Aug. 8, 1961 A. W. KAWALLE 2,995,646

REMOVABLE TYPE ELECTRIC HEATING ELEMENT

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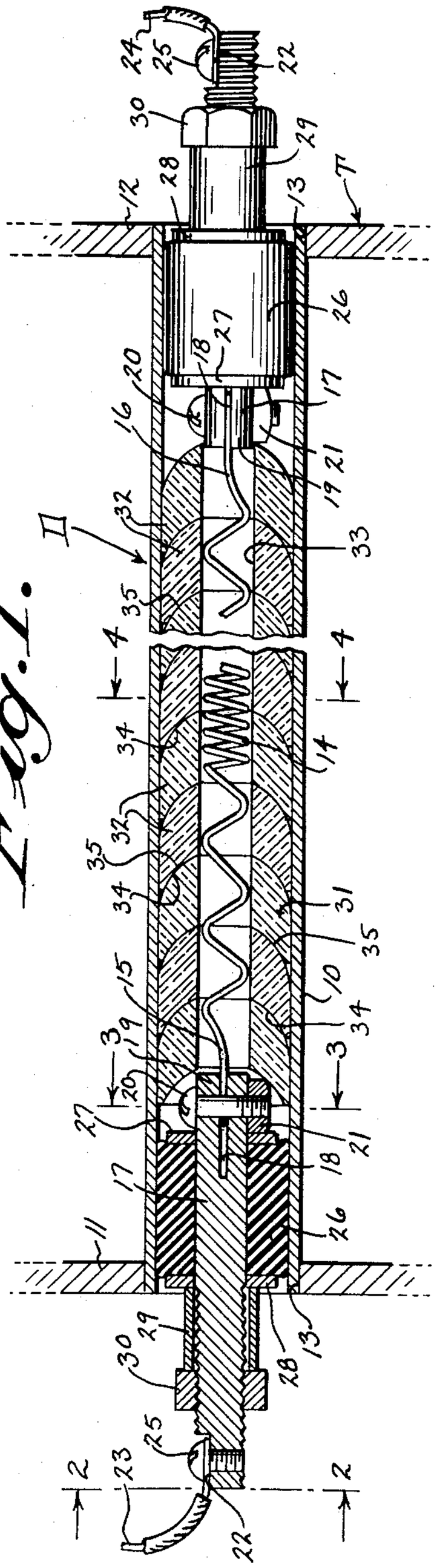

Fig. 1.

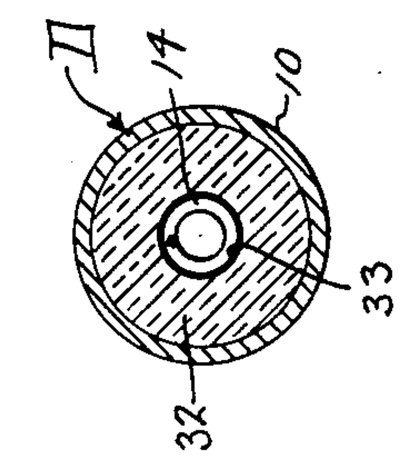

Fig. 4.

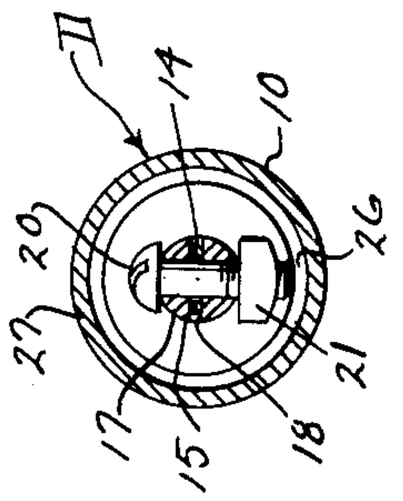

Fig. 3.

