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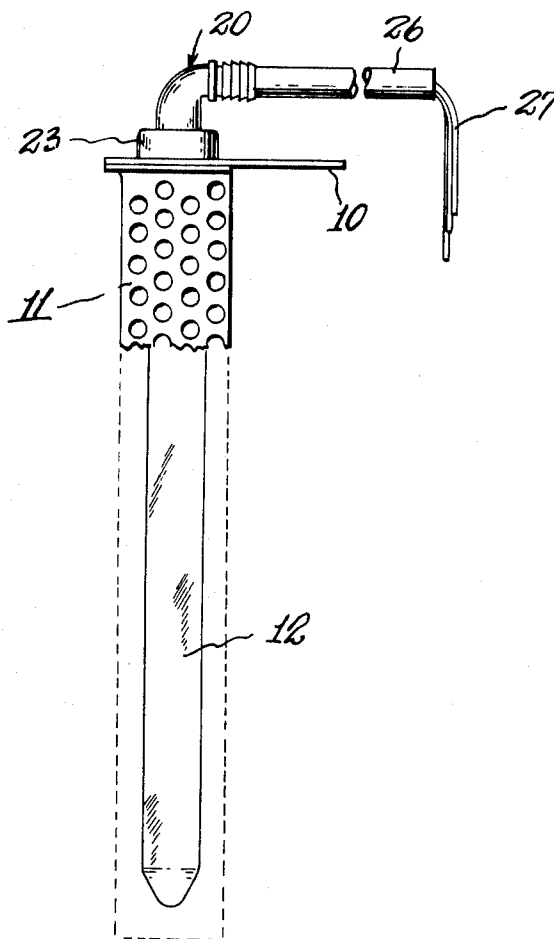
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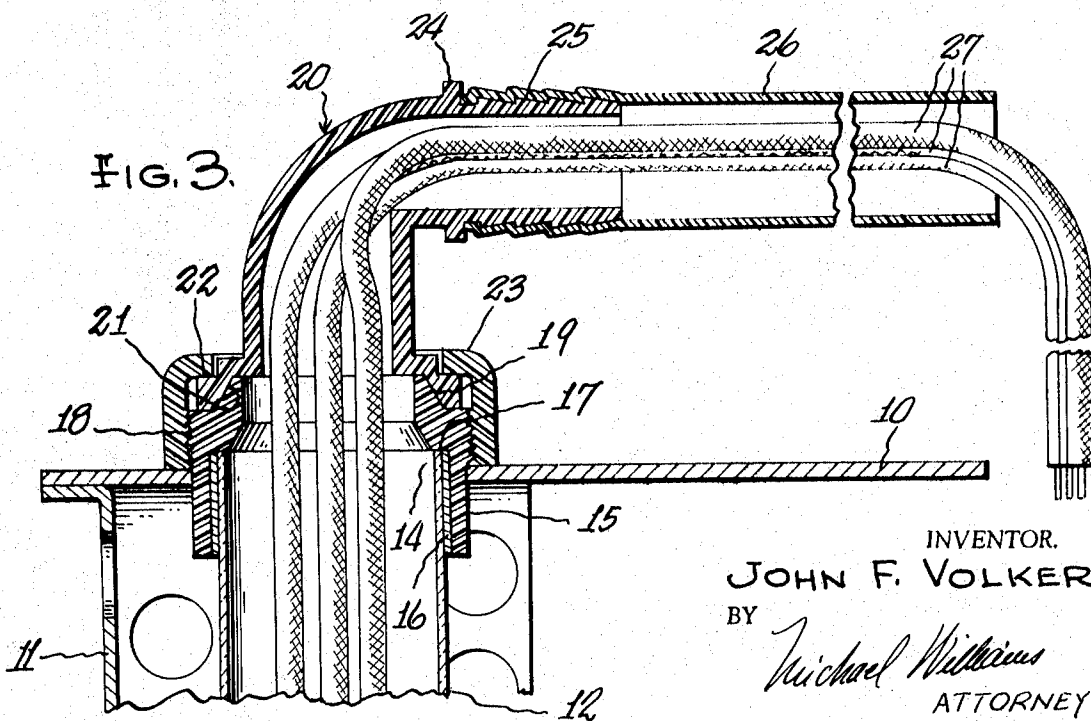
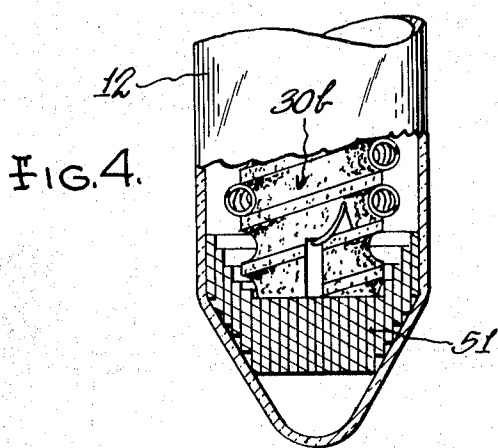
