Dec. 9, 1958 E. P. VON BERGEN 2,863,171

APPARATUS FOR COATING STRANDED CONDUCTORS FOR ELECTRIC CABLES

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FIG. 1.

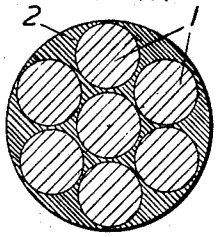


FIG. 2.

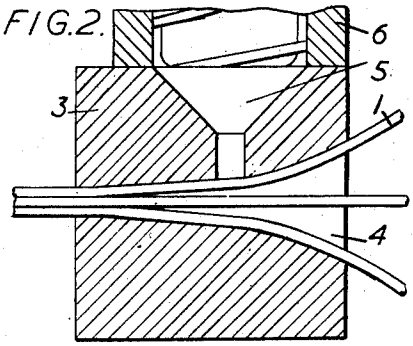


FIG. 3.

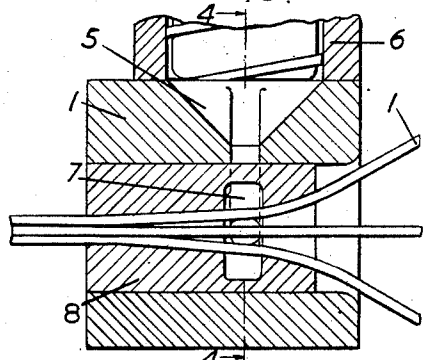
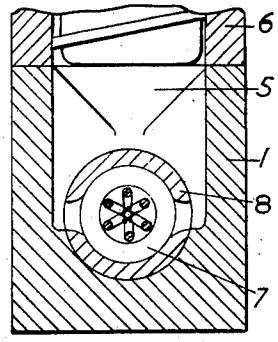


FIG. 4.



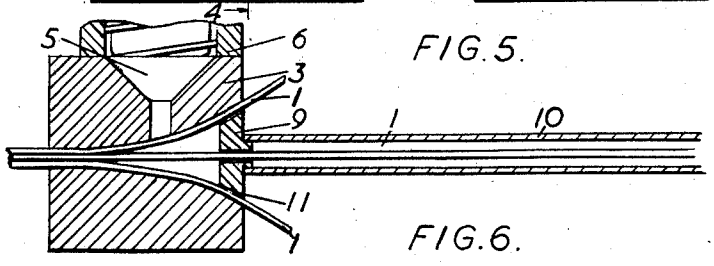
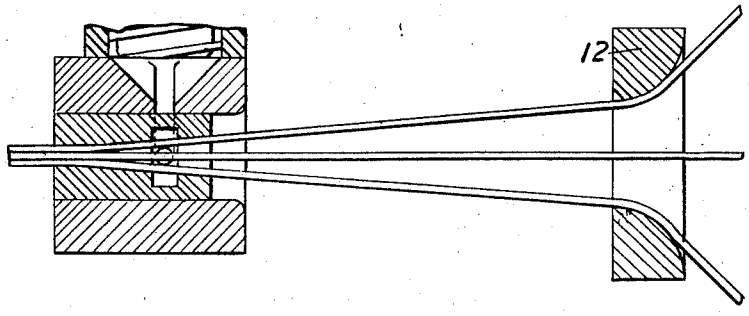


FIG. 5.

FIG. 6.



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APPARATUS FOR COATING STRANDED CONDUCTORS FOR ELECTRIC CABLES

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5 Claims. (Cl. 18—13)

This invention relates to apparatus for the manufacture of stranded conductors for electric cables of the type in which the interstices between the individual wires and/or tapes are filled with a barrier material. Such stranded conductors are particularly useful for the manufacture of submarine cables.

The object of the invention is to provide an apparatus to fill with a suitable compound the interstices of a multi-conductor core for cables, the core being composed of several strands of wire, or of wire and tapes herein generally referred to as conductors. The compound will usually consist of one of the softer (low viscosity) grades of polyethylene, either alone or mixed with other materials, or it may be any other suitable material.

The principle of the apparatus operation according to this invention consists in applying the compound between the various conductor wires and/or tapes, at the point where the outer layer or layers of wires or tapes are closed down onto the central wire or wires, in the course of manufacture of the complete core.

The compound will normally be brought to a suitable liquid consistency by heat, and it may or may not be necessary for any particular application of the apparatus, to heat the wires or tapes before they reach the point of application of the compound.

The invention will be described with reference to the accompanying drawings in which:

Fig. 1 is a cross-section of a finished stranded conductor with the barrier compound applied according to this invention.

Fig. 2 is a sectional elevation of a closing die with extrusion press according to this invention.

Fig. 3 is a sectional elevation of a modified form of closing die with extrusion press according to the invention.

Fig. 4 is a cross-sectional elevation of the die on the line 4—4 of Fig. 3.

