

PATENT SPECIFICATION

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(54) A DREDGING HEAD

(71) We, NATIONAL CAR RENTAL SYSTEM, INC., a Corporation organised and existing under the laws of the State of Nevada, United States of America, of 5501 Green Valley Drive, Minneapolis, Minnesota 55437, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The invention relates to an improved dredging head for use on a movable dredging apparatus utilized in removing material such as mud, silt, weeds, bog and the like from bodies of water such as lakes, marshes, and rivers.

Dredging equipment which perform this function is sold and in use. At the present time, such equipment may take a variety of forms. The dredging head of the present invention embodies improvements in the type of dredging head which is shown in British Patent Specification No. 1,367,695, and may be associated with a complete dredging apparatus such as is shown in U.S. Patent Specification No. 3,521,387.

The present invention is directed to improvements in the cutting means and suction pump of the dredging head which significantly increase the capabilities of the dredging head to cut heavy material and fibrous material, such as boggy material, on the bottom of rivers and lakes, to effectively sever the cut material into small portions and to direct the same together with water to a suction pump.

According to this invention, there is provided a dredging head adapted to be carried by a boom on one end of a movable pumping dredge to loosen and remove material from the bottom of a body of water, said dredging head including an elongated frame attached to the boom and extending transversely to the boom, a suction intake conduit attached to the elongated frame and adapted to transmit material into the dredge from the dredging head, a shaft positioned

on the frame and having a drive motor mounted on one end of the shaft for rotating the same, a pair of screw type augers, having oppositely pitched flighting mounted on and spaced apart on the shaft for directing material towards the centre of the shaft and towards the spacing between the augers positioned adjacent the intake conduit on the frame, wherein said dredging head comprises a plurality of cutting blades distributed circumferentially on the auger flighting in longitudinally spaced relationship, each blade being connected to the peripheral edge of adjacent flighting so as to position the blades generally normal to the extent of the flighting, a blade mounting plate positioned on the frame adjacent the peripheral edge of each auger and extending parallel to the shaft, removable cutting blades positioned on the edge of the plate and distributed along the extent of the plate for co-operation with the cutting blades on the augers to sever material therebetween, and an adjustable elongated panel pivotally mounted on the frame and above the blade mounting plate, the panel being generally concave towards the augers and overlying the extent of the flighting on the augers so as to cause flow of water and material around the augers and to the suction intake and projecting fender members being provided on said panel to prevent entrance of large objects into the augers.

A preferred embodiment of the present invention will now be described by way of example with reference to the accompanying drawings, in which:—

Figure 1 is a side elevation view of a dredging apparatus having a dredging head constructed according to this preferred embodiment of the invention, showing the dredging head moving along the bottom of a body of water to clear the same;

Figure 2 is a front elevation view of the dredging head and lower boom of Figure 1;

Figure 3 is a sectional view of the dredging head of Figure 2 taken along the lines 3—3 therein;

Figure 4 is a sectional view of a portion of the cutting blade taken along the lines 4—4 of Figure 3; and,

Figure 5 is a plan view of the dredging apparatus with parts of the dredging head broken away to show the location of the pump and motors for the same.

