

No. 652,876.

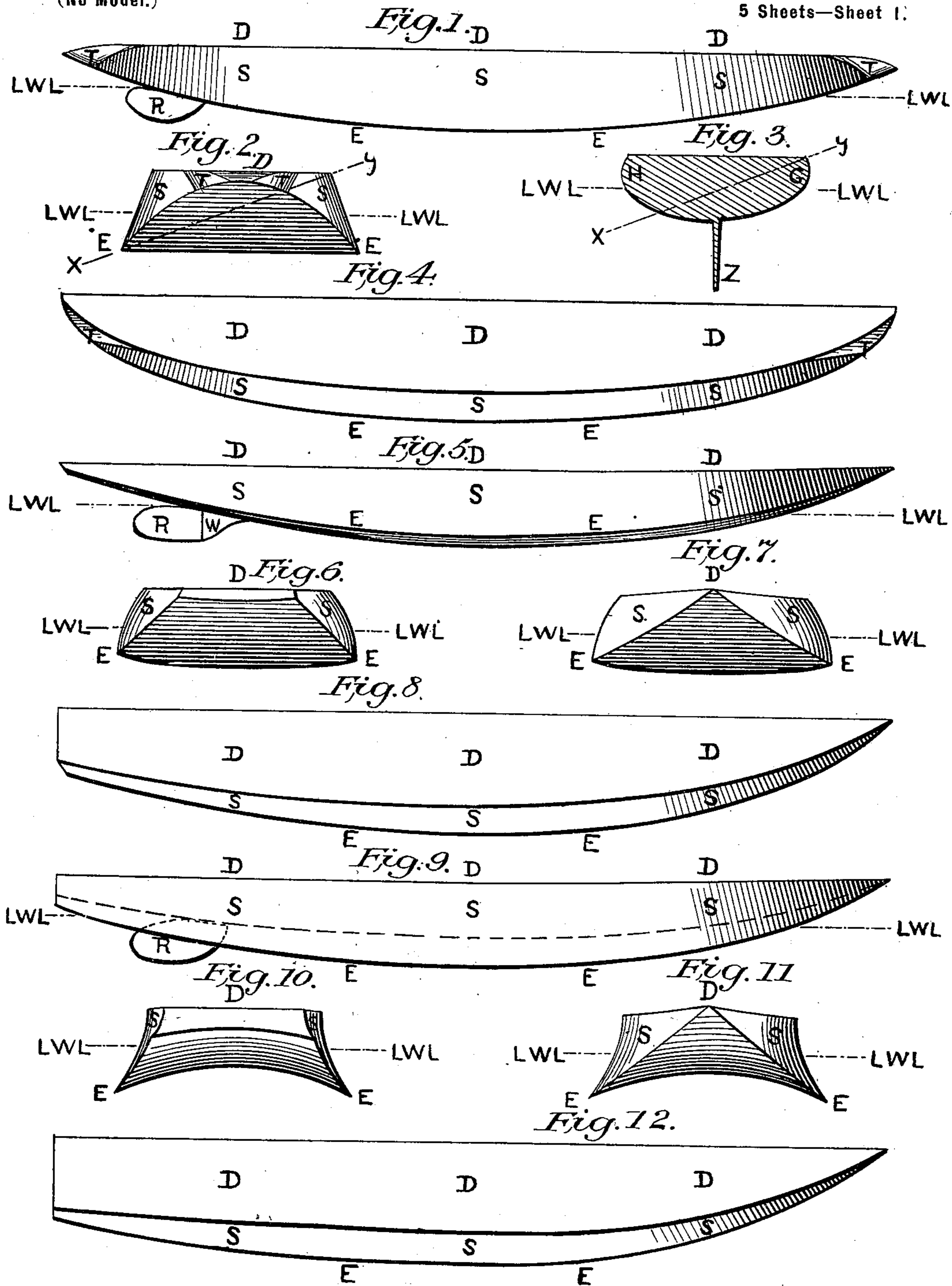
Patented July 3, 1900.

C. ANDRADE, JR.
HULL FOR SHIPS OR BOATS.

(Application filed Apr. 17, 1899.)

(No Model.)

5 Sheets—Sheet 1.



WITNESSES

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Captain. G. Andrade. U. S. N.

