Oct. 24, 1939. J. C. WILLIAMS 2,177,196

CLAMSHELL DREDGE

Filed Nov. 10, 1937 2 Sheets-Sheet 1

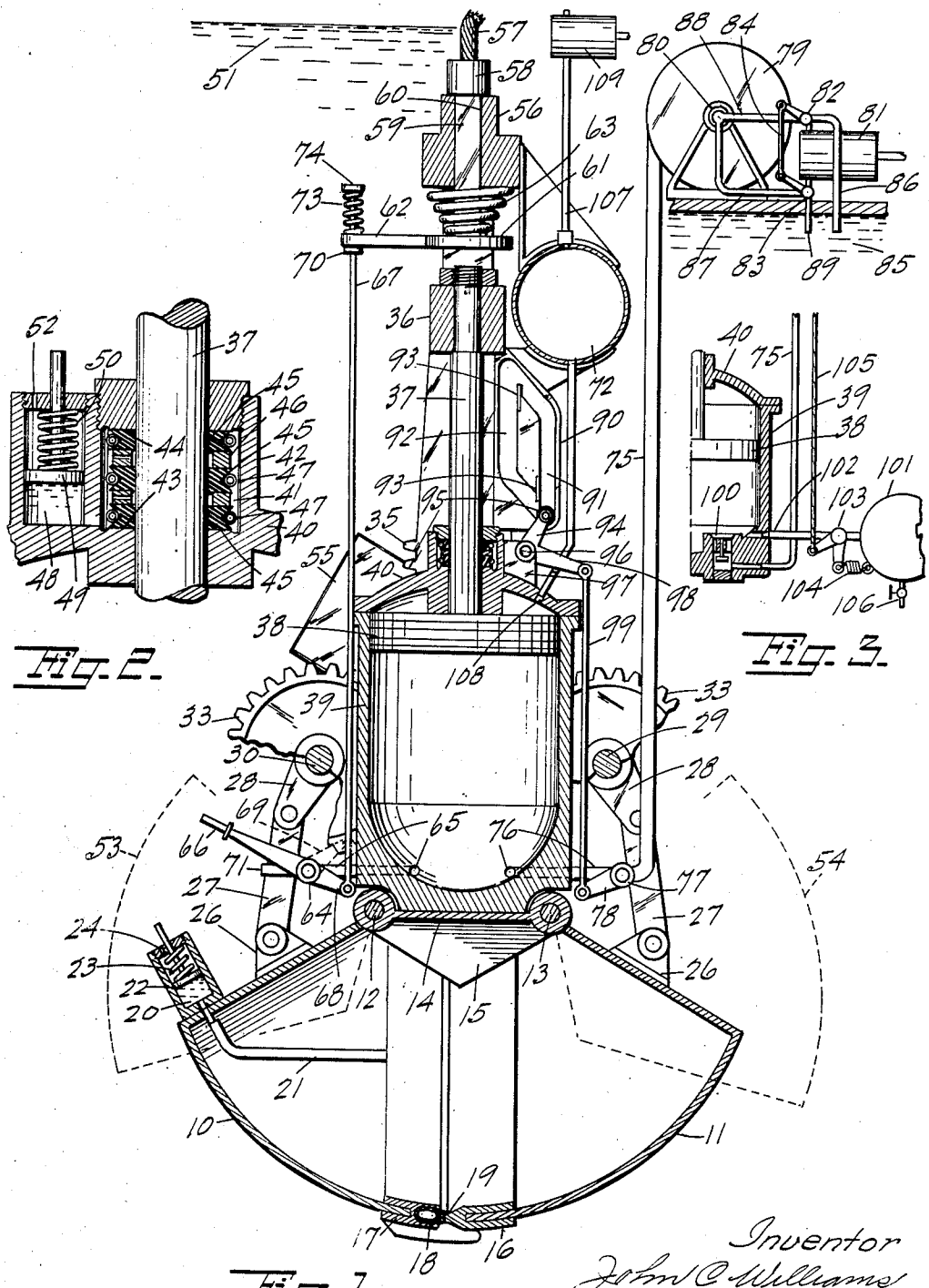

Fig. 1.

Fig. 2.

Fig. 3.

