

Dredger

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The invention relates to a dredger comprising a floating means, for instance a hull on pontoons or the like, a transport member including an at least substantially open front portion for the reception of material dredged from below the water, and means for the transfer of dredged material from the dredged area into the transport member.

Dredger devices of the type referred to above, as well as of several other types, are previously known. Finnish Patent Specification 31377, for instance, describes a floating dredger which is provided with an inclined loading ramp lowerable to the bottom to be dredged and along which the dredged material is lifted by means of a drag bucket. It is common to provide a vessel, either a normal ship or one constructionally resembling a barge, with some form of conveyor means for lifting the dredged mass as disclosed in Patent Specifications DE 664 623, FR 2 434 240 and US 4,394,841. The barge can be provided with a separate conveyor device for the unloading of the dredged material as shown in German Patent Specification 664 623. A common excavator for the conveyance of the dredged material can also be positioned on such a barge. A known method of stabilizing such a vessel includes adjustable pontoons supported at the bottom (see US Patent 3,064,370). Another alternative is to provide a large excavator with pontoons, as disclosed in German Published Patent Application 2411115.

These prior art dredgers usually have two disadvantages. On the one hand, it is not normally possible to operate the dredger as an entirely independent unit, that is, to carry out both the sediment lifting and the sediment unloading using the same means. The other disadvantage is the rather expensive construction of such prior art devices, especially if one tries to eliminate

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said earlier mentioned defect by combining the loading and unloading functions.

5 The present invention seeks to remove these defects and to provide a dredger which is relatively inexpensive and uncomplicated in its construction, which can carry out the task of dredging, the task of transporting the dredged material and the task of discharging the dredged material. In this context, the facility for independent operation includes the possibility of co-operating with
10 a separate floating transport vessel for subsequent transportation of the dredged material to a remote destination. Additional aims are to construct a dredger which generates as little water disturbance as possible, as little stirring-up of the bottom deposit, by mixing the bottom
15 deposit with the water, as possible, and to construct a dredger which is operated easily in varying water depths and which can undertake embankment build-up work, if necessary.

20 What constitutes a dredger according to this invention is defined in the following claim 1.

The loading and unloading of the transport member become uncomplicated by means of the provision of a member which can be lowered and raised relative to the water level. The conveying or transfer of the dredged material
25 is realized in an uncomplicated and inexpensive manner in comparison, for instance, to an endless bucket conveyor, a screw conveyor or a suction pump.

By effecting a series of charge and return motions of the material transfer means, the loading member will
30 push the material through the opening at the front of the transport member and move the material towards the rear end of the transport member. The same type of pushing operation, in reverse order, can be used to expel the dredged material out of the transport member without

any need to lower the front end during such an unloading stage.

The loading member is desirably a digger plate located at the distal ends of two extendible arms, for example telescopic arms or arms movable relative to a guide member. The arms may be movably attached to a hull of the dredger and can be powered in any convenient way. A favourable construction of an arm-digger plate means has each arm turnably mounted via a bushing through which each arm can slide.

In a convenient embodiment, the transport member is supported on a horizontal transverse shaft located at a position towards the rear of the member relative to the central point of the member. The member, being tiltable or turnable relative to this shaft, allows its front portion to extend towards the bottom to be dredged. The loading member can then be driven into the material to be dredged in front of the transport member, and the loading member used to draw the material into the transport member. The pulling action of the loading member tends to drive the fore end of the transport member into the mass of under-water sediment, and as will be understood from the balancing effect of such a force and its reaction, no auxiliary forces are necessary for holding the dredger in position.

The transport member, having an opening at its front portion, will allow a digger plate to operate as a front closing member when the digger plate is retracted into the correct position within the transport member. The dredger suitably includes two longitudinal pontoons, between which the transport member, in the form of an open-topped basin, can be located. A stable dredging operation is often more easily carried out when the pontoons extend beyond the basin. According to one embodiment of dredger, the transport basin is further provided

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with longitudinal guides connected to a hull of the dredger. In this way the basin is movable in the longitudinal direction relative to the hull, which is very useful especially when carrying out embankment building tasks. If necessary, the dredger can also be provided with transverse members drivable into the sea bed by means of which any reverse motion of the dredger during unloading of the basin is prevented. Where the water depth is sufficient for material discharge to occur onto the bottom, a precisely located discharge is possible by simply lowering the front portion of the transport member and by holding the dredger stationary using these transverse members.

The capacity of the transport member of the dredger is conveniently at least 50 cubic metres and preferably between 100 and 1500 m³. The maximum vertical motion of the front portion of the transport member during a tilt action is suitably at least 4 m, and preferably between 6 and 25 m. In shallow waters, the required vertical motion can be considerably less than the maximum value.

