A. J. HOLMES.

ELECTRIC HEATER.

APPLICATION FILED MAY 10, 1906.

898,578. Patented Sept. 15, 1908.

Fig. 3.

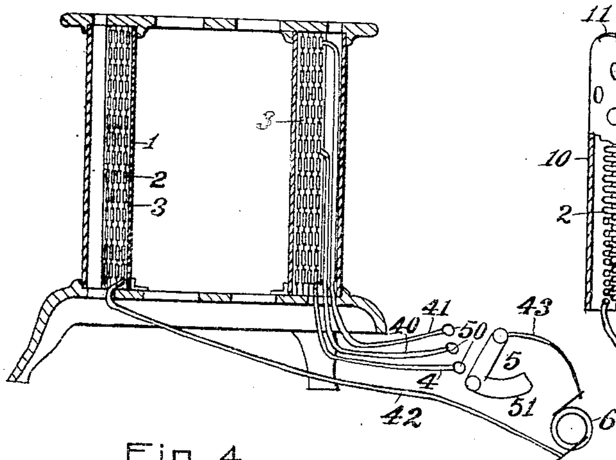


Fig. 2.

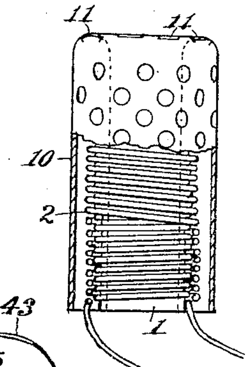


Fig. 1.

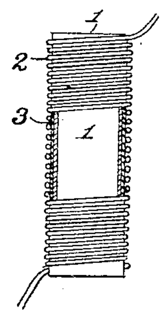


Fig. 4.

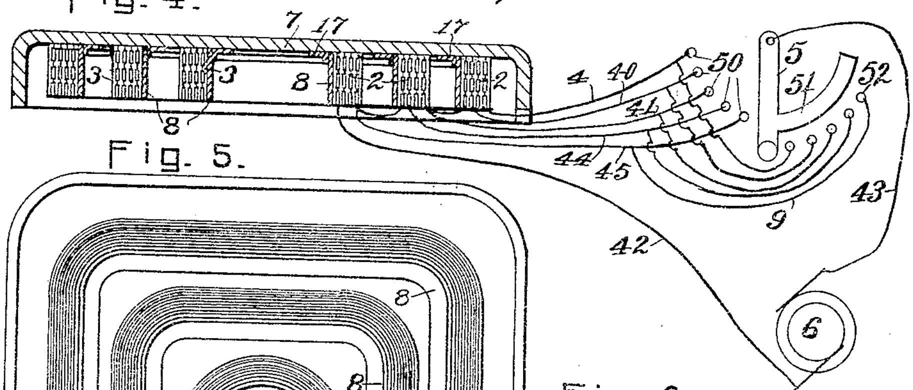


Fig. 5.

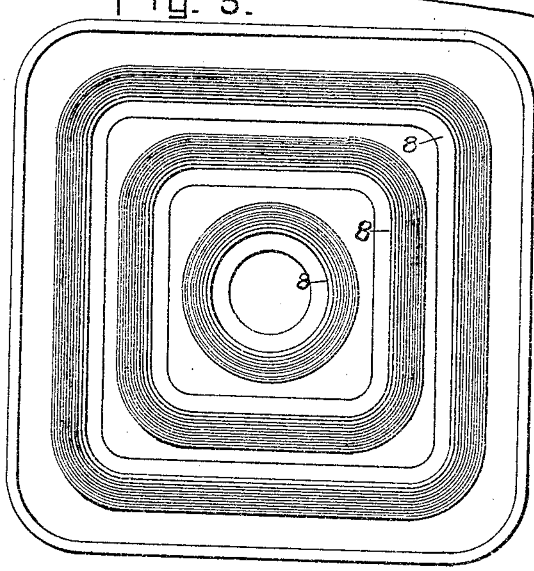
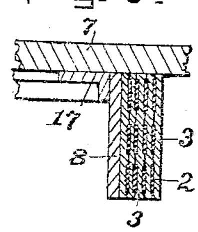


Fig. 6.



WITNESSES

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ELECTRIC HEATER.

No. 898,578. Specification of Letters Patent. Patented Sept. 15, 1908.

Application filed May 10, 1906. Serial No. 316,175.

To all whom it may concern:

Be it known that I, ANDREW J. HOLMES, a citizen of the United States, and resident of the city of Tacoma, in the county of Pierce and State of Washington, have invented certain new and useful Improvements in Electric Heaters, of which the following is a specification.

