Sept. 25, 1956 C. G. MADGWICK, SR 2,763,940

STATIONARY SAND DREDGER

Filed Jan. 26, 1953

6 Sheets-Sheet 1

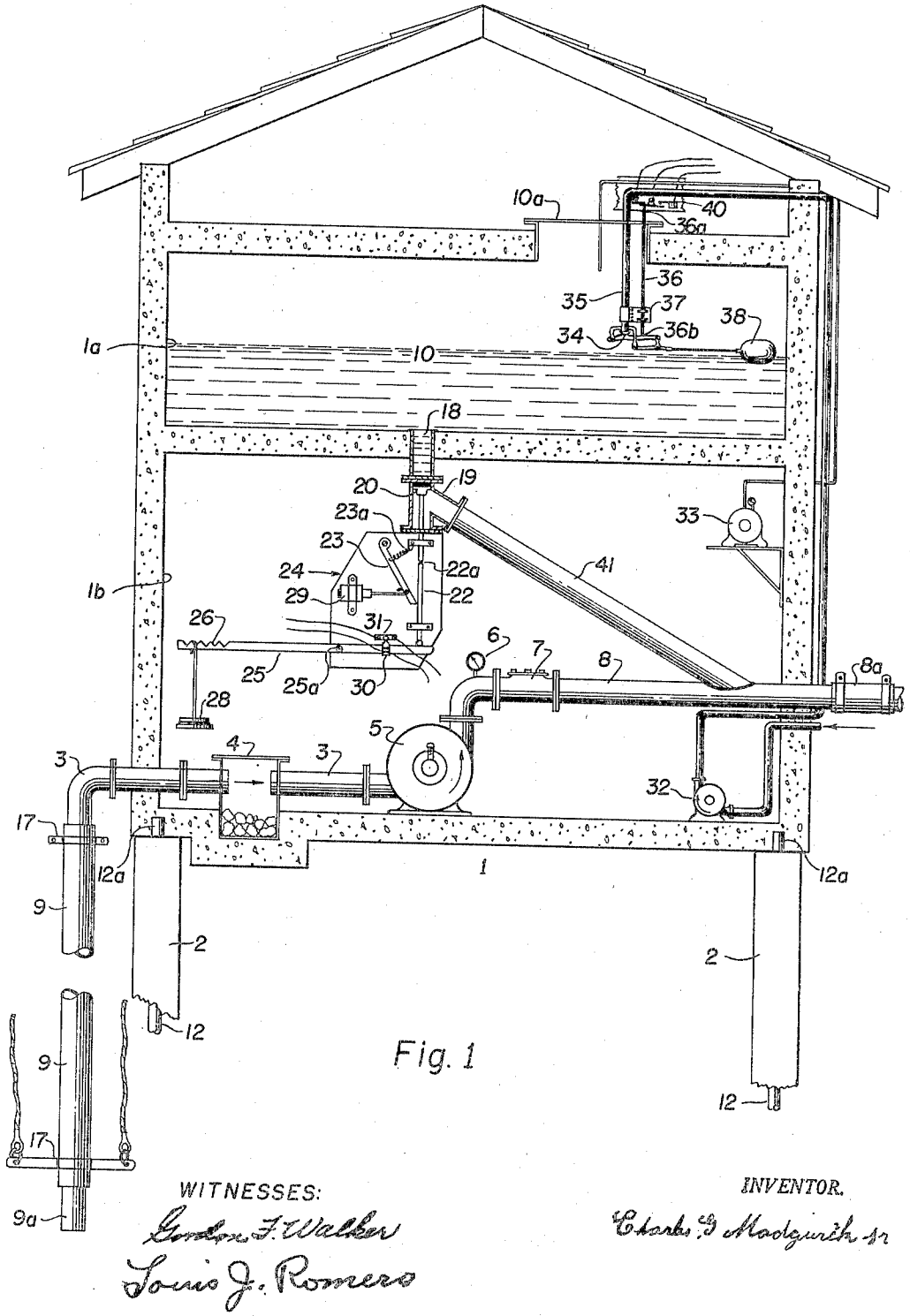


Fig. 1

WITNESSES:

Gordon F. Walker

Louis J. Romero

INVENTOR.