One embodiment of dredger in accordance with the invention and its advantages will now be described, by way of example, with reference to the accompanying drawings, in which:-

Figure 1 is a schematic sectional side elevation of a dredger according to the invention during a loading phase thereof,

Figure 2 shows a sectional front view of the dredger of Figure 1 on a slightly enlarged scale,

Figure 3 shows a section of the dredger of Figure 1 showing it in a transport position,

Figure 4 discloses, in section, the dredger in the transport position, at a beginning of an unloading phase,

Figure 5 shows, also in section, discharge of dredged material onto the bottom in deep water, and

Figure 6 discloses, in side view, a dredger carrying out an embankment task.

Figures 1 and 2 of the drawings show two longitudinal hollow pontoons 1 which serve as the load-bearing, floating portions of a dredger. The pontoons 1 are connected in parallel spaced apart arrangement to a hull 5 of the dredger by means not shown. The pontoons can be made, for example, of metal or of glass-fibre reinforced plastics.

Between the pontoons 1 is located a transport member 2 which is a channel-shaped member of generally rectangular cross-section, is open at its front end 2a and is turnably journaled to the hull 5, via a shaft 7, at its rear end 2b. Also journaled to the hull 5 are two telescopic arms 3, at the distal end of which a loading member in the form of a digger plate 4 is attached. Each arm 3 is journaled via a shaft 16 attached to a bushing 17 through which the arm 3 can move in its axial direction. The dredger is preferably provided with its own prime mover for generating power to operate the moving members of the dredger and for driving a propeller 18. A control cabin 9, from which the dredger tasks can be controlled is also provided. The arrows 11a-c indicate the motions of the digger plate 4 during a material loading phase.

The transport member 2 can be raised and lowered relative to the hull 5, by hoist members 21-24, which

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are only shown schematically and are indicated by the general reference numeral 6. Hydraulic cylinders, for instance, can be used as hoist members in rather small dredgers, whereas wire cables 21 or chains wound by winches 22, 23 are more appropriate in larger appliances. The dredger includes a deck construction 25. The hoist cable 21 is shown attached to the member 2 at a location 24.

The front portion 2a of the transport member 2 can be lowered down to the sea bottom 20 during a loading phase of a dredging operation and material 10 is moved into the channel-shaped member or basin 2 via the open front end 2a by means of the telescopic arms 3 and the digger plate 4. As will be clear from Figure 1, no auxiliary devices are needed to keep the dredger in place against the bank of material being dredged. The digger plate 4 and the dredged material moving relative to the basin 2, generate an opposite reaction force by which the member 2 is either stationary or is being drawn into the bank in a direction opposite to the motion of the digger plate 4. Figure 2 shows the digger plate 4 in its position during a transport phase of the dredger. The plate 4 is lifted above the basin 2. During unloading of the basin 2, the arms 3 can be retracted while the plate 4 is held above the dredged material 10, prior to starting a reverse movement of the plate 4 to expel the material through the open front end 2a.

The transport member is filled by one or more charges or pulls using the transfer means 3, 4 and, once filled, it is hoisted up by the hoist members 6 into a position shown in Figure 3. The digger plate 4 is suitably dimensioned so that it forms a closure member for the front portion 2a of the member 2.

Unloading of dredged material from the member 2

can be carried out by pushing the material from the member 2 using the digger plate 4, as shown in Figure 4. The movable supports of the arms 3 at the bushings 17 are such that each arm 3 can be moved longitudinally relative to its bushing 17. The telescopic arms 3 can be replaced by rigid arms, which can be moved by wires, chains, racks and pinions or the like relative to their bushing 17 or a guide allowing the required reach adjustment of the arms 3. Reference numerals 12a-c in Figure 4 indicate the motions of the plate 4 and the arms 3 during such discharge and arrow 13 indicates the discharge direction of the unloaded material. An alternative discharge method involves lowering the front portion 2a of the member 2 by tilting the member 2 down, as shown in Figure 5, the dredged material deposited on the bottom 20 being designated by the numeral 20. It will also be apparent that the member 2 could include an openable discharge bottom such as is used in a hopper barge. Finally, it should be noted that if, in certain circumstances, it is not desired to employ either of the discharge methods illustrated in Figures 4 and 5, it is possible to remove the dredged material from the member 2 using a separate external device.

Having regard to minimising energy consumption, it might be desirable to locate the turning shaft 7 of the member 2 closer to the central point of the member, especially if the dredger has a high dredging capacity, such as a capacity of between 500 and 1500 m³. That portion of the member 2 between the shaft 7 and the rear end 2b then operates as a counter-weight, which reduces the power required for the up-lifting of the filled member 2. It is clear that the entire transport member can be made lowerable and raisable within the scope of the invention, although a rotatable journalled turning appears to be more appropriate in practice.

