Sept. 13, 1960 J. H. FORKNER 2,952,083

DREDGE CONSTRUCTION

Filed July 27, 1956

FIG_1_

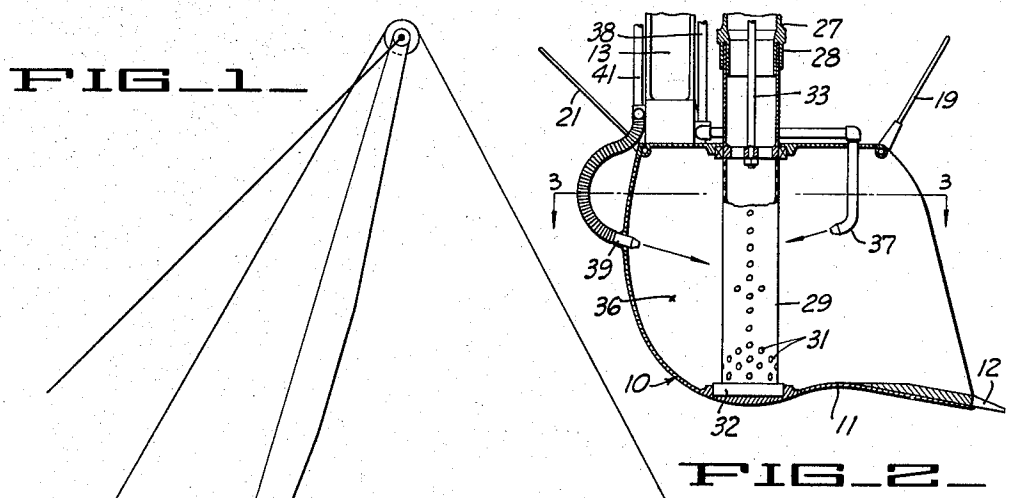
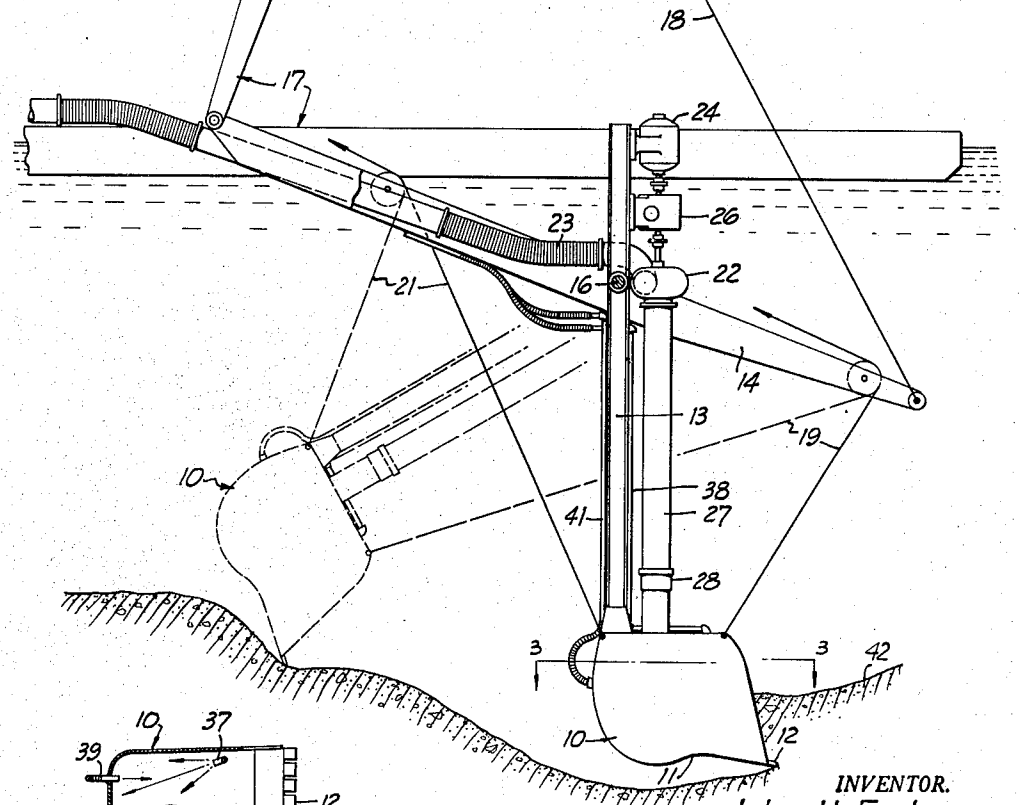



