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(54) IMPROVEMENTS IN CUTTING WHEELS FOR SUCTION DREDGES

(71) We, WERF CONRAD EN STORK HIJSCH N.V., a Dutch Body Corporate, of Haarlem, The Netherlands, and CORNELIS BAARS, a subject of the Queen of The Netherlands, of Rijkssstraatweg 22, Haarlem, The Netherlands, 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 a cutting wheel for a suction dredge, the wheel consisting of an annular box-like body rotatable around its symmetrical axis of generation and having at an otherwise completely closed outer circumferential face thereof, orifices which conform to rearward opening faces of radially protruding boxes on the box-like body, which boxes, when viewed in planes perpendicular to the axis gradually taper towards the outer circumferential face of the body, and a stationary suction mouth within the box-like body, which funnel is connected at one end to a bend at the end of a suction pipe and at the other end opens to the inside of the outer circumferential face of the body. Such a cutting wheel is described in British Patent Specification No. 665431.

The above described cutting wheel is applied at the end of a suction pipe to cut loose the material to be dredged before the material is sucked up through the suction pipe. This is of particular importance if the material to be dredged has a compact texture so that a normal suction pipe without a cutting device will have no effect.

In the above-mentioned known device the funnel has been located in such a way that the protruding boxes of the body first dig out the material to be dredged and then while lifting this material pass along the funnel where the material inside the boxes is subjected to the action of the suction inside the funnel. So the boxes of this known device are in fact dredging buckets which fill with the material to be dredged and after that are subjected to the action of a suction.

Furthermore in this known device the orifices lie against the outside of a cylindrical screen and the suction mouth lies within this screen. The purpose of this is that the fine material is sucked together with water through the screen while the coarse material is moved upwardly by the cutting wheel before being discharged on a belt conveyor.

When the material being dredged is compact and sticky the screen orifices can easily be blocked.

The disadvantage of discharging not at all or not in time is still present in normal bucket dredges where the buckets generally have a form, much more favourable to discharging. Moreover, bucket dredges are not suitable for dredging at great depths.

To a depth of about 30 to 35 m, bucket dredges can be successfully used, but at greater depths this method becomes uneconomic because of the great weight of the numerous buckets and the longer bucket ladder and the numerous pivots required. Therefore at greater depths, suction dredges are used where the material to be dredged is sucked up through a suction pipe by means of centrifugal pump which works well only if the material to be dredged has a loose texture, for instance sand. With a compact material, however, the pipe has to be provided at its suction end with a cutting device which first cuts loose the material. Especially when working sub-aqueous alluvial ore deposits it is important that a cutting and scraping device is present which can scrape off the so-called bedrock which consists mostly of solid rock, because the ore minerals are concentrated near the bedrock.

According to the present invention there is provided a cutting wheel for suction dredges, the cutting wheel for suction dredges, the cutting wheel consisting of an annular box-like body rotatable around its symmetrical axis of generation and having at an otherwise completely closed outer circumferential face thereof orifices which conform to the inward discharge openings of radially protruding forwardly opening cutter boxes on the box-like



body, which boxes, when viewed in planes perpendicular to said axis, gradually taper towards the outer circumferential face of the body, and a stationary suction funnel within the box-like body which funnel is at one end connectable to a bend at the end of a suction pipe of a suction dredge and at the other end opens to the inside of the outer circumferential face of the body, and wherein the funnel is formed so that in use of the wheel the cutter boxes are in communication with the funnel throughout their cutting operations whereby the material cut loose by the boxes is subjected directly to the total flow of water through those boxes into the suction funnel.

Preferably the suction funnel seen in a plane perpendicular to the shaft of the cutting wheel as walls which extend inwardly of the circumference of the annular body in direction opposite to the rotational directions of the wheel.

Further the suction funnel may be mounted on a part located centrally within the box-like body which does not rotate with the wheel and is preferably constructed in such a way that the suction mouth is adjustably in its position relative to the circumference of the body.

The central part is preferably constructed as a hollow shaft having a diameter of such a size that the bend, which is subjected to considerable wear, lying at the end of the suction pipe can easily be inserted and taken out. Driving motor or motors can be provided within the box-like body in a watertight box which is fixed to the stationary central part.

The construction of this cutting wheel is very strong and simple and furthermore, practically symmetrical because the suction pipe can be centrally coupled. The width of the wheel is not larger than the width of a normal dredging bucket so the device according to the invention is pre-eminently suitable to dig off sub-aqueous alluvial ore deposits up to the bedrock.

Because the sucked water can only flow through the mentioned orifices the edges of which exert their cutting action, a continuous flow of material occurs and the pumps are uniformly loaded.

To prevent large portions of the material to be dredged material blocking the inlet orifices of the cutting blades, the sides of the blades are not radially directed but deviate from the radial direction opposite to the rotational direction of the wheel.

Preferably an additional cutting edge is located forwardly of said edges, which edge extends radially and is rearwardly inclined at a greater angle than the side edges of the box in order to prevent pieces which are too big, to pass the dredge pump get in the suction pipe.

The cutting edges of the blades may be hollowed by milling or scalloping so that the

material to be dredged tends to disintegrate on cutting instead of sticking together. If desired, the disintegration of the material can be completed by supplying sprayed water through an encompassing waterpipe which is situated in the hollow part of the cutting edges. This water spray can automatically assist in discharging the material cut loose.

