May 19, 1931. E. L. WIEGAND 1,806,512

ELECTRIC HEATING APPARATUS

Filed April 11, 1929

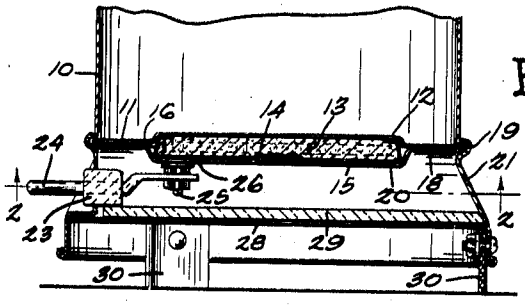

Fig. 1

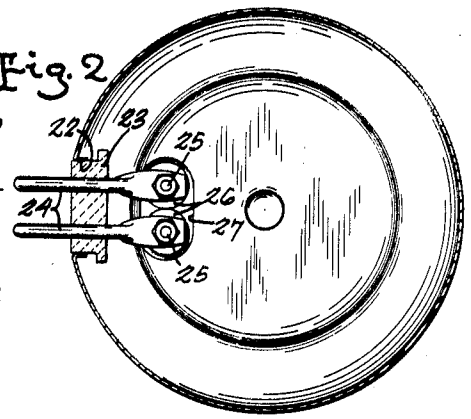

Fig. 2

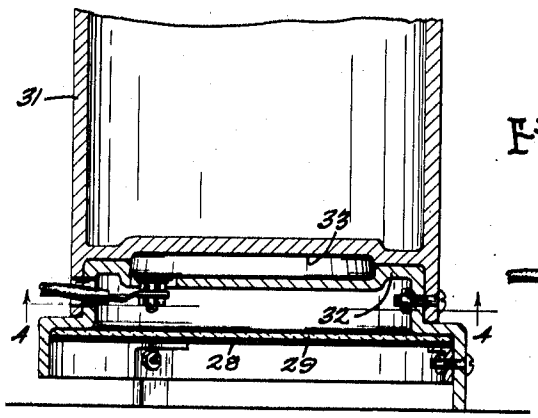

Fig. 3

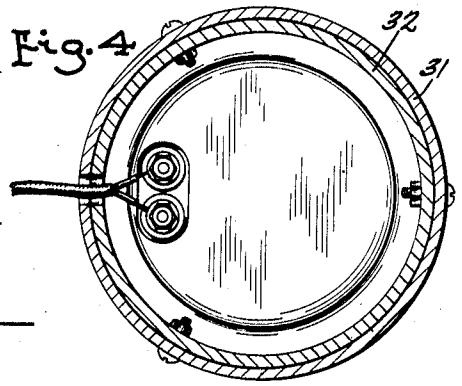

Fig. 4

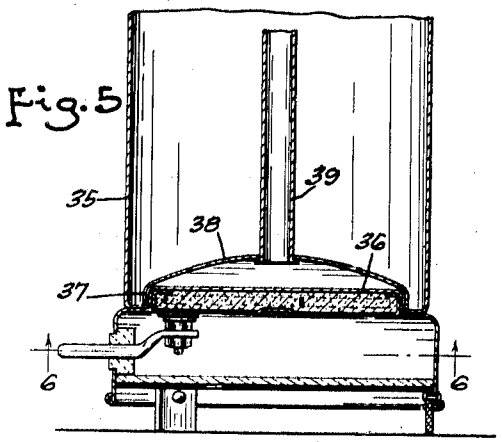

Fig. 5

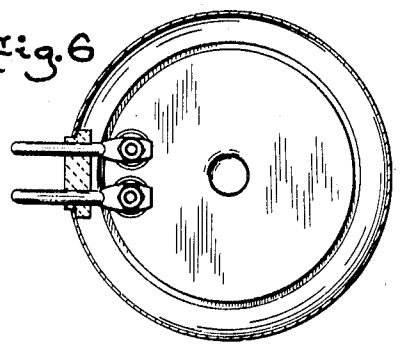

Fig. 6

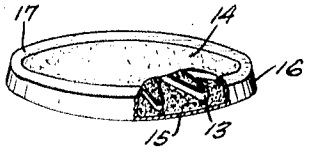

Fig. 7

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UNITED STATES PATENT OFFICE

EDWIN L. WIEGAND, OF PITTSBURGH, PENNSYLVANIA, ASSIGNOR TO EDWIN L. WIEGAND COMPANY, OF PITTSBURGH, PENNSYLVANIA, A CORPORATION OF PENNSYLVANIA

ELECTRIC HEATING APPARATUS

Application filed April 11, 1929. Serial No. 354,283.

