Nov. 3, 1931. H. W. CHRISTIAN 1,829,785

ELECTRIC WATER HEATER

Filed May 26, 1930

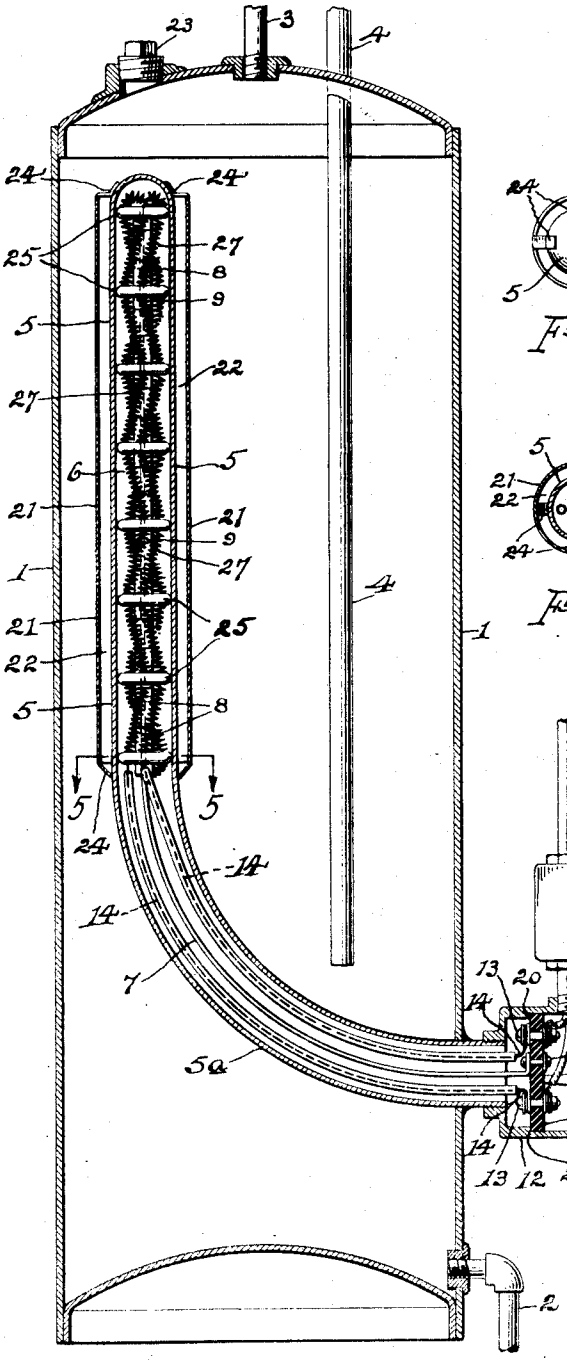


Fig. 1.

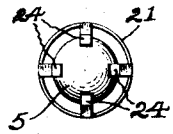


Fig. 4.

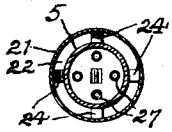


Fig. 5.

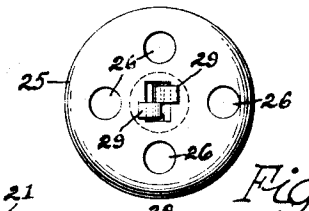


Fig. 3.

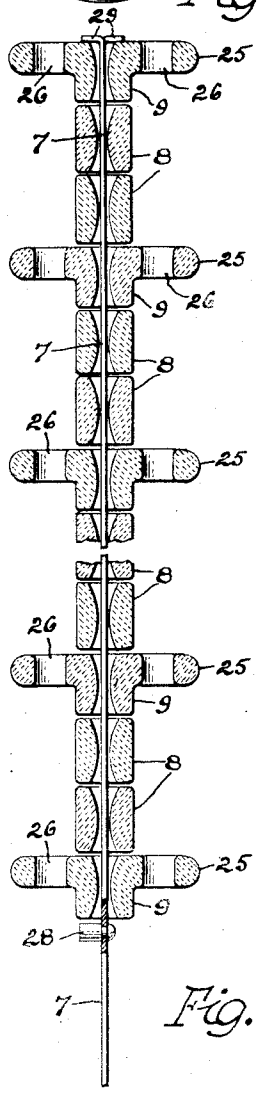


Fig. 2.

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UNITED STATES PATENT OFFICE

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ELECTRIC WATER HEATER

Application filed May 26, 1930. Serial No. 455,514.

This invention relates to water heaters, and more particularly to electric heating devices especially designed for insertion in tanks and other water containers.

An object of the invention is to provide for the ready insertion and removal of a heating element from a container of considerable capacity, such as a water tank and an arrangement whereby said element may be removed laterally from such a tank, avoiding the necessity for supporting such tank at an elevation to provide space whereby the element may be removed through the bottom of the tank and an element of cheap and efficient construction secured. A further object is to provide a flexible element, whereby the same may be inserted in a laterally bent tube or tortuous passage wherever the use of such tube or passage is advantageous.

