Sheet 1-2 Sheets.

# J. S. Gilbert.
## Dock for Floating Ships.

No. 1,792. Patented Sep. 19, 1840.

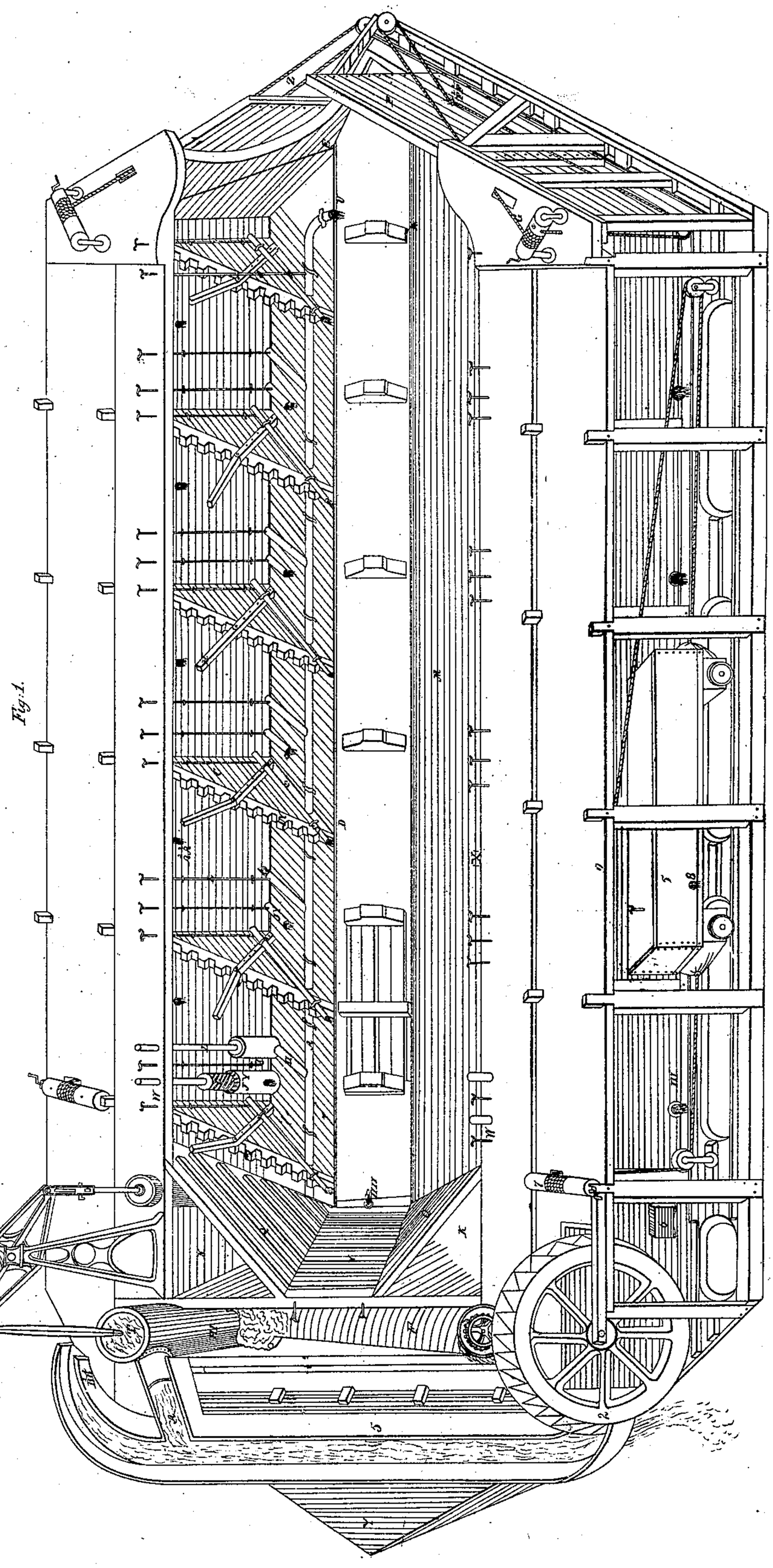

Fig. 1.

Sheet 2-2 Sheets.