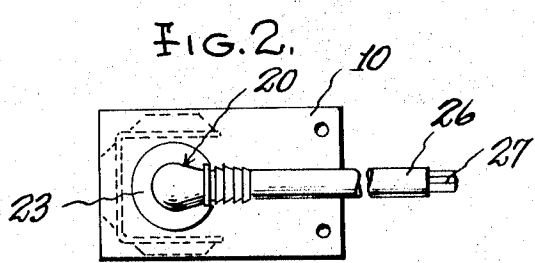
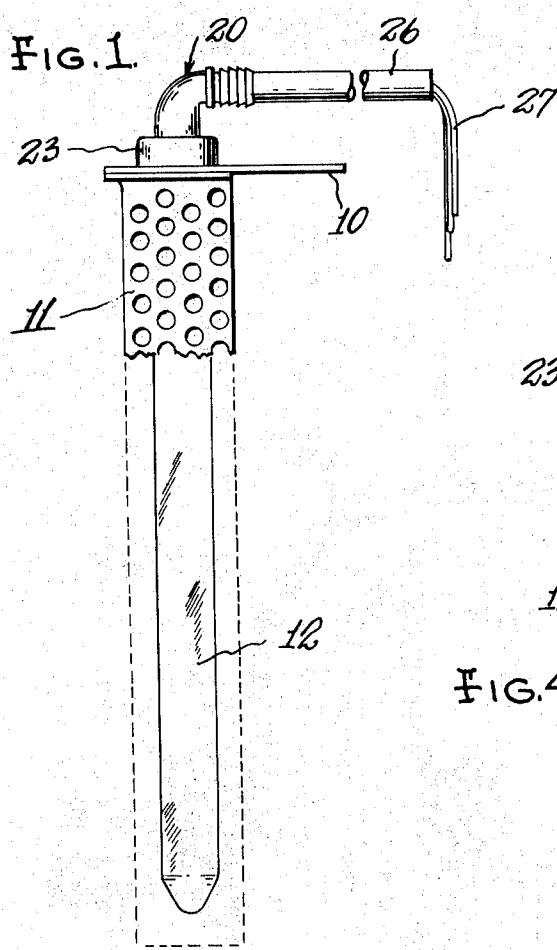
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[54] **ELECTRIC HEATING ELEMENTS**
10 Claims, 10 Drawing Figs.

