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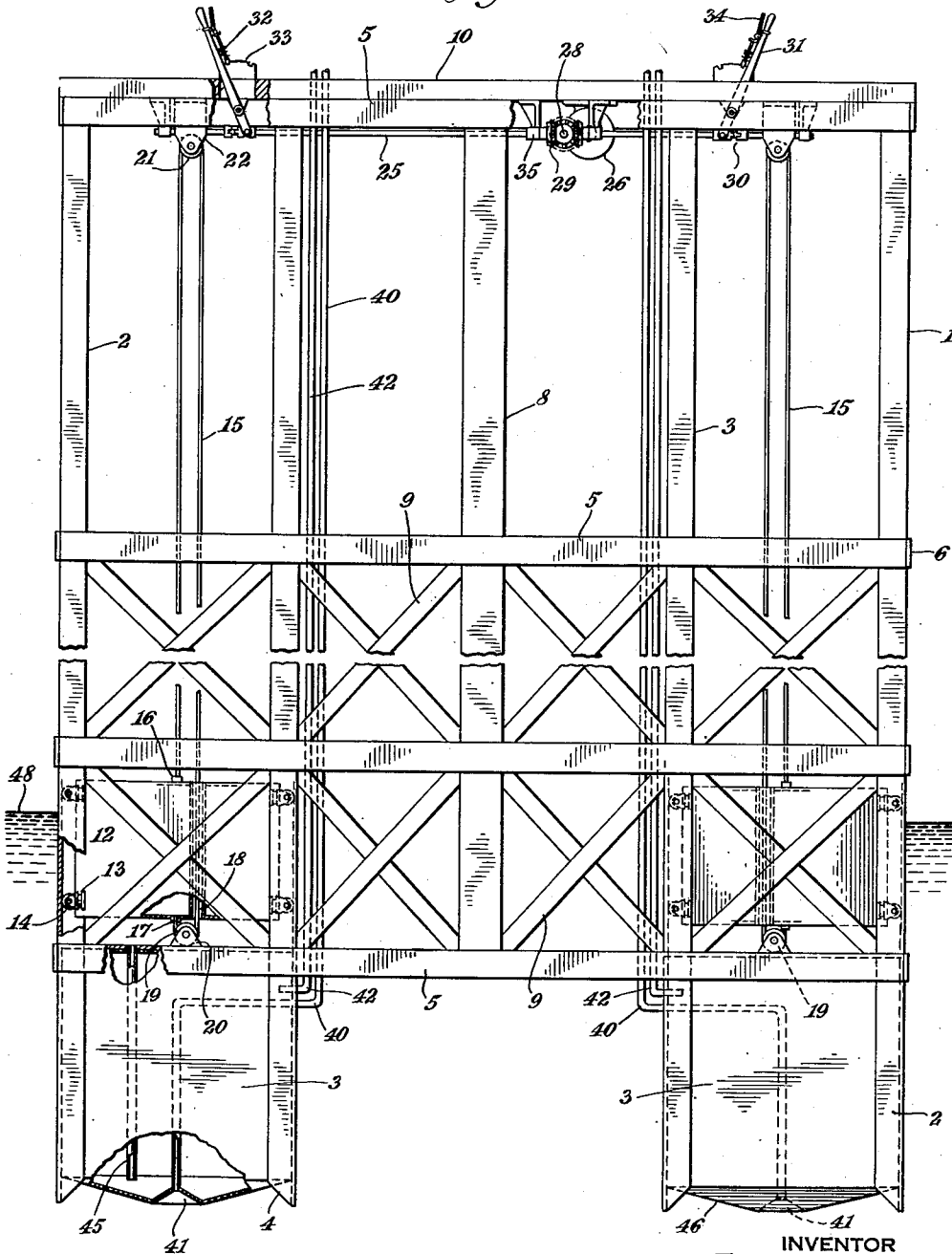
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FOUNDATION STRUCTURE FOR DERRICKS

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Fig. 1.



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Fig. 2.

