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(54) **Apparatus for dredging underwater bottoms, and dredge head for such an apparatus**

Vorrichtung zum Baggern von Unterwasserboden und Saugkopf für Absaugvorrichtung

Appareil de dragage de fonds de plans d'eau et tête de dragage pour dispositif d'aspiration

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FR-A- 909 831 **US-A- 4 058 914**
US-A- 4 146 982 **US-A- 4 227 323**

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Description

[0001] This invention relates to an apparatus for dredging underwater bottoms, in particular of waterways, which apparatus comprises a ladder mounted on a base structure, means for laterally displacing this ladder in the transverse direction thereof, both to the left and to the right, means for adjusting the inclination of the ladder, and dredge head mounted on the free extremity of this ladder and comprising a cap arranged for screening off during operations, at least one scraper for collecting during said left and right lateral movement of the ladder materials which are sedimented on the underwater bottom and at least one suction opening which is connected to a suction tube arranged for sucking up the collected materials.

[0002] An apparatus showing herewith a similarity is disclosed in United States patent 4,143,982. This known apparatus is equipped with a screw-like rotator consisting of an Archimedean screw mounted within a half-cylindrical sludge collector plate.

[0003] The aim of this half-cylindrical collector-plate is essentially to define a chamber within which the sludge scraped by the Archimedean screw is stirred up, without too much disturbance of sludge water caused by the operating rotator.

[0004] One drawback of the dredge head according to US-A-4,146,982 is thus that it still requires a rotatable member for being able to suck up sludge. Consequently special measures had to be taken to avoid distribution of sludge in the surrounding water and to allow efficient drawing of sludge into the suction opening. It is doubtful whether the sludge collector plate surrounding partially the screw-like rotator is capable of solving this problem. Anyway this collector plate is not intended to draw the sludge in the direction of one or more suction openings the suction device is equipped with.

[0005] In contrast to the dredge head disclosed in US-A-4 146 982, the sedimented materials have not to be stirred up but due to the special arrangement of the scraper, these materials will be conveyed to the suction opening by the scraper itself. Such an arrangement causes a minimum of turbidity in the surrounding water and allows to suck up sludge with a minimum amount of water.

[0006] An object of the invention is therefore to provide a dredging apparatus of the hereabove indicated stationary type which enables to reduce mixing of the dredged material in the surrounding water during the dredging operation and to realise a high concentration of sludge to be sucked up.

[0007] To this end said scraper extends substantially in the direction of said suction opening and is arranged to scrape said materials towards the suction opening, said scraper defining a passage for the material towards suction opening, which passage narrows in the direction away from the suction opening.

[0008] Further particularities and advantages of the

invention will become apparent from the following description of some possible embodiments of an apparatus and in particular of a dredge head according to the invention. This description is only given by way of example and is not intended to limit the invention. The used reference numerals relate to the annexed drawings wherein :

figure 1 shows schematically a general view of a dredging apparatus according to the invention ; figure 2 shows schematically a top plan view of the apparatus of figure 1 wherein a number of components have however been omitted for clarity's sake ; figures 3, 4 and 5 show schematically some dredging movements which can be performed with the dredger according to figure 1 or with a variant dredger ;

figures 6, 7 and 8 show schematically a top plan view and a cross-sectional view according to line VII-VII and line VIII-VIII in figure 6 of a first embodiment of the dredge head according to the invention ;

figures 9, 10 and 11 show schematically a top plan view and a cross-sectional view according to line X-X and line XI-XI in figure 9 of a second possible embodiment of the dredge head according to the invention ;

figures 12, 13 and 14 show schematically a top plan view and a cross-sectional view according to line XIII-XIII and line XIV-XIV in figure 12 of a third possible embodiment of the dredge head according to the invention ;

figure 15 shows schematically a longitudinal section through a preferred embodiment of the dredge head according to the invention ;

figure 16 shows a cross-sectional view according to line XVI-XVI in figure 14 ;

figures 17 and 18 show schematically the two different operative positions of the scrapers from the dredge head according to figures 15 and 16 ; and figure 19 shows schematically a side elevational view of the free extremity of the ladder and of the dredge head according to figures 15 and 16 mounted thereon.

[0009] In these different figures, the same reference numerals relate to the same or to analogous elements.

[0010] In general, the present invention relates to an apparatus for dredging underwater bottoms, for example of waterways, watercourses, lakes, etc., more particularly to a so-called stationary dredger. The general structure of the apparatus according to the invention corresponds to the general structure of the known cutter suction dredgers and will consequently be described hereinafter only in broad outline.

[0011] Like the known cutter suction dredgers, the apparatus shown in figure 1 comprises a base structure 1 composed of a floating pontoon, a ladder 2 mounted

thereon, means 3 for adjusting the inclination of this ladder 2, and means for laterally displacing the ladder 2 both to the left according to arrow 6 and to the right in the transverse direction of the ladder 2. These latter means may comprise for example cables and anchor winches, not shown in the drawings, for effecting lateral swinging of the entire dredger usually about spuds 4.

[0012] Two possible dredging movements are shown by way of example in figures 3 and 4, respectively for a stationary dredger which is provided with a so-called tilting spud as shown in figure 1 or for a dredger provided with a spud carriage which is not shown in the figures and for a stationary dredger which is on both lateral sides provided with a fixed spud 4.

[0013] In addition to these two systems for moving stationary dredgers, other systems are known including the one which is shown schematically in figure 5. According to the movement shown in this figure 5, the dredger 1 swings under a certain swing angle about a bower anchor 5 with a circular cut. The bow line is indicated in figure 5 with reference 26 while the so-called bow barge is indicated with reference 27. No further description of these movements is given here since they are known by the man skilled in the art. For this skilled man it will also be clear that still other movements are possible.

