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CORROSION PREVENTING MOUNT FOR ELECTRIC WATER HEATERS

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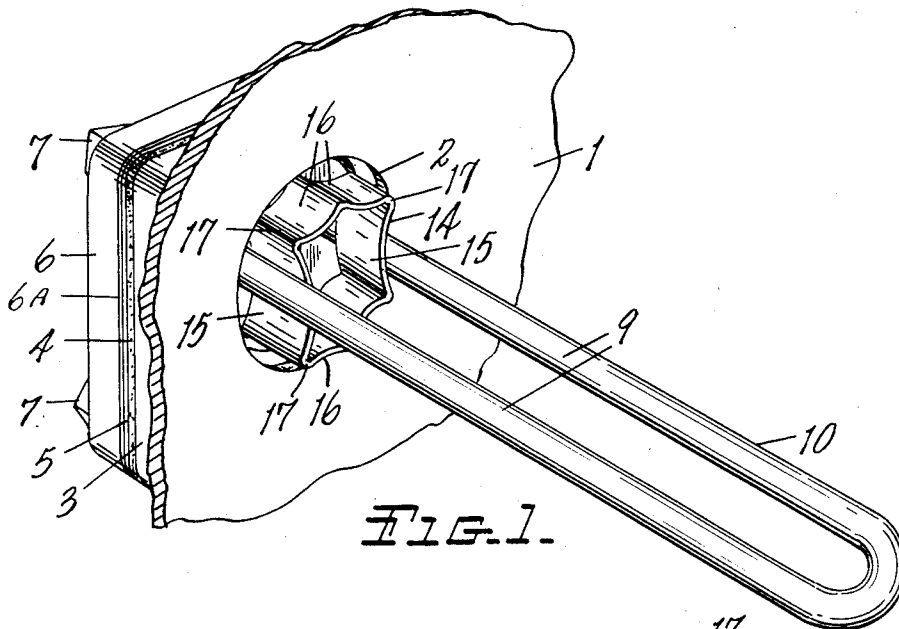


FIG. 1.

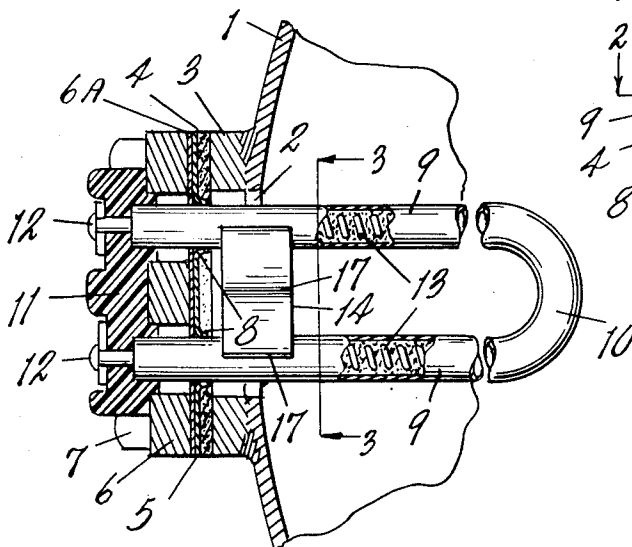


FIG. 2.

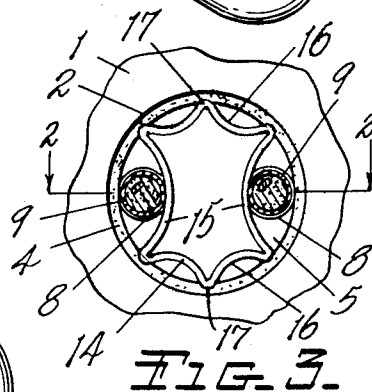


FIG. 3.

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**CORROSION PREVENTING MOUNT FOR
ELECTRIC WATER HEATERS****John J. Finn, Allegan, Mich., assignor to Heatube
Corporation, Allegan, Mich.****Application June 17, 1955, Serial No. 516,120****12 Claims. (Cl. 219—38)**

This invention relates to corrosion preventing mount for electric water heaters.

The principle objects of this invention are:

First, to provide a mounting for an immersion heating element in a water heater tank that will prevent or retard corrosion of both the tank and the heating element sheath.

Second, to provide a mounting for the immersion heating element of electric water heaters which will prevent or retard corrosion of the heating element sheath and thus extend the effective life of the heating element.

Third, to provide an electrical discharge controlling clip for the immersion heating element of an electric water heater to localize and control the electrical discharge of leakage current between the sheath of the heating element and the wall of the tank so that the heating element sheath is not attacked by electrolytic action.

