H. B. GALE.

ELECTRIC HEATER.

APPLICATION FILED DEC. 29, 1910.

990,124. Patented Apr. 18, 1911.

Fig. 1.

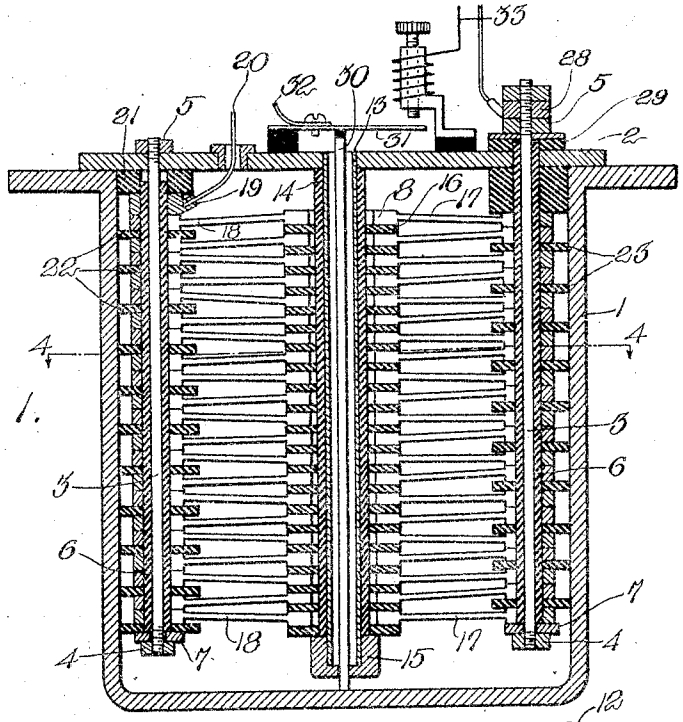


Fig. 2.

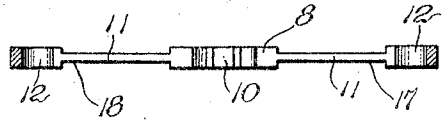


Fig. 3.

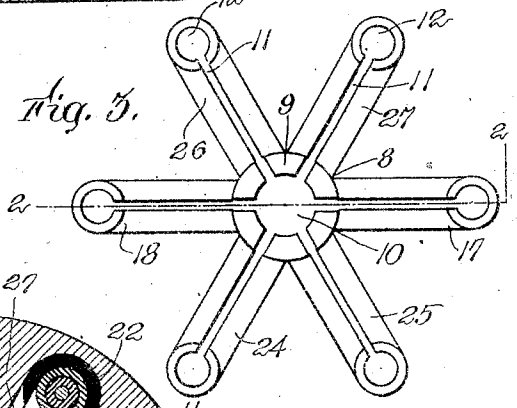
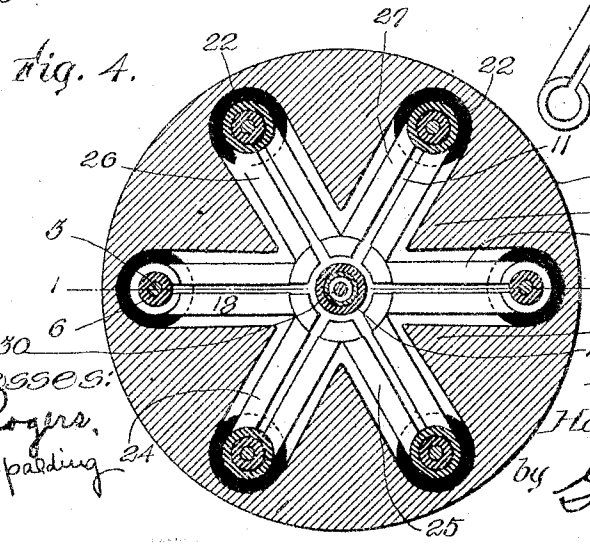


Fig. 4.