FIG_2_



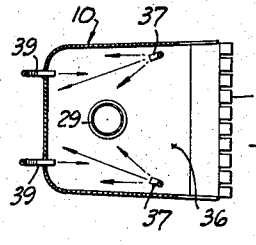




FIG_3_

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# DREDGE CONSTRUCTION

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4 Claims. (Cl. 37—71)

This invention relates generally to dredges of the type generally carried by pontoons or barges and adapted to operate on underwater formations. In particular the invention is applicable where it is desired to recover mineral values contained in the formation.

In the past dredges of the endless bucket line type have been used to remove underwater formations for treatment to recover gold or other mineral values. Such equipment is relatively costly and its use is prohibitive except in relatively few locations where warranted by proven mineral values. The high cost is due largely to the extensive bucket line and its supporting ladder, and the relatively large barge required to float the working parts. In the operation of such dredges, as in the operation of barge mounted scoops or shovels, the buckets containing the removed material are lifted out of the water, and this characteristic must be taken into account in designing the size of barge employed, and the power requirements. Efforts have been made to use dredges of the suction type in gold dredging and like operations. Such dredges have the theoretical advantage that the underwater operating parts need not be lifted above the water level for discharge of the dredged solids, and therefore the size of the barge or pontoons employed may be reduced accordingly. In addition the over-all construction of such suction dredges is relatively simple compared to the dredges of the bucket line type. However the performance of suction dredges as heretofore constructed have been disappointing, particularly since the proven assay value of the formation being dredged has not been realized in the processed material. It has been found that this is due to a loss of values occurring in the region generally adjacent to the suction head, which probably results from a dropping out of the heavier gold or mineral values from the mineral moving toward the suction head.

In general it is an object of the present invention to provide an improved dredge construction and method which will make use of hydraulic suction, but which will avoid the defects and difficulties outlined above.

Another object of the invention is to provide a dredge construction and method of the above character which will be relatively inexpensive compared to dredges of the bucket line type, and which therefore can be used in many instances where more elaborate equipment would be prohibitive.

Another object of the invention is to provide equipment of such a character that it may be land borne for test or exploratory operations.

Another object of the invention is to provide a dredge construction and method of the suction type in which a classifying action takes place in conjunction with movement of material to the suction head.

Another object of the invention is to provide an equipment and method capable of coping with flash flood conditions.

Another object of the invention is to provide a dredge construction and method in which boulders or relatively



large rocks found in the formation are placed back into previously worked areas without lifting the same from the water.

Another object of the invention is to provide a suction dredge in which a classifying action takes place without clogging of the suction head.

A further object of the invention is to provide a suction dredge and method in which the pumping means is mounted in such a manner with respect to the suction head, as to produce a relatively powerful suction with a minimum amount of power consumption.

Additional objects and features of the invention will appear from the following description in which the preferred embodiment of the invention has been set forth in detail in conjunction with the accompanying drawing.

Referring to the drawing:

Figure 1 schematically illustrates dredging apparatus incorporating the present invention.

Figure 2 is an enlarged detail in section illustrating the bucket and suction head.

Figure 3 is a cross-sectional view taken along the line 3—3 of Figures 1 and 2.

In accordance with the present invention digging means of the bucket or dipper type is employed for operating upon a bank or other underwater formation. A special suction head is disposed directly within the bucket and is connected to pumping means for creating the requisite hydraulic suction. When in operation material within the bucket is classified as to size with the smaller sized material carrying the desired mineral values passing into the head and being discharged upon the barge, and the relatively large boulders and rock remaining in the bucket. Accumulated boulders or rock are from time to time discharged in previously worked underwater areas where they will not interfere with continued operations.