# J. S. Gilbert.

## Dock for Floating Ships.

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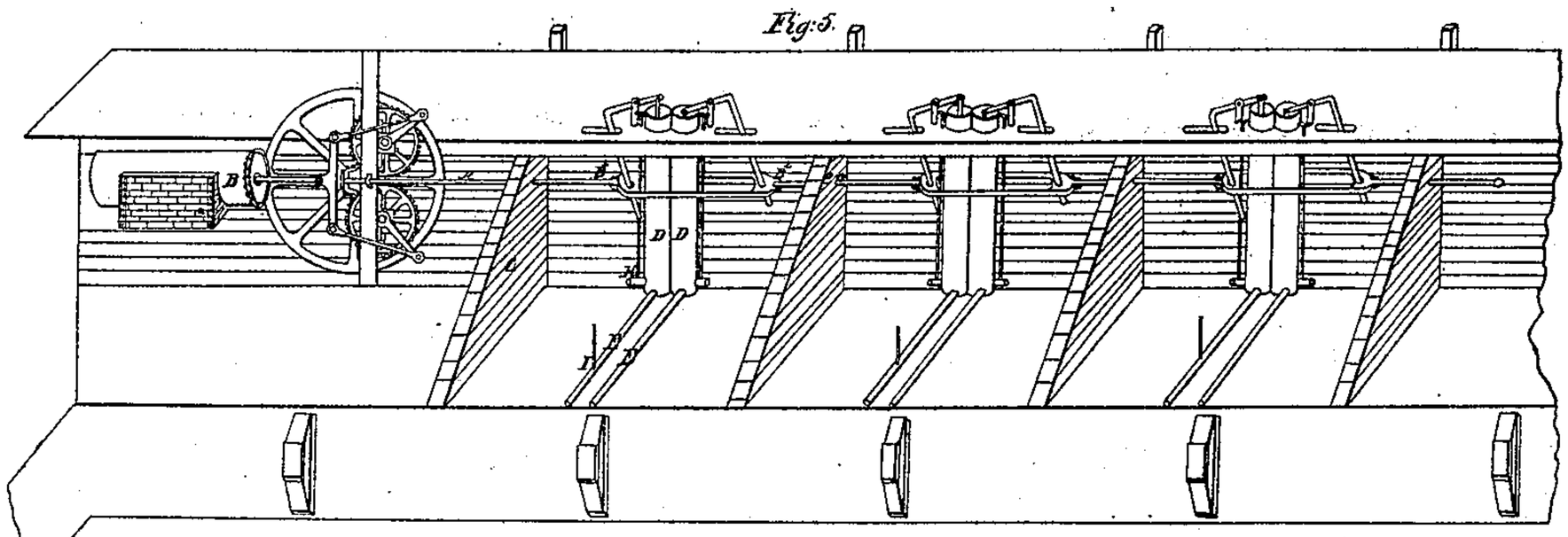
Fig: 5.



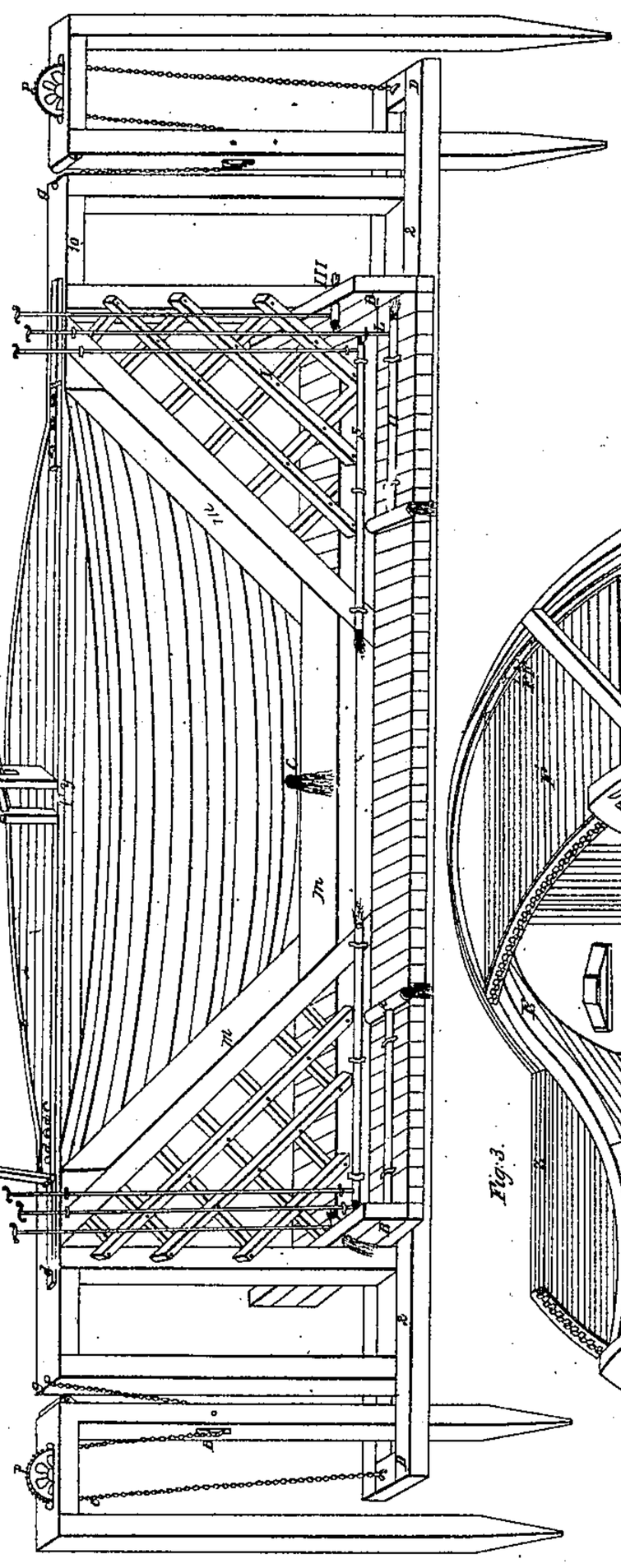


Fig: 6.