[0014] A stationary dredger, such as the known cutter suction dredgers, offers the advantage that the movements of the dredge head 7 fitted onto the free extremity of the ladder 2 can be accurately controlled. The material sedimented on the underwater bottom will therefore not be disturbed by a repeated passing of the dredge head 7 over the same position. The dredging depth can further also be controlled accurately.

[0015] The existing cutter suction dredgers offer however the drawback of having a dredge head which mixes the sedimented material actively with the surrounding water so that it can be sucked up through a suction tube 8. It is clear that a high turbidity is created hereby in the water and that the dredged material has a high water content.

[0016] In order to obviate this drawback, the dredge head according to the invention comprises at least one scraper 9 which is arranged for scraping the sludge together along the underwater bottom 10 during the lateral movement of the ladder 2 towards at least one suction opening 11. The material which has been scraped together can thus be sucked up through this opening 11 without having to mix the material actively with the water. The scraper 9 extends in particular substantially in the longitudinal direction of the ladder 2.

[0017] Figures 6, 7 and 8 show a first possible embodiment of the dredge head 7 according to the invention. In this embodiment, the dredge head 7 comprises only one scraper 9 which extends in the longitudinal direction of the suction tube 8. In the dredge head 7, the suction tube splits up by means of a substantially funnel-shaped cavity 12 so as to end both in front of and behind

the scraper 9 through a suction opening 11, 11'. During the left lateral movement (according to arrow 6), the material which is scraped together is sucked up through the second suction opening 11' while the first suction opening 11 is closed off by means of a schematically shown valve 13 and, vice versa, the second suction opening 11' can be closed off by means of a valve 13' when the sludge is sucked off through the first suction opening 11 during the right lateral movement.

[0018] On both sides of the scraper 9, a cap 14, 14' is provided arranged for screening off, during the dredging operation, the material which is scraped together from the surrounding water and for guiding this material to the respective suction opening 11, 11'. This cap 14, 14' and the scraper 9 define preferably a passage for the material, which passage narrows in the direction away from the suction opening 11, 11'. The presence of such a cap enables to prevent an undesired amount of water to be sucked up together with the dredged material.

[0019] In the embodiments shown in the figures, the cap 14, 14' is each time provided with openings 15, 15' for supplying water to the material which is to be sucked up and for making this material, if necessary, sufficiently fluid. Preferably, means are provided for adjusting the fluid flow rate through these openings 15, 15', for example control valves 17, 17' disposed in the supply channels 16, 16' of the openings 15, 15'. In this way, the water content or in other words the density of the dredged material can be controlled during the dredging operation.

[0020] Figures 9, 10 and 11 show schematically a second possible dredge head according to the invention wherein the suction tube 8 splits up also in two alternatively used suction opening 11, 11' but wherein use is made of two scrapers 9, 9'. Both the first 9 and the second scraper 9' are hingedly fitted onto the dredge head 7 between an operative and inoperative position. During the left lateral movement (according to arrow 6), the first scraper 9 is folded out and the second scraper 9' is situated in the inoperative position wherein it closes off the second suction opening 11' in such a manner that the suction tube 8 sucks up the material which is scraped together by the first scraper 9 through the first suction opening 11. During the right lateral movement, the situation is reversed. In this embodiment also, water supply openings 15, 15' and supply channels 16, 16' are provided in the cap 14, 14'.

[0021] In the variant embodiment according to figures 12, 13 and 14, the first 9 and second scraper 9' are fitted to the dredge head 9 in an up and downwards slideable way. In this embodiment, the suction tube 8 is further not branched but debouches via one suction opening 11 between both scrapers 9, 9'. Consequently, this embodiment does not require an alternate opening and closing of the suction openings. As it appears clearly from figures 12 and 14, the water supply openings 15 in the cap 14 are situated substantially in the middle of this cap 14.

[0022] A particularly effective embodiment of the

dredge head according to the invention is shown in figures 15 and 16. In this embodiment, the suction tube 8 is connected through a substantially funnel-shaped cavity 12 to the suction opening 11. A flange 18 is provided around this suction opening 11, both scrapers 9, 9' being swingably mounted around this flange by means of a ring 19. Both scrapers 9, 9' form in particular one unit which has a substantially circular cross-section and which narrows conically in the direction away from the suction opening.

[0023] By swinging the scraper unit 9, 9' about the axis 20 between the two extreme positions shown in figures 16 and 17, dredging can be effected both in the left (arrow 6) and the right lateral direction. The dredge head 7 comprises hereto further a motor or analogous means which are not shown and which enable to achieve this swinging motion.

[0024] At its upper side, the dredge head 7 comprises an outer casing 21 fixed to the suction tube 8 and extending around the scraper unit 9, 9'.

[0025] At the front of the outer casing 21, centrally opposite the suction opening 11, the conical scraper unit 9, 9' is swingably mounted around a shaft 22 to provide an additional support for these scrapers.

[0026] Within the conical scraper unit 9, 9', a longitudinal water supply channel 16, 16' containing the water supply openings is provided opposite the outer casing 21. In the preferred embodiment shown in figures 14 and 15, this supply channel consists of a double supply channel 16, 16' but, on the other hand, use could also be made of a single water supply channel. Each of the supply ducts 23, 23' to the supply channels 16, 16' comprises preferably a control valve which is not shown in the figures and which may for example be opened and closed alternately. In this way, the necessary water can be supplied exclusively through the supply channel 16 situated above the first scraper 9 during the left lateral movement (according to arrow 6) and vice versa through the supply channel 16' during the right lateral movement (figure 18) so as to obtain a better fluidisation compared to the situation wherein the water supply is effected evenly through both channels 16, 16'.

