

R. H. READ.
ELECTRIC HEATER.

APPLICATION FILED MAR. 23, 1909. RENEWED JULY 15, 1912.

1,127,373.

Patented Feb. 2, 1915.

Fig. 1.

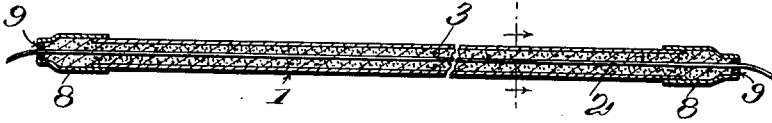


Fig. 1a



Fig. 2.

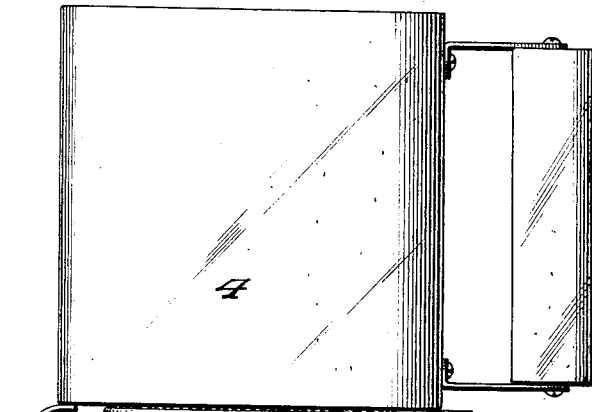


Fig. 3a

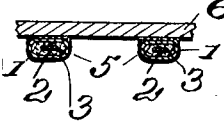


Fig. 3.

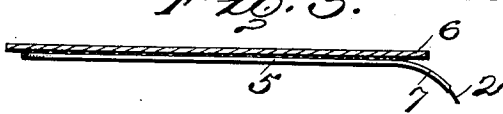


Fig. 4.

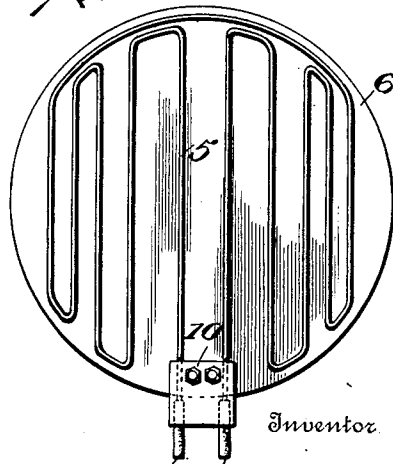
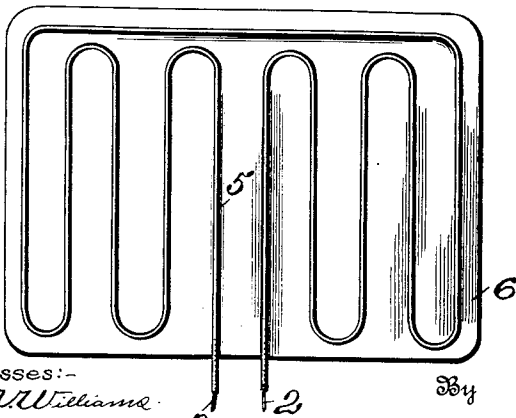


Fig. 5.



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11 11a

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UNITED STATES PATENT OFFICE.

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ELECTRIC HEATER.

1,127,373.

Specification of Letters Patent.

Patented Feb. 2, 1915.

Application filed March 23, 1909, Serial No. 485,329. Renewed July 15, 1912. Serial No. 709,577.

To all whom it may concern:

Be it known that I, ROBERT H. READ, a citizen of the United States, residing at Schenectady, in the county of Schenectady and State of New York, have invented new and useful Improvements in Electric Heaters, of which the following is a specification.

My invention has for its object the establishment of a better thermal conductive relation between the heating or resistance element of electric heating apparatus and the body of the heater or the metal plate which supports its heating element and transmits the generated heat to the work.

In most electric heating apparatus the resistance element is separated by mica or asbestos from the supporting plate or body of the utensil and clamped by screw pressure. Obviously, with such structures the repeated expansion and contraction tends to reduce the pressure by reason of the screws or bolts easing the pressure under the stresses of molecular forces due to heat, and also by reason of a continual tendency of the screws to work loose, and when the pressure is diminished in any way the rapidity of heat transmission is seriously impaired, not only interfering with the rapidity of action of the heater but also endangering the heating element which under such circumstances will become much hotter and tend to burn out. Other devices have the heating element supported on insulators in air and such are slow to transmit the heat of the resistance element. The types best adapted for rapid transmission are those in which the heating element is insulated and cast into a body of surrounding metal or the well known type in which the resistance conductor is embedded in a covering of vitreous enamel which is fused on the supporting plate. My present invention is somewhat similar to the latter type, but differs from it in the important particular that the heat transmitting material between the resistance element and the distributing plate is metal instead of vitreous material, by which the thermal transmitting power is enormously enhanced.

