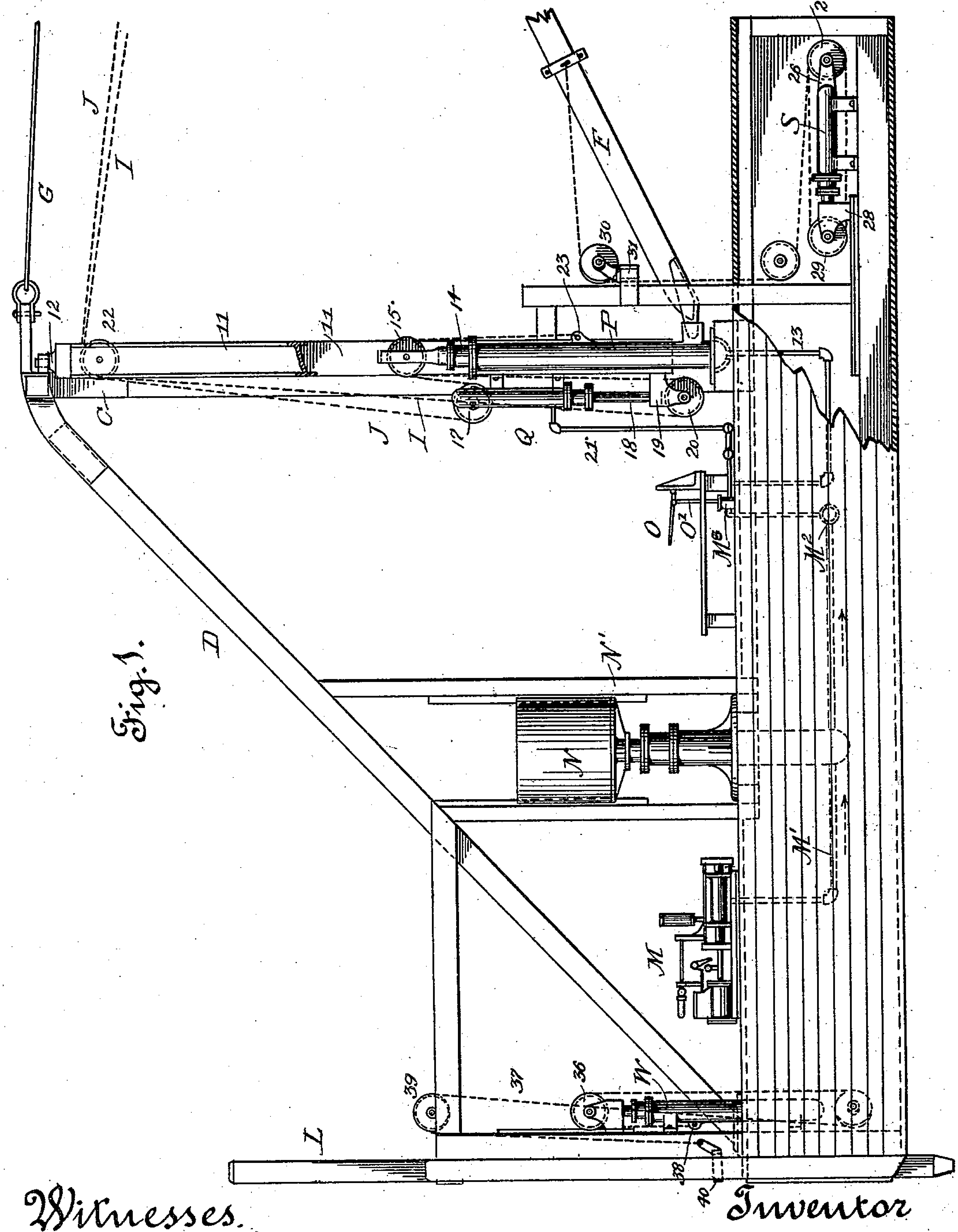
(No Model.) 4 Sheets—Sheet 1.

W. B. PLESS.

DREDGING APPARATUS.

No. 549,658. Patented Nov. 12, 1895.



Witnesses.
H. L. Monteverde.
Geo. Cooper

Inventor
William B. Pless.
by Spear & Seely
Attorneys.

(No Model.) 4 Sheets—Sheet 2.

W. B. PLESS.

DREDGING APPARATUS.

No. 549,658. Patented Nov. 12, 1895.

Fig. 3.

