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ELECTRIC HEATING MEANS

Filed Feb. 7, 1929

Fig. 1.

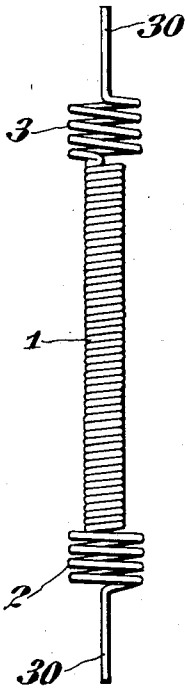


Fig. 2.

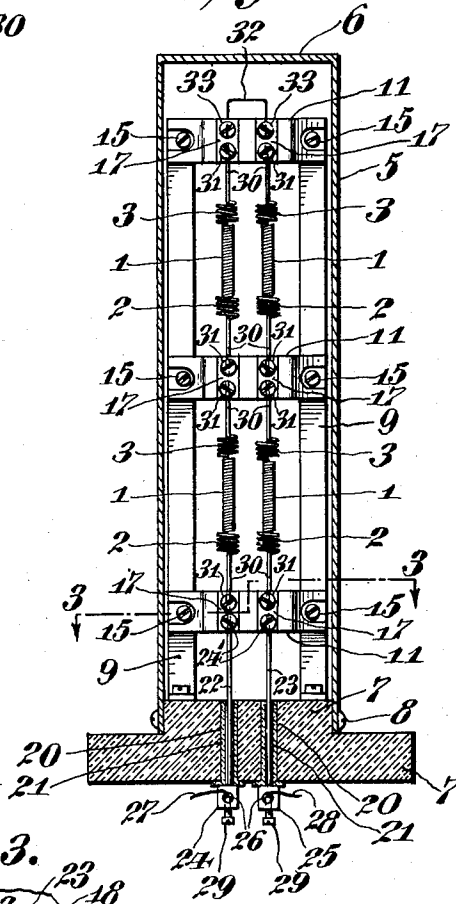


Fig. 3.

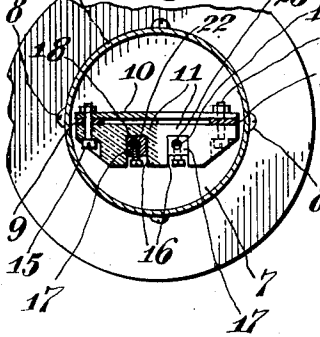


Fig. 4.

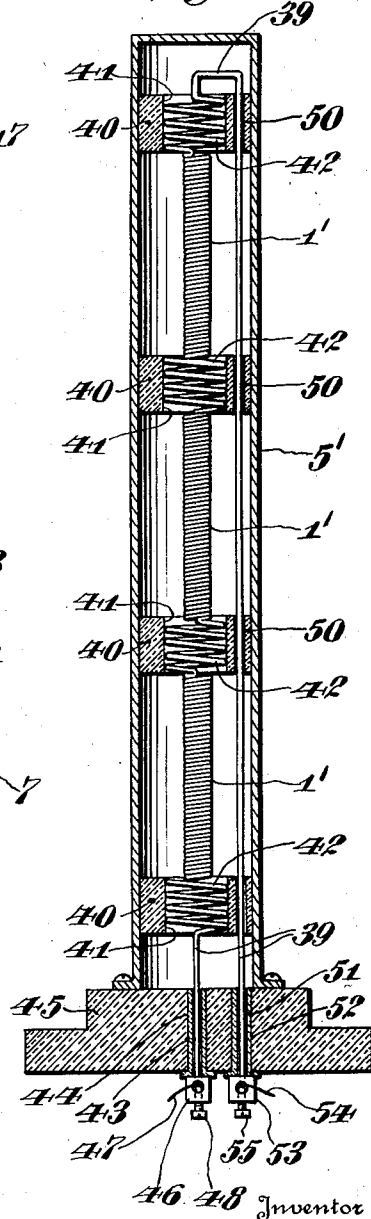
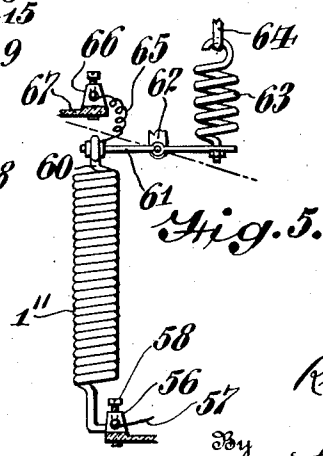


