

July 4, 1944.

E. L. BLACKMAN

2,353,007

SAILING VESSEL

Filed Oct. 8, 1940

2 Sheets-Sheet 1

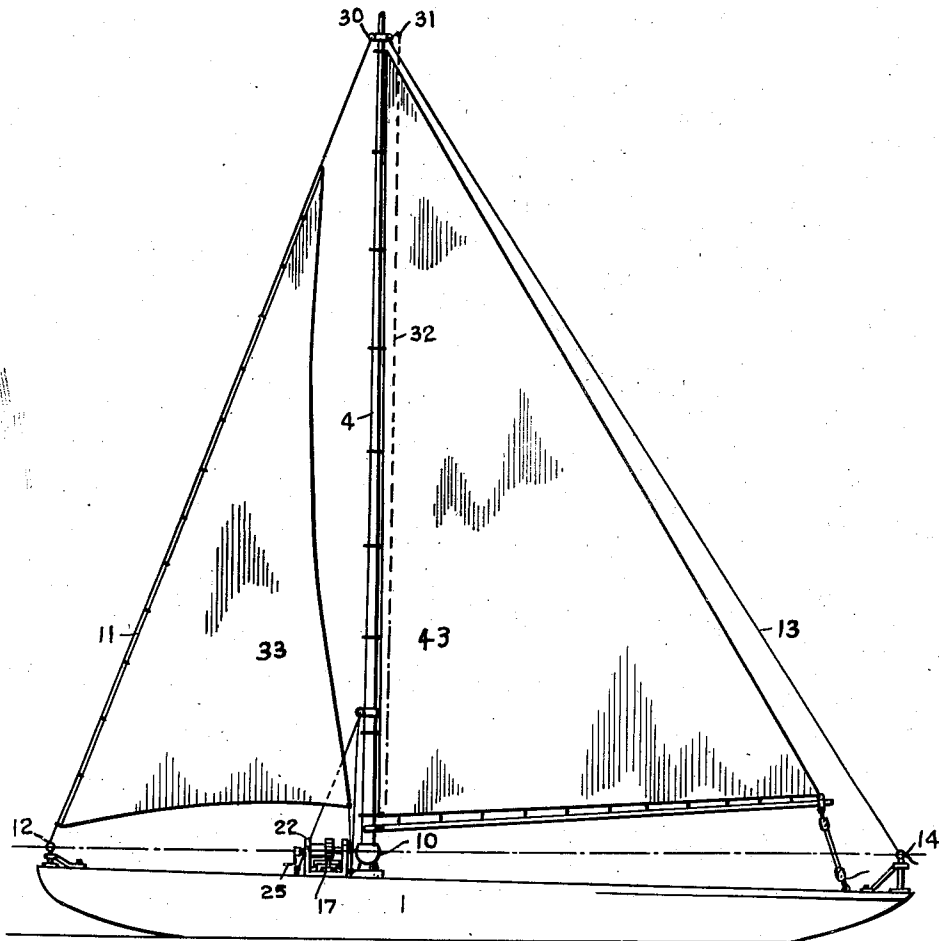
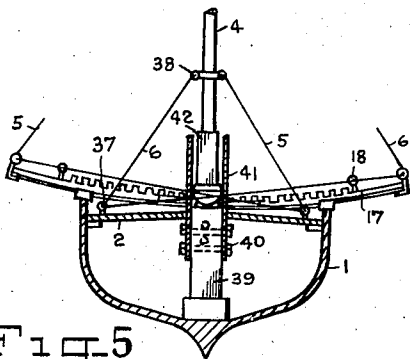


