(No Model.)

A. E. APPLEYARD.

ELECTRICAL HEATER.

No. 483,759. Patented Oct. 4, 1892.

FIG. 1.

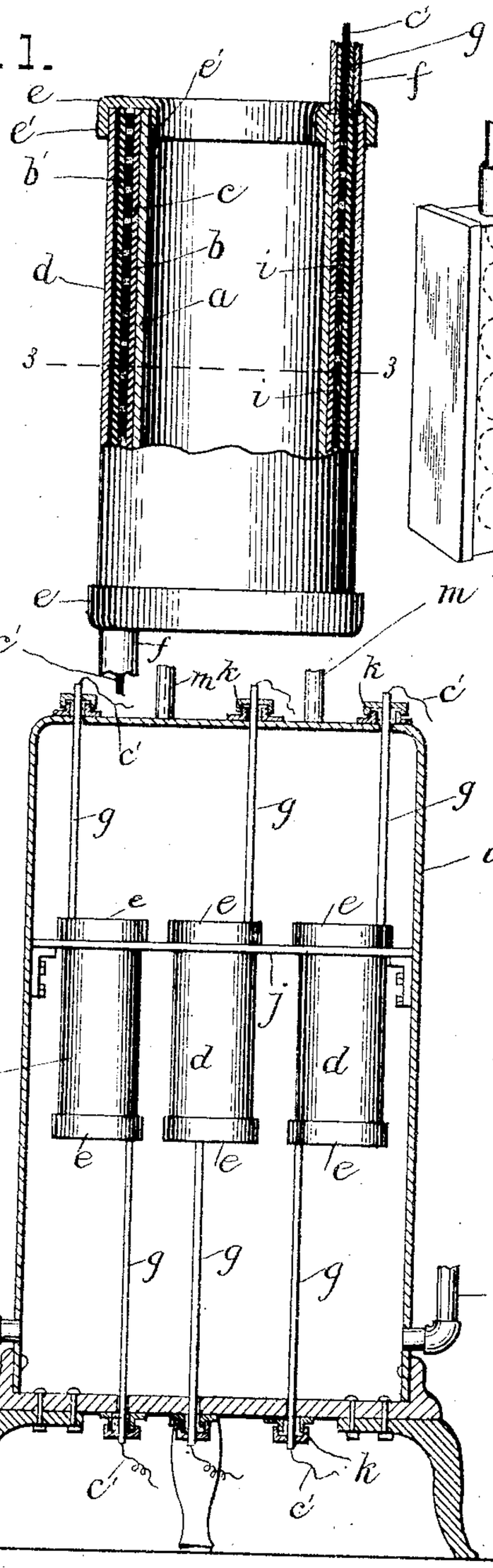
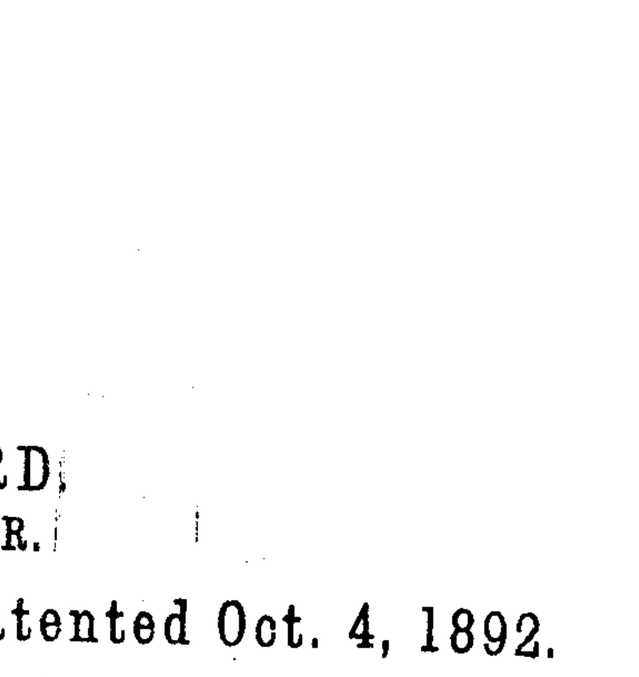


FIG. 5.



