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G. F. BROWN & D. L. B. CONDON, EXECUTORS.

OIL AND SAND SEPARATOR.

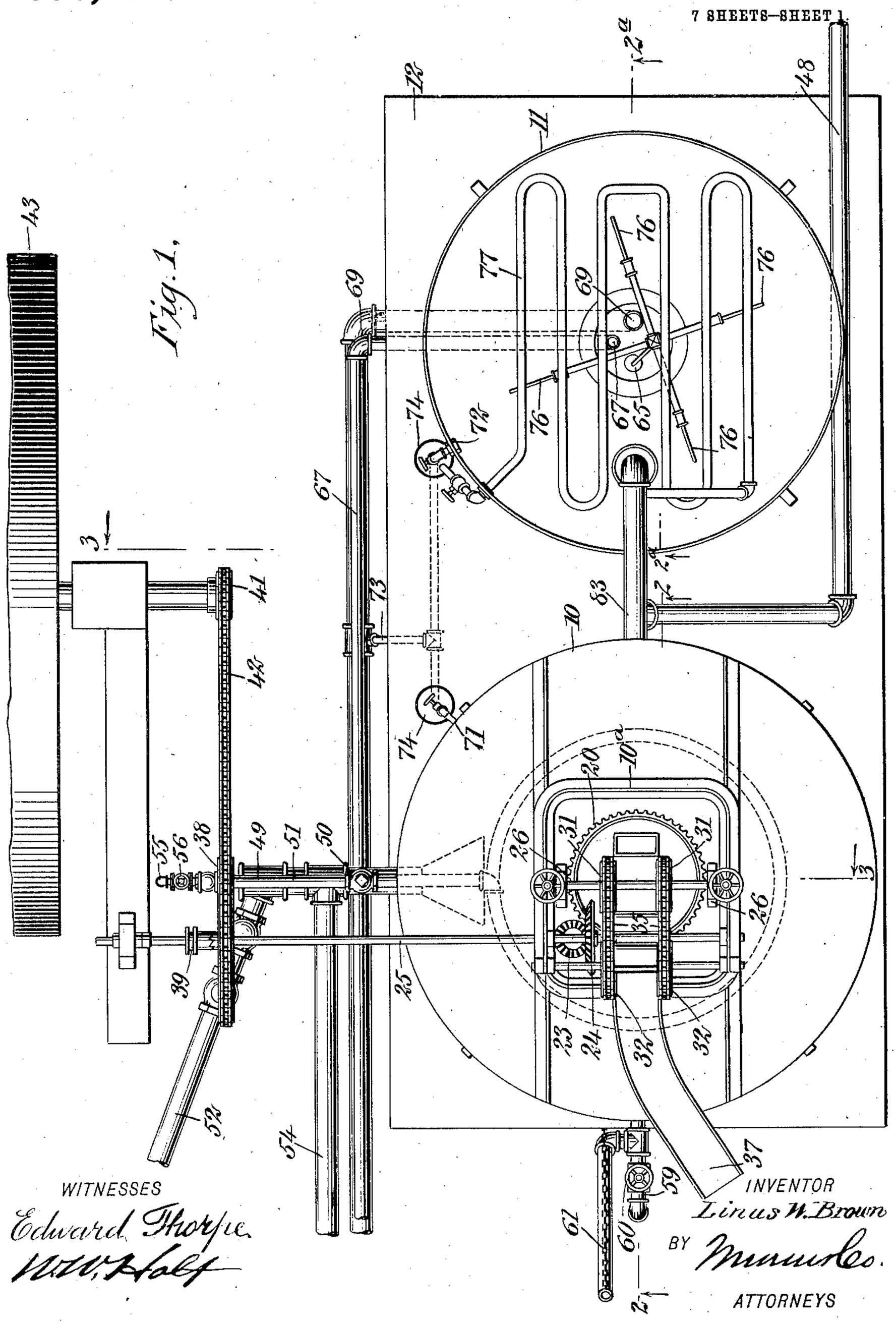
APPLICATION FILED MAY 29, 1908.

990,800.

Patented Apr. 25, 1911.

7 SHEETS—SHEET 1.

Fig. 1.



WITNESSES

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[illegible]