My invention relates to improvements in electric heaters, particularly those using alternating current, and comprises the novel parts and combinations of parts which will be hereinafter defined in the claims.

The object of my invention is to increase the simplicity and efficiency and, in general, to improve and simplify such devices.

In the drawings accompanying I have shown my invention embodied in forms which are now preferred by me.

Figure 1, shows an elemental form of heater embodying my invention. Fig. 2 shows a modification of the same containing a slightly more complex structure. Fig. 3 shows a preferred method of embodying my invention in an air heater for warming rooms. Figs. 4 and 5 show, respectively in sectional elevation and bottom plan, an adaptation of my invention to "hot plates", for cooking purposes. Fig. 6 is a sectional elevation showing in detail the construction of the coils.

My experiments with electric heaters for use with alternating currents indicate that the best results are obtained when using an impedance coil composed of a conductor having a magnetic nature, and with this, a core having a similar magnetic nature, that is, a material which, under the influence of a field of magnetic force develops numerous lines of force, such materials, for instance, as hard, close-grained, white cast iron or hard rolled steel. Such a material has a molecular structure which resists the molecular vibrations and rearrangements which are induced therein when it is subjected to alternating current pulsations, and by reason of such resistance, heat is developed in the body of the metal when it is subjected to such influences. In such a core subjected to the rapid variations of magnetic conditions which would occur when it is placed in the field of force of an impedance coil operated by an alternating current, there is an effort to rearrange the position of the molecules, at each alternation of the current, which effort is resisted by the cohesive action between the molecules, the result being that heat is developed in the body of the core. With the coil composed of such magnetic material, the same molecular disturbances and the resultant heating effect occur in the coil wire as in the core. In such a coil induced magnetic currents or pulsations are produced within the wire of the coil, which much intensifies the heating effect. For these induced magnetic currents the coil conductor constitutes an open magnetic circuit, as these pulsations are mainly confined to the coil wire and do not, in any considerable extent, extend to the line wire leading from said coil. The degree of this heat depends upon a number of conditions, such as the character and volume of the current supplied, the strength of the coil, the character of the material composing the core and coil, the secondary induction produced, etc. I have been able with such a device to heat the core to a white heat.

In Fig. 1, I have shown such a heating apparatus in an elemental form. This consists of a core 1, and a coil 2 insulated from and surrounding the core. Preferably the core is in the form of a tube, as is shown in Fig. 1; the coil is also insulated from the core, preferably by such a material as asbestos, mica and the like, which is uninjured by the heat developed in both coil and core and which enables the core itself to support the coil. In Fig. 1 a sheet 3 of this is shown between the coil and the core, and in the other figures between successive layers of the conductor also.

The device as shown in Fig. 2 is the same as in Fig. 1 except that the coil 1 contains additional layers of the conductor and an outer cylindrical tube 10 surrounds the whole and is connected at one end with the core 1, forming a casing for the whole. These may, however, be connected at both ends. This casing is preferably of the same character of material as the core and is in reality an extension thereof. This casing may be perforated as shown in Fig. 2, thereby equalizing the magnetic track, making outer and inner casings of same area and consequently heating them alike. In some cases where uniform expansion and contraction of parts is desirable this may be of importance. The device may be operated satisfactorily if this casing be connected at either one or both ends with the core, thus forming either an open or a closed electric circuit.

In designing my device for use as an air heater, I prefer that the casing 10 be at a slight distance from the outer surface of the coil 2, thus forming an annular space which, at its upper end, is connected with the outside by openings 11, whereby a free circulation of air there through may be maintained.

In devices for applying heat by direct conduction, such as cookers and various tools and utensils, this space may be and often would preferably be filled with solid insulating materials.

Fig. 3 shows my invention embodied in a form which much resembles that shown in Fig. 2 but which, in details of construction is more like what would be used in practice. In this the conductor 2 extends in several helical layers about the core 1. Between the successive layers are sheets 3 of insulating material, as asbestos. The conductor is also in the form of flat strips or bands.

