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P/00/011 28/5/91
Regulation 3.2

AUSTRALIA

Patents Act 1990

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ORIGINAL
COMPLETE SPECIFICATION
STANDARD PATENT

Invention Title:

"CABLE PROTECTION DEVICE"

The following statement is a full description of
this invention, including the best method of
performing it known to us:-

This invention relates to mechanical protection of an elongate article such as, for example, a pipe or a cable, particularly, though not exclusively a submarine cable.

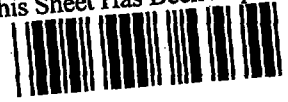
5 It is known to provide mechanical protection to sections of submarine cable to be laid in shallow water, that is water less than 50M deep, by manually fitting articulated cast iron pipe sections to the cable as it is being paid out from a cable laying vessel or by divers after the cable is laid. Each pipe section, of approximately 500 mm in length comprises two mating shells which when mated longitudinally about the cable encase the cable and form a hollow bulb at each end of the pipe section which permits one section
10 to be linked to a preceding section in an articulated manner to form a continuous length of armour about the cable. Each section is clamped by bolting the shells of the section together.

A disadvantage of the aforementioned known arrangement is that it takes up to one minute to assemble and bolt together each section which adds to the total cable
15 installation costs. The cable laying vessel's progress must be slowed to accommodate the time required for assembly of the sections. Further, bolts used to bolt the shells together are normally steel and tend to corrode.

It is an object of the present invention to provide an articulated armour pipe section which does not require bolting and thus can be quickly assembled.

20 According to the invention, there is provided a protective pipe section for protecting a length of an elongate article, said pipe section comprising a first shell section and a second shell section, each shell section comprising an elongated intermediate section of hemi-tubular cross-section terminating at each end in a respective first end section and a second end section, each end section being in the shape of a
25 truncated hollow hemisphere, wherein said first end section of each shell section includes a pivotable attachment means for mutual pivotable engagement to clamp the first shell section to the second shell section to form a pipe having an open-ended first hollow spherical section at one end thereof and an open-ended second hollow spherical section on the other end for encasing a section of said elongate article extending
30 therethrough.

According to a further aspect of the invention, there is provided an articulated pipe section arrangement of the aforementioned kind including cable gripping means



grippingly attached to said cable at a point thereon where said plurality of pipe sections starts, said cable gripping means including a spherical element for co-operation in an articulating manner with the inner surface of the hollow spherical section of the first pipe section of the concatenation.

In order that the invention may be readily carried into effect, an embodiment thereof will now be described in relation to the accompanying drawings, in which:

Figure 1 is a perspective view of a pipe section of the present invention.

Figure 2 shows two pipe sections separately assembled and concatenated about a cable.

Figure 3 shows a cable clamp for use when assembling a concatenation of pipe sections.

Figure 4 shows a jointing device for jointing separate concatenations of pipe sections.

Referring to Figure 1, the pipe section comprises two halves, shell A and shell B. Shell A comprises an intermediate section 1 having a hollow cylindrical cross-section. At each end of intermediate section 1 is a hollow hemispherical section 2 and 3 truncated by an opening 5 and 6. Hemispherical section 2 is provided with two co-axial outwardly extending steel axels 7 and 8 whose cross-section is truncated to form flat surfaces 9 and 10. The axis of axels 7 and 8 lies in the same plane as upper edge 11 of shell A, and flat surfaces 9 and 10 of axels 7 and 8 lie in a plane which forms an angle of 15° with upper edge 11. Two strengthening side webs 12 and 13 and a central web (not shown) are located behind hemispherical section 2. From each side web extends a locating pin 14 and 15, and in each side web is a bolt hole 16 and 17.

Shell B is substantially identical to shell A except that shell B is provided with a pair of hooks 18 and 18a dimensioned to co-operate with stub axels 7 and 8 of shell A, and also that side web 19 and 19a are provided with sockets, one of which, 20, is shown for co-operating with pins 14 and 15 of shell A. Side webs 19 and 19a are also provided with threaded screw holes (not shown) for co-operating with bolts inserted into bolt holes 16 and 17 of shell A.

