No. 635,133. Patented Oct. 17, 1899.

E. E. GOLD.

ELECTRIC HEATER.

(Application filed Jan. 9, 1899.)

(No Model.)

FIG. 1.

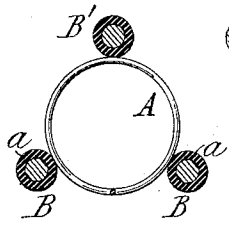


FIG. 2.

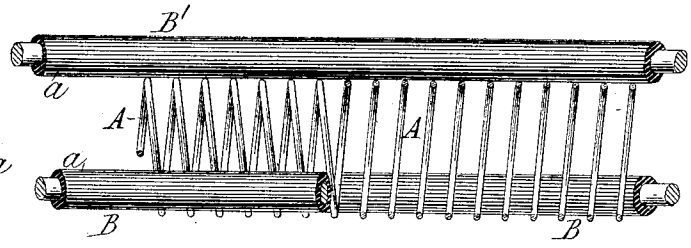


FIG. 3.

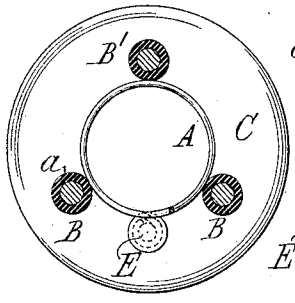


FIG. 4.

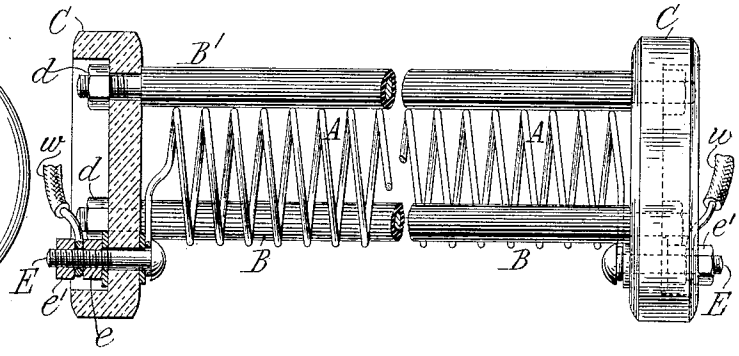


FIG. 5.

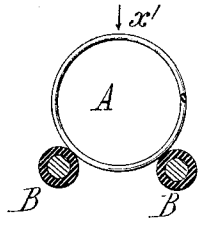
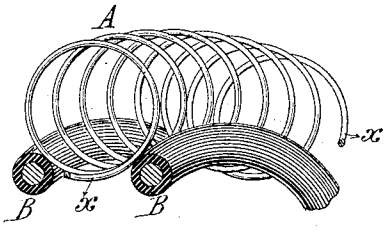


FIG. 6.



WITNESSES:
Fred Whitz
Thomas F. Wallace

INVENTOR:
Edward E. Gold,
By his Attorneys.
Arthur C. Orasell & Co

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

EDWARD E. GOLD, OF NEW YORK, N. Y.

ELECTRIC HEATER.

SPECIFICATION forming part of Letters Patent No. 635,133, dated October 17, 1899.

Original application filed January 31, 1898, Serial No. 668,528. Divided and this application filed January 9, 1899. Serial No. 701,686. (No model.)

To all whom it may concern:

Be it known that I, EDWARD E. GOLD, a citizen of the United States, residing in the city, county, and State of New York, have invented certain new and useful Improvements in Electric Heaters, of which the following is a specification.

This application is a division of my application, Serial No. 668,528, filed January 31, 1898.

This invention relates to electric heaters in which the heat is generated by passing an electric current through a coil or helix of resistant wire which is exposed to the air, (or other fluid,) by the circulation of which the generated heat is conducted away.

My present invention relates to means for supporting such a resistant helix and provides other features of construction pertaining to electric heaters.

My invention involves the use of an open helix of resistant wire having sufficient stiffness or resilience to retain its helical form and the use as a support therefor of a stiff wire or rod (one or more) extended parallel with it and making only tangential contact with its successive convolutions. The helix being interiorly open, it permits free circulation of air within it into contact with all portions of the resistant wire. The supporting wire or rod may extend either, first, inside of the helix or, second, outside of it. The former species is shown and claimed in my application, Serial No. 666,024, filed January 8, 1898, (Patent No. 621,604, issued March 21, 1899.) The latter species is shown in my present application.

