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THERMOSTATICALLY CONTROLLED IMMERSION HEATER

Filed April 20, 1961

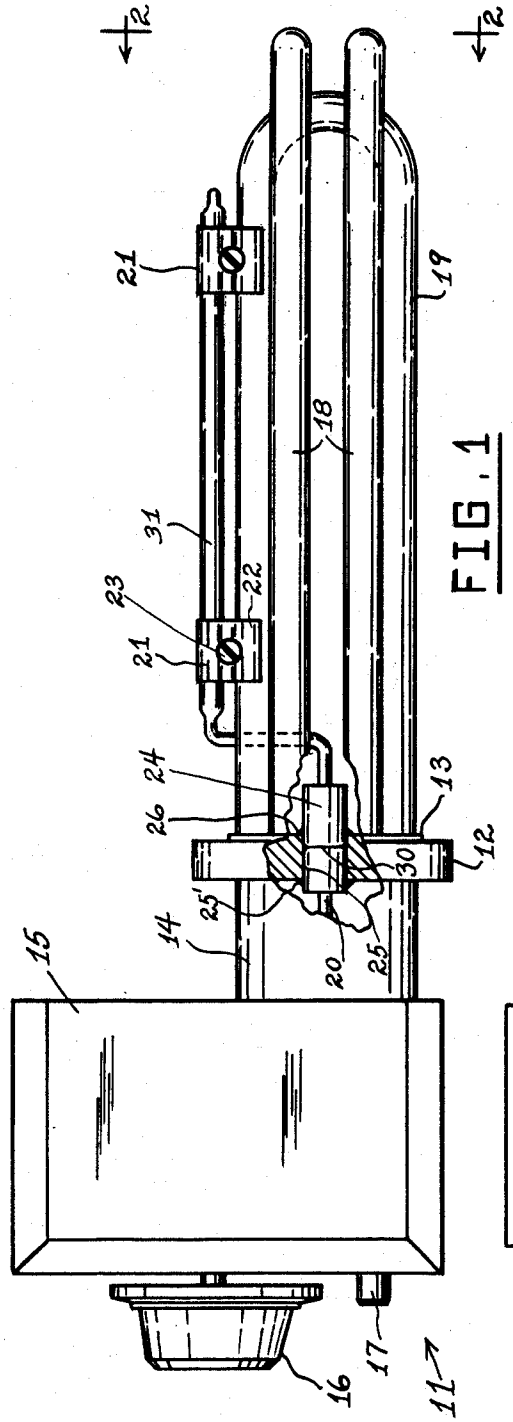

FIG. 1

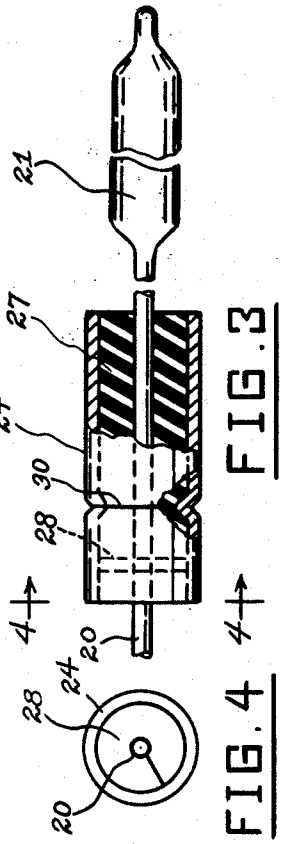

FIG. 3

FIG. 4

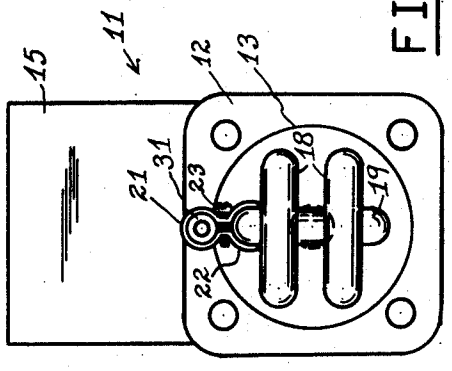

FIG. 2

INVENTOR.
JOHN J. FINN
BY Herman J. Gordon
ATTORNEY

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3,134,008 THERMOSTATICALLY CONTROLLED IMMERSION HEATER

John J. Finn, Rockville, Md., assignor to Electro-Therm, Inc., Silver Spring, Md.