Clarke G. Madgwick Sr

Sept. 25, 1956 C. G. MADGWICK, SR 2,763,940

STATIONARY SAND DREDGER

Filed Jan. 26, 1953 6 Sheets-Sheet 2

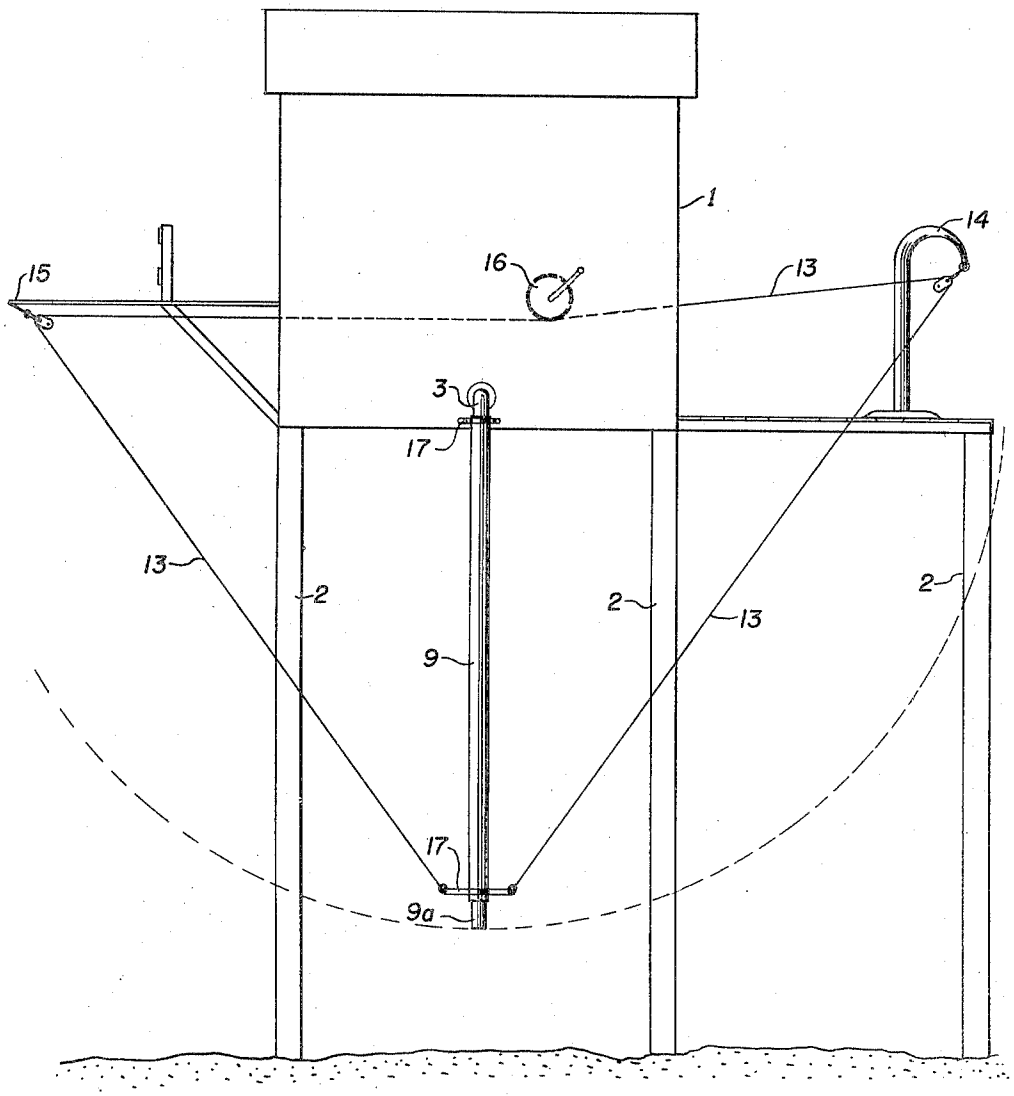


Fig. 2

WITNESSES:
Gordon F. Walker
Louis J. Romero

INVENTOR.
Charles G. Madgwick Sr.

Sept. 25, 1956 C. G. MADGWICK, SR 2,763,940

STATIONARY SAND DREDGER

Filed Jan. 26, 1953 6 Sheets-Sheet 3

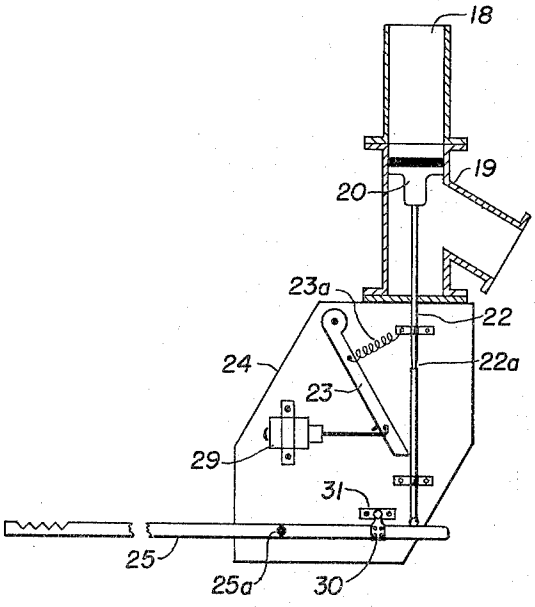


Fig. 3

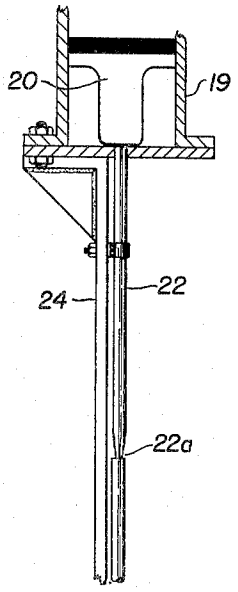


Fig. 5

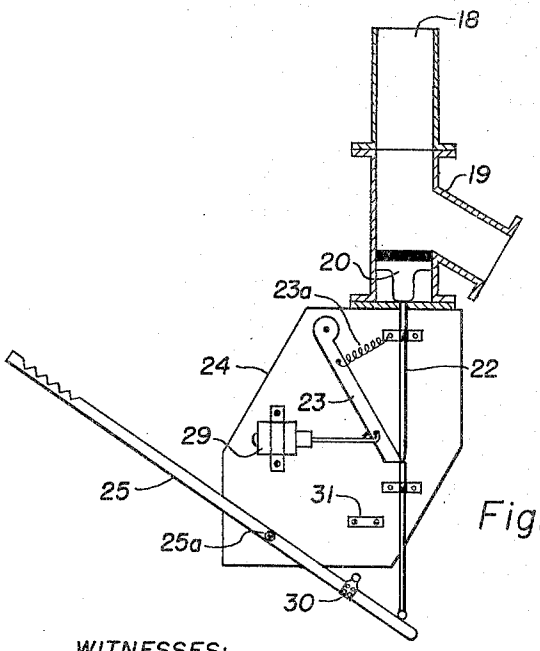


Fig. 4

WITNESSES:

Gordon F. Walker

Louis J. Romero

INVENTOR.

Charles G. Madgwick Sr.