Fourth, to provide simple and inexpensive means for lengthening the effective life of the tank and immersion heating elements in electric water heaters.

Fifth, to provide an electric water heater that prevents or controls both galvanic and leakage currents that tend to cause corrosion of the tank wall and heating element sheath.

Other objects and advantages of the invention will be apparent from a consideration of the following description and claims. The drawings, of which there is one sheet, illustrate a highly practical form of the electrical discharge and corrosion control element of the invention.

Fig. 1 is a fragmentary perspective view of an immersion heating element mounted in the wall of an electric water heater with the electrical discharge and corrosion control elements operatively associated with the heating element.

Fig. 2 is a fragmentary horizontal cross sectional view through the tank and heating element taken along the plane of the line 2—2 in Fig. 3.

Fig. 3 is a fragmentary transverse cross sectional view through the heating element taken along the plane of the line 3—3 in Fig. 2.

Electric water heaters have conventionally been made of steel tanks having zinc or other metallic coating on the inside to prevent rusting of the tank walls. Immersion electric heating elements have commonly been installed through a port in the tank wall and these heating elements consist of a copper or other metallic sheath enclosing an electrical resistance heating element. The copper sheath for the heating element is relatively inexpensive and forms a good heat conductor between the heating element and the water in which it is immersed and at the same time is not subject to rusting due to the presence of the water around the sheath. However, it has been known for some time that the dissimilar character of the metallic lining of the tank and the metallic sheath of the heating element creates a galvanic action similar to that of a battery with current flowing through the water in the tank between the tank wall and the sheath of the heating element. This electrolytic action results in corrosion or

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eating away of the material of the tank wall. This electrolytic action has been found to be particularly objectionable when the copper sheath of the heating element is in direct electrical connection with the tank and its lining and to control the action it has been proposed to electrically insulate the heating element sheath from the tank wall with electrically insulating gaskets. While the insulating gaskets for all practical purposes eliminate the battery type of corrosion they permit the establishment of an electrical potential between the sheath of the heating element and the wall of the tank from which it is insulated and a new type of corrosion occurs at some indeterminate point on the heating element sheath where electrical discharge between the sheath and the tank occurs. This new or different discharge is due to leakage current from the resistance heating element in the heating element sheath. When the heater is energized the resistance element is at high potential relative to the tank which is grounded and due to the imperfect character of all insulating materials a small leakage current finds a path through the insulation in the sheath to the sheath and from there through the water to the tank wall. The current naturally follows the shortest or easiest path to ground and will discharge off of a pointed or curved surface in preference to a flat surface. In passing from the sheath the leakage current causes corrosion or erosion of the heating element sheath and ultimately the sheath is punctured causing complete and rapid failure of the insulation around the resistance element.

The present invention greatly extends the effective life of immersion heating elements by providing a controlled path for the discharge of leakage currents between the sheath of the heating element and the wall of the tank with the current passing through a clip or other piece of metal electrically connected to the heating element sheath so that the clip is eaten away in preference to the sheath.

In the drawings the tank wall of a water heater is indicated at 1 and it may be assumed that the tank wall is coated on the inside with a zinc or other non-rusting metallic coating. The wall is pierced to form the port 2 and provided with an external plate or ring 3 around the port that forms an outwardly facing gasket seat. Seated against the ring 3 is a gasket 4 of electrically insulating material. Seating against the gasket is a sealing plate 5 preferably formed of copper. The plate 5 is firmly and sealingly clamped against the gasket by means of a backing plate 6 held in place by bolts 7 as is common in water heater construction. Galvanic discharge between the heating element and the tank is prevented as has previously been disclosed by an insulating sheet 6A located between the plate 5 and the plate 6.

The copper sealing plate 5 is provided with two flanged apertures 8 within the outline of the hole in the gasket 4 and these apertures pass the outwardly extending legs 9 of a U-shaped tubular sheath 10 desirably formed of copper. The surface of the copper sheath 10 is fused or integrally connected with the sealing plate to prevent leakage of water along the surface of the sheath. The backing plate 6 supports the sealing plate and resists the pressure of the water within the tank on the sealing plate. As is common in electric water heaters, the arms of the sheath project through holes provided therefor in the backing plate. An insulating terminal block 11 surrounds the outer ends of the sheath and the electrical conductors 12 that project from the sheath. The conductors 12 are electrically connected within the sheath to a coiled resistance element 13 that is electrically insulated within the sheath.