Witnesses:
C. L. Rogers.
M. J. Spalding.

Inventor:
Horace B. Gale,
by Geo. S. Maxwell,
Attorney.

UNITED STATES PATENT OFFICE.

HORACE B. GALE, OF NATICK, MASSACHUSETTS, ASSIGNOR TO SIMPLEX ELECTRIC HEATING COMPANY, OF CAMBRIDGE, MASSACHUSETTS, A CORPORATION OF MASSACHUSETTS.

ELECTRIC HEATER.

990,124. Specification of Letters Patent. Patented Apr. 18, 1911.

Original application filed September 19, 1910, Serial No. 582,753. Divided and this application filed December 29, 1910. Serial No. 599,981.

To all whom it may concern:

Be it known that I, HORACE B. GALE, a citizen of the United States, residing at Natick, in the county of Middlesex and State of Massachusetts, have invented an Improvement in Electric Heaters, 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 electric heating device adapted to collect and conserve the heat generated in resistance elements by the passsage of current therethrough.

While the device has other and more general fields of usefulness, one particular application is in connection with a method and apparatus for equalizing temperature described and claimed in my copending application Ser. No. 582,753 filed Sept. 19, 1910, of which this case is a division.

The objects of the invention are to provide a construction in simple, compact form, having relatively large heat-generating and storing capacity, and other matters of detail as will hereinafter appear.

The invention will be clearly understood from the following description in connection with the accompanying drawings, wherein,

Figure 1 is a central vertical section through the improved heater on line 1—1 Fig. 4; Fig. 2 is a sectional detail of a resistance element on line 2—2 of Fig. 3; Fig. 3 is a plan view of a resistance element; and Fig. 4 is a transverse section through the heater on line 4—4 of Fig. 1.

The heater casing 1, usually made of iron or other metal, is shown as of cylindrical exterior form, although this particular form is obviously not material. The cover 2 of this casing has depending therefrom a series of rods 3 extending downward to near the bottom of the casing, and supporting in clamped relation thereto resistance elements by means of nuts 4 threaded on the lower ends thereof, the rods themselves being held engaged with the cover by other nuts 5 threaded to their tops. The several rods 3 each have slipped thereover an insulating sleeve 6, washers 7 of metal being interposed between the ends of such sleeves and the nuts 4. The resistance elements consist of a number of similar metal sections 8 each cast or otherwise formed as a continuous one-piece strip or bar with a series of radial arms, shown as six, extending in a common plane so as to have a general flat form. The hub of these sections has an enlarged central opening 10 with slits 11 extending therefrom centrally of each arm and terminating in enlarged openings 12 adjacent the end of each arm.

A central guide shown as a tube 13 is fixed in depending relation to the cover 2, and an insulating sleeve 14 slipped thereover is held in position by a cap 15 fixed to the end of said tube. The resistance elements are slipped over the several rods 3 and tube 13, the openings 12 being shaped to fit around the insulating sleeves 6, and the hub opening 10 being shown as somewhat larger than the insulating sleeve 14. Insulating washers 16 are interposed between the several resistance elements and between the lower resistance element and the cap 15, and like insulating washers are interposed between the extremities of the several arms of successive resistance elements fitted over the rods 3 except two opposite arms 17, 18 of each resistance element, through which the electrical connection between successive elements and to the terminals is made. The arm 18 of the upper resistance element contacts with a block 19 connected with one terminal 20 of the heater, this block being insulated from the cover by an insulating block 21. This arm is insulated from the adjacent arm of the next resistance element by an insulating washer 22, like resistance washers being interposed to leave the successive arms 18 electrically connected in pairs, there being an insulating washer between each pair. The opposite arms 17 are likewise electrically connected in pairs, like insulating washers 23 being interposed between pairs, and the washers 22, 23 at opposite sides being interposed between alternate resistance elements, so that current entering the arm 18 of the top resistance element will pass through both sides of each intermediate arm 24, 25, 26, 27 at either side to the opposite arm 17, thence in like manner through the next resistance element in opposite direction back to the next arm 18, and so on through the series of elements, and finally out from the lower right-hand arm 17 of the last resistance element through the metallic washer 7 and right-hand rod 3

to the other terminal 28, this terminal being insulated from the cover by suitable insulating washers 29.

