

A METHOD OF DREDGING USING A DREDGE
VEHICLE AND PUMPING TRANSPORTATION

5 The present invention relates to a method for dredging and transporting particulate material such as earth or sand from a dredge vehicle such as a boat equipped with a backhoe to a place of reclamation.

10 In conventional dredging operations using a dredge boat equipped with a backhoe, scoops earth and sand from a seabed or from a steep face of a seashore, and then a transportation boat is loaded with the earth and sand to transport the same near a place of reclamation. The earth and sand which is unloaded from the transportation boat is conveyed to the place of reclamation by dump trucks, conveyers and other transporting means.

15 In such dredging operation using a dredge boat equipped with a backhoe, the scraper is driven forward to scoop earth and sand for instance from a seabed. The backhoe has its bucket with the mouth opening towards the machine, and in use the machine puts its bucket away from the machine, and then pulls its bucket towards the machine to scoop and load earth and sand.

20 Such conventional dredging operation requires transportation boats, dump cars, heavy machines for loading and unloading earth and sand from transporting means. This and labor wages raise the dredging and reclaiming cost. The earth and sand is liable to fall down from the bucket under around the bow of the dredge boat, and the earth and sand lie in heaps there. This reduces the efficiency with which the dredging operation is carried out.

30 One object of the present invention is to provide a dredging method which can eliminate the necessity of transportation boats, dump cars or other transportation means and require little or no loading and unloading labor.

Another object of the present invention is to provide a dredging method which can prevent the formation of heaps of earth and sand under the bow of a dredge boat, and accordingly improve the dredging efficiency.

5 A dredging method according to the present invention uses a dredge vehicle equipped with a backhoe, and it comprises the steps of: scooping particulate material, e.g. earth and/or sand, e.g. from the bottom of a sea, river or the steep face of a shore; transferring the scooped
10 material to a hopper which is equipped with obstacle-eliminating means and a cutter; mixing the obstacle-free particulate material thus obtained by means of the cutter in the hopper; driving the resultant slurry into an associated suction tube by means of a pump; and transporting the same to a
15 place of reclamation via associated inboard, marine and land tubes, which are preferably designed to be connected together. A bucket can be fixed to an operation arm with its open mouth ahead of the backhoe, in the form of a "face-shovel", and the bucket is pushed forward to scoop, and
20 pulled back to bring earth and sand into the vehicle, e.g. a boat, thereby preventing the formation of heaps of earth and sand under the bow of the boat, as would be otherwise caused as a result of falling of earth and sand from the steep face of the seashore and from the bucket if it were
25 fixed to an operating arm with its open mouth towards the backhoe.

Suitable apparatus for removing pieces of obstacle from earth and sand, which can be used in a dredging operation according to the present invention essentially comprises
30 a pivotable primary selection grid and a secondary selection grid; these primary and secondary selection grids are arranged at upper and lower levels above the hopper located within the dredge vehicle; the secondary selection grid comprises an overlying screen which is composed of a
35 plurality of parallel bars, and an underlying screen which is composed of a plurality of wires resiliently stretched perpendicular to the overlying parallel bars; a rotary scraper is adapted to move on the upper surface of the rod screen to remove

pieces of obstacle, such as pieces of wood or rock. With this arrangement pieces of obstacle whose size is larger than the mesh of the selection grids, are removed from earth and sand before being thrown in the hopper. In operation earth and sand is thrown on
5 the primary selection grid, allowing pieces of obstacle of smaller size than the mesh or parallel space of the rod grid to fall on the underlying secondary selection grid, leaving larger pieces of obstacle on the primary selection grid. Then, the primary selection grid is turned to throw away the remaining pieces of
10 obstacle. On the other hand the pieces of obstacle remaining on the secondary net are taken off by the rotary scraper. For instance, elongated pieces of wood will be pushed down by the rotating scraper blades while the resiliently stretched wires yieldingly withdraw. Then, the elongated pieces of obstacle will
15 rise from the meshes and will be put in horizontal position in which the pieces of obstacle are easily caught and removed by the rotating scraper blades. Thus, whether or not pieces of obstacle are caught in the meshes of the secondary net, all remaining pieces of obstacle will be removed from the secondary selection
20 grid. Finally, obstacle-free earth and sand is thrown in the hopper.

Other objects and advantages of the present invention will be better understood from the following description of a preferred
25 embodiment of the present invention, which is shown in the accompanying drawings:

Fig.1 is a plan view of a dredge boat equipped with a backhoe;

Fig.2 is a side view of the dredge boat;

30 Fig.3 shows one mode of dredging operation with the backhoe;

Fig.4 shows another mode of dredging operation;

Fig.5 is a sectional view of the dredge boat taken along the line V-V in Fig.1;

Fig.6 is an enlarged perspective view of the secondary selec-

tion grid of an obstacle eliminating device; and

Fig.7 shows how the secondary selection grid works together with an associated scraper in removing pieces of obstacle.

5 As best shown in Fig.1 and 2, a dredge boat 1 has a backhoe type hydraulic power shovel 2 at its bow. It should be noted that the backhoe 2 can have its bucket 21a with the mouth open towards the machine as shown in Fig.3, or can have its bucket 21b with the mouth open ahead of the machine in the form of
10 "faceshovel" as shown in Fig.4. The backhoe can selectively take either form, depending on the degree of hardness of the ground of bay or river floor and other dredging conditions.

