No. 855,154. PATENTED MAY 28, 1907.

W. I. BABCOCK.

SHIP CONSTRUCTION.

APPLICATION FILED NOV. 30, 1904.

2 SHEETS—SHEET 1.

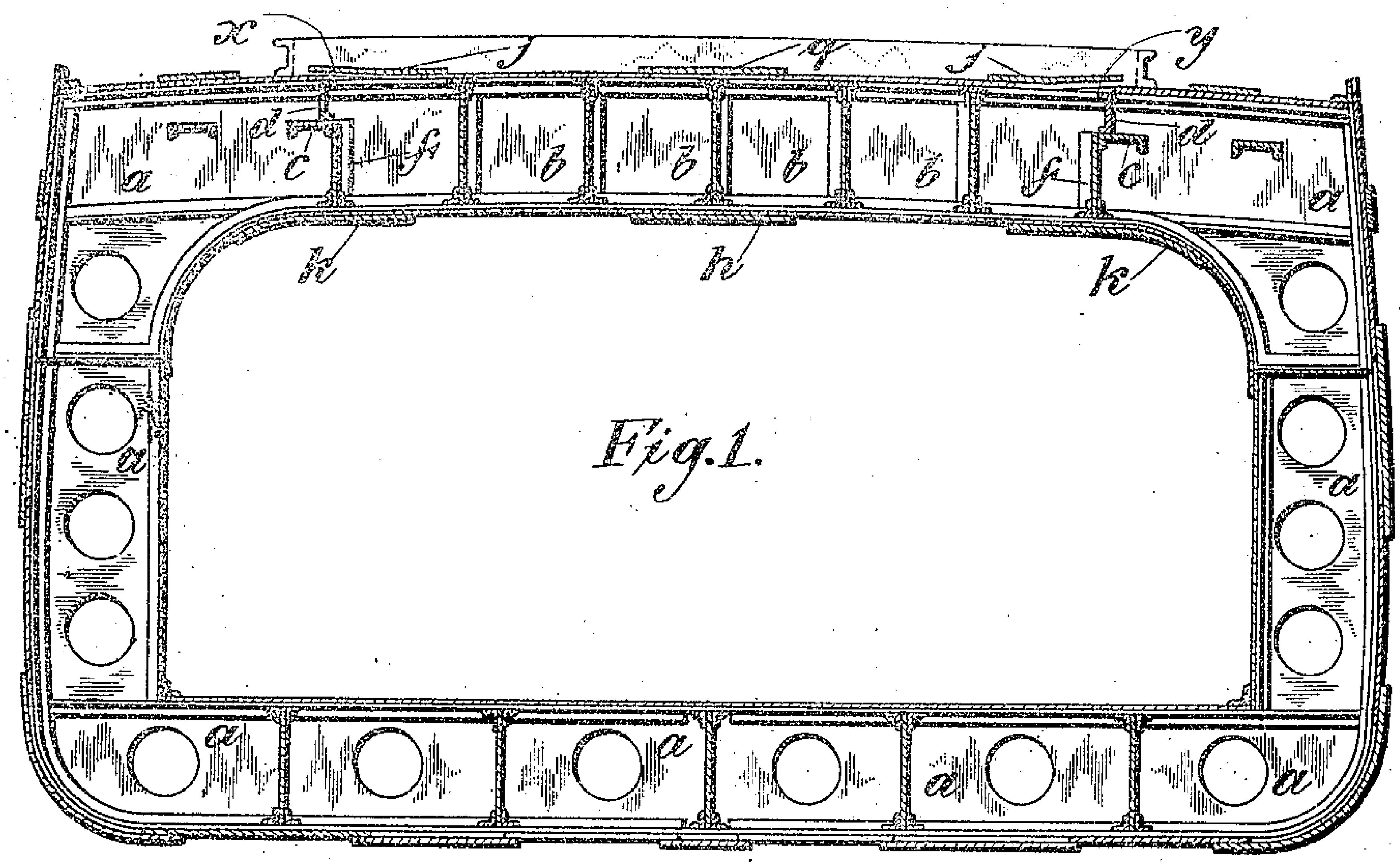


Fig. 1.

