Sept. 6, 1938. R. A. CLAY 2,129,046

ELECTRICAL HEATER AND RESISTANCE

Filed June 19, 1936

Fig. 2

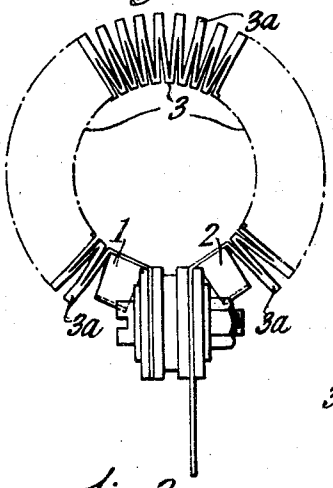


Fig. 1.

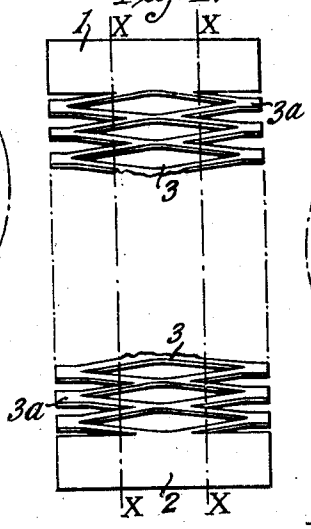


Fig. 5.

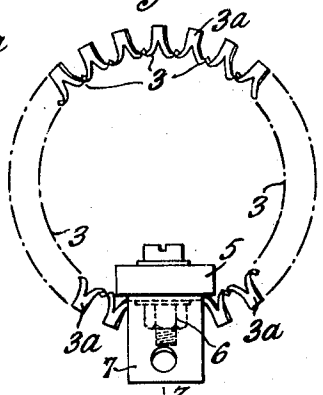


Fig. 3.

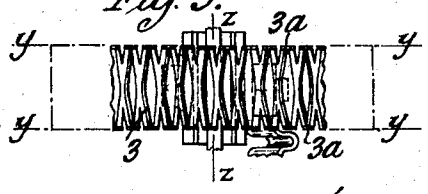


Fig. 6.

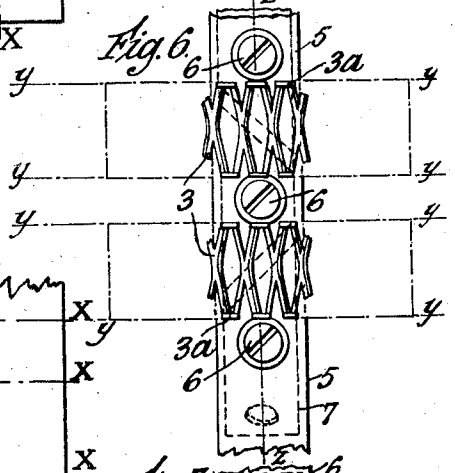


Fig. 4.

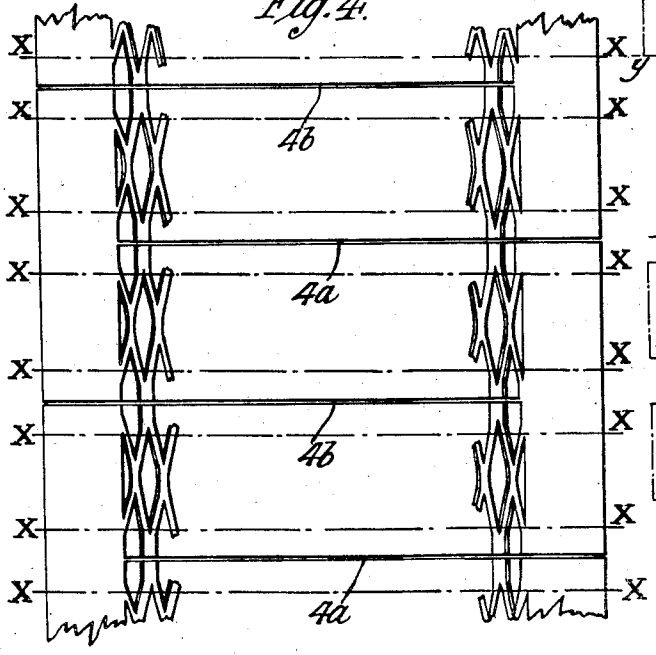
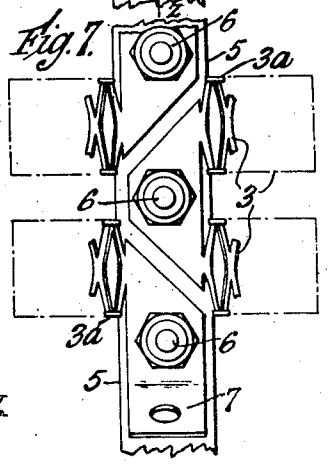


Fig. 7.



