Oct. 17, 1961 J. NAWARA 3,004,510

SHIP STABILIZERS

Filed Aug. 13, 1958

Fig. 1

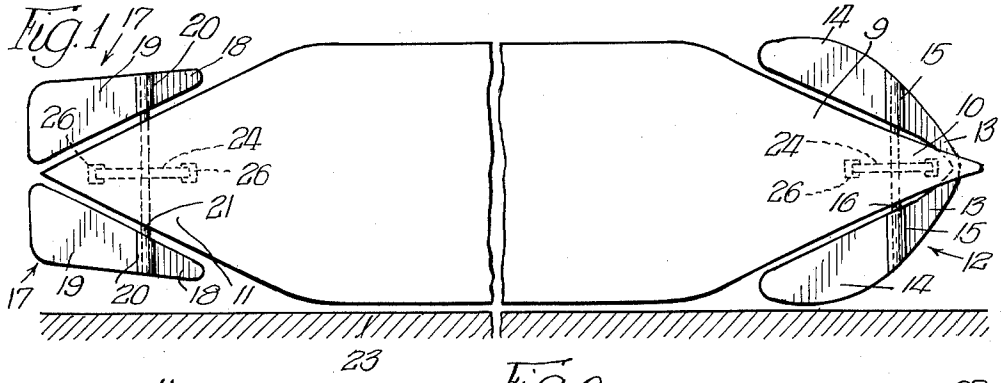


Fig. 2

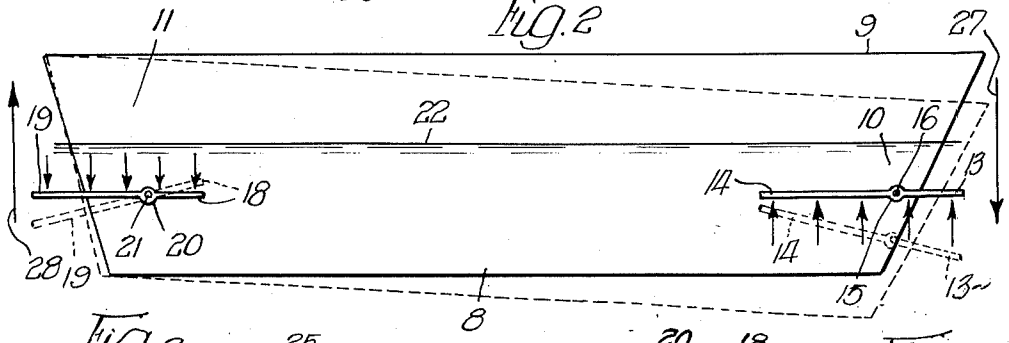


Fig. 3

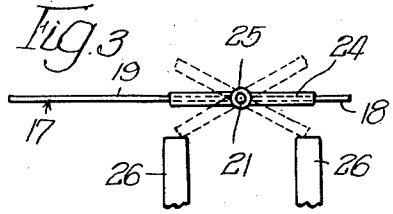


Fig. 4

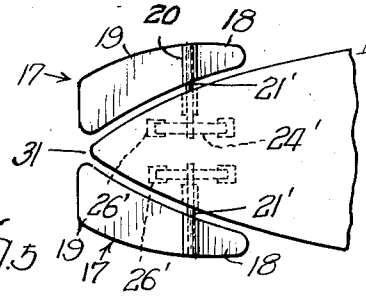


Fig. 5

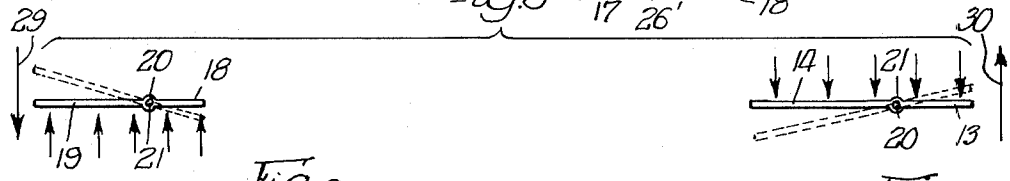


Fig. 6

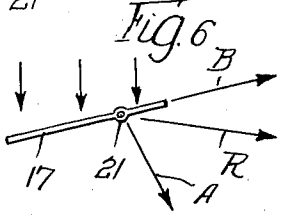
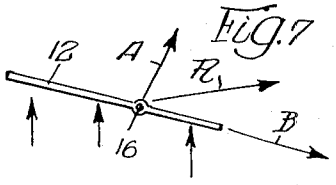


Fig. 7



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3,004,510
SHIP STABILIZERS

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The present invention relates to ship stabilizers and has for its main object the provision of ship stabilizing planes, pivotally supportable both adjacent the bow and the stern of a ship for reducing the pitching motion of a ship.