In carrying out my invention I employ a new form of conductor invented by me and described in my copending applications

Nos. 484,266, filed March 18, 1909, and 572,778, filed July 9, 1910, and which consists essentially of a resistance conductor inclosed throughout its length in a metal sheath and insulated therefrom by a heat refractory insulating powder. The outer metallic sheath of the conductor is perfectly insulated from the conductor itself by a spacer of insulating material which will withstand much higher temperatures than the metals composing the conductor. I take advantage of the peculiar nature of the insulated conductor by soldering, brazing silver-soldering, or welding the outer metallic armor to any desired heat distributor. For example, the conductor may be reflexed, coiled, or otherwise arranged and applied directly to an iron or other metal plate and secured thereto rigidly by a film of metal molecularly uniting it with the plate. In this way the most perfect thermal relation is established by exceedingly cheap means and a bond is formed which cannot be destroyed except under conditions which would destroy the conductor or container itself. The life of such a heater is evidently limited only by the durability of the materials of which it is composed. The resistance element being incased by the drawing of the wire within its insulating envelop is perfectly symmetrical with reference to the armor around it and always remains so by reason of the inalterability of the flint or other powder which forms the insulation. The hard solder or welded bond provides a metallic joint which gives a maximum transmitting power, and being refractory to heat will not melt under the most severe operating conditions. For some types of heater as boilers, ovens, and the like where only a few hundred degrees Fahrenheit is necessary a lower melting solder might be employed; I prefer, however, to braze, silver-solder or weld, since this permits me to run the heater at a higher heat and secure quicker results on the work by raising the device sooner to a desired temperature. Any suitable resistance metal or alloy may be used in the conductor, as German silver, nickel-iron, nickel-chromium, all of which are well known.

The mode of manufacturing the conductor is fully described in my copending applica-

tion 484,266 above referred to; to make the present application clear it may be stated that an ingot containing a bar or rod of any metal is prepared by securing the rod inside a metal tube and ramming the space between them full of an insulating powder, then sealing the tube and treating the ingot to make wire by rolling and drawing by the usual wire manufacturing process. In securing the conductor to the heater plate the ends are flexed outward to permit terminal connections with a source of current supply. Thus it will be seen that my invention consists of an insulated conductor provided with an outer metallic sheath and metal-lically united with a metal support by means of a molecularly integral metallic joint.

In the accompanying drawings illustrating my invention, Figures 1 and 1^a show in enlarged section a metal conductor of the kind I prefer to employ; Fig. 2 shows a water heater to which the invention is applied; Fig. 3 shows in section a sheet-metal supporting plate mounted with a heating element in accordance with my invention; Fig. 3^a shows an enlarged section of Fig. 3; Fig. 4 is a bottom view of the heater of Fig. 2; and Fig. 5 is a bottom view of the plate of Fig. 3.

The resistance element of Fig. 1 is composed of an outer metal shell 1 which may be of any malleable or ductile metal, as copper, brass, iron or the like. Within, and preferably centrally within is a high resistance wire or conductor 2, and between the central wire and the shell is a closely packed powder 3 non-conducting and refractory to heat. I prefer to employ finely ground flint because it is the best heat conductor of the insulating oxids, is an exceptionally good insulator, has an extremely high melting point, is non-hygroscopic, does not readily decompose at any temperature, and especially does not form a conductor of the second class when heated, and all these conditions make for the best product in electric heating. The powder insulation flows somewhat in the manner of a viscous liquid under reduction in the rolls and dies, producing a perfectly centralized relation of the core-wire to the metallic casing, and moreover being solidly compacted permits less air-carrying moisture to be entrapped within the pores by a breathing effect under repeated heating and cooling. Thus the insulating value of the product is enhanced in value. Further, the powder being perfectly flexible permits the metal-armored wire to be sharply flexed without cracks being formed. Under repeated heating and cooling in use the wire remains central as the core can shift slightly without strains. The conductor may be of any desired sectional shape but I prefer to make it flattened in

the form of a strip as indicated in Fig. 1^a. This provides a wide area of contact with the metal support which permits rapid transmission of the heat because of the low thermal resistance of the wide area. The conductor is reflexed or coiled into the desired shape and applied to a metal support. In Figs. 2 and 4 are shown a mode of attaching it directly to the bottom of a sheet metal vessel 4, the heating element being indicated at 5. It should be annealed and applied to the desired surface and soldered with silver solder and a blast flame. If desired electric welding may be employed, in which case the one electrode may be placed against the bottom of the vessel inside the same and the other against the conductor—part or all of it according to the current available. Welding would be preferred by reason of the stability and hardness of the joint, but it is much more expensive.

In Figs. 3 and 5 I have shown the element metal-lically united with a flat plate as 6. In this form the heater plates are self-contained and might be placed in stock readily for quick delivery and sale. Such plates might be applied to almost any surface to be heated.

It will be seen that my conductor being metal-lically bound to the surface of a metal plate there is no chance for faulty heat distribution, if the plate warps. The warping of metal plates when heated is the chief cause of inefficiency in electric heaters; the warping springs the plate away from the heating element and the contact becomes instantly of very high thermal resistance and the heat which before was carried away to its work cannot escape and is stored in the conductor until it burns out thus putting the apparatus out of commission. Under my invention, however, if the plate buckles or warps, the conductor must move with it, and the same fidelity of thermal relation is maintained as at the beginning; therefore, however much the plate may warp it does no damage. Plates of this kind are of universal application in electric heating. In electric ovens, for instance, much trouble is experienced from the thin metal walls warping away from the resistance element; it is evident that with my invention this cannot happen.

