(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number : **0 535 835 A1**

(12) EUROPEAN PATENT APPLICATION

(21) Application number : **92308547.6**

(22) Date of filing : **18.09.92**

(51) Int. Cl.[5] : **H01B 13/24,** H05B 3/40

(30) Priority : **02.10.91 GB 9121042**

(43) Date of publication of application :
07.04.93 Bulletin 93/14

(84) Designated Contracting States :
AT BE DE FR IT NL

(71) Applicant : **ASSOCIATED ELECTRICAL INDUSTRIES LIMITED**
1 Stanhope Gate
London W1A 1EH (GB)

(72) Inventor : **Filler, Edward Albert**
56 Paradise Lane, Freshfield
Formby, L37 7DX (GB)
Inventor : **Gidney, Alan**
4 Gorse Way, Freshfield
Formby, L37 1PB (GB)

(74) Representative : **Kirby, Harold Victor Albert**
The General Electric Company, p.l.c. GEC
Patent Department Wembley Office Hirst
Research Centre East Lane
Wembley Middlesex HA9 7PP (GB)

(54) Manufacture of cables by hydrostatic extrusion.

(57) A cable is formed by extruding an extrusible sheath through a die by applying pressure to a non-compressible fluid surrounding the sheath, the sheath having held within it at least one extrusible conductor, spaced from the sheath by pressure-transmitting material, such as compacted powdered insulating material.

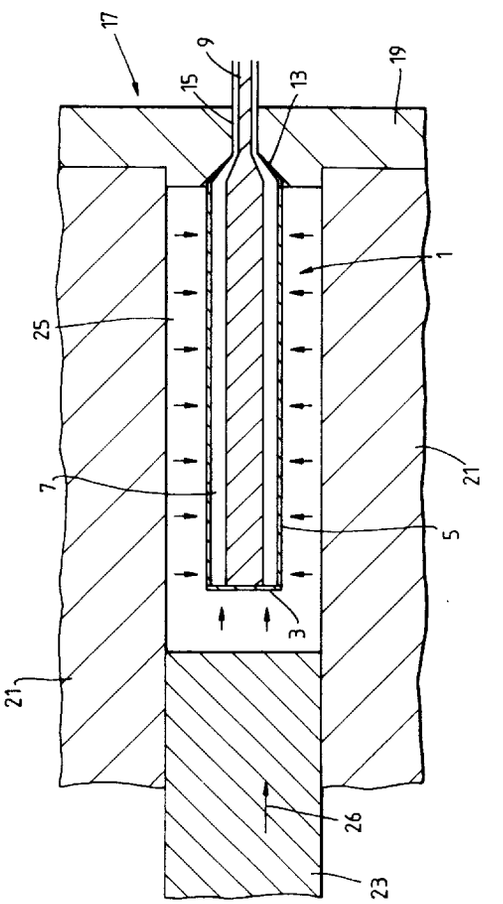

Fig.2.

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This invention relates to a method of manufacturing cables and especially, though not exclusively, to a method of manufacturing mineral insulated cables, that is to say, cables of the type consisting of one or more electrical conductors enclosed within a tubular metal sheath and insulated from the sheath by compacted powdered insulating material. The invention also relates to apparatus for carrying out such manufacture.

It is known to use a hydrostatic extrusion process to form cable cores and wires. In such processes, the metal to be shaped into a core or wire is preshaped to fit a die formed at one end of a high-pressure container. The metal is surrounded by a pressuretransmitting liquid inside the container. By applying a force to a plunger to compress the liquid within the container, pressure from the liquid gradually forces the metal through the die to form a cable core or wire.

Hydrostatic extrusion processes have not hitherto been used to manufacture cables, although it has now been found that such a process provides an economical and attractive alternative to conventional cable manufacturing processes.

Accordingly it is an object of the present invention to provide a novel and advantageous method of manufacturing cables.

According to one aspect of the present invention, there is provided a method of manufacturing a cable by hydrostatic extrusion including the step of extruding an extrusible elongate member through a die by applying pressure to a non-compressible fluid at least partially surrounding said elongate member, said member comprising an extrusible tube and at least one extrusible conductor held within and spaced from said tube by pressure-transmitting material.

It may further include the step of forming a fluid-tight seal in said die formed in a container by introducing one end of said member into said die prior to introducing said fluid into said container.

Preferably said pressure-transmitting material is mineral insulating material.

