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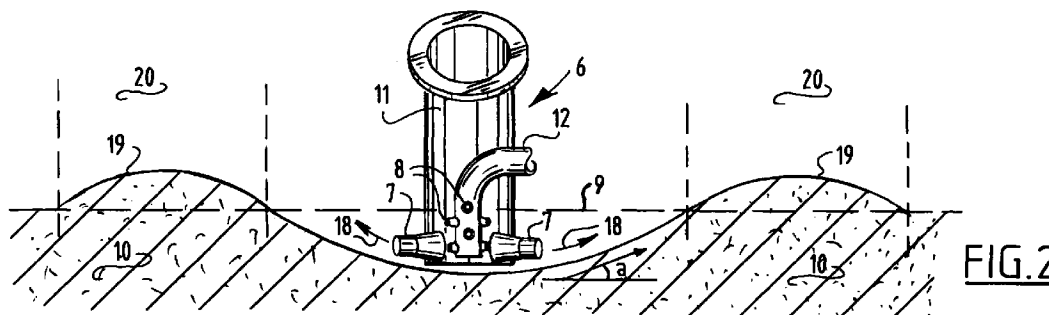
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(54) Method for making a trench under water and device therefor

(57) The invention relates to a method for making a trench (9) under water, wherein bed material (10) of the trench (9) for excavating is processed by means of water under pressure flowing out of at least one water jet (7), wherein the water jet (7) is displaced in an at least partially dug-in position along the path of the trench (9), that water under pressure is sprayed from the water jet (7) in a spraying direction (18) lying transversely of the trench direction along the bed material

(10) of the trench for excavating and that by means of at least one auxiliary water jet (8) water under pressure is sprayed at bed material (10) of the trench (9) for excavating such that the displacement path of the water jet (7) is cleared.

The invention also relates to a device for performing the above stated method.



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Description

The invention relates to a method for making a trench under water, wherein bed material of the trench for excavating is processed by means of water under pressure flowing out of at least one water jet.

Such a method is known.

This known method requires a considerable amount of time since water is sprayed onto the bed material in a manner which is difficult to control, wherein an additional transporting operation is necessary to remove eroded bed material, whereby this known method has a low efficiency.

The invention improves the known method as stated in the characteristic of claim 1.

By applying the method according to the invention the thrust force of the water is used efficiently for displacing bed material out of the trench so that no, or less, transport is required later.

The recommended method is further characterized by the dependent claims 2-6.

The invention also provides a device as stated in claim 7.

The invention further provides preferred embodiments of the device in the claims 8-12.

The invention will be better understood in the light of the annexed drawings, in which:

figure 1 shows a side view of a preferred embodiment of a device according to the invention for making a trench,

figure 2 is a front view in cross-section of the profile of the excavated trench and a front view of a carrier head of an embodiment of a device according to the invention,

figure 3 shows the form of the slope of the bed material in top view and a carrier head in cross-section,

figure 4 is a front view of a preferred embodiment of a carrier head according to the invention, and figures 5 and 6 show side views of the carrier head in different positions.

The device 1 according to the invention comprises a vessel 2 in the form of a dredger having at least one pump 3 for supplying water under pressure via a conduit 5 adjustable by suspension means 4 to water jets 7 and auxiliary water jets 8 supported by a carrier head 6.

Such a device 1 allows a trench 9 to be made of for instance about 1 m deep and 10 m wide per water jet in one movement.

The carrier head 1 is partly dug into the bed 10 and comes to lie in a rest position supporting on bed 10, whereby the carrier head 6 is held in a horizontal position for the jets 7,8. Conduit 5 comprises a water feed 11 and an auxiliary water feed 12 for supplying water under pressure respectively to water jets 7 and auxiliary water jets 8, which feeds 11, 12 can be controlled individually

by means of valves (not shown). It is also possible to provide the auxiliary water jets 8 with water via the auxiliary water feed 12 by means of another pump.

The direction arrow 13 indicates the direction in which carrier head 6 is further towed by the vessel 2 defining the direction of the displacement path of trench 9. Carrier head 6 and conduit 5 are held in a suitable position respectively via support member 16 adjustable with adjusting means 14 and via suspension means 4.

