4 Sheets--Sheet 1.

J. L. CLARK & J. STANDFIELD.

Floating-Dock and Pontoon.

No. 162,531. Patented April 27, 1875.

Fig: 2.

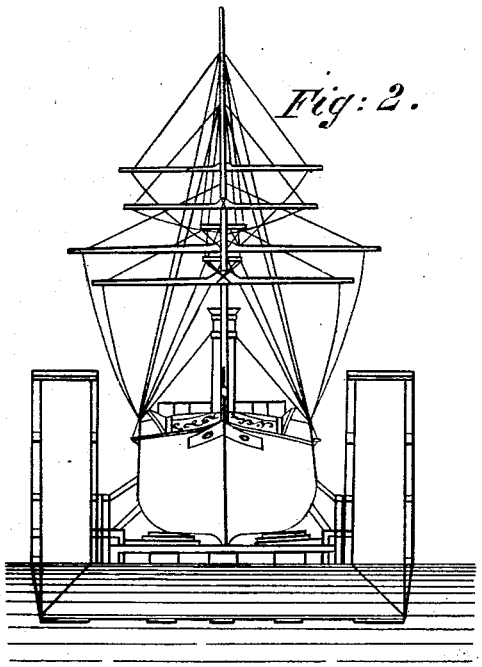


Fig: 1.

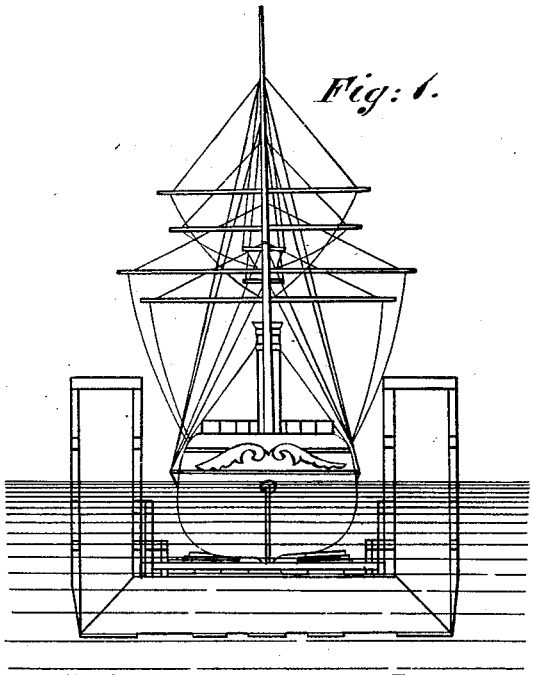


Fig: 3.

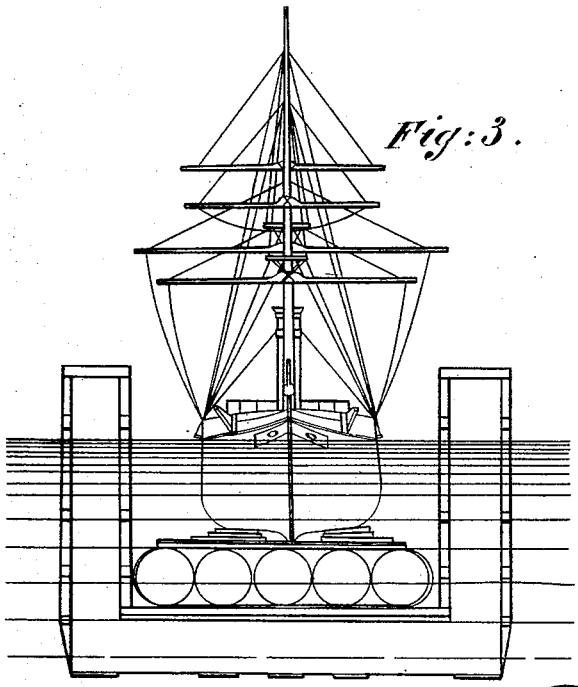
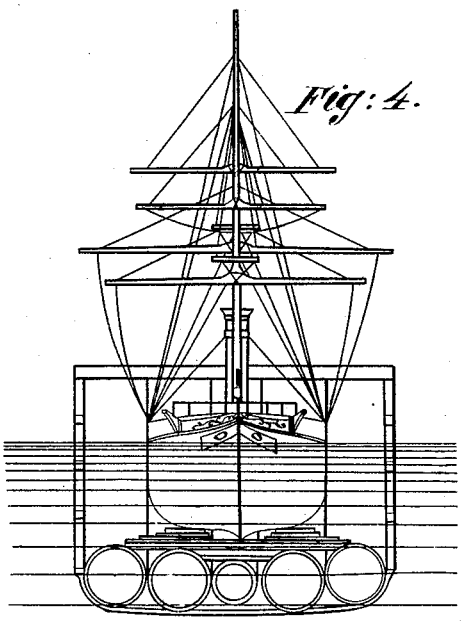


