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US 4594029 A US 4059893 A

(58) Field of Search
UK CL (Edition L) H2C CAE CAH
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(54) Tool for preparing cable ends

(57) A tool for stripping semiconducting dielectric screen from the end of a high-voltage cable and circularising it has an annular body 1 carrying a stripping blade 6 and means (such as a handle 2 or a motor drive 25, Fig 6) for rotating the body around a cable end extending through it to strip helically a surface layer from the end. So that the movement of the blade follows the general cylindrical shape of the cable end and is not significantly influenced by minor local departures from nominal dimensions, the body is mounted on the end by means of resilient rings 16, for example located by grooves 15 in its inner surface or in the inner surface of a second, non-rotating, annular body coupled to it. To accommodate cables of different diameters rings of different sizes may be employed. Alternatively the body 1 may be provided with a threaded collar (18 Figure 5) whereby a ring may be squeezed to reduce its effective diameter. The blade 6 has cutting edges set at right angles (13, 14 Figure 3). The tool can also be used to strip dielectric or a conductor screen from a cable.

Fig.2.

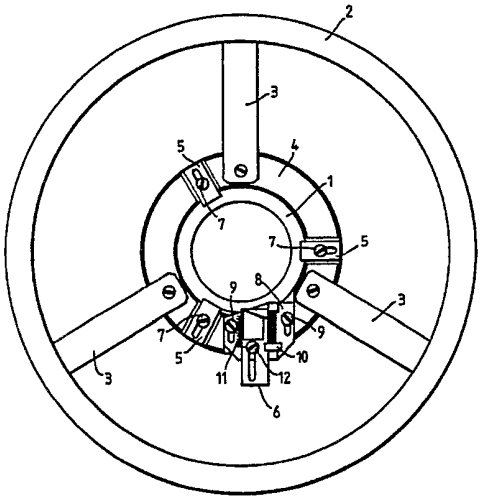
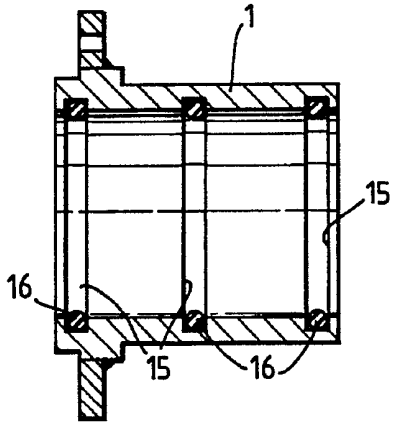


Fig.4.



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This print incorporates corrections made under Section 117(1) of the Patents Act 1977.

At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

Fig.1.

