(No Model.) 5 Sheets—Sheet 1.

C. G. LUNDBORG.

CONSTRUCTION OF SHIPS, &c.

No. 384,047. Patented June 5, 1888.

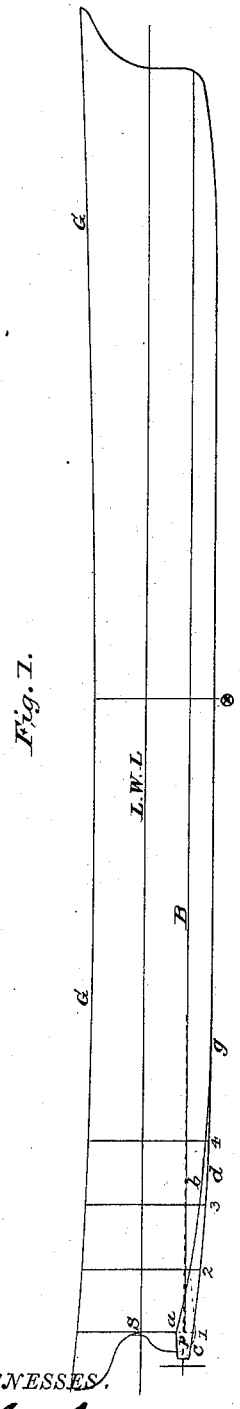


Fig. 1.

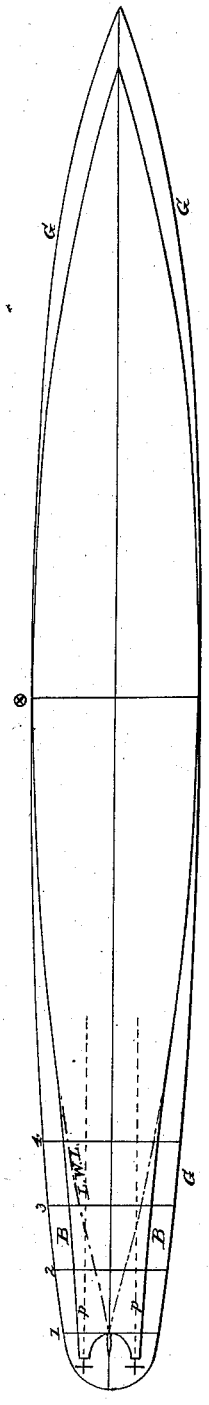


Fig. 2.

WITNESSES.

Thurlow Burgess.

J. B. Rockwell.

INVENTOR.

Charles G. Lundborg.

By J. Holt Sypher.

