Nov. 26, 1935. E. SCHNEIDER 2,022,056

SHIP AND SHIP CONSTRUCTION

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Fig: 1.

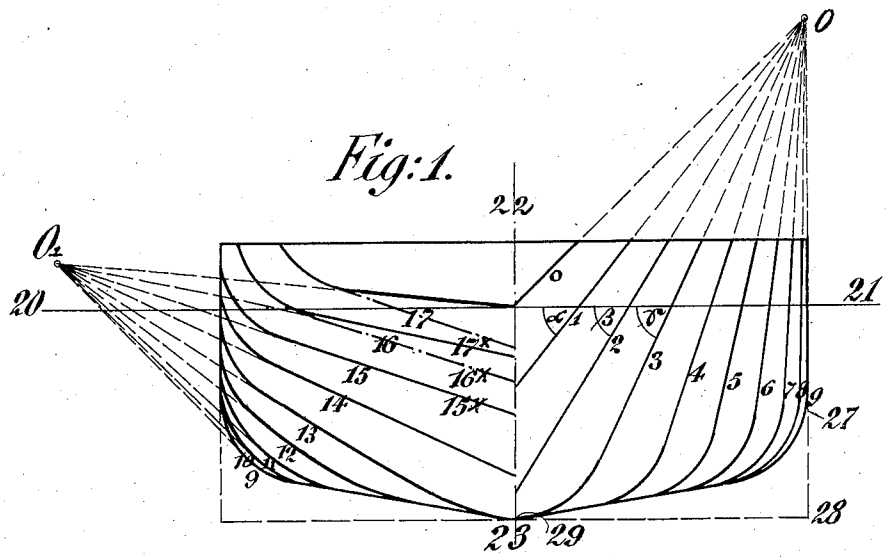


Fig: 2.

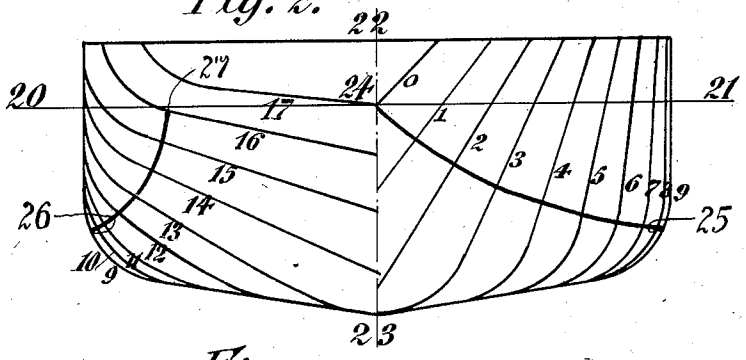
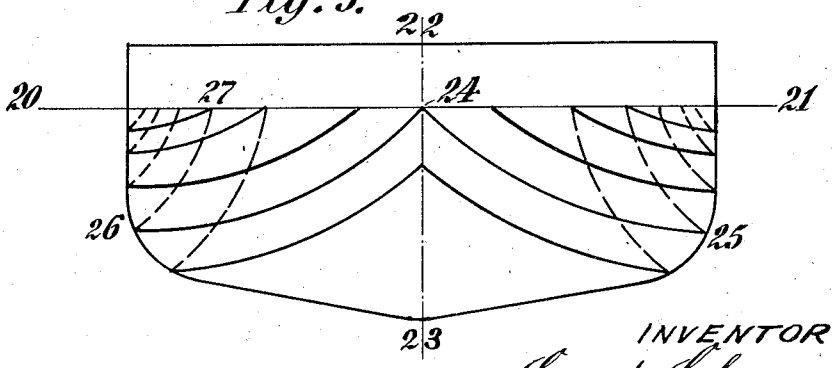


Fig: 3.



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SHIP AND SHIP CONSTRUCTION

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6 Claims. (Cl. 114—56)

This invention relates to ships and ship constructions to enable the most advantageous contour of the hull, particularly of its wetted surface, to be provided. The invention provides a novel method of determining the inclinations of the frames in the fore and aft sections of a ship, and also provides a novel ship construction.

More particularly, the invention comprises the utilization of straight or substantially straight frame lines extending above and below the water-line, which have an inclination varying from frame to frame according to a well defined law, namely, that the frame lines form with the water level an acute angle which increases from the bow of the ship to its middle portion, and decreases from its middle portion to the stern of the ship. A substantial part of the bow portion, as also of the stern portion of the ship, form helicoidal surfaces, the axis of which being substantially parallel with the longitudinal axis of the ship, its generatrices being the straight or slightly curved frame lines.

