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ELECTRIC HEATER-REFLECTOR ASSEMBLIES

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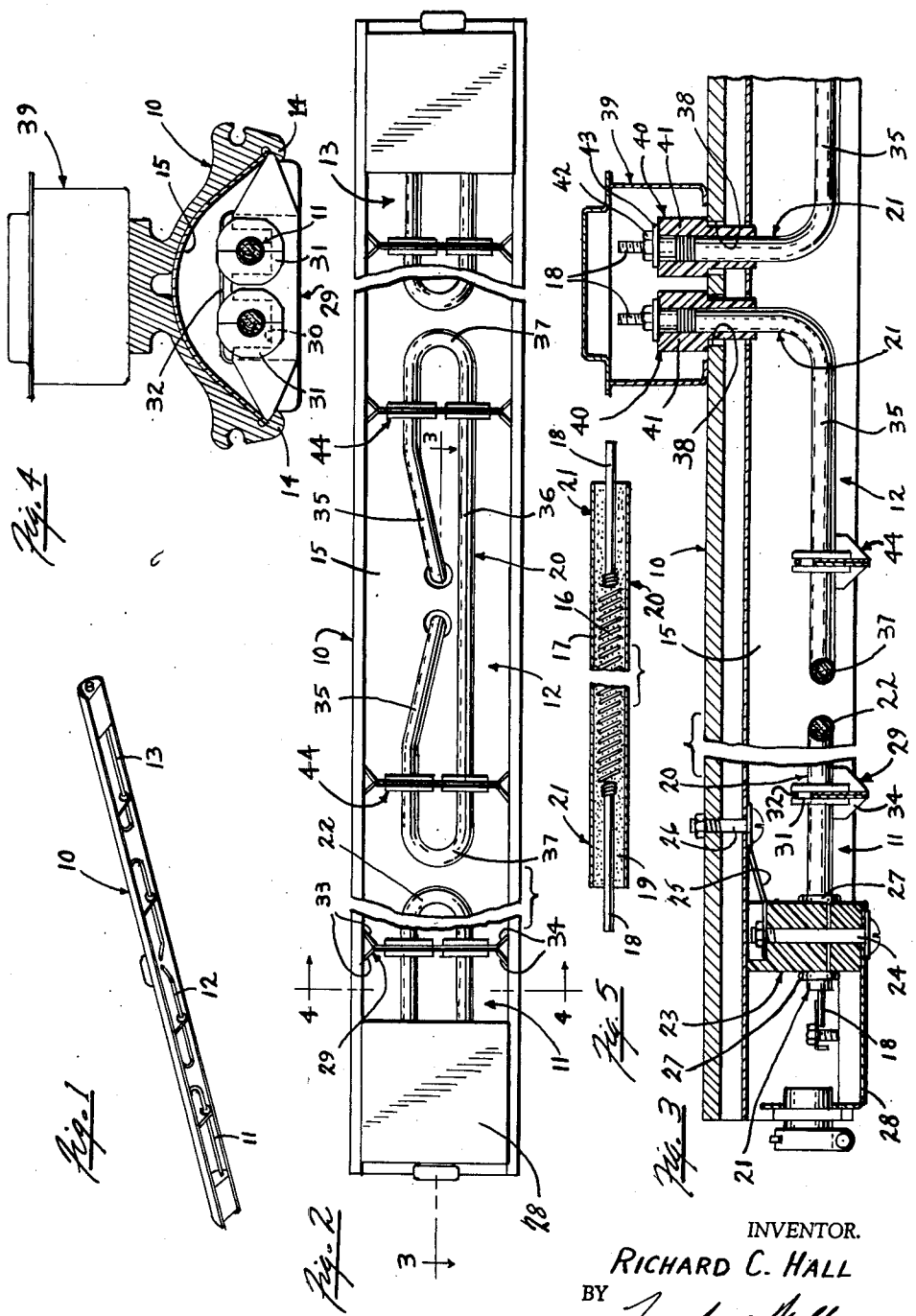


Fig. 1

Fig. 2

Fig. 3

Fig. 4

Fig. 5

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ELECTRIC HEATER-REFLECTOR ASSEMBLIES

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The present invention relates to radiant heaters, more particularly to radiant electric heater-reflector assemblies of the type for effecting a desired pattern of heat distribution on material to be heated, and the principal object of the invention is to provide new and improved devices of such character.