Inventor
John C. Williams
By Philip A. Friedell
Attorney

Oct. 24, 1939. J. C. WILLIAMS 2,177,196

CLAMSHELL DREDGE

Filed Nov. 10, 1937 2 Sheets-Sheet 2

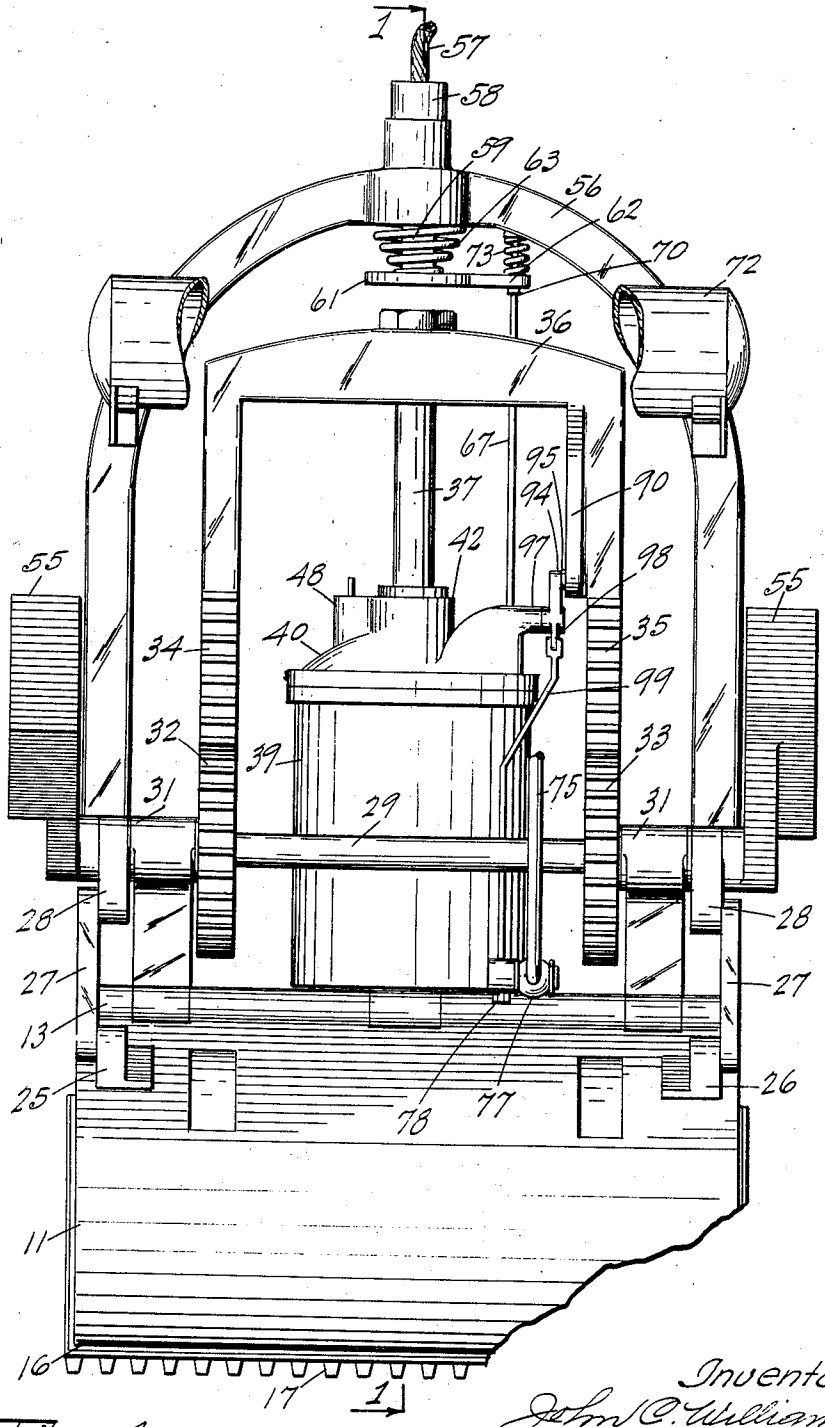

Fig. 4.

