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(54) **DEVICE FOR BURYING A LINE IN THE SEA BED.**

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| (30) Priority: 06.04.79 NO 791171 | (73) Proprietor: PRESTEGARDEN, MAGNE
Amtm. Bredersgt. 15
N-3000 Drammen (NO) |
| (43) Date of publication of application:
08.04.81 Bulletin 81/14 | (72) Inventor: PRESTEGARDEN, MAGNE
Amtm. Bredersgt. 15
N-3000 Drammen (NO) |
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18.01.84 Bulletin 84/3 | (74) Representative: Rostovanyi, Peter (SE) et al,
AWAPATENT AB Box 5117
S-200 71 Malmö (SE) |
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Device for burying a line in the sea bed

This invention relates to a device for burying a line, for instance a cable, a pipeline or the like in the sea bed, comprising a number of rearwardly facing nozzle arrangements (viewed in the direction of digging), each of which is connected to a pressure liquid hose and positioned on either side of the centre line of the device.

Trenching devices of this kind are disclosed in US—A—3,217,499 and 3,505,826.

The device of US—A—3,217,499 comprises a sledge with a row of nozzles on each side of a cable to be buried, said nozzles being directed downwardly and rearwardly and forming a trench in the sea bed, and a confining means arranged on the sledge to refill the trench. The device of US—A—3,505,826 includes a sledge with nozzles arranged to form a trench in the sea bed and to suck off mud. The trench is backfilled by a towed shovel.

One drawback of these devices is that they are complicated especially concerning their means for the trench refilling, which are necessary since the material from the trench is disposed beside the trench during the trench forming.

Reference is also made to US—A—3,576,111 and 2,755,632 describing trench forming devices with nozzles to make the trench forming with the aid of pressurized fluid.

It is necessary to place very high demands on efficiency, operation reliability, simplicity and ease of handling under the special conditions encountered when digging and refilling a trench in the sea bed. Thus, any device which is used for digging a trench in the sea bed must be uncomplicated, since problems will arise for instance, as regards the adjustment of the device on the sea bed. The device must also be robust, since repairs and improvements are difficult to perform on the sea bed and the working site may be such that repairs are difficult to effect even on land. There is a self-evident requirement for the device to be light in weight, since it will often be necessary to carry the device to the place of use or to transport it in small boats.

The device according to this invention is thus intended to be an improvement on existing devices of said kind and is characterized in that the nozzle arrangements are mounted on the hose, that each nozzle arrangement comprises a pair of nozzles, and in that one nozzle of each pair is inclined downwards at an angle with respect to the centre line of the device and the other nozzle is inclined upwards at an angle to the centre line of the device. In a preferred embodiment of the invention, the said angles are at least approximately equal in each case. In individual instances, it may be appropriate to set the downward angle smaller than the upward angle.

Thus, the present device is very simple, com-

prising only a single pair of nozzles directly mounted to a pressurized fluid line. With the above arrangement of the nozzles there is obtained a very effective digging and fluidisation of the sea bed material for a sufficient time to allow the cable or the like to sink in the trench, before the excavated material again sinks and fills the trench.

One practical embodiment is characterized in that each pair of nozzles is attached to a pipe stub which is connected to a common holder which in turn is easily coupled to the common pressure liquid hose. Another practical embodiment thereof is characterized in that it has a holder in the form of a socket which is arranged so as to facilitate coupling with the pressure liquid hose, and the socket has attached to it two parallel pipe stubs separated from each other by a distance which is rather larger than the line which is to be buried.

The invention will be described in greater detail below with reference to the drawing in which

Fig. 1 is a diagram of the device according to the invention in use;

Fig. 2 shows the device as seen from the side; and

Fig. 3 shows a section along the line 3—3 in Fig. 2.

It will be seen from the drawing that the device of the invention may be executed in an extremely simple manner. It consists in principle of a hose containing liquid under pressure 1 to which nozzle arrangements 2 are attached on either side of the centre line of the hose. The nozzles are arranged in pairs 3 with one nozzle 4 being inclined upwards and backwards at an angle α and the other nozzle 5 being inclined backwards and downwards at an angle β . Each pair of nozzles 3 is located at the end of a pipe stub 7 which is suspended from a holder 6 in the form of a socket. The holder 6 in the form of a socket is easily coupled to the hose 1. In this way it is easy to extend the entire digging device by the attachment of one or more additional lengths of hose and one or more holders 6 with stubs 7 and pairs of nozzles 3. The length of the device, i.e. the number of pairs of nozzles, will depend on the nature of the sea bed in which the trench 8 is to be dug. If the sea bed is of a light material such as silt, then it will be possible to manage with one or two sets of holders with stubs and pairs of nozzles. The length of the device, i.e. the number of pairs of nozzles, may be increased in proportion to the hardness of the sea bed.