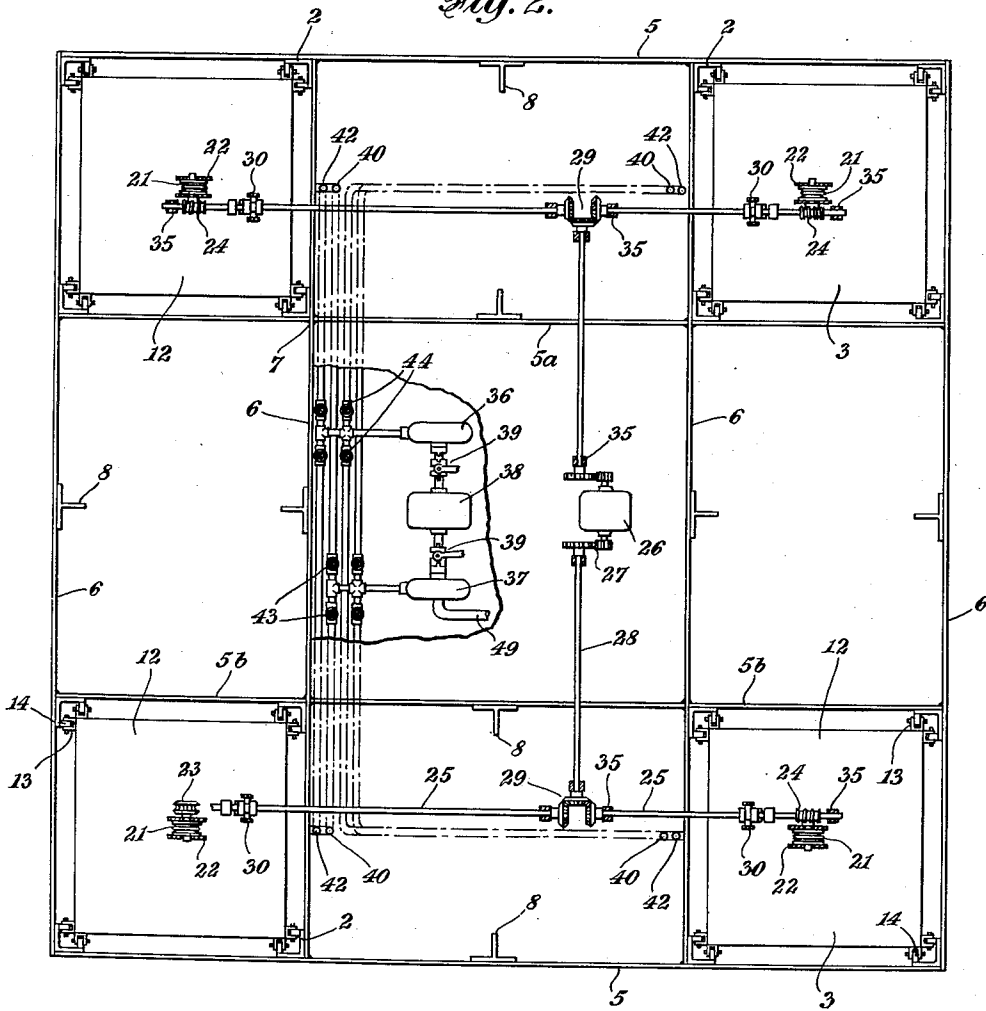
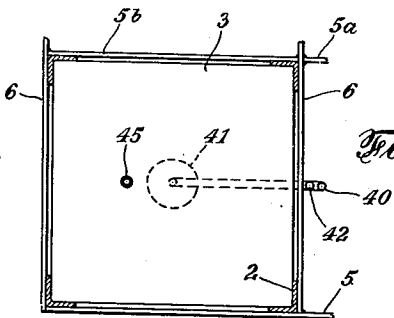


Fig. 3.



