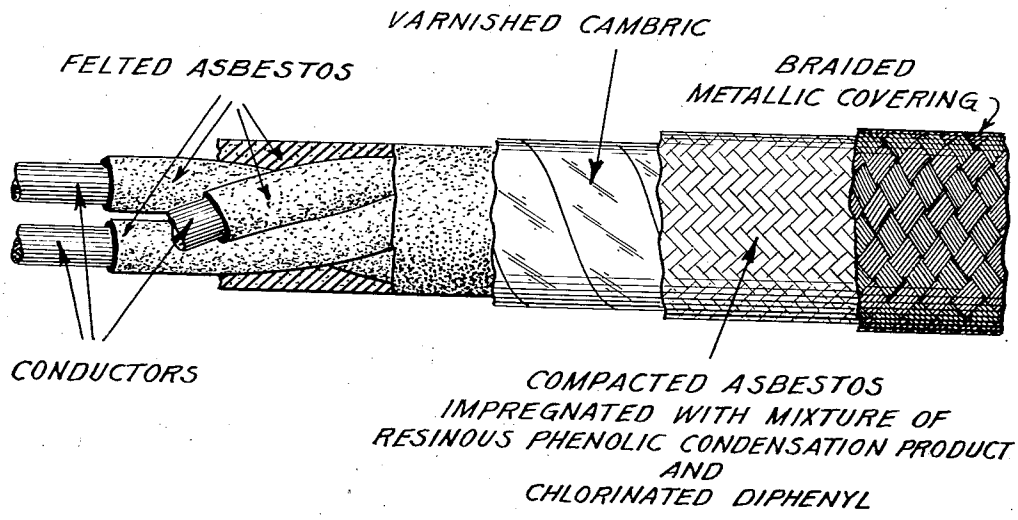
June 20, 1939. R. B. LATTIN 2,162,953

INSULATED ELECTRICAL CONDUCTOR

Filed Feb. 20, 1936



INVENTOR
ROBERT B. LATTIN
BY Pennie, Davies, Marvin & Edmonds
ATTORNEYS

Published by AsbestosClaims.Law
asbestosclaims.law/library/22729/1

Patented June 20, 1939

2,162,953

UNITED STATES PATENT OFFICE

2,162,953

INSULATED ELECTRICAL CONDUCTOR

Robert B. Lattin, Cheshire, Conn., assignor to Rockbestos Products Corporation, a corporation of Massachusetts

Application February 20, 1936, Serial No. 64,814

13 Claims. (Cl. 174—121)

This invention relates to insulated electrical conductors and cables and has for its object the provision of an improved article of this character. The invention is particularly directed to the provision of an improved insulating medium for electrical conductors and cables capable of withstanding submersion in water for extended periods or when subjected to hydrostatic pressure.

Electrical conductors and cables insulated with asbestos, as well as with combinations of asbestos and other forms of insulating material, have heretofore lacked adequate waterproofness to withstand submersion in water for extended periods or when subjected to hydrostatic pressure. Asbestos is itself hygroscopic. Impregnation of the asbestos with wax-like compounds provides a moderately satisfactory insulating medium capable of resisting atmospheric moisture or dampness and in some cases even submersion in a shallow depth of water for a short period of time. However, none of the previously known impregnating compounds, having the other requisite characteristics of heat resistance, flame-proofness, etc., have provided sufficient water resistance to withstand submersion in water for an extended period of time or when subjected to hydrostatic pressure.

I have discovered that asbestos impregnated with a mixture of a resinous phenolic condensation product and a chlorinated diphenyl possesses remarkable resistance to water and at the same time is highly flameproof. Based on that discovery the insulated conductor of my present invention comprises a metallic conductor insulated by a surrounding layer of asbestos impregnated with a compound composed principally of a mixture of a resinous phenolic condensation product and a chlorinated diphenyl, preferably in about equal parts by weight.

The use of resinous phenolic condensation products for impregnating asbestos has heretofore been suggested, but these products have not been found satisfactory for this purpose principally because of their lack of flameproofness. Moreover, in attempting to use curing types of such products, it has been found that the products become brittle and any subsequent flexing of the wire or cable causes cracking of the insulating medium which destroys its waterproofing quality. Furthermore, it has been found impractical to impregnate compactly matted or felted asbestos coverings with such products because of their high viscosity and their tendency to become increasingly viscous when heated to the temperature necessary for the impregnating treatment. The inherent and objectionable high viscosity of these products can be lowered sufficiently for the impregnating treatment by the use of volatile solvents, but after evaporation of the solvent the residue is porous and consequently not waterproof.

The use of chlorinated diphenyl for impregnating asbestos has also been suggested, but while these substances possess the requisite flameproof property, they do not provide the necessary resistance to water.

