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ELECTRIC HEATER

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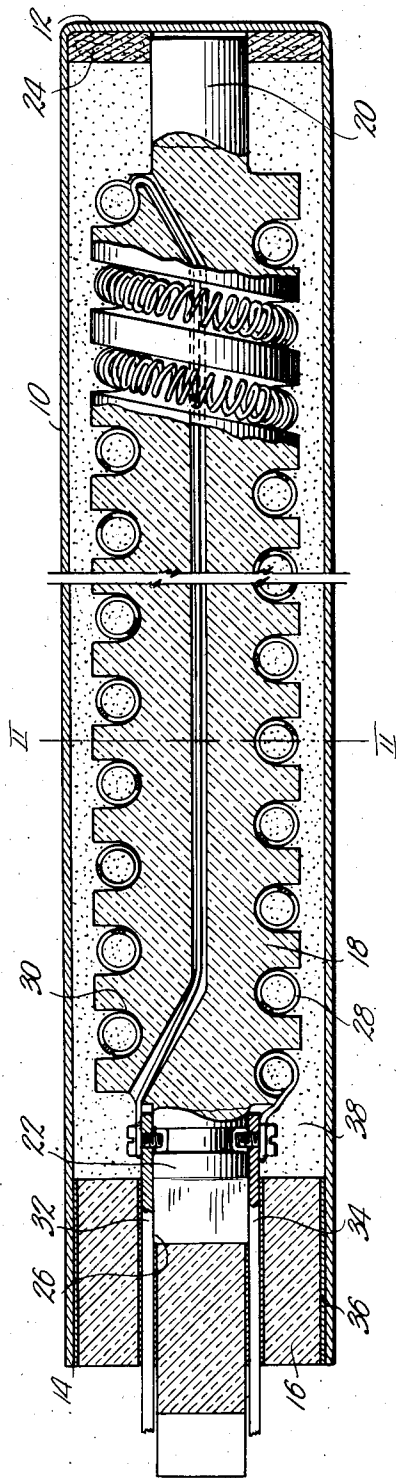


Fig. 1.

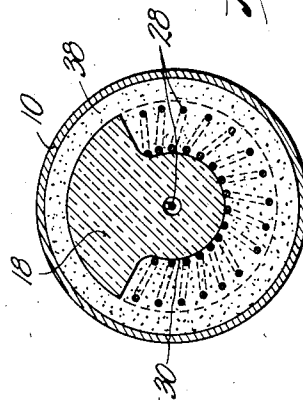


Fig. 2.

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ELECTRIC HEATER

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4 Claims. (Cl. 201—66)

This invention relates to electric heaters and particularly to the hermetically sealed sheath type, wherein an electric resistance conductor is embedded in powdered material which is substantially a non-conductor of electricity.

It is the object of the instant invention to produce this type of electric heater wherein is provided a powdered packing for the electric resistance conductor which will be a good electric insulator, and one that will cause the radiant heat waves from the electric resistance conductor to be converted into sensible heat. The impinging of the radiant heat on the powdered particles insures the production of a maximum of sensible heat which is important in the production of an efficient electrical heater.

A further object of the present invention is the provision of an electric heater having a dry powdered packing for the electric resistance conductor which is, when packed to a sufficient density, a partial support for the electric resistance conductor.

Another object is the provision of an electric heater provided with a fine, powdered mixture of substantially equal sized particles, which will tend to occupy substantially all the space of the hermetically sealed sheath, thereby eliminating substantially all the air to reduce to a minimum, the oxidation of the electric resistance conductor and to reduce to a minimum, the possibility of stratification of the powder due to vibration.

Other objects of this invention are efficiency of operation and adaptability for use with electric heaters of various shapes and sizes.

Referring to the drawing wherein but one embodiment of the invention has been shown:

Figure 1 is a longitudinal sectional view, partly in elevation, of an electric heater embodying this invention; and,

Fig. 2 is a cross sectional view taken on line II—II of Fig. 1.

In the drawing the numeral 10 designates a sheath or envelope made of a suitable material such as metal alloys for instance, nickel chromium. This sheath is shown to have an integral end closure 12 and an open end 14 which is adapted to receive the plug 16, made of an electrical insulating material, such as porcelain.

The refractory support 18 is a good electrical insulator and is supported at its reduced end portions 20 and 22 in concentric, spaced apart relation to the wall of sheath 10, and portion 20 is mounted in a washer 24 made of a heat resisting and electrical insulating material, such as asbestos. The other end 22 of the support is positioned in a recess 26 formed in plug 16. When so positioned, the refractory support will be spaced apart from the wall of the sheath so that when the helical, coiled electric resistance conductor 28 is positioned within the helical

groove 30, formed in the refractory support, it will be spaced uniformly from the wall of the sheath, as shown.

It is found practical to substantially embed the resistance conductor in the groove 30 for its protection.

It is understood that this heating conductor 28 may be so wired as to make it possible to use any desired portion thereof to obtain different amounts of heat. This is common practice and is not here shown.

In the drawing, a single resistance conductor is shown to extend the full length of the support 18 with the terminals thereof secured respectively to the terminal bars 32 and 34, which pass through plug 16 and are hermetically sealed therein. A source of electrical current may be connected to these terminal bars whereby an electric current is conducted to the electrical resistance conductor 28. Plug 16 is sealed in position in sheath 10 by means of sealing material 36, which will function under sudden changes of temperature without becoming ineffective to produce a hermetic seal.

