No. 846,853. PATENTED MAR. 12, 1907.

J. T. HOWELL.

ELECTRIC HEATER.

APPLICATION FILED MAY 7, 1906.

Fig. 1.

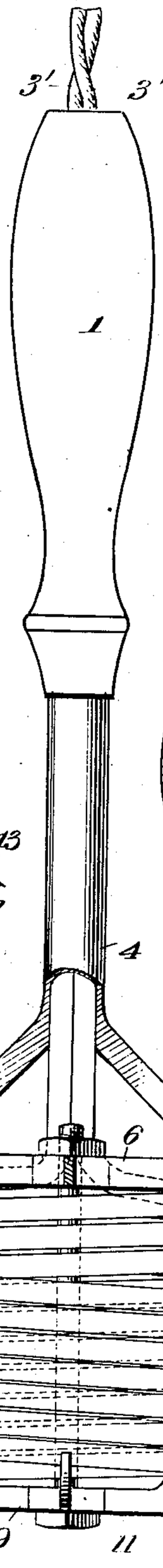


Fig. 2.

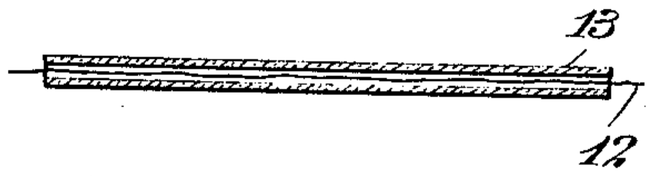


Fig. 3.

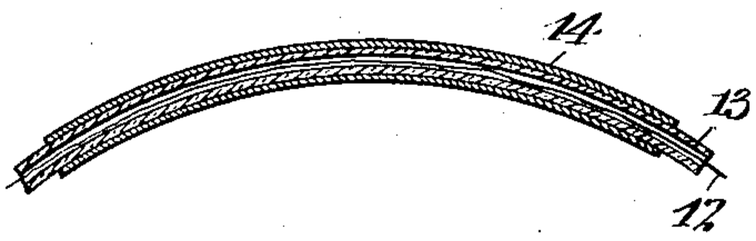


Fig. 4.

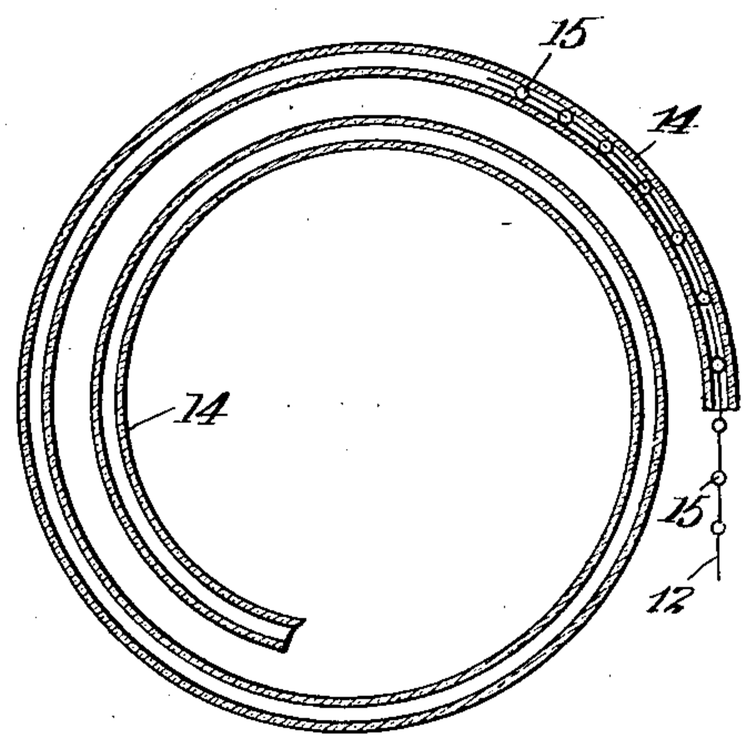
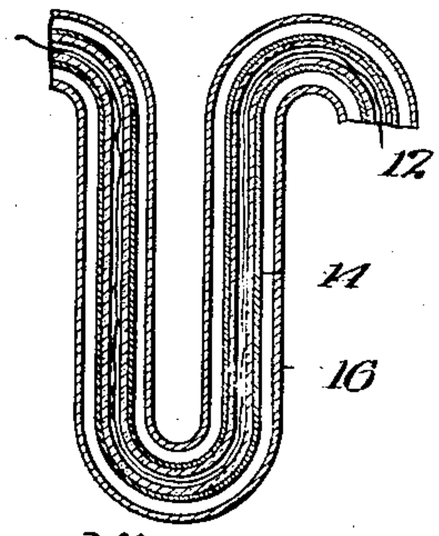


