

DEVICE AND METHOD FOR CHANGING A SUCTION MOUTH

The present invention relates to a device and method for changing a suction mouth of a cutter suction dredge of a dredging vessel with cutter ladder, comprising a work platform which, as seen in the transverse direction
5 of the vessel, is provided substantially in the middle with an opening. The invention also relates to a method for replacing a first suction mouth connected to a cutter suction dredge with a second suction mouth.

It is known to provide a work platform, often also
10 referred to as cutter platform, on a vessel with cutter suction dredge so that the cutter head, which is subject to wear, can be exchanged on a regular basis. A suction mouth on the other hand is a component which for most types of cutter suction dredge does not have to be
15 replaced, or rarely so. In a new type of cutter suction dredge as described in the international application WO 2004/1113535 in the name of applicant a number of suction mouths with differing entry section can however be connected to the suction pipe, wherein the entry
20 section is determined by the nature of the dredged material to be removed. For a material such as sand or gravel a suction mouth will be connected which has an entry section which is larger than that which would be connected in order to dredge for instance rock. For
25 optimum efficiency of such a system it is thus necessary to change suction mouth each time a transition is made from rock and stone to soil, so that the device can be optimally productive and competitive in both fields of application.

30 The present invention has for its object to provide a device and method of the type stated in the preamble with which a suction mouth can be exchanged in an efficient manner.

For this purpose the device according to the invention is distinguished in that:

- a support structure is provided which can be fixedly connected to the work platform in a position
- 5 substantially under the opening, which support structure is adapted to support a suction mouth at a level substantially below the work platform;
- the work platform with support structure is tiltable around a substantially horizontal transverse axis
- 10 between a substantially horizontal operating position and a high position in which the cutter ladder can be moved upward, which positions are such that the work platform with support structure is movable from its high position to its operating position when the cutter
- 15 ladder is situated in a high raised position, typically also in the case a suction mouth is fixed onto the support structure.

As seen in a longitudinal section, the suction mouth lies under the drive shaft of the cutter head and offset

20 over a longitudinal distance relative to the cutter head. In order to make the work platform, which is normally intended for change of the cutter head, also suitable for changing the suction mouth, a support structure is provided in the central opening of the work

25 platform such that the support structure is movable to a position under the suction mouth. As will be further elucidated in detail, the method according to the invention can be performed in that the work platform with support structure is tiltable between an operating

30 position and a high position while the cutter ladder is situated in a high position.

According to a preferred embodiment, the support structure comprises a bottom and two longitudinal walls which are connected to the work platform close to

35 respective longitudinal edges of the opening in the work

platform. In view of the weight of the suction mouth, the support structure is preferably provided with a horizontal steel frame which can bear the weight of the suction mouth. In a particularly advantageous embodiment
5 variant the support structure is a flat rack.

In a typical embodiment of the device according to the invention the work platform is also tiltable around a second, substantially horizontal transverse axis for raising the platform so that it is sufficiently far
10 removed from the surface of the sea, if the vessel is for instance making a sea journey or if it is lying at anchor in turbulent water. Possible changing of the cutter head is hereby also made easier. This second transverse axis is preferably located behind the first
15 transverse axis as seen in longitudinal direction of the vessel.

According to a possible variant, positioning means are provided on the support structure for the purpose of positioning a suction mouth which is placed on the
20 support structure and which must be connected to a suction pipe connected to the cutter ladder. Jack means can for instance thus be provided for the vertical and horizontal positioning of the suction mouth. Chain pulleys can further also be provided, for instance for
25 positioning in athwartship direction.