Sept. 25, 1956 C. G. MADGWICK, SR 2,763,940

STATIONARY SAND DREDGER

Filed Jan. 26, 1953 6 Sheets-Sheet 4

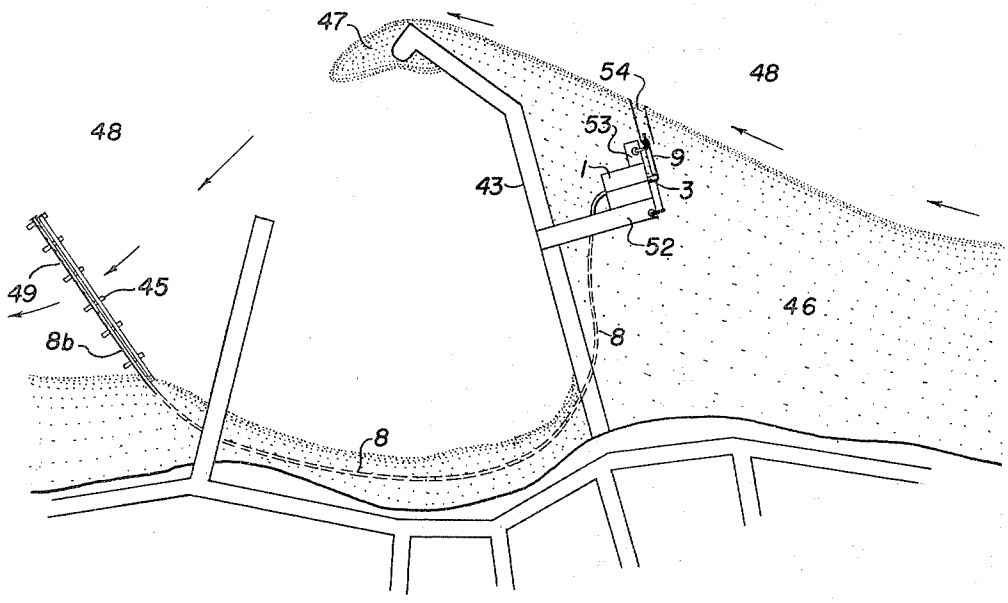


Fig. 6

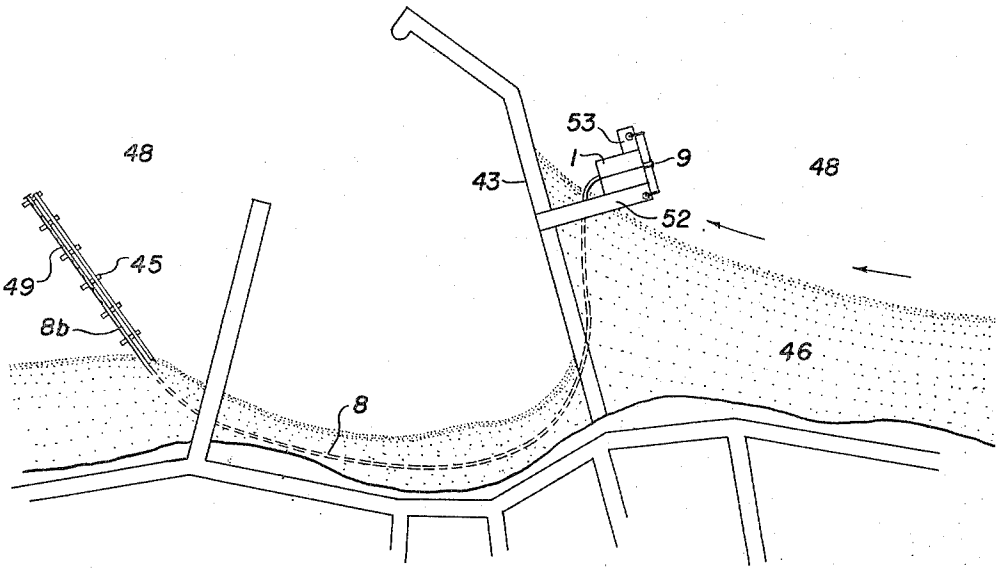


Fig. 7

WITNESSES:
Gordon T. Walker
Louis J. Romero

INVENTOR.
Charles G. Madgwick Sr

Sept. 25, 1956 C. G. MADGWICK, SR 2,763,940

STATIONARY SAND DREDGER

Filed Jan. 26, 1953 6 Sheets-Sheet 5

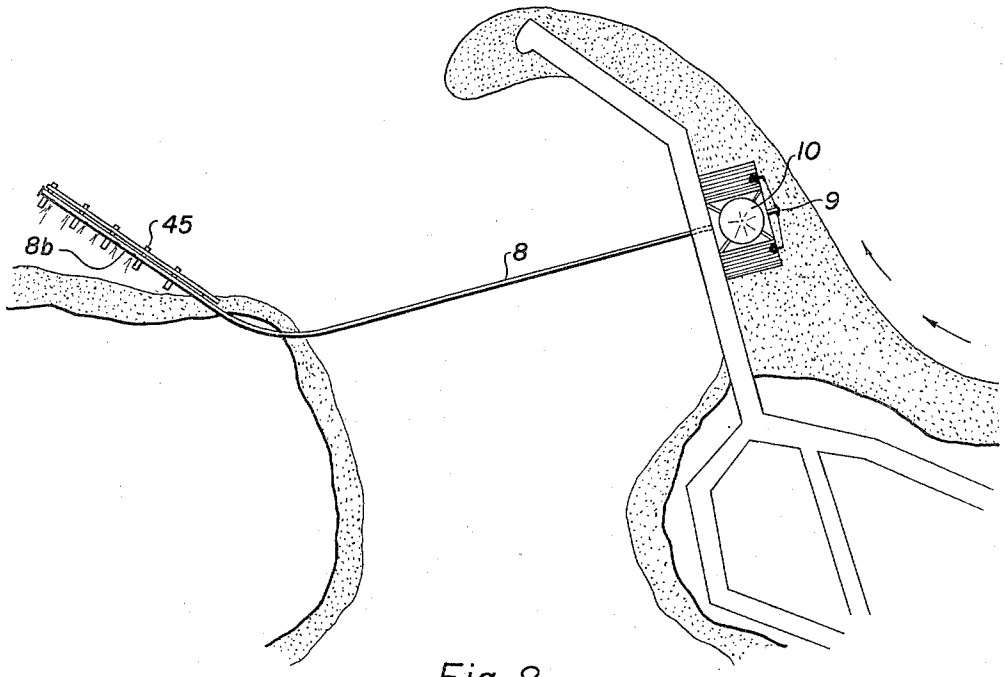