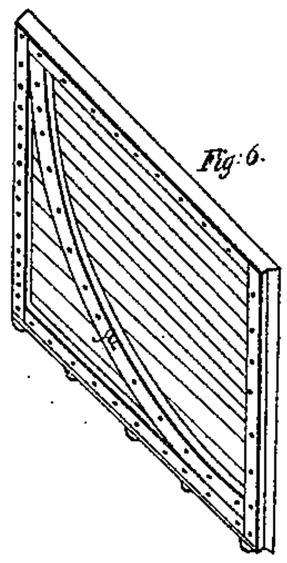


Fig: 2.



Fig: 3.

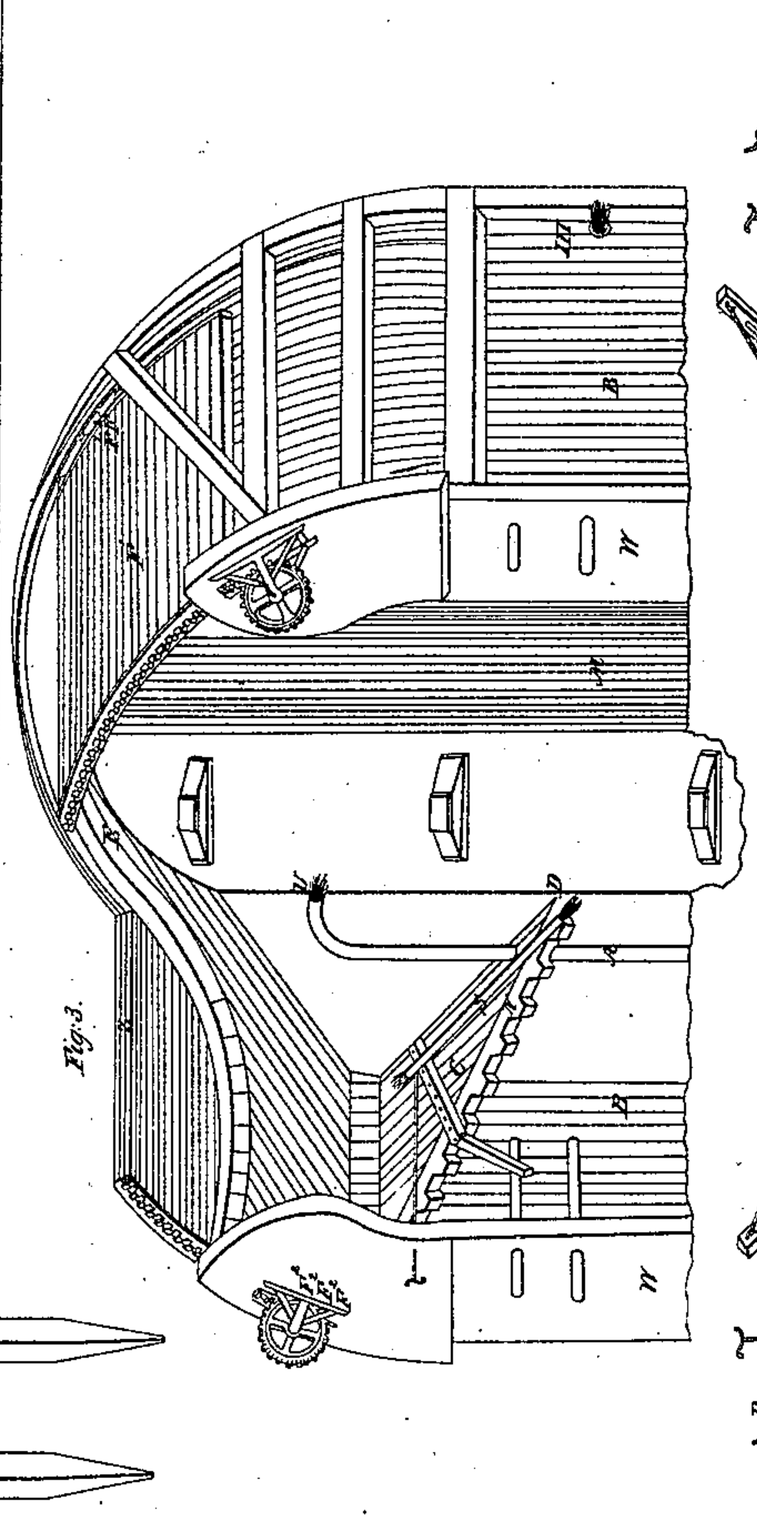
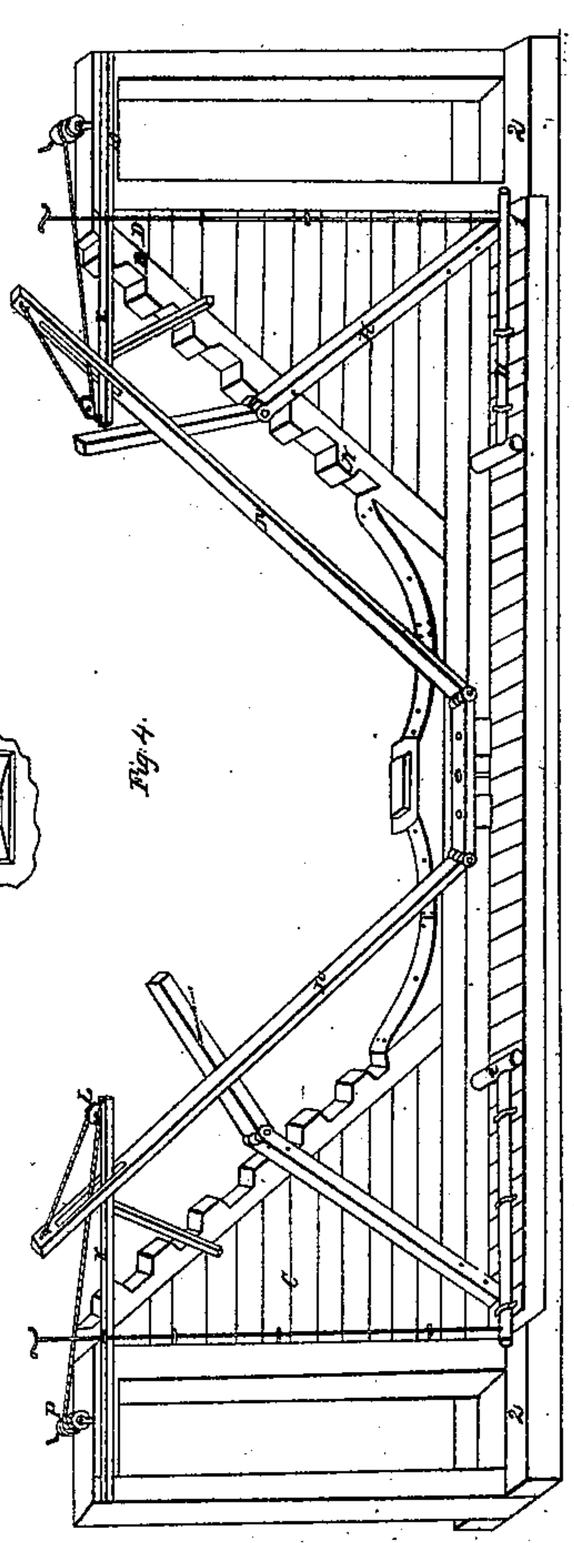