Inventor
John C. Williams
By Philip A. Friedell
Attorney

Patented Oct. 24, 1939

2,177,196

UNITED STATES PATENT OFFICE

2,177,196

CLAMSHELL DREDGE

John C. Williams, Oakland, Calif., assignor to John C. Williams Corporation, a corporation of Nevada

Application November 10, 1937, Serial No. 173,840

22 Claims. (Cl. 37—71)

This invention, a clam-shell dredge, is particularly designed for operation under conditions of submergence and is an improvement over copending application Serial No. 93,971, filed August 3, 1936, which has issued under date of September 6, 1938, as Patent No. 2,129,158, for Clam shell dredge, which describes and claims a dredge of similar characteristics but does not include any means for releasing the clam shell bucket from an object, such as a jutting rock which cannot be lifted from the bottom of the sea, and it also does not include any means for augmenting the inherent power of submergence when the depth of submergence does not create sufficient pressure to operate the power unit to the point of complete closure of the bucket, these latter features being added to the instant application as the main features of improvement.

The objects and advantages of this invention are as follows:

First; to provide a clam-shell dredge, which under suitable degree of submergence will operate automatically to close the bucket upon reaching a sub-sea surface, through the influence of the water of submergence, and lock the clam-shell in closed position while being hoisted from the sea and until manually released.

Second; to provide a device of the type outlined with means controllable from the surface or other remote point, for releasing the clam-shell while submerged, from an object to which it has become attached and which is too heavy to lift, and to permit re-operation thereafter through the medium of the water of submergence without raising the clam-shell to the surface.

Third; to provide a device as outlined in which the means specified heretofore may be employed to augment the power available through depth of submergence and which permits the dredge to operate automatically to the limit of the available power of submergence, the means being employed to increase the power to the value required for complete closing of the shell.

Other objects and advantages of the invention will become apparent as the following description is read on the drawings forming a part of this specification, and in which similar reference characters are used to designate similar parts throughout the several views, of which:

Figure 1 is a transverse sectional elevation through the invention, taken on line 1—1 of Fig. 4.

Fig. 2 is an enlarged sectional elevation through the piston rod seal or packing.

Fig. 3 is a fragmentary view of a modified system of bucket release.

Fig. 4 is a front elevation of the invention.

The scoops 10 and 11 are hinged at 12 and 13 respectively, to a head or deck 14 which has integral end wings 15 at its opposite ends coincidently forming closures and reinforcements. Sealing means for the cooperative jaws 16 and 17 consist of a resilient tube 18 set in one jaw 17 and having one side wall exposed for cooperation with the cooperatively related seal edge 19 of the other jaw 16, and this tube 18 is filled with a fluid which is maintained at a predetermined pressure above the pressure of the water of submergence, as by means of a cylinder 20 having the bottom in communication with the tube 18, as through a pipe 21, and having a piston 22 urged by a spring 23 and also by fluid of submergence through a passage 24.

Any suitable type of toggle or link mechanism may be employed as an operative connection to the prime mover for opening and closing the shells, and a positive acting and comparatively simple system is illustrated as consisting of brackets 25 and 26 for each shell, to each of which is pivotally connected a link 27 by one of its ends, the other end of the link having a pivotal connection to a crank 28.

The shafts 29 and 30 each have one of the cranks 28 fixed at each end, and are each mounted in bearings 31 supported on the deck 14, and on each shaft is fixedly mounted two gears 32 and 33 for cooperation with the respective racks 34 and 35.

These racks are dependent from, and integral with or affixed to opposite ends of the cross-head 36, and this cross-head is intermediately affixed to the upper end of the piston rod 37, which has affixed at its lower end a piston 38 operating in a cylinder 39 having a cylinder head 40, and which piston rod, piston, and cylinder comprise a prime mover suitable for the purpose of operating the shells.

Suitable packing for the piston rod against high fluid pressures both internally and externally of the cylinder is illustrated in Fig. 2, and described and claimed per se in copending application Serial Number 173,837 filed Nov. 10, 1937, for Bearing seals, and consists of a seal chamber 41 formed in the hub 42 of the cylinder head 40 and provided with opposed seal thrust faces 43 and 44, and a series of alternate resilient rings 45 and rigid rings 46 fill the space between the thrust faces under predetermined compression, and encompassing spiral springs 47

under predetermined tension compress the resilient rings against the piston rod.

The chamber 41 is filled with a fluid, such as grease, and means is provided for maintaining a predetermined pressure on the grease of predetermined value above the instant pressure of fluid of submergence, and consists of a cylinder 48 having a piston 49 which is urged by a spring 50 and additionally urged by water of submergence 51 by admission thereof during submergence through passage 52.

The clam shell is normally in open position as indicated by the dotted outlines 53 and 54, and each of the shafts 29 and 30 has a counterweight 55 affixed thereto for opening the shells and keeping them open normally.

