UNITED STATES PATENT OFFICE.

JOHN W. HOARD AND FREDERICK R. HOARD, OF PROVIDENCE, R. I.

INSULATING AND PROTECTING ELECTRIC WIRES AND CABLES.

SPECIFICATION forming part of Letters Patent No. 342,694, dated May 25, 1886.

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To all whom it may concern:

Be it known that we, JOHN W. HOARD and FREDERICK R. HOARD, both of the city and county of Providence, and State of Rhode Island, have invented certain new and useful Improvements in Insulating and Protecting Electric Wires and Cables; and we do hereby declare that the following is a full, clear, and exact description of the invention, which will enable others skilled in the art to which it appertains to make and use the same.

The purpose of our invention is to furnish a suitably-insulated electric conductor wire or cable, particularly for underground telegraphs, that shall be efficacious, durable, and reasonably inexpensive. For this purpose we cover an electric conductor or combination of conductors with a drying-oil, preferably linseed-oil, which we oxidize by exposure to or admixture with oxygen or atmospheric air by any known method capable of producing the requisite high degree of oxidization throughout the mass of the oil, but preferably by that described in our Patent No. 312,351, dated February 17, 1885, by passing and repassing the oil by the agency of a blast of air through an atomizer within the vessel containing the same.

By oxidization, as is well known, drying-oils gradually become thicker and more viscid, attaining the consistence of molasses, and then gradually changing to a solid substance, becoming first a thin and then a firmer jelly, which becomes tougher and heavier, and the melting-point of which rises as the oxidization proceeds, and finally the oil passes from its jelly-like condition into that of a hard, tough, leathery gum, which at a temperature of about 600° Fahrenheit decomposes without melting. This ultimate condition is readily obtained by exposing the oil in thin films to the air until it has hardened, and forming film over film until a sufficient thickness is obtained to be economically removed for use, as is now commonly done in the manufacture of linoleum; but the intermediate stages of high oxidization, especially when it is desired that the mass of the oil should be uniformly oxidized, can only practically be obtained by admixing oxygen or air with the oil, since as soon as a film of moderate thickness has formed on a mass of oil by exposure to the air such film will so protect the oil beneath it as to stop the process of oxidization, or, at all events, to retard and reduce it to an almost or quite imperceptible progress. Even if the oil is constantly stirred, yet the oxidization of any considerable quantity of the oil by exposure to the air is so extremely slow and tedious, and at the same time imperfect and uneven, that good results can only be obtained by exposure in thin films, or by admixture with oxygen or air, as above stated. This process of oxidization must for our purpose be carried to a very high degree until the oil shall attain such a consistence that when cold it will be a more or less solid substance, according to the precise degree or amount of oxidization it has received. We prefer to use it for insulating purposes when it is in the first stages of solidity—that is to say, when the oil very highly, but not quite completely, oxidized is of a tough, elastic, jelly-like consistency, requiring about 300° Fahrenheit of heat to melt it. There is no precise point which is essential, but as the oxidization falls short of that suggested the tenacity of the material diminishes, and as it is carried beyond this point the material becomes harder and less yielding and elastic. The exact degree of oxidization which will produce the best results cannot be more precisely defined, and will vary somewhat with the method to be used in constructing the insulated wire or cable, the place in which it is to be used, the dangers, strain, and tension to which it is to be subjected, the nature of the protection or covering, if any, to be applied to it, and similar considerations, the rule of variation being, as above stated, that greater oxidization will increase the firmness of the material at the expense of a portion of its elasticity. This material may, by the application of considerable heat—about 300° Fahrenheit, as above specified—be melted or reduced to a semi-liquid condition, in which it will flow or run, or by the application of a somewhat less amount of heat, or of heat combined with pressure, one or both, be rendered plastic and readily molded. In either case, on cooling, it returns to its former condition of solidity with but very slight, if any, perceptible shrinking. It then is highly insulating, perfectly water-proof, and insoluble