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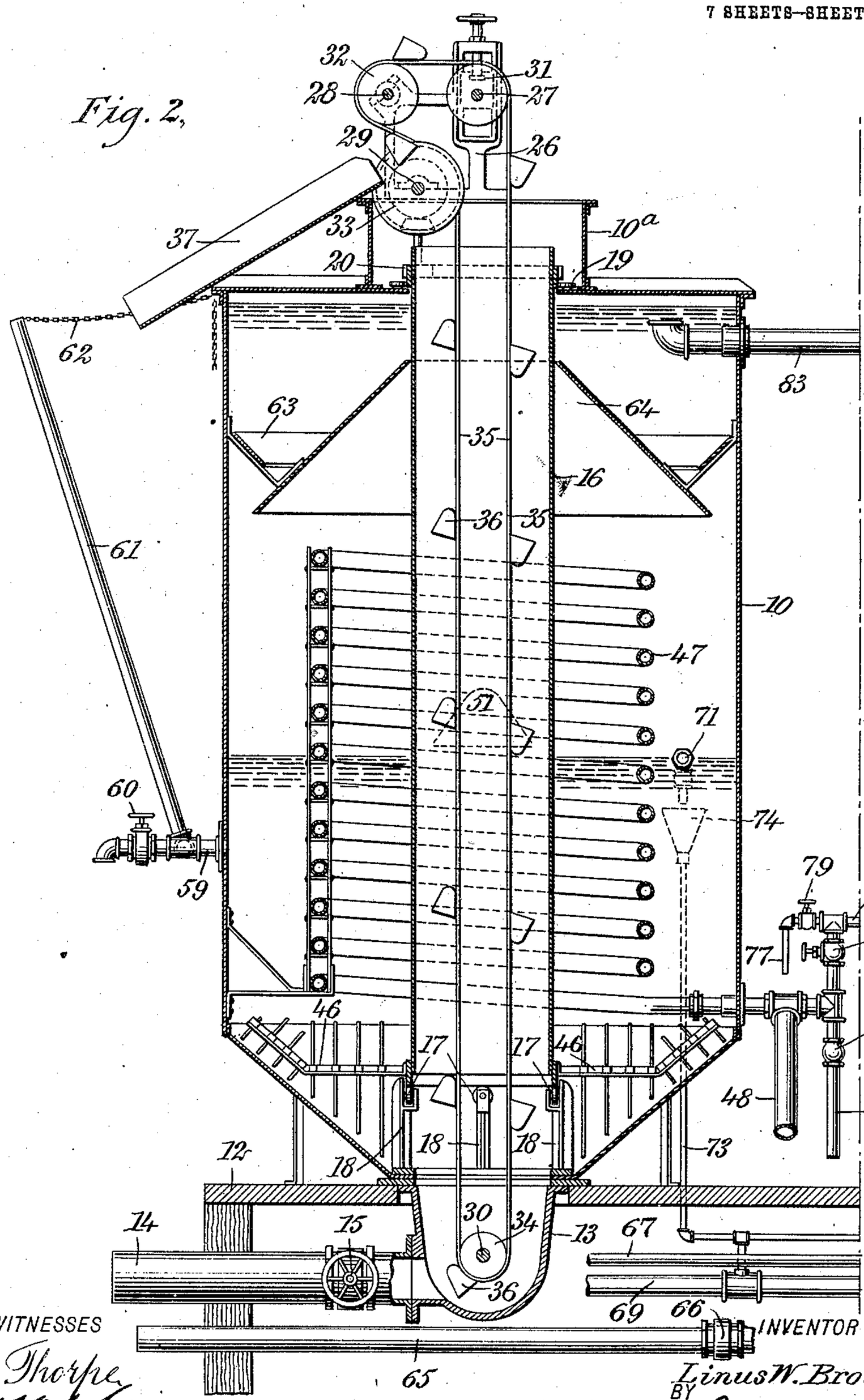
7 SHEETS—SHEET 2.

Fig. 2.



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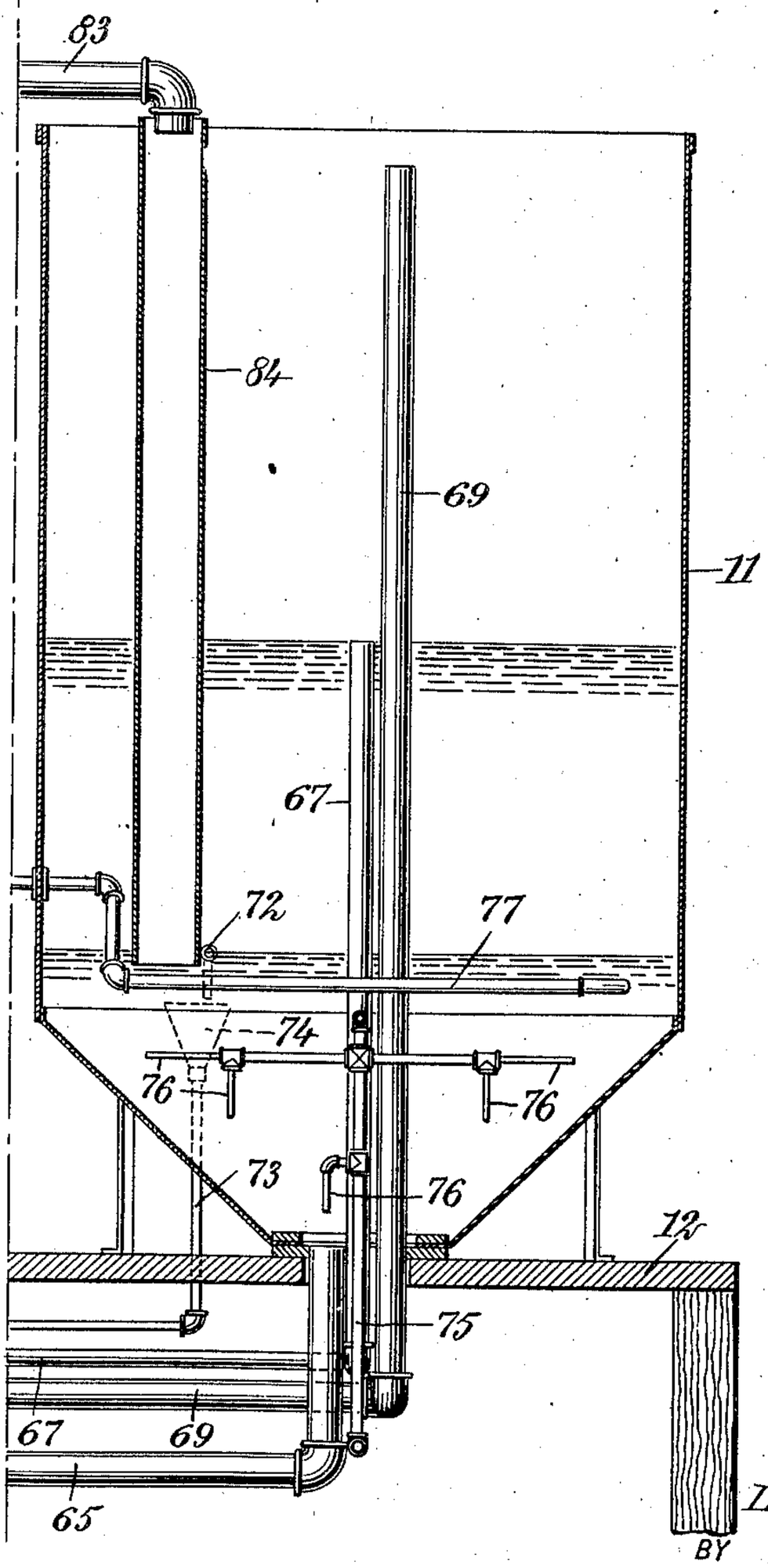
7 SHEETS—SHEET 3.