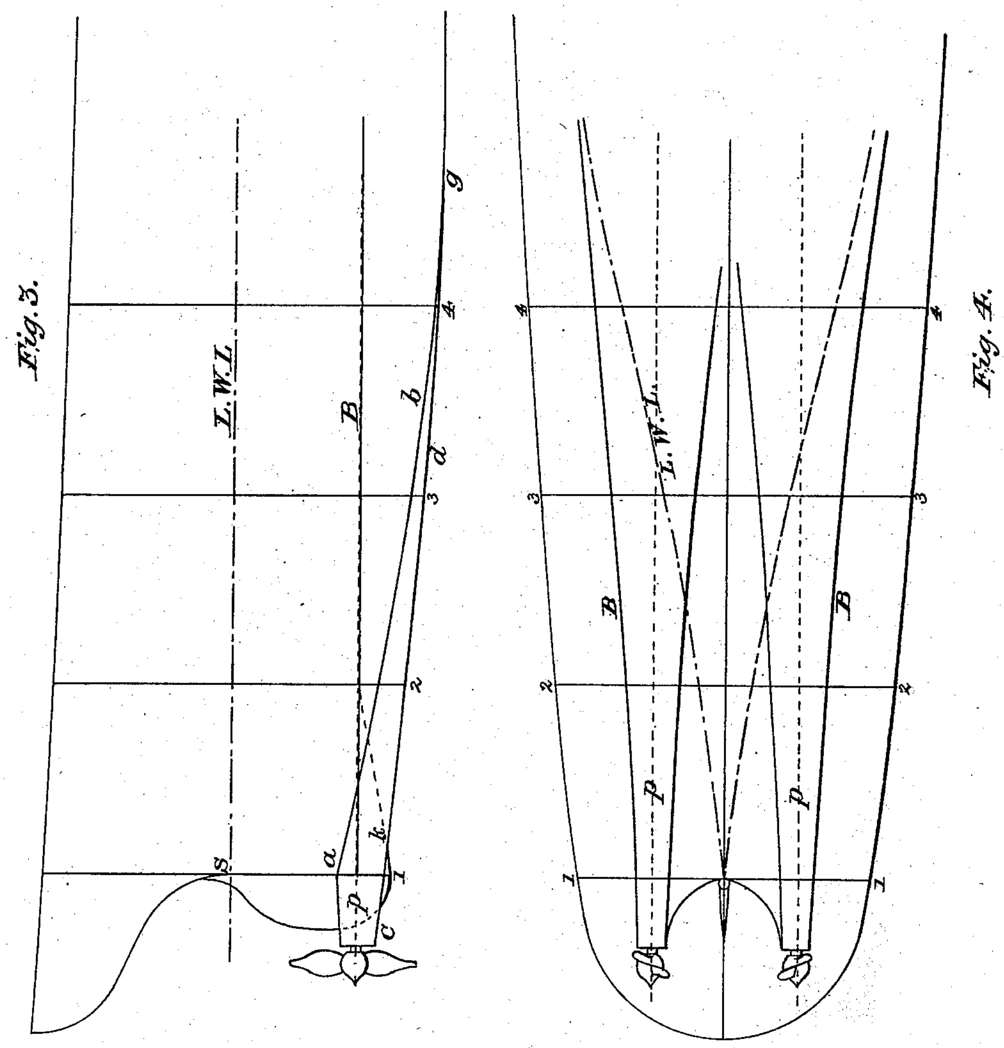
Attorney.

(No Model.) 5 Sheets—Sheet 2.

C. G. LUNDBORG.

CONSTRUCTION OF SHIPS, &c.

No. 384,047. Patented June 5, 1888.



WITNESSES.

Schuyler Duryee.

J. E. Rockwell.

INVENTOR,

Charles G. Lundborg.

By J. Hale Sypher

Attorney.

(No Model.)

5 Sheets—Sheet 3.

C. G. LUNDBORG.

CONSTRUCTION OF SHIPS, &c.

No. 384,047. Patented June 5, 1888.

Fig. 7.

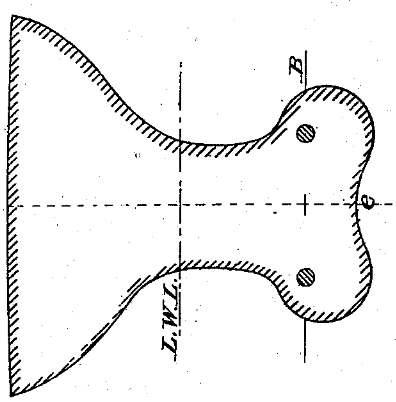


Fig. 6.

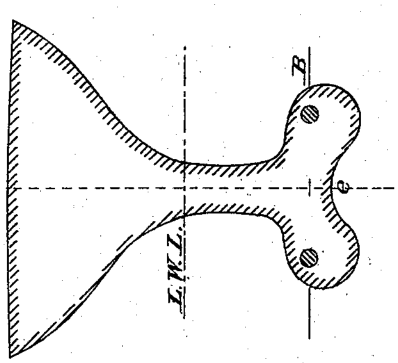


Fig. 5.