[0027] Figure 19 shows schematically how the hereinabove described dredge head 7 is mounted onto the free extremity of a ladder 2. It can be seen that the dredge head is hinge-connected to the bottom of the ladder 2, more particularly to a rigid portion of the suction tube 8, by means of a double rod system 24, on both sides of the suction tube 8. In order to be able to adjust the angle between the dredge head 7 and the ladder 8, the top of the dredge head is fixed to the top of the free extremity of the ladder 2 by means of a connecting construction 25 whose length is adjustable. Such a construction enables to position the dredge head under the desired angle, for example horizontally, and this independent of the dredging depth.

[0028] From the hereinabove given description of some embodiments of the apparatus and the dredge

head according to the invention it will be apparent that the present invention is not limited to the described embodiments but that all kinds of modifications can be applied thereto without leaving the scope of the present patent application.

[0029] It is for example possible to spray pressurized water through the openings in the cap in front of the scrapers so as to enhance the fluidisation of the material without creating however too much turbidity in the water.

Claims

1. Apparatus for dredging underwater bottoms (10), in particular of waterways, which apparatus comprises a ladder (2) mounted on a base structure (1), means for laterally displacing this ladder in the transverse direction thereof, both to the left and to the right, means for adjusting the inclination of the ladder (2), and dredge head mounted on the free extremity of this ladder and comprising a cap (14, 14') arranged for screening off during operations, at least one scraper (9, 9') for collecting during said left and right lateral movement of the ladder (2) materials which are sedimented on the underwater bottom (10) and at least one suction opening (11, 11') which is connected to a suction tube (8) arranged for sucking up the collected materials, characterized in that said scraper (9, 9') extends substantially in the direction of said suction opening (11, 11') and is arranged to scrape said materials towards the suction opening (11, 11'), said scraper (9, 9') defining a passage for the material towards suction opening (11, 11'), which passage narrows in the direction away from the suction opening.
2. An apparatus according to claim 1, characterized in that said cap (14, 14') is provided with openings (15, 15') for supplying water to the material scraped together, means (17, 17') being preferably provided for controlling the water supply through these openings.
3. An apparatus according to one of the claims 1 and 2, characterized in that the dredge head (7) comprises at least a first (9) and a second scraper (9') movably fitted onto this dredge head between an operative and inoperative position, said dredge head further comprising means for keeping the first scraper (9) during said left lateral movement in the operative position and the second scraper (9') in the inoperative position and vice versa for keeping the first scraper (9) during said right lateral movement in the inoperative position and the second scraper (9') in the operative position.
4. An apparatus according to claim 3, characterized in that the first (9) and the second scraper (9') are dis-

posed in their operative position to scrape said material to one and the same suction opening (11).

5. An apparatus according to claim 3 or 4, characterized in that the first (9) and the second scraper (9') are hinge-connected to the dredge head (7), more particularly around a hinge axis extending substantially in the longitudinal direction of the ladder (2). 5
6. An apparatus according to any one of the claims 3-5, characterized in that the first (9) and the second scraper (9') are fitted to the dredge head (7) in an up and downwards slidable way. 10
7. An apparatus according to claim 6, characterized in that the first (9) and the second scraper (9') have a substantially circular cross-section. 15
8. An apparatus according to claim 7, characterized in that the first (9) and the second scraper (9') narrow conically in the direction away from said suction opening. 20
9. An apparatus according to any one of the claims 3-6, characterized in that the first (9) and the second scraper (9') form one unit which is swingable about a swing axis (20) extending opposite said suction opening (11), in the longitudinal direction of the dredge head. 25

Patentansprüche

1. Vorrichtung zum Baggern von Unterwasserböden (10), insbesondere von Wasserstraßen bzw. Fahrrinnen, wobei die Vorrichtung einen auf einer Basisstruktur (1) montierter Naßeimerbagger bzw. Eimerleiter-Naßbagger (2), Einrichtungen für ein seitliches Verschieben dieses Naßeimerbaggers in der Querrichtung desselben sowohl nach links als auch nach rechts, Einrichtungen zur Einstellung der Neigung des Naßeimerbaggers (2) und einen Baggerkopf, welcher an dem freien Ende dieses Naßeimerbaggers angeordnet ist und eine Kappe bzw. Abdeckung (14, 14') umfaßt, welche für ein Abschirmen bzw. Sieben während des Betriebs angeordnet ist, wenigstens einen Schaber bzw. Kratzer (9, 9') für ein Sammeln von Materialien, welche auf dem Unterwasserboden (10) abgelagert sind, während der Seitenbewegung des Naßeimerbaggers (2) nach links und rechts, und wenigstens eine Saugöffnung (11, 11') umfaßt, welche mit einem Saugrohr (8) verbunden ist, welches für ein Ansaugen der gesammelten Materialien ausgebildet ist, dadurch gekennzeichnet, daß sich der Schaber (9, 9') im wesentlichen in der Richtung der Saugöffnung (11, 11') erstreckt und ausgebildet bzw. angeordnet ist, um die Materialien zu der Saugöffnung (11, 11') 35 40 45 50

zu schaben bzw. zu kratzen, wobei der Schaber (9, 9') einen Durchtritt für das Material zu der Saugöffnung (11, 11') definiert, wobei sich der Durchtritt in der Richtung weg von der Saugöffnung verengt.