Fig-1



F15-5

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2 Sheets-Sheet 2

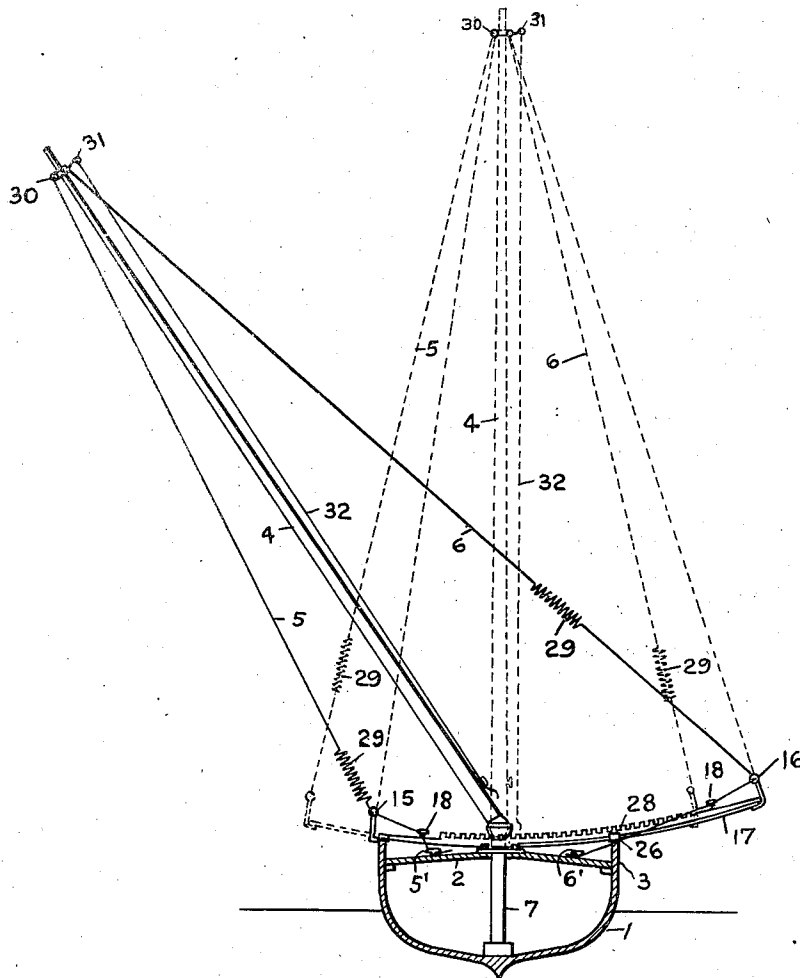


Fig 2

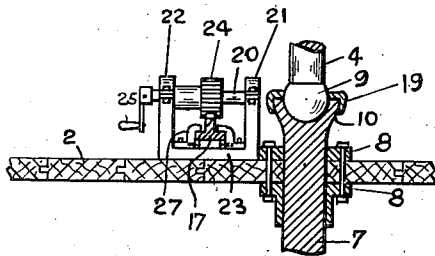


Fig-3

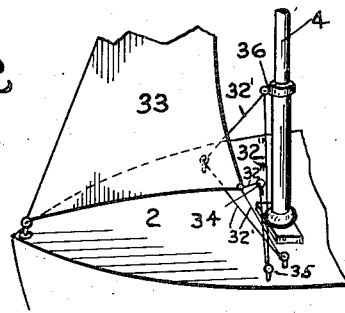


Fig-4

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UNITED STATES PATENT OFFICE

2,353,007

SAILING VESSEL

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Application October 8, 1940, Serial No. 360,239

13 Claims. (Cl. 114—91)

The improvements relate to sailing vessels and have for their objects, among others, to provide an improved mast and rigging construction so as to ensure greater efficiency of operation, speed of the vessel and safety against capsizing or injury to the vessel or its rigging by sudden or unusual wind.

It is often desirable in the case of a sailing vessel to have the mast adjustable so that it will not remain at all times approximately normal to the plane of the deck of the vessel. By permitting the mast to incline to leeward the center of thrust of the sail is moved toward the leeward and thus the force of the wind tends to press the vessel further to windward, making it point higher and reducing the leeway. So, also, if the mast is inclined toward leeward and if the angle with the plane of the deck is less than 90°, the vessel will not careen to leeward as far under the same weight of wind as it would if the mast were perpendicular to the deck.