A pipe section is formed by engaging, in a co-operating manner, hooks 18 and 18a of shell B with respective stub axels 7 and 8 and bringing together, in a pivoting



manner shells A and B. Pins 14 and 15 of shell A rest in co-operating sockets (20) to maintain alignment of the shells.

5 The shells are made from any suitable material such as plastics or metal, but in the case of submarine cable protection, are preferably made from cast iron, and in particular spherulitic graphitic iron (SGI).

The thickness of each shell is, for example, 9mm and its length is 500 mm, the assembled shells defining an internal space of approximately 80 mm diameter for a cable.

10 In use, and referring to figure 2, a plurality of pipe sections are separately assembled about a cable 21 and concatenated, each pipe section locking the preceding pipe section. The ball joint formed by the inner boundary of spherical section 2 and the out boundary of spherical section 3 of a successive section locks the preceding pipe section and provides articulation to the concatenated sections.

15 If, during an after laying, a pipe section is damaged, it can be bolted together using bolts in bolt holes 16 and 17.

Preferably, a cable clamp, as shown in figure 3, is clamped onto that point of the cable length from which the pipe sections start to provide an "anchor" for the successive concatenated sections. The cable clamp comprises two halves C and D each comprising
20 two opposite hemispherical sections 23 and 24 joined by a straight intermediate section 25. When halves C and D are bolted together about a cable (not shown) it forms a pipe section whose predetermined internal diameter is such that it grips the cable. The hemispherical sections 23 and 24 form a truncated spherical section on each end of the cable clamp. The first pipe section of the concatenation of pipe sections may then be
25 assembled about a truncated spherical section of the cable clamp thus anchoring the concatenation to prevent movement of the concatenation along the cable length. Preferably, the cable clamp is made of SGI.

If one or more pipe sections of a concatenation are damaged, or the concatenation is interrupted, the jointing device shown in figure 4 may be used to link
30 the interrupted ends of the concatenation.

The jointing device comprises two halves E and F having two end sections 26 and 27 of hemi-circular cross section and an intermediate section 28 of hemi-circular cross-



section of a diameter greater than the diameter of the end sections. When assembled about two interrupted pipe sections the end sections of the jointing device form a collar and grips the intermediate section 1 of the pipe sections to be joined thereby locking the concatenation each side of the joint.

While the present invention has been described with regard to any particulars, it is understood that equivalents may be readily substituted without departing from the scope of the invention.



The claims defining the invention are as follows:

1. A protective pipe section for mechanically protecting a length of an elongate article, said pipe section comprising a first shell section and a second shell section, each shell section comprising an elongated intermediate section of hemi-tubular cross-section terminating on each end in a respective first end section and a second end section, each end section being in the shape of a truncated hollow hemisphere, wherein said first end section of each shell section includes a pivotable attachment means for mutual pivotable engagement to clamp the first shell section to the second shell section to form a pipe having an open-ended first hollow spherical section at one end thereof and an open-ended second hollow spherical section on the other end for encasing a section of said cable extending therethrough.
2. A protective pipe section as claimed in claim 1, wherein said pivotable attachment means included on each first end section comprises, on one first end section a pair of spaced outwardly extending co-linear stub axels whose co-axis is transverse said pipe section, and on the other first end section a pair of spaced rearwardly extending hooks each of which lie in a plane normal to the co-axis of said stub axels.
3. A protective pipe section as claimed in claim 2, wherein each said stub axel's cross section is truncated to form a flat surface thereon of a predetermined angle relative to said pipe section's longitudinal axis.
4. A protective pipe section as claimed in any one of claims 1 - 3, including means for maintaining alignment of said first shell member and second shell member when said pipe section is formed.
5. A protective pipe section as claimed in claim 4, wherein said means for maintaining alignment comprise at least one pin extending from one shell section and arranged to be located and nest in a co-operating socket in the other shell section when said pipe section is formed.
6. A protective pipe section as claimed in claim 5, including at least one web section joining said first end section of each shell to its associated intermediate section.
7. A protective pipe section as claimed in claim 6, wherein said at least one pin extends from said at least one web section of said at least one shell section and said co-operating socket is located in said at least one web section of the other shell section.