Fig. 2a.



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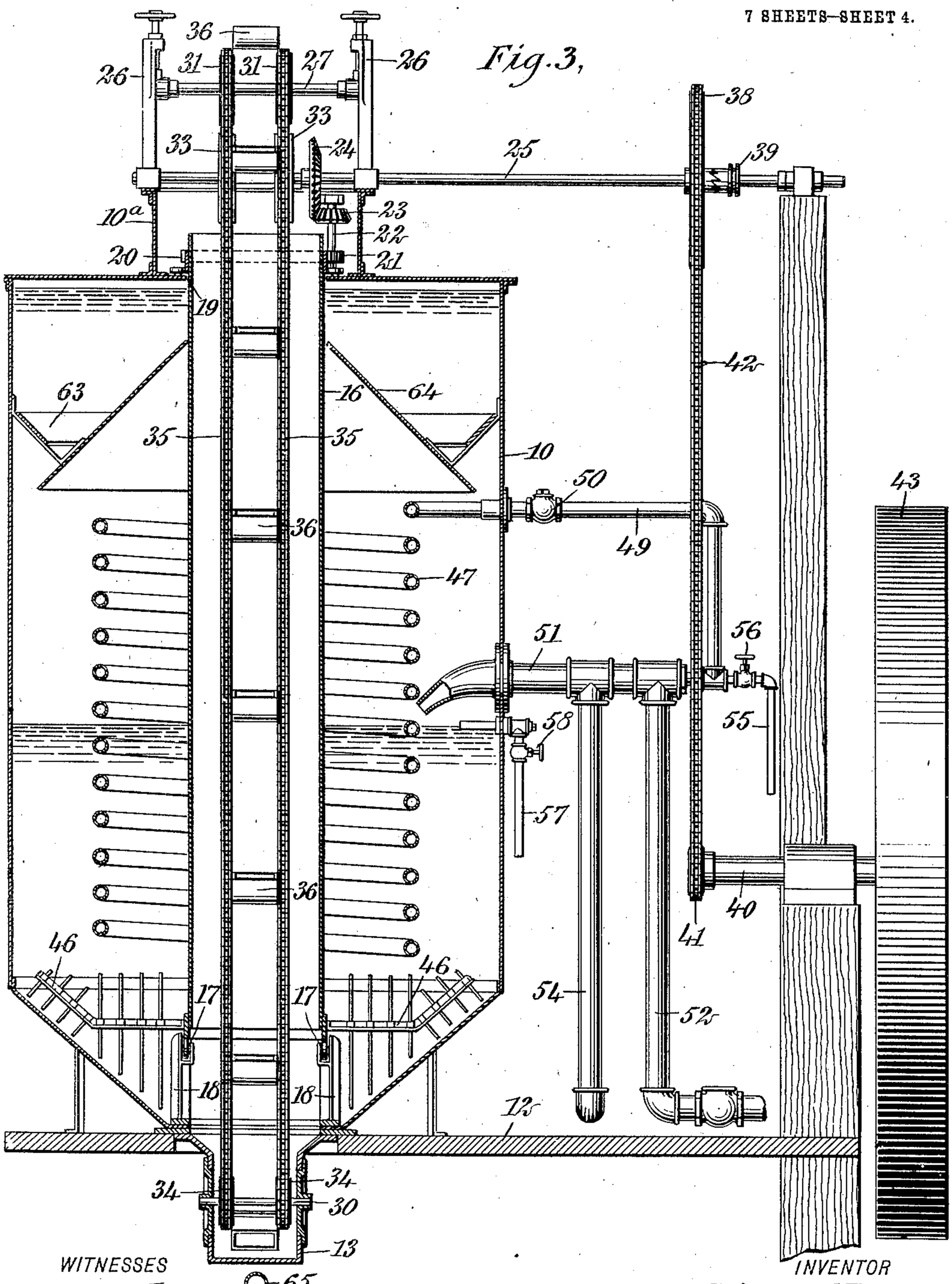
7 SHEETS—SHEET 4.

