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M. F. HILL

DRY DOCK

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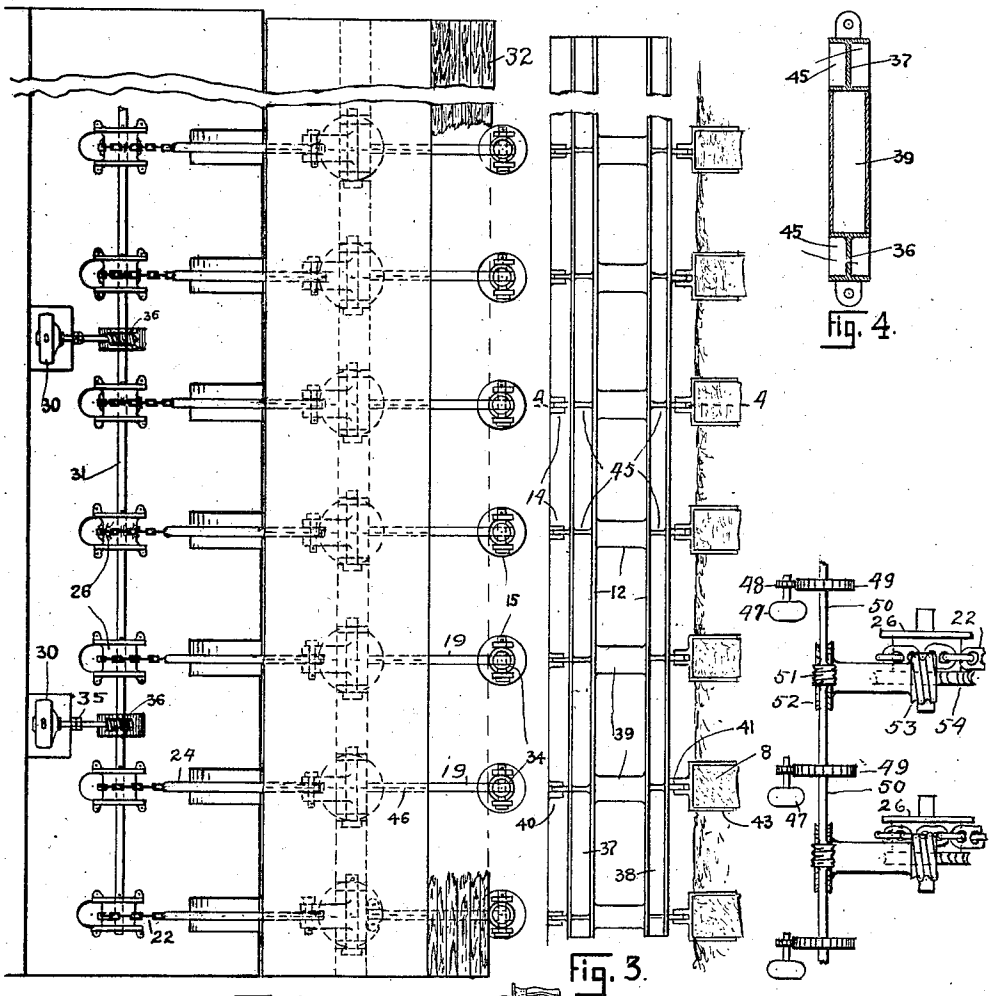


Fig. 3.

Fig. 4.