Fig. 5 illustrates a modification of the invention and is a sectional elevation of the closing die combined with a plug device carried on the stranding machine, and

Fig. 6 illustrates a further modification of the invention and shows the closing die combined with an auxiliary closing die.

In Fig. 1, which shows a stranded conductor manufactured according to the invention, the conductors are indicated by the reference **1** and the barrier compound by the reference **2**. It will be seen that this compound effectively fills the interstices between the conductors so that air is excluded and an effective barrier is provided against the passage of liquid along the conductor. It is not the purpose of the barrier compound to insulate the conductors from each other and it is desirable that these should maintain electrical contact throughout their length. The stranded conductor thus produced would be insulated and sheathed in the usual way according to the type of cable to be manufactured.

It is usual to use a suitable closing die on the stranding machines which make multiconductor copper wire strands. This die serves the purpose of guiding the various wires or tapes and pressing the outer layer or layers of wires or tapes evenly around the central wire or wires. For the purpose of this invention, this die is modified in a manner to be described, and is mounted on the end of the barrel of a conventional plastics screw extrusion machine. This extrusion machine is mounted in a suitable position relative to the stranding machine, such that the die mounted on the extrusion machine, occupies the position which would be occupied by an ordinary closing die on the stranding machine.

Fig. 2 illustrates a modified closing die according to the invention which consists of a block of metal **3** of a suitable length (the length being varied to suit the particular application) with a suitably shaped tapering hole **4** bored through it, through which the conductors **1** will pass. The die is provided with a channel **5** communicating with the barrel **6** of the plastics extrusion machine, so that the compound, which is passed through the extrusion machine and heated in a conventional manner is led from the end of the barrel of the extrusion machine to the tapering hole **5** in the closing die, where it is brought into intimate contact with the conductors **1** and is forced through the spaces between them. As these spaces are reduced as the wires or tapes pass through the die, the compound will fill the spaces completely, so that when the fully formed multi-conductor core emerges from the closing die, the interstices are completely filled with compound as shown in Fig. 1. A means of heating the closing die may be provided but is not shown in the drawings.

As previously mentioned, it may be found desirable to pre-heat the wires or tapes. It may also be found desirable to provide a means of synchronising the speed of the plastics extrusion machine with the speed of the stranding machine.

Figs. 3 and 4 illustrate a further modification of the closing die. In this case an annular groove **7** is provided in the bore **4** of the die, into which the channel **5** providing passages for the compound would lead. Thus a better distribution of the compound would be obtained. For convenience of manufacture, such a die may conveniently be made in two parts, as shown in the figure. The inner part **8** may be changed as required to suit the size of the finished core.

For use with either of the closing dies described above, it may be desirable to insert a plug in the larger end of the tapering hole **4** of the closing die, as shown in Fig. 5. This plug **9** is mounted on a sleeve **10** attached to the rotary carriage of the stranding machine (not shown), and fits closely into the closing die, apart from a suitable clearance left on account of the fact that the plug rotates while the closing die is stationary. Suitable channels **11** are made in the plug to allow the passage of the conductors **1**.

A further variation of the method, to reduce the angle at which the conductors enter the closing die, is to use two closing dies at a suitable distance apart, this distance being from a few inches to several feet as required and as indicated in Fig. 6. The first closing die **12** is a conventionally shaped die positioned and mounted in a conventional manner, but with an oversize hole, so that the various wires and/or tapes are not completely closed up, but have spaces left between them. They then pass into the second closing die, which is a modified die, according to either of the patterns described above, where compound is forced into the space of the multi-conductor core, and the various wires and/or tapes of the core are completely closed up, all as previously described.

By using a moderately large distance between the closing dies the space between them could be used for preheating the conductor, otherwise the dies may be quite close together. The size of the first die depends on its distance from the modified second die.

It will be seen therefore that the invention provides a simple apparatus for the manufacture of multi-conductor strands of the barrier type which are particularly applicable for submarine cable cores insulated with Polythene or Polythene compound.

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 I claim is:

1. Apparatus for manufacturing a multi-strand electric cable consisting of a plurality of conductors provided in the interstices therebetween with a barrier of insulating material, comprising a closing die formed with a tapered bore, an extrusion barrel and a passage extending through the wall of said die intermediate the ends of said tapered bore and connecting said bore with said extrusion barrel.

2. Apparatus according to claim 1, further comprising an annular passage in said bore of the closing die to surround the conductors passing therethrough and wherein said passage in the wall of said die leads into said annular passage.

3. Apparatus according to claim 1 wherein the closing die is constituted by a removable sleeve within the die block for the purpose described.

4. Apparatus according to claim 1 wherein the opening end of the closing die is closed by a plug shaped to allow of the passage of the conductors therethrough and mounted to rotate with said conductors.

5. Apparatus according to claim 1 combined with an auxiliary closing die spaced apart from the main closing die for the purpose of reducing the angle of the conductors entering the main die.

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