I have found that by combining a resinous phenolic condensation product with chlorinated diphenyl, and more especially certain particular types of these substances, a resultant compound is obtained which is flameproof, waterproof, elastic and possesses the ability to penetrate and saturate the customary felted layers of fibrous insulating material, like asbestos, to render them substantially impervious to water. At the same time, the resultant insulation exhibits highly satisfactory flame and heat resisting characteristics along with a dielectric strength of a higher order than possessed by asbestos impregnated with the heretofore customary waterproofing compounds.

The resinous phenolic condensation products which I find most satisfactory for the purpose of the invention are thermoplastic, solid and somewhat brittle at ordinary temperatures. They should have a flow point around 105° C. An example of a satisfactory material is marketed by the Bakelite Corporation as "Bakelite XR 8430". The products are not themselves flameproof and do not possess the necessary penetrating properties to properly impregnate the fibrous insulation.

The chlorinated diphenyls which I find most satisfactory for the purpose of the invention have a viscosity of approximately 96 seconds Saybolt at 100° C., and combine or mix readily with the resinous phenolic condensation product. An example of a satisfactory material is marketed by the Monsanto Chemical Company as "Aroclor No. 1262".

I combine or mix the resinous phenolic condensation product and the chlorinated diphenyl, preferably in about equal parts by weight, at a temperature of about 160° C. Preferably, a plasticizer, such for example as tricresyl-phosphate, is included in the mixture, about 5% by weight on the weight of the mixture giving satisfactory results. The chlorinated diphenyl imparts to the resinous phenolic condensation product the necessary flameproofing characteristics, and also gives to the resulting mixture a viscosity

Published by AsbestosClaims.Law
asbestosclaims.law/library/22729/2

at the impregnating temperature sufficiently low to thoroughly penetrate and saturate the compacted mass of asbestos. The resulting compound is stable and can be stored for use as required in manufacturing the insulated conductors and cables of the invention.

The single figure of the accompanying drawing diagrammatically illustrates a multiple conductor cable embodying the novel features of the invention.

As illustrated in the drawing, the cable contains three metallic conductors, each composed of stranded copper wire. Each of these conductors is individually insulated in any appropriate manner, as for example by a surrounding layer of felted asbestos impregnated with a suitable flame-proof and moisture-proofing compound. The three insulated conductors are twisted together and covered with a common layer of felted asbestos to provide a substantially cylindrical structure. Several layers of varnished cambric, or other insulating material of high dielectric strength, are spirally or helically wrapped around the asbestos-covered cable to provide the required dielectric strength. The high dielectric strength insulation is surrounded by a layer of asbestos (preferably felted asbestos covered by asbestos braid) impregnated with the mixture of resinous phenolic condensation product and chlorinated diphenyl. The cable may have an outer protective covering of braided metal strands or the like.

In manufacturing the cable illustrated in the drawing, the individual conductors are insulated, twisted and covered with the layers of impregnated asbestos and varnished cambric (or the like) in the manner well understood in the art. A layer of loosely felted dry asbestos of suitable thickness is then applied around the thus-assembled cable, and a dry asbestos braid is applied over the felted layer of asbestos. The so-covered cable is then passed through the impregnating compound (mixture of resinous phenolic condensation product and chlorinated diphenyl) while maintaining the compound at a temperature of about 155° C. The time required to impregnate the layer of felted asbestos and asbestos braid will depend on the thickness of the layer. As the cable emerges from the heated bath of impregnating compound, it is passed through suitable snubbing devices to remove the excess compound from its outer surface.

In order to prevent migration of the outer surface compound when the finished wire or cable is subjected to high temperatures in service, it has been found advantageous in some instances to apply to the impregnated layer of asbestos a second coat of the impregnating compound to which has been added about 15 to 20% of ground mica or other finely divided inert solid material. The impregnating compound on the outer surface of the impregnated asbestos then contains dispersed finely divided particles of the inert solid material, which act to thicken the compound and render it less susceptible to flow. The admixture of mica or the like is not required or desirable in the compound used to impregnate the asbestos layer, since the asbestos fibers themselves satisfactorily perform the function of retaining the compound within the mass by capillary attraction.

The insulated conductor or cable of the invention possesses all the necessary characteristics of heat resistance, flameproofness, pliability, dielectric strength, and resistance to water. The outer insulating layer of asbestos impregnated with a mixture of resinous phenolic condensation product and chlorinated diphenyl is substantially waterproof, even when submerged in water for extended periods of time or subjected to hydrostatic pressure as high as 25 pounds per sq. in. In general, the use of asbestos as an electrical insulating material has heretofore been limited to locations where high temperatures or the hazard of inflammable material made the use of ordinary forms of insulation (such as rubber, varnished cambric, paper, etc.) undesirable or prohibitive. It will therefore be evident that the invention widely extends the usefulness of asbestos insulated wires and cables.

I claim:

1. An insulated electrical conductor comprising a metallic conductor insulated by a surrounding layer of asbestos impregnated with a mixture consisting of a resinous phenolic condensation product and a chlorinated diphenyl, said impregnated asbestos being flexible and highly resistant to flame and penetration by water.

