

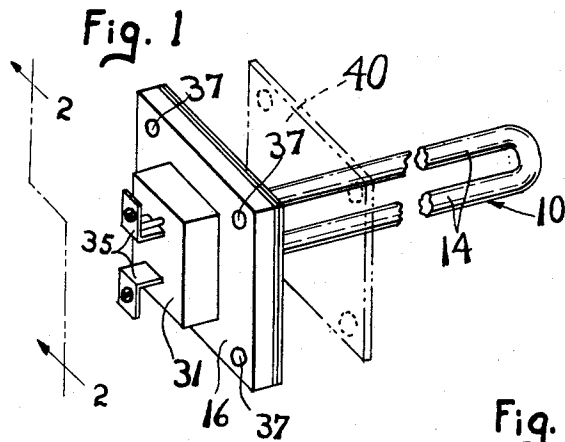
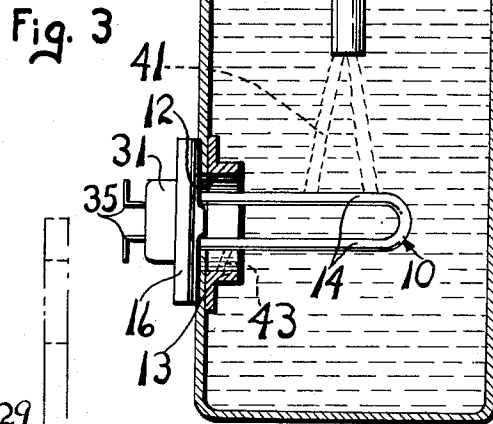
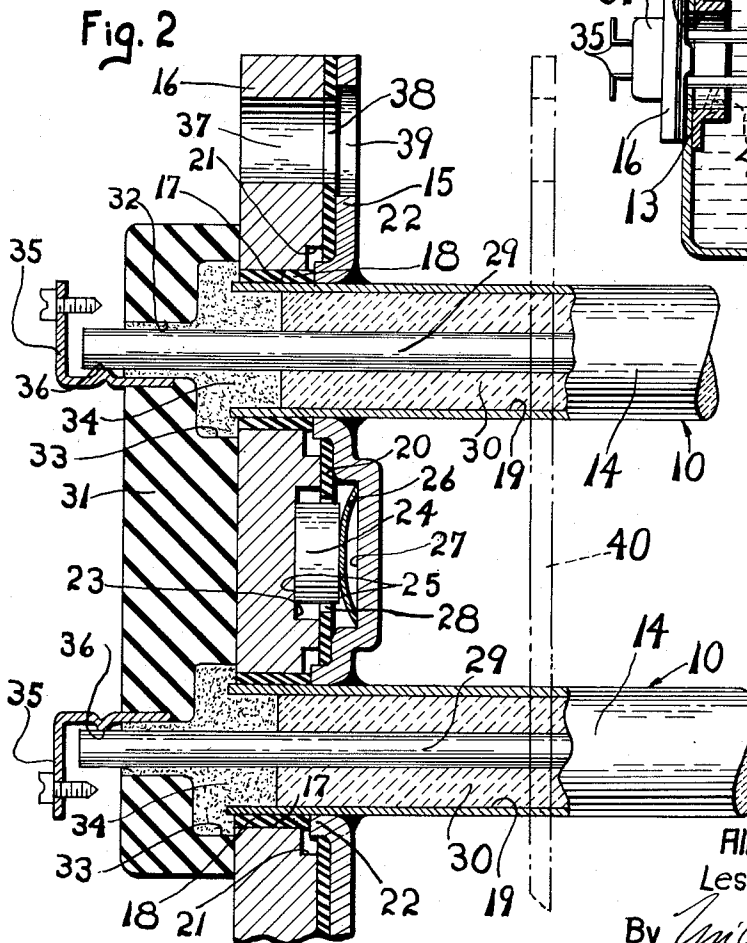
Nov. 8, 1955

A. C. BOGGS ET AL

2,723,340

CORROSION RESISTANT IMMERSION HEATER

Filed April 20, 1953



INVENTORS.