In the past and especially when heating strip material by means of radiant heat, it has been difficult to achieve even heating from edge to edge of the material since its center tends to become heated more than its edges. This apparently results for two reasons: Firstly, the center tends to receive a greater amount of effective radiation than do the edges. Secondly, heat is dissipated more quickly from the edges of the material than from the center and this heat loss tends to lower the temperature of the edges.

A common and quite satisfactory arrangement for the heating of longitudinally moving strip material, apart from the disabilities above mentioned, has been to dispose an elongated, electric radiant heater-reflector assembly adjacent the side of the material to be heated and extending transversely thereof so as to direct heat from edge to edge of the material.

The present invention contemplates a heater assembly of the general type above mentioned, however, this assembly utilizes a plurality of highly efficient, long lived, low cost, tubular metallic sheathed electric resistance heating elements arranged in a suitable reflector to provide the desired heat distribution on the material to be heated. The advantages of the present invention will readily become apparent from a study of the following description and from the drawings appended hereto.

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

FIGURE 1 is a perspective view of a preferred embodiment of the invention, facing downwardly to direct heat upon underlying strip material (not shown) or other body,

FIGURE 2 is an enlarged, broken, bottomside plan view of the assembly seen in FIGURE 1,

FIGURE 3 is a further enlarged, fragmentary sectional view generally corresponding to the line 3—3 of FIGURE 2,

FIGURE 4 is an enlarged sectional view generally corresponding to the line 4—4 of FIGURE 2, and

FIGURE 5 is an enlarged, broken, sectional view of a type of heating element employed by the present invention during an intermediate stage of manufacture.

As seen in the drawing, the present invention comprises two major components: First, an elongated, channel-like reflector member **10** which, for convenience, may be made by an extrusion process and a plurality of electric resistance heating elements **11**, **12** and **13**, preferably of the tubular, sheathed, embedded type, mounted within the channel opening of the reflector.

As best seen in FIGURE 4, reflector member **10** has opposed, inwardly directed, longitudinally extending lips **14** on each side of the channel opening for retaining within such opening and in conformity with the defining wall thereof, a strip of highly reflective metal or other material which extends substantially the full length of the reflector. Such lips also serve another purpose as will later appear.

It is an important feature of the present invention that the heating elements **11**, **12** and **13** are of the metallic, tubular sheathed embedded type. With reference to FIGURE 5, each element preferably comprises a coiled resistor conductor member **16** disposed within the intermediate portion of an elongated tubular metallic sheath **17**. Respective ends of the resistor terminate short of respective ends of the sheath and, for the purpose of conducting electrical energy to the resistor, respective ends thereof are electrically connected with terminal pins **18**, each of which projects beyond a respective sheath end to permit the necessary electrical connection to be made thereto. The free ends of the terminal pins may, if desired, carry any suitable lugs or the like to facilitate connection of the current supply wiring thereto. The interior of the sheath is preferably filled with electric-insulating, heat-conductive material **19** compacted to rock-like hardness by exerting transverse pressure upon the filled sheath. It is to be understood that each of the elements is usually manufactured in the rectilinear form seen in FIGURE 5 and thereafter bent, as will be disclosed, to provide the desired configuration.

For obvious reasons, the intermediate portion **20** of the heating element seen in FIGURE 5, that is, that portion of the element adjacent the resistor conductor **16**, is known as the heat-generating element portion while the element portions adjacent the terminal pins **18** are known as terminal end portions.

Heating element **11** of the present invention, and also element **13** since it is preferably identical to element **11**, is formed by doubling a rectilinear element such as seen in FIGURE 5 back on itself to a U-shaped configuration with respective terminal ends **21** of the element in side by side relation spaced from the bight **22** at the other end of U-shaped configurated element.

Each element **11**, **13** is disposed at a respective end of the reflector **10** within the channel opening thereof to extend longitudinally of the reflector. Such elements are disposed within the reflector as seen in FIGURE 2 with their bight portions **22** in spaced, facing relation and with their terminal end portions at respective extreme ends of the reflector.

Any suitable means may be employed for holding element **11** in position within the reflector. For example and as shown in FIGURE 3, a split, dielectric body **23** may be clamped over the terminal end portions of the element by means of a screw **24**. A bracket **25** may be secured to the body by means of the screw **24** and to the reflector by means of a screw **26** to thus support the terminal end portions of this element. One of the element terminal portions may be provided with fixedly positioned, spaced collars **27** which straddle body **23** and limit relative movement between the body and the element. It is to be noted that the foregoing element supporting arrangement disposes the heat-generating portion **20** of element **11** on one side of the body **23** and the projecting ends of its terminal pins **18** on the other side of the body. A plate **28** may be carried by body **23** to overlie the reflector channel opening adjacent the element terminal pins to provide with the reflector channel a compartment which encloses the electrical connections between the current supply wiring (not shown) and the terminal pins.

