The present invention relates to electric heater assemblies, more particularly to electric heater assemblies of the type adapted to be positioned about a body to be heated, and the principal object of the invention is to provide new and improved assemblies of the character described. Advantages of the present invention over prior art heater assemblies will readily become apparent from a study of the following description and from the drawings appended hereto.

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

FIGURE 1 is a transverse sectional view through a body to be heated showing a preferred embodiment of the invention in end elevation.

FIGURE 2 is a side elevational view of the embodiment shown in FIGURE 1.

FIGURE 3 is a reduced size perspective view of a detail of the construction seen in FIGURES 1 and 2.

FIGURE 4 is a sectional view generally corresponding to the line 4-4 of FIGURE 1.

FIGURE 5 is a sectional view generally corresponding to the line 5-5 of FIGURE 1.

FIGURE 5a is a view similar to FIGURE 5 but of another embodiment of the invention.

FIGURE 6 is a view similar to FIGURE 1 but of still another embodiment of the invention.

FIGURE 7 is a side elevational view of the embodiment shown in FIGURE 6.

FIGURE 8 is a sectional view generally corresponding to the line 8-8 of FIGURE 6.

FIGURE 9 is a fragmentary perspective view of a detail seen in FIGURES 6 and 7 but during an intermediate stage of manufacture, and

FIGURE 10 is a view similar to FIGURE 8 but of still another embodiment of the invention.

The present invention relates to electric heater assemblies of the type to be positioned about a body to be heated and, as seen in FIGURES 1 and 2, such body is presently illustrated as a pipe, or tank, which is in cross-section. It will readily be apparent, however, that the present invention is not limited to use in heating hollow, circular bodies.

Briefly, the present invention comprises a split-type flexible clamping band 11, generally formed of metal, which is adapted to encircle the body with its end portions 111, 211, in spaced-apart relation. Means 12 are provided for drawing the band ends together so as to tension the band about the body. Underlying the band, as best illustrated in FIGURE 3, is an electric resistance heating element 13 of a conventional type having a tubular metallic sheath filled with highly compacted electric-insulating, heat-conductive material in which is embedded a resistor conductor. Projecting from respective sheath ends are terminal pins 14 which are electrically connected to respective resistor conductor ends internally of the sheath and to which the usual electrical connections may be made for the purpose of passing electrical energy to the resistor conductor. For a purpose to appear, element 13 is of hair-pin formation to provide a pair of elongated legs 113, 213 in side by side relation connected together at one end by a byight portion 313. Legs 113, 213 are preferably curved or otherwise formed to generally correspond to the external configuration of the body about which it is to be disposed.

Element 13 is adapted to underlie the band with its legs 113, 213 extending generally in coincidence with the latter so as to be clamped thereby to the body. Those ends of legs 113, 213 opposite byight portion 313; that is, those ends of the legs which carry the terminal pins 14, are bent for disposition between the band ends 111, 121 as illustrated. At the present time, it is preferable to employ two identical elements 13 disposed on opposite sides of the body beneath the band with their respective byight portion ends in adjoining relation and with their opposite end portions in adjoining relation between the band ends. For a purpose to appear, one of the legs of each element 13, herein shown to be leg 113, has a groove 15 (see especially FIGURE 3) welded or otherwise secured thereto adjacent the terminal pin end of the leg for extension in a direction toward the leg 213 of the opposite element (see especially FIGURE 5).

As best seen in FIGURES 1 and 2, each band end 111, 211 is formed by doubling a band end back on itself and is spot welded at 16 or otherwise secured in position to form respective loops for receiving respective trunion pins 17, 18. Welded or otherwise secured to an intermediate portion of pin 17 to extend transversely thereof (see FIGURE 5) is a threaded stud 19 whose free end passes through an enlarged transversely extending aperture 20 formed in an intermediate portion of pin 18. Threaded upon stud 19 is a nut 21 and underlying the nut is washer member 22 having a centralizing extension fitting within a spacer sleeve 23 interposed between the pin 18 and the washer 22. The end of the spacer sleeve 23 adjacent pin 18 may conveniently be formed for complementary engagement with the pin as illustrated in FIGURE 4.