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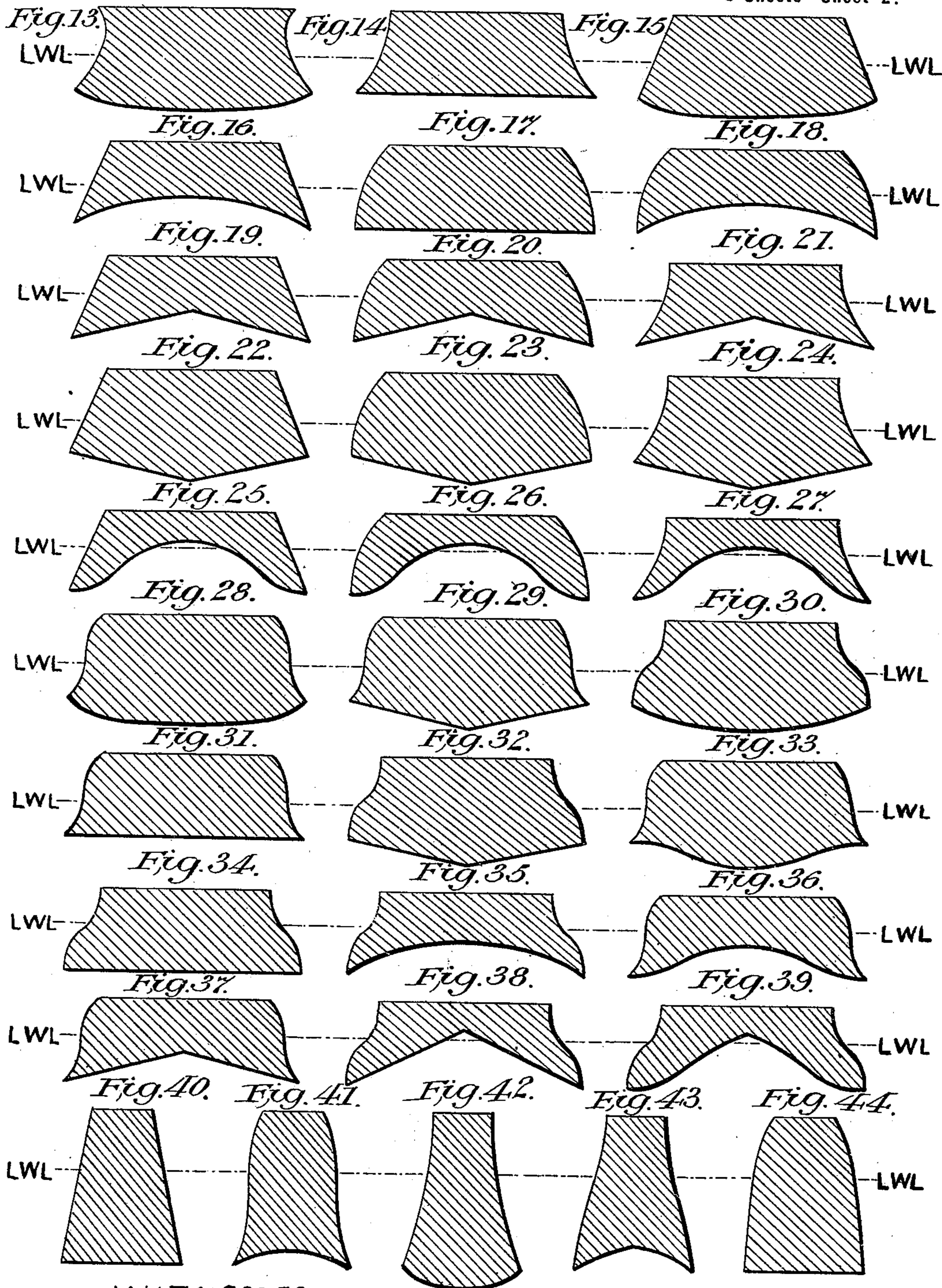
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5 Sheets—Sheet 2.



WITNESSES

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Fig. 45.

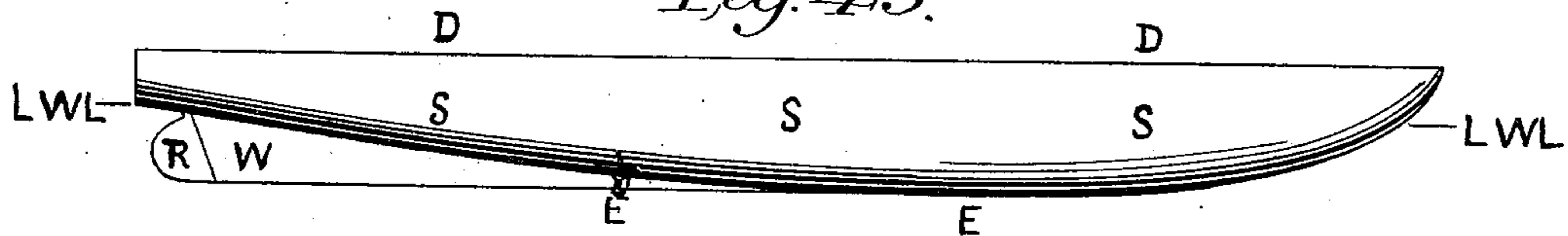


Fig. 46.