2. Vorrichtung nach Anspruch 1, dadurch gekennzeichnet, daß die Abdeckung (14, 14') mit Öffnungen (15, 15') zur Zufuhr von Wasser zu dem zusammengeschabten Material versehen ist, wobei vorzugsweise Einrichtungen (17, 17') für eine Steuerung bzw. Regelung der Wasserzufuhr durch diese Öffnungen vorgesehen ist.
3. Vorrichtung nach einem der Ansprüche 1 und 2, dadurch gekennzeichnet, daß der Baggerkopf (7) wenigstens einen ersten (9) und einen zweiten Schaber (9') umfaßt, welche bewegbar an diesem Baggerkopf zwischen einer Betriebs- und einer Außerbetriebsposition angeordnet bzw. angepaßt sind, wobei der Baggerkopf weiters Einrichtungen zum Halten des ersten Schabers (9) während der seitlichen Bewegung nach links in der Betriebsposition und des zweiten Schabers (9') in der Außerbetriebsposition und umgekehrt für ein Halten des ersten Schabers (9) während der Seitenbewegung nach rechts in der Außerbetriebsposition und des zweiten Schabers (9') in der Betriebsposition aufweist.
4. Vorrichtung nach Anspruch 3, dadurch gekennzeichnet, daß der erste (9) und der zweite Schaber (9') in ihrer Betriebsposition angeordnet sind, um das Material zu ein und derselben Saugöffnung (11) zu schaben. 30
5. Vorrichtung nach Anspruch 3 oder 4, dadurch gekennzeichnet, daß der erste (9) und der zweite Schaber (9') gelenkig am Baggerkopf (7), insbesondere um eine Schwenkachse, welche sich im wesentlichen in der Längsrichtung des Naßeimerbaggers (2) erstreckt, festgelegt sind. 35
6. Vorrichtung nach einem der Ansprüche 3 bis 5, dadurch gekennzeichnet, daß der erste (9) und der zweite Schaber (9') an dem Baggerkopf (7) nach oben und unten gleitend angeordnet bzw. angepaßt sind. 40 45
7. Vorrichtung nach Anspruch 6, dadurch gekennzeichnet, daß der erste (9) und der zweite Schaber (9') einen im wesentlichen kreisförmigen Querschnitt aufweisen. 50
8. Vorrichtung nach Anspruch 7, dadurch gekennzeichnet, daß sich der erste (9) und der zweite Schaber (9') konisch in der Richtung weg von der Saugöffnung verengen. 55

9. Vorrichtung nach einem der Ansprüche 3 bis 6, dadurch gekennzeichnet, daß der erste (9) und der zweite Schaber (9') eine Einheit bilden, welche um eine Schwenkachse (20) schwenkbar ist, welche sich gegenüberliegend der Saugöffnung (11) in der Längsrichtung des Baggerkopfes erstreckt.

Revendications

1. Appareil pour le dragage de fonds subaquatiques (10) en particulier de cours d'eau, appareil qui comprend une élinde (2) montée sur une structure de base (1), des moyens pour déplacer latéralement cette élinde dans la direction transversale par rapport à celle-ci, et cela aussi bien vers la gauche que vers la droite, des moyens pour ajuster l'inclinaison de l'élinde (2) et une tête de dragage montée à l'extrémité de cette élinde et comprenant un couvercle (14, 14') disposé pour faire écran au cours des opérations de dragage, au moins un racleur (9, 9') pour collecter au cours des mouvements latéraux vers la gauche et vers la droite de l'élinde (2) les matériaux déposés sur le fond subaquatique et au moins un orifice d'aspiration (11, 11') qui est connecté à un tuyau d'aspiration (8) conçu pour aspirer les matériaux collectés, caractérisé en ce que ledit grattoir (9, 9') s'étend en substance dans la direction dudit orifice d'aspiration (11, 11') et est conçu pour gratter lesdits matériaux en direction de l'orifice d'aspiration (11, 11'), ledit grattoir (9, 9') définissant un passage pour les matériaux en direction de l'orifice d'aspiration (11, 11'), ledit passage se rétrécissant dans une direction qui s'écarte de l'orifice d'aspiration.

2. Un appareil selon la revendication 1, caractérisé en ce que ledit couvercle (14, 14') présente des orifices (15, 15') pour amener de l'eau aux matériaux à collecter par grattage, des moyens (17, 17') étant de préférence prévus pour contrôler l'amenée d'eau par ces orifices.

3. Un appareil selon l'une des revendications 1 et 2, caractérisé en ce que la tête de dragage (7) comprend au moins un premier grattoir (9) et un second grattoir (9') montés de façon mobile sur cette tête de dragage entre une position active et une position inactive, ladite tête de dragage comprenant, de plus, des moyens pour maintenir en position active le premier grattoir (9) au cours dudit mouvement latéral vers la gauche et le second grattoir (9') en position inactive et vice versa pour maintenir, au cours dudit mouvement latéral, le premier grattoir (9) en position inactive et le second grattoir (9') en position active.

4. Un appareil selon la revendication 3, caractérisé en

ce que le premier grattoir (9) et le second grattoir (9') sont disposés en position active pour gratter lesdits matériaux vers le même orifice d'aspiration (11).