The means provided for supporting the bight portion end of the U-shaped element **11** may comprise a sheet metal bracket **29**, see FIGURES 2, 3 and 4, slotted at **30** to receive split, dielectric bushings **31** which are apertured to slidably pass respective legs of the U-shaped element. A retaining wire **32** may removably hold bushings **31** assembled with the bracket. As best seen in FIGURE 2, bracket **29** is formed of two pieces of sheet metal welded or otherwise secured together in side by side rela-

tion and respective adjoining pairs 33, 34 of the ends of such pieces are spread apart to rest upon the previously mentioned lips 14 of the reflector.

Since element 13 is identical to element 11 and is supported in an identical manner, the foregoing decription directed toward element 11 will suffice for an understanding of element 13 and its mode of support.

Turning now to heating element 12, this element may be similar to that seen in FIGURE 5; however, it differs from the elements 11 and 13 in that its heat-generating portion 20 is doubled back on itself to provide a pair of legs 35, 36 (see FIGURE 2) in side by side relation connected together at adjoining ends by respective bight portions 37. As illustrated, element 12 extends longitudinally of the reflector 10 and is disposed within its channel opening with respective bight portions 37 thereof adjacent the bight portions 22 of respective elements 11, 13.

The terminal ends 21 of element 12 preferably extend in side by side relation from leg 35 and in a direction transversely thereof to project through respective enlarged apertures 38 (see FIGURE 3) formed in the reflector 10 and in the reflective strip 15. The free ends of the element terminal ends are disposed within a sheet metal box 39 which is carried by the reflector and which encloses the electrical connections between the current supply wiring (not shown) and the terminal pins.

Dielectric sleeves 40 are disposed over the terminal ends 21 of the element 12 to insulate this element from the reflector at the point where it passes through apertures 38. These sleeves have enlarged heads 41 which rest upon the upper surface of the reflector to retain the terminal ends of the element in position within box 39. To retain the sleeves 40 assembled with the element terminal ends, terminal pins 18 may be threaded to receive nuts 42. Suitable washers 43 may be interposed between the washers and a respective sleeve to complete the assembly. For a purpose to be seen, apertures 38 are larger than the shank portions of sleeves 40 to permit limited transverse movement of the element terminal ends relative to the reflector.

Means are provided for supporting each end of element 12 adjacent its bight portions 37, such means preferably comprising bracket assemblies 44 identical to the previously described bracket 29 and its associated parts. The apertures in this bracket assembly through which pass respective element legs 35, 36 are slightly larger than the transverse size of respective legs to provide for longitudinal movement thereof.

It will be understood that since bracket 29 slidably supports the bight end of element 11, the latter may freely expand and contract longitudinally during its heating and cooling cycles. The same is true of element 13 since the latter and its mode of support is a duplication of element 11. It will also be understood that the bracket assemblies 34 and the oversize apertures 38 in the reflector and reflecting plate permit similar expansion and contraction of the element 12 during heating and cooling cycles.

To provide the desired heat distribution with the present heater-reflector assembly, it is only necessary to choose heating element having the requisite heat output. For example, when strip material is to be evenly heated, the end heating elements 11 and 13 will preferably have a higher heat output per unit length of element than the intermediate element 12 so that the greater heat output at the ends of the assembly will counterbalance the edge losses of the strip material.

While the use of heating element having different heat outputs as above described is simple and low in cost, certain applications require a more flexible arrangement. In such cases, all of the elements may have the same heat output per unit length of element and the heat output of the intermediate element reduced as required by means of a suitable current input controller.

In view of the foregoing it will be apparent to those skilled in the art that I have accomplished at least the principal object of my invention and it will also be apparent to those skilled in the art that the embodiment 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 embodiment is illustrative only, and that my invention is not limited thereto.