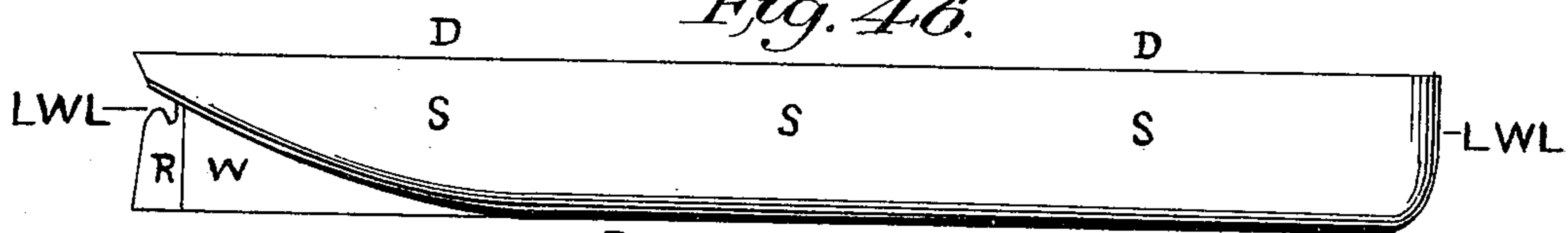


Fig. 47.

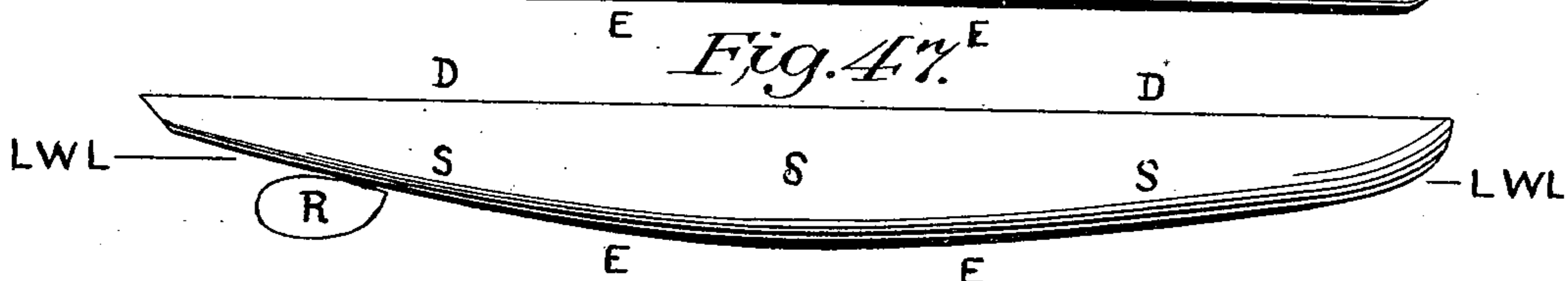


Fig. 48.

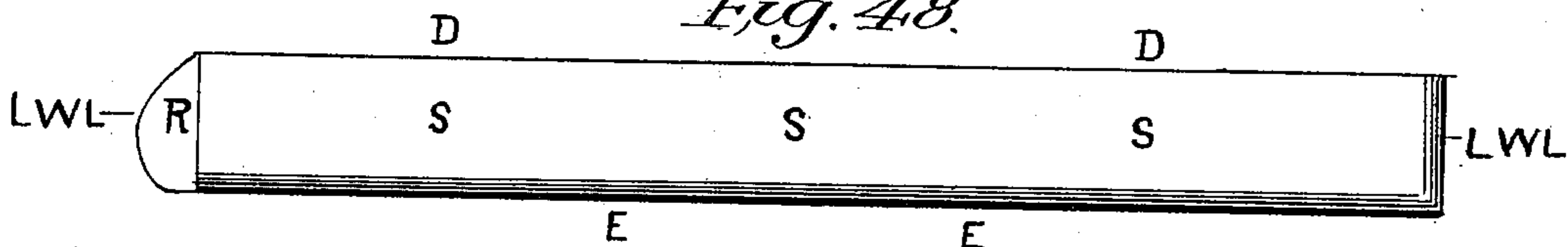


Fig. 49.

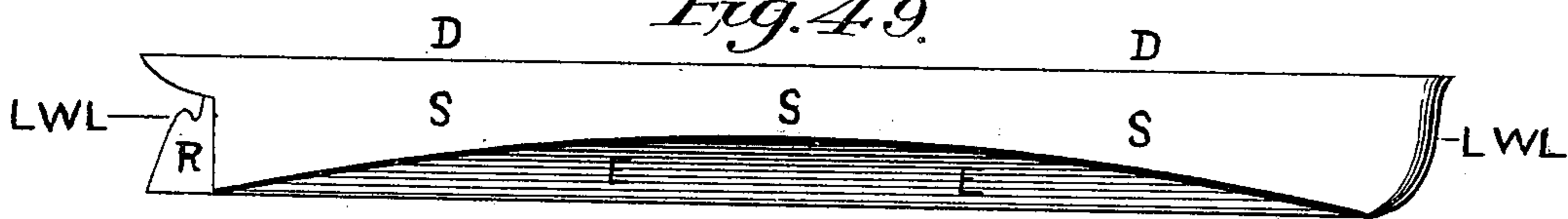


Fig. 50.