Fig. 2.

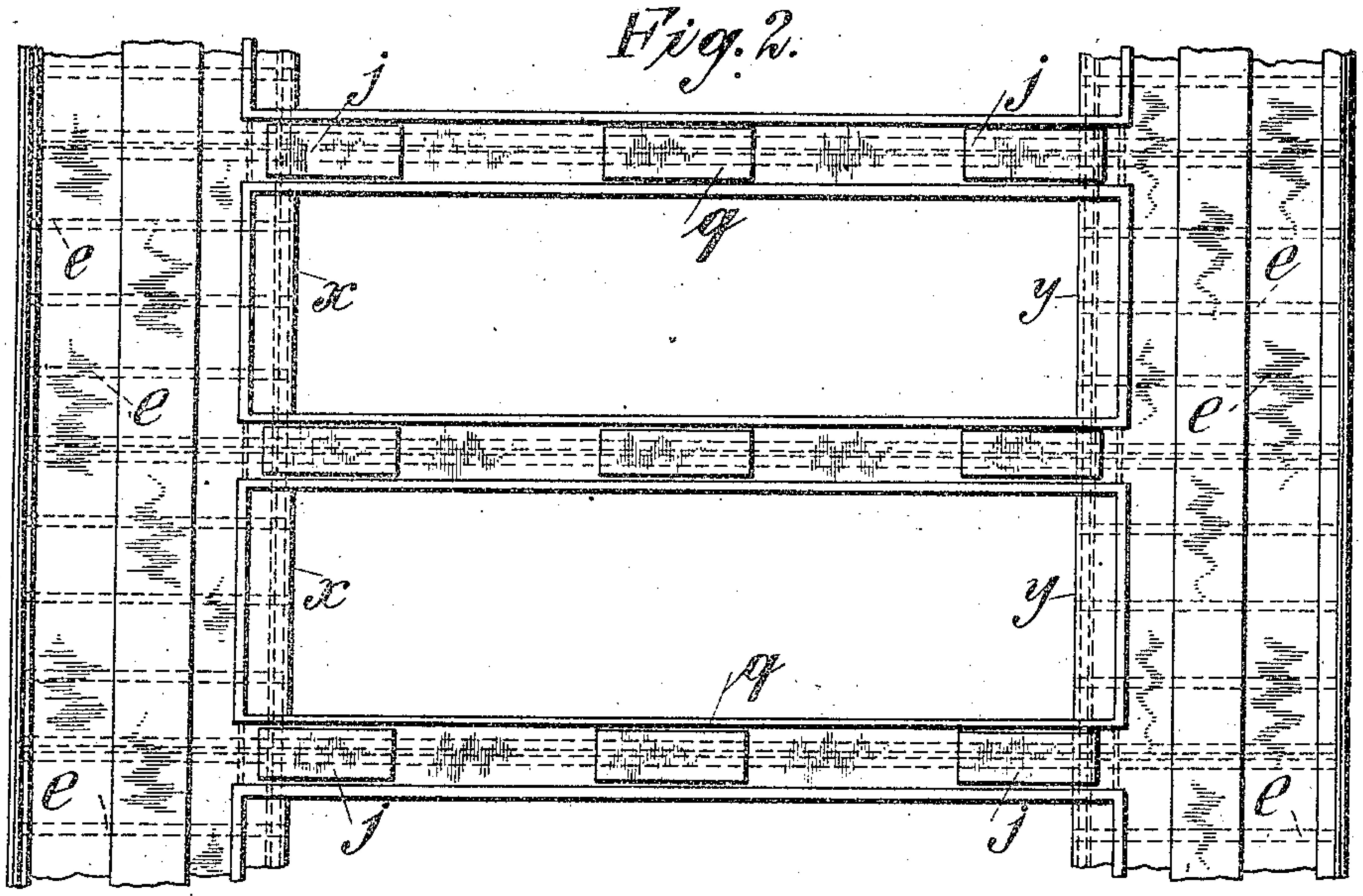
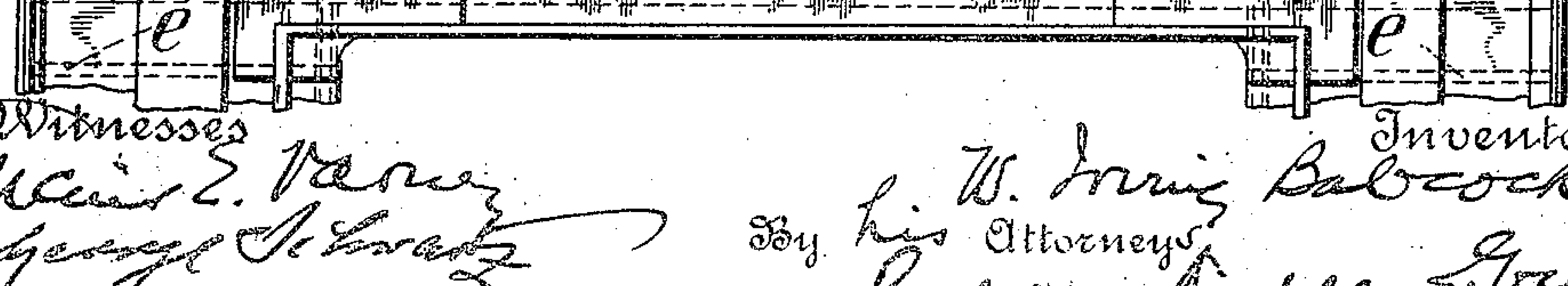