With the above and other ends in view, the invention consists in providing an electric heating element which is flexible to facilitate its insertion in and removal endwise from an enclosing tube having a lateral bend or bends, and to provide a construction whereby such bent tube may be secured within a tank or other water container with an open end of the tube projecting laterally through the side of the container, thus facilitating the endwise removal of the element through the side of such container. The invention further consists in the construction of a heating element whereby the same is made to readily bend laterally and a very efficient, strong and durable element having certain other new and useful features, is provided.

As illustrative of an embodiment of the present invention and its application in use, reference is had to the accompanying drawings, in which—

Figure 1 is a longitudinal vertical section through a water tank and heating element therein;

Fig. 2 is a detail of a coil carrying insulator, showing the same in longitudinal section;

Fig. 3 is an end elevation of Fig. 2;

Fig. 4 is an end elevation of the upper end of a complete heating element as installed; and

Fig. 5 is a cross section of the element, substantially upon the line 5—5 of Fig. 1.

An electrical heating element illustrative of an embodiment and arrangement whereby the same is especially adaptable to the heating of water tanks, is shown, but it will be understood that the same may be applied to other uses where the ready insertion and removal of the element is desirable.

As shown, the invention is applied to an ordinary cylindrical water tank 1 having a drain pipe 2 connected thereto near the bottom thereof, an outlet pipe 3 and a water inlet pipe 4 extending downwardly in the tank through the head to near the bottom of the tank. This tank is of the ordinary vertical cylindrical type and may be of any desired size.

To receive and hold an electrical heating element, a water tight tube 5 is secured in the tank to provide a casing for an electrical heating element and prevent the water in the tank from contacting the element, this casing being submerged in the water in the tank and held with its upper end portion extending vertically upward in the tank to near the upper end or head thereof, by curving the lower end portion 5*a* of this tube or casing laterally and firmly securing it within an opening in the side wall of the tank in any suitable manner, as by soldering, welding, etc., with its lower open end projecting a short distance through this wall. The heating element, which is indicated as a whole by the numeral 6 and which is flexible, is then inserted endwise into this tube or casing through its open end.

The electrical heating element 6 is held in place in the straight upper end portion of the tube by a preferably flat metal strip 7 which extends through the several insulating sections 8 and 9 of the heating element and is long enough to project at its lower end, a short distance through the open outer end of the tube where it is made fast in any suitable manner, as at 10, to an insulating block 11 set within a metal box 12 preferably screwed upon the outer end of the casing tube. The heating element is thus held in place in its tube and its insertion therein and removal

therefrom facilitated by this flexible strip.

This insulating block 11 also provides a place of attachment for electric terminals 13 to which the wires 14 leading to the heating or resistance coils of the heating element, which wires are covered with an insulation to prevent them from coming into contact with the tube or strip, or with each other and causing a short circuit. The lead-in wires 15 are detachably secured in the usual manner to the outer ends of the terminals 13 and are led into the box 12 through a conduit pipe 16 screwed into an opening in the upper side wall of said box, and in this pipe adjacent the box, is provided an electrical switch casing 17 containing the usual switch for turning the current on and off. The box 12 is provided with a detachable cover 18 for its outer open end and this cover is formed with a leg or legs 19 to engage the block 11 and detachably hold this block in place against a shoulder 20 formed on the casing wall. Removal of the cover thus exposes the wiring connections and also releases the block so that this block and the heating element connected thereto by the strip 7, may be quickly and easily removed for the purpose of replacement or repair.

In this arrangement with the casing tube extending through the side wall of the tank, the removal of the heating element is greatly facilitated and it is not necessary to support the tank in an elevated position as where the element is removable through the bottom of the tank. Further, the element casing is supported above the bottom of the tank, leaving the lower end of said tank free for the accumulation of sediment which will in no way interfere with the operation of the heater.

To form a water passage outside the casing tube opposite the heating element, so that the water in the tank will be caused to flow up in contact with the heated portion of said casing tube, a sleeve 21 is secured over this straight upper end portion of the tube, said sleeve being of greater diameter than the tube to form a water passage 22 between sleeve and tube, the ends of said sleeve being open to permit water in the tank to enter the lower end of said sleeve and as it becomes heated, to rise, and flow out of the open upper end into the upper end of the tank from which it will be drawn off through the outlet pipe 3. This arrangement also facilitates the cleaning out of this passage 22 as its upper open end may be positioned adjacent to and directly below a removable plug 23 in the top of the tank, the sleeve 21 being secured to and held spaced from the casing tube, by lugs 24 on the sleeve bent inwardly and welded or otherwise secured to the casing.

The heating element 6 as a whole, is made up of a series of separate insulating members 8 and 9, these members each having an axial opening therethrough for the strip 7 upon which they are loosely strung, and the opening through each insulator is formed flaring toward its ends so that the insulators may move freely on said strip and rock thereon to a limited extent as the strip is bent laterally in inserting the element through the bend 5a of the casing tube.

