

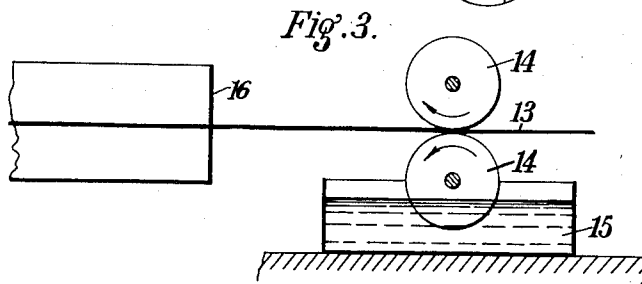
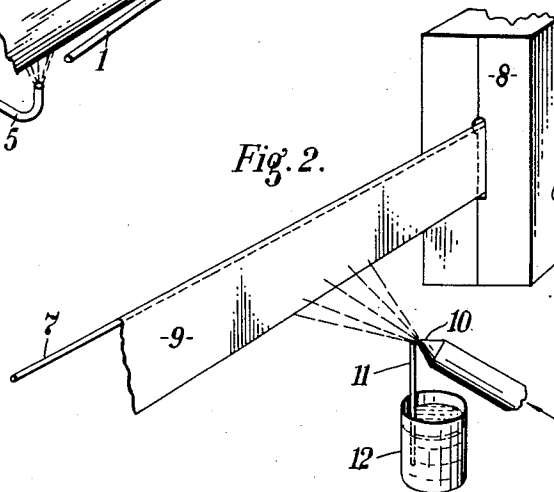
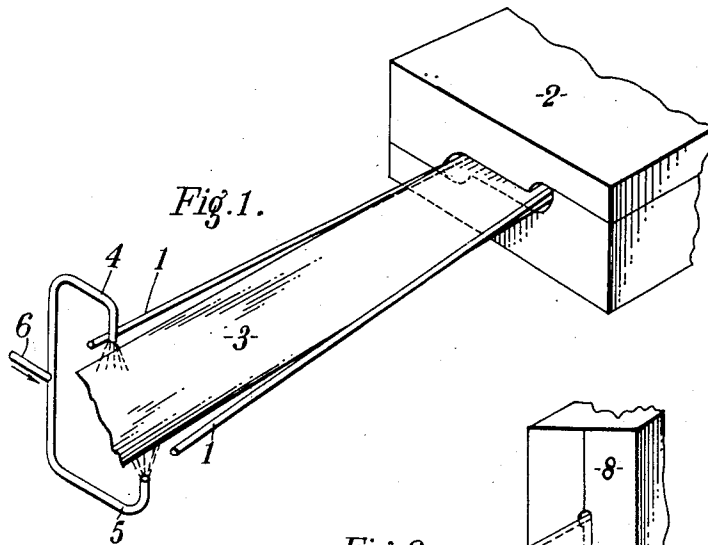
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S. W. PERGUNAS ET AL

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HUMIDIFYING PROCESS IN ELECTRIC CABLE INSULATION MAKING

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Inventor
S. W. PERGUNAS - L. COWAN

By *Philip M. Bolton*
Attorney

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HUMIDIFYING PROCESS IN ELECTRIC CABLE INSULATION MAKING

Sidney Wilfred Pergunas and Leslie Frank Cowan, London, England, assignors to International Standard Electric Corporation, New York, N. Y.

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8 Claims. (Cl. 154—2.24)

This invention relates to the manufacture of electric cables and has particular reference to the process of applying paper insulation to conductors for use in multi-conductor telephone cables.

In the copending application, Serial No. 201,348 filed December 18, 1950, there is described a process for making pairs of insulated conductors in which two conductors are passed simultaneously with a strip of paper through a heated die, the shape of the die being such that the paper is folded in S formation around and between the two wires thus forming an insulated pair.

As explained in that specification the strip of paper is supplied in an undried condition and the evolution of water vapour as steam facilitates the passage of the paper through the folding die. In addition the folding of the paper while it is giving off its moisture in the heated die results in an ironing action which causes the paper to be folded round each wire in the form of a permanently shaped tube which cannot readily be detached from the wire.

In the copending application, Serial No. 456,266 filed September 15, 1954 there is described a further development of the process in which single conductors are insulated. This has been found possible because of the unexpected firmness developed by the insulating paper after it has been formed around the conductor in the heated die.

Under normal conditions with the atmospheric relative humidity about 60% it is found that the insulating paper contains about 8% by weight of water. However weather conditions are changeable and during and after a prolonged spell of high relative humidity the moisture content of the paper may be found to be in excess of 8% while after a prolonged spell of very dry weather the moisture content may fall considerably and even result in the ironing process in the heated die being unsatisfactory.

In some climates it is possible that the relative humidity would often be so low that the process could not be successfully operated. In any case the variations in relative humidity must result in variations in the electrical characteristics of the product.

Attention has therefore been directed to the effects of controlling the moisture content of the paper. It has been found, as would be expected, that if very dry paper is used the ironing effect is imperfect and the paper tends to unroll on leaving the die. At the other extreme it has been found that if very wet paper is used it wraps itself very closely around the conductor. In this case the mutual capacity between the conductors, particularly in the case of the S formation, is very high and possibly for many purposes excessive. The insulation is however mechanically excellent and for some purposes this may be more important than low mutual capacity.

Although the process has been reasonably satisfactory with the ordinary condition of approximately 8% humidity experiments have shown that a more satisfactory

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product is obtained if the moisture content is increased providing it is not excessive.

