Dec. 21, 1926. 1,611,478

G. B. MASSEY

HYDRAULIC DREDGING DEVICE

Filed July 18, 1923 2 Sheets-Sheet 1

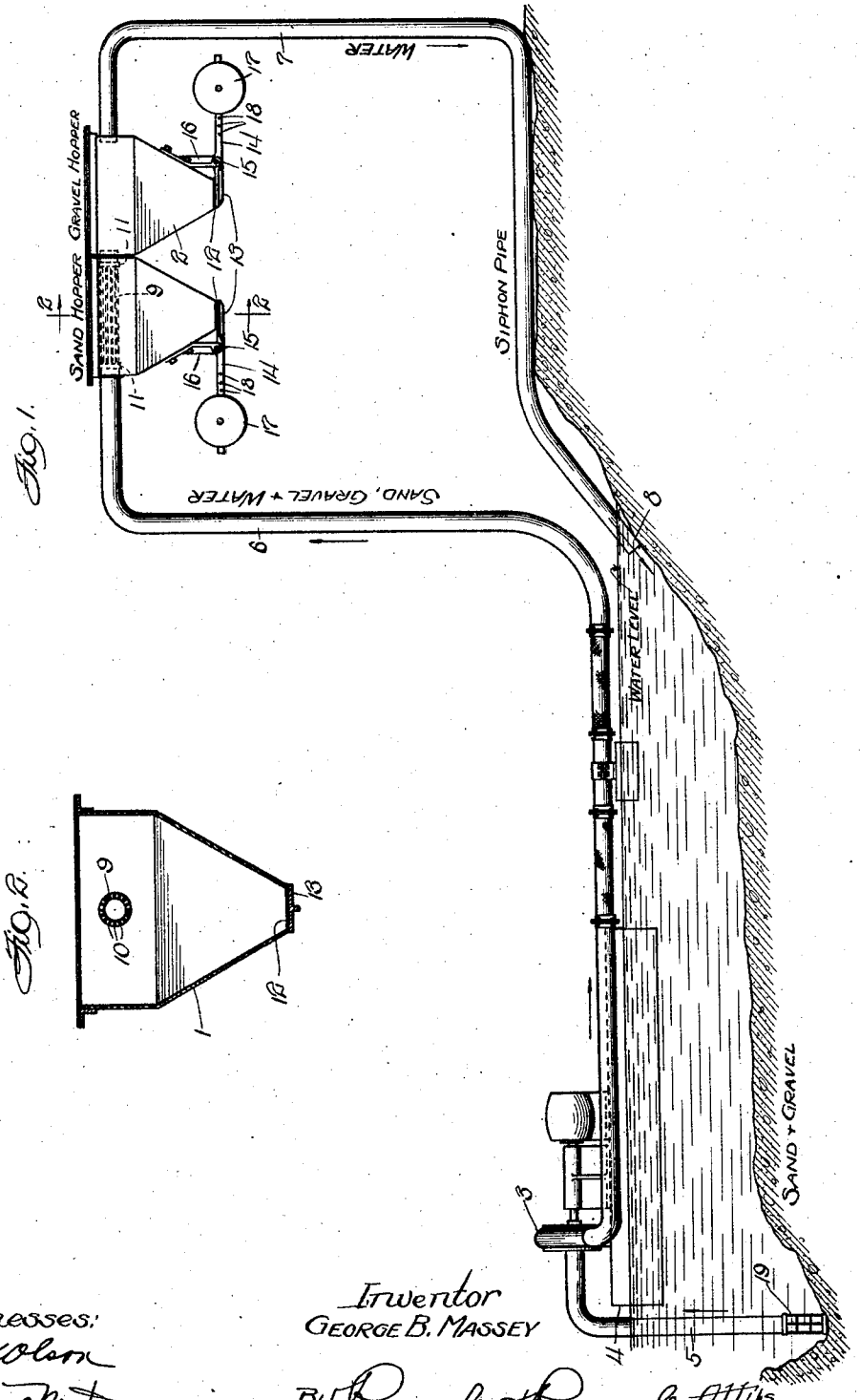


Fig. 1.

Fig. 2.

