2 Sheets—Sheet 1.

J. B. HALL.
Ship-Building

No. 209,167. Patented Oct. 22, 1878.

FIG. 1.

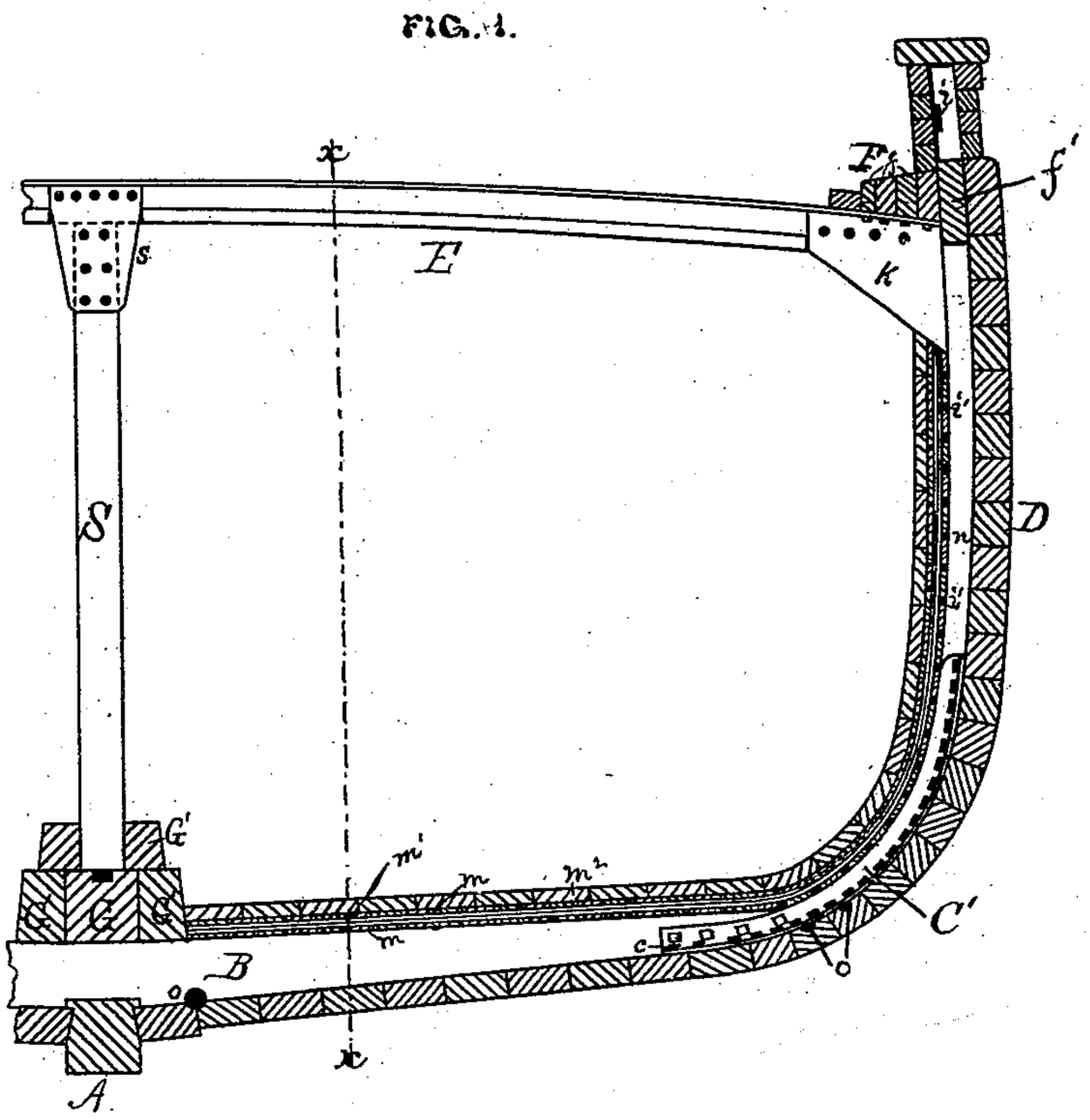

FIG. 5.

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2 Sheets—Sheet 2

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FIG. 2.