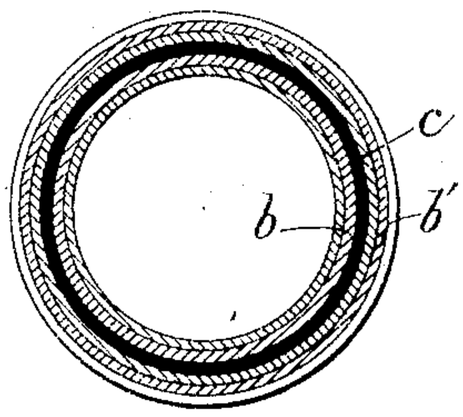


FIG. 3

FIG. 2.

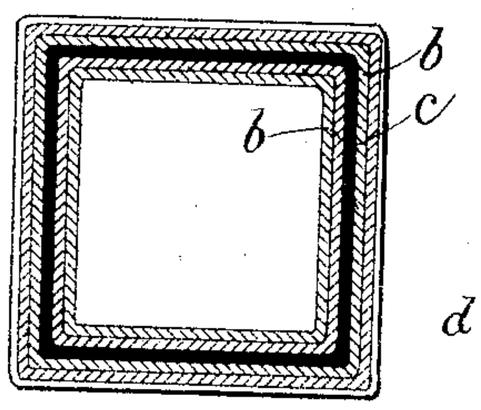


FIG. 4.

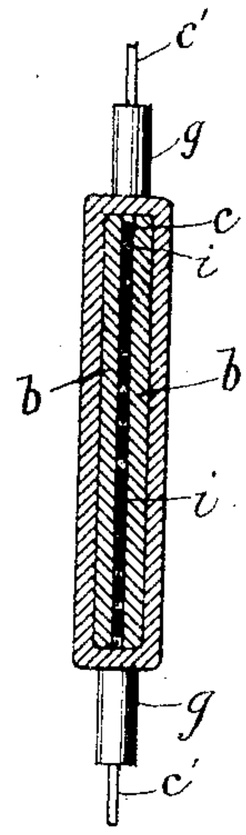


FIG. 6

WITNESSES:
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UNITED STATES PATENT OFFICE.

ARTHUR E. APPLEYARD, OF BOSTON, MASSACHUSETTS.

ELECTRICAL HEATER.

SPECIFICATION forming part of Letters Patent No. 483,759, dated October 4, 1892.

Application filed December 28, 1891. Serial No. 416,303. (No model.)

To all whom it may concern:

Be it known that I, ARTHUR E. APPLEYARD, a subject of the Queen of Great Britain, and a resident of Boston, in the county of Suffolk and State of Massachusetts, have invented certain new and useful Improvements in Electrical Heating Apparatus, of which the following is a specification.

This invention has for its object to provide a simple and inexpensive means for electrically heating water and thereby utilizing the well-known heat radiating and conducting properties which water possesses.

The invention consists, first, in an electrical heating apparatus comprising a waterproof casing of metal or other suitable material, an electrical resistance inclosed in the casing and composed of a flat or ribbon-like strip of any suitable material adapted to serve as a resistance in an electric circuit—such, for example, as platinum wire—the ends of said resistance being suitably connected with the opposite poles of a dynamo or other source of electrical energy, so that the resistance will be heated by the passage of the electric current through it, and layers of insulating material interposed between the resistance and the inner surface of the casing, the sides of the strip being in contact with said insulating-layers, the whole forming a structure presenting large areas of external surface adapted to be heated electrically and adapted to be immersed in water for the purpose of heating the same.

The invention also consists in certain incidental improvements, all of which I will now proceed to describe and claim.

Of the accompanying drawings, forming part of this specification, Figure 1 represents a side elevation and partial section of an electrical heating apparatus embodying my invention. Fig. 2 represents a sectional view of a water-receptacle containing a series of said heating apparatuses. Fig. 3 represents a section on line 3 3, Fig. 1. Fig. 4 represents a sectional view of a modified form. Fig. 5 represents a perspective view of another form. Fig. 6 represents a section on line 6 6, Fig. 5.

The same letters of reference indicate the same parts in all the figures.

In carrying out my invention I make a water-tight casing, which may be of iron or other suitable material and of any suitable form.

