UNITED STATES PATENT OFFICE.

DEMETRIUS M. STEWARD, OF CHATTANOOGA, TENNESSEE.

REFRACTORY MATERIAL FOR ELECTRIC INSULATION AND OTHER PURPOSES.

No. 816,270. Specification of Letters Patent. Patented March 27, 1906.

Application filed February 25, 1903. Serial No. 145,081.

To all whom it may concern:

Be it known that I, DEMETRIUS M. STEWARD, a citizen of the United States, and a resident of Chattanooga, in the county of Hamilton and State of Tennessee, have invented certain new and useful Improvements in Refractory Materials for Electrical Insulation and other Purposes, of which the following is a specification.

My invention relates to insulators and insulating material generally, and particularly to such as are especially adapted to be employed for electrical insulation, it being well recognized that certain insulators of high non-conductivity afford insulation equally against heat as against electricity.

Generally speaking, the substance of my present invention is a compound, a refractory material of high electrical resistance and of practically perfect homogeneity that is absolutely fireproof and that is unaffected by cold or moisture. Its hardness, its stress-resisting qualities, and its resistance to moisture and to the effects of heat and cold render my material superior to any vitreous or amorphous insulating substance, such as rubber or the like, and render it available in many instances under conditions which would absolutely prohibit the employment of many, if not all, substances which have been under favorable conditions employed for insulating purposes.

The "compound" or "material," by either of which terms my invention is herein designated, is the product of a process which constitutes the subject-matter of a separate application for patent made by me filed May 25, 1905, Serial No. 262,262.

The substance, which may be regarded as constituting the basis of my invention—that is, the indispensable ingredient of it—is magnesium silicate or aluminium silicate or a substantial equivalent of either. In their most familiar forms the silicates referred to have close resemblance one to another and are found in nature in the form of soapstone, steatite, talc, or the like. For convenience I shall hereinafter employ the term "steatite" to designate conventionally all substances of the general description above specified or their substantial equivalents, including pyrophillite.

In the manufacture of my material or compound, as herein described, I utilize the steatite or its equivalent, as specified, preferably in finely comminuted or pulverulent form, and having reduced that component by mixture with other ingredients to a plastic mass impart to such plastic mixture any desired shape. The "molding," as it may be termed, of the plastic mixture, although, perhaps, more accurately described as shaping or modeling, is preferably effected under great pressure. The molding feature of the invention is particularly important, because aside from and in addition to the characteristic qualities it imparts to the product or compound, particularly that of uniform homogeneity when it is practiced under great pressure, which is, as specified, always preferred, it affords an important and valuable aid or contribution to the manufacture in general of certain articles from steatite. The known deposits of native steatite are not only limited, but the value of that substance in workable bulk is at present considerable and is increasing. My invention renders equally serviceable all raw material and much which ordinarily would be esteemed waste or at any rate of inferior value. Besides that the employment of the steatite in plastic form alone renders it possible to produce at diminished cost articles of a shape and configuration different from that in which they could be produced by the formerly universal practice of cutting or carving the massive steatite it makes it possible in very many instances to produce shapes which could not in anywise be produced from the native material, as by cutting or carving or any other of the usual methods of working it. In respect to the former suggestion contained in the last sentence specific reference may be had to the manufacture of steatite gas-burner tips, which although they may be made and have been made of native steatite may be better made and cheaper from the mixture subsequently converted, which constitutes my present invention herein specified. In respect to the latter suggestion contained in the aforesaid sentence reference may be had not only to the production of minute tubes of any desired lengths and possessing certain characteristic qualities specified herein as belonging to my material, which is rendered practicable by the use of my invention and which cannot be arrived at in manufacture from native steatite, but also to the manufacture of insulators of exact dimensions, which from the nature of the compound can be produced in my material, owing to its homogeneity and quality of resistance without warping upon application

of heat—qualities not possessed by the native steatite to the same degree or, generally speaking, to a reliable degree

In specifying the proportions of components employed in my mixture I desire to have it understood that while magnesium silicate or aluminium silicate is the basis as aforesaid of the compound, and therefore always introduced into the mixture considerably in excess of any other component, some latitude of variation is permissible without departing from the principle of my invention, the object aimed at by change of the proportionate quantity of water-glass, as hereinafter specified, being to vary the composition of the material, compound, or finished product, so as to obtain the degree of hardness and density or compactness sought.

In the manufacture of my compound the proportions of the components of the mixture I prefer by reason of the comparative width of range of utility in the resultant product to use one hundred parts of finely-comminuted steatite or its equivalent, as specified, and twenty parts of water-glass—that is, sodium silicate or potassium silicate in fluid form—the said parts being proportioned by weight.

