

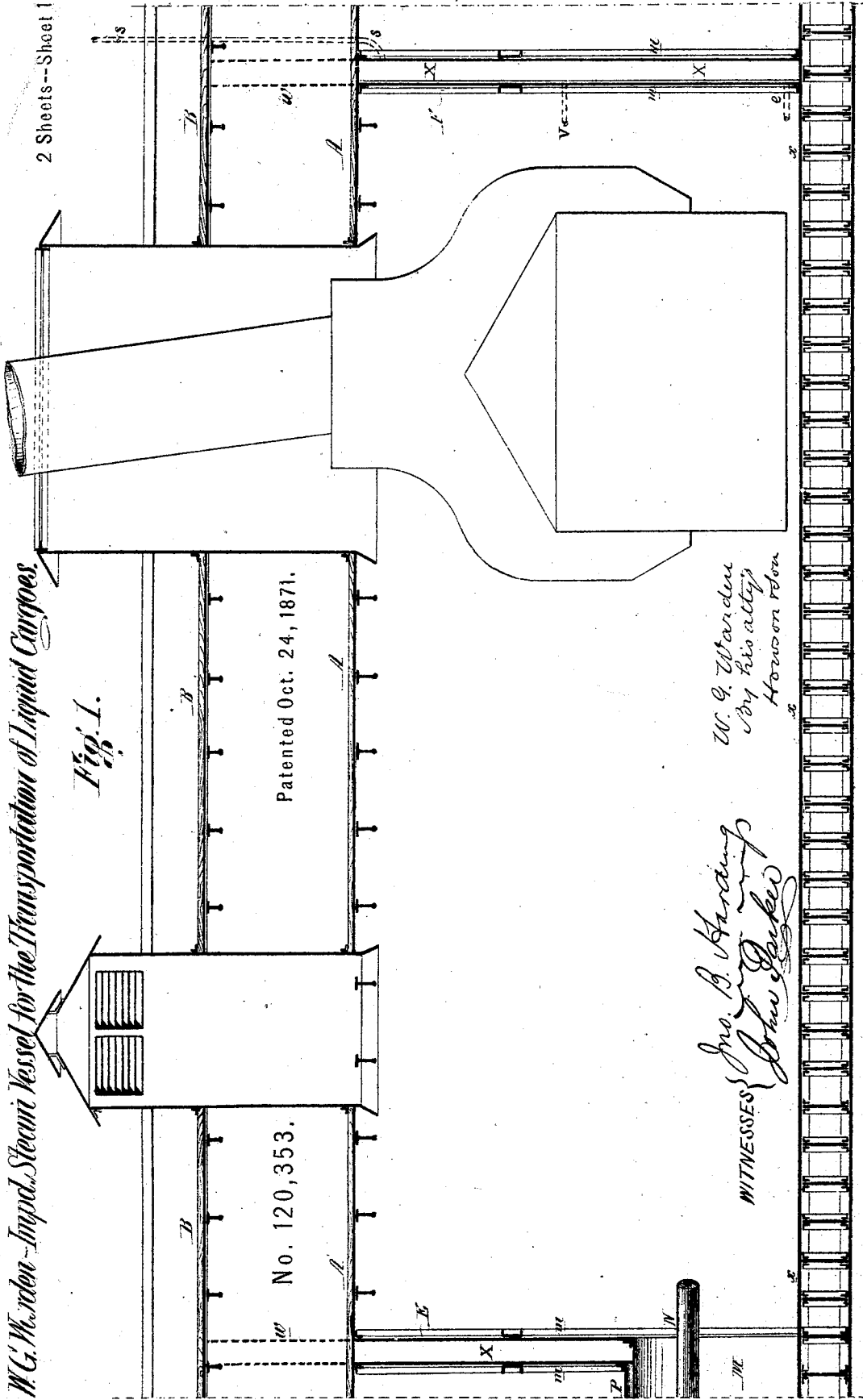
W.G. Warden - Improved Steam Vessel for the Transportation of Liquid Cargoes.

2 Sheets--Sheet 1.

Fig. 1.

No. 120,353.

Patented Oct. 24, 1871.



