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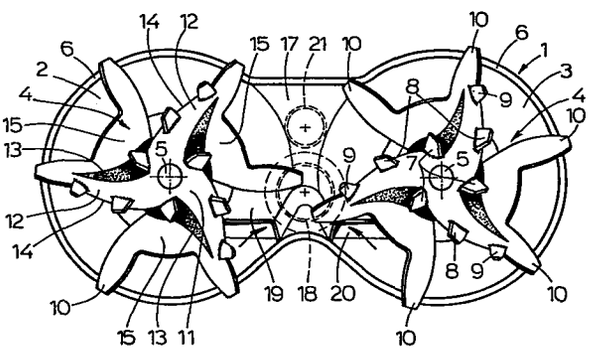
(54) An apparatus for disintegrating and removing earth, in particular under water.

(57) An apparatus comprising a housing – in which at least one compartment is formed – that can be connected to the suction side of a pump, which compartment is open on the underside and accommadates a rotor which is equipped with a member of downwardly projecting knives (10) which have different angular positions and which are arranged in groups that are approximately equidistant from the rotary shaft (5).



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AN APPARATUS FOR DISINTEGRATING AND REMOVING EARTH, IN PARTICULAR UNDER WATER

The invention relates to an apparatus for disintegrating and removing earth, in particular under water, comprising a housing, in which at least one compartment is formed, that can be connected to the suction side of a pump, which compartment is open on the underside, and accommodates a rotor which comprises disintegrating means, the rotary shaft of said rotor being supported in the housing and being coupled to a drive means which is mounted on the housing, said rotary shaft being at least substantially perpendicular to the plane through the lower edge of the compartment, while the rotor protrudes beyond this plane.

It is an object of the invention to provide an apparatus of this kind which is particularly suitable for processing hard and/or cohesive layers of earth and which has a high discharging capacity.

To this end, the apparatus according to the invention is characterized in that the rotor is equipped with a number of downwardly projecting knives which have different angular positions and which are arranged in groups that are approximately equidistant from the rotary shaft.

The knives are capable of exercising a very powerful cutting action upon the earth layer to be removed, so that the earth is disintegrated and discharged. A satis-

factory distribution of the forces which act upon the rotor is attained as a result of the particular arrangement of the knives in the groups. As a result, this rotor, despite the great magnitude of the forces which develop, nevertheless has a long service life. Furthermore, its operation is marked by the absence of vibrations.

A preferred embodiment of the apparatus according to the invention is characterized in that the rotor is provided with a central plate member lying in a plane extending at right angles to the rotary shaft, said central plate member comprising a plurality of blades each having a concave and a convex side edge, said convex side edge being the leading edge, when viewed in the direction of rotation of the rotor.

Each of the blades may carry a number of said knives, while said blades connect to obliquely arranged vanes that are positioned farther outwardly, near the wall of the housing, which vanes extend inside the compartments to the vicinity of the upper wall of the housing and terminate in the outermost knives.

A favourable position is thus obtained for the knives, while the blades and the vanes further the removal of the loosened earth.

The housing may comprise two compartments that are arranged side by side, while the rotors that are housed in these compartments are driven in opposite directions, a suction chamber being provided between the compartments which is connected to the two compartments as well as to the suction side of the pump.

This suction chamber may connect to a pipe which debouches below the water level, a valve being inserted in the pipe which is normally closed but which opens when the vacuum in the suction chamber becomes too high.

The compartments may have a substantially conical shape and increase in diameter towards the open side, a suction channel being formed in each compartment near the suction chamber, said suction channel being defined on one

side by the wall of the housing and opening at one end into the relative compartment, while the opposite end of the suction channel is in open communication with the suction chamber.

The ratio of the developed length of the lower edge of the housing to the amount of earth-and-water mixture to be removed by suction of the pump may be selected in such a way that the rate of passage of the earth-and-water mixture is so low as to prevent any air pocket from being attracted. It thus becomes possible to perform suction operations under shallow water as well.

The invention will be explained hereinafter with reference to the drawings, which illustrate an embodiment of the apparatus according to the invention by way of example.

Fig. 1 is a lateral view, partly in section, of an apparatus according to the invention, in which the rotors are shown with dash-and-dotted lines.

Fig. 2 is a bottom view of the apparatus according to fig. 1.

The drawing illustrates an embodiment of an apparatus for loosening, crushing and removing earth layers, in particular under water.

