

(19)



Europäisches Patentamt

European Patent Office

Office européen des brevets



(11)

EP 0 982 468 A1

(12)

EUROPEAN PATENT APPLICATION

(43) Date of publication:
01.03.2000 Bulletin 2000/09

(51) Int. Cl.⁷: **E21B 17/01**, E21B 19/22,
B65H 81/06

(21) Application number: **98202877.1**

(22) Date of filing: **28.08.1998**

(84) Designated Contracting States:
**AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU
MC NL PT SE**
Designated Extension States:
AL LT LV MK RO SI

(71) Applicant:
**SINGLE BUOY MOORINGS INC.
CH-1723 Marly (CH)**

(72) Inventor: **Lemoel, Marc
6440 Peille (FR)**

(74) Representative:
**de Bruijn, Leendert C. et al
Nederlandsch Octrooibureau
P.O. Box 29720
2502 LS Den Haag (NL)**

(54) **Method for wrapping a cable around a pipe construction and pipe construction assembly**

(57) The invention relates to a method for wrapping a cable around a pipe construction, in particular a method for wrapping an umbilical around a flow line such as flexible or a rigid riser. In one embodiment the umbilical is connected to the riser at first and second spaced apart connection points. The cable length extending between the connection points is larger than the distance therebetween such that the cable can be wrapped around the riser several times. Thereafter, the umbilical is fixed against the riser at the third connection point located between the first two points. The present invention provides a quick and cheap way of wrapping the umbilical around the flow line and allows for exchange of flow line parts or the umbilical without disassembling the complete flow line.

EP 0 982 468 A1

Description

[0001] The invention relates to a method for wrapping a cable around a pipe construction, in particular a method for making a flow line bundle in which an umbilical is wrapped around a flow line, and to a flow line-umbilical assembly.

[0002] Such a method is for instance described in U.S. patent nrs. 4,979,296 and 4,843,713 in which a flow line bundle is formed of two pipe sections, an umbilical cable and other risers, which are twisted or braided into a permanent rope-like helical configuration prior to laying the flow line bundle offshore by a reel method. By wrapping the umbilical around the pipe sections in a helical manner, it is prevented that the umbilical becomes overstressed or buckles upon bending of the flow line, which would occur in a parallel configuration of the pipe sections and umbilical. The known helical winding and assemblage of the pipe sections and umbilical requires one free end of the umbilical, which is unwound from a reel and helically wrapped around each pipe section prior to attachment of said pipe sections to the partially assembled flow line. For very large flow lines and umbilicals, which may have a length of 2,000 metres or more, said method is unpractical. Furthermore, if after installation a part of the flow line is leaking, the complete flow line-umbilical arrangement must be dismantled to change the non-functional part of the flow line because of the very tight helical wrapping of the umbilical. The same applies when a defect in the umbilical occurs or when after installation one or more umbilicals must be replaced by a new one.

[0003] It is therefore an object of the present invention to provide a method for wrapping a cable around a pipe construction and to provide a flow line-umbilical assembly which allows for easy installation at limited costs, which allows for replacement of a section of the flow line in case of a defect and which allows for easy replacement of the umbilical in case of exchange.

[0004] Thereto the method according to the present invention is characterized by the steps of:

- providing along the pipe construction spaced apart first and second connection points and a third connection point located between said first and second connection points,
- connecting the cable at said first and second connection points or at said third connection point such that a cable length that is larger than the distance between said first and second connection points extends between said first and second connection points,
- wrapping the cable length between the first and second connection points at least one time around the pipe construction by rotating the cable part at the position of the third connection point around the pipe construction, while maintaining a fixed position of the cable parts of the first and second connection

points or by rotating the cable part at the position of the first and second connection points around the pipe construction while maintaining a fixed position of the cable part of the third connection point and fixing the rotated cable parts to the pipe construction.

[0005] With the method according to the present invention a part of the cable is locally wrapped around the pipe construction between two spaced apart connection points. Hereby it is possible, in case of a defect of the flow line, to locally unwrap the umbilical and to exchange the defective flow line part. The method of the present invention also allows to first install the flow line, and after testing thereof place the umbilical cables around the flow line. In case the umbilical cable has to be exchanged, the flow line needs not be dismantled and can in certain circumstances remain operative during change-out of the umbilical.

