Aug. 21, 1934. H. SONNENFELD 1,970,778

CABLE MANUFACTURE

Original Filed Oct. 21, 1926

Fig. 1.

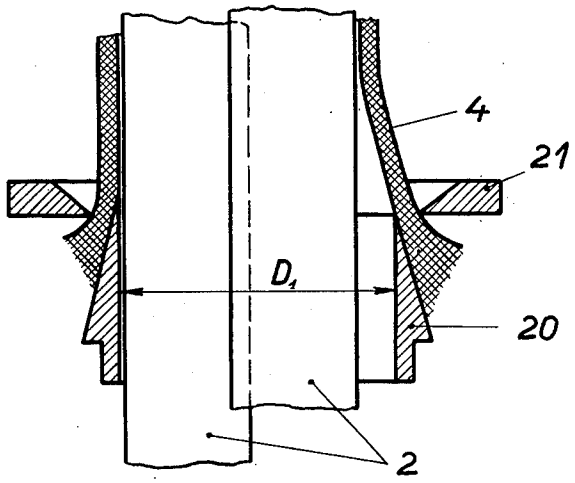
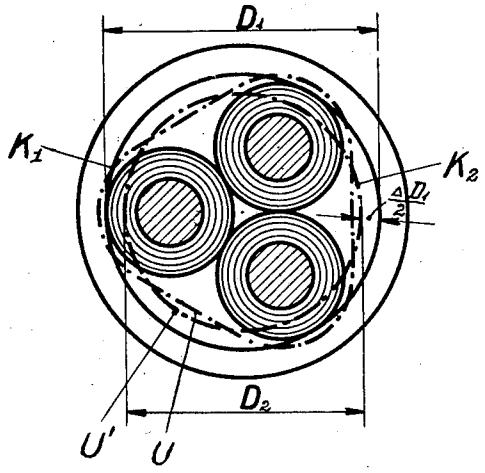


Fig. 2.



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UNITED STATES PATENT OFFICE

1,970,778

CABLE MANUFACTURE

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Original application October 21, 1926, Serial No. 143,274, now Patent No. 1,838,332, dated December 29, 1931. Divided and this application November 2, 1927, Serial No. 230,620. In Czechoslovakia June 25, 1926

2 Claims. (Cl. 173—244)

Multiple conductor cables having three or more conductors have been constructed hitherto in such a way that the sheathed cable would have a cylindrical cross section. On this account the cross section of the three or more stranded conductors was supplemented by the insertion of insulating fillers between the individually insulated conductors to round out the cable core. The sheathing of the built-up cable core was afterwards perfected in a well known manner by means of an also well known lead sheath press.

To be capable of carrying a greater load as well as to minimize the consumption of lead and insulating materials, it is important that the cross section of the three or more conductor cables be made as small as possible. Preferably the cross section will not be circular as hitherto, but of a polygonal shape. The approximate polygonal shape is attained by the insertion of insulating fillers, which being smaller, do not supplement the cross section of the stranded three or more conductor cables to a round shape, but only to a shape defined by the three or more stranded conductors and the tangents to the same. It is an object of this invention to provide a method of sheathing the stranded or unstranded conductors and insulating fillers in such a way that the inner surface of the lead sheath lays close at every place to this polygonal shaped cable structure.

If the several conductors were arranged in parallel in the cable, covering of the built-up cable body of polygonal cross section could be effected by means of an ordinary cable press, the matrix and counter-die through which the metal (e. g. lead) is formed being of polygonal cross section. However, it usually is desirable to twist the several conductors of a multiconductor cable. Therefore the shape of the lead sheath is not only a simple polygonal one, but the lead sheath progresses spirally. The pitch of that spiral conforms to the twist length of the stranded cable. In cases where the cable is twisted and the matrix and counter die are of polygonal cross section, a method is employed according to this invention in which the cable is caused to rotate in such a way as it passes through the lead press that this rotation combined with the progressive movement of the cable imparts the desired twist. This movement is accomplished by rotation of the cable drum from which the cable is unwound as it passes to the counter die in the cable press, and by rotation of the cable drum on which the lead sheath covered cable is to be wound.

According to another method of carrying the invention into practice the cable which is built up of separate conductors twisted together makes a purely longitudinally progressive movement during its passage through the cable press. With this method the matrix and counter die of the cable press have a rotational movement imparted to them corresponding to the twist upon the several conductors.

In another method according to the invention the sheathing of the built-up body of polygonal cross section with the metal is effected by the aid of a matrix and counter die of circular cross section.