Fig. 3,



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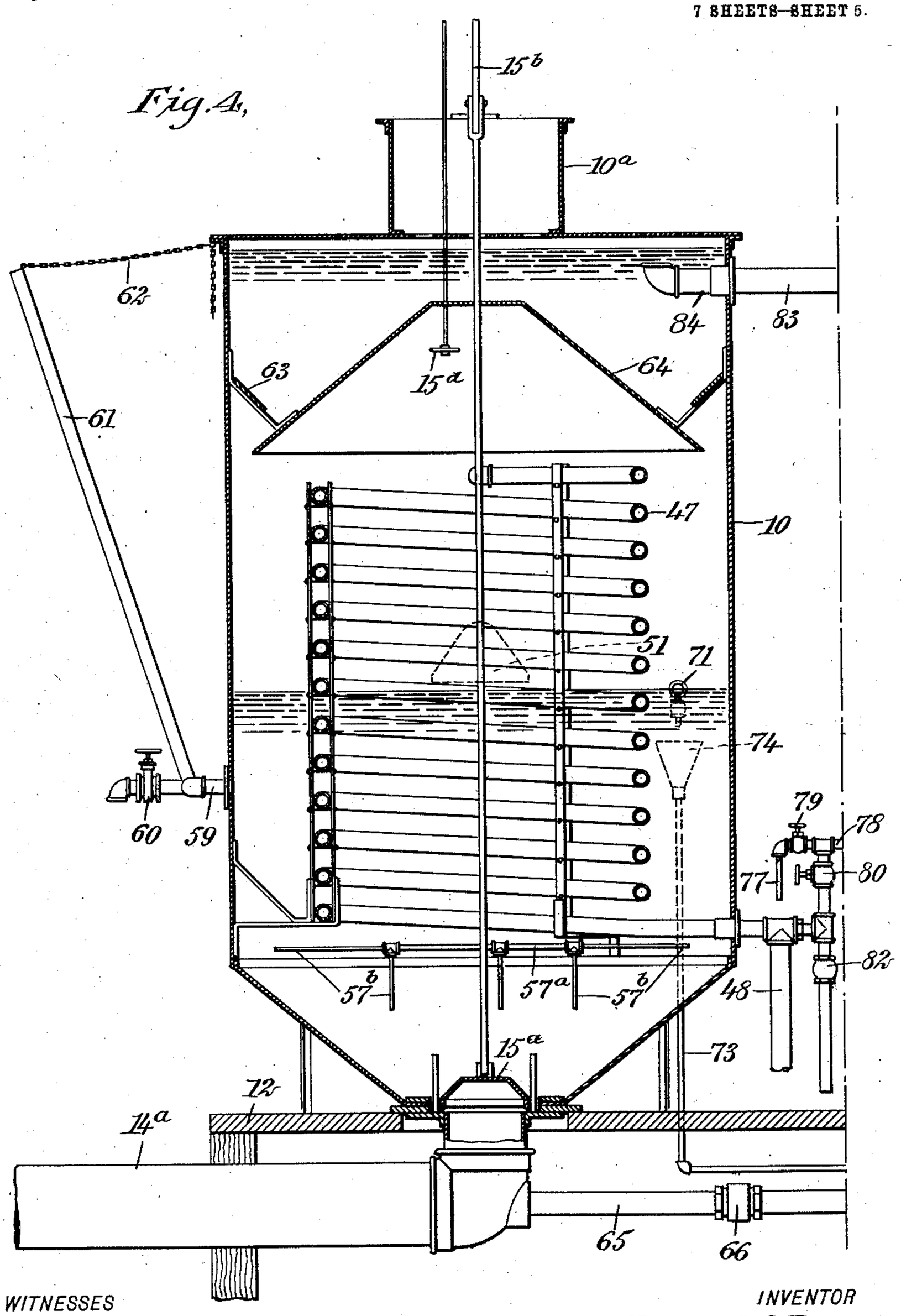
7 SHEETS—SHEET 5.

Fig. 4.