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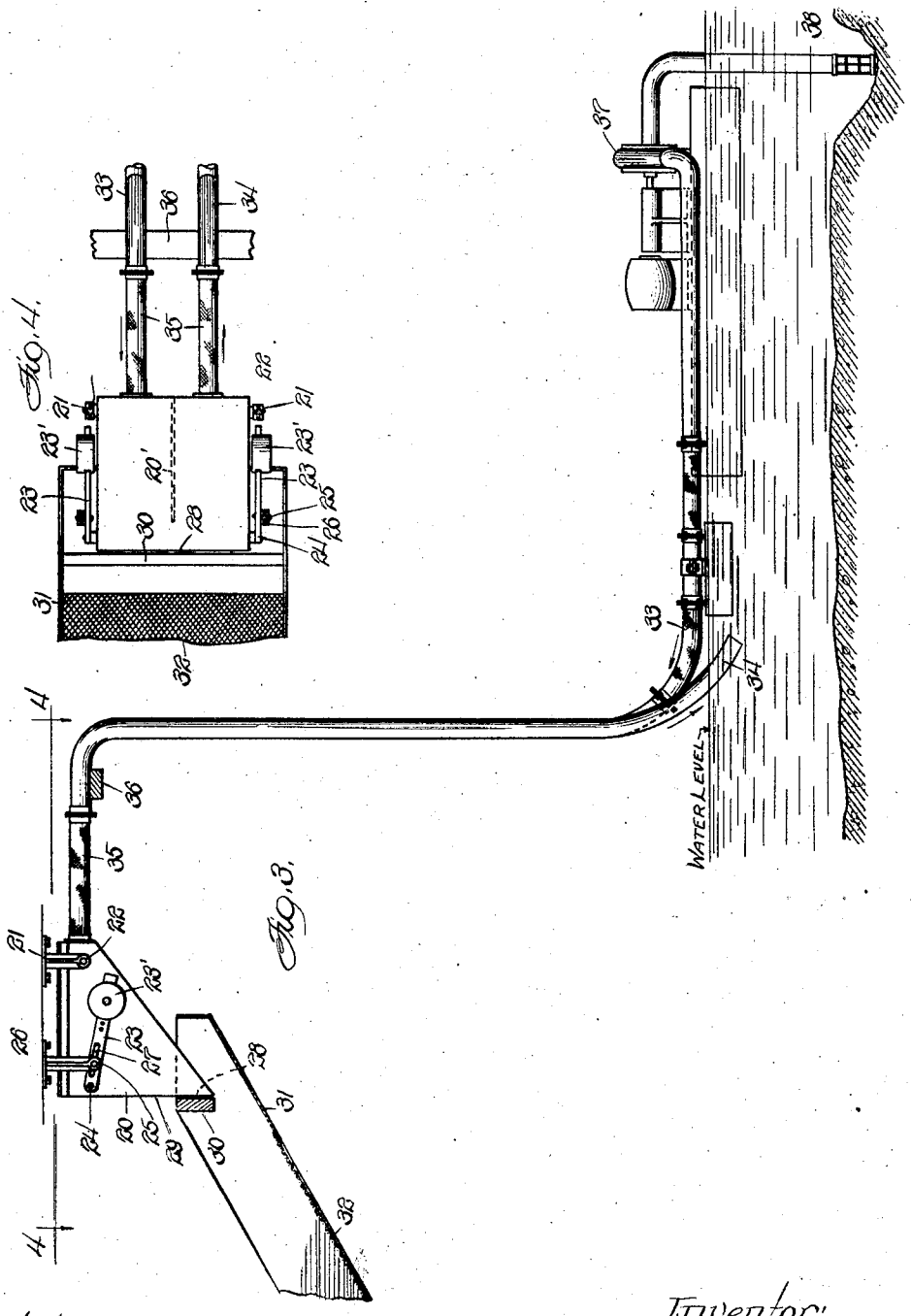


Fig. 4.

Fig. 3.

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Patented Dec. 21, 1926. 1,611,478

UNITED STATES PATENT OFFICE.

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HYDRAULIC DREDGING DEVICE.

Application filed July 18, 1923. Serial No. 652,379.

This invention relates to hydraulic suction dredges, and especially to devices of this character adapted for separating different grades of material excavated, as sometimes required, especially when such materials are to be used for commercial purposes.