Fig: 4.



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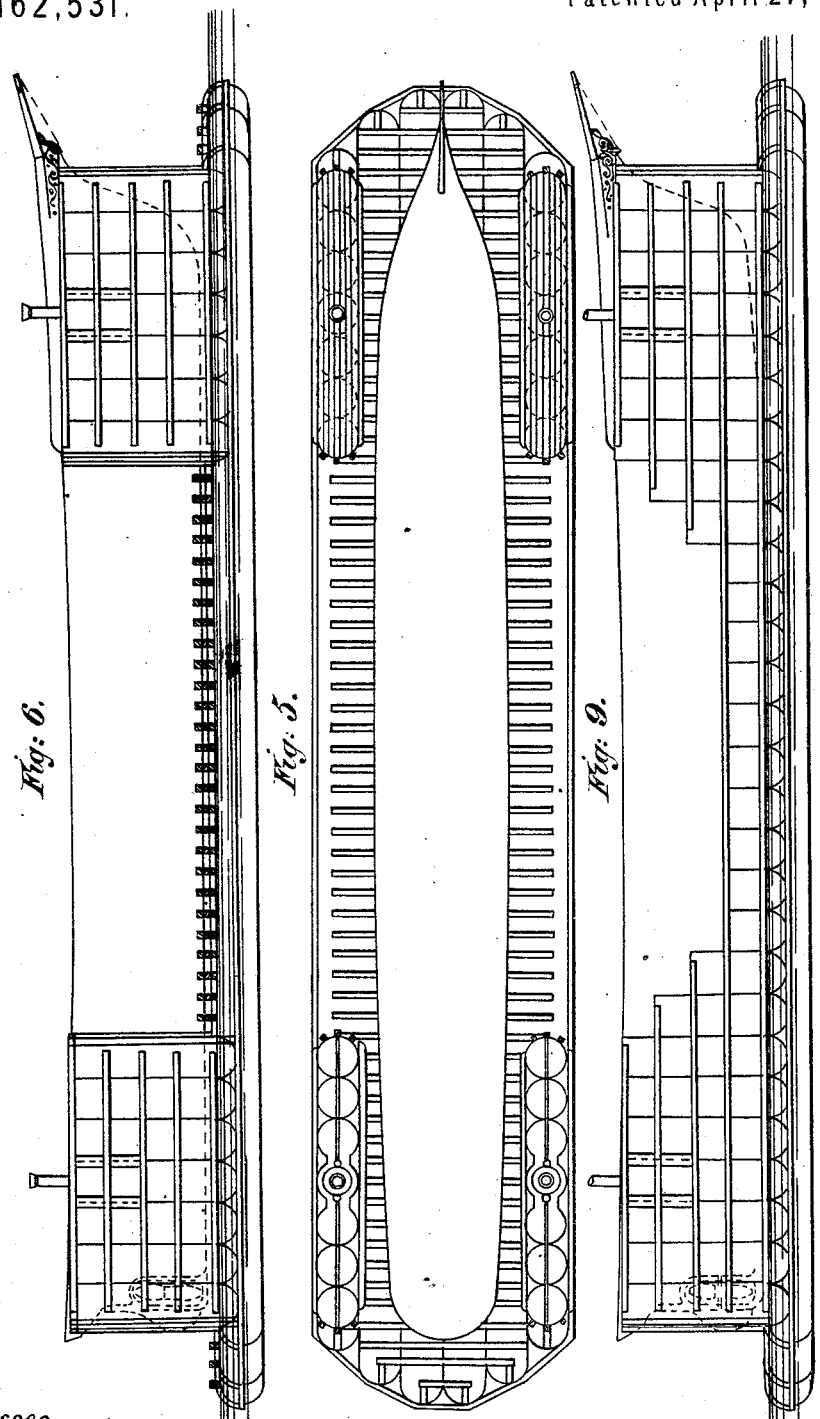

