W. G. Warden,

Ship Building.

No. 110,942. Patented Jan. 10, 1871.

Fig. 1.

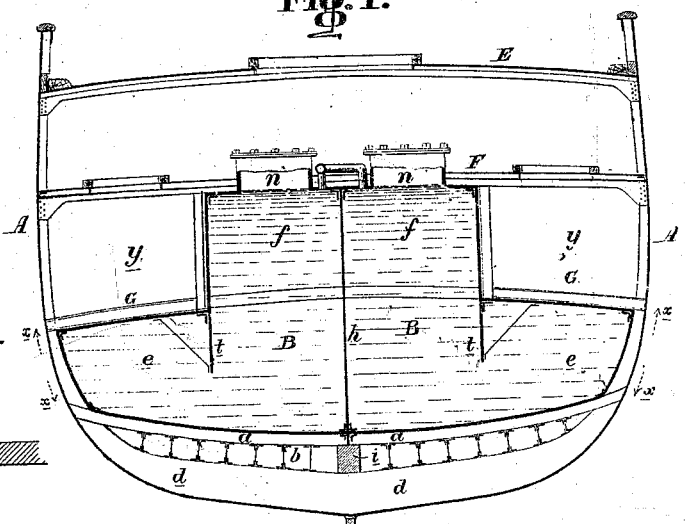


Fig. 4.

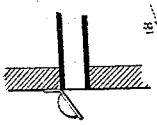


Fig. 2.

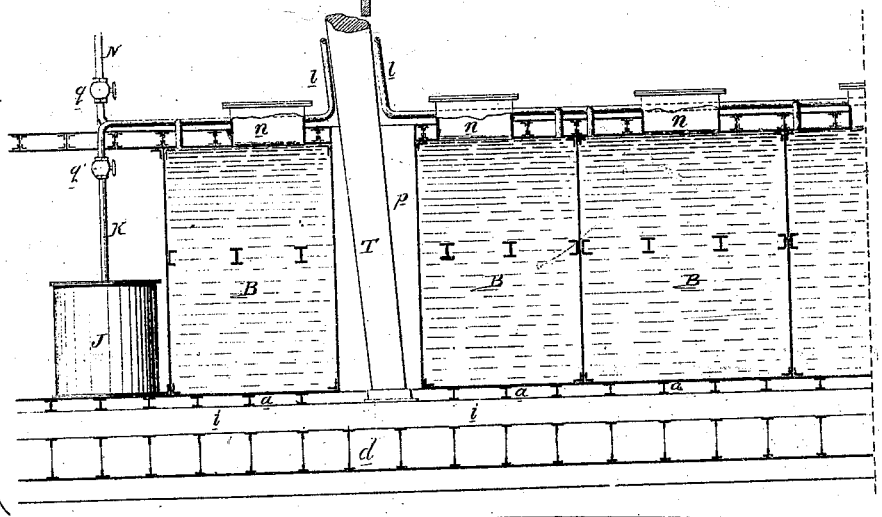
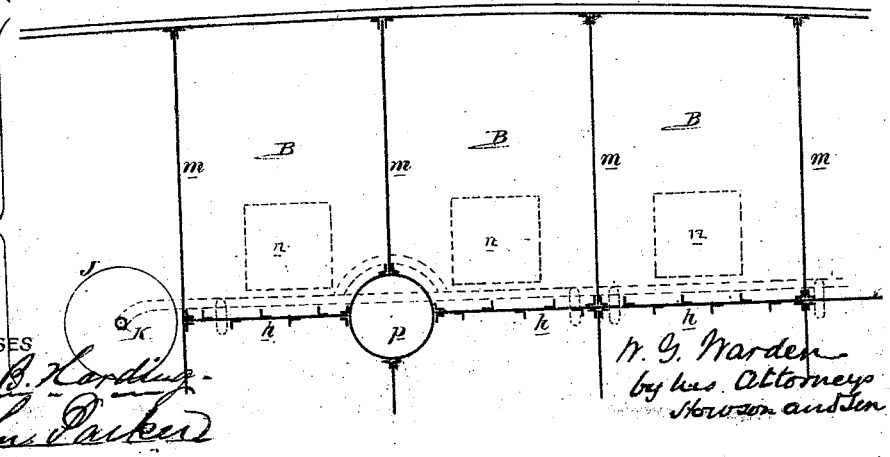


Fig. 3.