Fig. 5.



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## ELECTRIC HEATING MEANS

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My invention relates to electric heating means wherein one or more electric heating coils of novel construction is or are supported by suspension or otherwise within a chamber to be heated, or within a chamber of an element the latter being the heat radiating means of the heater structure.

The general object of the invention is to provide a heating means comprising one or more coils or helices through which current is adapted to flow and which coils are provided with means whereby the inductance thereof is reduced, the said means also operating to prevent objectionable humming noises when alternating current is supplied.

It also is an object of the invention to provide the coils with means of novel construction whereby pressure is adapted to be applied axially thereto to compensate expansion and contraction changes due to variations in temperature.

In order that the invention may be readily understood and its practical advantages fully appreciated reference should be had to the accompanying drawing in which I have illustrated a coil embodying the invention and certain applications thereof to practical uses.

In the drawing:

Fig. 1 is a view in elevation of a coil constructed in accordance with the invention;

Fig. 2 is a longitudinal sectional view of a tubular member having a plurality of coils mounted in series therein, the heating of which is adapted to effect heating of the tubular member which acts as a heat radiating element;

Fig. 3 is a view in transverse section taken on the line 3—3 of Fig. 2;

Fig. 4 is a view in longitudinal section similar to that shown in Fig. 2 but illustrating a modified construction of embodiment of the invention; and

Fig. 5 is a view showing still another modified construction embodying the invention.

Before proceeding with a detail description of the invention by reference to the drawing I desire to point out that the heating coil illustrated in Fig. 1 of the drawing, or a plurality of such coils, is or are adapted to be supported in any suitable manner in a cham-

ber, such as the fuel chamber of a stove, which is to be heated; or the said coil or a plurality of such coils may be mounted within a hollow member of tubular character and a current caused to flow therethrough for heating the said member, the latter operating as the heat radiating element of the heating structure.

One form of heating coil or helix embodying my invention as illustrated in the drawing comprises a coil or helix 1 of small diameter in which the turns of the coil are located in contact with each other. The adjoining contacting turns of the coil or helix 1 should be insulated from each other so as to prevent short-circuiting between the said turns, and to this end the wire of which the coil is formed may be covered with an oxide of the metal of which the wire consists or other oxide of suitable character which possesses the requisite qualities of insulation. The wire of the coil or helix 1 is extended at its opposite ends and is employed in the formation of terminal coils or helices 2 and 3 of large diameter as compared with the diameter of the coil or helix 1. The turns of these coils or helices 2 and 3 are separated from each other as indicated, and the said coils or helices are wound in directions opposite that of the winding or coiling of the coil or helix 1. The purpose of reversing the directions of the turns of the coils or helices 2 and 3 with respect to the direction of the turns of the coil or helix 1 is to reduce the inductance of the structure and also to prevent or at least reduce objectionable humming noises which otherwise would be present. By providing a helix 1 of small diameter the magnetic flux there-through is relatively small whereby the inductance is reduced and also singing noises which otherwise might be present are reduced. The coils or helices 2 and 3 not only serve as means to reduce the inductance of the element but they also serve as means for yieldingly holding or suspending the helix 1 and for protecting the element against shocks to which they may be subjected when shipped by the ordinary means of transportation. The said coils 2 and 3 also operate to compensate for changes in length of the helix 1 due to variations in temperature.