The invention further relates to a method for replacing a first suction mouth connected to a suction pipe by a second suction mouth, and is distinguished in that:

- 30 - the work platform is carried into a high position;
- the cutter ladder is carried into a high position, wherein the cutter axis preferably inclines slightly upward relative to the horizontal;

- the work platform is carried into a substantially horizontal operating position under the first suction mouth;
 - the first suction mouth is arranged on the support structure and uncoupled from the cutter ladder;
 - the first suction mouth is removed from the support structure; this preferably taking place as follows:
 - the first suction mouth is connected fixedly to the support structure;
 - the work platform with first suction mouth is carried into the high position;
 - the cutter ladder is carried into a low position;
 - the work platform with first suction mouth is carried into a substantially horizontal operating position;
 - the first suction mouth is removed using lifting means present on the dredging vessel;
 - a second suction mouth is placed on the support structure;
 - the second suction mouth is arranged on the cutter ladder; this preferably taking place as follows:
 - the work platform is carried into a high position;
 - the cutter ladder is carried into a high position;
 - the work platform is carried into the substantially horizontal operating position;
 - the cutter ladder is allowed a little slack, preferably until the cutter axis is practically horizontal;
 - the suction mouth is coupled to the cutter ladder.
- The work platform is thus used as auxiliary means for changing a suction mouth, without means from outside the vessel being necessary for this purpose.
- The arranging of the first suction mouth on the support structure preferably takes place by lowering the cutter ladder until the suction mouth rests on the

support structure. The suction mouth can then be pressed up, for instance by means of jacks, and detached from the cutter ladder and the suction pipe. By retracting the jacks the suction mouth is lowered onto a seat
5 disposed for this purpose on the support structure.

After being placed on the support structure, the second suction mouth must further be positioned precisely relative to the suction pipe to which it must be connected. According to a possible variant, this
10 positioning can take place by lifting or lowering the cutter ladder and/or the work platform. According to another variant, this positioning takes place using jack means and/or chain pulleys.

The present invention will be further elucidated on
15 the basis of a number of non-limitative exemplary embodiments with reference to the accompanying drawing, in which:

figure 1 shows a side view of a vessel with cutter suction dredge;

20 figures 2(A), (B), (C) and (D) show respectively a longitudinal view, a top view, a transverse view along C-C and a transverse view along D-D of an embodiment of the device according to the invention, with the work platform in the low operating position and the cutter
25 ladder in the high position;

figures 3(A)-(J) illustrate schematically an embodiment of the method according to the invention.

Figure 1 shows an embodiment of a vessel with cutter suction dredge. The typical components of such a vessel
30 are a cutter ladder 1 with ladder hoisting cable 2, and two anchor or spud posts 3, 4. Situated on the outer end of the ladder is a cutter head 5, and provided along the ladder are suction means 9 which comprise a suction mouth, suction pipe and a pump. The ship is further
35 provided with a deck crane 8 for all kinds of operations

on deck, a bridge 7 and a work platform 6, for instance for performing maintenance operations on cutter head 5, or for changing the suction mouth. This work platform will be further described with reference to figures 5 2(A)-2(D) which show an embodiment of the device according to the invention.

The embodiment shown in figure 2 comprises a work platform 6 which, as seen in the transverse direction (see figure 2(B)), is provided with a central opening 10 18. Provided in this central opening 18 is a support structure, here a flat rack 16, which has two longitudinal walls 26 which are connected by means of connecting means 27, 28 to work platform 6. Work platform 6 is tiltable around a first, substantially 15 horizontal transverse axis 23 for the purpose of folding the work platform sufficiently far upward, for instance during sailing, and around a second, substantially horizontal transverse axis 15 located further forward for the purpose of exchanging the suction mouth.

20 The flat rack is further equipped with two vertical hydraulic jacks, a first hydraulic jack 21 for the front side of the suction mouth and a second hydraulic jack 22 for the flange side of the suction mouth. A horizontal hydraulic jack (not shown) is also provided for 25 positioning of the suction mouth in alongship direction. Finally, chain pulleys 20 are provided for athwartship positioning of the suction mouth.

