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(54) Armour jointing method.

(57) This invention relates to a method for replacing the armour over a cable joint (20), including the steps of making a number of pretwisted armour elements. The elements are premade by stranding a number of armour elements (12) over a length of pipe or tube (4) having a diameter smaller than the cable core and cable core joint. The stranded or spiralled wire elements are transferred from the tube(s) (4) to an intermediate tube (10;13) having a diameter larger than the cable core and cable armour. The armour is replaced by inserting the tube (10; 13) over one of the cable ends (21) before making the cable joint (20), and sliding the tube over the cable joint when it is finished, withdrawing the tube (14) from underneath the armour elements, and clamping, welding or soldering the ends of the elements to the cable armour (27,28).

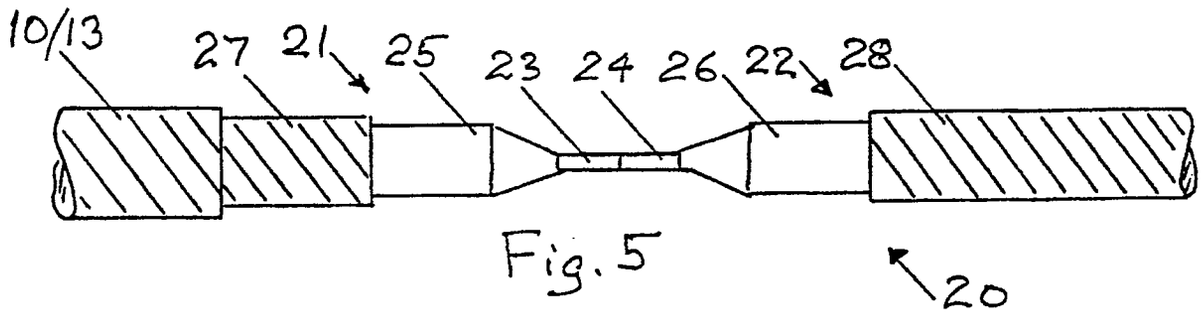

Fig. 5

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The present invention relates to a method for replacing the armour over a cable joint. The process includes the steps of making a number of pretwisted armour elements, placing the elements over the joint and clamping, welding or soldering the ends of the elements to the cable armour on both sides of the joint.

The armour elements required to make up the armour over a cable joint, such as a submarine power cable joint, are usually made one by one by winding an armour wire over a mandrel . Difficulties are experienced in obtaining the correct diameter and length of lay. Furthermore, the process takes relatively long time. When making repairs on submarine cables the jointing process must take as short time as possible, and the main object of the invention is to improve this process.

The main features of the invention are defined in the claims. By using the invention there is obtained a reliable process which requires relatively short time.

Above mentioned and other features and objects of the present invention will clearly appear from the following detailed description of embodiments of the invention taken in conjunction with the drawings, where

Figure 1 schematically illustrates an armouring line for cables,

Figures 2 - 4 shows two alternative tube-supported element sections, and

Figures 5 - 8 illustrate four steps during the process of replacing the armouring elements over a cable joint in accordance with the invention..

In Figure 1 is illustrated a cable armouring line 1 having an wire armouring machine 2, the details of which are not shown. A cable 3 has just been passed through the machine so that its left end is about to leave the machine to the right in the drawing. The machine may provide single or double layer armour on the cable core. A pipe or tube 4 of desired length and diameter is inserted into the machine 2 at its left side.

In order to obtain a number of spiralled armour elements having the correct diameter and lay length, the elements must be wound onto a tube having a smaller diameter than that at which they were wound onto the cable core. If, as an example, the diameter of a cable core is 100 mm, the tube could have a diameter of 80 mm. If an armour layer of a cable has 32 wires, it would be practical to wind 16 wires onto a tube which is twice as long as the joint, and cut the wires to size afterwards. If the length of the joint is 5 m, the length of the tube should be 10 m. The tube-supported elements must be bonded, taped or otherwise fastened to the tube at both ends, to prevent the elements from unwinding and loosening. The tube may be cut into a number of required sections and both ends of the elements must be secured on the tubes. The tube with the tube-supported elements may be worked, i. e. it may be bent back and forth a number of times to take the unspiralling tendency out of the elements.

The spiralled armouring elements of the present invention may be wound or inserted over a power cable joint in a predetermined number, one by one, after the cable core joint has been completed, but this is not considered to give the best results. In some cases it will be necessary to do it this way.