This fact offers several advantages. First, the steering of the vessel is easier and the rudder does not act as a brake to the same effect as it does when the vessel is heeling materially, second, the vessel being heeled less, offers a smaller amount of surface of the bottom to the action of the wind, thus driving less to leeward and allowing the wind to act more upon the sail and less upon the hull of the vessel, and, third, the vessel sailing on or near an even keel offers less resistance to the water and makes better headway. The improvement in steering and the safety factor are obvious.

In other circumstances it may be desirable to have the mast canted to windward rather than to leeward so that the angle between the mast and the plane of the deck to leeward of the mast is greater than 90°. One of the advantages of this position is that if the breeze is not too strong the heeling of the boat to leeward will place the mast in an upright or approximately upright position perpendicular to the plane of the sea, so that the sail will receive the full force of the breeze instead of spilling a portion thereof over the top.

The desirability of adjusting the plane of the sail from side to side has been recognized and devices for accomplishing that result have been developed. None of these devices, however, has proven to have been entirely practical, but the following is, it is believed, a simple and practical

means for accomplishing to a large extent at least what has been so often attempted.

The plan comprises a mast similar to that in everyday use except that at a point at or slightly above the deck of the vessel the mast is jointed or made movable so that it will lean to one side or the other of the vessel and toward the bow or stern as pressure is applied. The mast is held in an upright position or a position approximately upright partly by means of stays, one leading toward the bow and one toward the stern, and one or more to each side of the vessel and partly by means of springy members attached rigidly to front, back and sides of the stump of the mast and extending upward beyond the joint so as to provide a support but a yielding one to maintain the mast in an upright position or one nearly so. The bow-stay and the back-stay hold the mast in rigid position longitudinally, except that by taking in on the bow-stay and letting out on the back-stay the mast may be tipped forward, and vice versa.

The side-stays or shrouds are not fastened to the side of the hull or to the gunwale but engage a preferably metal member mounted athwart the ship somewhat longer than the width of the vessel. This member is fitted with gear teeth which are engaged by a gear forward of the mast and which is operated by a crank. The member may be shifted backwards and forwards so that it will protrude upon whichever side of the vessel it is desired. The length of this rod or piece of metal may be approximately one and one-half times the width of the vessel at the point where it crosses the deck. Thus, by turning the gear, the member can be made to extend a few feet beyond either side of the vessel as desired. The side desired would naturally be the windward side, and the reason for having the extension beyond the gunwale is to provide a greater angle at the point where the shroud joins the mast at or near the top thereof. When in position, the member should be flush with the side of the deck on the leeward side and extending outwardly on the windward side, after the manner of an outrigger. The side stays or shrouds should be so arranged that they will have a substantial amount of yield or give, and when a blast of wind that would be sufficient to heel the boat substantially under ordinary circumstances strikes the sail, the windward stay will yield so that the mast will incline several degrees to leeward. This of course reduces the amount of heeling of the hull by

approximately the same number of degrees as those by which the mast is canted to leeward.

The giving of the windward shroud or stay can be accomplished either by having the metal member to which the shroud is attached made flexible and springlike, or by having the shroud attached to a spiral or other spring which is in turn attached to the cross member. The form of the member is arcuate with a radius equal to the distance between the point at which the shrouds are attached to the mast at or near its upper end and the point at which the said member touches or approaches the mast above the deck. The reason for this arcuate form is so that when the strip or member is shifted from side to side the tension on the shrouds on both sides of the vessel will remain approximately the same.

