No. 861,745. PATENTED JULY 30, 1907.

J. D. MAXWELL.

HYDRAULIC DREDGING APPARATUS.

APPLICATION FILED NOV. 21, 1906.

4 SHEETS—SHEET 1.

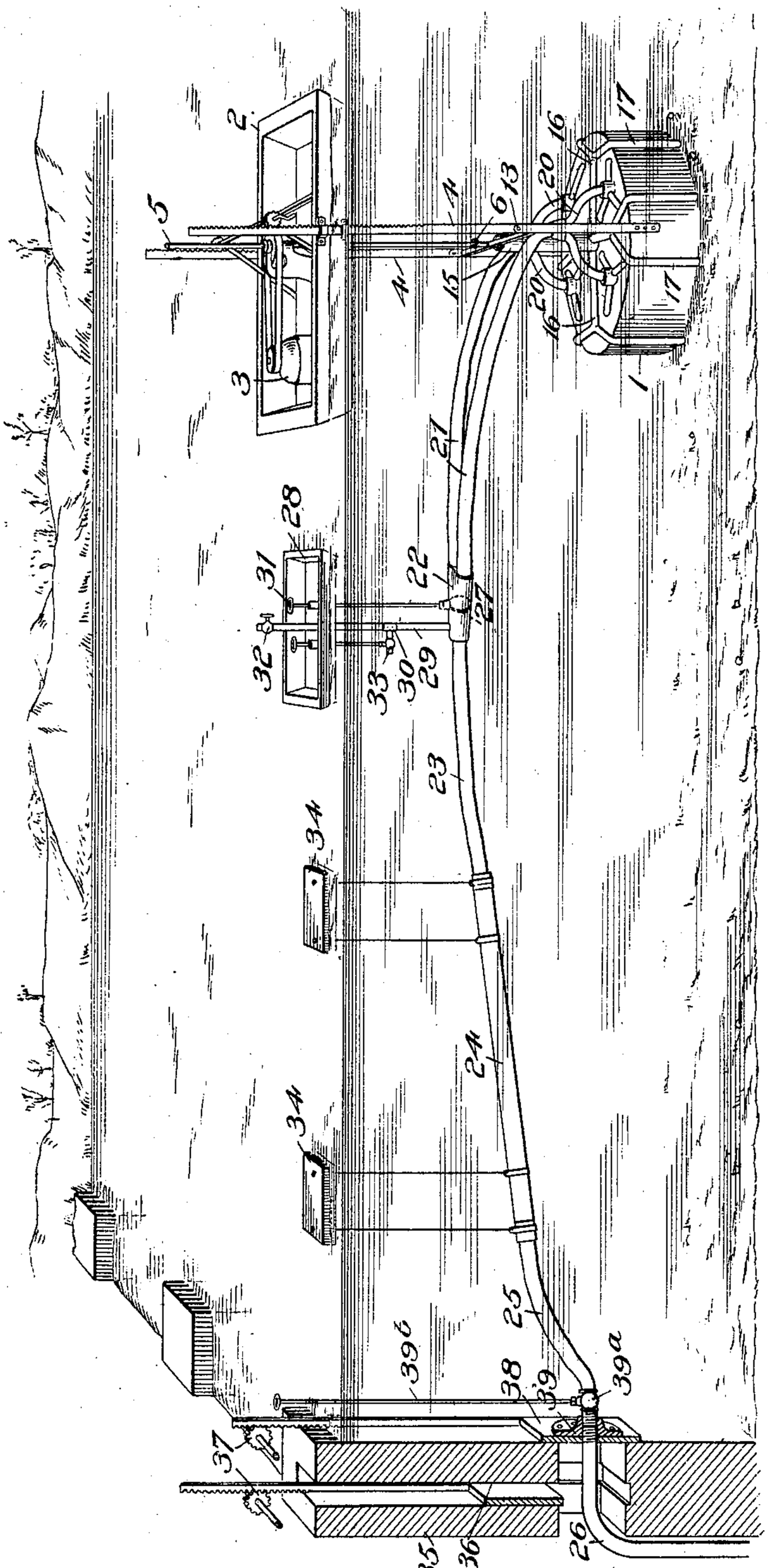

Fig. 1.

Witnesses

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4 SHEETS—SHEET 2.

