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(54) Submarine catenary offshore cable.

(57) The present invention relates to a hold and release arrangement for an offshore catenary cable (1). The hang-off head (2) of the cable (1) is releasably secured to a platform (3) or the like by means of a pin/slot arrangement (4,5). In one embodiment of the invention a part (5) of the hold and release means cooperates with a hydraulically operated wedge arrangement (10) which may be operated to release the hang-off head (2) from the platform (3).

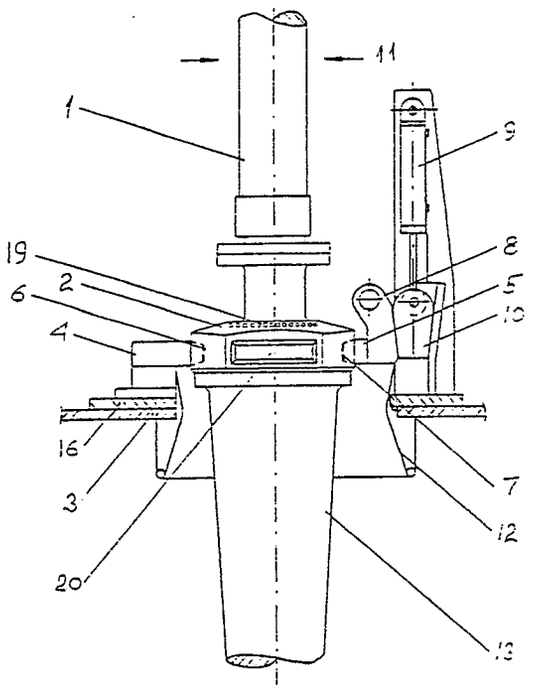

FIG. 1

EP 0 335 218 A2

Submarine catenary offshore cable

The present invention relates to offshore cables and in particular to deep sea catenary cables, where one end of the cable is terminated on an offshore installation or platform. The cable end is usually secured to a so-called hang-off head, so that the cable hangs from the platform into the sea. The cables concerned are heavy and the arrangement for securing the hang-off head to the platform must be capable of taking up weight in the order of 5.000 kg and more.

The submarine cables concerned may contain power conductors and/or telecommunication conductors as well as flow lines for fluids and control conductors of various kinds, such as hydraulic hoses. These cables are rather expensive and the repair of such cables is difficult and takes considerable time, especially in rough offshore environments.

The submarine cable usually interconnects the platform with some other installation on the sea bed or on shore or on a floating installation. One problem which arises in connection with such cable installations is that connectors are not easily disconnectable. In case of emergency it must be possible to release the cable from the platform very rapidly, and the preferred solution is therefore to cut the cable and let it sink to the sea bed. With known connectors and cutting devices it is not possible to release the cable without damaging installations on the platform.

The object of the present invention is therefore to provide an improved hold and release device for catenary offshore cables, so that the cable may be released without breaking fixed installations.

The main features of the invention are defined in the accompanying claims. With the defined device the hang-off head and the cable stump can be released rapidly and safely without destroying the fixed installations. The pin/slot arrangement ensures that the hang-off head is lowered in an upright position until it is released.

Above mentioned and other features and objects of the present invention will clearly appear from the following detailed description of embodiments of the invention taken in conjunction with the drawings, where

Figure 1 illustrates the principles of a lockable and releasable hang-off head,

Figure 2 illustrates the lock and release mechanism seen form above, and

Figures 3 and 4 schematically illustrate details of the release mechanism of the invention.

In Fig. 1 is schematically illustrated a cable 1 which is provided with a socalled hang-off head 2. The cable armouring 19 is secured to the hang-off head so that when the cable is locked to a structure 3, all the weight of the cable and the longitudinal strain in the cable as well as the bending movements coming from the cable, are taken up by the structure. The structure is usually an offshore platform and the cable is usually a submarine cable which is designed to hang along a catenary line to the sea bottom or to some other structure. The structure is provided with a number of locking pins 4 and 5 which fits into corresponding slots 6 and 7 arranged on the hang-off head.