Fig. 8

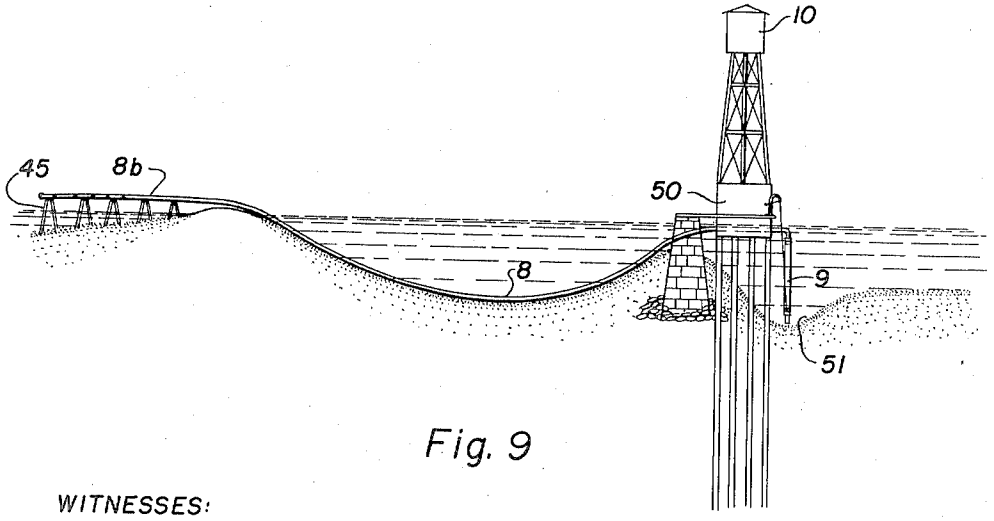


Fig. 9

WITNESSES:

Gordon F. Walker

Louis J. Romero

INVENTOR.

Charles G. Madgwick Sr.

Sept. 25, 1956 C. G. MADGWICK, SR 2,763,940

STATIONARY SAND DREDGER

Filed Jan. 26, 1953 6 Sheets-Sheet 6

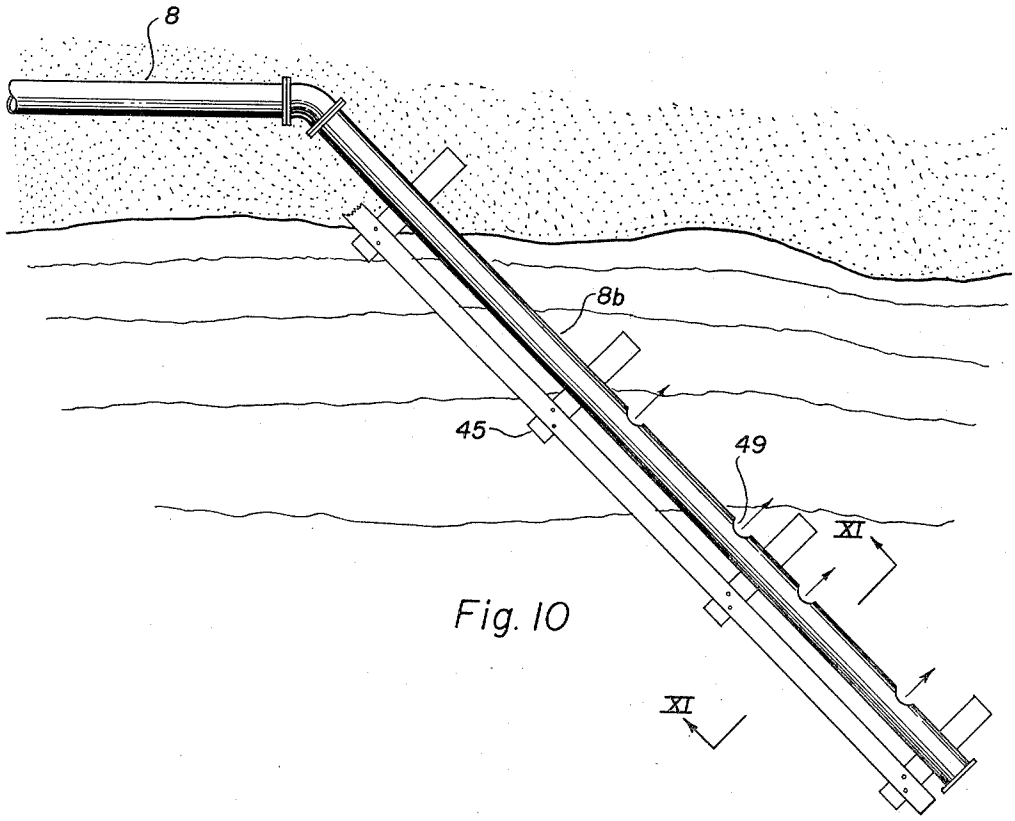


Fig. 10

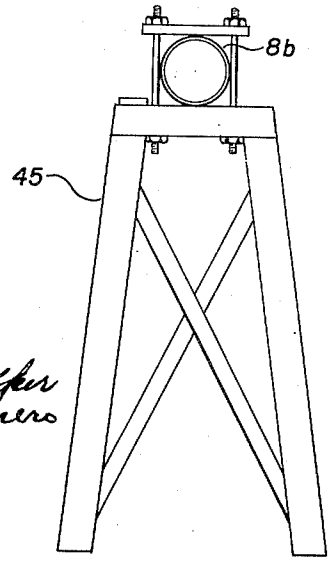


Fig. 11

WITNESSES:

Gordon F. Walker

Louis J. Romero

INVENTOR.