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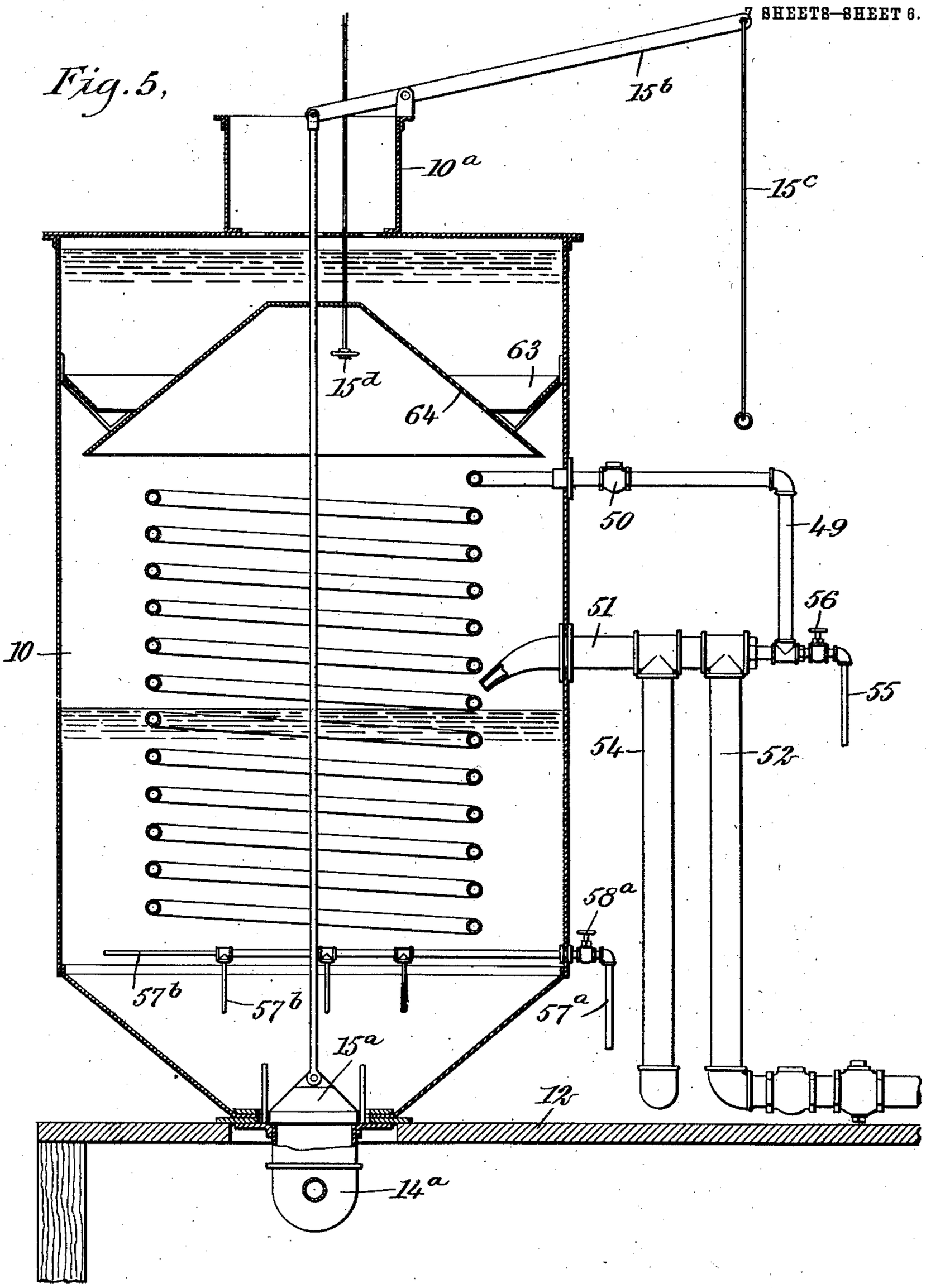
7 SHEETS—SHEET 6.

Fig. 5,



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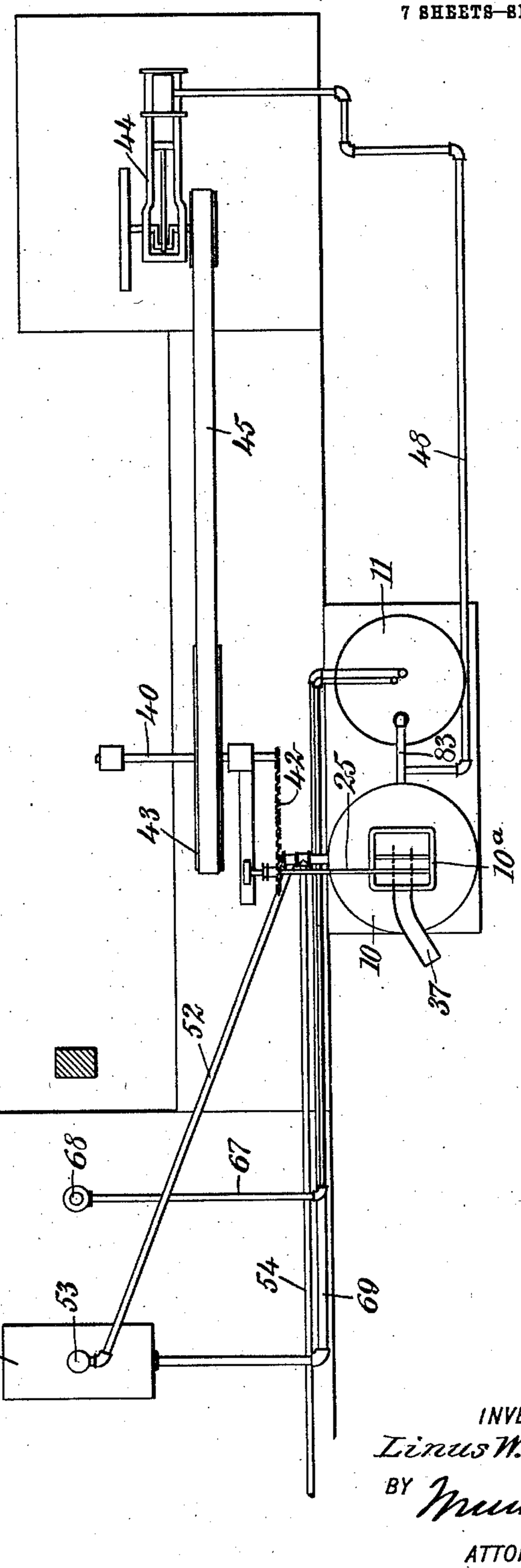
7 SHEETS—SHEET 7.