The wedge like pin 4 is illustrated as a fixed pin, whereas the pin 5 is arranged on a hinged arm 8. By operating a hydraulic cylinder 9, a wedge like device 10 is forced downwards as illustrated to press the pin part 5 of the hinged arm 8 into the corresponding slot 7. The pin ends and the slots should have corresponding inclined surfaces with angles in the order of 20 to 30 degrees with the pin axis. The bottom of the slots should be deeper than the end of the pins so that the hang-off head can be completely locked sideways as well as in the vertical direction.

The upper end of the cable 1 which is relieved of its armouring, is terminated with electrical circuits (not shown) on the platform. In case of emergency the cable must be released in three steps: First the current must be switched off and earthed to avoid sparks, - then the cable core must be cut at a place indicated at 11, - and finally the hang-off head 2 must be released from the structure 3. The hang-off head 2 will be released by lifting the wedge like device 10. The rotatable pin 5 will then be gradually moved to the right (on the drawing) and the weight of the cable will ensure that both pins 4 and 5 slide downwards on the lower inclining surfaces of the slots 6 and 7 until the hang-off head with the cable stump drop down through a bellmouth 12 in the platform structure. The hang-off head should preferably be provided or combined with a bend restrictor 13.

The hang-off head of the present invention satisfies the following requirements:

- it takes up the weight of the cables and additional dynamic loads,
- it is resistant against wear and tear, corrosion and vibrations,
- it is designed both for factory and field installation,
- it is designed for being mechanically released,
- it withstands short circuit forces,
- it can form part of a pull-in arrangement (not shown) for mechanical installation,
- it forms part of a bend restrictor,

- it does not introduce permanent torque into the cable, and
- it gives proper earth connection to the armoring wires.

In Fig. 2 is schematically illustrated a crossection through the cable 1 with the hang-off head 2 locked to the structure 3 by means of the two locking pins 4 and 5. The aperture of the bellmouth 12 is indicated. Opposite sides 14 and 15 of the hang-off head 2 may also be provided with slots 20 (Figure 1) so that additional movable pins (not shown) can be inserted into these slots. The purpose of such additional pins/slots would be for testing the release mechanism for the pin 5. By locking the hang-off head with pins inserted into slots arranged in the sides 14 and 15, the pin 5 may be withdrawn, oiled and tested. The slots arranged at the sides 14,15 could be wide enough to allow also disengagement and checking of the pin 4 before operating the pin 5 again and retaining the normal locked position.

The cable 1 is usually rather rigid and it may be difficult to rotate it to obtain alignment of the premounted hang-off head slots with the locking pins. A plate 16 for the pins 4 and 5 may therefore be rotatably mounted on the structure 3 by providing it with oval mounting holes indicated at 17,18.

In Figures 3 and 4 are schematically illustrated a crossection (not to scale) of the pins 4 and 5 inserted into the slots. In Figure 3 the pins are inserted into their slots whereas in Figure 4 the hang-off head 2 has been lowered slightly in an upright position and is about to be released.

The emergency release device of the invention has been shown to satisfy the following requirements:
- it supports the cable and transfers the forces from the cable to the structure,
- it allows periodic function testing of the release mechanism, even with power on the cable,
- it may be interlocked with a cutting device for proper sequence in the emergency release operation,
- it can have strategically placed positioning alarm(s) for the mechanical locking device in order to prevent accidental release,
- when using hydraulic cylinder(s) for the release mechanism, the hydraulic pressure may be obtained from an emergency power supply, from a combined electrically and manually operated system or from an accumulator system. The accumulator system may be provided for charging and recharging both from an electrically driven pump and from a hand pump. The electrically driven pump may start and stop automatically by means of pressure sensors. Pressure alarms may be installed.
- it is designed for a manual release operation as back-up,
- the release operation does not take more than 5 minutes including time for switching off the power and cutting the cable, and
- it can be installed in areas with explosion risks.