Fig. 2

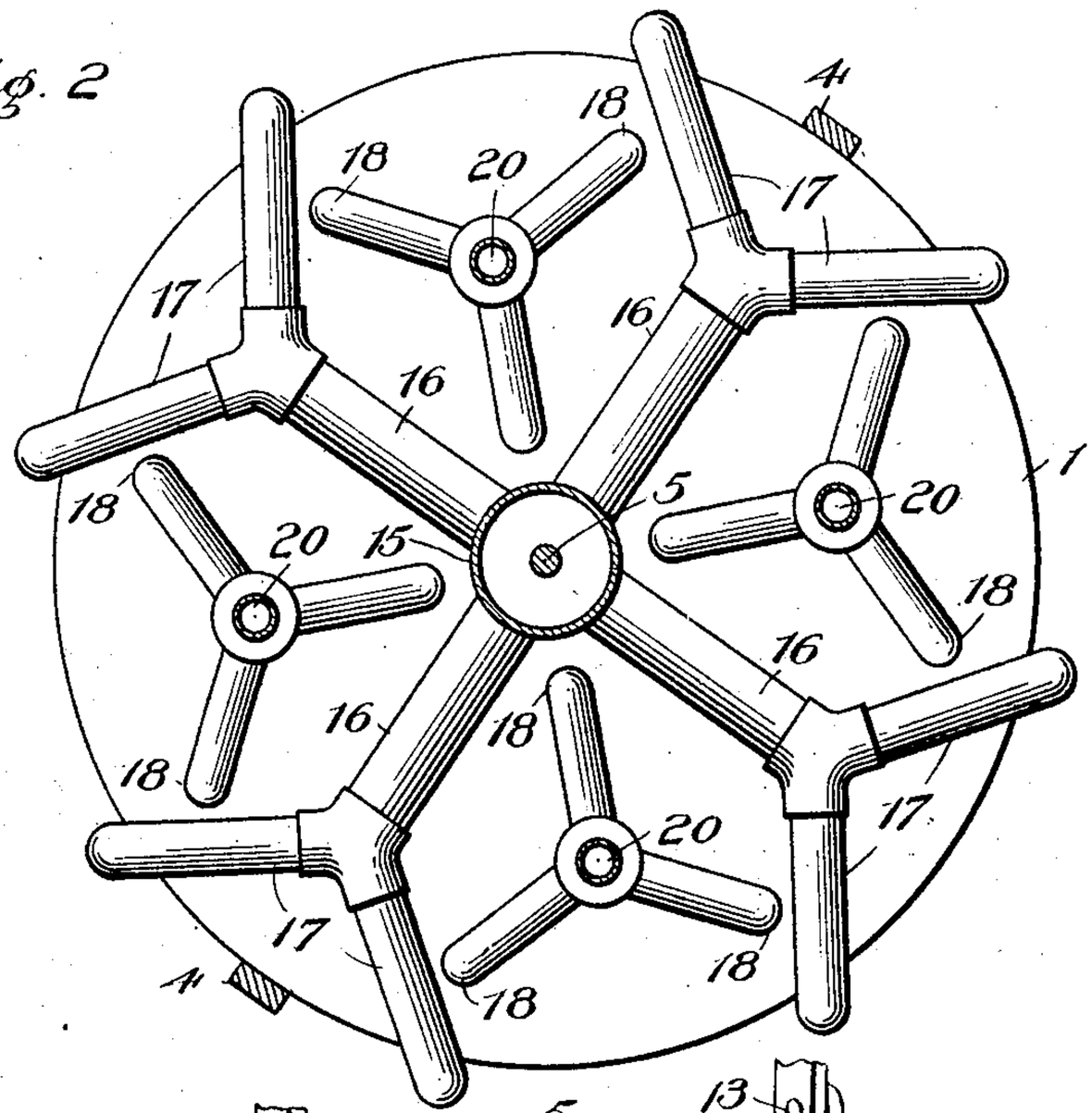
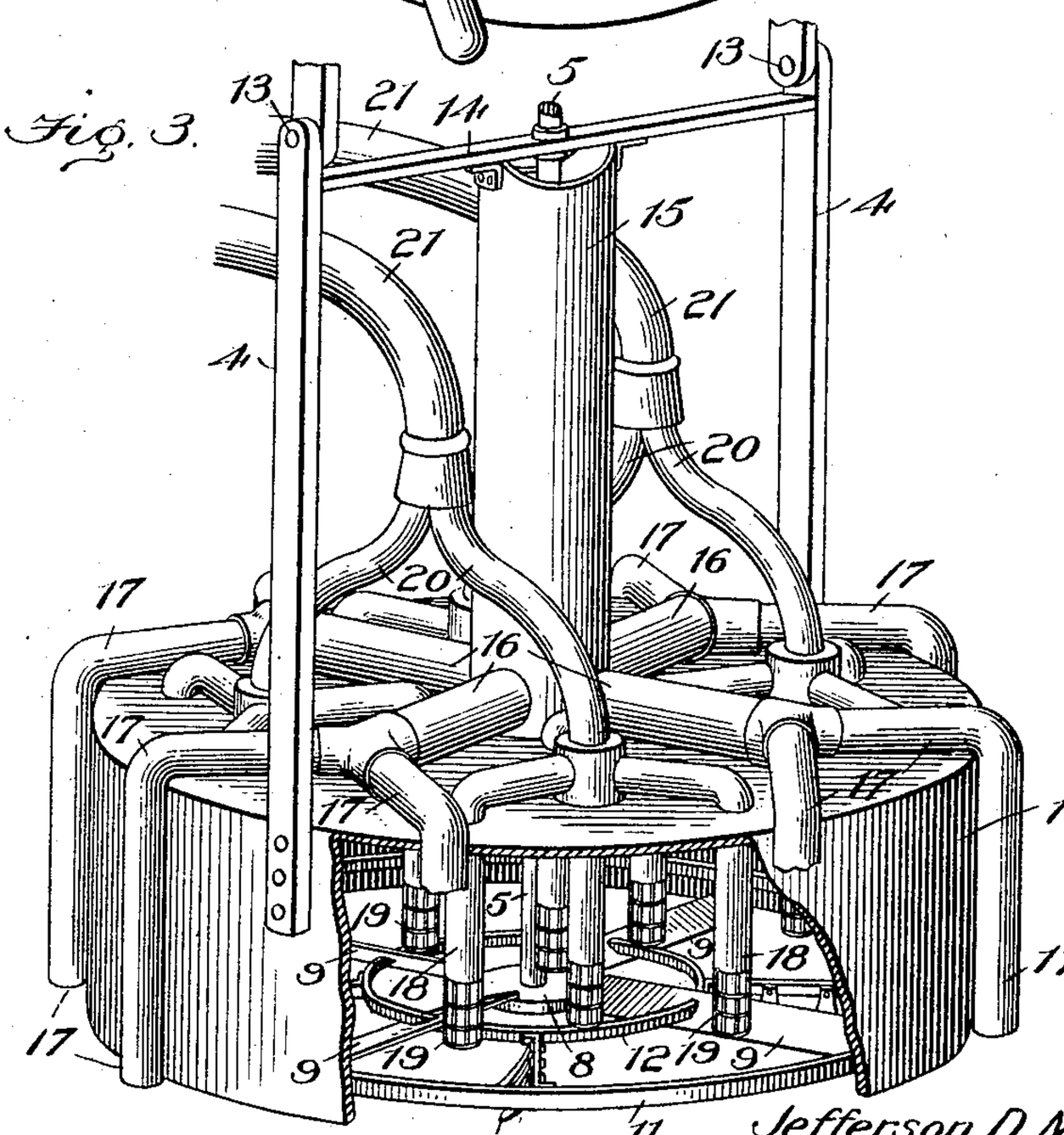


