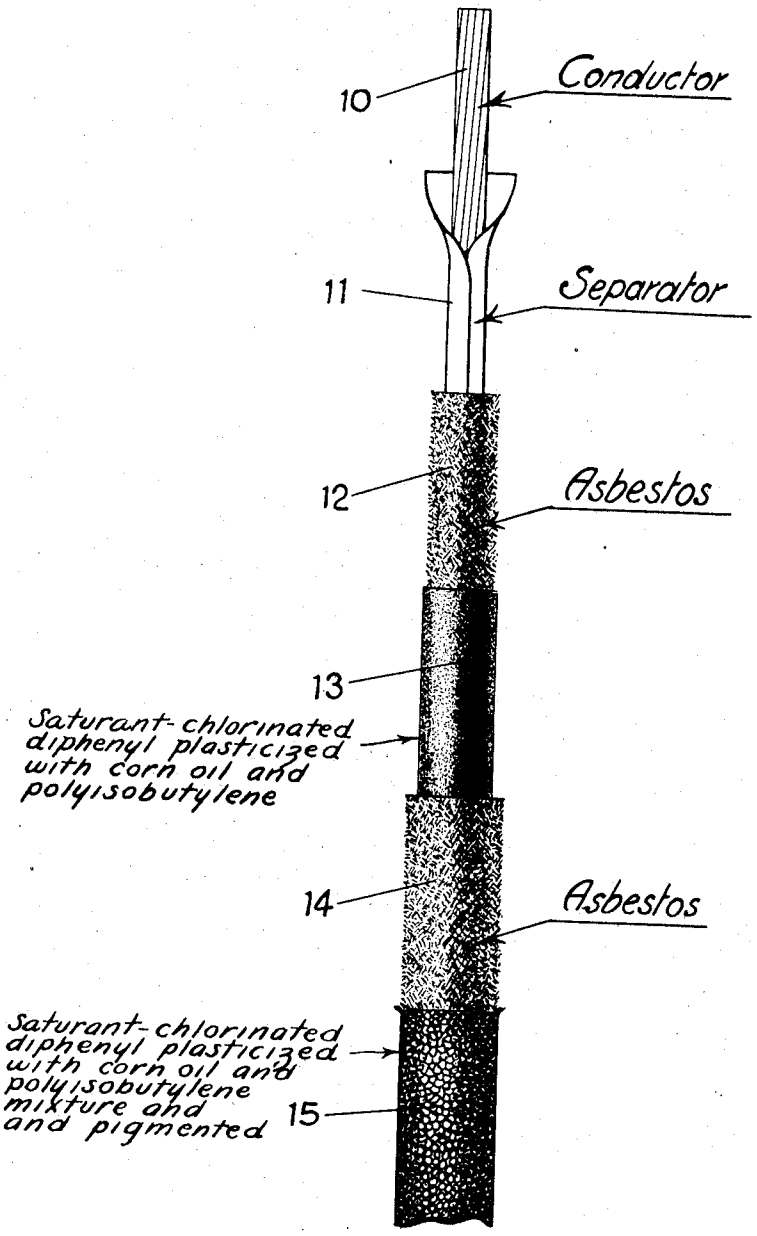
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ELECTRICAL CONDUCTOR

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ELECTRICAL CONDUCTOR

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The present invention relates to improvements in asbestos insulated electrical conductors and has for an object the provision of an improved flame- and moisture-resisting insulating compound with good electrical and physical properties. It is a further object of the invention to provide improved insulated conductor constructions. Other objects and advantages of the invention will appear hereinafter.

Asbestos is used for electric insulation because of its flame- and heat-resisting properties. However, because of its hygroscopic nature, asbestos must be saturated with a moisture-resisting compound in order to make it useful as electrical insulation. This saturating compound must be heat- and flame-resistant in order to preserve the heat- and flame-resisting properties of the asbestos.

There are a number of heat-, flame- and moisture-resistant compounds which have been used heretofore to saturate asbestos insulated wires. During the past few years the electrical and physical test requirements for asbestos insulated wires have been made more strict.