Fig. 3.



Witnesses

Inventor

W. Irving Babcock

By his Attorneys

Redding, Kiddle & Greeley

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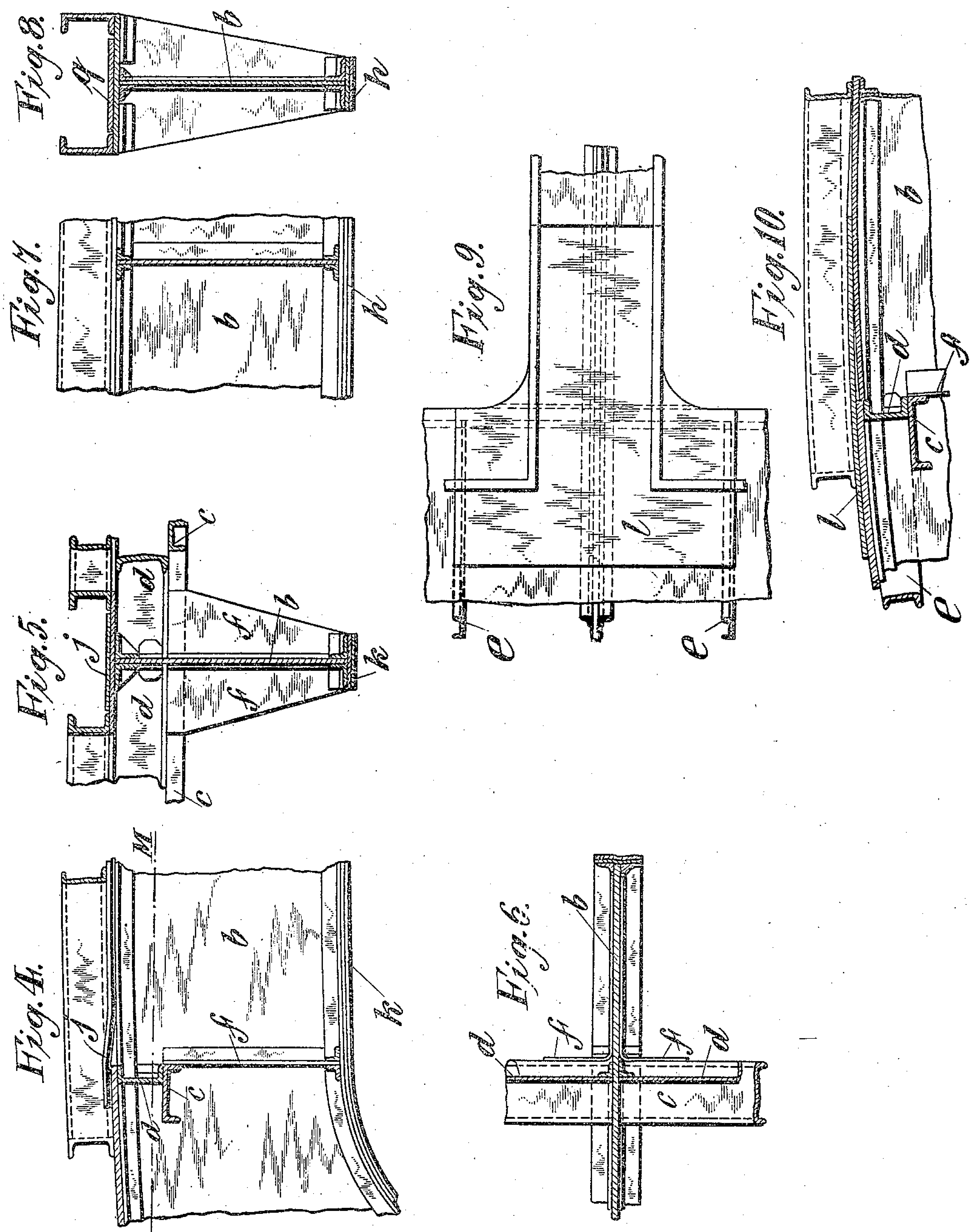
2 SHEETS—SHEET 2.