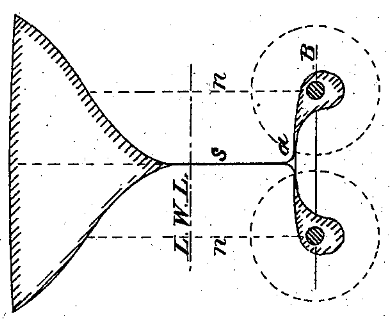


Fig. 5a.

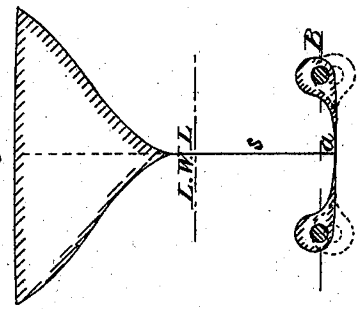


Fig. 9.

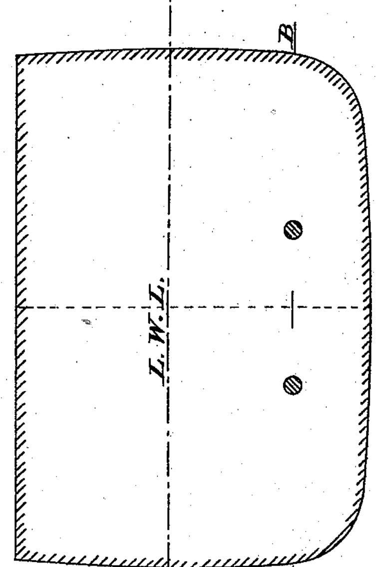
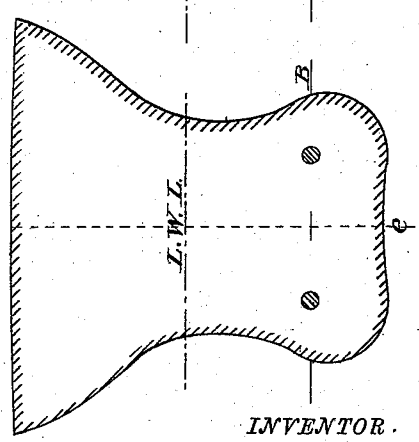


Fig. 8.



WITNESSES.

Edwin[?] Bunyee
J. E. Rockwell.

INVENTOR.

Charles G. Lundborg.

By J. Holt Sypher

Attorney.

N. PETERS, Photo-Lithographer, Washington, D. C.

(No Model.) 5 Sheets—Sheet 4.

C. G. LUNDBORG.

CONSTRUCTION OF SHIPS, &c.

No. 384,047. Patented June 5, 1888.

Fig. 10.