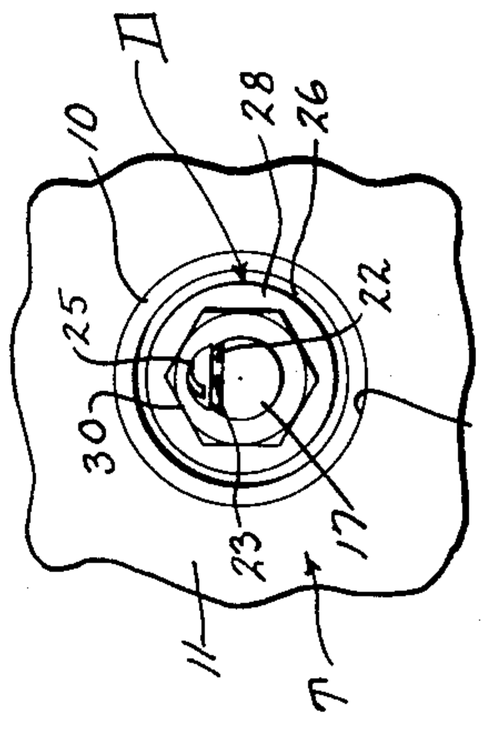

Fig. 2.

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Fig. 5.

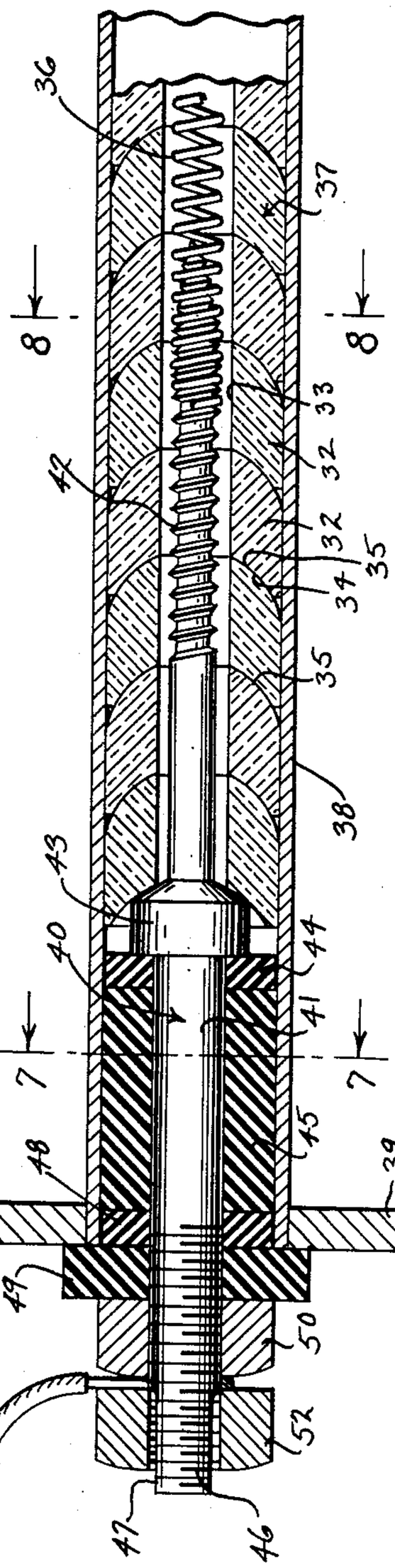


Fig. 8

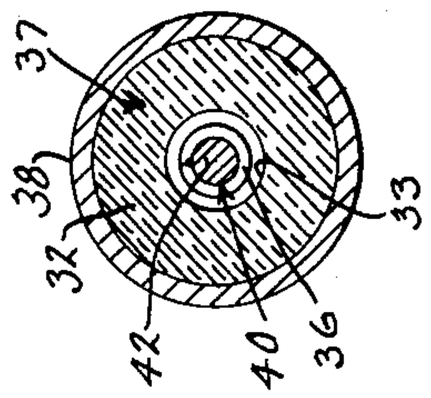


Fig. 7.