The dredge is provided with a bail 56 which has connections to the opposite ends of the deck 14, and a hoisting cable 57 has a connection to the bail through the head 58 of a plunger 59 which is slidable through a bore 60 provided through the bail, and a combined spring seat and thrust collar 61 having an integral valve-actuating arm 62 is fixed on the lower end of this plunger 59, and a conical coil spring 63 acts between the collar 61 and bail.

A valve 64 controls admission and discharge of fluid to and from cylinder 39 and is connected to the cylinder as indicated at 65, and a hand lever 66 permits hand control of the valve for dumping the bucket.

When the dredge is being raised or lowered, or when the cable 57 is drawn taut, the plunger 59 is retained in its uppermost position with the spring 63 fully compressed and with the collar 61 riding on the spring, and acting through the arm 62 and rod 67, retains valve arm 68 in the position indicated by the dotted outline 69, keeping valve 64 closed.

As the dredge is lowered to a sub-sea surface and comes to rest thereon, slacking of cable 57 permits spring 63 to depress plunger 59, and with it, arm 62, which cooperates with collar 70 on rod 67 forcing the valve lever 68 down to the position shown in full lines, opening valve 64 and permitting water of submergence 51 to enter the cylinder 39 through the valve intake 71, the water under the pressure of submergence forcing piston 38 with piston rod 37, cross-head 36 and racks 34 and 35 up to the position shown in Figs. 1 and 4, air in the upper part of the cylinder above the piston being maintained at low pressure through breathing to the breather tank 72.

On taking up slack in the cable 57, as for raising the dredge, the arm 62 is first drawn up, moving lever 68 to the dotted position 69, closing the valve 64 and locking the opposed shells 10 and 11 in closed position through the fluid lock formed in the cylinder by the valve.

When the dredge is hoisted to the surface and ready for dumping, valve 64 is manually, or otherwise opened by means, such as the lever 66, the air in tank or compartment 72 under low pressure acts on the top of the piston, and counterweights 55 act through the linkage 27—28 to open the shell 10—11 as the water drains from the cylinder. Spring 73 permits manual opening of the valve when the arm 62 is in its uppermost position and automatically closes the valve by acting on collar 74, when released.

The structure so far described is illustrated and described in somewhat similar form in the copending application previously referred to.

In sub-sea dredging it is possible that the dredge may close over a jutting rock which could not be raised or broken off, or may attach itself to some other object which is too heavy to be lifted to the surface, and under such conditions it is necessary to provide means for releasing the bucket from its trap.

One type of releasing means is shown in Figs. 1 and 4, in which a flexible tube 75 has a connection 76 with the lower end of the cylinder 39 through a valve 77, and this valve is controlled by a lever 78, the tube 75 being windable on a drum 79 and having a communicating connection through the drum shaft 80 with both ports of a pump 81, these ports being controlled by suitable valves 82 and 83. If these valves are moved to one position by means of the connecting rod 84, water will be pumped from the sea 85 through pipe 86 and delivered through pipe 87 to tube 75 and if moved to the other position, water is drawn from tube 75, through pipe 88 and discharged to the sea 85 through pipe 89.

Fixed on one of the racks, as 35, is a cam plate 90 which is provided with end-connected cam grooves 91 and 92, the terminals being provided with latches 93, such as leaf springs. A bell-crank lever has one arm 94 provided with a roller 95 operating in the cam grooves and is mounted on a shaft 96 which is mounted in a suitable bearing 97 which may be mounted on, or integral with the cylinder head 40, and the other arm 98 is connected to the valve 77 through a connecting rod 99.

Thus, as water enters the cylinder, roller 95 rides in groove 92, keeping valve 77 open, and as the piston reaches the end of its stroke, the roller is shifted through the lower angular groove to groove 91, latch 93 passing the roller to the groove 91 but preventing its return back through the angular groove, this movement closing the valve 77 to lock the admitted water against escape through the tube as the dredge is hoisted, and as cable 57 is drawn taut, valve 64 is also closed, forming a water lock against opening of the bucket.

When the bucket is to be dumped, on opening valve 64 by means of lever 66, the water drains from the cylinder, the cam plate 90 lowers with the piston, roller 95 rides in groove 91 and finally shifts to groove 92 at the end of the stroke, latch 93 preventing return of the roller to groove 91, and valve 77 is again open.

