Dec. 17, 1940. W. E. COOK 2,225,298

INSULATED WEATHERPROOF WIRE

Original Filed June 13, 1936

Fig. 1.

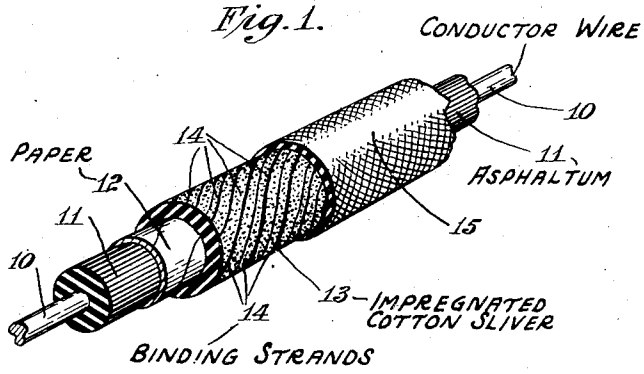
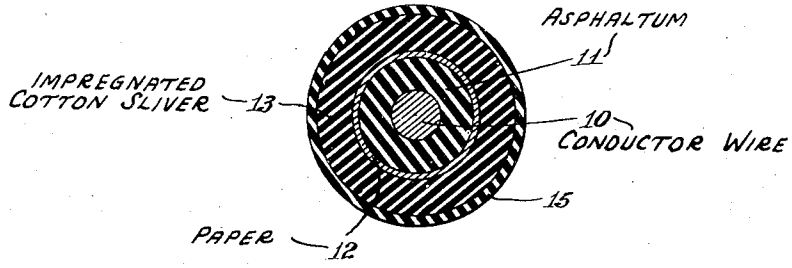



Fig. 2.




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## INSULATED WEATHERPROOF WIRE

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4 Claims. (Cl. 174—120)

The invention relates to insulated weatherproof wire, and more particularly to a wire adapted for use in the transmission of high voltage currents and produced by the method set forth in Letters Patent No. 2,155,403 granted to me under date of April 25, 1939, of which this application is a division.

For many years there has been in successful use, an insulated wire in which the covering for the conductor wire consists of cotton sliver saturated or impregnated with an asphaltum compound, this covering sliver being confined by binder threads or binder braid. While such wires have been found to have extraordinarily long life, the insulation is not suitable for use in high voltage transmission lines now extensively used. This is due in part to the formation of air pockets in the fibrous covering matter, or to the difficulties of securing a thorough, uniform impregnation of the sliver with the asphaltum compound. The low melting point of this compound, from 150° to 200° F., when the wires are subjected to the heat of the summer sun, also causes a partial softening of the compound with a tendency to creepage toward the bottom of the wire with a resultant loss in the effectiveness of the insulation toward the top thereof which is subjected to greatest deterioration from exposure to the weather.

I have heretofore produced insulated wire having a solid stratum of the asphaltum compound in continuous contact with, and closely adherent to, the conductor wire, this stratum being inclosed by a covering cotton sliver saturated or impregnated with an asphaltum compound having a lower melting point than the stratum about the wire, the whole being confined by binding strands or by braid commonly used upon the outside of insulated wires. Actual tests have shown that such a wire is suitable for the transmission of high voltage currents, but that by reason of the structure of the wire and the method of producing same, there is likelihood of considerable variation in the resistance to the development of blow holes or punctures in the insulation in different parts of the completed wire.

With the above conditions in mind, I have produced an insulated wire embodying therein an inner stratum of asphaltum compound closely adherent to and enveloping the conductor wire, the insulation embodying therein what may be termed a "dam," which not only confines the inner stratum of the asphaltum but prevents any substantial variation in the thickness of different parts thereof, either during the production of the wire or while it is in use. This barrier or dam, resisting deformation of the inner asphaltum compound stratum, is positioned between this stratum and an outer layer of saturated or impregnated sliver, the sliver being held in position by confining strands or an outer braid imbedded in the sliver covering or anchored thereto in a manner well known in the production of sliver covered wires.