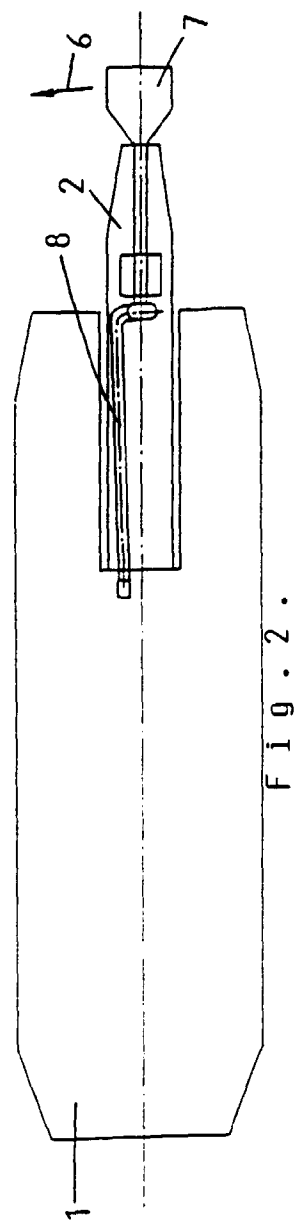
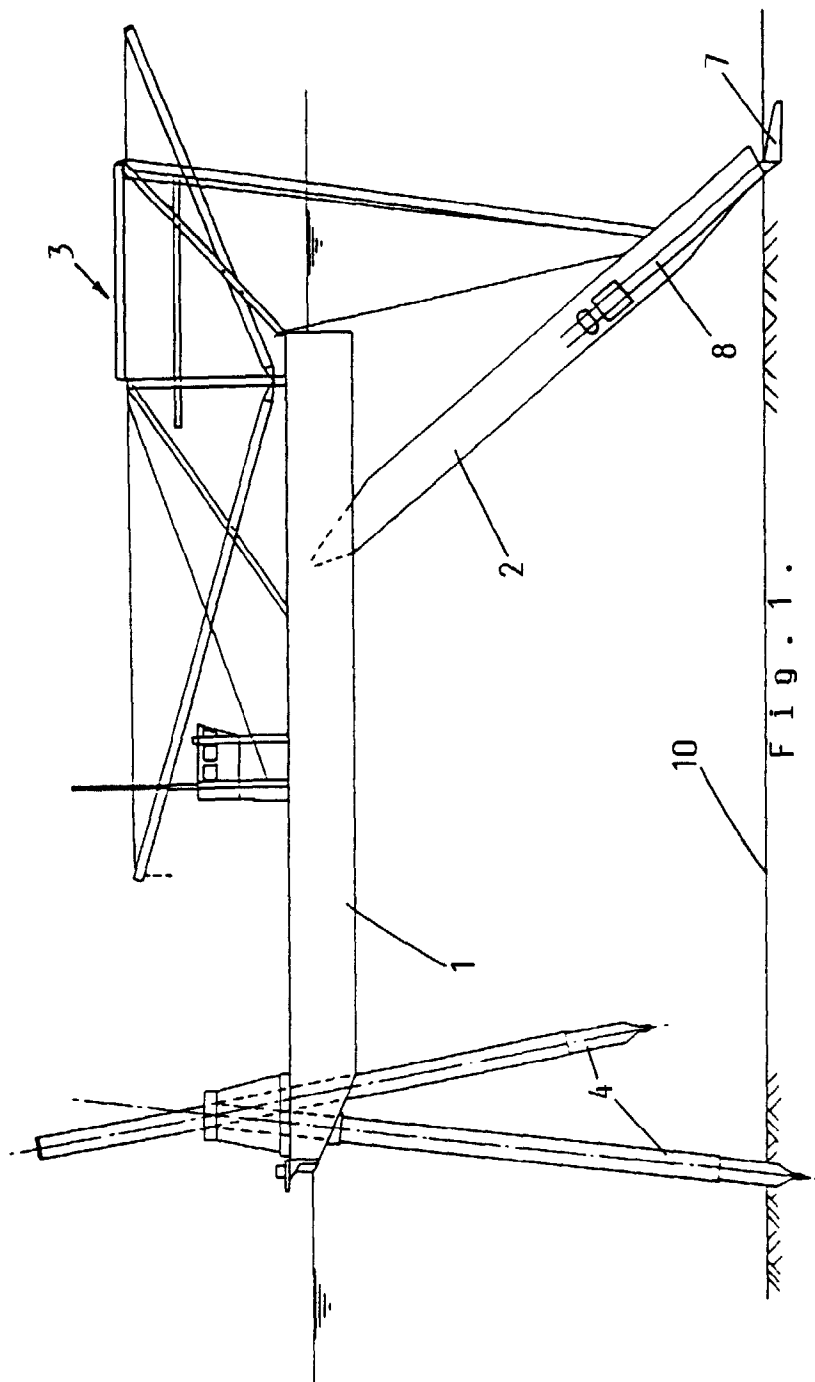
5. Un appareil selon les revendications 3 ou 4, caractérisé en ce que le premier grattoir (9) et le second grattoir (9') sont reliés à charnière à la tête de dragage (7), plus particulièrement sur un axe qui s'étend en substance dans le sens longitudinal de l'élinde (2).

6. Un appareil selon l'une des revendications 3 - 5, caractérisé en ce que le premier grattoir (9) et le second grattoir (9') sont montés sur la tête de dragage (7) de manière à pouvoir glisser vers le bas et vers le haut.

7. Un appareil selon la revendication 6, caractérisé en ce que le premier grattoir (9) et le second grattoir (9') présentent en substance une section transversale circulaire.

8. Un appareil selon la revendication 7, caractérisé en ce que le premier grattoir (9) et le second grattoir (9') se rapprochent de manière conique dans une direction opposée audit orifice d'aspiration.

9. Un appareil selon l'une des revendications 3 - 6, caractérisé en ce que le premier grattoir (9) et le second grattoir (9') forment un ensemble qui peut osciller autour d'un axe de pivotement (20) qui s'étend à l'opposé dudit orifice d'aspiration (11), dans la direction longitudinale de la tête de dragage.



