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(54) **Termination assembly**

(57) Termination assembly for three-phase high voltage submarine cable(s) (1a-c), comprising a water-tight enclosure (10) with at least one cable lead-in (3a-c) located at one end (16) of the enclosure, at least three termination units (21-29) within said enclosure for receiving three phase conductors per cable, respectively, and lifting means (100) located on the enclosure (10) at an opposite end (17) in relation to said lead-in(s) (3a-c).

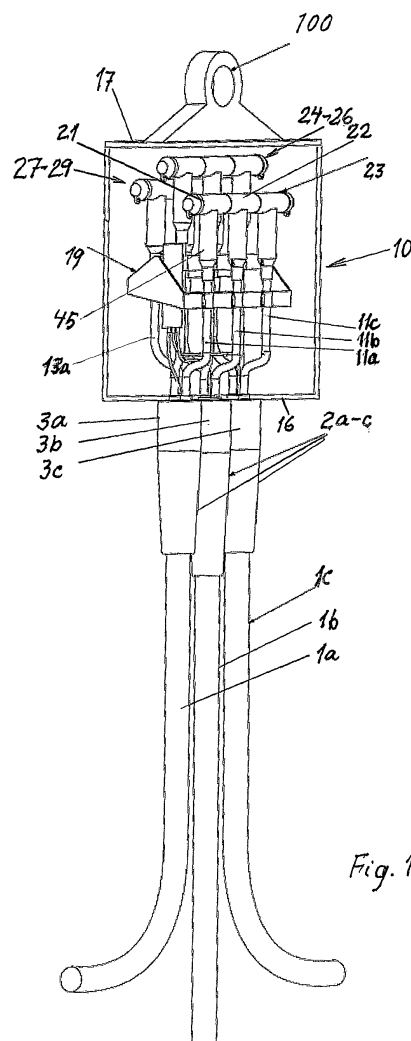


Fig. 1

Description

[0001] The present invention in general relates to a termination assembly for three-phase high voltage submarine cables, and in particular to splitting of power cables subsea into two or more cables.

[0002] In offshore oil and gas operations there is often a need for distribution of electric power to or from a number of subsea installations, with branching or splitting of cable systems, for example from several points along a main supply cable. A particularly interesting field of use for this invention is in offshore windmill parks.

[0003] Wind turbines may be combined with wave turbines in one park. Collecting the electric power from several sources is one of the challenges that are facing wind and wave power production at sea. Today there is no subsea solution available connecting the cables from individual wind turbines and wave turbines together and further to a larger or main cable connecting the whole plant to an onshore power network. The prior art solution to this problem is to terminate all the interconnection cables inside a windmill or other local installation above the sea level. This implies that several cables must connect to one installation like a windmill.

[0004] It would be highly desirable in plants or parks of the above type to be able to provide for the required interconnections or terminations in assemblies normally located on or near the seabed, or at least well immersed below the sea surface so as not to interfere with surface operations and to avoid many riser cables extending to platforms or windmill structures above sea level. Problems encountered in that connection involve deployment of cables and equipment concerned, as well as the need for retrieval in case of repair and maintenance. From time to time there may also be a need for changing the cable connections established.

[0005] Thus, according to this invention there is provided a termination assembly for three-phase high voltage submarine cables, comprising a water-tight enclosure with at least one cable lead-in located at one side of the enclosure, at least three termination units within said enclosure for receiving three cable phase conductors, respectively, and lifting means located on the enclosure at an opposite side in relation to said lead-in(s).

[0006] A component or unit of particular interest here is a type of T-connectors, being configured substantially in the shape of a "T". One example of such a unit is the T-connector supplied by Euromold® (a Nexans company). Such T-connectors are used with great advantage in the present termination assembly, since their plug-in functionality makes possible relatively easy replacement or addition of cable connections that may be required in the offshore installations and operations concerned. Maximum voltage levels may be for example up to 36kV.

[0007] A special advantage is obtained with this invention in the case of offshore floating windmills, since there will be a need for only one dynamic (riser) cable to each windmill.

[0008] In the following description this invention will be further explained by way of exemplary embodiments shown in the drawings:

Fig. 1 in a simplified manner partially in cross-section and in perspective view shows an assembly according to the invention for splitting an electric power cable into two cables.

Fig. 2 is a cross-section at an enlarged scale of three T-connectors assembled within an enclosure, corresponding to parts of Fig. 1.

