UNITED STATES PATENT OFFICE.

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COMPOSITION OF MATTER AND THE MANNER OF MAKING THE SAME.

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To all whom it may concern:

Be it known that I, WILLIAM ANSYL PHILLIPS, a citizen of the United States, residing at St. Louis, in the State of Missouri, have invented certain new and useful Improvements in Composition of Matter and the Methods of Making Same, of which the following is a full, clear, and exact specification.

This invention relates to a composition of matter and its method of production more especially designed for use as an electric conductor where conductors of high resistance are required, as, for example, in resistance boxes or rheostats, electric heaters, etc., and the invention has for its primary object to provide an improved composition of matter of the described character which will be effective, economical to produce, and lasting.

Another object of the invention is to provide an improved composition of matter of the desired character which will be practically indestructible by the electric current, and which also possesses the power to a marked degree of resisting the destructive effects of fire, water and the action of the atmosphere, thus giving the material a certain value when used for certain other purposes, as, for example, for construction purposes, fire-proofing materials, and the like.

With these ends in view, the invention consists in certain features of novelty which will now be fully described, and then more particularly pointed out in the claims.

In carrying out the invention, I employ a clay that will be capable of resisting fire, such as ordinary fire-clay, which is first mixed with a suitable binder, as, for example, Portland cement, or any other form of calcium, after which it is pressed, with or without a metallic net-work or sheet in its interior to give added strength, or allowed to set into shape and subjected to heat of a sufficient degree of temperature to bake or vitrify it. The material thus prepared forms the body or base of the non-conducting portion of the compound or composition, and this body or base is then impregnated with a metallic element of a suitable character which combines with the base or body, either chemically or mechanically, or both chemically and mechanically, and forms therewith a durable and lasting article. This metallic element being a conductor of electricity, of course imparts to the body thus impregnated with it the properties of an electric conductor, but which, by reason of the high resistance of the base or body of the composition, is especially adapted for use where conductors of high resistance are required or are desirable. The metallic element which it is preferable to employ is in the form of a fluid, consisting of a mixture and preferably a molten mixture, of sulfid of iron and sulfid of lead. These two elements have a neutralizing effect with respect to one another so far as the degree of electrical resistance is concerned. When the material is used as an electric conductor, or a part of a rheostat, for example, it of course becomes heated, but it is found that the tendency of the lead to increase in resistance while the iron decreases in resistance, maintains the degree of resistance of the conductor as a whole substantially uniform or constant throughout the varying temperatures. If it is desired to form a unit which will decrease in resistance very materially, iron sulfid alone is used as the metallic element; to increase materially, lead sulfid alone is used. A small amount of copper or tin may be added to each, singly or together, with good results.

The proportions, of course, might be varied throughout considerable range without departing from the spirit of the invention, and will depend in each instance largely upon the uses to which the material is to be put and the character of the base substance employed, but a suitable proportion ordinarily would be about seven ounces of lead to one-fourth ounce of iron. The degree of resistance of the material as a whole will also depend largely upon the amount of calcium or its salts and compounds, or lime employed in the body or base of the material. It will also be understood that by varying the proportions of iron and lead the degree of resistance may be made to increase with heat or decrease with heat, or remain constant, since the resistance of the iron decreases in a greater degree or rate than the lead increases.

The non-conducting body or base, when treated as above, is heated and immersed in this molten metallic element and sufficient heat is applied in any suitable manner to cause the non-conducting material to take up the fluid conductor; or the conductor may be applied to the non-conductor in powdered form and caused to become absorbed into the non-conducting body, which in this case can be reinforced with a suitable metal sheet or netting, and given the required amount of

heat; the non-conductor being surrounded by the powdered metallic element and inclosed while the heat is applied.

In the application of the metallic element with reinforcement in the base, the non-conducting material is preferably coated with the metallic element, and by regulating the degree of heat, the amount of the metallic element absorbed by the base or body may be varied as desired, causing the metallic element to entirely penetrate the base or body so as to produce a uniform impregnation, or the penetration or impregnation may be arrested after the metallic element has penetrated but a fraction of the body, thus leaving an inner core of the body, the non-conducting element, surrounding the reinforcing material, in its original form, while a shell is formed therearound consisting of the non-conductor element and the metallic element combined and bonded together by fusion. It is of course understood that by thus varying the degree of impregnation, the degree of resistance may also be varied.

It is found that a fire-proof or non-conducting body composed primarily of fire-clay may be comparatively improved in character by the addition of porcelain clay, alumina, silica, or compounds of silica, or any substance containing from 20% to 80% combined silica with other earthy matter, as well as compounds of calcium, aluminum, magnesium and carbon. With any of these, however, it is desirable to use the calcium, or calcium compounds in varying proportions, according to the degree of conductivity or resistance required, and for the further reason that the presence of the calcium hastens the impregnation of the non-conducting body with the metallic elements. It is found that the resistance varies considerably with the amount of calcium compound or lime added to the clay composition, and that the calcium or lime, if equal to or in excess, or thereabouts, to the clay mixture, the molten sulfid or mass causes the non-conductor or base itself to combine chemically or mechanically, or both, and fuse with the metallic element, forming a composition of matter consisting of a non-conducting element saturated or impregnated throughout with the conducting element, and which can be poured into molds, or puddled, or run into rods or bars, or pressed into shape.