It should be mentioned that the hydraulic arrangement for locking and releasing the pin 5 could be exchanged with any kind of mechanical, electrical or pneumatic arrangement. Further, the number of pins and corresponding slots could be increased to any number over two, such as for instance 3 pins/slots arranged 120° around the circumference of the hang-off head. Two of the pins could then be fixed, leaving only one pin movable, and there could be arranged a number of auxiliary pins/slots for test purposes.

The above detailed description of embodiments of this invention must be taken as examples only and should not be considered as limitations on the scope of protection.

Claims

1. Submarine catenary offshore cable hold and release device including a hang-off head (2) which is secured to the cable end (1) for taking up all longitudinal strain in the cable (1), and means for releasingly securing the hang-off head to an offshore platform (3) or similar structure, **characterized in this that** the means (4,5) for releasing the hang-off head (2) includes at least two wedge like locking pins (4,5) arranged on the structure (3) and two corresponding slots (6,7) arranged on the hang-off head.

2. Device according to claim 1, **characterized in this that** at least one of the locking pins (5) is arranged to be moved at right angles to the cable axis, into and out of the corresponding slot (7).

3. Device according to claim 2, **characterized in this that** it includes means (8,9,10) for locking the movable locking pin (5) in a desired position.

4. Device according to claim 3, **characterized in this that** the means for locking includes a hydraulic arrangement (9,10).

5. Device according to claim 1, **characterized in this that** the pins and corresponding slots are evenly distributed around the hang-off head.

6. Device according to claim 1, **characterized in this that** it is provided with a set of auxiliary locking pins and corresponding slots 7. Device according to claim 1,**characterized in this that** it includes adjustable fixing means (16,17,18) so that locking pin arrangement (4,5) may be rotated to a desired angular position on the structure.

