

(No Model.)

2 Sheets—Sheet 1.

W. R. SMITH.
ELECTRIC HEATER.

No. 579,611.

Patented Mar. 30, 1897.

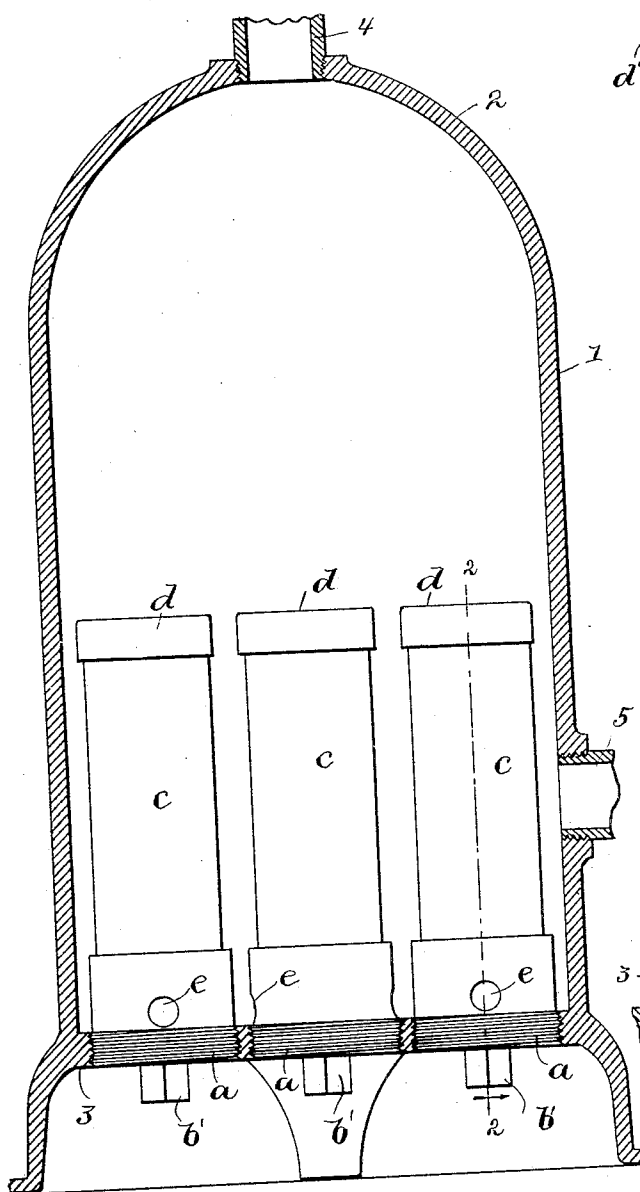


FIG. 1.

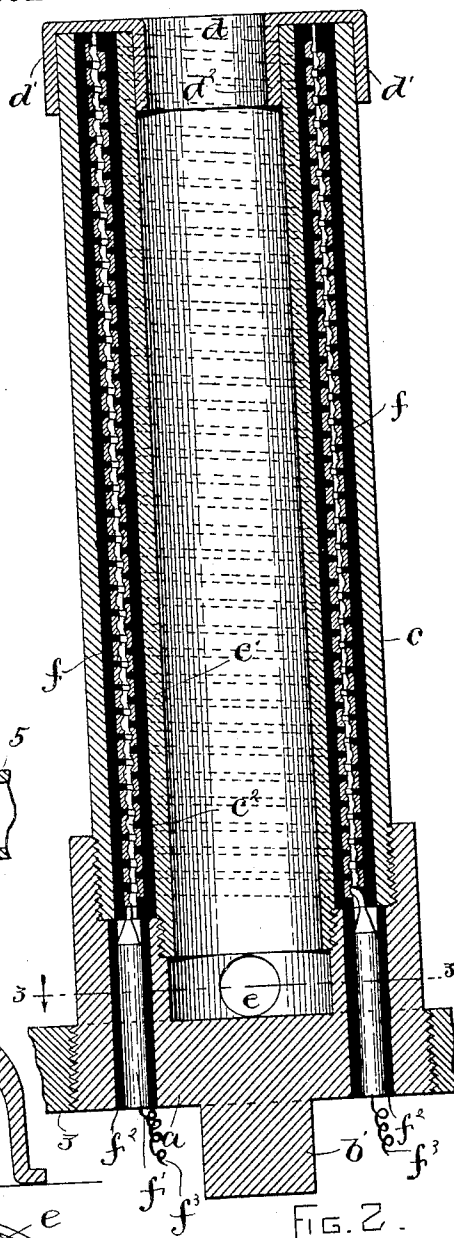


FIG. 2.

