J. I. AYER.

HELICAL HEATER FOR TUBES, &c.

APPLICATION FILED NOV. 25, 1910.

995,051. Patented June 13, 1911.

Fig. 1.

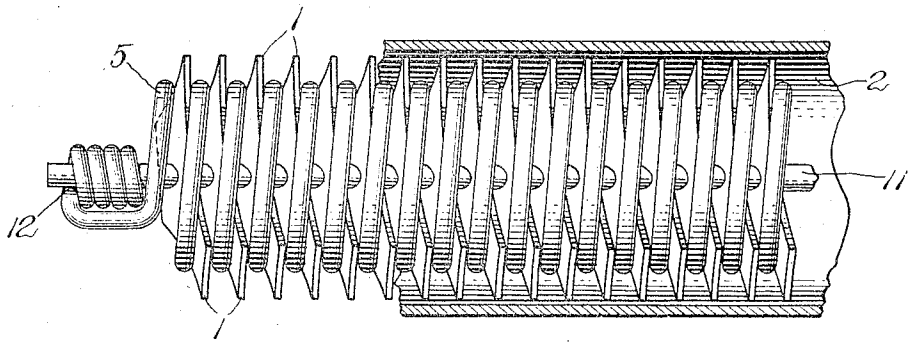


Fig. 2.

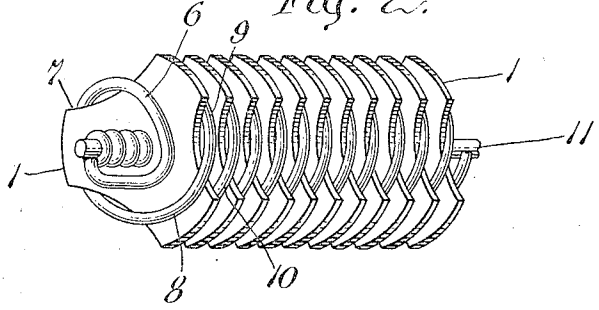
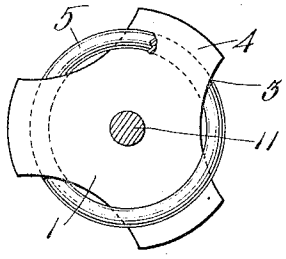


Fig. 3.



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UNITED STATES PATENT OFFICE.

JAMES I. AYER, OF CAMBRIDGE, MASSACHUSETTS, ASSIGNOR TO SIMPLEX ELECTRIC HEATING COMPANY, OF CAMBRIDGE, MASSACHUSETTS, A CORPORATION OF MASSACHUSETTS.

HELICAL HEATER FOR TUBES, &c.

995,051. Specification of Letters Patent. Patented June 13, 1911.

Application filed November 25, 1910. Serial No. 594,129.

To all whom it may concern:

Be it known that I, JAMES I. AYER, a citizen of the United States, residing at Cambridge, in the county of Middlesex and State of Massachusetts, have invented an Improvement in Helical Heaters for Tubes, &c., of which the following description, in connection with the accompanying drawings, is a specification, like letters on the drawings representing like parts.

This invention relates to an arrangement of insulation for spiral conductors used in tube or like heaters, whereby the conductor is insulated from its containing tube, and the adjacent turns of the spiral from each other.

Spiral heating coils for use within tubes have heretofore been made by covering the resistance conductor of the spiral or lining the inside of the tube, or both, with layers of insulating material, but this is subject to the objection that it seriously interferes with the free conduction of heat from the source to the walls of the tube.

The novel construction of the present invention not only permits direct radiation without the intervention of obstructing insulating material, but further provides free circulation of convection currents and insures uniform parallel relation between the inner wall of the tube and the heater, thereby securing equal temperature in all parts of the length of the device; this permits the construction of heaters of like size with greater heating capacity than in the case of previous methods, for the reason that in former constructions involving a retarded rate of heat conduction there is always a higher temperature in the resistance element than if free conduction and convection of heat was possible.

The general aspects of the invention may be embodied in a great number of specific forms, and of these, one of the forms which is at present deemed most practicable, is illustrated.

Referring to the accompanying drawings for a full understanding of the details of this form, Figure 1 shows in side elevation the preferred form of heater, a portion of an inclosing tube being shown broken away; Fig. 2 is a perspective view; and Fig. 3 is an end view thereof.