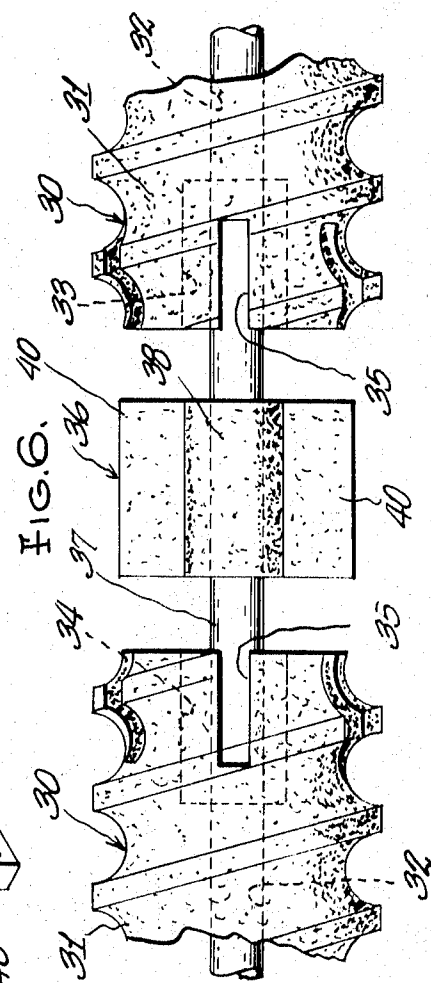
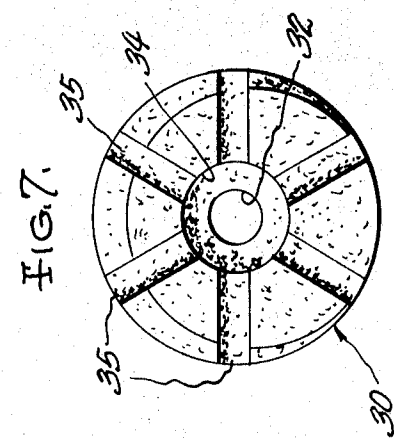
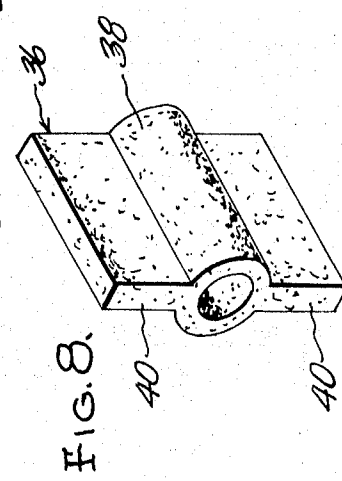
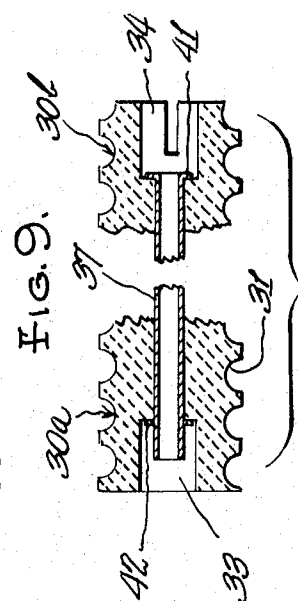
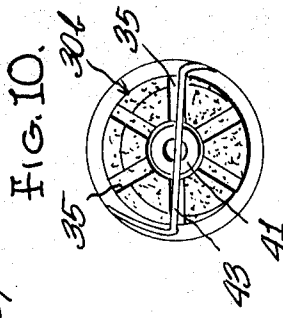
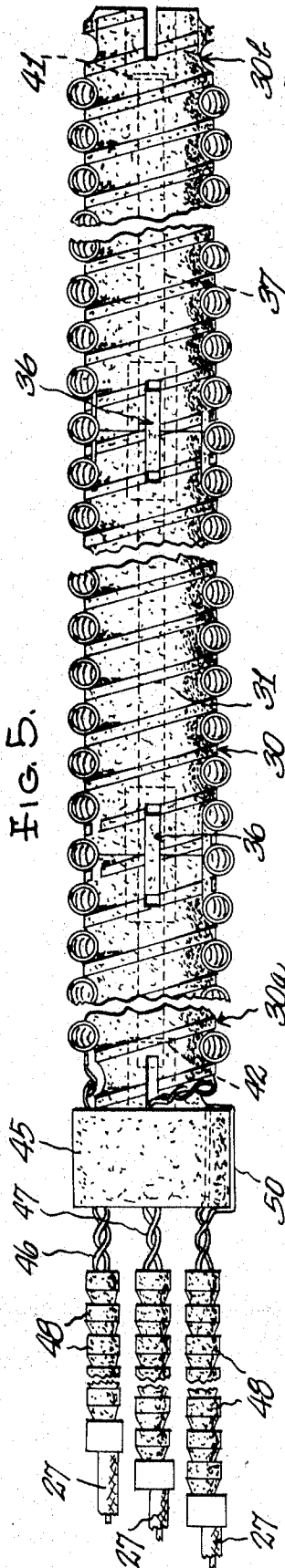
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ABSTRACT: An electric heating element within a quartz tube, the latter having a swivel head connected to one end. The heating element comprises a ceramic core on which a resistance wire is wound helically, the core being formed in sections, each section having a helical groove formed thereon for receiving the resistance wire, the core sections being relatively rotatable to align the helical grooves.