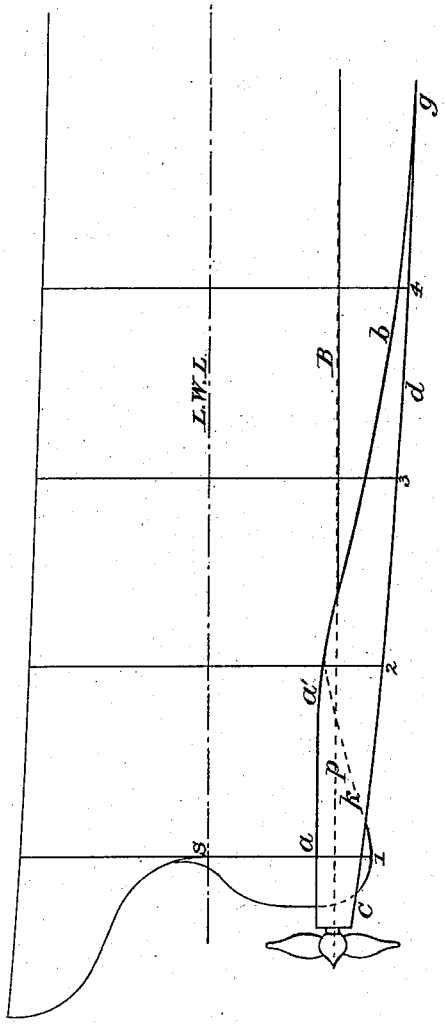
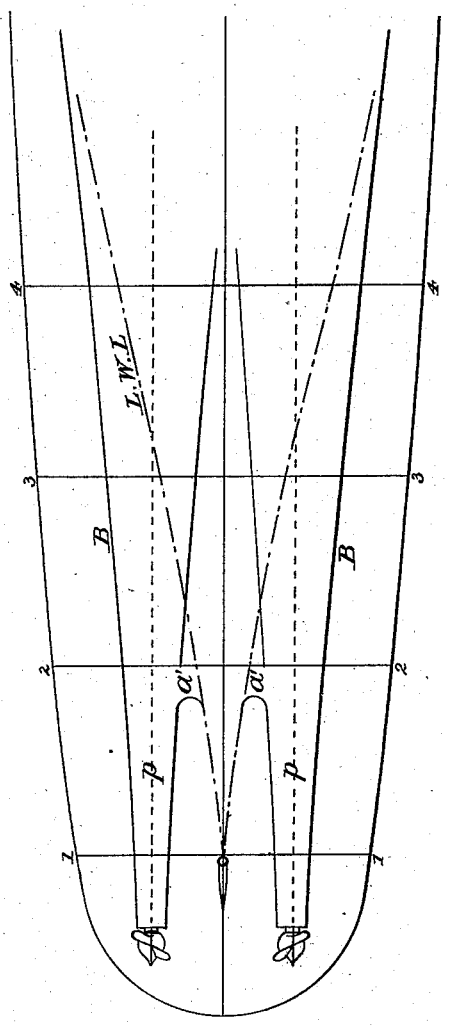


Fig. 11.



WITNESSES,
Samuel Sawyer
J. E. Rockwell.

INVENTOR,
Charles G. Lundborg.
By J. Wall, Sykes & Co.
Attorney.

(No Model.) 5 Sheets—Sheet 5.

C. G. LUNDBORG.

CONSTRUCTION OF SHIPS, &c.

No. 384,047. Patented June 5, 1888.

Fig. 14.

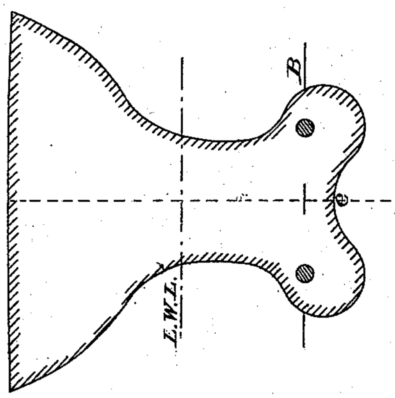


Fig. 16.

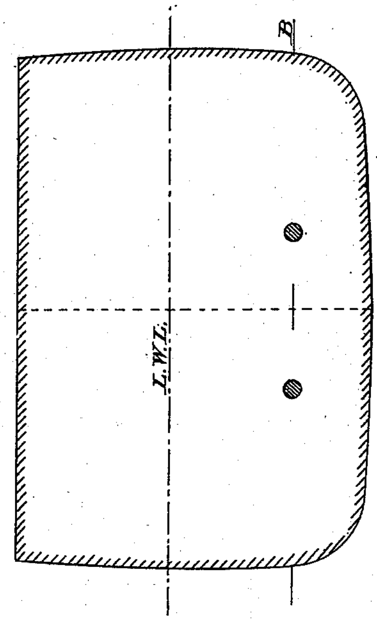


Fig. 13.