The invention will now be described in more detail by referring to the accompanying drawings illustrating an embodiment of the invention.

Figure 1 is a side view of a cutting wheel according to the invention.

Figure 2 is a section through the cutting wheel taken along line II—II of Figure 1.

Figure 3 is a schematic side view of a dredger vessel with a cutting wheel according to the invention.

Figure 4 shows at an enlarge scale a side view of the cutting edge of a cutting blade of the cutting wheel according to the invention.

The cutting wheel according to the invention consists of an annular box 1 which is provided along the circumference with cutting boxes consisting of cutting edges 2 and flow guiding blades 3. The casing of the box 1 is open at the circumference where the cutting boxes are positioned. Inside the box 1 is a suction funnel 4 the outer end of which is just free of the circumferential casing of the box 1. Further the suction funnel has been arranged in such a way and has such a configuration that water is sucked through only the cutting boxes that are cutting material during use of the wheel so that the material cut loose is entrained more or less in suspension in this water flow and a uniform flow of material arises. The other end of the suction funnel 4 is connected with a hollow stationary shaft 5 (Figure 2) which has such a diameter that the bend 6 of a suction pipe can easily be inserted and taken out again.

The suction pipe is connected by the piping 8 to the dredge pump 9 (Figure 3). The hollow shaft is adjustably joined to a ladder 11 by means of clamps 10. In order to rotate the box 1 with the cutting boxes around the hollow shaft 5 a toothed rim is mounted in the box 1 to engage pinions 13 each of which is driven by a motor 14 e.g. a hydro-motor. These motors are placed in a water-tight box 15 which is fixed to the stationary hollow shaft 5. The energy for the motors is supplied by the lines 16. The rotating part 1 is fixed to the hollow shaft 5 by means of ball bearings 17.

The sides of the cutting edges 2 deviate from the radial direction in the direction opposite to the rotational direction of the wheel. By this means big obstacles can be rolled away by the cutting boxes. In addition a cutting edge 18 extending still more obliquely is provided across the middle of the orifice of the

cutting blades. The cutting edges are constructed as scalloped knives so that the material falls apart while cutting. If desired water to form sprays can be supplied through the encompassing pipe 23 which is provided in the hollow space of the cutting edges 2.

Fig. 3 shows schematically the cutting wheel 1 mounted at the end of a ladder 11, which is pivotally connected to the pontoon 19 by means of two deck pedestals. The ladder can completely be hoisted out of the water by the pulley-block 21. The dredge pump 9 is positioned at the lower end of the ladder, the pressure pipe 20 runs upwardly along the ladder so the material to be dredged can be delivered to the shore or to an ore-treating plant.

WHAT WE CLAIM IS:—

1. A cutting wheel for suction dredges, the cutting wheel consisting of an annular box-like body rotatable around its symmetrical axis of generation and having at an otherwise completely closed outer circumferential face thereof, orifices which conform to the inward discharge openings of radially protruding forwardly opening cutter boxes on the box-like body, which boxes, when viewed in planes perpendicular to said axis, gradually taper towards the outer circumferential face of the body, and a stationary suction funnel within the box-like body, which funnel is at one end connectable to a bend at the end of a suction pipe of a suction dredge and at the other end opens to the inside of the outer circumferential face of the body, and wherein the funnel is formed so that in use of the wheel the cutter boxes are in communication with the funnel throughout their cutting operations whereby the material cut loose by the boxes is subjected directly to the total flow of water through those boxes into the suction funnel.

2. A cutting wheel as claimed in claim 1, wherein the funnel extends along the inside of the outer circumferential face of the body from a point approximately vertical below said axis to near a point at the same level as the axis.

3. A cutting wheel as claimed in claim 1

or claim 2, wherein the suction funnel seen in a plane perpendicular to the shaft of the cutting wheel has walls which extend inwardly of the circumference of the annular body in direction opposite to the rotational direction of the wheel.

4. A cutting wheel as claimed in claims 1—3, wherein the suction funnel joins a hollow stationary shaft inside the box-like body on which shaft the bend is fixed.

5. A cutting wheel as claimed in claim 4, wherein the bend is fixed in the hollow shaft, the diameter of which is large enough to permit the bend to be easily inserted and taken out.

6. A cutting wheel as claimed in any of the preceding claims, wherein the suction funnel is fixed at the end of a ladder in such a way its circumferential position can be adjusted.

7. A cutting wheel as claimed in any of the preceding claims wherein the side edges of the cutter boxes which cut the material to be dredged extend outwardly of the annular body and are rearwardly inclined with respect to radii of the body passing through their inner edges with respect to the direction of rotation of the annular body.

8. A cutting wheel as claimed in claim 7 wherein an additional cutting edge is located forwardly of each pair of said side edges, each of which additional cutting edges is rearwardly inclined to a radius of the body extending through the inner end of the edge at a greater angle than the side edges of the box.

9. A cutting wheel as claimed in any of the preceding claims, wherein each side edge of the cutter box is hollowed and a water conduit producing water sprays is provided in the hollow.

10. A cutting wheel substantially as hereinbefore described with reference to and as illustrated in the accompanying drawings.

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