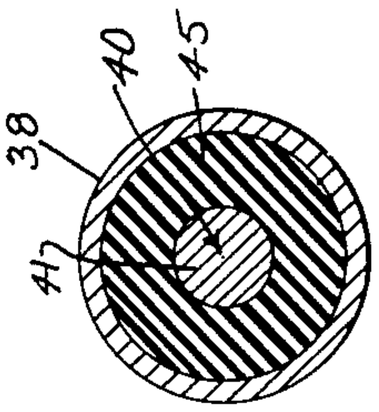
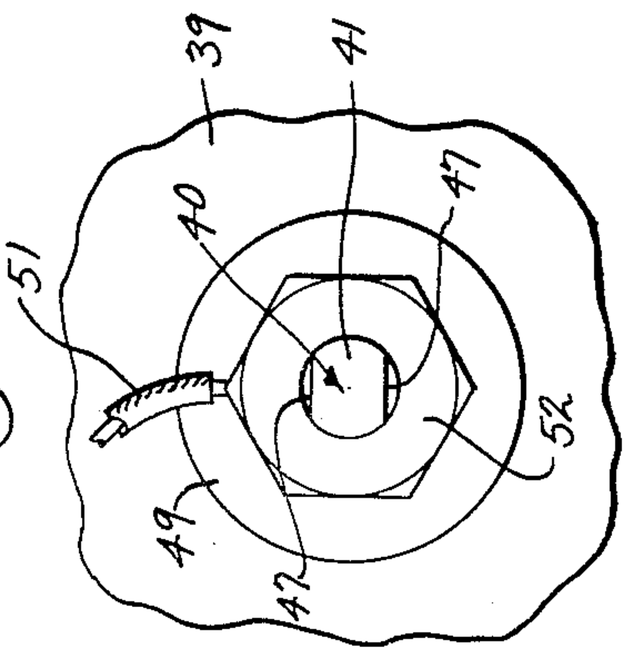


Fig. 6.



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REMOVABLE TYPE ELECTRIC HEATING ELEMENT

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2 Claims. (Cl. 219—38)

This invention appertains to electric heating elements and mountings therefor, and more particularly to a removable, horizontal type electric heating element for water tanks and other installations.

One of the primary objects of my invention is to provide means for sealing and supporting an electric heating element within a protecting tube, whereby the following advantages will be had: (1) the heating element will operate within a non-oxidizing atmosphere; (2) will prevent the attraction of moisture to the electric element and its adjuncts so that electric shorts from condensation will be prevented, and, (3) whereby the heating element can operate at a pressure higher than gravity and thus promote better heat conductivity.

Another salient object of my invention is to provide means whereby the heating element can be quickly removed and replaced without disturbing the mounting of the protecting tube so that different characters of elements can be interchangeably used and so that burned out elements can be readily replaced.

A further important object of my invention is the provision of novel end mountings for the heating element embodying terminal connector studs or bolts for firmly receiving the ends of the element and for supporting expansion plugs of non-electric material for tight sealing engagement with the inner surfaces of the protecting tube, with means for expanding the plugs on the terminal studs or bolts, the terminal studs or bolts having means at the outer ends thereof for connection with electric lead wires.

A still further object of my invention is the provision of a novel sectional insulator for receiving and protecting the heating element and for extending from one terminal stud or bolt to the other, the insulator engaging the inner surface of the protecting tube, whereby to prevent accidental engagement with the tube and heating element.

A still further important object of my invention is to provide an electric heating element and mounting therefor, which will be durable and efficient in use, one that will be simple and easy to manufacture, and one which can be placed upon the market at a reasonable cost.

With these and other objects in view, the invention consists in the novel construction, arrangement and formation of parts, as will be hereinafter more specifically described and claimed, and illustrated in the accompanying drawings, in which drawings,

FIGURE 1 is a longitudinal sectional view through my improved electric heating device, the same being shown mounted within a tank for heating hot water or other liquids;

FIGURE 2 is a fragmentary end elevational view of the improved electric heating device, with a part in section, the section being taken on the line 2—2 of FIGURE 1, looking in the direction of the arrows;

FIGURE 3 is a transverse sectional view through the electric heating device taken on the line 3—3 of FIGURE 1, looking in the direction of the arrows, and illustrating the novel means of clamping one end of the electric heating element to a terminal stud or bolt;

FIGURE 4 is a transverse sectional view through the electric heating device taken on the line 4—4 of FIGURE 1, looking in the direction of the arrows, the view illustrating, more particularly, the novel insulator and protector for the heating element;

FIGURE 5 is a fragmentary longitudinal sectional view showing a modified form of mounting for the electric heating element;

FIGURE 6 is an end elevational view of the form of the electric heating element shown in FIGURE 5;

FIGURE 7 is a transverse sectional view taken on the line 7—7 of FIGURE 5, looking in the direction of the arrows, the view showing the mounting of the expansion plug on the terminal stud or bolt, and

FIGURE 8 is a transverse sectional view taken on the line 8—8 of FIGURE 5, looking in the direction of the arrows, showing the novel insulator and the modified form of connecting the electric heating element with the terminal stud or bolt.