Alben C. Boggs
Lester D. Drugmand

By *Wichard Williams*
Attorney

1

2,723,340

CORROSION RESISTANT IMMERSION HEATER

Alben C. Boggs and Lester D. Drugmand, Pittsburgh, Pa., assignors to Edwin L. Wiegand Company, Pittsburgh, Pa., a corporation of Pennsylvania

Application April 20, 1953, Serial No. 349,850

14 Claims. (Cl. 219—38)

Our invention relates to means for protecting an electric immersion heater against corrosive galvanic action and the principal object of our invention is to provide new and improved means of the character described.

For some time, electric water heaters or tanks have been provided with a protective magnesium rod which is adapted to be immersed in the water in the interior of the tank. This magnesium rod is installed to protect the interior wall of the tank against the formation of rust in the event the protective lining of the tank is faulty. The magnesium rod accomplishes the foregoing by setting up galvanic currents between itself and the unprotected portion of the tank wall which causes magnesium from the rod to become deposited upon such unprotected portion. This plating action thus protects the interior of the tank against rust and corrosion. However, the protective plating deposited by the magnesium rod is not permanent since it is easily dissolved by the water in the tank; therefore, in order to be effective, the plating action must be a continuous one.

In using magnesium rods in water heaters having conventional electric immersion heating elements, it was found that the magnesium rod was rapidly being consumed because of galvanic action set up between the rod and the heating element. This galvanic action effected transference of magnesium from the rod to the heating element and, since the bare metallic sheath of the heating element presented a considerable area, the magnesium rod was rapidly dissipated.

In order to protect the magnesium rod from too rapid dissipation with consequent loss of protection to the tank relatively early in its useful life, it was proposed that the heating element be electrically insulated from the tank wall to thereby break the galvanic circuit between the magnesium rod and the heating element.

Insulating the heating element from the tank wall proved satisfactory from the standpoint of magnesium rod life; however, a more serious problem developed. A certain amount of galvanic current flow still occurred between the magnesium rod and the heating element, the current completing the circuit between the heating element and adjacent parts of the tank wall by passing through the water. This resulted in serious corrosion of the sheath of the heating element and consequent early failure of the element when the corrosion reached the interior of the sheath.

Our invention solves the corrosion problem that exists in electric water heaters using prior art immersion heating elements. This and other advantages will become apparent from a study of the following description and of the drawing appended hereto.

In the drawing accompanying this specification and forming a part of this application there is shown, for purpose of illustration, an embodiment which our invention may assume, and in this drawing:

Figure 1 is a perspective view of an electric immersion heater constructed in accordance with our invention,

Figure 2 is an enlarged, fragmentary sectional view

2

generally corresponding to the line 2—2 of Figure 1, and

Figure 3 is an interior view of a water heater embodying our improved immersion heater.

As shown in the drawing and particularly in Figure 3, the embodiment of the invention herein disclosed comprises a U-shaped sheathed electric resistance heating element 10 disposed interiorly of a water heater 11. The wall of the water heater 11 is apertured at 12 to permit insertion of the heating element 10, and the conventional flange member 13 is secured to the inner wall of the heater adjacent the aperture 12 to strengthen the wall at this point.

Although the presently disclosed embodiment of the invention is a flange-mounted element, it will be understood that the element may be secured to the wall of the water heater by any other suitable means.

As illustrated, the heating element 10 comprises a sheathed electric resistance element formed to a generally U-shape to provide spaced-apart leg portions 14. The leg portions 14 extend through respective apertures formed in a gasket plate 15 and each of the legs 14 is secured to the gasket plate by welding, soldering, or other suitable means. The terminal portions of the legs 14 extend beyond the plate 15 as shown, and it is to be understood that the welding or soldering operation forms a water-tight joint between each of the legs 14 and the plate 15 for a purpose that will later be made clear.

A flange plate 16 is adapted to overlie the gasket plate 15, each of the legs 14 extending through a respective aperture 17 provided in the flange plate. A dielectric sleeve 18 is interposed between the flange plate 16 and the sheath 19 of each of the legs 14 as shown, and a dielectric gasket 20 is interposed between adjoining faces of the two plates. The plate 16 is recessed at 21 to provide clearance over lips 22 extending laterally of the gasket plate 15, and it will be clear that the plate 15 and the legs 14 are insulated from the flange plate 16 by construction thus far disclosed.