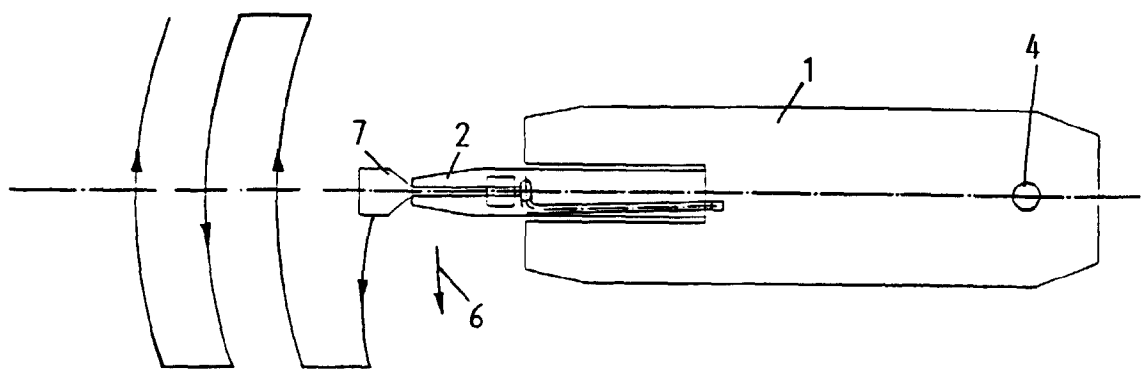


Fig. 3.

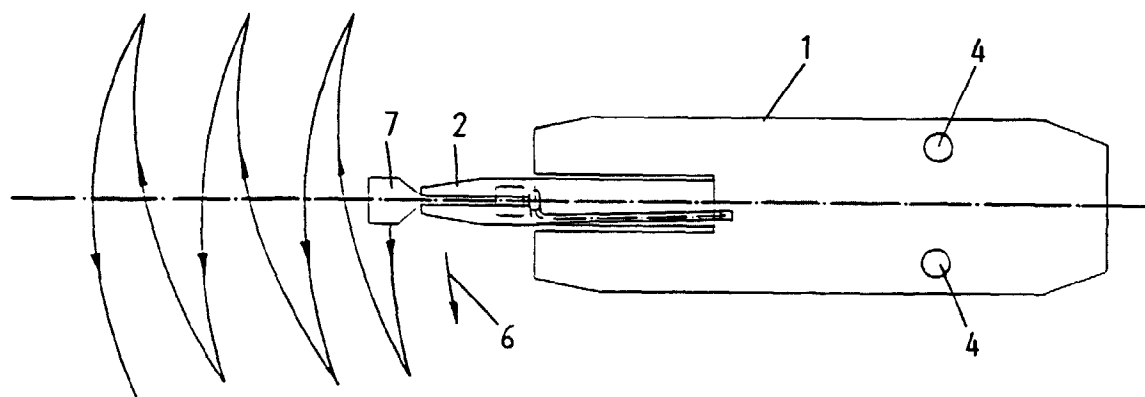


Fig. 4.

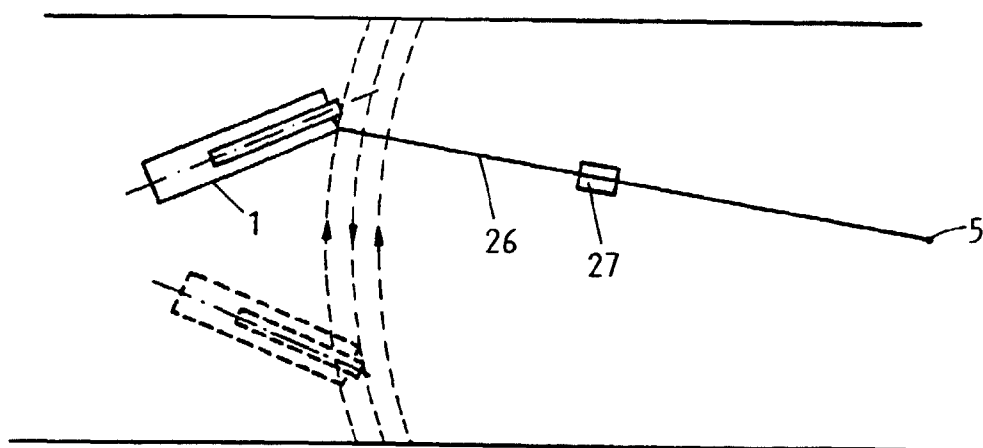
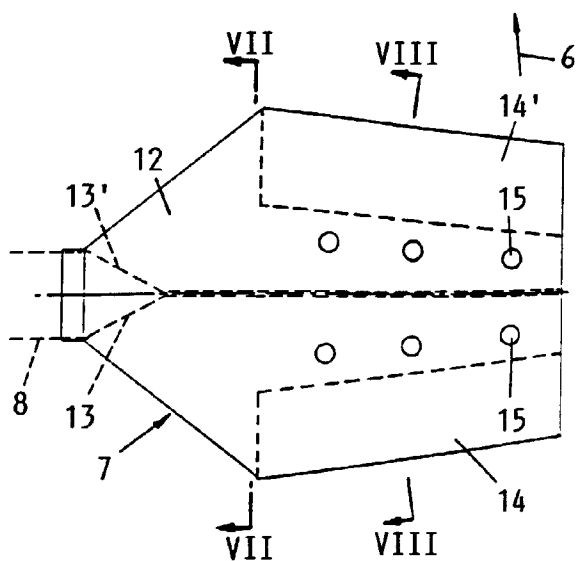
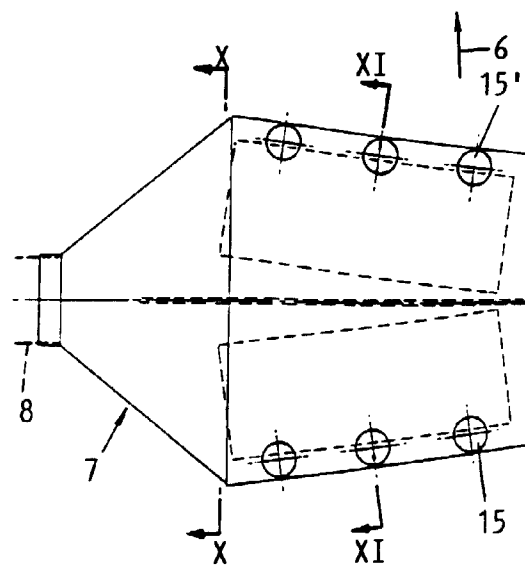