In the hydraulic transportation of solids in pipes it is usual, in addition to lateral motion, to give the solids vertical translation. Thus, in pumping sand from a sand pit up to the separators in a screen house, a considerable static head has to be overcome. Usually the sand is deposited in open hoppers over the screens and the water runs away.

Incident to my invention, I make the hoppers air tight, except for the discharge valve at the bottom, and I arrange to carry the water back to the source in the pit through an air tight pipe, which will greatly reduce the static head at a slight increase of friction head. In other words, I provide a siphon which deposits at the highest point the sand and such material carried up from the discharge of the rotary pump. The two columns of water balance each other and the work done consists in overcoming the friction in the pipes due to the velocity, and in lifting the solids. The sand valve at the bottom of the hopper is arranged so as to open when the depth and weight of sand has reached a certain amount and to close when a certain part of the sand has been released. Or a screw or other conveyor can be used of sufficient length to make a practically air-tight stop and discharge sand from the hopper at a fixed rate. The effect of any appreciable leakage at the valve is to draw in air which displaces the water in the sand near the opening and tends to dry out the sand to some extent which is desirable for screening. Moreover the stream of water running away from the hopper through the air-tight pipe will tend to carry off in suspension clay and sticks, which also is desirable.

The main objects of this invention are to minimize or eliminate a static head against the pump or other elevator; to provide a more efficient combination and arrangement of parts or members; to provide a dredge and hopper system adapted to operate in a large measure siphonically and automatically; to provide in a siphonic dredge system means in the supply pipe between the dredge and hopper for urging the water and material forwardly and upwardly into the hopper, and a downwardly extending overflow pipe adapted and arranged to serve continuously as a suction member to reduce the work required of the pump; and to provide a plurality of hoppers and equipment therefor adapted for automatic operation to separate and collect the several size grades of material handled.

An illustrative two hopper embodiment of this invention is shown on the first sheet of drawings, and another embodiment is shown on the second sheet of drawings.

Figure 1 is a diagrammatic elevation view of a multiple hopper separating system with a tilting valve mechanism for each hopper.

Fig. 2 is a section on the line 2—2 of Fig. 1.

Fig. 3 is a diagrammatic view showing a tilting hopper and means for screening the material discharged from the hopper.

Fig. 4 is a plan of the hopper on the line 4—4 of Fig. 3.

In the construction shown by Figs. 1 and 2, the hoppers 1 and 2 are mounted on the shore, where they are supported in an elevated position, by a framework, not shown, so as to permit dumping into bins, cars or trucks, as will be understood. The elevator unit 3, in the form of an electric motor driven centrifugal pump, is mounted on a scow 4 which may be anchored over the area to be dredged. A suction pipe 5 extends from the pump down to the material to be dredged, a force pipe 6 extends up to the first hopper 1, and a siphon pipe 7 extends from the last hopper 2 down and back to the level of the water, the discharge end 8 being submerged somewhat to prevent possible admission of air and to assure full maximum effect of the siphon.

The hoppers, two or more, are arranged side by side and are connected by a passageway for the material and water. In order that the coarse materials may be carried over from the first hopper to the next, a screening conduit 9 extends from pipe 6 through hopper 1 over to hopper 2. This conduit lets the sand escape into hopper 1, but all gravel is carried over to hopper 2. The sifting member 9 comprises a cylindrical arrangement of longitudinally disposed horizontal bars 10, the ends of which are set in rings 11 secured to the hopper.

The material discharge port 12 of each hopper is normally closed by a valve closure

13, each having a long leverage arm 14 pivoted at 15 medially, near the valve plate, to a bracket 16 fixed on the hopper. On the opposite end of each arm 14 is a weight 17 which is slidably adjustable along the length of said arm, as indicated at 18, to control the closure of said valve, according to the amount of solid material collected in the corresponding hopper.

In operation the hoppers remain closed until material collects, sand in hopper 1 and gravel in hopper 2, sufficient to trip the valve against the opposition of the counter weight 17. The collected material, or a substantial part of it, then rushes out and releases the pressure on the valve which is then quickly restored by weight 17. Although some air, more or less, rushes in at 12 during the hopper discharge, the effect is inappreciable, and the little air admitted escapes with the water through pipe 7.

It is to be noted that the operation is continuously automatic and normally requires no attention more than to see that the suction feed nozzle 19 is kept in due dredging position, as may be accomplished with a derrick or the like, not shown, as will be understood.