My present invention is characterized generically by the combination, with such a resistant helix, of a support consisting of a rod or rods extending parallel with and exterior to the helix and making tangential contact with the convolutions thereof at two points separated less than the diameter of the helix, so that the latter cannot pass between them. I provide also means for holding the helix seated on said rods, consisting, preferably, of a third rod bearing upon the helix opposite to them, so that the combined rods constitute, in effect, a cage within which the helix is confined.

Figure 1 of the accompanying drawings is a transverse section of the helix and its supports. Fig. 2 is a fragmentary side elevation thereof, partly in vertical section. Figs. 3 and 4 show a completed heater, of which Fig. 3 is a transverse section and Fig. 4 is an elevation, partly broken away, in vertical midsection. Fig. 5 is a transverse section answering to Fig. 1, but showing a modification. Fig. 6 is a perspective view showing a modification.

In all the figures let A designate a helix of resistant wire, and let B B designate supporting wires, rods, or bars therefor.

The helix A is of resistant wire of sufficient size and stiffness and of a metal or alloy having sufficient strength and resilience so that the wire when wound into a helix will retain its helical form. The helix A constitutes an open helix—that is, one in which the convolutions or loops of wire are separated to permit free circulation of air between, either by being openly wound in the first instance or, if wound closely, by being pulled open and retained in that condition upon the support. The helix is also interiorly open or empty, so as to afford free opportunity for circulation of air within it. The resistant wire is wound into a helix in any usual manner—as, for example, by winding it upon a mandrel.

The supporting wires or rods B are preferably of considerably greater size than the resistant wire in order to afford the requisite stiffness. The resistant helix A is extended parallel with the supporting wires or rods B, so that the latter form a continuous longitudinal support, making contact with each successive convolution of the resistant helix. The helix is at each convolution supported on two parallel rods B, (or on two portions or convolutions of the same rod B,) so that it rests thereagainst at two points, thereby making its support firm and stiff. As these points of contact are formed by the exterior tangential contacts of circles, they are in fact mere geometrical points disposed longitudinally of the supporting wires or rods B B at distances apart equal to the pitch of the helix A. It results from this that with the exception of these minute points the entire surface of the resistant wire of the helix A is out of con-

tact with every other part and fully exposed to the air or other surrounding medium by which its generated heat can be rapidly conducted away, so that this form of heater attains the ideal of free radiation combined with a secure support for the resistant wire. The entire heater is in fact a skeleton having wide spaces through which the air may freely circulate, which spaces are crossed and subdivided at frequent intervals by the hot wires of the resistant helix, so that the air flowing through the heater is successively subdivided by these hot wires and consequently is effectively heated. The support is also of such construction as to have the minimum of mass for a given degree of strength or rigidity, so that there is the least possible heat-absorptive property in the support consistent with its properly performing its supporting function. It results from this that the heater is highly efficient from the very instant when the electric current is turned on, since but a very small proportion of the heat is absorbed in heating up the support, and by reason of the support being formed as slender elements exposing a large radiating-surface it gives out the heat to the air almost as rapidly as it receives it from the resistant wire.

It is of course essential to insulate the resistant wire A from the supporting wires or rods B. This might be done by coating either with insulating material; but it is preferable to apply the insulation to the supporting wires or rods B. This insulation must be of such character as to be unaffected by the heat, and for this reason it is preferable to employ a vitreous enamel. This is found highly successful in practice, it being only necessary to employ iron wire of sufficient diameter, dip it in enamel, and fire this enamel on. The enameled coating is lettered *a a*. The ends of the wire, however, are preferably left uncoated in order that they may be screw-threaded for attaching the wires or rods in the heater.