As seen in FIGURES 2 and 5, each band end 111, 211 is slotted at 24 to provide clearance for stud 19 and the parts carried thereby. From the construction thus far disclosed, it will be understood that band 11 will be tensioned about the body to clamp the elements 13 in good thermal transfer relation therewith by running nut 21 along stud 19 in a direction toward pin 17. This will draw the band ends in a direction toward each other to thereby tension the band as will be apparent.

In the embodiment seen in FIGURES 1, 2, 4 and 5, means are provided for improving thermal transfer relation between the elements 13 and the body 10 by interposing therebetween a pair of shoes 25 formed of a material having high thermal conductivity such as, for example, aluminum. Each shoe 25 is curved longitudinally or otherwise formed to generally conform to the configuration of the adjoining body portion and, in the present embodiment, each extends about approximately one half of the body circumference for underlying a respective heating element 33.

In order to insure that the band, the elements and the shoes are retained in proper superimposed relation, each shoe 25 is generally channel-shaped in transverse section (see FIGURE 4) to provide spaced ribs 26, 27 engageable with respective legs 113, 123 of a respective element 13 and with respective side margins of the band. Obviously, the above described ribbed construction of shoes 25 provides abutments which interlock the shoes, band and elements to thus insure their proper superimposed relationship without necessitating welding or other complicated integrating structure. Moreover, with respective element legs in engagement with the shoe ribs 26, 27 as well as in engagement with the shoes portion extending between the ribs and underlying respective elements, greater heat transfer between the elements and respective shoes will take place and thus the heat generated by the elements will be more effectively transmitted to the body to
be heated. Obviously, while element legs 113, 213 are herein shown to be round in cross-section it is to be understood that they may be flattened or otherwise transversely configured to increase their area of contact with the shoes 25 to thereby even further improve thermal heat transfer.

During tensioning of the band 11, there may be a tendency for the elements 13 to shift relative to each other which could result in the terminal pins 14 of one being disposed so closely to the terminal pins of the other as to interfere with making the necessary electrical connections to the terminal pins and to reduce electrical clearance therebetween with the risk of one element shorting out against the other. It is to prevent the foregoing, that the previously described tongues 15 are provided. As will be clear, the tongue of one element will abut with the other element to thereby maintain minimum spacing between the adjoining terminal pins of respective elements.

It is contemplated that some difficulty may be encountered in holding the elements, the bands and the shoes in proper assembled relation while the assembly is positioned about the body to be heated. Accordingly, it may be desirable to provide means for maintaining these parts in assembled relation before the assembly is clamped about the body. One such means is shown in FIGURE 5e wherein similar parts are identified with the same reference characters as before but with the suffix "p" added.

As therein illustrated, shoe ribs 26b, 27b are somewhat deeper than ribs 26, 27 to extend slightly beyond the clamping band 11a. Each rib may be cut out at closely spaced places to provide one or more tongues 28 intermediate the transverse cuts. Such tongues will preferably be arranged in opposite relation and will be bent toward each other, as shown, to overlie respective band edges and thus retain the band, elements and shoes against disassembly. It will be appreciated that in the event more than one tongue 28 is provided by each rib, such tongues will be appropriately spaced longitudinally along respective ribs. If it should become necessary to replace certain parts, such as, for example, one of the heating elements, it will only be necessary to straighten the appropriate tongues 28 to thus permit ready disassembly of the appropriate shoe and heating element from the band. Following replacement of the defective part, the tongues may once again be bent over as shown to retain the various parts in assembled relation.