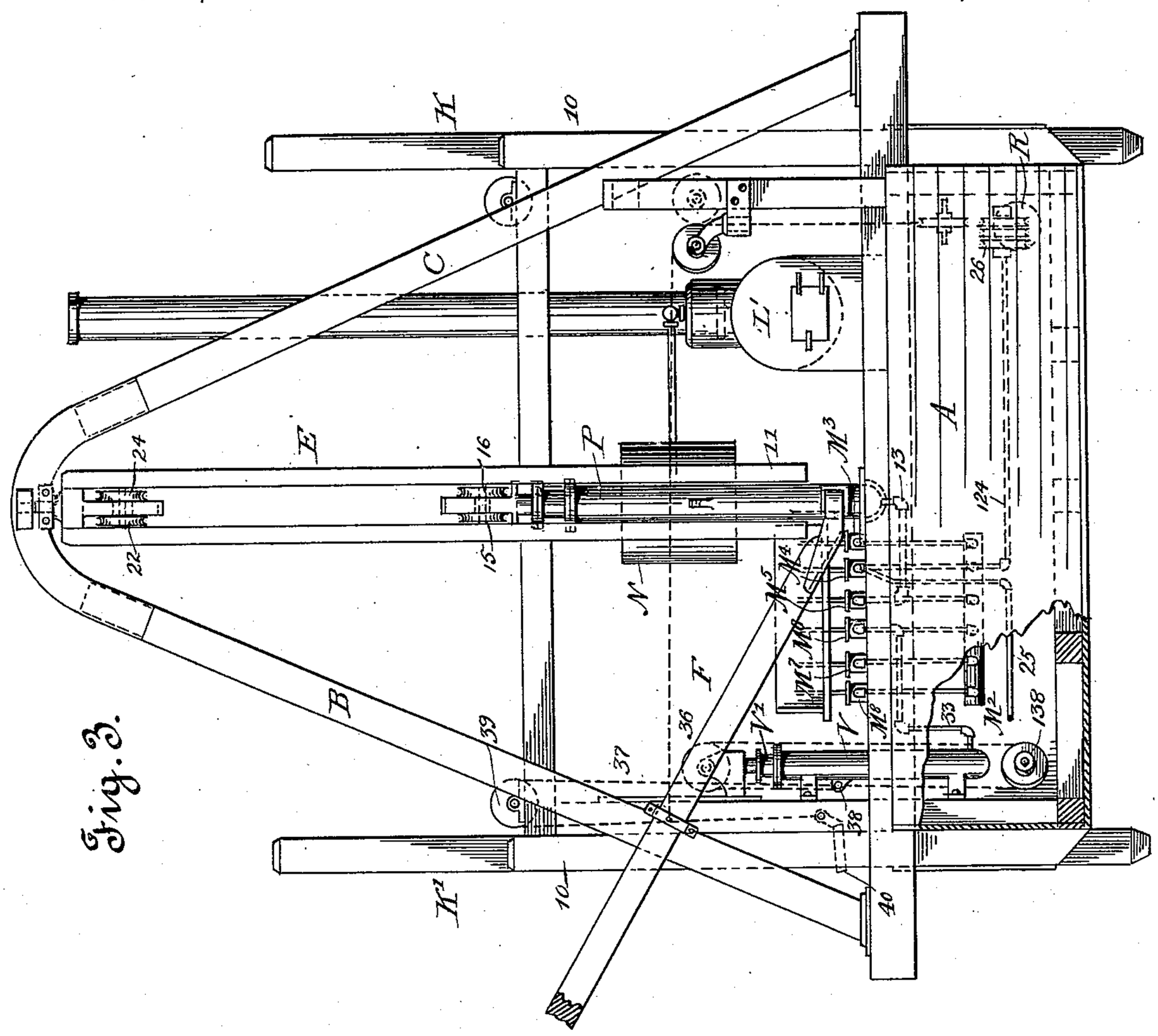
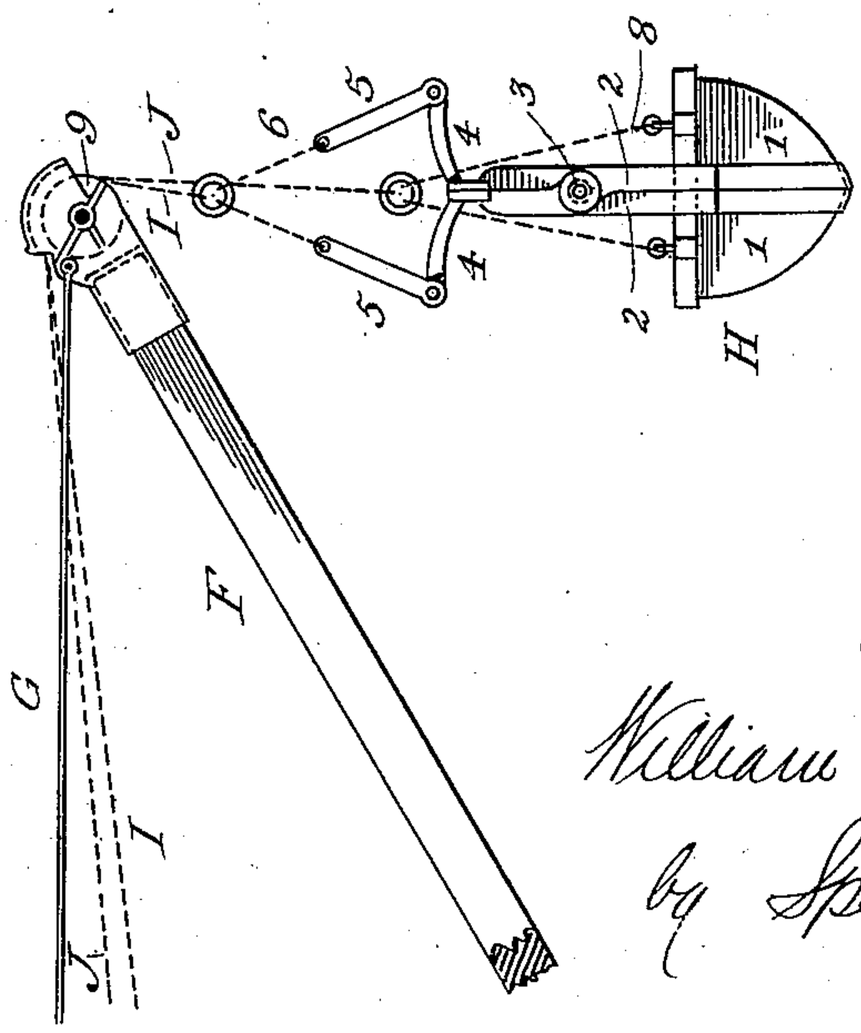


