H. W. DENHARD.

ELECTRIC RESISTANCE UNIT.

APPLICATION FILED OCT. 31, 1911.

1,102,249.

Patented July 7, 1914.

2 SHEETS—SHEET 1.

Fig. 1.

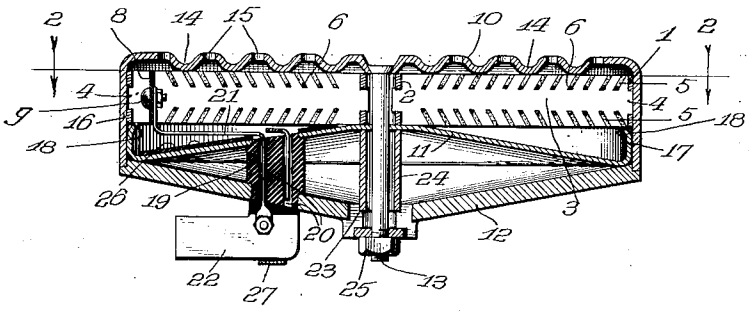


Fig. 2.

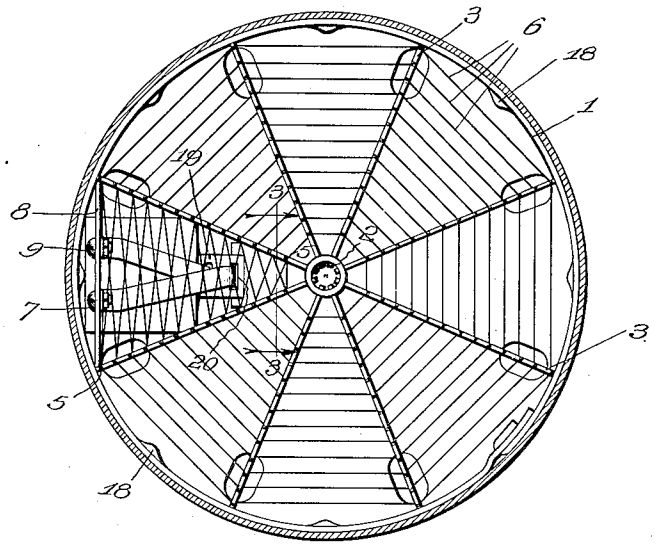
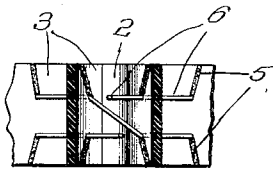


Fig. 3.



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2 SHEETS—SHEET 2.

Fig. 4.

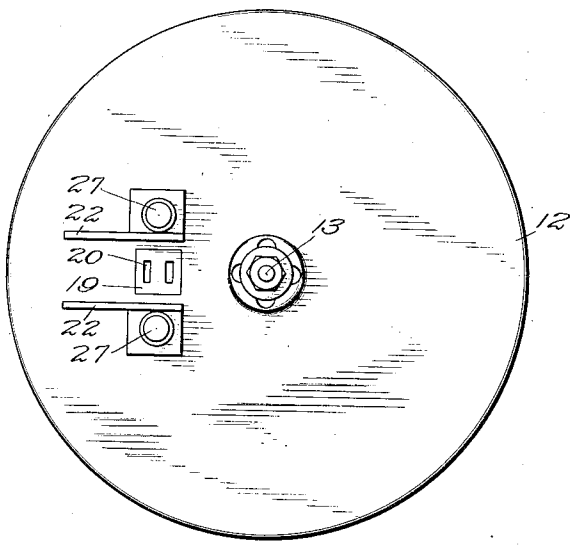
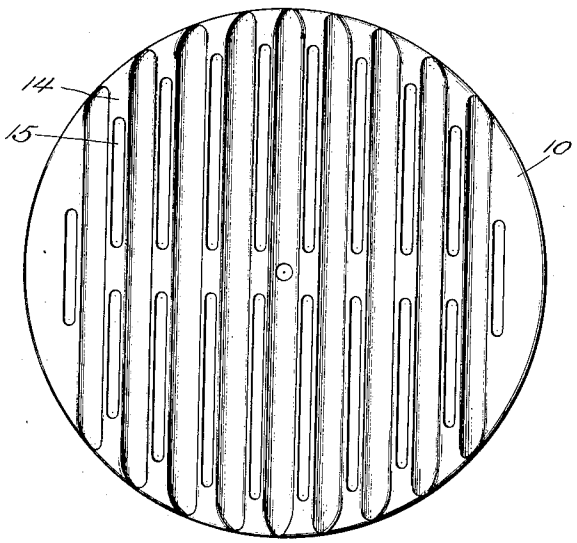


Fig. 5.



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UNITED STATES PATENT OFFICE.

HARRY W. DENHARD, OF SAN FRANCISCO, CALIFORNIA, ASSIGNOR TO THE CUTLER-HAMMER MFG. CO., OF MILWAUKEE, WISCONSIN, A CORPORATION OF WISCONSIN.