The electrical tests now require that the wire, e. g., No. 16 flexible asbestos fixture wire with $\frac{1}{32}$'' asbestos insulation wrapped 14 times around a ½'' metal mandrel and immersed in water of 40° C. for 3 hours, should have after this period a minimum A. C. resistance of 15,000 ohms. It is also required that this wire withstand 1500 volts for at least 1 minute when this voltage is applied between conductor and a tin foil wrapped around the insulation. The physical tests now require that the insulation of the wire be flexible at 0° C. and not drip at 100° C.

None of the previously used compounds, whether based on chlorinated diphenyl or chlorinated naphthalene, were entirely satisfactory. Some were too brittle at 0° C.; others too fluid at 100° C.; others failed to meet the A. C. resistance test after 3 hours immersion.

I have discovered that if chlorinated diphenyl (M. P. 60–66° C.) is plasticized with a mixture of corn oil and polyisobutylene a compound is obtained which consistently meets all requirements. Asbestos wire saturated with this compound passes the electrical tests, is flexible at 0° C. and does not drip at 100° C.

My tests show that neither polyisobutylene nor corn oil alone can give these improvements in a chlorinated diphenyl compound. If more corn oil is used instead of polyisobutylene, the compound is too fluid at 100° C. Also the wire fails on the 40° C. insulation resistance test because the compound is too fluid at that temperature and does not have the moisture resistance obtained with the chlorinated diphenyl compound prepared with a mixture of corn oil and polyisobutylene. Using only polyisobutylene and no corn oil in the chlorinated diphenyl results in a wire which will pass the 100° C. drip test and the 40° C. insulation resistance test, but will fail on the 0° C. flexibility test. Also this compound would be too viscous to saturate asbestos at about 150° C., the temperature used to saturate the asbestos insulation of this wire during its manufacture. The use of a combination of polyisobutylene and corn oil gives improved physical and electrical properties which can not be obtained by the use of only one of these compounds, or by the use of any other plasticizer or combination of plasticizers of which I am aware.

A preferred example of the composition is as follows:

	Pounds
Chlorinated diphenyl (M. P. 60–66° C.)	70
Paraffin (M. P. 52° C.)	10
Polyisobutylene (mol. wt. 10,000–20,000)	10
Corn oil	10

The paraffin is added to the above formula for the purpose of providing a slippery surface finish and for counteracting the stickiness of the chlorinated diphenyl. If a certain degree of stickiness is desired the paraffin may be omitted in the above formula. Other petroleum waxes may be used in the above formula instead of the paraffin wax.

While the above is the preferred composition, the ingredients may be varied somewhat within the following limitation:

	Per cent
Chlorinated diphenyl (M. P. 60–66° C.)	60–80
Paraffin (M. P. 52° C.)	10–20
Polyisobutylene (mol. wt. 5,000–20,000)	5–15
Corn oil	5–15

The polyisobutylene preferred in these compositions has a molecular weight of 10,000 to 20,000, but polyisobutylene with lower molecular weight may be used. Corn oil is the preferred oil, but other saponifiable oils with similar physical and chemical properties may be used, such as cottonseed and peanut oil. Very viscous oils like castor oil could not be used because due to the higher congealing temperature of this oil, compounds made with it would not be sufficiently flexible at 0° C.

On most asbestos wire constructions the asbestos is applied in two or more layers. The

above compounds are eminently suitable for the saturation of the first or inner layer, although at times for the second or outer layer a slightly harder and "drier" (less tacky) finish may be desirable. This can be obtained, for example, by adding 10–30 parts by weight, but preferably not over 25 parts by weight, of a pigment to the above compound.

As an example, for a white finished wire the following compound may be used on the outer asbestos layer:

	Pounds
Chlorinated diphenyl (M. P. 60–66° C.)	70
Paraffin (M. P. 52° C.)	10
Polyisobutylene (mol. wt. 10,000–20,000)	10
Corn oil, refined	10
Titanium dioxide	15

The use of a pigmented compound in the outside asbestos layer over a softer saturant in the inner asbestos layer has several advantages. First, by using pigments of different colors, wires with different colors can be made for polarity identification. Second, the pigmented outer saturant acts as a seal to prevent, even at temperatures over 100° C., the migration of the inner saturant if the latter has been applied in excess.