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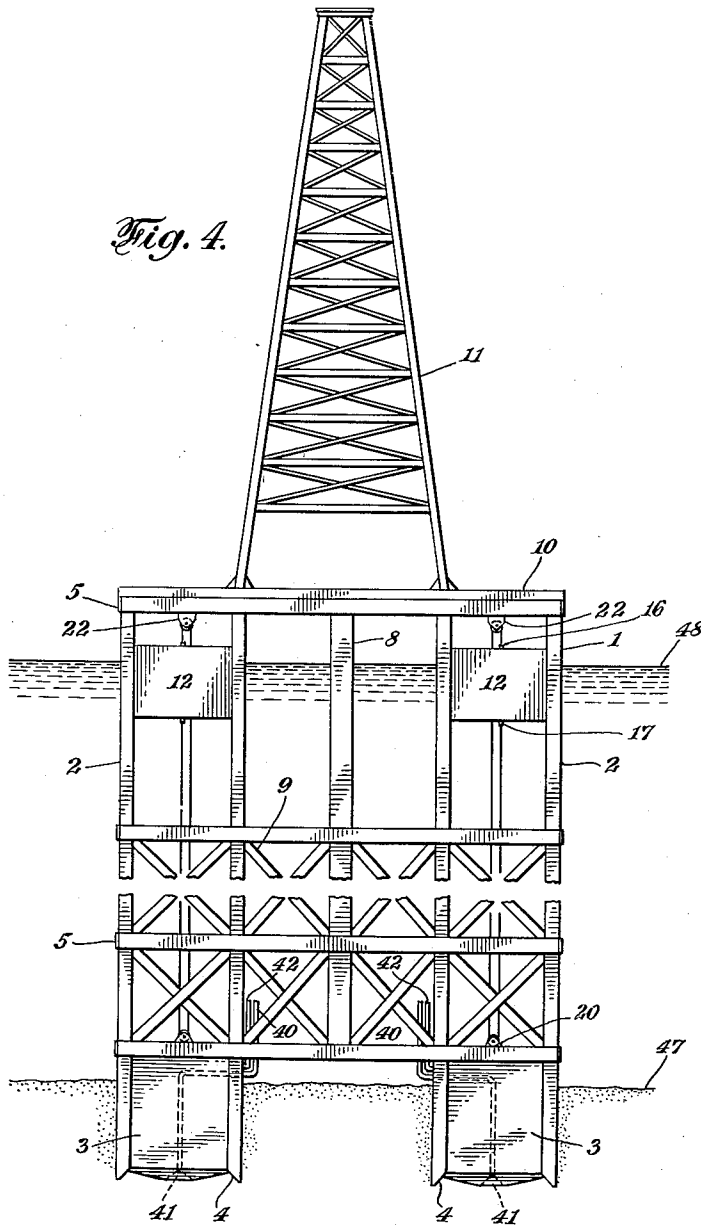
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3 Sheets-Sheet 3



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# UNITED STATES PATENT OFFICE

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## FOUNDATION STRUCTURE FOR DERRICKS

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14 Claims. (Cl. 61—46)

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This invention is an improvement in foundation structures for derricks and similar towers erected to drill wells; especially derricks for sinking into the earth, wells to produce oil; and for other structural equipment by which oil is extracted from natural underground deposits.

An important object of the invention is to provide a foundation structure for installation upon the bottom of a lake, river or other body of water having considerable depth to facilitate the recovery of oil from submarine pools and reservoirs.

Another object is to provide a foundation made up of framework of special construction; containing members by which the entire structure, after assembly can be rendered buoyant and floated as a unit to the desired location; and so controlled that it can then easily and quickly be submerged and securely anchored upon the exact site where the extraction of the oil from the earth is to be performed.

A further object is to provide a foundation so built that it can, whenever necessary, be detached from the bottom of a body of water; and transferred without dismounting or taking down any of its parts, to another location, where it can be again submerged and embedded in the bottom as before, so that drilling operations can be promptly resumed.

The invention in its preferred embodiment is shown on the accompanying drawings and fully described herein; but alterations in detail may of course be adopted without changing the essential construction wherein the invention resides.

On said drawings:

Figure 1 is a side elevation of a foundation structure having the distinguishing features of the invention.

Figure 2 is a top plan of the framework and other parts as they appear just below the top deck.

Figure 3 is a sectional detail; and

Figure 4 shows the structure in working position with a tower erected on its top.

The structure is made up of a framework 1 which is shown as generally square or rectangular but of course may be otherwise shaped. It has legs at the corners, each leg consisting of several piles 2. The piles are preferably angle beams or columns of steel, and secured to the legs at the lower ends are submersible caissons or tanks 3. These tanks are surrounded by the piles, and the corners thereof fit within the angles of the piles, as indicated in Figure 3. The tanks and the legs are rigidly attached together by welding or in some other manner. At their lower extremities

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the piles are bevelled off to present points 4, so that they can be more easily embedded in the earth.

The framework is reinforced and stiffened by cross beams 5 at the top, and from a point at the required distance from the top down to the upper ends of the caissons 3. The beams 5 run across the full width of two opposite faces of the framework, from the outer side of one leg to the outer side of the other leg; and the beams on one face are of course parallel to those of the other face. The ends of the beams 5 are joined by cross beams 6, which are attached to the other two faces or sides of the framework. The beams 5 and 6 are affixed to the outside of the legs and enclose the latter; and the outside beams 6 are supplemented by additional beams 6 parallel thereto which are inside the framework and are also affixed at their opposite ends to the beams 5. These additional beams 6 are made rigid also with the adjacent piles of the legs 2. Further, on the inside of the framework are cross beams 5a affixed at their opposite ends to the inside beams 6, and beams 5b in line with the beams 5a connecting the inside beams 6 to the outside beams 6. The beams 5a and 5b are also secured and made rigid with the adjacent piles 2 of the legs. As illustrated, the framework has the cross beams 5, 5a and 5b and 6 at three points in the height thereof, as well as at the top; and the four piles 2 of each leg are thus united. The cross beams can be joined by welding as indicated at 7.