[0006] The firmness of the wrapping pattern of the cable can be easily adapted to the water depth and flow line characteristics (flexible versus rigid) by adjusting the distance between first and second connection points, and by adjusting the cable length extending between those points.

[0007] With the term "pipe construction" as is used therein, it is meant to include flexible and rigid pipe segments. The connection points can be separate clamps placed around the pipe construction having a guide opening for receiving the cable or can be formed as a part of integral coupling members of the pipe sections, such as flanges having separate attachment means for the cable.

[0008] According to the method of the present invention the cable may be attached to the pipe in the first and second connection points by means of clamps. Thereafter the cable may be connected to a further clamp which is connected to the pipe at the third connection point and which is thereafter rotated to wrap the cable around the pipe segment while the first and second clamps are stationary. It is also possible to connect the cable to the pipe at the first and second connection points, then wrap the middle section around the pipe and thereafter connect the middle section fixedly to the pipe at the third connection point. Finally it is also possible to first fix the cable at the third connection point, to connect the cable at the first and second connection point which are then rotated and finally fixed to the pipe to wrap the cable locally around the pipe.

[0009] A further embodiment of the method according to the present invention comprises the steps of:

- connecting two or more pipe sections via their coupling members on shore to form a pre-assembled element,
- placing a number of pre-assembled elements on an installation vessel,
- connecting the cable to a respective pre-assembled

element at the three connection points at an installation site, and

- adding the pre-assembled element to a second pre-assembled element to which the cable has been connected at the three connection points in a previous step.

[0010] The method according to the present invention allows a cheap and fast wrapping of an umbilical cable around the flow line, especially on the limited deck space of an installation vessel.

[0011] By pre-assembling two or more pipe sections, for instance three or four pipe sections (depending on the size of the installation vessel), beforehand on shore and wrapping the umbilical around the pre-assembled elements on the installation vessel at the installation site, the offshore time and cost of installation of the flow line is reduced, offshore time being much more expensive than onshore time.

[0012] In a further embodiment the cable can be slidably connected to the first and second connection points such that upon wrapping of the cable around the pipe construction an extra tension is placed on the cable of the adjacent segments. By executing the holding device at the third connection point as a rotatable holding device, cable tensioning can be carried out by adjusting the angular position of said holding device.

[0013] The principles of the method according to the present invention will be explained in detail with reference to the accompanying drawings. In the drawings:

Figure 1a to 1c show the principle of the method according to the present invention on a single pipe segment,

Figures 2a and 2b show wrapping an umbilical cable around a pre-installed flow line, and

Figures 3 and 4 show a plan view and a cross-sectional view, respectively, of a connection member for use in the present invention.

[0014] Figures 1a to 1c show a flow line 1 made of flexible or rigid piping for the transportation of hydrocarbons from a subsea structure to a surface structure such as a floating production, storage and offloading vessel (FPSO), a tension leg platform, a shuttle tanker or other vessel. Around the flow line 1, two spaced apart connection members 2, 3 are provided through which a cable, such as an umbilical 4, is guided. Cable length 5 extending between the connection members 1, 2 is longer than the distance between the connection members 1, 2 measured along the flow line 1. As shown in figure 1b, the umbilical 5 is wrapped around the flow line section that extends between the connection members 1, 2 such that the helical configuration shown in figure 1c is obtained. Thereafter the cable length 5 is fixed to the flow line 1 by means of a third connection member 6. In one embodiment, the connection member 6 is rotatably connected to the flow line 4, such that by turn-

ing said element the umbilical 5 can be tightened around the flow line 1. For applying a further pretension, it is possible that the umbilical 5 is slidably connected to the first connection members 1, 2. Engaging means (not shown in the drawing) may be provided on the connecting members 1, 2 for blocking any further movement of the umbilical 5 upon engagement thereof.

[0015] Figures 2a and 2b show another method of wrapping an umbilical 10 around segments 7, 8 of flow line 9. Each segment is near its end provided with flanges 12, 13 for mutually attaching to a neighbouring segment. Near the flanges 12, 13 the first and second connection members 15, 16 are attached to the flow line. It is, however, also possible that the connection members 15, 16 are integrated with the flanges 12, 13. After installation of the complete flow line 9 and testing thereof, the umbilical 10 may be wrapped around each flow line segment 7, 8 several times as shown in figure 2b. After being placed in the configuration shown in figure 2b, a third connection member may be applied at positions 18 and 19, shown in figure 2b for maintaining the umbilical 10 in its wrapped around configuration.

