April 15, 1969 C. M. GALLIN 3,438,350

HULL STRUCTURE FOR FAST-MOVING SHIPS

Filed April 11, 1967

Sheet 1 of 5

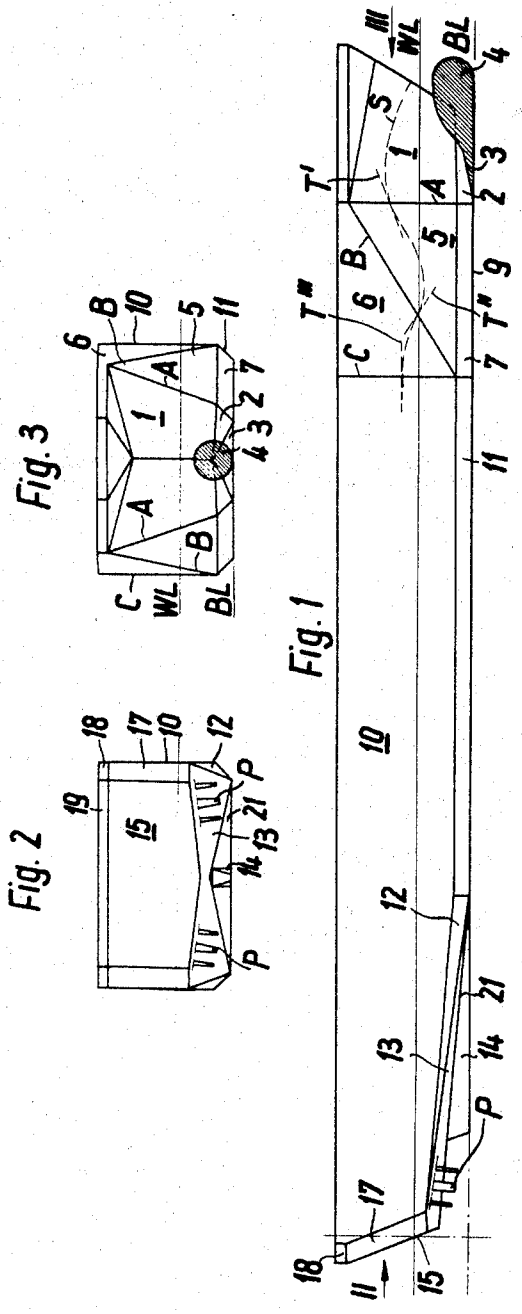

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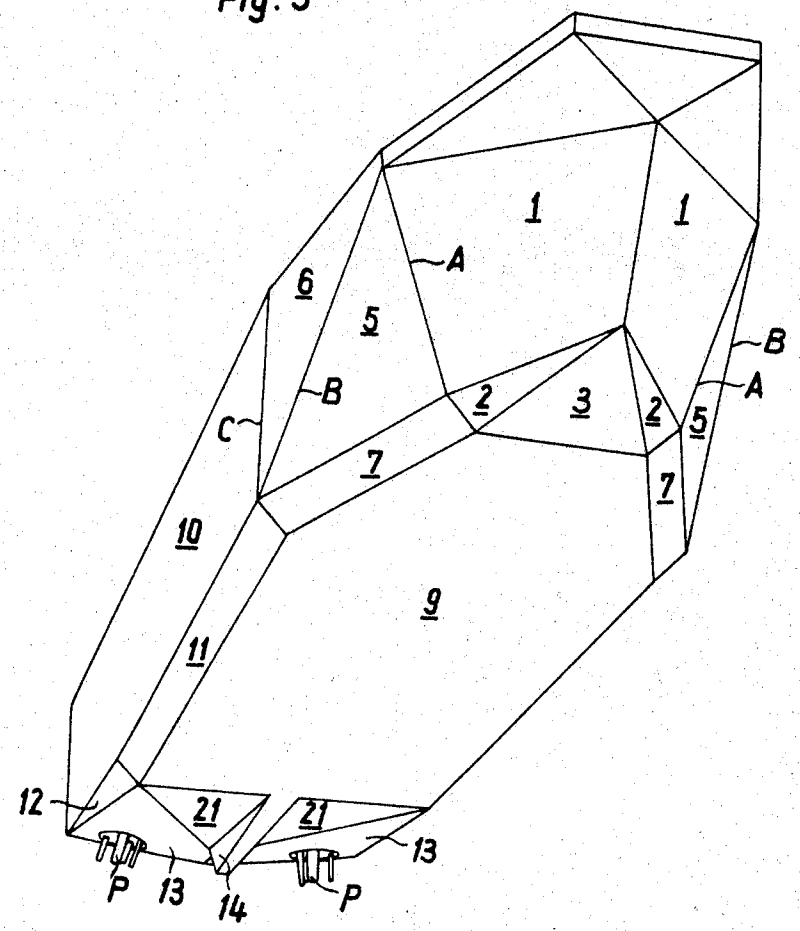
Fig. 5