Fig: 4.



# UNITED STATES PATENT OFFICE.

JNO. S. GILBERT, OF NEW YORK, N. Y.

## FLOATING DRY-DOCK FOR RAISING AND REMOVING VESSELS.

Specification of Letters Patent No. 1,792, dated September 19, 1840.

*To all whom it may concern:*

Be it known that I, JOHN S. GILBERT, of the city of New York, in the State of New York, engineer, have invented a new and useful mode of constructing machines for floating ladened vessels over bars or shoals in rivers or harbors and which is equally well adapted to the purpose of repairing the keels and bottoms of vessels as a floating dry-dock, which machine I denominate a "floating balance"; and I do hereby declare that the following is a full and exact description thereof.

This machine is built in the water or on the land as may be preferred by the builder. In the first instance a square vessel is built or rather a vessel with a flat bottom and perpendicular sides with one end built up solid with the sides and of the same height. The other end is built up solid to the height of from four to five feet above the bottom as E, Figures 1 and 3, extending up in such shape as shall most nearly resemble the bottom of a ship. The open end is provided with horizontal sliding gates either straight, as at F, Fig. 1, or circular as at F, Fig. 3. This flat bottomed vessel is calked and made tight. The gates F are made in such a manner as to shut into each other, as at Z, Figs. 1, 3. The gate with a groove in the shutting edge is shut first and the other is shut into it by this method, the lightness of the end joints will not be affected by the springing of the machine, the tongue and groove are both of cast iron. The surface of these gates which are exposed to strain from the pressure of the water is an ellipsis, the open end being nearly of that form. The bottom of the gates are supported and strengthened by a piece of cast iron their whole length, into which rollers are fixed to run on iron ways as at F, F, Figs. 3 and 1. These gates are opened and shut by a rack and pinion as at F F F, Fig. 3, or by a windlass and chain running through blocks fastened to the bottom of the machine, outside of the gates and back to the windlass in such a way as to open and shut by reversing the motion of the windlass, all of which is plainly exhibited at G, Fig. 1, and will need no further description.

Section 2. Having thus constructed a vessel, that is when shut up by the gates entirely tight, we next divide off at the solid end a pump well as at H, J, Fig. 1, by building up a tight bulkhead five feet more or less from the said solid end. Where the bulkhead joins the bottom and the side it is calked and made tight and is thus a separate compartment having as yet no connection with any other part of the machine.