Fig. 2.



Witnesses.
Calvert Meade.
Edwin Goodwin

Inventor.
William B. Pless
by Spear & Seely
Attorneys

(No Model.) 4 Sheets—Sheet 3.

W. B. PLESS.

DREDGING APPARATUS.

No. 549,658. Patented Nov. 12, 1895.

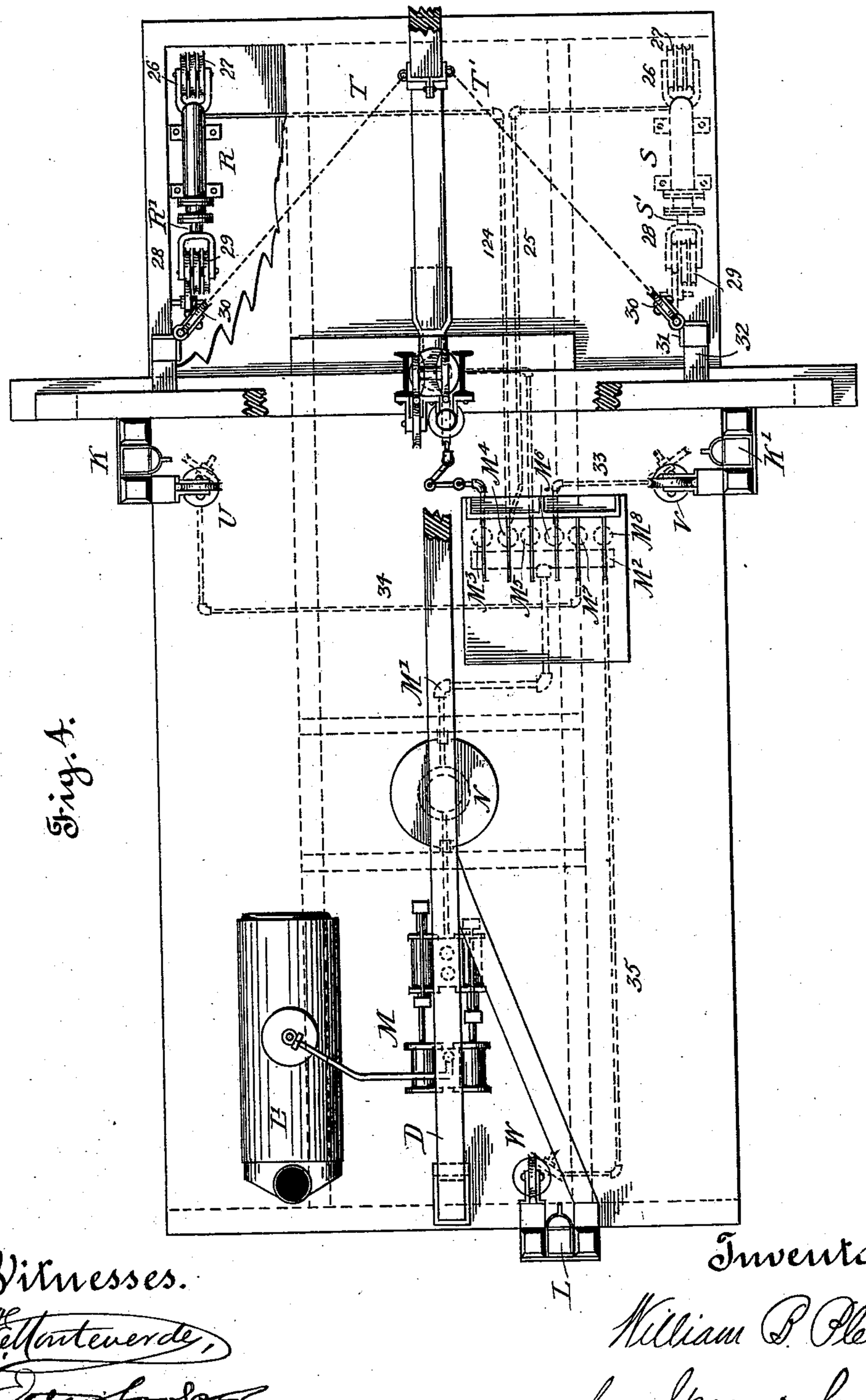


Fig. 4.