In accordance with the present invention and for a purpose that will later be made clear, electrically conductive means is interposed between the gasket plate 15 and the flange plate 16. As illustrated, the flange plate 16 is recessed at 23 to receive an electrically conductive block that is formed of carbon in the presently disclosed embodiment and that has a fixed electrical resistance value, which, in the present example, is in the order of approximately 700 ohms. Opposite faces 25 of the block 24 are preferably coated with a plating of copper or the like for insuring good electrical contact, the block 24 being positioned within the recess 23 so that one of the faces 25 engages a defining wall of the recess as shown.

Good electrical contact between the plates 15, 16 through the block 24 is insured by disposing a spring member 26 between the block and a depression 27 formed in the gasket plate 15 adjacent the block. As illustrated, the gasket 20 is apertured at 28 to permit the block 24 to extend therethrough; however, the aperture 28 is smaller than the recess 23 in the plate 16 to insure centering of the block within the recess for preventing establishment of electrical circuits other than those between the faces 25, 25.

As illustrated, conventional terminal pins 29 extend from the ends of each of the legs 14 and the pins are adapted to be electrically connected to the usual resistance wire (not shown) imbedded in the refractory material 30 that customarily fills the sheath. In the present embodiment, the refractory material 30 stops short of respective ends of the legs 14 for a purpose to be shown.

A dielectric block 31 is adapted to overlie the apertures 17 of the flange plate 16, the block 31 being apertured at 32 to pass respective terminal pins 29 and recessed at 33 to provide clearance over the apertures 17

3

and over the ends of the legs 14 that protrude beyond the flange plate 16. Each space defined by an aperture 32 and a recess 33 of the block 31 and the interior of the sheath 19 and the respective end of the refractory material 30, is adapted to be filled with a semi-plastic, non-hardening electric insulating putty-like material 34 that serves to seal the open ends of the legs 14 and protects the refractory material against foreign matter.

The block 31 is adapted to be held in position against the plate 16 to thereby lock the foregoing parts together and, in the present embodiment, is recessed adjacent each of the apertures 32 to closely receive one leg of a terminal clip 35 to which a power lead may be attached and each terminal clip is adapted to be spot welded to a respective terminal pin 29 at 36. Any movement of the block in a direction away from the plate 16 is resisted by abutment of the end of the leg of a terminal clip against the adjacent defining surface of the block recess.

As previously mentioned and as shown in Figure 3, the heating element is adapted to be inserted through the aperture 12 in the wall of the water heater 11 and secured in position by cap screws that pass through apertures 37 in the flange plate and apertures 38, 39 formed in the gasket 20 and the gasket plate 15 respectively and that are threaded into apertures provided in the wall of the water heater. It is to be noted that apertures 39 in the gasket plate 15 are enlarged to insure that the fastening cap screws do not engage the plate 15. A dielectric gasket 40 (shown by dot-dash lines in Figures 1 and 2) is adapted to be interposed between adjoining surfaces of the gasket plate 15 and the outer wall of the water heater 11 for sealing purposes.

As shown in Figure 3, a galvanic current 41 will flow between the magnesium rod 42 and the immersion heating element 10. The electrical circuit will be completed by current flow from the element 10 to the flange plate 16 through the conductive resistor block 24, and from the plate 16 to the wall of the water heater through the fastening bolts passing through apertures 37, 38 and 39.

The provision of a path through which a controlled amount of current may flow directly from the heating element 10 to the wall of the water heater prevents galvanic currents from passing from the element 10 through the water to the wall of the water heater as indicated at 43. This prevents the destructive corrosive action that heretofore seriously shortened the life of immersion heating elements. However, since the circuit provided offers resistance to current flow, the galvanic current will be relatively small and thus the effective life of the protective magnesium rod will not be materially shortened.

While it was previously stated that the resistance provided in the present embodiment was in the order of 700 ohms, it is to be understood that this value is illustrative only and that the ideal resistance will be as high as possible to limit galvanic current flow to its lowest value without forcing the galvanic current to seek another path.

As a modification of the embodiment herein disclosed, the block 24 may be dispensed with and either one or both of the dielectric sleeves 18 may be replaced by a conductive sleeve having a predetermined resistance value. Obviously, employment of conductive sleeves having a predetermined resistance value will provide for passage of a predetermined amount of current between the element 10 and the flange plate 16 for the purposes hereinbefore described.