Fig. 3.



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4 SHEETS—SHEET 3.

Fig. 4.

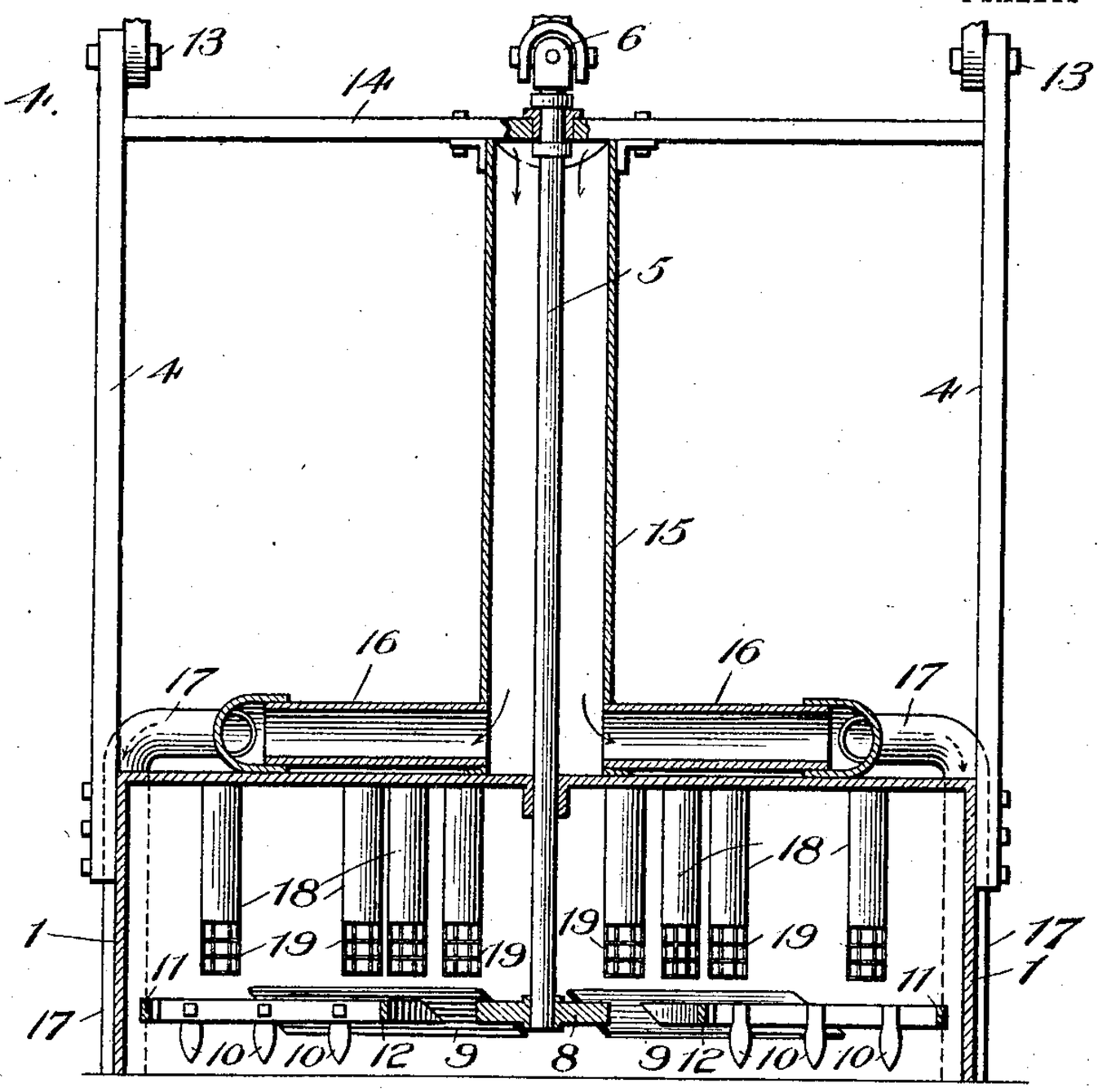