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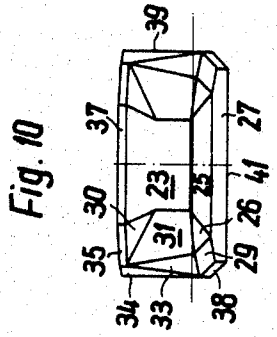

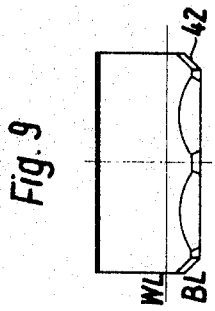

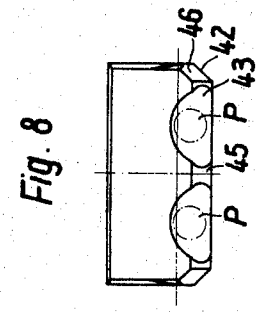

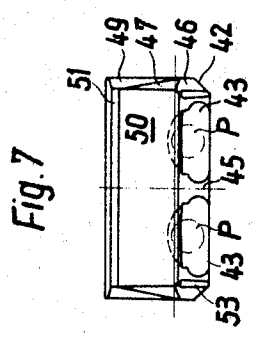

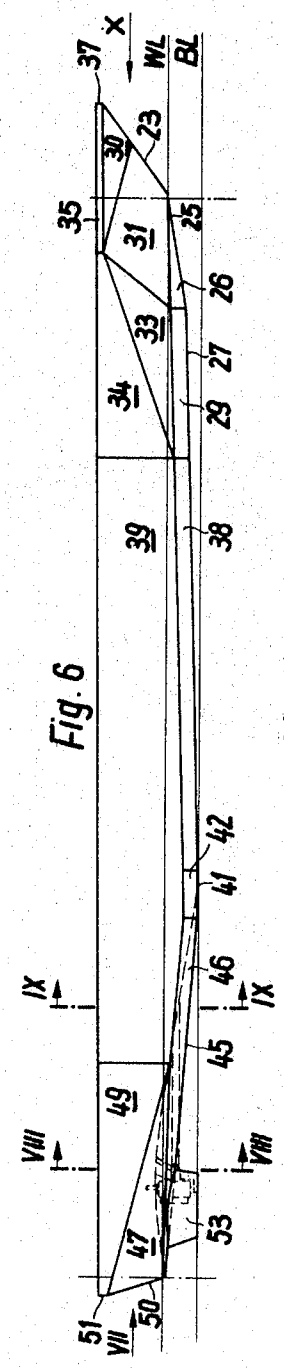

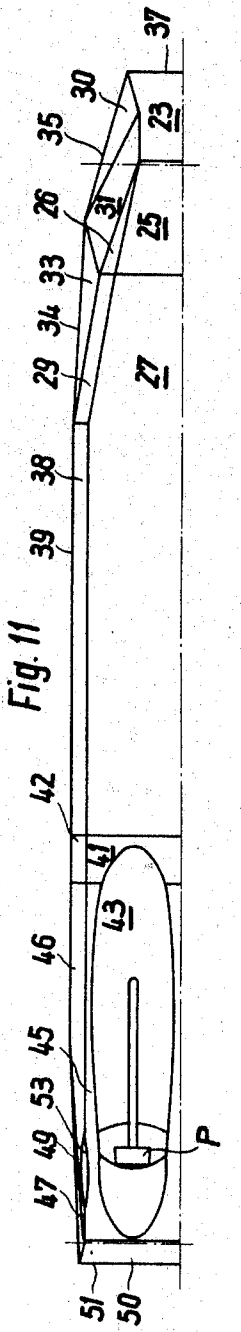

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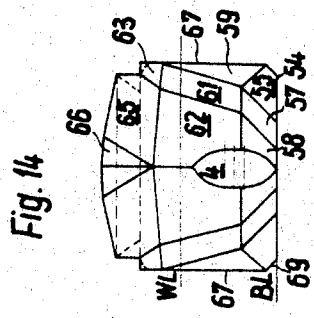