This apparatus comprises a housing 1, inside which two compartments 2,3 are formed side by side. These compartments 2,3 have a substantially conical shape and increase in diameter towards the underside.

Each compartment 2,3 is open on the underside and accommodates a rotor 4. The rotary shaft 5 of this rotor 4 is supported in the housing 1 and is coupled to a driving means (not shown) that is mounted on the housing 1. Each rotary shaft 5 is substantially perpendicular to the plane through the lower edge 6 of the compartment 2,3.

Each of the two rotors 4 is integrally formed from sheet metal and is equipped with a plurality of downwardly projecting knives 7,8,9,10 which have different angular positions and which are arranged in groups that

are substantially equidistant from the rotary shaft 5. The knives 10 protrude beyond the plane through the lower edge 6 of their compartment 2,3.

Each rotor 4 is provided with a central plate member 11 lying in a plane extending at right angles to the rotary shaft 5 and comprising three blades 12. Each blade 12 has a concave side edge 13 and a convex side edge 14. This convex side edge 14 is the leading edge, when viewed in the direction of rotation of the rotor 4. These blades 12 carry the knives 7, 8, 9.

The blades 12 connect to obliquely arranged vanes 15 that are integral with the central plate 11 and that are positioned farther outwardly near the wall of the housing. These vanes 15 extend to the vicinity of the upper wall 16 of the housing 1 and terminate in the outermost knives 10.

The vanes 15 lie at least in part on a conical surface which is substantially parallel to the conical wall of their compartment 2 or 3.

A suction chamber 17, located between the compartments 2,3, is connected to each of the two compartments 2,3. This suction chamber 17 further connects to a stub 18 which is connected to the upper wall 16 of the housing 1. This stub 18 is connected by a suction pipe (not shown) to the suction side of a pump.

A suction channel 19 is formed in each compartment 2, 3 near the suction chamber 17. The suction opening 20 of this suction channel is located in the compartment 2,3 and the opposite end of this suction channel is in open communication with the suction chamber 17. The suction channels 19 are defined on one side by the wall of their compartment 2,3.

The suction chamber 17 is likewise connected to a pipe 21 which debouches below the water level. A valve 22 is inserted in this pipe, which valve is normally closed but opens when the pressure in the suction chamber 17 falls below a given value.

The apparatus may be suspended by its suction pipe from the ladder of a boat on which the pump is supported,

or from the jib of a hydraulic crane. This crane may be supported on a crane boat or on a tractor, depending on the depth of the water and on the circumstances in which the work is to be carried out.

When the apparatus is in operation, the two rotors 4 are driven in opposite directions in their compartments 2,3, in such a way that the convex side edge 14 of the blades 12 is the leading edge. The knives 7,8,9,10 powerfully attack the underlying earth layer which is to be removed. The disposition and arrangement of these knives 7-10 make them particularly suitable for applying an efficient cutting action to this earth layer, even if this layer is hard and/or cohesive.

The earth is loosened by the knives 7-10 which are twisted relatively to each other and which are arranged in groups that are equidistant from the rotary shaft 5, whereupon this earth enters into the compartments 2,3 and is supplied under the action of the particular shape of the blades 12 to the suction channels 19. Hereupon, the earth is discharged through the suction chamber 17, the stub 18, the suction pipe and the pump. If the pressure in the compartments 2, 3 becomes too low, the valve 22 opens, thus allowing water to flow through the pipe 21 into the suction chamber 17 and through the suction channels 19 into the compartments 2,3. This prevents the possibility of the apparatus becoming drawn too far into the earth under the action of suction, which would make it impossible to control the apparatus.

As fig. 2 indicates, the lower edge 6 of the housing 1 is bent inwardly between the compartments 2, 3 on one side. This furthers a uniform forward motion of the housing 1 along the earth layer, without being impeded by any subsisting earth ridge.

The ratio of the developed length of the lower edge 6 of the housing 1 to the amount of earth-and-water mixture to be removed by suction of the pump is established in such a way that the rate of passage of the earth-and-water mixture is so low as to prevent any air pocket from being

attracted. This also allows suction operations to be performed under shallow water.

The invention is not restricted to the embodiment shown in the drawing by way of example, which may be modified in various manners within the scope of the appended claims.

Claims:

1. An apparatus for disintegrating and removing earth, in particular under water, comprising a housing, in which at least one compartment is formed, that can be connected to the suction side of a pump, which compartment is open on the underside, and accommodates a rotor which comprises disintegrating means, the rotary shaft of said rotor being supported in the housing and being coupled to a drive means which is mounted on the housing, said rotary shaft being at least substantially perpendicular to the plane through the lower edge of the compartment, while the rotor protrudes beyond this plane, characterized in that the rotor is equipped with a member of downwardly projecting knives which have different angular positions and which are arranged in groups that are approximately equidistant from the rotary shaft.