One object of the invention is to provide means whereby the water at the aft of the ship closes in, in ordered lanes, and without forming a vortex. Thereby, the resistance of the ship is decreased, and on the other hand, a reduction in the efficiency of the propulsion means at the stern is avoided. The former is made possible because churning or rotary movement of the water, being a useless energy loss, is not present, and the latter is made possible by providing a stronger and more regulated stream of the water towards the propulsion means, which stream heretofore was unregulated and weakened.

One of the essentials of the invention is that due to the helicoidal surface of the bow portion of the ship, a water movement is produced opposite to the rotation of the water effected by the aft part of the ship, or in other words, the rotation of the water created by the bow portion is neutralized by the reverse rotation effected by the stern portion, so that the water closes at the stern, forming practically parallel stream lines. Also the direction of the absolute water paths in the bow part of the ship is in an arc "from above outwardly", instead in an arc from above downwardly. This arc movement from above outwardly at the bow portion of the ship brings about a symmetry with the arc movement of the absolute water path in the stern portion of the ship, and a favorable movement of the displaced water along the ship results from the bow portion to the stern portion of the ship.

In one embodiment this is attained by having the straight or substantially straight (slightly curved) frames of the hull below the water level in the body plan, form acute angles with the water line, which angles increase from the bow to the middle portion of the ship, and decrease from the middle portion of the ship to the stern of the ship, and which frame lines in the body plan of the ship converge, both for the bow portion and for the stern portion, at points above the water level line, and outwardly. As is well known, between the bow portion of the ship and the stern portion, a middle body of suitable length can be placed, having a suitable contour in respect to the design of the ship. In the intermediate portion between the bow portion and middle body, or between the middle body and stern portion, the principle of the invention is necessarily only generally applied in that the frame lines converge in the described manner only partially.

Further features of the invention will be more specifically set forth in the accompanying description and shown in the drawing, and the invention will be finally pointed out in the claims.

In the accompanying drawing,

Figure 1 is a body plan incorporating the invention, in which a special use of pure helicoidal surfaces for the hull is illustrated, showing also the points of convergence above the water level and outwardly of the body plan;

Figure 2 is the same body plan shown in Figure 1, omitting the convergence lines, and showing one of the absolute water paths, in respect to the frames; and

Figure 3 is a projected view of one of the absolute water paths, both bow and stern portions, with the stern absolute water path placed behind the bow path, and duplicated to show both sides of the ship.

Referring to the drawing, and particularly to Figure 1, the right-hand side of the body plan represents the bow portion with the frames 0 to 9; and the left-hand portion represents the stern portion with the frames 9 to 17. On both sides, the frame lines converge towards the upper and outer side of the body plan, the bow frame lines at point 0, and the stern frame lines at point 0_1. The points 0 and 0_1 are indicative of the axes of the helicoidal surfaces perpendicular to the plane of the drawing sheet that is parallel to the longitudinal axis of the ship. The water level line is shown by 20—21. The straight frame lines 0 to 9, form acute angles with the water line 20—21, beginning with the center plane 22—23 of the hull, with angles α, β, γ, etc.

increasing from the bow to the middle body of the ship, where the angles are substantially right angles. The straight frame lines 9 to 17 form acute angles with the water line, which decrease from the middle body to the stern of the ship. In the bow portion, the lowermost ends of the straight frame lines merge into curved portions suitable to the contour of the ship in a manner well known, and likewise, the uppermost ends of the straight frame lines of the stern portion merge into curves in a manner well known.

For blade wheel propellers with substantially vertical axes, it is preferable to have the stern portion disposed in parallel planes and to enable this adaptation to be readily made, the lines are drawn on the body plan as indicated in full lines, both the straight lines and attendant curves, and then the lines 15x, 16x, and 17x are drawn parallel with each other, the line 15x being selected as the key line, and the lines 16x and 17x are drawn parallel therewith, lines 16x and 17x being drawn tangentially to the curved portions of lines 16 and 17. Key line 15x was chosen arbitrarily in this illustration of the principle; another line could be chosen as well, it being dependent on the contour desired.