Section 3. For a seventy four gun man of war ship, this machine in the state thus far described will be two hundred feet long, sixty-five feet wide, and thirty feet depth of hold inside measurement, more or less. The transverse sections of the machine is next divided into three parts generally equal; but this will be varied according to circumstances in a small degree. The object is to have the middle of the machine narrow as possible and have the requisite room for the workmen to carry on the repairs of the ship when the machine is used for that purpose as a dry dock as the more narrow the bottom is the more capable it is to resist pressure. The transverse sections being thus divided by lines drawn the whole length of the machine, into three parts, the two sides are divided into five or more sections by timbers bolted one on the top of another as at C, Figs. 1, 3 4 and 5, starting on the bottom at the line of division as at D, Figs. 1 and 2, and running up such an angle as shall intersect the perpendicular lines of the sides as at D D, Fig. 4. These bulkheads are fastened to the bottom and perpendicular sides, and where there is a seam it is made tight by calking. Fastened to the solid bulkheads and extending down to the bottom of the machine, are joint shores, to support the ship in the machine and at the same time keep the sides from rising up. See H, Figs. 1 and 4. When these solid partitions are finished as described, and made tight by calking I build up the inner or angle sides as seen finished at M, Figs. 1 and 3. These inner sides are built up by letting every intermediate course, or layer of timber, half its thickness, say six inches into the edge of the solid partitions, thereby forming steps as at N, Figs. 1, 3 and 4. These projections also form rests for shores, to support the vessel and answer the purpose of stages for the workmen to stand on while repairing the vessel, in the machine for that purpose. When these inner angle sides are thus built up, being strongly fastened to the partitions and made tight all around by calking, they together with the parts already divided form five, more or less, water tight chambers, in each side of the machine, possessing say one

third of the entire buoyant power of the machine, each chamber being separate and independent of the other, and all on both sides independent of the middle or body.

Section 4. Between these solid partitions brace work as at I, Fig. 2, of sufficient strength to support the sides, between the solid work is framed, a hatch is cut in the upper part of the inner sides as at X, Fig. 1, through which the workman may enter to make any repairs that may be found necessary. The steam engine rooms on each side (as at K K, Fig. 1) are formed by tight bulkheads built across the corners (as at Q Q, Fig. 1). The coal hold is situated behind the tight bulkhead V. These engine rooms and coal hold are separate, and being calked are entirely disconnected, with every other part of the machine. W W, Figs. 1 and 2, are side decks which project one half inward and one half outward, for the workman to prepare the various materials, and in repairing ships and for all the purposes for which the bottoms of decks are used in the preparing of material in general. Y, Fig. 1, is a sharp bow extending beyond the perpendicular end of the machine, this bow is necessary where the machine is used as a bar float or when it is in a bay or river as a dry dock. The machine as thus far described is composed of various water tight chambers and compartments, all separate and independent of each other and having no communication from which water may be made to pass from one to the other or from the said separate compartments to the middle of the machine or from the middle to the pump, will then bring no communication between the various parts. In the ensuing sections I shall describe the method I have invented for connecting all the separate compartments with each other, also the method of connecting them with the pump well, and with the body of the dock in such a manner as enables me to exercise a complete control over the whole machine and which constitutes it a complete floating balance.

Section 5. Letter A, Figs. 1, 2, 3 and 4, is a pipe of wood or metal running the whole length of the machine and passing through the tight and separate sections or chambers enters at the pump well heretofore described as at O, Fig. 1, and the other end passes into the middle or body of the machine as at U, Figs. 1 and 2. Both ends of the pipe are governed by a cock or valve. The shaft reaches to the deck. I, I, Figs. 1, 2 and 4, are pipes made to intersect the pipe A and governed by a valve or cock as at L, Figs. 1, 2 and 4, and by screw gates as at L, Fig. 1. The said cocks, valves, or gates are opened and shut by a shaft extending up through the side decks as at W, Figs. 1 and 3. These screw gates in Fig. 1, are drawn too large in proportion to the other parts. The uses of the pipes I I are to lead water from a particular one or all of the separate chambers to the middle of the machine as at Figs. 1 and 3, or to lead water from each section or chamber to the pump well as at O, Fig. 1, for the purpose of raising the machine at any required point. J, Y, Figs. 1 and 2, is a screw gate valve seal to admit water from the ouside of the machine, as at I, I, I, Figs. 1, 2 and 3, into the chambers to sink the machine as low as required to admit the ship for repairs or for setting that part of the machine down to level it and for the various purposes herein specified. S, Figs. 1, 2 and 3, are pipes leading from the middle of the machine to the separate chambers, although this may be accomplished by letting the water pass through the pipe A at U in Figs. 1 and 3 and through the pipes I I, Figs. 1, 2 and 4, and at the other end of the same pipe A at O into all the separate chambers by the pipes I I, but the operation will not be so speedy as it will be by having the pipes S as above described. As one of the objects which I accomplish by the tight chamber is to sustain the machine at any required height when the entrance gates are opened for the entrance of a ship, it will be plainly perceived by any competent engineer, that the altitude of water in the chambers will be less than it is in that part in which the ship enters, the difference of altitude being the power that sustains the machine in this situation, providing the machine always has sufficient ballast on board to overcome the buoyancy of the materials of which it is constructed. The entrance gates being closed the pipes S are opened and the water around the ship is through them admitted into the said tight chambers on each side until it forms a level with the water therein, the lower part of the chambers being broad and the upper part of the body of the machine being broad the water from the largest part of the body is taken into the broadest part of the chambers and will be seen by this arrangement that much pumping will be saved, for when the ship is ready to be let out this water is let back into the body of the machine by the same pipes through which it passed to the sides. It will be seen that I have made a number of scuttle or sinking gates on each side, when one will fill all the separate chambers on one side, and if the water is allowed to pass through the pump well it will fill both sides, but the advantage of these is despatch. There is a pipe, Fig. 1, I, I, I, I, which leads the water from the body of the machine into the pump well under the coal hold, and governed by a cock or valve, with a shaft leading up to the top of the machine.