According to a second aspect of the present invention, there is provided an apparatus for manufacturing cables by hydrostatic extrusion including a substantially fluid-tight container capable of receiving an elongate member to be extruded, said member including an extrusible tube and at least one extrusible conductor held within and spaced from said tube by pressure-transmitting material and said container having a die formed in an outer wall thereof, one end of said member being introduced into said die, in use; said container being arranged to contain a non-compressible fluid, said fluid at least partially surrounding said member; and means for applying pressure to said fluid sufficient to cause the tube and conductor to be extruded through the die.

One embodiment of the invention will now be described by way of example with reference to the accompanying drawings in which:-

Figure 1 is a cross-section of the apparatus according to one embodiment of the invention prior to extrusion of the cable;

Figure 2 is a cross-section of the apparatus of Figure 1 during the extrusion process, and

Figure 3 is a cross-section of the apparatus, according to a further embodiment of the invention, prior to extrusion of the cable.

In Figure 1 the preform 1 to be formed into a cable is shown prior to extrusion. It comprises a copper tube 5, 1m in length with a diameter of 165mm. The tube walls are 15mm thick. At one of end of the tube 5 is a base plate 3 formed integrally with the tube. The tube 5 contains a copper conductor 9 spaced from the tube walls by pressure-transmitting mineral insulating material 7, such as magnesium oxide.

The insulating material is held in place by a disc 11.

For extrusion, the preform 1 is inserted into a die 13, 15 formed in the bottom wall 19 of a container 17. The die has a part-conical section 13 open to the inside of the container 17 and a cylindrical section 15, open to the outside of the container 17. The maximum diameter of the part-conical section 13 is larger than the outer diameter of the tube 5 so that the tube 5 can be held in place by forcing it into the die prior to extrusion. The minimum diameter of the part-conical section 13 is less than the outer diameter of the tube 5 and equal to the diameter of the cylindrical section 15. Thus, on forcing tube 5 through the die, it emerges outside the container 17 as a cable. If the diameter of section 15, and hence the cable diameter, is 15mm, the length of cable produced is approximately 90m.

The container 17 has a cylindrical wall 21 sealed at the bottom end by wall 19 and at the top end by a plunger 23.

Referring to Figure 2, during extrusion, after the preform 1 is inserted into the part-conical section 13, thereby sealing the die, the container is filled with hydraulic fluid 25. By forcing the plunger 23 downwards, (towards wall 19 in the direction of the large arrow 26), the hydraulic fluid 25 is compressed and exerts a pressure on the tube 5 and back plate 3 in the directions shown by the small arrows. The effect of the pressure is to force the preform 1 down through the die 13, 15 thereby compacting the insulating material 7 and reducing the diameters of the tube 5 and conductor 9.

Clearly the shape of the die need not be part-conical; the die could have a partly ogival cross-section, for example, as shown in Figure 3.

To prevent leakage of the hydraulic fluid 7, it will be appreciated that the external surface of one end of the preform 1 could have a shape which matches the shape of the inner end part of the internal surface 13′ surface of the die 31. In Figure 3, the inner end of the die 31 has a part ogival cross-section which is

matched by the shape of one end of the preform 1. In the embodiment shown in Figure 1, for example, the preform could have the same conical shape as the part-conical section 13.

Claims

1. A method of manufacturing a cable by hydrostatic extrusion including the step of extruding an extrusible elongate member through a die by applying pressure to a non-compressible fluid at least partially surrounding said member, said member comprising an extrusible tube and at least one extrusible conductor held within and spaced from said tube by pressure-transmitting material.

2. A method as claimed in Claim 1 further including the step of forming a fluid-tight seal in said die formed in a container by introducing one end of said member into said die prior to introducing said fluid into said container.

3. Apparatus for manufacturing a cable by hydrostatic extrusion including a substantially fluid-tight container capable of receiving an elongate member to be extruded, said member including an extrusible tube and at least one extrusible conductor held within and spaced from said tube by pressure-transmitting material and said container having die in an outer wall thereof and one end of said member being introduced into said die, in use; said container being arranged to contain a non-compressible fluid, said fluid at least partially surrounding said member; and means for applying pressure to said fluid sufficient to cause the tube and conductor to be extruded through the die.

4. Apparatus as claimed in Claim 3 wherein said means for pressurising said fluid, is a plunger which forms at least part of a wall of the container.

5. Apparatus as claimed in Claim 3 or 4 wherein said member further includes, at at least one end of said tube, blocking means to confine said insulating material within said tube.

6. Apparatus as claimed in any of Claims 3 to 5 wherein the internal surface of the inner end of the die is shaped to match the external surface of said one end of said member, so as to prevent egress of said fluid from said container in use thereof.

Fig.1.