The adjusting means 17 allow the carrier head 6 to be positioned via a control member 15 and water jets 7 and auxiliary water jets 8 to thus be directed by pivoting of carrier head 6 over its longitudinal axis 18.

Water under pressure flows out of the water jets 7 and the auxiliary water jets 8. Arrows 18 indicate the flow direction of the water out of the two water jets 7 which erode bed material from the bed 10 and displace this bed material out of the trench 9. An accumulation 19 of bed material from the trench 9 for excavating hereby occurs along the side edges 20.

The auxiliary water jets 8 serve to clear away bed material in front of the carrier head 6 in the direction 13 of the path of movement of water jets 7.

The auxiliary water jets 8 extend roughly axially relative to the trench for excavating, whereby bed material is eroded axially of the trench 9 for excavating by water under pressure from auxiliary water jets 8 so that carrier head 6 can be moved by vessel 2 via suspension means 4 in the displacement direction 13 of the trench for excavating.

Water jets 7 spray water under pressure in a spraying direction (arrow 18) lying transversely of the trench direction along the bed material of the trench 9 for excavating as well as the bed material eroded by auxiliary water jets 8 and displace this material from the trench 9 to the side edges 20.

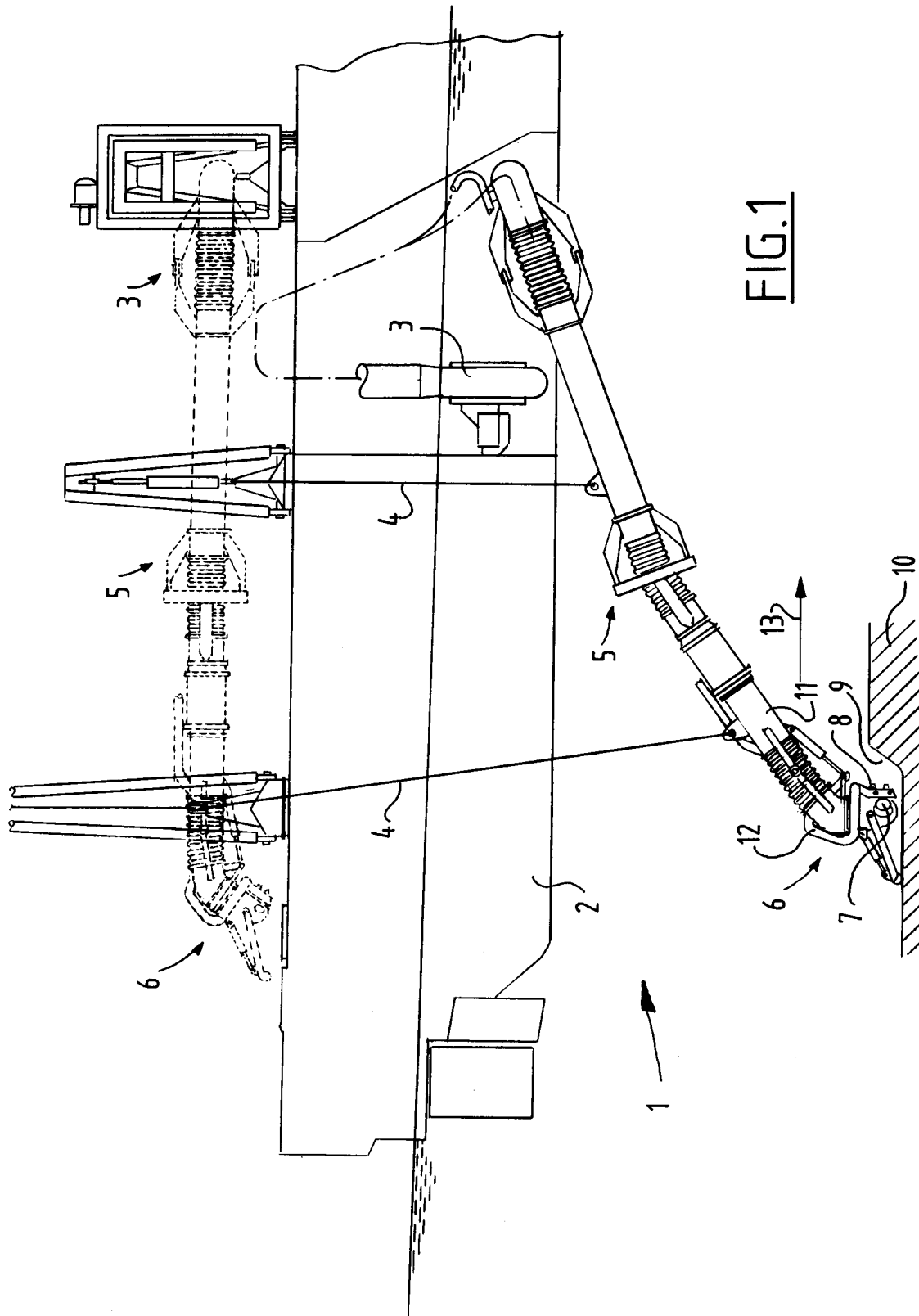
In the position shown in figure 6 it is possible where necessary to dig in the carrier head 6 quickly and simply in the bed. Auxiliary water jets 8 are then directed downward 21 toward the bed 10 and erode as much bed material as necessary for digging in the carrier head 6. A gradual digging-in of carrier head 6 into bed 10 can hereby be dispensed with.