[0016] Figures 3 and 4 show a connection member 20 with a central opening 21 which can be fixed around a pipe segment. The connection member 20 consists of two halves 22, 23 which are attached by bolts 24, 25. The connection member 20 comprises a clamping part 26 in which a cable 27 can clampingly engaged, as is clearly shown in figure 4.

[0017] Although the invention is illustrated by an umbilical being wrapped around a flow line, it can also be applied to other cables such as a bundle of umbilicals, a bundle of electrical cables or a combination of umbilicals, electrical cables and/or flowlines.

Claims

1. Method for wrapping a cable (4,10) around a pipe construction (1,9) characterised by the steps of:

- providing along the pipe construction spaced apart first and second connection points (2,3; 15,16) and a third connection point (6; 18,19) located between said first and second connection points,
- connecting the cable (4,10) at said first and second connection points (2,3; 15,16) or at said third connection point (6; 18,19) such that a cable length that is larger than the distance between said first and second connection points extends between said first and second connection points (2,3; 15,16),
- wrapping the cable length between the first and second connection points (2,3; 15,16) at least one time around the pipe construction by rotating the cable part at the position of the third connection point (6; 18,19) around the pipe construction, while maintaining a fixed position

of the cable parts at the first and second connection points (2,3; 15,16) or by rotating the cable part at the position of the first and second connection points (2,3; 15,16) around the pipe construction while maintaining a fixed position of the cable part at the third connection point (6;18,19), and

- fixing the rotated cable parts to the pipe construction.

5

10

2. Method according to claim 1, wherein the pipe construction comprises a number of segments (7,8) having coupling members (12,13), the first and second connection points (15,16) being provided at or near each respective coupling member (12,13).

15

3. Method according to claim 2, characterised by the steps of:

- connecting two or more pipe segments (7,8) via their coupling members (12,13) on shore to form a pre-assembled element,
- placing a number of pre-assembled elements on an installation vessel,
- connecting the cable (10) to a respective pre-assembled element at the three connection points (15,16;18,19) at an installation site, and
- adding the pre-assembled element to a second pre-assembled element to which the cable has been connected at three connection points in a previous step.

20

25

30

4. Method according to any of the previous claims, characterised in that the cable (14,10) is slidably connected to the first and second connection points (2,3;15,16).

35

5. Method according to any of the previous claims, characterised in that connection means are provided at the first and second connection points and/or at the third connection point (6;18,19) which comprise a cable holding device which is rotatably attached to the pipe construction.

40

6. Assembly of a pipe construction comprising spaced apart first and second cable connection elements (2,3;15,16), and a third cable connection element (6;18,19) located between said first and second connection elements, and a cable comprising outer cable parts connected to the first and second connection elements (2,3;15,16) and a middle cable part being wrapped at least once around the pipe construction and being attached at the third connection element (6;18,19).

45

50

55

7. Assembly according to claim 6, characterised in that at least one of the connection elements (2;3;6;15;16;18;19) is rotatably connected to the

pipe construction and comprises a fixing member for fixing the angular position of the connection element with respect to the pipe construction.