Fig. 3 is a still more enlarged and detailed cross-section of a T-connector for use in a specific embodiment of this invention.

[0009] The embodiment of fig. 1 is of major importance, since this is the case of interconnecting three submarine power cables 1a, 1b and 1c. Thus, cables 1a and 1c, for example, may belong to a main cable for supplying produced electric energy from a number of windmills, to consumers onshore. Cable 1b in this example would then be the one connected to a windmill in the system. What is done at this point in the system is to electrically connect each phase of the three-phase cable 1b to each corresponding phase of cable(s) 1a and 1c. This takes place inside a water-tight enclosure 10 shown in fig. 1 (and fig. 2). Before entering enclosure 10 cables 1a-c are each surrounded by a bend stiffener 2a-c, respectively, according to known methods. Moreover, lead-in means 3a-c for sealed entry of each cable into the enclosure are provided, also as known per se.

[0010] Inside the enclosure 10 there are three groups of T-connectors 21-23, 24-26 and 27-29, respectively, supported by a bracket 19. T-connectors 21-23 are shown more detailed in fig. 2, i.e. for one (corresponding) phase 11a, 11b and 11c from respective cables 1a-c. The similar arrangements are provided for connecting the other two cable phases by means of groups 24-26 and 27-29, respectively, of T-connectors.

[0011] As will be seen from fig. 2, T-connectors 21, 22 and 23 are directly attached to one another by plugging together at their upper or transverse legs with a through-running electrically conductive path comprising conducting elements 34 and 35. In this manner conductors 31, 32 and 33 belonging to cable phases 11a, 11b and 11c, respectively, are connected together. Looking again at fig. 1, there is shown one phase 13a from cable 1a, being extended to T-connector 27 in the third or rear group of T-connectors.

[0012] The central or main leg 45 is indicated for T-connector 21, with all other T-connectors having the same kind of central leg, all such central legs being oriented vertically as shown in the drawings. This of course does not mean that in actual service this orientation is normal. It is to be noted also that in the embodiment shown in fig. 1, the axial direction of power of cables 1a-c, as well as the bend stiffeners 2a-c is generally the same as for the above central or main legs 45. In actual

practice this is a very advantage arrangement, facilitating the assembling operations as well as any repair or changes to be made during the lifetime of the termination assembly.

[0013] Lead-ins 3a-c are provided at one end or side-wall 16 of enclosure 10. The opposite end or side wall is denoted 17. At the end 17 there is provided lifting means in the form of an eye structure 100 making possible deployment as well as retrieval of the whole assembly with power cables 1a-c connected thereto. It will be understood that depending on water depth at the site of installation, there may be a quite considerable weight to be carried by lifting eye 100 during such operations. In many cases it may be considered advantageous to have the dimensions of enclosure 10 to be largest in a direction between the end or side walls 16 and 17, and also to have the central legs 45 of the T-connectors mounted to extend substantially in the longitudinal direction of the enclosure, i.e. more or less in parallel to the direction of cables 1a-c when entering the enclosure through bend the stiffeners 2a-c and lead-ins 3a-c.

[0014] Whereas fig. 1 illustrates the important case of three electric power cables 1a-c interconnected within enclosure 10, there may be more simple cases where the general concept of this invention is also applicable, for example when only two three-phase high voltage submarine cables are to be connected to one another (in a simple joint), whereby it may be sufficient to provide two cable lead-ins and six T-connectors within the enclosure.

[0015] A still more simplified arrangement is illustrated in fig. 3, where a single phase of cable 1x is connected to T-connector 20 with a similar kind of central leg 45 as in the above embodiment, and with two transverse legs 26 and 27, to serve only as a termination and insulation of cable 1x. Thus, a common cylindrical housing 41 of insulating material and insulating plugs 42 as well as rubber caps 43 provide for the required insulation and termination. This embodiment is particularly useful for testing purposes, which may be a quite important operation during installation of submarine cables. For this purpose it may be sufficient to have just one cable lead-in and three termination units or T-connectors for testing of a three-phase high voltage submarine cable.