The wire elements which are wound onto the smaller diameter pipe or tube 4 should, preferably, and in accordance with the invention be transferred to a tube section 10, (Figures 2 and 3) having a larger diameter than the cable core and even larger than the diameter of the armoured cable. The number of spiralled wires transferred to the tube 10 in this intermediate step should correspond to the number of wires in the cable armour. The tube-10-supported wire element section can then be stored until its use is required. The tube 10 should be made of a (plastic) material strong enough to withstand the radial tension of the spiralled wire elements.

The tube section 10 itself, with spiralled armour elements 11, can then be pushed over one of the cable ends before completing the cable core joint, so that after completion of the joint, the tube-supported elements can be pushed back to cover the joint. One side of the elements can then be welded to the armour elements of one of the cable ends. The tube 11 can then be withdrawn from the elements 12 before welding or otherwise securing the other side of the elements to the ends of the armour of the other cable end. The surface of the tube should preferably be lubricated to facilitate withdrawal of the tube from between the cable core and the armour elements.

An alternative to using one piece of tube 11 for a set of elements 12 as illustrated in Figures 2 and 3, is to use a large diameter tube 13 consisting of two parts, e.g. one long part 14 and one short part 15, as illustrated in Figure 4, and having a correct number of armour elements 16. The two parts may be interconnected so that the tube can be handled as one unit, but the interconnection should not be stronger than allowing one part to be torn away from the other part in the axial direction.

In Figure 5 is schematically illustrated a power cable joint 20, showing two cable ends 21 and 22, each having a conductor 23, 24, coned insulation 25, 26 and armour layers 27, 28. To the left in the drawing is indicated the end of an armour tube 10 or 13 which is to be pulled over the joint to complete the armour layer when the cable conductors

have been jointed and the insulation replaced.

In Figure 6 is illustrated how a tube 13 with armour wires 16 is placed over the joint. In Figure 7 the short part 15 of the tube has been separated from the long part 14 and pulled to the right so as to allow the armour element ends 30 to be joined or secured to the cable armour wires 28. Thereafter the long tube 14 is pulled to the left as shown in Figure 8 so that the left hand end 31 of the armour elements can be joined or secured to the cable armour wires 27. Finally the tubes 14 and 15 can be removed from the cable or they can be left on the cable joint as protection.

It will be understood that in the case of two layer armoured cables or cross armoured cables there can be prepared two sets of tube-supported armour elements which can be placed one over the other. Each of the sets can be prepared as described above.

The above detailed description of embodiments of this invention must be taken as examples only and should not be considered as limitations on the scope of protection.

Claims

1. Method for replacing the armour over a cable joint (20), including the steps of making a number of pretwisted armour elements, placing the elements over the joint and clamping, welding or soldering the ends of the elements to the cable armour (27,28) on both sides of the joint,
characterized in this that
the elements are premade by stranding a number of armour elements (12) over a length of pipe or tube (4) having a diameter smaller than the cable core and cable core joint.

2. Method according to claim 1, **characterized in this that** the elements (12) are cut to correct length from a tube (4) which is long enough to support a number of successive lengths of armour element sections.

3. Method according to claim 1 or 2, **characterized in this that** the elements (12) are stranded onto a tube (4) in a cable armour stranding machine (2).

4. Method according to claim 1, 2 or 3,
characterized in this that after
stranding the elements onto the tube (4), the tube is worked so as to take out the spring tension of the elements.

5. Method according to any one of the claims 1-4,
characterized in this that
the stranded or spiralled wire elements are transferred from the tube(s) (4) to an intermediate tube (10;13) having a diameter larger than the cable core and cable armour.

6. Method according to claim 5, **characterised in this that** the armour is replaced by inserting a tube (10; 13) over one of the cable ends (21) before making the cable joint (20), and sliding the tube over the cable joint when it is finished, withdrawing the tube (10/13) from underneath the armour elements, and clamping, welding or soldering the ends of the elements to the cable armour (27,28).

7. Method according to claim 6, **characterised in this that** the tube consists of two parts, e.g. one long (14) and one short (15), the shortest being withdrawn first so that the released armour ends (30) can be clamped to the cable armour (28) on one of the cable ends (22) before withdrawing the long end (14) and clamping the other end (31) of the elements to the armour (27) of the other cable end (21).

8. Method according to claim 1, **characterised in this that** it makes use of a tube or pipe made of reinforced plastic material.

