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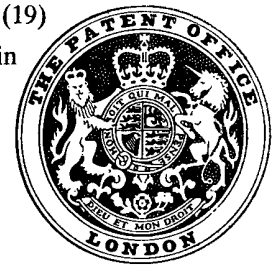

(54) IMPROVED METHOD OF CORRUGATING CABLE SHEATHING

(71) We, LIGNES TELEGRAPHIQUES ET TELEPHONIQUES - 89 Rue de la Faisanderie - 75782 Paris Cedex 16 - France - a Body Corporate organized according to the laws of France, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:

The present invention relates to an improvement in cable sheaths of the type using a double metallic sheath, the first of a highly electrically conductive metal (copper or aluminium) intended to act as a shield, while the second is of a more rigid metal (for example steel) and confers the necessary mechanical strength. To enable such cables to be wound onto drums it is customary to corrugate the sheath. The invention is directed more particularly to a method of corrugating sheaths consisting of two strips of different metals permitting the simultaneous corrugation of both metallic sheets and the formation of a single composite strip likewise with a view to permitting the mechanical laying of the cable.

Solutions to the problem to be solved by the present invention have already been proposed and have been the subject of publications, such as French patent n° 1,264,169 filed by Western Electric C° on 4th July 1960. This patent describes a method according to which the two metallic strips are corrugated separately with different pitches, the matching between the corrugations being ensured by tensioning the corrugated strip following the shorter pitch by application to the corrugations of the second strip.

The present invention is based on the corrugation of one of these strips which afterwards serves as a die for corrugating the second, previously glued, strip. The adhesion obtained between the two strips favours the corrugation of the second strip and produces, by moderate force, the coincidence of the corrugations of the two strips. According to a feature of the invention the first-corrugated strip is that which is constituted by the less elastic metal. According to a further feature of the invention, the more malleable strip has the continuous application of adhesive close to the corrugating station, which is itself adjacent to the shaping station of the sheath round the cable.

The method of continuously corrugating two metallic strips of different rigidities intended to constitute a single strip according to the invention consists in:

(a) guiding the first strip of maximum rigidity between two toothed pinions so that the axes of those parts of the strip located upstream and downstream of the pinions respectively are parallel and coplanar so that the strip remains applied to half the circumference of the first of the pinions;

(b) applying adhesive to the face of the second strip of minimum rigidity which will be in contact with the first strip;

(e) guiding said second strip so that its longitudinal axis is inclined with reference to the longitudinal axis of the first strip upstream of the said pinions;

(d) pressing the second strip onto the first along a part of the zone where the latter is in contact with one of the pinions; and

(e) driving the composite strip by a unit located downstream of said pinions.

According to another feature of the invention, the corrugation of the more malleable strip is effected with no drawing motor, the drive being provided by the strip itself.

The embodiments of the present invention are particularly economical due to the possible elimination of synchronising devices between the corrugating tools of the two strips. Moreover, as the corrugation of the second strip is performed by the first one, the application of the two strips to one another is as accurate as possible. The corrugation method according to the invention confers

upon the finished cable a longitudinal fluid-tightness between the two strips constituting the sheath which prevents any passage of water along the cable between the two strips.

The invention will be readily understood by referring to the description hereinbelow and to figures 1 to 4 of the accompanying drawings given by way of illustration and non limitatively, wherein:

Figure 1 is the diagram of a first embodiment of the method according to the invention;

Figure 2 is the diagram of a second embodiment of the method according to the invention;

Figure 3 is a large scale sectional view of the assembly of the two strips after corrugation; and

Figure 4 is a large scale sectional view of the part in contact with two pinions of figure 2.