In addition to the fact that the transport member 2 can be lowered and raised, it can also be moved in its longitudinal direction relative to the hull 5, for

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instance by being supported on guides 26 located on the inner sides of the hull 5 or both the pontoons 1. This arrangement is shown most clearly in Figure 6, although guides 26 are also sketched in outline in Figures 1, 2 and 5. The motion of the shaft 7 is indicated by the numeral 14 in Figure 6. An arrangement of this kind is especially useful when dredged material is required for building an embankment, because the transport member 2 can be pushed forward over the shore line and, thus, the dredged material can be deposited on land. It is useful, especially for such work, to provide the dredger with, for instance, hydraulically operated transverse members 8 which can be moved in directions of the arrows 15 and thus driven into the sea or river bottom and thereby prevent a reverse motion of the dredger during the unloading or discharge of the transport member. Reference numerals 13 and 19 in Figure 6 again refer to the discharge direction and the material unloaded and collected on the embankment.

Figure 1 shows a loading phase in which the open front portion 2a is lowered to less than the maximum distance available, which is at least 4 m, and preferably between 6 and 25 m. These distance values relate to the actual location of the turning axis or shaft 7, relative to which the tilting takes place. Figure 5 shows a discharge phase in which the front portion 2a is lowered less than the maximum amount.

The invention is not limited to embodiments illustrated and several modifications thereof are clearly feasible within the scope of the following claims. Instead of the anchoring members 8 shown in Figure 6, the member 2 can be provided with attachment means such as spikes or hook members. Spikes are useful to anchor the front end of the member 2 to an embankment. Hooks can be used if the dredged material is to be unloaded into a transport



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vessel, which is considerably larger than the dredger. This is a useful arrangement if, for example, a small dredger (say one of a capacity of at least 50 m³ and up to about 500 m³) operates in an area far from the
5 final destination of the dredged material. Since the transport vessel is likely to have a freeboard which is higher above the waterline than that of the dredger (at least when empty), the member 2 should be able to be upwardly inclined and has to be securely anchored
10 to the transport vessel.



CLAIMS

1. A dredger comprising a floating means, a transport member for the reception of dredged material, said transport member including an opening in the front portion, and means for the transfer of material from a dredged area into the transport member, wherein the transport member is movable by hoisting means so that at least said front portion of the member is lowerable for the reception of dredged material through the opening and raisable to a transport position or to a position above said transport position, and wherein the transfer means comprises a loading member and power means to move the loading member.

2. A dredger according to claim 1, in which means is provided to cause the material transfer means to carry out repeated loading and return motions during a filling stage of the transport member, each loading motion being carried out from a location in front of the transport member towards the rear end of said member.

3. A dredger according to claim 1 or 2, in which said loading member is adapted to discharge dredged material by pushing the same out of the opening in the front portion of the transport member during an unloading phase of the dredger.

4. A dredger according to any preceding claim, in which the loading member is located at the distal end of extendible arms movably attached to the floating means, said arms extending in the longitudinal direction of the transport member above the latter.

5. A dredger according to claim 4, in which each of said arms is turnably journaled to a hull of the floating means through a turnably mounted bushing.

6. A dredger according to claim 5, in which each



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arm is movably supported at its bushing in order to allow movement of the arm in its longitudinal direction through the bushing.

7. A dredger according to any one of the preceding
5 claims, in which the transport member is turnably jour-
nalled to a hull of the floating means about a trans-
versely directed axis located at a position between a
central portion of the longitudinal extension of the
transport member and the rear of the hull.

10 8. A dredger according to any one of the preceding
claims, in which the transport member is adjustably mov-
able in its longitudinal direction relative to the float-
ing means.

9. A dredger according to any of the preceding
15 claims, in which anchoring means is located at a front
portion of the dredger, which means prevents a longitud-
inal movement of the dredger.

10. A dredger according to any one of the preceding
claims, in which said transport member is located between
20 two hollow pontoons which extend horizontally beyond
the dimensions of the transport member.

11. A dredger according to any one of the preceding
claims, in which the loading member is a plate movable
within the transport member towards and away from a closed
25 rear end of the transport member.

12. A dredger according to any one of the preceding
claims, in which said loading member is capable of at
least substantially closing the opening in the front
portion of the transport member.

30 13. A dredger according to any one of the preceding



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claims, in which the transport member is an open-topped channel-shaped member of generally rectangular cross-section.

14. A dredger according to any one of the preceding
5 claims, in which the capacity of the transport member is at least 50 cubic metres, and the maximum vertical motion of the front portion thereof, relative to the turning axis of the transport member is at least 4 metres.

15. A dredger according to claim 14, in which the
10 capacity is between 100 and 1500 cubic metres and the maximum vertical motion of the front portion thereof is between 6 and 25 metres.

16. A dredger according to any one of claims 8
15 to 15, in which the transport member is movable in its longitudinal direction and the front portion thereof is upwardly tiltable so that said transport member can be anchored to a floatable unit for transfer of dredged material from the dredger to said floatable unit.

17. A dredger substantially as hereinbefore des-
20 cribed with reference to, and as illustrated in, the accompanying drawings.