Fig. 5.



Witnesses

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ELECTRIC HEATER.

No. 846,853. Specification of Letters Patent. Patented March 12, 1907.

Application filed May 7, 1906. Serial No. 315,511.

To all whom it may concern:

Be it known that I, JAMES T. HOWELL, a citizen of the United States, residing at Seattle, in the county of King and State of Washington, have invented certain new and useful Improvements in Electric Heaters, of which the following is a full, clear, and exact description.

My invention relates to electric heaters of that class employed particularly for heating water and other liquids by the aid of current from an ordinary lamp-circuit or other source of fixed potential.

The principal object of the invention is to provide a heater of this class having a resistance element of very large radiating or conducting area, so that the heat therefrom is quickly and efficiently transmitted to the fluid or material to be warmed and also so as to avoid the resistance material or medium itself becoming unduly heated, and thereby injured or destroyed.

A further object of the invention is to so construct the resistance element that perfect insulation is secured and all liability to grounds and short circuits overcome.

A still further object of the invention is to protect the resistance material or wire from contact with the air, moisture, or other oxidizing influences.

With these and other objects in view my invention consists in the construction, combination, location, and arrangement of parts and in the order and sequence of steps and operations, as hereinafter set forth and shown and finally particularly pointed out in the appended claims.

In the drawings, Figure 1 is a side view of a complete heater embodying the principles of my invention. Fig. 2 is a detail sectional view illustrating the first step of the formation of the resistance element. Fig. 3 shows a following step in the construction of the resistance element. Fig. 4 indicates a slightly-modified construction, and Fig. 5 is a sectional view showing the invention applied to heating a continuous current of water flowing through a pipe.

The passage of an electric current through any poor conductor generates heat proportional to the potential used; but the utilization of this principle for practical heating purposes presents many difficulties. In the first place the resistance material must have a fairly constant value in its resistance qualities, since otherwise an unequal current would flow at different times. The form of resistance which best suits this condition is a section of comparatively fine metal wire of resisting qualities. The next important feature to be secured is a very large surface area through which the heat is transmitted. This is essential not only for the purpose of securing prompt and efficient action, but also to preclude the resistance material itself becoming unduly heated at any point, as would be the case if the heat generated were not promptly carried away. In addition to this it is important to have the insulation perfect at all points, since a ground or short circuit immediately results in destruction of the heater.

In carrying out my invention I aim to secure all the above desiderata and in a cheap and durable form of construction.

Referring to the drawings, I have shown a heater having a handle 1 and a head 2 formed of a spirally-coiled resistance element 3. The particular form of the resistance element 3 is unimportant and also its manner of support. It is evident that the resistance element would be differently supported when used for warming a room than when employed for heating liquids. The disposition would also be varied in case the resistance element were applied to the purposes of cooking, or heating solid objects, such as a flat-iron. In the drawing I have shown the resistance element supported from the handle 1 by connecting-tube 4, from which extend diverging arms 5, supporting the cross-arm structure 6. The ends of the resistance element extend up through the hollow connection 4 to the terminal wires 3′. The extremities 7 of the cross-arms 6 are notched, as shown at 8, so as to receive the convolutions of the resistance element. 9 indicates a similar cross-arm structure having notched extremities 10 opposed to the parts 7, above described. 11 designates an ordinary bolt connecting the cross-arm structures and by means of which the resistance element is securely held in place therebetween. This particular construction gives a firm manner of supporting the resistance element and at the same time permits a ready flow of the liquid to be heated over the entire surface thereof.