In my application, Serial No. 668,528, filed January 31, 1898, of which the present application is a division, I have described and shown one substantial embodiment of my present invention in its generic aspect, the supporting wire or rod B being coiled into an open helix and the resistant helix A being wound into a compound helix extended parallel with the helically-coiled rod B and either inside or outside thereof. This species I do not specifically claim in my present application. Fig. 6 of the accompanying drawings may be taken as showing a fragment of such a heater, the rods B B shown being portions of a single rod so coiled into an open helix and the resistant helix A being wound against the exterior thereof and distended thereon, so that it is subjected to stretch in the direction of the arrows *x x*, whereby it is firmly seated against the parallel supporting rods or portions B B. In this case the tension applied to the resilient wire A is relied upon to hold it firmly seated against the supporting-rods B B. In another arrangement the resistant helix A may be extended in a straight line and supported by resting upon a pair of straight supporting wires or rods B B, as shown in Figs. 1, 2, and 5. The construction shown in Fig. 5 will be suitable where the heater is to remain stationary and free from vibration or disturbance and located where it cannot be tampered with. In this case the weight of the helix A, pressing in the direction of the arrow *x'*, constitutes the force by which the helix is held firmly seated upon the rods, or a rigid structure in which the resistant helix A is confined in place and which consequently can be subjected to movement or vibration may be made by providing a third supporting-wire B', as shown in Fig. 1, by which the helix is confined against the pair of wires B B beneath. This construction, which constitutes the preferred species of my invention according to my present application, provides, in effect, a cage of parallel rods B B B', within which the resistant helix is confined, so that its escape between them is prevented.

For the support of the supporting wires or rods B, I have shown in Figs. 3 and 4 heads or disks C, preferably of porcelain, at the ends of the heater, the two heads being held rigidly apart by means of tie-rods, which may be constituted by the rods B B B'. The ends of the rods are screw-threaded and have nuts *d* screwed thereon to clamp the heads tightly upon the rods. The ends of the resistant helix A are secured by being fastened to binding-posts E E, which pass through holes in the heads, being secured by screwing a nut *e* on the outer end of each post, and a circuit-wire *w* may be clamped by the same nut or by an outer nut *e'*.

The words "wire" and "rod," as used in this specification with reference to the supports B B B', include not merely a small metal rod, but also any suitable substitute therefor, such as bars of glass or porcelain or any material having sufficient stiffness for the purpose and either an insulator in itself or capable of being effectively coated with insulation.

I make no claim in my present application to the supporting wires or rods B being carried inside the convolutions of the resistant helix A, that being specifically claimed in my aforesaid application, Serial No. 666,024, (Patent No. 621,604.) The construction herein claimed has the advantage over that species that the interior of the helix is left wholly empty, so that there is no obstruction whatever to the circulation of air within it.

I claim as my invention the following-defined novel features, substantially as hereinbefore specified, namely:

1. An electric heater comprising an open helix of resistant wire having sufficient stiffness or resilience to retain its helical form, and a support therefor consisting solely of a stiff rod or rods extended parallel with and exterior to said helix, and making tangential

contact with the convolutions thereof at two points separated less than the diameter of the resistant helix, so as to permit the latter to enter only partly between the supporting-rods.

2. An electric heater comprising an open helix of resistant wire having sufficient stiffness or resilience to retain its helical form, supporting-rods extending parallel with and exterior to said helix, and making tangential contact with the convolutions thereof at two points separated less than the diameter of the helix, and opposite end heads supporting said rods.

3. An electric heater comprising an open helix of resistant wire having sufficient stiffness or resilience to retain its helical form, supporting-rods extending parallel with and exterior to said helix, and making tangential contact with the convolutions thereof at two points separated less than the diameter of the helix, and means for holding the helix seated on said rods.

4. An electric heater comprising an open helix of resilient resistant wire, combined with a pair of supporting-rods extending parallel with and exterior to said helix, and making tangential contact with the convolutions thereof at two points separated less than the diameter of the helix, and a third rod in opposed position to said pair, bearing upon the helix and holding it seated upon said pair of rods.

5. An electric heater comprising an open helix of resistant wire having sufficient stiffness or resilience to retain its helical form, combined with a supporting-cage therefor composed of parallel rods extending exterior to the helix and separated less than the diameter thereof, so that the escape of the helix between them is prevented.

6. An electric heater comprising an open helix of resistant wire having sufficient stiffness or resilience to retain its helical form, combined with a supporting-cage therefor composed of parallel rods extending exterior to the helix and separated less than the diameter thereof, so that the escape of the helix between them is prevented, and opposite end heads connecting said rods.

In witness whereof I have hereunto signed my name in the presence of two subscribing witnesses.

EDWARD E. GOLD.

Witnesses:
FRED WHITE,
CHARLES K. FRASER.