Witnesses.

F. Cantenerde,

Inventor.

William B. Pless

by Spear & Seely

Attorneys

(No Model.)

4 Sheets—Sheet 4.

W. B. PLESS.

DREDGING APPARATUS.

No. 549,658. Patented Nov. 12, 1895.

Fig. 5.

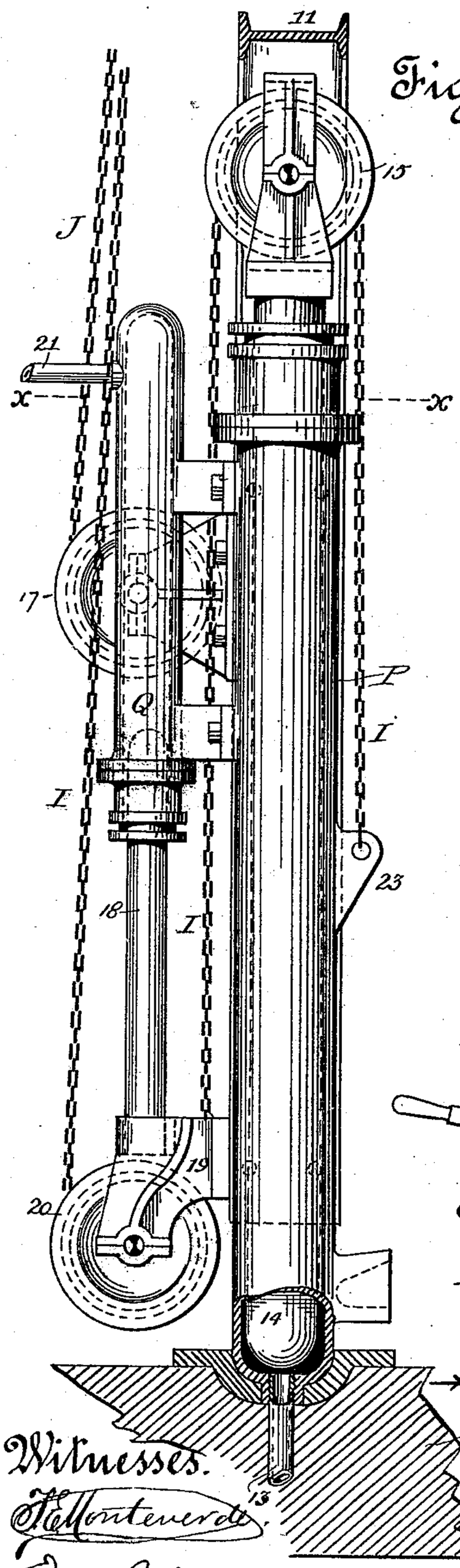


Fig. 6.

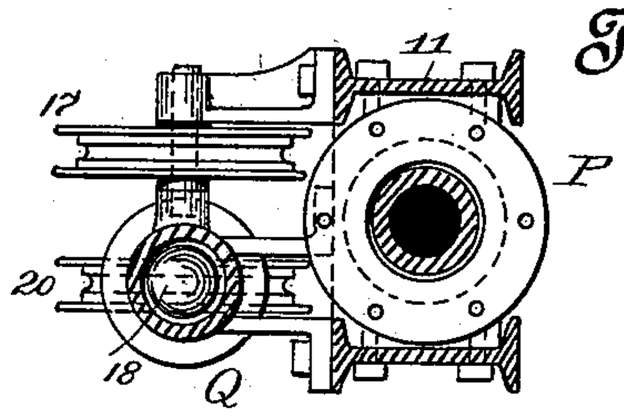


Fig. 7.

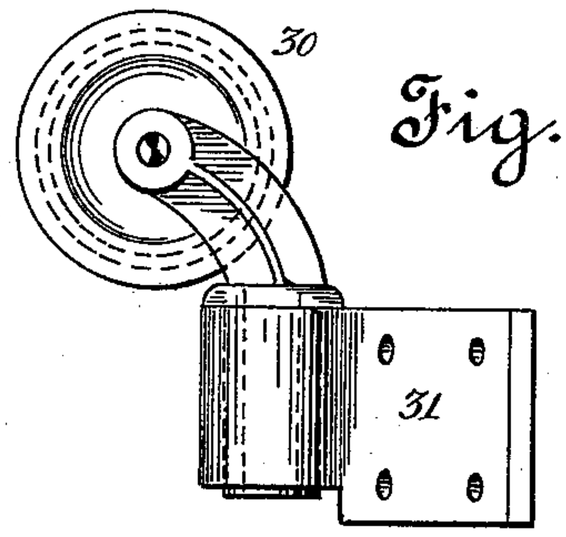


Fig. 8.

