Nov. 2, 1948. R. B. SHANNON 2,452,875

CONVECTION TYPE ELECTRICAL HEATING DEVICE

Filed Nov. 7, 1945 2 Sheets-Sheet 1

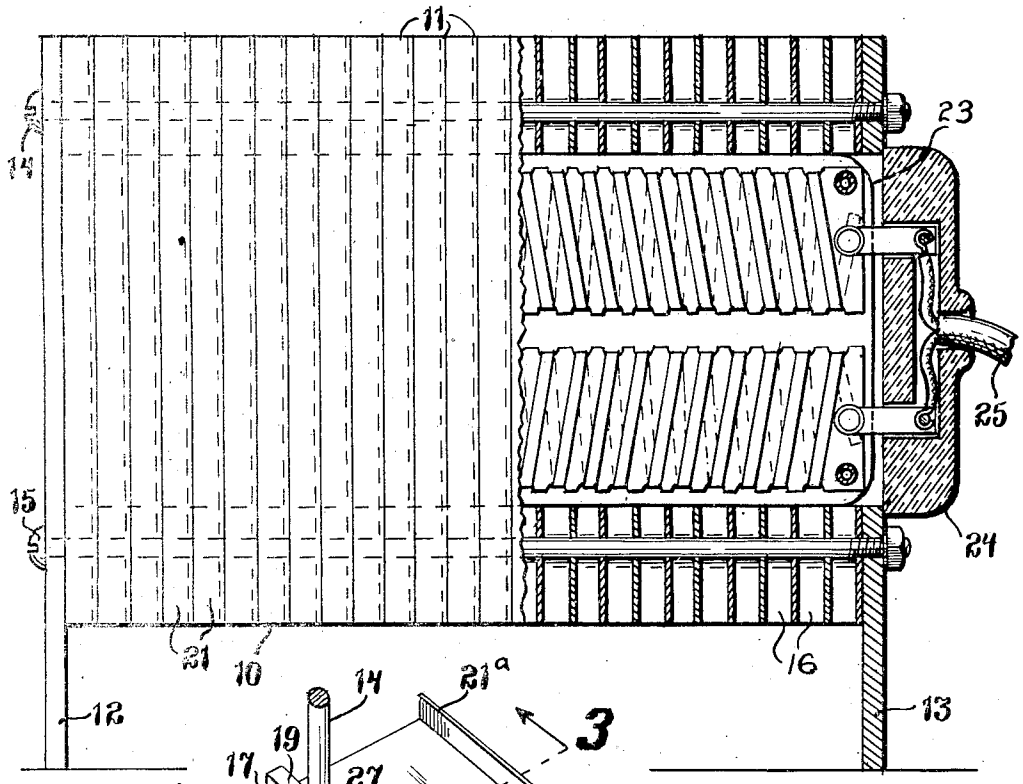



FIG 1

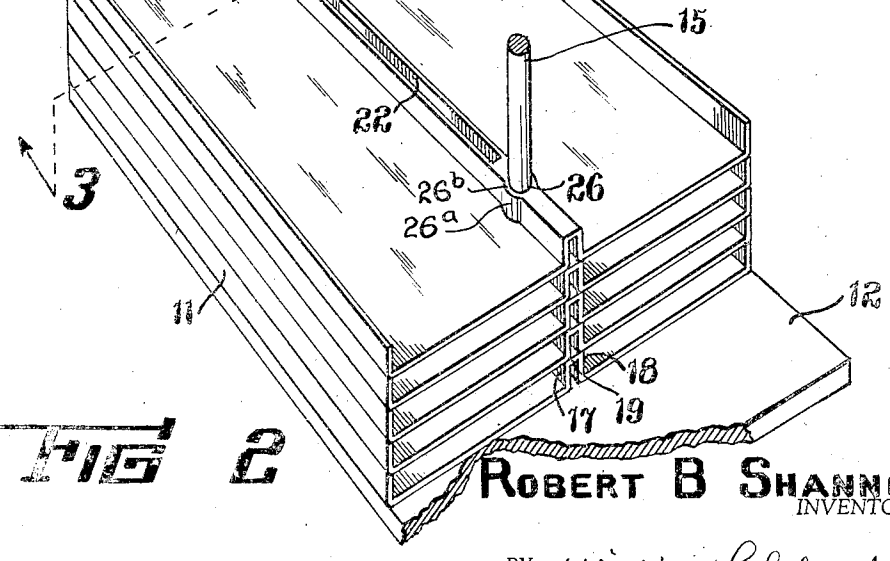



FIG 2

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CONVECTION TYPE ELECTRICAL HEATING DEVICE

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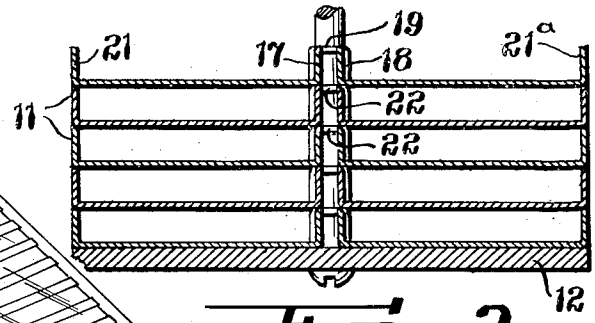