The accompanying drawing illustrates diagrammatically a single conductor construction embodying the novel features of the invention. The legends applied to the drawing are by way of illustration and not limitation.

As illustrated in the drawing, the conductor **10**, which may be of any suitable type and material common in the art, may be covered with a separator **11** of paper or Cellophane, or if desired, the separator may be omitted. Overlying the conductor or the separator, as the case may be, is an insulating jacket **12** of asbestos, which may be felt, roving, tape, or braid, as desired, which insulating layer is saturated by the heat-, flame- and moisture-resistant compound **13** described above. A second insulating jacket **14** of felted, roving, taped or braided asbestos may be applied over the saturated layer **12**, if desired, and this layer may be treated in turn with the protective compound **15** according to this invention.

The manner of manufacturing the cable will be apparent to those skilled in the art in view of the above description of the invention.

Advantages of the invention reside in the provision of an insulated conductor which possesses all of the necessary characteristics of heat resistance, flameproofness, waterproofness, dielectric strength, insulation resistance, pliability at 0° C., and drip-proof at 100° C. While the chlorinated diphenyl-wax-polyisobutylene-corn oil composition of the invention is particularly useful as a saturant for asbestos insulation, it is also useful with beneficial results on other fibrous materials.

I am aware that chlorinated diphenyl has previously been proposed as a moisture and flame resistant saturant for asbestos insulation and the like, but so far as I am aware, chlorinated diphenyl has not previously been compounded with the plasticizing and fluxing ingredients as in my invention, or so as to provide a saturant for asbestos insulated wire of the properties above described.

While certain preferred embodiments of the invention have been described by way of illustration, it is to be understood that the invention is not to be so limited as it may have various other modifications within the limits of the prior art and the scope of the subjoined claims.

I claim:

1. An insulated electrical conductor comprising a conductor core, an asbestos insulation therefor, said insulation being saturated with a compound comprising chlorinated diphenyl and paraffin wax plasticized with a mixture of polyisobutylene of 10,000 to 20,000 molecular weight and corn oil, the polyisobutylene and the corn oil each representing not less than about 5% of the compound by weight.

2. An insulated electrical conductor comprising a conductor core, an asbestos insulation therefor, said insulation being saturated with a compound comprising chlorinated diphenyl, petroleum wax, polyisobutylene of 5,000 to 20,000 molecular weight and corn oil, said saturated asbestos being flame- and moisture-resistant, resistant to flow at 100° C. and flexible without cracking at 0° C.

3. An insulated electrical conductor comprising a conductor core, an asbestos insulation therefor, said insulation being saturated with a compound comprising chlorinated diphenyl, paraffin and a coloring pigment plasticized with a mixture of polyisobutylene of 10,000 to 20,000 molecular weight and corn oil, the polyisobutylene and the corn oil each representing not less than about 5% of the compound by weight.

4. An insulated electrical conductor comprising a core, an asbestos insulation therefor, said insulation being saturated with a compound comprising chlorinated diphenyl plasticized with a mixture of polyisobutylene of 5,000 to 20,000 molecular weight and corn oil, a second asbestos layer thereover, said second layer being saturated with a compound comprising chlorinated diphenyl, paraffin wax and a coloring pigment plasticized with a mixture of polyisobutylene of 10,000 to 20,000 molecular weight and corn oil, the polyisobutylene and the corn oil in the compound saturating the said second layer each representing not less than about 5% of the compound by weight.

5. An insulated electrical conductor comprising a conductor core, an asbestos insulation therefor, said insulation being saturated with a compound comprising chlorinated diphenyl plasticized with a mixture of polyisobutylene and corn oil, the polyisobutylene and the corn oil each representing not less than about 5% of the compound by weight.