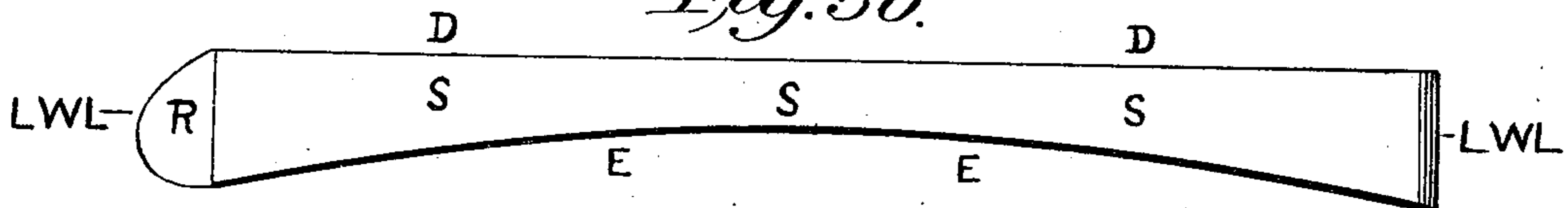
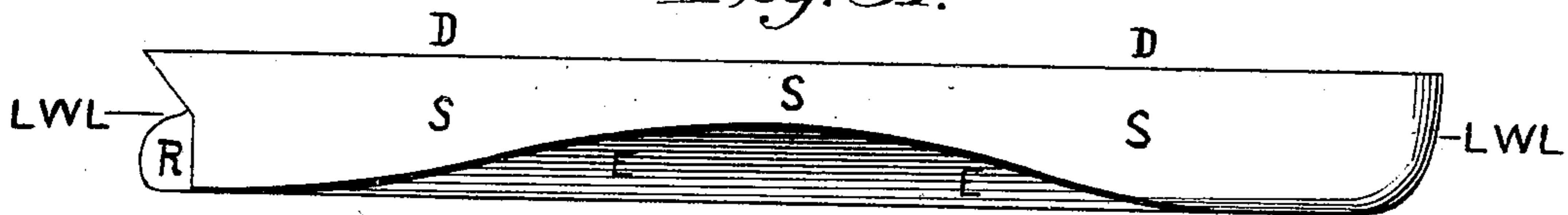


Fig. 51.



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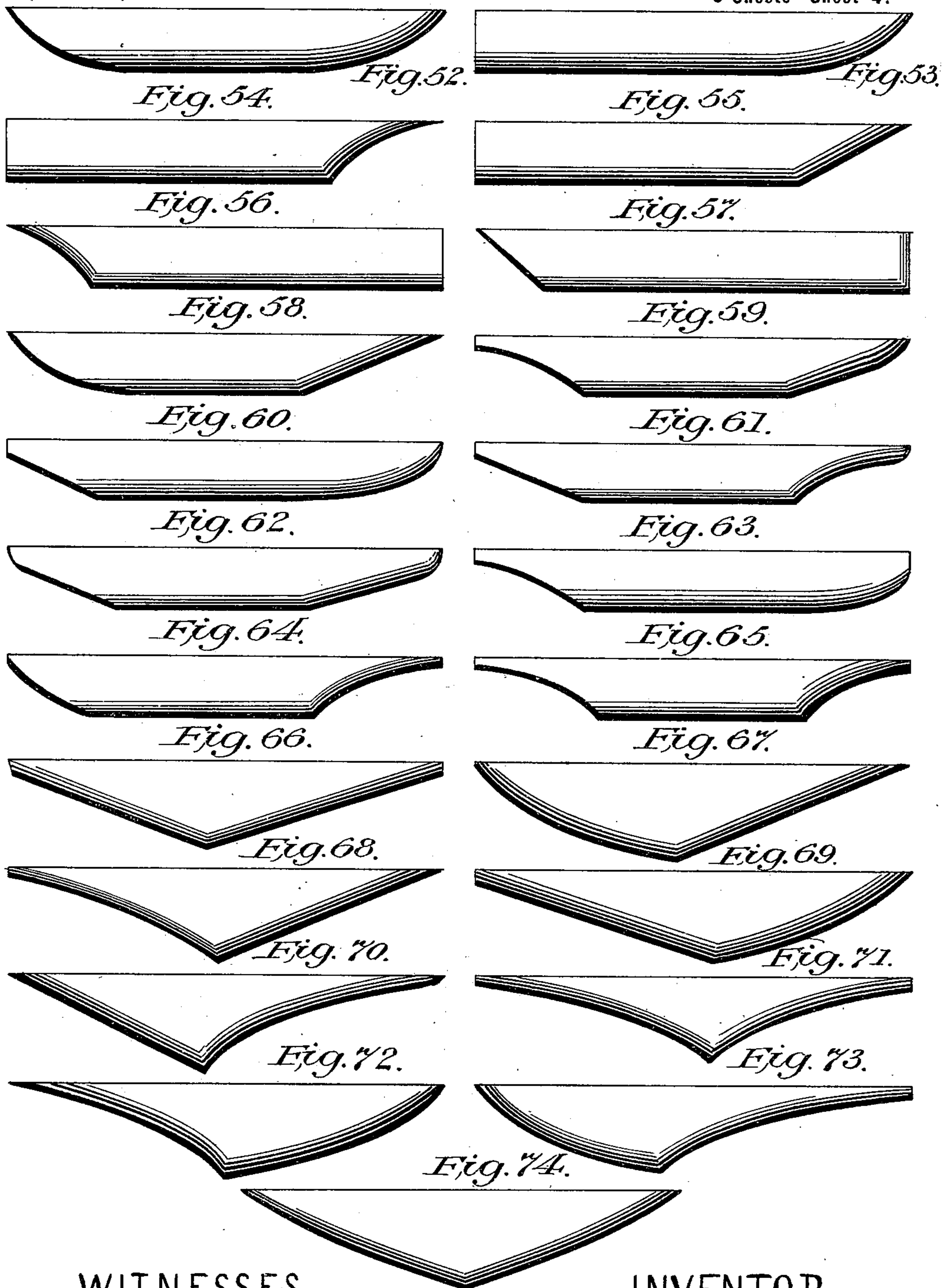
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(Application filed Apr. 17, 1899.)