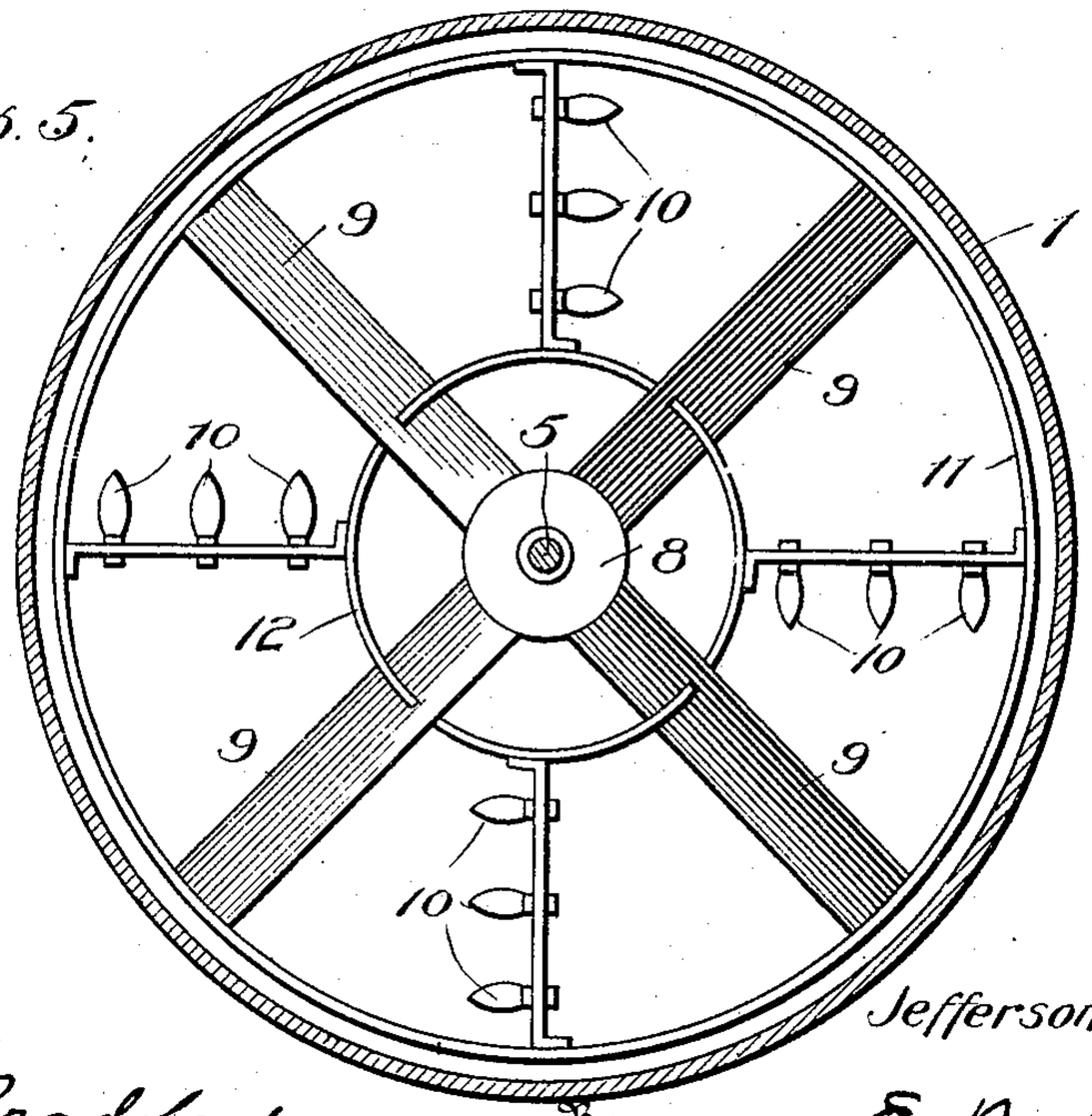


Fig. 5.



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4 SHEETS—SHEET 4.