Another object of the present invention is the provision of substantially horizontal stabilizing planes, positioned below the water level, one pivotally supported adjacent the bow and another adjacent the stern of a ship, the two planes utilizing the alternate water pressures at the under-faces or upper faces of the two planes as the bow and stern of the ship alternately dip and rise for reducing the pitching motion of the ship and thereby for maintaining the ship upon a substantially even keel.

A still further object of the present invention is the provision of means for limiting angular shifting movement of the planes upon their pivots.

A still further object of the present invention is to provide means whereby the pressure of water acting upon the stabilizing plane, from below or above, that is during the dip or rise of a given end of a ship, would be capable of angularly shifting the plane upon its pivot for thereby easing the dip or rise motion of the ship and reconditioning of the plane's operation.

Another object of the present invention is to devise a ship stabilizing plane in such a manner that the resultant force of the water pressure upon the stabilizing plane added to that of the normal propulsion of the ship would be generally to a forward direction, thereby reducing any drag of the water upon the plane to a minimum and adding to the efficiency of the ship's propulsion.

With the above general objects in view and others that will appear as the invention is better understood, the same consists in the novel construction, combination and arrangement of parts hereinafter more fully described, illustrated in the accompanying drawing and pointed out in the appended claims.

In the drawing forming a part of this application, and in which like designating characters refer to corresponding parts throughout the several views:

FIG. 1 is a top elevational view of a ship illustrating an operative position of the stabilizing planes adjacent the bow and the stern of a ship;

FIG. 2 is a side elevational view of a ship, with the stabilizing planes in an operative position therewith, illustrating in dotted lines the operation of the planes during the dip of the ship's bow;

FIG. 3 is a fragmentary side elevational view of the mechanism for limiting the angular shifting motion of a stabilizing plane when under the pressure of water, during the dip or rise of either end of the ship;

FIG. 4 is a top elevational view of the stern of a ship with a pair of stabilizing planes in an operative position, similar to that of FIG. 1, further illustrating separate mechanism for each stern plane for limiting angular shifting movement thereof;

FIG. 5 is a diagrammatical view of the bow and stern planes to illustrate the action of the water pressure thereon from faces opposite from those shown in FIG. 2;

FIG. 6 is a graphic illustration of combined force resulting from the propulsion force of a ship and a water pressure force when acting against the upper face of the plane; and

FIG. 7 is a similar view graphically illustrating the combined force when the water pressure force upon the plane is from the opposite direction, that is against the lower face of the plane.

Referring to the present drawing in detail there is shown a ship, which includes a hull 8, bow 9, prow 10 and stern 11.

The bow stabilizing plane, generally indicated by 12 in FIG. 1, is of generally V-shaped formation and includes forward section 13 and a pair of rearwardly disposed sections 14. Both of said sections 13 and 14 are in a spaced relation with bow 9 of the ship. Each side of the stabilizer plane 12, intermediately of the rear ends of the forward section 13 and the front ends of the rearward sections 14, is provided with transverse tubular bearing 15, for reception therewithin of shaft 16, within which each end of said shaft 16 is rigidly connected. Intermediately of its ends shaft 16 is extended through prow 10 in a transverse relation. It is observed that the rearward sections 14 of the stabilizer plane 12 have a combined surface area corresponding to about two-thirds and the forward section 13 to about one-third of the entire area of the stabilizing plane 12, for the purpose which will be later apparent.

The stern stabilizing plane is made of a pair of sections, indicated by 17 in FIG. 1, each, by its inner edge, in a spaced relation with the sides of stern 11 of the ship. Each of said sections 17 includes forward end 18 and a rearwardly disposed end 19. Intermediately of ends 18 and 19 each section 17 is provided with a tubular bearing 20, for reception therewithin of the ends of shaft 21, wherein said shaft is rigidly affixed. The intermediate central portion of said shaft 21 is passed through stern 11 in a transverse relation. In area the forward end portion 18 of each plane 17 is about one-third, and the area of the rearwardly disposed end portion 19 of each plane 17 is about two-thirds, of the entire area of each plane 17.