2. Assembly according to claim 1, wherein said termination units are T-connectors (20,21-29).
3. Assembly according to claim 2, wherein said T-connectors (21-29) are oriented within said enclosure (10) with their central legs (45) extending substantially in a direction between said one and opposite ends (16,17).
4. Assembly according to claim 3, wherein the dimensions of said enclosure (10) are largest in said direction.
5. Assembly according to any one of claims 1-4, wherein at least two cable lead-ins (3a-c) are provided, and with at least six T-connectors (20,21-29) within said enclosure (10).
6. Assembly according to any one of claims 1-5 for a branching connection of cables, wherein three cable lead-ins (3a-c) are provided, and with nine T-connectors (21-29) within said enclosure (10).
7. Assembly according to claim 5 or 6, wherein three T-connectors (21-23, 24-26 and 27-29, respectively) for one phase conductor (31,32,33) are mounted directly interconnected on a common supporting bracket (19).

Claims

1. Termination assembly for three-phase high voltage submarine cable(s) (1a-c), comprising
a water-tight enclosure (10) with at least one cable lead-in (3a-c) located at one end (16) of the enclosure,
at least three termination units (20,21-29) within said enclosure for receiving three phase conductors (31,32,33) per cable, respectively, and
lifting means (100) located on the enclosure (10) at an opposite end (17) in relation to said lead-in(s) (3a-c).