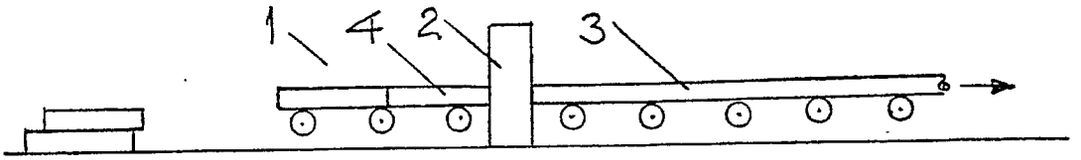

Fig. 1

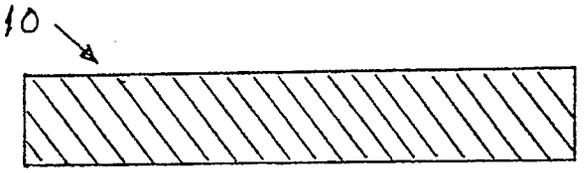

Fig. 2

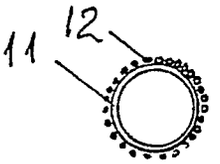

Fig. 3

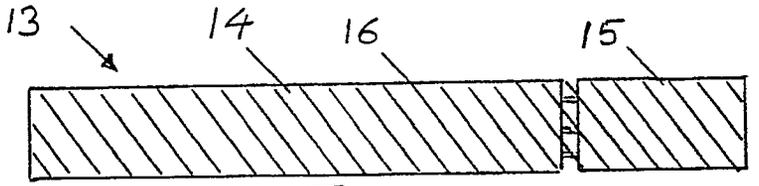

Fig. 4

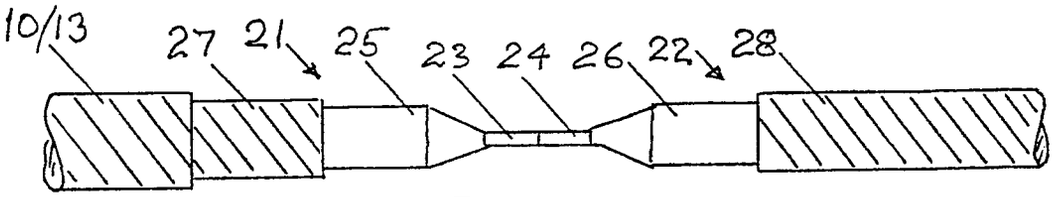

Fig. 5

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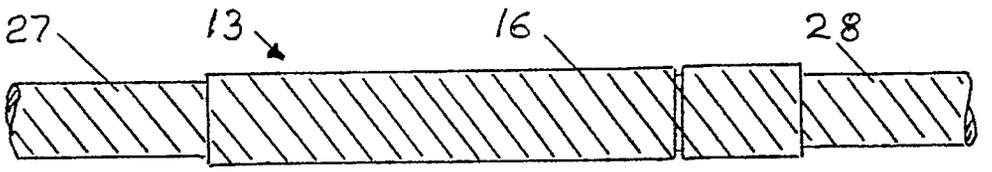

Fig. 6

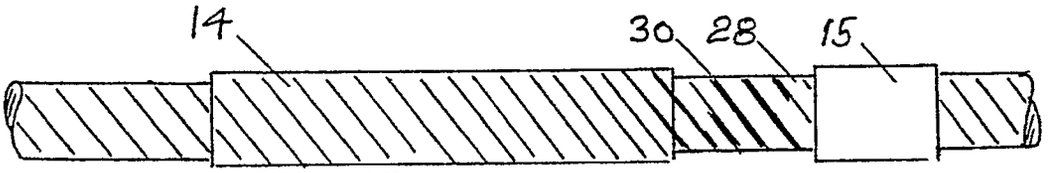

Fig. 7

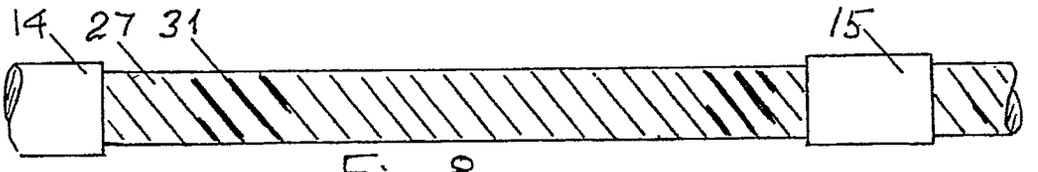

Fig. 8