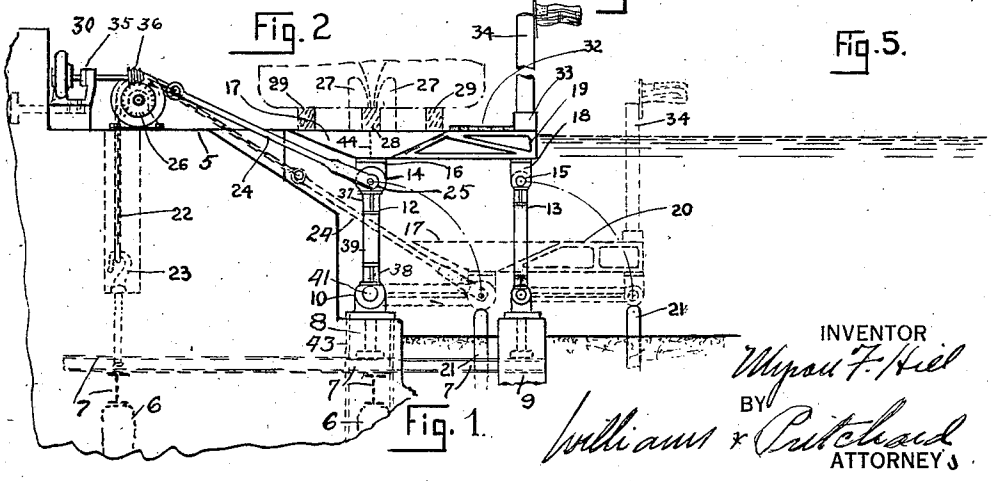


Fig. 1.

Fig. 2

Fig. 5.

INVENTOR
Myron F. Hill
BY
Williams & Pritchard
ATTORNEYS

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UNITED STATES PATENT OFFICE.

MYRON F. HILL, OF NEW YORK, N. Y.

DRY DOCK.

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To all whom it may concern:

Be it known that I, MYRON F. HILL, citizen of the United States, resident of the county, city, and State of New York, have invented an Improvement in Dry Docks, of which the following is a specification.

My invention relates to dry docks and consists of means and apparatus to lift a ship bodily out of water sidewise.

A graving dock has to be emptied of water and with a dock of given size the smaller the ship the more water there is to pump out.

A floating dock requires that the floating dock itself, which is a very heavy structure, shall be raised out of water with the ship and since the floating dock may weigh four times the weight of the ship only a fraction of the lifting power is devoted to raising the ship itself. The marine railway, adapted to pull a ship out of water endwise, avoids these troubles, but it is impractical for large ships because of the enormous units of mechanism necessary to haul a big ship out of the water. Furthermore in a marine railway the same difficult conditions exist about supporting a ship as those which exist during launching with the added difficulty of properly locating a ship upon a cradle before it is drawn out of water. For these reasons marine railways for big ships are found so impractical that although they are a very old institution, nobody has attempted to use them for that purpose. My invention lifts the ship out of water without emptying a huge volume of water from a graving dock, without raising a huge floating structure like that of a floating drydock and without the necessity of using a huge and impractical form of mechanism for large ships such as would be necessary with a marine railway.

My invention consists of means to draw a ship sidewise and upwards out of the water by means of a plurality of hauling units located along the length of the ship thereby bringing within practicable limits the size of the mechanical devices necessary for the purpose.

In the drawings:

Fig. 1 shows an end view of the preferred form of my dock.

Fig. 2 shows a plan view.

Fig. 3 shows the preferred form of link in which a plurality of supporting and lifting columns are united into a single trestle.

Fig. 4 is a cross section thereof upon the line 4—4 Fig. 3.

Fig. 5 shows the preferred form of operating mechanism.

In Fig. 1, a wharf 5 is shown having foundations on a solid bottom, or upon piles 6 stiffened into a mat if desired by girders 7. A series of extensions 8 and 9 may be built out, upon which may be pivoted at 14 and 15 brackets 16 upon the bottom of the float 17 or platform, and brackets 18 upon the outriggers 19 to form a rigid unit and are adapted to be swung down to receive a ship towards a position shown in broken lines 20 so that if desired it may rest upon supports or piles 21 driven into the bottom. Or the float may be supported in its lowered position by the chains 22, fastened to the hooks 23, the chains being connected to draw bars 24, pivoted at 25 to the tops of the columns of the trestle 12. Each chain 22 passes over a drum 26 suitably provided with devices such that when the drum is rotated the chain is pulled up. When the float is lowered to a proper depth the ship is floated over it and by means of any well known blocking system it is centered over the float so that the keel is supported above the trestle 12. Suitably fixed blocks 27 may be fixed to the float to guide the stem of the ship into position. Similar blocks may be employed, operated from above the water level or otherwise, to bring the stern of the ship into position over the central line of blocks 28 upon which the keel of the ship is adapted to rest. Side series of blocks 29 are adapted to keep the ship on an even keel. When the ship has been guided into position a series of motors 30 may be operated in unison to rotate the shaft 31 (see Fig. 2) carrying the series of drums 26 which thereby wind up the chains 22 and lift the float until the weight of the ship rests upon it and thereafter lift the ship until it reaches the position shown in broken lines in Fig. 1. The float 17, may be hollow and water tight and of sufficient displacement to provide a specific gravity slightly greater than 1, so that when permitted to fall no power may be required to lower it to the position shown in broken lines 20. For this purpose it is desirable that the trestle 12 should be pulled up not quite to a vertical position so that there is always a tendency for the float to drop back into its lower position. It is quite evident, however, that the float may be