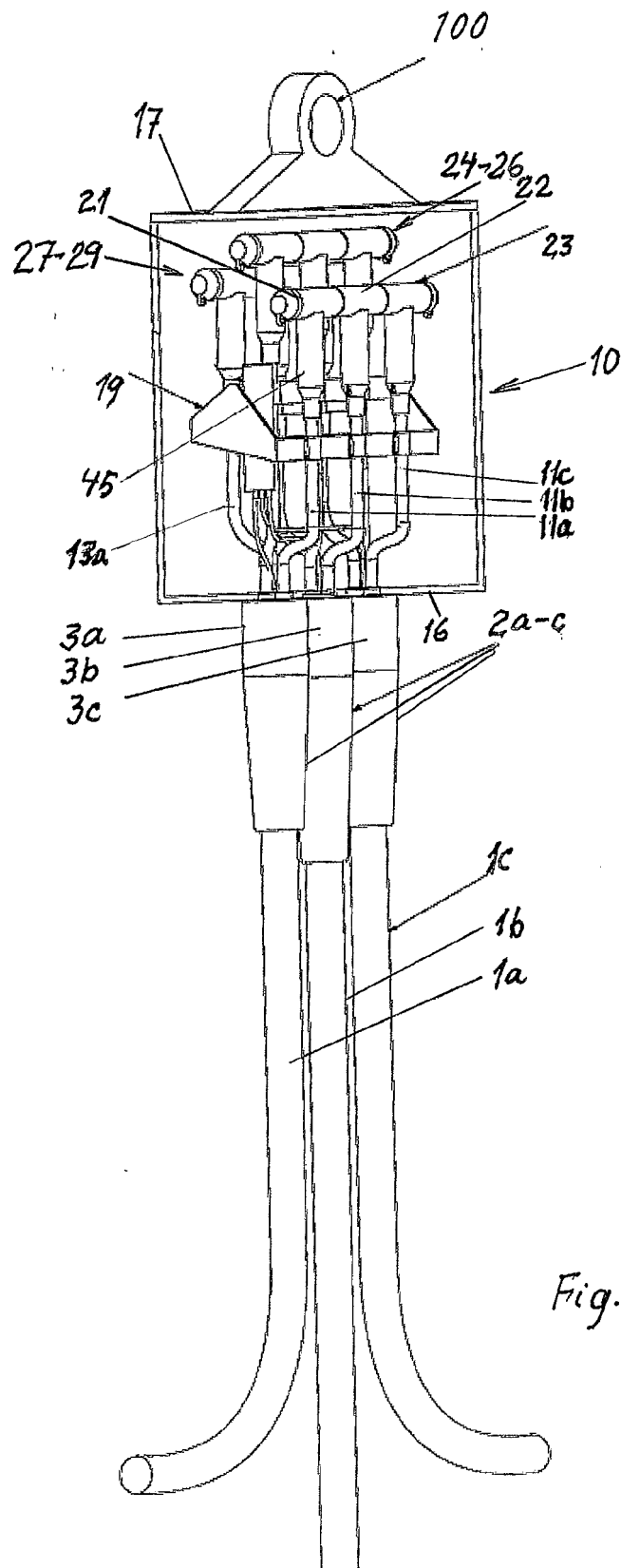


Fig. 1

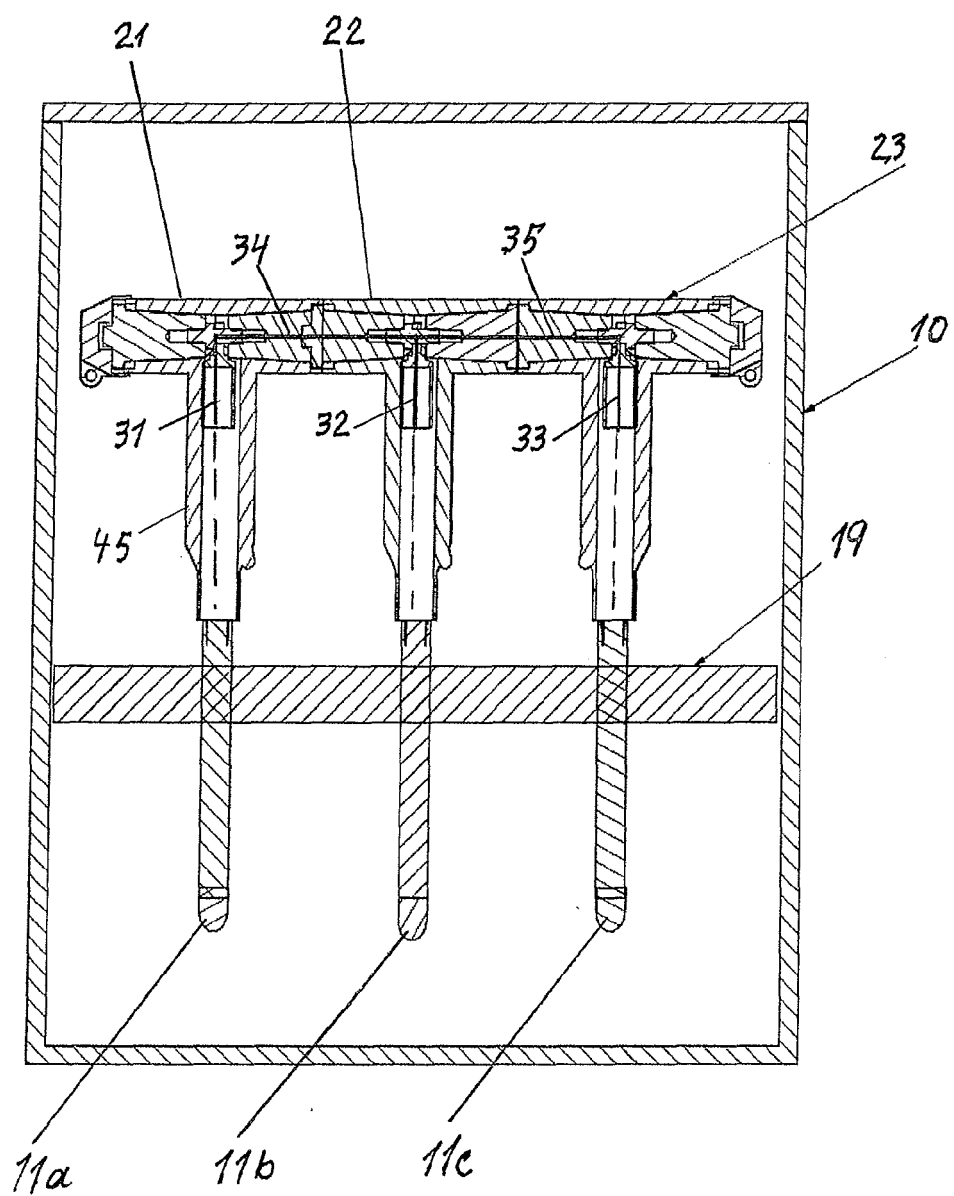
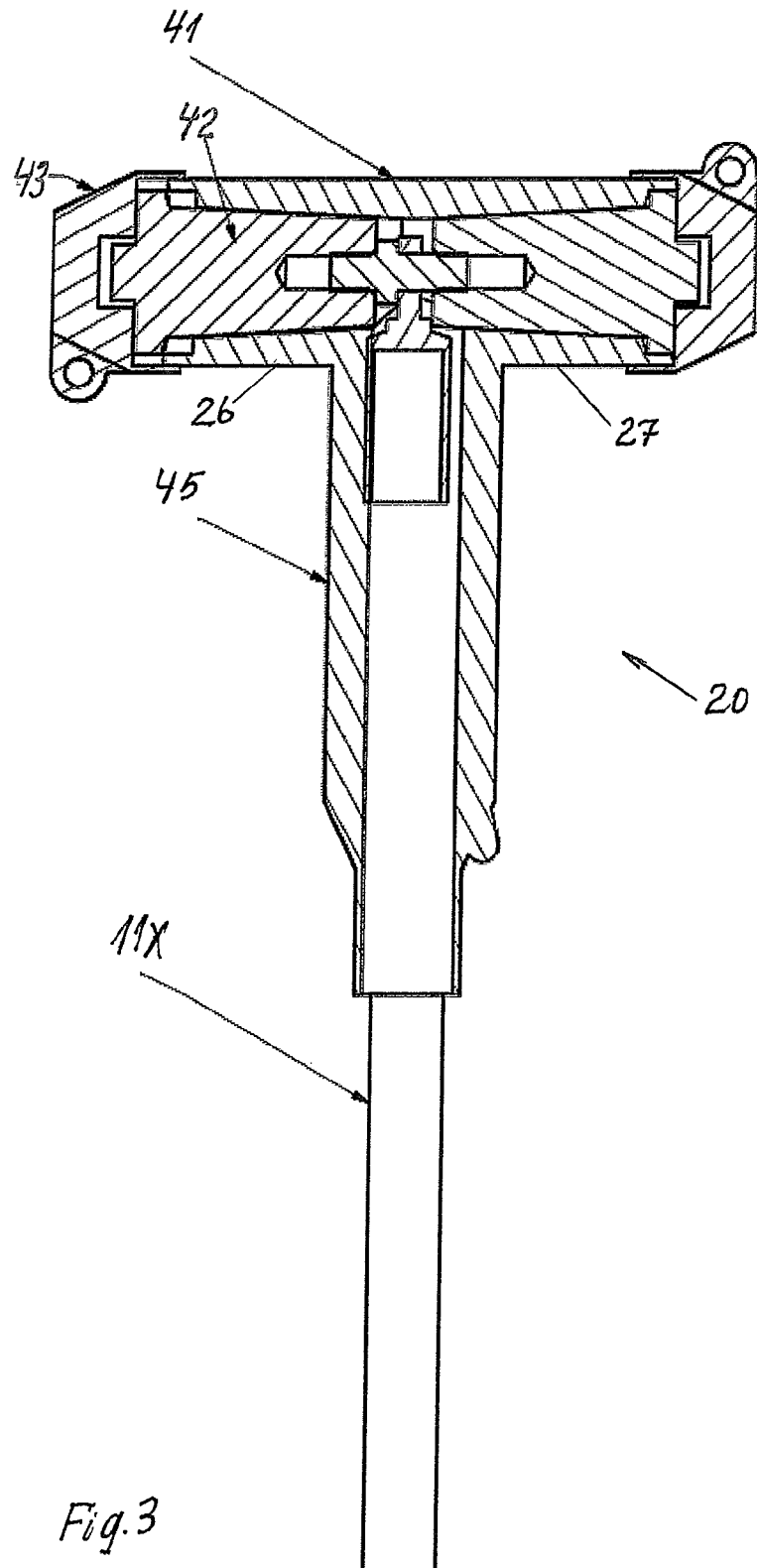