In connecting the resistance element in circuit the outer shell is removed and a spacer used to keep the insulated wire from grounding. This may be done in any good way; one such is to use a metallic nozzle; in Figs. 2 and 3 it will be seen the terminals or ends are shown bent away from the support as at 7. The inner wire is exposed by removing the metal shell near the end; this may be done easily by rolling the conductor under the blade of a knife with light pressure until severed and then stripping off the

cut section. The nozzle 8 of Fig. 1 may then have the resistance wire threaded through it; the nozzle has a perforated insulating bead of glass, lava or the like, 9, which insulates it and at the same time holds it central, and prevents flexure or grounding on the shell. The wire may then be fastened with a screw or otherwise in the insulating block 10 carrying contacts 11 11^a to make plug connections with a source of current in the ordinary way.

I have herein described the best mode known to me of carrying out my invention, as required by the patent statutes but I do not desire to be limited to the means described but intend to cover all means of carrying out my invention within the scope of my claims.

I do not claim in this application a core-wire of high resistance in a seamless tube with closely compacted insulation and a seamless metallic shell on the outside, such matter being claimed in my copending application #841,544, filed May 28, 1914, nor do I claim means for excluding moisture, which is claimed in my application #843,236, filed June 5, 1914.

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

1. An electric heater comprising an insulated electric conductor having a metal tube along the axis, a thin covering of heat refractory compact insulating powder between the conductor and tube throughout its length, and a metal support united to the face thereof throughout the length of the conductor.

2. An electric heater comprising a metallic support, a tubular metallic shell, and a resistance element inclosed within and insulated from the metallic shell throughout its length, said shell being metallically united with one face of the support.

3. An electric heater or the like comprising a resistance wire, heat refractory insulation around the same, a metallic shell closely embracing the insulation, and a heat distributing plate to the surface of which the shell is metallically united throughout its length.

4. An electric heater comprising a resistance element, heat refractory insulation around the same, a metallic shell closely embracing the insulation throughout its length, and a heat distributing metal plate soldered to the shell.

5. An electric heater comprising a resistance element, heat refractory powder insulation around the element, a metallic shell closely embracing the powder, and a heat distributing metal plate metallically and molecularly united on its outside with the shell, the ends of the shell being free.

6. An electric heater comprising a heating

utensil, a tubular heating wire secured to its face by a metallic joint molecularly integral with the utensil and the wire, and a resistance wire embedded in heat refractory insulating powder within the tubular wire.

7. An electric heater comprising a heating utensil, a tubular heating wire secured to the outside thereof by a metallic joint molecularly integral with the utensil and the wire, a resistance wire, heat refractory insulating powder embedding the wire within the tubular wire, and enlarged metallic terminals at the ends of the resistance wire.

8. An electric heater comprising a heating element consisting of a tubular metallic shell, a resistance wire along its axis, closely packed insulation of heat refractory insulating powder between the two, whereby the relatively large radiating surface of the shell cools the resistance wire, and terminals integral with the resistance wire projecting from the shell.

9. An electric heater comprising a heating element consisting of a tubular metallic shell, a resistance wire along its axis, closely packed insulation of heat refractory insulating powder between the two, whereby the relatively large radiating surface of the shell cools the resistance wire, and short terminals integral with the resistance wire projecting from the shell in heat absorbing relation to a clamping device in the supply circuit.

10. An electric heater comprising a heating wire consisting of a tubular metal shell inclosing a resistance wire and separated therefrom by a closely packed heat refractory insulating powder, and a heat absorbing body in good thermal relation to the wire throughout its length.

11. An electric device comprising a heat absorbing body in good thermal relation to an insulated conductor consisting of an outer tubular metal shell and an inner resistance wire insulated therefrom by a closely packed mineral powder, short ends of the resistance wire projecting from the ends of the shell and secured to a supply circuit connector, whereby easy heat radiation is afforded the inner conductor.

12. An electric device comprising a heat absorbing body in good thermal relation to an insulated conductor consisting of a flattened tubular metal shell and an inner wire insulated therefrom by a closely packed mineral powder, whereby easy heat radiation is afforded the inner conductor.

13. An electric device provided with a heat radiating surface in good thermal relation to an insulated wire, and a wire surrounded by a closely packed mineral insulating powder provided with tubular insulated ends in heat absorptive relation to the radiator.

14. An electric heater comprising a resistance wire, a tubular metal shell of rela-

tively large heat radiating surface inclosing the wire, and a closely packed insulating powder between the shell and wire, said shell having tubular ends confining the powder and threaded by and insulated from the wire.

In testimony whereof I have signed my

name to this specification in the presence of two subscribing witnesses.

ROBERT H. READ.

Witnesses:

WALTER C. WHITMYRE,
W. S. ANDREWS.