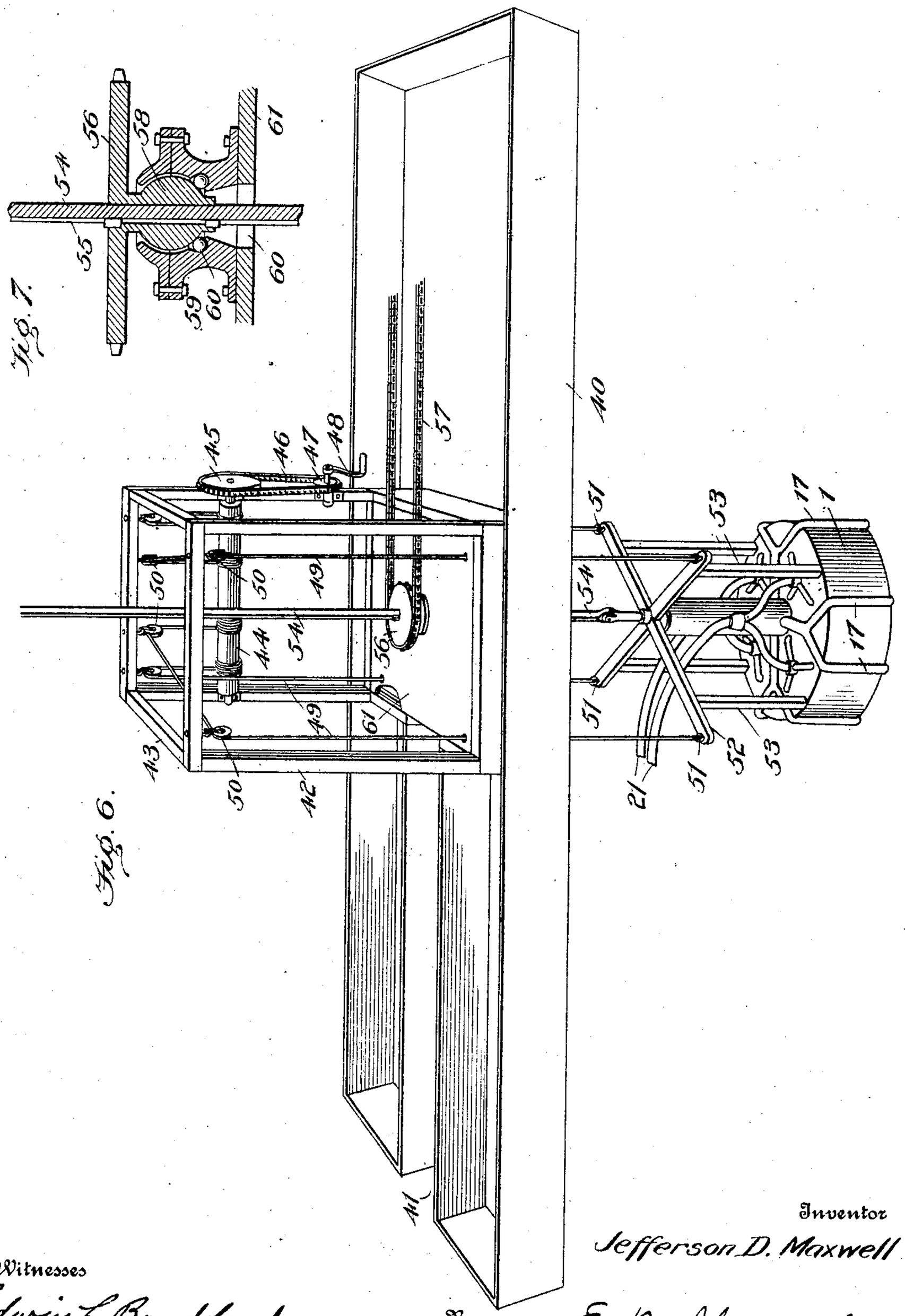

Fig. 6.

Fig. 7.

Witnesses

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UNITED STATES PATENT OFFICE.

JEFFERSON D. MAXWELL, OF ANDERSON, SOUTH CAROLINA.

HYDRAULIC DREDGING APPARATUS.

No. 861,745. Specification of Letters Patent. Patented July 30, 1907.

Application filed November 21, 1906. Serial No. 344,525.

To all whom it may concern:

Be it known that I, JEFFERSON D. MAXWELL, a citizen of the United States, residing at Anderson, in the county of Anderson and State of South Carolina, have invented certain new and useful Improvements in Hydraulic Dredging Apparatus, of which the following is a specification.

This invention relates to an improved means for removing mud, silt, sand, etc. from the bottom of lakes, rivers, dams, reservoirs, canals, and the like, and more particularly to an apparatus for this purpose which is operated largely by the natural head of the water.

The objects of the invention are to provide improved apparatus of the above character, and to so arrange the several parts as to accomplish the desired results in a very convenient, simple and efficient manner.

