June 27, 1944. C. K. LITTLE 2,352,394

HYDRAULIC DREDGING APPARATUS

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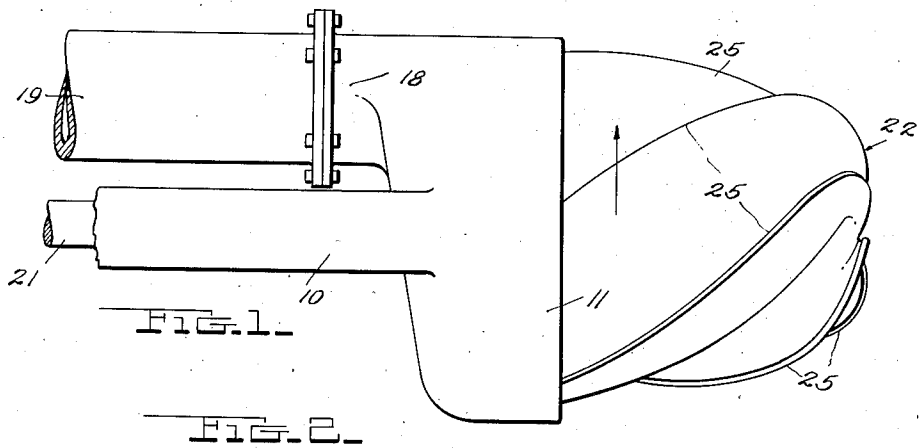


FIG. 1.

FIG. 2.

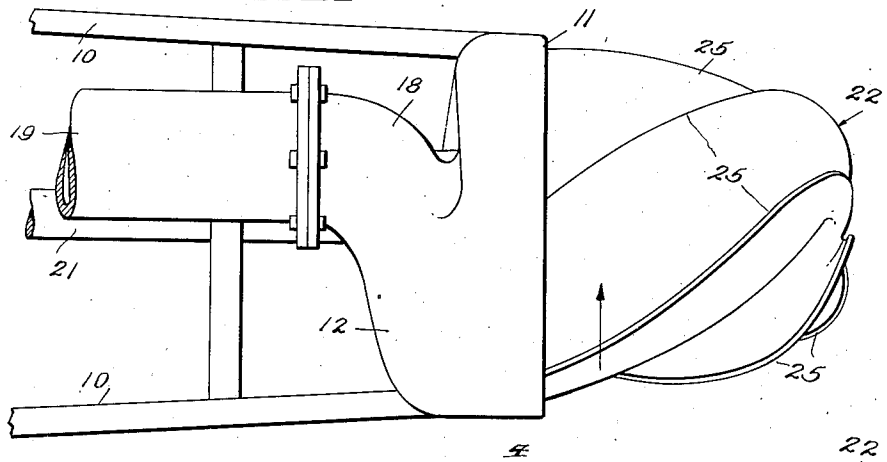


FIG. 3.

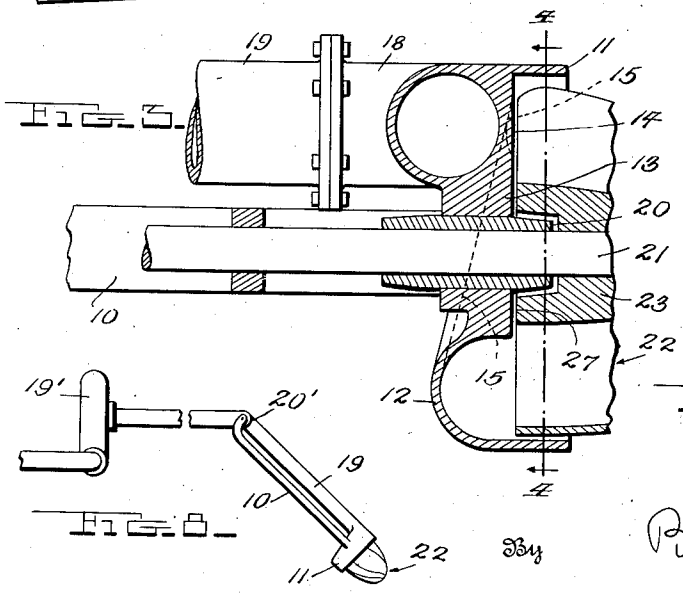
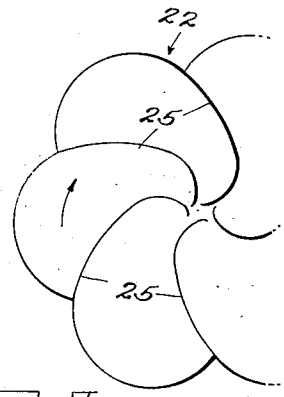


FIG. 4.