Fig. 6.

Fig. 5.

Fig. 9.

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4 Sheets--Sheet 3.

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Fig: 7.

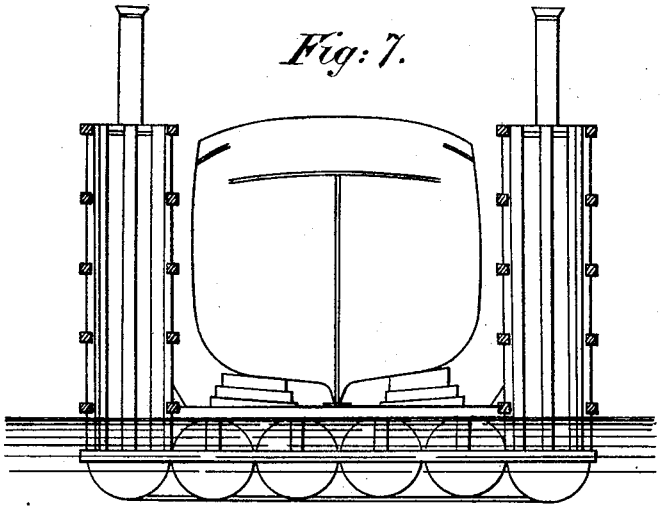

Fig: 8.

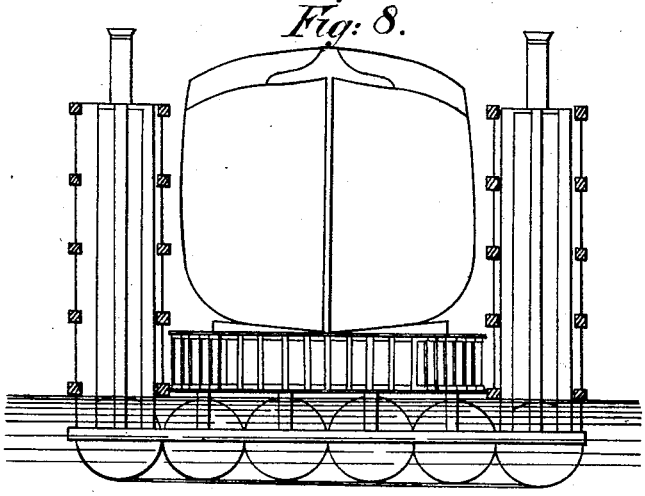

Fig: 10.

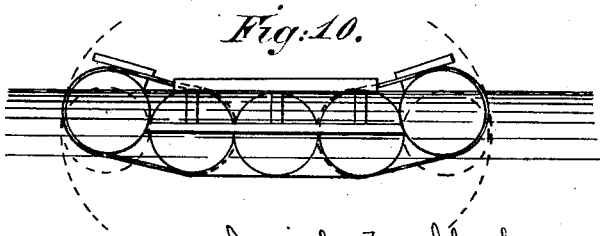

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Fig: 11.