It is essential, in a wire constructed in accordance with the invention, that the dam or barrier shall be inherently non-deformable and impenetrable by the heavier constituents of the inner asphaltum compound stratum so as to avoid seepage of such constituents in the event of the softening of the material of either the inner stratum or of the asphaltum compound with which the sliver stratum is saturated or impregnated, whether this softening is due to heat to which the covered wire is subjected during the process of manufacture of the wire, or after the wire has been strung.

This barrier or dam itself has insulating properties and the continuity and substantially uniform thickness of the same throughout, aids materially in preventing the development of voids in the covering for the wire, known generally as blow holes or punctures. Furthermore, in the process of manufacturing, particularly when coiling the wire after it leaves the asphaltum bath for saturating or impregnating the sliver, the presence of this barrier or dam prevents the displacement of the inner stratum of asphaltum compound with a resultant variation in the thickness of the inner stratum in different parts thereof.

In the production of wire embodying the invention, the inner stratum of asphaltum compound is accumulated upon the conductor wire; the dam or barrier strip, the sliver stratum and the binder threads are applied to the wire in rapid succession, and the wire thus covered is collected in a coil upon a drum prior to the impregnation or saturation of the sliver and the final finishing operations including sizing, waxing and polishing.

In thus building up the insulation upon the wire, the inner stratum of the asphaltum compound is subjected to compression from the dam or barrier strip, the sliver, the confining strands and the coiling operation. This compression may result in displacement of the inner stratum in a manner to vary the thickness of this inner stratum at different points in the length of the wire. Without the use of the dam or barrier strip this condition is much accentuated where the binder strand is applied to the sliver, since this strand is so tensioned as to be imbedded deeply in the sliver, and if the inner stratum of asphaltum compound is soft at the time of the application of the binder, it will be indented along the line of the binder strand, forming alternate high and low spots along the entire length of the said inner stratum.

In an insulated weatherproof wire embodying the invention, the covering for the wire has substantially uniform insulating properties throughout the entire length of wire, with a substantially solid body of asphaltum composition surrounding and in immediate contact with the bare wire, this body being of substantially uniform density throughout, free of any air ducts or interstices which might result in a blowout, and having a melting or fusing point sufficiently high to permit the production of the wire without any material deformation in the asphaltum of this stratum.

While this inner stratum may become plastic, either from weather conditions or while producing the wire, the dam strip of paper or other equivalent material will hold the form of the inner stratum of asphaltum composition and, itself being an insulating material, will supplement said composition in securing high insulating properties in the covering for the wire.

The covering stratum of cotton sliver saturated or impregnated with an asphaltum composition having a lower fusing point than the inner stratum of asphaltum composition, has high weather resisting properties protecting the dam strip and the inner stratum of asphaltum composition, is firmly adherent to the dam strip, and itself possesses insulating properties of a high order as has been demonstrated by the use of weatherproof wires, the sole weatherproof coating of which consists of the cotton sliver saturated or impregnated with the asphaltum.

In the wire of my present invention, this cotton sliver stratum has little effect in increasing the insulating properties of the covering of the wire, except in the event of impairment of the dam strip or the inner insulating stratum, due to the handling of wires when stringing same or of defects in the material of the inner stratum from other causes.

The invention consists primarily in an insulated wire consisting of a conductor wire and an insulating cover therefor embodying therein an inner stratum composed of a preformed body of asphaltum compound in continuous contact with, and closely adherent to, said conductor wire, an inclosing dam or barrier of non-deformable, electro-non-conductive material impenetrable by the heavier constituents of said asphaltum compound, a body of compacted, matted fibrous material inclosing and contacting with said dam or barrier, and confining strands exteriorly of said fibrous material, said fibrous body and said strands being impregnated with an asphaltum compound; and in such other novel characteristics as are hereinafter set forth and described, and more particularly pointed out in the claims hereto appended.

Referring to the drawing,

Fig. 1 is a perspective view of a short section of wire embodying the invention; and

Fig. 2 is a cross section thereof.