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2,129,046

ELECTRICAL HEATER AND RESISTANCE

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Application June 19, 1936, Serial No. 86,177
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11 Claims. (Cl. 201—69)

This invention relates to electrical heaters and resistances and more particularly to such devices of the kind comprising one or more resistance elements of expanded metal.

Though not limited exclusively to its application thereto the invention is primarily applicable, as regards heaters, to radiant and high temperature convector heaters and, as regards resistances, to so-called "oil immersed" resistances, i. e., to resistances wherein the resistance element or elements operate immersed in insulating oil.

According to this invention an electrical heater or resistance element consists of a strip of expanded metal at least one of the longitudinal edges of which (and preferably both longitudinal edges) is or are bent up substantially at right angles to the original plane of the strip, the strip with its bent up edge or edges being then bowed round into or approximately into a circle or part thereof so that the bent up edge or edges project approximately radially outward.

The invention is illustrated in the accompanying drawing in which

Figure 1 is a plan view of a blank or strip of expanded metal which may be used for making one embodiment of the invention;

Figure 2 is an elevation of a resistance element embodying the invention in one form;

Figure 3 is a plan view of the embodiment shown in Figure 2;

Figure 4 is a plan view of a sheet of expanded metal or blank which may be used for making another embodiment of the invention comprising a multi-element resistance or heater;

Figure 5 is an elevation of the multi-element embodiment;

Figure 6 is a top plan view of the embodiment shown in Figure 5; and

Figure 7 is a bottom plan view thereof.

Referring to Figures 1 to 3 which illustrate one way of carrying out this invention an electrical heater or resistance element is made from a straight strip of expanded metal as shown in Figure 1 said strip being one "mesh" wide, the strip being terminated by unexpanded metal portions 1, 2, integral therewith and serving to make connection to the expanded portion 3. The edges of the expanded portion are then bent up in the same direction about the lines X—X so as to be substantially at right angles to the original plane of the strip. A convenient arrangement for a one "mesh" wide strip is to make the bent up portions (3*a*) each equal to or rather less than one quarter of the original total width of the strip. The strip with its bent up edges is then bowed round part of a circle so that the central portion of the strip lies on and embraces about three quarters of an imaginary cylinder, the bent up edges lying in parallel planes at right angles to the axis of the imaginary cylinder. The bent up bowed round strip which when appears as shown in elevation in Figure 2 and in plane in Figure 3 is then held in the bowed round form—e. g., at its ends—against its natural springiness in any convenient way, e. g., as shown in Figure 2, and, as will be appreciated, the resultant structure which, according to the illustrated embodiment, is U-shaped in cross section and circular in longitudinal section, and offers (by reason of its shape) great strength against deformation so that the invention is of great advantage where light gauge metal is required to be used. The unexpanded ends are used for support and may be arranged in any convenient way, e. g., as shown in Figure 2.

A multi-element resistance or heater in accordance with this invention may conveniently comprise a plurality of elements such as above described, mounted side by side and, as it were, co-axially, i. e., so that the central portions of the strips of which the elements are composed all lie on or substantially on the same imaginary cylinder. Such a multi-element construction may be, and preferably is, integrally formed from the same sheet of metal so as to be jointless. For example, referring to Figures 4 to 7, a sheet of metal may be expanded and left, as shown in Figure 4, with opposite parallel unexpanded edges and the said sheet then cut with parallel cuts 4*a* 4*b* so as to form a zig-zag current path through the sheet. In other words the cuts are at right angles to the unexpanded edges, alternate cuts starting from opposite edges and each cut passing through one unexpanded edge only so that the sheet is formed into strips which are connected electrically in series by the uncut unexpanded edge portions. The side edges of the strips thus formed are then bent up at right angles to the original plane of the sheet about the lines X—X and the sheet then bent round an imaginary cylinder so that the strips are parallel and side by side, each embracing about three quarters of the said cylinder. The portions of unexpanded sheet which mechanically and electrically connect the strips may be utilized in any convenient way to maintain the strips in the bowed round form, e. g., the said portions may be insulatingly fixed to a support such as a metal bar or directly fixed to

a bar of insulation running parallel to the axis of the bowed round strips. Such a construction is shown in elevation in Figure 5, in plan in Figure 6 and in underneath plan in Figure 7. In these figures 5 is the insulating bar support. The said portions may also be formed to take external connections so that they constitute intermediate tappings (not shown). In the construction of Figures 5, 6 and 7 intermediate tappings may be taken from the holding bolts 6 passing through the bar and connectors 7 integral with the resistance unit are shown. It will further be noted (from Figure 7) that the unexpanded portions have been cut away in triangular fashion to facilitate mounting the unexpanded edges neatly on the support bar.

