C. P. M. JACK.

SUBMERSIBLE STORAGE TANK.

APPLICATION FILED MAR. 11, 1915.

1,201,051.

Patented Oct. 10, 1916.

3 SHEETS—SHEET 1.

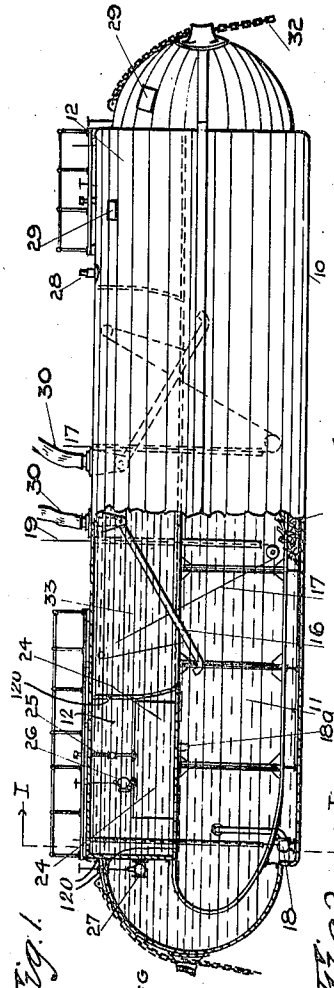


Fig. 1.

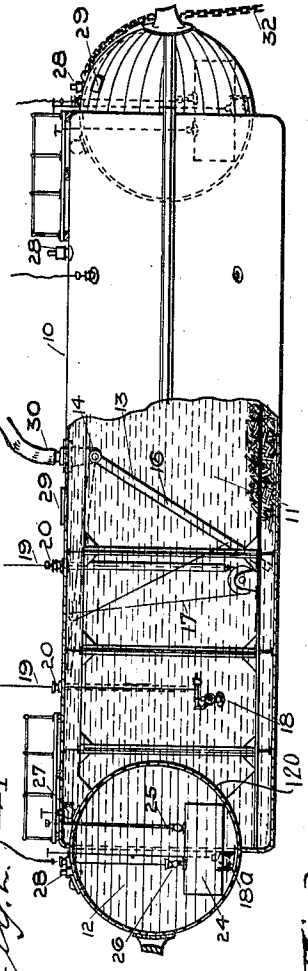


Fig. 2.

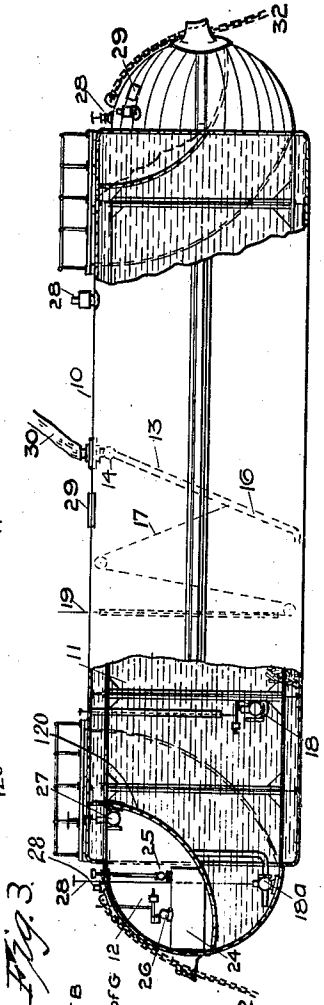


Fig. 3.