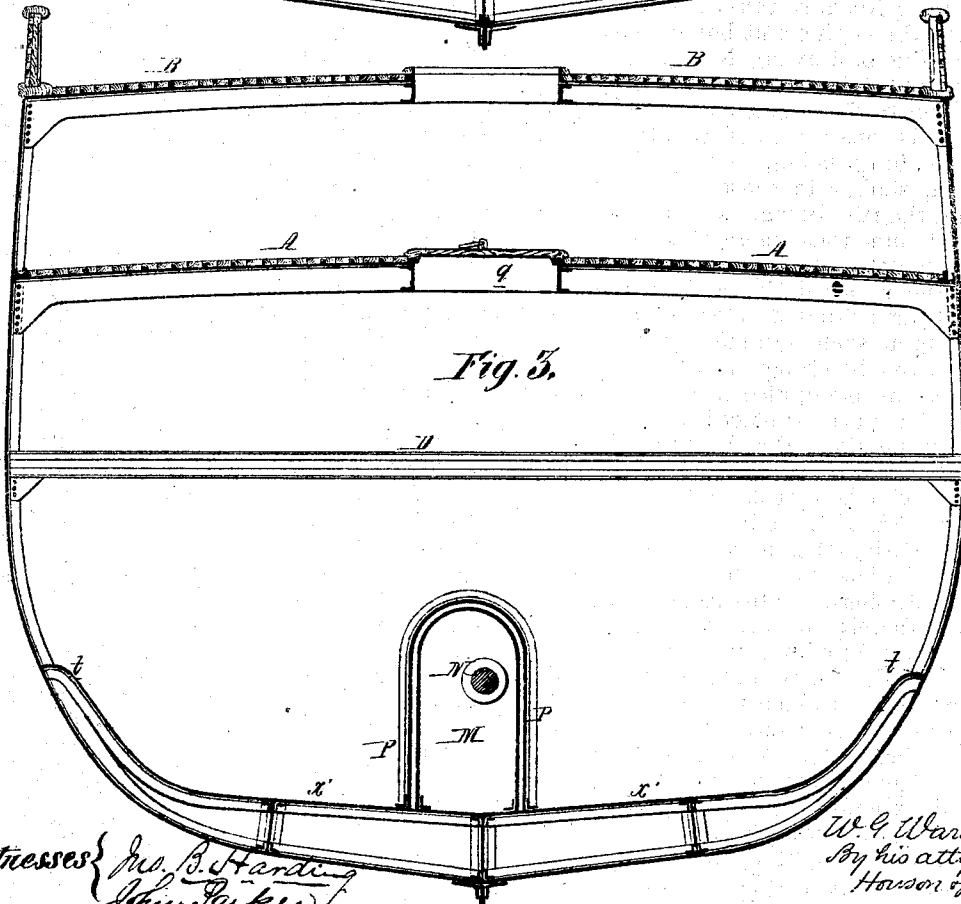
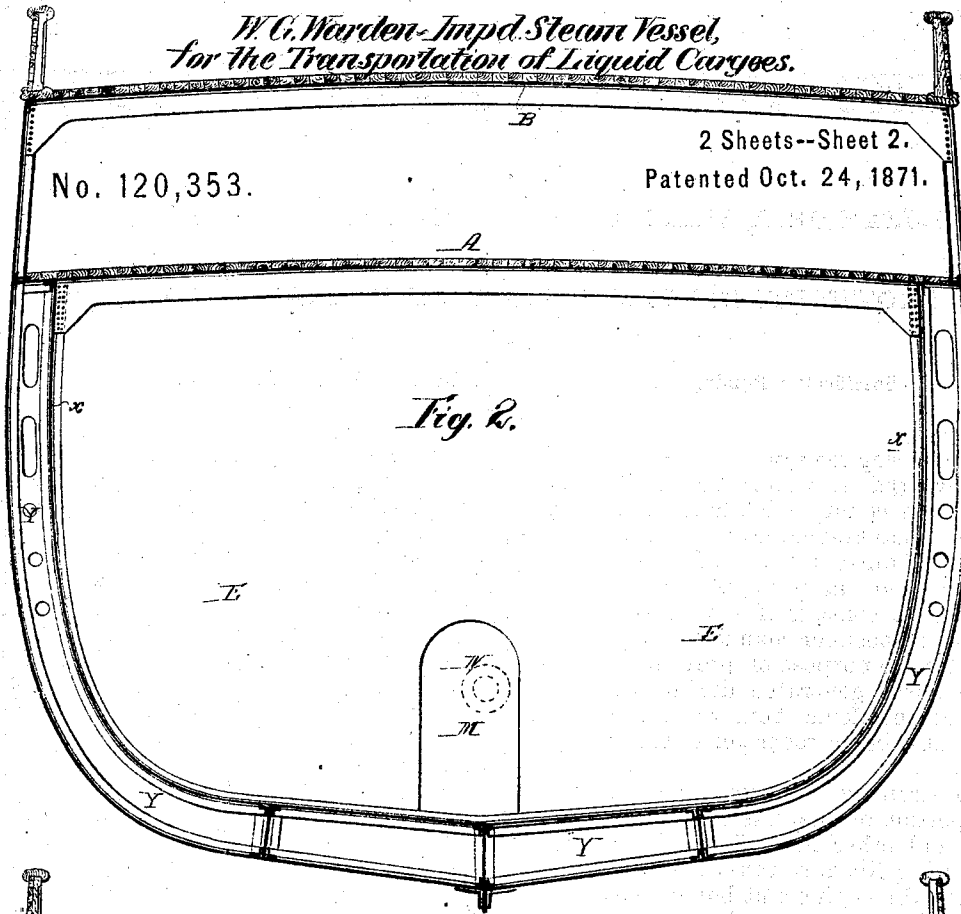
WITNESSES { *Geo. B. Harding*
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My atty
Horace W. Warden

*W. G. Warden-Impd. Steam Vessel,
for the Transportation of Liquid Cargoes.*

No. 120,353.