A portion of a circuit controller is shown, consisting of a metallic rod 30 adapted to be expanded by heat, which is disposed within the tube 13, rests on the bottom of the casing, and at its top is arranged to press against a spring contact bar 31, and thus close a contact through terminals 32, 33 of a secondary circuit which, when closed, is arranged to open the main circuit, as more fully explained in my co-pending application to which reference is above made.

The heater casing is preferably made of massive construction so as to afford a large heat-storing capacity, and the internal surface thereof is desirably made in a scalloped section, as shown at 34 in Fig. 4, in order to bring all parts of the heating resistance into as close proximity as possible to the heat-absorbing surface thereof, and to facilitate heat transmission between the resistance element and the casing by providing the largest practicable extent of transmitting surface within a given space. The resistance element in the form of a scalloped and slit ring with radiating arms, presents a form which has a considerable length of conductor in a compact space, every portion of the conductor moreover being exposed on the outside to free radiation of heat to the opposite surface of the casing 1 and also free to expand toward the center when heated. This form is also adapted to be easily cast and economically insulated and supported by suspension rods in the case, as shown. If desired, the entire resistance element may be lifted out of the case by raising the cover plate, and inspected without loosening screws or other parts. On account of the substantial mass of heat-storing metal thus provided, it is obvious that the heat deliverable by the heater will be to a large extent independent of temporary fluctuations in the current supply, the heater thus having an exceptionally high capacity for uniform heat delivery in very compact form.

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

1. An electric heater, comprising a resistance conductor formed as a series of conductive sections with radiating arms, insulation separating the sections except at alternate opposite points, and a casing conforming in interior shape to the external form of said sections.

2. An electric heater, comprising a resistance conductor composed of a series of flat conductive sections, insulation separating the sections except at alternate opposite points, and a casing having parts in immediate heat-receptive relation to all parts of said conductor.

3. In an electric heater, a resistance element composed of flat conductive plates having a hub with an enlarged central opening and a series of arms radiating therefrom, each of said arms having an enlarged opening at its extremity to receive a support, and a slit extending from said opening to said hub opening.

4. In an electric heater, a resistance conductor composed of a series of conductive plates, each having a central hub and radial arms, said plates having insulation disposed therebetween and being divided so that current introduced at an extremity of one arm will pass through all the arms of the successive plates.

5. In an electric heater, a resistance conductor comprising a series of conductive elements, each with a hollow central hub and radial arms, each of said arms being slitted from the hollow of the hub to near its extremity, and electric connection to non-adjacent arms of each element, whereby current will pass through each element partly in multiple and partly in series.

6. An electric heater, comprising a resistance conductor composed of a series of flat conductive elements, each having a hollow hub and slitted radial arms, insulation arranged so as to leave non-adjacent arms of successive elements electrically connected, a casing, a cover therefor, and means for clamping said conductive elements and insulation in assembled relation to said cover.

7. An electric heater, comprising a resistance conductor composed of a series of flat conductive elements, each having a hollow hub and slitted radial arms, insulation arranged so as to leave non-adjacent arms of successive elements electrically connected, and a casing, having its inner walls lying adjacent and conforming in shape to the external form of said resistance conductor.

8. An electric heater, comprising a resistance conductor composed of a set of flat conductive sections electrically connected in pairs at opposite points, insulation separating the sections alternately between pairs, and a casing having a part on which said sections are adapted to be slidably assembled.

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

HORACE B. GALE.

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