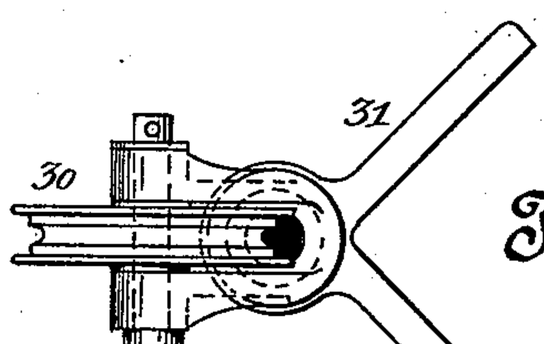
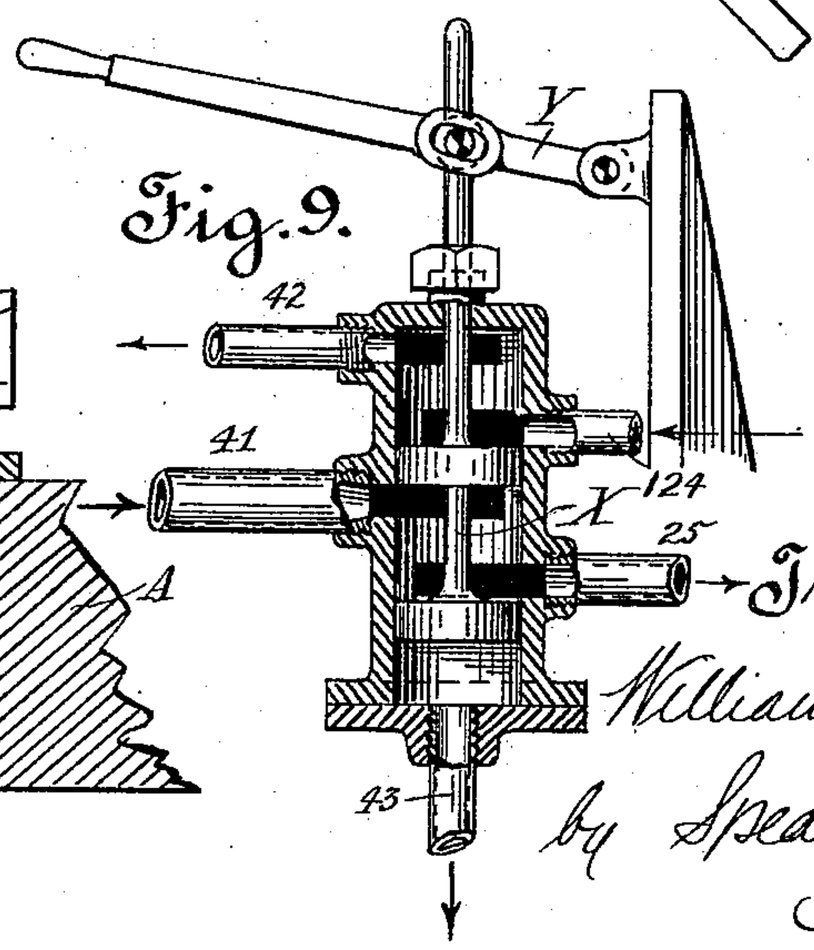


Fig. 9.



Witnesses.

F. Montenerde.

Inventor.

William B. Pless

by Spear & Seely

Attorneys

UNITED STATES PATENT OFFICE.

WILLIAM B. PLESS, OF STOCKTON, CALIFORNIA, ASSIGNOR TO THE PLESS DREDGING AND RECLAMATION COMPANY.

DREDGING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 549,658, dated November 12, 1895.

Application filed January 2, 1894. Serial No. 495,338. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM B. PLESS, a citizen of the United States, residing at Stockton, in the county of San Joaquin and State of California, have invented certain new and useful Improvements in Dredging Apparatus; and I do hereby declare that the following is a full, clear, and exact description thereof.

My invention relates to improvements in dredging apparatus or machinery; and my object is to perform all the operations required in dredging and excavating and in discharging the spoil by hydraulic power instead of by gearing which transmits power from one or more engine-shafts to the mechanisms for accomplishing these different mechanical operations.

I have in the present case shown and shall describe my invention as applied to a dredger of the type set forth in my Patents No. 418,221, granted December 31, 1889; No. 426,681, granted April 29, 1890; No. 502,934, granted August 8, 1893, and No. 505,176, granted September 19, 1893, and in my applications for patents, Serial Nos. 476,738 and 476,739, filed June 6, 1893—that is, a dredger of the "clam-shell" type, having a swinging boom, a suspended sectional bucket, and movable spuds used both as anchors and as pivots for the hull. The different operations performed by a dredger of this kind require, first, mechanism for lowering and hoisting the bucket; second, mechanism for closing the bucket-sections to take the load and for permitting them to open and discharge it; third, mechanism for swinging the boom or crane laterally in both directions, and, fourth, mechanism for raising and lowering each spud independently. Where steam-power is used, applied through engine-shafts and connections, to accomplish these several operations, complicated and expensive gearing must be employed, together with positively-operated clutches and separately-applied brakes, and hence several sets of levers must be provided, all intended to be controlled by a single operator.