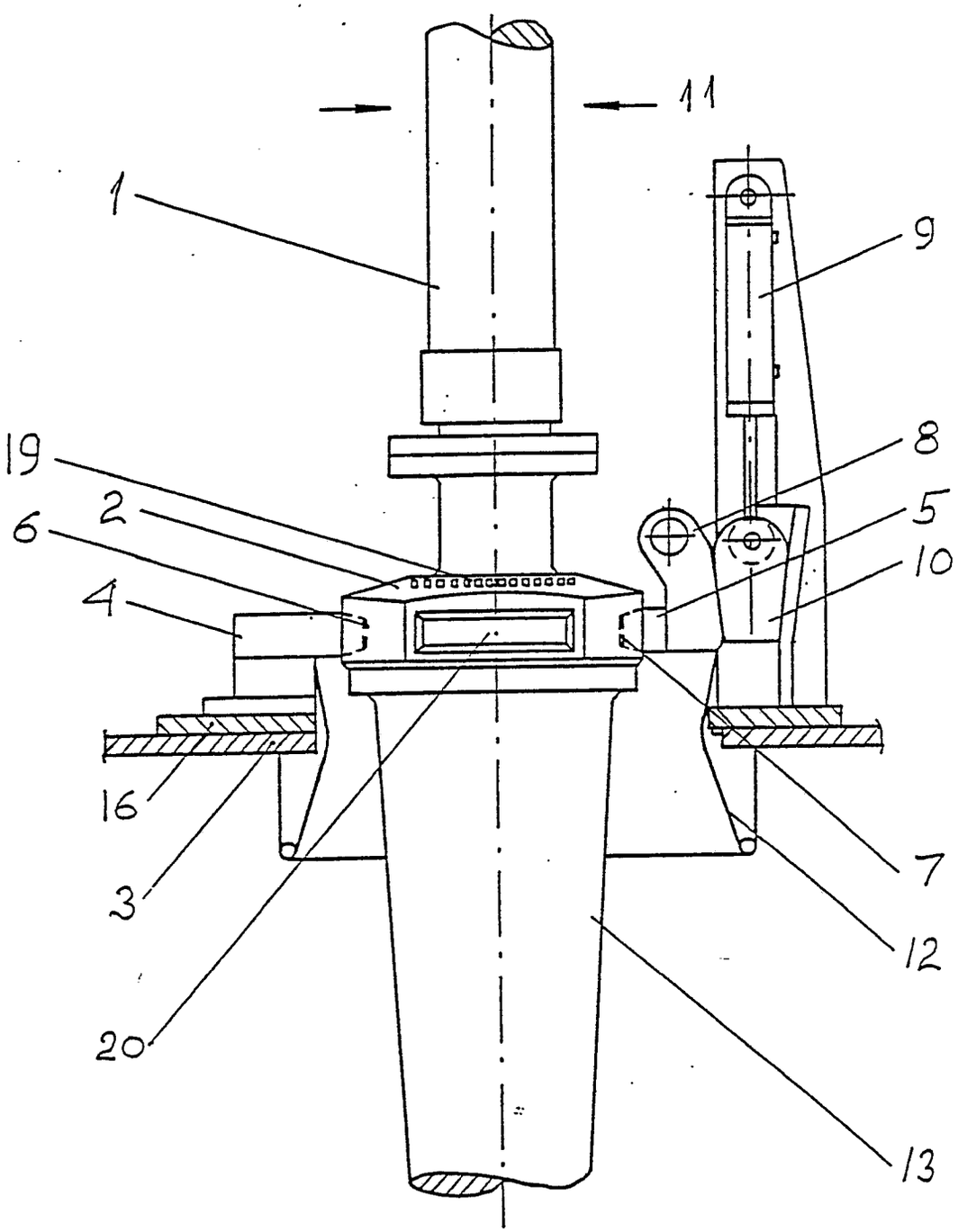

FIG. 1

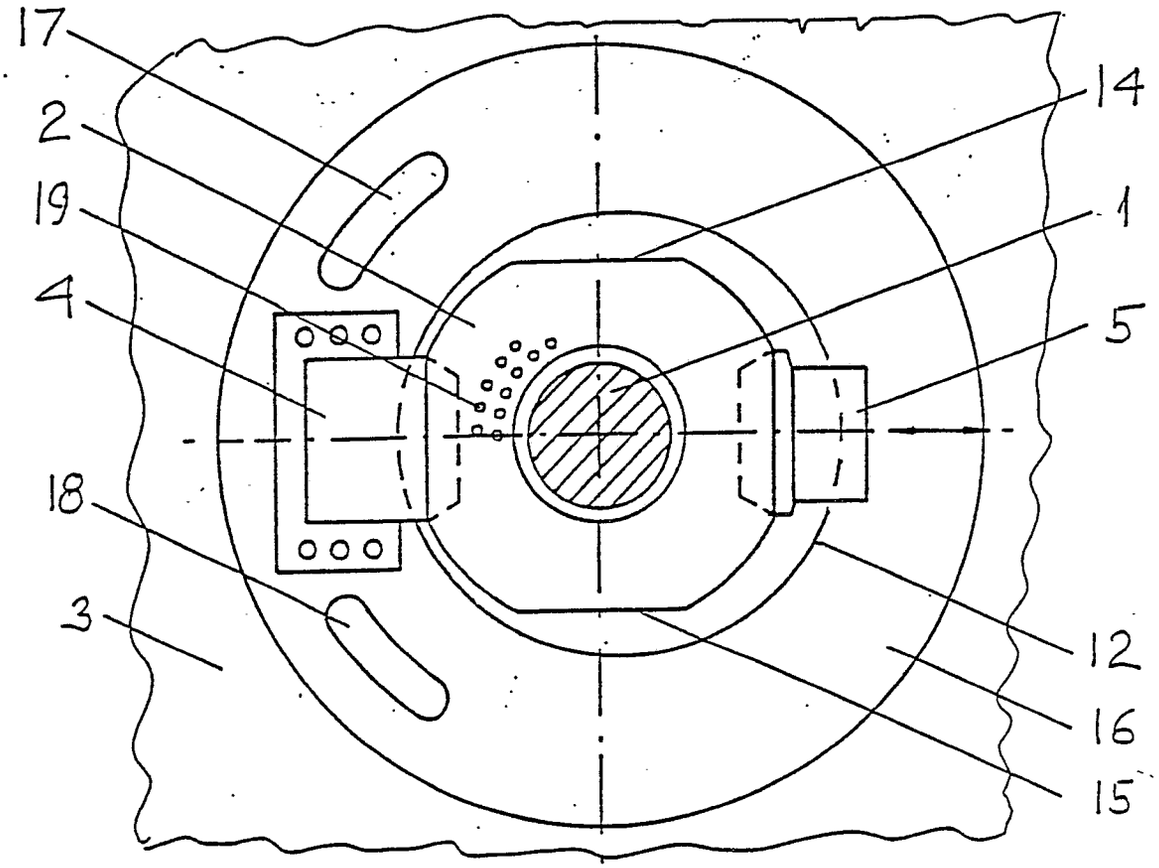

FIG. 2