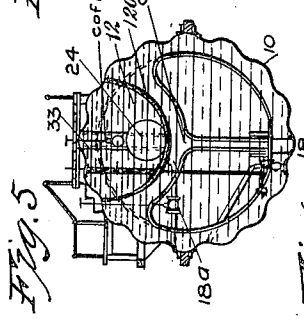


Fig. 5

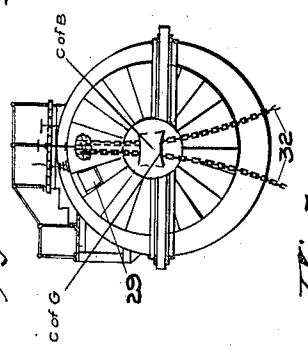


Fig. 6

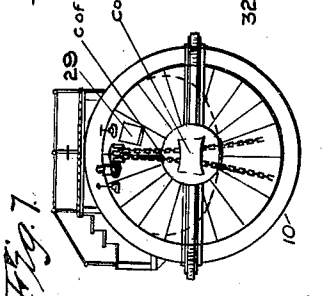


Fig. 7

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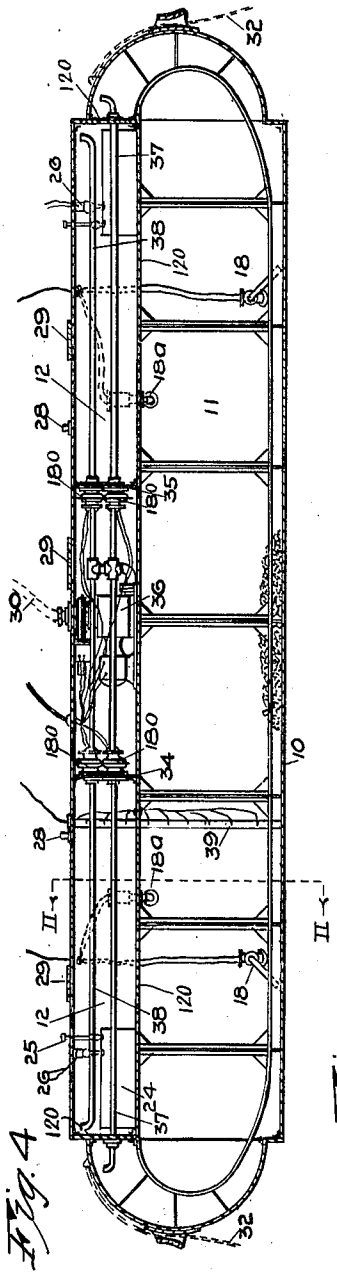


Fig. 4

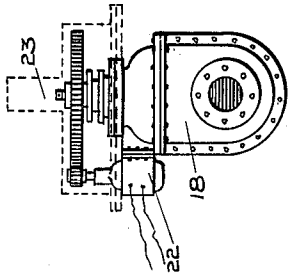


Fig. 14

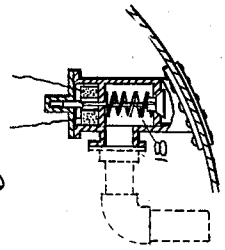


Fig. 15

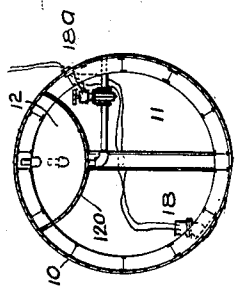


Fig. 8

Witnesses:

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3 SHEETS—SHEET 3.