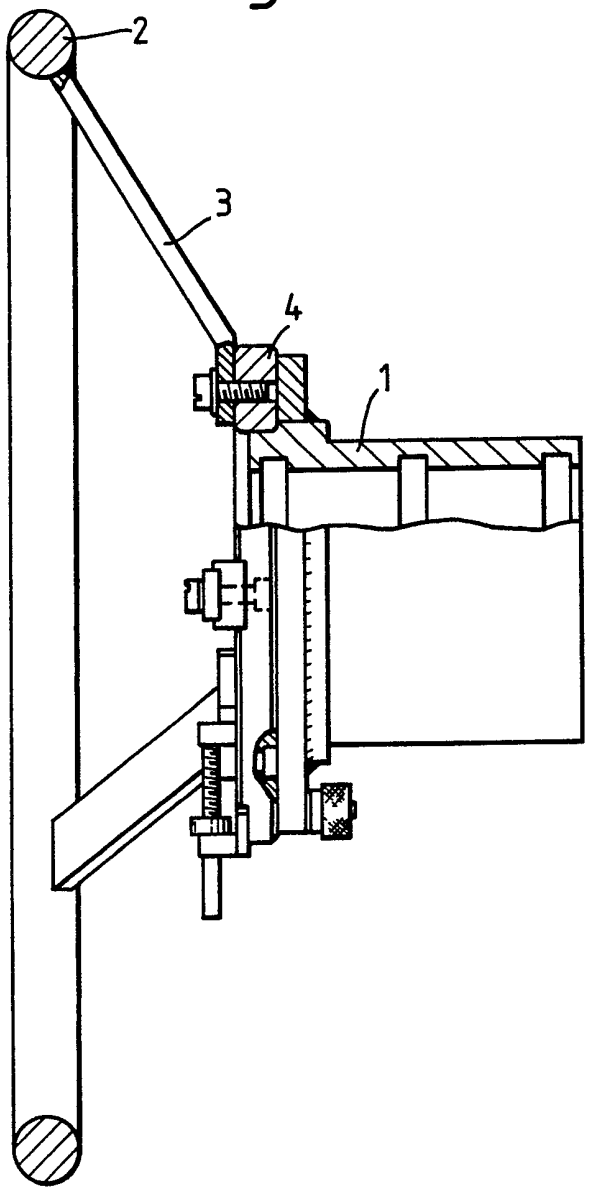


Fig.2.