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5 Claims. (Cl. 219—38)

This invention relates to electric heaters, and more particularly to an electric immersion heater of the thermostatically controlled type.

A main object of the invention is to provide a novel and improved thermostatically controlled electric immersion heater which is simple in construction, which is easy to assemble, and which provides a sealed mechanical connection between the supporting flange of the heater and the temperature-responsive element thereof.

A further object of the invention is to provide an improved thermostatically controlled electrical immersion heater assembly which is inexpensive to manufacture, which is mechanically rugged, and which is relatively compact in size.

A still further object of the invention is to provide an improved thermostatically controlled electrical immersion heater assembly which provides a thoroughly sealed and mechanically strong connection between the thermostat element thereof and the supporting flange of the assembly without requiring the use of threaded bushings or other threaded elements, whereby the assembly may be efficiently and economically manufactured.

Further objects and advantages of the invention will become apparent from the following description and claims, and from the accompanying drawings, wherein:

FIGURE 1 is a side elevational view, partly in vertical cross-section, of an improved thermostatically controlled electric immersion heater assembly constructed in accordance with the present invention.

FIGURE 2 is an end elevational view of the heater assembly of FIGURE 1, taken on the line 2—2 of FIGURE 1.

FIGURE 3 is an enlarged fragmentary elevational view, partly in vertical cross-section, of the thermostat element and its supporting conduit as employed in the assembly of FIGURES 1 and 2.

FIGURE 4 is a transverse cross-sectional view taken substantially on the line 4—4 of FIGURE 3.

Referring to the drawings, **11** generally designates an immersion heater assembly according to the present invention. The assembly **11** comprises a generally square main supporting flange **12** adapted to be sealingly secured over an aperture in the wall of a tank or similar vessel containing liquid to be heated. The flange is formed with a circular boss **13** around which a suitable sealing face plate or gasket, not shown, is adapted to be positioned. Suitably secured in and extending through the flange **12** at the boss **13** are the legs of a plurality of U-shaped heating elements of the type comprising tubular metal sheaths containing coiled resistance wires with compacted insulating heat-conductive material filling the spaces in the tubular sheaths, the ends of the wires being connected to suitable terminals provided at the ends of said legs. Said terminals extend into a spacer sleeve **14** secured between the flange **12** and a control box **15**. The control box **15** contains a conventional adjustable thermostatically controlled switch assembly through which connection is made from the power supply lines to the terminals of the heating elements, the switch assembly including a temperature setting knob **16** and a reset button **17**, whereby the switch assembly may be reset for operation subsequent to cooling after the heat-responsive controls of the switch have opened as a result of the rise in temperature in the associated tank to a value higher than a predetermined amount.

In the typical assembly illustrated, there are a pair of parallel heating elements **18**, **18** and a third heating element **19** arranged transverse to and disposed within the parallel U-shaped heating elements **18**, **18**.

The thermostatic switch in box **15** is provided with a capillary tube **20** connected to an elongated temperature sensing bulb **31** which is mounted on the uppermost leg of the vertical element **19** by means of a pair of spaced generally U-shaped metal clips **21**, **21** which receive the bulb and which are provided with opposing arcuate concave legs **22** embracing the upper leg of element **19** and clamped thereto by fastening screws **23**.

The capillary tube **20** extends axially through a generally cylindrical sheet metal sleeve **24** secured in a central aperture **25** provided therefor in flange **12**. The sleeve **24** is brazed to the opposite surfaces of the flange **12** as shown at **25'** and **26** to define a liquid-tight connection therewith. The tube **20** is sealingly secured axially in the sleeve by a mass of suitable potting compound **27**, such as epoxy resin material, capable of withstanding high temperature and pressure. A radially split flexible retaining washer **28** of fibre, or other suitable flexible material, is frictionally engaged in one end portion of sleeve **24** to aid in centering the tube **20** therein and to retain the potting compound when it is introduced into the sleeve in its liquid condition. An annular inwardly directed corrugation or crimp **30** is provided in the intermediate portion of sleeve **24**, serving as an anchoring means for the potting compound **27** after it has hardened.