Referring to the particular construction illustrated in the drawing, I have shown a dipper or bucket **10** having a bottom **11** provided with a digging edge or teeth **12**. The front side of the bucket, above the digging edge is open to receive material. The bucket is shown carried by the rigid structural member **13** which is generally referred to as a bucket stick. As representative of suitable means for carrying the stick **13**, and for operating the same as required for the various digging and discharge operations, I have shown a boom **14** to which the stick is attached by a pivot pin **16**. The boom in turn is carried by the pontoons or barge parts **17**, and by means of operating cables **18**, it can be raised or lowered as desired. Additional operating cables **19** and **21** can be manipulated as by winches located on the pontoons, and serve to swing the stick for digging and return movements of the bucket.

The stick **13** also serves to mount the centrifugal pump **22**, which has its discharge connected to a conduit **23** that extends above the water level for discharging material for processing. The driving means illustrated for pump **22** includes the electric motor **24** and gear box **26**, which preferably are likewise mounted upon the stick. Conduit **27** connects with the inlet side of pump **22**, and at its lower end is connected by journal coupling **28** with the hollow suction head **29**. The suction head preferably consists of a wall which may be cylindrical, and which is provided with a plurality of perforations **31**. It is desirable for the lower end of the head to be journaled to the lower wall of the bucket as indicated schematically at **32**. A shaft **33** extends downwardly through conduit **27** from pump **22**, and has a driving connection with the head. This shaft rotates with operation of the pump, and serves to cause continuous rotation of the head. As will be presently explained a perforated head of this type makes it possible to carry out size classification within the bucket, and at the same time continuous motion of the head pre-

vents clogging of the perforations 31. Although as described above the head rotates continuously, it will be evident that it may be oscillated or reciprocated with sufficient amplitude to prevent clogging of the perforations. If desired the head may be provided with ribs or corrugation that may extend in an axial direction, to aid in breaking conglomerate material being pressed against the same. In this connection it may be noted that material tends to be pressed against the head by the confining action of the bucket, during digging operations.

The head 29 extends substantially the entire height of the space 36 within the bucket and is located between the open front of the bucket and the bucket back-wall, and between the side walls.

It is desirable to provide the bucket with hydraulic jetting nozzles. Thus one or more nozzles 37 connect with the water supply pipe 38, and are disposed to discharge in a direction rearwardly from the open front of the bucket, and toward the head 29. As will presently be explained such jets tend to break up material moving into the bucket during digging operations and aid in the desired classifying action. Also they aid in creating a flow into the suction head. Additional jetting nozzles 39 communicate through the rear wall of the bucket and connect with the water supply pipe 41. Jets discharging from nozzles 39 can be employed to aid in removing rocks, boulders, and the like from the bucket. Suitable means (not shown) such as valves are employed to selectively control operation of these nozzles, whereby only one or the other (i.e. 37 or 39) is operated at one time.

Operation of the dredge described above is as follows: In Figure 1 it is assumed that an underwater bank 42 contains gold or other values and is to be operated upon by the bucket. The pump 22 is operated to continuously maintain suction tending to hydraulically move material into the suction head 29. The operator manipulates the bucket whereby it is swung into the bank 42 along an arc as illustrated, whereby material is forced into the bucket. Within the bucket the smaller sized material capable of passing through the perforations 31, is hydraulically conveyed into the head through these perforations. Hydraulic movement into the head is facilitated by the action of the hydraulic jets 37, and in addition these jets act upon masses of aggregates to break them up, thus freeing the smaller sized material. Within the confined region 36 of the bucket there is no opportunity for gold or like heavy minerals to separate out without being hydraulically moved into the head. Assuming that the formation contains some large rocks or boulders, which do not contain values, these remain within the bucket and after one or more sweeps against the formation, the bucket may be swung to a rear position such as illustrated in dotted lines, whereby rocks are discharged in an area not being operated upon, such as an area that has previously been worked. As illustrated by the dotted line position of the bucket, after swinging the bucket to its rearmost position for discharge of the rocks or boulders, it may be lifted somewhat from the formation for its return swing to clear the deposited rocks. The discharge of the rocks or boulders can be aided by jetting water from the nozzles 39.