Where my present invention is used, all the mechanical movements in the operation of dredging are caused and controlled by a single set of valves and levers, while clutches, brakes, gear-wheels, winding-drums, and winches are entirely dispensed with. The operations are more positive, can be performed in shorter time, and the dredger can be run at less expense than formerly.

The following is a detailed description of a dredging-machine of this class embodying my invention, which should be read in connection with the accompanying drawings, in which—

Figure 1 is a side view of a dredger with the hull partly broken away forward. Fig. 2 is a continuation of Fig. 1 to show the end of the boom and the bucket and should be read in connection with it. Fig. 3 is a front elevation. Fig. 4 is a plan view. Fig. 5 is a detail elevation of the hydraulic cylinders for hoisting the bucket and contents. Fig. 6 is a cross-section on line $x\,x$ of Fig. 5. Fig. 7 is a side view of one of the swiveled guide-pulleys. Fig. 8 is a plan of the same. Fig. 9 is a vertical section of a double-acting valve for controlling the lateral swinging of the boom and bucket.

A represents the hull of a dredge-boat, B and C the converging beams of the **A** frame, and D the bracing-beam extending from the stern and connected to the **A** frame at its top.

E is the mast, which is of a peculiar construction to be hereinafter described. The bottom of the mast is stepped in one of the timbers of the hull and the top pivoted in a bearing formed in the casting or other cap of the **A** frame.

F is the crane or boom, secured to the mast so as to turn with it and supported by the hog-chain or tension-rod G, which extends from the top of the **A** frame to the extremity of said boom.

H is the dredge-bucket, which I prefer to construct and support as shown in Letters Patent of W. B. Pless, No. 502,934, granted August 8, 1893, and have so illustrated it in the drawings. The bucket is composed of the two sections or jaws 1 1, which are in end elevation approximately of the shape of sectors formed by radii at right angles, as shown. These sections are connected by levers 2 2, having a scissors-joint 3, and they are closed and hoisted by arms 4 and links 5, connected by chains 6 to a chain I. The bucket is

dumped by a main dumping-chain J through chains 8, secured to the bucket-sections near their corners. Both main chains I and J pass over sheaves 9 at the end of the boom, and thence to operating mechanism supported upon the hull.

K K′ L are anchors or spuds, the two former being loctated, respectively, at the port and starboard sides of the hull and the latter at the stern. These spuds slide in guiding frames or timbers 10 and are raised and lowered by chains or cables connected to the main source of power. The spuds are for anchoring the hull, and the port and starboard spuds are also used as alternate pivots in swinging the hull, so as to advance it as the work progresses. This is usually accomplished by using the bucket, dropped upon the bottom, as a warp—that is, by raising all the spuds excepting one of the side ones, then putting strain on the boom as if swinging it laterally, but instead swinging the hull by the reaction of the sidewise pull on the boom and bucket, the resistance of the latter being much greater than that of a floating hull anchored at one point only.

The connections by which the bucket is closed, by which the bucket is hoisted, by which the boom is swung laterally in either direction, and by which the several spuds are raised and lowered independently of one another are all operated by a boiler and steam-pump, in connection with hydraulic cylinders and means for filling and emptying the cylinders, as may be necessary during the different operations of which the dredger is capable.

L′ represents a boiler and furnace, and M is a steam-pump of any desired construction, shown as located near the stern and having the water-pipe M′ leading forward from it.

N represents an ordinary vertically-moving accumulator or pressure-governor moving in guides N′ and having the cylinder in which its plunger works connected to the water-pipe M′. The water-pipe leads into a transverse branch M^2, Fig. 4, connected by separate pipes to valve-chambers and valves M^3, M^4, M^5, M^6, M^7, and M^8, arranged in line and operated independently by levers O and valve-rods O′, placed conveniently to a platform for the operator, who should be raised above the deck to give an unobstructed view. These six valves control all the movements of the operative parts of the dredger. In describing them separately I commence with the means for closing and hoisting the bucket.

The mast is composed of two pieces of iron 11, preferably **I**-beams, which are connected at their upper ends by a cap carrying the pintle or pivot-pin 12. The lower ends of the beams 11 are bolted to a cylinder P, which is stepped in a timber of the hull, so as to pivot freely. It thus forms the base of the mast. Into the lower part of this cylinder is led the water supply and discharge pipe 13, which is connected to the valve M^5, as shown in dotted lines in Fig. 4. The plunger 14 of the cylinder P projects above its open end and carries two sheaves 15 and 16.

Q is an auxiliary cylinder of smaller capacity bolted to the mast and carrying near its upper end a sheave 17. The plunger-rod 18 of cylinder Q is connected to a sliding bracket 19, carrying a pulley 20 and guided in its vertical movement by the mast. This cylinder is supplied and emptied through a pipe 21 from the valve M^3, and, as it turns with the mast, a flexible pipe must be used, such as the jointed sections shown in Fig. 4, or, if preferred, a length of hose or some other flexible tubular connection.