With the above and other objects in view, the invention consists in the construction of an improved dredging or suction head and associated parts, together with certain novel details of arrangement hereinafter described, and illustrated in the accompanying drawings, in which:—

Figure 1 is a view, partially in vertical section, showing the manner of installing my complete apparatus, at an ordinary dam. Fig. 2 is a plan view of my improved dredging head. Fig. 3 is a perspective view of the head and associated parts, part of the casing being broken away. Fig. 4 is a vertical section of said head and connections; and Fig. 5 is a horizontal section of the head, showing the arrangement of stirrers and blades. Fig. 6 is a view, in perspective showing my preferred arrangement of supporting and operating means. Fig. 7 is a sectional view of one of the details of construction.

As is well known, it is a common occurrence for reservoirs, ponds, and the like to become filled to a greater or less degree with, mud, silt, or sand, etc., which is washed down by rain and such accumulations are objectionable, owing to the fact that they diminish the depth or capacity, or both, of the reservoir. The common method of removing such accumulations, as heretofore practiced, has been to dredge them up and carry them away, by means of diggers and pumps, driven by powerful engines. Such a method is expensive, in that it necessitates the expenditures of a large amount of energy or power in bodily lifting the excavated material through considerable distances. In the present invention, I propose to utilize the head of the water, itself as the source of power in performing the work of lifting and conveying the material, and merely employ a small auxiliary motor to assist in stirring up the accumulations.

Referring to the drawings in detail, 1 represents my improved dredging or suction head. This rests on the bottom of the lake or reservoir, and has attached thereto vertical hinged rods 4, which project above the surface of the water. Associated therewith is a scow or flat boat, 2, which floats immediately above the head 1, and which carries any suitable means, as, for instance pinions, coöperating with racks on the bars 4, for raising and lowering the head, and also a small motor, 3, of any desired type, for rotating the vertical shaft 5, hereinafter described. Referring particularly to Figs. 4 and 5, my improved dredger consists of a cylindrical casing 1, open at the bottom, and closed at the top, and having a stand pipe 15, set onto the center thereof, left open at the top, but closed at the bottom.

The rods 4 are attached to either side of the casing 1 and are provided, as at 13, with hinges, whereby the casing may adjust itself to the irregularities of the lake bottom. The rods 4 are joined as by a brace 14, to which, also the upper end of pipe 15 is secured. Through a bearing in this brace member, and through the top of the head, at the bottom of pipe 15 the vertical shaft 5 passes, and is journaled. This shaft is provided with a universal joint as 6, to allow for movement of the head. On its lower end, near the bottom of the casing or head, the shaft 5 carries a hub, 8, to which are attached four or more radially disposed blades, 9, set at an angle, like fan blades. The blades are further held by inner and outer brace rings, 11 and 12. Secured between these rings, are four or more sets of diggers or stirrers, 10, arranged alternately with the blades, 9, and consisting of downwardly inclined points or plows of suitable shape.

Referring to Figs. 2 and 3, it will be seen that the stand pipe 15 is tapped at its bottom by four horizontal pipes, 16, lying along the top of the casing 1, and each of which, in turn, branches, by means of a Y-connection into two smaller pipes 17. These smaller pipes are bent downwards over the sides of the casing 1, as clearly shown in Fig. 3, and terminate adjacent the bottom edge of the said casing. These constitute relief or supply pipes, and their purpose is to supply water to the outer edge of the suction head, in case it becomes buried in the mud or sand. They thus prevent choking, and also obviate the pressure on the head which would otherwise result from the suction within.

The suction or dredging pipes proper consist of a plurality (sixteen, as shown) of intakes, 18, protected by suitable guards, 19, to prevent the entrance of coarse material. These intakes pipes branch, in groups of four, from four other pipes 20, in the nature of flexible rubber or canvas hose. These pipes 20 join in pairs to form other flexible pipes 21, and these, in turn, as shown in Fig. 1, finally unite as at 22 to form the main suction or discharge pipe 23. This is also flexible for some distance, to admit of proper manipulation.

Above the junction 22 is located another and smaller

boat 28, or other suitable support. In the junction 22 is arranged a gate valve 27, operated by a handwheel, 31. From the junction also rises a small pipe 29, terminating above the boat in a valve 32. This arrangement is to permit of the escape or admission of air from or to the main pipe. Fitted to this pipe is a T-connection, 30, carrying a valve, 33, opening under water, and controlled from the boat 28. The hose 23 connects with a section of ordinary pipe, 24, of any desired length, and supported by means of floats, 34. This pipe is preferably supported in an inclined position, as shown. From its lower end, leads another piece of flexible hose, 25, to the sluice gate.

35 is the dam, provided with the usual sluice gate, 36, operated by any suitable means, shown in the present instance as a rack and pinion 37.

38 is an auxiliary sluice gate, working against the inside of the dam, and carrying a pipe connection 39, into which the end of the hose 25 is secured. In the end of the section 25, just before it enters the connection 39, is arranged a valve 39^a, controlled from the dam by means of a rod 39^b, extending above the water. Also fastened in this connection 39 is one end of the discharge pipe or hose 26, which extends through the gate aperture and runs down outside the dam.