While the preferred metallic element or conducting material consists of a mixture of sulfids of iron and lead, it is found that many of the common metals, such as iron, lead, copper, tin, zinc and the like, either in their pure form or alloys, or in the form of oxids, sulfids, phosphids, tellurids, selenids, arsenids, or other salts, singly or together, have a certain value when used for this purpose. In fact, it is found that any metal or salt or compound of that metal, if it (when either sulfur, phosphorus, tellurium, selenium, arsenic or acid is added) forms an electrical conducting oxid, sulfid, phosphid, tellurid, selenid, arsenid or other salt of that metal, may be employed in conjunction with the non-conducting base or body before described, and there will be produced a material possessing in a certain degree, at least, the advantages of this invention.

In impregnating the non-conducting base or body with the powdered form of the metallic or conducting element, with the non-conducting element also in powdered form, the non-conductor should be mixed with the powdered pure metallic conductor, or an electrical conducting oxid thereof, and then either sulfur, phosphorus, tellurium, arsenic, or selenium should be added, with or without calcium compounds, and the mixture pressed into the required shape and subjected to the necessary degree of heat to cause the same to fuse. If desired, powdered metallic electrical conducting oxids, sulfids, phosphids, tellurids, selenids, arsenids or compounds or other salts, may be mixed with any of the aforesaid non-conducting materials, with or without calcium or lime, and after pressing the same into the shape desired, subjected to the necessary heat, causing them to fuse together. But, as before stated, the preferred, and by far more advantageous method and superior product or material, is that involving the formation of the non-conducting body and its subsequent impregnation by the molten metallic element.

It is also found that in practicing the invention, another convenient manner of manipulating the materials in order to coat, impregnate or saturate the base of non-conducting material with the metallic conductor is to cause the metallic element to volatilize, sublime or spray on the non-conducting material. In such case, the iron or lead, whether used singly or together, or any of the other common metals enumerated, in their pure form or in the form of oxids, sulfids, phosphids, arsenids, tellurids, or selenids, or their salts, are reduced to a molten state and may be caused to volatilize, sublime or spray by the application of heat, either with or without an artificial draft. When the metal, under such conditions, begins to volatilize, spray or sublime, the surface of the non-conducting material is subjected to it, and it soon becomes as hot as the metal itself, and being porous and absorbent, begins to take up the metal mass in a coat and impregnation at once begins. If the time of exposure be continued, complete saturation of the absorbent non-conducting material with the metallic material will result.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:—

1. The herein described composition of

matter containing a non-conducting element impregnated with a metallic element.

2. The herein described composition of matter containing a fire-proof element impregnated with a metallic element.

3. The herein described composition of matter containing a non-conducting element impregnated with a metallic element, the two existing in a fused condition.

4. The herein described composition of matter containing a fire-proof element and an electrical conductor, the two being fused together and one impregnated with the other.

5. The herein described composition of matter consisting of a non-conducting body or base saturated with a fused metallic element.

6. The herein described composition of matter containing fire-clay impregnated with a metal.

7. The herein described composition of matter containing fire-clay as a non-conductor impregnated with a metallic conductor.

8. The herein described composition of matter containing fire-clay impregnated and coated with a metallic conductor.

9. The herein described composition of matter containing fire-clay and a suitable binder saturated or impregnated with a metallic conductor.

10. The herein described composition of matter containing fire-clay and a suitable binder impregnated and coated with a metallic conductor.

11. The herein described composition of matter containing fire-clay impregnated with a metallic conductor containing iron and lead.

12. The herein described composition of matter containing fire-clay impregnated with a conductor containing sulfids of iron and lead.

13. The herein described composition of matter containing fire-clay and a suitable cement or binder impregnated with the sulfids of iron and lead.

14. The herein described method which consists in subjecting fire-clay to a composition containing a metallic conductor and causing the metallic conducting material to enter the fire-clay.

15. The herein described method which consists in vitrifying and solidifying a mixture containing fire-clay and a suitable binder or cement and afterwards saturating or impregnating the same with a metallic conductor.

16. The herein described method which consists in subjecting a porous non-conducting substance to a composition containing sulfids of iron and lead as a conductor, and afterwards applying heat to cause the porous non-conductor to become impregnated with the said conductor.

17. The herein described method which consists in subjecting a porous non-conducting substance to a metal conductor and causing the metallic conducting material to enter the porous nonconductor by the application of heat.

18. The herein described method which consists in driving a metallic substance into a porous body of material by the application of heat.

19. The herein described method which consists in impregnating a non-conducting element with a molten conducting element and bonding the two together by fusion.

20. The herein described method which consists in forming an absorbent body or base and impregnating the same with a molten metallic element.

21. The herein described method which consists in forming a non-conducting base or body of a porous material and saturating the same with a molten metallic element.

22. The herein described method which consists in subjecting a porous non-conducting substance to a spray of metallic conducting material.

23. The herein described method which consists in subjecting a porous absorbent non-conducting substance to a metallic conductor in volatile form or spray.

24. The herein described method which consists in subjecting a porous absorbent non-conducting substance to a metallic conductor in volatile form or spray by the application of heat and a forced draft to the metallic conducting material.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, on this 6th day of August A. D. 1907.

WILLIAM ANSYL PHILLIPS.

Witnesses:

C. L. WEBER,

L. S. ELMORE.