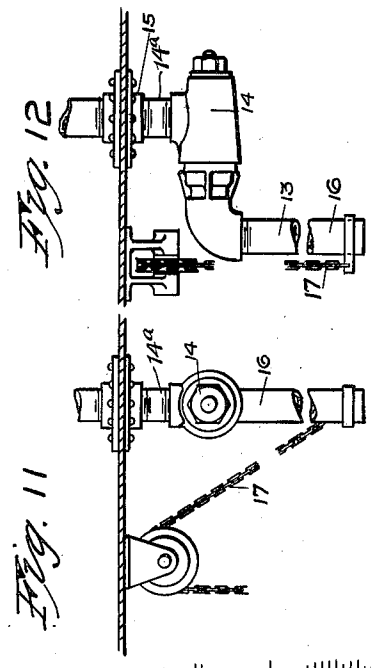


Fig. 12

Fig. 11

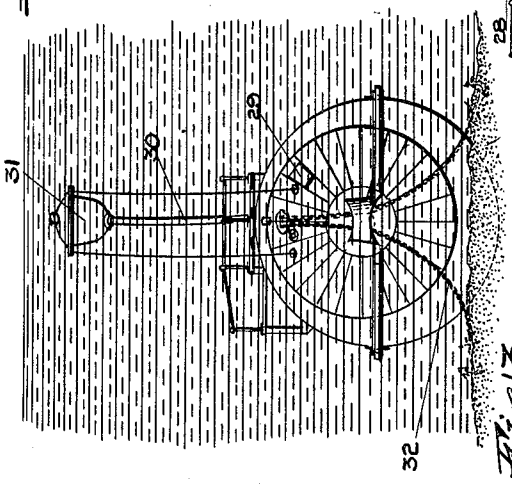


Fig. 10

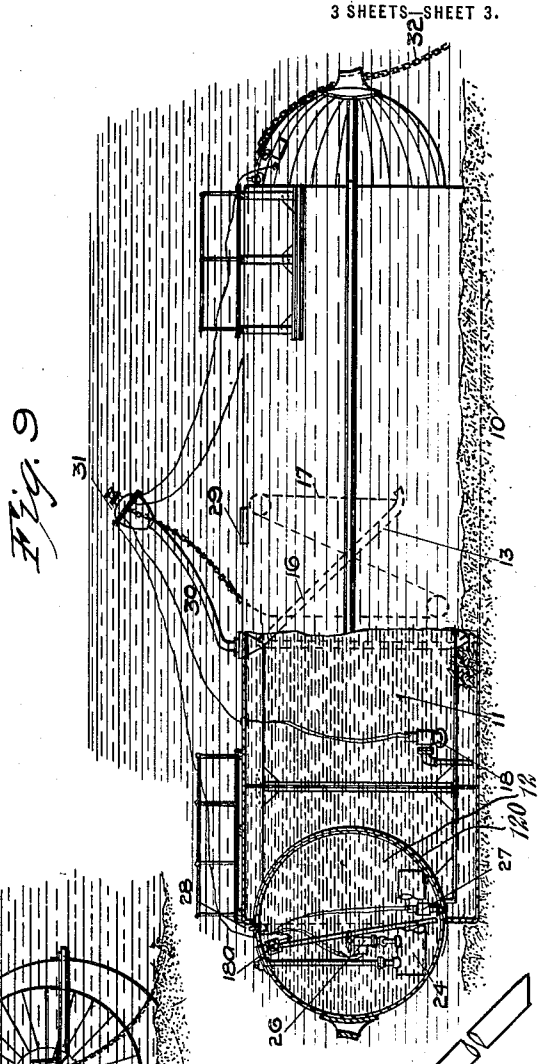


Fig. 9

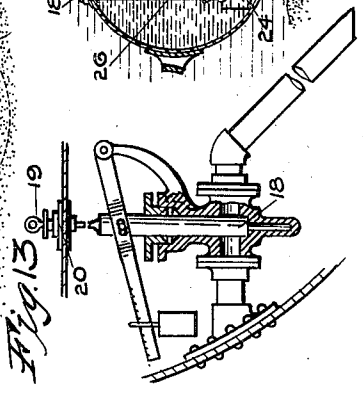


Fig. 13

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UNITED STATES PATENT OFFICE.

CHARLES PETER MITCHELL JACK, OF BROOKLYN, NEW YORK.

SUBMERSIBLE STORAGE-TANK.

1,201,051. Specification of Letters Patent. Patented Oct. 10, 1916.

Application filed March 11, 1915. Serial No. 13,811.

To all whom it may concern:

Be it known that I, CHARLES PETER MITCHELL JACK, a subject of King George V. of Great Britain, and resident of the borough of Brooklyn, in the county of Kings and State of New York, have invented certain new and useful Improvements in Submersible Storage-Tanks, of which the following is a specification.