It is well known that the absolute path of the water along the hull of a ship is substantially parallel with the orthogonal trajectories of the frame lines, and in Figure 2, one of these absolute water paths is shown by the arc 24—25 in the bow portion, and by arc 26—27 in the stern portion. It will be particularly noted that arc 24—25, passes from the bow, or from towards the center line of the body plan, downwardly and outwardly, and this is one novel feature of this invention. This has many important advantages. It enables a more slender shape to be given to the load water line of the ship, and at the same time a greater fullness of the lower portions of the wetted surface is made possible. This arc is specially advantageous for shallow water, as in such localities a movement of the water displaced "from above in an arc towards the outside" is by far better than a movement of the water "from above in an arc towards the bottom." In the former case, the water flow is not impeded by the bottom of the sea, and reactions are not set up which impede the movement of the ship, by unregulated reverse movements of the water accompanied by energy losses. Also, the novel frame lines simplify the contour of the hull of the ship, in that it permits also with the simple and hydraulically preferable V form of the bow frames, the transposition from the wetted surface of the hull to its part above the water, in straight lines or planes. Furthermore, a most desirable center of gravity location, and displacement distribution, adapted to the principal mass of the ship and its speed, is obtained. For certain ship types, it is advantageous to concentrate the displacement principally in the middle body, and to lay out the body plan in such a manner, that the longitudinal profile of the frame section areas at both ends of the ship, or at least at the bow, begins with only a slight inclination if not with an entirely horizontal tangent. This requirement is complied with, in a specially advantageous and simple manner. Also, hydraulically considered, the use of the invention in contrast to the known forms of bow construction, brings about a shifting of the bow wave towards the middle of the ship, which, when taken into consideration in the selection of the most efficient ratio of length to speed, results in an additional saving in resistance.

In Figure 3, is shown a diagram symmetrical to the center line, in which at each side of the center line, several of the bow and stern absolute water path arcs are shown, and it will be particularly noted that each of these bow and stern arcs presents a continuous curve longitudinally along the hull with its convex side towards the water level, whereby a downward forcing of water is avoided, especially as it approaches the middle body of the ship.

This invention is particularly applicable to ships using propellers with approximately perpendicular axes. By the actuation of such propellers which enable the rudder and other appendages to be dispensed with, the entire ship body can receive a simple form controlled only by hydraulic requirements, and the present invention renders this especially possible. Propellers having vertical axes and placed at the stern usually require within the sphere of the propeller, plane surfaces of the hull, which can be readily formed, as before described, by giving the straight frame lines the same inclinations, as shown in Fig. 1, by 15x, 16x and 17x.

The action of the bow portion on the water is like that of a screw with its winding inwardly towards the hull which has a tendency to create a rotation of the water wherein the particles near the water level move towards the ship, whereas the particles near the bottom of the hull move away from the ship, and the water re-entrance at the stern portion is likewise screw fashion like. The shaping of the two portions of the ship, the bow and stern, according to this invention, is such that these two screw effects neutralize each other.

It will have been particularly noted that the ship's form produced by the invention causes the water behind the ship to close in well ordered lanes, without vortex, whereby, not only the flow of the water into the propeller is more regulated, but the wake action is made stronger. Also, the shapes of the fore and aft portions are such that the displaced waters, moved in helicoidal forms at the fore and aft portions, balance or neutralize each other. The direction of this helicoidal movement at the fore part of the ship is inward at or near the water level; and at the aft part is such that compensatory actions take place, enabling the propeller blades to most effectively impinge so as to get the greatest efficiency out of the propeller. It will also be particularly noted that the axes of the converging frame lines represented by the points 0 and 0_1 are placed above the water level line for both the fore and aft parts of the ship. Whether the axis of one or the other is placed laterally of the body plan or hull lines, is not so controlling as the fact that both axes are above the water line. By this disposition, the trajectory of the absolute path of the water along the bow portion is always predominantly lateral instead of downwards, and while some component may be downwards, in all cases the greater component is outwards. The exact positions of the axes 0_1 and 0, need not be defined other than herein set forth, since the invention lies in the fact that these axes are both above the water line. The definite positions of the axes may be dictated by considerations not necessarily within the scope of this invention, since the shipbuilder is in this respect free to a certain extent if he only positions both axes above the water level, thereby

obtaining the favorable results herein set forth, namely, the neutralization by the stern portion of the ship of the water's motion against the hull forced upon the water by the bow portion. With respect to the body plan, the water moves practically horizontally along the ship as it passes the middle body with a direction of flow in consonance with the direction of flow initiated at the stern portion of the hull, reference being here made to the absolute water paths.

It is well known to have axes **0** and **0¹**, but in applicant's case, both axes are placed above the water level. In the embodiment, the axis **0** is above the water level and substantially vertically disposed over the lateral boundary of the main frame, that is, middle frame, and the axis **0¹** is also above the water level and disposed within a rectangular area, formed by sides, one of which is the distance not exceeding one-half of the width of the ship, and extending along the water level beyond the main middle frame, and the other is the distance corresponding to the depth of the ship extending above the water level line. From an examination of Figure 1, it will be seen that the axes **0** and **0¹** comply with these requirements. In the use of the words "bow" and "stern", it is not intended to define the "bow" and "stern" in their narrower nautical conception, but both in the description and in the claims, the word "bow" is used to indicate the "bow portion of the hull" and the word "stern" is used to indicate the "stern portion" or "after portion of the hull".