This invention relates to electric heating apparatus of the metallic resistor type and has for its object the provision of an assemblage of this nature having peculiarly high attributes of reliability and longevity.

In my Patents No. 1,614,330 and 1,614,331 granted January 11, 1927, I illustrated and claimed numerous electric resistance heating elements consisting of resistor wires submerged in electrically-non-conducting material and wholly surrounded by metal sheathing of different shapes so as to be protected from injury by handling or by the absorption of grease and other cooking-liquids. I have found, however, by experience, that in some cases such a completely sheathed unit exhibits a peculiar phenomenon, especially when the object to be heated has a high coefficient of reflection or re-radiation. For example a bright aluminum vessel, while an excellent conductor after the heat has been absorbed by it, is a very poor receiver of heat by radiation; and its reception by metallic conduction, even though a good nominal contact may exist when the device is new, always decreases with age as the contact itself deteriorates, after which the heat must be transmitted more by radiation. Sometimes, in applications where the energy density is rather high, the reflection of heat from the surface even of a comparatively cool vessel is so great as to force the temperature of an interposed metallic sheath to such a point as seriously to injure the sheathing metal, thus further impeding heat transfer and leading eventually to a breaking down of the unit itself.

A high rate of re-radiation may have much the same effect even though the coefficient of absorption be high. For example vessels or melting pots which themselves operate at a high temperature are difficult to heat by radiation from a metal surface, although in these the surface is generally a better absorber than bright aluminum; however, as the temperature rises the re-radiation also increases, so that the only value available for heat-transmission is the difference of temperature between the heating element and the vessel heated which forces up the temperature of the heating element in the same way as does a polished aluminum vessel at a lower temperature. Thus in the case of the high-temperature melting pot, for example, the resistance of the vessel to receiving heat is to force the heating element to high temperature and if sheathing is interposed between the refractory unit and the articles to be heated, that sheathing unless made of the more expensive high heat resisting alloys, is liable to progressive destruction, and the contact to steady deterioration.

Accordingly the object of the present invention is the provision of a new and improved assemblage and relation of heating-element and heated-element which shall secure the advantages of the fully sheathed units without the disadvantages; the provision with a vessel or element to be heated of a partially-sheathed element so arranged as to be protected against injury or contamination without itself becoming disintegrated by the thermal results of the operation; the provision of a combination of heating and heated elements which shall secure new advantages of quick heating; while further results and advantages of the operation will become apparent as the description proceeds. The heating element shown herein is specifically claimed in my application Serial Number 297,612, filed August 6, 1928.

In the drawings accompanying and forming a part of this application I have shown certain typical embodiments of my inventive idea though without intent to limit myself to those embodiments which are chosen merely as being illustrative of the principles of my invention and not as being exhaustive of its details. Fig. 1 is a vertical sectional view through part of a liquid heater containing my improvements and Fig. 2 is a horizontal sectional view corresponding to the line 2—2 thereof, Fig. 3 is a vertical sectional view through the bottom part of a metal melting pot and Fig. 4 a horizontal sectional view corresponding to the line 4—4 thereof; Fig. 5 is a vertical sectional view through the bottom part of a percolator embodying my improvements, and Fig. 6 is a horizontal sectional view corresponding to the line 6—6

thereof; and Fig. 7 is a perspective view of one of my improved elements removed with parts broken away to show the interior construction.

In choosing liquid heaters or metal melters as illustrative embodiments of my invention I do not disclaim its use for heating other types of devices. The heated device in Fig. 1 consists of a sheet-metal vessel 10 having its bottom wall 11 slightly embossed upwardly as shown at 12 for the reception of the upper part of the heating element; and said heating element comprises a ribbon or wire 13 of high temperature- and oxidation-resisting metal submerged in a closely-compacted mass 14 of electrically-insulating material leaving as high a heat-conductivity as may be, the whole embraced on the bottom and sides by a metallic housing 15. Without in any wise limiting myself thereto, I have had my best success with certain of the more refractory oxide, aluminum oxide in the form of corundum or granular zirconium silicate or a mixture of them being very satisfactory when mixed with just enough clay to constitute a binder without unduly lowering the melting point or impairing the di-electric strength of the material. However, practically all the insulating materials which exhibit prolonged usefulness are of a somewhat porous and brittle nature and require an intimate support, added to which it is desirable, in order to secure quick heating and diminish residual heat, to make such a heating-element much thinner and lighter than would be possible in case it were homogeneous in composition. Hence, in order to secure these advantages of lightness and protection I construct the unit with a flat circular sheet of metal having its edges rolled, spun or pressed upwardly to form a side wall 16, and also preferably a lip flange 17 defining the space in which the insulating material 14 is compacted about the resistor 13.

