E. N. LIGHTFOOT.

ELECTRIC HEATER.

APPLICATION FILED JULY 29, 1920.

1,433,465. Patented Oct. 24, 1922.

Fig. 1.

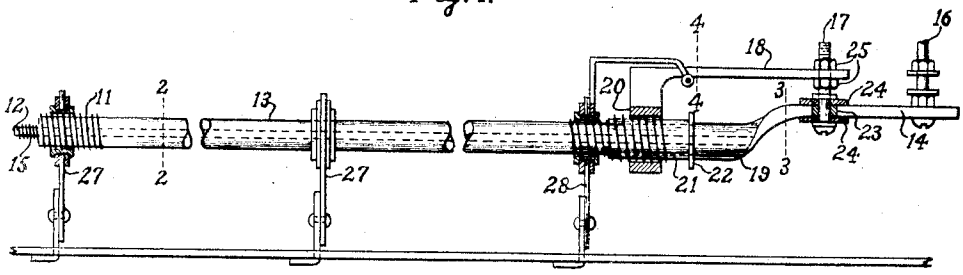


Fig. 2.



Fig. 3.

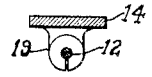


Fig. 4

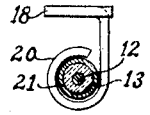


Fig. 5.

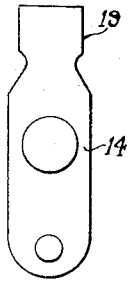


Fig. 6.

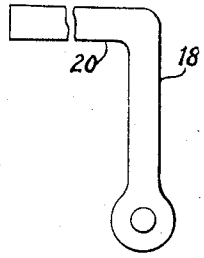


Fig. 7.

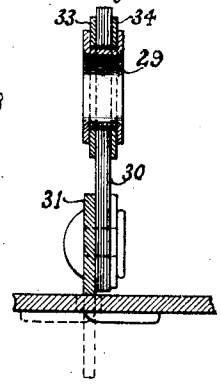


Fig. 8.

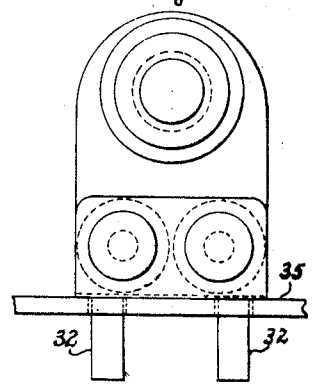


Fig. 9.

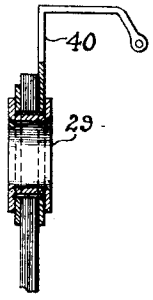


Fig. 10.

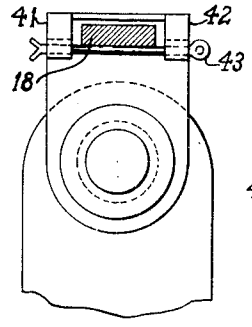


Fig. 11.

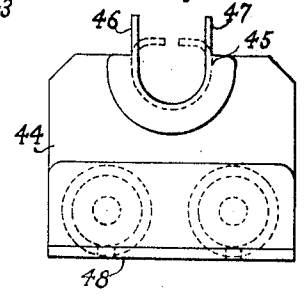
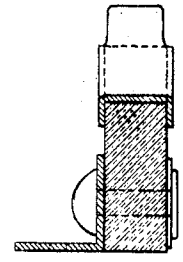


Fig. 12



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By Frank W. Hubbard

Attorney

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UNITED STATES PATENT OFFICE.

EDWIN N. LIGHTFOOT, OF NEW YORK, N. Y., ASSIGNOR TO THE CUTLER-HAMMER MFG. CO., OF MILWAUKEE, WISCONSIN, A CORPORATION OF WISCONSIN.

ELECTRIC HEATER.

Application filed July 29, 1920. Serial No. 399,861.

To all whom it may concern:

Be it known that I, EDWIN N. LIGHTFOOT, a citizen of the United States, residing at New York, in the county of Bronx and State of New York, have invented new and useful Improvements in Electric Heaters, of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawing, forming a part of this specification.

This invention relates to electric heaters and more particularly to heaters of the radiant type.

Radiant heaters are in various instances preferable to heaters of other types and in many instances may be used interchangeably with the latter, but the use of radiant heaters has been greatly restricted by reason of the difficulties met with in providing for support thereof.

Ordinarily it is desired to employ for such a heater a resistor wire of a relatively small cross section and of helical form and to operate the heater to obtain an incandescent temperature of its radiating surface, i. e., a temperature above red heat. The selection of the length and cross section of the resistor wire is governed by various conditions, among others, wattage and the circuit voltage or amperage, a heater of approximately 600 watts capacity on a 110 volt circuit being ordinarily provided with a resistor wire of .020″ in diameter and approximately 1-ft. in length, while in some instances a resistor wire of even smaller cross section may be desired. Thus it will be apparent that such resistor wires when heated to the desired temperature will not be self supporting and that the supporting materials used for resistors operated at moderate temperatures will not be practical.