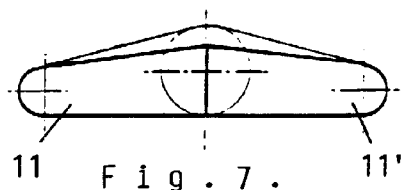
Fig. 5.



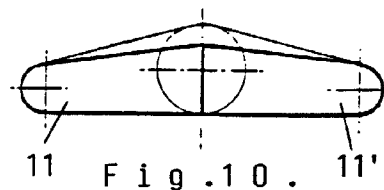
F i g . 6 .



F i g . 9 .



F i g . 7 .



F i g . 1 0

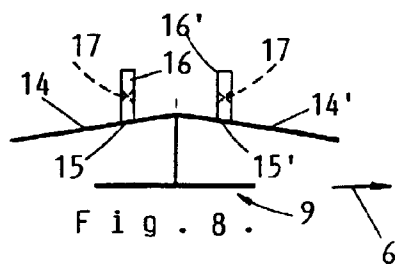


Fig. 8.

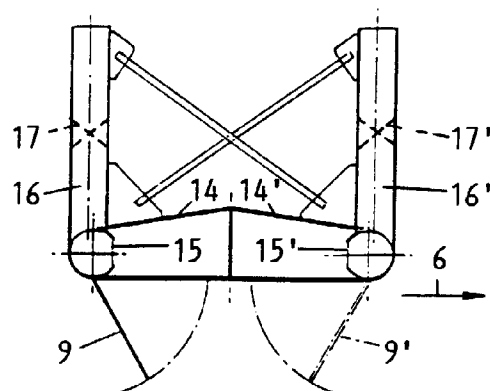


Fig. 11.

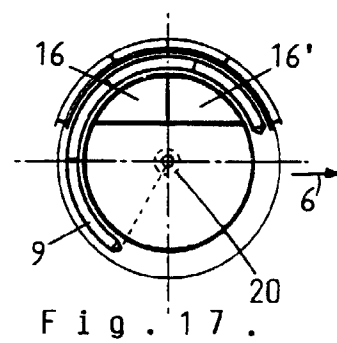
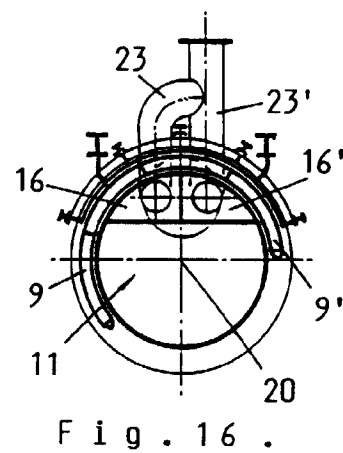
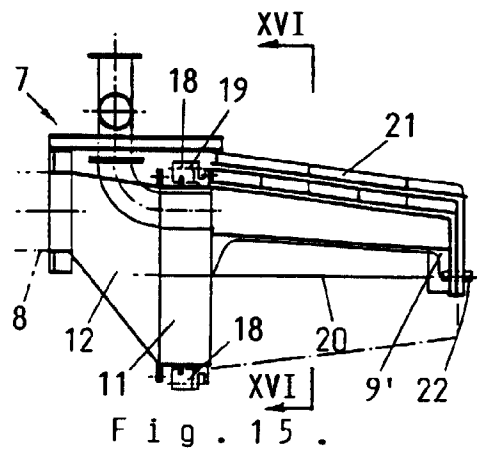
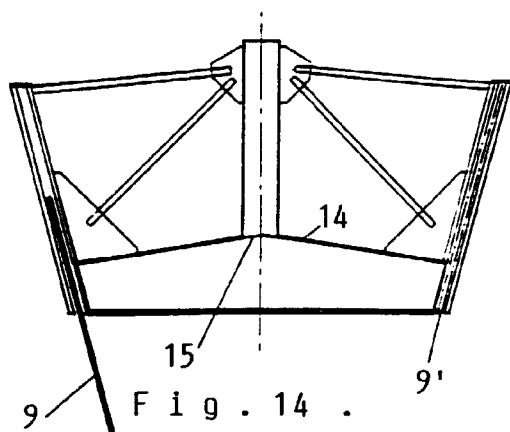
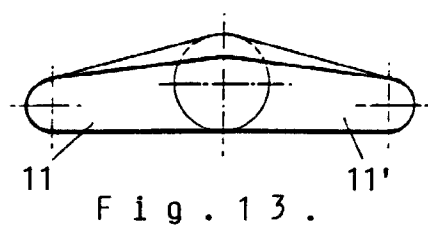
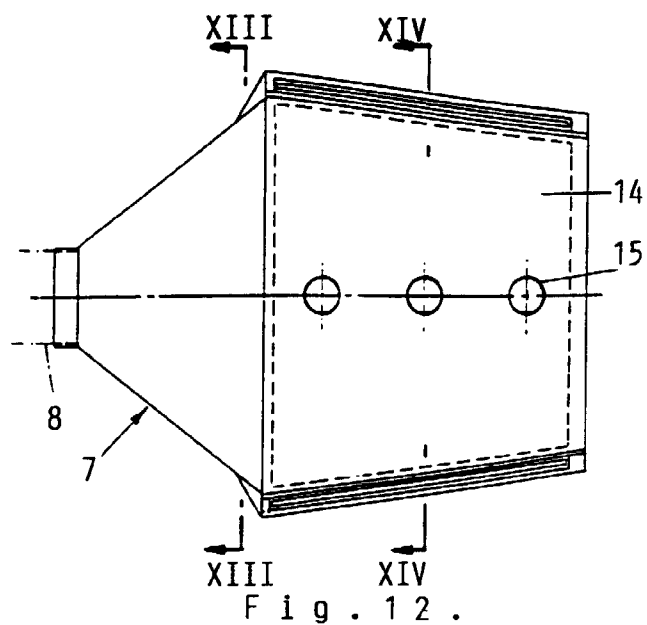
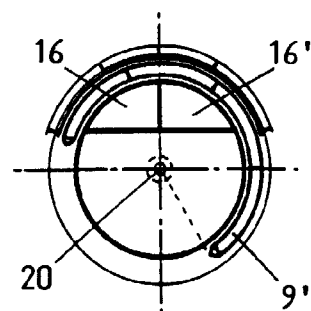