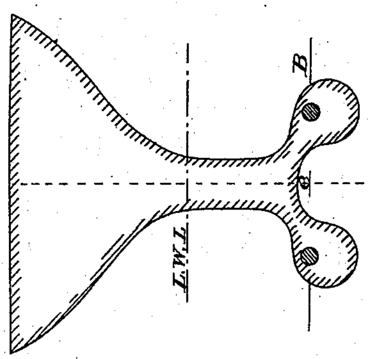


Fig. 12.

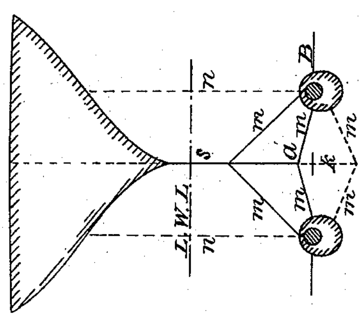
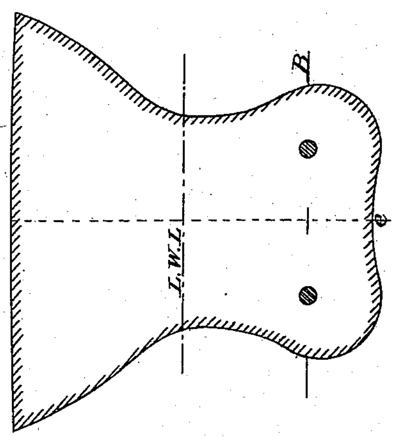


Fig. 15.



WITNESSES.

Schuyler Durye.
J. C. Rockwell.

INVENTOR.

Charles G. Lundborg.

By J. Hale Sypher

Attorney.

N. PETERS. Photo-Lithographer, Washington, D. C.

UNITED STATES PATENT OFFICE.

CHARLES G. LUNDBORG, OF NEW YORK, N. Y.

CONSTRUCTION OF SHIPS, &c.

SPECIFICATION forming part of Letters Patent No. 384,047, dated June 5, 1888.

Application filed March 22, 1887. Serial No. 231,939. (No model.)

To all whom it may concern:

Be it known that I, CHARLES GEORGE LUNDBORG, a citizen of the United States, residing in the city and State of New York, have invented certain new and useful Improvements in the Construction of Ships and Vessels Propelled by Steam-Power; and I do hereby declare that the following is a clear and exact description of the invention, which will enable others skilled in the art to which it appertains to make and use the same.

In steamers having two propellers or twin screws the usual manner of construction is to project the propeller-shafts—one on each side of the vessel from the ship's hull—into the water at such distance from the stern as is found to be necessary in order to bring the rear ends of the shafts out from the ship's side far enough to permit the free working of the propellers. The length of shafting thus exposed outside of the vessel's hull, which must be greater in vessels with sharp after bodies and fine lines designed for high speed than in vessels with fuller lines, should evidently be rigidly supported and maintained in line as perfectly as in single-screw ships. The ordinary way of attaining this necessary unyielding support is by means of struts or arms projecting from the ship's hull into the water. In vessels with engines of only moderate power and light propeller-shafts this method of securing the shafting in proper position may present no serious obstacles; but in large ships designed for high speed, with engines of great power and having great lengths of heavy shafting thus exposed and suspended in the water, a perfectly rigid and unyielding support of such shafting must be more difficult to attain, even under ordinary conditions, and much more so under the severe strain caused by the vessel's violent motion and labor in gales and heavy sea. The outside suspended shafting is also liable to injury while in port by coming in contact with smaller craft—such as coal-barges and water-boats—and at sea by striking floating pieces of wreck or other similar bodies; and this danger is greatly enhanced by the fact that the portion of the propeller-shafting suspended in the water outside of the ship's hull is altogether inaccessible for repairs, except when the vessel is in dry-dock. The struts and arms projecting into the water for the support of the propeller-shafts must also cause increased resistance, and therefore diminished speed of the vessel, while a considerable portion of the engine-power must necessarily be lost by the propellers working partly in the friction eddy-water or counter-current always following the immersed surface of the ship's body.