It will be evident from the foregoing that I have provided an apparatus and method having a number of desirable features. With respect to the method employed, classification and hydraulic removal of the smaller sized material from the interior of the bucket takes place concomitantly with digging operations, and this likewise applies to breaking up the formation by the action of the jets 37. All of the gold or other mineral values in the smaller sized material is moved into the suction head and delivered to the top of the barge, and does not have an opportunity to settle out or otherwise be come lost. The mineral bearing material is delivered to the top of the barge, and the undesired boulders and rocks are separated out and deposited in an out of the way area. Mounting of the pump 22, and also the motor and gearing 26, upon the bucket stick 13, facilitates construction of the dredge, and makes for efficient pumping action with a minimum amount of power.

My dredge is particularly applicable for use in the tropics or like regions where minimum servicing is desirable, and where the equipment must withstand adverse weather conditions, such as floods. In the event of flash flood conditions, the stick can be lowered until the bucket rests upon the bottom. The pin 16 can be removed to allow the stick to drop to the bottom, with only a cable serving to attach it to the barge. This serves to relieve the barge of the weight of a considerable part of the operating equipment. As further measures, the boom 14 can be disconnected and dropped to the bottom, and remaining equipment on the barge, such as the motor and electrical generator, may be removed and lifted to a safe elevation by suitable hoisting equipment. Thereafter the barge itself may be flooded to permit it to rest upon the bottom. When the water recedes, it is a simple matter to refloat the barge, reinstall the motor and generator, and retract the boom, stick and bucket.

While my equipment is intended primarily for installation on barges or pontons, it may be made land borne, in which event it is supported by a carrier of the track laying or rubber tired wheel type. For example, the carrier may be a track laying or tired tractor, in which event the tractor can be manipulated during digging and load discharge operations, whereby the bucket digs in the manner of a back-hoe. Washing or other hydraulic equipment for recovering the desired values can be located on the tractor, or on a separate trailer. When carried in this manner the equipment can be used to advantage for test or exploratory purposes.

In describing the apparatus as illustrated in the drawing, it is assumed that the bucket is moved forwardly against the formation. However, the bucket can be operated in the manner of a hoe, and in such event when operating upon a bank, the bucket is engaged with the upper portion of the bank and then swung downwardly with digging action to move the material into the bucket.

I claim:

1. In a dredge construction, a bucket having digging means on a lower wall, a stick serving to mount the bucket, a carrier, pivoted means on the carrier for supporting the stick, a pump mounted upon the stick, means mounted on the stick for driving the pump, a suction head disposed within the space enclosed by the bucket, said head comprising a vertically extending hollow member having perforations of a size suitable for passing desired material, said head being journalled for turning within said bucket, means for cyclically turning the head to prevent clogging of the perforations with dredged material, nozzle means for delivering water jets into the bucket and in the direction towards the suction head from the open front of the bucket, and additional nozzle means carried by the bucket and disposed to deliver jets of water into the bucket and toward the open front thereof to discharge over-sized material.

2. The dredge of claim 1 wherein said head and said perforations extend for substantially the entire height of the enclosed space within the bucket.

3. In a dredge construction, a substantially enclosed bucket having digging means on a lower wall, support means serving to mount the bucket for digging operations, suction means including a suction conduit extending to the bucket, a suction head mounted within the enclosed space of said bucket for movements relative to the bucket and to dredged material contained therein, said suction head being in fluid communication with the suction conduit, said suction head being also provided with a plurality of inlet openings dimensioned to limit and classify the size of material passing into said suction head and conduit, and means for cyclically moving

said suction head to prevent clogging of said inlet openings.

4. In a dredge construction, a substantially enclosed bucket having digging means on a lower wall, support means serving to mount the bucket for digging operations, suction means including a suction conduit extending to the bucket, a suction head mounted within the enclosed space of said bucket and movable relative thereto, said suction head being in fluid communication with the suction conduit, said suction head being provided with a plurality of inlet openings, means for applying cyclic movement to said suction head to prevent clogging of said inlet openings, and nozzle means within the bucket for discharging jets of water towards the suction head and in the direction toward the open front of the bucket, said nozzle means serving to cause smaller particles to enter the suction head and larger oversized material to be discharged from the bucket.



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