The framework is further strengthened by vertical T-beams 8 attached to both the inner and outer cross beams between the legs of the framework; and the cross beams 5, 5a, 5b and 6 are reinforced by diagonal braces 9. At the top of the legs is the platform or deck 10, upon which the derrick or tower 11 is erected.

The structure is also equipped with floats or pontoons 12, one movably enclosed by each of the legs. The piles 2 surround the pontoons and at the corners thereof are bearings 13 mounting rollers 14 which engage both of the inner angularly arranged faces of the piles 2. The floats are hollow and their position is controlled by cables 15, operated from the deck 10, and fastened at one end to the tops of the pontoons as at 16, and at the other end to the bottoms as at 17. Each pontoon has a guide conduit 18 for the cable to pass through it. From the points of attachment 17 on the bottoms of the pontoons, the cables run over grooved rollers 19, each mounted in bearings 20 on the tops of the caissons 3. Each cable also passes around a

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drum 21 supported by the deck 10, holding on to the drum by friction; so that rotation of the drum will move the cable and raise or lower the attached pontoon. The drums are rigidly mounted on shafts in bearings 22 affixed to the under face of the deck; and on one end of each of said shafts is a gear 23, which meshes with a worm 24 on a shaft 25. The various shafts 25 are revolved by a motor 26 mounted on the underside of the deck, and connected by gearing 27 to shafts 28, which are in turn connected by gearing 29 to the shafts 25. The shafts 25 and 28 are supported in suitable bearings 35.

The drums 21 can be independently controlled by clutches 30 in the line of the different shafts 25. The movable member of each clutch is actuated by a lever 31 with a catch 32 thereon to engage a rack 33. The catches are controlled by handles 34. Hence the height of each pontoon can be adjusted. If one side of the deck is loaded somewhat heavily, the pontoons on the other side can be lowered to achieve balance.

The deck 10 also carries an air pump 36 and a water pump 37. These two pumps are operated by a motor 38 with separate clutch connections diagrammatically indicated at 39 for the pumps. From the water pump 37 lead pipes 40 to each of the caissons 3, running through them from top to bottom and terminating at the bottoms in wide nozzles 41. Thus a stream of liquid can be forced into the earth at the bottom of the water under each tank to excavate the bottom and embed the tank. From the air pump 36 into the caissons 3 run pipes 42 and the various air and water pipes have valves indicated at 43 and 44 respectively to be operated by hand as required, so that each caisson can be independently controlled. Each tank also has a stand pipe 45 therein which opens through the top and extends nearly to the bottom. The caissons can thus be flooded through the stand pipes and the water forced out by air driven in by the air pump, through the pipes 42 entering the caissons 3 near the tops thereof.

With this construction, the foundation structure can be floated by means of the empty tanks and pontoons to the selected location, and then sunk into the position shown in Figure 4, till all the tanks rest on the bottom of the water. It is stabilized enroute and while sinking by the pontoons 12. The sinking is effected by flooding the tanks. This is done by letting water enter through pipes 45. The valves 43 in the air pipes are two-way valves, so that they can be actuated to vent the pipes 42, disconnecting the tanks from the pump 36, or to close the vent ports when the pump 36 is to force air into the tanks 3 through the pipes 42. When the tanks are on the bottom, the water pump forces water through the pipes 40 and nozzles 41 till all the tanks are securely embedded in the bottom and the structure is firm. One or more of the pipes can be closed by the valves 43, to operate less than all the nozzles 41. The structure can afterwards be raised by forcing air into the tanks so that the buoyancy of the structure due to the empty tanks 3 and pontoons 12 enables it to float free and be towed to another place of use if desired.

The bottoms of the caissons may slope downward toward the nozzles 41 as indicated at 45.

When the structure is floated it will be higher in the water because the tanks 3 will be empty and the closed water-tight pontoons 12 may be lowered to increase the buoyancy. As the tanks

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are flooded and sinking begins, the pontoons are raised to regulate the operation and keep the deck 10 horizontal. These pontoons are controlled by the power connections and clutches 30 as required.

