Nov. 17, 1936. B. O. BECK ET AL 2,060,968

ELECTRIC HEATING DEVICE AND METHOD OF MAKING SAME

Filed Feb. 4, 1933

Fig. 1

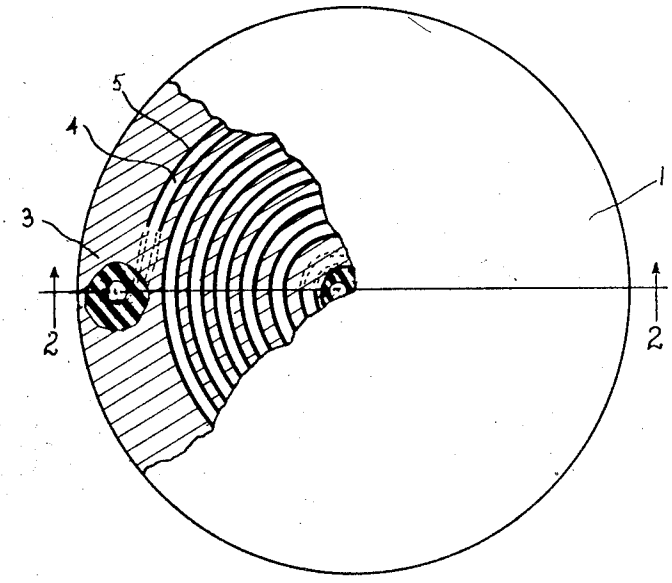


Fig. 2

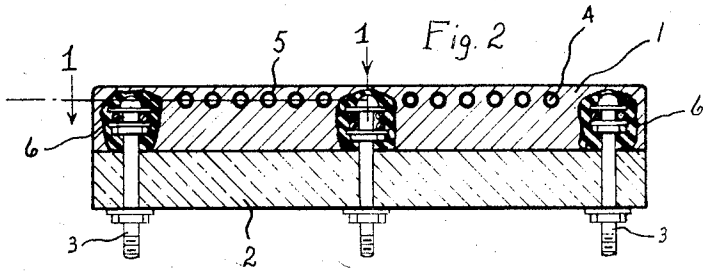


Fig. 4

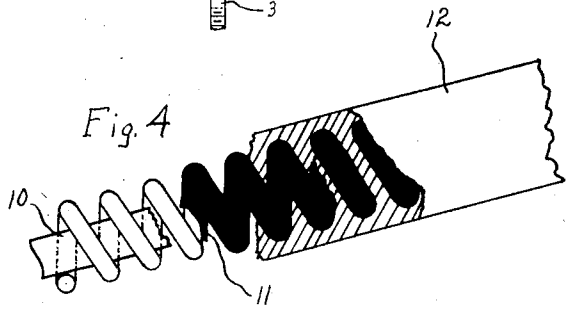
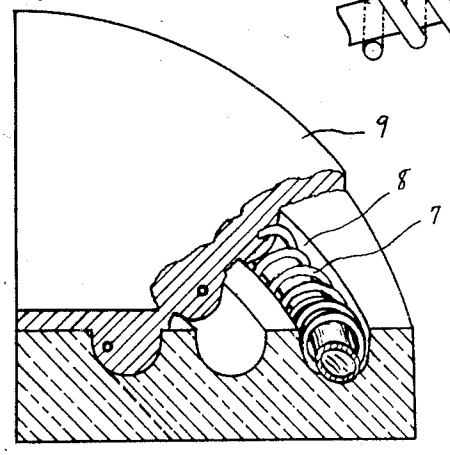


Fig. 3



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ELECTRIC HEATING DEVICE AND METHOD OF MAKING SAME

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4 Claims. (Cl. 219—37)

Our invention relates to electric heating devices and more especially to heating elements for stoves, flat irons, curling irons and the like.

It is an object of our invention to provide a simple, practical, and efficient device of the character described.

It is another object of our invention to provide a heating device which is adapted for a quick transfer of heat from the resistor element to the surface plate or other point of utilization.

A further object is to provide a heating device in which the resistor element is cast into a metal surface plate or outer jacket in order to obtain a superior heat conducting contact with the same.

A still further object is to provide a heating device by the method of applying an insulating coating to a resistor wire, hardening said coating and embedding the resistor in a cast metal.

Other objects and advantages will appear and be brought out more fully in the following specification, reference being had to the accompanying drawing, in which

Fig. 1 is a plan view partly in section of an embodiment of our invention;

Fig. 2 is a sectional elevation taken along the line 2—2 of Fig. 1;

Fig. 3 is a perspective view partly in section of a modification, and

Fig. 4 is a partial sectional view in enlargement showing the resistor element, its insulating coating and the casting in which the same is embedded.