In the event that the shells were prevented from closing completely by some obstruction and became locked on the obstruction so that the dredge could not be lifted, obviously the roller 95 would be located at some point in groove 92 with valve 77 open and the draw on cable 57 closes valve 64, therefore, to release the dredge, it would merely be necessary to maintain tension on the cable 57 to keep valve 64 closed, switch valves 82—83 to create suction in tube 75 and operate pump 81 to release the pressure in the cylinder until the dredge was released, raise the dredge partly and lower to another position and slack the cable 57 to open valve 64 for another operation. Thus the dredge may be opened at will unless the piston has reached the top of its stroke and the shells are fully closed, under which conditions opening would not be required.

In the event that there is insufficient head to operate the shells to close tightly, the water of submergence is permitted to act on the piston to the limit of its power, after which the cable is

drawn taut and the valves 82 and 83 are shifted to deliver water under pressure through tube 75 and the wet pump 81 operated to complete operation of the piston and complete closing of the shells, and during the final closing movement of the shells, valve 77 will be closed in the usual manner, locking the shells in closed position until lever 66 is manually operated to open valve 64 to drain the water from the cylinder.

Another method of operation is disclosed in Fig. 3 and includes the flexible tube 75 connected directly to the cylinder 39 and having a check valve 100 preventing passage of water from the cylinder 39 to tube 75 but permitting passage in the opposite direction, the upper end of the tube 75 being connected to a pressure pump, as 81, Fig. 1, for augmenting the pressure in the cylinder 39 when the head of submergence or hydrostatic head is insufficient for complete operation of the dredge.

For releasing the dredge when trapped on an object, a tank 101 having a connection 102 to cylinder 39 and controlled by a valve 103 which is normally retained closed by a spring 104 and operated manually from a remote point, such as the surface of the sea, for opening, as by a cable 105, is illustrated in Fig. 3.

With this arrangement, if the dredge cannot be raised, it is merely necessary to draw cable 57 taut to close valve 64, then pull up on cable 105 to open valve 103, and the water in cylinder 39 will drain into tank 101 until the dredge is released, after which cable 105 is released to close valve 103. The tank 101 should preferably be made of sufficient capacity for at least two releases, and a cock 106 is provided for draining this tank when it reaches the surface.

Another method of releasing and augmenting the pressure can be incorporated in the system previously described in connection with Fig. 1, by connecting a tube 107 to tank 72, or directly to the breather connection 108 in the cylinder head 40, and connecting the other end of this tube to a pump 109.

By connecting the conduit 107 to tank 72, there will be no interference with the normal functioning of this tank, and by creation of a partial vacuum therein, the power is augmented in the cylinder 39, and if release of the clam shell is required, by pumping the pressure in tank 72 to a value as great or greater than the value of the pressure of submergence or hydrostatic head while valve 64 is kept open, the piston 38 will be forced down, and upon release of this pressure in the tank, the dredge will operate in its normal manner.

This system, when using only the tube 107 and dry pump 109, has the advantage of extreme simplicity, of requiring no valves, and of being a dry system, and when so used, valve 77 with its associated parts including cam plate 90 is not required, and any type of opening and closing mechanism for valve 64 may be employed which will keep valve 64 open until the dredge is lifted, since this valve must be kept open for this system to operate, unless an additional unit, such as shown in Fig. 3, or the entire structure shown in Fig. 1 is employed.

This system is limited, by itself, for augmenting the pressure, to the possible vacuum which can be created in tank 72 or in the tube 107, and under pressure is required to work against the total hydrostatic head, but any combination with the other devices provides a most efficient unit. As for instance, with valve 64 closed, pressure in tank 72 delivered through conduit 107 from pump 109, and suction built up in conduit 75 by wet pump 81 will act on both sides of the piston for release. Conduit 107 and tank 72 must always be maintained dry. Reversing the arrangement augments the power in the cylinder, additively over the available power of the hydrostatic head.

It will be understood that variations in construction and arrangement of parts, which variations are consistent with the appended claims, may be resorted to without detracting from the spirit or scope of the invention, or sacrificing any of the advantages thereof.

I claim:

1. In combination, a clam-shell bucket and a prime mover mounted thereon, an operative connection between said prime mover and said bucket for closing said bucket; means for admitting water of submergence to said prime mover for operation thereof when the bucket reaches a sub-sea surface and for locking admitted water in said prime mover as said bucket is raised from said sub-sea surface; counterweight means urging opening of said bucket; means for releasing said admitted water at will after said bucket has been removed from said water of submergence; and releasing means and remote control means therefor for releasing and removing said admitted water for opening said bucket while said bucket and prime mover is submerged.

