

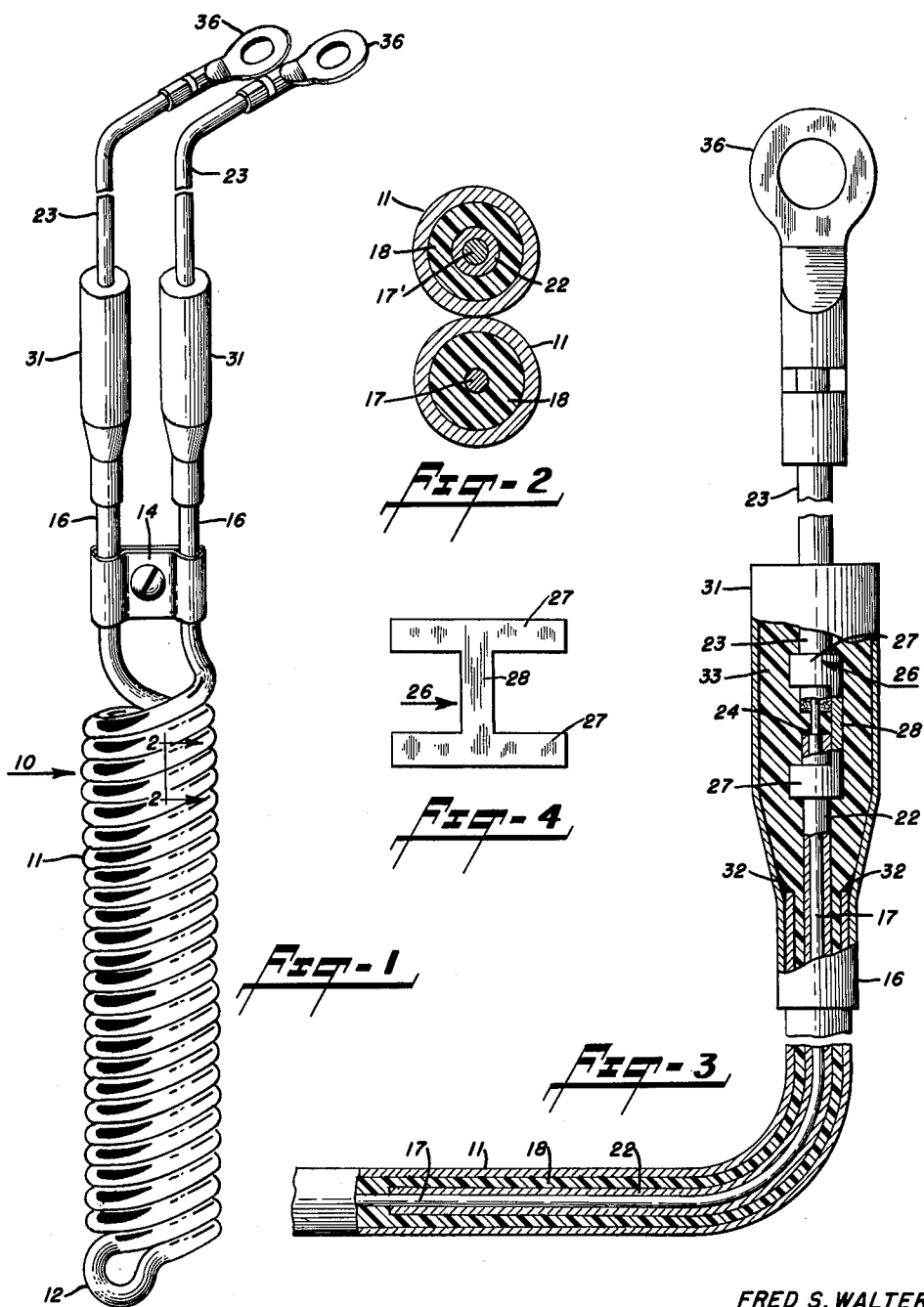
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ELECTRICAL CONNECTION FOR A RESISTANCE HEATER

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ELECTRICAL CONNECTION FOR A RESISTANCE HEATER

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This invention relates to sheathed electrical heaters and more particularly to a resistance heating element terminating means.

