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Williams

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[54] **ELECTRIC HEATING ASSEMBLIES**

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[73] Assignee: **Emerson Electric Co.,** St. Louis, Mo.

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[52] **U.S. Cl.** **219/336,** 29/516, 219/523, 219/316, 219/318

[51] **Int. Cl.** **F24h 1/00,** H05b 1/00

[58] **Field of Search** 219/315, 316, 318, 219/335, 336, 523; 29/516

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Primary Examiner—C. L. Albritton

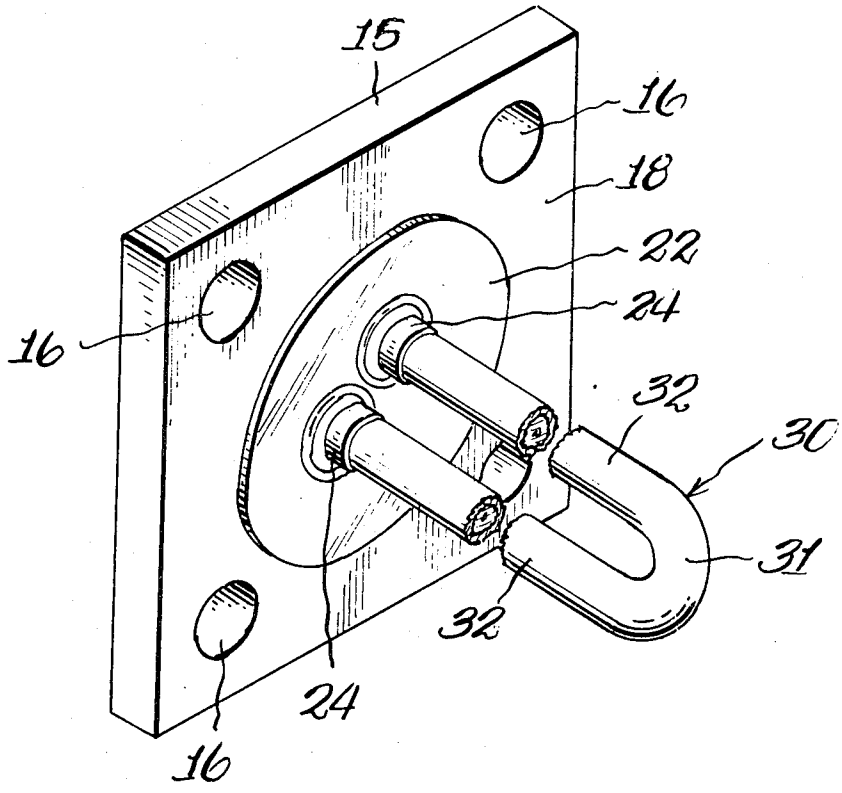
[57] **ABSTRACT**

The invention relates particularly to an electric immersion heater for use in heating liquid in a tank, such as a hot water tank. The heater includes the standard construction of a mounting flange and a sheathed heating element rigidly carried by the flange in cantilever fashion so that it may be positioned through a tank opening and in contact with the liquid to be heated.

A corrosion shield overlies the flange surface which is exposed to the liquid in the tank, the shield having a collar through which an end of the heater sheath passes, such end also passing through an opening in the mounting flange. The collar is deformed radially inwardly against the wall surface of the sheath, the deformation causing the wall of the collar to be reduced in cross-section and substantially cold welded to the sheath to form a liquid-tight joint therewith.

The flange is staked to the sheath to provide a mechanically rigid joint therebetween. A dielectric terminal block is rigidly connected to the mounting flange and has a pocket in which an end seal bushing at the sheath end is compressed.