Fig. 6.



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UNITED STATES PATENT OFFICE.

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OIL AND SAND SEPARATOR.

990,800. Specification of Letters Patent. Patented Apr. 25, 1911.

Application filed May 29, 1908. Serial No. 435,705.

To all whom it may concern:

Be it known that I, LINUS W. BROWN, a citizen of the United States, and a resident of Bakersfield, in the county of Kern and State of California, have invented a new and Improved Oil and Sand Separator, of which the following is a full, clear, and exact description.

This invention is an oil and sand separator, relating more particularly to improvements in appliances of the character described in an application filed by me March 21, 1907, serially numbered 363,762, on which the Patent No. 879,728 was granted February 12, 1908.

The present apparatus is for the separation of the oil from the sand as fast as they are pumped from the well, which permits of the running of the oil to the storage without being delivered to the sumps or otherwise coming in contact with the ground or exposed where evaporation can take place, or the danger of fire.

Reference is to be had to the accompanying drawings forming a part of this specification, in which similar characters of reference indicate corresponding parts in all the views.

Figure 1 is a plan of the separating and flow tanks and adjacent construction; Figs. 2 and 2ª are sections respectively on the lines 2—2 and 2ª—2ª of Fig. 1, looking in the direction of the arrows; Fig. 3 is a section on the line 3 of Fig. 1; Fig. 4 is a vertical central sectional view, showing a modification of the separating tank as shown in Fig. 2; Fig. 5 is a vertical central sectional view of the separating tank shown in Fig. 4, looking in a direction at substantially right-angles thereto; and Fig. 6 is a diagrammatic view of the appliance complete.

Referring more particularly to Figs. 1, 2, 2ª, 3 and 6, the appliance is shown to consist primarily of a separating tank 10 and a flow tank 11, these tanks being of substantially the same outward form and arranged in an upright position at the same elevation on a suitable support or platform 12. Both tanks preferably have bottoms of conical form to which is detachably connected in the case of the tank 10, a boot-casing 13, which is in communication with a sluice or sand discharge pipe 14, having a controlling valve 15. Centrally and longitudinally arranged in the tank 10 is a tube 16, which, at its bottom, is supported on rollers 17 a substantial distance above the bottom of the tank, the rollers being carried by supports 18, positioned at suitable intervals. The upper portion of the tube 16 passes through the top of the tank, where it is provided with contacting rollers 19, and a surrounding gear 20, the latter being in mesh with a pinion 21 fixed to the lower end of a shaft 22, which also carries at its opposite and upper end, a bevel pinion 23 in mesh with a similar but larger pinion 24, this last-named pinion being carried on a driven shaft 25.

Surrounding the upper portion of the tube 16 is a drip tank 10ª, and rising thereabove at opposite sides are frames 26 having adjustable bearings in which a shaft 27 is journaled. The frames also provide bearings for a shaft 28 arranged at substantially the same elevation and at one side of the shaft 27, and a shaft 29 arranged below and between the shafts 27 and 28.

Journaled crosswise in the boot-casing is a shaft 30, parallel to the shafts 27, 28 and 29, and to all of these shafts are attached spaced sprocket wheels, respectively indicated by the reference characters 31, 32, 33 and 34, over which pass chains 35 having buckets 36 attached at intervals of their length, the said buckets discharging as they pass over the sprocket wheels 32 into an inclined chute 37.

I have shown the shaft 25 extended beyond the frames 26 at one side, where it carries a sprocket 38 adapted to be thrown into and out of operation by a clutch 39. This last mentioned sprocket wheel is driven by a driving shaft 40 through a sprocket wheel 41 and chain 42, the driving shaft being provided with a band-wheel or pulley 43, which, as shown in Fig. 6, is operatively connected with the driving pulley of an engine 44 by the belt 45.