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ELECTRIC HEATING ELEMENTS

BACKGROUND AND SUMMARY

The heater of my invention is adapted to be immersed in a fluid under conditions wherein its terminal portion is exposed to vapors of the heated fluid, and therefore protection of the heater, and particularly the electrical connections thereto, presents a problem. The problem becomes more serious when an acid or similar liquid is heated. The portion of the heater which is immersed in the heated fluid is usually protected by means of a quartz tube which withstands the corrosive effects of the fluid, and my invention provides a vapor-tight swivel head which protects the electrical connections from corrosive action of the vapors given off by the heated fluid.

My invention also provides an electric heating element which may be of considerable length. A ceramic core supports a resistance wire which is disposed in a helical groove on the periphery of the core. It has been found that a ceramic core may be formed only to a predetermined length without sagging longitudinally, and therefore for long length heaters, I propose to make the core in sections, with each section formed with a helical groove, and with the sections relatively rotatable for alignment of the helical grooves.

It is therefore an object of my invention to provide new and improved electric heaters of the type above mentioned.

DESCRIPTION OF THE DRAWINGS

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

FIG. 1 is a side elevation of an electric heater, illustrating an embodiment which my invention may assume, parts being broken away,

FIG. 2 is a top plan view of the heater,

FIG. 3 is an enlarged, fragmentary longitudinal section of the top portion of the heater,

FIG. 4 is a broken sectional view of a lower portion of the heater,

FIG. 5 is a broken elevational view of the core assembly of the heater,

FIG. 6 is an enlarged, fragmentary view of a detail,

FIG. 7 is an end view of a core section seen in FIG. 6,

FIG. 8 is a perspective view of a key member,

FIG. 9 is a broken, sectional view of the core assembly, and

FIG. 10 is a view of the right-hand end of the heater shown in FIG. 5.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The heating element herein disclosed is carried by a mounting plate 10 by means of which it is supported in a tank or vat (not shown). A perforated guard 11 is secured to the plate 10 to protect the tube 12 which is usually made of quartz or the like, and therefore is fragile. The guard is usually made of metal and is coated with plastisol or the like to resist corrosive action of the fluid in the tank. The tube is adapted to be immersed in the fluid within the tank and therefore has its lower end closed, as best seen in FIG. 4.

The upper end of the tube 12 is open, as seen at 14 in FIG. 3, and a collar 15 surrounds this upper end and is cemented thereto, as by the epoxy seal 16, to seal the collar to the tube. The collar has an internal shoulder 17 against which the extremity of the tube open end abuts to position the latter. External screw threads 18 are formed on the collar, and a conical portion 19 extends upwardly beyond the threads.

The collar 15 is preferably formed of a plastic material which resists corrosive action of the vapors of the heated fluid within the tank, and may be formed of polyvinyl chloride, polypropylene, or the like. As seen in FIG. 3, the collar 15 extends through an opening in the plate 10, the fit between the parts permitting the collar and attached quartz tube 12 to be lifted from the plate.