Section 6. T, Fig. 1, is a pump worked by

a steam engine. The water thrown out by the pump passes through the conductor A and is thrown upon the water wheel, Fig. 1. This bucket water wheel which is governed by a cog wheel on the shaft with a beveled edge to a beveled edge wheel E on the shaft of the screw pump F. This my method of exhausting the water from my machine, has the advantage of the use of the water discharged by the engine to turn the screw pump before it falls overboard; it likewise gives less motion to the water surrounding the machine, the buckets depositing the water quietly as the wheels turn and thus obviates the danger of undermining the piers and wharves around the machine.

Section 7. Fig. 2 is a transverse section representing a boat gate fitting into grooves made by timbers fastened up and down through the sides and across the bottom to receive the two ends and keel as shown at *m*, *m*, *m*. There are a number of such grooves in different parts of the dock. By the aid of this boat gate a vessel may be inclosed in a space adapted to its length and thus obviate the necessity of pumping more water from the machine than is absolutely necessary for the size of the ship to be repaired. This boat gate is also used for dividing the machine for the admission of two vessels. There is an opening at C through the boat gate from side to side near the bottom or keel, which may be opened for the purpose of allowing water to flow through. A plugtree carrying a wicket gate through a trunk Y passes down the middle of the boat gate, and is raised or lowered by the lever B. It may be raised to such height as will allow water to pass from side to side only through the opening for that purpose, but when raised entirely the water will then be admitted into the hold of the boat and allow the gate to settle down into the grooves formed for that purpose. When this boat gate is used it is after having been settled down into the proper grooves to be firmly attached to the sides of the machine in order to keep the sides of the machine from spreading, which might cause a leakage of water past the ends and bottom. This may be done by means of screw bolts and nuts, or there may be a bar of iron fastened to the machine by a hinge or staple joint at each end of the boat, and having loops or openings at the other end to fit over staples as *d*, *d*, *d*. One of the main objects of this transverse section is to show the difference of the arrangement and division of the buoyant power and general principle upon which my machine is constructed, and thereby plainly show the difference between my invention and those which have been heretofore constructed. In some of those the buoyant space, which gives the power of lifting the ship, is situated between the keel of the vessel to be lifted, by which arrangement the machine bears the weight of the ship in the same manner, as the ship would bear the weight of her cargo if that cargo was placed on the deck, instead of her hold, the result in both cases being thus the center of gravity is raised to such a height as to endanger the vessel or machine.

Another difference between my machine and such as I have just described is the amount of water to be pumped out to raise the keel of the vessel out of water. The ascertained weight of a 74 gun ship when stripped being 1400 or near it it follows as a matter of certainty that nearly double that amount of water must be pumped out of the machine above referred to in order to raise the keel sufficiently out of water to enable the workmen to operate upon it, for a great amount of ballast will be necessary to sink the machine. In the first instance, the keel of the vessel must be raised some distance above water. The weight of the workmen and all the stages and all other appliances necessary in repairing a vessel are to be considered in the calculation of amount to be pumped out. In my machine the amount of water to be pumped out will in no case exceed the weight of the ship to be repaired, for having so divided the transverse section, as to approximate to the general shape of vessels, as near as possible, the weight of the vessel is displaced as she enters the machine, and the ballast instead of adding to the weight of water to be pumped out of my machine is the cause of an unoccupied space into which the water passes from the body of the machine as heretofore described in this specification.

Another difference between my machine and the kind referred to above is that the center of gravity in the machine when the vessel is in, and the water pumped out, is not much removed from the point at which it rested in the ship before it was taken into the machine.

Another difference of no less importance is when my machine is used in any of the Atlantic cities is that the waves cannot break in upon the workmen, as in the machine referred to. There are many cardinal points in which my machine differs in principle from those spoken of, the difference in arrangement is so plain as to require no explanation.

Other machines are in use in various parts of the world, but all of them I believe to be different in principle and general arrangement from mine, for in those machines the buoyant power is so arranged as that the machine must of necessity rise and fall with the tide. This however is not necessarily the case with mine. When the rise and fall of the tide is small as at the city of New York, viz., from 5 to 6 feet, for as the tide

rises it may be made to pass into the sides of my machine at the scuttle gates heretofore described and at the ebb of the tide it may be thrown out at one point, viz., the pump well. This power of keeping the machine down to nearly the level of the pier or wharf at which it may lie is one of the advantages derived from my method of dividing the transverse sections in such a way as to give no more space than is necessary for calking and graving the bottom of the ship, at the bottom and lower part of the machine, and instead of the space which other machines referred to have on the bottom I make use of that room as an occasional buoyant power. I have furnished side decks for the purpose of preparing timber and other materials for which room is required in repairing ships.

