

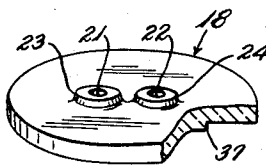
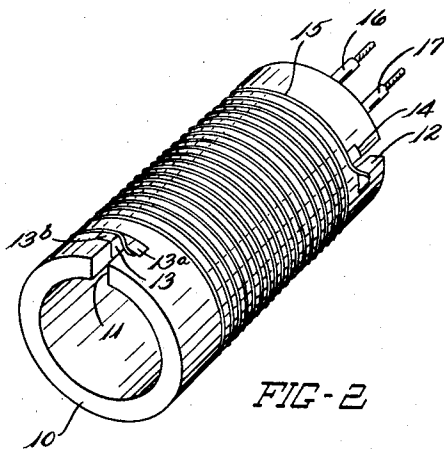
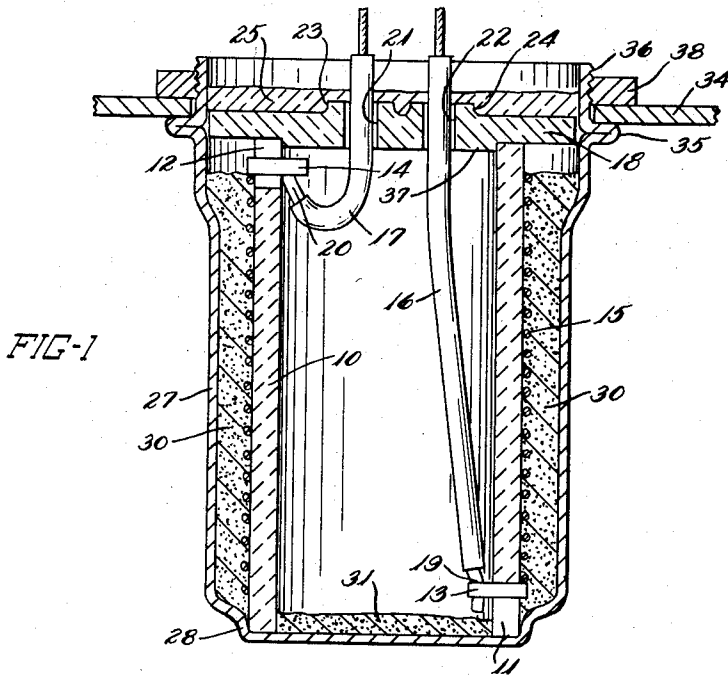
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HEATER

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2,864,929

HEATER

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3 Claims. (Cl. 219—19)

This invention relates to a heater unit for use in coffee makers or similar devices where an electrically heated immersion unit is desired.

In the provision of heating means for electrically heating a liquid, it is necessary to isolate the electricity-conducting elements from the liquid. Heat transfer varies inversely with distance spacing the heating conductor and the liquid to be heated, so that, for rapid heat transfer, the heating element should be close to the liquid.

However, proximity of the heating conductor to a metallic surface separating the liquid from the heating element is conducive of dangerous shorts in the electric circuit and where such elements are relatively close together means must be provided to prevent such accidents.

It is an object of the present invention to provide a heating unit in which the heating element is close to the liquid to be heated but is well sealed and insulated electrically therefrom.

It is another object to provide an insulating structure which will have substantially the same coefficient of expansion as the heating elements.

Another object is to achieve uniform spacing of the conductive parts of the heating unit from the metal enclosure.

Still another object is to provide a heater in which the conductive resistance unit is surrounded by a non-hygroscopic insulating material having high electrical resistance and high heat conductivity.

Further objects are to provide a compact heater having long life, to provide a construction which will facilitate manufacture and to provide high heating efficiency.

These and other objects will appear from the following description and the accompanying drawings.

Of the drawings:

Fig. 1 is an axial sectional view of a heater constructed in accordance with and embodying the invention;

Fig. 2 is a perspective side view of the tubular ceramic core with the resistance wire winding, the anchor clips and wire leads attached thereto; and

Fig. 3 is a perspective view of the insulating disc partly broken away and partly in section.

Referring to the drawings, the heater includes a cylindrical tubular body 10 of ceramic insulating material formed with an axially open notch 11 at one end and a similar oppositely open notch 12 at the opposite end of the body. The notches 11 and 12 may be diametrically opposed as shown in the drawing, or preferably, are arcuately separated by about 90° to make the wire leads lie closer together as hereinafter described.

Clamped to the ceramic body within each notch is a metal anchor clip 13, 14 respectively, the notch and the clip being of such dimensions as to provide communication from the interior of the tubular body to the outside thereof through said notches when the anchor clips are in place. The clips are of the type shown and described in my copending application Ser. No. 609,595, filed September 13, 1956, and entitled "Clip." The clips are of inconel metal of soft spring properties.

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The heating element 15 is of nichrome wire preferably of round cross-section and is wound in a helix of spaced apart turns from one of the clips to the other, the ends of the heating element being spot-welded to the clips 13, 14.