Sheathed electrical heaters comprise an electrical resistance wire coaxially positioned within a metallic tubular sheath, and an intermediate tube or packing of insulating material separating the wire and sheath. With the resistance heating element completely sheathed, the heater may be used under any environmental conditions which the sheath is capable of withstanding. Thus, with a stainless steel sheath, the heater may be used in most liquids or an oxidizing atmosphere, for example, without deleterious effects. One class of heaters of the type to which this invention is directed is known as an "immersion" heater, adapted for immersion into a liquid for heating the same.

Often, it is desired to terminate the heating effect of the resistance heating element at a point within the outer protective sheath to prevent undesirable heating of the entire sheath to the ends thereof. Heretofore, to accomplish this, the heater element has been terminated within the sheath, at the desired point, and connection to a low resistance lead wire made to the end of the said heating element. In prior arrangements, however, this connection between the heater element and lead wires often fails. It is, accordingly, the purpose of this invention to provide a good electrical and mechanical connection to the heater element to effectively terminate the heating effects of the said heating element at a desired point within the protective sheath.

In accordance with my invention, the resistance heating element is not physically terminated within the sheath but, instead, extends outwardly from the sheath end. In order to eliminate the heating effect of the resistance heating element adjacent the ends thereof, I secure a low resistance metallic tube to each of the end portions of the element which are fitted therein, which tube may terminate at one end within the sheath. Electrical connection to suitable lead wires is made adjacent the outer free ends of the said tubes and outside of the sheath. In this manner, the heating effect of the resistance heating element is effectively eliminated along the end sections thereof over which the metallic tubes extend since most of the electrical current will flow through the low resistance tube rather than the resistance heating element.

An object of this invention is the provision of an immersion heater, of the class comprising a resistance wire enclosed within a protective sheath, wherein the heating of the normally exposed portion of the sheath is reduced to a minimum.

An object of this invention is the provision of a novel electrical termination for the resistance element of an electrical heater which termination is not subject to failure.

An object of this invention is the provision of an electrical termination for a resistance heating element, which termination comprises a low resistance, metallic tube coaxially secured to the heating element adjacent one end thereof and which tube is connected to the external lead wire.

These and other objects and advantages of the invention will become apparent from the following description when taken with the accompanying drawings. It will be

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understood that the drawings are for purposes of illustration and are not to be construed as defining the scope or limits of the invention, reference being had for the latter purpose to the appended claims.

In the drawings wherein like reference characters denote like parts in the several views:

FIGURE 1 is an isometric view of one type of electrical heater embodying this invention;

FIGURE 2 is an enlarged, transverse, cross-sectional view taken on line 2-2 of FIGURE 1;

FIGURE 3 is an enlarged, fragmentary view with parts cut away and parts in section, showing the construction for effectively terminating the heating element within the outer sheath; and

FIGURE 4 is a plan view of an H-clamp before bending into the position shown in FIGURE 3.

Reference is first made to FIGURE 1 of the drawings wherein the heater, designated by the numeral 10, is shown comprising an outer tubular sheath 11 formed with a reverse bend, as at 12, and with adjacent halves of the sheath positioned in an abutting relation and wound in the form of a bifilar helical coil. The free ends of the sheath 11 are spaced apart by a clamping means 14, with the end portions, designated 16, 16, extending in a generally parallel manner longitudinally of the coil axis.

Referring, now, also to FIGURES 2 and 3, a resistance heating element comprising a wire 17, made of a nickel-chromium alloy, or the like, for example, is coaxially located within the sheath 11 and separated therefrom by insulating means 18 of ceramic, an inert metal oxide, or the like. In order to prevent the undesirable heating of the end portions 16, 16 of the sheath, it is common practice to terminate the resistance wire 17 within one of the upper convolutions thereof and, heretofore, in prior art arrangements, the termination of the resistance heating wire with low resistance lead wires within the sheath has been one of the weakest points in the overall construction of the device, with frequent failures of such terminal points.