A conduit member 20 has a cone-shaped recess 21 complementary to the conical portion 19, and a shoulder 22 against which the inside surface of a cap 23 is brought to bear when the internal threads on the cap are threaded home on the external threads on the collar 15. The cap forces the surfaces of the cone-shaped recess and the conical portion in vapor-tight engagement, but permits swivel action of the conduit member. The conduit member and the cap are also formed of plastic material, preferably compatible with the material of the collar 15.

As seen in FIG. 3, the conduit member has a portion coaxial with the collar (that portion in which the cone-shaped recess is formed) and a portion 24 at right angles to the coaxial portion. The portion 24 terminates in an end which is formed with peripheral steps 25, one end of a plastic tube 26 being forced over the steps, and cemented if necessary. The tube 26 is of considerable length and protects the conductors 27 from corrosive action of the vapors of the heated fluid in the tank. As seen in FIG. 3, the conductors extend through the open end of the quartz tube 12, through the collar 15, and through the conduit member and connected tube 26, and therefor are afforded adequate protection. It will be appreciated that the open end of the tube 12 is not subjected to stress in the assembly, and therefore is not subject to breakage at this point. The entire heater assembly may be removed from the tank by application of a lifting force to any part of the assembly above the plate 10.

The parts above described make assembly of the heating element, and its lead wires, with the quartz tube and the collar 15 and conduit member 20, a relatively simple operation. Although the cap 23 maintains a vapor-tight seal between the conical recess 21 and the conical portion 19, the conduit member may be rotated to dispose the plastic tube in any desired position relative to the tank. The swivel connection provides a low profile so that no parts project to interfere with operations at or near the tank.

The electric heating element (see FIG. 5) generally comprises a resistance wire wound helically about a ceramic core, it has been noted that ceramic cores may only be made to predetermined lengths, without sagging longitudinally. Since the cores in immersion heaters of the type herein disclosed are usually of considerable length, the ceramic core in the present embodiment is made in longitudinal sections, preferably identical in construction.

Each core section 30 is formed with a helical groove 31 on its exterior surface, and a central opening 32 with enlargements 33 and 34 at opposite ends. Each end of a core section is provided with a plurality of diametrical slots 35, and a key member 36 is adapted to fit the slots of adjoining core ends to hold the core sections against rotation.

An elongated supporting member, such as the metal tube 37, extends through the central openings of the core sections, and through a tubular part 38 of the key member 36, with a key member interposed between each pair of adjoining core sections.

The core sections may be axially separated, as shown in FIG. 6, to clear the key member 36, whereby the core sections may be relatively rotated to line up the helical grooves of the core sections and thereby provide a regular helical groove throughout the entire length of the ceramic core. With the helical grooves lined up, the core sections are moved axially along the tube 37 so that diametric flanges 40-40 on the key member enter mating slots 35 on the adjoining ends of the core sections. The tube 37 has a head 41 bearing against the bottom of the opening enlargement 34 in the lower end core section 30b, and a spring toothed washer 42 may be inserted over the tube end to bear against the bottom of the opening enlargement 33 in the upper core section 30a, to hold the core sections against axial separation.

In the disclosed embodiment, the ceramic core is provided with a double helical groove, so that one resistance wire (coiled as shown) is wound in one helical groove, from core section 30a to core section 30b, and a straight span 43 of re-

sistance wire is disposed through a cross slot 35, and the coiled resistance wire is then wound in the other helical groove from the core section 30b to the core section 30a.

A ceramic plug 45 bears against the free end of the core section 30a and has holes to pass the two terminal wires 46, 47 connected to respective ends of the resistance wire, these terminal wires passing through insulating beads 48 and being connected to the lead wires 27. One of the lead wires 27 provides a ground, and is connected to a wire 50 which passes through a hole in the plug 45 and has an exposed portion along the sidewall of the plug, as seen in FIG. 5.