In Figure 1, 2 denotes the three separate conductors surrounded with insulation, which form the built-up body of polygonal cross section to be sheathed with lead. 21 denotes the matrix of the cable press and 20 the counter die thereof. The matrix and the counter die are so constructed that they provide a circular cross section for the metal to be extruded.

It would be essential that the periphery of the circular opening of the counter die 20 be exactly as large as the inner periphery of the lead sheathing shown in cross section and which is pressed around the cable, if we suppose that a contraction of the lead sheathing would not take place when pressed on. The diameter of the circular opening of the matrix 21 is selected according to the desired thickness of the lead.

In the operation of extruding the lead, a hollow lead cylinder circular in cross section would be formed at first, but this will however at once adapt itself to the peripheral shape of the multiple conductor cable, and since the inner periphery of the circular cross section of the lead sheathing according to the present invention is equal to the periphery of the multiple conductor cable, the lead sheathing would fit itself closely to the multiple conductor cable and assume its required shape.

The diameter of the circle circumscribed about the polygonal cross section is larger than the diameter of the circle of the same circumference as the polygonal cross section. It follows that the diameter of the counter die should be chosen smaller than the diameter of the circle which may be circumscribed about the polygonal cross section. Therefore the cable structure could not pass through the counter die, and the sheathing would be impossible.

But we can see that as the extruded plastic metal emerges from the sheathing press there takes place, as a result of a sudden cooling and a contraction arising from mechanical causes, a

shrinking (see Fig. 1) of the extruded hollow metal cylinder 4.

This contraction is allowed for by choosing the proper diameter of the counter die for sheathing cables not only of the usual round construction, but also for polygonal cross section cables. In consequence we have to choose a counter die the diameter of which is an amount larger than the diameter of the cable structure to which the lead sheath is to be applied. In consequence of that enlargement we find that contrary to the mentioned geometrical circumstances the opening of the counter die is sufficiently large to permit the cable structure to pass, because the inner diameter of the counter die is larger than the diameter of the circle circumscribed about the cable core cross section. The passage of the cable core is possible and there is no hindrance for a good sheathing process. Naturally there is one condition to be fulfilled according to the invention.

The condition is that the diameter D_1 of the circular counter die be chosen at least so large that the inner periphery U' of the circular hollow cylinder, which will be formed in consequence of the above mentioned shrinking, is equal to the external periphery U of the body of polygonal cross section which is to be sheathed with lead. To still further explain the possibility of sheathing such a body with a cable sheathing press of circular cross section at its exit the following description is given:

The counter die 20 is of a diameter D_1 which may conveniently be slightly greater but must be at least as great as the diameter D_1 of the circle K_1 which encloses the body of polygonal section, so that the body can be passed through the opening of the counter die 20. The diameter D_1 of the emerging metal cylinder 4 shrinks however under the influence mentioned above by a certain amount ΔD_1 so that it would acquire the diameter $D_1-\Delta D_1=D_2$ of the circle K_2 Figure 2, if the emerging lead body were formed into a hollow circular cylinder as would be the case for example when sheathing a body of circular cross section. As however in the present case a cable body of polygonal cross section is being sheathed a circular hollow cylinder will not be formed.

It has however been found that for the present special case where a body of polygonal cross section is to be sheathed the amount ΔD_1 by which the inner diameter of a counter die must be made greater than the diameter D_2, need only be sufficient to enable the body of polygonal cross section to pass through the circular counter die.

The internal diameter D_1 can be easily determined from the relationship $D_1=D_2+\Delta D_1$, as the magnitude ΔD_1 can be easily determined empirically and the magnitude D_2 results from the periphery of the body to be sheathed.

This application is a division of my application filed October 21, 1926, Serial No. 143,274, which application was patented on December 29, 1931, Patent No. 1,838,332.

Having now particularly described and ascertained the nature of my said invention, and in what manner the same is to be performed, I declare that what I claim is:

1. The method of sheathing a multiple conductor cable having three or more individually insulated conductors assembled to form a cable core substantially polygonal in cross section, which method comprises extruding upon the cable core a lead tube which is circular in cross section having at the extruding temperature an internal diameter substantially equal to the diameter of the smallest circle which can be circumscribed about the cable core, and permitting the lead tube to cool to cause it to contract and conform closely to the polygonal contour of the cable core.

2. The method of sheathing a multiple conductor cable having three or more individually insulated conductors assembled to form a cable core substantially polygonal in cross section, which method comprises extruding upon the cable core a circular metal tube having at the extruding temperature an internal diameter at least as great as the diameter of the smallest circle which can be circumscribed about the cable core and using for the tube a metal which contracts sufficiently on cooling to conform closely to the polygonal contour of the cable core.

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