This element is then located with its naked face closely presented to the bottom 11 of the vessel 10. The embossing 12 is not strictly necessary but is desirable for several reasons, among which are the fact that such a boss generally retains it shape with a minimum of tendency to warp; also that it helps establish the position of the heating element; also that it tends to assist in protecting the same against ingress of liquid; and there may be other reasons.

The element is clamped tightly against the bottom of the vessel in any suitable manner, here by means of the circular plate 18 gripped tightly against the bottom 11 by a bead 19 rolled over the outwardly-projecting edges of the two, and having at its center a downwardly pressed boss 20 cooperating with the boss 12 to provide a recess in which the element is tightly received. In this case the bead 19 is integral with a bottom member 21 whose wall is formed at one side with an aperture 22 receiving an insulating block 23 provided with the connectors 24 whose inner ends are attached to terminals 25 projecting through the bottom 15 of the sheath and suitably insulated therefrom by washers 26. I deem it unnecessary to illustrate the attachment of these terminals to the resistor wire since this will be apparent to those skilled in the art. The embossed portion of the plate 18 is apertured as shown at 27 for these terminals, and in case the device is intended for domestic use, the hollow bottom is preferably traversed by a metallic plate 28 and an asbestos sheet 29 laid thereon in order to prevent the heat of the element from injuring the supporting surface. I have shown the sheet 28 as held in place by fibre feet 30 which further protect any article on which the device is set.

The receptacle 31 shown in Fig. 3 is made of a thicker wall, as for example cast iron, and against the bottom of said vessel is clamped a naked-topped, electric-resistance heating element of the same kind of construction as shown in Fig. 1. I have shown the base 32 also as made of cast metal, the abutting faces of the two parts being formed as before with a suitable recess 33 for the tight reception and secure protection of the heating element. I have also retained the metal plate 28 and insulating layer 29 since these are desirable in all cases although they should always be spaced from the heated element in order to permit exchange of heat between different portions thereof and thus decrease the danger of attaining destructive temperatures locally.

In Fig. 5 I have illustrated my present improvements as applied to a domestic percolator which offers in some ways a particularly difficult problem from the fact that it is ordinarily made of aluminum so as to be light and non-corrodible, requires a very large energy input to accomplish the quick results demanded by users, yet has its heating area severely restricted by reason of the essential characteristics of a percolator.

This percolator comprises a receptacle 35 of any suitable shape having a bottom 36 preferably embossed upwardly to define the circular cylindrical wall 37 to which the false-bottom or funnel 38 carrying the geyser-tube 39 can be removably applied. A heating element of the type described and having a naked upper face is located in this recess and clamped against the bottom 36 of the receptacle in any suitable or desired manner.

Having thus described my invention what I claim is:

1. Electrically heated apparatus comprising an element to be heated, an electric resistance heating unit comprising an electric resistance wire submerged in a mass of com-

pacted electrically insulating material, said mass having one face naked and the other face covered by a metallic reinforcement, a second element adjacent to said first element, said first element and second element defining between them a substantially closed recess and said resistance unit located in said recess with its naked face presented to said first element and said metallic reinforcement presented to said second element.

2. Electrically heated apparatus comprising an article to be heated whose surface exhibits during heating a degree of counter-radiation, an electric resistance heating unit comprising an electric resistance wire submerged in a compacted mass of electrically insulating material, a metal reinforcing plate on the side away from said article, the face of the insulating material being naked on the side presented toward said article, and means additional to and separate from said reinforcing plate to hold said insulating material in contact with the article to be heated and to return to said article any heat which escapes from said reinforcing plate.

In testimony whereof I hereunto affix my signature.

EDWIN L. WIEGAND.