The components specified are thoroughly mixed in any suitable manner by machinery or otherwise to a plastic or semiplastic mass of about the consistency of workable putty. The first step in the treatment of the mixture is to expel or partially expel the water it contains, which may be accomplished by drying it in a drying-kiln—for example, one heated by steam.

The mixture may be formed into blanks and shaped, as by cutting, after they are steam dried, or it may be molded or shaped while the mixture is in the plastic state and steam dried in any desired form imparted to it.

In preparing the mixture above specified for the drying-kiln it is preferably, as specified, reduced to a closely-compacted mass of uniform density throughout. This effect may be produced by subjecting the plastic mixture to heavy pressure, as in a hydraulic press, and that treatment is preferably resorted to whether the mixture be presented to the drying-kiln in the form of a blank or in its perfected and final shape. If the final shape is imparted to it prior to kiln-drying, it may be done by the use of hydraulic presses provided with nipples of the kind that are well known in the fictile art.

As it comes from the drying-kiln the mixture may be for convenience termed "green," being then in a comparatively soft state—that is to say, of about the consistency of the native or massive steatite. It is then, nevertheless, hard enough and ready for such dressing, rubbing, smoothing, drilling, tapping, mitering, grooving, or any other manual or mechanical operation necessary or desirable for the completion or finishing of the article.

The mixture undergoes in the final step of the process by which the compound is produced a radical change from its green state, and becomes exceedingly hard—hard enough, it may be, by way of illustration, to scratch glass and to resist the action of any ordinary cutting-tool. In passing to that state the mixture ceases to be a mixture having steatite for its basic component, and becomes a compound. That final step of the process is to subject the mixture, preferably kiln-dried, as above specified, to a sufficiently high temperature to convert it into the finished product, material, or compound, which is distinguishable by a variety of characteristic qualities. From among such qualities there may be selected for enumeration the following, to wit: The compound possesses the quality of resistance to moisture, it is unaffected by heat, and it may not be carbonized or ignited by intense heat, it is believed, even in that of any electric arc. Articles produced therefrom are durable, being incomparably stronger than porcelain or any vitreous or other similar material, and of an electrical resistance that is practically infinite, and may be manufactured at reasonable cost.

The temperature at which the change in the character of the mixture to that of a compound occurs may be varied somewhat. The reaction by which the mixture is converted begins at about 700° centigrade and it appears to depend upon an elevated temperature rather than upon the length of time of exposure. Experience has shown the reaction to be complete and the best results in the manufacture of minute articles to be obtainable at about 1,500° centigrade. The time of exposure may be varied and is dependent in part upon the bulk of the mass that is being treated. In actual manufacture I employ a temperature of from 1,500° to 2,000° centigrade for a period dependent upon tests repeated during the firing, but usually of from five to eight hours. Laboratory tests upon minute articles have shown the best results to be obtainable by a five-minutes' exposure to a temperature of about 1,500° centigrade.

While in the foregoing specification I have indicated a choice of materials as available in the preparation of the mixture from which my compound is produced, yet I wish it to be distinctly understood that I regard magnesium silicate and sodium silicate as the unquestionably available components of the mixture. Whatever is predicated of the mixture of those components—to wit, steatite and water-glass—and of the compound derived therefrom is founded upon actual experience in extensive and long-continned use

of the same in the manufacture of my product for commercial purposes. Said mixture constitutes, therefore, the standard with which proposed substitutions in the preparation of my mixture must be compared in order to determine their equivalency or non-equivalency to the said components.

Articles made of my finished material may be, if preferred, supplied with a surface glaze by the use of magnesium or other suitable enamel—such, for example, as that used on porcelain or kaolin ware.

What I claim is—

1. An insulating and refractory material comprising the combination of water-glass and steatite or their substantial equivalents, chemically converted practically to a complete extent by heat.

2. An insulating and refractory material comprising the combination of steatite and water-glass or their substantial equivalents, converted by practically complete reaction.

3. An insulating and refractory material comprising the combination of powdered steatite and water-glass or their substantial equivalents, substantially in the proportions specified, converted by practically complete reaction.

4. An insulating and refractory material consisting of the combination of steatite and water-glass or their substantial equivalents, in convertible proportions, converted by practically complete reaction.

5. An insulating and refractory material consisting of the combination of powdered steatite and water-glass or their substantial equivalents, substantially in the proportions specified, converted by practically complete reaction.

6. An insulating and refractory material consisting of a complex anhydrous bisilicate composed essentially of silica with sodium and magnesium oxids.

Signed at Chattanooga, in the county of Hamilton and State of Tennessee, this 13th day of February, A. D. 1903.

DEMETRIUS M. STEWARD.

Witnesses:

HERMAN FERGER,

A. CANFIELD.