In the embodiment of the invention seen in FIGURES 6 through 9 wherein parts similar to those heretofore disclosed are identified by the same reference characters as before but with the suffix "a" added, it will be noted that the previously mentioned shoes 25 have been eliminated in the interest of simplicity and cost reduction. With particular reference to FIGURES 6 and 9, band 11a differs from band 11 primarily in that its side margins, extending those of its ends 111a, 211a, provide a plurality of spaced-apart tabs 29, 30. As viewed in FIGURE 8, these tabs are bent transversely of the band to extend in a direction toward the body to be heated and thus provide spaced abutments engageable with respective element legs 113a, 213a of elements 13a. The abutments formed by the tabs thus function in the same manner as the ribs formed in the shoes of the first mentioned embodiment to retain the elements and the band in proper superimposed relation.

In the embodiment of the invention seen in FIGURE 10, parts similar to those herebefore disclosed are identified by the same reference characters as before but with the suffix "c" added.

The embodiment seen in FIGURE 10 employs a simple band 11c similar to that disclosed in FIGURES 1, 2, 4, 5 and 5a, rather than a band of the type seen in FIGURES 6, 7, 8 and 9 having the tabs 29, 30. This embodiment, however, eliminates the shoes 25 of the first disclosed embodiment but instead employs the following construction to hold the elements 13c and the band in superimposed, assembled relation.

Welded or otherwise secured across the element legs 113c, 213c is a ductile strap member 31. Member 31 is secured to that side of the element legs facing the band 11c and each end of the member is of sufficient length to permit it to be double back on itself at 32 to overlie respective band edges following assembly of the element with the band. This construction will, of course, not only insure assembly of the elements and the band in proper superimposed relation when the assembly is wrapped about the body to be heated but will also retain the band and the elements in assembled relation for storage and shipment and will also facilitate wrapping the assembly about the body.

While each element 13c has been disclosed as having but one strap member 31, it will readily be apparent that each element may carry as many strap members, spaced longitudinally of the band legs from each other, as deemed necessary to insure retention of the parts in proper assembled relation. Furthermore, it will readily be apparent that an element may readily be disassembled from the band by straightening the strap member (or members) and may be as readily reassembled by once again bending the strap end to overlie the band edges.

In view of the foregoing it will be apparent to those skilled in the art that we have accomplished at least the principal object of our invention and it will also be apparent to those skilled in the art that the embodiments herein described may be variously changed and modified, without departing from the spirit of the invention, and that the invention is capable of, uses and has advantages not herein specifically described, hence it will be appreciated that the herein disclosed embodiments are illustrative only, and that our invention is not limited thereto.

We claim:

1. An electric heater assembly to be positioned about a body to be heated, comprising a split-type clamping band for disposition about the body to be heated with its ends in spaced-apart adjoining relation, a pair of sheathed electric resistance heating elements of hair-pin formation each providing a pair of elongated legs in side by side relation connected together at one end by a bight portion, said elements being adapted to be interposed between said band and the body to be heated with their bight portion ends in adjoining relation and with the opposite end leg portions of one element in side by side adjoining relation with the opposite end leg portions of the other and with such opposite end leg portions disposed intermediate said band ends, means for drawing said band ends in a direction toward each other for tensioning said band about said elements and clamping the latter in good thermal transfer relation to the body, and means projecting transversely of one opposite end leg portion of one element and in a direction toward an opposite end leg portion of the other element for engagement therewith to thus space apart said opposite end leg portions of respective elements.