6. An insulated electrical conductor comprising a conductor core, fibrous insulation therefor, said insulation being saturated with a compound comprising chlorinated diphenyl and paraffin wax plasticized with a mixture of polyisobutylene of 5,000 to 20,000 molecular weight and corn oil, the polyisobutylene and the corn oil each representing not less than about 5% of the compound by weight.

7. An insulated electrical conductor comprising a conductor core, fibrous insulation therefor, said insulation being saturated with a compound comprising chlorinated diphenyl plasticized with a mixture of polyisobutylene and corn oil, the polyisobutylene and the corn oil each representing not less than about 5% of the compound by weight.

8. A flame- and moisture-resistant saturant having good electrical insulating properties comprising chlorinated diphenyl and paraffin plasticized with a mixture of polyisobutylene of 10,000 to 20,000 molecular weight and corn oil, the polyisobutylene and the corn oil each repre-

senting not less than about 5% of the saturant by weight.

9. A flame- and moisture-resistant saturant having good electrical insulating properties comprising chlorinated diphenyl and paraffin plasticized with a mixture of polyisobutylene and corn oil, the chlorinated diphenyl representing not less than about 60% of the saturant by weight and the polyisobutylene and the corn oil each representing not less than about 5% of the compound by weight.

10. A flame- and moisture-resistant saturant having good electrical insulating properties comprising chlorinated diphenyl plasticized with a mixture of polyisobutylene and corn oil, the polyisobutylene and the corn oil each representing not less than about 5% of the saturant by weight.

11. A flame- and moisture-resistant saturant having good electrical insulating properties and consisting substantially of:

	Pounds
Chlorinated diphenyl (M. P. 60–66° C.)	70
Paraffin wax (M. P. 52° C.)	10
Polyisobutylene (mol. wt. 10,000–20,000)	10
Corn oil	10

12. A flame- and moisture-resistant saturant having good electrical insulating properties comprising:

	Per cent
Chlorinated diphenyl (M. P. 60–66° C.)	60–80
Paraffin (M. P. 52° C.)	10–20
Polyisobutylene (mol. wt. 5,000–20,000)	5–15
Corn oil	5–15

13. A flame- and moisture-resistant saturant having good electrical insulating properties comprising:

	Per cent
Chlorinated diphenyl (M. P. 60–66° C.)	60–80
Paraffin (M. P. 52° C.)	10–20
Polyisobutylene (mol. wt. 5,000–20,000)	5–15
Corn oil	5–15
Pigment	10–25

14. A compound comprising chlorinated diphenyl and a plasticizer comprising a mixture of polyisobutylene of 5,000 to 20,000 molecular weight and corn oil, there being from about one-third to about three times as much polyisobutylene as corn oil.

15. A compound comprising chlorinated diphenyl and a plasticizer comprising a mixture of approximately equal parts of polyisobutylene of 5,000 to 20,000 molecular weight and corn oil.

16. An insulated electrical conductor comprising a conductor core, a fibrous insulation therefor, said insulation being saturated with a compound comprising:

	Per cent
Chlorinated diphenyl	60–80
Paraffin	10–20
Polyisobutylene	5–15
Corn oil	5–15

17. An insulated electrical conductor comprising a conductor core, a fibrous insulation therefor, said insulation being saturated with a compound comprising:

	Per cent
Chlorinated diphenyl	60–80
Paraffin	10–20
Polyisobutylene	5–15
Corn oil	5–15
Pigment	10–30

18. An insulated electrical conductor comprising a conductor core, fibrous insulation therefor, said insulation being saturated with a compound comprising chlorinated diphenyl plasticized with a mixture of polyisobutylene and corn oil, the chlorinated diphenyl representing not less than about 60% of the compound by weight and the polyisobutylene and the corn oil each representing not less than about 5% of the compound by weight.

19. A flame- and moisture-resistant saturant having good electrical insulating properties comprising chlorinated diphenyl plasticized with a mixture of polyisobutylene and corn oil, the chlorinated diphenyl representing not less than about 60% of the saturant by weight and the polyisobutylene and the corn oil each representing not less than about 5% of the saturant by weight.

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