Referring now more particularly to Figs. 2, 3, and 4, I have illustrated the preferred manner of constructing the resistance element. For this purpose I obtain a wire of resisting substance, preferably iron or Ger-

man silver, of suitable gage—say No. 23—and thread this wire or filament through a small glass tube of the sort ordinarily procurable upon the market. 12 indicates the wire, and 13 the tube, at this stage of the manufacture. I now pass the glass tube through a metallic sheathing, preferably of copper, which can be obtained in straight lengths of suitable diameter. It is now merely necessary to expose the whole to heat in a furnace, so as to soften the copper sheathing and at the same time the glass tube within. When this is accomplished, the combined tubes can be readily bent into any desired form, as shown in Fig. 3, in which the copper part is shown at 14. This bending operation is accomplished without difficulty, since the glass supports the metallic tubing and prevents its collapse during the bending operation. On the other hand, the metallic tubing has the effect of maintaining the temperature of the glass and keeping it equally softened throughout its length while the bending takes place.

In the above way the resistance element is coiled or wound into any desired shape. This may be a double spiral, as shown in Fig. 1, or a helical coil, as illustrated in Fig. 4, or any other shape.

In Fig. 4 a different form of insulating-wire is used. In place of the glass tube 13 above described I sometimes make use of glass or porcelain beads 15, strung along the resistance-wire 12 at uniformly-spaced intervals. The metallic sheathing 14 is separated from the wire by the beads in the same way as by the glass tube above described. It is obvious that the beads prevent collapse of the casing when the element is bent exactly as in the previous case.

In some cases I use the invention for heating water which flows continuously through pipes. My form of resistance element is particularly suitable for this purpose, since the complete element may be threaded through an ordinary pipe 16, Fig. 5, and the fluid passed through said pipe between its interior wall and the exterior surface of the resistance element. In all cases the important desiderata of an electric heater are secured—namely, the use of a resistance medium of sufficient fineness and length to utilize the ordinary potential drop of a lamp-circuit and at the same time present a uniform electrical resistance thereto, and also the feature of a large radiating or heat-conducting area to secure quick and efficient heating of the liquids or articles desired and also to prevent undue rise of temperature in the resistance medium itself.

A practical feature of the invention relates to the possibility of completely sealing up the resistance wire or medium within its inclosing glass tube. Inasmuch as the glass tube is continuous from end to end, it is merely necessary to connect a pair of small platinum wires to the end of the resistance wire or medium and fuse the platinum into the glass. The ordinary terminals 3′ may then be connected to the platinum ends. By this construction all possibility of any moisture entering the glass tube is precluded.

What I claim is—

1. The method of forming a resistance element which consists in threading a resistance medium through a glass tube, placing the glass tube within a metallic sheathing, and bending the whole into desired form under the influence of heat.

2. The method of forming a resistance element, which consists in threading wire through a glass tube, inclosing the tube in a metallic sheathing, and bending the whole under the influence of heat.

3. The method of forming a resistance element, which consists in threading a resistance-wire through an insulating medium, inclosing the same within a hollow sheathing, and bending the whole to any desired form.

4. A heater comprising a resistance-wire, a vitreous tube surrounding said wire and adapted to seal the same against air and moisture, said tube being inclosed in an outer tube or sheathing of heat-conducting material, the vitreous tube being loosely contained in said outer tube whereby it is not broken by slight bends or strains in the outer tube.

5. A resistance element, comprising a resistance-wire, a metallic tube or sheathing, and an intermediate glass tube.

6. A resistance element, comprising a resistance-wire, a metallic tube or sheathing, and an intermediate glass tube, all bent to any desired form.

7. A heater comprising a resistance element, coiled into a spiral form, a pair of cross-arms for supporting said resistance element, means for connecting said cross-arms, and a handle connected to one of said cross-arms.

8. A heater, comprising a resistance element in the form of a double spiral coil, a pair of cross-arms engaging the respective coils, means for holding said cross-arms in clamping relation upon the coils, and a handle connected to one of said cross-arms, the ends of said resistance element being carried by and through said handle.

In witness whereof I subscribe my signature in the presence of two witnesses.

JAMES T. HOWELL.

Witnesses:

PHILIP H. FIELDING,

FRANK S. OBER.