My invention relates to tanks for the storage of oil, which are adapted to be floated or submerged at will, the said tanks when submerged being under a balanced pressure both within and without. Such an oil-tank can be floated to any desired position, and submerged, where it is free from the danger of fire. Furthermore, in case of war, it is free from an attack by aerial bombs or rifle fire of an enemy. When submerged it can be found only by those who know of its location. The tank is of the type that has its centers of gravity and its center of buoyancy in a line that is transverse to the length of the tank. I attain these objects by the construction illustrated in the accompanying drawings in which:—

Figures 1, 2 and 3 are views in part elevation, and part section of several forms of the tank. Fig. 4 is a longitudinal central section of another form of the tank. Fig. 5 is a sectional view on line 1—1 of Fig. 1. Figs. 6 and 7 are end views of Figs. 2 and 3 and Fig. 8 is a sectional view on line II—II of Fig. 4. Fig. 9 is a part sectional and part full view of a submerged tank, and Fig. 10 an end view of the same submerged tank. Fig. 11 is a side elevation partly broken and Fig. 12 a front elevation of a swivel discharge pipe by which a tank is emptied of its contents. Fig. 13 is an enlarged view of a sea cock or valve, for controlling inlet and outlet of water to and from the interior of a tank. Fig. 14 an enlarged view of an ordinary gate valve operated by an electric motor, and Fig. 15 an enlarged sectional view of a sea cock or valve, adapted for electric operation.

Similar reference numerals refer to similar parts throughout the several views.

The elongated storage tank 10, comprises a main or central chamber 11, strengthened or divided by bulkheads if desired, for carrying the oil in bulk. The tank is braced longitudinally and transversely to secure the greatest strength, but such construction does not enter into my invention. The tank has at each of its ends, or at the top a chamber 12 built strongly to withstand pressure, and adapted to be used as a buoyancy or flotation-chamber when the tank is to be floated from one point to another, or to be filled with liquid for sinking the tank. The flotation-chamber 12 has a wall 120 that is fluid-tight and divides up the tank interior so as to isolate the flotation-chamber 12. Within the main chamber 11, are secured one or more swivel pipes and their connections, used for discharging oil; each of these arrangements comprises a plug valve 14, hung from the roof by any suitable means, but preferably by a nipple 14^a secured to a flanged coupling 15. From the plug of valve 14 extends a pipe 16, which turns with the plug, being attached thereto and in communication with the interior thereof, and reaches to the lower floor of the chamber 11. The pipe 16 can be raised and lowered in the interior of the chamber 11 from the exterior of the tank by means of a cable 17, passing through stuffing boxes. On the exterior of the tank, the cable or chain is graduated to indicate the amount of oil which could be contained within the chamber 11 up to different levels to which the lower end of the pipe is adjustable by the chain. Inlet valves 18 of any adaptable type are placed in conduits constituted by the valve casings, and afford communication between the sea and the interior of the chamber 11. The valves 18 are preferably placed above the lowest point in the tank, and their openings to the sea brought down to the lowest point. Furthermore they are operated from the exterior of the tank by means of rods 19, as shown in Fig. 2 passing through a stuffing box 20, fixed to the shell of the tank. Or they might be ordinary gate valves 18, operated by an electric motor 22 as illustrated diagrammatically in Fig. 14. The upper works of the valve in Fig. 14 may be inclosed by a water tight jacket 23, shown by dotted lines. Another form of valve may be used as shown in Fig. 15, where the valve is lifted by a solenoid. But none of these constructions of valves and valve-operating means are of my invention.