fig-1a

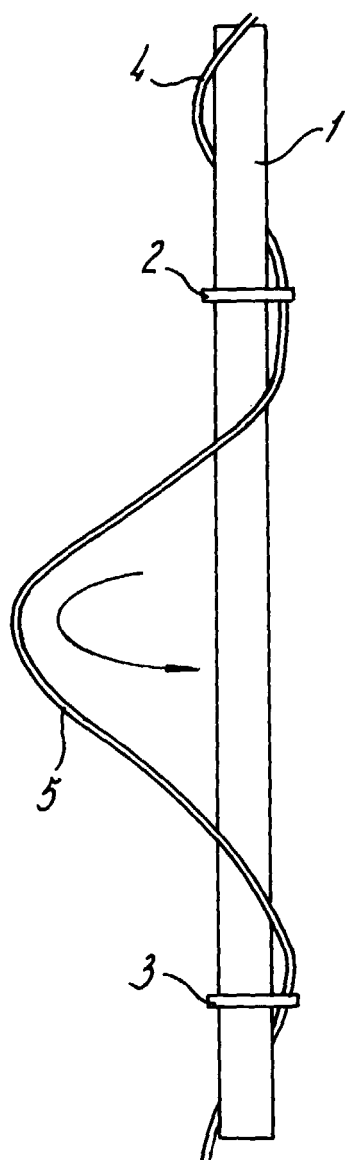


fig-1b

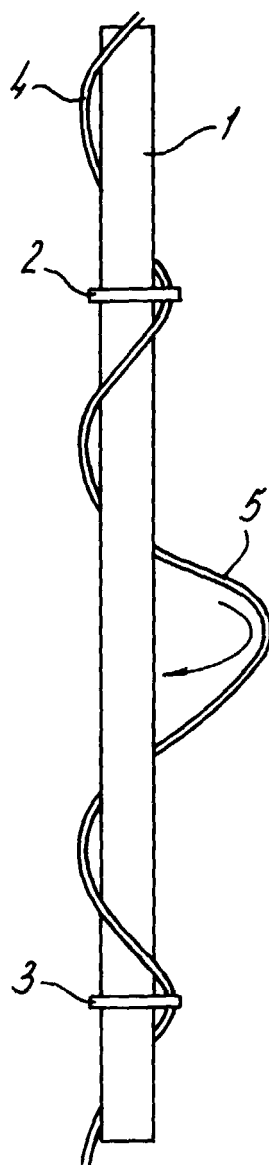


fig-1c

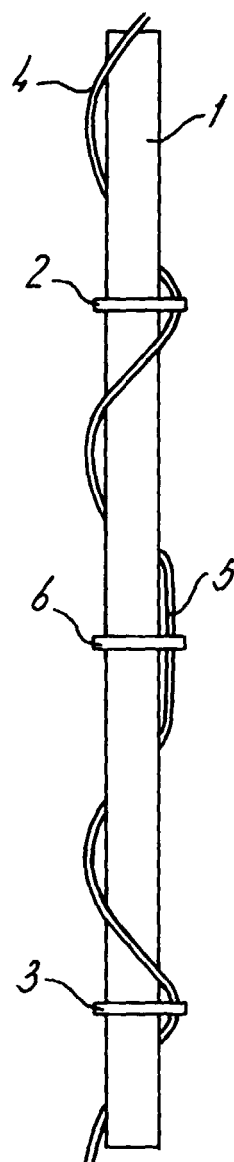


fig-2a

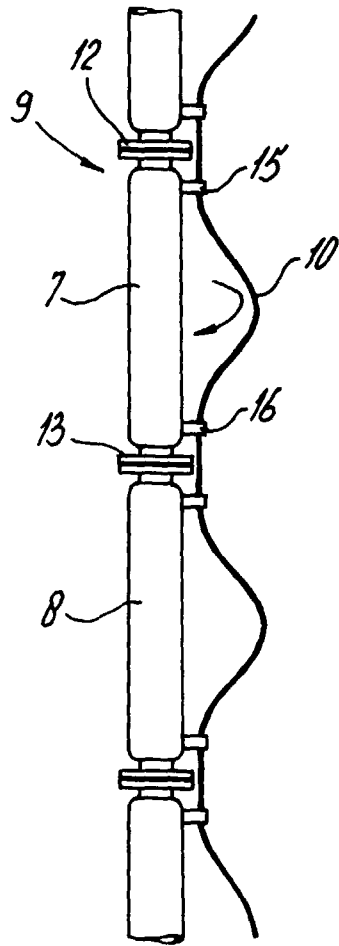


fig-2b

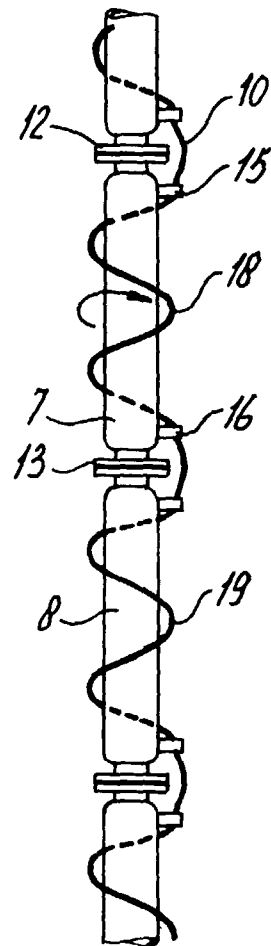


fig-3

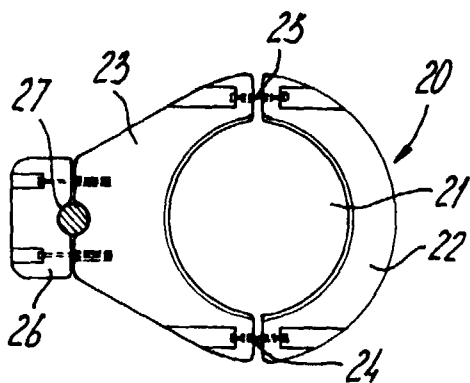
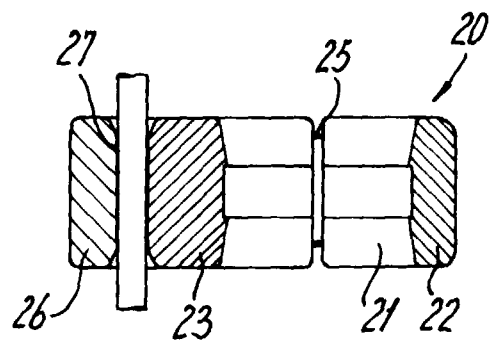


fig-4





European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 98 20 2877

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.6)
A	US 3 718 183 A (DCOTT) 27 February 1973 * column 3, line 34 - line 45 * ---	1,6	E21B17/01 E21B19/22 B65H81/06
A	GB 2 117 822 A (GRAEME EDWIN REYNOLDS) 19 October 1983 * abstract * ---	1,6	
A	GB 2 063 968 A (INSTITUT FRANÇAIS DU PÉTROLE) 10 June 1981 * abstract * ---	1,6	
A	US 3 424 242 A (TRIPLETT) 28 January 1969 * column 6, line 42 - line 45 * ---	1,6	
A	FR 2 376 989 A (COMPAGNIE FRANÇAISE DES PÉTROLES) 4 August 1978 * the whole document * ---	1,6	
A	WO 97 29944 A (PETROLEUM GEO-SERVICES A.S.) 21 August 1997 * the whole document * ---	1,6	
A	US 5 547 314 A (AMES) 20 August 1996 * column 12, line 46 - line 63 * ---	1,6	E21B F16L B65H
A,D	US 4 979 296 A (LANGNER) 25 December 1990 * abstract * * column 1, line 31 - line 51 * -----	1,6	