A comminuted, electric insulating material 38 is packed tightly into the sheath about the refractory support and the electric resistance conductor so as to present a packing for the resistance conductor, whereby it is partially supported to prevent sagging because of fatigue due to rapid changes of temperature. This material 38 also serves to exclude air from the sheath and to insulate the sheath from the heating conductor 28.

The insulating material 38 is made of varying proportions of silica, aluminum oxide, ferric oxide, calcium oxide, and magnesium oxide, as hereinafter set forth. Electric heaters requiring different amounts of electric current are provided respectively with insulating compounds of different proportions of the various ingredients for the best results.

The silica, or silicon dioxide, SiO_2 , may vary in proportion from 40% to 89% by weight—the smaller amounts being used in compounds used in heaters using the lower wattage.

The aluminum oxide, or alumina, Al_2O_3 , is provided in varying quantities by weight, from 2% to 5.5%.

The ferric oxide, Fe_2O_3 , ranges in proportion by weight, from .9% to 1.25%.

The proportions of lime or calcium oxide, CaO , ranges from 1% to 2.5% by weight.

Magnesia or magnesium oxide MgO may vary from 48% to 1.25% by weight.

It is found best to separately grind these ingredients to substantially the same screen size so that they, when intermixed, will not tend to separate because of different sizes, thus making it possible to maintain the different materials in

like relative proportions throughout the mass.

It is very apparent that this feature is very important since each ingredient is essential to the proper functioning of the resultant material and should the particles be permitted to stratify, due to their difference in size, the effectiveness of the compound would be greatly reduced. While it is not contended that it is possible to grind all the particles of the powdered insulating compound to exact sizes, however, they can be ground and passed through like screens of sufficiently small mesh so that when intermixed there will be very little tendency for the different materials to separate because of gyration, such as is encountered in a heater of this kind.

In the preparation of this insulating material, it is subjected to a heat of substantially 100° C. for a period of time sufficient to drive off substantially all the water before it is inserted in the sheath. After the powder is positioned about the heating element in the sheath and before the plug is sealed in position, the entire assembly may be heated to a relative high temperature to drive out the moisture in the air and also any water that may have been absorbed by the powder material. While the parts are still hot, the plug is thoroughly sealed in position so that the sheath is hermetically sealed. The exclusion of all moisture is very important to prevent excessive pressure within the sheath when the heater is in use.

It is quite apparent that this same general structure and composition is suitable for use in the various types of electrical heaters, regardless of their shape or size.

For the smaller electric units, a powdered insulating compound of the following proportions, by weight, has been found very effective:

	Per cent
Silica.....	46.83
Aluminum oxide.....	2.25
Ferric oxide.....	.95
Calcium oxide.....	2.01
Magnesia.....	47.97

When the larger electric heaters, requiring heavier currents are required, the following proportions, by weight, may be used:

	Per cent
Silica.....	91.
Aluminum oxide.....	5.37
Ferric oxide.....	1.16
Calcium oxide.....	1.14
Magnesia.....	1.33

Since these materials are weighed in their natural state and heated after they are ground and intermixed, it is evident that there will be a slight reduction in the weight of the dry powder.

Careful testing has been made of the various materials, and by using different proportions of the materials the composition best suited for this particular type of electric heater has been obtained, and while it is possible to vary these proportions within certain limits, it is very essential all of the ingredients be used to obtain the results necessary to produce an efficient heater.

Since variations may be made in the powdered insulating compound without departing from the spirit of the invention, it is desired to be limited only by the scope of the appended claims.

Having thus described the invention, what is claimed as new and desired to be secured by Letters Patent is:

1. An electric heater comprising a hermetically sealed sheath having within it a refractory support, an electric resistance conductor mounted on said refractory support in spaced relation to said sheath and embedded in a powdered, electric insulating material produced by intermixing the following ingredients, by weight, 46% to 89%—silica, 2% to 5½%—aluminum oxide, .9% to 1.25%—ferric oxide, 1% to 2¼%—calcium oxide, and 48% to 1¼%—magnesia.

2. An electric heater comprising a hermetically sealed sheath having within it a refractory support, an electric resistance conductor mounted on said refractory support and embedded in a relatively dry powdered, electric insulating material produced by intermixing the following ingredients, by weight: 46% to 89%—silica, 2% to 5½%—aluminum oxide, .9% to 1.25%—ferric oxide, 1% to 2¼%—calcium oxide, and 48% to 1¼%—magnesia.

3. An electric heater comprising a hermetically sealed sheath having within it a refractory support spaced apart from the side walls thereof, an electric resistance conductor mounted on said refractory support and embedded in a powdered, electric insulating material produced by intermixing the following ingredients, by weight: 46.83%—silica, 2.25%—aluminum oxide, .95%—ferric oxide, 2.01% calcium oxide, and 47.97%—magnesia.

4. An electric heater comprising an elongated hermetically sealed sheath having within it a refractory support supported at its ends to extend lengthwise in said sheath and in spaced relation to the side wall thereof, an electric resistance conductor mounted on said refractory support and embedded in a powdered, electric insulating material produced by intermixing the following ingredients, by weight: 46.83%—silica, 2.25%—aluminum oxide, .95%—ferric oxide, 2.01%—calcium oxide, and 47.97%—magnesia.

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