The potting compound **27** provides a liquid and pressure-tight seal between the sleeve **24** and the capillary tube **20**, and supports the capillary tube in centered axial position in the sleeve. In prior construction, it has been necessary to provide relatively complicated and expensive sealing glands between the capillary tube and the flange, and it has been necessary to form internal threads in the aperture in the flange through which the tube passes in order to threadedly mount the outer bushings of the sealing glands. The present invention eliminates the necessity of providing threaded openings in the flange and of employing expensive sealing gland assemblies.

While a specific embodiment of an improved thermostatically controlled electric immersion heater assembly has been disclosed in the foregoing description, it will be understood that various modifications within the spirit of the invention may occur to those skilled in the art. Therefore it is intended that no limitations be placed on the invention except as defined by the scope of the appended claims.

What is claimed is:

1. A thermostatically controlled electrical heating unit comprising a supporting flange, a heating element mounted on said flange, a thermostat bulb mounted adjacent the element, a sleeve member open at its ends and rigidly secured in and extending through the flange in watertight relationship therewith, a capillary tube connected to the bulb and extending through the sleeve member, said bulb being outside the sleeve member and being arranged to be in direct contact with the fluid being heated by said heating element, a mass of relatively heat resistant potting compound in the sleeve member surrounding the tube and sealing the tube with respect to said sleeve member, and a thermostatic control means mounted on the flange and connected to the thermostat bulb by said capillary tube, said control means being operatively associated with the heating element to control the latter.

2. A thermostatically controlled electrical heating unit comprising a supporting flange, a heating element mounted on said flange, a thermostat bulb mounted adjacent the element, a sleeve member open at its ends and rigidly

secured in and extending through the flange in water-tight relationship therewith, a capillary tube connected to the bulb and extending through the sleeve member, said bulb being outside the sleeve member and being arranged to be in direct contact with the fluid being heated by said heating element, a mass of heat-resistant potting compound in the sleeve member surrounding the tube and sealing the tube with respect to the sleeve member, an inwardly projecting indentation in the sleeve member to anchor the potting compound, and a thermostatic control means mounted on the flange and connected to the thermostat bulb by said capillary tube, said control means being operatively associated with the heating element to control the latter.

3. A thermostatically controlled electrical heating unit comprising a supporting flange, a heating element mounted on said flange, a thermostat bulb mounted adjacent the element, a sleeve member open at its ends and rigidly secured in and extending through the flange in water-tight relationship therewith, a capillary tube connected to the bulb and extending axially through the sleeve member, said bulb being outside the sleeve member and being arranged to be in direct contact with the fluid being heated by said heating element, a mass of substantially heat-resistant potting compound in the sleeve member surrounding the tube and sealing the tube with respect to the sleeve member, an inwardly projecting annular corrugation formed in the sleeve member to anchor the potting compound, and a thermostatic control means mounted on the flange and connected to the thermostat bulb by said capillary tube, said control means being operatively associated with the heating element to control the latter.

4. A thermostatically controlled electrical heating unit comprising a supporting flange, a heating element mounted on said flange, a thermostat bulb mounted adjacent the element, a sleeve member open at its ends and rigidly secured in and extending through the flange in water-

tight relationship therewith, a capillary tube connected to the bulb and extending through the sleeve member, said bulb being outside the sleeve member and being arranged to be in direct contact with the fluid being heated by said heating element, an annular centering washer in the sleeve member surrounding the tube, a mass of heat-resistant potting compound in the sleeve member surrounding the tube and sealing the tube with respect to the sleeve member, and a thermostatic control means mounted on the flange and connected to the thermostat bulb by said capillary tube, said control means being operatively associated with the heating element to control the latter.

5. A thermostatically controlled electrical heating unit comprising a supporting flange, a heating element mounted on said flange, a thermostat bulb mounted adjacent the element, a sleeve member open at its ends and rigidly secured in and extending through the flange in water-tight relationship therewith, a capillary tube connected to the bulb and extending through the sleeve member, said bulb being outside the sleeve member and being arranged to be in direct contact with the fluid being heated by said heating element, an annular centering washer in the sleeve member surrounding the tube, a mass of heat-resistant epoxy potting compound in the sleeve member surrounding the tube and sealing the tube with respect to the sleeve member, an inwardly projecting annular corrugation formed in the sleeve member to anchor the potting compound, and a thermostatic control means mounted on the flange and connected to the thermostat bulb by said capillary tube, said control means being operatively associated with the heating element to control the latter.

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