The lower end of the tube 16 has attached thereto a number of radiating vanes or stirrers 46, each vane having a number of cross-pins conforming to and approximately filling the conical bottom of the tank. Above these vanes or stirrers the tube 16 is surrounded a considerable portion of its length by a heating coil 47, which, as best shown in Figs. 1, 2 and 6, is supplied with the exhaust steam from the engine 44 through a pipe 48. The upper portion of the heating coil 47 discharges through a pipe

49 having a check valve 50, the said pipe being connected to the outer end of an oil injecting nozzle 51, which leads into the separating tank approximately midway its height, and, as shown in dotted outline in Fig. 2 and in full lines in Fig. 3, curves slightly downwardly in the tank and is constructed with an elongated discharge opening to deliver the oil in the form of a relatively thin film. Also connecting with the nozzle 51, intermediate the separating tank and pipe 49, is an oil and sand pipe 52 leading from the well 53, as shown in Fig. 6, and a pipe 54 leading from one or more other wells. A pipe 55 for the conduction of live steam connects with the nozzle through the connection in the pipe 49, and has a controlling valve 56. Leading into the separating tank at or below the elevation of the nozzle 51 is a water supply pipe 57 having a controlling valve 58. A pipe 59 connects with the tank a substantial distance below the normal water level and has a controlling valve 60, and between said valve and the tank it is provided at one side with a communicating swinging or pivoted pipe 61 which is held in adjusted position by a chain or other flexible connection 62.

Above the coil 47 the separating tank is provided with baffle plates 63 and 64, both baffle plates being of conical form, with the baffle plate 63 arranged adjacent to the wall of the tank and inclining inwardly and downwardly, and the baffle plate 64 arranged adjacent to the central tube 16 and inclining outwardly and downwardly.

The bottom of the flow tank 11 connects with a wash-out pipe 65, having a controlling valve 66. A vertical suction pipe 67 leads from the normal oil level of the flow tank to a pump 68, as shown in Fig. 6, which pumps the oil to the storage. A vertically-arranged overflow pipe 69 leads from a point near the top of the flow tank 11 to the well 53, the connection between it and the well preferably being through a drip tank 70 which surrounds the upper portion of the well and collects and returns to the well such oil as is generally lost by leakage. The pipe 69 also connects with the discharge from telltales 71 and 72, connecting respectively with the separating and flow tanks at their normal water levels, the discharge from these telltales being through a U-shaped pipe 73 having funnels 74 at its ends. A water supply pipe 75 passes to the lower portion of the flow tank, where it is provided with discharge nozzles 76, which, as shown in Fig. 2ª, are radially and downwardly directed, with one of said nozzles pointing directly over the entrance to the wash-out pipe. Above the discharge nozzles of the water supply pipe, and at or near the normal water level in the flow tank, is a horizontally-arranged heating coil 77, which connects, as best shown in Fig. 2, with a live steam pipe 78 having a controlling valve 79, and with the exhaust steam pipe 48 through a pipe having a controlling valve 80, this pipe also being extended to provide a pipe 81 discharging into the atmosphere and having a controlling valve 82.

Leading from a point near the top of the separating tank, which is the normal oil level, is a pipe 83 which discharges into a vertical pipe 84 in the flow tank. This pipe 84 is open at the top and projects to or slightly below the normal water level in the flow tank.

The operation of the apparatus is as follows: The separating tank is filled with water up to the adjoining tell-tale, and this water level is maintained automatically by the pipe 61, regardless of the water from the wells or from condensed steam, by the water regulator device 61, which device is adjustable to suit not only any water level desired but any gravity of oil by changing the angle of the pipe 61. The distance the top of the regulator pipe should be adjusted from the surface of the water level is dependent on both the depth and gravity of the oil. The water regulator may be washed out when desired by opening the valve 60. The water which is at the height of the telltale 72 in the flow tank serves the purpose of an absorbent cushion to receive any small particles of sand passing into the flow tank from the separating tank. Oil as pumped from the well or wells is delivered direct to the separating tank through the pipes 52 and 54, and nozzle 51. As it passes through this nozzle it is spread out in a thin film, breaking up the sand. The contents of the separating tank are kept to the required temperature by the exhaust steam from the engine, which has heretofore been allowed to waste. The exhaust steam admitted through the pipe 48 passes through the heating coil and heats the contents of the tank as a dry heater. Such heat as is contained in the exhaust steam which is not taken off in its passage through the coil, together with the hot water from condensation in the coil, passes through the check valve 50 and enters the oil delivery pipe or nozzle and then passes into the separating tank with the oil as a wet heater, the check valve 50 operating to keep the oil from entering the heating coil. Should there be any more heat in the exhaust steam than is required, the valve 82 is opened and a portion allowed to escape to the atmosphere. Should there not be enough heat in the exhaust steam, the deficiency is made up by using live steam as a wet heater by opening the valve 56. The exhaust steam is admitted to the dry heating coil in the flow tank by the valve 80, or this coil may be heated with live steam by

closing the valve 80 and opening the valve 79.