FIG 3

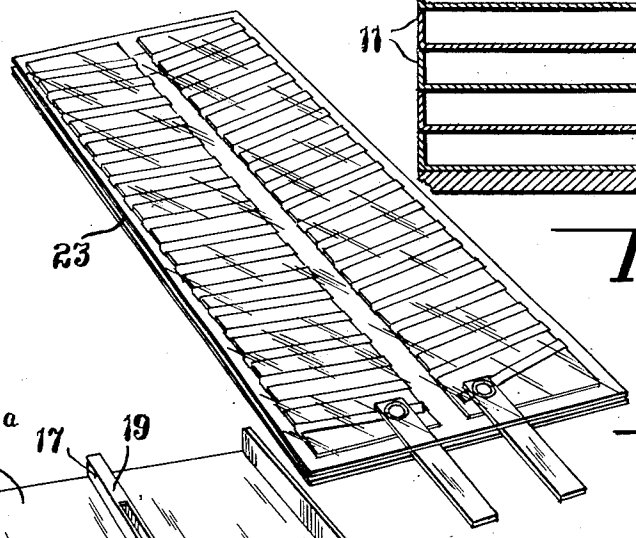



FIG 4

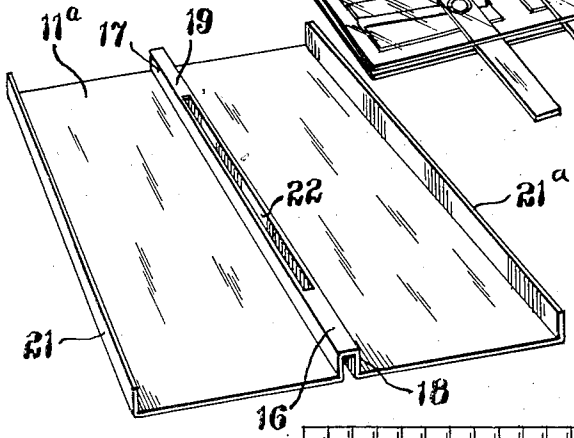



FIG 5

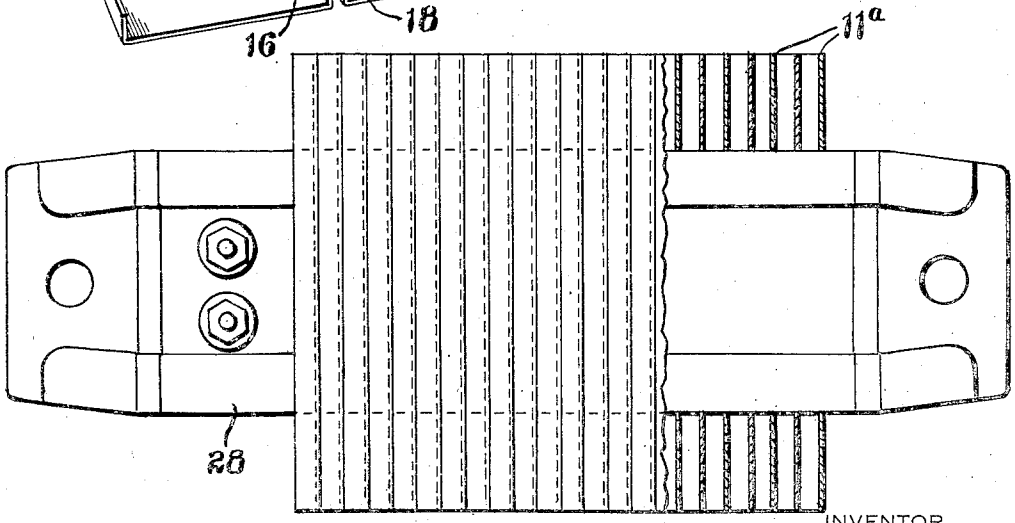



FIG 6

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# UNITED STATES PATENT OFFICE

2,452,875

## CONVECTION TYPE ELECTRICAL HEATING DEVICE

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Application November 7, 1945, Serial No. 627,123

6 Claims. (Cl. 219—38)

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This invention relates to electric heaters and in particular relates to convection type electric heaters.

