June 2, 1936. H. G. KNODERER 2,043,044

ELECTRIC CABLE

Filed March 5, 1935

Fig. 1.



Fig. 2.

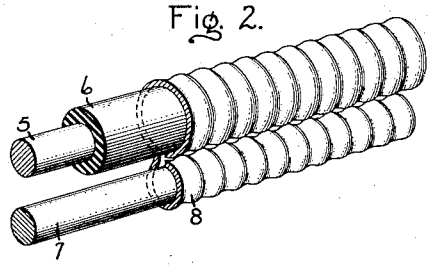


Fig. 3.

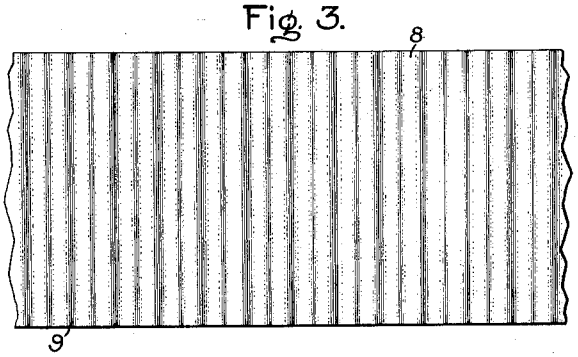


Fig. 4.



Fig. 5.

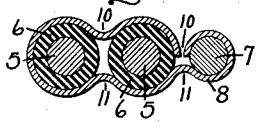
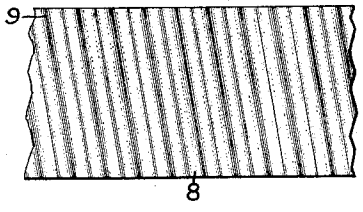


Fig. 6.



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2,043,044

ELECTRIC CABLE

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4 Claims. (Cl. 173—266)

For some kinds of electrical installations, as for example the wiring of buildings, it is desirable to utilize flexible cable comprising an insulated wire carrying current at line potential, an uninsulated wire carrying current at ground potential, and an enclosing flexible metallic armour, the uninsulated wire and armour both being connected to ground. It has been proposed for such cable to enclose the insulated and uninsulated wires in a cylindrical armour made of spirally wrapped interlocking steel tapes, commonly referred to as BX, the cross-sectional area of the space within the armour being appreciably larger than the combined cross-sectional areas of the wires. Such being the fact, it follows that more metal is used in the armour than is necessary for protective reasons. Such a cable while less expensive than one of the same type where both of the conductors are insulated is nevertheless a substantial item of expense in wiring a building.

My invention has for its object the provision of a cable of improved and simplified construction which has the advantages of the type of cable above mentioned and is less expensive to manufacture and is lighter in weight.

For a consideration of what I believe to be novel and my invention, attention is directed to the accompanying description and the claims appended thereto.

In the drawing, which is illustrative of my invention, Fig. 1 is a cross-section of my improved cable; Fig. 2 is a perspective view thereof; Fig. 3 is a detail view of the armour; Fig. 4 is a small section showing the corrugations in the armour; Fig. 5 is a cross-section of a three-conductor cable, and Fig. 6 illustrates a modified arrangement of the corrugations of the strip.

In the drawing, **5** indicates a conductor which is intended to be connected to a source of current supply as a lighting main, for example. Around it is insulation **6** of any suitable character as, for example, rubber and a fabric, the latter covering the former. Besides acting as an insulation, the rubber prevents access of moisture to the conductor. The second or grounded uninsulated conductor **7** extends parallel with the first and in the same plane.

