(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 2 434 061 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
28.03.2012 Bulletin 2012/13

(21) Application number: **11182998.2**

(22) Date of filing: **27.09.2011**

(51) Int Cl.:
E02F 3/92 *(2006.01)* ***E02F 5/28*** *(2006.01)*
E02F 3/90 *(2006.01)*

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME

(30) Priority: **28.09.2010 BE 201000576**

(71) Applicant: **Baggerwerken Decloedt en Zoon N.V.**
8400 Oostende (BE)

(72) Inventors:
- **Van der Keere, Luc**
  B2160 Wommelgem (BE)
- **De Backer, Lien**
  B9070 Heusden (BE)

(74) Representative: **Brouwer, Hendrik Rogier**
Patentwerk B.V.
P.O. Box 1514
5200 BN 's-Hertogenbosch (NL)

(54) Dredging device and method for dredging without damaging structures present in the bottom to be dredged

(57) The invention relates to a dredging device, comprising a dredging vessel and a dredge suction head connected to the dredging vessel and having a dredge suction opening. The dredge suction opening of the dredge suction head is provided with smooth edges and the dredging device comprises a measuring device for measuring the distance between the dredge suction head and the bottom. The invention also relates to a corresponding method, wherein the measuring device ensures that during dredging the dredge suction head is held at a distance from the bottom. The dredging device and corresponding method reduce the danger of damage to structures present in the bottom.

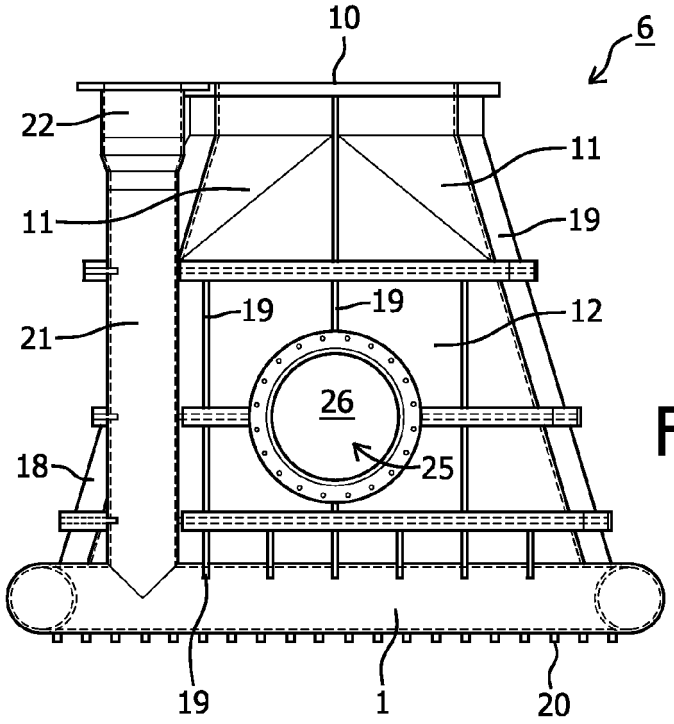

FIG. 3

EP 2 434 061 A1

Description

[0001] The present invention relates to a dredging device, comprising a dredging vessel adapted for movement in a direction of movement, a dredge suction head connected to the dredging vessel and having a dredge suction opening, a dredge pump placed on the dredging vessel and having a suction connection, a suction conduit connecting the dredge suction head to the suction connection of the dredge pump, and support means placed between the dredging vessel and the dredge suction head for supporting the dredge suction conduit, the support means being adapted to determine the depth of the dredge suction head.

[0002] Such dredging devices are generally known. A known dredge suction head is provided here with teeth arranged around the dredge suction opening for the purpose of dislodging from the bottom material to be brought up by dredging. During use such a dredge suction head is dragged forward over or in the bottom for dredging, wherein the teeth dislodge the soil. Such a dredge suction head is therefore also referred to as a trailing dredge suction head. These are very satisfactory for dredging bottoms of basins in which dredging is possible without the danger of damaging structures present in the bottom for dredging. Dredging operations must however be carried out at locations where there is danger of damaging structures present in the bottom. Such structures are formed for instance by cables or conduits present in the bottom. There is a danger here of the dredging head and/or the teeth of the dredging head damaging these structures. Damage to these structures can result in great problems since the thus resulting damage is usually difficult to repair and so can only be repaired with great difficulty and only at high cost.

[0003] The present invention seeks to provide means for dredging with reduced danger of damage to structures present in the bottom.

[0004] This object is achieved with a dredging device of the above stated type, wherein the dredge suction opening of the dredge suction head is provided with smooth edges and comprises a measuring device for measuring the distance between the dredge suction head and the bottom.