Fig. 14

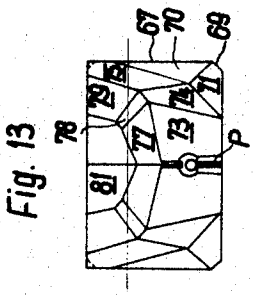

Fig. 13

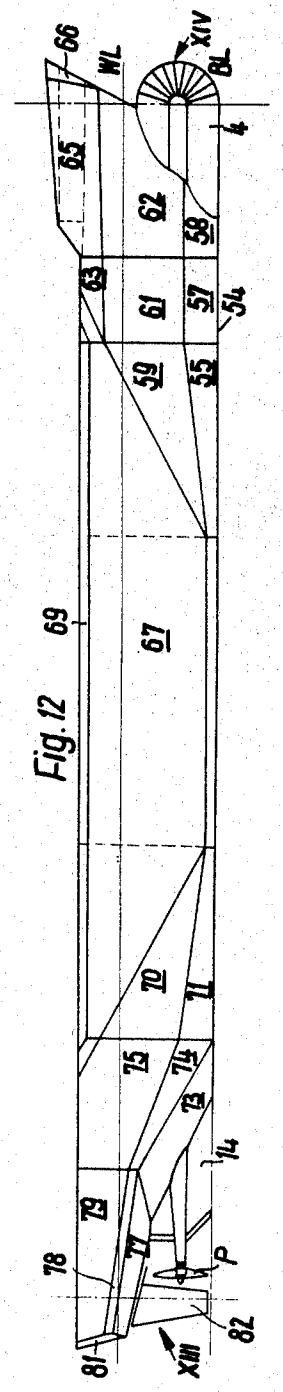

Fig. 12

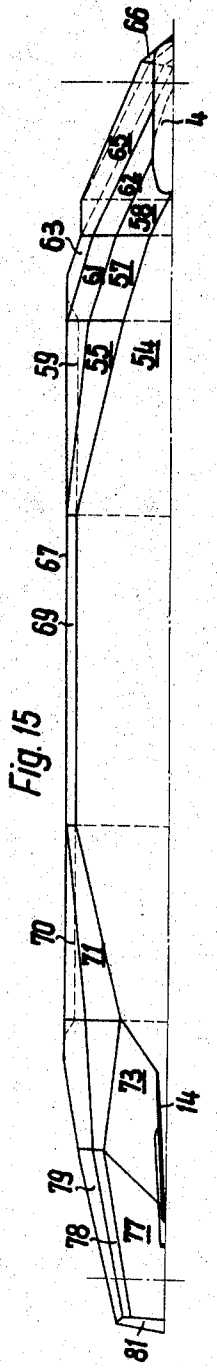

Fig. 15

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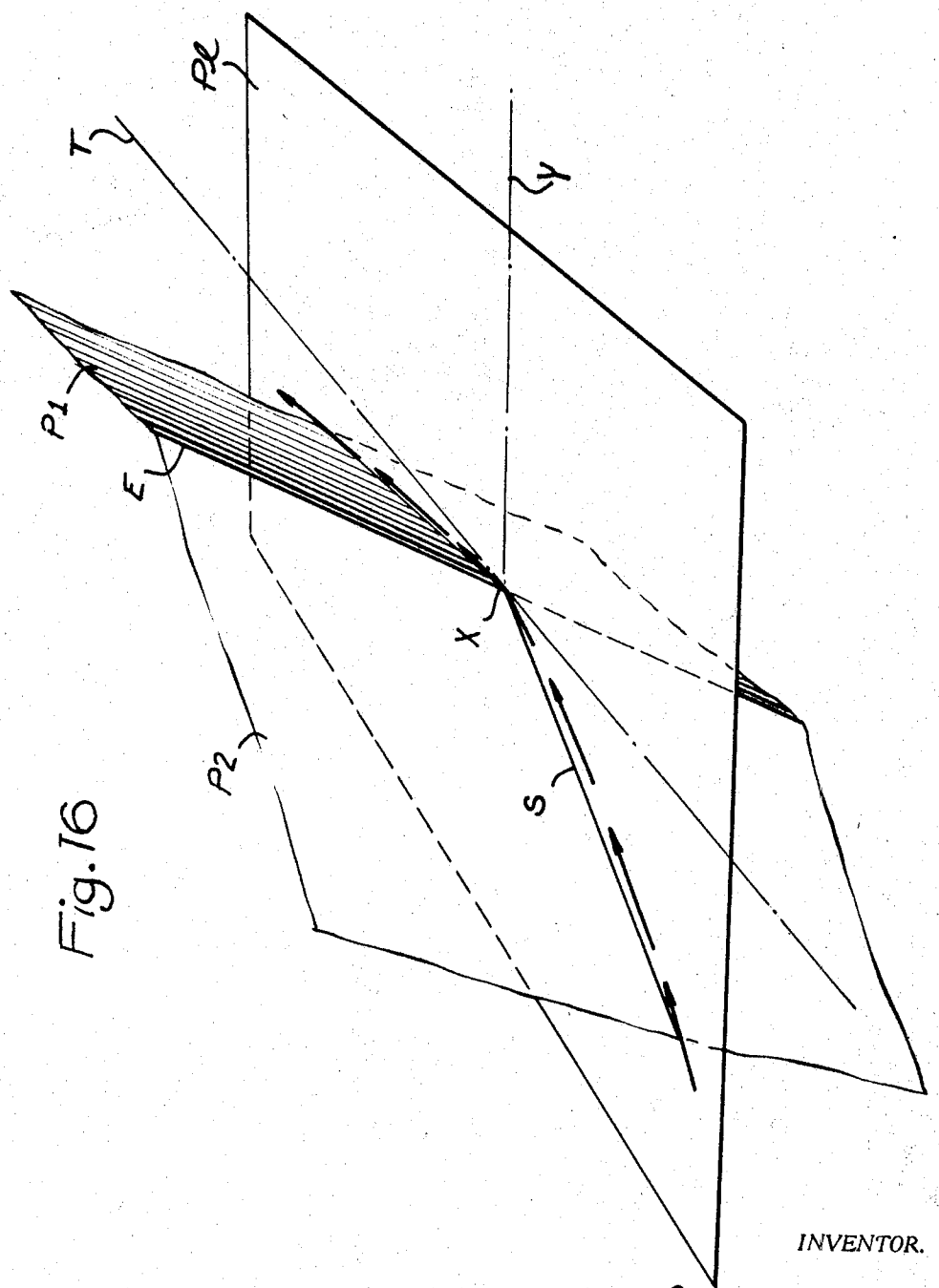

Fig. 16

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HULL STRUCTURE FOR FAST-MOVING SHIPS

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Int. Cl. B63b 1/06, 1/08
U.S. Cl. 114—56 6 Claims

ABSTRACT OF THE DISCLOSURE

Hull structure for fast-moving ships in replacement for conventional smooth line hull formation utilizing plane surfaces at the bow and stern of the ships, which plane surfaces intersect at critical angles of approximately 150 to 180° along planes passing through the tangents to the streamline in the bow and at critical angles not exceeding 120° in the stern to keep down power consuming turbulence or wave formation in such a way that the ship's resistance remains of the same order of magnitude as that of a similar ship with conventional curved smooth outline while preserving the hull's main dimensions, displacement and displacement center.

Brief summary of invention

This invention relates to a hull shape or construction for fast-moving ships. In the case of floating bodies which are not required to move at high speed, e.g. tugboats, dredges and floating support bodies for cranes, pontoons and the like as a rule one selected a box-like configuration made of plane surfaces that may, if need be, be tapered at the bow and at the stern. In the case of fast-moving ships in which, for efficiency considerations, it is desired to achieve as favorable as possible at relationship between the achievable speed of the ship and the available driving power, hulls constructed of such plane surfaces have hitherto not been used. In the shipbuilding field, the opinion is prevalent that a favorable relationship between speed and driving power can be achieved only with hull shapes whose lines present bent curves providing so-called smooth outlines which, even in their secondary derivatives, do not show any discontinuity. On the basis of this prevalent opinion, which constitutes general knowledge in the shipbuilding art, only hulls with smooth outlines have hitherto been used with such fast-moving ships.