2. A structure as claimed in claim 1; said releasing means including means for augmenting the available power of said water of submergence when in itself deficient in pressure to fully and efficiently close said bucket.

3. In combination, scooping means having cooperative scooping elements; a prime mover mounted on said scooping means; an operative connection between said prime mover and said scooping means; cooperative sealing means on the respective scooping elements; means for building up the internal pressure of said sealing means as the external pressure is increased, to a value greater than the external pressure; means for admitting water of submergence to said prime mover for operation thereof to close said scooping means when said scooping means reaches a sub-sea surface, and for locking the admitted water against escape upon raising of the scooping means from said sub-sea surface; means associated with said prime mover and remote control means therefor, for selectively, releasing and removing said admitted water for opening the scooping means, or, for augmenting the available power of the water of submergence in the event of deficiency in pressure of submergence, while said prime mover is submerged.

4. In combination, a clam shell bucket having a water-of-submergence-actuated prime mover mounted thereon and an operative connection between said prime mover and said bucket for closing said bucket; counterweight means associated with said bucket for opening said bucket; control means for admitting water of submergence for operation of said prime mover when said bucket reaches a sub-sea surface and for locking admitted water in said prime mover when said bucket is raised from said surface to lock said prime mover against retrograde operation; auxiliary power means and remote control means therefor associated with said prime mover and selectively operating to release and remove admitted water from said prime mover to open the bucket, or, to augment the available power

of said water of submergence when deficient in pressure to efficiently close and lock the bucket, while said prime mover is submerged.

5. In combination, a submersible device and a prime mover mounted thereon and operated through the medium of fluid in which said device and prime mover are submerged; control means controlled by the weight of the submersible device and prime mover and controlling operation of said prime mover for one operation of said device; manually-controlled means for controlling operation of said prime mover for another operation of said device when said device and prime mover are removed from said fluid; and remotely controlled auxiliary power means associated with said prime mover for operation thereof for either operation at will while said device and prime mover are submerged in said fluid.

6. In a prime mover having a mounting having a hoisting cable, and operated under conditions of submergence by the fluid of submergence and control means controlled by said hoisting cable for controlling operation of said prime mover for one cycle of operation; auxiliary power means and remote control means therefor associated with said prime mover for retractively operating said prime mover while under conditions of submergence, at will.

7. A structure as claimed in claim 6; said auxiliary power means and control means therefor being controllable at will for alternatively operating to augment the power for operation of said prime mover after the total available power of said fluid of submergence has been expended, for completing said one cycle of operation of said prime mover.

8. A submarine dredge comprising a clam-shell bucket having cooperative scoop elements; a cylinder having a piston and mounted on said bucket; operating means connecting said piston with said scoop elements; a valve for controlling admission of water in which said dredge is submerged, to one end of said cylinder; a receiver in communication with the other end of said cylinder forming a breather chamber; means for opening said valve when said dredge reaches a sub-sea surface and closing said valve when said dredge is raised from said surface; manually operated means operable when said dredge has been removed from the water of submergence for discharging admitted water from said cylinder; counterweight means urging said bucket to open; said bucket being fluid-locked in both its open and closed positions; auxiliary power means and remote control means therefor associated with said cylinder for selectively, releasing and removing admitted water from said cylinder to open the bucket, or, for augmenting the power of the water of submergence when deficient to close the bucket, while the cylinder is submerged.

9. A submarine dredge comprising; scooping means having cooperative scooping elements; a fluid-actuated prime mover mounted on said scooping means; an operative connection between said prime mover and said scooping means for opening and closing said scooping means; and weight controlled means operable when said scooping means reaches a sub-sea surface for admitting fluid of submergence to said prime mover for operation thereof to close said scooping means; and auxiliary power means and remote control means therefor associated with said prime mover for selectively, releasing and removing admitted water from said prime mover to open the bucket, or, to augment the available power of said fluid of submergence when deficient to close the scooping means, while the dredge is submerged.

10. A structure as claimed in claim 9; cooperative sealing means on the respective scooping elements for sealing said scooping means in closed position against escape of sludge, the sealing means on one of said elements being formed of resilient material; and means initially subjected to a predetermined pressure and additionally subjected to the pressure of the fluid of submergence maintaining the internal resistance of said resilient material at a value equal to the combined pressure of the fluid of submergence and said predetermined pressure to maintain said resilient sealing means effective against its external fluid pressure.