[0005] As a result of the smooth edges the danger of damage to structures present in the bottom is per se already greatly reduced. The measuring device moreover allows the distance between the dredge suction head and the bottom to be visualized for the helmsman of the dredging vessel.

[0006] The invention likewise relates to a method for dredging the bottom of a basin with a dredge suction head, wherein use is made of a dredge suction head, the suction opening of which is provided with smooth edges. During dredging the dredge suction head is held at a distance from the bottom of the basin for dredging. The danger of damage to structures present in the bottom is reduced still further as a result of the distance relative to the bottom and the smooth edges.

[0007] In the prior art dredge suction heads the teeth loosen the material present on the bottom, whereby this material can be easily suctioned up. The dredging device according to the invention is preferably not provided with teeth to obtain the smooth edges. When use is made according to the invention of a suction opening with smooth edges and no teeth, less material, or even no material, is expected to be loosened. It is surprising that sufficient bottom material can nevertheless be dredged using the dredge suction head.

[0008] In order to enable dredging with a sufficient flow rate of dredged material, it is attractive for the surface area of the dredge suction opening of the dredge suction head to be relatively small in relation to the periphery of the dredge suction opening. A good dredging efficiency is achieved by making use of such an embodiment, among other reasons because of the thus increased suction pressure. In most types of ground sufficient material is hereby dislodged from the bottom. According to a preferred embodiment of the dredging device, the ratio of the surface area of the dredge suction opening to the periphery thereof lies between 0.02 m and 0.5 m, more preferably between 0.03 m and 0.25 m and most preferably between 0.05 m and 0.10 m. In an embodiment in which the dredge suction opening takes an elongate form, it preferably has a width of 0.5 m to 10 m, and a height of 0.05 m to 1 m. Other dimensions are however possible.

[0009] In order to enable effective use of the working width of the dredge suction head, a further preferred embodiment proposes that the longitudinal direction of the dredge suction opening extends substantially transversely of the direction of movement.

[0010] Although the danger of damage to structures present in the bottom, such as cables and conduits, is already greatly reduced by the absence of teeth and other protruding parts and by moving the dredge suction head at a distance from the bottom during use, there is still the danger of the edges of the suction opening causing damage when they make incidental contact with the bottom. In order to also reduce this danger, a further embodiment yielding smooth edges proposes that a structure with a rounded cross-section is arranged extending at least partially around the suction opening. The rounded cross-section is after all less likely to catch on a cable or conduit.

[0011] In the known method the known dredge suction head is dragged through the bottom, wherein the material on the bottom is dislodged by the teeth of the dredge suction head. In the invention these teeth are no longer present, so that it is the expectation that less material is removed from the bottom. In order to avoid this possible drawback, a further preferred embodiment proposes that the dredging head is provided with water jet nozzles for generating water jets directed substantially transversely of the plane of the dredge suction opening. The water jet nozzles serve here to dislodge the material from the bottom. The danger of damaging the structures present in

the bottom is negligible here because the water jet nozzles are situated at a distance from the bottom during use and because of the relatively limited operational range of the water jet nozzles.

[0012] In order to optimize the effectiveness of the water jet nozzles it is attractive for the water jet nozzles to comprise a directional component directed toward the dredge suction opening. Material is thus dislodged here at the location where it is suctioned away.

[0013] The water jet nozzles are preferably placed on a tube extending in the longitudinal direction of the suction opening.

[0014] Although the problem of damage to structures present in the bottom of the basin for dredging is avoided, there is the danger of the suction opening incidentally resting directly on the bottom and suctioning itself too deeply into the bottom. Structures situated deeper in the bottom can hereby be damaged. This is also highly undesirable.

[0015] The dredge suction head suctioning itself fixedly to the bottom may be an incidental occurrence. In order to avoid this a further embodiment proposes that in at least one of the walls of the dredge suction head an opening is arranged in which is placed a water valve controllable by a valve control device, and that the valve control device is adapted to keep the valve closed and to open the valve when a determined difference between the surrounding water pressure and the pressure prevailing inside the dredge suction head is exceeded. This embodiment makes use of the fact that the dredge suction head being suctioned too deeply into the ground can be detected by the increase in the difference between the surrounding pressure and the pressure inside the dredge suction head. This embodiment also proposes a method wherein the pressure prevailing in the dredge suction head is determined during dredging and, in the case of deviations from an adjustable pressure range, a valve arranged in one of the walls of the dredge suction head is opened, preferably manually. This avoids damage being caused, for instance to the dredge pump, by the increased underpressure in the dredge suction head and suction conduit.

[0016] A particularly effective dredging device according to an embodiment of the invention is characterized in that the valve control device comprises a spring which is adapted to keep the valve closed and which, when a determined difference between the surrounding water pressure and the pressure prevailing inside the dredge suction head is exceeded, deforms such that the valve opens.