Referring to the drawings in detail, wherein similar reference characters designate corresponding parts throughout the several views, the letter D generally indicates my improved heating device, and the same includes an elongated protector tube **10** formed from heat conducting material, such as copper. The tube **10** should also be of a character that will not corrode when immersed in liquids. In FIGURE 1, I have shown one use of the electric heating device, namely, within a tank T for heating liquids. As shown, the tank T includes opposite side walls **11** and **12**. In the showing, I have illustrated a straight tube, but it is also to be understood that the tube can be of an arcuate shape should such be desired. It is to be also understood that the use of the electric heating device is not limited to hot water heaters, but also can be effectively used in baseboards for heating rooms and buildings.

Where the heating device D is used with a tank T the terminals of the tube **10** are welded or otherwise rigidly secured in liquid tight engagement with the walls **11** and **12** of the tank. The terminals of the tube extend through openings **13** in said walls and due to the construction and arrangement of my device, the terminals of the tube can end flush with the outer surface of the walls of the tank.

Mounted within the tube **10** is an electric heating element **14** and this element is preferably coiled to increase the efficiency thereof with the terminals **15** and **16** thereof stretched substantially straight, for a purpose which will later appear. The heating element **14** can be of various characters and types according to the voltage and wattage of the current being used and the work to be done. Arranged at the ends **15** and **16** of the heating element **14** and at the ends of the tube **10** are centrally disposed electric conducting terminal studs or bolts **17**. The inner ends of the bolts are bifurcated or slotted, as at **18**, to provide clamping jaws **19** which receive therebetween the stretched terminals **15** and **16** of the heating elements **14**. Headed bolts **20** are passed diametrically through the slotted ends of the terminal studs or bolts and the ends of the heating element can be hooked or coiled around the intermediate portions of the bolts **20**. Nuts **21** are threaded on the bolts and can be tightened into intimate contact with the inner slotted ends of the bolts **17** so as to force the jaws **19** into intimate gripping contact with the ends of the heating element. The outer ends of the terminal bolts **17** can be threaded and provided with a flattened portion **22** for receiving the inner ends of electric conducting lead wires **23** and **24**, which can lead to any suitable source of electrical energy. Headed screws **25** threaded into the ends of the terminal bolts **17** can be utilized for holding the inner ends of the lead wire in electrical engagement with the terminal studs or bolts **17**.

Mounted upon the terminal studs or bolts **17** are expansion plugs **26** formed from non-electric conducting material. The inner ends of the plugs can rest against washers **27** placed on said terminal studs or bolts **17**, and

these washers rest against nuts **21** and limit the inward movement of the washers **27** and the expansion plugs on said terminal bolts or studs **17**. The plugs **26** have a normal diameter substantially equal to the internal diameter of the tube **10** so that the plugs can be slipped into the ends of the tube. Also mounted on the terminal studs or bolts **17** are outer washers **28** which engage the outer faces of the plugs **26**. Spacer sleeves **29** are placed on the terminal studs against the washers **28** and these spacer sleeves are engaged by adjusting nuts **30** threaded on the terminal studs or bolts **17**.

By tightening the nuts **30** it can be seen that the plugs **26** can be compressed longitudinally and thus bring about the expansion thereof circumferentially. The expansion of the plugs permits the tight sealing thereof with the inner surface of the tube **10**.

The heating element **14** is protected by a novel insulator **31** preferably formed of refractory material. This insulator **31** includes a plurality of independent sections **32** all of the same shape and design. Each section is provided with an axial bore **33** which receives the heating element **14**. One face of each section is concaved, as at **34**, and the opposite face is of a convex shape, as at **35**, and one face of one section fits within the adjacent face of an adjoining section. The ends of the insulator **31** fit against and engage the terminal studs or bolts **17**.

In assembly, one end of an electric heating element **14** is secured to its terminal stud or bolt **17** after which the sections of the insulator **31** are threaded over the heating element and the heating element with the insulator and with the plugs are slipped into the tube **10** through one end thereof. After these parts are correctly placed within the tube, then the nuts **30** are tightened.

It can be seen that the heating element is confined within an air tight chamber and hence the creeping of moisture into the tube is prevented and corrosion is eliminated. As the element is sealed within the tube the same operates in a non-oxidizing atmosphere.

It can be seen also that the construction is such that the heating element can be quickly removed from the tube and replaced when so desired.