The design of the valves 43 and 44 need not be fully illustrated as they are of well known types. They are accessible from the deck 10, as the pipes 40 and 42 will be close to or above the deck at some points as indicated in Figure 1. The tower 11 is preferably erected only when the structure is firmly anchored and the tanks fully embedded in the bottom 47 below the surface of the water 48. The inlet for the water pump 37 is shown at 49. It may be a conduit immersed at one end in the water 48.

The tower 11 can also be put up before the foundation structure is sunk and it can be carried about in upright position on the deck 10 when the structure is towed to a new site, without causing the structure to capsize or become top-heavy.

Having described my invention, what I believe to be new is:

1. A foundation structure having upright supporting legs, a platform thereon, submersible caissons secured to the lower ends of said legs, pontoons movably engaging said legs, and means for adjusting said pontoons with reference to said legs, said means comprising cables and pulleys therefor, one of said pulleys for each pontoon being fixed and mounted adjacent one of said caissons.

2. A foundation structure having upright supporting legs, a platform thereon, pontoons adjustably engaging said legs, submersible caissons secured to the lower ends of said legs, and connections for flooding and emptying said caissons, the structure having cables and pulleys therefor to move said pontoons, one of said pulleys for each pontoon being fixed and mounted adjacent one of said caissons.

3. A foundation structure having upright supporting legs, a platform thereon, pontoons adjustably mounted on said structure, said legs comprising piles surrounding said pontoons to guide same, means for changing the positions of said pontoons, and submersible caissons secured to the legs at their lower ends.

4. A foundation structure according to claim 3 which also has connections for flooding and emptying said caissons.

5. A foundation structure according to claim 3 which also has a pipe for each of said caissons, each of said pipes having one end disposed adjacent the bottom of its respective caisson, and means for delivering a stream of excavating liquid from said ends of the pipes.

6. A foundation structure according to claim 3 which also has connections for flooding and emptying said caissons, and a pipe for each of said caissons, each pipe having one end disposed adjacent the bottom of its respective caisson for delivering a stream of excavating liquid below the caissons.

7. A foundation structure according to claim 1 wherein said means also comprises shafts supported by said platform, drums coupled to said shafts, cables connecting said drums to said floats, and a power unit coupled to said shafts to operate same.

8. A foundation structure according to claim 1, wherein said means also comprises shafts supported by said platform, drums coupled to said shafts, said cables being connected to said drums.

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and to said pontoons, and a power unit for operating said shafts, and said caissons have connections for flooding and emptying same and for directing a stream of excavating fluid from the bottom of each caisson.

9. A foundation structure according to claim 1, wherein said means comprises, a power unit and connections mounted on said platform for operating said cables, the latter being attached at one end to the tops of the pontoons and the pontoons having guideway conduits therethrough to permit the cables to be attached at the opposite ends to the bottom of the pontoons.

10. A foundation structure comprising a framework having upright supporting legs and a platform thereon, a pontoon adjustably engaging each of said legs below said platform, the legs each embracing a group of piles surrounding the respective pontoons, cables for raising and lowering the pontoons, connections carried by the platform for operating the cables, a power unit for said connections, submersible caissons secured to the legs at the lower ends thereof, connections for flooding and emptying said caissons, means for delivering a stream of excavating liquid from the bottom of each of said caissons, and pulleys for the cables, one pulley for each pontoon being fixed and mounted adjacent one of said caissons.

11. The foundation structure according to claim 10 wherein said framework also comprises crossbeams and bracing affixed to said legs.

12. The foundation structure according to claim 10, wherein said piles have the form of angle beams, and the pontoons have rollers engaging the inner faces of said beams.

13. The foundation structure according to claim 10, which also has shafts carrying drums on the platform, a motor carried by the platform to operate the shafts, cables connecting

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the drums to both ends of the pontoons, a pump and motor therefor supported by the platform, pipes running from the pump to the caissons, the pipes from the pump opening through the bottom of the caissons, and an open pipe in each caisson for the admission and expulsion of water therefrom.

14. A foundation structure comprising a frame-work having upright supporting legs and a platform thereon, a pontoon adjustably engaging each of said legs below said platform, the legs each embracing a group of piles surrounding the respective pontoons, cables for raising and lowering the pontoons, connections carried by the platform for operating the cables, a power unit for said connections, submersible caissons secured to the legs at the lower ends thereof, connections for flooding and emptying said caissons, and means for delivering a stream of excavating liquid from the bottom of each of said caissons, said connections comprising gearing and a clutch for each of said pontoons and guide pulleys in the frame-work for said cables, and means for independently controlling each clutch, the pontoons each having a guideway through it to permit its cables to be attached to the top and bottom thereof.

FREDERIC R. HARRIS.

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