[0017] According to a structurally attractive embodiment, the valve with a spring as valve control device is adapted to rest in closed position against the inner side of a valve seat enclosing the opening. This measure has the result that the difference in pressure between the surrounding area and the interior of the dredge suction head keeps the valve closed due to the reaction of the spring, and no special means need be provided in addition to the spring for the purpose of opening the valve. Should the pressure difference become too great, the spring will then extend, causing the valve to displace inward.

[0018] In order to further avoid these drawbacks, according to a preferred embodiment of the invention the dredging device comprises a control device adapted to control the support means for the purpose of holding the dredge suction head at an, if desired predetermined, distance from the bottom of the basin for dredging. This measure makes it possible to hold the dredge suction head, and thereby the suction opening arranged therein, at a distance from the bottom for dredging. This not only prevents the suction opening suctioning itself fixedly to the bottom, the dredging process is moreover kept more constant because a water flow can be maintained at all times through the dredging device. The same embodiment results in a method of the above stated type, wherein during dredging the dredge suction head is held as much as possible at a distance from the bottom of the basin for dredging.

[0019] A preferred embodiment of the dredging device according to the invention has the feature that the control device comprises a swell compensating device adapted to hold the support means at a predetermined tension. The support means preferably comprise one or more cables from which the suction conduit (and therefore also the dredge suction head) is suspended. The swell compensating device measures the tension in the cable(s) and then adjusts the length of the cable(s) such that the tension remains substantially constant or varies within determined limits. According to the present embodiment of the invention, the constant (desired) tension in the cable(s) is set such that it equals the underwater weight of the dredge suction head and attachments. Should the dredging head make incidental contact with the bottom, the tension in the cable(s) will then decrease quickly. The swell compensating device reacts to this decrease by tightening the cable(s), whereby the suction conduit (and the dredge suction head) is moved in the direction of the water surface and the dredge suction head, and in particular the dredge suction opening, still hardly rests on the bottom and pressure on the bottom is minimal.

[0020] A further possibility for maintaining this distance is that the control device is coupled to a measuring device for measuring the distance between the dredge suction head and the bottom, and the control device is adapted to control the suction head support means subject to the distance between the dredge suction head and the bottom. This is a relatively simple embodiment, the advantages of which are likewise gained when the distance between the dredge suction opening and the basin bottom is determined during dredging and, in the case of deviations from an adjustable value of this distance, the distance is adjusted. It is likewise possible to make use of a camera or ultrasonic multibeam or the like mounted on the dredging head and pointed in the direction of movement, the information from which is viewed in the

form of images or measurement values by a person on the dredging vessel, and the person adjusts the height of the dredging head. It is also possible to fulfil this function electronically when means are used for processing images.

[0021] A further option for maintaining this distance comprises the measure that the control device is coupled to a pressure measuring device for measuring the pressure prevailing in the dredge suction head, and that the control device is adapted to control suction head support means subject to the pressure prevailing in the dredge suction head. A smaller distance between the suction opening and the bottom will after all result in a lower flow rate, and thereby in a greater pressure difference between the surrounding pressure and the pressure prevailing inside the dredge suction head. This option can be used instead of the above-mentioned measure of measuring the distance, but also as addition to this measure. These advantages are likewise achieved by a method wherein during dredging the pressure prevailing in the dredge suction head is determined and, in the case of deviations from an adjustable pressure range, the distance between the dredge suction opening and the basin bottom is adjusted.

[0022] Another option for maintaining this distance comprises the measure that the dredge suction head is provided with one or more spacers. Such spacers comprise for instance wide wheels arranged on both sides of the dredge suction head. The underside of the wheels (or the spacer in general) is situated a certain distance, for instance 10 cm, below the underside of the dredge suction head. In the case that during dredging the dredge suction head threatens to sink undesirably deeper than the certain distance, the wheels make contact with the bottom without the dredge suction head coming into contact with the bottom. Owing to the form of the wheels (a relatively large contact surface with the bottom), and the spacer(s) in general, they will not sink into the bottom, or do so only slightly. Another possibility comprises a carriage and/or round tube mounted on the dredge suction head. It will be apparent that other embodiments of spacers can be applied within the scope of the present invention.

[0023] According to the invention the dredge suction head is held a determined distance from the bottom during dredging. A preferred distance here is less than 1 m, more preferably less than 0.6 m, still more preferably less than 0.45 m and most preferably less than 0.25 m.

[0024] In some dredging operations a material is brought up by dredging which oxidizes in the air and thereby acquires environmentally undesirable properties. In order to prevent the dredged material being exposed to the air, a preferred embodiment provides the measure that the outlet connection of the dredge pump is connected to a pressure conduit, the end of which debouches under the water surface. This embodiment also provides a method wherein the material brought up by dredging is discharged under the water surface.