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8. A protective pipe section as claimed in claim 6 or claim 7, wherein said web section/s of one shell section includes at least one through-hole for receiving a fastening bolt.
9. A protective pipe section as claimed in claim 1 or claim 2, made of cast iron.
10. A protective pipe section as claimed in claim 1 or claim 2, made of spherulitic graphitic iron.
11. A protective pipe section as claimed in claim 2, wherein said cable is a submarine cable.
12. An articulated pipe section arrangement comprising a plurality of pipe sections as claimed in claim 1 or claim 2, wherein an initial pipe section is assembled to encase a section of said cable followed by successive assembled pipe sections, whereby a ball-joint is formed by the inner surface of said first hollow spherical section of one pipe section and the outer surface of the second hollow spherical section of the next pipe section to form an articulate concatenation of pipe sections.
13. An articulated pipe section arrangement as claimed in claim 13, including cable gripping means grippingly attached to said cable at a point thereon where said plurality of pipe sections starts, said cable gripping means including a spherical element for co-operation in an articulating manner with the inner surface of the hollow spherical section of the first pipe section of the concatenation.
14. An articulated pipe section arrangement as claimed in claim 13 or 14, including a jointing means for joining two ends of an interrupted concatenation of pipe sections, said jointing means comprising a casing arranged to encase a section of cable exposed by an interruption of said concatenated pipe sections, and fastening means to fasten said casing to the pipe sections proximate said interruption thereby locking said pipe sections.



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15. An articulated pipe section arrangement as claimed in claim 13, wherein said pipe sections are made of cast iron.
16. An articulated pipe section arrangement as claimed in claim 13, wherein said pipe sections are made of spherulitic graphitic iron.
17. An articulated pipe section arrangement as claimed in claim 13, wherein each said protective pipe section includes means for maintaining alignment of said first shell member and second shell member when said pipe section is formed.

DATED THIS TWENTY-SIXTH DAY OF MAY 1995

ALCATEL N.V

(A.C.N. 000 005 363)

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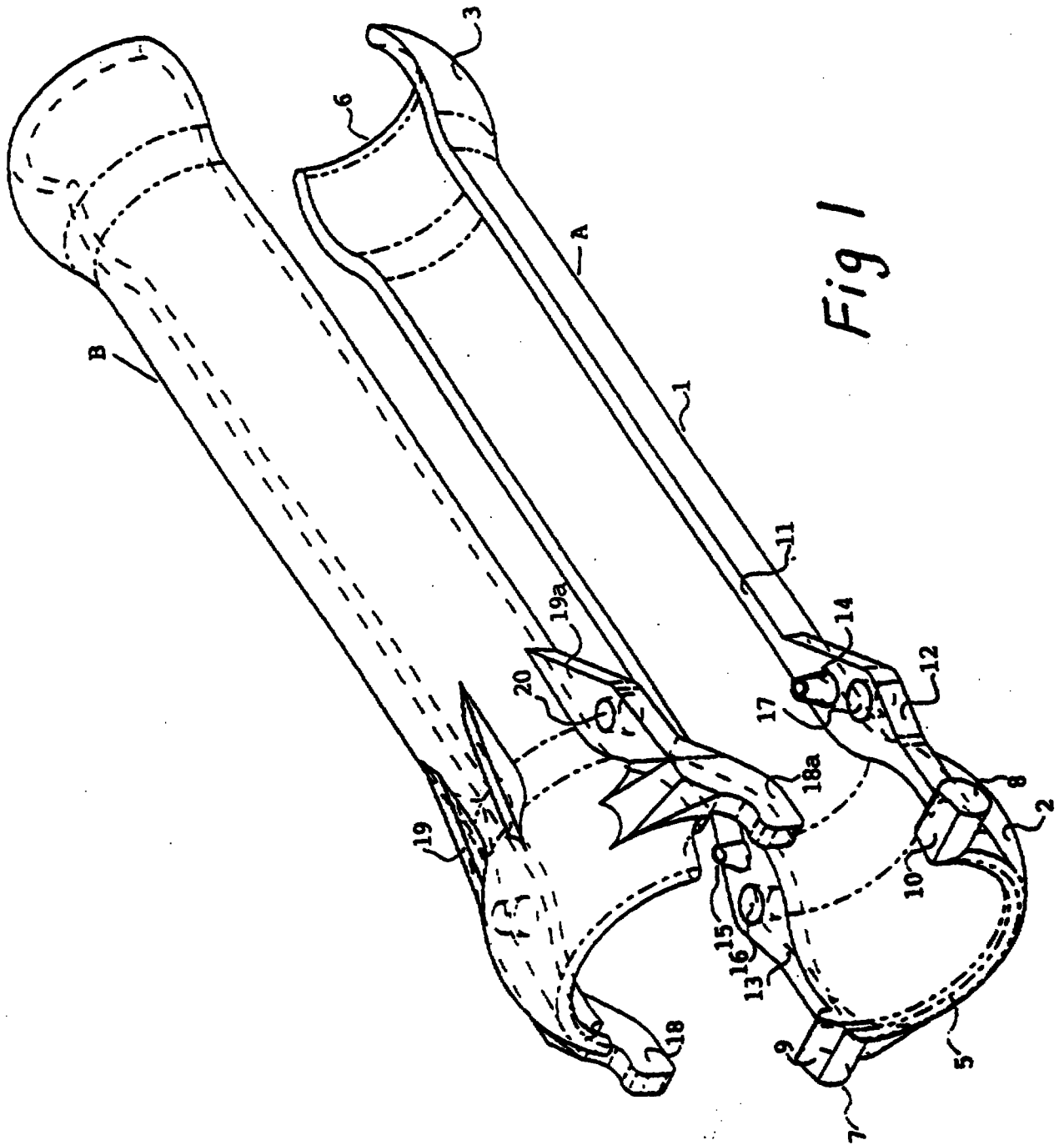
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ABSTRACT