Embodiments of my invention have been shown and described, but it is understood that changes may be made in the form of details and in the construction and arrangement of parts without departing from the spirit and scope of the invention or the scope of the appended claims.

I claim;

1. In a ship's hull, a bow portion, a middle portion and a stern portion, with substantially straight frame lines extending above and below the load water line; the frame lines of the said bow portion forming acute angles with said water line which progressively increase from a value of about 45° at the bow of the ship to the middle portion and which converge in an axis which is substantially parallel to the longitudinal axis of the ship, which is above said water line and is outside the body plan of the ship; the frame lines of the said stern portion converging in an axis which is substantially parallel to the longitudinal axis of the ship, which is above the load water line but lower than the axis of the frame lines of the said bow portion and which is at a horizontal distance from the lateral boundary of the ship not substantially exceeding one-half the width of the ship.

2. In the determination of a ship's construstructional design, the steps which comprise selecting a load water line and a longitudinal axis for the ship design, choosing a bow axis parallel to said longitudinal axis and above said water line, sweeping out one side of the fore part of the ship design by passing lines through and perpendicular to said bow axis making angles varying progressively from about 45° to about 90° with said water line, thereby determining the frame lines from the bow to the middle portion of the ship design; choosing a stern axis parallel to said longitudinal axis and above said water line but below the bow axis and sweeping out one side of the stern of the ship design by passing lines through and perpendicular to said stern axis making angles varying continuously from about 30° to 6° with said water line, thereby determining the frame lines from the middle portion to the stern of the ship design.

3. A ship's hull comprising in combination a bow portion and a stern portion having substantially straight frame lines extending above and below the load water line, the frame lines of the said bow portion forming acute angles with said water line which increase progressively from the bow of the ship to a middle portion and which in a large part of the bow portion lie between 45° and 90°, and the frame lines of the said stern portion forming acute angles with said water line which decrease progressively from the middle portion of the ship to the stern and which in a large part of the stern portion lie between 6° and 30°; the said frame lines of the bow portion and of the stern portion converging in two axes above the water level which are substantially parallel to the longitudinal axis of the ship and are outside of the body plan of the ship, the axis of the frame lines of the stern portion being below the corresponding axis for the bow portion.

4. In a ship's hull, a bow portion, a middle portion and a stern portion, with substantially straight frame lines extending above and below the load water line; the frame lines of said bow portion forming acute angles with said water line which progressively increase from a value of about 45° at the bow of the ship to the middle portion and which converge in an axis which is substantially parallel to the longitudinal axis of the ship, and which is above said water line and outside the body plan of the ship; the frame lines of said stern portion converging in an axis which is substantially parallel to the longitudinal axis of the ship, which is above the load water line but lower than the axis of the frame lines of the said bow portion and which is at a horizontal distance from the lateral boundary of the ship not substantially exceeding one-half of the width of the ship, the frame lines of said stern portion forming angles with the water level varying from about 30° to 6°.

5. In a ship's hull, a bow portion, a middle portion and a stern portion, with substantially straight frame lines extending above and below the load water line; the frame lines of the said bow portion forming acute angles with said water line which progressively increase from a value of about 45° at the bow of the ship to the middle portion and which converge in an axis which is substantially parallel to the longitudinal axis of the ship, which is above said water line and is outside the body plan of the ship; the frame lines of the said stern portion converging in an axis which is substantially parallel to the longitudinal axis of the ship, which is above the load water line but lower than the axis of the frame lines of the said bow portion and which is at a horizontal distance from the lateral boundary of the ship not substantially exceeding one-half the width of the ship, the axis of the frame lines of said bow portion being disposed substantially vertically above the lateral boundary of the body plan of the ship.

6. In a ship's hull, a bow portion, a middle portion and a stern portion, with substantially straight frame lines extending above and below the load water line; the frame lines of the said bow portion forming acute angles with said water line which progressively increase from a value of about 45° at the bow of the ship to the middle portion and which converge in an axis which is

substantially parallel to the longitudinal axis of the ship, which is above said water line and is outside the body plan of the ship; the frame lines of the said stern portion converging in an axis which is substantially parallel to the longitudinal axis of the ship, which is above the load water line but lower than the axis of the frame lines of the said bow portion and which is at a horizontal distance from the lateral boundary of the ship not substantially exceeding one-half of the width of the ship, and several of the last stern frame lines being parallel to each other.

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