Charles G. Madgwick Sr

United States Patent Office

2,763,940

Patented Sept. 25, 1956

2,763,940

STATIONARY SAND DREDGER

Charles George Madgwick, Sr., Santa Barbara, Calif.

Application January 26, 1953, Serial No. 333,224

10 Claims. (Cl. 37—58)

This invention relates to improvements in stationary harbor dredges of the suction type used for preventing accumulations of sand and detritus at or in harbor or other entrances.

One object and feature of novelty of my invention is that it provides an overhead tank or reservoir of clear water under air pressure which is automatically released to completely flush out the discharge pipe of the dredging system the moment the main dredge pump fails to function for any reason. This action is accomplished through a pressure operated release valve of my own design which is further described and listed among the claims herein.

One of the well-known disadvantages of stationary harbor dredges, as well as other types, is the fact that whenever the main dredge pump fails to function the sand and detritus in the discharge pipe settle in the pipe and plug it so tightly that it often becomes necessary to remove sections of the pipe and clear it before operations can be resumed. My invention eliminates this disadvantage by completely flushing out the discharge pipe the moment the main pump fails to function. This action is completely automatic and does not require the presence of an attendant.

Another novelty of my invention is that it provides a flexible suction or intake hose which may be set to any predetermined depth or moved laterally in an arc. This flexibility provides a wide lateral coverage in the immediate vicinity of the unit housing the main dredge pump. A special feature of this intake hose is that it embodies no moveable mechanical joints that sometimes cause a loss of suction in the intake pipe resulting in pump failure.

Another novelty of my invention is that it provides an outlet at the end of the discharge pipe which is designed in such a manner as to take full advantage of natural wave action (littoral drift) and littoral current to help distribute the sand and detritus discharged so that it does not pile up at the end of the discharge pipe.

Other objects and features of novelty of my invention will become apparent from the following description taken in conjunction with the accompanying drawings in which:

Fig. 1 is a sectional side view of a reinforced concrete building showing in detail a conventional dredging system and embodying my invention of an overhead tank or reservoir of clean water connected through an automatic pressure operated release valve to the discharge pipe of the main system.

Fig. 2 is a front elevation view of the building shown in Fig. 1 showing the flexible intake hose and means for its controlled movement.

Fig. 3 is a detailed sectional view of the pressure operated release valve which releases the water from the overhead reservoir into the discharge pipe of the dredging system showing the valve in a closed position.

Fig. 4 is another view of Fig. 3 showing the valve in an open position.

Fig. 5 is an exaggerated sectional side view of the valve

showing how the panel carrying the mechanism for operating the valve is positioned below the main valve housing.

Fig. 6 is a plan view of a typical harbor protected by a breakwater which has backed up sand and detritus until a harbor bar is forming at the end of the breakwater threatening to block the harbor channel. This drawing shows the position in which I would construct a dredging system embodying my inventions.

Fig. 7 is a view of the same harbor shown in Fig. 6 and showing the results of having installed a stationary dredging system embodying my inventions in the position shown.

Fig. 8 is a plan view of the entrance to an open harbor, lagoon, river, etc., showing a stationary dredging system embodying a variation of my invention installed at the entrance.

Fig. 9 is an elevation view of Fig. 8 showing the overhead reservoir raised in a tank tower, and showing how the discharge pipe may be laid under the entrance to the harbor.

Fig. 10 is an enlarged plan view of the end section of the discharge pipe showing the approximate relation between this end section and the foreshore.

Fig. 11 is an enlarged sectional view of Fig. 10 taken along the line XI—XI and showing the jetty on which the end section of the discharge pipe is supported.

Referring to Figs. 1 and 2, I prefer for the embodiment of my invention a reinforced concrete building 1 set on concrete pilings. These pilings 2 to have a pipe 12 running longitudinally through the center of the pile. The pipe may extend a sufficient distance above the concrete of the pile to form a secure dowell into the base of the building 1. However, the main purpose of this pipe through the pile is to provide a means for jetting the pile into position through deep sand. The building 1 is divided into two sections, the upper section 1*a* to be or to house a water tank or reservoir for clear water 10 with provisions to pressurize the tank; the lower section 1*b* to house machinery and pumps. This building 1 may be constructed in such a manner as to conform with the type of architecture most predominant in the area in which it is to be built.

Referring now to Fig. 1, contained in the lower or machinery section 1*b* of the building is a conventional hydraulic suction or dredge pump 5, having an inlet pipe 3 extending through the front of the building, and a discharge pipe 8 extending through the rear of the building and continuing through a flexible coupling 8*a* to a point of discharge. The pump 5, hereinafter referred to as the "main pump" may be powered by electricity, diesel, gasoline, or other available power.

Connected with the inlet pipe 3, and outside of the building 1, is a suction hose 9, which is flexible throughout its middle portion and arranged so that its head or suction mouth 9*a* may be moved transversely in an arc. This action may be accomplished, as shown in Fig. 2, by a continuous cable 13 attached to the suction hose 9 at or near its head or mouth 9*a* and passing through davits 14 or outriggers 15 and thence to and around a winding drum 16 housed within the building 1. By rotating the winding drum 16 the suction hose 9 may be raised to a horizontal position or moved so as to pick up more or less sand during operations. The suction hose 9, being fastened to the inlet pipe 3 by clamps 17 embodies no mechanical moving joints which have a tendency to become worn and allow air to enter the suction pipe causing failure of the main pump.