Another advantage which has been found to be incident to and inherent in the coil 1 of small diameter is that when thus formed of small diameter the adjoining contacting turns of the coil or helix do not slip or slide relatively to each other and thereby become telescoped, as it were, in relation to each other. The heating coil 1 is of relatively rigid structure so that when it is supported at its opposite ends no intermediate support or steady-  
ing means is required.

In Fig. 2 of the drawing I have shown a plurality of heating coils of the character of that shown in Fig. 1 mounted within a tubular member 5 which is adapted to be heated by heat radiated from the said coils, the said tube 5 becoming the heat radiating element of the structure. The metal tubular member or element 5 is closed at one end by an integral portion 6, as indicated, and its opposite end is closed by a plug 7 of insulating material such as steatite, which is secured in place by means of fastening screws 8. A couple of metal bars 9 are secured to the inner side of the plug 7 and extend throughout the greater portion of the length of the tubular member or element 5. Crosswise extending metal bars 10 and blocks 11 of insulating material, such as steatite, are mounted at intervals upon the said bars 9, the said bars 10 and 11 being arranged in couples and located upon opposite sides of the bars 9 and being secured in place upon the latter by means of fastening bolts 15. In the construction as illustrated there are three of these couples of members 10 and 11, but it will be understood that the number of such couples may be increased or diminished within practical limits if desired. One of the blocks 11 of insulating material is provided, in the construction shown, with a couple of transversely extending notches 16 of rectangular shape within which are mounted metal blocks 17 of suitable metal, such as brass. These blocks are provided with holes or openings 18 extending therethrough in directions parallel with the axis of the tubular member or element 5.

The plug 7 of insulating material is provided with a couple of openings 20 which lead from the outside into the interior of the tubular member or element 5. These openings are provided with tubular linings of suitable insulating material 21 through which extend wires 22 and 23 to the outer ends of which are connected terminal blocks 24 and 25. These terminal blocks are provided with holes 26 which extend transversely therethrough, into which holes the ends of conducting wires 27 and 28 are adapted to be inserted and held in place by binding screws or posts 29.

The inner ends of the wires 22 and 23 project into the outer ends of the holes 18 in the blocks 17 mounted upon the first of the insulating blocks 11 and are secured therein by

means of binding screws 24'. The wire at the opposite ends of each of the heating elements is extended as indicated at 30, and the outer ends of these extensions project into the opposing ends of openings 18 in the blocks 17. It will be noted that there are two of the heating units located in parallel relation to each other between the adjoining blocks 11 of insulating material. The outer ends of the wire extensions 30 previously referred to project into the opposing ends of the openings 18 in the blocks 17 and are secured therein by means of binding screws 31. The two brass blocks 17 located in the outermost of the insulating blocks 11 are connected to each other by means of a wire connection 32, the ends thereof being held in connected relation to the said blocks by means of binding screws 33. Assuming that current enters through and from the conductor 27 it will be apparent that it will flow through the heating elements in series and that all of them will be heated to an extent depending upon the energy of the current flowing therethrough and that the heat therefrom will radiate therefrom and result in the heating of the tubular member or element 5 from which the heat is radiated into a room or into any other chamber within which the said member 5 may be located. It will be noted that the brass blocks 17 are located considerable distances from the heating elements consisting of the coils 1 and the extensions 2 and 3 thereof, in consequence of which they are without the zones of greatest heat intensity. Hence destruction thereof by the application of too high heat thereto is avoided.