2. An insulated electrical conductor comprising a metallic conductor insulated by a surrounding layer of asbestos impregnated with an elastic and thermoplastic compound composed principally of the mixture resulting from combining about equal parts by weight of a resinous phenolic condensation product and a chlorinated diphenyl.

3. An insulated electrical conductor comprising a metallic conductor insulated by a surrounding layer of asbestos impregnated with a thermoplastic compound consisting of a mixture of a resinous phenolic condensation product and a chlorinated diphenyl and containing a small amount of tricresylphosphate, said compound being plastic at atmospheric temperatures and highly resistant to flame and penetration by water.

4. An insulated electrical conductor comprising a metallic conductor insulated by a surrounding layer of asbestos impregnated with an elastic mixture of a resinous phenolic condensation product having a flow point around 105° C. and a chlorinated diphenyl having a viscosity of approximately 96 seconds Saybolt at 100° C.

5. An insulated electrical conductor surrounded by a layer of asbestos impregnated with a compound composed principally of a mixture resulting from combining about equal parts by weight of a resinous phenolic condensation product having a flow point around 105° C. and a chlorinated diphenyl having a viscosity of approximately 96 seconds Saybolt at 100° C.

6. An insulated electrical conductor, surrounded by a layer of asbestos impregnated with a compound composed principally of a mixture resulting from combining in the presence of a small amount of a plasticizer about equal parts by weight of a resinous phenolic condensation product having a flow point around 105° C. and a chlorinated diphenyl having a viscosity of approximately 96 seconds Saybolt at 100° C.

7. A multiple conductor cable comprising a plurality of individually insulated metallic conductors surrounded by a layer of asbestos impregnated with a thermoplastic compound composed principally of the mixture resulting from combining a thermoplastic resinous phenolic condensation product and a chlorinated diphenyl in such proportions that the resulting compound is elastic and highly resistant to flame and water penetration.

8. A multiple conductor cable comprising a

plurality of individually insulated metallic conductors surrounded by a layer of asbestos impregnated with a compound composed principally of the mixture resulting from combining about equal parts by weight of a resinous phenolic condensation product having a flow point around 105° C. and a chlorinated diphenyl having a viscosity of approximately 96 seconds Saybolt at 100° C.

9. An insulated electrical conductor comprising a metallic conductor insulated by a surrounding layer of asbestos impregnated with a mixture consisting of a resinous phenolic condensation product and a chlorinated diphenyl, the impregnating mixture on the outer surface of the asbestos being elastic and resistant to flame and water penetrating and containing dispersed finely divided particles of an inert solid material.

10. A preparation for the impregnation of fibrous material for insulating purposes consisting of a mixture formed by combining a thermoplastic synthetic phenolic resin, a plasticizer and a chlorinated diphenyl, in such proportions that the mixture is elastic at atmospheric temperatures and not brittle.

11. A preparation for the impregnation of fibrous material for insulating purposes comprising a mixture formed by combining about equal parts of a phenolic resin having a flow point around 105° C., and a chlorinated diphenyl having a viscosity of approximately 96 seconds Saybolt at 100° C.

12. An electrical insulating medium comprising a layer of asbestos impregnated with a thermoplastic preparation formed of an admixture consisting of a phenolic resin, a chlorinated diphenyl, and a plasticizer, said insulating medium being elastic at atmospheric temperatures highly flame and water-proof and having high dielectric properties.

13. An electrical insulating medium comprising a layer of asbestos impregnated with a compound comprising a mixture formed by combining about equal parts of a phenolic resin having fluid properties when heated, and a chlorinated diphenyl having a viscosity of approximately 96 seconds Saybolt at 100° C., and a relatively small quantity of a plasticizer, approximately 5% by weight of the mixture.

ROBERT B. LATTIN.

Published by AsbestosClaims.Law
asbestosclaims.law/library/22729/4

CERTIFICATE OF CORRECTION.

Patent No. 2,162,953. June 20, 1939.

ROBERT B. LATTIN.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 2, second column, line 38, claim 3, for the word "plastic" read elastic; page 3, first column, line 17, claim 9, for "penetrating" read penetration; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 1st day of August, A. D. 1939.

(Seal)

Henry Van Arsdale,
Acting Commissioner of Patents.

Published by AsbestosClaims.Law
asbestosclaims.law/library/22729/5

CERTIFICATE OF CORRECTION.

Patent No. 2,162,953. June 20, 1939.

ROBERT B. LATTIN.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 2, second column, line 38, claim 3, for the word "plastic" read elastic; page 3, first column, line 17, claim 9, for "penetrating" read penetration; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 1st day of August, A. D. 1939.

Henry Van Arsdale,
Acting Commissioner of Patents.

(Seal)

Published by AsbestosClaims.Law
asbestosclaims.law/library/22729/6