Witnesses

George Schwarz

Inventor

W. Irving Babcock

By his Attorneys

Redding Kiddle & Greeley

UNITED STATES PATENT OFFICE.

WASHINGTON IRVING BABCOCK, OF NEW YORK, N. Y.

SHIP CONSTRUCTION.

No. 855,154. Specification of Letters Patent. Patented May 28, 1907.

Application filed November 30, 1904. Serial No. 234,344.

To all whom it may concern:

Be it known that I, WASHINGTON IRVING BABCOCK, a citizen of the United States, and a resident of Flushing, in the borough of Queens, in the city and State of New York, have invented certain new and useful Improvements in Ship Construction, of which the following is a specification, reference being had to the accompanying drawings, forming a part hereof.

My invention relates especially to the construction of steel vessels intended for carrying cargo in bulk, such as grain, ore, coal, &c., these vessels being usually constructed with numerous and very wide hatches in order to facilitate the handling of the cargo, and for the same reason having all deck beams below the upper deck and all braces and stanchions omitted. Such vessels, although they may be of large size, are therefore built with a single deck only through that part of the length which is devoted to cargo. By reason of the multiplicity, width and close spacing of these deck hatches, and the omission of the deck beams, braces and stanchions below the upper deck, which are universally fitted in large vessels, the vessel is much weakened transversely; hence there may be considerable racking of the structure when in a seaway and the general strength and cohesion of the hull is endangered by the insufficiency of transverse connections. It is usual in such vessels, in order to make up for this transverse weakness, to provide frames of extra depth extending from the gunwale on one side, down the side across the bottom and up the other side of the ship to the opposite gunwale, one such frame being placed between each two hatches. These frames have hitherto been connected across the top by a beam in the form of an arched girder, the upper flange being formed by the deck plating, which, between the hatches, is only a narrow strip, the lower flange by two angle irons in arch form, springing from the shelf formed on each side by the deck stringer next below, and a single vertical web of plate between the two flanges. This vertical web plate has been stiffened by bracket plates at intervals in that portion of it within the hatch lines, such bracket plates extending from the upper to or nearly to the lower flange but being fastened only to the upper flange; but there have been no bracket plates fitted at the hatch lines, which are the ends of the unsupported portions of the girder. The crown of the arch being at the center the depth of the web plate is least there also, and there is less material at that point than anywhere else.

