same in position in the porcelain tube 5.

The object of constructing the heating element or coil 8 in the form of a tapered spiral is to provide the greatest possible contact surface between the water and the heating coil and by tapering the coil from the bottom to the top a greater contact surface for a given length of path over which the water travels is provided at the lower end, and, consequently, more heat units are distributed at this portion of the tube than at the upper. This provides a more efficient distribution of the heating energy as the water column is cold at the lower portion and requires a maximum heating at this point. A further object of tapering the heating coil is to distribute the weight of the same so as to prevent sagging and so permit a construction without the usual insulating core, leaving the coils open on all sides and allowing a free flow of the water therethrough.

An insulating joint 9 is provided in the upper portion of the heater upon which is supported the spout 10. An outer casing 11 is supported upon the box 1 at the lower end and held in position at the upper end by means of the collar 12 and the insulating ring 13.

The spring 14 holds the support 7 in the position against the upper end of the porcelain tube 5. This support is provided with openings which allow the water to pass freely therethrough from the porcelain tube 5. A spring 15 holds the support 6 in position against the lower end of the porcelain tube 5 in a similar manner.

Tubes 26 and 29 are positioned in the lower and upper portions, respectively, of the heater and inclose the ends of the insulating tube 5. These tubes are insulated from each other by the porcelain tube 5 and from the casing by the insulating joints 2 and 9, respectively, and carry the line connections 25 and 30 by means of which current is supplied to the heating coil 8, as will be more fully explained hereinafter. Ordinary wire connections are supplied from the line connections 25 and 30 to the main switch on the outside of the supporting box 1. These wire connections are not shown in Figs. 2 and 3 but the main switch is shown in Fig. 1.

The spring 15 is connected to a support 16 to which is attached the contact support 17 carrying the contact member 18, which is adjustable thereon. An insulating member 19 may be supported on the fitting 4 by means of the three posts as shown.

A contact lever 20 is pivotally attached to the fitting 4 and carries a contact 21. This contact lever 20 is operated by means of the guide rod 22 carried by the plunger 23. When the water is turned on through the coupling 3 the same passes through the opening in the fitting 4 and raises the plunger 23 carrying the rod 22 and causes the contact lever 20 to move the contact 21 into engagement with the contact 18. A spring, such as 24, is interposed between the plunger 23 and the lever 20, which insures the contact 21 being held in place against the contact 18 and also allows the plunger 23 to be raised as the flow of water may be increased.

The opening in the fitting 4 in which the plunger 23 is positioned is of such a size that the plunger fits closely in the lower portion thereof but is permitted to be raised by the pressure of the water, causing the contacts 21 and 18 to be brought together as described. At the point in the opening in the fitting 4 corresponding to the point of engagement between the contacts 21 and 18 the opening is flared outwardly or enlarged to allow the water to flow freely past the plunger 23 at this point. If the water pressure be increased to an amount greater than is necessary to lift the plunger 23 to this position the increased pressure lifts the plunger 23 above this point and compresses the spring 24, thus insuring the contacts 21 and 18 being held together and at the same time permitting a large volume of water to pass through the fitting 4 into the interior of the heater.

The insulating support 19 is somewhat smaller than the tube 26 in which it is positioned so as to allow the water to pass freely by the same. The support 6 may be provided with a central portion having an opening sufficiently large to allow the required amount of water to pass therethrough to the interior of the porcelain tube 5. The central portion of the support 6 also forms a support and terminal for the lower end of the heating coil 8, and it will be seen that the water is discharged to the interior of the heating coil 8 at its lower and larger end. As the heating coil is entirely open between its upper and lower supports the water will flow through in contact therewith at all points.

The controlling switch, shown in Fig. 1, is connected on one side to the terminal ring 25, shown in Fig. 2. From this point

the current is taken through the inclosing tube 26 to the fitting 4 and through the lever 20 to the contact 21. Assuming now that the water has been turned on the plunger 23 will be raised, causing the contact 21 to engage the contact 18 and the current will flow through the support 17 and spring 15 to the lower support 6, through the heating element or coil 8 to the upper support 27, shown in Fig. 3, through the spring 14 and fitting 28 to the inclosing tube 29 and the terminal 30, which is connected to the other side of the controlling switch.

If the water be turned off the plunger 23 will drop to the position shown in Fig. 2 and the contact between 21 and 18 will be broken, thus cutting off the current from the heating coil and preventing any damage which might be caused to the same if the current was allowed to pass therethrough when no water was present. It will be noted that the direction of movement of the contact 21 in breaking the circuit is transverse to the direction of flow of the water. This tends to prevent the forming of an arc when the circuit is broken which would result in damage to the contacts.