In Figures 1 and 5, the dredging apparatus is shown generally at 10 and has a hull incorporating float members 12 on either side of a central hull portion 15 which houses a drive motor 20 for an hydraulic pumping system, indicated at 25, and a control console 30 and cab 32. The cab and console provides a station for the operator with the controls for operating the various motors of the dredging apparatus, as will be hereinafter defined. The motor 20 through its hydraulic system operates a hydraulic capstan 40 about which is wound cabling 42 leading through guides on the float members 12 to remote anchoring points on either side of the body of water for moving the dredging apparatus within the body of water. Flange members 50 positioned on the forward end of the hull pivotally mount a pair of boom arms 55 positioned between the float members 12 and extending beyond the forward ends of the same. The boom arms 55 are pivotally mounted on a shaft 60 which in turn is journaled in flange members 50 to permit pivoting of the boom arms relatively to the hull of the dredging apparatus. Mounted on the free ends of the boom arms 55 is a dredging head 90, the level of which is adjustable relatively to the hull between a transport position and any one of several positions for dredging at corresponding different depths by raising and lowering the boom arms by means of a pair of hydraulic actuators 72. Each of these hydraulic actuators 72 is connected between a corresponding anchorage (not shown) on the hull and a corresponding one of two lever arms 65, each of which is associated with a respective one of the boom arms 55 and is fixed for pivotal movement therewith about the axis of the shaft 60. Adjustable linkages 70, 71 are provided for disengageably securing the boom arms 55 and dredging head 90 in the transport position or any selected dredging position. Each of these linkages comprises a support arm 70 pivotally mounted at its lower end on the hull and formed with apertures at spaced apart intervals between its upper and lower ends and a further lever arm 71 fixed for pivotal movement, together with a corresponding one of the two boom arms 55, about the axis of the shaft 60 and having an aperture in its free end. In order to secure these linkages in any given position of adjustment, locking pins are inserted through the holes in the free ends of the further lever arms 71 and through those holes in the

support arms 70 which have been brought into alignment with the holes in said further lever arms.

A suction pipe 95 extends rearwardly from the dredging head through the dredging apparatus to flexible conduits (not shown) associated with floatation equipment or with barges by means of which the dredged material may be removed from the body of water in which the dredge is working.

As shown in Figures 2 and 3, the dredging head comprises a transversely extending frame 100 which is rigidly secured to the boom arms 55 through cross bracing 102 (Figures 1 and 5). The frame 100 includes downwardly extending side plates 104 positioned on each end of the frame which plates include bearings to journal a head shaft 110. The shaft is driven by a motor 120 mounted at one end of the shaft 110 and on one of the side plates 104. The motor 120 is of an hydraulic type and is reversible or bi-directional. Positioned on the shaft 110 are a pair of spaced augers 125, 130, which are oppositely pitched so that the flighting directs material toward the centre of the shaft between the augers where a frame member 135 positioned on the frame 100 carries a central bearing 140 journaled to the centre of the shaft 110. The auger sections extend from each of the side plates 104 to a position short of the central bearing 140 and cutting knives 144 are positioned on the shaft at this point to cooperate with the frame member 135 as a cutting surface. The entire dredging head has a width substantially the same as the combined width of the float members 12 and the central hull portion 15, and the augers 125, 130 have mounted on them a plurality of cutting plates 145 which are connected on the peripheral edge of the auger flighting and are curved to conform to the circumference of the same. The individual plates 145 are spaced in a helical manner along the extent of each of the augers, each plate being positioned adjacent similar plates on either side of the same to provide a helical disposition of the plates 145 which extend around the circumference of the augers 125, 130, and are spaced along the extent of the same similarly to the positioning of the flighting of the augers. The plates 145, which may be secured to the peripheral edge of the flighting by welding are generally rectangular in form and are positioned normal to the flighting surface with the radius of the curvature concentric with the auger flighting and with the shaft upon which the augers are mounted. Each cutting plate 145 has a pair of teeth 146 thereon which project from the body of the plate in the direction of rotation of the shaft to define a toothed cutting edge. The teeth 146 have bevelled cutting edges 148, as have

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also the bases of the gaps between the teeth, so as to provide cutting edges extending across the entire leading edge of each of the cutting plates. Each of the augers 125, 130 has similarly located cutting plates 145 along the extent of the same so that, as the auger is rotated, two teeth 146, one on one of the cutting plates on the auger 125 and the other on one of the cutting plates 145 on the auger 130 will simultaneously engage a cooperating blade 165 carried by a respective cutting blade holder 162 which is mounted on the frame 100 of the dredging head.