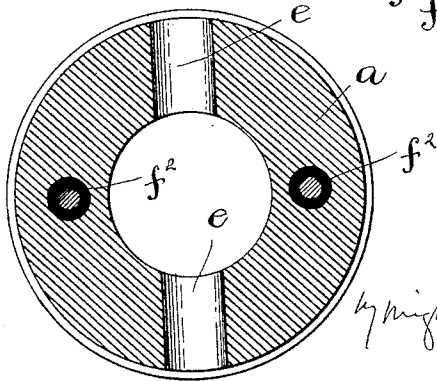


FIG. 3.

WITNESSES:

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INVENTOR:

W. R. Smith

by Night & Son
att'y

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FIG. 5.

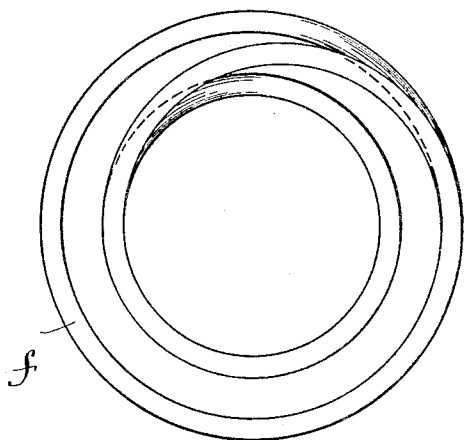
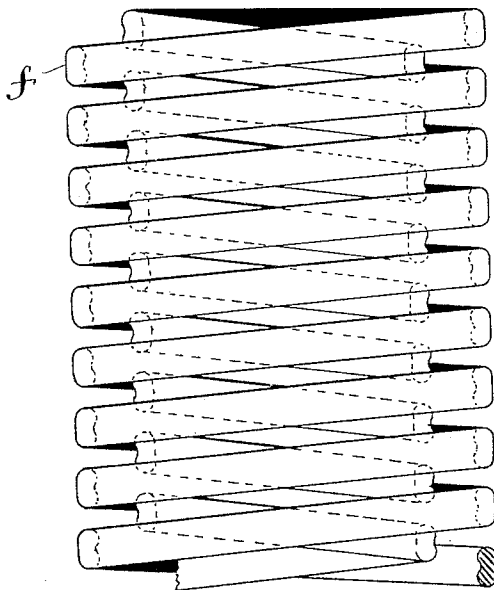


FIG. 4.



WITNESSES:

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INVENTOR:

W. R. Smith
by *Wm. B. Smith*
Atty.

UNITED STATES PATENT OFFICE.

WILLIAM R. SMITH, OF MANCHESTER, NEW HAMPSHIRE.

ELECTRIC HEATER.

SPECIFICATION forming part of Letters Patent No. 579,611, dated March 30, 1897.

Application filed June 11, 1896. Serial No. 595,178. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM R. SMITH, of Manchester, in the county of Hillsborough and State of New Hampshire, have invented certain new and useful Improvements in Electrical Heaters, of which the following is a specification.

This invention relates to electrical heating apparatus comprising a boiler or chamber containing water-heating tubes, each of which consists of an inner tube and an outer tube provided with an electrical resistance contained in a space between said tubes, the said resistance being arranged to form an outer helix on the inner surface of the outer tube and an inner helix on the outer surface of the inner tube.

The present invention has for its objects, first, to enable the two helices to be made of a single integral piece without joints or couplings of any kind and without the formation of an angle in that part of the resistance that connects the outer ends of the helices, and, secondly, to provide means for insulating said helices and holding them securely in their proper relative positions.

To these ends the invention consists in the improvements which I will now proceed to describe and claim.

Of the accompanying drawings, forming a part of this specification, Figure 1 represents a vertical section of a heating apparatus embodying the invention. Fig. 2 represents an enlarged vertical section of one of the heating-tubes. Fig. 3 represents a section on line 3 3 of Fig. 2. Fig. 4 represents a side view of a portion of the resistance. Fig. 5 represents an end view of the same.

Similar reference letters and figures indicate the same parts throughout the several views.

In the drawings the boiler-casing 1, which may be a casting provided with suitable feet, is formed with a dome-shaped upper end 2 and a horizontal floor or lower wall 3, said wall being provided with a plurality of screw-threaded openings to receive the tubular electric heaters hereinafter described. 4 indicates the exit-pipe from the upper end of the casing, and 5 the inlet-pipe, said pipes being adapted to be connected with any suitable radiator. This shape of the casing prevents

the formation of any still bodies of water in any portion of the casing, since the dome-shaped top causes the water as it is heated to rise and flow through the pipe 4 at an accelerated rate of speed.