2. An electric heater assembly to be positioned about a body to be heated, comprising a split-type clamping band for disposition about the body to be heated with its ends in spaced-apart adjoining relation, a pair of sheathed electric resistance heating elements of hair-pin formation each providing a pair of elongated legs in side by side relation connected together at one end by a bight portion, said elements being adapted to be interposed between said band and the body to be heated with their bight portion ends in adjoining relation and with the opposite end leg portions of one element in side by side adjoining relation with the opposite end leg portions of the other and with such opposite end leg portions disposed intermediate said band ends, means for drawing said band ends in a direction toward each other for tensioning said band about said elements and clamping the latter in good thermal transfer relation to the body, and means projecting transversely of one opposite end leg portion of one element and in a direction toward an opposite end leg portion of the other element for engagement therewith to thus space apart said opposite end leg portions of respective elements.
and means projecting transversely of one opposite end leg portion of one element and in a direction toward an opposite end leg portion of the other element and also projecting transversely of the other opposite end leg portion of said other element and in a direction toward the other opposite end leg portion of said one element for engagement therewith to thus space apart said opposite end leg portions of respective elements.

3. An electric heater assembly to be positioned about a body to be heated, comprising a split-type clamping band for disposition about the body to be heated with its ends in spaced-apart adjoining relation, a pair of sheathed electric resistance heating elements of hair-pin formation each providing a pair of elongated legs in side by side relation connected together at one end by a bight portion, said elements being adapted to be interposed between said band and the body to be heated with their bight portion ends in adjoining relation and with the opposite leg portions of one element in side by side relation with the opposite end leg portions of the other and with such opposite end element end portions disposed intermediate said said band ends, means for drawing said band ends in a direction toward each other for tensioning said band about said elements and clamping the latter in good thermal transfer relation to the body, means projecting transversely of one opposite end leg portion of one element and in a direction toward an opposite end leg portion of the other element and also projecting transversely of the other opposite end leg portion of said other element and in a direction toward the other opposite end leg portion of said one element for engagement therewith to thus space apart said opposite end leg portions of respective elements, and abutment means provided by said assembly adjacent respective side margins of said band and clamping the latter in good thermal transfer relation to the body by means of respective element legs to retain the latter in position underlying said band.

4. An electric heater assembly to be positioned about a body to be heated, comprising a clamping band for disposition about the body to be heated, a sheathed electric resistance heating element of hair-pin formation providing a pair of elongated legs in side by side relation connected together at one end by a bight portion, said element legs and said bight portion being adapted to be interposed between said band and the body to be heated with said legs extending generally in coincidence with said band so as to underlie the latter, a heat conductive shoe interposed between the body and said element to underlie the latter and providing spaced abutments engageable with respective element legs and with respective side margins of said band to retain the latter, said element and said shoe in proper superimposed relation, and means for tensioning said band about said element and clamping the latter in good thermal transfer relation to the body.

5. An electric heater assembly to be positioned about a body to be heated, comprising a clamping band for disposition about the body to be heated, a sheathed electric resistance heating element of hair-pin formation providing a pair of elongated legs in side by side relation connected together at one end by a bight portion, said element legs and said bight portion being adapted to be interposed between said band and the body to be heated with said legs extending generally in coincidence with said band so as to underlie the latter, a heat conductive shoe interposed between the body and said element to underlie the latter and being channel-shaped in cross-section to provide spaced ribs between which a respective element and said band are receivable, said shoe ribs being engageable with respective legs of a respective element and with respective side margins of said band to retain the latter, said element and said shoe in proper superimposed relation, and means for tensioning said band about said element and clamping the latter in good thermal transfer relation to the body.

6. An electric heater assembly to be positioned about a body to be heated, comprising a clamping band for disposition about the body to be heated, a pair of sheathed electric resistance heating elements of hair-pin formation each providing a pair of elongated legs in side by side relation connected together at one end by a bight portion, said elements being adapted to be interposed between said band and the body to be heated with their bight portion ends in adjoining relation and with the opposite end leg portions of one element in adjoining relation with the opposite end leg portions of the other, a pair of heat conductive shoes interposed between the body and respective elements to underlie the latter and each providing spaced abutments engageable with respective legs of respective elements and with respective side margins of said band to retain the latter, said elements and said shoes in proper superimposed relation, and means for tensioning said band and clamping said elements in good thermal transfer relation to respective elements and clamping said shoes in good thermal transfer relation to the body.