As shown in Figures 3 and 4, each of the holders 162 is "U"-shaped in form and is secured to the frame 100 by bolts 164 extending through plates 160 disposed along the entire extent of the frame 100, so as to provide a continuous holder adjacent each auger. Each of these holders has the respective blade 165 welded at the ends of the same. The holders 162 are slotted at 161 to adjust the spacing between the blades 165 and the cutting plates 145. The blades 165 carried by the holders 162 have teeth similar to those of the cutting plates 145, which teeth and the bases of the gaps between them have bevelled edges as in the case of the cutting plates. The blades 165 on each holder cooperate with the cutting plates 145 on the corresponding auger as the same is rotated, each individual tooth 146 on each cutting plate 145 having a shearing or scissors-type action with the corresponding teeth of the associated blade 165. Thus, each of the holders 162 has distributed along the extent of the same a continuous blade 165 with surfaces which cooperate with the cutting plates 145 on each of the augers adjacent the same as the auger is rotated. Any material in between will be severed and directed inwardly toward the shaft 110 of the auger to be moved with the auger rotation towards the centre of the shaft of the dredging head.

Positioned over the augers is a curved shield 170 which is pivoted along and above the frame 100 as indicated at 175, so that the shield, when lowered, overlies the augers. The shield has reinforcing plates 176 distributed along the extent of the same to reinforce its concave surface. At the outer edge of the shield is a plurality of projecting fender members 178 which prevent large objects from moving into the auger surfaces on the head. The shield 170 provides a vaned concave surface to direct water flow and material flow around the auger and confines the material to the cutting surfaces of the auger, thus permitting the material to be moved along the dredging head to the centre of the same. During rotation of the shaft and augers, water flow will be directed around the surface of the auger conforming to the concave surface of the shield to

improve water flow to the intake pipe 185 of the dredging head. The dredging pipe 185 of the dredging head has a flared extremity 190 overlying the central portion of the augers or the spacing between them, together with the frame member 135 of the shaft and the cutting knives 144 associated with the shaft at this point. The flared extremity 190 surrounds the rear side of the augers to ensure that all material directed to the centre of the auger will be directed into the intake pipe 185. Behind the intake pipe and mounted on the arms 55 of the boom is a suction pump 195, as seen in Figures 1 and 5, which is driven by a pair of motors 200 drivably connected to the ends of the drive shaft 201 of the pump. The motors 200 are of the hydraulic type and the pump 195 may be a centrifugal pump of the type which incorporates a double-sided rotary impeller 210 mounted on the shaft 201 and housed within a pump casing 215, the casing having inlet openings 218 for receiving water and materials which will be directed by centrifugal action around the extent of the casing to an outlet pipe 220. The casing 215 is mounted on the arms 55 of the boom and a shroud 230 encloses the same on the sides, top and bottom thereof, the sides flaring out to define the flared opening 190 at the intake end of the intake pipe 185 which partially surrounds the central portion of the auger. Mounted externally on the side walls of the shroud 230 are the motors 200.

The location of the pump and motors on the boom arms at the dredging head enables the distance from the intake pipe 185 of the suction head to the pump to be reduced, thereby increasing the suction at the flared opening of the dredging head and significantly increasing the flow of water and material through the pump for improved efficiency in the dredging operation. Hydraulic fluid lines extend from the body of the dredging apparatus to the motors which are operated from a common supply line and through multiple control valves. Similarly, an actuator 245 is coupled between the dredging head and the shield 170 for tilting the same relative to the augers on the dredging head. Thus, hydraulic fluid is supplied through control valves from the hydraulic reservoir 25 in the hull 15 of the dredging apparatus and through the control console 30 and valves therein to the actuator motor 120 for driving the auger shaft, to the actuators 72 for elevating the boom and hence, positioning the dredging head with respect to the dredging apparatus, for the actuator 245 tilting the shield with respect to the augers on the dredging head, and for operating the motors 200 driving the pump 195 of the dredging head.

The improved dredging head for the dredging apparatus provides for more

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uniform speed and increased power to the head and in operation of the pumps to vary the flow of material there-through. The improved cutting surfaces ensure more positive cutting of the fibrous material on the bottom of the body of water, such as bog, and entrapment of the same in the augers to advance the same into the suction pump for removal from the body of water. With the improved apparatus, a more efficient dredging operation may be effected.