FIG. 7.



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FIG. 4

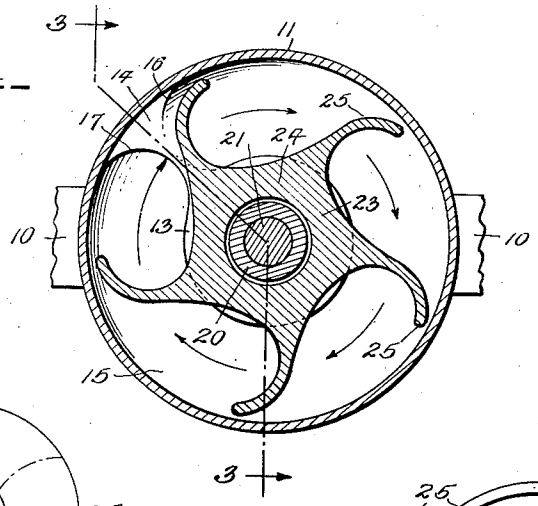
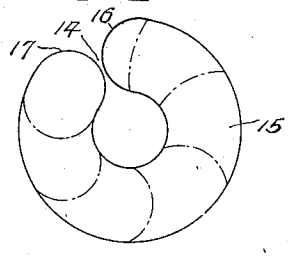


FIG. 5A



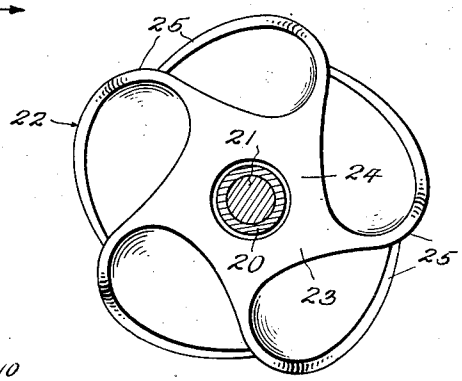
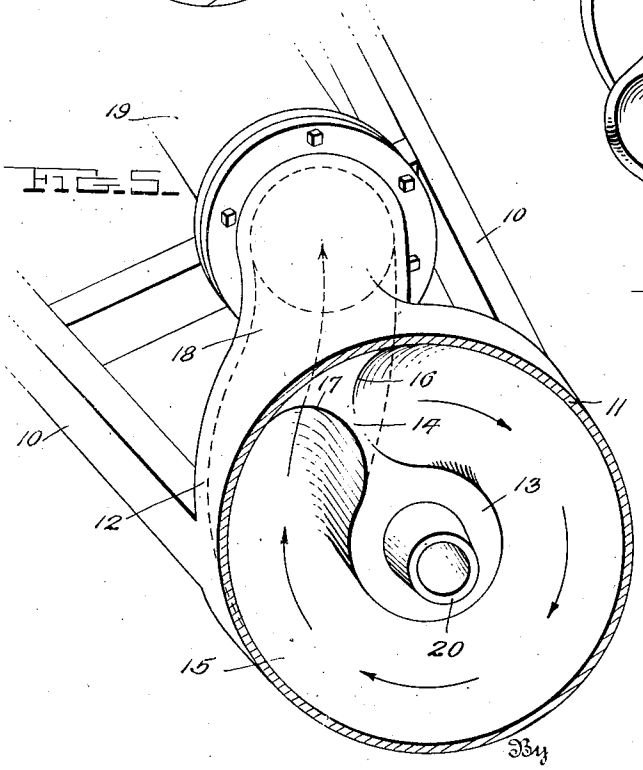


FIG. 6

FIG. 5



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HYDRAULIC DREDGING APPARATUS

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Application June 23, 1943, Serial No. 491,993

4 Claims. (Cl. 37—67)

My invention relates to hydraulic dredging apparatus.

An important object of the invention is to provide apparatus of the above mentioned character including a rotary cutter which not only loosens the solid material to be dredged, but serves to aid in loading the same into the intake of a centrifugal dredging pump, in addition to the suction loading action of such pump, which is limited to atmospheric pressure.

A further object of the invention is to provide apparatus of the above mentioned character including a rotary cutter, to be used with the conventional centrifugal dredging pump, and which may also be used without the centrifugal dredging pump, to loosen the material, and feed the same through the pipe line.