(No Model.)

5 Sheets—Sheet 4.



WITNESSES

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Patented July 3, 1900.

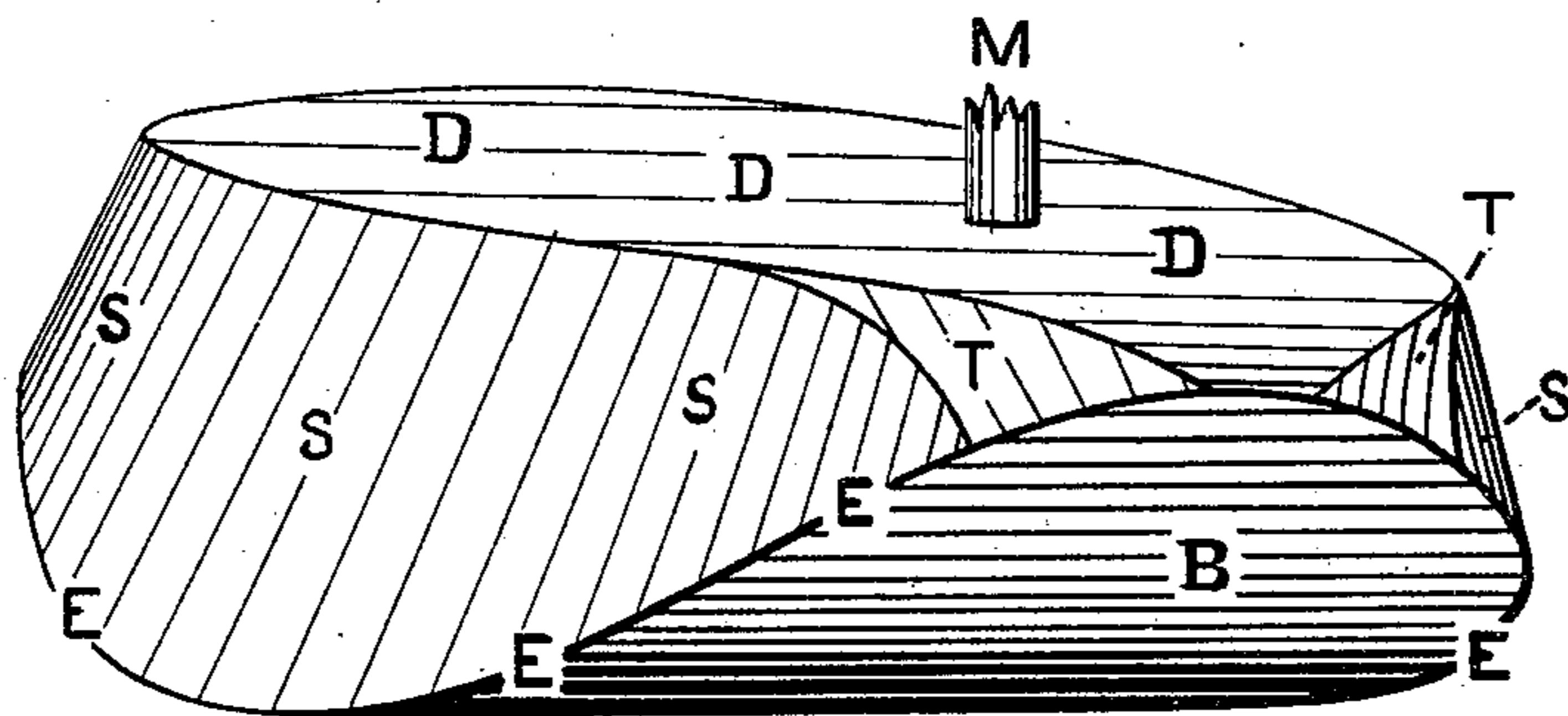
C. ANDRADE, JR.
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(Application filed Apr. 17, 1899.)

(No Model.)

5 Sheets—Sheet 5.

Fig. 75.



WITNESSES

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UNITED STATES PATENT OFFICE.

CIPRIANO ANDRADE, JR., OF HAVERFORD, PENNSYLVANIA.