[0025] The present invention will now be elucidated in more detail with reference to the accompanying figures, in which:

Figure 1 is a schematic cross-sectional view of a dredging device according to the invention;
Figure 2 is a detail view of the dredge suction head shown in figure 1;
Figure 3 is a top view of the dredge suction head according to a preferred embodiment;
Figure 4 is a side view of the dredge suction head shown in figure 3; and
Figure 5 is a front view of the dredge suction head shown in figures 3 and 4.

[0026] Figure 1 shows a dredging vessel 1 which is provided with a motor, not shown in the drawing, for driving a propeller 2 via a propeller shaft for the purpose of propelling dredging vessel 1. Also present are devices, not shown in the drawings, for steering dredging vessel 1, such as a rudder and transversely placed propellers for facilitating manoeuvring.

[0027] A dredge pump, not shown in the drawings, is arranged in dredging vessel 1. Arranged against a side wall of the dredging vessel is a dredge suction conduit 3, one end of which is connected to the suction connection of the dredge pump. In the present embodiment the dredge suction conduit 3 comprises two members 3a and 3b which are connected to each other by means of a coupling allowing some relative angular displacement. The connection between upper member 3a of dredge suction conduit 3 and the vessel also allows angular displacement in the vertical plane and about the axis. For support of the movable end of upper member 3a of dredge suction conduit 3 this member is connected to a cable 4a, the other end of which is connected to a winch 5a. For support of the movable end of lower member 3b of dredge suction conduit 3 this member is likewise connected to a cable 4b, the other end of which is connected to a winch 5b. It is thus possible using winches 5a, 5b to vary the height of dredge suction conduit 3. It will be apparent that, also subj ect to the depth of the basin for dredging, the number of members of dredge suction conduit 3 can be increased or decreased, with a corresponding adjustment of the number of cables 4 and winches 5.

[0028] As shown in the detail view of figure 2, a dredge suction head 6 is arranged on the free end of the second member 3b of dredge suction conduit 3. Figure 2 shows a bracket plate which is attached to the second member 3b of the dredge suction conduit and to which cable 4b is attached. This figure also shows a curved piece of pipe 8 placed between the second member 3b of the dredge suction conduit 3 and dredge suction head 6 for the purpose of determining the angular position of dredge suction head 6. It will be apparent that the curvature of pipe piece 8 can be adjusted subject to the dimensioning of dredge suction conduit 3 and the depth of the bottom for dredging.

[0029] The construction of dredge suction head 6 will now be discussed with reference to figures 3, 4 and 5. In the shown embodiment the dredge suction head 6 comprises a round flange 10 adapted for connection to the curved pipe piece 8 or to the terminal member 3b of suction conduit 3. Connected by welding to flange 10 are plates 11, at least a part of which is connected to an upper plate 12, to a lower plate 13 and to two side plates 14, 15 respectively. The upper, lower and side plates 12, 13, 14 and 15 are positioned and connected to each other in a trapezium-shaped structure. Plates 11 serve for the purpose of forming a smooth transition between flange 10 and the rectangular structure of the dredging head. A round tube 16 is arranged around suction opening 17 (formed by the outer ends of plates 12, 13, 14 and 15), wherein tubes 16 together form a rectangular structure enclosing an opening forming the dredge suction opening 17. The round shape of tubes 16 prevents catching on cables or conduits present in the bottom. A number of strengthening rib plates 18 and 19 (running respectively in the transverse and longitudinal direction) are also arranged on the outer side of plates 12-15. The form of plates 12-15 is chosen for the purpose of obtaining an elongate dredge suction opening 17.

[0030] Arranged as shown in figures 3-5 in one of the tubes 16 is a series of nozzles 20 which are adapted to generate water jets directed toward the bottom. These water jets serve to dislodge material to be dredged from the bottom. For the purpose of generating the water jets the interiors of each of the tubes 16 are connected to each other. A water jet tube 21 extending with its axis substantially parallel to the axis of dredge suction head 6 is connected to tubes 16, wherein the interior of water jet tube 21 connects to the interior of tubes 16. Arranged on the free end of the water jet tube is a pump 22 for generating a flow in the water jet tube, and thereby water jets flowing from nozzles 20. Arranged in upper plate 12 of dredge suction head 6 is a round opening 25 in which a water valve 26 is placed. Valve 26 normally rests against a valve seat, not shown in the drawing, arranged in opening 25, so that the opening is normally closed. Valve 25 is arranged on the outer side of the valve seat so that in normal operating conditions, wherein the pressure prevailing inside dredge suction head 6 is lower than the pressure in the surrounding area, the pressure difference presses valve 25 onto the valve seat. For the purpose of opening the valve a mechanism, not shown in the drawings, is arranged for causing valve 25 to open when the pressure difference exceeds predetermine values or when there are other reasons for opening valve 25.