The advantages I derive from this division of the transverse sections of my machine and any other now in use in any country are, 1st, as I in general make my machine double the width of the class of ships for which I intend it, and then divide the transverse sections into three nearly equal parts at the bottom, the middle bottom is narrower or in other words the cross timbers are shortened between joints without diminishing the breadth at the top of the dock. By reference to the two transverse sections, Figs. 2 and 4, it will be seen that my method of strengthening my machine in that portion of it set apart for separate chambers is so full and complete that no doubt can exist as to the strength of that part of the machine. I then have the middle bottom to provide for. I have before stated that the middle bottom is stronger and more capable of sustaining the weight of the ship within and the pressure of the water without, by being short between joints. This can be more plainly seen by Fig. 3 where the sheaves H are shown extending up to the sides of the vessel. The three points of pressure are the keel on the middle and the sheaves on each side as at H, taking their proportions of the strain and transmitting said pressure to the bilge or side of the vessel, thereby making the strain on the keel less which is important, and greater on its sides; 2d, by this direction of the transverse sections I am enabled to turn the side of my machine up in order to repair the machine down to the bottom without the assistance of any other machine. The process is to exhaust this middle body of the machine and one side and fill the other by the scuttle gases. The exhausted sides will rise entirely out of water. The ends and gates may be repaired in like manner, by building up the inner sides on an angle of 45 degrees, or on such an angle as shall at the same time resist the lateral pressure and upward force in a great degree when the machine is strained upward or when the sides are pressed inward greater strength is attained. This machine draws not to exceed one half the water that many others referred to do. There being no buoyant space below the keel the workmen stand upon the false or shifting bottom and thus use that space which in other machines is a part of the buoyant power. The keel of the vessel rests upon the cross logs or floor timbers which are each six feet deep, up and down and two feet thick. The space between them is two feet, where the workmen stand when at work at the keel so that the actual loss of room is nothing—for it being necessary to place the keel from 4 to 6 feet above the false floor on which the workmen stand. The filling up of this space with timbers as above described is on top of draft. The dimensions given above is proper and right for a 74 gun man of war ship, and the buoyant power is so divided in my machine that together with the downward tendency of one side and the upward tendency of the other, when the machine is off its balance there is a balancing power generally equal to the entire weight of the ship in the machine, and in consequence there is no danger of capsizing.

Fig. 4, *n*, *n*, are two spring sheaves working on a point at the bottom so as to allow of their being raised up to the bottom of a vessel of any shape or size. The upper end of these sheaves have a core or mortise through them to slide over a beam as at K K. A rope or chain is fastened to the upper end of these sheaves and passing out to the end of the beam through a block L and back to a windlass P by which they are heaved up to touch the vessel. The sheaves are made broad and flat so that they may bend or spring. The object of having such sheaves along the sides of the machine is to catch and steady the vessel when she first enters the machine. The communication between the middle and the sides is then opened and as the vessel settles on the keel blocks, she is pressed over whichever way is required to place her in the middle of the machine. The sheaves being broad and flat they will not be liable to break if they should be pulled before the keel touches. When the keel touches the block, the sheaves H are set.

When one small vessel has been admitted for repairs, and it is desired to admit a second the valves which govern the main pipes A at U are opened and the water thereby admitted into the pump well. The weight of the first vessel inclosed by the boat gate and the second inclosed by the wicking gate are balanced by either admitting water into the chambers opposite to the lightest vessel, or taking water from those opposite the heaviest one.

I have thus far described my floating balance as having no other means or contrivances for maintaining a just balance in case the ship should rest on one side or her weight be thrown on one side by the action of the wind or waves or from any other cause, such as the machine touching an uneven bottom at low tide or sudden leak from any unforeseen accident to the internal arrangements, as above described.

To assist the operation of the balancing power placed within the line of the perpendicular or outer sides of my machine, as above described I sometimes extend the lower cross logs or floor timbers, as shown at 2 in Figs. 2, and 4, and upon these floor timbers is extended on each side iron rails are placed upon which loaded boat cars 5, Fig. 1, are capable of being moved back and forth. I also place similar cars 6, Fig. 1, to traverse on rails at the closed ends of the machine. These cars are to be moved by means of the windlass 7, Fig. 1, which is provided with double chains passing around guide pulleys and attached to the car in such a manner, as that by reversing the motion of the windlass the cars may be made to move either way at pleasure. These cars may contain a sufficient quantity of ballast to overcome the buoyancy of the materials of which the machine is constructed more or less to cause it to sink when water is admitted into all parts of the machine. Whether this machine be built of wood or iron, ballast will be used in order to create a greater difference in the altitude of the water within the sides and the water that surrounds the ship than the mere weight of the machine would cause, so that in forming a level, a greater portion will be taken from around her without pumping, and which is let back again when the ship is to be let out of the machine. These ballast cars as above stated are made tight and have one or more scuttle gates 8, Fig. 1, with a shaft to open and shut them extending up to within reach of the side deck 9, Figs. 1, 2, and 4, which are sometimes built over these cars on posts running up ouside of these cars fastened at the bottom to the floor timbers 2, Figs. 2 and 4, at the top to dock beams attached to the sides of the machine 10, Figs. 2 and 4. When used in a bay or run this will be the proper way of constructing it as a larger space will be required for materials on each side, than when it is, alongside the pier.

At certain situations when the tide is strong and where the machine is exposed to strong winds and unquiet waters, and where it is used as a mere dry dock it will be necessary to place it between two pieces or rows of piles. Steadying chains will be necessary in that case.