Heretofore it has been customary to support the helices of radiant heaters by mounting the same in grooves of heavy insulating bases or by threading the same through porcelain or mica barriers both of which methods are obviously very disadvantageous. Where an insulating base is employed it absorbs a considerable amount of heat from the resistor and can be used only in a horizontal position unless the resistor is anchored thereto at a number of points. On the other hand if a helix is threaded through porcelain or mica barriers it must be supported at a multitude of points and even then it is likely to become distorted. Moreover, both forms of support are limited to the particular space conditions and details of construction for which they are designed.

The present invention has among its objects to overcome the difficulties heretofore experienced in supporting the resistor wires of radiant heaters.

Another object is to provide a radiant heater element having both the flexibility and mechanical strength to adapt the same to a wide range of uses.

Another object is to provide a radiant heater element wherein the helices of the resistor wire are supported in a closely adjacent relation to minimize the heat losses by convection.

Another object is to provide a flexible and mechanically strong radiant heater element which may be manufactured and installed at a cost not exceeding and probably materially less than that of other forms of heater element having a comparable degree of flexibility and mechanical strength.

Another object is to provide a radiant heater complete in itself, i. e., including terminals rigidly attached thereto.

Another object is to provide a radiant heater complete in itself with simple and durable means for mounting the same in a convenient and expeditious manner on various forms of support with a minimum degree of impairment of the efficiency thereof.

Various other objects and advantages of the invention will hereinafter appear.

The accompanying drawing illustrates one embodiment of the invention which will now be described, it being understood that the embodiment illustrated is susceptible of various modifications without departing from the scope of the appended claims.

In the drawing,

Fig. 1 illustrates a complete heater;

Fig. 2 is a sectional view taken on line 2—2 of Fig. 1;

Fig. 3 is a sectional view taken on line 3—3 of Fig. 1;

Fig. 4 is a sectional view taken on line 4—4 of Fig. 1.

Fig. 5 is a development view of the terminal shown in Fig. 1;

Fig. 6 is a development view of an electrical connector shown in Fig. 1;

Figs. 7 to 10 are detail views of the supporting elements shown in Fig. 1; and,

Figs. 11 and 12 are detail views of a modified form of supporting element.

The heater illustrated comprises a resistor 11 coiled about a core wire 12 which has an insulating covering 13 to insulate the resistor therefrom. The resistor may comprise any preferred material such, for example, as nichrome wire and the core wire 12 may likewise comprise any preferred material such, for example, as nichrome, said core wire being preferably readily bendable. Any preferred insulation may be employed for the covering 13 but in practice it is desirable to employ asbestos applied to the wire 13 in a loose or disintegrated state. The resistor 11 is coiled tightly about the covering 13, its coils preferably being partially imbedded therein to maintain said coils in a slightly spaced relation. It is to be understood, however, that resistors such as nichrome wire, ordinarily have a surface scale or oxide which prevents short-circuiting of the coils even though they may touch one another and it is preferred to arrange the coils in close proximity to one another.

An element thus formed obviously has both flexibility and mechanical strength and the core wire 12 may be and preferably is utilized for making electrical connection to one terminal of the resistor. To this end the core wire has its opposite extremities exposed, a terminal lug 14 being rigidly attached to one exposed extremity of said core wire and the resistor 11 having an end portion 15 coiled about the opposite extremity of said core wire for electrical connection therewith. The terminal lug 14 carries a binding post 16 electrically connected thereto and a second binding post 17 which is insulated therefrom and connected to the other terminal of the resistor by a connector 18.

The terminal lug 14 as shown in Fig. 5 may comprise a stamping having a portion 19 adapted to be bent into cylindrical form and to be clamped onto the exposed core wire as shown in Fig. 3. Likewise, the connector 18 as shown in Fig. 6 may comprise a stamping having a portion 20 to be bent to surround an insulated portion of the core wire and a number of coils of the resistor as shown in Fig. 4. Such portion of the core wire is preferably provided with a layer of sheet mica 21 interposed between the resistor and the asbestos covering 13 and the portion 20 of the connector is tightly clamped about the resistor. The sheet mica 21 is also projected beyond the clamping portion of the connector to space the terminal lug from the latter and a mica washer 22 is preferably interposed between the terminal lug and the end of the sheet mica 21. The binding post 17 is effectually insulated from the terminal lug by an insulating bushing 23 and insulating washers 24 and said binding post extends through the connector, being provided with clamping nuts 25 for firm securement to said connector.