An object of the invention is to provide a heating device of the character described including a unit having heat-conducting vanes uniformly spaced in parallelism, and an electrical heating member extended therethrough, wherein the vanes are adapted to have maximum effective surface contact with the heating member and yet which may be economically produced by relatively simple stamping or forming procedure.

Another object of the invention is to provide a heating device of the character described having a minimum of parts, and which is simple and easy to assemble or to take apart for repairs.

Another object of the invention is to provide a heating unit of the character described, having improved heat-conducting vanes therein which make possible the use of a relatively flat, thin heating member for effectively heating the vanes, whereby is made possible the provision of a maximum amount of heat as compared with the relatively small compact size of the unit.

Still another object of the invention is to provide a heating unit of the character described wherein the vanes are effectively bolted together in positive spaced relation without the use of separate spacing means.

These and other objects of the invention will be manifest from the following brief description and the accompanying drawings.

Of the accompanying drawings:

Figure 1 is a side elevation, partly broken away and in section, illustrating a convection type of heater embodying the invention.

Figure 2 is a perspective view, partly broken away and in section, illustrating the manner of assembling the heat-conducting vanes in the unit.

Figure 3 is a cross-section taken substantially on the line 3—3 of Figure 2.

Figure 4 is a perspective view showing a flat electrical heating member of the type utilized in the heater of Figure 1.

Figure 5 is a perspective view illustrating a modified form of heat conducting vane embodying the invention.

Figure 6 is a side elevation, partly broken away and in section, illustrating a plurality of the vanes of Figure 5 assembled on a strip type electrical heating member.

Referring particularly to Figures 1, 2 and 3 of the drawings, the numeral 10 designates a convection type heating unit, the same including a plurality of separate vanes 11, 11 of high heat-conducting material, such as copper. The vanes may be clamped or secured in longitudinally spaced relation between supporting plates 12 and 13 at opposite ends of the unit, as by means of spaced bolts 14 and 15 extending through aligned

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apertures in the supporting plates and the vanes. A suitable reticulated cover (not shown) may be provided over the unit for decorative or other purposes.

As best shown in Figures 2 and 3, each vane 11 may be formed of a rectangular blank, of copper or other thin sheeting, to provide a central, relatively narrow channel-shaped rib 16 which extends from edge to edge transversely of the sheet. The rib 16 preferably is rectangular in cross-section to define spaced parallel side portions 17 and 18 and a flat outer connecting web 19, the channel between said side portions opening outwardly at the ends of the rib. Thus the rib 16 may be formed of any desired depth, and as narrow as required within practical limitations. The lateral edge portions of the vane may be formed in the same direction and to the same extent as the rib 16, to provide right-angled flanges 21 and 21*a*. Both the ribs and flanges are adapted, when the vanes are assembled in unit 10, to retain the same in spaced parallel relation in the manner illustrated.

Blanked or cut in the web 19 of the rib of each vane 11, may be elongated slots 22 of the same width as the space between side portions 17 and 18 of the rib. These slots are arranged to be in alignment in the vane assembly. A relatively thin, flat electrical heating element 23, as shown in Figure 4, is readily slidable through the aligned apertures 22 of the assembled unit 10, from one end thereof, to the position shown in Figure 1. In this position of the heating member, it will have close heat-transferring contact with the side portions 17 and 18 of the ribs 16, over an area commensurate with twice an area defined by the length of a slot multiplied by approximately the length of the heater unit 10. A suitable electrical connector block 24 is secured to supporting plate 13 for connecting the heating member 23 with a source of electrical current by means of cable 25.

Apertures 26 and 27 are provided in the webs 19 adjacent opposite ends of the rib 16 of each vane, for receiving the bolts 14 and 15 for clamping the vanes together in unit 10 as previously described. The rib may be enlarged or widened at the points where the apertures 26 and 27 are provided to permit use of bolts of desired relatively large size. These enlargements, designated by numerals 26*a* and 27*a*, are also utilized to form squared shoulders 26*b*, 27*b* which provide positive vane-spacing means around the clamping bolts.

In the operation of the heater just described, heat is transferred from the electrical heating member 23 to the side portions 17 and 18 of the vane ribs 16, this heat being conducted through the vanes and being radiated from the broad flat surfaces at opposite sides thereof. Air within

the space between the vanes is thus effectively heated and conveyed upwardly by convective action through the open upper ends of the passageways defined by the spaced vanes and the side flanges 21 thereof, the heated air (or other fluid medium) thus being continuously replaced by cold air drawn through the bottom openings of said passageways. Because the present construction of the vanes makes possible the use of a relatively thin, flat electrical heating member 23, it is possible to obtain maximum heating capacity with the use of a relatively small heater unit.