7. An electric heater assembly adapted to be positioned about a body to be heated, comprising a split-type clamping band for disposition about the body to be heated with its ends in spaced-apart adjoining relation, a pair of sheathed electric resistance heating elements of hair-pin formation each providing a pair of elongated legs in side by side relation connected together at one end by a bight portion said elements being adapted to be interposed between said band and the body to be heated with their bight portion ends in adjoining relation and with the opposite end leg portions of one element in adjoining relation with the opposite end leg portions of the other, a pair of heat conductive shoes interposed between the body and respective elements to underlie the latter and each providing spaced abutments engageable with respective legs of respective elements and with respective side margins of said band to retain the latter, said elements and said shoes in proper superimposed relation, and means for tensioning said band and clamping said elements in good thermal transfer relation to respective elements and clamping said shoes in good thermal transfer relation to the body.

8. An electric heater assembly to be positioned about a body to be heated, comprising a clamping band for disposition about the body to be heated, a sheathed electric resistance heating element of hair-pin formation providing a pair of elongated legs in side by side relation connected together at one end by a bight portion, said element legs and said bight portion being adapted to be interposed between said band and the body to be heated with said legs extending generally in coincidence with said band so as to underlie the latter, a heat conductive shoe interposed between the body and said element to underlie the latter and providing spaced abutments engageable with respective element legs and with respective side margins of said band to retain the latter, said element and said shoe in proper superimposed relation, and means for tensioning said band about said element and clamping the latter in good thermal transfer relation to the body.

9. An electric heater assembly to be positioned about a body to be heated, comprising a clamping band for disposition about the body to be heated, having a plurality of tabs spaced longitudinally of said band and from opposed side margins thereof, said tabs being bent transversely of said band to project toward the body and provide spaced ribs adjacent respective band margins, a pair of sheathed electric resistance heating elements of hair-
pin formation each providing a pair of elongated legs in side by side relation connected together at one end by a bright portion and said elements being adapted to be interposed between said band and the body to be heated with their bright portion ends in adjoining relation and with the opposite end leg portions of one element in adjoining relation with the opposite end leg portions of the other, said element legs extending generally in coincidence with said band so as to underlie the latter and with respective legs of each element engageable with respective ribs to retain said elements and said band in proper superimposed relation, and means for tensioning said band about said elements and clamping the latter in good thermal transfer relation to the body.

10. An electric heater assembly to be positioned about a body to be heated, comprising a clamping band for disposition about the body to be heated, a sheathed electric resistance heating element of hair-pin formation providing a pair of elongated legs in side by side relation connected together at one end by a bright portion, said element legs and said bright portion being adapted to be interposed between said band and the body to be heated with said legs extending generally in coincidence with said band so as to underlie the latter, means for tensioning said band about said element and clamping the latter in good thermal transfer relation to the body, and structurally integral means extending from said element and removably secured to said band for connecting said element thereto.

11. The construction of claim 10 wherein the last mentioned means comprises spaced portions overlying respective band edges for the purpose aforesaid.

12. The construction according to claim 10 wherein said structurally integral means comprises a metal plate overlying and welded to said element legs, said band and said plate having interlocking marginal portions.

13. An electric heater assembly for disposition about a cylindrical body to be heated, comprising a clamping band of sheet metal and shaped to channel formation to provide a wide bottom wall and short side walls, each side wall having a plurality of slits to enable said band to be bent accurately about said body with the marginal edges of said side walls in engagement with the outer surface of said body to cooperate with said bottom wall and define a transversely closed tunnel about said body and opening at the ends of said band, a sheathed electric heating element of hair-pin formation within said tunnel with its terminal ends projecting through and outwardly of said tunnel opening, said bottom wall being extended at each band end and fixed upon itself to form a loop for receiving a band tensioning element.

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