Like numerals refer to like parts in both of said views.

In the embodiment of the invention shown in the drawing, the insulated wire structure includes a conductor wire **10**, which may be the ordinary drawn wire or a stranded cable now commonly used in high voltage transmission lines. Enveloping the conductor wire or cable, and in continuous contact with and closely adherent thereto, is an inner stratum of an asphaltum compound. This stratum is of substantially uniform thickness throughout an entire length of wire, but may vary in thickness according to the size or service required of the wire. Ordinarily, the stratum **11** will have a thickness of from one-sixty-fourth to one-eighth of an inch.

The asphaltum compound of the inner insulating stratum **11** has a high melting point, in a range of from 250° to 300° F.

Inclosing the inner stratum **11** is a barrier or dam **12** of non-deformable material such as a smooth hard paper. Various kinds and grades of paper may be used, such as kraft or Express paper, although the exact paper used is not material so long as it has little inherent characteristics permitting stretch of the paper circumferentially of the wire, and is impenetrable by the heavier constituents of the asphaltum compound stratum **11**.

Inclosing and contacting with said dam or barrier is a body of fibrous material **13** such as cotton sliver, which is impregnated or saturated with an asphaltum compound having a lower melting point than the compound of the inner stratum **11**. The melting point of the saturant for the sliver body is within a range of from 150° to 200° F. The body of sliver **13** is compacted as it is applied to the wire, either by being wound spirally thereon or applied lengthwise of the wire, and a binding strand or strands **14** is applied exteriorly of the body of sliver to hold it under compression. These strands are deeply imbedded in the sliver and are spaced apart sufficiently to allow the asphaltum compound to penetrate between the strands into the body of the sliver.

In applying the strands, they are so tensioned as to secure the above result, and the presence in the insulation of the dam or barrier **12** is in part for the purpose of preventing these strands from forming a sequence of depressions in the inner stratum of asphaltum compound **11** sufficiently deep to result in material variation in the thickness of this stratum.

The method employed in covering the wire **10** is such as to impart to the inner stratum **11** sufficient hardness, compatible with the materials used, to avoid distortion thereof when applying the material of the dam or barrier.

The dam or barrier **12** is mainly for the purpose of holding the form of the inner stratum **11** during the production of the wire and while it is in use, of preventing the penetration of the material of the fibrous body into the inner stratum **11**, and of preventing the formation of alternate dents and ridges in the outer surface of said body **11** by the forcing of the sliver by the binding strand or strands into the inner stratum **11**. This dam or barrier also prevents the action of constituents of the compound with which the sliver body is impregnated, upon the compound of the inner stratum **11**. It also acts as an additional insulating medium to prevent blow holes or punctures by reason of air pockets or imperfect impregnation or saturation of the sliver body.

In a wire embodying the invention, there is a strong bond between the material of the dam or barrier and the inner stratum, and a relatively weaker bond between the sliver body and said dam or barrier.

When stripping wire, the sliver body may be readily separated from the barrier or dam, and the inner stratum **11**, while strongly adherent to the conductor wire, may be readily stripped from the wire.

While the binder strands and the sliver body may be used for giving an outside dress to a wire,

ordinary outside braid, as shown at 15, may also be used for this purpose.

Where I have referred to uniformity in thickness of the stratum 11, I do not intend to convey the idea that there is no variation in the thickness of the inner stratum 11, since in producing such wires mathematical accuracy is impossible, but the inner stratum 11 at every point of the wire will be approximately of the same thickness or of a thickness which will give the desired measure of insulating properties without danger of the formation of blow holes or punctures.

In the drawing, I have shown a spiral winding of the sliver about the paper dam or barrier and a spiral winding of a binding strand or strands 14 about the sliver.

An asphaltum compound having a melting point within the range stated has been found desirable, since when fused, it has a viscosity sufficiently low to ensure a fairly thorough impregnation or saturation of the cotton sliver of the body 12.