Several methods for dampening the paper are available. In one method steam jets are directed onto the paper just before it enters the forming die. This means in effect that the paper passes through an atmosphere with a relative humidity of 100% but the resulting moisture content of the paper is controlled by the speed of the paper and the size of the steam jet. This method has an advantage when insulated pairs with S shaped insulation are being formed. It has been found that the paper tends to curl when the jet is applied so that by applying one jet to one half of one side of the paper and a second jet to the other half of the paper and from the other side the strip of paper can be made to commence to take up the S formation before it enters the die.

If single conductors are to be insulated a single steam jet is applied to the whole of one surface of the paper strip.

An alternative method of dampening the paper is to direct very fine sprays of water on it, preferably one on each surface, before it enters the die. This requires very careful control if the paper is not to be made too wet but this method has been used successfully.

Yet a third method is provided by passing the paper strip between moistened sponge rollers and this method lends itself to easy control of the amount of moisture applied.

A further method is to supply the paper from pads (rolls) which have been held in a chamber at a controlled humidity for a time sufficiently long to ensure that the paper is uniformly humidified.

Yet another method is to pass the strip of paper through a humidifying chamber after it is rolled off the supply pad and before it enters the die.

The invention therefore comprises a method of insulating electric conductors by the longitudinal folding of a strip of paper in a heated die so that it lies around the conductors, characterised in this that the strip of paper is subjected to a humidifying process to impart a controlled moisture content thereto immediately before it is supplied to the heated folding die.

As the paper supplied to the die according to this invention may have a higher moisture content than that previously used it may be found necessary to dry the insulated conductor as it leaves the folding die. This can be done by passing the insulated conductors through a short sizing die maintained at a temperature above that of the folding die.

Embodiments of the invention will now be described with reference to the accompanying drawing in which:

Fig. 1 illustrates the dampening of the paper by means of steam jets;

Fig. 2 illustrates the dampening of the paper by means of a water spray and,

Fig. 3 illustrates the dampening of the paper by passing it between moistened sponge rollers.

In Figure 1 there is shown a forming die such as is described and illustrated in the aforesaid copending application Serial No. 201,348 which is employed to form insulated pairs with the insulating paper wrapped around the two conductors in S formation. It can be seen that the two conductors 11, are passed into the die 2 simultaneously with a strip of paper 3 which is then folded within the die into S formation around and between the conductors. In the present invention steam jets 4 and 5 are directed against the paper strip 3. The steam is supplied through the inlet 6. As shown steam jet 4 is directed against one half of the upper surface of the strip and jet 5 against one half of the lower surface. Apart from the fact that these jets increase the moisture content

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of the paper strip they produce a tendency in the strip to curl in the desired directions and therefore facilitate the forming operation. The speed of the paper strip and the emission of steam from the jets must be so controlled as to result in the desired humidification of the paper strip which is determined by the desired result.

In Figure 2 there is shown a forming die such as is described in the aforesaid copending application Serial No. 456,266 in which a strip of paper is wrapped around a single wire to form an insulated conductor. The conductor 7 is passed into the die 8 together with a strip of paper 9. As shown in the figure a jet of compressed air from an orifice 10 is blown against the upper end of a tube 11 the lower end of which is immersed in a water container 12. This water spray is directed against one side only of the paper strip 9 and increases the moisture content of the paper, and also induces a tendency for the paper strip to curl in the desired direction. Although a water spray is illustrated in Fig. 2 the same result can equally be achieved by means of a single steam jet such as is illustrated in Fig. 1.

In Fig. 3 a third process for increasing the moisture content of the paper strip is illustrated. A paper strip 13 is passed between two sponge rollers 14, the lower one of which dips into a water bath 15 and then led to the die 16. This die, which is only represented schematically can be either of the kind illustrated in Fig. 1 designed to form S shaped insulation or of the kind illustrated in Fig. 2 designed to wrap the strip of paper around a single conductor.

While the principles of the invention have been described above in connection with specific embodiments, and particular modifications thereof, it is to be clearly understood that this description is made only by way of example and not as a limitation on the scope of the invention.

What we claim is:

1. A method of insulating electric conductors by the longitudinal folding of a strip of paper in a heated die so that it lies around the conductors, characterized in that the strip of paper is subjected directly to a jet of steam to impart a controlled moisture content thereto immediately before it is supplied to the heated folding die.

2. A method according to claim 1 in which a first steam jet is applied to one half of one surface of the paper strip

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and a second steam jet is applied to the opposite half of the other surface of the paper strip.

3. A method of insulating an electric conductor by applying a strip of paper therearound, comprising subjecting substantially the complete paper strip to a humidifying process to impart a controlled moisture content thereto, longitudinally folding said moistened strip of paper around said conductor, and heating said paper sufficiently so that the reaction of the heat and moisture sets the paper in its folded position.

4. A method according to claim 3 in which the humidifying process comprises the application of a water spray to at least one side of the paper strip.

5. A method according to claim 4 in which a first water spray is applied to one half of one surface of the paper strip and a second water spray is applied to the opposite half of the other surface of the paper strip.

6. A method according to claim 3 in which the humidifying process comprises passing the paper strip between two rollers one of which is moistened by being partially immersed in a water bath.

7. A method according to claim 3 in which the humidifying process comprises the use of rolls of paper strip which have been held in a humidifying chamber at a controlled humidity for such time as to ensure that the paper is uniformly humidified.

8. A method according to claim 3 in which the paper strip is passed through a humidifying chamber maintained at a controlled humidity immediately before it is passed to the folding die.

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