pulled by the chains over the center so that the float rests against the wharf 5 and may be in a more secure position after which any suitable ram or jack may be used to push it back for the center and downward again, when it is desired to lower the dock to release the ship. Upon the outriggers 19 any suitable flooring or grating 32 may be laid either permanently or temporarily for the convenience of workmen around the hull. Upon the ends of the outriggers may be mounted sockets 33 into which telegraph poles or other suitable devices 34 may be inserted and fastened, which, as indicated in broken lines, may be of such length as to reach above the water level to show the position of the dock when submerged and to ward off any craft that might collide with the same. The motor shaft of the motor 30 should be provided with a thrust bearing 35 to take the pull of the worm gear mechanism 36 employed to rotate the shaft 31 and the thrust bearing should be strongly anchored to the foundations in any suitable way.

In Fig. 3 is shown the preferred form of trestle 12 consisting of girders 37 and 38 between which are connected hollow columns 39. The girders 37 are linked by the pivots 41 to the bottom of the float and by the pivots 41 to the foundations 8 or to the caps 43 of the foundations. By this means the columns 39 and girders 37 and 38 form a long rigid girder with a plurality of foundations 8 so that in case any one foundation should prove insecure, other foundations will assume a portion of its load. Furthermore if there is a tendency of the foundations to sink, they will all sink more or less in unison owing to the distribution of the load.

As many motors 30 and worm gear drives 36 may be used as may be desired to operate the shaft 31. The shaft 31 should be sufficiently strong to equalize the pull of the chains 22. Each chain may be located in line with a transverse stiffener 46, located across the inside of the float, each stiffener in alignment with an outrigger 19. The float may be provided with a central longitudinal girder 44 to transmit the load from the blocks 28 under the ship's keel to the trestle 12. The cross section of this link is shown in Fig. 4, the column 39 being hollow and the girders 37 and 38 being supplied with stiffeners 45 over and under the columns for the purpose of transmitting the load of the ship down to the foundations. The interior of the float may be provided with any suitable ship construction such for example as the transverse or the longitudinal system, with the main transverses over the columns 39 as indicated by the broken lines 46 and with any suitable longitudinal stiffeners located wherever there is a water pressure to be sustained and of sufficient strength to withstand the water pressure at any depth to which the float may be submerged. The buoyancy in the columns 39 and in the wooden posts 34 may be so adjusted as to maintain the specific gravity of whole structure somewhat greater than its displacement of water at all levels so that the whole construction has a tendency to sink when permitted to do so and yet such a comparatively small tendency that little power is required to raise it to the water level. Upon the wharf 7 may be mounted any suitable scaffolding for permanent purposes. Upon the water side of the hull the scaffolding may be nailed to or otherwise supported upon the telegraph poles 34; or scaffolding may be otherwise located and be removable when desired.

The details of the preferable hauling mechanism are shown in Fig. 5, the bearings for the counter shaft, gears and drum, as well as the anchorages for them, being omitted. A series of motors 47 operate pinions 48 meshing with gears 49 mounted on a countershaft 50, operating worms 51 on the shaft, which in turn rotate worm gears 52 and worms 53, meshing with worm gears 54 on the chain winding drums 26. This construction permits the use of a small shaft for linking the hauling drums together, instead of the massive shaft required by the diagram construction shown in Figs. 1 and 2, the latter form being shown for illustrating the broad idea. The motors are preferably operated from a common circuit in multiple with each other, with a common switch and rheostat for opening and closing the circuit.