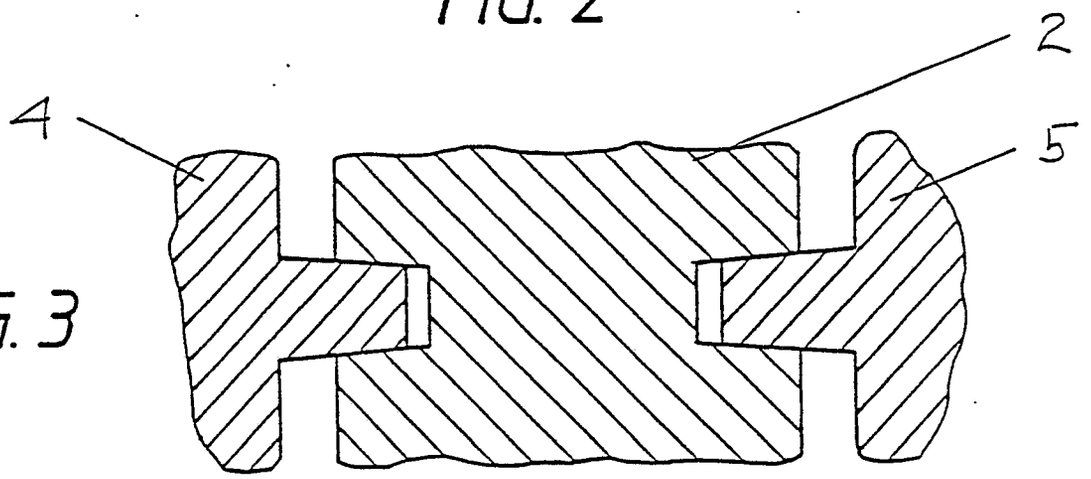

FIG. 3

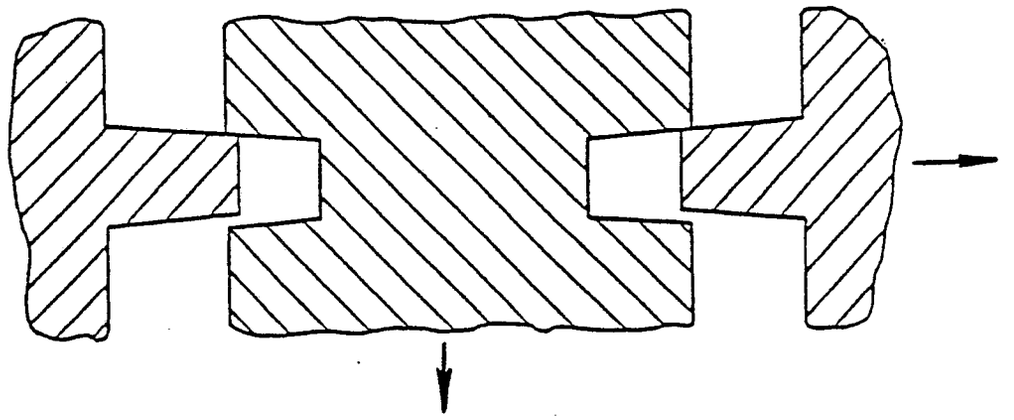

FIG. 4