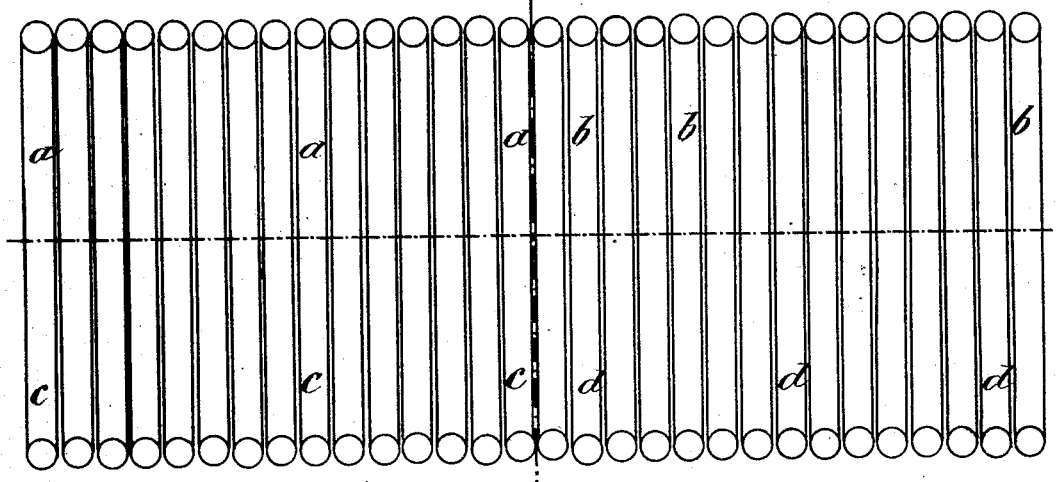


Fig: 12.

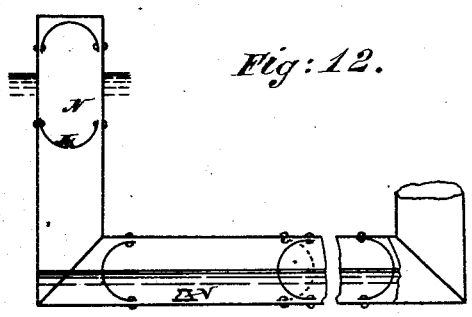
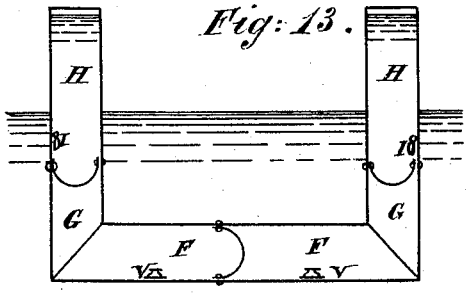


Fig: 13.



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UNITED STATES PATENT OFFICE.

JOSIAH L. CLARK AND JOHN STANDFIELD, OF WESTMINSTER, ENGLAND.

IMPROVEMENT IN FLOATING DOCKS AND PONTONS.

Specification forming part of Letters Patent No. **162,531**, dated April 27, 1875; application filed September 11, 1874.

To all whom it may concern:

Be it known that we, JOSIAH LATIMER CLARK and JOHN STANDFIELD, both of 5 Westminster Chambers, Victoria street, in the city of Westminster, England, subjects of the Queen of Great Britain, have invented or discovered new and useful Improvements in Floating Docks and Pontons, and we, the said JOSIAH LATIMER CLARK and JOHN STANDFIELD, do hereby declare the nature of the said invention, and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement thereof—that is to say:

Our invention consists in an improved form of floating dock or ponton.