By stretching the ends **15** and **16** of the heating element **14** temperature is reduced at the terminal posts **or bolts 17.**

It is to be noted that the nut **21** and the bolt **20** not only function to draw the jaws **19** of the terminal studs or bolts **17** into gripping contact with the ends of the heating element, but also as stops for the washer **27** and the expansion plug **26**.

In FIGURES 5 to 8, inclusive, I have shown a modified form of terminal support for the heating element.

In this form, the heating element, now indicated by the reference character **36**, does not have the ends thereof stretched, and consequently, the heating element **36** is a continuous coil from one end to the other. The heating element is confined and protected by an insulator **37** of the same type and character as the insulator **32** and the insulator **37** and heating element **36** is confined within the protector tube **38**. This tube is in turn rigidly secured to a desired support, such as a wall **39** of a water tank.

Extending axially within the tube **38** and into the bore of the insulator **37** is a terminal stud or bolt **40**. This terminal stud or bolt includes a cylindrical body portion **41** and a pointed threaded shank **42**. This shank is in the nature of a screw and its diameter is such that the same can be threaded into an end of the heating element **36**. The threads of the shank are so formed as to receive and hold the coils of the heating element. The body portion **41** and the shank **42** are separated by an annular enlargement or head **43**, which constitutes a stop for an insulating washer **44** and an expanding resilient plug **45**. The plug **45** and the washer **44** are provided with bores and are slipped on the body portion **41**. The

outer end of the body portion is provided with threads **46** and this threaded end protrudes beyond the tube **38**. The extreme end of the threaded portion of the body is preferably flattened on at least one side, as at **47**, for a purpose which will later appear. The body portion **41** also has slipped thereon an insulating washer **48** of the same type and character as the washer **44** and hence the expansion plug **45** is confined between the washer **44** and the washer **48**. In this form of my invention, I employ an insulating plate or washer **49** of a greater diameter than the washer **48** and this washer **49** engages the outer surface of the wall **39** and the outer edge of the tube **38**. An adjusting nut **50** is threaded on the body portion **41** against the washer **49** and by tightening the nut **50** the terminal stud or bolt can be drawn outwardly to compress the plug **45** longitudinally and thus bring about the radial expansion thereof so that the plug will tightly engage the inner surface of the tube **38** and hold the assembly sealed within the tube. A lead in wire **51** is placed on the bolt and the flattened surface **47** tends to prevent the turning thereof and this lead in wire is held in intimate contact with the nut **50** by means of a second nut **52** threaded on said terminal stud or bolt **40**.

In this form, it can be seen that I have provided means for permitting the quick association of the heating element **36** with the terminal stud or bolt.

Various changes in details may be made without departing from the spirit or the scope of this invention, but what I claim as new is:

1. In a tank for heating liquids having side walls provided with aligned openings and an electrical heating element for the liquid of the immersion type including, a heat conducting tube having its opposite ends open and disposed within said openings in liquid tight engagement therewith, the outer ends of said tubes being flush with the outer surface of said walls, an electric heating element within said tube, means for sealing the element within said tube including end terminal studs having their inner ends extending into the tube and their outer ends disposed externally of the tube, means securing the ends of the element to the inner ends of the terminal studs, expansion plugs fitted on said studs, means for limiting inward movement of the plugs on the studs, means on the outer ends of the studs for contracting the plugs longitudinally and for expanding the plugs radially into intimate sealing contact with the inner surface of the tube, an insulator disposed within said tube and extending from one terminal stud to the other having an axial bore receiving said heating element, said insulator engaging the inner surface of the tube and including a plurality of like mating sections with each of said sections including a concave face and a convex face, and means for electrically connecting lead wires to the outer ends of the studs.

2. In an electric heating device, a heat conducting tube, a coiled electric heating element disposed axially within the tube, a terminal stud extending into said tube and having a body portion and a pointed threaded shank, said shank being adapted to be threaded into the coils of the element for supporting the element, a stop head formed on the stud between the body portion and shank, an expansion plug on the body portion disposed within the tube and limited in its inward movement by said head, an insulator disposed within said tube and extending from one terminal stud to the other having an axial bore receiving said heating element, said insulator engaging the inner surface of the tube and including a plurality of like mating sections with each of said sections including a concave face and a convex face, a washer on the outer end of said stud for the expansion plug, and a nut threaded on said stud and against said washer for contracting the plug longitudinally and expanding the plug radially into intimate sealing contact with the tube upon adjustment of said nut.

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