Stabilizing planes 12 and 17—17 are positioned upon the ship upon a common horizontal plane, in a longitudinal relation with the ship, and below the water level 22, as is seen in FIG. 2.

It is also noted that the outer edges of planes 12 and 17—17 do not extend outwardly and beyond the vertical plane coincidental with the side of hull 8, as is seen in FIG. 1, in order that said planes may not interfere with wharf or dock 23 when the ship is brought thereto for loading or unloading.

Mounted upon each shaft 16 and 21 at its center point, within prow 10 and stern 11, respectively, and in a transverse relation therewith, is bar 24, in a longitudinal relation with the ship. Centrally each of said bars 24 may be provided with an annular bearing 25 for accommodating therewithin each shaft 16 and 21, wherein each shaft is keyed or otherwise rigidly affixed. Supported vertically within prow 10 and stern 11, as the case may be, is a pair of posts 26, the upper ends of which are in the path of the ends of bar 24, so that one or the other end of each of said bars 24, may alternately come in contact with the end of one or the other of said posts 26, for thereby limiting the angular shifting movement of the stabilizing planes 12 and 17—17, when under the alternate water pressure at the upper or lower faces thereof, all as indicated in FIG. 3.

In the modified construction, illustrated in FIG. 4 each section 17 of the stern stabilizing plane is provided with a separate shaft 21', the inner end of which rigidly connects with bar 24', the angular shifting movement of which is limited by the ends of a pair of posts 26'. Thus, the modified construction shown in FIG. 4 contemplates the water pressure to act independently upon each of said stabilizing plane sections 17.

Referring now to the operation of the stabilizer, shown particularly in FIGS. 2 and 5, if due to the pitching action of the ship brought about by the turbulence of water such

as waves, and if it be assumed that the ship bow 9 dips in the direction indicated by an arrow 27 in FIG. 2, then the pressure of water on the lower face of the stabilizing plane 12 will be increased, said water pressure being indicated by a number of arrows in FIG. 2 pointing to the underface of said stabilizer 12. The water pressure acting upon said stabilizer 12 will eventually shift said plane 12 to the angularly shifted position, indicated by dotted lines in FIG. 2, with the rear ends 14 of the stabilizing plane elevated and with section 13 of the stabilizing plane in a lowered position, due to the fact that sections 14 of the stabilizing plane are larger in area than the area of the forward section 13.

The dipping of bow 9 influences the ship to make an angular shifting movement about its transverse axis, urging stern 11 to shift upwardly in the direction pointed by arrow 28 in FIG. 2. The rising of stern 11 is impeded by the water pressure upon the upper face of the stern stabilizing planes 17—17, as is indicated by arrows in FIG. 2 pointing from above and against the upper faces of said stabilizing planes 17—17. As the stern rises, the stabilizing planes 17 will ultimately assume the position indicated by dotted lines in FIG. 2.

That last referred to position of the stabilizing planes 17—17 will be an angularly shifted position with rearwardly disposed ends 19 of the stabilizing planes disposed downwardly and with the forwardly disposed ends 18 of the stabilizing planes disposed upwardly. This position will result from the greater pressure of water at ends 19 than the water pressure upon the forwardly disposed ends 18 due to the fact that the rearward ends 19 of the stabilizing planes are larger in area than the area of the forwardly disposed ends 18.

FIG. 5 shows the reverse action of the two stabilizing planes when under water pressures at the time when stern 11 of the ship dips, as indicated by arrow 29 and the bow of the ship rises, as indicated by arrow 30 in FIG. 5. When the stern dips the pressure upon stabilizing planes 17—17 is from below, thereby alternately bringing the stabilizing planes 17—17 to the position indicated by dotted lines in FIG. 5, with portions 19 disposed upwardly and forward ends 18 disposed downwardly. The dipping of the stern due to the pitching of the ship causes the ship to angularly shift about its transverse axis, thereby inducing rising of the bow upwardly in the direction pointed by arrow 30. This in turn brings about an increased pressure of water on the upper face of the stabilizing plane 12, and as the rise of the bow continues said stabilizing plane will eventually assume angular position, indicated by dotted lines in FIG. 5, with sections 14 disposed in a downward direction and section 13 disposed in an upward direction, due to the area relationship between the two sections, as hereinabove pointed out.