It has also been proposed to construct a twin-screw vessel with two so-called "tails" on opposite sides of the longitudinal center, each resembling somewhat the stern of an ordinary vessel and each adapted to receive one of the screw-shafts at the bottom, the keel being terminated far in advance of the screws and provided with a central longitudinal rift or valley in the under side, as shown in British Letters Patent No. 628 of 1882. This plan, which increases the immersed surface and displacement at the stern and which prevents the propeller-shaft from being completely surrounded by water at the stern, fails to secure the ends which I have in view.

By the present invention the propeller-shafts are perfectly supported and maintained in position throughout their whole length from the engines to the propellers. They are entirely protected against injury from small vessels or bodies floating in the water. They are accessible all the way from the engines to the stern-tubes as readily as in single-screw ships. The water has free and unobstructed flow astern, and the propellers work in undisturbed "solid" water, free from the retarding influence of the friction-current following the skin of the vessel. I accomplish this by so constructing the vessel that its bottom conforms to and makes part of the shaft-tunnels surrounding the propeller-shafts, which latter are thus completely inclosed within the hull of the ship, as will be more fully described hereinafter, and specifically pointed out in the claims, reference being had to the accompanying drawings, in which—

Figure 1 represents a side view, and Fig. 2 a plan, of the vessel. Fig. 3 is a side view, and Fig. 4 a bottom view, on an enlarged scale, of the stern portion. Figs. 5, 6, 7, and 8 are transverse sections on the lines 1, 2, 3, and 4, Figs. 1 and 4, respectively, of the after body. Fig. 9 is the greatest transverse section of the vessel on

the enlarged scale. Fig. 5ª is a cross-section at the extreme stern, showing my hull in slightly modified form. Figs. 10 and 11 are respectively a side view and a bottom plan view of my hull in another form. Figs. 12 to 15 are cross-sections on the lines 1, 2, 3, and 4 of Figs. 10 and 11. Fig. 16 is a cross-section of the same at the point of greatest sectional area.

The present invention has reference to the form of the stern portion of the hull, which may have its bow of the form represented or of any other ordinary or approved form. In its general outline the body of my hull resembles those of ordinary form in that it diminishes in width toward the stern and terminates in a single central stern-post midway between the screw-shafts, as seen at *s*, Fig. 5. It further resembles an ordinary hull in that it diminishes in width from the water-line downward to about the level of the shafts; but instead of being contracted toward the stern within the line of the shafts, so as to necessitate their extension outward through its sides, it is again widened at the bottom in the form of tubes or tunnels adapted to encircle and inclose the two shafts to their rear ends, as shown in Figs. 5, 7, and 8. It will be perceived that in thus adapting the hull at its lowermost part to follow the line of the shafts, while its portion above the shafts follows the usual lines of lateral contraction toward the stern and the keel, it is gradually given in approaching the keel a sectional form, in which it is wider at the level of the shafts than at the point immediately above them. Consequently the stern presents to the eye very much the appearance of an ordinary single-keel vessel with two fins or chambers extending laterally from opposite sides of the keel. In top plan view these tunnels diminish in width forward until they finally merge into or vanish within the sides of the hull. At their rear ends these tunnels are projected in tubular form, so that the screw-shafts and screws carried at their exposed or overhanging ends are completely encircled by the water. Those portions of the tunnels which are forward of the stern-post, and which lie between the shafts and the keel, serve to sustain and carry the tunnels, but being made of slight vertical thickness, as seen in Figs. 5 and 6, they allow the water a free run to the rear to the entire face of the screws.

In Fig. 1, G is the deck-line; W, the load water-line; *a b*, the outline of the bottom of the vessel in its longitudinal middle line; and *c d* the outline of the vessel's bottom under the propeller-shafts, being also the outside of the bottom of the shaft-tunnels.