The oil and sand as pumped from the well or wells is delivered to the separating tank through the pipes 52 and 54 and nozzle 51 as above described and falls directly into the hot contents of the tanks, and in this heated condition the oil separates from the sand and rises, and the sand falls. As the oil rises it strikes the baffle plates, and any entrained sand is kept back while the oil passes around the plates and rises to and overflows into the flow tank through the pipe 83. Any sand separating from the oil above the baffle-plates falls thereon and slides back into the lower part of the separating tank. The oil passing into the flow tank falls through the vertical pipe 84 on top of the water, where any small particles of the sand escaping from the separating tank are absorbed, and the oil thus cleansed rises to the outlet of the suction pipe 67 and is delivered thereby to the oil pump 68 and is thence by this pump pumped direct to the storage. Should the oil pump 68 become disabled or fail to take oil from the flow tank as fast as produced by the separator tank, the oil in the flow tank rises and passes out through the overflow pipe 69 back to the well, thus avoiding any loss of the oil from such a contingency. The heating coil in the flow tank is for the purpose of heating the oil in the event that more heat is necessary than the oil contains on leaving the separating tank, or to heat the oil in the flow tank in event the oil therein becomes cold. The sand as it separates from the oil in the separating tank falls through the hot water to the bottom of the tank, and is there kept in slow motion by the vanes or stirrers 46, which allows any entrained oil to separate from the sand and float to the top of the separating tank and works the sand between the supports 18, where it falls into the boot casing 13. The sand as it is stirred in the hot water and thoroughly washed, falls into the elevator boot casing, and is by the elevator buckets discharged into the sand chute 37 and delivered away from the machine. The bore of the central tube 16 provides a space in which the elevator buckets operate, and the walls of this tube separate this space from the oil and sand contained in the surrounding portion of the tank. Should any oil be entrained in the sand and reach the inside of the tube, it floats to the top and is delivered into the drip tank by the buckets 36, from which the oil passes back around the central tube or through openings in the bottom of this tank if desired, thus saving any oil which might escape from the apparatus in this direction. Water as may be required for the separating tank is admitted by opening the valve 58. When desired to empty the tanks, the water is allowed to flow into the separating tank until all the oil is raised to and flows through the pipe 83 into the flow tank, when the valve 15 of the discharge pipe 14 is opened and the separating tank drained. The deposit of sand, etc., at the bottom of the flow tank is removed by allowing the water to flow through the several jets or nozzles 76 which thoroughly cleanses the conical bottom, one of said jets flowing directly into the wash-out pipe and operating to prevent the same from clogging, the valve 66 at this time being open to permit the flow of the sand to the water and sand pile. The telltales of the separating tank and flow tank discharge into the funnels 74, and this oil, water, etc. pass through the overflow pipe back to the well.

In the modified form of separating tank shown in Figs. 4 and 5, the construction and operation is in all respects the same as that just described, except that it has no sand stirring or sand elevating appliance, and the water in this tank is introduced through a pipe 57^a having the discharge jets or nozzles 57^b arranged directly over the conical bottom, and a controlling valve 58^a; also a manually-controlled valve 15^a seating over the outlet of a sand pipe 14^a, the valve stem passing through the center of the tank, where it is connected to one end of a lever 15^b, the opposite end of which has an operating handle 15^c. In this construction, a sand thief 15^d is employed, which the attendant uses in determining when the tank needs cleaning, at which time he open the valves 58^a and 15^a, causing the flow from the jets to break up the sand and wash it through the sand pipe.

While I have described the preferred form of my improved oil and sand separating appliance in detail, I nevertheless recognize that various changes may be made falling within the scope of the annexed claims.

Having thus described my invention, I claim as new and desire to secure by Letters Patent:

1. The combination of an oil separating tank adapted to contain water, an oil injecting nozzle leading into the tank above the normal water level, having an elongated discharge opening to deliver the oil in the form of a relatively thin film, and a steam supply leading into the nozzle.

2. The combination of a separating tank for separating a mixture of sand and oil, a flow tank for further separating the sand and oil, each of said tanks adapted to contain water normally maintained at different levels, an oil well, means for passing the oil from the well in the separating tank above the water level therein, means for discharging the oil from the separating tank into the flow tank below the water level therein, an overflow pipe leading from the flow tank to the oil well, and telltales dis-

charging from the tanks at their respective water levels into the overflow pipe.

3. The combination of a separating tank for separating a mixture of sand and oil, means for discharging the oil at the upper portion of the tank, a tube within the tank communicating therewith at its lower end, and an elevator for discharging the sand from the tank, operating within the tube.

4. The combination of a separating tank for separating a mixture of sand and oil, a revoluble tube within the tank having stirring vanes on the lower portion thereof, and an elevator for removing the sand from the tank, operating within the tube.

5. The combination of a separating tank, a drip tank carried at the top of the separating tank, a tube leading from the lower portion of the separating tank to the drip tank, and an elevator operating within the tube.

6. The combination of a separating tank having a boot casing attached to the bottom thereof, a tube within the tank communicating therewith above the casing, and an elevator discharging from the casing through the tube.

7. The combination of a separating tank for separating a mixture of sand and oil, a revoluble tube in communication with the tank at its lower end having stirrers on the lower portion thereof, a discharge chute at the top of the tank, a casing attached to the bottom of the tank having a sand pipe leading therefrom, and an elevator for removing the sand from said tank through the tube and discharging it into said chute.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

LINUS W. BROWN.

Witnesses:

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W. H. CASTLE.