From what has been said it is apparent that the action of the stabilizing planes 12 and 17—17 is in an alternate fashion. When a greater degree of pressure at one face of the stabilizing plane at one end of the ship takes place, the greater degree of pressure will be engendered at the opposite face of the stabilizing plane at the opposite end of the ship, and vice versa.

The extent of the angular shifting movement of the stabilizing planes induced by the alternate pressure of water at one or the opposite face of each stabilizing plane due to the pitching motion of the ship must necessarily be limited as otherwise the operation of the stabilizing planes would be inefficient. Hence the mechanism, best shown in FIG. 3, for limiting the angular shifting movement of each stabilizing plane to one or the opposite direction, brought about by the ends of bars 24 alternately coming in contact with the adjacent upper end of one or the other post 26, as is indicated by dotted lines in FIG. 3. The degree of the angular shifting movement of the stabilizing planes may be regulated by either shifting posts 26 to or away from bars 24 or shifting said

posts to or away from each other to bring the upper ends of said posts 26 in alinement with any predetermined points of said bars 24 intermediately of shafts 16 and 21, as the case may be, and the ends of each of said bars 24.

It is of course obvious that the water pressure engendered upon one or the other face of the stabilizing planes 12 and 17—17, indicated by the vertical arrows in FIGS. 2 and 5, and brought about by the alternate pitching movement of the two ends of the ship, acts upon the stabilizing planes gently due to the fact that the said water pressure has to overcome the normal pressure acting upon the opposite faces of the stabilizing planes. Thus, the action of the stabilizing planes is not abrupt but is cushioned, thereby permitting gradual easing of the ship during its pitching movement.

Although the present invention was primarily designed for the purpose of imparting a degree of stability to the ship by minimizing the extent of the ship's pitching movement, the stabilizing planes will at the same time act upon the ship in a transverse direction for minimizing the rolling action of the ship due to the action of waves thereon.

FIGS. 6 and 7 graphically illustrate that the combined forces represented by arrows R, resulting from the force of water pressures upon the stabilizing planes, as represented by vector A, and the force of ship propulsion to move the ship forwardly, as represented by vector B, which latter force is in a continuing planar relation with the stabilizing planes, are to a forward direction and substantially parallel to the ship's motion.

It is further observed that planes 12 and 17—17 could be adapted for use in connection with submersible vessels such as submarines. In connection with such vessels a simple mechanism could be devised to lock the planes in their predetermined angular position in either direction for facilitating diving or surfacing of the vessel.

The stern stabilizing plane 17—17 is preferably made in two separate plates, and not of a homogeneous construction as stabilizing plane 12, for the purpose of effecting space 31 between the ends of sections 19, adjacent their inner edges, for accommodating therewithin a rudder (not shown).

It is to be understood however that the bow stabilizing plane 12 need not be made of a single homogeneous plate, but may be slit at its apex, thereby effecting a pair of stabilizing planes 12, each disposed laterally of the bow 9. The separate planes 12 may be supported upon a single shaft 16, having a single rocking limiting bar 24, as in seen in FIG. 1, or separate shafts, corresponding to shafts 21', shown in FIG. 4, may be employed, with separate bar 24' employed with each separate shaft to limit its rocking movement in either direction.

It is further noted that if the upper end of the rudder does not extend past said planes 17 in an upward direction, then the rearwardly disposed portions 19 of said planes 17 may be interconnected, thereby eliminating space 31.

From what has been said, it is to be understood that stabilizing planes 12 and 17—17 may be made of homogeneous plates, surrounding, in a spaced relation, the bow and the stern of a ship, respectively, or optionally said planes may be slit upon the vertical plane coincidental with the ship's keel to define a pair of laterally disposed planes with relation to the ship's bow and stern, respectively. It is therefore to be understood that the reference in this description to the bow and stern stabilizing planes shall include the homogeneously formed stabilizing planes as well as planes formed in two lateral sections.

The increased degree of water pressure resulting from dips and rises of the ship's ends upon the respective faces of stabilizing planes 12 and 17—17, as indicated by arrows in FIGS. 2 and 5, not only overcomes the normal water pressure acting upon the planes at the opposite faces thereof, but is also capable of permitting angular

shifting movement of the leading ends of said planes in the direction counter to the said increased degree of water pressure. This last result is due to the fact that the rearmost ends of said planes have a greater area than the area of the leading ends thereof. The end result of the action of the increased degree of water pressure upon the stabilizing planes is that the angular shifting movement of the planes, to assume their ultimate angularly shifted positions, indicated by dotted lines in FIGS. 2 and 5, is not abrupt, sudden or jerky, but is gradual, even and smooth, thereby cushioning the dips and rises of the ship's ends, while at the same time retarding, diminishing or impeding the extent of the dips and rises of the ship's ends.