HULL FOR SHIPS OR BOATS.

SPECIFICATION forming part of Letters Patent No. 652,876, dated July 3, 1900.

Application filed April 17, 1899. Serial No. 713,258. (No model.)

To all whom it may concern:

Be it known that I, CIPRIANO ANDRADE, Jr., a citizen of the United States, residing at Haverford, in the county of Delaware and State of Pennsylvania, have invented a new and useful Improvement in Hulls of Ships or Boats, of which the following is a specification.

My invention relates to improvements in the shape of the hulls of ships and boats; and the objects of my improvements are, first, to provide a form of hull which shall operate to check the leeway of a vessel without the use of lee-board, centerboard, keel, fin-keel, bilge-keel, or other similar device; second, to lessen the skin resistance, resistance of form, and wetted surface incident to the use of lee-boards, centerboards, keels, fin-keels, bilge-keels, and other similar devices; third, to save the space inside of boats and ships which would otherwise be filled by the center-board and centerboard-well; fourth, to prevent the structural weakness incident to the cutting away of floor-frames, timbers, keels, ribs, braces, &c., for the introduction of center-board and well; fifth, to diminish the draft of water incident to the use of lee-boards, centerboards, keels, fin-keels, bilge-keels, and other similar devices; sixth, to provide a form of hull which when heeled, as in going to windward, shall present a windward side offering to the opposing wind and waves a resistance less than the resistance offered by other known forms of hull; seventh, to provide a form of hull whose efficiency in checking leeway shall be in direct ratio to the angle of the heel up to the degree of heel where the leeward side is at right angles to the surface of the water and to the line of lateral resistance; eighth, to provide a form of hull which when it is buried under a mass of superimposed water, as when a sea breaks over it in very heavy weather, shall shed said superimposed water and free itself with greater quickness and ease than a hull of the ordinary type; ninth, to provide a form of hull which when it buries forward, as in running under a press of sail in a heavy sea, shall shed the water and free itself with greater quick-

ness and ease than a hull of the ordinary type; tenth, to provide a form of hull which when it buries aft, as when making sternway after missing stays in a heavy head wind and sea, shall shed the water and free itself with greater quickness and ease than a hull of the ordinary type; eleventh, to provide a form of hull which shall present to the water a greater comparative surface under the bow and stern than does a hull of the ordinary type and thus prevent that excessive pitching in a choppy sea which so often kills the headway of a vessel, especially in windward work. I attain these objects by the form of hull illustrated in the accompanying drawings, in which—

Figure I is a longitudinal elevation of said hull with turtleback bow and stern. Fig. II is a bow view of the same hull as shown in Fig. I. Fig. III is the midship-section of a hull of the ordinary centerboard, keel, or fin-keel type. Fig. IV is a horizontal plan of one-half of the same hull as Fig. I viewed from above. Fig. V is a longitudinal elevation of such hull with a pointed bow and square stern. Fig. VI is a stern view of the same hull as Fig. V. Fig. VII is a bow view of the same hull as Fig. V. Fig. VIII is a horizontal half-plan of the same hull as Fig. V viewed from above. Fig. IX is a longitudinal elevation of such hull with pointed bow and square stern. Fig. X is a stern view of the same hull as Fig. IX. Fig. XI is a bow view of the same hull as Fig. IX. Fig. XII is a horizontal plan of one-half the same hull as Fig. IX viewed from above. Figs. XIII to XLIV, inclusive, represent midship-sections of such hulls of various styles. Figs. XLV to LXXIV, inclusive, represent longitudinal elevations or side views or lateral aspects of such hulls, except Figs. XLIX, L, and LI, which are inserted purely for purposes of illustration and comparison. Fig. LXXV represents a perspective view of the same hull as shown in Figs. I, II, and IV, but on a larger scale.

I do not intend said figures as an attempt to enumerate or exhaust all the possible combinations and arrangements of the lines; but

simply as a few examples illustrative of the diversity of forms in which my invention may be embodied.

Similar letters refer to similar parts throughout the several views.

LWL represents the load water-line in all the figures.

The sides S of the hull "tumble home"—that is to say, their transverse sections show the hull to be narrower at the deck D than at the bottom—and, furthermore, the said sides S make an angle with the bottom, thus forming the edge E at the junction of the bottom and sides S.

Figs. I, II, and IV illustrate, respectively, the longitudinal elevation, bow view, and horizontal half-plan, of my invention applied to a boat or ship whose sides S and bottom in transverse section are straight and form an acute angle or edge E at their point of junction, whose lines fore and aft of midships are symmetrical, "double-ended," whose deck D has no sheer, said deck dropping at the bow and stern, and whose bow and stern in horizontal plan are rounded and terminate in turtlebacks T. The rudder R is of the ordinary balance type. The dotted line xy in Fig. II shows the water-line of the midship-section of my improved hull when the boat is heeled, as in going to windward. Her leeward side (the side nearer y) acts as a lee-board to check leeway, while the weather side (the side nearer x) makes an acute angle with the surface of the water, and thus offers less resistance to the wind and water to windward than does a hull of the ordinary type. This last fact is illustrated by Fig. III, which represents the midship-section of a hull of the ordinary centerboard, fin-keel, or keel type, heeled down to the water-line xy . The leeward side G is useless to prevent leeway, while the windward side H is thrown out of water approximately at right angles to the wind and waves to windward, which wind and waves thus obtain a greater hold upon the weather side and throw the boat back to leeward.