A further object of the invention is to provide a hood for coaction with the improved rotary cutter, for aiding in the loading of the water and solid material in suspension therein to the centrifugal dredging pump, and which hood will also increase the efficiency of the apparatus, when the conventional open rotary cutter is substituted for my improved rotary cutter and used in connection with the hood.

A further object of the invention is to provide a device of the above mentioned character which will act as a low pressure pump and having blades or vanes which will cut and loosen the solid material.

Other objects and advantages of the invention will be apparent during the course of the following description.

In the accompanying drawings forming a part of this application and in which like numerals are employed to designate like parts throughout the same,

Figure 1 is a side elevation of a combined rotary cutter and low pressure pump embodying my invention, parts broken away,

Figure 2 is a plan view of the same,

Figure 3 is a longitudinal section taken on line 3—3 of Figure 4,

Figure 4 is a transverse section taken on line 4—4 of Figure 3,

Figure 5 is a perspective view of the hood and associated elements, partly in section, with the rotary cutter removed,

Figure 5ª is a diagrammatic view of the volute passage, showing its gradual increase in depth,

Figure 6 is a rear end elevation of the rotary cutter,

Figure 7 is a front end elevation of the same, and

Figure 8 is a partly diagrammatic view of the assembled centrifugal dredging pump and the combined low pressure pump and rotary cutter.

In the drawings, wherein for the purpose of illustration is shown a preferred embodiment of my invention, the numeral 10 designates a ladder or support, which is hinged at on end to the dredge vessel, to be swung in a vertical plane so that its free end may be raised and lowered.

Arranged at the free end of the ladder 10 is a combined low pressure pump and rotary cutter including a cylindrical hood or housing 11, rigidly attached to the latter by any suitable means. This hood has its front end open while its rear end is covered by a head 12. The head 12 includes a central hub 13, integral with the head 12, and having a radial stationary abutment 14, in the plane of the face of the hub. The head 12 is formed or shaped to provide a volute or spiral passage 15, starting at 16, upon one side of the stationary abutment 14 and extending circumferentially of the hood 11 interiorly of the same. The passage 15 is between the periphery of the hood 11 and the hub. The intake end of the volute passage 15 starts at 16, as stated, and the passage gradually increases in depth until its outlet end is reached. This is indicated by the transverse curved lines in Figure 5ª which is a diagrammatic view of the passage. The passage 15 extends beyond the opposite side 17 of the stationary abutment. The outlet end of the volute passage 15 extends behind the abutment 14 and is continued in the form of a tubular extension 18, integral with the hood, and this tubular extension is connected with a suction pipe 19, which leads to the intake side of a conventional centrifugal dredge pump 19', mounted upon the vessel. The pipe 19 has a flexible joint 20' so that it will not interfere with the manipulation of the ladder.

The hub 13 is provided with a bearing 20, receiving a rotary shaft 21, driven by any suitable means. Mounted upon this rotary shaft to turn therewith is a rotary cutter 22. This rotary cutter includes a solid or closed hub 23, having a flat rear end 24, operating in contact with or in close relation to the face of the hub 13 and the abutment 14, as shown. This hub 23 may taper forwardly. Formed integral with the hub are imperforate blades or vanes 25, extending longitudinally thereof. These blades or vanes start at the hub and extend continuously radially outwardly to their outer or cutting edges. These blades or vanes are volute or spiral longitudinally with respect to the axis of the rotation of the hub. The blades or vanes 25 are disposed generally radially and are curved in cross section, and all blades or vanes face in the same direction, which is the direction of rotation of the hub. These blades or vanes also radially taper toward their forward ends. These blades or vanes form separate volute passages 25' between the blades, which gradually increase in depth toward their rear ends, Figure 6. The vanes have their rear ends circumferentially spaced, Figure 6, while the

forward ends of the blades or vanes circumferentially overlap, Figure 7. The rear end of the hub 23 and the rear ends of the blades or vanes 25 extend into the cylindrical hood or housing 11, with a slight radial clearance between the blades or vanes and the hood 11.