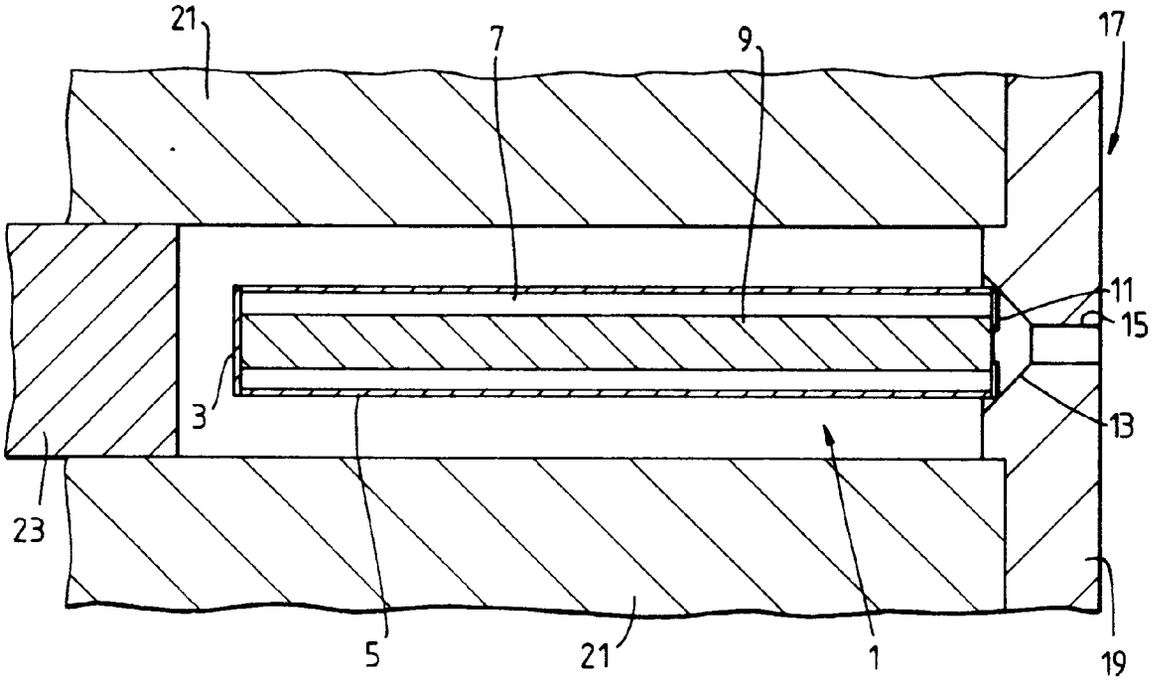


Fig.3.