[0031] It is possible and advantageous to provide dredge suction head 6 with a camera (not shown) pointed in the direction of movement, the images from which are viewed on the dredging vessel by a person, for instance by visualizing the images or measurement values on a computer screen. It is also possible to fulfil this function electronically when means are used to process images.

[0032] The above described embodiment of a dredging device according to the invention operates as follows. During dredging of basins where there is a danger of damaging structures present on and/or in the bottom such as cables or conduits, dredge suction head 6 is held during sailing at a distance from the bottom of the basin for dredging. Use is made in the present embodiment of the camera images which record the distance between the bottom and the underside of dredge suction head 6. In the case the distance exceeds or falls below predetermined values, the height position of dredge suction head 6 is changed by means of winches 5a and 5b. Winches 5a and 5b are for instance operated by a crew member or can be controlled in other manner. It will be apparent that other methods of controlling the height are not precluded and that the above elucidated controls can be combined with each other.

[0033] The water jets flowing out of nozzles 20 also ensure that material is dislodged from the bottom irrespective of the distance between the bottom and the underside of dredge suction head 6.

[0034] Despite the height of dredge suction head 6 being adjusted relative to the bottom during dredging, it may occur incidentally, for instance in the case of unevenness in the surface of the bottom, that dredge suction head 6 'suctions itself fast' into the bottom and/or penetrates increasingly deeper therein and so threatens to damage structures located deeper in the ground. In order to move clear of such an undesirable situation without stopping the dredge suction pump, use is preferably made of valve 26. The mechanism, not shown in the drawings, for opening the valve is adapted to open valve 25 in the case of an excessive pressure difference between the surrounding pressure and the pressure prevailing inside dredge suction head 6, whereby the pressure difference is equalized and dredge suction head 6 can be moved away from the bottom. A possible mechanism comprises a spring.

[0035] Instead of the usual method of discharging the dredged material, such as in a bin, a transport vessel or on land, the dredged material is preferably discharged under the water surface in order to prevent oxidation.

Claims

1. Dredging device, comprising:

- a dredging vessel adapted for movement in a direction of movement;
- a dredge suction head connected to the dredging vessel and having a dredge suction opening;
- a dredge pump placed on the dredging vessel and having a suction connection;
- a suction conduit connecting the dredge suction head to the suction connection of the dredge pump; and
- support means placed between the dredging vessel and the dredge suction head for supporting the dredge suction conduit, the support

means being adapted to determine the depth of the dredge suction head, **characterized in that** the dredge suction opening of the dredge suction head is provided with smooth edges and the dredging vessel comprises a measuring device for measuring the distance between the dredge suction head and the bottom.

2. Dredging device as claimed in claim, **characterized in that** the ratio of the surface area of the dredge suction opening to the periphery thereof lies between 0.03 m and 0.25 m.

3. Dredging device as claimed in any of the claims 1-2, **characterized in that** the longitudinal direction of the dredge suction opening extends substantially transversely of the direction of movement.

4. Dredging device as claimed in any of the claims 1-3, **characterized in that** a structure with a rounded cross-section is arranged extending at least partially around the dredge suction opening.

5. Dredging device as claimed in any of the foregoing claims, **characterized in that** the dredge suction head is provided with water jet nozzles for generating water jets directed substantially transversely of the plane of the dredge suction opening.

6. Dredging device as claimed in any of the foregoing claims, **characterized by** a control device adapted to control the support means for the purpose of holding the dredge suction head at a distance from the bottom of the basin for dredging.

7. Dredging device as claimed in claim 6, **characterized in that** the control device is coupled to the measuring device for measuring the distance between the dredge suction head and the bottom, and that the control device is adapted to control the support means subject to the distance between the dredge suction head and the bottom.

8. Dredging device as claimed in claim 6, **characterized in that** the control device is coupled to a pressure measuring device for measuring the pressure prevailing in the dredge suction head, and that the control device is adapted to control the support means subject to the pressure prevailing in the dredge suction head.

10. Dredging device as claimed in any of the foregoing claims, **characterized in that** in at least one of the walls of the dredge suction head an opening is arranged in which is placed a water valve controllable by a valve control device, and that the valve control device is adapted to keep the valve closed and to open the valve when a determined difference between the surrounding water pressure and the pressure prevailing inside the dredge suction head is exceeded.

11. Dredging device as claimed in claim 10, **characterized in that** the valve control device comprises a spring which is adapted to keep the valve closed and which, when a determined difference between the surrounding water pressure and the pressure prevailing inside the dredge suction head is exceeded, deforms such that the valve opens.

12. Dredging device as claimed in any of the foregoing claims, **characterized in that** the dredge suction head is provided with one or more spacers for adjusting the distance between the dredge suction opening and the basin bottom.

