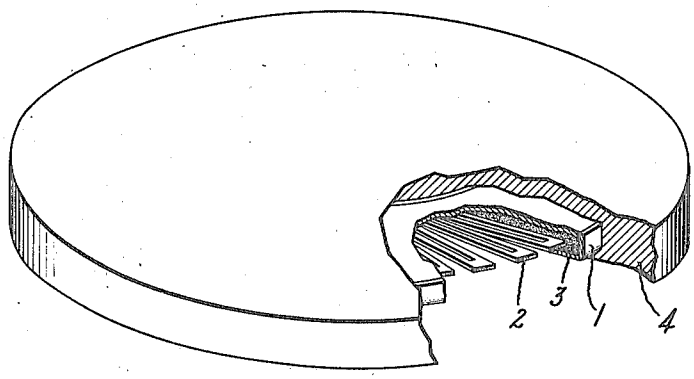
C. P. RANDOLPH.

ELECTRICAL INSULATING PLASTIC COMPOSITION.

APPLICATION FILED AUG. 2, 1912.

1,181,800. Patented May 2, 1916.



Witnesses:

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UNITED STATES PATENT OFFICE.

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ELECTRICAL INSULATING PLASTIC COMPOSITION.

1,181,800. Specification of Letters Patent. Patented May 2, 1916.

Application filed August 2, 1912. Serial No. 712,874.

To all whom it may concern:

Be it known that I, CHARLES P. RANDOLPH, a citizen of the United States, resid- at Great Barrington, county of Berkshire, State of Massachusetts, have invented certain new and useful Improvements in Electrical Insulating Plastic Compositions, of which the following is a specification.

The present invention relates to the insulation of electric resistors in heating devices such as laundry irons, stoves, water heaters and the like, and its main object is to secure efficient electrical insulation with maximum heat conduction between the resistor and the body to be heated.

My invention while of general application is particularly useful for the insulation of resistors, or heat generating elements, which are in direct contact with the body to be heated, for example, in devices in which metal is cast about the heater.

In accordance with my invention, I employ as an insulating composition a mixture of a highly refractory, inert, insulating material and a substance which becomes somewhat plastic at the running temperature of the resistor without chemically combining either with the other ingredients of the composition or the resistor.

The accompanying drawing illustrates in perspective a heating device provided with a resistor embedded in insulating material.

Among the desirable characteristics of the insulating material for a heating device resistor are, first, that it shall retain its insulating value at high temperature, secondly, that it shall remain sufficiently rigid to remain in place even when subjected to pressure and strain at high temperatures and thirdly, that it shall not readily combine with metals constituting the resistor and the heat radiating body of the apparatus, fourthly that it shall readily conform to the contraction and expansion of these two elements as they are heated and cooled and fifthly that it shall have a fairly good heat conductively. Many substances which are good insulators at ordinary temperatures conduct the current when heated. Others although satisfactory as regards their insulating properties, slowly attack metals with which they are in contact and thus shorten the life of the apparatus. Some substances although having the desired insulating properties are unsuitable mechanically because they crack and crumble when subjected to changes of temperature. These difficulties are overcome by using as the main body of the insulating medium a highly refractory, inert, granular material which remains unchanged at the operating temperature and another material less refractory but also inert acting as a binder, or cementing material, to hold the insulation in place and preserve its shape even when subjected to temperature changes. The two substances, of course, must be so chosen as not to react upon each other. The preferable material for the binder consists of boric anhydrid. I may use with it either another acid anhydrid such as silica, alumina, titanium oxid or the like, or other higher refractory inert compound such as boron nitrid, or even a refractory silicate such as calcium or magnesium silicate. In some cases glass may be used in place of boric anhydrid. These inorganic materials are good insulators and do not react directly with metals. Boric anhydrid is also a good nonconductor but softens at 500 degrees C, while it does not appreciably volatilize at a temperature as high as 1500 degrees C. At a temperature in the neighborhood of 1000 degrees C the boric anhydrid softens enough to allow the mass as a whole to expand and contract without producing rupture and abrasions which would tend to deteriorate the insulation.

In carrying out my invention, I prefer to first fuse the boric anhydrid to a clear glass, thus insuring the absence of moisture. When this fusion has hardened, it is ground to a fineness sufficient to pass through a 200 mesh sieve. This particular degree of fineness is mentioned as illustrative. The finely ground anhydrid is then mixed with finely ground silica or whatever refractory material is used as the body of the composition. The proportions will vary somewhat with the conditions but I have found that a mixture containing 95 parts by weight of silica, or other refractory material, and 5 parts of boric anhydrid will give good results.

In some cases the mixture is merely packed around the resistor or heating element but I prefer to apply it as a paste using as a binder an anhydrous volatile liquid, such as anhydrous benzol (C_6H_6). Boric anhydrid is somewhat soluble in benzol which

thus coats the individual grains of silica or other refractory material with the boric anhydrid and produces a mass which has the desired cementing properties. I have found it necessary to exclude moisture as it leads to the formation of metallic oxid on the metals to be insulated and thereby to chemical combination with the insulating material.

According to one method of building up the resistors and insulation the paste above described is spread on two plates of metals, such as steel which later are shaped to constitute a casing for the heater and is indicated as 1 in the drawing. The paste is applied about $\frac{1}{32}''$ thick and then allowed to dry enough to adhere slightly to the metal. A resistor 2 is then laid upon the insulating paste upon one of the plates and the other plate is placed upon it so that the resistor is embedded in insulation. The unit thus assembled is then put into a hydraulic press, a slight pressure is applied and the insulation is dried out by heating the unit to about 150° C. by passing currents through it. After drying the current is increased until both casings are brought to redness,—that is to about 600 degrees C. or more, which insures that all moisture is driven off and that the cementing material, for example, the boric oxid, is softened. Pressure is then applied to the extent of about 3000 pounds per square inch. By this process, the insulation 3 is very firmly cemented around the resistor. The top and bottom plates are then welded together with an acetylene flame or other suitable means to form a casing. The incased heating unit may be placed in a mold and iron or other metal may be cast around it, or it may be used in any other desired manner in heating devices.

What I claim as new and desire to secure by Letters Patent of the United States, is:—

1. An insulating composition for electric heaters comprising a mixture of grains of silica and boric anhydrid.

2. An insulating composition for electric heaters comprising a mixture of grains of silica and anhydrous boric anhydrid, both of said materials being finely divided.

3. An insulating composition for electric heaters comprising a mixture of about 95 parts of granular silica and 5 parts of boric anhydrid.

4. A composition for insulating electric conductors comprising a mixture of boric anhydrid, and a granular insulating material inert chemically thereto, and more refractory than boric anhydrid.

5. An insulating composition comprising a mixture of about 90 to 95 parts of a stable, highly refractory, electrically non-conducting material and about 5 to 10 parts of an inorganic non-conducting binder inert with respect thereto and softening at a temperature of several hundred degrees.

6. An insulating paste comprising silica, boric anhydrid and benzol.

7. An insulating composition comprising a mechanical mixture of granular acid anhydrids inert with respect to each other at high temperatures and non-conductors of electricity, one of said anhydrids softening at red heat and thus acting as a binder to prevent mechanical deterioration of the insulation.

In witness whereof, I have hereunto set my hand this 31 day of July, 1912.

CHARLES P. RANDOLPH.

Witnesses:
C. M. SMITH,
M. J. OVERHOLSER.