The operation of the system is as follows: The pipe line is filled with water by closing the valve 39^a and opening valve 33, the air contained in the pipe escaping by means of valve 32. Then, upon closing valves 32 and 33 and opening valve 39^a the action is started. The motor 3, (which may be a gasolene engine or other suitable device) rotates the shaft 5, and drives the stirrers 10, and blades 9. The mud etc. is loosened up by the stirrer, and, the water, entering under the edge of the casing 1, both directly and through the branches of pipe 15, mixes with the loose material, and the revolving blades lift the mixture toward the mouths of the intake pipes 18. It will be observed that, owing to the head of water above the suction head, the pressure of the water will be considerable, and it will rush up into the intake pipes with a velocity sufficient to easily enable it to carry along the mud, sand, etc. The excavated material will be driven through the main dredging pipe, 23, 24, 25, and finally out through the discharge pipe 26. In the arrangement shown the force tending to urge the water through the pipeline is dependent both upon the static pressure due to an effective head equal to the distance from the surface of the water to the center of connection 39, and upon the siphonic action, due to the depending end of the discharge pipe. If, however, the water level should fall to or below the level of the sluice gate, the dredging action would still continue, due to siphonic action alone, so long as the discharge end of the pipe 26 is led to a point below the water level, and the lift does not exceed 32 feet.

By virtue of the flexible connections 21 and 23 the suction head may be moved about as desired, as the material is removed and carried off.

In Fig. 1 of the drawing I have shown one form of float or scow and operating means for the tank or head 1, but in practice I prefer to employ the construction of float or scow and lifting or elevating means shown in Figs. 6 and 7. In Fig. 6 the reference numeral 40 designates a scow having an opening or passage-way 41 throughout about one-half of its length to permit of the passage therethrough of the outlet pipes 21, leading from the head, when the latter is elevated. Rising vertically from the scow is a plurality of standards 42 having the connecting cross-pieces 43 at the top thereof. Journaled in two of the vertical standards 42 is a drum 44 having fixed to one end thereof a sprocket wheel 45 over which passes a sprocket chain 46, said chain also passing over a small sprocket wheel 47 to the shaft of which is attached a crank handle 48 by means of which the drum 44 may be rotated. Secured to said drum are four lifting cables 49 each of which passes over a pulley 50 secured to the cross-pieces 43, the lower ends of the cables being attached to rings 51 secured to a suitable frame work 52 carried by standards 53 rising upward from the head 1. The operating shaft 54 for operating the diggers or stirrers arranged within the head and which corresponds with the shaft 5 of the other figures, is longitudinally grooved as at 55, Fig. 7, and with this shaft is splined a sprocket wheel 56, about which a sprocket chain 57 passes, said sprocket chain being operated by any suitable form of motor to rotate the shaft. The sprocket wheel 56 is mounted upon a spherical support 58 that is housed in a suitably formed casing 59, and has a ball raceway in which a series of balls 60 are freely mounted and upon which the spherical body 58 normally rests. The said casing 59 is secured to a well door 61 supported upon suitable cleats within the well of the scow, a sufficient space or opening 60 being provided in the bottom of the casing 59 and in the well door 61 to permit of a lateral or swinging movement of the shaft 55 in all directions.

When it is desired to raise the head, this can be accomplished by rotating the crank handle 48 in a direction to wind the lifting cables 49 on the drum 44, and this will tend to raise the head up through the well in the scow to a sufficient height to enable access to be gained to the interior of the head for repairing or examining the diggers or stirrers or for transportation purposes. The pipe line will also rise with the head, and can be freely brought to the surface through the passageway 41, above referred to, formed by the bifurcated portion of the scow or boat.

When it is desired to shut down the plant, the gate valve 27 is closed. Then, by admitting air through valve 32, the pipe line will empty itself, and, owing to its buoyancy rise to the surface. Then, by detaching pipe 26, and closing gate 36, auxiliary gate 38, carrying pipe 25, may be hoisted to the surface, and the pipe disconnected.

It will be seen that by the above apparatus, I have provided means whereby dredging may be accomplished with the expenditure of very little artificial power, and it is thought that the economy, simplicity, and efficiency of my system will be readily appreciated by those skilled in the art.

It will be understood that where I use the word "reservoir" I intend to include any natural or artificial body of water whatsoever.

I claim as new and desire to secure by Letters Patent:—

1. In a hydraulic dredging apparatus, a suction head comprising a casing, and means for supplying water to the lower edge of said casing.

2. In a hydraulic dredging apparatus, a suction head,

suction pipes extending therefrom and tending to produce a vacuum therein, and hydraulic means acting around the lower edge of the head for preventing undue pressure on the same.

3. In a hydraulic dredging apparatus, a suction head consisting of a closed casing, a stand pipe rising vertically therefrom and opening under water, and relief pipes extending from the stand pipes, and terminating adjacent the lower edge of said casing.

4. In a hydraulic dredging apparatus, a suction head, suction pipes extending therefrom, means for supplying water around the lower edge of said head and means within said suction head for loosening up the material to be excavated.