The suction pump 195, instead of being driven by two motors 200 as described above and shown in Figure 5, may be driven by only one such hydraulic motor which is drivably connected to one end of the shaft 201 and is mounted externally on the corresponding side wall of the shroud 230.

WHAT WE CLAIM IS:—

1. A dredging head adapted to be carried by a boom on one end of a movable pumping dredge to loosen and remove material from the bottom of a body of water, said dredging head including an elongated frame attached to the boom and extending transversely to the boom, a suction intake conduit attached to the elongated frame and adapted to transmit material into the dredge from the dredging head, a shaft positioned on the frame and having a drive motor mounted on one end of the shaft for rotating the same, a pair of screw type augers, having oppositely pitched flighting mounted on and spaced apart on the shaft for directing material towards the centre of the shaft and towards the spacing between the augers positioned adjacent the intake conduit on the frame, wherein said dredging head comprises a plurality of cutting blades distributed circumferentially on the auger flighting in longitudinally spaced relationship, each blade being connected to the peripheral edge of adjacent flighting so as to position the blades generally normal to the extent of the flighting, a blade mounting plate positioned on the frame adjacent the peripheral edge of each auger and extending parallel to the shaft, removable cutting blades positioned on the edge of the plate and distributed along the extent of the plate for cooperation with the cutting blades on the augers to sever material therebetween, and an adjustable elongated panel pivotally mounted on the frame and above the blade mounting plate, the panel being generally concave towards the augers and overlying the extent of the flighting on the augers so as to cause flow of water and material around the augers and to the suction intake and projecting fender members being provided on said panel to prevent entrance of large objects into the augers.

2. A dredging head according to claim 1,

wherein the elongated adjustable panel is provided with reinforcing ribs positioned on the concave surface thereof and in a direction normal to its pivot axis to strengthen the panel and improve the water flow around the concave surface of the panel.

3. A dredging head according to claim 1, wherein each of the cutting blades on each auger flighting has a plurality of teeth projecting from the general extent of the cutting edge thereof and in the direction of rotation of the augers.

4. A dredging head according to claim 3, wherein the edges of the teeth of the cutting blades on each auger flighting and the edges of the gaps between said teeth all have bevelled surfaces to provide a plurality of elongated cutting surfaces on each cutting blade cooperating with the removable cutting blade positioned on the blade mounting plate.

5. A dredging head according to claim 2, wherein the cutting blades on the augers overlie the edges of the flighting, are welded thereto and are curved along their extent to conform to the edges of the flighting.

6. A dredging head according to claim 1 wherein the cutting blades on the augers are spaced along the curve of the flighting, each cutting blade being disposed adjacent cutting blades on each side thereof and the teeth on the cutting blades being so distributed that two teeth, one on each of the augers, simultaneously engage a co-operating removable cutting blade on the blade mounting plate at any one time.

7. A dredging head according to claim 1, wherein the intake conduit leads to the intake of a suction pump carried by the frame.

8. A dredging head according to claim 7 wherein the intake conduit has a flared opening adjacent the spacing between the augers.

9. A dredging head according to claim 7, wherein the suction pump has a shroud covering section pump and coupling the flared opening of the intake conduit with the intake of the suction pump and motors coupled to the drive shaft of the suction pump are arranged outside and one on each side of the shroud.

10. A dredging head according to claim 1, wherein the suction intake conduit contains a suction pump carried by the frame and positioned adjacent the augers, the intake conduit including a shroud enclosing the suction pump and providing a passage to the pump from the spacing between the augers and at least one motor for driving the suction pump positioned outside the shroud and carried by the frame.

11. A dredging head according to claim 10, wherein the intake conduit adjacent the



uniform speed and increased power to the head and in operation of the pumps to vary the flow of material there-through. The improved cutting surfaces ensure more positive cutting of the fibrous material on the bottom of the body of water, such as bog, and entrapment of the same in the augers to advance the same into the suction pump for removal from the body of water. With the improved apparatus, a more efficient dredging operation may be effected.