WITNESSES

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WILLIAM GRAY WARDEN, OF PHILADELPHIA. PENNSYLVANIA.

Letters Patent No. 110,942, dated January 10, 1871.

IMPROVEMENT IN VESSELS FOR CARRYING LIQUID CARGOES.

The Schedule referred to in these Letters Patent and making part of the same.

I, WILLIAM GRAY WARDEN, of Philadelphia, county of Philadelphia, State of Pennsylvania, have invented a Vessel for Carrying Liquid Cargoes in Bulk, of which the following is a specification.

Nature and Object of the Invention.

My invention relates to the peculiar construction of vessels for the transportation of liquid cargoes in bulk, and

My invention consists of a cellular structure for containing the liquid cargo, the said structure being wide below and contracted above, and adapted to a vessel substantially as described hereafter, so that the bulk of the liquid cargo may be distributed in the vessel with due regard to the proper trimming of the same, and so as to impart longitudinal and transverse strength to the vessel where the greatest strength is required, and so that space may be afforded outside the said cellular structure for the purpose of affording room for a return cargo of a character which would be deteriorated by storing inside the structure.

My invention further consists of other improvements too fully explained hereafter to need preliminary explanation.

Description of the Accompanying Drawing.

Figure 1 is a transverse midship section of a vessel constructed according to my invention, for carrying liquid cargoes in bulk;

Figure 2, a longitudinal midship section of part of the vessel;

Figure 3, a plan view; and

Figure 4, a sectional view of a portion of one of the overflow or vent-pipes.

General Description.

A represents the hull of the vessel, which, in the present instance, is built of iron, but which may be built of wood, although I prefer an iron vessel.

B B are a series of compartments or cells of the peculiar sectional form best observed in fig. 1, the structure inclosing the cells resting on and being secured to transverse beams *a*, which are connected, by suitable longitudinal beams *b*, to the ribs *d* of the vessel. There is, consequently, a space of considerable capacity between the bottom of the cellular structure and the bottom of the vessel's hull, for bilge-water, &c.

In the present instance the vessel has three decks, E, F, and G, and the outer portions *e*, fig. 1, of the cells extend in altitude as far as the under side of the beams of the deck G, to which beams the cellular structure is properly secured, the said portions *e* terminating laterally at the inner edges of the vessel's ribs, to which they are also properly secured.

The central portions *f f* of the cellular structure extend to the under side of the beams of the intermediate deck F, to which they are also secured.

A bulk-head or girder, *h*, properly strengthened by ribs, as seen in fig. 3, extends from the kelson *i* of the vessel to the highest portion of the cells, and, in fact, forms a part of the same, as it is a longitudinal midship partition between and forming a part of two rows of cells which are separated from each other by transverse partitions *m*, as seen in fig. 3. In other words, the portion of the vessel set apart for the liquid cargo consists of a cellular structure of plank or sheet-iron, or other suitable material, united to the beams and ribs of the vessel, and forming an integral part of the entire structure of the vessel.

The peculiar shape of this cellular structure, viewed transversely, has been adopted for reasons which I will now proceed to explain.

First, the space in the hold of the vessel to be devoted to liquid cargo must, owing to the weight of the latter, be restricted and proportioned in accordance with the carrying capacity of the vessel;

Secondly, the bulk should be distributed within the vessel with due regard to the proper trimming of the same;

Thirdly, the cellular structure containing the cargo should be such as to impart strength to the vessel, both longitudinally and transversely; and

Fourthly, the structure should be so arranged and distributed as to afford space other than that within the cells, for the storage of a return cargo.

It will be seen that in carrying out my invention I have had a due regard for these requirements.

The cellular structure for containing the liquid cargo is of such extent that when filled with liquid, it will load the vessel to its full carrying capacity.