The core assembly, with resistance wire thereon and leads attached to the latter, may be easily inserted into the quartz tube 12. Preferably a stopper 51 formed by a winding of strip asbestos, is first inserted into the quartz tube, and this winding is deformed by the inner end of the core assembly to form a nest (see FIG. 4) for cushioning the core assembly at this point.

I claim:

1. An immersion heater, comprising a quartz tube adapted to be immersed in a fluid to be heated, the inner end of said tube being closed and the outer end being open, a heating element in said tube, a plastic collar around and cemented to the tube open end, said collar having exterior screw threads and a coaxial conical surface, a plastic conduit member having a conical recess complementary to and interfitting with the collar, conical surface and also having an annular shoulder, such conical surface and shoulder being formed in a portion of said conduit member which is coaxial with said collar, and said conduit member having a portion extending angularly from said coaxial portion, a plastic cap having internal screw threads interfitting with the threads on said collar to draw said cap down on said shoulder and urge the interfitting conical surfaces to tight engagement, said heating element having terminals which extend outwardly of said tube open end and through said collar and said conduit member.

2. The construction of claim 1 wherein said heating element comprises an electric resistance wire wound helically on a ceramic core, the inner end of said core being adjacent the closed end of said quartz tube, said core being formed of a plurality of axially aligned sections, each having a helical groove for receiving said resistance wire, said core sections being relatively rotatable to align the groove in one section with the groove in an adjoining section, and a key member between adjoining sections for holding the same against rotation.

3. An electric heating element, comprising a ceramic core, an electric resistance wire wound helically on said core, the latter being formed in axially aligned sections, each section having a helical groove for receiving said resistance wire, said core sections being relatively rotatable to helically align the groove in one section with the groove in an adjoining section, adjoining ends of said core sections being formed with a plurality of radially extending slots and a key member between said adjoining ends and fitting into respective slots therein which are matched to provide helical alignment of the grooves

in said core sections, said key member thereby holding the latter against rotation.

4. The construction according to claim 3 wherein each core section has a longitudinal central opening, a supporting member extending through the central openings of all core sections, said key member also having a central opening through which said supporting member extends, said core sections being slidable longitudinally on said supporting member to clear said key, whereby said sections may be relatively rotated to align the grooves thereon, the aligned core sections being movable toward each other to engage said key member in matched slots in said core ends.

5. The construction according to claim 4, wherein said supporting member is in the form of a rodlike member having heads at opposite ends to hold said core sections against longitudinal separation.

6. An immersion heater, comprising a tube having an open end, an electric heating element in said tube, a tubular collar having a portion encompassing and secured to said tube open end and a conical portion extending from said tube open end, a conduit member having an internal conical surface mating with said collar conical portion, said conduit member being elongated so that its other end is disposed an appreciable distance from said collar, and a cap nut encompassing said conduit member and said collar in the vicinity of said mating conical portion and conical surface, said cap nut having a cap portion bearing against said conduit member and a skirt portion threaded on threads on the exterior of said collar, said cap nut being adapted to draw said mating conical portion and conical surface in tight interengagement, said heating element having terminals which extend outwardly of said tube open end, through said collar and said conduit, and outwardly of said other end of said conduit member.

7. The construction according to claim 6 and further including a horizontal support plate for the immersion heater, said plate having an opening through which said tube and collar freely extend in vertical manner, the free end of said cap nut skirt bearing against the upper surface of said support plate to suspend said heater.

8. The construction according to claim 6 wherein said tube is formed of quartz and said collar, conduit member and cap nut are formed of dielectric material which will resist the corrosive action of fluids heated by said heater.

9. The construction according to claim 6 wherein the opposite end of said tube is closed, and wherein said electric heating element comprises a resistance wire wound on an elongated ceramic core, said heating element being disposed within said tube with said resistance wire spaced from the interior surface of said tube, said core having an end abutting the closed end of said tube.

10. The construction according to claim 9 wherein insulating material is disposed within said tube at its closed end, said insulating material having a recess for receiving said core end to center such end.