11. In a device for submarine operation; a fluid-operated prime mover; a valve for controlling passage of fluid of submergence to and from said prime mover for actuation thereof; and valve control means mounted on said device and actuated upon contact of said device with a sub-sea surface for opening said valve for admission of fluid of submergence to said prime mover for operation thereof and for closing said valve as said device is urged to raise above said surface, for hydraulically locking said prime mover against further operation; auxiliary power means and remote control means therefor associated with said device for selectively, releasing and removing admitted water from said prime mover for reverse operation thereof, or, for augmenting the available power of the water of submergence when deficient to complete an operation of said device, while the device is submerged.

12. A submarine dredge comprising scooping means consisting of cooperative scooping elements and counterweight means normally maintaining said scooping elements in open position; a cylinder mounted on said scooping means; a piston operating within said cylinder and an operative connection between said piston and said scooping elements; a first valve for controlling admission of fluid of submergence to one end of said cylinder and hand control means for opening said valve; means for opening said valve when said dredge reaches a sub-sea surface and for closing said valve as said dredge is lifted or urged to lift from said surface; a breather compartment in communication with the other end of said cylinder; a second valve for controlling communication with said one end of said cylinder; auxiliary power means and remote control means therefor associated with said second valve for releasing and removing water of submergence from said cylinder while said dredge is submerged to release said cooperative scoop elements.

13. A structure as claimed in claim 12; said remotely controlled means including water-delivery means for augmenting the power of the water of submergence when deficient for complete closing of said scooping means.

14. A structure as claimed in claim 12; control means associated with said dredge closing said second valve when said scoop elements are completely closed and opening said valve coincident with final opening of said scoop elements.

15. A structure as claimed in claim 12; said auxiliary power means and control means therefor comprising a pump having an intake and a discharge and having a flexible conduit connection to said second valve, and valve means associated with said pump for changing the con-

nection of said conduit selectively to the intake and discharge of said pump.

16. A structure as claimed in claim 12, said remotely controlled auxiliary power means comprising a pump having a communicating connection with said second valve.

17. A structure as claimed in claim 12, said auxiliary power means and remote control means therefor comprising a pump having a communicating connection with said second valve; control means associated with said dredge closing said second valve when said scoop elements are in their final closing movement and opening said second valve during the final opening movement of said scoop elements.

18. A structure as claimed in claim 12; said auxiliary power means and remote control means therefor comprising a pump having an intake and a discharge and having a connection to said second valve and valve means associated with said pump for changing said connection selectively to the intake and discharge of said pump; and control means associated with said dredge for closing said second valve when said scoop elements are operating through their final closing movement and opening said second valve during the final opening movement of said scoop elements.

19. A structure as claimed in claim 12, said auxiliary power means and remote control means therefor comprising a dry pump and a wet pump respectively connected to said breather compartment and to said second valve, and means for closing said second valve to water lock said piston in the closed position of said scoop elements.

20. A structure as claimed in claim 12; said auxiliary power means and remote control means therefor comprising a dry pump and a wet pump respectively connected to said breather compartment and to said second valve, and means for closing said second valve to water lock said piston in the closed position of said scooping means, and consisting of a control element associated with said piston, closing said second valve when said scooping elements are passing through their final closing movement and opening said valve when said scooping elements are opened and retaining said valve open during the closing operation of said scooping means.

21. In a submersible device having a water-of-submergence actuated prime mover for operation thereof, and a hoisting cable and a connection therefor to said device; means for controlling operation of said prime mover comprising a valve; said connection comprising a slidably mounted plunger; a spring continuously urging to depress said plunger against the restraint of said cable; an arm on said plunger and an operative connection between said arm and said valve for maintaining said valve closed when said cable is restraining said plunger against the urgence of said spring and for opening said valve when said cable is slacked to free said plunger for depression.

22. A structure as claimed in claim 21, said operative connection comprising a connecting rod slidably operating through said arm and having a collar for cooperation with the underside of said arm and having a spring seat at its upper end and a second spring operating between said arm and said spring seat; a hand lever for manual operation of said valve and connected to said connecting rod; said second spring permitting operation of said hand lever to open said valve while said plunger is fully restrained by said hoisting cable.

JOHN C. WILLIAMS.