L. E. BARRINGER.

INSULATING MATERIAL FOR EMBEDDING ELECTRICAL CONDUCTORS.

APPLICATION FILED FEB. 5, 1906. RENEWED APR. 8, 1910.

1,009,035.

Patented Nov. 21, 1911.

Fig. 1.

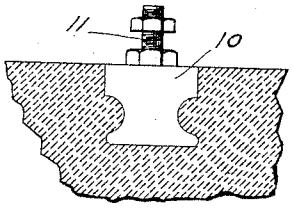


Fig. 2.

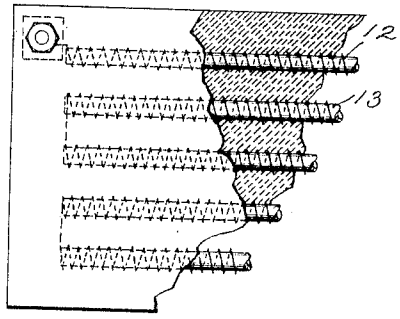


Fig. 3.

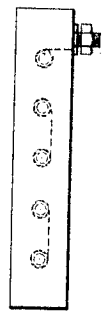


Fig. 4.

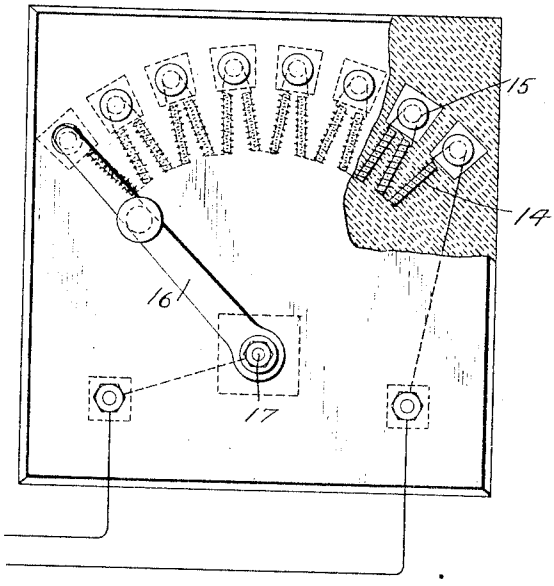
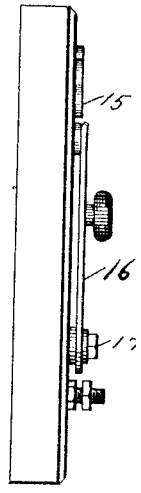


Fig. 5.



WITNESSES.

W. R. Taylor.

Helen Alford

INVENTOR.

LAWRENCE E. BARRINGER.

by Albert G. Davis Atty.

UNITED STATES PATENT OFFICE.

LAWRENCE E. BARRINGER, OF SCHENECTADY, NEW YORK, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

INSULATING MATERIAL FOR EMBEDDING ELECTRICAL CONDUCTORS.

1,009,035. Specification of Letters Patent. Patented Nov. 21, 1911.

Application filed February 5, 1906, Serial No. 299,448. Renewed April 8, 1910. Serial No. 554,269.

To all whom it may concern:

Be it known that I, LAWRENCE E. BARRINGER, a citizen of the United States, residing at Schenectady, in the county of Schenectady, State of New York, have invented certain new and useful Improvements in Insulating Material for Embedding Electrical Conductors, of which the following is a specification.

This invention relates to improvements in insulating compounds and has for its object the provision of a material which is an electrical insulator of a high order in addition to being capable of withstanding a high temperature without injury, which at ordinary temperature will be sufficiently plastic to permit of embedding a metallic conductor therein and which will harden under steam treatment.

In my previous application, No. 274,409, filed May 11th, 1905, I have described and claimed a process whereby my material may be produced. I have found, however, that this material possesses qualities which make it very desirable as a substance in which to embed electrical conductors. As disclosed in the above-mentioned application, the material may be hardened under steam treatment, a pressure of 150 lbs., corresponding to a temperature of 181° C., being sufficient to harden it in about five hours.

It has been common heretofore to embed conductors in substances such as enamel, which are fused around the conductor or cements which are air-hardened around the conductor. Substances like clays or porcelain cannot be used for embedding because of the high temperature necessary for hardening which would lead to slagging of the metal with the insulation. Enamel also has the disadvantage of requiring heat which renders necessary much care in application, is expensive and when completed will not stand any great temperature changes without cracking and exposing the conductor. Enamels also conduct when heated, conductivity beginning just below redness and increasing rapidly as the temperature rises. This leads to short circuiting and destruction of the conductor. Cements have the disadvantage of being not very strong nor dense and not being first-class insulators—they are also easily destroyed by heat, and by acids. Other materials have been employed for embedding resistance, and in some cases the compounds are hardened by exposure to the air and by chemicals, but these compounds have been found to disintegrate and crumble and have not the requisite toughness, strength, or heat resistance, nor can they be machined and worked into the variety of forms that it is often desired that an insulating material assume. I have found in hardening my material that it shrinks an amount just sufficient to tighten and firmly hold a conductor in place. The temperature at which it is formed is low and the material when formed will stand a high temperature and is highly insulating, at all temperatures. The material while extremely hard and strong can be machined when desirable for special shapes, tapped for screws, etc.