Specifically, the backhoe in the form of "faceshovel" can be
15 advantageously used in scraping soft ground, for instance a deposit of sand, mud, etc. Then, the bucket 21b is pushed forward to scoop earth and sand from the deposit. Then, less amount of earth and sand falls from the bucket and from the steep face of deposit to lie in heaps around under the bow of the boat, compared with the backhoe dredging mode, in which a relatively large
20 amount of earth and sand is liable to fall from the bucket 21a when pulled and dragged on the seabed towards the machine and fall from the steep face of deposit to lie in heaps around under the bow of the boat, thus reducing the dredging efficiency.

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A hopper 3 has an openable bottom. It is located behind the backhoe 2. When the hopper 3 is opened, its bottom opens to the sea. The hopper 3 has an obstacle eliminating arrangement 4, which is shown in Figs. 5 to 7.

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The obstacle eliminating arrangement 4 comprises a rotatable primary selection grid 41 and secondary selection grid 42 arranged at upper and lower levels above the hopper 3. The primary selection grid 41 is rotatably attached to the frame at its one

end, and a hydraulic motor or the like is used to raise the other end of the primary selection grid 41 to turn about its other end pivot. The secondary selection grid 42 comprises an overlying screen 43 which is composed of a plurality of parallel bars 43a, and an underlying screen 44 which is composed of a plurality of wires 44b resiliently stretched (by springs 44a) perpendicular to the overlying parallel bars 43a, and a rotary scraper 45 which is adapted to move on the upper surface of the rod screen 43 in the longitudinal direction of rods to remove pieces of obstacle.

The rotary scraper 45 has a plurality of radial blades 45b on its shaft 45a, the shaft 45a is engaged with a chain drive (not shown).

A suction tube 5 has a cutter 6 at its front end, and the front end of the suction tube 5 is put in the hopper 3. The rotation of the cutter 6 in the hopper 3 will change the earth and sand to slurry. A slurry pump 7 is connected to the rear end of the suction tube 5, and the slurry pump 7 is connected at its output to marine and land tubes (not shown) via an associated inboard tube.

In operation first, the bucket of the backhoe throws earth and sand on the primary and secondary selection grids 41 and 42. Pieces of obstacle whose size is larger than the mesh of the selection grids 41 and 42, are removed from earth and sand before falling in the hopper 3. Specifically, earth and sand is thrown on the primary selection grid 41, allowing pieces of obstacle of smaller size than the mesh or parallel space of the rod grid to fall on the underlying secondary selection grid 42, leaving larger pieces of obstacle on the primary selection grid 41. Then, the primary selection grid 41 is raised and tilted by the hydraulic motor to throw away the remaining pieces of obstacle. Some pieces of obstacle 13 may be caught in selected

meshes of the secondary selection grid. These pieces of obstacle still remaining on the secondary selection grid can be taken off by the rotary scraper 45. For instance, elongated pieces of wood 13 will be pushed down by the rotating scraper blades 45b, while the resiliently stretched wires 44b yieldingly withdraw, as seen from Fig.7. Then, the elongated pieces of obstacle 13 will rise from the meshes under resilient counterforce, and will be put in horizontal position in which the pieces of obstacle 13 are easily caught and removed by the rotating scraper blades 45b. Thus, whether or not pieces of obstacle are caught in the meshes of the secondary selection net, all remaining pieces of obstacle will be removed. Finally, obstacle-free earth and sand is thrown in the hopper 3, where the earth and sand is mixed with a liquid by the cutter 6. The resultant slurry will be pumped to a place of reclamation via associated inboard, marine and land tubes smoothly without such a trouble that the pump and/or tubes are blocked with pieces of obstacle.

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CLAIMS:

1. A method of dredging using a dredge vehicle equipped with a backhoe, comprising scooping particulate material; transferring the scooped material to a hopper which is equipped with obstacle-eliminating means and a cutter; mixing the obstacle-free particulate material thus obtained by means of the cutter in the hopper; driving the resultant slurry into a suction tube by means of a pump; and transporting the same to a place of reclamation via associated onboard, marine and land tubes.

2. A method as claimed in Claim 1, wherein the backhoe comprises a bucket fixed on the end of an operating arm with its mouth opening facing away from the dredge vehicle, and the scooping step comprises pushing the bucket forward away from the vehicle, on a sea-bed or sea-shore to scoop up the particulate material.

3. A method as claimed in Claim 1 or 2, wherein the obstacle-eliminating means used comprises a pivotable primary selection grid and a secondary selection grid comprising a plurality of parallel bars overlying a plurality of wires, resiliently stretched perpendicular to the overlying parallel bars, and a rotary scraper adapted to move over the upper surface of the grid to remove obstacles, and wherein an obstacle retained on the primary selection grid is removed by pivoting the grid upwards about one side and an obstacle retained on the secondary selection grid is removed by the rotary scraper as it moves across the upper surface of the grid.

4. A method as claimed in Claim 3, wherein the primary selection grid of the obstacle-eliminating means is located above and has a larger mesh size than the secondary selection grid.

5. A method as claimed in any preceding claim, wherein the particulate material is earth and/or sand.

6. A method of dredging substantially as hereinbefore described with reference to Figs. 1 to 7.