Each of the heaters is composed of a base or holder *a*, formed as a plug adapted to be screwed into an opening in the lower wall of the casing and provided with a squared end *b'*, by means of which the heater may be turned into or out of place by means of an ordinary wrench. This plug is screw-threaded to receive an outer tube *c* and an inner concentric tube *c'*, the space *c²* between said tubes being provided with the resistance-wire hereinafter described. The upper ends of the two tubes are covered by means of a cap *d*, having flanges *d'* *d²* to fit over the ends of the tubes to prevent the access of water to the space between them. Through the wall of the plug a passage or conduit *e* is formed, said conduit being below the space *c²* and forming a passage for the circulation of water from the outside to the interior of the tube *c'*.

The interior of the outer tube *c* is provided with a lining of suitable insulating material having a helical groove formed as a coarse right-hand screw-thread for the reception of the outer helix of the resistance *f*, and the outer surface of the inner tube *c'* is provided with a coating of suitable insulating material having a helical groove formed as a coarse left-hand thread to form a groove for the inner helix of the said resistance.

f represents the resistance-wire, which is a single piece of platinum or other suitable material, extending continuously, without joint or weld, from one end where it commences and is coiled in contact with the lower end of the inner wall of the outer tube to where it terminates in contact with the lower end of the outer wall of the inner tube, said piece comprising an outer helix and an inner helix. The convolutions of the outer helix are contained in the helical grooves in the inner surface of the outer tube, while those of the inner helix are contained in the helical groove in the outer surface of the inner tube.

The arrangement of the resistance in two helices, one of a pitch which is opposite that of the other, enables the entire resistance to be made of a single piece of wire without a

joint or coupling at the outer ends of the helices, the change of direction of the pitch enabling the portion of the wire that connects the two helices to cross the intervening space at a gradual curve and without angular deviation from the curvature of the convolutions which it connects.

It will be seen that if both helices had the same pitch it would be necessary to either abruptly bend the portion of the wire which connects the outer convolutions of the helices or to make the helices in separate pieces and unite their ends by a solder-joint or by a coupling. In either case the connection between the two helices necessarily projects outwardly from the ends of the helices and makes the resistance undesirably long and bulky. I have found that an abrupt bend in a resistance of this character is further objectionable because of the liability of the resistance to burn away at the bend, this being due, as I believe, to the abrupt change in the direction of the current. A joint or union of two pieces is also objectionable, because, if a solder-joint, it is liable to vary in diameter and burn away at the smallest part, and it is also liable to be destroyed by the fusing of the solder. If two pieces are united by a coupling having screws or rivets, the latter become loose by the action of the current, and the joint becomes unreliable and often useless. I avoid these difficulties by making the two helices of opposite pitch, whereby I am enabled to make the entire resistance, including the portion that connects the outer convolutions, in a single seamless or jointless piece, free from abrupt bends, the connection between the outer ends of the helices adding nothing to the length or bulk of the structure.

The insulating-coatings having the helical grooves conforming to the pitch of the helices of the resistance provide for securely holding the convolutions of the resistance and preventing contact between them.

I have found that in case of a flat ribbon-like wire there is a liability of the edges becoming unduly heated and fused. I have found that by making the resistance-wire in ribbon form, but with its edges thicker than its center, this difficulty is avoided and the durability of the resistance is greatly prolonged.

The ends of the resistance-wire pass through suitable cylindrical blocks or insulators f^2 in the plug and are connected to circuit-wires f^3 .

The portion of the wire which passes through the insulators f^2 I term the "conductor," as at f' , and this may or may not be integral with the ribbon-like portion of the resistance. As shown in Fig. 2, the conductor f' is considerably larger in diameter than the portion of the resistance within the space c^2 , the object of this being to more readily conduct the current where it passes through the plug and to thereby prevent heating at points where heat is not desired.

The casing is preferably made in a single casting, which includes the body 1, dome 2, and bottom 3, and may be made of any suitable metal. I thus insure a water-tight construction, so far as the casing is concerned, there being no joints, rivet-holes, &c., the only joints being those between the heater-plugs and the bottom of the casing. These joints are made water-tight by cutting the threaded openings in the bottom of the casing and the threaded portions of the plugs on a slight taper, so that when the plugs are screwed home they will have a water-tight connection with the bottom of the casing.

I claim—

1. In an electrical heating apparatus, an electrical resistance composed of a single jointless piece disposed in two helices of opposite pitch, one within the other.

2. An electrical heating apparatus comprising in its construction a plug provided with inner and outer tubes forming an annular chamber, and a resistance composed of a single jointless piece disposed in two helices of opposite pitch, one helix being at the outer side and the other at the inner side of said chamber.

3. An electrical heating apparatus comprising in its construction a plug provided with inner and outer tubes forming an annular chamber the walls of which are provided with insulating material, one wall being provided with a helical groove and the other with a helical groove of opposite pitch, and a resistance in said grooves composed of a single piece formed into two helices of opposite pitch.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, this 13th day of May, A. D. 1896.

WILLIAM R. SMITH.

Witnesses:

A. D. HARRISON,
P. W. PEZZETTI.