It will be further observed that from the time my form of hull leaves an even keel until she is heeled to a degree where her leeward side is at right angles to the surface of the water and to the line of lateral resistance her ability to hold up to windward is steadily increasing, because during that change of heel her leeward side, first, is going deeper into the water and, secondly, is approaching more nearly a right angle to the direction of the lateral resistance. Exactly the opposite occurs in the ordinary type of centerboard, keel, or fin-keel. Fig. III shows that from the moment a boat of the latter type leaves an even keel her keel, centerboard, or fin Z becomes less and less efficient to check leeway because, first, it becomes constantly shallower, and, secondly, it constantly makes a more acute angle with the direction of the

lateral resistance. Therefore in beating to windward, when a vessel is always more or less heeled, my form of hull is most efficient, while a hull of the ordinary type is at a disadvantage.

It will be further observed that the transverse sections of my improved hull, both amidships and fore and aft, present roughly the form of a blunted wedge pointed upward, and therefore my form of hull is more efficient than the ordinary type of hull to free itself from a mass of superimposed water, whether said mass of water be thrown upon the deck by a breaking sea or by the vessel plunging into a heavy head sea or making sternway into a sea after missing stays or otherwise.

It will be further observed that my form of hull gives a greater comparative surface of bottom under the bow and stern than does the ordinary hull, and thus my form of hull is more efficient to check excessive pitching than is the ordinary hull.

Figs. V, VI, VII, and VIII illustrate, respectively, the longitudinal elevation, stern view, bow view, and horizontal half-plan, of my invention applied to a vessel whose sides S and bottom in transverse section are convex and form an obtuse angle or edge E at their point of junction, with a sheer fore and aft, with a pointed bow and square stern, with a dead-wood W, and rudder R. In order to avoid unnecessary confusion of detail, the dead-wood W and rudder R are not shown in the stern view, Fig. VI.

Figs. IX, X, XI, and XII illustrate, respectively, the longitudinal elevation, stern view, bow view, and horizontal half-plan, of my invention applied to a vessel whose sides S and bottom in transverse section are concave and form an acute angle or edge E at their point of junction, with a sheer fore and aft, with a pointed bow and square stern, and with a balance-rudder R. In order to avoid unnecessary confusion of detail, the rudder R is not shown in the stern view, Fig. X.

Fig. XIII is the midship-section of my improved hull, whose sides in transverse section are concave and whose bottom in transverse section is convex; Fig. XIV, sides concave, bottom flat; Fig. XV, sides flat, bottom convex; Fig. XVI, sides flat, bottom concave; Fig. XVII, sides convex, bottom flat; Fig. XVIII, sides convex, bottom concave; Figs. XIX, XX, and XXI, bottoms all reëntrant, sides respectively flat, convex, and concave; Figs. XXII, XXIII, and XXIV, bottoms all salient, sides respectively flat, convex, and concave; Figs. XXV, XXVI, and XXVII, bottoms all concave compound curve, sides respectively flat, convex, and concave. It will be observed that these last views, Figs. XXV, XXVI, and XXVII, represent boats of the so-called "double-hulled" type—*i. e.*, the bottom curves upward to a point above the LWL. I do not claim as my invention

said "double hull," being aware of its extensive and ancient use both here and in the Pacific islands. The views, Figs. XXV, XXVI, and XXVII, are inserted merely for the purpose of showing that my tumble-home side, making an angle or edge with the bottom, is applicable as well to double-hulled as to single-hulled vessels.

Figs. XXVIII to XXXIX, inclusive, represent midship-sections whose sides in transverse section are various compound curves and whose bottoms in transverse section are severally either convex, salient, flat, concave, or reëntrant. It will be observed that Figs. XXXVIII and XXXIX are examples of the double-hulled type, and I apply the same remarks to these views, Figs. XXXVIII and XXXIX, as to Figs. XXV, XXVI, and XXVII above.

Figs. XL to XLIV, inclusive, represent midship-sections of various vessels of my improved type, but all deeper than in the preceding views; Figs. I to XXXIX, inclusive.

Fig. XLV represents the side view or lateral aspect of a hull in which R is the rudder, W is the dead-wood, D is the deck, S is the tumble-home side, and the heavily-shaded line E represents the edge formed by the junction of the side and bottom. It will be observed that this edge when viewed from the side or in lateral aspect forms a curve whose midship portion is lower than its forward or after end.

Fig. XLVI represents the side view or lateral aspect of a hull in which R is the rudder, W is the dead-wood, D is the deck, S is the tumble-home side, and the heavily-shaded line E represents the edge formed by the junction of the side and the bottom. It will be observed that this edge when viewed from the side or in lateral aspect forms a straight line for a portion of its length and terminates at its after end in a curve whose midship portion is lower than its after end.