Referring again to Fig. 1, there may be a trap or "rock-box" 4 built into the inlet pipe 3 so as to catch any large rocks or other objects picked up by the suction hose 9 that would damage the main pump 5. This trap is conventional in all dredging systems and form no part of this invention.

Located above the pump on the discharge pipe 8 is a pressure gauge 6 which indicates the head of pressure built up in the discharge pipe when the main pump 5 is in operation.

In the bottom of the overhead tank or reservoir 10 is an orifice 18, flanged at its lower end to fit a casting or valve housing 19 carrying a mushroom type valve 20 with gasket face pointing upwards and seating at the top of the valve housing. The valve 20 is provided with a valve stem 22 of sufficient length to extend downward through the bottom of the valve housing 19 and has a groove or notch 22*a* therein, which may be engaged by a pawl 23 when the valve 20 is in an open position. The lower end of the valve stem 22 passes through valve guides mounted on a positioned panel or plate 24 and rests on the short end of a lever bar 25, which is suspended at a fulcrum point 25*a* on the panel 24. The long end of this lever bar is notched at 26 typical of old style scales so that counterbalance weights 28 may be suspended from it exerting any desired amount of pressure on the valve stem 22.

Mounted on the short end of the lever bar 25, between the fulcrum 25*a* and the valve stem 22, is one half of a sliding bar switch or circuit breaker 30. The other half of the circuit breaker 31 is mounted in a stationary position on the panel 24 and so located on the panel 24 as to make an electrical contact when the valve 20 is in a closed position. This switch or circuit-breaker, when in contact, closes an electrical circuit to a starter box trip switch on the main pump motor; closes an electrical circuit to the motor of the secondary pump 32; and closes a circuit to the air compressor 33.

Attached to the panel 24 is a pawl 23 and a conventional solenoid starter switch 29 which releases the pawl 23 from the notch 22*a* in the valve stem 22 allowing the valve 20 to be closed. Attached to the pawl may be a tension spring 23*a* to insure that the pawl 23 will engage the notch 22*a* when the valve 20 is open.

Located at any convenient place within the lower or machine section 1*b* of the building 1 may be a conventional air compressor of a type similar to those used in service stations. This compressor is to be wired through the circuit breaker 30 and 31, and also through the starter box trip switch on the main pump motor in such a manner that the compressor will not operate unless the valve 20 is in a closed position and the main pump 5 is running. When in operation, this compressor can be adjusted to maintain an even pressure of a predetermined amount over the water in the overhead tank or reservoir 10.

The overhead tank or reservoir 10 should hold a volume of clear water equal to at least twice the volume of the entire length of the discharge pipe of the system to insure an adequate flushing out of the discharge pipe. This volume may be controlled by a conventional float valve 34 at the end of the clear water inlet pipe 35 to the tank 10. This float action may also operate a hydraulic actuator 36 attached to the clear water inlet pipe 35 on a bracket 37 and extending upwards through the top 10*a* of the overhead tank 10 to a conventional two way "make and break" switch 40.

When the water in the overhead tank or reservoir 10 has reached the desired level the float 38 is raised by the water to the position shown in Fig. 1. With the float 38 in this position, the float mechanism makes contact with the lower end of the hydraulic actuator 36*b* forcing the top end of the actuator 36*a* upwards making contact with the switch 40. This contact closes an electrical circuit to the air compressor 33, and opens an electrical circuit to the motor of the secondary pump 32 shutting off the pump 32 and stopping the flow of water to the overhead tank 10. The circuit leading from the hydraulic actuated switch 40 to the air compressor 33 must pass through the starter box trip switch on the main pump motor so that the compressor will not start to

operate until the main pump 5 is put into operation. When the overhead tank 10 is empty or the water drops below the desired level, the float 38 drops downward breaking contact with the lower end of the hydraulic actuator 36*b* causing the switch 40 to open the circuit to the air compressor 33 shutting off the compressor, and closes the circuit to the secondary pump. As long as the valve 20 is closed the secondary pump 32 will bring the water in the overhead tank 10 to the desired level.

When in operation this dredging system will operate in the following manner:

Assuming that the volume of water to be retained in the overhead tank 10 has been predetermined, the tank is empty, and the valve 20 is in an open position as shown in Fig. 4—