In securing the wire heating element to the clips 13, 14, it is desirable to provide some yieldability in the connection. For this reason, the clips 13, 14 are formed each with a pair of spaced apart anchoring horns 13a and 13b, spaced from each other circumferentially of the ceramic support and each end of the resistance wire is passed around one of the horns and reversely about the other to which it is welded, the bowed condition of the wire between the horns provides sufficient slack to prevent breaking of the wire at the weld, all as more specifically illustrated and described in the aforesaid application.

Wire leads 16, 17 of stranded nickel wire insulated with asbestos and glass braid are secured to the anchor clips 13, 14 respectively and extend through the bore of the body 10 and through a perforated disc 18 of steatite, or other insulating material, the lead wires being secured to the anchor clips by crimping a portion of the clip thereto as at 19, 20 and may be additionally secured by welding to provide a continuous conductive path from one lead wire to another in which all of the metal parts are of corrosion resisting material.

The disc 18 is considerably larger in diameter than the tubular core 10 and may have a pair of spaced apart openings 21, 22 therethrough, which may be spaced radially of the center of the disc to receive the wire leads 16, 17. These openings may be optionally surrounded by tubular raised collars 23, 24 on the side of the disc away from the core 10.

The tubular core 10 with the heating element thereabout is surrounded by a metal case 27 of cup-like construction usually of aluminum, the walls of the case adjacent the resistance wire being spaced radially from the heating element and the conductive clip being spaced axially from the bottom of the case by the end of the core 10 extending beyond the clip and into an end portion 28 of the case of reduced diameter for centering the core.

The disc 18 rests upon the opposite end of the core tube 10 and insulates the clip 13 from the metal case 27, the core tube 10 preferably but not necessarily being centered by a shoulder 37 engaging in the end of the core tube.

To provide against shorting of the heating unit due to expansion of the heating wire into contact with the case and to prevent shifting of the convolutions of wire 15 on the core tube, a solid filling 30 of insulating material is provided about the core 10 within the case. This filling is of substantially the same coefficient of expansion as the surrounding material and preferably comprises a solidified body of magnesium phosphate formed in place. The material for forming the filling 30 may be introduced into the case 27 between the case and the core 10 in liquid state or as a powder and ordinarily flows through slot 11 so as to provide a layer 31 across the bottom of the case. One manner of positioning or obtaining solidified magnesium phosphate in the position described is disclosed and claimed in copending application Ser. No. 628,272, filed December 14, 1956, and entitled "Method of Making Electrically Insulated Heating Units." The magnesium phosphate adhesively adheres (without chemical reaction or fusion) to the ceramic tube and the aluminum case and the nichrome wire.

Completing the assembly of the heater are suitable means for holding the disc 18 in the case 27 and these comprise, in the form of the invention illustrated, a layer of sealing material 25, such as ceramic cement, which is

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poured in place as shown and which sets up to seal the end of the heater.

The heater unit is adapted to be mounted, for example, in a coffee maker. In the embodiment illustrated, the case 27 is formed with a circular shoulder 35, as by folding a portion of the case on itself during the forming operation, which shoulder abuts against one side of the plate 34. The end of the case is externally threaded at 36 to receive a nut 38 which can be screwed on and tightened down in place against the other side of plate 34.

The objects of the invention are thus obtained by the provision of a heater having very low electric leakage characteristics, extremely excellent life (due to the very rigid placement and holding of the heater wire), but retaining relative inexpensiveness and ease of construction.

While one embodiment of the invention has been shown and described for illustrative purposes, it will be apparent to those skilled in the art that various changes and modifications may be made therein without departing from the spirit or scope of the invention as it is defined by the following claims.

I claim:

1. A heater for an appliance, said heater comprising a cylindrical tubular core of ceramic material having axial notches in its opposite ends, an anchor clip engaged in each notch, a resistance wire element extending helically about said core from one anchor clip to the other in open spaced coils, said element being welded to said clips, a disc of insulating material of larger diameter than the tubular core, said disc being mounted over one end of the core, lead wires connected to said anchor clips and extending through openings in the disc, a cup-like case of aluminum enclosing said tubular core and said

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disc, a cylindrical body of solidified magnesium phosphate filling the space between the case and the core and providing a solid enclosure of insulating material surrounding the resistance wire element, said body of magnesium phosphate also forming a cover layer extending across the bore of the inner end of said core, said case having a reduced diameter portion at its closed end engaging the inner end of the core to center it, said disc having a shouldered portion engaging with the other end of the core to center it, and sealing means between the disc and the case and sealing the lead wires in the openings in said disc.

2. A heater as in claim 1 wherein said body of magnesium phosphate extends through one of the notches in said core.

3. A heater as in claim 1 wherein the end portions of said wire element are reversely bent around said anchor clips, an external shoulder is provided on said case with the end of the case beyond the shoulder being threaded, and a nut engaging the threaded end of said case.

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