The electrical discharge and corrosion control element 14 consists of a looped strip of metal, preferably of

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copper the same as the sheath 10, positioned between the arms 9 of the sheath and within the port 2. The clip 14 is a multi-sided loop having concave sides 15 yieldably engaged between the branches of the sheath and other concave sides 16 connecting the ends of the sides 15. The several side reaches of the clip 14 are connected by a plurality of folds or bends 17, the outer edges of which form outwardly convex points or ridges opposed to the inner surface of the tank and port 2.

As is more readily apparent from Fig. 3 the external points 17 on the control clip are desirably extended beyond the circumference of the hole in the gasket 4 so as to be positioned closer to the inner wall of the port 2 than the side surfaces of the branches 9. However, this close spacing is not absolutely essential as electrical discharge will take place between two ports at different electric potential at points where the parts are pointed in preference to flat or rounded surfaces. Since the clip 14 is positioned within the port 2 the external points or ridges 17 are opposed to the edge of the tank around the port and electrical discharge between the tank wall and the heating element sheath due to leakage current will take place between points or ridges of the clip and the edge or inside surface of the port 2. The points or ridges of the clip will thus be eaten away before any harmful corrosion occurs in the sheath 10 and it is pointed out that the corrosion action on the clip 14 is progressive from one point or ridge 17 to another with the closest spaced ridge 17 being eaten away first until another ridge presents a shorter path between the tank surfaces and the clip. The clip 14 thus effectively delays and substantially prevents corrosion of the heating element sheath and greatly extends the life of the heating element by preventing failure of the heating element due to corrosion of the sheath. An electric water heater provided with the heating element mount as described is thus protected against corrosion due to galvanic action and also leakage currents and the effective life of the heater is substantially extended.

Having thus described the invention, what is claimed as new and is desired to be secured by Letters Patent is:

1. An electric water heater comprising a tank having a zinc coating on the inside thereof and a port formed in the wall thereof with a gasket seat surrounding the outside of the port, a U-shaped sheath of copper tubing projecting through said port with its ends located exteriorly of the tank, a plate of corrosion resistant copper having holes therein passing the ends of said sheath with the surface of the plate integrally sealed around the surfaces of the sheath, an electrically insulating gasket positioned between said plate and said seat, a backing member clamping said plate and said gasket against said seat and insulated from said plate, an electric heating element in said sheath having its ends exposed on the outer side of said backing member, and a discharge localizing clip of copper mounted between the branches of said sheath and within said port, said clip being a multi-sided loop with concave sides yieldably engaging said sheath and having a plurality of externally convex corners between said sides projecting into more closely spaced relation with the inner surface of said port than the space between the exposed surfaces of said sheath and the inner surfaces of said port.

2. An electric water heater comprising a tank having a port formed in the wall thereof with a gasket seat surrounding the outside of the port, a U-shaped sheath of corrosion resistant tubing projecting through said port with its ends located exteriorly of the tank, a plate of corrosion resistant material having holes therein passing the ends of said sheath with the surface of the plate integrally sealed around the surfaces of the sheath, an electrically insulating gasket positioned between said plate and said seat, a backing member clamping said plate and said gasket against said seat and insulated from said plate, an electric heating element in said sheath having

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its ends exposed on the outer side of said backing member, and a discharge localizing clip of the same material as said sheath mounted between the branches of said sheath and within said port, said clip being a multi-sided strip with concave sides yieldably engaging said sheath and having a plurality of externally convex corners between said sides projecting into more closely spaced relation with the inner surface of said port than the space between the exposed surfaces of said sheath and the inner surfaces of said port.

3. An electric water heater comprising a tank having a metallic surface on the inside thereof and a port formed in the wall thereof with a gasket seat surrounding the outside of the port, a U-shaped sheath of metal tubing dissimilar to the metal of said surface projecting through said port with its ends located exteriorly of the tank, a plate of corrosion resistant metal having holes therein passing the ends of said sheath with the surface of the plate integrally sealed around the surfaces of the sheath, an electrically insulating gasket positioned between said plate and said seat, a backing member clamping said plate and said gasket against said seat and insulated from said plate, an electric heating element in said sheath having its ends exposed on the outer side of said backing member, and an electrical discharge localizing clip of metal mounted between the branches of said sheath and within said port, said clip being a multi-sided loop of the same material as said sheath with concave sides yieldably engaging said sheath and having a plurality of externally convex corners between said sides projecting into more closely spaced relation with the inner surface of said port than the space between the exposed surfaces of said sheath and the inner surfaces of said port.