A series of sheets or plates 1 of mica, this typifying any suitable insulating material, is produced of a proper form to fit the inclosing tube 2, usually as disks, with a series of cut out portions 3 about the periphery thereof, thus leaving a corresponding series of lobes or projections 4 spaced apart around the disk. The resistance element is shown in this form as a spiral wire 5, this typifying a resistance element which may be either wire or ribbon or any other convenient form. As shown, the resistance conductor, starting from the front of one lobe as at 6, passes behind the second lobe at 7 and in front of the third lobe of the same disk as at 8, thence in front of the first lobe of the next disk as at 9, which is in alinement directly behind the lobe 6; thence it passes behind the second lobe of the second disk, which it will be understood is likewise directly behind and in alinement with the lobe 7, and in front of the third lobe of the second disk, as at 10. In a similar manner the wire is intertwined about the lobes of the successive disks, passing in front of and behind alternate lobes, thus causing said lobes to constitute an effective insulation between adjacent turns. It is likewise apparent that the intertwined arrangement of the disk lobes in the coil will hold the several disks in proper position in the coil and in uniform parallel relation without necessity for any central support. A central rod or bar 11 may optionally be employed in this form to constitute a convenient return conductor, being connected to one end of the coil at 12, so that the two terminals can be applied at the same end of the coil. The disks 1 are cut away at 3 deep enough so that the wire turns lying therein will be spaced some little distance from the ends of the lobes 4, so that an uncovered metallic tube 2 when slipped over the assembled heater will be spaced away from the coil uniformly at all points, and this irrespective of any form to which it may be desired to bend such tube; for instance, the containing tube may

be bent to a circular, spiral or any other desired form and there still be no possibility of a short circuit between different portions of the coil nor any appreciable approach between adjacent portions thereof or of any portion to the tube. There is thus provided a construction wherein the insulating elements while insuring proper insulated relation between the several parts of the coil and between the coil and the tube, at the same time in no way interfere with the radiation of heat from the coil to the tube or from the tube to the object to be heated, while also permitting currents of air to pass freely through the device, thus effecting transfer of heat by convection as well as conduction and radiation.

It is to be understood that my invention in its broader aspect contemplates the construction of the novel arrangement of insulators or insulating means in the spiral, designed for use in tubes or containers not necessarily round. For instance, the tube or container may be of square, elliptical, hexagonal, or other cross-section; in such case the spiral resistance element or the insulating disks, or both, would preferably be formed to follow the form of the walls of the duct or channel, whatever shape its cross-section might be, to lie as nearly parallel as possible therewith. Further, it is obvious that while in the preferred construction shown, round wire is employed, formed into a regular spiral, as the resistance element, it is equally within the scope of the invention with the necessary slight changes in the form of disk, to modify the form of the coil within wide limits, or to change the cross-section of the resistance element from a round to an angular wire or ribbon or to any other shape which might be found desirable, these being merely minor changes that can obviously be carried out without departing from the spirit of the invention.

Having described my invention, what I claim as new and desire to secure by Letters Patent is,

1. An electric heater member comprising a spiral resistance element, insulating plates disposed between turns of said resistance element, and held in place thereby, said plates projecting radially outward adjacent the several turns of the resistance element beyond the same, about the circumference thereof to provide an insulating protector around the periphery of the resistance element and permit free transmission of heat from said resistance element both by radiation and air convection.

2. An electric heater member comprising a continuous spiral resistance element, insulation disposed between turns of said resistance element and projecting radially beyond the same adjacent the respective spiral turns, and a tube fitted to the periphery of said insulation, and held thereby in spaced apart relation to said resistance element whereby distribution of heat by air convection from said resistance element is permitted.

3. An electric heater member, comprising a continuous spiral resistance element, and insulating plates having cut out portions disposed between turns thereof, each turn crossing a plate at its cut out portion.

4. An electric heater member, comprising a continuous spiral resistance element, insulating plates with cut out portions disposed between turns thereof, and projecting from the periphery thereof, each coil crossing a plate at a cut out portion thereof.

5. An electric heater member, comprising a resistance coil, insulating plates having spaced apart lobes projected between turns of said coil, said coil engaging alternate lobes on opposite sides.

6. An electric heater member, comprising a resistance coil, and insulating plates having a series of lobes projected therethrough, the coil engaging opposite sides of the alternate lobes of each successive plate.

7. An electric heater member, comprising a resistance coil, insulating plates disposed between turns of the coil and constructed to permit the coil to pass alternately from one side to the other thereof at determinate spaced apart points.

8. An electric heater member, comprising a resistance coil, insulating disks having cut out portions to form three equidistant lobes projected between turns of said coil and beyond the periphery thereof, the coil passing on opposite sides of successive lobes.

9. An electric heater member, comprising a resistance coil, insulating disks having portions cut out to form lobes projected between turns of said coil beyond the periphery thereof, to permit the coil to pass alternately from one side to the other of successive lobes, and a conductive casing fitted over said disks.

10. An electric heater member, comprising a resistance coil, insulating disks having portions cut away to form equi-distant lobes, and having the coil intertwined around said lobes, said lobes projecting beyond the coil, a return conductor rod connected to an end of said coil extending through said disks, and an inclosing heat conductive tube fitted over said disks.

11. An electric heater member comprising a continuous resistance spiral, and insulating plates held in fixed operative position by engagement with the turns of said spiral, each plate having different portions between different turns.

12. An electric heater member comprising a continuous resistance spiral, insulating plates, held in fixed operative position by

engagement with the turns of said spiral, each plate having different portions between different turns, said plates extending peripherally beyond the turns of the spiral, and an inclosing heat conductive tube fitted over said plates.

In testimony whereof, I have signed my name to this specification, in the presence of two subscribing witnesses.

JAMES I. AYER.

Witnesses:
DORA A. PROCTOR,
ELIZABETH M. CONLIN.