The improvement relates to the construction of the horizontal platform of the dock or ponton of a series of tubes of iron or other material, placed parallel to each other, either longitudinally or transversely, in combination with vertical tubes at the sides or ends, so that the structure represents somewhat the form of the letter **U**. When the dock is floating with a vessel upon it, the horizontal tubes support the weight and the vertical tubes stand upright out of the water. When it is submerged, the horizontal tubes, and in some cases, also, the vertical tubes, are partly filled with water, and the flotation is maintained by the vertical tubes. The tubes are divided into a suitable number of compartments by bulk-heads. When the tubes range longitudinally with vertical tubes at the ends the vessel is docked sidewise, but when the vertical tubes are ranged along the sides of the dock (which is the more usual form) the vessel is brought in "end on," between the two side rows of vertical tubes, in the usual manner.

Sometimes we make the horizontal platform one large square chambered ponton of the usual character, and combine with it vertical tubes at the sides or ends, as the case may be. The tubes are provided with valves for admitting water for partially submerging the ponton, and pumps or other gear are provided for emptying them. We prefer to use the following arrangement: The tubes or chambers of the horizontal platform are filled with air when the ponton is floating at its highest level. This may be done either by forcing air into them or pumping the water out of them. These chambers are provided with valves at the top, which can be closed, and with other valves beneath, which may be opened so as to admit the water below. If it be desired to submerge the ponton, the valves at the bottom are opened and water allowed to flow into the bottom tubes, and to assist the submersion of the ponton water may be at the same time admitted or pumped into the vertical tubes, or some of them, until they are sufficiently filled to submerge the ponton to the desired level. As the ponton descends, and the water enters the open valves at the bottom, it gradually compresses the air within the chambers more and more, according to the depth of submersion, and when it is subsequently raised this air expands again and expels the water, so that when it is at its highest level the chambers are again empty. The dock or ponton being now at its lowest level, the vessel is brought over it and secured in the usual manner. If it be now desired to raise the vessel, it is only necessary to expel the water from the bottom tubes, either by allowing the water to escape out of the vertical tubes by suitable valves provided for that purpose, or by admitting air, under pressure, into the bottom tubes. As the water flows out, and the dock or ponton rises, the air in the bottom chamber expands and expels the water, and by the time the whole of the water has run out the vessel is raised and docked. In some cases we employ the vertical tubes, or some of them, as reservoirs into which air may be compressed by pumping-engines, and the compressed air contained in such reservoirs may be used for expelling water from the bottom tubes when the dock or ponton is to be raised. The dock may be so constructed as to be capable of being divided into two or more separate portions, each forming a smaller dock, which can, when desired, be recombined into one larger one.

When it is required to dock more than one vessel at a time we construct pontons or grids without vertical sides, consisting of a number

of horizontal tubes provided with bulk-heads, and braced together so as to form a flat ponton or grid of sufficient capacity to support the vessel. These flat pontons are brought over and within the floating dock or ponton previously described, and sufficient water is admitted into them to allow them to descend within the larger dock. The vessel is then brought over this ponton and secured, the whole is raised to the surface in the manner described, the water is allowed to flow out, the valves are closed, and the large dock being again partially submerged the ponton, with the vessel upon it, is left floating, and may be towed away to any desired place, and may be again lowered by a similar dock, in the same manner as is done by ordinary hydraulic-lift docks.

If the vessel and ponton be of greater weight than the dock is capable of lifting, the water in the ponton may be pumped out or expelled by the admission of compressed air, so that the ponton and dock combined have greater lifting power than either of them would have separately.

By these pontons vessels may be readily raised and floated over shallow bars or through canals, and again lowered into the water.

In the drawings hereunto annexed we have shown examples of docks and pontons constructed according to our invention.

Figures 1 and 2 show one of these docks with a vessel upon it. In Fig. 1 a dock is shown submerged in the act of raising a vessel. In Fig. 2 water has been pumped or forced out of the tubes, and the dock is shown at its full elevation with the vessel out of the water.

The dock consists of circular U-shaped tubes, which are shown in elevation in Figs. 1 and 2. The general construction of the dock is clearly shown by the drawings, so that it is unnecessary to give any detailed description of it.

Fig. 3 shows an end elevation of a similar dock submerged, with a tubular ponton within it, and a vessel upon the ponton ready for being lifted.