A protective pipe section for providing mechanical protection for electrical/optical cable, particularly submarine cable. The pipe section comprises two shells (A and B) which when mated form an intermediate pipe section having a hollow hemispherical section (4 and 5) at either end. One end section (5) includes a pivotable clamping arrangement ((7, 8, 11 and 12). The clamping arrangement permits a plurality of pipe sections to be concatenated without the need for fastening the shells (A, B) together. Each succeeding pipe section locks the shells of the preceding pipe section together. The hemispherical sections provide articulation.

Figure 8.



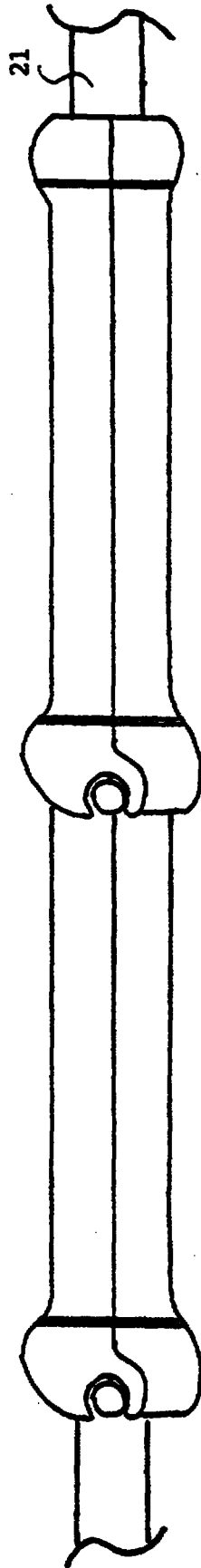
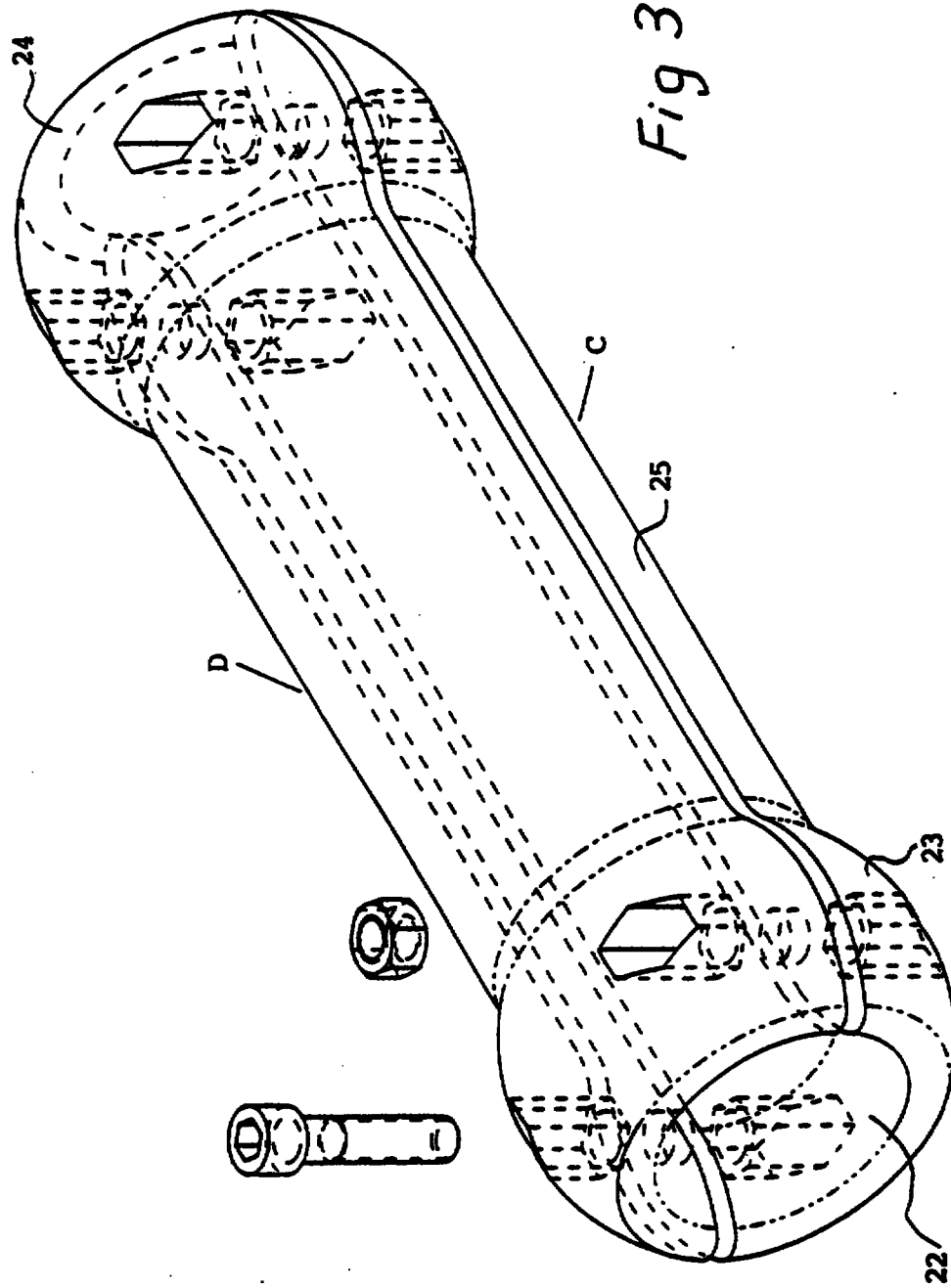
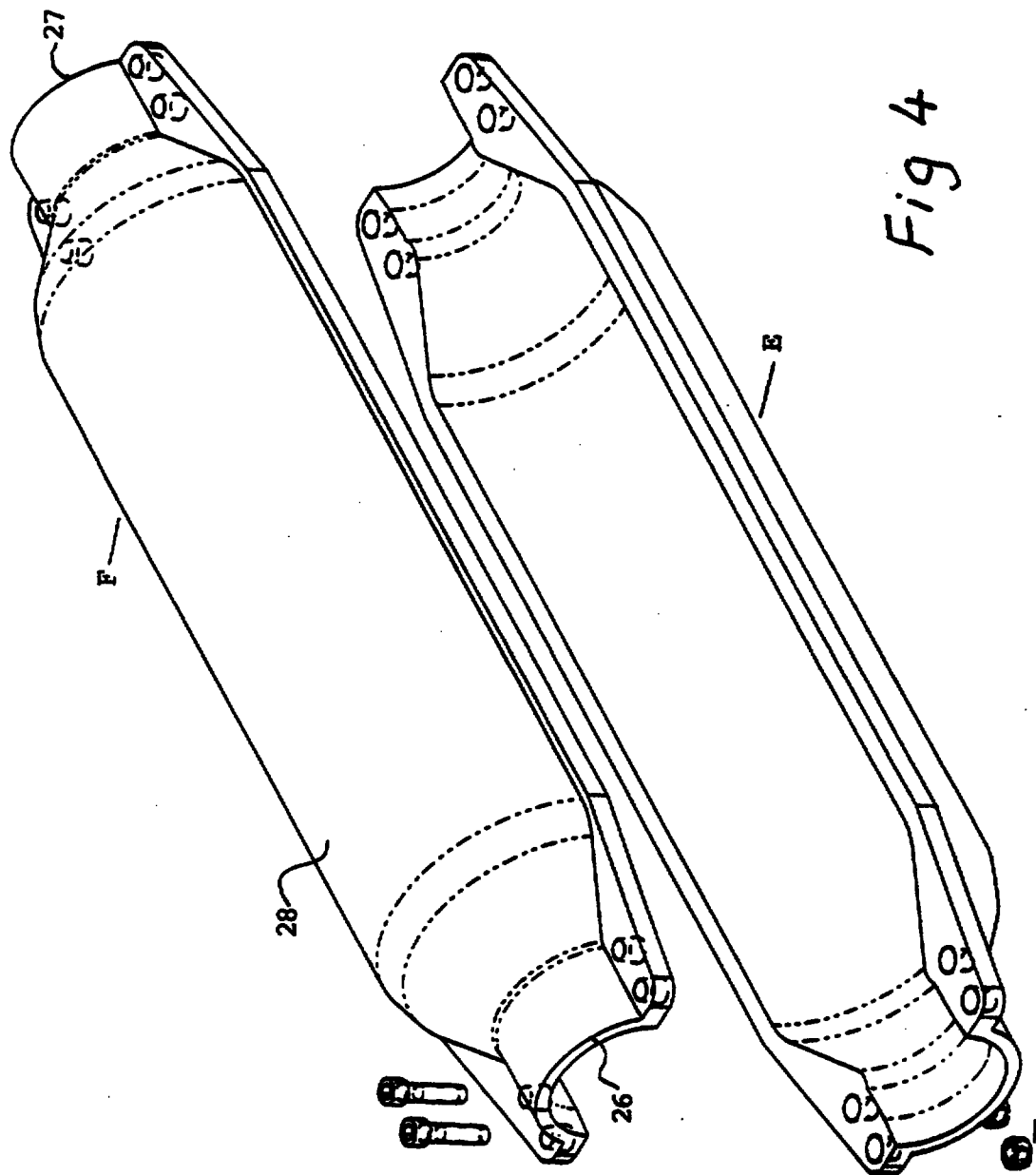