The suction pump 195, instead of being driven by two motors 200 as described above and shown in Figure 5, may be driven by only one such hydraulic motor which is drivably connected to one end of the shaft 201 and is mounted externally on the corresponding side wall of the shroud 230.

WHAT WE CLAIM IS:—

1. A dredging head adapted to be carried by a boom on one end of a movable pumping dredge to loosen and remove material from the bottom of a body of water, said dredging head including an elongated frame attached to the boom and extending transversely to the boom, a suction intake conduit attached to the elongated frame and adapted to transmit material into the dredge from the dredging head, a shaft positioned on the frame and having a drive motor mounted on one end of the shaft for rotating the same, a pair of screw type augers, having oppositely pitched flighting mounted on and spaced apart on the shaft for directing material towards the centre of the shaft and towards the spacing between the augers positioned adjacent the intake conduit on the frame, wherein said dredging head comprises a plurality of cutting blades distributed circumferentially on the auger flighting in longitudinally spaced relationship, each blade being connected to the peripheral edge of adjacent flighting so as to position the blades generally normal to the extent of the flighting, a blade mounting plate positioned on the frame adjacent the peripheral edge of each auger and extending parallel to the shaft, removable cutting blades positioned on the edge of the plate and distributed along the extent of the plate for cooperation with the cutting blades on the augers to sever material therebetween, and an adjustable elongated panel pivotally mounted on the frame and above the blade mounting plate, the panel being generally concave towards the augers and overlying the extent of the flighting on the augers so as to cause flow of water and material around the augers and to the suction intake and projecting fender members being provided on said panel to prevent entrance of large objects into the augers.

2. A dredging head according to claim 1,

wherein the elongated adjustable panel is provided with reinforcing ribs positioned on the concave surface thereof and in a direction normal to its pivot axis to strengthen the panel and improve the water flow around the concave surface of the panel.

3. A dredging head according to claim 1, wherein each of the cutting blades on each auger flighting has a plurality of teeth projecting from the general extent of the cutting edge thereof and in the direction of rotation of the augers.

4. A dredging head according to claim 3, wherein the edges of the teeth of the cutting blades on each auger flighting and the edges of the gaps between said teeth all have bevelled surfaces to provide a plurality of elongated cutting surfaces on each cutting blade cooperating with the removable cutting blade positioned on the blade mounting plate.

5. A dredging head according to claim 2, wherein the cutting blades on the augers overlie the edges of the flighting, are welded thereto and are curved along their extent to conform to the edges of the flighting.

6. A dredging head according to claim 1 wherein the cutting blades on the augers are spaced along the curve of the flighting, each cutting blade being disposed adjacent cutting blades on each side thereof and the teeth on the cutting blades being so distributed that two teeth, one on each of the augers, simultaneously engage a co-operating removable cutting blade on the blade mounting plate at any one time.

7. A dredging head according to claim 1, wherein the intake conduit leads to the intake of a suction pump carried by the frame.

8. A dredging head according to claim 7 wherein the intake conduit has a flared opening adjacent the spacing between the augers.

9. A dredging head according to claim 7, wherein the suction pump has a shroud covering section pump and coupling the flared opening of the intake conduit with the intake of the suction pump and motors coupled to the drive shaft of the suction pump are arranged outside and one on each side of the shroud.

10. A dredging head according to claim 1, wherein the suction intake conduit contains a suction pump carried by the frame and positioned adjacent the augers, the intake conduit including a shroud enclosing the suction pump and providing a passage to the pump from the spacing between the augers and at least one motor for driving the suction pump positioned outside the shroud and carried by the frame.

11. A dredging head according to claim 10, wherein the intake conduit adjacent the



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frame includes a flared opening surrounding the rear half of the central portion of the shaft and augers and forming a part of the shroud surrounding the pump.

- 5 12. A dredging head according to claim 10, wherein the suction pump has intake openings within the shroud enclosing the

pump and an outlet port outside the shroud and coupled to the intake conduit leading to the dredge.

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