I claim:

1. An elongated radiant heater assembly comprising an elongated, trough-like reflector together with first and second heating element means carried by said reflector and provided by elongated, tubular sheathed electric resistance heating elements each having an intermediate heat generating portion and each also having terminal end portions for conducting electrical energy to its heat generating portion, said first element means comprising a pair of such heating elements each doubled back on itself to a U-shaped configuration to dispose respective terminal end portions of each element in side by side relation spaced from the bight of said U-shaped configuration and each element of said pair being supported at a respective end of said reflector with the heating element bight portions in spaced, facing relation, said second element means comprising a single such heating element having its intermediate portion doubled back on itself to provide a pair of bight portions in spaced, opposed relation and having its terminal end portions disposed in side by side relation intermediate its bight portion pairs, said heating element of said second element means being supported at an intermediate portion of said reflector with its bight portions adjacent respective adjoining bight portions of respective elements of said element means.

2. An elongated radiant heater assembly comprising an elongated, trough-like reflector having an apertured portion intermediate its ends, a pair of heating elements spaced longitudinally of said reflector from each other and supported at respective reflector ends, and an elongated, tubular sheathed electric resistance heating element having an intermediate heat generating portion and terminal end portions for conducting electrical energy to said heat generating portion, said intermediate heat generating portion being doubled back on itself to provide an elongated heating body having looped end portions and having its said terminal end portions extending in side by side relation transversely of said body intermediate its looped end portions, said body extending longitudinally of said reflector between the elements of said pair and with its looped end portions adjacent respective such elements and with said terminal end portions through said apertured reflector portion.

3. An elongated radiant heater assembly comprising an elongated, trough-like reflector having an apertured portion intermediate its ends, first and second heating element means carried by said reflector and provided by elongated, tubular sheathed electric resistance heating elements each having an intermediate heat generating portion and each also having terminal end portions for conducting electrical energy to its heat generating portion, said first element means comprising a pair of such heating elements each having its heat generating portion doubled back on itself to a U-shaped configuration to dispose respective terminal end portions of each element in side by side relation spaced from the bight of said U-shaped configuration and each element of said pair being supported at a respective end of said reflector with their bight portion in spaced, facing relation, said second element means comprising a single such heating element having its intermediate heat generating portion doubled back on itself to provide an elongated heating body having looped end portions and having its terminal end portions extending in side by side relation transversely of said body intermediate its looped end portions, said second element means body extending longitudinally of said reflector between the elements of

said pair and with its looped end portions adjacent the bight portions of respective elements of said pair and with its terminal end portions through said apertured reflector portion, and means supporting the heat generating portions of respective heating elements for movement longitudinally of said reflector to provide for free expansion and contraction of such elements during heating and cooling cycles thereof.

4. An elongated radiant heater assembly comprising an elongated, trough-like reflector having an apertured portion intermediate its ends, a pair of heating elements spaced longitudinally of said reflector from each other and supported at respective reflector ends, an elongated, tubular sheathed electric resistance heating element having an intermediate heat generating portion and terminal end portions for conducting electrical energy to said heat generating portion, said heat generating element portion being doubled back on itself to provide a pair of legs in side by side relation connected together at adjoining ends by respective bight portions and said terminal end portions extending in side by side relation transversely of an intermediate portion of one of said legs, said sheathed element having the legs of its heat generating portion extending longitudinally of said reflector between the elements of said pair with its bight portions adjacent respective such elements and with its terminal end portions through said apertured reflector portion, and means supporting the legs of said heat generating element portion for movement longitudinally of said reflector to provide for free expansion and contraction of such element during heating and cooling cycles thereof.

5. An elongated radiant heater comprising an elongated, trough-like reflector having a portion intermediate its ends providing enlarged aperture means, first and second heating element means carried by said reflector and provided by elongated tubular sheathed electric resistance heating elements each having an intermediate heat generating portion and each also having terminal end portions

for conducting electrical energy to its heat generating portion, said first element means comprising a pair of such heating elements each having its heat generating portion doubled back on itself to a U-shaped configuration to dispose respective terminal end portions of each element in side by side relation spaced from the bight of its U-shaped configuration and each element of said pair being supported at a respective end of said reflector with their bight portions in spaced, facing relation, said second element means comprising a single such heating element having its heat generating portion doubled back on itself to provide a pair of legs in side by side relation connected together at adjoining ends by respective bight portions and the terminal end portions of such second element means extending in side by side relation transversely of an intermediate portion of one of said legs through the enlarged aperture means of said reflector and having limited movement longitudinally thereof, said second element means having its heat generating portion extending longitudinally of said reflector between the elements of said pair with its bight portions adjacent the bight portions of respective elements of said pair, and means supporting the heat-generating portions of respective heating elements for movement longitudinally of said reflector to provide for free expansion and contraction of such elements during heating and cooling cycles thereof.

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