Fig 2





REPLACEMENT SHEET
Date 17 JAN 1996

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P/00/011 28/5/91
Regulation 3.2

AUSTRALIA

Patents Act 1990

ORIGINAL
COMPLETE SPECIFICATION
STANDARD PATENT

Invention Title:

"CABLE PROTECTION DEVICE"

The following statement is a full description of
this invention, including the best method of
performing it known to us:-

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REPLACEMENT SHEET
Date : 17 JAN 1996

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ABSTRACT

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A protective pipe section for providing mechanical protection of electrical or optical cables comprises two shells (A,B) forming an intermediate pipe section when placed together, each shell having a hollow hemispherical section (4,5) at either end. One end section (5) includes a pivotable clamping arrangement (7,8,18,18a) which allows a plurality of pipe sections to be concatenated without the need for fastening the shells (A,B) together. Each succeeding pipe section locks the shells of the proceeding pipe section together, with the hemispherical sections providing articulation.

grippingly attached to said cable at a point thereon where said plurality of pipe sections starts, said cable gripping means including a spherical element for co-operation in an articulating manner with the inner surface of the hollow spherical section of the first pipe section of the concatenation.

In order that the invention may be readily carried into effect, an embodiment thereof will now be described in relation to the accompanying drawings, in which:

Figure 1 is a perspective view of a pipe section of the present invention.

Figure 2 shows two pipe sections separately assembled and concatenated about a cable.

Figure 3 shows a cable clamp for use when assembling a concatenation of pipe sections.

Figure 4 shows a jointing device for jointing separate concatenations of pipe sections.

Referring to Figure 1, the pipe section comprises two halves, shell A and shell B. Shell A comprises an intermediate section 1 having a hollow cylindrical cross-section. At each end of intermediate section 1 is a hollow hemispherical section 2 and 3 truncated by an opening 5 and 6. Hemispherical section 2 is provided with two co-axial outwardly extending steel axels 7 and 8 whose cross-section is truncated to form flat surfaces 9 and 10. The axis of axels 7 and 8 lies in the same plane as upper edge 11 of shell A, and flat surfaces 9 and 10 of axels 7 and 8 lie in a plane which forms an angle of 15° with upper edge 11. Two strengthening side webs 12 and 13 and a central web (not shown) are located behind hemispherical section 2. From each side web extends a locating pin 14 and 15, and in each side web is a bolt hole 16 and 17.

Shell B is substantially identical to shell A except that shell B is provided with a pair of hooks 18 and 18a dimensioned to co-operate

with stub axels 7 and 8 of shell A, and also that side web 19 and 19a are provided with sockets, one of which, 20, is shown for co-operating with pins 14 and 15 of shell A. Side webs 19 and 19a are also provided with threaded screw holes (not shown) for co-operating with bolts inserted into bolt holes 16 and 17 of shell A.

A pipe section is formed by engaging, in a co-operating manner, hooks 18 and 18a of shell B with respective stub axels 7 and 8 of shell A and bringing together, in a pivoting manner shells A and B. Pins 14 and 15 of shell A rest in co-operating sockets (20) to maintain alignment of the shells.

The shells are made from any suitable material such as plastics or metal, but in the case of submarine cable protection, are preferably made from cast iron, and in particular spherulitic graphitic iron (SGI).

The thickness of each shell is, for example, 9mm and its length is 500 mm, the assembled shells defining an internal space of approximately 80 mm diameter for a cable.

In use, and referring to figure 2, a plurality of pipe sections are separately assembled about a cable 21 and concatenated, each pipe section locking the preceding pipe section. The ball joint formed by the inner boundary of spherical section 2 and the outer boundary of spherical section 3 of a successive section locks the preceding pipe section and provides articulation to the concatenated sections.

If, during an after laying, a pipe section is damaged, it can be bolted together using bolts in bolt holes 16 and 17.

Preferably, a cable clamp, as shown in figure 3, is clamped onto that point of the cable length from which the pipe sections start to provide an "anchor" for the successive concatenated sections. The cable clamp comprises two halves C and D each comprising two opposite hemispherical sections 23 and 24 jointed by a straight intermediate

section 25. When halves C and D are bolted together about a cable (not shown) it forms a pipe section whose predetermined internal diameter is such that it grips the cable. The hemispherical sections 23 and 24 form a truncate spherical section on each end of the cable clamp. The first pipe
5 section of the concatenation of pipe sections may then be assembled about a truncated spherical section of the cable clamp thus anchoring the concatenation to prevent movement of the concatenation along the cable length. Preferably, the cable clamp is made of SGI.

If one or more pipe sections of a concatenation are damaged,
10 or the concatenation is interrupted, the jointing device shown in figure 4 may be used to link the interrupted ends of the concatenation.