As a further embodiment, the gasket 20 may be omitted and the gasket plate 15 may be electrically connected to the mounting plate 16 as by abutting the latter, or the gasket plate may take the form of a plating which is plated directly on the surface of the mounting plate. Also, the sheath 19 may be electrically connected to the mounting plate, such as by direct contact therewith, so that the sheath is in electrical contact with the mount-

4

ing plate 16 and gasket plate 15, in the event the latter is used. In this embodiment, both the sleeves 18 and the block 24 may be eliminated, and to insulate the heater from the tank, insulating sleeves and washers may be used in combination with each mounting bolt, to fully prevent direct engagement between the mounting plate and gasket plate (if used) with the tank. In this embodiment, if desired, one or more of the mounting bolt sleeves and/or washers may be made semi-conductive for the purpose hereinbefore described.

In view of the foregoing it will be apparent to those skilled in the art that we have accomplished at least the principal object of our invention and it will also be apparent to those skilled in the art that the embodiment herein described may be variously changed and modified, without departing from the spirit of the invention, and that the invention is capable of uses and has advantages not herein specifically described, hence it will be appreciated that the herein disclosed embodiment is illustrative only, and that our invention is not limited thereto.

We claim:

1. An immersion heater for heating liquid in a vessel, comprising an electric heating element of the sheathed type adapted to at least in part extend within said vessel in contact with the liquid therein, means for mounting said heating element to a wall of said vessel, and carbon block means of fixed ohmic properties providing for a predetermined amount of galvanic current flow between said vessel and said heating element.

2. In an electric heater mounting assembly, a heater for insertion through an opening in a receptacle, said heater including a metallic gasket plate for overlying said opening, an electrically insulating gasket for insertion between the inner surface of said gasket plate and the outer surface of said receptacle contiguous to said opening, a metallic mounting plate for urging said gasket plate toward said receptacle wall, means adjacent said mounting plate for electrically insulating said mounting plate from said heater, and means between said gasket plate and said mounting plate and of fixed electrical current resistance providing for a predetermined amount of galvanic current flow therebetween.

3. In an electric heater mounting assembly, a heater for insertion through an opening in a receptacle, said heater including a metallic gasket plate for overlying said opening, an electrically insulating gasket for insertion between the inner surface of said gasket plate and the outer surface of said receptacle contiguous to said opening, a metallic mounting plate for urging said gasket plate toward said receptacle wall, means adjacent said mounting plate for electrically insulating said mounting plate from said heater, and carbon block means of fixed ohmic properties spring-pressed between said mounting plate and said gasket plate.

4. A heating device for heating liquid in a metallic container, comprising an electric heater having a sheath portion adapted to be immersed in the liquid, said sheath also being formed of metal whereby the conditions of galvanic action may be present, and means establishing substantially sole electrical current flow between said metallic sheath and said metallic container, said means being of known electrical resistance to provide for a regulated amount of galvanic current flow between said sheath and said container.

5. The combination with an electric heater for immersion in a liquid containing tank, of means including a mounting for attaching said heater to said tank, insulating means for preventing establishment of normal galvanic circuits between said tank and said heater, and means of known electrical resistance having its terminals respectively in electrical engagement with said tank and said heater to provide for a regulated amount of galvanic current flow therebetween.

6. The combination with a metallic-sheathed electric heater for immersion in a metallic liquid-containing tank,

of means including a mounting for attaching said heater to said tank, and means interposed between said heater and tank and establishing the sole electrical engagement therebetween, said means being of known electrical resistance to regulate galvanic current flow between said heater and tank to an amount below the amount which would normally flow if said heater and tank were in direct electrical engagement.

7. A water heater comprising a metallic water storage tank having a non-corrosive lining on its inner wall surface, a sacrificial anode disposed within said tank and adapted through galvanic action to restrict corrosion of said tank at places where said non-corrosive lining is inadequate, an electric heater mounted on said tank and having a metal sheath adapted to be immersed in the liquid within said tank, and means for regulating galvanic current flow between said sheath and said anode and tank, whereby rapid dissipation of the anode is reduced and damage to said sheath by flow of galvanic current between said sheath and said tank is minimized.

8. A water heater comprising a metallic water storage tank having a non-corrosive lining on its inner surface, a sacrificial anode disposed within said tank and adapted through galvanic action to restrict corrosion of said tank at places where said non-corrosive lining is inadequate, an electric heater including a mounting for attaching said heater to said tank and a metallic sheath covering the active heating portion of said heater and immersed in the liquid in said tank, and means establishing substantially sole electrical current flow between said sheath and said tank, said means being of known resistance to provide for a regulated amount of galvanic current flow between said sheath and said anode and tank, whereby dissipation of the anode is reduced and damage to said sheath by flow of galvanic current between said sheath and said tank is minimized.