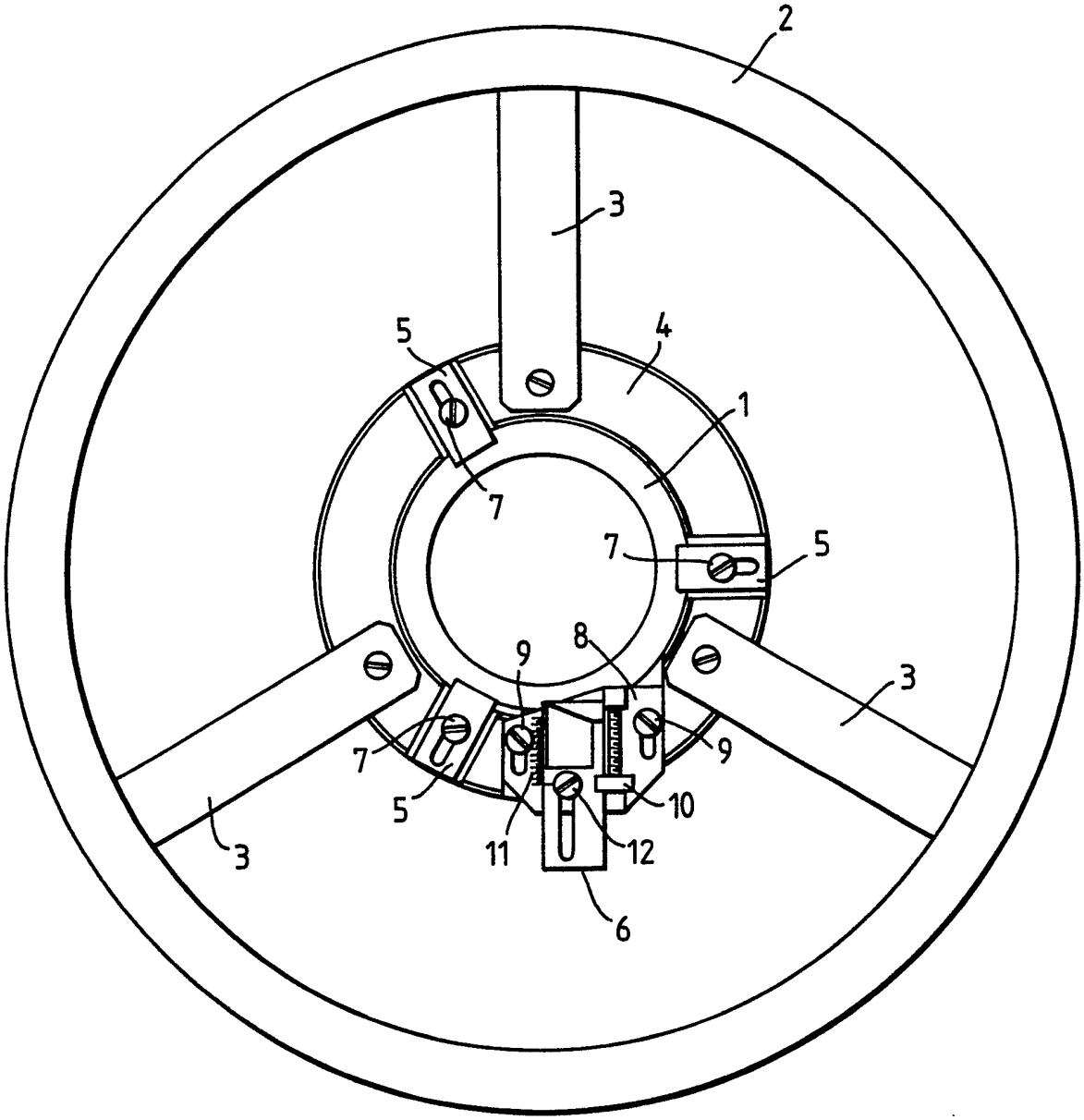


Fig. 3.

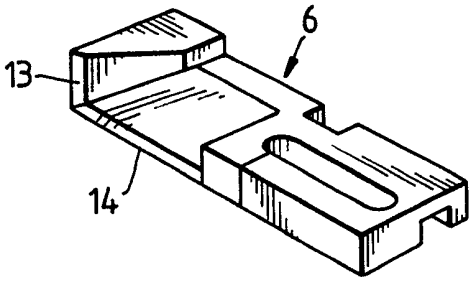


Fig. 4.

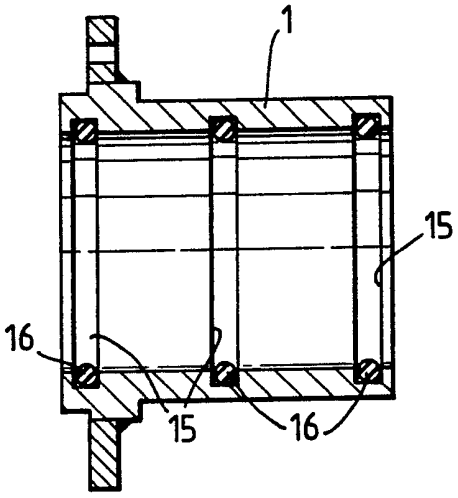
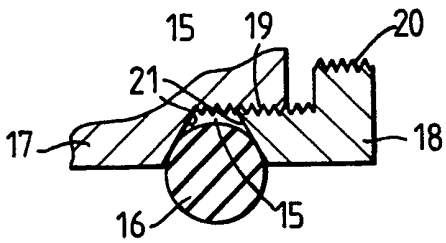


Fig. 5.