Provided in the flat rack is a so-called seat on which the suction mouth is placed. This seat comprises 30 four legs 24a-24d with respective upper surfaces which are adapted to the shape of the suction mouth. These legs are provided with horizontal flanges which are connected by means of nut-bolt connections 25a-25d to a support platform 31 in flat rack 16. The openings in the 35 flanges for bolts 25a-25d have a larger diameter than

that of the bolts, so that the bolts are received with some clearance in the openings and the legs can be moved to a limited extent in the horizontal plane when the nuts are not tightened. By providing six rods, i.e. two
5 transverse rods 25-26, two diagonal rods 27-28 and two longitudinal rods 29-30 which mutually connect the legs 24a-24d, the seat forms a rigid whole which has limited movement relative to support platform 31. This movement can for instance take place in the longitudinal
10 direction using the horizontal jack, and in athwartship direction using the chain pulleys, as will be further elucidated.

An embodiment for exchanging the suction mouth according to the invention will now be explained step-
15 by-step with reference to figure 3. Work platform 6 is first brought into its substantially horizontal, low position and cutter ladder 1 is brought into a low position under the work platform, for instance at an angle which is greater than about 5°, preferably greater
20 than 8° relative to the horizontal (figure 3(A)). Flat rack 16 is placed in the central opening of the cutter platform and secured with for instance conventional container locking means.

Work platform 6 with flat rack 16 fixed therein is
25 carried into a high position by tilting around a horizontal transverse axis 15, for instance through an angle lying between about 60° and 80° (figure 3(B)). The cutter ladder is brought into the highest position, for instance between about -1 and -5° relative to the
30 horizontal, whereafter work platform 6 can be returned to the low, substantially horizontal position, wherein suction mouth 12 is situated above work platform 6 (figures 3(C) and (D)).

The cutter ladder is then lowered until suction
35 mouth 12 is almost supported by flat rack 16, whereafter

the suction mouth will be pressed up by two jacks 21, 22, which support on the seat of the flat rack, so that it can be uncoupled from the cutter ladder, whereafter the jacks are retracted and the suction mouth rests on
5 the seat. The cutter ladder is then returned to the highest position and the suction mouth is secured to the seat on the flat rack such that the work platform can be tilted back to its high position (figures 3(E) and (F)).

The cutter ladder is now lowered back to its low
10 position, and the work platform is subsequently carried back into the low position (figures 3(F) and (G)). In this position the cutter ladder is not in the way and the suction mouth can be exchanged for another suction mouth using for instance the deck crane 8.

15 After placing thereof, the other suction mouth 12' must be secured to the seat on the flat rack so that first the work platform and then the cutter ladder can be carried into their highest position (figure 3(H)), whereafter the work platform is carried into its low,
20 substantially horizontal operating position (figure 3(I)).

The new suction mouth 12' can now be uncoupled from the flat rack, whereafter the cutter ladder is lowered until the suction mouth is located substantially in
25 front of the suction pipe such that the new suction mouth can be mounted on the suction pipe. The positioning of the suction mouth relative to the cutter ladder can take place in different ways, as will be set forth in further detail. Once the new suction mouth has
30 been connected to the suction pipe, the cutter ladder can be moved back to the highest position. Finally, the work platform is moved back to the high position, and the ladder with new suction mouth is ready for use (figure 3(J)).

A correct vertical, athwartship and alongship positioning of the suction mouth relative to the suction pipe can take place in different ways.

According to a first option, the vertical
5 positioning of the suction mouth can take place by moving the ladder upward/downward. According to another option, the substantially vertical jack means 21, 22 between suction mouth and flat rack are used. A combination of these options is of course also possible.
10 The athwartship positioning typically takes place using the chain pulleys 20.

The alongship positioning can for instance be carried out by horizontal jack means or by moving the work platform upward (and therefore also forward) using
15 the winches of the work platform.

The invention is not limited to the above illustrated embodiment, and a skilled person will appreciate that other means or methods can for instance be provided for the positioning relative to the cutter
20 ladder. The scope of the invention includes all these variants and is defined solely by the following claims.

