

(No Model.)

G. H. WHITTINGHAM.  
ELECTRIC HEATER.

No. 579,459.

Patented Mar. 23, 1897.

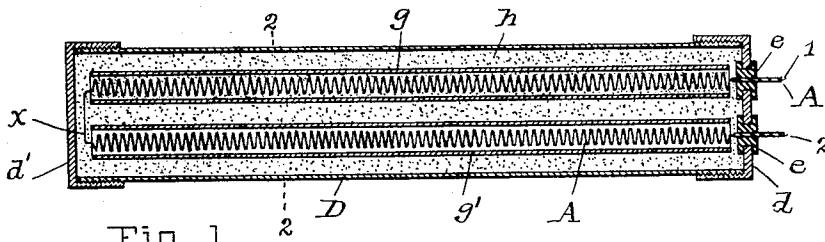


Fig. 1.

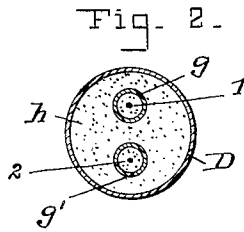


Fig. 2.

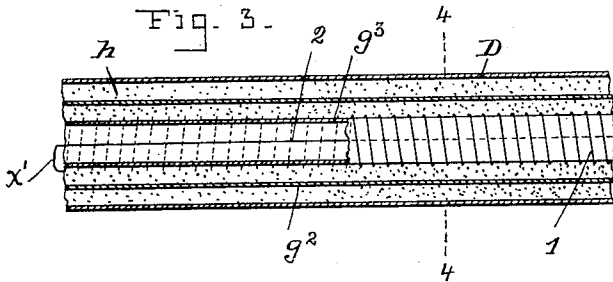


Fig. 3.

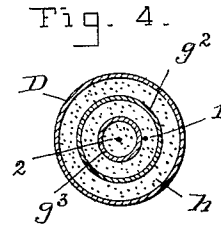


Fig. 4.

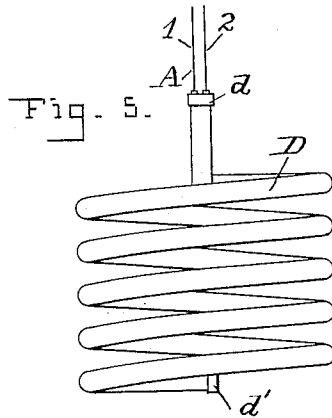


Fig. 5.

WITNESSES:—

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GEORGE H. WHITTINGHAM, OF BALTIMORE, MARYLAND.

## ELECTRIC HEATER.

SPECIFICATION forming part of Letters Patent No. 579,459, dated March 23, 1897.

Application filed January 30, 1896. Serial No. 577,359. (No model.)

*To all whom it may concern:*

Be it known that I, GEORGE H. WHITTINGHAM, a citizen of the United States, residing at Baltimore, in the State of Maryland, have invented certain new and useful Improvements in Electric Heaters, of which the following is a specification.

My invention relates to an improvement in electric heaters, and has for its object to provide a tubular heater in which the resistance-wire shall have its entrance and exit at the same end of the tube and have efficient means for relieving the resistance-wire of the heat generated by the passage of the electric current.

For a full understanding of the invention reference is made to the accompanying drawings, in which—

Figure 1 is a longitudinal central section showing the resistance-coils and two parallel glass tubes in the casing and the insulating heat-conducting filler. Fig. 2 shows a cross-section. Fig. 3 is a longitudinal section showing a modification in the construction of the two glass tubes. Fig. 4 shows a cross-section of the modified form seen in Fig. 4. Fig. 5 shows the heater in the form of a coil.

Referring to Figs. 1 and 2 of the drawings, the letter A indicates the resistance-wire, and D a tubular casing, of iron or other material suitable for rapidly radiating heat, and which incloses the resistance-wire and is closed at its ends by screw-caps  $d$   $d'$ . The resistance A enters the tube and also comes out at the same end.

In the simplest form of my device there is within the tubular casing D and surrounding the resistance-wire a plurality of glass tubes shorter than the interior of the casing and a filling of clear loose sand  $h$ , which is employed as a heat-conducting medium between the wire and the outer casing and at the same time electrically insulates the wire therefrom. By this construction the heat of the wire is rapidly conducted to the outer casing, and the latter has its exterior surface exposed for radiation of the heat. It will be seen that the radiating-surface of the tubular casing D is greatly larger than the surface of the wire it incloses.

The cap  $d$  at one end of the tubular casing has two insulating bushings or plugs  $e$ , and the wire passes through one of these in en-

tering and through the other in coming out. Where the wire passes through the insulation  $e$ , it is larger, to increase the conducting capacity.

I employ two glass tubes  $g$   $g'$ , extending longitudinally of the exterior tube D. These serve to separate and electrically insulate the two stretches of resistance-wire inclosed in the radiating-tube D. In Figs. 1 and 2 the two glass tubes are side by side, parallel, and the entrance stretch 1, of wire, passes through the tube  $g$  and at the end crosses over, as at  $x$ , to the other tube  $g'$ , and the exit stretch 2 passes through this second tube. Thus the wire which enters the radiating-tube at one end continues to the other end and then returns to the same end, where it enters. Thereby there is a double-resistance wire inclosed in the tube D, and the device is adapted and is more convenient for use in certain situations. The sand  $h$  is filled in both glass tubes, and also between the glass tubes and the inclosing tube D, so as to form a continuous heat-conducting medium from the resistance-wire to the said outer casing-tube.

The modification shown in Figs. 3 and 4 employs two glass tubes  $g^2$   $g^3$ , parallel with each other, but here the tubes are of different size, in order that the smaller tube  $g^3$  may extend through the larger tube  $g^2$ . In this form the entrance stretch 1, of wire, is coiled around the small tube, and therefore is in the larger tube or between the small and the large tube  $g^2$ . At the end the wire crosses, as at  $x'$ , from the outside to the inner side of the tube, and the exit stretch 2 in this case extends straight through the inner tube back to the entrance end.

The ends of the tube D may be closed in any suitable manner.

A tube D, filled with sand packed in and having glass tubes through which the resistance-wire passes, sand being filled within as well as around the glass tubes, may be bent or coiled, as desired. This is illustrated in Fig. 5. During this operation of bending the metal tube the glass tubes will be broken into small particles, but these particles will still retain the tubular form and have the same relative position with respect to the sand-filler.

It will be seen that the resistance-wire is

sustained in the tubular radiating-casing and prevented from sagging independent of both the filler and of said case.

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

In an electric heater, the combination of a tubular casing; means for closing both ends thereof; a plurality of glass tubes shorter than the interior of the casing and situated therein; a resistance-wire entering one end of the casing, extending through one of the

glass tubes and returning through another of the tubes and passing out of the casing at the same end at which it enters; and a suitable granulated filler placed in the spaces in and around the glass tubes. 15

In testimony whereof I affix my signature in the presence of two witnesses.

GEORGE H. WHITTINGHAM.

Witnesses:

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