I shall for the present assume that the controlling-valves are of such a construction as to permit the cylinders to be filled and emptied at will; but I shall of course describe them in detail hereinafter.

Referring particularly to Figs. 1, 2, and 5, we will suppose that the bucket is lying upon the bottom open and ready to take its load. Both cylinders P and Q are empty. The chain I extends from the lever-arms of the bucket over the end of the boom over a guide-sheave 22 near the top of the mast, thence directly down and around the sliding pulley 20, thence up and over pulley 15 on the plunger-rod of cylinder P, and thence to a lug 23 on the last-named cylinder, to which it is fastened. Water is now admitted to cylinder Q. Its plunger is forced down and, one end of the chain I being secured, the pull is transmitted directly through that chain to the bucket-closing levers and the bucket takes its load. Water is now admitted to the large cylinder P and its plunger 14 rises. The dumping-chain J passes from the bucket-sections over the pulleys 9 and 24, thence down and around the sheave 17 on the small cylinder, thence up and over the pulley 16 on the plunger of cylinder P, and thence to a lug on the latter, to which it is fastened. As the plunger 14 rises the strain upon the chain I is transmitted to the bucket and the latter, with its load, is raised above the water. The chain I remains under tension and keeps the bucket closed, because the cylinder Q is still full of water, and hence the plunger 18 cannot rise. The boom is now swung to the point of discharge, (an operation which will be described later on.) The water is now let out of cylinder Q, permitting its plunger to rise and slacking chain I, the plunger 14 still keeping tension on the chain J. The levers of the bucket being no longer under strain, the weight of the bucket-sections and of the load contained by them and the positive pull of chain J opens the bucket and discharges the contents. The boom is now swung back to position over the point of excavation, the water is let out of the cylinder P, and the plunger 14 descends. Both chains are now slack and the open bucket descends by its own weight in readiness to receive another load. The lateral movement is derived from hydraulic cylinders R S, which I prefer to place forward

below the deck and on the port and starboard sides, respectively. M^4 is the controlling-valve, which is the double-acting piston-valve shown in Fig. 9, and which is connected by pipes 124 and 25 to the cylinders R and S, Fig. 4. This valve will be hereinafter described in detail. At this time it is sufficient to say that by means of it the operator can supply water to and discharge it from the two cylinders independently. At one end of each cylinder is fixed a yoke 26, in which are journaled side by side loose pulleys 27, preferably three in number. Similar yokes 28 are secured to the plunger-rods R′ S′, carrying like pulleys 29. Chains T T′ are secured to opposite sides of the boom and extend to the respective cylinders, passing first over swiveled guide-pulleys 30, Figs. 7 and 8, normally at an angle of about forty-five degrees and journaled in brackets 31 on the corners of standards 32. The boom is supposed to have a sweep of about ninety degrees in each direction, and hence the pulleys 27 and 29 are employed to furnish in a small compass sufficient means for guiding the whole length of either chain T or chain T′, permitting them to be run on or off the pulleys to their full extent, and preventing any slack from accumulating at any time. This manner of running the chains is illustrated in Fig. 1. At the same time the system of pulleys forms a multiplying-gearing, which with a comparatively short stroke of plunger will transmit a much greater extent of movement to the boom. Thus if the plunger has a stroke of seven feet the series of six pulleys will transmit a motion of forty feet or more, which is sufficient to give the boom its full sweep either to port or starboard.

When the boom is swung to port to its fullest extent, the port cylinder is full of water. When the boom is swung to starboard, the starboard cylinder is full. When the boom is amidship, both cylinders are half full, or, to better express it, one is half full and the other half empty. Supposing we desire to swing to port, water is let into the port cylinder, the movement of the controlling-valve at the same time permitting the exhaust or escape of water from the starboard cylinder. The plunger R′ pulls on the chain T and winds all that chain upon the pulleys 27. The moving boom closes the plunger S′ within the emptying cylinder S and unwinds the chain T′ from the pulleys 29. The swing to starboard is the exact converse of the operation just described. At any point in its lateral swing in either direction the boom can be stopped and held by closing the supply-ports to both cylinders. Should the boom have swung to port at an angle of forty-five degrees and then stopped, the port cylinder will be approximately three-fourths full and the starboard cylinder approximately three-fourths empty. A single lever controls the movement in both directions and the stoppage at any point.