P, P, Fig. 2, are wheels with cogs upon them to take into the chains C. These chains answer several useful purposes, among which is their giving stability to the machine, when used as a dry dock. In Fig. 2 the manner in which they are arranged is shown. P, P, are the cogged wheels sustained on the timbers of the pier, and over which as above stated the chains pass. The chains are at one end fastened to the top of the machine as at *g*, *g*, and after passing down to low water mark over a wheel B′, they ascend to and pass over the cogged wheels P, P, and down again to a platform or cross timber, projecting as at D D where they are fastened. It will be seen that both ends of the chain are fastened to the machine in such a way as when they are hauled taut they keep the machine in shape it will be seen that any weight or downward force applied to the projecting cross log is expended at the cogged wheel at the top and the pulley in the pile at low water mark hauling in different directions and has little or no tendency to strain the sides of the machine outward they are more steadying chains to which any power may be applied and to which those operating may be performed, viz., when the cogged wheel is stopped the dock is stopped in its upward or downward motion; when the cogged wheel is turned toward the machine it will rise; when from the machine it will settle. I am not aware of anything of this nature in use at the present time. Blocks and falls cannot in either natures be similar to this, for the very principle of a block and fall is to lift by shortening the rope or chain between the power applied and weight moved. I have stated above that horizontal sliding gates as applied to docks are of my invention. The particular manner or method of constructing these gates requires further explanation. The inner surface or side that lies against the end of the machine is made in such a manner that no part of it touches the machine except the frame to which the outside thickness of the gate is bolted as at A, Fig. 6. The object of this frame on the inside of the gate is that no part of the gate may rub against the end of the machine except the projecting frame, thereby insuring a more perfect water tight joint and as these edges are fastened on by screw bolts, they may be removed when worn by friction against the ends and replaced by new ones at little expense.

It will be seen that the boat cars have a power of assisting the other parts in keeping the machine upright, for when the machine is blown over more to one side than the other, the boat in the leeward side will bear more lightly and that on the windward side will bear more heavily. It will also be seen that they may be pumped out and floated off the machine entirely through an opening at the gate, and for that purpose the

wheels as may be seen by reference to Fig. 1 are separate.

A², A², Fig. 1, are openings in the perpendicular sides of the machine to admit water into the tight and separate chambers from a conductor that passes across the head of the machine at Figs. 1 and 5, and down in each side of the machine, making a conductor all around it except across the gate end, this conductor at Fig. 1 is seen at B², B², where it passes under the outside deck, but I sometimes place this conductor immediately over the water tight chambers. The object of the conductor is to lead water into the section for ballasting down the machine in whole or in part and for leading the water to the extreme end of the outer part of the machine to avoid undermining wharves or piers though the section may be filled by raising the water in the pump well and opening pipes A and I I Fig. 1.

Although I have represented my machine as being made tight by framing and calking I sometimes build on the outer sections or chambers strong iron or iron bound tanks fastened down to the plaftorm by iron straps passing over their tops, the same pipes and conductors being used in all cases. The advantages of these tanks are great for in case of an accident to one of the chambers the tanks may be made a separate buoyant. I have shown in Fig. 1, letters J Y, two screw gates, one to admit water into the chambers, the other to let it out by the pipe I, I. These screw gates do fairly represent the tanks as above described, by the mere addition of a connection pipe C² to pass water from one to the other governed by a valve. In case it should be desirable to use these tanks as a buoyant the pipe that leads water from the outside through these tanks to the chamber is closed and the pipes C are opened and then the pipe I, I, which leads all the water from both tanks into the pump well.

In the above I have specified my method of drawing water all to one point. I have also described my pump well, but I sometimes make each of the separate chambers a pump well. Fig. 5 represents three of these chambers, each furnished with suitable pumps with vertical brakes worked by a horizontal engine B. The connecting bar is shown at A working under the side decks. When the brakes B² B² are attached this bar works between friction rollers as at *e*, *c*. The pumps D, D, are connected with the body of the machine by the pipes E, E, these pumps are so attached to the connecting bar, that any number may be attached at pleasure. They may be worked by a horizontal engine or by horse power in the usual manner known to all competent engineers, the cylinder and balance wheel of an engine are represented and no further. When it is desired to draw water from the body of the machine alone, the valve H Fig. 5 is shut and the valve I is opened. The valve I has a shaft that reaches up to the side deck as the valve H or it may pass through the angle sides with a joint to fold down. It will plainly be seen that the whole number of pumps may be made to draw water from the body or by shutting the water off they may be made to draw water from the sides only or one pump may draw from the sides and one from the middle. The main object of this arrangement of the pumps and pump brakes is to enable me to bring my pump gear so low that I may work them under the side decks out of the way of the workmen.

Having thus fully described the manner in which I construct my floating balance and of the mode of using the same, I do hereby declare that what I claim therein as my invention and desire to secure by Letters Patent is—

The combination of the body of the dock, in which a ship can float with water tight trunks or tanks at the sides separated by water tight bulkheads for the purpose and in the manner specified.

In testimony whereof I the said JOHN S. GILBERT hereto subscribe my name in the presence of witnesses, whose names are hereto subscribed on the tenth day of August A. D. one thousand eight hundred and forty.

JOHN S. GILBERT.

Witnesses:
G. C. WING,
ROBERT RUSSELL OWEN.