Individual motor rheostats may be inserted in the multiple motor circuits to adjust the current in the different motors to the particular loads they carry.

If the motors run at 1000 R. P. M. and the pinion spur gear is 1 to 4, the two worm gears 1 to 25, and the drum 2 ft. in diameter a ship after being located on the blocks may be raised in 15 to 20 minutes. A 440 ft. dock with columns 10 to 12 ft. apart lengthwise, and properly constructed is capable of lifting a 12000 ton ship in this short time.

The lifting devices 22 and 24 keep the platform 17 in substantial alignment throughout its length.

Any variation in the pulling effect of shaft 50 is due to its elasticity and the torsional lag of one portion in relation to another is minimized by the fact that even a torsional twist of the shaft of 180°, which can hardly ever happen, would have an imperceptible effect on the platform, due to the slow speed of the gear. The elasticity of the platform and of a ship mounted thereon would compensate for any minute variation in relative rotation of the drums.

The dock may be as wide and as long as may be desired but the width of the float platform may be limited where desired to the spacing of the side series of blocks 29. Any variations may be made in the details and form of apparatus or in the mechanical movements necessary for lifting the ship out of water. The chief requirements of it are that it shall be lifted sidewise and upwards by a plurality of lifting mechanisms distributed along the length of the ship thereby dividing up the power into comparatively small units.

What I claim and desire to secure by Letters Patents is:

1. The combination with a ship lifting platform, of a rigid girder disposed longitudinally under the keel of a ship carried thereby, a row of pivotal columns supporting substantially the entire weight of the ship on said girder, a plurality of tension members secured to the girder for raising and lowering the same, and means for mechanically interconnecting said tension members to simultaneously control the same.

2. A stationary platform, a movable platform alongside the stationary platform for lifting a ship sidewise out of the water, supporting columns for swinging the movable platform toward and from and at right angles to the adjacent edge of the stationary platform and to the keel of a ship carried by the movable platform, and means alongside said movable platform to maintain the same in a horizontal plane, said last mentioned means comprising a plurality of auxiliary columns arranged along the outside of said platform and adapted to swing transversely to a ship contained on the platform.

3. The combination with a boat lifting platform, of a foundation therefor, a supporting column pivotally secured adjacent one end to the platform and pivotally attached adjacent its other end to the foundation, said platform being raised and lowered by movement about said foundation, a relatively stationary wharf or abutment located near and above said foundation and against which the platform is adapted to rest when moved slightly to one side of the pivotal attachment between the column and the foundation.

4. A movable platform, a shaft journaled in fixed bearings along one side of the platform and provided with a series of worms, a series of worm gears, in mesh with said worms to rotate at a reduced speed, and means operatively connecting the worm gears with said platform.

5. A moving platform, a shaft alongside said platform, a plurality of driving means geared transversely of said shaft, a series of speed reducing gears transversely of said shaft, and means operatively connecting the platform with said speed reducing means.

6. A movable platform, a shaft journaled in fixed bearings alongside the major dimensions of said platform and provided with a series of worms, a series of worm gears in mesh with said worms to run at a reduced speed, said worm gears provided with worm shafts, a series of worm gears in mesh with said series of worm shafts to run at a lower speed than said worm shafts, and means operatively connecting said platform with said last mentioned gears.

7. A movable platform, a series of power driven gears, a shaft journaled in fixed bearing alongside the platform, a shaft provided with a series of gears in mesh with the power driven gears and with a series of worms, a series of worm gears in mesh with said worm to run at a reduced speed, said worm gears provided with worm shafts, a series of worm gears in mesh with said series of worm shafts, to run at a lower speed than said worm shafts and means operatively connecting said platform with said last mentioned gears.

In testimony whereof, I have affixed my signature to this specification.

MYRON F. HILL.