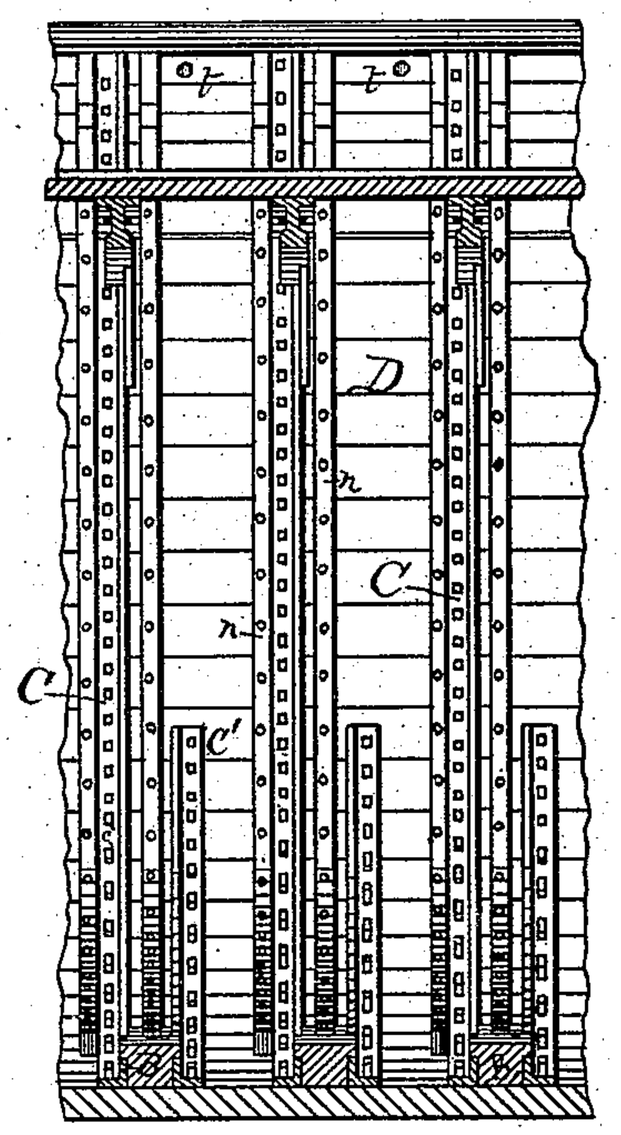


FIG. 4.

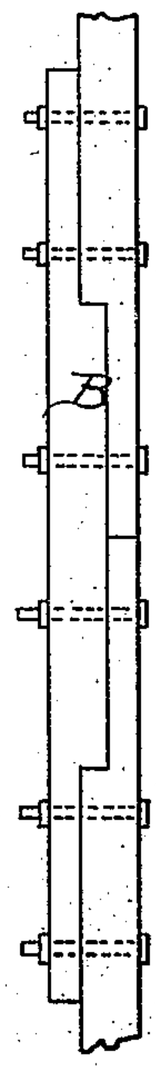
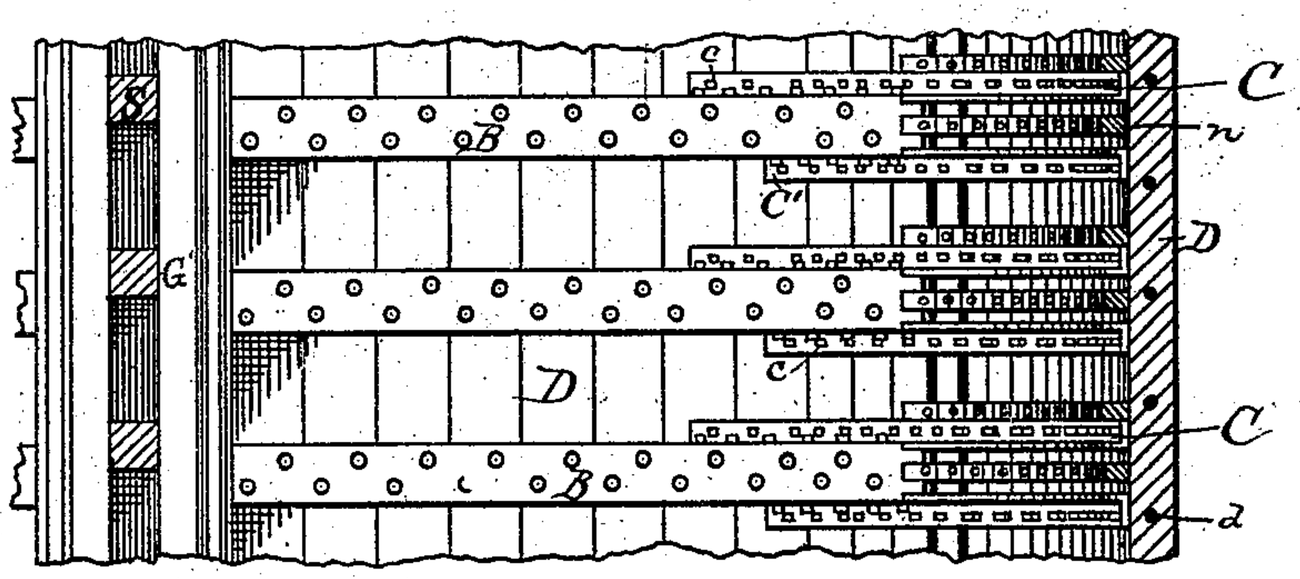


FIG. 3.