An arch is only fitted to carry a load on top and has no strength in itself if the abutments are pressed together. As these ships never carry a deck load, and from the absence of bulwarks cannot even get a weight of water on deck in bad weather, this arched form of beam, which is only fitted to support a load on top, is not the best or even a good form for the disposition of the material used in it. When the vessel is at rest in still water the action of the weight of the cargo in the bottom and the fluid pressure of the water on each side combine in a tendency to force the sides of the vessel inward. This action is principally resisted by the deck beams which are therefore subjected to a compressive strain acting along the line of their length and act as struts or horizontal pillars instead of beams. When the vessel is in a seaway the racking strains to which she is subject, tending to twist and distort the deck and to alternately bring together and separate the sides, will augment the strains in these beams which will be alternately compressive and tensile. Of these the compression strains are the more severe on the structure and need to be more carefully guarded against. These beams, therefore, instead of being in the form of an arch, where the least material is at the point of greatest strain under compression, that is, the center, should be as strong there as anywhere else. There is not only no advantage but a positive waste of material in making them deeper at the hatch lines than at the center, as in the arch form, nor can the webs be properly stiffened without the use of an excessive amount of material, as the brackets become much larger. They should therefore be substantially as deep in the center as anywhere else and practical considerations require that they be made of substantially uniform depth within the hatch lines, that is, with the lower flange substantially parallel to the upper. As, on account of the omission of the stanchions and the large hatches extending across the center of the ship, it is impossible to give these beams the necessary rigidity under compression by bracing them, either in a vertical or a fore and aft direction, I make them of more uniform strength throughout by means of extra material applied at or near the center.

There is thus secured the maximum of strength with the minimum of material, which is most important in a structure like a ship where unnecessary material diminishes by just so much the carrying capacity or other useful qualities of the vessel. If the beams are strongly bracketed to the strong upper deck or to the fore and aft hatch stringers at the hatch lines so as to hold the lower flange securely against side movement, and the connection of the upper flange to the deck is sufficient, then they may be regarded as pillars or struts "fixed at both ends" which are much stronger than when the lower flange is not thus supported, and in addition to extra material at the center they should have extra material applied at and near the ends also, that is, at the hatch lines.

The object of this invention is accordingly to provide a vessel of the character described with suitable transverse connections at the top in which no material is wasted and all material is properly distributed to resist the strains which come upon it.

In the drawings in which the invention is illustrated, Figure 1 is a midship section of a vessel showing the deck beam constructed in accordance with my invention and one of the deep frames. Fig. 2 is a plan view of a portion of the deck showing two hatches and parts of two more and the deck beams between them. Fig. 3 is a plan view of a portion of the deck showing parts of two hatches and the deck beam between them with a modified connection to the deck at the ends of the beam. Fig. 4 is a detail view partly in section and partly in elevation looking fore and aft, showing a part of the beam at the hatch lines on a larger scale. Fig. 5 is a sectional detail view looking athwartship showing the part of the beam at the hatch line. Fig. 6 is a sectional detail view taken on the plane indicated by the line N M in Fig. 4. Fig. 7 is a detail fore and aft view partly in section and partly in elevation of a portion of a beam at the center line of the ship. Fig. 8 is a detail view in transverse section of a beam at the center line of the ship. Fig. 9 is a detail plan view on a larger scale showing the modified connection to the deck at the ends of the beam. Fig. 10 is a detail view of the same partly in section.