5. In a hydraulic dredging apparatus, a suction head open at the bottom, suction or intake pipes projecting thereinto and extending therefrom, and motor driven stirring means arranged within said suction head, and comprising diggers adapted to act on the material below said head.

6. In combination, a suction head, a suitable support arranged above the same, hinged members connecting said head with said support, stirrers in said suction head operated by a vertical shaft having a universal joint, and a motor carried by said support and arranged to drive said shaft.

7. In a suction head, a plurality of intake pipes projecting downwardly thereinto, and means within said head for lifting the excavated material toward said intake pipes.

8. In a suction head, a casing, intake pipes extending downwardly thereinto, and rotating means arranged in said casing comprising alternate radially disposed diggers and inclined blades, whereby the material to be excavated is both loosened up and lifted toward the intake pipes.

9. In a hydraulic dredging apparatus, a main flexible suction pipe supported under water by means of floats, a suction head, and a plurality of branch suction pipes extending from said main pipe, and terminating in said suction head.

10. In a hydraulic dredging apparatus depending for its action, upon the natural head of water, a suction pipe consisting of suitable sections means for supporting the same, in a substantially siphonic configuration, and suitable air and water pipes and valves attached to said suction pipe at its highest point, whereby the operation of the apparatus may be controlled, without the use of pumps.

11. In a hydraulic dredging apparatus depending for its action, upon the natural head of water, a flexible discharge pipe, and means for leading said pipe through a dam or the like, comprising double sluice gates operating to close the same orifice in the dam, and to one of which the discharge pipe is detachably connected.

12. In a hydraulic dredging apparatus, a suction head, water inlet and outlet pipes therefor, said outlet pipe terminating in a plurality of branches, a junction box in said pipe, and a valve in said junction box.

13. In a hydraulic dredging apparatus, a suction head, water inlet and outlet pipes therefor, said outlet pipe lying entirely under water, and terminating in a plurality of branches, a junction box in said pipe, a valve in said junction box, and a vent pipe also connecting with said junction box and extending above the surface of the water.

14. In a hydraulic dredging apparatus, a suction head, inlet and outlet pipes therefor, said outlet pipe lying entirely under water and containing a junction box, a valve in said junction box, a water supply and vent pipe also connecting with said junction box, valves in said pipe, a boat or other suitable support above said junction box, and means for controlling all of said valves from said support.

15. In a suction head, a casing, a standpipe projecting upwardly therefrom and opening under water, a plurality of branch pipes extending from said stand pipe, and each of said branch pipes being provided with a plurality of branches diverging therefrom.

16. In a suction head, a casing adapted to rest on the bottom of a reservoir, a stand pipe opening under water extending vertically therefrom and provided with a plurality of branches, said branches being bent over the sides of said casing, and terminating adjacent its lower edge.

17. In a suction head, a casing, water outlet pipes connecting therewith and terminating, in said casing, in a plurality of groups, each group comprising a plurality of suction pipes.

18. In a suction head, a casing, water outlet pipes connecting therewith and terminating in said casing in a plurality of groups, each group comprising a plurality of suction pipes, each suction pipe being provided with a suitable foraminous guard.

19. In a hydraulic dredging apparatus, a flexible pipe, having one end extending beyond a bank of the reservoir being dredged, and having its other end connected with a vertically movable suction head, and a scow arranged above said head and provided with a well, and passageway opening from said well through the end of said scow, through which well and passageway the suction head and connected pipe may be vertically lifted.

20. In a hydraulic dredging apparatus, a suction head, power driven stirrers therein, a scow arranged to support said head, and a shaft attached to said stirrers and mounted in said scow by means of a journal having universal movement.

21. In a hydraulic dredging apparatus, a suction head, a floating support therefor, motor driven stirring means arranged within said head, and a power transmitting shaft extending between said head and said support, said shaft being universally journaled in said support and also provided with a universal joint, whereby its operation is not interfered with by displacements of said support.

22. In a hydraulic dredging apparatus, a scow, dredging means supported thereby, a shaft for operating said dredging means journaled in said scow, the journal comprising a spherical member, a casing therefor, and rolling members, arranged between said spherical member and said casing, whereby free rocking movement is permitted, between said shaft and scow.

23. In a hydraulic dredging apparatus, a suction head, a support therefor, a well in said support through which said head may be hoisted, and hoisting means carried by said support comprising a drum, and a plurality of cables connected with said head and adapted to be wound on said drum.

24. In a hydraulic dredging apparatus, a support, a suction head arranged thereunder, stirring means in said head, a shaft connected with said stirring means and extending through said support, a universally mounted journal in said support for said shaft, and a driving sprocket slidably mounted on said shaft.

25. In a hydraulic dredging apparatus depending for its operation on siphonic action, a suction pipe consisting of suitable sections supported by means of floats in a substantially siphonic configuration, and air and water pipes and valves attached to said suction pipe at its highest point, whereby the operation of the apparatus may be controlled.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

JEFFERSON D. MAXWELL.

Witnesses:

J. GRANVILLE MEYERS,

GEO. W. REA.