In carrying out my invention, the process used is the same as that described in the above-mentioned application. A quantity of asbestos or other fibrous material is mixed with a definite quantity of calcium hydrate and flint, or silica. Other materials such as magnesium hydrate or magnesium oxid may be used, it being only essential that a substance be employed which will combine with silica to form a silicate under steam treatment. It is preferable in mixing materials to be combined in this manner that amounts corresponding to the molecular proportions be used; the approximate formula of the silicate formed being $CaOSiO_2.2H_2O$. the percentage of water varying somewhat. For instance when slaked lime and flint are used in the proportion of 74 to 60. there will be no excess of either lime or flint. The exact proportions may, however. be varied throughout a considerable range, and I have found that for certain classes of work the proportions of 40% asbestos, 38% flint and 22% calcium hydrate give very satisfactory results. These ingredients, after being thoroughly mixed, are moistened and molded into the desired shape under a pressure sufficient to give a densely compressed body. Before the material is compressed, however, I embed the metallic conductor in the material so that it may be firmly fixed while pressing the insulation into form. The material is then placed in a closed chamber and treated with steam under pressure. The steam converts the calcium hydrate and

silica into a hydrous silicate of calcium, which forms a strong bond for the asbestos fiber.

In the accompanying drawings, I have shown several embodiments of my invention, but it should be understood that they are merely typical and intended to illustrate only a few of the possible forms which my invention may assume.

Figure 1 shows a stud embedded in the insulating material; Fig. 2 shows a resistance conductor embedded in the material; Fig. 3 is an end view of the same; Fig. 4 shows a starting rheostat made by embedding a series of resistance conductors in a block of high insulating material; and Fig. 5 is an end view of the same.

The form shown in Fig. 1 requires no description, since it merely shows one of the possible uses to which I may apply my invention. In this case a metallic conductor 10, in the form of a block having a stud 11 connected therewith, is firmly embedded in the material.

In Fig. 2 I have applied my invention to a rheostat. The resistance conductor 12 may be embedded in the material in any desired manner, as for instance, by winding the wire about a glass rod 13 and then embedding the rods in the material as shown.

In Figs. 4 and 5 I have shown another possible arrangement. In this case I have formed a starting rheostat by embedding the resistances 14 in the material in the manner shown in Fig. 2 and forming terminals for the sections of resistance by embedding studs 15 after the manner shown in Fig. 1. A controlling arm 16, pivoted at 17, is arranged to successively engage the studs to vary the resistance.

It will be seen from the foregoing that I have produced an insulating material which is exceedingly valuable as an embedding substance for metallic conductors. When hardened, it becomes like slate or soapstone, but has the advantage over these of being capable of lending itself readily to various forms by molding in addition to being capable of being machined.

Many modifications of my invention will suggest themselves to those skilled in the art, and it should be understood that I do not limit my invention to the materials or process of forming and arranging same herein mentioned, but that all such modifications will come within the spirit of my invention in so far as they fall within the scope of the claims annexed to and forming a part of this application.

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

1. A steam-hardened insulating compound having an electrical conductor embedded therein.

2. A steam-hardened insulating compound of silica and a hydrate having an electrical conductor embedded therein.

3. A steam-hardened insulating compound of an alkaline hydrate and silica having a metallic conductor embedded therein.

4. A steam-hardened insulating compound of calcium hydrate and silica associated with a fibrous material and an electrical conductor embedded in said compound.

5. An insulating composition of a fibrous material and hydrous silicate of calcium having an electrical conductor embedded therein.

6. An insulating material of asbestos and hydrous silicate of calcium having an electrical conductor embedded therein.

7. A steam-hardened insulating compound of silica and an alkaline earth metal having an electrical conductor embedded therein.

8. A rheostat comprising a resistance conductor embedded in a steam-hardened compound.

9. A rheostat comprising a resistance conductor embedded in a steam-hardened compound containing hydrous silicate of an alkaline earth.

10. A rheostat comprising a resistance conductor embedded in a steam-hardened compound of silica and a hydrate.

11. A rheostat comprising a hydrous silicate and a heat resisting fibrous material having a resistance conductor embedded therein.

12. A rheostat comprising a composition of hydrous silicate of calcium and asbestos having a resistance conductor embedded therein.

13. A rheostat comprising a resistance conductor embedded in a steam-hardened mass of calcium silicate, silica and asbestos.

In witness whereof, I have hereunto set my hand this 2nd day of February, 1906.

LAWRENCE E. BARRINGER.

Witnesses:

BENJAMIN B. HULL,

HELEN ORFORD.