2 Sheets--Sheet 2.
Patented Oct. 24, 1871.



Witnesses { *Geo. B. Harding*
John Parker

W. G. Warden
By his atty
Horison

UNITED STATES PATENT OFFICE.

WILLIAM GRAY WARDEN, OF PHILADELPHIA, PENNSYLVANIA.

IMPROVEMENT IN VESSELS FOR CARRYING LIQUID CARGOES.

Specification forming part of Letters Patent No. 120,353, dated October 24, 1871.

To all whom it may concern:

Be it known that I, WILLIAM GRAY WARDEN, of Philadelphia, county of Philadelphia, State of Pennsylvania, have invented an Improved Steam-Vessel for the Transportation of Liquid Cargoes, of which the following is a specification:

My invention consists of a steam-vessel constructed in the peculiar manner fully described hereafter, for the purpose of preventing the inflammable gases generated during the transportation of petroleum from gaining access to the engine and boiler-rooms, or to the galley or cabin fires.

Figure 1, drawing No. 1, is a longitudinal section of a portion of the vessel for transporting petroleum and other like inflammable cargoes; Fig. 2, drawing No. 2, a transverse vertical section through the engine and boiler-space of the vessel; and Fig. 3, drawing No. 2, a transverse vertical section of the vessel through the cargo-space adjacent to the engine and boiler-space.

The vessel is constructed of iron, the ribs and exterior sheathing being, as regards detailed construction, similar to those of ordinary iron vessels, and the ribs being, as usual, more substantial and numerous where the engines and boiler are situated. A is the main deck of the vessel; B, the upper deck; and D, Fig. 3, are transverse beams situated below the main deck, and occurring at such suitable intervals as may be necessary to add proper strength to the vessel; these beams being discontinued in the engine and boiler-space, or placed in this space at such suitable points as the character of the engines and boilers will permit. The engine and boiler-space extends from the bulkhead E to the bulkhead F, each of these bulkheads extending transversely entirely across the vessel, and vertically from the bottom of the inner lining *x* of the engine and boiler-room to the under side of the main deck A, thereby entirely isolating the engine and boiler-space from both the fore and aft cargo-spaces. Each of these bulkheads consists of two casings, *m m*, between which is a perfectly steam-tight space, X, which may be from nine to sixteen inches wide. A steam-tight lining, *x*, Fig. 2, is properly secured to the ribs of the vessel, and extends longitudinally throughout the engine and boiler-space from bulkhead to bulkhead, and in height extends to the under side of the main deck, so that there is between

the outer sheathing of the vessel and the said inner lining *x* a steam-tight space extending down both sides and across the bottom of the vessel, and longitudinally from one steam-tight bulkhead to the other; in other words, the engine and boiler-space is contained within a steam-jacket as far as the under side of the main deck A, and, if desired, as far as the underside of the upper deck. It is necessary, however, to make an opening, M, in the rear bulkhead E for the propeller-shaft N, and this opening is continued in the form of a tunnel to the extreme stern of the vessel, the tunnel being bounded at the top and sides by the double casing P, Fig. 3, and at the bottom by a portion of the inner lining of the vessel. The space between the double casing P is steam-tight, and the tunnel formed by this double casing is of such dimensions as to admit of its being easily traversed from end to end by any one who desires to gain access to any part of the propeller-shaft. The cargo-space of the vessel ahead of the bulkhead F and astern of the bulkhead E may be separated into compartments or cells, for containing petroleum, by partitions and bulkheads, forming a part of the vessel's structure, as described in the Letters Patent granted to me on the 10th day of January, 1871. In the present instance, however, the cargo-space is illustrated as arranged for containing oil-barrels, and extends entirely across the vessel and from the lining *x'*, Fig. 3, to the under side of the main deck A, which is lined throughout beneath the deck-planks with sheet-iron made perfectly tight at the joints. Whenever a hatchway, *g*, Fig. 3, occurs in the main deck A, the sides of the hatchway should be of iron, and the covers should consist entirely of iron; or if wood be used for the cover it should be tightly lined on the under side; and between the edges of the hatchway and the cover there should be a suitable packing, onto which the cover may be firmly secured by bolts or other fastenings. The danger incurred by transporting petroleum or other like fluids in steam-vessels arises from the possibilities of the inflammable vapors or gases generated from the contents of the cargo-space or leakage from the same gaining access to the boiler and engine-space. The first precaution which I have adopted against such accidents are the bulkheads E and F, within which steam can always be present. The