Figure 1 shows schematically a continuous transverse corrugating device for two metallic strips, 1 and 2 respectively, so as to form a corrugated composite strip 3 intended to constitute the sheath of a cable, not shown in the drawing, by any method known to the expert. As is customary, the two strips may have different widths. It will be assumed, although this does not constitute a limitation of the invention, that the strip 1 is of steel and the strip 2 of aluminium. Whatever the nature of the two metallic strips, that which has the lower elasticity, either due to the nature of the metal constituting it, or due to its thickness, is placed at 1. As will be seen, the strip 1 is corrugated by passing between two toothed pinions 4 and 5 driven synchronously as is customary. The feed of the composite strip 3 being generally controlled by a cable drawing station placed downstream in the production line, the drive of the pinions 4 and 5 is controlled from said drawing station. The path of the strip 1 is guided by pulleys in such a way that the direction of the incoming smooth strip and the direction of the out-going corrugated strip allows the axis of the strip to remain parallel to itself. Consequently, the contact between the strip 1 and the pinion 5 is maintained over a half-circumference of the pinion. The feed of the smooth strip 2 is made in such a way that the axis of the strip 2 is substantially perpendicular to that of the strip 1. It is essential to the performance of the method that the planes of the smooth strips 1 and 2 should not be parallel. The choice of two perpendicular planes, such as illustrated in figures 1 and 2, is non limitative. The figures show at 6 a station for applying adhesive to station the face of the strip 2 in contact with that of the strip 1 in the composite strip 3. The application of adhesive may be performed by roller, by gun, or by any other known method. The smooth strip 2 is then passed between the pinion 5 and a smooth roller 7, the axis of which is not contained in the plane defined by the axes of the pinions 4 and 5. The strip 2 is corrugated by the pressure transmitted to it by the roller 7, which applies its face on which adhesive has been applied to the strip 1 against the pinion 5. The roller 7 may be constructed by a material with a hardness of 50 on the Shore scale. In the variant embodiment illustrated in figure 2, the smooth roller 7 is replaced by a pinion 8, preferably loose, i.e. driven by the strip itself.

By way of example, the simultaneous corrugation of a strip 1 of steel 0.25 millimetre thick and a strip 2 of aluminium 0.25 millimetre thick was performed in this way. The adhesive used was of the cold polymerisable type. As an adhesive, the Palstab Super K5 manufactured by COLLANCHEMIE of Bielefeld (West Germany) has given good results.

The profile of the teeth of the pinions 4 and 5 presents no particular characteristic and depends solely upon the type of transverse corrugation desired.

In the embodiment of figure 2, the profile of the teeth of the pinion 8 must be calculated as a function of the profile of the teeth of the pinion 5 taking into account the thickness of the strip 1 since the latter serves as a die to corrugate the strip 2 so as to prevent any voids between the two strips in the composite strip 3. This will be clearer by referring to the larger scale figures 3 and 4. In figure 3, the radii of curvature of the corrugations in the external surface of the strip 1 are represented by R_2 and R_3. In order to simplify the drawing, it was assumed that the teeth and the hollow parts of this surface are portions of a cylinder and that $R_2 = R_3$, this condition not being in any way limitative. The radius of curvature of the contact surface of the two strips is designated R_4 and the radii of curvature of the external face of the strip 2 by R_1 and R_5. In the embodiment illustrated in figure 3, $R_5 = R_1$. The thickness of the two strips are respectively designated e for the strip 1 and e' for the strip 2.

Figure 4 is a larger scale view of figure 2 illustrating the zone where the pinions 5 and 8 cooperate. The figure shows at 1 the strip already corrugated by passage between the pinions 4 and 5, and at 2 the more malleable strip which is applied, by its glued face, to the strip 1 maintained on the pinion 5. The composite strip 3 remains in contact with the teeth of the pinion 5 by virtue of the orientation of the strips and of the forces exerted by the cable driving unit.

In the foregoing, the embodiments of the method applied to the transverse corrugation of two strips intended to constitute a composite strip have been considered. Obviously, this method is likewise applicable in the case of longitudinal corrugations.

Moreover, the construction of the pinions 4, 5 and 8 may be made so as to perform the method which is disclosed in our British Patent No. 1,551,373 with respect to the formation of a cable envelope from a metal tape in order to produce a strict coincidence of the corrugations in line with the edges of the composite strip 3 after the cable sheath has been shaped. The method disclosed in the above numbered Patent relates to the manufacture of a cable envelope from a metal tape in which the following steps are performed:

(a) subjecting the tape to a transverse predeformation such that the profile of the corrugations in a first face of a first edge of the tape is identical to the profile of the corrugations in a second face of a second edge of the tape; and

(b) wrapping said tape around a cable with a longitudinal overlap zone at said edges to form said cable envelope.

WHAT WE CLAIM IS:

1. Method of continuous corrugation for two metallic strips of different rigidities intended to constitute a single strip comprising:

(a) guiding the first strip of maximum rigidity between two toothed pinions so that the axes of those parts of the strip located upstream and downstream of the pinions respectively are parallel and coplanar so that the strip remains applied to half the circumference on the first of the pinions;

(b) applying adhesive to the face of the second strip of minimum rigidity which will be in contact with the first strip;

(c) guiding said second strip so that its longitudinal axis is inclined with reference to the longitudinal axis of the first strip upstream of the said pinions;

(d) pressing the second strip onto the first along a part of the zone where the latter is in contact with one of the pinions; and

(e) driving the composite strip by a unit located downstream of said pinions.

2. Continuous corrugating method for two strips according to claim 1 wherein the pressing of the second strip is performed by a smooth roller.