The jointing device comprises two halves E and F having two end sections 26 and 27 of hemi-circular cross-section and an intermediate section 28 of hemi-circular cross-section of a diameter greater than the
15 diameter of the end sections. When assembled about two interrupted pipe sections the end sections of the jointing device form a collar and grips the intermediate section 1 of the pipe sections to be joined thereby locking the concatenation each side of the joint.

While the present invention has been described with regard
20 to any particulars, it is understood that equivalents may be readily substituted without departing from the scope of the invention.



The claims defining the invention are as follows:

1. A protective pipe section for mechanically protecting a length of an elongate article, said pipe section comprising a first shell section and a second shell section, each shell section comprising an elongated intermediate section of hemi-tubular cross-section terminating on each end in a respective first end section and a second end section, each end section being in the shape of a truncated hollow hemisphere, wherein said first end section of each shell section includes a pivotable attachment means for mutual pivotable engagement to clamp the first shell section to the second shell section to form a pipe having an open-ended first hollow spherical section at one end thereof formed by the first end sections and an open-ended second hollow spherical section on the other end formed by the second end sections, for encasing a section of said elongate article extending therethrough, the inner radius of said first hollow spherical section relative to the outer radius of the second hollow spherical section being such that the second hollow spherical section is moveably contained within the first hollow spherical section when one said pipe section is concatenated with another said pipe section.
2. A protective pipe section as claimed in claim 1, wherein said pivotable attachment means included on each first end section comprises, on one first end section a pair of spaced outwardly extending co-linear stub axels whose co-axis is transverse said pipe section, and on the other first end section a pair of spaced rearwardly extending hooks each of which lie in a plane normal to the co-axis of said stub axels.
3. A protective pipe section as claimed in claim 2, wherein each said stub axel's cross section is truncated to form a flat surface thereon of a predetermined angle relative to said pipe section's longitudinal axis.
4. A protective pipe section as claimed in any one of claims 1 - 3, including means for maintaining alignment of said first shell member and second shell member when said pipe section is formed.



5. A protective pipe section as claimed in claim 4, wherein said means for maintaining alignment comprise at least one pin extending from one shell section and arranged to be located and nest in a co-operating socket in the other shell section when said pipe section is formed.
- 5 6. A protective pipe section as claimed in claim 5, including at least one web section joining said first end section of each shell to its associated intermediate section.
7. A protective pipe section as claimed in claim 6, wherein said at least one pin extends from said at least one web section of said at least one shell section
- 10 and said co-operating socket is located in said at least one web section of the other shell section.
8. A protective pipe section as claimed in claim 6 or claim 7, wherein said web section/s of one shell section includes at least one through-hole
- 15 for receiving a fastening bolt.
9. A protective pipe section as claimed in any one of the preceding claims made of cast iron.
10. A protective pipe section as claimed in any one of claims 1 - 8, made of spherulitic graphitic iron.
- 20 11. A protective pipe section as claimed in any one of the preceding claims wherein said intermediate section of hemi-tubular cross section is cylindrical.
12. A protective pipe section as claimed in any one of the preceding claims, wherein said elongate article is a submarine cable.
- 25 13. An articulated pipe section arrangement comprising a plurality of pipe sections as claimed in any one of the preceding claims, wherein an initial pipe section is assembled to encase a section of said elongate article followed by successive assembled pipe sections, whereby a ball-joint is formed by the inner surface of said first hollow spherical section of one
- 30 pipe section and the outer surface of the second hollow spherical section



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of the next pipe section to form an articulate concatenation of pipe sections.

14. An articulated pipe section arrangement as claimed in claim 13, including gripping means grippingly attached to said elongate article at
5 a point thereon where said plurality of pipe sections starts, said gripping means including a spherical element for co-operation in an articulating manner with the inner surface of the hollow spherical section of the first pipe section of the concatenation.

15. An articulated pipe section arrangement as claimed in claim 13 or
10 14, including a jointing means for joining two ends of an interrupted concatenation of pipe sections, said jointing means comprising a casing arranged to encase a section of elongate article exposed by an interruption of said concatenated pipe sections, and fastening means to fasten said casing to the pipe sections proximate said interruption thereby locking said
15 pipe sections.