The greatest bulk of the cargo is contained within the lower portion of the cellular structure, which is below the load water-line, and such portion of the structure as is above this line occupies a central position in the vessel. This arrangement I consider the best for properly trimming the vessel, and it possesses the advantage of affording spaces, *y y*, for the storage, on the lower deck G, of a return cargo, that might be deteriorated if introduced into the cells previously filled with petroleum.

As regards the addition of transverse strength to the hull of the vessel, it will be seen that the lower portion of the cellular structure extends from side to side of the hull, is united to the ribs, and is essentially a part of the hull, and, as regards additional strength longitudinally, this is imparted by the entire structure, and especially by the longitudinal bulkhead or girder *h*; in fact, increased strength is imparted to the vessel where the greatest strength is required,

that is, where the heaviest cargo is stowed within the cellular structure.

The structure, however, while it adds strength to the vessel, does not impart objectionable rigidity or stiffness to it, for it is not united directly to the shell excepting at the opposite sides between the points *x x*, where the structure is connected directly to the ribs, and here a packing may be introduced between the structure and the shell of the vessel, of such yielding character as to counteract the rigidity which would otherwise exist at those points.

Each cell of the structure is provided with a hollow projection, *n*, passing through the deck G, and furnished with a cover, on the removal of which access may be had to the interior.

Should it be desirable to introduce a mast in the vessel at any point within the space occupied by the cellular structure, I construct the latter as shown in fig. 3; that is to say, I so form the cells, and so construct the central bulkhead, *h*, as to leave an open space, *p*, much larger than the mast, for the reception of the same, which is therefore totally disconnected from the cellular structure, the latter being consequently free from all liability to injury by any movement of the mast.

Petroleum, for the transportation of which in bulk the vessel has been especially designed, is liable to expand under a comparatively slight increase of temperature, and this might result in the disruption of any one or more of the cells, in the absence of any provision for obviating such accidents.

Near one or both ends of the cellular structure, I arrange a supplementary vessel or vessels, J, with which communicates a pipe, *x*, one of these pipes passing above each row of cells, and having a branch communicating with each cell, so that a portion of the contents may find their way into the vessel J, when any cell becomes surcharged by the expansion of the fluid. A valve opening downward, as shown in fig. 4, may be arranged beneath the top of each cell, where the branch-pipe enters the same, so that the valve may be self-closing and prevent unnecessary escape of the fluid from the cells when the vessel rolls.

In order that the gas generated within each cell may always have free vent, I connect to the pipe *k* a branch or branches *l*, which are continued along the mast T, or are otherwise so disposed of that there can be no danger of the accidental ignition of the escaping gas.

If desired, there may be a separate system of pipes arranged above and communicating with the several cells for the escape of gas, or, if the mast be made of iron, and hollow, it may be used as a vent for carrying off the gas.

After the tanks have been emptied, they require to be thoroughly freed from gas, an operation which I perform by injecting steam into each cell, thereby forcing the gas therefrom through movable or stationary pipes.

Any desired number of properly-stiffened plates, *t*, may project downward into each cell, for the purpose of preventing the undue agitation of the fluid as the vessel rolls, should the cells not be quite full, the plates at the same time serving to impart additional strength to the structure.

Although I have illustrated and described my invention as applied to a vessel with three decks, it is not restricted to a vessel of this class, but may be applied to any vessel, due regard being in all cases paid to the proper proportioning and disposal of the cellular structure in accordance with the capacity of the hull, draught of water, &c.

I do not desire to confine myself to one central bulkhead or girder only, as there may be two or more, and, in some cases, this bulkhead may be entirely dispensed with.

Claims.

1. The within-described cellular structure, having its lower portion extending entirely across the hold of the vessel, and contracted above so as to leave cargo-spaces *y y*, substantially as described.

2. An overflow vessel or vessels, J, communicating through a system of pipes with the cells of the structure, and situated so as to retain the liquid which overflows from said cells, substantially as described.

3. An open space, *b*, formed through and by the cellular structure, for the reception of the mast, but of such a diameter that the mast cannot bear against the sides of the same.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

WILLIAM G. WARDEN.

Witnesses:

WM. A. STEEL,

JNO. B. HARDING.