ELECTRIC RESISTANCE UNIT.

1,102,249. Specification of Letters Patent. Patented July 7, 1914.

Application filed October 31, 1911. Serial No. 657,812.

To all whom it may concern:

Be it known that I, HARRY W. DENHARD, a citizen of the United States, residing at San Francisco, in the county of San Francisco and State of California, have invented new and useful Improvements in Electric Resistance Units, of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawing, forming a part of this specification.

My invention relates to electric resistance units.

It has among its objects to provide an improved electric resistance unit.

A further object of my invention is to provide an improved electric heating device which is capable of being made up into flat form and used as a radiant heater, the heat waves being directly radiated to the object to be heated.

Other objects and advantages of my improved construction will hereinafter appear.

In the accompanying drawings I have for purposes of illustration shown one form which my invention may assume in practice. My invention is not, however, limited to this form, but may assume other forms.

In the views of these drawings: Figure 1 shows a central sectional view through a heater. Fig. 2 shows a top plan view on line 2—2 of Fig. 1, the cover being removed. Fig. 3 shows a sectional view on line 3—3 of Fig. 2. Fig. 4 shows a bottom view of the heater. Fig. 5 shows the top plate in elevation.

In the construction shown for purposes of illustration I have illustrated an electric heater of a disk type including a plurality of radial extending arms upon the opposite sides of which a resistance material is wound spirally; the whole being inclosed in a metallic casing including a top plate having slots in the same and adapted to carry the object to be heated, and bottom plates arranged to support the heating element in position and carry suitable terminal connections for the same.

The heating element 1 is in a preferred form constructed as shown in Fig. 2, including an outer-ring like frame or band 1, a central hub 2 and radial extending arms 3 fixed in the hub and at points about the periphery of the ring 1. In a preferred form the ring 1 is formed of a stiff material the ends being interfitted as shown in Fig. 2. If desired I may use a metal ring. The hub 2, may if desired, be made of a similar material to that used for the ring. The arms 3 are preferably fitted in a suitable manner in both the hub 2 and the ring 1, so that they may not be readily dislocated. If desired I may provide extensions 4 on the ends of the arms which extend through these members, as shown for instance in Fig. 2. In a preferred form the arms 3 are formed of an insulating material. If desired, I may use mica as this insulating material. In order to receive the resistance material the arms 2 are preferably slotted, as shown at 5 in Fig. 1, the slots being arranged on opposite sides of the arms and preferably extending a trifle diagonally toward the outer edge of the arms. As illustrated in Fig. 1, the slots on the opposite arms extend in opposite directions and are preferably so arranged that a resistance material may be wound upon one edge of the arms in a spiral and then brought back to the opposite edge of the arms, upon which it is again wound in a spiral form. The resistance material 6 may be of any desired form. In a preferred form, however, I use a single length of resistance wire which is brought in at the side of the unit, as for instance at a binding post 7 carried upon a strip of insulating material 8 extending between the ends of two adjacent arms 3. If desired, the strip 8 may likewise be made of mica. In a preferred form the entering length of resistance wire is passed around the inner shank of the binding screw and is then brought out to the first slot 5, which in this instance is illustrated as the first slot in the lower adjacent arm 3. From this notch the wire is then preferably wound successively around the unit in a spiral form, passing the first notch 5 previously mentioned in the second notch on the same arm and being successively brought toward the center of the unit, where, at the inner notch 5 on the arm at the opposite side of the binding post, the wire is passed downward to the first notch on the underside of the first mentioned arm, from which it is again wound spirally from

the center of the device to the outside of the same and then brought out at the other binding screw 8. It is obvious that if desired I may so connect these several coils in series or in parallel as to provide a plurality of heats.