As may be seen from the drawing and from the above description, the equipment is extremely simple and robust. It consists of nothing more than a hose containing liquid under pressure fitted with holders for pipe stubs 7 with pairs of nozzles 3. Before digging

commences, a trench must first be excavated by some other means which is of sufficient length to allow a section of the line 9 to be placed at the bottom of the trench at the required depth. Then the device of the invention with the stubs 7 on either side of the line is laid in the trench and water is introduced under pressure into the line 1. The source of pressure for the water, e.g. a powerful pump, may be at the surface in a boat, or may be moved along on a sled immediately ahead of the digging device. The whole may be controlled by a diver or with the aid of a television camera. The nozzles 5 which are inclined downwards at an angle β will blow away the material from the bottom and throw it backwards. The turbulence produced within this fluidized mass will cause the particles contained in the mass to be carried upwards and into the vicinity of the nozzles 4 which will ensure that the fluidized mass is then carried away upwards and backwards. Thus the material will be kept in suspension in the water until the line 9 has reached the specified depth, and once the material passes outside the effective range of the rearmost pair of nozzles it will then come to rest and will fall back into the trench again, filling it. If the sea bed is of a light material, then of course some of the material which has been stirred up will be carried away in the water, for instance by currents, with the result that the trench will not be filled up immediately. However, the trench will fill up of its own accord relatively quickly.

The device which is the subject matter of the invention is cheap to produce, easy to transport and erect on-site, reliable and efficient in use and simple to adjust to suit the different types of material found on the sea bed.

A prototype of the device of the invention has been tested with excellent results laying electric cables in the fjords of northern Norway.

Claims

1. A device for burying a line (9), e.g. a cable, pipeline or similar, in the sea bed, comprising a number of rearward-facing nozzle arrangements (2) (viewed in the direction of digging) each of which is connected to a pressure liquid hose (1) and positioned to either side of the centre line of the device, characterized in that the nozzle arrangements (2) are mounted on the hose (1), that each nozzle arrangement (2) comprises a pair (3) of nozzles (4, 5) and in that one nozzle (5) of each pair (3) is inclined downwards at an angle (β) with respect to the centre line of the device and that the other nozzle (4) is inclined upwards at an angle (α) to the centre line of the device.

2. A device as claimed in claim 1, characterized in that the upward and downward angles (α and β) are at least approximately equal in each case.

3. A device as claimed in claim 1, characterized in that the downward angle (β) is smaller

than the upward angle (α).

4. A device as claimed in any one of the above claims, characterized in that each pair of nozzles is attached to a pipe stub (7) which is connected to a holder (6) which in turn is easily coupled to the pressure liquid hose (1).

5. A device as claimed in claim 4, characterized in that the holder (6) is in the form of a socket, and in that the socket has attached to it two parallel pipe stubs (7) separated from each other by a distance which is rather larger than the diameter of the line (9) which is to be buried.

Revendications

1. Dispositif destiné à enterrer une ligne (9), par exemple un câble, une canalisation ou analogue, dans le fond de la mer, comprenant un certain nombre d'arrangements (2) de buses tournées vers l'arrière (dans le sens du creusement), chaque arrangement étant raccordé à une tuyauterie souple (1) de liquide sous pression et étant placé de part et d'autre de l'axe central du dispositif, caractérisé en ce que les arrangements de buses (2) sont montés sur la tuyauterie souple (1), en ce que chaque arrangement de buses (2) comporte une paire (3) de buses (4, 5), et en ce qu'une première buse (5) de chaque paire (3) est inclinée vers le bas, avec un angle (β) par rapport à l'axe central du dispositif, et en ce que l'autre buse (4) est inclinée vers le haut avec un angle (α) par rapport à l'axe central du dispositif.

2. Dispositif selon la revendication 1, caractérisé en ce que les angles vers le haut et vers le bas (α et β) sont au moins approximativement égaux dans tous les cas.

3. Dispositif selon la revendication 1, caractérisé en ce que l'angle vers le bas (β) est inférieur à l'angle vers le haut (α).

4. Dispositif selon l'une quelconque des revendications précédentes, caractérisé en ce que chaque paire de buses est fixée à un tronçon de tuyauterie (7) qui est raccordé à support (6) qui est lui-même facilement accouplé à la tuyauterie souple (1) de liquide sous pression.

5. Dispositif selon la revendication 4, caractérisé en ce que le support (6) est sous forme d'une douille, et en ce que la douille porte deux tronçons parallèles de tuyauterie (7) qui lui sont fixés et qui sont séparés l'un de l'autre par une distance qui est un peu supérieure au diamètre de la ligne (9) qui doit être enterrée.