13. Method for dredging the bottom of a basin with a dredge suction head, **characterized in that** use is made of a dredge suction head, the suction opening of which is provided with smooth edges, and that during dredging the dredge suction head, or at least the suction opening thereof, is held at a distance from the bottom of the basin for dredging.

14. Method as claimed in claim 13, **characterized in that** the distance between the dredge suction opening and the basin bottom is determined during dredging and that, in the case of deviations from an adjustable value of this distance, the distance is adjusted.

15. Method as claimed in any of the claims 13-14, **characterized in that** the material brought up by dredging is discharged under the water surface.

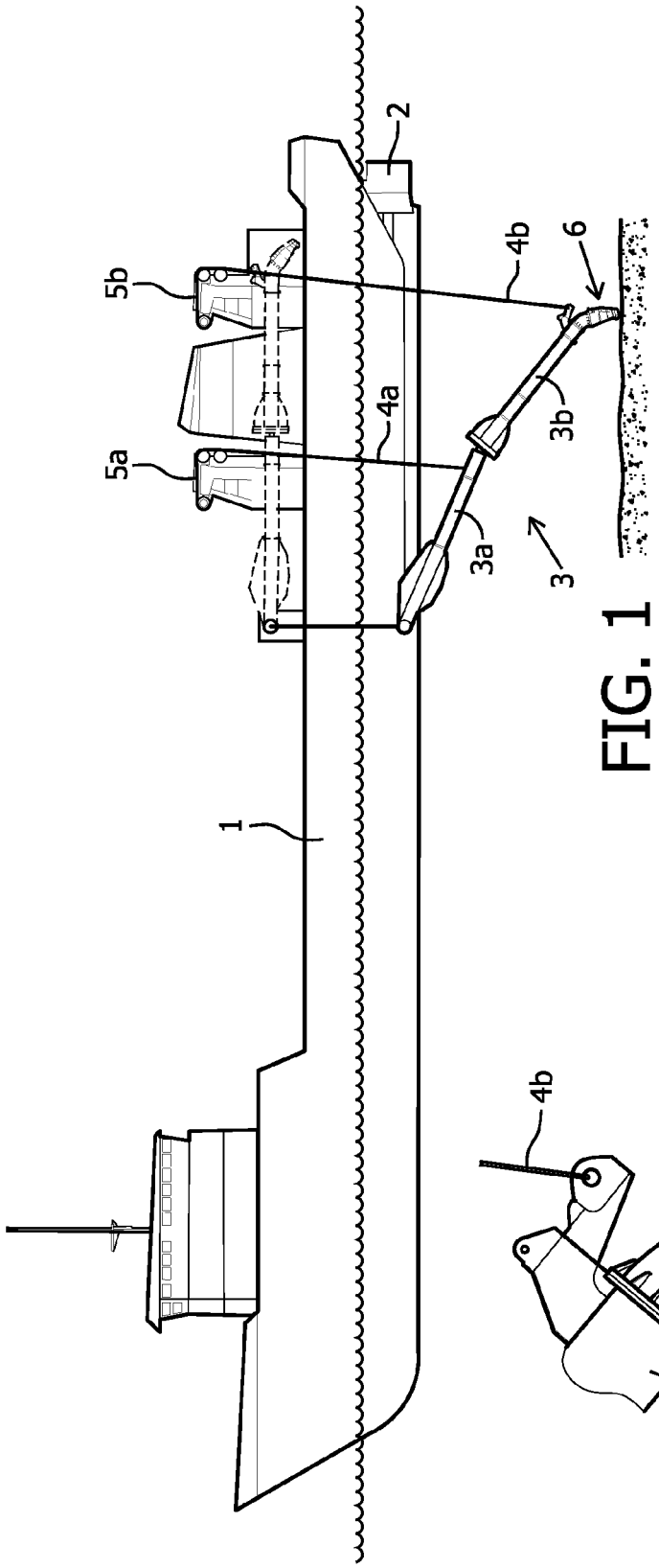

FIG. 1

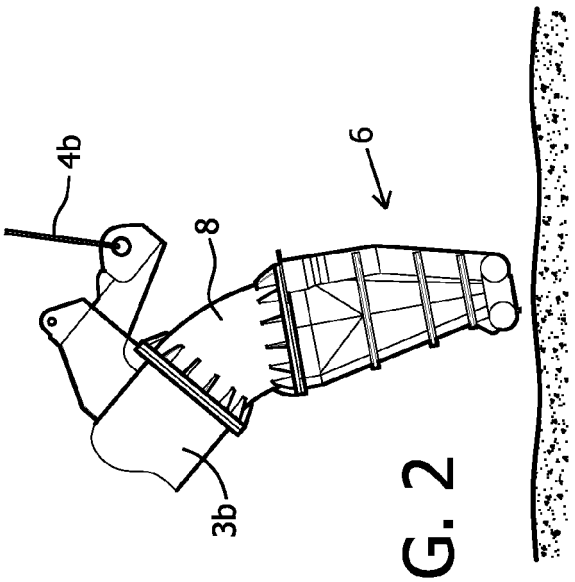

FIG. 2

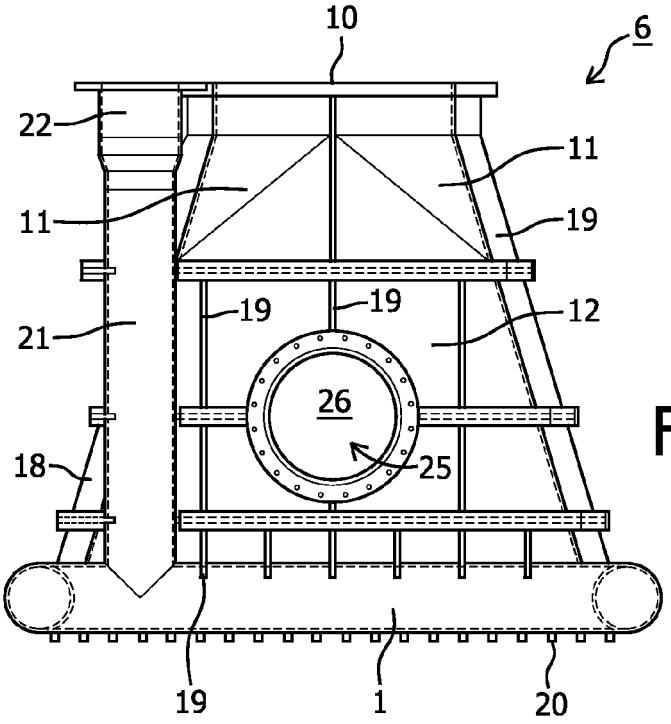

FIG. 3

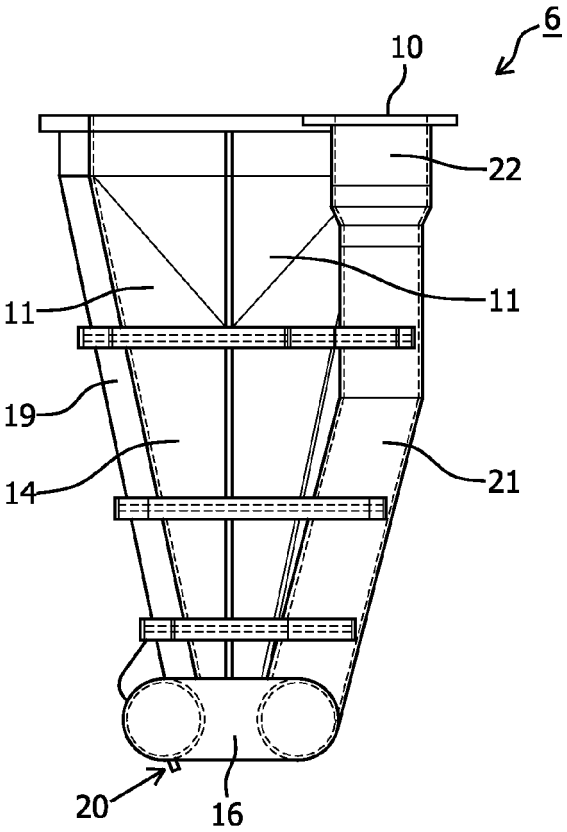

FIG. 4

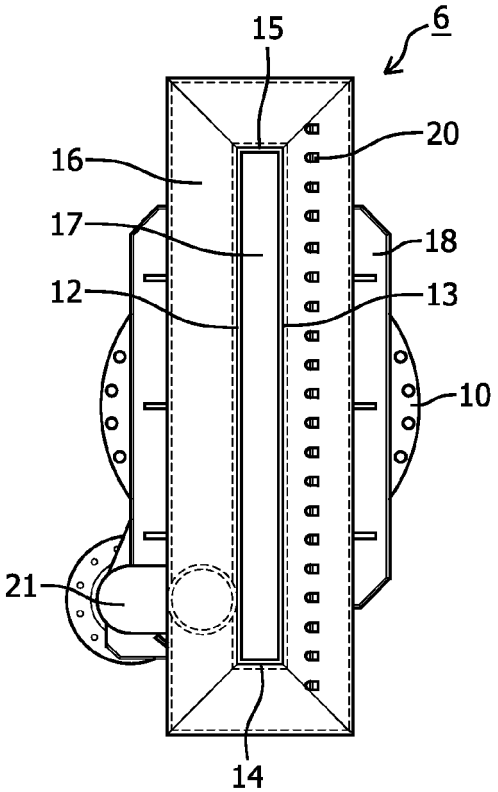

FIG. 5

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 11 18 2998

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X Y	GB 908 529 A (ATLAS WERKE AG) 17 October 1962 (1962-10-17) * the whole document *	1,12-14 6-8,10, 11	INV. E02F3/92 E02F5/28 E02F3/90
X Y	DE 44 05 451 A1 (KRUPP FOERDERTECHNIK GMBH [DE]) 31 August 1995 (1995-08-31) * the whole document *	1-5,12 6-8,10, 11	
X Y	US 6 966 132 B1 (JACOBSEN TOM [NO] ET AL) 22 November 2005 (2005-11-22) * the whole document *	1,12-15 6-8,10, 11	
X	US 2 252 803 A (PIERRE DUREPAIRE) 19 August 1941 (1941-08-19) * the whole document *	1	
A	US 5 970 635 A (WILMOTH DARYL [US]) 26 October 1999 (1999-10-26) * the whole document *	1	TECHNICAL FIELDS SEARCHED (IPC)
X	DE 968 932 C (KARL WILDI) 10 April 1958 (1958-04-10) * figure 1 *	1	E02F G01S G10K