The operation of the apparatus is as follows: The suction pipe 19 is connected with the suction side of the centrifugal dredging pump 19' upon the dredge vessel, and the usual suction is created in the pipe, to load the water and solid material in suspension therein, into the centrifugal dredging pump. This suction action is limited to atmospheric pressure. The ladder 10 is manipulated to bring the rotary cutter 22 into engagement with the solid material to be loosened. The cutter 22 is rotated clockwise, Figures 1, 2, 3, 4 and 7. The blades or vanes 25 have their outer longitudinal cutting edges brought into engagement with the solid material and cut or loosen the same. The water and loosened solid material in suspension therein enters the passages 25' between the blades or vanes 25 and rotates with the blades or vanes and also travels axially with relation to the blades or vanes toward their rear ends. The water and solid material in suspension therein now enters the volute passage 15 and will impinge against the wall of this passage due to the axial movement of the same. This axial movement of the water and solid material in suspension therein will cause the same to travel circumferentially within the volute passage 15 from the intake end thereof to its outlet end. This circumferential travel within the passage 15 is also caused by the rotation of the water and solid material in suspension therein with the rotary cutter, and also to the action of centrifugal force upon the same. The pump produced by the rotary cutter 22 and hood 11 is a low pressure combination centrifugal, screw, and axial flow pump. It is thus seen that the rotary cutter 22 and hood 11 serve as a low pressure pump to force or feed the water and solid material suspended therein into the pipe 19 and serves to aid in loading the same ito the intake of the centrifugal dredging pump, in addition to the suction loading action of the centrifugal dredging pump. It is preferred to drive the rotary cutter at about 40 to 60 R. P. M., when it is used in connection with the centrifugal dredging pump.

In the event that extremely hard digging should be encountered, such as rock, I contemplate removing my improved rotary cutter and substituting therefor the conventional open rotary cutter employed for this work. When the conventional rotary cutter is used with my hood 11, the volute passage 15 would then reduce entrance losses, to some degree.

While I prefer using my hood and rotary cutter as a low pressure pump in connection with the centrifugal dredging pump, for aiding in loading the same, yet I contemplate dispensing with the centrifugal dredging pump. When this is done, the rotary cutter would be driven at a high speed and would be relied upon to force or feed the water and solid material suspended therein through the pipe line.

It is to be understood that the form of my invention herewith shown and described is to be taken as a preferred example of the same, and that various changes in the shape, size and arrangement of parts may be resorted to without departing from the spirit of my invention or the scope of the subjoined claims.

Having thus described my invention, what I claim is:

1. In hydraulic dredging apparatus, a low pressure combined pump and rotary cutter to aid in loading water and solid material in suspension therein to the intake of a centrifugal dredging pump in addition to the suction loading action of the centrifugal dredging pump, said low pressure combined pump and rotary cutter including a rotary cutter element to loosen the solid material and feed the water and solid material in suspension therein axially of the rotary cutter element, and a part having a spiral passage to receive the water and solid material in suspension therein from the rotary cutter element.

2. In hydraulic dredging apparatus, a low pressure combined pump and rotary cutter to aid in loading water and solid material in suspension therein to the intake of a centrifugal dredging pump in addition to the suction loading action of the centrifugal dredging pump, said low pressure combined pump and rotary cutter including a rotary cutter element having a closed hub and spiral blades carried by the hub and extending generally radially continuously from the hub to their outer edges and providing spiral passages between the blades, the blades serving to loosen the solid material, and means forming a spiral passage to receive the water and solid material in suspension therein from the rotary cutter element.

3. In hydraulic dredging apparatus, a hood having an end provided with a spiral passage in communication with the intake of a centrifugal dredging pump, and a rotary cutter having one end operating within the hood near the spiral passage, the rotary cutter including a closed hub and generally radial volute imperforate blades, said blades being circumferentially spaced to form separate passages between them, the hood and rotary cutter serving as a low pressure pump to aid in loading water and solid material in suspension therein to the intake of the centrifugal dredging pump in addition to the suction loading action of the centrifugal dredging pump, and means to drive the rotary cutter.

4. In hydraulic dredging apparatus, a hood having its forward end open and including a head covering its rear end, said head having an abutment and a spiral passage, said volute passage starting upon one side of the abutment and extending substantially to the opposite side of the abutment, a pipe connected with the outlet end of the spiral passage and having connection with the intake of a centrifugal dredging pump, and a rotary cutter associated with the hood, said rotary cutter including a closed hub and generally radial blades carried by and extending longitudinally of the hub, said blades extending continuously from the hub to their outer edges to form separate passages, said blades extending longitudinally of the hub and being spiral and transversely curved, the blades extending into the hood and terminating in close relation to the head, the hood and rotary cutter serving as a low pressure pump to aid in loading the water and solid material in suspension therein to the intake of the centrifugal dredging pump in addition to the suction loading action of the centrifugal dredging pump, and means to drive the rotary cutter.

CHARLES K. LITTLE.