The flotation-chambers 12 have their center of buoyancy located above the center of gravity of the tank, thus preventing the tank from becoming unstable. If the chamber 12 and the oil compartments 11 are filled

with oil, the center of buoyancy is still above the center of gravity of the tank and ballast. Within the chambers 12 are located auxiliary tanks 24, for holding a supply of compressed air. These tanks 24 are provided with pipe connections 25, extending to the exterior of the tank 10, and used for charging the tanks 24 with compressed air. There are also valves 26 on the tanks 24 operated mechanically, or electrically for discharging the compressed air into the flotation-chambers 12, when needed. To afford communication between these chambers 12 and the sea outside the tank are sea-cocks 18ª; they constitute sea-inlets to admit water to the chambers 12 when desired. There is a valve 27, operated in any desired manner and constructed so that its casing constitutes a conduit to afford communication between the interior of the chamber 11 and that of the chamber 12. On the wall of the flotation-chamber 12 is a valve 28 which lets pressure-fluid out of the chamber 12. The use of these valves is explained later, when the operation of floating, sinking or raising the tank is described.

Covered manholes 29 are provided in the walls of the chambers 11 and 12 to afford access to the interior of each. From each valve 14 a flexible pipe 30 extends to a float or buoy 31, adapted to float at some predetermined level below the surface of the water. There are also connected to the float the electrical wires, and other connections, leading to the valves used in operating the tank. At the ends of the tank are anchor chains 32.

The tanks are preferably elongated and cylindrical in form. If desired, they may be corrugated as shown in cross section Fig. 5. In Figs. 1 and 5 wherein the discharge-pipe reaches to the roof of the tank I form a long chamber or truck 33 within the chamber 12 and open at its bottom to the chamber 11. The pipe 16 extends up through this trunk 33. In Fig. 4, I have shown a slight modification, where the chamber 12 is divided into three parts—that is, the chamber has partitions 34, and 35, the space between which is made air tight; this space contains a pump 36, operated electrically or mechanically for discharging the oil. It also contains the valves 180 operated electrically from the exterior of the tank and controlling the flow of oil through pipes 37 and 38. The pipes 37 draw from the main chamber 11 and the pipes 38 draw from the chambers 12. Oil can pass from the main chamber 11 to the ends of the flotation-chamber 12 in this construction by the valves 27.

Any of the tanks above described can be floated and submerged and such operations are carried out as follows:—Having the tank floating with the chambers 12 closed and full of air, and the chambers 11 full of water and open to the sea through the valves 18, the chambers 11 may be filled with oil by pumping oil in through pipes 30, the water being expelled by the oil through the valves 18, the oil always remaining on top of the water. The valves 18 may next be closed and the tank towed to the location in which it is desired to submerge or sink it. To sink the tank, open valves 18 and valves 27 and 28, thus allowing sea water to enter chambers 11, by the valves 18 and oil displaced by it to enter chambers 12 through valves 27 and air to escape from chambers 12 to without the tank by the valves 28, this escape of air destroying the surplus buoyancy required to float the tank. The tank will then descend to and rest on the ground below the water. Valve 28 is then closed. The pressure within the tank is equal to the pressure without, and therefore counteracts the stress of that without upon the structure which thus is not strained as it would be if subjected to an unbalanced external head. If oil is withdrawn through pipe 30, water enters through the valves 18. Conversely if oil is forced in through pipes 30, water is expelled through valves 18 and the tank need never be empty.

To raise any of the tanks to the surface after it has been sunk in the manner just previously described open valves 27 and open valves 26 which permit air to enter compartments 12 from compressed air tanks 24, thus expelling the oil from compartments 12 through valves 27 into 11, thus increasing the buoyancy of the tank sufficiently to float it to the surface.

Should the chambers 12 have been filled with water through the sea-cocks 18ª to destroy the buoyancy of the tank it can be expelled through valve 28 by the compressed air from tank 24; in this case the valve 27 should be shut.

I do not wish to limit myself to the exact constructions shown—for changes can be made in them without departing from the spirit of my invention.

What I claim as my invention and desire to secure by Letters Patent is:—

1. An elongated cylindrical balanced pressure tank for the storage of oil, adapted to be floated or submerged at will, in combination with valve and pipe connections for receiving and discharging oil, a delivery pipe connected thereto, and a buoy for supporting the delivery pipe to the valve-controlling device.