Fig. 2





EUROPEAN SEARCH REPORT

Application Number
EP 10 30 5253

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
Y	WO 02/43215 A1 (TAPPAT ENG PTY LTD [AU]; DANNENBERG PATRICK PAUL [AU]) 30 May 2002 (2002-05-30) * page 16, paragraph 2; figures 9,10 *	1,2	INV. H01R13/523 H01R13/53 H01R9/03
Y	FR 2 350 496 A1 (MATRA ENGINS [FR] MATRA [FR]) 2 December 1977 (1977-12-02) * figure 1 *	1	
Y	FR 1 397 945 A (ELASTIC STOP NUT CORP) 7 May 1965 (1965-05-07) * figure 8 *	2	
			TECHNICAL FIELDS SEARCHED (IPC)
			H01R
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 10 June 2010	Examiner Corrales, Daniel
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

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EPO FORM 1503 03 82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 10 30 5253

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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10-06-2010

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 0243215 A1	30-05-2002	AT 328386 T	15-06-2006
		AU 1365002 A	03-06-2002
		EP 1348248 A1	01-10-2003
		US 2004072469 A1	15-04-2004
FR 2350496 A1	02-12-1977	GB 1529652 A	25-10-1978
		NO 771486 A	04-11-1977
		US 4080025 A	21-03-1978
FR 1397945 A	07-05-1965	NONE	