steam thus contained between the two walls of the bulkhead is a most effective bar against the access of the inflammable gases to the engine-room, and it possesses the additional valuable property of at once indicating the slightest leak in the bulkheads, and thus, promptly suggesting the necessity of repairing such a leak, insures the constant maintenance of a tight partition impenetrable by the ignitable gases emanating from the cargo. Although I prefer the presence of steam within the bulkheads at all times, it may be introduced periodically, as circumstances may suggest. As a still further security against such leakage it will be observed that I form another steam-jacket, Y, on the sides and bottom of the vessel as far as the engine and boiler-room extend. No gases or oil can escape from the rear cargo-space into the tunnel M and thence into the engine and boiler-room, as the walls of the tunnel, which, as before remarked, extend from the rear bulkhead to the stern, are double and may contain a supply of steam. As there must necessarily be hatches and ventilators to the engine and boiler-room it is important that all possibilities of the vapor from the cargo gaining access to these openings be prevented; and the best mode of accomplishing this end is to make the cargo-space tight at the top, for which reason I line the under side of the main deck A above the cargo-space with tightly-jointed sheet-iron securely united to the sheathing of the vessel; and I furthermore provide the hatchways with such tightly-fitting and well-secured covers that no gases can escape there. I propose in some cases to carry the double-steam tight bulkheads E and F up to the under side of the upper deck B, as shown by the dotted lines *nn* in Fig. 1, so that the space above the main deck and between these extensions of the bulkheads may be devoted to cooking and other purposes in which the employment of fire is indispensable. It should be understood, however, that there should be doorways in these extensions of the bulkheads for the free traversing of the space between decks when the vessel is on its return trip, the door-ways being provided with suitable tightly-fitting doors. The lining *x' x'*, Fig. 3, of the cargo-space need not extend to a greater altitude than to the points *t t*, where it should be united to the outer sheathing of the vessel. This limited lining, which should be tight, will form a sufficient receptacle for leakage of oil-barrels, which can be thus saved, and the lining or cargo-space can be thoroughly cleansed, by steam or otherwise, prior to the return-trip of the vessel. The space X between the steam-tight walls of each bulkhead need not be continuous; it may, for instance, be separated by transverse partitions into compartments communicating with each other through suitable openings; in like manner the ribs of the vessel, which interrupt

the continuity of the steam-space between the sheathing and lining, may have openings, as shown in Fig. 2, so that the steam may have free access to every part of the space. It should be understood that it is best to maintain a continuous supply of steam to the bulkheads and to the space between the lining and sheathing of the vessel, and this can be accomplished in the manner adopted in steam-heating apparatus by permitting a small jet of steam to continuously escape from each space, with which the live steam should have a constant communication. Provision should also be made for the ready removal of the water of condensation from the steam-spaces. For instance, a constant supply may be admitted to the bulkhead F through a pipe, *v*, and a small jet may escape through a pipe, *s*, (Fig. 1,) while the water of condensation may escape through a pipe, *e*, communicating with the bilge-pump of the engine.

Hitherto I have referred to steam only as the fluid to be admitted to the bulkheads and other spaces; but water or other material may be employed in place of steam, although I prefer the latter for obvious reasons. I have also alluded to the cargo-space as being so tight as to prevent the escape of ignitable gases; but it should be understood that to prevent dangerous accumulation of gases in these spaces small ventilating-pipes extend therefrom up through the decks and along the sides of the mast to such an altitude that there can be no danger of igniting the escaping gas, and the gases are forced through these pipes from the cargo-spaces by introducing therein a jet or jets of steam, for without such forcible means of expulsion the gases could not be effectually discharged from the cargo-space.

I claim—

1. A vessel having its engine and boiler-room between double bulkheads, to which steam or water can be admitted.
2. A space, Y, arranged between the sheathing and inner lining of a vessel and communicating with a steam or water-pipe, as set forth.
3. A tunnel, M, extending from the rear bulkhead E to the stern of the vessel, and formed by two casings to the space, between which steam or water can be admitted, all substantially as specified.
4. A vessel for carrying liquid cargo, in which the deck is lined at the under side and the hatchways are sealed, as herein described, so as to render the cargo-space gas-tight, as set forth.

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

WILLIAM GRAY WARDEN.

Witnesses:

WM. A. STEEL,
FRANKLIN B. RICHARDS.

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