First, sufficient counterbalance weights 28 are suspended from the long end of the lever bar 25 to overcome the weight of the water to be pumped into the overhead tank 10. Then by operating the solenoid starter switch 29 on the control panel 24, the pawl 23 is released from the notch 22*a* in the valve stem 22 allowing the valve 20 to close due to the weight suspended from the long end of the lever bar 25. When the valve 20 has seated itself in a closed position as shown in Figs. 1 and 3, the circuit-breaker 30 and 31 closes electrical circuits to the starter box trip switch on the main pump motor, to the motor of the secondary pump, and to the air compressor. Neither the main pump 5 nor the air compressor 33 will start until the starter switch to the main pump motor is operated. The overhead tank 10 being empty, the secondary pump will start automatically as soon as the circuit breaker 30 and 31 makes contact. When the overhead tank 10 is filled to the desired capacity, the float 38 rises and the float mechanism makes contact with the lower end of the hydraulic actuator 36*b* causing the switch 40 to open the electrical circuit to the secondary pump thereby stopping the pump 32. By opening the circuit to the secondary pump 32, the switch 40 closes the circuit to the air compressor, which will not operate until the main pump 5 is started. Now, assuming that the head of pressure that will be exerted in the discharge pipe when the main pump is in operation in clear water is known to be forty-five pounds (45#), this same pressure will be exerted upwards on the bottom, lower side of the valve 20 through the pipe 41 from the discharge pipe 8. If the combined pressure of the weight of the water and the air pressure maintained in the overhead tank 10 is to be sixty-five pounds, counterweights 28 must be added to the long end of the lever bar 26 to bring the pressure exerted by these counterbalance weights on the valve stem 22 to slightly over twenty pounds. The main pump 5 may now be put in operation with the suction hose mouth 9*a* in clear water. This also starts the compressor, which starts to bring the pressure in the overhead tank 10 to sixty-five pounds (65#). The pressure head now built up in the discharge pipe being forty-five pounds (45#) indicated on the gauge 6, forty-five pounds (45#) is also exerted on the bottom lower side of the valve 20. This forty-five pounds pressure added to the twenty pounds plus exerted upwards on the valve stem by the counterbalance weights 28 is equal to slightly more than the pressure of sixty-five pounds (65#) exerted downward on the valve 20 from the overhead tank 10. The intake hose may now be lowered to start picking up sand. This will raise the pressure in the discharge pipe slightly, but this will merely give an added pressure on the bottom side of the valve 20 which will help keep the valve 20 seated tightly. The entire system is now in operation and is set to operate automatically. Automatically meaning without the presence of an operator. If for any reason the main pump 5 should now fail to function, the forty-five pounds of pressure exerted upwards on the under side of the valve 20 will be released. This leaves only slightly over twenty pounds pressure being exerted upwards on the

valve stem by the counterbalance weights **28**. The pressure in the overhead tank **10** being sixty-five pounds (65#) forces the valve **20** downwards. The notch in the valve stem **22***a* passes the end of the pawl, which engages the notch **22***a* holding the valve **20** in an open position. This allows the water in the overhead tank **10** to pass through the pipe **41** into and through the discharge pipe **8** completely flushing out the discharge pipe. There being a swing valve **7** in the discharge pipe **8** between the pump **5** and the junction of the discharge pipe **8** and the pipe **41**, the water from the overhead tank **10** will not back up into the main pump **5**. When the valve **20** is forced open as described above, the valve stem **22** forces the short end of the lever bar **25** downwards breaking the electrical contact of the circuit breaker **30** and **31** shutting off all power to the system. To restart the system, leave the counterbalance weights **28** in position and operate the solenoid starter switch **29** releasing the pawl from the notch **22***a* in the valve stem **22**. The valve **20** will now close and the circuit breaker will make contact restoring power to the system. The tank **10** will fill itself automatically and close the circuit at the switch **40** to the compressor **33**. When the overhead tank **10** is full the main pump **5** may be restarted.

The figures used in the above description are merely to show a proportion of weights and pressures that may be used and will not necessarily be the same for all installations.

Referring to Fig. 6 showing a typical harbor installation, in this drawing I have shown a harbor in which a breakwater **43** has already built up a bank of sand until a harbor bar **47** is forming at the outer end and threatening to close the harbor channel. I have shown the approximate location in which I would install a stationary dredging system embodying my invention. The building **1** such as that in Fig. 1 is constructed on the built up foreshore **46** approximately one hundred (100) feet shoreward from the corner or angle point of the breakwater and approximately seventy-five (75) feet away from the breakwater at right angles. The building should be so constructed that the base or floor of the building is below the level of the water in the bay or ocean **48** so that the intake pipe **3** will be under water when the dredge is in operation. This may best be seen in the elevation drawing, Fig. 9. A walkway or loading platform **52** to be constructed above sea level and to the top of the breakwater. A catwalk or platform **53** to be constructed on the opposite side of the building of sufficient length so as to provide access to the mouth **9***a* of the suction hose **9**. When the building has been constructed, a discharge pipe or conduit **8** may be installed to carry the sand and detritus by the most direct means along the shore or beach to a point on the foreshore clear of the "shadow" of the breakwater **43** and clear of the harbor where natural wave action and littoral currents may be had. (This section of the discharge pipe may be buried.) From this point on the foreshore, a jetty **45** is to be built out into the bay or ocean **48** at an angle of approximately forty-five degrees (45°) to the foreshore in the direction of the beach drift and littoral current. The top of this jetty is to be of sufficient height to carry the end section of the discharge pipe a safe distance above the waves allowing for storms. On top of the jetty the end section of the discharge pipe **8***b* is to be fastened securely in place as shown in Fig. 11. The sand and detritus carried through the discharge pipe **8** is discharged through the ports **49** in the end section **8***b* of the discharge pipe **8** in such manner as to spread the discharged matter into the waves so that the waves and littoral current will carry it on its way and it will not pile up at the discharge point. An intake hose **9** may now be attached to the inlet pipe **3** to the main dredge pump. This intake hose is laid along the sand in a nearly horizontal position as shown in Fig. 6. To begin operations a large ditch or canal **54** is to be dug through the sand to the bay or ocean during low water. At high water the dredge may be started in operation. As the intake hose makes a larger hole for itself in the sand it may gradually be lowered to a vertical position as shown in Fig. 9. The action of the waves and littoral current moving in the direction indicated by arrows in the drawing Fig. 6 will carry the sand and detritus to the suction mouth of the hose so that the sand may not pass the dredging system. This natural wave action and littoral current coupled with the washing action of the tides will gradually work away the sand between the dredge and the end of the breakwater and will gradually dissipate the harbor bar **47** until the end of the breakwater will be clear as shown in Fig. 7.

Referring now to Figs. 8 and 9 in which I have shown one variation of my invention in which the overhead reservoir **10** is raised in a tower over the main pump which is housed in the building **50**. The valve for releasing the water from the overhead tank **10** into the discharge pipe **8** is also housed in the building **50** as in the lower section **1***b* of the building pictured in Fig. 1. As shown in this drawing, it may become necessary to lay the discharge pipe **8** on the bottom of the harbor. By raising the clear water reservoir **10** above the building **50** in the manner shown in Fig. 9, a greater gravity pressure can be had to flush out the discharge pipe **8** and if necessary provisions may be made for further pressurizing the overhead tank **10**.