The heater element thus equipped with rigidly attached terminals constitutes a complete heater which by reason of its mechanical strength may be mounted as shown in Fig. 1 in spaced supports 27 and 28. The supports 27 as shown in Figs. 7 and 8 may each comprise a metallic eyelet 29 carried by an insulating member 30, said member being riveted or otherwise secured to a supporting plate 31 having end lugs 32 for attaching the same to a suitable support. The insulating member 30 is preferably formed of sheet mica and the eyelet 29 extends therethrough being preferably provided with metallic washers 33 and 34 interposed between the flanges thereof and the mica. The lugs 32 enable the supports to be readily and firmly secured to a supporting plate 35, said plate having openings through which the lugs may be projected and bent in opposite directions as best shown in Fig. 7. The support 28 as shown in Figs. 9 and 10 is of the same construction as the supports 27 except that a metallic strip 40 is substituted for washer 34, said strip being bent to hook over the connector 18 as shown in Fig. 1 to secure the heater against endwise movement. The end of the hooked strip 40 is preferably provided with lugs 41 and 42 (Fig. 10) said lugs being arranged to straddle the shank of connector 18 and being provided with eyes to receive a cotter pin 43 engaging the underside of said connector.

The supports may of course assume various other forms as, for example, that shown in Figs. 11 and 12. In this instance each support comprises a block of insulation 44 carrying a metallic element 45 of substantially semi-circular form to receive the heater element, said element 45 having lugs 46 and 47 adapted to be bent as shown in dotted lines to grip the heater element. Also in this instance the block has riveted or otherwise secured thereto a metallic foot 48 comprising a right-angle plate to be bolted or otherwise secured to a suitable support.

The heater is thus provided with supporting means as flexible as itself whereby it may be readily and conveniently installed to meet widely varying space requirements, etc. Also by virtue of the construction of its heater element the ohmic value of said element may be varied through a wide range as by varying the pitch of the resistor coils while maintaining the element of given length or by varying the length of the element as a whole. In this connection it will be noted that the construction of the heater element is such that it may be cut for reduction of its length without the difficulties met with in cutting down the sheath type of resistor, especially as regards the provision of adequate creepage surfaces between the ends

of the resistor and its reinforcing element. Also it will be noted that the heater element although formed of wire of small cross section, in effect constitutes a solid wire of relatively large diameter whereby the heat losses by convection are minimized and the efficiency of the heater consequently increased.

What I claim as new and desire to secure by Letters Patent is:

1. A radiant heater element comprising a core wire having an insulating covering permitting bending thereof and a resistor coiled about said core wire in intimate contact with said covering.

2. A radiant heater element comprising a helical resistor, a bendable metallic member extending through successive helices of said resistor to support and reinforce the same, and insulation between said member and certain of the helices of said resistor permitting the element to be bent into different forms.

3. A radiant heater element comprising a core wire having an insulating covering but projecting there-beyond and a resistor mounted on the covered portion of said core wire to be supported and reinforced thereby, said resistor having a terminal thereof electrically connected to an exposed portion of said core wire, the element being bendable into different forms.

4. A radiant heater comprising a helical resistor, an insulated core wire upon which said resistor is wound and to which one terminal of said resistor is electrically connected and a pair of terminals rigidly attached to said core wire, one of said terminals being electrically connected to said core wire and the other being insulated therefrom and electrically connected to the other terminal of said resistor.

5. A radiant electric heater comprising a core wire having an insulating covering for an intermediate portion thereof, a resistor coiled about the covered portion of said core wire and electrically connected to one extremity thereof, a terminal lug rigidly secured to the opposite extremity of said core wire in electrical contact therewith and a second terminal for said resistor mounted upon said terminal lug but insulated therefrom.

6. A radiant electric heater comprising a core wire having an insulating covering for an intermediate portion thereof, a resistor wound upon the insulated portion of said core wire and having one terminal electrically connected to one extremity of said core wire, a terminal lug rigidly secured to the opposite extremity of said core wire in electrical contact therewith, a terminal carried by said lug but insulated therefrom and a connector between such terminal and said resistor, said connector having a clamping part surrounding the end turns of said resistor.

7. A radiant electric heater comprising a helical resistor, an insulated core wire upon which said resistor is wound and to which one end thereof is electrically connected and a conducting band surrounding certain coils at the opposite end of said resistance, and clamping the same against the insulating covering of said core wire.

8. The combination with a radiant heater element comprising an insulated core wire and a resistor wound thereon, of supporting members for said element, each having a part to engage the latter at any point longitudinally thereof and further having means for attaching the same to a supporting plate.

9. The combination with a radiant heater element comprising an insulated core wire and a resistor wound thereon, of supporting members for said element each having an eyelet through which the same may be passed and further having means to secure the same to a base plate.

10. The combination with a radiant heater element comprising a helical resistor and internal reinforcing means therefor, of supports for said element, each engageable therewith at any point longitudinally thereof and each having lugs for securement thereof to a perforated base plate.

11. The combination with a radiant electric heater comprising a helical resistor having an internal reinforcing member and terminal parts rigidly attached to said reinforcing member, of supports for said reinforced resistor, each having an eyelet to receive the same and certain ones having means to engage certain of said terminal parts to secure the heater against withdrawal from said supports.

In witness whereof, I have hereunto subscribed my name.

EDWIN N. LIGHTFOOT.