WITNESSES:
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UNITED STATES PATENT OFFICE.

JOSEPH B. HALL, OF CHICAGO, ILLINOIS.

IMPROVEMENT IN SHIP-BUILDING.

Specification forming part of Letters Patent No. **209,167**, dated October 22, 1878; application filed February 4, 1878.

To all whom it may concern:

Be it known that I, JOSEPH B. HALL, of Chicago, in the county of Cook and State of Illinois, have invented certain Improvements in Ship-Building, of which the following is a specification:

This invention relates to the construction of the hulls of vessels, and it is applicable to all classes of merchant-vessels, both steam and sail.

The main features of it are, first, a novel combination of wood floor-frames with metal bends and top frames and auxiliary metal futtocks, whereby I attain increased strength at the bends, where it is so necessary; second, the strength usually obtained by heavy ceiling I transfer to the outside by increasing the thickness of the outside planking and diminishing that of the inside; third, fastening the outside planking to the metal portions of the frames wholly from the inside, whereby the fastenings are withheld from contact with the outside water; fourth, an endless-plank waterway; fifth, a water-tight ceiling; and sixth, a new system for ventilating the frame-spaces. These features will all be understood from the accompanying drawings and the subjoined description.

In said drawing, Figure 1 is a cross-section of a vessel constructed after my invention. Fig. 2 shows the inside of the vertical part of the frame system, the same being a section upon the line *x x* of Fig. 1 with the ceiling removed. Fig. 3 is a section with the flooring removed. Fig. 4 shows a modified construction of the floor-frames.

Like letters indicate like parts in all the figures in which they appear.

In the drawing, A represents the keel. B B are the floor-frames, crossing the keel and extending to the bends on each side. They are constructed of wood, and in vessels having a moderate dead rise they are formed from single timbers, as shown in Figs. 1 and 3; but in sharp vessels and large ships they may be constructed of three pieces, cut and joined together, as shown at Fig. 4.

The bends and top frames are of metal, and I use, preferably, angle-bars such as are used in the framing of iron ships. Other convenient forms or shapes may be used, if desired. When the angle form is used, one side forms the face and the other the flange. They are lapped with their flanges upon the sides of the floor-frames far enough to give sufficient strength of connection, and bolted to the outer planking. Their upper ends terminate at the rail or other covering board. These metal frames are lettered C C in the drawing. For securing them to the planking I use what are known as "lag-screws" *c c*. In conjunction with these metal frames I employ auxiliary metal futtocks C′, also of angle-iron, having their flanges reversed, so as to fit and be secured to the opposite side of the floor-frames, as in Fig. 3 is clearly shown. Their upper ends terminate just above the top of the bends. It will thus be seen that they give great additional strength to the bends where the turns are short. They may also be employed with bilges of wood-framed vessels to advantage.

The outside planking, D, is about half thicker than that ordinarily used, and is fastened to the metal portions of the framing by screws from the inside, as already mentioned. It is also fastened to the floor-frames and all wooden connections with treenails, after the ordinary manner in seagoing ships. The lag-screws should be heavy, and should not be so long as to project through the plank. In this manner all contact of the screws with any metal sheathing employed is prevented—an item of importance in many cases. This outside planking, from the floor-heads up to the gunwale, are thoroughly edge-fastened one to another by means of stout treenails *d*, of strong durable wood.

The thinner planks of the bulwarks between the gunwale and rail may be edge-fastened, and connected with those below by metal bolts.

The deck-beams E in this construction are of metal, and are fastened to the metal top frames C in the manner usual in iron ships.

An endless-plank water-way, F, is made of several strakes of planks, *f*, set on edge across the ends of the deck-beams against blocks of timber *f′* in the frame-spaces, the blocks being fastened to the inner face of the gunwale-strake, and thick enough to come flush with the edges of the frame-flanges. These strakes are bent around the bow and stern, forming a complete band around the deck. The strakes

are all fastened together and to the gunwale through the blocks of timber by headed metal bolts, driven from the outside and forelocked upon the face of the inner strake. The planks should all break joints with each other and with the gunwale, all the butts falling several feet apart, so as to give the full strength of all the planks but one at every point. Each strake is secured edgewise to each deck-frame with lag-screw bolts—like those used to fasten the outside planking to metal frames. In ships having more than one deck each deck may be provided with a water-way of this description.