With these known hulls it is necessary that the plates forming the outer skin of the ship be bent to provide the required smooth outlines at least in one direction and frequently, also, in two directions. This requires of necessity the working of the plates that are to be joined to form the ship's outer skin and constitutes a considerable expenditure in terms of time and money in shipbuilding. In addition, it requires the use of rollers, bending presses, patterns, jigs and the like, expensive equipment. Furthermore, in the case of plates that require complex bending processes, the application of heat is, in addition, frequently also necessary. Likewise, costs are incurred in the formation of the ribs which must also be adapted to the shape of the hull to form smooth outlines and which therefore likewise require complicated bending processes also demanding the application of heat. Because of these reasons with regard to efficient operation in service, these costs that have been incurred in the making of a ship's hull has been tolerated because, in that field, the opinion had been prevalent that only with hulls made of smooth outlines was it possible to achieve a justifiable relationship in operation between speed and driving power.

It is an objective and feature of this invention of giving up the hitherto used smooth curves designed for fast-moving ships and to design the hull in such a way that the latter can be manufactured at a comparatively low labor cost. For the purpose of materializing this objective, it is contemplated, in accordance with the invention, that the ship's outer skin be formed exclusively of plane three or multi-cornered surfaces, whereby the angles formed by the abutting edges of various of the surfaces in the planes tangentially positioned along the streamlines when viewed from the interior of the ship, lie within a critical range of approximately from 150 to 180° along the path of the streamlines and do not exceed 120° at the terminals of the streamlines in the stern.

Thus, the invention runs counter to the generally prevalent opinion, which latter constitutes a technical prejudice, and has recognized that it is possible also to build hulls by using plane surfaces for the ship's outer skin, in which hulls, an identical or similarly favorable relationship between speed and driving power can be achieved provided that in using such plane surfaces, certain critical angular relationships are maintained between the respectively adjoining plane surfaces.

The inventor furthermore has found that it is possible to keep down the power-consuming turbulence or wave formation in his novel hulls in such a way that the ship's resistance remains of the same order of magnitude as in the case of a similar ship with smooth outlines, in the event that a normally developed hull with classical curved lines, which are developed on the basis of the most favorable resistance properties, is converted in the inventor's construction in such a way that the main dimensions, displacement, displacement center and the like are preserved; provided, however, in accordance with the characteristic on which the invention is based, the plane surfaces are arranged with respect to one another so as to maintain the indicated critical angles.

The technical advance achieved by a hull constructed in accordance with the invention is considerable and self-evident. It demonstrates itself in a substantial reduction in the expenditure of work and in cost of the making of a hull while maintaining identical or substantially identical service efficiency.

A further feature and characteristic of the invention resides in the fact that the rib planes outside the keel are intersected on each side of the ship by not more than three edges. As a result of this provision, an economic production of the ribs with simple means is possible.

In further development of the invention it is possible to arrange at the hull a per se known bead to promote the speed of the vessel.

Furthermore, in accordance with the invention, it is possible to provide at the stern a per se known propeller tunnel.

As a result of the invention it is possible to build ships having an outer skin of plane surfaces, ships which, with respect to their speed and power requirement, are equivalent in efficiency as compared to hitherto built ships with smooth outlines, while providing substantially simplified building possibilities.

It was found that the hull according to the invention shows, hydrodynamically, a resistance of an identical order of magnitude as a ship with smoothly shaped outlines—in other words, a ship built according to conventional design—as has been thoroughly established by means of towing experiments with several models designed in accordance with the invention.