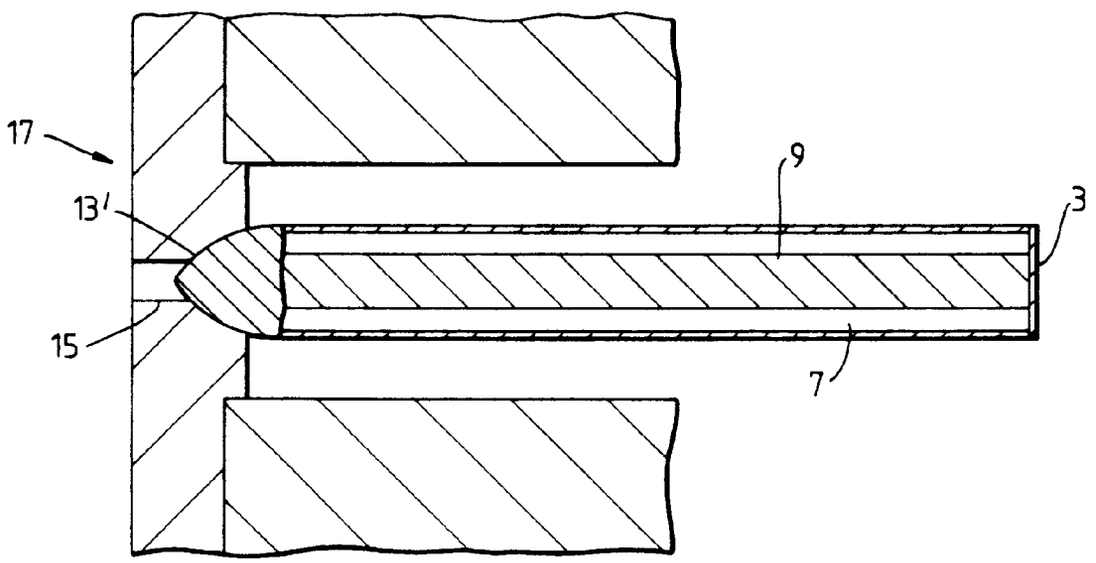
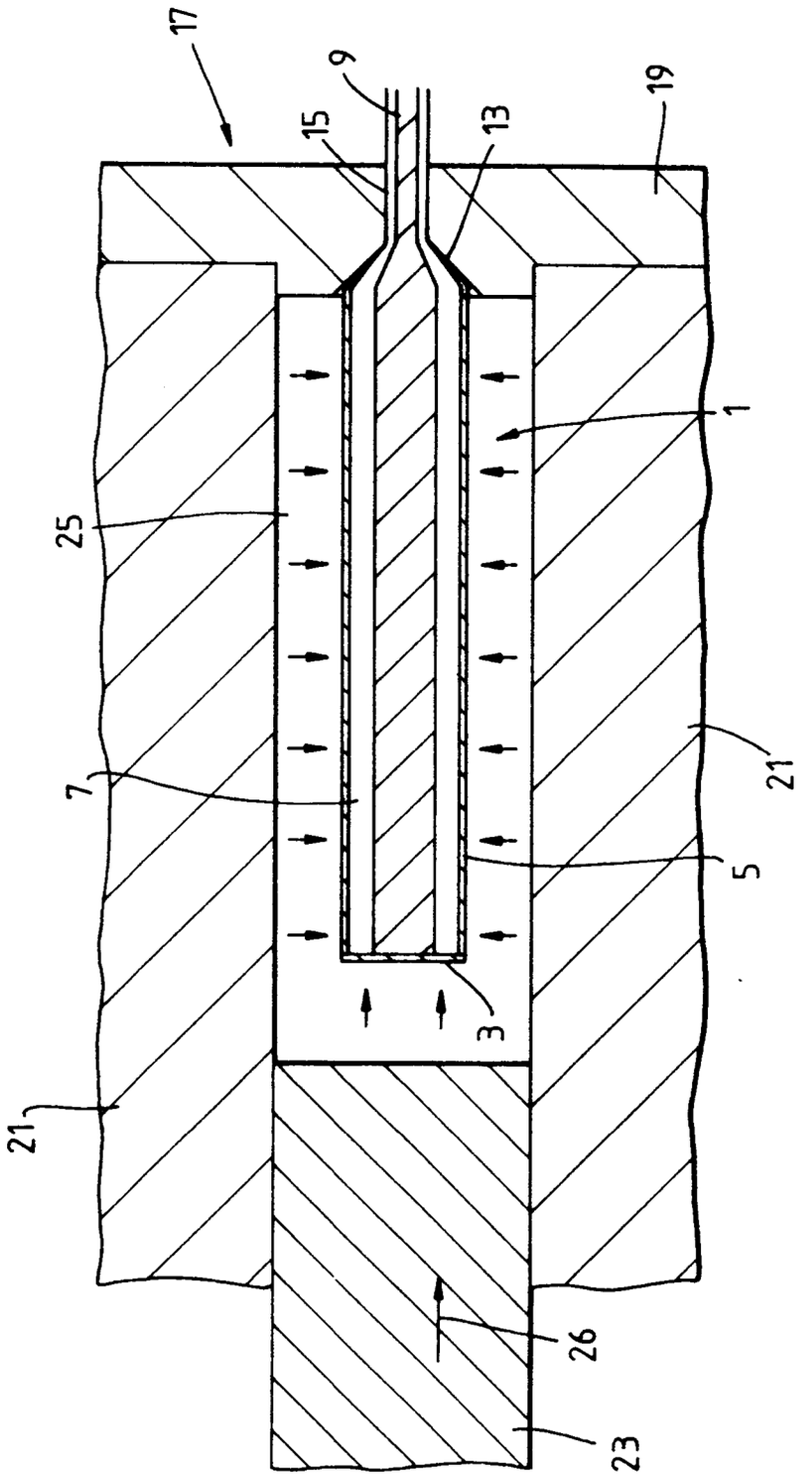


Fig.2.



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EUROPEAN SEARCH REPORT

Application Number EP 92308547.6

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
Y	WO - A - 90/14 671 (METAL MANUFACTURES) * Claims; fig. 1 * --	1-3	H 01 B 13/24 H 05 B 3/40
Y	DE - B - 1 957 700 (TÜRK & HILLINGER) * Totality * ----	1-3	

TECHNICAL FIELDS SEARCHED (Int. Cl.5)

H 01 B 13/00
H 05 B 3/00
G 01 K 7/00

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
VIENNA	09-12-1992	KUTZELNIGG

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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