Fig. 18.



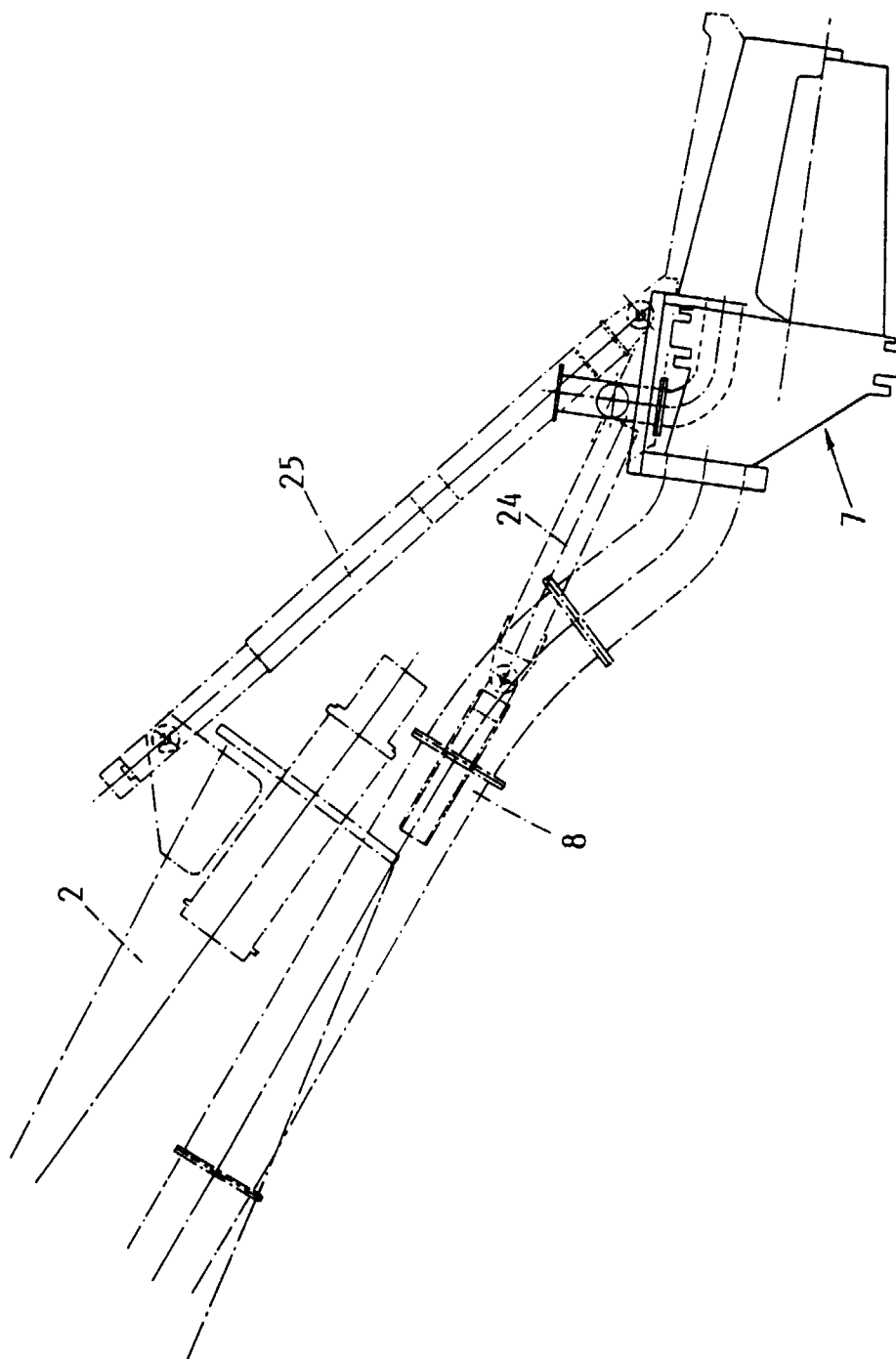


Fig. 19.