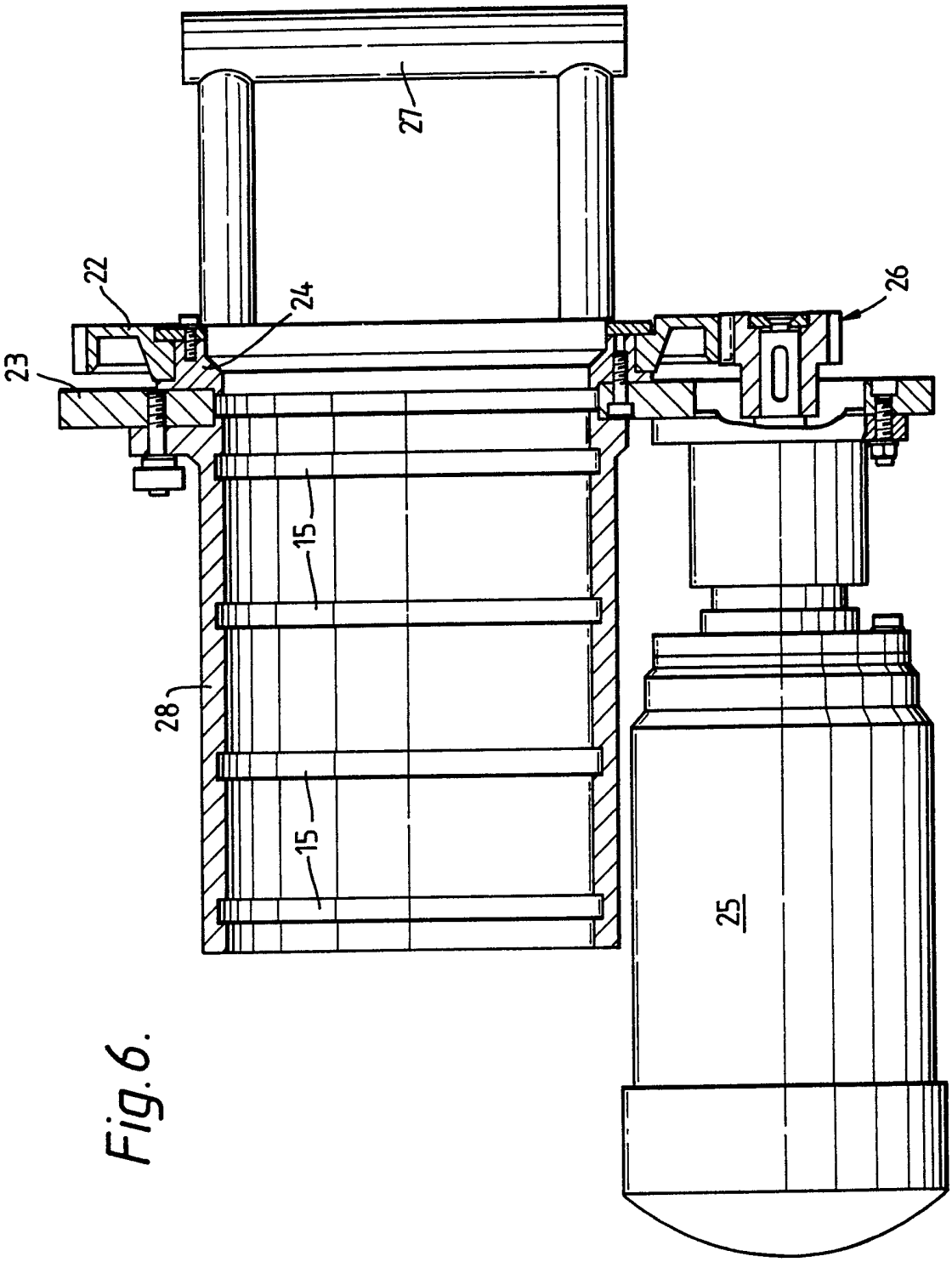


Fig. 6.

Tool for Preparing Cable Ends

This invention relates to a tool for stripping semiconducting dielectric screen, and dielectric if required, from an end part of a "polymeric" (as distinguished from paper-insulated) high-voltage cable in preparation for jointing or termination. For avoidance of doubt, any cable with at least one core of circular cross-section having a conductor screen and a dielectric screen is to be considered a "high voltage" cable for the purposes of this invention.

The dielectric of such cables is a large-section extrusion, and whereas its outer surface is nominally circular, minor inaccuracies in shape and dimension occur; these are of no significance in relation to the electrical function of the cable, provided that the surface is smooth and the radial thickness everywhere sufficient. However, in making joints and terminations, it is often necessary to use moulded or otherwise preformed components that will not conform to such minor inaccuracies, and the part of the dielectric from which the dielectric screen has been removed needs to be cut to an accurately circular shape to avoid risk of electrical stress concentrations occuring locally in places between the exposed dielectric and the preformed body.