I provide the vessel with a water-tight ceiling, constructed in manner following: Two courses of boards, *m*, are laid on the frames, with an intervening course of common roofing-paper or other water-proof fabric, m^1, of several layers or thicknesses between them, and these are covered with a third course of boards or planks, m^2, of sufficient strength to sustain the cargo and resist the abrasions thereof. The first two courses, *m*, may be of thin pine boards, free from sap edges, thoroughly covered with hot coal-tar to retard decay, except that the first course from the bends upward should be about an inch thick, and laid in narrow strakes about an inch apart their whole length, thereby forming air-passages from each frame-space to the adjoining spaces. This ceiling is fastened with nails and spikes to the floor-frames, and elsewhere to furring made of strips of durable wood just thick enough to answer the purpose, and deep enough to come flush with the flanges of the metal frames. This furring *n* extends from the floor-heads to the water-way, and is fitted and spiked to the outer planking. I prefer to treat this furring, and also the different layers of the interlining, with hot coal-tar.

The seams between the main keelson, G, and sister keelsons, G′ G′, and all scarf-seams in them, are thoroughly calked and stop-watered.

A water-tight connection of the interlining with the keelsons and all timber-faces along the edges of the ceiling is made by doubling the edges of all the layers of paper together into sufficiently thick folds, placing them against the faces of the timbers, over the ends of all stop-waters where they occur, covering the folds with stout battens of wood, and nailing through both firmly to the timbers. This is fully shown in Fig. 5, where *r* designates the battens, the scale being considerably enlarged from that in the other figures. The nails used with or driven through this water-proof material should be so pointed that they will penetrate without tearing the same, and when made of iron or steel should be galvanized to prevent oxidation.

The frame-spaces are all ventilated freely by means of air-passages along the bulwarks, by means of holes made through the metal-frame flanges, and grooves *i* across the faces of the small timbers to which the inside bulwark-planks are fastened. Other passages for the air, *i′*, are formed, as already described, along the sides by separating the inner ceiling-boards, *m*. These air-passages are continuous from end to end of the ship, where they should be connected with the open air by pipes or openings *t*.

Whenever the motion of the ship is sufficiently violent to throw the bilge-water from side to side, the air will be forced out through the passages and openings, and all pressure therefrom prevented upon the side toward which the water is thrown, while at the same time the vacuum created upon the opposite side of the vessel is supplied by outside air, drawn in through the same system of ventilation; and in this manner the air is first forced out and then drawn in upon each side alternately as the ship rolls from side to side. Thus perfect ventilation is afforded, and all danger of the expulsion of calking from the outside seams is avoided.

The outside openings should be so located or protected (as at *t*, under the rail) that they will not be immersed by the careening of the vessel, and so constructed that they will not take in any of the sea which may break over them.

Salt-chambers will be formed between the bulwark-planks and the outside planking, above the gunwale, by the construction I have shown.

S in the drawing represents the stanchions which support the center of the deck-beams. They are secured to the beams by flat metal plates *s*. The deck-beams and the metal frames are firmly secured together by plate-iron knees *k*, riveted thereto. At *o o* are openings in the floor-frames for the passage of the bilge-water from end to end of the vessel.

By my construction I attain over ordinary wooden vessels greater strength, durability, burden, stowage-room, and safety to cargo, while ordinary repairs are cheapened, and the cost of construction is enhanced but little if any.

I am aware that in the construction of composite vessels short metal dowels have been attached to the outside of the metal frames to enter the planking, steady it in place, and relieve the fastenings, and that vertical tree-nails have been used to fasten one plank to the next below, and I do not claim this construction.

I am also aware that water-proof fabric has been used between the planks forming the bulk-heads of vessels, and I do not claim this material, broadly, for that purpose.

What I claim as new is—

1. The combination, in a vessel having the floor-frames of wood and the bends and top frames of metal, of a heavy outside planking upon said metal frames, and screw-bolts and fastenings for said planking introduced wholly from the inside, substantially as set forth.

2. The water-way constructed of a series of planks set upon edge and bolted together, with the joints broken, substantially as specified.

3. The water-tight ceiling for the hull, consisting of layers of water-proof fabric laid between courses of thin boards, and turned up vertically on each side of the keelsons, substantially as described.

4. The filling or spaces between the frames, ventilated by means of horizontal openings *i'*, extending the whole length of the vessel and formed between the courses of ceiling adjoining the frames, substantially as set forth.

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Witnesses:
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