UNITED STATES PATENT OFFICE.

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INSULATING COMPOUND.

SPECIFICATION forming part of Letters Patent No. 420,648, dated February 4, 1890.

Application filed May 25, 1887. Serial No. 239,332. (No specimens.)

To all whom it may concern:

Be it known that I, JAMES B. WILLIAMS, a citizen of the United States, residing at San Francisco, in the county of San Francisco and State of California, have invented a new and useful Composition of Matter, of which the following is a specification.

My invention relates to improvements in insulating compounds, and is an improvement upon the composition of matter for which Letters Patent were granted to me February 2, 1886, No. 335,495, and for which I am about to file an application for a reissue.

Experiment has demonstrated that when india-rubber is used as an insulating-covering for electric wires it can be subjected to a temperature of about 295° Fahrenheit before its insulation fails entirely, and that if the temperature does not exceed 120° Fahrenheit, or thereabout, its insulating properties can generally be depended upon. When gutta-percha, however, is subjected to a temperature of 100° Fahrenheit, its insulating properties begin to fail very rapidly, and if the temperature reaches 120° Fahrenheit, or thereabout, depending upon the quality of the gutta-percha used, the insulating properties which it possesses at ordinary atmospheric temperatures are almost entirely lost, and when electric conductors insulated with it or with compounds of which it forms one of the principal ingredients are subjected to a temperature of about 120° Fahrenheit large losses of the electric current from such conductors by leakage through the insulating-covering occur by reason of the defective insulation of the gutta-percha. Further, if paraffine-wax be used as an ingredient of insulating compounds, instead of paraffine-oil, the consistency of such insulating compounds is rendered firmer, and if a quantity of sulphur be added to insulating compounds containing india-rubber in the proportion of one pound of sulphur to every eight to fifteen pounds of india-rubber the india-rubber in such compounds is more durable after being vulcanized than when preserved only by the admixture with it of paraffine-oil and a resin or resins; and bituminous matter, if used as an ingredient of such insulating compounds, is rendered more durable and requires a higher temperature to soften it after having been incorporated in such compounds if the volatile and aqueous matters which it contains are eliminated by the aid of heat before it is incorporated in the compound.

My improved composition of matter for insulating material consists of india-rubber, paraffine, a resinous body, and sulphur, all in combination, and to which may be added or not what may be designated as "inert material," which serves, if added, to harden the insulating material or compound and to lessen its cost.

By paraffine-wax is meant ozocerite or mineral wax, or, more particularly speaking, a substance having the consistency of wax, whose main constituents are hydrocarbons, the formula of which is CnH_2n+_2, and by a resinous body is meant one of those vegetable products commonly termed "resins" or "gum-resins," such as shellac, copal, colophony, sandarach, &c.

The inert material which should be added (if added at all) for the purpose hereinbefore specified is silica or its equivalent, or bituminous matter, which is solid when cold. By equivalent of silica is meant glass, asbestus, solid steatite, kaolin, talc, and various carbonates, silicates, and oxides of the alkalies.

The paraffine which I prefer to use is that which is obtained from ozocerite or mineral wax, the resin which I prefer is shellac, and the inert material is silica or a silicate, although other paraffines, resins, and inert materials herein designated may be used instead of the ones preferred with good results.

To make an insulating compound which, when properly applied to conductors of electricity and vulcanized, will be to a high degree durable, flexible, and anhygroscopic, and will have a high insulation resistance, I take india-rubber, (forty parts, by weight,) paraffine, (fifteen parts, by weight,) shellac, (forty parts, by weight,) and sulphur (five parts, by weight.) If a harder and less flexible insulating compound than that made according to the formula just given is desired—for example, when the electric conductors to which it is applied are to be placed in conduits or other receptacles where they are expected to remain in one position for a length of time—a quantity of the inert material is added to the formula above given, the quantity of the

inert material to be thus added varying according to the degree of hardness desired. The greater the proportionate quantity of the inert material in the insulating compound the less flexible and the more brittle it becomes. I therefore prefer to keep the proportionate quantity of the inert material below about thirty per cent. of the whole composition after the inert material is added, when the compound is to be applied to electric wires to insulate them; but if the compound is to be used in the manufacture of telegraph-insulators, or substitutes for hard rubber, the proportionate quantity of the inert material may equal about fifty per cent. of the whole composition.

I do not wish to restrict myself to the use of the exact proportions of the ingredients as specified in the formula above given, as they are relative only and may be varied somewhat from those which are specified without departing from the principle of my invention, and without greatly impairing the efficiency of the compound as an insulating material. Neither do I wish to restrict myself to the use of silica or its equivalent or bituminous matter taken separately as the inert material for the purpose hereinbefore specified, because the two may be combined in various proportions with good results; but in case both are used the proportionate quantity of the two when combined should not be greater than the proportionate quantity of either if taken separately.

The compound made according to the formula above given will be one which is suitable for ordinary purposes of insulation; but there are cases in which flexibility is not desired—as, for instance, when the insulating material is to be placed in tubes to insulate and maintain electric conductors in a fixed position in said tubes, in which case the india-rubber may be used in smaller proportions than that specified. There are also cases in which a very flexible and elastic insulating-covering is desired, and in such cases the india-rubber may be used in larger proportions than that specified. I therefore desire to claim, broadly, the combination of india-rubber, paraffine, and a resinous body in any proportions, as compounds formed by using the same in any proportions will be more or less useful as insulating material.