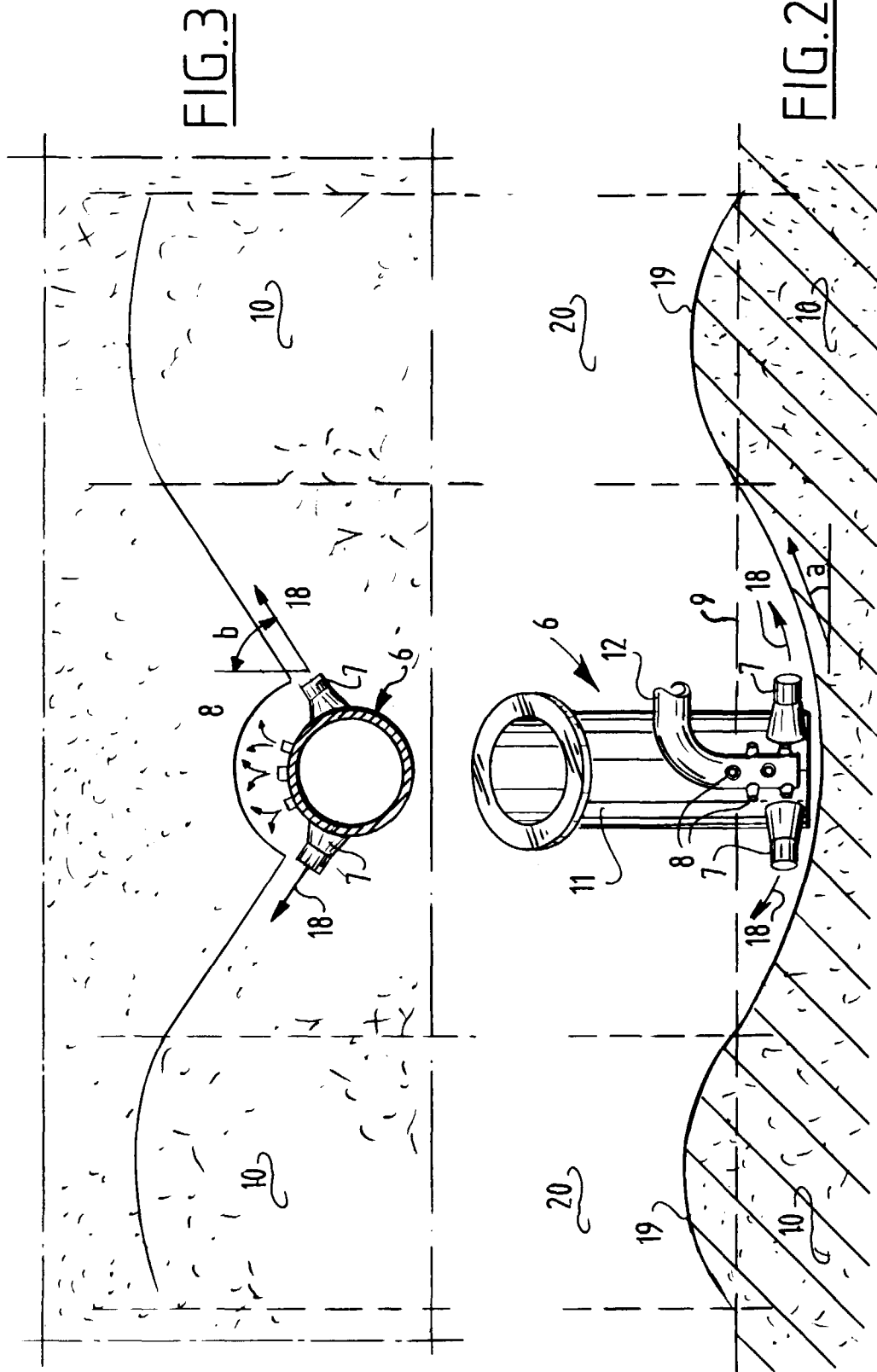
The carrier head 6 is preferably hydraulically adjustable so that:

- the angle α of the water jet relative to the horizontal plane can be adapted as a function of the working depth;
- the angle β of the water jet relative to the axis of the trench for excavating can be adapted as a function of the angle between the axis of the ship and the axis of the trench; and
- the carrier head 6 can make oscillations round a vertical axis in order to have a favourable effect on productivity.

Claims

1. Method for making a trench under water, wherein bed material of the trench for excavating is processed by means of water under pressure flowing out of at least one water jet supported by a carrier head, **characterized in that** the water jet is displaced in an at least partially dug-in position along the path of the trench, that water under pressure is sprayed from the water jet in a spraying direction lying transversely of the trench direction along the bed material of the trench for excavating and that by means of at least one auxiliary water jet water under pressure is sprayed at bed material of the trench for excavating such that the displacement path for the water jet is cleared. 5 10 15
2. Method as claimed in claim 1, **characterized in that** the water jet encloses an angle relative to its direction of displacement of at least 45° but preferably an angle in the order of magnitude of 60°. 20
3. Method as claimed in claim 1 or 2, **characterized in that** water under pressure is sprayed in two spraying directions lying transversely of the trench direction along bed material of the excavated trench located on either side of the displacement path of the carrier head. 25
4. Method as claimed in claim 1, 2 or 3, **characterized in that** the displacement path of each water jet is cleared by means of a plurality of auxiliary water jets directed in diverse directions. 30
5. Method as claimed in any of the foregoing claims, **characterized in that** the water jet or water jets is/are placed in an at least partly dug-in position by directing the auxiliary water jet or auxiliary water jets in a mainly downward direction onto the bed material. 35 40
6. Method as claimed in any of the foregoing claims, **characterized in that** the carrier head is supported relative to the bottom of the excavated trench by means of support means adjusting the height of the carrier head. 45
7. Device for performing the method as claimed in any of the foregoing claims, comprising: 50
 - a vessel,
 - a pump carried by the vessel for supplying water under pressure,
 - a carrier head adjustable in depth relative to the vessel, 55
 - at least one water jet supported by the carrier head and connected to the pump, **characterized in that** the water jet can be displaced in an
- at least partly dug-in position along the path of the trench, while water under pressure is sprayed from the water jet in a spraying direction lying transversely of the trench direction along the bed material of the trench for excavating and that the carrier head bears at least one auxiliary water jet which is connected to a pump supplying water under pressure and which is positioned and directed such that the bed material is thereby sprayed in order to clear the displacement path of the water jet.
8. Device as claimed in claim 7, **characterized in that** each water jet encloses an angle relative to its direction of displacement of at least 45° but preferably an angle in the order of magnitude of 60°.
9. Device as claimed in claim 7 or 8, **characterized in that** the device comprises an auxiliary water feed for feeding water to the auxiliary water jet(s).
10. Device as claimed in claim 7, 8 or 9, **characterized in that** the device comprises a control member for directing the carrier head.
11. Device as claimed in any of the claims 7-10, **characterized in that** the device comprises support elements for adjusting the height of the carrier head relative to the bed of the trench for excavating.
12. Device as claimed in any of the claims 7-11, **characterized in that** the parameters of the water flowing out of the carrier head in pressure, flow rate and speed lie respectively between 5 and 20 bar, 1 and 10 m³/s and 30 and 60 m/s.