Other objects and features of the invention will become apparent from the following detailed description and the accompanying drawings forming a part here of and wherein:

FIG. 1 is a side view of a hull according to a first embodiment;

FIG. 2 is an end view of the hull stern;

FIG. 3 is an end view of the bow of the hull illustrated in FIG. 1;

FIG. 4 is a view from below taken on one half section of the keel;

FIG. 5 is a perspective view of the hull illustrated in FIGS. 1–4;

FIG. 6 is a side view of a hull according to a second embodiment;

FIG. 7 is an end view of the hull stern;

FIG. 8 is a cross-section along line VIII—VIII in FIG. 6;

FIG. 9 is a cross-section along line IX—IX in FIG. 6;

FIG. 10 is an end view of the hull bow;

FIG. 11 is a view from below of one keel half section of the hull illustrated in FIGS. 6 to 11;

FIG. 12 is a side view of a hull according to a third embodiment;

FIG. 13 is an end view of the hull stern;

FIG. 14 is an end view of the hull bow;

FIG. 15 is a view from below of one keel half section of the hull illustrated in FIGS. 12 to 14.

FIG. 16 is a diagrammatic figure indicating the plane of measurement of the hull surfaces.

Detailed description

Referring now to the drawings and first to FIGS. 1 to 5, they illustrate a hull intended for inland waters and coastal shipping and driven, for example, by two Voith-Schneider type propellers P. The water line is referred to as WL and the base line (see FIGS. 1 and 3) as BL.

The bow of the hull illustrated in FIGS. 1 to 5 is essentially composed of the plane lateral surfaces **1** and **2** as well as of the bottom plane surface **3**. A bow bead **4** of conventional design for speed is attached appropriately to the aforementioned plane surfaces. Joined to the latter also are the plane surfaces **5**, **6** and **7**. The plane surfaces **6** are connected with the hull side walls **10**, whereas the plane surfaces **7** merge or blend into the plane surfaces **11**. The plane bottom area of the hull is designated by the reference character **9**. The hull stern as seen in FIG. 2 is described below. In the bow, the plane surfaces **1** and **5** respectively at their junction define an edge A and the plane surfaces **5** and **6** at their junction define an edge B, whereas the plane surfaces **6** and the plane sidewalls **10** at their junctions define an edge C. The edges defined between the remaining plane surfaces have not been referred to in detail, but are, however, readily evident from FIGS. 1 to 5.

In order to explain the characteristic according to the invention—which relates to the particular design of the critical angles between the adjoining plane surfaces—in FIG. 1 there has been traced as a broken line the streamline S, the accuracy of which as regarding correctness is not asserted, it serving merely as an imaginary line whose function is to illustrate the characteristics in accordance with the invention.

At that point at which the streamline S intersects the edge A, first tangent T′ has been applied at the streamline S. A second tangent T″ has likewise been applied at the point of intersection of the streamline S with the edge B, and a third tangent T‴ has been applied at the point of intersection of the streamline S with the edge C.

In the plane passing through the respective tangents T′, T″ and T‴, and vertically to the respective edges A, B and C, the critical angles formed between the various surfaces **1–11** must be located and are in the order of 150–180° as viewed from the inside. At the point at which the streamlines S detach themselves from the hull, for instance, in the area of the hull stern—there must also exist certain critical angles likewise defined at junctures of plane surfaces forming the skin of the ship and which amount to less than 120°. In the embodiment shown, such angle ends at a streamline at the level of the water line WL at which the angle between the hull shell and stern plate **13** is less than 120°. The stern illustrated in FIG. 2 consists of the lateral plane surfaces **12**, the bottom surface **13**, the so-called deadwood **14**, as well as the plane surfaces **15**, **17**, **18**, **19** and **21**.

FIGS. 6 to 11 illustrate a ferry suitable for particularly shallow waters, which is likewise provided with two propellers P, each of which being respectively arranged in a screw or propeller tunnel **43**. The bow of the forecastle of the hull illustrated in these drawings consists of the front surface **23**, the bottom surfaces **25**, **26**, **27** and **29**, as well as the side surfaces **30**, **31**, **33**, **34** with the same critical angular relations of 150–180° being maintained. Finally, in the area of the deck, the surfaces **35** and **37** also constitute a part of the forecastle. The forecastle designed in this manner is followed by the lateral walls **38** or **39** and the bottom surface **41** with its side surfaces **42**. Thereupon follows the stern or afterbody illustrated in FIG. 7. The latter consists, among others, of another bottom surface **45** and the screw or propeller tunnel **43** followed by the fin **53**. In other respects, the stern consists of the surfaces **46**, **47**, **49**, **50** and **51** which, in accordance with the invention, are arranged at said certain critical angles of less than 120° with respect to one another.