Extending around the ship between the hatches are the deep frames *a* which are preferably constructed of plates and angles as illustrated in the drawings. The upper ends of each of these frames are connected by a beam *b* which extends across the top and lies in the same plane as the corresponding frame. These beams *b* are also built preferably of plates and angles which form, in each beam, a vertical web and top and bottom flanges. The top plates form the part of the deck between hatches and lap on to the side deck plating at the hatch lines as shown. Bracket plates may be fitted between the top and bottom flanges also as shown.

The hatch stringers *c* extend fore and aft of the ship at the ends of the hatches or at the hatch lines *x* and *y* respectively; and these stringers are firmly secured to the deck through the means of hatch carlines *d*, the beams *b* and half beams *e*. Brackets *f* may also be fitted to the hatch stringers *c* and the beams *b* at the hatch lines to support the lower flanges of the beams *b* at these points and make the beams "pillars fixed at both ends" when subjected to compressive strains acting along their axes.

Doubling plates *g* and *h* are applied respectively to the upper and lower flanges of each beam *b* at the center line of the ship; and doubling plates *j* and *k* are similarly applied at the hatch lines. In Fig. 9 there is shown a modification of the doubling plate on the top of the beam at the hatch line. In this case, the doubling plate, represented at *l* is extended further on the deck plate and carried far enough on each side of the beam to reach and be fastened to the adjoining half beams *e* opposite the hatch openings on either side, the object being to better stiffen the connection of the beam to the deck stringer at each end of the same and prevent any fore and aft movement of one side of the vessel in relation to the other side caused by racking and twisting strains in a seaway.

I claim as my invention:

1. In a decked ship having hatches extending across the center line and without stanchions; the combination of deep frames between the hatches, and a beam of substantially uniform depth between the hatch lines across the top of each deep frame, the lower flange of said beam being braced to the deck at or near the hatch lines to prevent sidewise motion.

2. In a decked ship having hatches extending across the center line and without stanchions, the combination of deep frames between the hatches, a beam of substantially uniform depth between the hatch lines across the top of each frame, and means to secure the lower flange of said beam to the deck at or near the hatch lines.

3. In a decked ship having hatches extending across the center line and without stanchions, the combination of deep frames between the hatches, and a beam across the top of each deep frame, said beam being of substantially uniform depth between the hatch lines and strengthened or made heavier in itself at the center line of ship.

4. In a decked ship having hatches extending across the center line and without stanchions, the combination of deep frames between the hatches, and a beam across the top of each deep frame, said beam being of substantially uniform depth between the

hatch lines and strengthened or made heavier in itself at or near the hatch lines.

5. In a decked ship having hatches extending across the center line and without stanchions, the combination of deep frames between the hatches, and a beam across the top of each deep frame, said beam being of substantially uniform depth between the hatch lines and strengthened or made heavier in itself at the center line of the ship and at or near the hatch lines.

6. In a decked ship having hatches extending across the center line and without stanchions, the combination of deep frames between the hatches, and a beam across the top of each deep frame, said beam being of substantially uniform depth between the hatch lines and strengthened or made heavier in itself at the center line of the ship, and the lower flange of said beam being braced to the deck at or near the hatch lines to prevent sidewise motion.

7. In a decked ship having hatches extending across the center line and without stanchions, the combination of deep frames between the hatches, and a beam across the top of each deep frame, said beam being of substantially uniform depth between the hatch lines and strengthened or made heavier in itself at the hatch lines, and the lower flange of said beam being braced to the deck at or near the hatch lines to prevent sidewise motion.

8. In a decked ship having hatches extending across the center line and without stanchions, the combination of deep frames between the hatches, and a beam across the top of each deep frame, said beam being of substantially uniform depth between the hatch lines and strengthened or made heavier in itself at the center line of the ship and at the hatch lines, and the lower flange of said beam being braced to the deck at or near the hatch lines to prevent sidewise motion.

This specification signed and witnessed this 23rd day of November A. D. 1904.

WASHINGTON IRVING BABCOCK.

Witnesses:

LUCIUS E. VARNEY,

ALBERT M. AUSTIN