One known type of tool for stripping the dielectric screen from such cables comprises an annular body carrying a stripping blade and means (such as a

handle or a motor drive) for rotating the body around an end part of a cable extending through it to strip a surface layer from the cable in a generally helical manner. Such known tools do not generate a sufficiently circular stripped surface, because they are too much influenced by the precise radial dimensions of the cable at the position of the blade and at a place directly opposite it.

It is an object of the invention to provide a tool that will strip dielectric screen from such a cable and at the same time circularise it ready for engagement with a preformed body in the joint or termination; preferred tools in accordance with the invention can also be used to strip dielectric from a different part of the cable to expose the conductor screen or the conductor, avoiding the need for a second tool.

In accordance with the invention, a tool for stripping semiconducting dielectric screen from an end part of a high-voltage cable in preparation for jointing or termination and at the same time circularising it has an annular body carrying a stripping blade and means for rotating the body around a cable end extending through it to strip a surface layer from the cable in a generally helical manner and is *characterised in that* the annular body is mounted on the cable by means of a plurality of resilient rings, so that the movement of the blade follows the general cylindrical shape of the cable end and is not significantly influenced by minor

local departures from nominal dimensions.

The resilient rings may be directly mounted in the said annular body, or they may be mounted in a second annular body coupled to it in a manner permitting relative rotation around the common axis of the two annular bodies, in which case it is intended that the second annular body and the rings do not rotate.

Preferably the resilient rings are located between pairs of abutment surfaces formed in the inner surface of the respective annular body, for example the sidewalls of a groove or the facing walls of two upstanding ribs. At least when this is done, the resilient rings may be formed by flexible strips of appropriate material bent into place, without necessarily joining the ends of the strip in any way.

The resilient rings may be of any appropriate cross-section: for example they may have a solid or hollow circular section (O-rings) or they may be oval, rectangular or of "V" or "X" section. They may be made of a suitable rubber or other polymeric material (the prime considerations being (a) freedom from any ingredients that might migrate into the cable dielectric and degrade its properties, (b) an appropriate degree of elastic resilience and (c) ability to slide on the cable surface without sticking). Rings of vinylidene fluoride/hexafluoropropylene copolymer elastomer (sold under the trademark *VITON*), of nitrile rubber, of polychloroprene, of butyl rubber, of

polytetrafluoroethylene or of an appropriate polyurethane are considered suitable.

The tool needs to be a close fit on the cable, and it will normally be necessary to provide a range of interchangeable rings to accomodate different sizes of cable and in at least some cases diameter tolerances in cable manufacture. Fine adjustment can be achieved by an adjustable mounting for the rings in many cases (depending on the resilience of the rings and whether they are complete rings or are formed by strips with unconnected and potentially gapped ends).

Since the exposed cable dielectric needs to be acurately dimensioned, the blade will normally need to be adjustable. Preferably it is adjustable by a screw and fitted with a vernier scale for accurate setting; alternatively a scaled micrometer screw could be used. If desired, it may be adjustable to the extent required to enable it to strip dielectric and conductor screen when required.

The use of resilient rings does not preclude the provision of abutments ("dummy blades") in or close to the plane of rotation of the cutting tool.

The invention will be further described, by way of example, with reference to the accompanying drawings in which:

Figures 1 and 2 are mutually perpendicular views of one form of hand-operated tool in accordance with the invention (figure 1 being partly sectioned);

Figure 3 is a cross-section through an annular body forming a major part of the tool;

Figure 4 is an enlarged detail of the blade used in this tool;

Figure 5 is a detail showing a modification to the tool of Figures 1-4; and

Figure 6 is a view, corresponding broadly to Figure 1, of an electrically powered tool in accordance with the invention.