2. An elongated cylindrical balanced pressure tank for the storage of oil, adapted to be floated or submerged at will, chambers within the tank for the admission of air, oil or water, the center of buoyancy of said chambers being above the center of gravity of the tank, ports in said chambers under control and connected to exterior of the tank for admission of water, means for storing

compressed air within said chambers, and under control from the exterior of the tank, for expelling the water within the chamber; for the purpose of floating the tank to the surface of the water.

3. An elongated cylindrical balanced pressure tank, for the storage or delivery of oil, adapted to be floated or submerged in any locality at will, an air tight compartment within said tank containing a pump, with valve and pipe connections for receiving and discharging oil, a delivery pipe connected thereto, valve and pump operating connections, and a buoy for supporting the end of the delivery pipe and the valve and pump operating connections.

4. In an elongated floatable and submersible cylindrical tank of the type which has its center of gravity and its center of buoyancy in a line that is transverse to the length of the tank, the combination with a fluid-tight partition that divides up the tank-interior and isolates a flotation-chamber therein from the main interior, of conduits through said partition and connecting the interior of the flotation-chamber to the remainder of the tank-interior, the interior of the flotation-chamber to a sea-inlet, the interior of the flotation-chamber to an outlet, respectively, valves in the said conduits, and operative connections extended from the said valves to the exterior of the tank, an oil-discharge pipe extending away from the tank-interior, means controllable from outside the tank and constructed to withdraw oil from the interior of the flotation-chamber as well as from the remainder of the tank-interior and deliver it to said oil-discharge pipe, means for delivering air to the interior of the flotation-chamber and likewise controllable from outside the tank and constructed to discharge the liquid contents of the said flotation-chamber from it, and a conduit connecting the bottom of the main tank-interior to the sea.

5. In an elongated floatable and submersible cylindrical tank of the type which has its center of gravity and its center of buoyancy in a line that is transverse to the length of the tank, the combination with a fluid-tight partition that divides up the tank-interior and isolates a flotation-chamber therein from the main interior, of conduits through said partition and connecting the interior of the flotation-chamber to the remainder of the tank-interior, the interior of the flotation-chamber to a sea-inlet, the interior of the flotation-chamber to an outlet, respectively, valves in the said conduits, and operative connections extended from the said valves to the exterior of the tank, an oil-discharge pipe extending away from the tank-interior, means controllable from outside the tank and constructed to withdraw oil from the tank-interior and deliver it to said oil-discharge pipe, means for delivering air to the interior of the flotation-chamber and likewise controllable from outside the tank and constructed to discharge the liquid contents of the said flotation-chamber from it, and a conduit connecting the bottom of the main tank-interior to the sea.

6. In an elongated floatable and submersible cylindrical tank of the type which has its center of gravity and its center of buoyancy in a line that is transverse to the length of the tank, the combination with a fluid-tight partition that divides up the tank-interior and isolates a flotation-chamber therein from the main interior, of conduits through said partition and connecting the interior of the flotation-chamber to the remainder of the tank-interior, the interior of the flotation-chamber to an outlet, respectively, valves in the said conduits, and operative connections extended from the said valves to the exterior of the tank, an oil-discharge pipe extending away from the tank-interior, means controllable from outside the tank and constructed to withdraw oil from the tank-interior and deliver it to said oil-discharge pipe, means for delivering air to the interior of the flotation-chamber and likewise controllable from outside the tank and constructed to discharge the liquid contents of the said flotation-chamber from it, and a conduit connecting the bottom of the main tank-interior to the sea.

Signed at New York, in the county of New York and State of New York, this tenth day of March, A. D. 1915.

CHARLES PETER MITCHELL JACK.

Witnesses:

M. WILLEMSTYN,

ARTHUR E. COPELAND.