7 Claims, 5 Drawing Figures



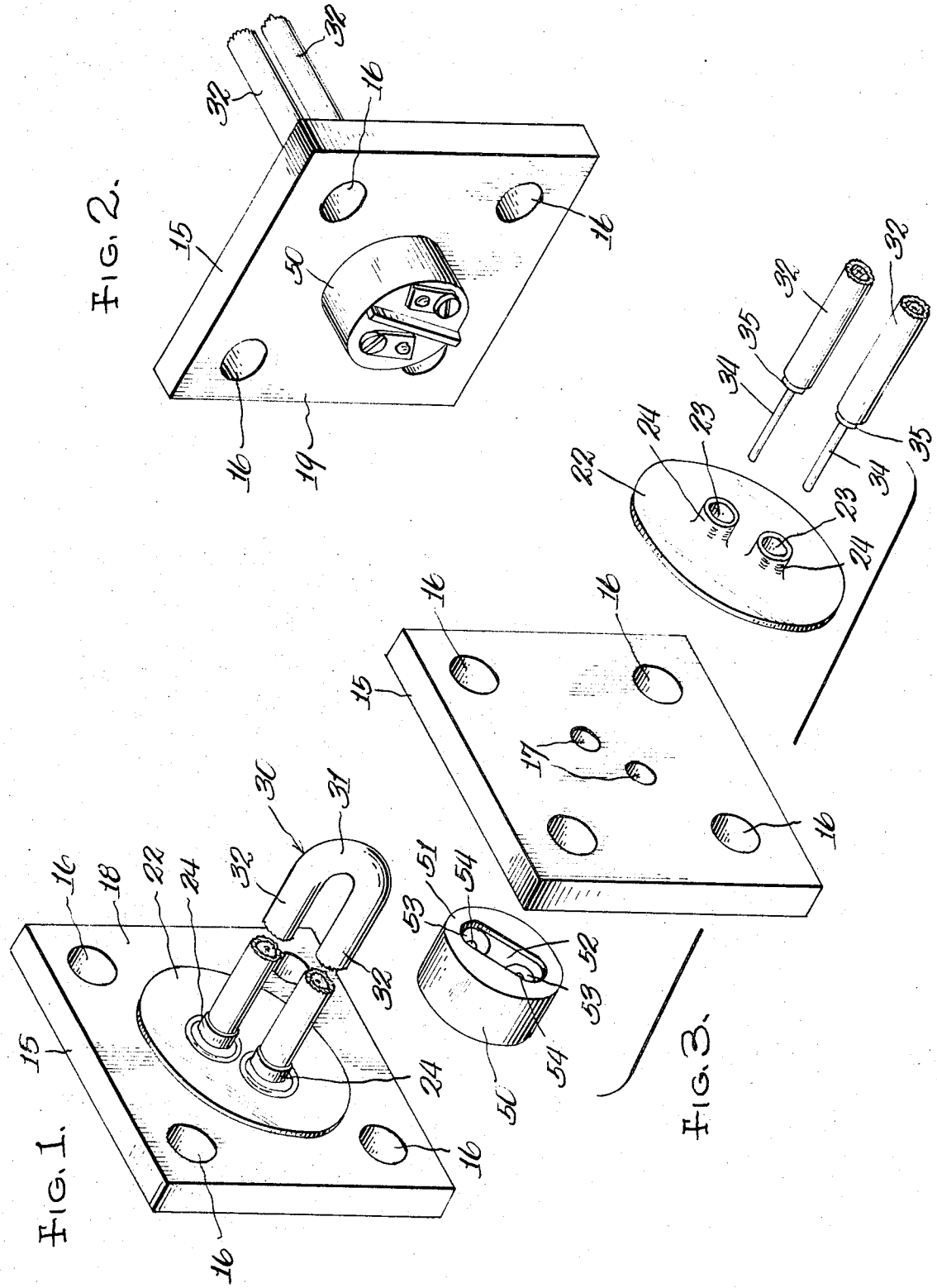

FIG. 1.
FIG. 2.
FIG. 3.

FIG. 5.