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 5 February 1999	Examiner Sogno, M
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	

EPO FORM 1503 03.82 (P04C01)

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

EP 98 20 2877

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
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

05-02-1999

Patent document cited in search report		Publication date	Patent family member(s)		Publication date
US 3718183	A	27-02-1973	CA	962994 A	18-02-1975
GB 2117822	A	19-10-1983	US	4437791 A	20-03-1984
GB 2063968	A	10-06-1981	FR	2470845 A	12-06-1981
			BR	8007804 A	16-06-1981
			CA	1156141 A	01-11-1983
			JP	1405937 C	27-10-1987
			JP	56093995 A	29-07-1981
			JP	62016307 B	11-04-1987
			NL	8006468 A	01-07-1981
			US	4362215 A	07-12-1982
US 3424242	A	28-01-1969	NONE		
FR 2376989	A	04-08-1978	CA	1083366 A	12-08-1980
			DE	2800833 A	13-07-1978
			GB	1592433 A	08-07-1981
			NL	7800102 A	13-07-1978
			US	4279544 A	21-07-1981
WO 9729944	A	21-08-1997	US	5697447 A	16-12-1997
			AU	1815197 A	02-09-1997
			GB	2326899 A	06-01-1999
			NO	983684 A	12-08-1998
US 5547314	A	20-08-1996	NONE		
US 4979296	A	25-12-1990	CA	1328040 A	29-03-1994
			CN	1007550 B	11-04-1990
			GB	2192966 A,B	27-01-1988
			US	4843713 A	04-07-1989