CLAIMS

1. Device for changing a suction mouth of a cutter suction dredge of a vessel with cutter ladder,
5 comprising a work platform which, as seen in the transverse direction of the vessel, is provided substantially in the middle with an opening,
characterized in that
- a support structure is provided which can be fixedly
10 connected to the work platform in a position substantially under the opening, which support structure is adapted to support a suction mouth;
- the work platform with support structure is tiltable around a first, substantially horizontal transverse axis
15 between a substantially horizontal operating position and a high position in which the cutter ladder can be moved upward, which positions are such that the work platform with support structure is movable from its high position to its operating position when the cutter
20 ladder is situated in a high raised position.
2. Device as claimed in claim 1, **characterized in that** the support structure comprises a bottom and two longitudinal walls, which longitudinal walls are connected to the work platform close to respective
25 longitudinal edges of the opening therein.
3. Device as claimed in either of the foregoing claims, **characterized in that** the support structure comprises a horizontal steel frame which can support the suction mouth.
- 30 4. Device as claimed in any of the foregoing claims, **characterized in that** the support structure is a flat rack.
5. Device as claimed in any of the foregoing claims, **characterized in that** the support structure is provided
35 with a receiving structure with a design adapted to that

of the suction mouth, which receiving structure is movable to a limited extent relative to the support structure.

6. Device as claimed in claim 5, **characterized in**
5 **that** the receiving structure comprises at least four legs rigidly connected to each other.

7. Device as claimed in claim 5 or 6, **characterized in that** the receiving structure is connected to the support structure by means of bolts protruding with
10 limited clearance into openings of the support structure.

8. Device as claimed in any of the foregoing claims, **characterized in that** the work platform is tiltable around a second, substantially horizontal transverse
15 axis for raising the platform so that it is sufficiently far removed from the surface of the sea, which second transverse axis is preferably located behind the first transverse axis as seen in longitudinal direction of the vessel.

20 9. Device as claimed in any of the foregoing claims, **characterized in that** positioning means are provided for the purpose of positioning relative to the cutter ladder a suction mouth resting on the support structure.

10. Device as claimed in claim 6, **characterized in**
25 **that** the positioning means comprise jack means.

11. Device as claimed in claim 6 or 7, **characterized in that** the positioning means comprise chain pulleys.

12. Method for replacing a first suction mouth of a cutter suction dredge connected to a suction pipe by a
30 second suction mouth, which dredging vessel comprises a work platform with a support structure connected fixedly thereto, **characterized in that**

- the work platform is carried into a high position;
- the cutter ladder is carried into a high position;

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- the work platform is carried into a substantially horizontal operating position under the first suction mouth;
- the first suction mouth is arranged on the support structure and uncoupled from the cutter ladder;
- the first suction mouth is removed from the support structure;
- a second suction mouth is placed on the support structure;
- the second suction mouth is arranged on the cutter ladder.

13. Method as claimed in claim 12, **characterized in that** placing of the second suction mouth on the cutter ladder takes place as follows:

- the work platform is carried into a high position;
- the cutter ladder is carried into a high position;
- the work platform is carried into the substantially horizontal operating position;
- the cutter ladder is allowed a little slack,
- preferably until the cutter axis is practically horizontal;
- the suction mouth is coupled to the cutter ladder.

14. Method as claimed in claim 12 or 13, **characterized in that** arranging of the first suction mouth on the support structure takes place by allowing the cutter ladder slack to an almost horizontal position.

15. Method as claimed in claim 12, 13 or 14, **characterized in that** removal of the first suction mouth from the support structure takes place as follows:
- the first suction mouth is connected fixedly to the support structure;
 - the work platform with first suction mouth is carried into the high position;
 - the cutter ladder is carried into a low position;

- the work platform with first suction mouth is carried into a substantially horizontal operating position;
- the first suction mouth is removed using lifting means present on the dredging vessel.

5 16. Method as claimed in claim 15, **characterized in that** after being placed on the support structure, the second suction mouth is positioned for connection to the latter structure.

10 17. Method as claimed in claim 16, **characterized in that** the positioning takes place by raising or lowering the cutter ladder and/or the work platform.

 18. Method as claimed in claim 16 or 17, **characterized in that** the positioning takes place with jack means and/or chain pulleys.