Before being incorporated into my insulating compound the different ingredients of which it is composed should be cleansed of all foreign matters which they may contain by any of the processes well known to the art, and the bituminous matter for use as an ingredient should be freed from the volatile and aqueous matters which it contains by subjecting it when in a powdered state to a temperature of from 300° to 400° Fahrenheit in an open vessel, care being taken not to burn or char it while the volatile and aqueous matters are being driven off.

To compound the ingredients of which my insulating compound is composed, I first dissolve the india-rubber in a volatile solvent which will dissolve it and paraffine—such as benzole or petroleum-naphtha—in a strong iron vessel provided with a tight-fitting metallic cover, which can be secured to the vessel by bolts or screws and surrounded by a steam-jacket heated to a temperature below the boiling-point of the solvent used.

As the kind of vessel used and also the process to be adopted for making solutions of india-rubber are well known to the art, it is unnecessary for me to describe them in detail. I find that a compound of india-rubber and a solvent in the proportion of about one-half a pound of india-rubber to every gallon of solvent used is a convenient one to handle during the process of incorporating the india-rubber and paraffine, to be hereinafter described.

After the india-rubber has been dissolved the solution is allowed to cool, when the proportionate quantity of paraffine in a coarsely-powdered state is added to the solution of india-rubber. The mixture is then well stirred and the cover of the vessel put on and secured and heat applied by means of the steam-jacket until the paraffine is dissolved, which will usually require from five to fifteen minutes' time. The solution of india-rubber and paraffine is then allowed to cool, and when cooled is transferred to a suitable distilling apparatus and the solvents distilled at a temperature of about 200° Fahrenheit, the solvent vapor being condensed in a suitable vessel and retained for future use. By adopting this method of combining the india-rubber and paraffine the india-rubber is reduced to a proper condition for incorporation with the remaining ingredients without subjecting it to a high temperature. The compound of india-rubber and paraffine is then incorporated with the remaining ingredients, which are first reduced to a finely-powdered condition by mixing all together by rollers heated by steam, and during the mixing all the solvent remaining in the compound of india-rubber and paraffine after the distillation thereof is eliminated.

All of the ingredients of which the compound is composed may be incorporated by mixing them, when in a finely divided or powdered state, upon hot rollers, which is the process usually followed in the art of compounding india-rubber with other substances; but by so doing the india-rubber is liable to deteriorate rapidly afterward, and also lose its insulating properties, whereas by combining it with the other ingredients substantially in the manner specified this subsequent deterioration is largely prevented.

Before the electric conductors are coated with the insulating material they should be covered with a layer of cotton fiber and the fiber saturated with a varnish of shellac dissolved in alcohol in any convenient manner, the purpose of the varnish layer being to

prevent as nearly as is possible the sulphur in the insulating material from coming in contact with or acting upon the material of which the wires are composed during the vulcanization of the compound, and also to prevent as nearly as possible moisture from creeping in between the wires and the insulating compound while the insulating-wires are in use. After the varnish has become thoroughly dry the insulating compound is applied over it in the same manner and by means of the same apparatus as is usually employed in coating electric wires with insulating compounds which become plastic when heated. The wires thus coated are then covered with one or more braids of cotton or other suitable fiber and the braid or braids saturated with the insulating compound by passing the wires through the compound held in a suitable vessel and kept in a liquid condition by heat. The insulating compound is then vulcanized in a suitable chamber heated by steam to a temperature of from 270° to 280° Fahrenheit for from one to three hours.

Besides being used as an insulating-covering for electric wires, the compound herein described can be used in the manufacture of condensers, substitutes for hard rubber, and for insulators of telegraph and other electric wires.

I do not claim the mode of applying my compound to conductors of electricity, as this may be done by well-known methods; nor do I claim as any part of my invention any of the ingredients, taken separately, of which my insulating compound is composed, as their insulating properties are well known.

It will be found that the compound herein described can be made more cheaply, can be more satisfactorily applied to conductors of electricity, will be more durable, and its insulating qualities are maintained at higher temperatures than in the case of the compound described in my said Letters Patent before referred to.

What I claim, and desire to secure by Letters Patent, is—

1. An electric insulating compound which consists of india-rubber, paraffine, and a resinous body, substantially as specified.

2. An electric insulating compound which consists of india-rubber, paraffine, a resinous body, and sulphur, substantially as specified.

3. An electric insulating compound which consists of india-rubber, paraffine, a resinous body, sulphur and silica or its equivalent, substantially as specified.

4. An electric insulating compound which consists of india-rubber, paraffine, a resinous body, sulphur, and bituminous matter which is solid when cold, substantially as specified.

5. An electric insulating compound which consists of india-rubber, paraffine, a resinous body, sulphur, silica or its equivalent, and bituminous matter which is solid when cold, substantially as specified.

6. The process of making the insulating compounds hereinabove specified and claimed, which consists in, first, dissolving the india-rubber in a volatile solvent; second, dissolving paraffine in the india-rubber solution thus obtained; third, distilling from the solution of india-rubber and paraffine the volatile solvent, and, fourth, incorporating the resident compound of india-rubber and paraffine with one or all of the remaining ingredients, all substantially as specified.

New York city, May 21, 1887.

JAMES B. WILLIAMS.

Witnesses:

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