In Fig. 2, B is an outline of the ship's bottom near the level of the propeller-shafts, which latter are shown by the dotted line *p*.

By inspecting Fig. 5 it will be seen that the bottom of the vessel under the propeller-shafts forms the deepest part of the hull in the transverse section at that place, the part of the hull in the middle line of the vessel coming down only to the point *a*, at which point the stern-post proper, *s*, terminates and branches out on each side, connecting with the part of the hull which forms the continuation of the shaft-tunnels. From the stern-post forward the bottom of the hull in the middle line of the vessel descends, as shown at *e* in Figs. 6, 7, and 8, gradually approaching the depth of the bottom under the propeller-shafts and reaching that depth at some point *g*, Fig. 3, at which point the transverse section of the vessel assumes the ordinary form, and from thence forward to the bow.

During the progress of the vessel the water, after passing the middle body about the greatest transverse section, flows along the tapering form of the hull and near the stern above the part of the hull which incloses the propeller-shafts, while below it follows the gradually-rising bottom of the vessel, having thus a clean and easy run to the rudder and propellers.

As shown in Figs. 1, 2, 3, and 4, the extreme aft part of the hull inclosing the propeller-shafts extends some distance abaft the stern-post and rudder, the position of the propellers being thus astern of the rudder. In this position the propellers are placed beyond the retarding influence of the friction eddy-current of water along the immersed surface of the vessel, and they are enabled to work to best advantage in undisturbed solid water.

Another advantage that follows from this invention is increased handiness or facility of maneuvering the vessel by its obeying the helm more quickly, which must result from the diminished area of the longitudinal vertical section of the after body in comparison with that of the ordinary vessel, and the consequent less resistance to lateral motion caused by the rudder.

The rudder, which, as shown in Figs. 1, 2, 3, and 4, is attached to the stern-post in the usual manner, may, if desired, be made to reach some distance below the latter. This part of the rudder below the termination of the stern-post at the point *a* may be protected on the forward side by a vertical triangular keel-plate, *k*, and for such purpose the stern-post *s* may be extended below the point *a*. By making the said keel-plate *k* deep enough the propellers may also be similarly protected, if thought desirable.

No keel is shown, except the plate *k* above mentioned; but, if desired, the vessel may be constructed with keel without prejudice to my invention.

The aft part of the hull forming the shaft-tunnels may be so constructed as not to come below the point *a*, as shown in Fig. 5ª, or in any intermediate position, as indicated by the dotted lines in the same figure; but I prefer the manner of construction as before described and shown in Fig. 5.

A modification of my invention is shown in

Figs. 10, 11, 12, 13, 14, 15, and 16, Fig. 10 being a side view, Fig. 11 a bottom view. Figs. 12, 13, 14, and 15 are transverse sections at different places of the after body; and Fig. 16 is, as before, the greatest transverse section of the vessel on the enlarged scale.

As will be seen by inspecting Fig. 11, the part of the hull inclosing the propeller-shafts separates from the middle portion of the hull at a point, *a'*, some distance from the stern-post, from which point forward the bottom of the hull in the middle line of the vessel gradually descends, as before described, as shown in Figs. 12, 13, 14, and 15, until its depth reaches that of the bottom under the propeller-shafts at some point aft of the greatest transverse section, Fig. 16, at which point and from thence forward to the bow the transverse section, as before described, assumes the ordinary form.

The extreme aft portion of the hull inclosing the propeller-shafts may, if desired, be secured to the middle portion of the hull by means of struts *m*, attached to or near the stern-post above the point *a*, and also below that point to the extended stern-post or to the keel-plate *k*, as shown in Fig. 12. Vertical or nearly vertical struts or pillars *n*, as shown in Figs. 5 and 12, may also be applied for additional strength, if thought desirable.

In the above description twin propellers are only spoken of; but it will be readily understood that the invention is equally applicable if it should be found desirable to divide the aggregate engine-power upon more than two propellers and also to vessels with only one propeller.