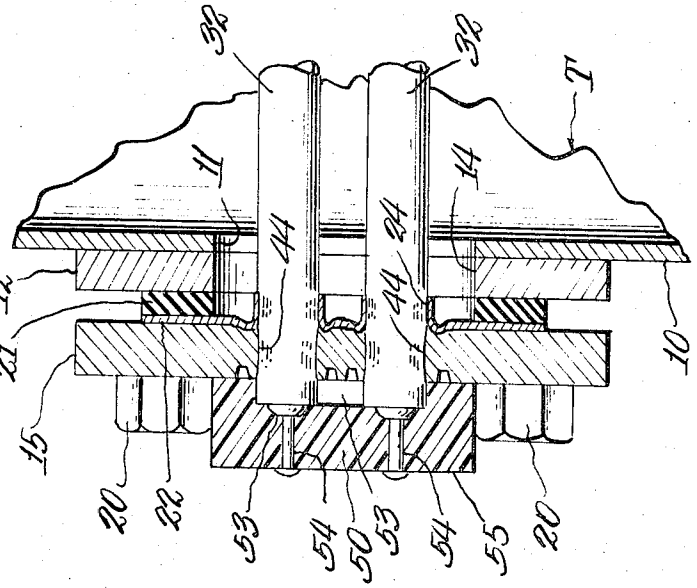
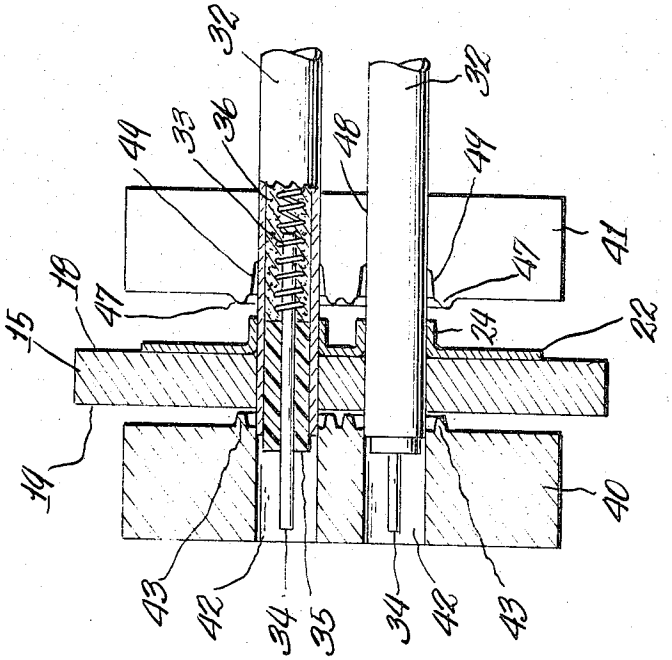

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FIG. 4.


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ELECTRIC HEATING ASSEMBLIES

BACKGROUND AND SUMMARY

Electric immersion heaters of the general type disclosed in this application are known in the art. Such heaters are particularly adapted for the heating of water in a tank and normally comprise a mounting flange and a sheathed electric heating element rigidly carried by the flange in cantilever manner. The flanges is normally bolted to the tank wall and the sheath extends through an opening in the tank wall and into the tank for immersion in the water to be heated.

In the normal installation, a face portion of the flange is exposed to the water in the tank and is subject to corrosion, and to prevent such corrosion the face portion is overlaid with a thin sheet of non-corrosive metal, such as copper. In the early art, the copper plate had a fused connection with the sheath to provide a liquid-tight joint therebetween, but this required relatively costly manufacturing operations. Some manufacturing economy was effected by inwardly deforming the metal of the flange against the sheath and a portion of the corrosion shield, but this required relatively costly forming operations.

My invention is directed to an improved assembly of the corrosion shield with the mounting flange in a manner wherein a satisfactory liquid-tight joint is formed in an economical manner. The corrosion shield is formed with a collar (or collars in the case of a hair-pin type element) which are turned outwardly from a face of the shield and deformed radially inwardly against the peripheral surface of the sheath. The deforming operation crowds the wall of the collar around the periphery of the sheath and causes a reduction in the wall thickness of the collar and forms practically a cold weld between the collar and the sheath.

DESCRIPTION OF THE DRAWINGS

In the drawings accompanying this specification and forming a part of this application, there is shown, for purpose of illustration, one form which my invention may assume, and in these drawings:

FIG. 1 is a fragmentary, perspective view of an electric immersion heater illustrating an embodiment of my invention,

FIG. 2 is a fragmentary, perspective view of the heater shown in FIG. 1, but viewed from a different angle,

FIG. 3 is a separated perspective view of parts forming the heater shown in FIGS. 1 and 2, the heating element being fragmentarily shown,

FIG. 4 is an enlarged fragmentary sectional view of the heater, illustrating an assembly operation, and

FIG. 5 is a view similar to FIG. 4, showing the completed assembly.