9. A water heater comprising a metallic water storage tank having a non-corrosive lining on its inner surface, a sacrificial anode disposed within said tank and adapted through galvanic action to restrict corrosion of said tank at places where said non-corrosive lining is inadequate, an electric heater including a metallic mounting plate for attaching said heater to said tank and a metallic sheath carried by said mounting plate and adapted to extend freely through and in spaced relation to the defining margin of an opening in the tank wall and be immersed in the liquid in said tank, insulating means between said heater and said tank for preventing establishment of normal galvanic circuits between said heater and said anode and tank, and means of known electrical resistance having its terminal respectively in electrical engagement with said tank and said heater to provide for a regulated amount of galvanic current flow between said heater and said anode and tank, whereby dissipation of the anode is reduced and damage to said sheath by flow of galvanic current between said sheath and said tank is minimized.

10. An immersion heater for heating liquid in a metallic vessel, comprising an electric heating element of the metallic sheathed type adapted to at least in part extend within said vessel in contact with the liquid therein, means for mounting said heating element to a wall of said vessel, said heater having insulating means normally preventing establishment of galvanic circuits between said vessel and said heater, and a current resistor body of fixed ohmic properties providing for controlled galvanic current flow between said vessel and said heater.

11. An electric heating element assembly for application to a metallic container for heating the contents thereof, comprising a heating element having a metallic sheath including an outer terminal portion adapted to extend through an opening in a wall of said container, a metallic

gasket plate having an aperture for receiving therethrough said terminal sheath portion in fluid tight relation, a rigid metallic backing plate in juxtaposed relation to said gasket plate and having an aperture aligned with said gasket plate aperture for receiving therethrough said terminal sheath portion of said heating element, electrical insulation insulating said backing plate from said gasket plate and said metallic sheath, and a current resistor of selected ohmage electrically connected between said mounting plate and said sheath to provide for controlled current flow therebetween.

12. An electric heater for heating the contents of a metallic container, comprising a metallic-sheathed heating element having a heating portion extending into the container and of a size to freely pass through an opening in said container clear of engagement with the surface defining said opening, metallic mounting means connected to said heating element for supporting the same, means for electrically insulating said mounting means from the metallic sheath of said heating element, a current resistor having fixed ohmic properties providing for controlled current flow between said mounting means and said sheath, a deformable gasket of electric insulating material between said mounting means and an outer surface of said container and around the container opening to electrically insulate said mounting means from said container, and fastening means for drawing said mounting means toward said outer container surface to compress said gasket between said mounting means and said outer surface and thereby seal against leakage of the container contents through said opening.

13. An electric heater securable to a container for heating the contents thereof, comprising as a unitary assembly a metallic-sheathed heating element, a resistance conductor and mounting means, said resistance conductor having fixed ohmic properties for regulating galvanic current flow between said heating element and said container and said mounting means carrying said element and said conductor and being securable to a wall of said container whereby said mounting means overlies an opening in said container and at least a portion of said element extends through said container opening in spaced relation with the defining wall thereof, and means limiting galvanic current flow between said heating element and said container to that current regulated by said resistance conductor, said limiting means comprising sealing means interposed between said mounting means and a wall surface of said container contiguous to said container opening to seal the latter.

14. An electric heater for the liquid contents of a metallic container and of the type which restricts free galvanic current flow between the heater and the container, comprising an elongated metallic-sheathed heating element adapted to extend into said container in contact with the container liquid, mounting means connected to said heating element and securable to said container for holding said heating element in position, said mounting means having a periphery spaced radially of said heating element, and a current resistor having fixed ohmic properties providing for controlled galvanic current flow between said container and said heating element, said current resistor being positioned within the confines of said mounting means periphery and forming a unitary assembly with said heating element.

References Cited in the file of this patent

UNITED STATES PATENTS

2,459,123	Bates et al. -----	Jan. 11, 1949
2,594,255	Charbonneau -----	Apr. 22, 1952
2,617,009	Hasley -----	Nov. 4, 1952
2,624,829	Dzaack -----	Jan. 6, 1953
2,649,532	Woodman -----	Aug. 18, 1953