3. Continuous corrugation method of two strips according to claim 1 wherein the pressing of the second strip is performed by a toothed pinion cooperating with the first of the said pinions.

4. Continuous corrugation method of two strips according to claim 3 wherein the longitudinal profile of the pinions conforms to the conditions of performance as disclosed in British Patent No. 1,551,373, and claimed in claim 1 thereof.

5. Telecommunications cable, the sheath of which is executed from a composite strip obtained by performing the method according to claim 1.

6. A method of continuous corrugation for two metallic strips of different rigidities substantially as herein described with reference to the accompanying drawings.

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Sheet 1

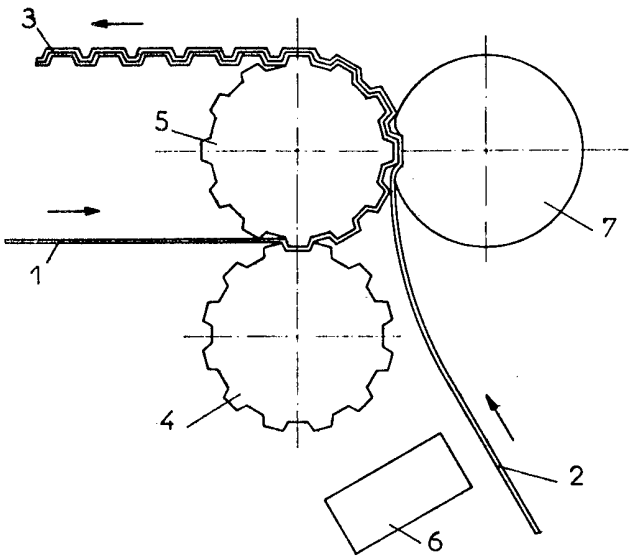

Fig. 1

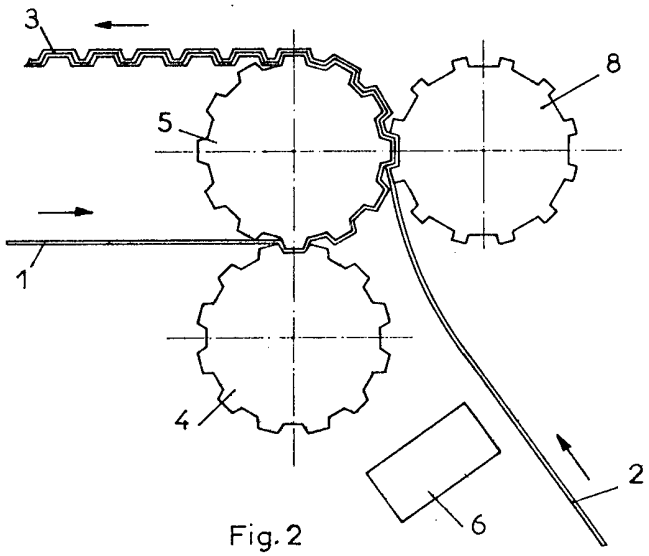

Fig. 2

1582157 COMPLETE SPECIFICATION
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Sheet 2

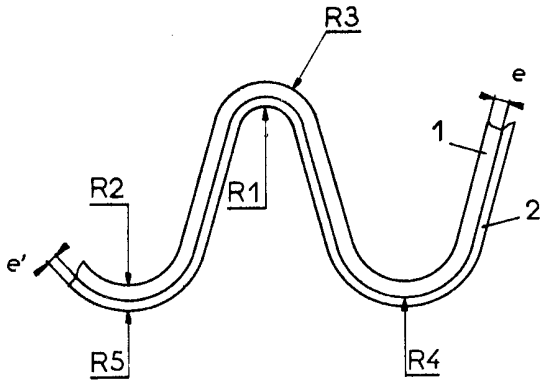

Fig. 3

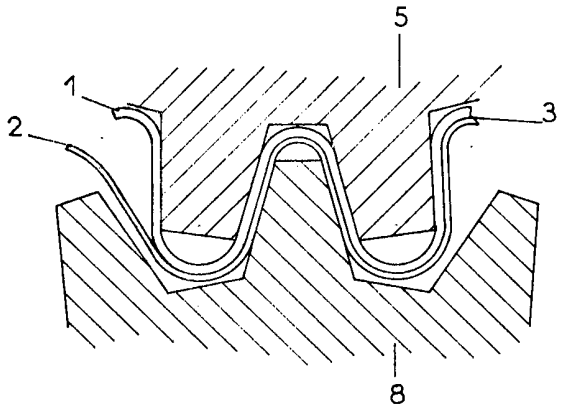

Fig. 4