I prefer that the coil be provided with tap connections whereby a portion thereof may be short-circuited, if desired. In Fig. 3 I have shown two tap wires 40 and 41 connected respectively with the middle and inner end of the outer layer of the coil. These tap wires extend to contact buttons 50 which are adapted to be engaged by a switch 5. A wire 4 connected with the outer end of the same outer layer connects with one of the buttons 50. The switch 5 has an arm 51 of sufficient length that it may make connection with all the buttons 50 at one time. The conductor 43, which is permanently connected with the switch, extends to one side of an alternating generator 6, and the conductor 42, which connects with the opposite end of the coil 2 extends to the other side of the same generator. The position of the switch 5 shown in Fig. 3 is that in which the current is cut off. If the switch be moved to contact with the first button 50 the circuit is closed through the entire coil 2. If the switch be moved to connect with the second button, half the outer layer of the coil is short-circuited. If the switch be moved to contact with the last button 50 the entire outer layer of the coil is short-circuited. The arm 51 of the switch is of such length that it will maintain connection with all the buttons 50 at the same time. This prevents actual cutting out of the portions of the outer layer of the coil, but simply short-circuits them. These short-circuited portions of the coil produce a secondary induction effect which intensifies the heating effect and, of course, increases the consumption of current. Their use is desirable when heating the apparatus up as it hastens this result. When the parts have been heated up I prefer, in ordinary use, to restore these parts to the coil, that is, to do away with the short-circuiting. By using a magnetic resistance wire for the coil an induction effect is produced which develops a greater magnetic energy and heating effect in the coil than if the wire were of non-magnetic resistance material.

In Figs. 4 and 5, I have shown my invention embodied in what is known as a "hot plate", to be used for cooking and like heating of other articles by contact. This comprises a top plate 7, having secured to its under side a series of flanges 8, corresponding in purpose and action to the cores 1 of the previous figures. These flanges are of the same kind of material indicated as preferable for the cores, and are shown as secured to the plate 7 through the intervention of angle flanges 17. Each of these flange cores 8 is a support for a coil 2. The successive coils are connected in series. I may use tap connections to employ the outer coil as a secondary, or a portion of each coil as a secondary. The former is the method shown in Fig. 4. The wires 40, 41, 44 and 45, in connection with the switch arm 51 enables portions or all of the two outer coils to be short-circuited. The wires 9, connecting these short-circuiting wires with buttons 52 also enables the switch 5 to be used to cut out the same portions of these coils. It will be noticed that the buttons 50 and 52 are at different distances from the pivot of the switch, the buttons 50 being at such distance as will cause them to contact with the arm 51 and the buttons 52, being at a different distance such that they will contact only with the narrow portion of the switch. The ability to cut out some of the coils will be found useful when it is desired to heat only a small central area.

The cross-sectional shape of the cores 1 is immaterial. They may be round, square, oblong or any other shape which best serves the specific purpose. My invention may also be applied to any heating use, such for instance as radiators, hot plates, ovens, tools, and numerous other purposes, whether the heat is applied directly by conduction, by radiation or conveyed by heated air. I wish to cover the novel features of my invention broadly as applied to any heating purpose.

What I claim is:

1. An electric heater for use with alternating currents having a coil to be placed in the primary circuit and composed of a material which is strongly resistant to the molecular changes induced by the current reversals.

2. An electric heater for use with alternating currents comprising a core, and a coil therefor composed of a conductor which is strongly resistant to the molecular changes induced by the current reversals.

3. An electric heater for use with alternating currents, comprising a coil and core, both being composed of materials highly resistant to the molecular changes induced by the current reversals.

4. An electric heater for use with alternating currents, comprising a coil and core, both composed of magnetic metals.

5. An electric heater for use with alternating currents, comprising a coil and core, both composed of hard iron or steel having permanent magnetic qualities.

6. An electric heater for use with alternating currents, having a coil composed of a conductor of a character to carry the primary or inducing current without directly thereby being specially heated, and also of a character to have strong eddy currents induced therein by the field of force produced by the primary current, to thereby be heated.

7. An electric heater comprising an induction coil and two tubes of magnetizable material placed, one within and the other without said coil, within its field of force and electrically connected at one end.

8. An electric heater comprising an impedance coil, two tubes of magnetizable material placed one within and the other without said coil, and electrically connected at one end only, the outer tube having an air space between it and the coil, said space having connections whereby the air may freely circulate therethrough.

9. An electric heater comprising an impedance coil a magnetic core and a magnetizable casing surrounding the coil and electrically connected with the core, said casing being peripherally non-continuous whereby the heating effect is equally distributed between core and casing.

In testimony whereof I have hereunto affixed my signature this 30th day of April, 1906, in the presence of two witnesses.

ANDREW J. HOLMES.

Witnesses:

JAMES C. DRUKE,

C. G. CROMBIE.