X	FR 1 310 635 A (BERTIN & CIE) 30 November 1962 (1962-11-30) * figures 2,3 *	1	
X	DE 24 48 308 A1 (BOS KALIS WESTMINSTER) 17 April 1975 (1975-04-17) * figures 4-6 *	1	
X	EP 0 047 803 A1 (DOSBOUW [NL]) 24 March 1982 (1982-03-24) * figures 5,14,15 *	1	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	10 January 2012	Laurer, Michael

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)

Europäisches Patentamt
European Patent Office
Office européen des brevets

Application Number
EP 11 18 2998

CLAIMS INCURRING FEES

The present European patent application comprised at the time of filing claims for which payment was due.

☐ Only part of the claims have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due and for those claims for which claims fees have been paid, namely claim(s):

☐ No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due.

LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

see sheet B

☐ All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.

☒ As all searchable claims could be searched without effort justifying an additional fee, the Search Division did not invite payment of any additional fee.

☐ Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid, namely claims:

☐ None of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims, namely claims:

☐ The present supplementary European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims (Rule 164 (1) EPC).

Europäisches Patentamt
European Patent Office
Office européen des brevets

LACK OF UNITY OF INVENTION
SHEET B

Application Number
EP 11 18 2998

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

1. claims: 1-8, 10-14

   is directed to a dredging device with the known suction head of claim 13