Instead of using only one rudder, additional rudders may easily be arranged by placing a rudder above the extreme end of the hull inclosing the propeller-shafts on or in the position of the vertical struts or pillars *n*. (Shown in Figs. 5 and 12.)

It will be observed that my shaft-receiving trunks or tunnels emerge completely from the hull at their rear ends only, and that for the remainder of their length they open directly into and form, in fact, a part of the hull, their height and width increasing in a forward direction in such manner as to afford free access to the shafts from the interior of the vessel rearward to points near the screws.

Having thus described my invention, what I claim is—

1. A twin-screw vessel having its hull tapered rearward to a central stern-post and provided on opposite sides with two laterally-extended trunks or tubes inclosing the screw-shafts.

2. A twin-screw vessel having its hull tapered rearward to a central stern-post and provided at the bottom on opposite sides with trunks or tubes gradually emerging from the sides of the hull at their forward ends and projected independently in tubular form at their rear ends, whereby they are adapted to inclose and sustain the screw-shafts to their rear ends and to permit the free run of the water to the entire face of the screws.

3. A hull for a twin-screw vessel, tapered rearward to a central stern-post and contracted at the stern from the load-line downward to a point above the screw-shafts, and again widened at the bottom in the form of two tubes or trunks to inclose the screw-shafts.

4. A hull for a twin-screw vessel, having a central stern-post, a rudder hung thereon, and two tubes projected rearward on opposite sides of and beyond the rudder, in combination with shafts mounted in said tubes and screws mounted on the rear ends of said shafts.

5. A hull having its rear end provided with a central stern-post and its lower portion divided vertically in the middle and terminated in the form of two shaft-receiving tubes or tunnels.

6. In a twin-screw vessel, a hull tapering to a central stern-post in the middle line and having on opposite sides two shaft-receiving tunnels emerging gradually from the sides and bottom of the hull at a point aft of its greatest transverse section, said tunnels contracting gradually rearward and extending in tubular form to the screws.

7. A hull for a twin-screw vessel, tapered rearwardly to a central stern-post, provided with two shaft-inclosing tunnels on opposite sides diminished in width between the said tunnels and the water-line and elevated on the bottom between the tunnels and forward of the stern-post.

8. In a twin-screw vessel, a hull tapered rearward to a keel-post and provided on opposite sides with two shaft-receiving tunnels emerging gradually from the sides of the hull and extending rearward to the screws, the stern being contracted in width above the tunnels and the latter contracted vertically between the shafts and the keel as they approach the stern, whereby the free run of the water to the screws is permitted and the displacement reduced.

9. The vessel with two or more stern-screws on opposite sides of its longitudinal center in which the bottom of the hull under the shaft-tunnel from the stern for some distance forward forms the deepest part of the hull in transverse section.

10. A vessel with one or more screw-shafts and screws in which the bottom of the hull, at a point aft of its greatest transverse section, merges into and coincides with the bottom of shaft-tunnels surrounding the screw-shafts and rises thence rearward to the screws gradually, thereby permitting an easy and unobstructed run of water astern.

11. In a twin-screw vessel, a hull having on opposite sides of the longitudinal center the rearwardly-projecting tubes or tunnels, in combination with the screw-shafts extended

therethrough, the screws applied to their rear ends, and the central rudder hung on the stern-post in advance of the screw.

12. A hull for a twin-screw vessel, having on opposite sides two shaft-receiving tunnels, substantially as described, which issue entirely from the hull only at their junction with the screws, their forward portions forming part of the hull and expanding in height and width from the screws forward, whereby firm support is obtained for the shafts and free access afforded thereto from the interior of the vessel.

In testimony whereof I hereby affix my signature in presence of two witnesses.

CHARLES G. LUNDBORG.

Witnesses:

J. HALE SYPHER,

SCHUYLER DURYEE.