The tool of figures 1-4 comprises an annular body 1 through which an end part of a cable (not shown) may extend, entering from the right as seen in figure 1. The annular body is connected to an annular operating handle 2 by spokes 3. The front of the annular body is formed by a separate ring 4, which can be transferred to alternative rear parts with different dimensions apt to different ranges of cable diameter; on the front of this separate ring 4 are mounted three abutments 5 (sometimes called "dummy blades") and a blade 6. All of these are adjustable in a radial direction and are shown in fully retracted and inoperable positions. The abutments 5 are slidable and are locked in adjusted positions by clamping screws 7; in use, they are to be set at a radius corresponding to the maximum external radius of the dielectric screen of the cable end to be prepared. The blade 6 needs to be set with greater precision and is therefore mounted in an adjustable slide 8 which locks with two clamping screws 9 and is additionally

fitted with an adjusting screw 10, a vernier setting scale 11 and a clamping screw 12. The blade is set to the required radius of the stripped dielectric, as determined by the preformed component to be fitted. The shape of the blade 6 is best understood from figure 3; it provides two cutting edges at right angles to one another, the first edge 13 to cut peripherally underneath the screen layer to be stripped and the second edge 14 to cut radially between the strip of the screen layer being removed and the remainder of the layer remaining on the cable at least until the next turn of the tool.

In accordance with the invention, the annular body 1 (best seen in Figure 4) is not dimensioned to fit closely on the cable: instead it is formed with a substantial clearance and has grooves 15 machined into its bore. These receive O-rings, or other resilient rings, which engage the surface of the cable to position the tool according to an average radius at the longitudinal position of each ring and not according to the local radii at the three points under the abutments 5.

In use, the end part of the cable (previously stripped back to expose the semiconducting dielectric screen) is inserted into the tool which is carefully rotated by hand under minimal axial pressure, so that the action of the cutting blade determines the rate of axial advance to pare a helical strip from the cable

end. When the required length has been stripped, the tool is removed and the exposed end of the cut-back screen is trimmed by hand in the usual way.

In a particular example in accordance with these drawings which has given good results, the nominal radius of the cable end over the semiconducting dielectric screen was 71mm; the internal diameter of the annular body was 74mm and the grooves 15 therein were 8.0mm wide and 4.0mm deep. Into these were fitted rings formed from 220mm lengths of 6mm diameter round cord of *VITON* fluoroelastomer with a Shore hardness of 60 to 90°. This enabled a crosslinked polyethylene insulated core in which the local radius varied by ±1mm from the nominal radius to be stripped and circularised in one operation to give a stripped end with a radius of 67.25 ± 0.05mm.

As so far described, adjustments to match the actual diameter of the cable must be made by exchanging the resilient rings 16 for ones with appropriately different dimensions. To reduce the need to stock large numbers of resilient rings, the tool may be modified to allow limited adjustment to the effective diameters of the rings. One way of doing so is illustrated by Figure 5, which shows one of the grooves 15 formed in a composite annular body including a major member 17 and a minor member 18 in the form of a ring connected to the major memeber 17 by a screw thread 19. A knurled face 20 facilitates adjustment, or formations for

engaging a spanner or other tool could be provided. Each of the members 17, 18 has a tapered face 21 which forms one of the sides of the groove 15. By screwing the members 17,18 towards one another, the width of the groove can be reduced and the ring 16 urged radially inwards, towards the axis of the tool; screwing in the opposite direction increases the effective diameter. It will be apparent that the range of adjustment available will be greater if the ring is formed by a strip with its ends not connected together.

Figure 6 shows a power-operated tool in accordance with the invention which incorporates a number of modifications from the tool of figures 1-4. The most significant is that the rotatable annular body is constituted by an annular gearwheel 22 on the front (right-hand as seen) of which the blades and abutment members (not shown) are mounted; the remainder of the tool advances axially along the cable without rotating. The gearwheel 22 is mounted from a non-rotating disc 23 by a bearing ring 24. This disc 23 (which is non-circular) also supports

(a) a mounting for a motor 25 (which may be electric, pneumatic or hydraulic, depending on the available power supplies) which drives the gearwheel 22 through any suitable gearing 26 (shown as meshing gears, but plain or toothed belts, chains or the like could be used);

(b) a handle 27, which is screwed to the disc in a

position behind the plane of the figure and behind the gearwheel; and

(c) an auxiliary annular member 28 in which are the grooves 15 for recieving the resilient rings (not shown).