The contact 18 being movable permits the point of cut-out to be adjusted relative to the water flow thus governing and controlling the maximum possible temperature, as the heat units are constant.

It will be noted that the operation of the cut-out is automatic and requires no attention, it being controlled entirely by the flow of the water. This avoids the necessity of turning off the current and the main switch every time the water is turned off to prevent damage to the heating coil, as it will be seen that in this device the current is entirely controlled by the flow of the water. By changing the point of contact the cut-out can be adjusted to close the circuit when a predetermined amount of water is flowing or to cut out the current when the flow is dropped below a predetermined amount.

If the water valve is open but the current not turned on, cold water will flow from the heater. The moment the current is turned on the water becomes heated almost instantaneously and by regulating the flow of water the temperature can be adjusted up to 200 degrees F.

It is possible with the device herein shown to draw a glass of hot water in thirty seconds whereas on the gas stove or with other forms of electric heating utensils now used this would take two minutes. It is also possible to fill a two quart hot water bag in two and one-half minutes whereas on the gas stove this would require at least six minutes actual heating time. The increased cost of the electric service at ten cents per K. W. hour is too small to consider.

As many changes could be made in the above construction and many apparently widely different embodiments of my invention designed without departing from the scope thereof, I intend that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative merely of an operative embodiment of my invention and not in a limiting sense.

What I claim is:

1. In an electric water heater, in combination, a heating element, supports forming terminals at either end of said heating element, two independent tubes carrying said supports and electrically connected thereto, and a cut out switch positioned in one of said tubes, said switch being controlled by the flow of water in said heater and operating automatically to cut out the current from said heating element when the water ceases to flow and to connect the same when the water flows therein.

2. In an electric water heater, in combination, a tapered heating coil positioned in said heater so that the water may flow therethrough and be brought into contact therewith, and means for supplying current to said coil.

3. In an electric water heater, in combination, an insulating tube resiliently supported in said heater, supports for said tube forming terminals for a heating coil, a heating coil suspended in said tube from said terminals, and means for supplying current to said coil.

4. In an electric water heater, in combination, an insulating tube, a heating coil suspended in said tube, a support for said tube provided with an opening therein adapted to discharge the water flowing through said heater to the interior of said heating coil, a cut-out having its contacts located in the path of and operated by the water flowing through said heater and adapted to automatically cut out the current from said heating coil when the flow of water has reached a predetermined amount, and means for supplying current thereto.

5. In combination with an electric water heater, a tapered heating coil positioned in said heater in the path of the flow of the water and arranged to permit the water to flow therethrough from the larger to the smaller end thereof in direct contact therewith, and means for supplying current to said coil.

6. In an electric water heater, in combination, a cut out comprising a pair of contacts positioned in the path of the flow of the water in said heater and arranged to open the circuit transversely to the direction of said flow, the operation of said cut out being controlled by the flow of the water.

7. In an electric water heater, in combination, a cut out comprising a pair of contacts positioned in the path of the flow of the wa-

ter in said heater, one of said contacts being arranged to be operated by the flow of the water to open and close the circuit.

8. A cut out adapted for use in an electric water heater comprising a pair of contacts positioned in the path of the flow of the water in said heater, one of said contacts being mounted upon a movable arm adapted to be operated by the flow of the water to open and close the circuit.

9. A cut out adapted for use in an electric water heater comprising a pair of contacts positioned in the path of the flow of the water in said heater, one of said contacts being arranged to be operated by the flow of the water to open and close the circuit and the other of which is adjustable to regulate the point of contact relative to the amount of water flowing.

10. In an electric water heater, in combination, a cut out comprising a pair of contacts positioned in the path of the flow of the water in said heater, a plunger operated by the flow of water in the heater, and means for causing said plunger to operate said cut out.

11. In an electric water heater, in combination, a cut out comprising a pair of contacts positioned in the path of the flow of the water in said heater, a plunger operated by the flow of water in the heater, and a resilient connection between said plunger and said cut out whereby the operation of the latter is controlled by the flow of water in the heater.

Signed at New York in the county of New York and State of New York this 27th day of January A. D. 1908.

JOSEF HENRIK HALLBERG.

Witnesses:

LEWIS J. DOOLITTLE,

HOWARD B. COLES.