In Fig. 4 of the drawing I have shown a construction comprising a tubular member or element 5' within which are mounted at intervals blocks 40 of insulating material through which holes 41 of relatively large diameters are provided. The heating member of this structure comprises a wire 39 having at intervals helices 1' of small diameter, similar to the helix 1 shown in Figs. 1 and 2 of the drawing. The turns of the helices 1' are located in contact with each other, as shown. The said wire also is provided at intervals with coils or helices 42 of relatively large diameter, the turns of which are separated as shown. In the construction as illustrated the two intermediate coils 42 of large diameter are located intermediate or between the adjoining ends of the helices 1' of small diameter, while the two outermost of the coils or helices of large diameter are in adjoining relation to the outer ends of the adjoining helices 1'. The diameters of the coils or helices 42 are somewhat larger than the diameters of the openings 41 so that when the said helices or coils are pushed into the said openings they are slightly contracted and are held therein by the tending thereof to expand. The wire 39 is extended from the outer end of the coil or

helix 42 through the tubular member 43 mounted in an opening 44 provided in the block 45 of insulating material which is secured to and closes one end of the tubular member 5'.  
 5 The outer end of the said wire is provided with a terminal block 46 having an opening therethrough into which one end of a conductor 47 projects. A binding screw 48 holds the said conductor in place in the said opening.  
 10 The wire at the inner end of the innermost coil 42 is extended and is threaded through openings 50 provided in the blocks 40 and is finally threaded through a tubular lining member 51 of insulating material mounted in  
 15 an opening 52 provided in adjoining relation to the opening 44. The outer end of the said extension wire is provided with a terminal block 53 having an opening therein into which one end of a conductor 54 extends. The said  
 20 conductor is held in said opening by means of a binding screw 55. The coils or helices 42, with their turns spaced or separated from each other as shown, yield so as to permit expansion and contraction of the coils or helices  
 25 1' due to variations in temperature. It will be noted that the turns of the wire which form the coils or helices 42 extend in directions opposite that in which the turns of the wire of the adjoining coils or helices 1' extend.  
 30 The purpose of such reversal in the direction of the coils has been fully set forth and described in connection with the description of the coils illustrated in Fig. 1.

In Fig. 5 of the drawing I have shown a  
 35 structure comprising a coil or helix 1'' in which the turns are located in contactual relation with respect to each other. The lower end of the coil or helix 1'' is extended and is connected to a terminal 56 to which a conductor 57 is connected and held by means of a  
 40 binding screw 58. The wire at the opposite end of the coil or helix 1'' is extended, as indicated at 60, and is connected to one end of a lever 61 pivoted intermediate its ends to a support 62. The opposite end of said lever is  
 45 connected to one end of a coiled spring 63 which tends to contract, the opposite end of said spring being connected to a stationary support 64. It will be seen that the spring  
 50 63 exerts continuously a pull upon the outer end of the lever 61 tending to cause inward movement of the inner or opposite end thereof. The extension 60 previously referred to is connected to one end of a wire conductor 65  
 55 the opposite end of which is connected to a binding post 66 mounted upon a support 67 of insulating material.

The heating elements in the several forms of construction may consist of any suitable  
 80 metal but preferably an alloy of chrome-nickel is employed. This alloy, by reason of its high specific resistance and resistance to heat, is particularly suitable for the construction of the heating elements employed for heating by radiation.

It will be seen that by my invention I have provided a heating element consisting of a heating coil or helix of small diameter with the turns thereof in contact with each other, the opposite ends of which helix are provided with or terminate in oppositely wound coils or helices of relatively large diameters which are adapted to yield upon variations in the length of the coil or helix of small diameter due to variations in temperature; and also it  
 70  
 75 will be seen that I have provided heating structures embodying said coils or helices in cooperative relation with respect to each other.

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

An electric heating means, comprising a wire having helical portions of relatively small diameter at intervals therein, and the said wire also having helical portions of relatively large diameter located alternately with respect to the first named portions, the turns of the first and second named portions extending in reverse directions with respect to each other, means for insulating the adjoining turns of the said coils from each other, and means having connection with said heating means at its opposite ends and constituting the sole means of support therefor.

In testimony that I claim the foregoing as my invention, I have hereunto signed my name this 11th day of December, 1928.

RUDOLF von BROCKDORFF.

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