4. An electric water heater comprising a tank having a metallic surface on the inside thereof and a port formed in the wall thereof with a gasket seat surrounding the outside of the port, a U-shaped sheath of metal tubing projecting through said port with its ends located exteriorly of the tank, a plate of corrosion resistant metal having holes therein passing the ends of said sheath with the surface of the plate sealed around the surfaces of the sheath, said plate being sealed to said seat and electrically insulated from the tank, an electric heating element in said sheath having its ends exposed on the outer side of said tank, and an electrical discharge localizing clip of metal mounted between the branches of said sheath and within said port, said clip being a multi-sided loop with concave sides yieldably engaging said sheath and having a plurality of externally convex corners between said sides projecting into closely spaced relation with the inner surface of said port.

5. An electric water heater comprising a tank having a port formed in the wall thereof with a gasket seat surrounding the outside of the port, a sheath of corrosion resistant tubing projecting through said port with an end located exteriorly of the tank, a plate of corrosion resistant material having a hole therein passing the end of said sheath with the surface of the plate integrally sealed around the surfaces of the sheath, means electrically insulating said plate from said tank and sealing said plate to said seat, an electrical heating element in said sheath having its ends exposed on the outer side of said tank, and an electrical discharge localizing clip of the same material as said sheath mounted in electrical contact with said sheath and within said tank, said clip having a plurality of external convex points projecting into more closely spaced relation with the inner surface of said tank than the space between the exposed surface of said sheath and the inner surfaces of said port.

6. An electric water heater comprising a tank having a port formed in the wall thereof with a gasket seat surrounding the outside of the port, a sheath of corrosion resistant tubing projecting through said port with an end located exteriorly of the tank, a plate of corrosion resist-

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ant material having a hole therein passing the end of said sheath with the surface of the plate sealed around the surfaces of the sheath, means electrically insulating said plate from said tank and sealing said plate to said seat, an electric heating element in said sheath having its ends exposed on the outer side of said tank, and an electrical discharge localizing clip of metal mounted in electrical contact with said sheath and within said tank, said clip having a plurality of external convex points projecting into closely spaced relation with the inner surface of said tank.

7. An electric water heater comprising a tank having a port formed in the wall thereof with a gasket seat surrounding the outside of the port, a sheath of corrosion resistant tubing projecting through said port with an end located exteriorly of the tank, means sealing said sheath to said tank and electrically insulating the sheath from the tank, an electric heating element in said sheath having its ends exposed on the outer side of said tank, and an electrical discharge localizing clip of metal mounted in electrical contact with said sheath and within said tank, said clip having a plurality of external convex points projecting into closely spaced relation with the inner surface of said tank.

8. An electric water heater comprising a tank with a port therein, a sheath of corrosion resistant tubing projecting into said port with an end located exteriorly of the tank, means sealing said sheath to said tank and insulating the sheath from the tank, an electric heating element in said sheath having its ends exposed on the outer side of said tank, and an electrical discharge localizing clip of metal removably mounted in electrical contact on said sheath and within said tank, said clip having a point projecting into closely spaced relation with the edge of said port.

9. An electric water heater comprising a tank having a port formed in the wall thereof with a ring surrounding the outside of the port and forming a seat, a sheath of corrosion resistant tubing projecting into said tank with an end located exteriorly of the tank, means sealing said sheath to said seat and insulating the sheath from the

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tank, an electric heating element in said sheath having its ends exposed on the outer side of said tank, and an electrical discharge localizing member of metal mounted in mechanically supported electrical contact on said sheath and within said tank, said member having a point projecting into closely spaced relation with the inner edge of said port.

10. In an electric water heater having a metallic walled container with an immersion heating element with a sheath of metal dissimilar to the metal of the container projecting into the container and electrically insulated therefrom, an electrical discharge control element consisting of a piece of metal supported in yieldable contact with said sheath and having a plurality of pointed projections extending into more closely spaced relation with the wall of said container than the closest space between the surfaces of the sheath and the container.

11. In an electric water heater having a metallic walled container with a port therein and an immersion heating element with a sheath of metal projecting into the container in spaced branches and electrically insulated therefrom, an electrical discharge control element consisting of a piece of metal supported in yieldable slidable contact between the branches of said sheath and extending into more closely spaced relation with the edge of said port than the closest space between the surfaces of the sheath and the container.

12. In an electric water heater having a container with an immersion heating element with a sheath of metal projecting in two spaced branches into the container and insulated from the container, an electrical discharge control element consisting of a piece of folded metal having spaced arms yieldably supported in contact between the branches of said sheath and having a pointed projection extending into closely spaced relation with the wall of said container.

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