Referring to the tilting hopper construction shown by Figs. 3 and 4, the hopper 20 is supported adjacent to the top by a pair of fixed brackets 21 having pivots 22 near the back edge of the hopper, and a pair of levers 23 secured to pivots 24 near the front edge. Said levers are fulcrumed medially, as at 25, on brackets 26 and are provided with adjustable weights 23′. Said levers are slotted as at 27 to accommodate the necessary play for pivots 25. The hopper has a port 28 in the lower part of its vertical face 29, which port is normally closed by the stationary bar 30, and opened by the downward and rearward tilting of the hopper in dumping. The inclined chute 31 having a screen bottom at 32, receives the mixed material collected by hopper 20 and separates it according to the mesh of screen 32. In this instance the water inlet and outlet pipes 33 and 34 are both connected through the back side of hopper 20 near the top. A partition 20′ extends a short distance between the inlet and outlet regions to assure sufficient opportunity for the sand and gravel to settle from the current of water before it enters pipe 34. In order to accommodate free tilting of the hopper the pipe connections include flexible sections 35, as for instance, rubber hose, disposed side by side, a support being provided at 36 for the adjacent ends of the pipes 33 and 34. Pipe 33 is connected to a pump 37 and an intake nozzle 38, as in Fig. 1, and pipe 34 terminates under water.

In operation the hopper 20 is held against the port closure bar 30 by means of the lever 23 and weight 23′. But when sufficient material collects in said hopper it swings back, toward the right in Fig. 3, and so opens the discharge port 28. As soon as the load in hopper 20 is sufficiently diminished the hopper, urged by weights 23′, swings back against bar 30 and closes the port 28.

In both instances, as will be seen, the hoppers are self emptying by gravity, the siphonic effect is inappreciably affected by the hopper action, and the control is automatic, and substantially continuous.

I have shown and described several specific embodiments of apparatus and connections thereof for carrying out my invention herein set forth, but it is to be understood that numerous details of the constructions and connections shown may be altered or omitted without departing from the spirit of this invention as defined by the following claims:

I claim—

1. An automatic dredging and separating device of the character described comprising in combination a plurality of material collecting hoppers connected in series, an inlet pipe through which water and dredged material carried thereby may be elevated and discharged into the first hopper, and a downwardly extending suction outlet pipe connected to the last hopper for the water to discharge through, said hoppers having material discharge ports with closure means therefor, and screening means arranged substantially as an extension of the inlet pipe extending through the first hopper, and said hoppers, pipes and connections therefor normally being substantially air tight, so that in operation said pipes may function siphonically.

2. An automatic dredge device of the character described comprising in combination a plurality of settling hoppers connected in series hydraulic relation for sorting the material, an inlet pipe through which water and dredged material may be fed into the first hopper, perforate sifting means extending through the first hopper for carrying over the coarser material to the next hopper, and a downwardly extending outlet return pipe for the water, said hoppers and their connections normally being closed substantially air tight, so that in operation said pipes may function siphonically.

3. An automatic dredging and separating device of the character described comprising in combination a plurality of material collecting hoppers connected in series, an inlet pipe through which water and dredged material carried thereby may be elevated and discharged into or through the first hopper, depending on the texture of the material, and a downwardly extending suction outlet pipe connected to the last hopper for the

water to discharge through, said hoppers having material discharge ports with normally shut gravity operated closure means therefor, and screening means arranged substantially as an extension of the inlet pipe extending through the first hopper, and said hoppers, pipes and connections therefor normally being substantially air tight, so that in operation said pipes may function siphonically.

4. An automatic dredge device of the character described comprising in combination a plurality of gravity emptying settling hoppers connected in series hydraulic relation for sorting the material, an inlet pipe through which water and dredged material may be fed into the first hopper, perforate sifting means extending through the first hopper for carrying over the coarser material to the next hopper, and a downwardly extending outlet return pipe for the water, said hoppers and their connections normally being closed substantially air tight, so that in operation said pipes may function siphonically, said hoppers having in their lower parts each an outlet for the dredged and sorted materials, and mutually independent closure means for said outlets, which closure means are so mutually related to said hoppers as to keep out excessive air and so maintain a sufficient vacuum to render the siphonic action continuously effective.

Signed at Chicago this 16th day of July, 1923.

GEORGE B. MASSEY.