In order to hold the two conductors or wires in their proper relative positions and at the same time protect them against external injury, an armour **8** is provided. To reduce the amount of metal required in its construction and thus reduce the cost of manufacture and the cost of transporting the finished product, the armour is made of thin gauge tough metal which is capable of being bent at relatively sharp angles without fracture. As an example, I may use aluminum or an alloy containing an appreciable percentage of aluminum, or copper. For some purposes, a lead covering will afford the necessary protection. The material for the armour is cut or formed into relatively narrow strips. To increase their ability to bend without injury, each strip is passed between one or more pairs of rolls to corrugate it. The corrugations which are indicated at **9** on an enlarged scale in Fig. 4 are desirably relatively small and shallow. The corrugations extend crosswise of the length of the strip with the pitch thereof comparatively small, say of the order of sixteen per inch of length of the finished strip. They may be truly perpendicular to the sides of the strip or they may be inclined somewhat to the perpendicular as shown in Fig. 6. The corrugations appreciably improve the bending quality of the finished cable by opening or stretching on the outside of the curve of the bend and closing or compressing on the inside of the curve or bend. After a strip is formed, it is folded over the insulated and bare wires in a manner to enclose them. This may be done in any suitable way. A simple way is to pass the strip through dies to give it a substantially U-shape, thereby forming an open trough into which the wires are laid side by side. After this, the sides of the U or trough are bent over in such a way as to completely enclose the wires. On one side, the armour snugly encloses the insulation **6** and on the other, the bare or uninsulated wire **7**, making a firm electrical and mechanical contact therewith. The closing operation, or a separate operation, also causes shallow insets **10** and **11** to be formed between the two wires so that the final shape in cross-section is substantially that of a figure **8**. The effect produced in forming these insets is to cause the metal of the armour to snugly fit the major portion of the peripheral surfaces of both wires. To shield or protect the edges of the armour, they are located in one of the insets. The various operations required in forming the armour and closing it about the conductors have been described as being separate and successive steps but whenever convenient or desirable, two or more operations may take place simultaneously or practically so. No attempt is made to joint the adjacent bent-over edges of the armour since no union or seal is required. Any foreign matter, such as moisture, does not have access to the conductor **5** because of the insulation thereon, and moisture acting on the bare conductor can

do no harm because it and the armour are both grounded.

In Fig. 5, I have shown my invention in connection with a three conductor cable. In this case, the insulated wires **5** are assumed to be connected to the outside wires of a three wire circuit, the bare wire **7** and the armour **8** forming the grounded neutral. The method of manufacture is the same as that previously described with the shapes of the tools or dies modified wherever necessary to conform to the shape of the finished product. This form of the invention also follows that previously described in that insets are provided between each pair of conductors with the folded over edges of the armour located in one of them.

A cable such as I have disclosed herein has the advantage that it is relatively inexpensive because the amount of metal in the armour is reduced to a minimum, and because the insulation is omitted from one wire. It is light in weight for the same reasons which decreases shipping costs. The kind of metal used is initially less expensive than the steel used in making the ordinary or so-called BX cable. Because the armour is thin and closely corrugated, the cable can readily be bent to conform to any desired shape during the installation of the wire in a building. Since both the grounded wire and the armour are in intimate contact throughout their respective lengths, even a defect in the armour caused by improper handling will not interrupt the continuity of the ground or return circuit of the installation. By utilizing the armour and bare wire jointly as a conductor instead of either one separately, a certain total saving of metal is also obtained. However, it is desirable that sufficient metal be used not only to effect a good ground or return circuit but to afford ample mechanical protection against external injuries.

By utilizing armour of the character disclosed, a further advantage is obtained because it is unnecessary to use a hack saw to cut it as is the case with BX armour. Unless such a saw is properly used, it results in leaving a rough jagged edge on the steel which cuts the insulation and causes short circuits. By firmly holding my improved cable near the cut end in a suitable tool, the armour can be raised from the bare wire at one end and by the use of pliers, the part so raised may be torn off, whereby any rough edge at the region of separation will be outward and away from the insulation so that cutting of the insulation will not take place.

I have described my invention with particular reference to cable for wiring buildings but it is not necessarily limited to such use nor to such small wires as are illustrated.

What I claim as new and desire to secure by Letters Patent of the United States, is:—

1. A cable comprising an insulated wire, an uninsulated wire, the two wires being arranged side by side, and an armour therefor comprising a metal strip folded over both wires so as to conform to the peripheral surfaces thereof and in electrical contact with one of them, with the open edges of the strip adjacent each other, said strip being corrugated in a direction cross-wise of its length.

2. A cable comprising an insulated wire, an uninsulated wire, the two wires being arranged in parallel side by side relation, and an armour therefor comprising a thin metal strip folded sidewise over the wires and snugly and substantially covering the peripheral surfaces thereof, the adjacent edges of the strip being open, said strip having shallow corrugations extending between the sides thereof.

3. A cable comprising an insulated wire and an uninsulated wire arranged side by side, and an armour therefor comprising a thin metal strip folded edgewise over the wires into electrical contact with the uninsulated wire throughout its length, the edges of the strip being disconnected, said strip having insets between the surfaces of the wires with the adjacent edges of the strip located in one of the insets.

4. A cable comprising insulated wires and a bare wire, said wires being arranged side by side, an armour therefor comprising a thin strip of metal folded sidewise over the wires with the edges thereof adjacent but out of engagement, said armour having insets between each pair of wires with the edges of the strip located in one of them.

HOMER G. KNODERER.