The insulators 8 are cylindrical and serve to space the insulators 9 apart, said insulators 9 being each formed with a circular flange 25 at one end having a plurality of openings 26 therein through which the resistance coil 27 is threaded in any suitable manner and to the lower end or ends of which coil or coils the wires 14 are connected adjacent the lowermost insulator 9. These several insulators, as shown, are strung loosely upon the center flexible carrying strip 7 to provide for free play upon said strip when the element is inserted through the curved portion 5a of the tube, and to hold the several insulators against sliding down upon said strip, said strip is provided with a lug 28 to engage the lower insulator. Laterally bent portions or lugs 29 on the upper end of this strip engage the upper insulator and prevent the same from coming off.

As above pointed out, the member 7 is a strip of thin flat metal and, therefore, the openings in the insulators 8 and 9 are elongated transversely to accommodate the width of the strip. This strip thus prevents the several insulators from being rotated upon the strip by the twisting action of the resistance coils 27 which are mounted upon said insulators under strain, in a zig-zag fashion as shown in Figure 1, the coils passing through the openings in one insulator 9 and then through the openings in adjacent insulators, which openings in said adjacent insulators are out of alinement with the openings in the first mentioned insulator. These coils are thus led from one insulator, laterally in one direction to the next insulator and then on to the next at an opposite inclination. The strain of the coils thus tends to rotate the insulators due to this zig-zag mounting, which prevents their sagging into contact with the cylindrical spacing insulators 8, and such rotation of said insulators is prevented by the flat strip 7 passing through the elongated openings in said insulators.

Obviously, this electrical heating device may be applied to water containers other than the tank shown, and changes may also be made in the construction and arrangement of the heating element, within the terms of the appended claims without departing from the spirit of the invention. I do not, therefore, limit myself to the particular construction or arrangement shown.

Having thus fully described my invention, what I claim is:—

1. In an electrical heating element, the

combination of a tubular casing with its upper end closed and its lower end portion curved laterally and open, a laterally flexible electrical heating element within the inner closed end portion of said casing, a laterally flexible non-extensible member extending through said heating element and through said curved outer end portion of said casing for positioning said element in said casing, wires connected to the lower end of said heating element and extended through the open end of said casing to conduct current to said heating element, a box mounted upon the lower end of said casing tube, and an insulating block in said box to which block said flexible member is secured at its outer end.

2. In an electrical heating element, the combination of a tubular casing member curved laterally adjacent its lower end, the inner end of said casing member being closed and its lower end open, an electrical heating element within the upper end portion of said casing member and comprising a series of relatively movable insulating members and a resistance coil carried by said members, a flexible non-extensible flat metal strip member upon which said insulating members are strung to hold the same loosely together, said flexible member being extended through the curved portion of said casing member to the outer open end thereof, electrical conductors connected to said resistance coil and extended through said casing member to the open outer end thereof, a box on the outer end of said casing member, and an insulating block in said box and to which the outer end of said flexible member and electrical conductors are secured.

3. In an electrical heating element, the combination of a tubular casing member having a lower end portion curved laterally, the upper end of said tubular member being closed and its lower end open, an electrical heating element within the upper end portion of said casing member and comprising a plurality of separate insulating members each having an axial opening flared outwardly toward its ends to provide freedom of bending movement of a flexible member extending therethrough, flanges on certain of said members of a diameter to fit within said casing member and a resistance coil carried by said flanges, a laterally flexible non-extensible member extending through said axial openings in said insulating members and upon which said members are loosely held for relative movement in flexing said heating element, said flexible member being extended through the laterally curved portion of said casing member to the outer open end thereof, a box on the outer end of said casing member, an insulating block in said box to which the outer end of said flexible member is secured, electrical conductors connected at their inner ends to said resistance coil within said casing member and at their outer ends secured to said block, and a sleeve on the upper end portion of said casing member opposite said heating element with a space between it and the wall of said casing member to form a water passage around said member.

4. In an electrical heating element, the combination of a tubular casing having a closed upper end and an open lower end, said tubular casing being bent laterally intermediate its ends, an elongated laterally flexible electrical heating element within the upper end portion of said tubular casing, a flexible non-extensible member connected to said heating element adjacent one end and extended through said curved portion of said casing to the open lower end thereof, a sleeve on the upper end portion of said tubular casing opposite said heating element with a space between it and the wall of said casing to form a water passage around said casing opposite said heating element, an insulating member carried by the open end portion of said tubular casing and to which said flexible member is secured at its lower end, and electrical conducting means connected to said heating element and extending through said curved portion of said casing to the open end thereof.

5. In an electrical heating element, the combination with a tubular casing and a heating element therein comprising a series of insulators each having an axial transversely elongated opening therethrough and an end flange provided with openings, a thin flat metal strip upon which said insulators are strung by passing said strip through said axial openings to connect said insulators together and prevent relative rotation thereof, and resistance coils extended through said openings in said flanges of said insulators in a zig-zag direction and the strain of which coils tends to rotate said insulators upon said strip, due to such zig-zag mounting.

In testimony whereof I affix my signature.

HERBERT W. CHRISTIAN.