The integral method of construction illustrated in Figures 4 to 7 is not limited to the case of elements in simple series, for, by suitably arranging the cuts in the original sheet and/or suitably connecting the individual elements connection of elements in parallel or series-parallel may be obtained.

It will be observed that the improved element is formed of an integral strip of expanded metal having the portion included between the two bending lines X—X and X—X bowed to conform in curvature to the surface of a cylinder whose axis is indicated at *z*—*z* in Figures 3 and 6. The strip also comprises, in the form shown, two longitudinal edge portions 3*a* each of which is bent up substantially at right angles to the portion between the bending lines X—X. The edge portions 3*a* moreover are disposed in the planes *y*—*y* (indicated in Figures 3 and 6) which are perpendicular with respect to the cylinder. The edge portions 3*a* terminate respectively in the planes *y*—*y*.

The principal advantages of this invention are:

1. The mechanical strength for a given gauge of material.

2. The good heat radiating qualities.

3. The facility with which a single mounting can be employed for a whole series of elements, e. g., a single metal bar, suitably insulated from the elements it carries, may serve as support for and be passed axially through the series.

4. The facility with which intermediate tappings between elements on a multi-element unit can be made.

5. The ease with which a jointless multi-element unit may be made, and

6. The general shape and arrangement of multi-element units as above described makes them very suitable for replacing wire-wound resistances in existing oil immersed resistance of the general design common for such purposes as electric motor starter resistances.

The invention is, of course, not limited to the use of expanded metal strips one "mesh" wide as other widths of strip may be employed. The use of strips only one or a very few meshes wide is however preferred.

What I claim is:

1. In combination, an electrical heater or resistance element comprising an integral strip of expanded metal, one portion of which is bowed to embrace at least 180° of an imaginary cylinder so as to lie on the surface thereof and another portion of which corresponding to a longitudinal edge portion of the strip is bent up substantially at right angles to the first mentioned portion so as to be radial with respect to said imaginary cylinder and outwards of said first mentioned portion; and means for anchoring said heater or resistance element in its curved form.

2. An electrical heater or resistance element comprising an integral strip of expanded metal one portion of which is bowed to conform in curvature to the surface of a cylinder and another portion of which comprising a longitudinal edge portion is bent up substantially at right angles to the first mentioned portion and lies in a plane substantially perpendicular with respect to the axis of said cylinder and outwards of said first-mentioned portion, the bent up longitudinal edge portion terminating in said plane.

3. In combination, an electrical heater or resistance element comprising an integral strip of expanded metal, one portion of which is bent to embrace at least 180° of an imaginary cylinder so as to lie on the surface thereof, and two other portions of which, each corresponding to a longitudinal edge portion of the strip are bent up substantially at right angles to the first mentioned portions so as to be radial with respect to said imaginary cylinder and outwards of said first mentioned portion; and means for anchoring said heater or resistance element in its curved form.

4. The invention as claimed in claim 1 further characterized in that the strip is one mesh wide and the bent up portion is substantially equal to one quarter of the original total width of the strip.

5. The invention as claimed in claim 3 further characterized in that the strip is one mesh wide and each of the bent up portions is substantially equal to one quarter of the original total width of the strip.

6. The invention as claimed in claim 1 further characterized in that the strip is formed with unexpanded ends which make connection to the expanded metal.

7. The invention as claimed in claim 3 further characterized in that the strip is formed with unexpanded ends which make connection to the expanded metal.

8. The invention as claimed in claim 1 further characterized in that the strip is formed with unexpanded ends which make connection to the expanded metal, the strip being supported in its bowed round position by the support means from which the unexpanded ends are carried.

9. The invention as claimed in claim 3 further characterized in that the strip is formed with unexpanded ends which make connection to the expanded metal, the strip being supported in its bowed round position by the support means from which the unexpanded ends are carried.

10. An electrical heater or resistance unit comprising a plurality of elements as claimed in claim 1, said elements being integrally formed with one another from a single slitted expanded metal sheet having unexpanded top and bottom ends, portions of said unexpanded edges joining the individual elements.

11. An electrical heater or resistance unit comprising a plurality of elements as claimed in claim 3, said elements being integrally formed with one another from a single slitted expanded metal sheet having unexpanded top and bottom ends, portions of said unexpanded edges joining the individual elements.

RALPH ARDEN CLAY.