In the modified form of the invention shown in Figures 5 and 6 a strip type of electrical heating member 28 is provided with a relatively stiff or rigid outer casing of copper or like material. Vanes 11a, 11a (Figure 5) are formed like the vanes 11, except that the apertures 26 and 27 are omitted, like parts otherwise being given like numerals. Because of the relative rigidity of heating member 28, when it is inserted through the elongated slots 22 of ribs 16 of the vanes, to assemble the latter thereon, the vanes are readily retained in this assembled relation until complete assembly of the heater device can be accomplished.

Other modifications of the invention may be resorted to without departing from the spirit thereof or the scope of the appended claims.

What is claimed is:

1. An electrical heating device comprising a unit including a plurality of separate vanes, each of said vanes being formed of heat-conducting sheet material to provide a channel-shaped rib extending completely across the vane and defining an open-ended groove, said ribs of the vanes being slotted along the outer web portion thereof, means for securing said vanes in spaced relation with said slots in alignment, and an elongated electrical heating element received through said slots of said ribs.

2. An electrical heating device comprising a unit including a pluarality of vanes, each of said vanes being formed of heat-conducting sheet material to provide a channel-shaped rib intermediate opposite lateral edges thereof and extending from edge to edge transversely of the vane and defining an open-ended groove, said ribs each including parallel side portions and an outer connecting web portion, cooperating slots extending longitudinally in said web portions of the ribs, means for securing said vanes in spaced relation with said slots in alignment, and an elongated electrical heating element received through said cooperating slots of said ribs and engaging between said parallel side portions of the ribs.

3. An electrical heating device comprising a unit including a plurality of separate vanes arranged in longitudinally spaced parallel relation, supporting members at opposite ends of said unit, each of said vanes being formed of heat-conducting sheet material to provide a channel-shaped rib intermediate opposite lateral edges thereof and extending from edge to edge transversely of the vane and defining an open-ended groove, said ribs each including parallel side portions and an outer connecting web portion, cooperating slots extending longitudinally in said web portions of the ribs, said rib of each vane being engageable with an adjacent vane for retaining the vanes in spaced parallel relation in the unit with said slots in alignment, means for clamping said spaced vanes between said supporting members, and an elongated electrical heating element received through said cooperating slots of the ribs and engaging between said parallel side portions of the ribs.



4. An electrical heating device comprising a unit including a plurality of separate vanes arranged in longitudinally spaced parallel relation, supporting members at opposite ends of said unit, each of said vanes being formed of heat-conducing sheet material to provide a channel-shaped rib intermediate opposite lateral edges thereof and extending from edge to edge transversely of the vane and defining an open-ended groove, said ribs each including parallel side portions and an outer connecting web portion, cooperating slots extending longitudinally in said web portions of the ribs, said rib of each vane being engageable with an adjacent vane for retaining the vanes in spaced parallel relation in the unit with said slots in alignment, means for clamping said spaced vanes between said supporting members, and an elongated electrical heating element received through said cooperating slots of the ribs and engaging between said parallel side portions of the ribs, said vanes being formed at said lateral edges thereof with flanges extending angularly to a distance approximating the spaces between the vanes.

5. An electrical heating device comprising a unit including a plurality of vanes, each of said vanes being formed of heat-conducting sheet material to provide a channel-shaped rib intermediate opposite lateral edges thereof and extending from edge to edge transversely of the vane and defining an open-ended groove, said ribs each including parallel side portions and an outer connecting web portion, aligned slots in said web portions of the ribs, and an elongated relatively stiff electrical heating element received through said aligned slots of said ribs, said heating member frictionally engaging the edges of said slots and said parallel sides of said ribs, whereby said vanes are retained together in a unit.

6. An electrical heating device comprising a unit including a plurality of vanes, each of said vanes being formed of heat-conducting sheet material to provide a channel-shaped rib intermediate opposite lateral edges thereof and extending from edge to edge transversely of the vane and defining an open-ended groove, said ribs each including parallel side portions and a flat outer connecting web portion, aligned slots in said web portions of the ribs, spaced cooperating apertures in said web portions of the ribs, elongated attaching elements engageable through said cooperating apertures for securing the vanes in spaced parallel relation and an elongated electrical heating element received through said cooperating slots of said ribs and engaging between said parallel side portions of the ribs.

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