   and comprises as potential special technical features, means which are foreseen for determining and/or maintaining the distance between the dredging suction head and the seabed. The resulting technical effect is the direct determination of the contour ahead of the dragged suction head in order to cope with variances in the seabed contour.

   ---

2. claim: 15

   is directed to the known method of claim 13
   and comprises as potential special technical features, that the dredged material is unloaded under water. The resulting technical effect is the displacement of seabed material from one place to another. The objective technical problem to solve may be formulated as: Managing displacement of seabed material under water.

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 11 18 2998

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.

10-01-2012

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
GB 908529 A	17-10-1962	NONE	
DE 4405451 A1	31-08-1995	AU 687483 B2	26-02-1998
		AU 1144395 A	31-08-1995
		DE 4405451 A1	31-08-1995
		EP 0668406 A1	23-08-1995
		ES 2139103 T3	01-02-2000
		FI 950726 A	22-08-1995
		JP 7259121 A	09-10-1995
		US 5603171 A	18-02-1997
US 6966132 B1	22-11-2005	AU 776999 B2	30-09-2004
		AU 1180201 A	14-05-2001
		BR 0015267 A	18-06-2002
		CA 2389331 A1	10-05-2001
		CN 1387600 A	25-12-2002
		EP 1305478 A2	02-05-2003
		MX PA02004373 A	10-09-2004
		NO 995362 A	04-05-2001
		TR 200201207 T2	21-02-2003
		TW 533166 B	21-05-2003
		US 6966132 B1	22-11-2005
		WO 0132503 A2	10-05-2001
		ZA 200203119 A	27-11-2002
US 2252803 A	19-08-1941	NONE	
US 5970635 A	26-10-1999	NONE	
DE 968932 C	10-04-1958	NONE	
FR 1310635 A	30-11-1962	NONE	
DE 2448308 A1	17-04-1975	AU 7434874 A	29-04-1976
		BE 820963 A1	11-04-1975
		DE 2448308 A1	17-04-1975
		ES 431041 A1	16-01-1977
		FR 2247583 A1	09-05-1975
		GB 1488508 A	12-10-1977
		NL 7314168 A	17-04-1975
		US 3975842 A	24-08-1976
EP 0047803 A1	24-03-1982	NONE	

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82