Referring to Fig. 9, it will be noted that when the dredging system is in operation the intake hose **9** is gradually lowered until it is in a vertical position. By leaving the intake hose **9** in this position a cone-shaped pit or trap **51** will be formed in the ocean bed under the mouth **9***a* of the intake hose **9**. The intake hose **9** may now be left in this position as the natural wave action and littoral current (indicated by arrows) will bring the sand to the trap **51**. To pick up more sand than is naturally accumulated in the trap **51** the intake hose may be moved to either side of the trap **51** where it will start to pick up a greater volume of sand from the sides of the trap. The only other time that it should be necessary to move the intake hose **9** would be in case of storms carrying a large volume of sand, or in case the system is shut down for any reason such as repairs. In the case of storms as mentioned above, it will probably become necessary to raise the intake hose **9** to prevent overloading the main pump. If the dredging system must be shut down for repairs for only a few hours, it will not be necessary to raise the intake hose **9**.

One of the decided advantages of this system embodying my inventions is that it can be installed at reasonable cost and operated at very small expense. One man can handle most normal operations of the system and he need not be present at all times because if the system fails to function for any reason, the power to all the operating mechanisms is shut off and the discharge pipe completely flushed out automatically. If desirable, an electrical circuit may be installed to the office of the harbor master which will automatically flash a light or other signal indicating that the dredging unit has ceased to operate.

Having described my invention with respect to a preferred embodiment, I do not limit myself to this embodiment, but claim all modifications and variations thereof that fall within the true spirit and scope of my invention.

I claim:

1. In a hydraulic dredger, a dredge inlet pipe, an outlet pipe, a pump connected to said inlet and outlet pipes, an airtight water tank, means for maintaining a supply of water in said tank, means for providing pressurized gas above the water in said tank, an outlet orifice in the base of said tank, a valve housing connected to said outlet orifice, a branch pipe connecting said valve housing and said outlet pipe, a pressure responsive valve

carried in said valve housing and closing said outlet orifice, means carried by said valve housing and operatively connected to said valve for maintaining said valve in closed position, said valve being operable on a drop in pressure in said outlet pipe to open and discharge water from said tank into said outlet pipe to flush out the latter.

2. In a hydraulic dredger, a dredger inlet pipe, an outlet pipe, a pump connected to aforesaid pipes, a closed water tank having an outlet orifice, means of maintaining a water supply in said tank, means for providing pressurized gas above the water in said tank, an outlet orifice in the base of said tank, a valve housing connected to said outlet orifice, a branch pipe connecting said valve housing and said pipe, a pressure responsive valve carried in said housing and closing said outlet orifice, said valve being vertically located, means carried by said valve housing and operatively connected to said valve for maintaining said valve in closed position, said valve being operative on a drop in pressure in said outlet pipe to open and discharge water from said tank into said outlet pipe to flush out the latter.

3. In a hydraulic dredger, an inlet pipe and an outlet pipe, a pump connected thereto, an airtight water reservoir having a basal outlet orifice, means for maintaining water in aforesaid reservoir, means for providing pressurized gas above the water in said reservoir, a valve housing connected to said outlet orifice, a branch pipe connecting said housing and said outlet pipe, a pressure responsive valve carried in said valve housing and closing said outlet orifice, said valve having a notched stem, means carried by said housing and operatively connected to said valve for maintaining said valve in closed position, said valve being operable on a drop in pressure in said outlet pipe to open and discharge the aforesaid water into said outlet pipe to flush out the latter.

4. In a hydraulic dredger, an inlet pipe and an outlet pipe, a pump connected to said pipes, a closed tank, an outlet orifice in the tank, means for maintaining a water supply in said tank, means for providing pressurized gas above the water supply, a valve housing connected to said outlet orifice, a branch pipe connecting said housing and said outlet pipe, a panel secured to said housing, a pressure responsive valve carried in said housing having a notched stem extending through said housing, latch means secured to said panel operatively engaging said stem for securing in an open position, means carried by said valve housing and operatively connected to said valve for maintaining said valve in closed position, said valve being operable on a drop in pressure in said outlet to open and discharge the water

from said tank into said outlet pipe to flush out the latter.

5. In a hydraulic dredger as in claim 1 the aforesaid valve housing having a panel secured thereto, said valve having a vertical stem extending outside said housing, a lever bar secured to said panel, one end of said lever contacting said stem, means for maintaining pressure upon the valve stem.

6. In a hydraulic dredger as in claim 1, the aforesaid housing having a panel secured thereto, said valve having a notched valve stem, a latch secured to said panel engageable in said notch, means to secure the valve in locked open position by said latch.

7. In a hydraulic dredger as set forth in claim 1, aforesaid valve having a stem extending vertically outside of said housing, a panel secured to said housing, a pivoted lever secured to said panel, an end of the said lever contacting the stem end, a movable weight supported on the opposite end of said lever, said weight being operable to give adjustable pressure upon said stem to position said valve in closed position.

8. An hydraulic dredger as set out in claim 4, a lever secured to aforesaid panel, an end of said lever pressing against said valve stem end, a movable weight supported by said lever, means affording adjustable pressure against the valve stem, the aforesaid valve when in open position affording free instantaneous discharge of the water in said tank.

9. In a hydraulic dredger as set out in claim 1; aforesaid water tank having an elevated tower supporting said tank.

10. In a hydraulic dredger as set out in claim 1, aforesaid valve housing a valve seat for the open valve position, said valve having a valve head and stem operable therein, aforesaid valve being operable on a drop in pressure whereby unobstructed flow of the pressurized water is attained.

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