I now describe the hydraulic means for operating the anchoring and pivot spuds. The movement of these spuds is controlled by the valves M^6, M^7, and M^8, from which water-pipes 33, 34, and 35 extend to the cylinders U, V, and W, located, respectively, near the port spud K, near the starboard spud K′, and near the stern spud L. The operation of all these cylinders is the same, and I shall therefore, in describing the details, refer only to Fig. 3, which shows the starboard spud K′. The cylinder V is shown as vertical in position; but this is not essential, as with slight changes in the leading and guiding of the hoisting-chains a horizontal cylinder can be used. The cylinder is bolted to the hull or framing of the dredge, and its plunger V′ carries a pulley 36, guided by a timber of the framing. The suspension-chain 37 is secured to a lug 38 on the cylinder, whence it passes up and over the movable pulley 36, thence down and around a lower guide-pulley 138, thence to and over an upper guide-pulley 39, and thence to a loose ring or clamp 40, which encircles the spud and to one side of which it is connected, so that the act of hoisting causes the clamp to bite angularly. As in the device before described, the pulleys multiply the stroke of the plunger to give the proper extent of hoist to the spud. The spuds are operated independently of one another by their respective hydraulic connections in order that they may be used either as anchors or as pivots upon which to swing the hull.

It will be understood that by means of the controlling-valve the lift of the spud can be accurately regulated after it has been raised. The water is gradually or freely let out of the cylinder, permitting the spud to descend by its own weight until its encircling clamp or ring strikes the deck and is forced into a horizontal position. This causes the clamp to release the spud, which then drops freely and enters the bottom to the required degree.

I have shown in Fig. 9 a sectional view of the double piston-valve M^4 which I prefer to use in controlling the lateral swinging of the boom in either direction. The only difference between this valve and the others of the series is in the internal construction, by which a single lever controls the admission and escape of water from two independent hydraulic cylinders, the other valves controlling only a single cylinder each. Externally each valve is a cylinder forming a chamber, into which a pipe 41 leads from the branch M^2. From the valve M^4 the pipes 124 and 25 extend to the cylinders R and S, respectively. Waste-pipes 42 and 43 to discharge the water from these cylinders are also connected to the valve-chambers, as shown. X is a double piston sliding in the valve-chamber and controlled by the lever Y. In Fig. 9 this valve is receiving water from the pump and is discharging it through pipe 25 to the starboard cylinder S, while the cylinder R is being emptied, the waste water passing through the chamber above the upper piston and out

through the pipe 42. To stop the swing of the boom, the piston is raised a little, so that the double piston will close both ports 24 and 25. To operate the cylinder R, the piston is raised far enough to shut off the waste-pipe 42, but leaving open the port 124, as well as port 25 and waste-pipe 43, through which the water from cylinder S will be discharged.

I have considered it unnecessary to illustrate the interior construction of the single-acting valves. They are simple cylinders having one double piston with inlet and outlet ports and a waste-pipe through which the water is discharged when the inlet-port is shut off.

What I claim is—

1. In a dredger, a swinging boom, hoisting and dumping chains passing over suitable guide pulleys, a hydraulic plunger operating independently to strain and slacken the hoisting chain, and a main plunger arranged to simultaneously strain or slacken both the hoisting and dumping chains, substantially as described.

2. In combination with the swinging boom and sectional bucket, the hoisting and dumping chains connected to said bucket and passing over suitable guide pulleys to a fixed support, the hydraulic plunger carrying a pulley over which the hoisting chain passes for independently straining and slackening said chain, and the main plunger moving in an opposite direction to the first and carrying two pulleys for simultaneously straining and slackening both chains, substantially as described.

3. In combination, the mast and swinging boom, the bucket, the hoisting and dumping chains passing over guide pulleys to a fixed support, the main vertical hydraulic plunger secured to said mast and carrying two pulleys bearing against the intermediate portions of said chains for simultaneously straining and slackening them, and the second hydraulic plunger carried by the cylinder of the main plunger and operating in a reverse direction to independently strain and slacken the hoisting chain, substantially as described.

4. In a dredger a pivoted mast, a boom, a bucket and a hoisting chain in combination with a hydraulic cylinder secured to the mast and forming its lower pivot, a step bearing for said cylinder, and a sliding plunger for straining and slackening the chain.

5. In a dredger a mast composed of two parallel beams, a cylinder secured to and between said beams, a step bearing for said cylinder, a boom, and means for swinging said boom laterally and giving a pivotal motion to the cylinder and mast.

6. In a dredger, the combination with a mast, a boom and a suspended sectional bucket, of a closing and hoisting chain I connected to the sections of the bucket, a cylinder P, its plunger having a guide pulley 15 and a cylinder Q, its plunger having a pulley 20, the chain I passing over said pulleys and having its end secured to the cylinder P, substantially as set forth, and connections from said cylinders to a pump, substantially as set forth.

7. In a dredger, the cylinders P and Q connected together but having independent inlets for water supplied by a pump in combination with a sectional bucket and a chain for closing and hoisting said sections connected to the plungers of both cylinders and having its end secured to the cylinder P, substantially as set forth.

8. In a dredger, the pivoted cylinder P, in combination with the cylinder Q secured to it, a valve for each cylinder, a flexible connection from cylinder Q to its valve, a pump for supplying water, and a bucket having a chain connected to each cylinder, substantially as set forth.

In testimony whereof I have affixed my signature, in presence of two witnesses, this 13th day of December, 1893.

WILLIAM B. PLESS.

Witnesses:
C. T. CLEVE,
E. L. WILHOIT.