Heretofore in the manufacture of electrical heating devices for ordinary use such as stoves, flat irons, curling irons and the like, a difficulty usually encountered has been the inability to satisfactorily insulate the resistor element from the surface plate or material to which the heat is to be conducted and at the same time obtain an efficient medium of heat transfer between these two parts of the device. A further difficulty usually presented is the necessity of embedding the resistor so far from the surface of utilization of the heat that an undesirable length of time is required for the transfer of heat between them.

We are aware that some attempts have been made to overcome these objections and difficulties such as disclosed in United States Patent No. 1,654,292 issued to A. D. Keene et al. in which a coating of alundum or aluminum oxide is applied to a resistor wire and located in grooves in a carbonaceous material. The alundum becomes powdery, leaving air spaces therein and defeating to a considerable extent the purpose for which it is intended to be used. Our invention is a particular improvement on this feature and we provide a resistor coating of ceramic material such as the porcelain group which can be embedded in a cast block and make a highly efficient heat transfer contact between the wire and the heating surface. This ceramic insulation can be applied in a liquid form and hardened or dried and cast within a metallic material. This ceramic insulation does not change its physical character which is a solid with practically no air content and is such that it will provide a highly efficient transfer of heat. This insulation may be of a ceramic cement, which upon hardening assumes many of the characteristics of ordinary porcelain. It may be chiefly fused aluminum oxide sold under the trade name "Alundum", magnesium oxide, silicon oxide or other suitable ceramic materials held together by a binding material such as sodium silicate, potassium silicate, bentonite, sillimanite, a ceramic cement sold under the trade name "Insolute", or any other suitable binding material or combination of several suitable binding materials.

Referring more partciularly to the drawing, we show a heating unit having a cooking surface or utilization plate 1, which may be of cast iron, cast steel, cast aluminum, or other suitable metal which may be cast, poured, or molded into the desired form to produce a suitable outer jacket. Using cast iron as the example, plate 1 is secured to a heat resisting base 2, as by bolts 3, which also serve as terminals for a resistor conductor 4, having a ceramic insulated coating 5 separating the resistor from plate 1. The base 2 may be of any suitable materials such as asbestos composition, porcelain, lava, or the like. A protecting layer of insulation is shown at 6 as a guard for the connections of conductor 4 with bolts 3. Resistor 4 is shown near the top of plate 1, which is made possible by this type of casting, and provides for a minimum heat passage path from source to the point of utilization. Insulation 5 is preferably of ceramic material such as "Insolute" or liquid porcelain, which is applied to the conductor in liquid or semi-liquid form and which, upon hardening forms an insulation similar to ordinary porcelain.

In the manufacture of our heating unit the conductor will first be shaped as desired, and given its ceramic insulation by painting, spraying, dipping or drawing through a bath while the conductor is either hot or cold. After the insulation has hardened, plate 1 is formed by

casting or molding the metal around the conductor, as may be done by conventional methods. After the cooling, or set, the insulation 5 will make a sealed or solid contact between conductor 4 and plate 1, permitting a high rate of heat transfer therebetween.

In Fig. 3 we show a modification wherein the conductor 7, insulated as above, is helical and laid in a groove 8, and the cast surface plate 9 cast to fill the space in the grooves not occupied by the conductor 7. We have found that in the spiral form the insulation is less likely to crack than when the conductor is straight. If desired a metal core to the surface of which has been applied a ceramic insulation, may be located within the helical conductor 7, the latter also having applied to its surface the ceramic insulation above described. Then the metal of the plate 9 is cast around the core and the conductor to intimately contact or seal with both.

In Fig. 4 we show an enlargement of the helical wire resistor 10 with its ceramic coated insulation 11, cast into a bar or rod 12, as it will be appreciated that the heating or surface member may be of a variety of shapes or configurations to form an outer jacket suitable for various purposes.

We claim:

1. An electric heating device comprising an electric conductor to the surface of which is bonded a solid coating of an electrically non-conductive and heat conductive ceramic substance, a refractory plate having a groove in which said coated conductor is located, and a surface plate of cast metal having a portion thereof extending into said groove and around said coated conductor and in which said coated conductor is sealed and embedded and to which said coating is bonded.

2. An electric heating device comprising a core, an electric conductor around said core and having a solid coating of an electrically non-conductive and heat conductive ceramic substance, and a cast metal jacket embedding and sealing said coated conductor and said core therein and being bonded thereto to form an integral unit.

3. An electric heating device comprising a core having a solid surface portion of an electrically non-conductive and heat conductive ceramic substance, and an electric conductor around said core and having a solid coating of an electrically non-conductive and heat conductive ceramic substance, and a cast metal jacket embedding and sealing said coated conductor and said core therein and being bonded thereto to form an integral unit.

4. An electric heating device comprising a metal core having a solid coating of an electrically non-conductive and heat conductive ceramic substance, and an electric conductor around said core and having a solid coating of an electrically non-conductive and heat conductive ceramic substance, and a cast metal jacket embedding and sealing said coated conductor and said core therein and being bonded thereto to form an integral unit.

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