While I have referred herein to the chilling or hardening of the inner stratum 11, I have used such terms to indicate a condition in which the asphaltum compound is brought to its maximum hardness. These compounds never become really hard or brittle, but will remain, over a period of years, in a semi-plastic condition permitting the material to bend freely with the wire without likelihood of the cracking or breaking down of the insulation because of rupture of the covering compound. They are sufficiently hard to have no tendency to flow under temperatures to which they would normally be subjected while in use, although during production, when at a temperature approaching the melting point of the compounds, there is a tendency of the compound to flow.

When an outside braid is used, it is applied to the sliver stratum prior to saturating or impregnating this stratum with the low fusing asphaltum compound. After the sliver stratum has been thus saturated or impregnated, the wire is collected upon a spool and subsequently is subjected to the final finishing operations of smoothing, waxing and polishing. No outer covering, excepting binding strands, need be used.

A wire embodying the invention will carry extremely high voltages without likelihood of blowing or puncturing at the insulation. This is due in large measure to the use of the inner stratum of the covering body, and the protection afforded this body so far as the avoidance of distortion and the effects of weather thereon are concerned, by the dam strip and the impregnated sliver outer stratum. The two outer strata contribute toward the availability of the wire in conducting such high potential currents, since, in addition to the insulating properties of the dam and of the covering sliver, they protect the inner stratum and prevent such short circuiting through the insulation as might occur from the breaking down of said inner stratum.

While the wire, in laboratory bending tests, shows no depreciation in the insulation, such wires, in actual use, are subjected to continued severe strains, the effects of which are guarded against by the particular arrangement of the insulating strata herein described.

It is not my intention to limit the invention to the precise temperatures of the asphaltum composition used, nor to the dimensions herein stated, since it is obvious that such are not critical. It has been found, however, that the use of an asphaltum composition having too high a fusing temperature will char the cotton sliver fibers to an extent to impair the efficiency of the impregnated sliver stratum.

Having described the invention, what I claim is new and desire to have protected by Letters Patent, is:

1. An insulated wire consisting of a conductor wire and an insulating cover therefor embodying therein an inner stratum of asphaltum compound having a high melting point in continuous contact with, and closely adherent to, said conductor wire, an inclosing dam or barrier of non-deformable material impenetrable by the heavier constituents of said asphaltum compound, and a body of fibrous material inclosing and contacting with said dam or barrier, said fibrous body being impregnated with an asphaltum compound having a relatively lower melting point than the asphaltum compound in said inner stratum.

2. An insulated wire consisting of a conductor wire and an insulating cover therefor embodying therein an inner stratum of asphaltum compound having a high melting point in continuous contact with, and closely adherent to, said conductor wire, an inclosing dam or barrier of a smooth, non-stretchable paper impenetrable by the heavier constituents of said asphaltum compound, and a body of fibrous material inclosing and contacting with said dam or barrier, said fibrous body being impregnated with an asphaltum compound having a relatively lower melting point than the asphaltum compound in said inner stratum.

3. An insulated wire consisting of a conductor wire and an insulating cover therefor embodying therein an inner stratum of asphaltum compound having a high melting point in continuous contact with, and closely adherent to, said conductor wire, an inclosing dam or barrier of a smooth, non-stretchable paper impenetrable by the heavier constituents of said asphaltum compound, a body of fibrous material inclosing and contacting with said dam or barrier, and binding strands about and imbedded in said body, said fibrous body being impregnated with an asphaltum compound having a relatively lower melting point than the asphaltum compound in said inner stratum.

4. An insulated wire consisting of a conductor wire and an insulating cover therefor embodying therein an inner stratum of asphaltum compound having a melting point within a range of from 250° to 300° F. in continuous contact with, and closely adherent to, said conductor wire, an inclosing dam or barrier of a smooth, non-stretchable paper impenetrable by the heavier constituents of said asphaltum compound, a body of fibrous material inclosing and contacting with said dam or barrier, and binding strands about and imbedded in said body, said fibrous body being impregnated with an asphaltum compound having a melting point within a range of from 150° to 200° F.

WILLIAM E. COOK.