The casing shown in Figs. 1, 2, and 3 is tubular and is composed of an inner tube *a*, having upon its external surface a coating *b*, of a suitable insulating material, which is a conductor of heat and is not liable to be affected by the heat to which it is subjected in the use of the heater. A mineral enamel—such as that used in coating metal vessels—is a suitable material for this purpose. Upon the exterior coating *b* I place an electrical resistance, which is preferably a platinum wire *c*, wound upon the coating *b* in the form of a helix, the wire being of ribbon form—that is to say, having an oblong form in cross-section. Upon the exterior of the resistance thus formed I place an outer metal tube *d*, having an insulating-lining *b'*, similar to the coating *b*, the inner tube *a* and the outer tube *d* being therefore separated by an annular space which is occupied by the insulating-coatings and the resistance.

e e represent annular metal caps, which are applied to the ends of the tubes *a d* and are secured thereto in such manner as to hermetically close the annular space between said tubes and prevent the admission of water thereto. The caps *e e* are preferably formed with flanges *e' e'*, one bearing on the inner surface of the tube *a* and the other on the outer surface of the tube *d*. Through the end caps *e e* extend tubes *f f*, through which pass the conducting-wires *c' c'*, which connect the resistance with the circuit in which it is included, said wires being insulated from the tubes by suitable insulating material *g*. The tubes *f f* are so connected to the caps *e e* as to prevent the admission of water at the joints formed by the union of the tubes with the caps.

In Fig. 2 I show a series of heating devices such as above described placed in a water-reservoir *i*, which is preferably an iron chamber and is provided with means for supporting the heating devices in its interior. I have here shown a horizontal shelf *j* secured to the interior of the reservoir *i*, said shelf having holes for the reception of the tubes *d*, said holes being of such sizes that the lower edges of the caps at the upper ends of said tubes will rest upon the upper surfaces of the shelf. The tubes *f f* extend through the walls of the reservoir and are provided with suitable pack-

ings or stuffing-boxes *k* to prevent the escape of water around them. The reservoir *e* may communicate with radiators through flow-pipes *m*, extending upwardly from its upper portion, and through return-pipes *n*, extending back from the radiators and entering the lower portion of the reservoir.

It will be seen that one or more electrical heaters of the construction above described placed vertically in a body of water will present large areas of heating-surface to the water, both the inner and outer surfaces of the tubular structure being heated. The vertical position of the heater will cause a quick circulation of water along its surface, as will be readily understood.

In Fig. 4 I show the heater formed as a flue surrounding a central conduit or passage, as in the construction shown in Figs. 1, 2, and 3, the only difference being in the form of the cross-section of the heater, said cross-section being rectangular instead of circular.

In Figs. 5 and 6 I show a flat casing, which does not surround a central conduit. In this case the resistance is arranged in a series of return-bends, as shown by dotted lines in Fig. 5, the resistance being separated from the walls of the casing by suitable refractory insulating material.

As before stated, the resistance is preferably composed of ribbon-wire. This form of wire is particularly advantageous for this purpose because the flat wire, when its sides are presented to the insulating-coatings, presents large areas of heating-surface, so that the heat developed is utilized to the best advantage. I regard it as important that the sides of the wire be in contact with the insulating-coatings and that the latter be pressed closely against the sides of the wire.

The convolutions or parallel edges of the resistance are separated by insulating material *i*, Fig. 1, packed in the space between said convolutions or edges.

I claim—

1. An electrical heating apparatus comprising in its construction a water-tight casing and a resistance consisting of a strip of flat or ribbon form contained in said casing and insulated therefrom, the sides of the strip being presented to the walls of the casing, as set forth.

2. An electrical heating apparatus comprising in its construction a water-tight casing lined with insulating material not affected by heat and an electrical resistance composed of a flat or ribbon-like strip within said casing and in direct contact with said insulating material, the sides of the strip being presented to the insulating material, as set forth.

3. An electrical heating apparatus comprising a water-tight casing lined with insulating material and a resistance composed of ribbon-wire placed within the casing and having its flat sides in contact with or presented to the insulating-lining, as set forth.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, this 3d day of December, A. D. 1891.

ARTHUR E. APPLEYARD.

Witnesses:
C. F. BROWN,
A. D. HARRISON