FIGS. 12–15 illustrate a third and preferred embodiment of the invention. The hull in question is intended for navigation on the high seas and consists also in this case of plane surfaces arranged at said certain critical angle in prism-like positioning with respect to one another.

The hull illustrated in FIG. 12 consists of a forecastle or bow shown in detail in FIG. 14, and the bow head **4**, and the surfaces **54**, **55**, **57**, **58**, **59**, **61**, **62**, **63**, **65** and **66**.

The bow or forecastle illustrated in FIG. 14 is followed by the midship substantially consisting of surfaces **67**, **69** and the surface **54** forming the floor. The midship is followed by the afterbody or stern specifically illustrated in FIG. 13 and showing in the area of the deadwood **14** a centrally arranged propeller P. The stern consists of the surfaces **70**, **71**, **73**, **74**, **75**, **77**, **78**, **79**, **81**. Behind the propeller P there is arranged a fin or a rudder **82**.

The arrangement of these surfaces is shown at FIG. 16 in which the said plane of measurement is indicated at **P1**. FIG. 16 shows two adjoining hull plates **P1** and **P2** which meet at an edge E. Arrows S represent the flow stream traversing the edge E at one particular point X and, in accordance with the above definition, the plane **P1** is defined by the intersection point X where the flow stream S at the design speed sweeps over the edge E. The drawing shows a line T tangential to the flow stream at the intersection point, also a line Y perpendicular to the edge E at the intersection point X. The plane **P1** is that plane which contains the tangent T and the line Y as well as the intersection point X.

As suggested by the specification, the invention relates to a hull for fast-moving ships, in which connection one may consider first and foremost merchant vessels in view of the fact that, in these ships, the economic advantage achieved through the use of plane surfaces is greatest, whereas, in the case of ships used exclusively as passenger or luxury liners, this advantage is considerably reduced as a result of the substantial costs incurred with regard to the interior decorating of such ships. Therefore, with passenger and luxury liners one will probably continue to use the smooth line configuration on account of the more pleasant appearance and elegance of the shape of the hull.

As is known, after the last World War, the demand has been for ever faster merchant ships in view of the fact that the output of the driving plants has increased by a multiple, though they are available at a lesser requirement of space and a lower weight. For this reason,

all merchant ships today travel at speeds above 14 knots, generally 16 to 18 knots, and speeds up to 24 knots no longer constitute a rarity with freighters. This invention relates to ships having such speeds.

While specific embodiments of the invention have been disclosed, variations within the scope of the appended claims are possible and are contemplated. There is no intention, therefore, of limitation to the aforegoing abstract or disclosure as herein presented.

What is claimed is:

1. Hull form for fast-moving ships comprising hull plating, said hull plating comprising primarily flat plates with plane faces, said plates each having at least three stright edges and wherein angles seen from the inside of the ship and formed by the abutting edges of the adjoining plane faces measured in the plane determined:

(a) by the intersection of the edge with streamline at the design speed,

(b) by the tangent to the streamline at the intersection and

(c) by a perpendicular line to the edge at the intersection

lies between 150° and 180° and does not exceed 120° at the end of the streamline.

2. Hull form according to claim **1**, including a foreship section having at least two symmetrically and con-

vergently inclined surfaces, a bottom surface and at leas two symmetrical transition surfaces to permit saic specified angles of the plates in the foreship section tc be maintained in relation to flow lines coming from the bow of said foreship section and passing downwardly to wards a midship section.

3. Hull for fast-moving ships according to claim **1** including at the bow of the ship, a speed-promotin bead.

4. Hull for fast-moving ships according to claim **1** including a propeller tunnel at the stern thereof.

5. Hull for fast-moving ships according to claim **2** in cluding at its bow a speed-promoting bead.

6. Hull for fast-moving ships according to claim 2 including a propeller tunnel at its stern.

References Cited

UNITED STATES PATENTS

23,105	3/1859	Montgomery	115—3
1,359,059	11/1920	Harter	114—6
3,302,603	2/1967	Eckert	114—5

FOREIGN PATENTS

404,603	6/1943	Italy.

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