Fig. XLVII represents the side view or lateral aspect of a hull in which R is the rudder, D is the deck, S is the tumble-home side, and the heavily-shaded line E represents the edge formed by the junction of the side and the bottom. It will be observed that this edge when viewed from the side or in lateral aspect forms a curve whose midship portion is lower than its forward or after end.

Fig. XLVIII represents the side view or lateral aspect of a hull in which R is the rudder, D is the deck, S is the tumble-home side, and the heavily-shaded line E represents the edge formed by the junction of the side and the bottom. It will be observed that this edge when viewed from the side or in lateral aspect forms a straight line.

Figs. XLIX, L, and LI represent the side view or lateral aspect of hulls in which R is the rudder, D is the deck, S is the tumble-home side, and the heavily-shaded line E represents the edge formed by the junction of

the side and the bottom. It will be observed that this edge when viewed from the side or in lateral aspect forms a curve whose midship portion is higher than its forward or after end, and therefore my claim does not apply to either of Figs. XLIX, L, or LI, which figures are inserted purely for the purpose of comparison with the other figures, all of which I claim.

Figs. LII to LXXIV, inclusive, represent the side view or lateral aspect of various forms of hull to which my claim applies. The edge is distinguished in each figure by the heavy shading. For the sake of clearness the rudder and all letters are omitted from said figures, and the hulls in all said figures are placed with the bow toward the right-hand side of the sheet.

I do not intend Figs. I, V, IX, XLV, XLVI, XLVII, XLVIII, and LII to LXXIV, inclusive, as an attempt to enumerate or exhaust all the possible combinations or arrangements of the lines in lateral aspect, but simply as a few examples illustrative of the diversity of forms in which my invention may be embodied. It will be observed, however, that all the said figures possess the common characteristic of an edge whose lateral aspect is a straight line or a broken line or curve whose midship portion is lower than its forward or after end.

Fig. LXXV is a perspective shaded illustration of the same hull as shown in Figs. I, II, and IV, but on a larger scale, viewed from a point slightly higher than the deck, about twenty-two degrees off the starboard bow. M is the mast, D is the deck, S is the tumble-home side, T is the turtleback, B is the bottom, and E is the edge formed by the intersection of the bottom B and the side S.

A glance at the various drawings will show that the width, sheer, and form of deck, the depth of hold, the beam, the ratio of beam to length, the overhang fore and aft, the form of bow, the form of stern, all the other dimensions and proportions of design, the rig, and the style of rudder may all be as various as the manifold considerations of fancy or utility may suggest. The sides in transverse section may be straight, concave, or convex, in simple or compound curves. The bottom in transverse section may be straight, salient, or reëntrant, or concave or convex, in simple or compound curves. The angle which the sides make with the bottom in transverse section may be a right, obtuse, or acute angle. All these matters are mere questions of detail, forms, and special examples of my essential and fundamental invention—to wit, a hull narrower at the deck D than at the bottom, whose sides S form an angle or edge where they join the bottom.

A centerboard, keel, bilge-keels or fin, weighted or unweighted, may be attached to my form of hull; but this is not at all necessary, and is in no sense an essential to my in-

vention. I mention the matter solely in order that no one may infringe on my form of hull by adding a centerboard, fin, keel, bilge-keel, or other similar device thereto, and thus
5 claim to have made an improvement on my invention.

It will probably be found that a balance-rudder (see Figs. I and IX) is the form best adapted to my form of hull, but a dead-wood
10 may be employed, W, Fig. V.

It is not essential that the tumble-home side make an angle or edge with the bottom or that said edge itself should extend from the extreme bow to the extreme stern. Only a
15 portion of the vessel's side need be treated in this manner. (See Figs. I, II, and IV.)

I am aware that prior to my invention ships and boats have been built the upper portions of whose sides in transverse section tumble
20 home; but all such tumble-home sides turn into the bilge with a substantial curve of more or less ease and do not form an angle or edge with the bottom. I am also aware that prior to my invention ships and boats have been
25 built whose sides form an angle or edge with the bottom; but in all such boats the deck is

either of the same width as the bottom immediately beneath it at each point, as in the case of the ordinary flat-bottomed scow with vertical sides, or else the deck at each point
30 is wider than the bottom immediately beneath it, as in the case of the New England fishing-dory or the New Jersey flat-bottomed surf-boat; but I am not aware that any
35 boat has ever been built whose transverse sections disclose a deck narrower than the bottom and whose sides form angles or edges with the bottom.

What I do claim as my invention, and desire to secure by Letters Patent, is—
40

In the hulls of ships and boats, a substantial edge (whose lateral aspect is a straight line, or a broken line or curve whose midship portion is lower than its forward or after end),
45 formed by the intersection of the hull's bottom with a side disclosing a deck narrower than said bottom in transverse section.

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Witnesses:

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LOUIS DE PUI VAIL.