DESCRIPTION OF THE PREFERRED EMBODIMENT

FIG. 5 shows one type of construction for mounting an electric immersion heater on the wall 10 of a water tank T. The tank wall has an opening 11 and usually a connection plate 12 is welded to the tank wall since the latter is normally of light gauge metal. The connection plate also has an opening 14 which may be of the same, or different, diameter as the wall opening 11.

The heater herein disclosed has a flat mounting flange 15 which may be rectangular in plan, as best seen in FIGS. 1 through 3, or circular or other configuration. In order to provide strength and to effect manufacturing economy the flange is usually formed as a steel stamping. The mounting plate herein shown has corner holes 16 ot pass mounting bolts and center holes 17 to pass the legs of the heating element. Through use of my invention, the center holes are uniform in diameter from one side face 18 of the flange to the other side face 19, and this uniformity is best seen in FIG. 4. My invention therefore reduces costs heretofore involved in counterboring the center holes 17, and makes it possible to form all holes 16 and 17 in the stamping operation.

The mounting flange 15, as seen in FIG. 5, is held to the tank T by bolts 20 which have their threaded shanks passing through the corner holes 16 and threaded into corresponding holes in the connection plate 12. A gasket 21 provides a liquid-tight seal. Since the inner face 18 would be exposed to contact with the liquid in the tank, a corrosion shield 22 is utilized to protect such face.

In the present embodiment, the corrosion shield is formed of a relatively soft, non-corrosive metal plate, preferably copper, and may be round in plan as shown, or any other configuration. The shield has a pair of openings 23 which align with the mounting flange openings 17 and are of about the same diameter. The shield openings are margined by collars 24 which are extruded from the face of the shield plate in a stamping operation and which have a wall thickness corresponding to the thickness of the shield plate. In the disclosed embodiment, a hair-pin type heating element is used, but in the event the element is a rod-type heater, only one collar would be formed on the shield plate, and only one corresponding hole 17 would be formed in the mounting flange.

The hair-pin type heating element 30 may be of conventional construction and, as seen in FIG. 1, comprises a bight portion 31 and a pair of legs 32—32. A coiled resistor wire 33 (see FIG. 4) extends from the end of one leg, through the bight and to the end of the other leg. A terminal pin 34 is mechanically and electrically connected to each end of the resistor coil, and a plastic or rubber bushing 35 is compressed within the sheath leg to form a seal. Compacted refractory material 36 holds the coil and terminal pins in centered relation within the sheath and serves as an electrical insulator and a heat conductor. The bushings extend outwardly of the respective sheath legs, as seen in FIG. 4. The tubular sheath of the heating element may be formed of any suitable metal which is either resistive to the corrosive action of the water in the tank T, or plated with a resistive coating. In the disclosed construction, the sheath is made of copper, which resists corrosion, and is plated, such as with tin or zinc, to resist galvanic action between the sheath and the tank wall.

The diameter of the mounting flange holes 17 and the holes 23 in the collars 24 are of a size to closely, but slidably pass the ends of the sheath legs. The corrosion shield plate is positioned to overlie the inner face 18 of the mounting flange with the collars 24 turned outwardly in a direction away from the face 18. This preassembly, as seen in FIG. 4, is placed between opposed dies 40, 41. The die 41 is formed in two sections so that it may be fitted around the sheath legs 32 and the sections are then clamped together to form a unitary die.

The die **40** may be formed as one piece, with a pair of openings **42** to pass the ends of the sheath legs.

Circumscribing the respective openings **42** are annular ridges **43** forming staking projections, and when the dies **40,41** are forced together, as by means of a press, the projections **43** enter the outer face **19** of the mounting plate **15** and deform the metal of such plate radially inwardly, as seen at **44** in FIG. **5**, against the sheath legs to form a mechanically rigid joint therebetween. Since the inward deformation **44** is in the vicinity of the bushing **35**, the sheath leg in this vicinity will be radially deformed inwardly a slight amount to further lock the bushing in place and to prevent any longitudinal movement of the sheath legs relative to the mounting flange.