2. An apparatus according to claim 1, characterized in that the rotor is provided with a central plate number lying in a plane extending at right angles to the rotary shaft, said central plate member comprising a plurality of blades each having a concave and a convex side edge, said convex side edge being the leading edge, when viewed in the direction of rotation of the rotor.

3. An apparatus according to claim 2, characterized in that the blades each carry a number of said knives, while said blades connect to obliquely arranged vanes that are positioned farther outwardly, near the wall of the housing, which vanes extend inside the compartments

to the vicinity of the upper wall of the housing and terminate in the outermost knives.

4. An apparatus according to claim 1, 2 or 3, characterized in that the housing comprises two compartments that are arranged side by side, while the rotors that are housed in these compartments are driven in opposite directions, a suction chamber being provided between the compartments which is connected to the two compartments as well as to the suction side of the pump.

5. An apparatus according to claim 4, characterized in that the suction chamber connects to a pipe which debouches below the water level, a valve being inserted in the pipe which is normally closed but which opens when the vacuum in the suction chamber becomes too high.

6. An apparatus according to claim 4 or 5, characterized in that the compartments have a substantially conical shape and increase in diameter towards the open side, a suction channel being formed in each compartment near the suction chamber, said suction channel being defined on one side by the wall of the housing and opening at one end into the relative compartment, while the opposite end of the suction channel is in open communication with the suction chamber.

7. An apparatus according to any one of claims 4 through 6, characterized in that the lower edge of the housing is bent inwardly between the compartments on at least one side.

8. An apparatus according to any one of the preceding claims, characterized in that the ratio of the developed length of the lower edge of the housing to the amount of earth-and-water mixture to be removed by suction of the pump is selected in such a way that the rate of passage of the earth-and-water mixture is so low as to prevent any air pocket from being attracted.

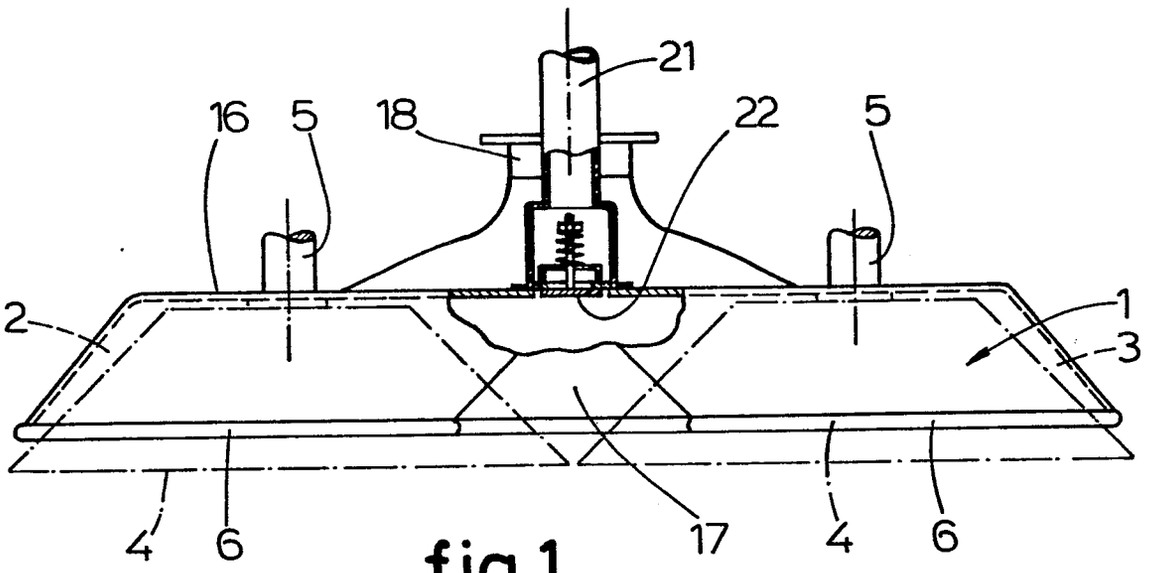
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fig.1