Patentansprüche

1. Vorrichtung zum Verlegen einer Leitung (6), beispielsweise eines Kabels, einer Rohrleitung od.dgl., auf dem Meeresboden, umfassend eine Anzahl von (in Ausgrabrichtung gesehen) rückwärts gerichteten Düsenrichtungen (2), die an einen Druckflüssigkeitsschlauch (1) angeschlossen und auf beiden Seiten der Mittellinie der Vorrichtung gelegen

sind, dadurch gekennzeichnet, dass die Düsen-
einrichtungen (2) auf dem Schlauch (1) ange-
bracht sind, dass jede Düseneinrichtung (2) ein
Paar (3) Düsen (4, 5) umfasst, und dass die eine
Düse (5) jedes Paares (3) im Verhältnis zur
Mittellinie der Vorrichtung in einem Winkel (β)
nach unten geneigt ist, während die andere
Düse (4) im Verhältnis zur Mittellinie der
Vorrichtung in einem Winkel (α) nach oben ge-
neigt ist.

2. Vorrichtung nach Anspruch 1, dadurch ge-
kennzeichnet, dass die nach oben und unten
gerichteten Winkel (α und β) jedesmal zu-
mindest annähernd gleichgross sind.

3. Vorrichtung nach Anspruch 1, dadurch ge-
kennzeichnet, dass der nach unten gerichtete

Winkel (β) kleiner ist als der nach oben
gerichtete Winkel (α).

4. Vorrichtung nach einem der vorherge-
henden Ansprüche, dadurch gekennzeichnet,
dass jedes Düsenpaar an einem Rohrstutzen (7)
befestigt ist, welcher mit einem Halter (6) ver-
bunden ist, der seinerseits leicht mit dem Druck-
flüssigkeitsschlauch (1) verbindbar ist.

5. Vorrichtung nach Anspruch 4, dadurch ge-
kennzeichnet, dass der Halter (6) die Form einer
Muffe hat, und dass die Muffe mit zwei pa-
rallelen Rohrstutzen (7) verbunden ist, die sich
in einem Abstand voneinander befinden,
welcher grösser ist als der Durchmesser der zu
verlegenden Leitung (9).

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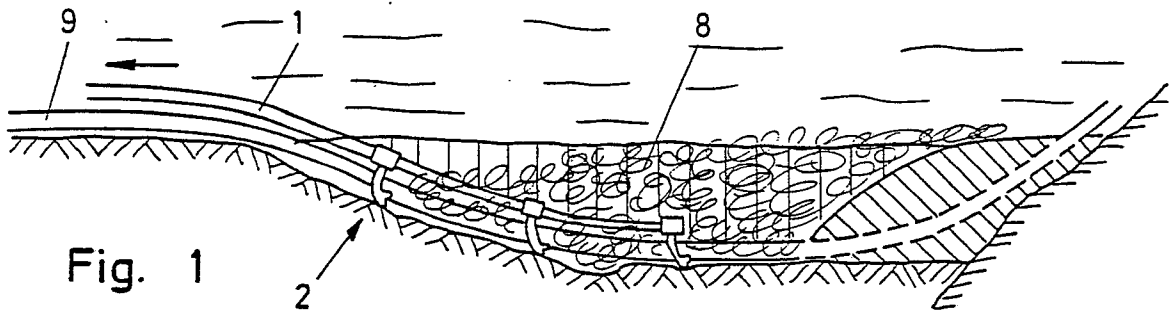


Fig. 2

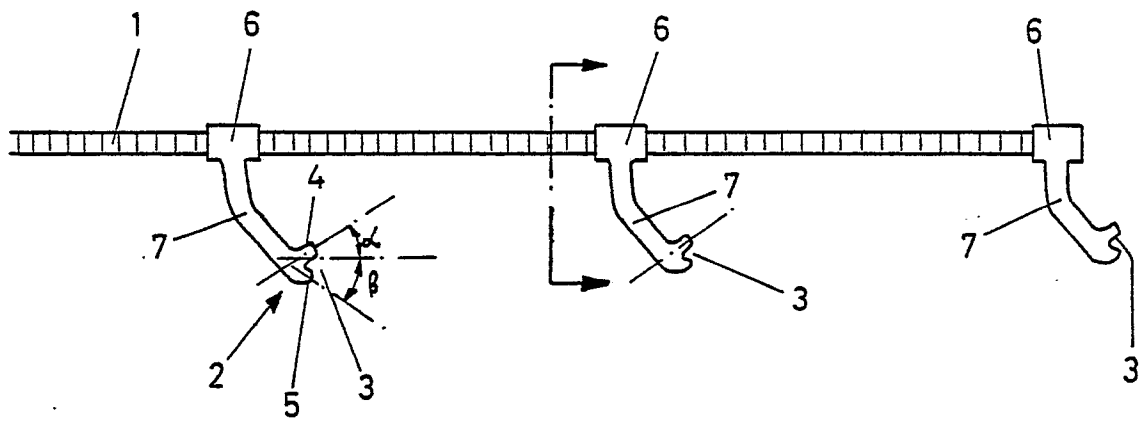


Fig. 3