The die **41** may also be formed with staking projections **47** which circumscribe openings **48** formed therein, and these projections may be shallow and blunt so as to only slightly indent the metal of the corrosion shield into the metal of the mounting flange, as seen in FIG. **5**. The die openings **48** have sockets **49** which taper, as seen in FIG. **4**, from an outer opening just large enough to pass the outer edge of the collars **24** to an inner opening about the size of the die opening **48**. As the dies **40,41** are pressed together, the sockets **49** deform the collars radially inwardly against the sheath legs **32** and crowd the metal of the collars against the metal of the sheath legs to practically form a cold weld therebetween and thereby form a liquid-tight seal between the collars and the legs of the heating element. In this process, the wall thickness of the collars is reduced and the collars are slightly indented into the sheath legs since the bushing **35** will yield. In some cases, the staking projections **47** may be omitted, while in other cases it is desirable to provide the rigid mechanical connection at both faces of the mounting flange.

A terminal block **50**, of any suitable plastic material, may then be connected to the terminal pins to complete the assembly. The block **50** is shown as round in FIG. **3**, although it may assume any other desired configuration. On its inner face **51**, the block has a shallow elongated recess **52** and a pair of conical pockets **53** at each end of the recess. The pockets **53** are adapted to closely receive the projecting ends of the bushings **35** when the block is pressed against the face **19** of the mounting plate **15** in final assembly. The block is formed with a pair of openings **54** to pass the terminal pins, and the latter are headed over the outer face **55** of the block, as seen in FIG. **5**, to maintain the assembly. The heading of the terminal pins may be accomplished by a heliarc weld.

I claim:

1. An electric heating assembly, comprising:

an electric heating element having a tubular metallic sheath, a resistor within said sheath, material within said sheath for electrically insulating said resistor from said sheath and for conducting heat from said resistor to said sheath, and a terminal pin connected to said resistor and extending outwardly of an end of said sheath,

a metallic mounting flange having an opening through which said sheath end passes from one side surface to another, the defining wall of said opening closely fitting around the adjoining peripheral surface of said sheath end,

a non-ferrous sheet metal plate overlying said one side surface to protect the same, said plate having an opening margined by an integral collar extending therefrom in a direction away from said mounting flange one side surface, and said sheath end passing through said late opening and through said collar in close fitting relation,

said collar being deformed radially inwardly against the periphery of said sheath end to form a liquid-tight joint therewith.

2. The construction according to claim **1** wherein said heating element is of the hair-pin type having a bight and a pair of legs,

said mounting flange having a pair of openings to pass the sheath legs,

said metal plate having a pair of openings, each margined by a collar, and

each collar being deformed radially inwardly against the periphery of a respective sheath leg.

3. The construction according to claim **1** wherein the metal of said flange is deformed inwardly against the periphery of said sheath end to provide a mechanically rigid joint therebetween.

4. The construction according to claim **1** wherein a dielectric terminal block overlies the other side surface of said mounting flange and has an opening of a size to receive said sheath end and a coaxial reduced opening to pass said terminal pin, and means connecting said terminal block to said flange.

5. The construction according to claim **1** wherein a compressible bushing is held with said sheath end and has a portion extending therebeyond,

and wherein a terminal block has an opening extending from one side surface to the other, said one side surface of said block abutting said other side surface of said mounting flange and said block opening at said block one side surface being of a size to receive said sheath end and to form a shoulder with a reduced portion of said block opening,

the extending end of said bushing being compressed against said shoulder,

said terminal pin passing through the reduced portion of said block opening and headed over said other side surface of said terminal block to hold the latter assembled with said flange.

6. The construction according to claim **5** wherein the metal of said flange is deformed inwardly against the periphery of said sheath to provide a mechanically rigid joint therebetween.

7. The construction according to claim **1** wherein the inward deformation of said collar causes a reduction in the wall thickness of said collar and substantially effects a cold weld between the metals of said collar and said sheath.

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