While there are described herein preferred embodiments of the present invention, it is nevertheless to be understood that minor changes may be made therein without departing from the spirit and scope of the invention as claimed.

What I claim as new is:

1. In a ship having a bow, including a prow, and a stern, a stabilizer comprising a substantially V-shaped planar member in embracing, spaced relation with the bow, a shaft extended through the prow in a transverse relation, the side portions of said planar member being rigidly affixed to the ends of said shaft, the rearward end portion of said planar member past said shaft having greater area than the forward end portion of said planar member, a second planar member having portions extending in spaced relation with the sides of the stern, a shaft extended through the stern in a transverse relation, the side portions of said second planar member being rigidly affixed to the ends of said last named shaft, the rearward end portion of said second planar member past said last named shaft having greater area than the forward end portion thereof, both said planar members being disposed upon a common horizontal plane in a longitudinal relation with the ship and below the water level, said planar members being capable of angular shifting movement in a vertical direction due to the water pressures thereon resulting from the wave induced motions of the ship, the two shafts being capable of rocking motion imparted thereto by the angular shifting movement of the respective planar members, and means supported within the ship for limiting the rocking motion of said shafts for thereby limiting the angular shifting movement of said planar members in either direction.

2. In a ship having a bow, including a prow, and a stern, a unitary stabilizer having a first portion extending along a side of the bow and forwardly therefrom, a second portion extending along the other side of the bow and forwardly therefrom, said portions defining a V-shaped recess for receiving the bow of the ship therein, a shaft extended through the prow in a transverse relation, said portions adjacent their forward ends being rigidly affixed to the ends of said shaft, the area of said portions rearwardly of said shaft being greater than the area thereof forwardly of said shaft, a second stabilizer comprising a pair of plane sections in a spaced relation with the sides of the stern and extending rearwardly therefrom, a shaft extended through the stern in a transverse relation, said plane sections adjacent their forward ends being rigidly affixed to the ends of said last named shaft, the end portions of said plane sections rearwardly of said last named shaft having greater area than the end portions thereof forwardly of said last named shaft, both pairs of stabilizers being disposed upon a substantially common horizontal plane in a longitudinal relation with the ship and below the water level, the pairs of said stabilizers being capable of alternate angular shifting movement in a vertical direction induced by the alternate increase of water pressure upon one or the opposite faces of each pair of said stabilizers resulting from the alternate dips and rises of the ends of the ship, the two shafts being capable of rocking motion induced by the angular shifting movement of the respective pairs of said stabilizers, and means supported within the ship for limiting the rocking motion of said shafts for thereby limiting the angular shifting movement of each stabilizer in either direction.

3. In a ship having a bow, including a prow, and a stern, a unitary stabilizer comprising a pair of plane sections in a spaced relation with the sides of the bow and defining a substantially V-shaped recess for receiving the bow therein, a shaft extended through the prow in a transverse relation, said plane sections adjacent their forward ends being rigidly affixed to the ends of said shaft, the end portions of said plane sections rearwardly of said shaft having greater area than the end portions thereof forwardly of said shaft, a pair of plane sections in a spaced relation with the sides of the stern, a shaft extended through the stern in a transverse relation, said latter plane sections adjacent their forward ends being rigidly affixed to the ends of said last named shaft, the end portions of said last named plane sections rearwardly of said last named shaft having greater area than the end portions thereof forwardly of said last named shaft, both pairs of said plane sections being disposed upon a substantially common horizontal plane in a longitudinal relation with the ship and below the water level, the pairs of said plane sections being capable of alternate angular shifting movement in a vertical direction induced by the alternate increase of water pressure upon one or the opposite faces of each pair of said plane sections resulting from the alternate dips and rises of the ends of the ship, the two shafts being capable of rocking motion induced by the angular shifting movement of the respective pairs of said plane sections, a pair of transverse bars each rigidly connected intermediately of its ends with each of said shafts, and a pair of posts supported within the ship in an alined relation with each of said bars, normally the ends of said posts being in a spaced relation with the ends of each of said bars, during the rocking motion of said shafts one or the opposite end of each of said bars being adapted to come in contact with the end of one or the other of said posts for limiting the angular shifting movement of each pair of said plane sections in either direction.

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