by ordinary means. It is very tough and elastic, is not liable to crack or to scale off, is not subject to any injury from the heat or cold to which the insulated wire may be exposed in use, nor to damage from dryness or moisture. It may be applied to the wire or wires to be insulated, or, more properly speaking, such wires may be embedded in it, either in its semi-liquid or in its plastic condition, above referred to, the method of application not being essential. When applied in its semi-liquid condition, we prefer to place it in a vessel in which the wire or wires to be insulated are contained or through which they are passed, so that the oil will completely surround and cover them. It will then on cooling adhere firmly and tenaciously to them, filling all their superficial irregularities; and if a pipe is laid with a wire or wires inside of it and filled with the oxidized oil to insulate the inclosed wire or wires frost acting on the pipe will not cause any cracking or pulling away of this covering from the wire by reason of the displacement of the pipe, since the elasticity and tenacity of the oxidized oil is such as to readily accommodate itself to even very material displacements of the pipe. The pipe may be materially bent, say, even to a right angle, without breaking or injuring the integrity of the insulating-covering of the wires contained in it. Such pipe may be accordingly laid, if desired, on the surface, or very near the surface, of the ground, as it is not necessary to place it below the frost-line.

It will be understood that the use of a pipe is not essential, but the oil may be allowed to cool and solidify in any suitably-shaped vessel, trough, bed, or mold, whether or not covered, and that it may be left in such vessel, trough, bed, or mold as a permanent protection and support to it, or when sufficiently cooled may be removed therefrom, and may or may not be protected by any suitable covering or armor. When used without any or with but slight protection, it is desirable that the oil should be more highly oxidized than when it is to be better protected, so that it may have greater solidity. When to be contained in a pipe, on the other hand, it may be but little removed from a point at which it would run, being preferably in the very first stages of solidity.

When but a thin coating is desired for the wire, the oxidized oil, reduced by heat to a semi-liquid condition as aforesaid, may be applied to the wire without the use of molds and allowed to harden when freely suspended or when placed on any substance from which it can easily be removed or which is to be used to coat or cover it. Again, the wire may be covered with fabric or threads saturated with the oxidized oil.

When the material is to be applied in its plastic state, the wire or wires to be insulated may be pressed between layers of the material, or the material may be wound, folded, or pressed about them, or the material, together with the wires, may be passed through an aperture, tube, or other mechanism to mold the material about the wires; or any other suitable method may be employed to inclose or embed them in it, and the wire or cable so formed may or may not be protected by any suitable covering or armor, as desired.

In short, our insulating material may be applied by any known method of insulating wire with liquid or plastic material, and having no solvent to evaporate from it and not perceptibly shrinking or cooling is not in danger of cracking or scaling.

We are aware that drying-oils have been solidified by the action of heat or of chemicals—such as chloride of sulphur, bisulphide of carbon, or similar substances—and when so solidified have been used for insulating purposes, generally, however, if not always, in combination with other materials; but such solid products are of a quite different chemical composition from the material we have above described as "oxidized oil."

We are further aware that drying-oils, oxidized by exposure to the air to the condition of a leathery gum or skin, have been used for insulating purposes, in combination with other substances—such as india-rubber, caoutchouc, asphaltum, volatile solvents, &c.; but prior to our invention oxidized linseed or equivalent drying oil has not been used as an insulator except in compounds, and never in its intermediate stage of high but partial oxidization, above described, when oxidized to the consistence of a jelly.

Any drying-oil may be used; but we prefer linseed.

We claim—

1. An electric conductor wire or cable insulated with a covering of linseed or equivalent drying oil highly oxidized throughout its mass by exposure to or admixture with oxygen or atmospheric air and applied without the aid of a solvent, substantially as above set forth.

2. An electric conductor wire or cable insulated with linseed or equivalent drying oil highly but not completely oxidized throughout its mass by exposure to or admixture with oxygen or atmospheric air having attained the consistence of a jelly and applied without the aid of a solvent, substantially as above set forth.

JOHN W. HOARD.
FREDERICK R. HOARD.

Witnesses:
HENRY B. ROSE,
EDWD. B. BIGELOW.