In accordance with my invention, the resistance heating wire 17 effectively is terminated by means of a sleeve 22 which extends over the end portion of the heating wire and its inner end may be within one of the outer or upper convolutions thereof. The sleeve 22, which is coaxial with the wire 17, is preferably swaged thereto to provide a good mechanical and electrical connection therebetween. The sleeve, which may be made of nickel, or the like, is relatively thin with the outside diameter thereof being only slightly larger than the wire diameter. With this construction, adequate insulation remains between the sleeve and metallic sheath 11 to prevent short circuiting therebetween. That section of the sheath containing the sleeve 22 remains as easily bendable as the remainder thereof, and the bending or curving thereof does not result in failure of the connection. The sleeve 22 is made of material having a lower resistivity than the heating wire 17, which resistivity is sufficiently low for minimum heating thereof with the flow of the heater current there-through.

Any suitable means may be employed for making electrical connection to the sleeves 22, 22 which extend from the ends of the sheath 11. As best seen in FIGURE 3, the sleeve 22 terminates at the end of the heating wire 17, and the skinned end of a low resistance, flexible, lead wire 23, made of copper, or the like, is silver soldered to the flush butt ends thereof as at 24.

For mechanical support of the silver solder joint, a clamp 26 may be employed, which clamp is of an H-shape, as seen in FIGURE 4, before application thereof to the device. The H-clamp comprises a pair of parallel leg members 27, 27 interconnected by a base member 28

engaging the leg members intermediate the ends thereof. One leg 27 of the clamp is crimped around the sleeve 22, while the other leg is crimped around the insulation surrounding the lead wire 23. A bell-shaped, termination member 31 is welded as at 32 to the sheath 11, surrounds and acts as a housing for the clamp 26, and extends beyond the upper end of the clamp. The interior of the bell-shaped member 31 is filled with an epoxy resin, or other suitable potting compound 33, to thereby further support the joint and protect the same from corrosive elements, and the like. The low resistance, insulated lead wires 23, 23, see FIGURE 1, may terminate in terminal lugs 36, 36, which are adapted for connection to a suitable source of supply potential, not shown.

Although my novel arrangement for electrically terminating the resistance element at a predetermined point within the sheath has been described with specific reference to a helical, immersion heater, it will be apparent that the invention is not limited to this particular form of heater. The heater can be of straight, U-shape, spiral or other form to fit a particular application.

Having now described my invention in detail, in accordance with the requirements of the patent statutes, various changes and modifications will suggest themselves to those skilled in this art, and it is intended that such changes and modifications shall fall within the spirit and scope of the invention as recited in the following claims.

I claim:

1. An electrical heater comprising an elongated tubular metallic sheath open at each end, a resistance heating element coaxially positioned in the sheath, insulated therefrom and terminating at both ends externally of the sheath a spaced distance from the respective sheath ends, sealing means at each end of said sheath, at least one of said sealing means comprising a low resistance tubular member in which is fitted and secured one end of the heating element, said member terminating at one end within the sheath and at the other end externally of the sheath, an insulated lead wire having an end fusion bonded in butt fashion to said one end of the resistance element, an H-shaped clamp having one end crimped about said tubular member and the other end crimped about an insulated portion of said lead wire, a sleeve having one end secured to the said sheath and surrounding the tubular member, the end of the lead wire and the clamp, and sealing material substantially filling the sleeve.

2. An electrical heater as recited in claim 1, wherein the elongated tubular metallic sheath is formed with a helical section and generally straight end sections.

3. An electrical heater as recited in claim 1, wherein the sealing means at the other end of said heating element comprises a tubular member, insulated lead wire, clamp, sleeve and sealing material similarly formed and connected.

4. An electrical heater comprising a tubular metal sheath and a resistance heating wire insulatedly supported coaxially therein and terminating externally of said sheath a spaced distance from the respective ends thereof, end sealing means at each end, at least one end of said end sealing means comprising a low resistance tubular member, uniform in diameter from end to end, surrounding the heating wire, secured thereto and terminating at one end within the sheath and at the other end externally of the sheath as a low resistance shunt therealong, an insulated lead wire having an end fusion bonded in butt fashion to said one end of the heating wire, an H-shaped clamp having one end crimped about said tubular member and the other end crimped about an insulated portion of said lead wire, a generally bell-shaped member having one end secured to said sheath and surrounding the tubular member, the end of the lead wire and the clamp, and sealing material substantially filling the bell-shaped member.

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