The ponton consists of tubes, and when raised by the dock to the surface with the vessel upon it the water flows out of it, the valves are closed, and the ponton and vessel are left floating in the same manner as is usual with hydraulic-lift docks.

One of the advantages of this system is, that, suppose the dock itself to be capable of lifting a vessel of three thousand tons and the ponton to be capable of floating a vessel of two thousand tons, the two combined will be capable of floating a vessel of five thousand tons, and therefore they can either be employed in their combined form, so as to dock a vessel of five thousand tons, or in their separate form, so as to dock a vessel of three thousand tons and two thousand tons, respectively.

The arrangements for pumping or forcing the water out of these docks will be explained hereafter.

Fig. 4 shows a dock in which the tubes are arranged longitudinally instead of transversely. The vessel in this case has to be hauled onto the dock sidewise instead of endwise. In other respects its construction is the same as that of the docks previously described.

Fig. 5 shows the plan of a dock in which the horizontal tubes are arranged longitudinally. It has at each corner a series of vertical tubes, which support the weight and insure stability when the dock is submerged.

Fig. 6 is the side elevation of the same dock, and Fig. 7 an end elevation. Four engines and pumps are indicated as being placed, one in each corner group, for the purpose of pumping out the water, or forcing it out by compressed air.

Fig. 8 is an end elevation of the same dock, with a flat ponton and vessel within it. The ponton is raised and the vessel floated in the manner already explained in referring to Fig. 3.

Fig. 9 is a side elevation of a similar dock, but in this case a larger number of tubes are brought up above the surface, along the sides of the dock, the inner tubes being each shorter than its neighbor, as shown in the drawing. Short side tubes are also arranged intermediate of the corner groups. By this system increased stability is obtained during flotation, at the time when the vessel is nearly raised out of the water.

Fig. 10 shows a construction for the ponton in which the outer tubes are strapped or hinged onto the inner ones in such a manner that they are capable of raising and supporting the bilges of the vessel so as to gripe it with greater firmness, the object being to insure the more perfect action of the side-shoring frames and bilge-blocks, and to give a more uniform pressure under the vessel while on the ponton.

Various forms of multiple compartments, in which the tubular form is introduced, and which may be useful in certain cases, may be employed.

Buckle-plates and girders may be used to connect semicircular tubes to form the outside. A series of circular tubes may be joined by segments of circles so as to give great flotation within a given space. In most cases we prefer to use the plain circular tubes, as shown, with egg-shaped conical or spherical-shaped ends and bulk-heads. The tubes are braced together with suitable angle, I, or channel irons, in a manner which will be familiar to all engineers. They are protected from injury by wooden fenders or balks of timber, as shown.

The docks are submerged by allowing water to flow into the tubes, when they sink by their own weight, in the usual manner, or this may be assisted by pumping water into vertical tubes.

In raising them out of the water again with the vessel upon them three different methods may be employed:

First, we close the valves in the bottom and

pump water out of them in the ordinary manner.

Second, we expel the water by forcing air into the upper part of the tubes, suitable valves being arranged at the bottoms of the tubes, which can be opened and closed at pleasure. When these valves are opened, and the air is forced in by an air-pump or from reservoirs of compressed air, the water is expelled through the bottom valves and the whole dock rises to the surface. The valves at the bottom are then closed and the dock left floating.

Third, if, in order to submerge the dock, water has been pumped into the vertical tubes in sufficient quantity to cause the dock to sink to the required level, then, when it is desired to raise the dock, this water is allowed to flow out again, and the dock rises by the floating power of the horizontal tubes. In each case we prefer to divide the dock into four or more portions. For example, the horizontal tubes may be separated in their center by diaphragms or bulk-heads, and if we suppose the dock to consist of thirty tubes, as shown in Fig. 11, each quarter of the dock would consist of fifteen half-tubes, viz: *a a a*, *b b b*, *c c c*, and *d d d*. By pumping or forcing the water out of these respective divisions in suitable proportions the dock can always be kept in a level position, both transversely and longitudinally, or can be canted on one side or one end at pleasure.