With this particular handle arrangement, the tool is suitably operated with the right hand on the handle and the left hand on the housing of the motor 25; many other handle arrangements could be chosen.

The tools described can be used in the jointing of cables with dielectric of low- or high-density thermoplastic polyethylene, of crosslinked polyethylene, of ethylene-propylene copolymer and terpolymer rubbers and of other suitable polymers.

CLAIMS

1 A tool for stripping semiconducting dielectric screen from an end part of a high-voltage cable in preparation for jointing or termination and at the same time circularising it comprising an annular body carrying a stripping blade and means for rotating the body around a cable end extending through it to strip a surface layer from the cable in a generally helical manner *characterised in that* the annular body is mounted on the cable by means of a plurality of resilient rings, so that the movement of the blade follows the general cylindrical shape of the cable and is not significantly influenced by minor local departures from nominal dimensions.

2 A tool as claimed in Claim 1 in which the resilient rings are mounted in the said annular body.

3 A tool as claimed in claim 1 in which the resilient rings are mounted in a second annular body coupled to the said annular body in a manner permitting relative rotation around the common axis of the two annular bodies.

4 A tool as claimed in any one of Claims 1-3 in which the resilient rings are located pairs of abutment surfaces formed in the inner surface of the respective annular body.

5 A tool as claimed in Claim 4 in which the resilient rings are formed by flexible strips of

appropriate material bent into place, without joining the ends of the strip in any way.

6 A tool as claimed in any one of Claims 1-5 in which the rings are made of vinylidene fluoride/ hexafluoropropylene copolymer elastomer, of nitrile rubber, of polychloroprene, of butyl rubber, of polytetrafluoroethylene or of polyurethene.

7 A tool as claimed in any one of Claims 1-6 in which fine adjustment of diameter is achieved by an adjustable mounting for the rings.

8 A tool for stripping semiconducting dielectric screen from an end part of a high-voltage cable in preparation for jointing or termination and at the same time circularising it substantially as described with reference to Figures 1-4.

9 A tool for stripping semiconducting dielectric screen from an end part of a high-voltage cable in preparation for jointing or termination and at the same time circularising it substantially as described with reference to Figures 1-5.

10 A tool for stripping semiconducting dielectric screen from an end part of a high-voltage cable in preparation for jointing or termination and at the same time circularising it substantially as described with reference to Figures 1-4 and Figure 6.

11 A tool for stripping semiconducting dielectric screen from an end part of a high-voltage cable in preparation for jointing or termination and at the same

time circularising it substantially as described with reference to Figures 1-6.

Patents Act 1977
Examiner's report to the Comptroller under Section 17
(The Search report)

Application number
GB 9321610.9

Relevant Technical Fields

(i) UK Cl (Ed.L) H2C (CAE, CAH)

(ii) Int Cl (Ed.5) H02G (1/12)

Search Examiner
J L FREEMAN

Date of completion of Search
23 DECEMBER 1993

Databases (see below)
(i) UK Patent Office collections of GB, EP, WO and US patent specifications.

(ii)

Documents considered relevant following a search in respect of Claims :-
1 to 11

Categories of documents

X: Document indicating lack of novelty or of inventive step.

Y: Document indicating lack of inventive step if combined with one or more other documents of the same category.

A: Document indicating technological background and/or state of the art.

P: Document published on or after the declared priority date but before the filing date of the present application.

E: Patent document published on or after, but with priority date earlier than, the filing date of the present application.

&: Member of the same patent family; corresponding document

Category	Identity of document and relevant passages		Relevant to claim(s)
A	US 4059893	(T F SOLURY)	1
A	US 4594029	(G W MICHAEL)	1

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