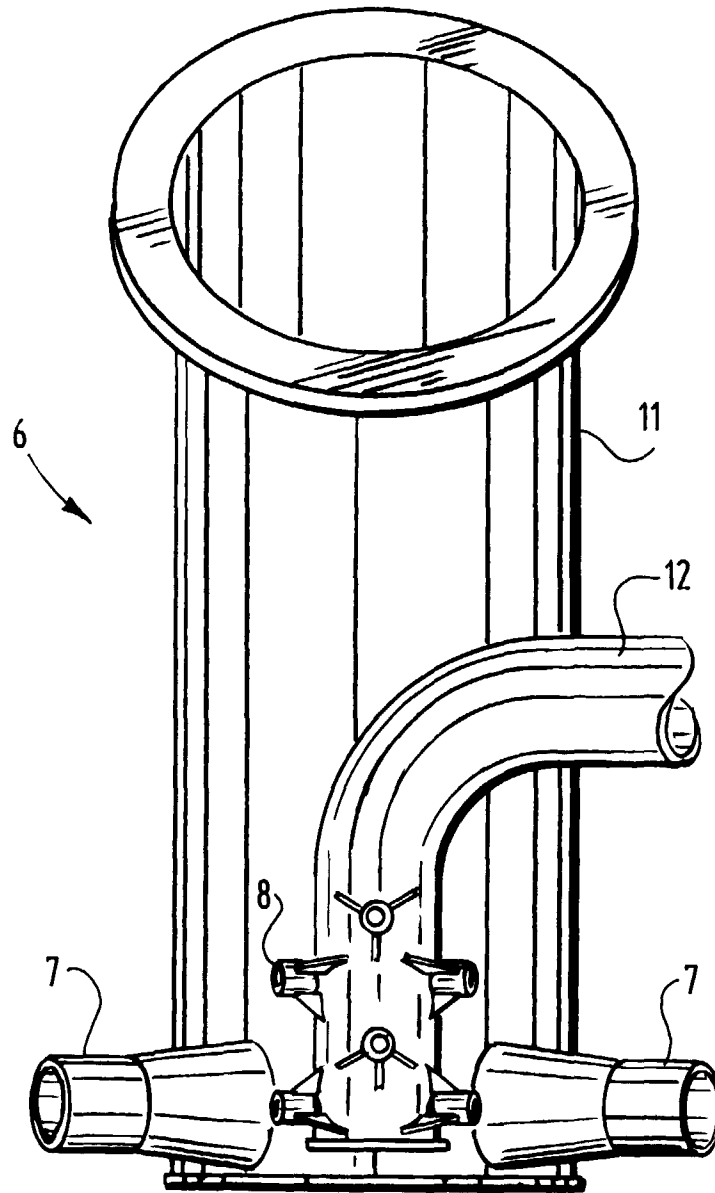


FIG. 4

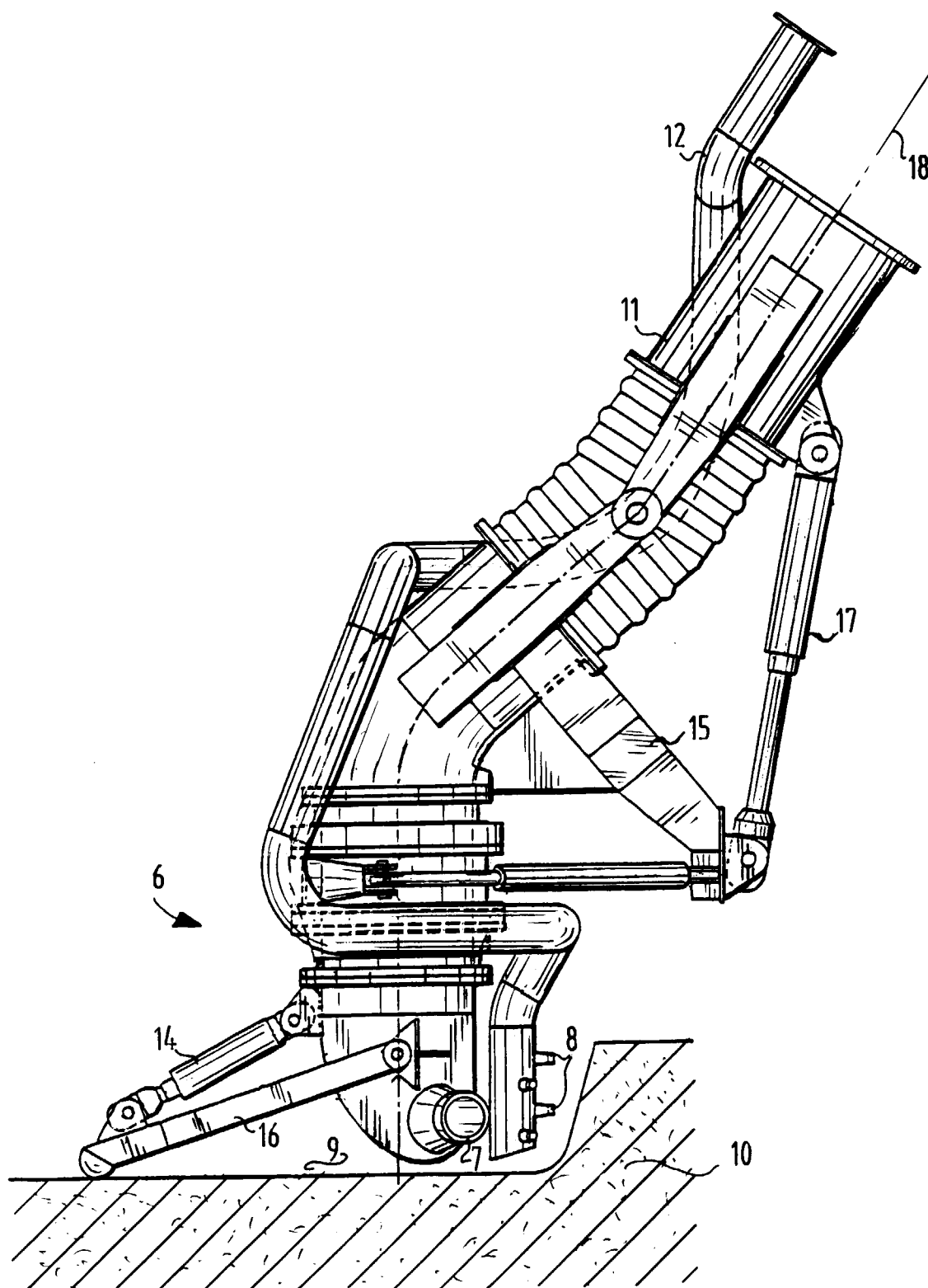
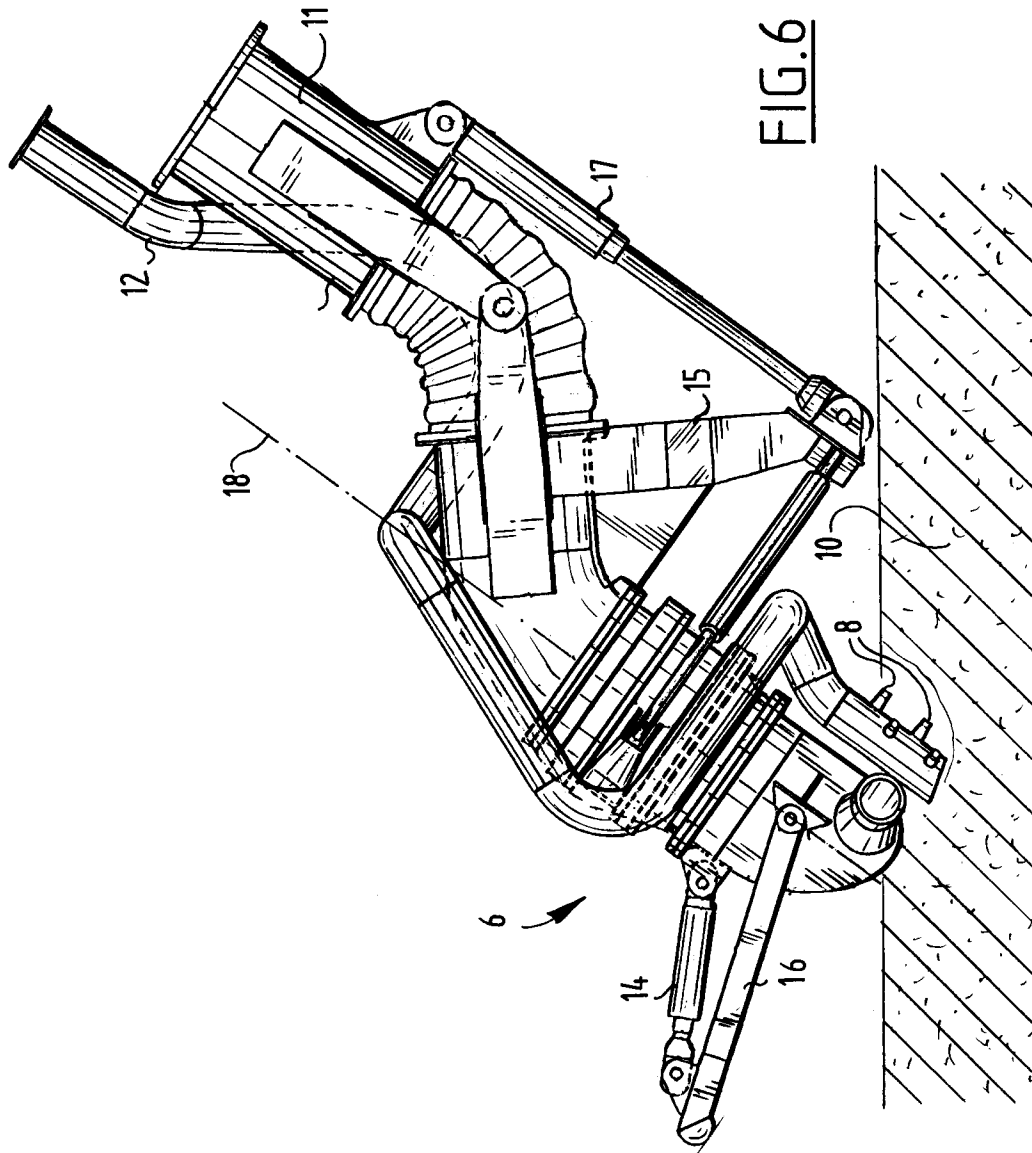


FIG.5





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EUROPEAN SEARCH REPORT

Application Number
EP 98 20 0227

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
Y	DE 29 195 C (STONE) 8 April 1884 * the whole document *	1-10,12	E02F5/28
Y	EP 0 243 994 A (VAN WEEZENBEEK) 4 November 1987 * column 4, line 25-42; figures 1-5 *	1-10,12	
A	US 1 698 515 A (ROBERT THOMSON STEWART) 8 January 1929 * page 2, line 11-19; figure 2 *	1,2,7,8,10	
A	EP 0 548 707 A (ANTON MÜSING) 30 June 1993 * abstract; claims 7,24; figures 1-3 *	1,2,7,8,10	
A	GB 2 038 902 A (VNII GIDROTEKH MELIORAT) 30 July 1980 * page 2, line 26-28; figures 3,6 *	6,11	
The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
			E02F
Place of search		Date of completion of the search	Examiner
THE HAGUE		12 May 1998	Matzdorf, U
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