When raising the dock by the second system we connect all the half-tubes *a a a* together by suitable pipes, and also the remaining halves *b b b*, *c c c*, and *d d d*, and the four pipes which connect these groups are led into one spot on the top of the dock and provided with suitable valves or taps. When raising the dock the bottom valves V V, Fig. 12, are opened, and air is forced in by an air-pump, and, by means of the pipes before mentioned, it is led into the respective compartments or groups *a a a*, *b b b*, *c c c*, and *d d d*, Fig. 11, and by partially opening or closing these valves in a suitable manner the proper amount of water is expelled from each compartment, and the dock is kept level both transversely and longitudinally. When the dock is raised the valves V V V are closed, and the whole remains floating. When it is desired to lower it again the valves V are opened, and the air is allowed to escape gradually from the four compartments in such manner that the water enters, and the whole descends uniformly. Sometimes we prefer to insert bulk-heads in the middle of the vertical tubes, or some of them, as shown at N, Fig. 12, so as to form upper compartments or air-chambers. The whole of these air-chambers are connected by an air-tube, which is common to them all, and they are used as a reservoir for compressed air. The air is forced into these compartments under considerable pressure, and remains stored up ready for use. When it is desired to lift a vessel quickly the compressed air is allowed to force itself into the four groups of tubes *a a a b b b c c c d d d*, Fig. 11, and, the water being expelled, the dock is quickly raised to the surface. This system is very useful when it is desired to lift a vessel quickly in rough water, as the compressed air forces the water out very rapidly, and allows the ship to take its bearings quickly in the dock before it has time to do injury by bumping. When the dock again descends the valves V V are opened, and the air is allowed partially to escape as the dock descends. The pressure on the air within it increases, and the pressure causes the valve M, Fig. 12, to open, and the air enters the reservoir at this pressure. The pressure is afterward increased by pumping to the necessary amount. It is quite unnecessary to show the valves and connections by which this is arranged, as their construction would be perfectly understood by any engineer.

Fig. 13 shows the third system of floating the dock. The transverse tubes F F, Fig. 13, and a portion of the vertical tubes G G, are constructed air-tight, and are separated from the vertical tubes by bulk-heads. They are open to the water at the bottom by the valves V V. When it is desired to submerge the dock water is pumped into the upper compartments H H in sufficient quantity to sink the dock to the desired level for docking the ship. As the dock descends into the water the pressure within the tubes F F is increased, and the air, being under compression, diminishes in bulk, so that a certain quantity of water enters the tubes and assists in submerging the dock. If, for example, the vertical tubes descend to a depth of thirty feet the pressure on the air will be equal to two atmospheres, and it will be contracted into half its bulk, and a corresponding quantity of water will therefore enter within the tubes. When it is again required to raise the dock it is only necessary to open the valves or taps at I I, and allow the water to flow out, by which means the dock will again rise, and the air, expanding, will expel the water out of the horizontal tubes, and the dock will again float at its highest level. If necessary, compressed air may be forced into the chambers F F to expel the last remaining quantity of water, or the valves V V may be closed and the remaining quantity of water pumped out.

We claim—

1. The combination of a series of horizontal tubes, divided longitudinally and transversely into compartments, and vertical tubes arranged in groups or series corresponding with said compartments, substantially as and for the purpose set forth.

2. The combination, with the horizontal or bottom portion of floating docks or pontons, of vertical tubes divided into compartments for water and for storing air under pressure, communicating by valves, as and for the purpose set forth.

3. The combination of horizontal tubes, vertical tubes arranged in groups at the corners of the horizontal tubes, and short intermediate side tubes, as and for the purpose set forth.

4. The combination, with the central horizontal portion of floating docks or pontons, of hinged or self-adjusting outer tubes, substantially as and for the purpose set forth.

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