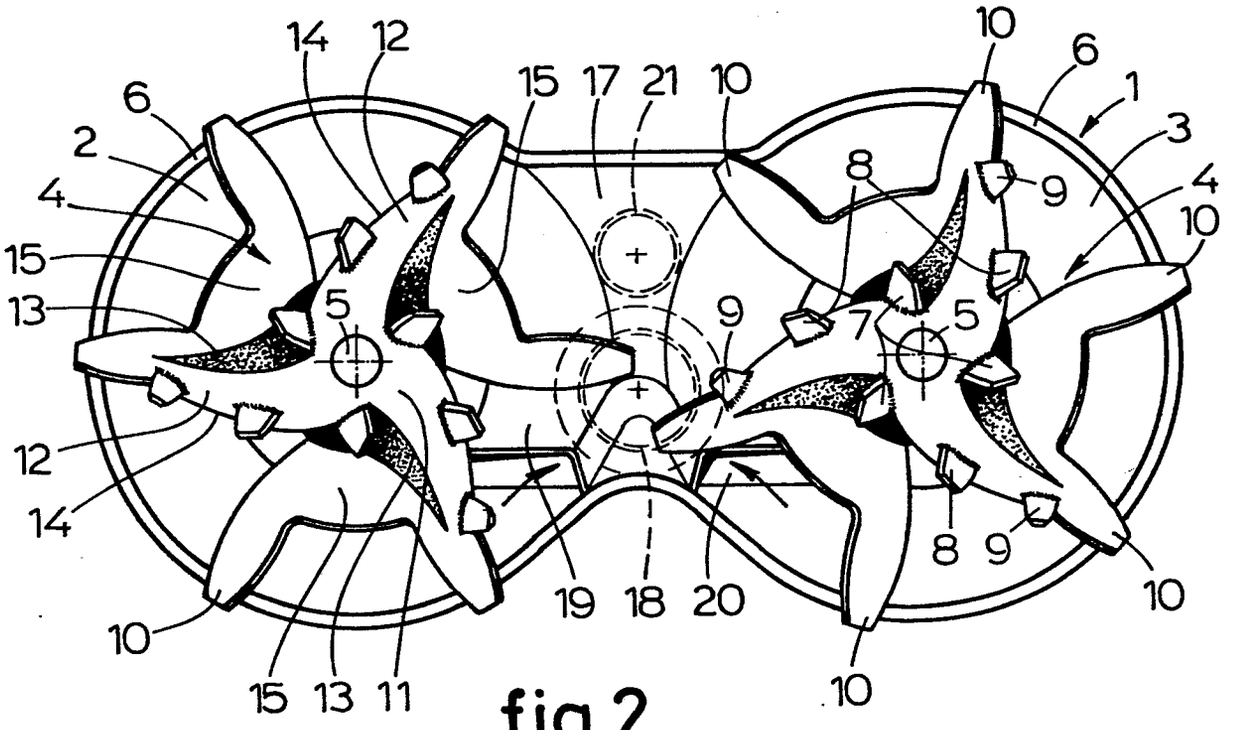
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fig.2

European Patent Office

EUROPEAN SEARCH REPORT

Application number
0012458
EP 79 20 0674

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim
X	FR - A - 2 355 961 (KONIJN) * Page 2, line 22 - page 4, line 11; page 5, lines 31-32; page 6, line 31 - page 7, line 21 *	1,3-8
X	US - A - 3 148 464 (JONES) * Column 2, line 31 - column 3, line 9; figures 1,2 *	1-3
	DE - A - 1 484 659 (DE CLOEDT) * Page 4, last paragraph - page 5 *	1,3,4
	DE - B - 1 063 985 (RIEDEMANN) * Column 1, line 35 - column 2, line 20 *	1,3
	US - A - 4 052 801 (SMITH) * Column 3, line 58 - column 4, line 36 *	1,2,4
	GB - A - 1 430 182 (TOSHINOBU) * Page 1, line 97 - page 3, line 8 *	1-3
	FR - A - 2 031 435 (MOLLER) * Page 2, line 18 - page 2, line 2 *	2,4,5

CLASSIFICATION OF THE APPLICATION (Int. Cl. 3)

E 02 F 3/92

TECHNICAL FIELDS SEARCHED (Int.Cl. 3)

E 02 F

CATEGORY OF CITED DOCUMENTS

X: particularly relevant
A: technological background
O: non-written disclosure
P: intermediate document
T: theory or principle underlying the invention
E: conflicting application
D: document cited in the application
L: citation for other reasons

&: member of the same patent family, corresponding document

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	13-02-1980	PAUCNIK

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