While in a preferred form I use a single length of resistance material, I may, if desired, use a plurality of lengths of resistance material, the lengths being connected to each other in a suitable manner at any desirable point. In a preferred form in order to hold the resistance material snugly within the notches, I preferably fill these notches with a suitable insulating material, as shown in Fig. 1. In a preferred form the junction of the arms with the hub member 2 is preferably covered with a similar insulating material, which, if desired, may be first made up in the form of paste or applied to the hub, upon which it then hardens. By the provision of this insulating covering for the hub I am able to provide a unit of great strength on account of the metallic frame, and at the same time provide a unit in which there is no danger of short circuiting due to the provision of the insulation. In a preferred form the heating element is inclosed in a metallic casing including a metallic cover plate 10, an under supported plate 11 and a bottom plate 12, the unit and the several plates being positioned upon a suitable central bolt or screw 13. The cover plate 10 is preferably provided with a grid-like top having corrugations 14 formed therein, in which the upwardly extending corrugations are preferably provided with slots 15 extending substantially across the upper surface of the same. It is thus seen that a grid-like surface is provided on the plate. In a preferred form the plate 10 is also provided with a flange 16 which extends around the unit and serves to house the same. The unit is preferably held in position snugly against the inner surface of the plate 10 by means of the plate 11, which is preferably provided with a raised or convex center having a central perforation within the same, through which the bolt 13 extends. The plate 11 is also preferably provided with an outer flange 17 around its periphery, which serves to support the outer edge of the unit and is preferably provided with extensions 18 which extend beneath the edge of the ring 1 and serve to support the same. In a preferred form the plate 11 is also provided with a substantially rectangular shaped opening on one side of the same between the flange 18 and the central opening. In this opening is housed in a preferred form the reduced end of an insulating block 19 having slots 20 formed therein, through which suitable leads 21 may extend from the binding posts 7 and 9 to suitable terminal plugs 22 preferably carried on the lower surface of the plate 12. In a preferred form the plate 12 is provided with a central recess 23 arranged to permit the bolt 13 to pass through the same and to receive the lower end of a spacing sleeve 24, which is preferably fitted around the bolt 13 between the plate 12 and the plate 11, as shown in Fig. 1. In a preferred form the bolt 14 is seated in a suitable central opening in the plate 10 and extends down through the hub of the heating unit, the opening in the plate 11, the sleeve 24 and the plate 12, being provided with a tap 25 on its lower end which serves to hold the parts securely together. If desired the upper surface of the plate 11, adjacent to the insulating block 19 may be covered with a suitable insulation 26 in order to prevent any possibility of the short circuiting of the device on the metallic plate. It is obvious that the leads 21 may be of any desired construction. However, in a preferred form I employ a flat lead of the ribbon type, since I find that these may be readily made to give a good contact at the binding posts and may be readily brought down through the device in a small space and brought out to the binding screws 27 of the terminal members.

By my improved construction I have provided an improved electric resistance unit wherein the electric resistance wire is arranged in a compact form on a suitable frame so that it is effectually insulated, and yet at the same time may develop a high degree of heat. Further, the device is such that the heat waves may be readily radiated to an object to be heated. By my improved construction and arrangement of the resistance unit and the casing which incloses the same I have provided an exceedingly compact heater, which may be readily made up in a disk or other form and adapted to use as a stove or heater or in a wide variety of relations. Further the resistance element is securely and effectually inclosed within the unit in such a manner as to be protected. Further the electrical connections for the device may be readily made and are fully protected within the casing so that all that it is necessary for one to do who desires to connect the device in circuit is to place an attachment plug upon the terminal members. It is obvious that the inclosed unit may be placed upon any suitable support or stand, or used in a wide number of different relations. By my improved construction I have provided a heating unit of increased efficiency in a very compact and rugged form, which may be very conveniently used in service for a long period and which may also be readily and cheaply manufactured.

While I have in this application described one form which my invention may assume in practice, I do not wish to be limited to the form shown for purposes of illustration, but

wish rather to include within the scope of this application all of those forms of my invention falling within its spirit.

What I claim as new and desire to secure by Letters Patent is as follows:—

1. In an electric resistance unit, a frame having a plurality of radially extending arms, and a resistance material engaging said arms and wound on the opposite sides thereof in parallel planes.

2. In an electric resistance unit, a frame, a plurality of notched radially extending insulating strips having their ends attached to said frame, and a resistance material wound on opposite sides of said strips and resting in said notches.

3. In an electric resistance unit, a ring, a hub, a plurality of notched radially extending arms attached to said ring and hub and a resistance material wound spirally in opposite directions on the opposite edges of said strips and passing through said notches.

4. In an electric resistance unit, a ring, a hub, a plurality of notched radially extending arms having extensions extending through said ring and said hub, a resistance material wound on the opposite edges of said arms and passing through said notches, an insulating strip connecting certain of said radially extending arms, and binding posts for said resistance material carried on said strip.

5. In an electric resistance unit, a ring, a hub, a plurality of radially extending arms having projections seated in said ring and said hub and having notches in their edges, a resistance material wound spirally on the opposite edges of said arms and passing through said notches, a strip connecting certain of said arms and binding posts for said resistance material carried on said chord-like strip.

6. In an electric heating device, a frame, a plurality of notched insulating strips carried in said frame, a resistance material wound on the opposite edges of said strips and passing through said notches, and an inclosing casing arranged to permit the radiant energy developed by said unit to pass to the object to be heated.

7. In an electric heating device, a slotted cover plate having a depending flange and depressed portions between the slots, a heating unit housed in said plate, a plate having a convex surface and an upwardly extending flange for positioning said unit in said cover plate, a bottom plate inclosing said last mentioned plate, means for holding the parts in assembled relation, and means for insulating the line connections within said heating unit.

In witness whereof, I have hereunto subscribed my name in the presence of two witnesses.

HARRY W. DENHARD.

Witnesses:
H. L. Rockwell,
Geo. B. Jones.