An important feature of the device is that the points at which the bow-stay and the back-stay are attached, and the point at which the mast is hinged should all be substantially in one vertical plane and aligned. This is so that both sails, jib and mainsail in one masted vessels, will move over like the leaves in a book and that the relative positions of both sails shall be the same no matter what the position of the mast with respect to the deck may be. Of course if the jib sheet were cleated to the mast, and if the main sheet were fastened at a point equally distant from each side of the stern, the whole operation would be substantially automatic and there would be no necessity for any shifting of the sails because of the tipping of the mast. However, sails are not usually or properly so fastened. The jib sheet is fastened to a point leeward of the mast so that there is a more or less downward pull on the jib, and if the mast is canted to leeward there will be a slacking on the jib sheet. This, however, can be taken care of automatically by passing the jib sheet first through a block or eye to leeward of the mast and then through a block to windward of the mast and then attaching the sheet to the mast above the joint, so that when the mast moves to leeward and there is a shortening of the distance between the clew of the jib and the point at which the jib sheet passes through the leeward eye or block, the slack is taken up by the tightening of the line extending from the leeward pulley to the windward pulley. In most positions the slacking effect will be greater than the tightening effect on the pulley to windward, but this can be compensated for by using a two-way pulley and increasing the tightening effect, as compared to the loosening effect. The same automatic adjustment can be made with respect to the mainsail. As the mast is inclined to leeward the distance between the top of the sail and the point at which the main sheet is attached to the traveller at the stern will become less and therefore the main sheet will be eased slightly when the mast is tilted to leeward. But this also can be automatically compensated for by a pulley to windward of the mast through which the main sheet is passed, and then attached to the mast at a point above the joint so that the motion of the mast to leeward tightens this line.

Another adjustment to be taken care of is the slacking of the shrouds to leeward due to the fact that when the mast tilts to leeward the shrouds or stays on that side are slackened. To accomplish this adjustment and maintain both windward and leeward stays taut so that the mast will not whip or have any free movement on its pivot, the end of the leeward stay may be run through a pulley to the windward of the mast and then

attached to the mast or a short extension of the mast so that the movement to leeward will hold the leeward stay taut. By tightening the stays on one side and letting out on the other the mast may be given a cant to either side.

In addition to the advantages obtained by inclining the mast from side to side, there are advantages in inclining it forward and aft. Thus, when sailing before the wind when the breeze is light, it is advantageous to incline the mast forward, but when the weight of the breeze is sufficient to have a burying tendency, it would be advantageous to incline the mast toward the stern.

An embodiment of the improvements is illustrated in the accompanying drawings in which—
Fig. 1 is a side view of a sloop exemplifying such embodiment;

Fig. 2 is a vertical medial section of the hull of the same just before the mast;

Fig. 3 is an enlarged detail and longitudinal vertical section substantially through the mast post of Fig. 2, illustrating outrigger and shroud operating devices;

Fig. 4 is a diagram of the means for taking up slack in the sheets; and

Fig. 5 is a vertical cross section showing a modified embodiment.

In the said drawings, 1 represents the hull, 2 the deck, 3 a bulwark, 4 the mast, 5 and 6 the shrouds.

The mast 4 is mounted in the top of a post or bottom mast section 7 stepped in the bottom of the hull and passing through and secured to the deck by means of ring plates 8. This mounting is by means of the ball and socket joint composed of the ball 9 on the bottom of the mast and the socket 10 on the top of the post and permits the mast to swing thereon in all directions to the extent permitted by its stays.

The fore stay 11 is secured to the bow by means of an eye bolt 12 and the back stay 13 to the stern by means of a similar bolt 14, both stays being suitably connected at the same elevation near the top of the mast and both ring bolts being substantially in line with and at the same elevation above the water line of the boat as the ball and socket joint 9, 10, so that the mast and fore and aft stays will swing laterally with respect to the hull as on one pivot. This permits them to swing, with the sails spread thereon after the manner of the leaves of a book or a door on its hinges.

The shrouds 5 and 6 pass over small sheaves 15 and 16 mounted on the ends of the shiftable outrigger 17 and through suitable guides 18 on the latter to the cleats 5' and 6' on the deck to which they are belayed. The mast may be swung fore and aft by taking in and letting out the fore and aft stays at the eye bolts without operating the shrouds. It is held in its socket by a keeper 19. It will be understood that the shrouds may be composed of two or more ropes or cables suitably secured to the hull.

The shiftable outrigger 17 slides through suitable guides 20 on the top of the bulwarks 3 and also the guides 27 on the base 23. It is preferably T-shaped in cross section and its cross member is held in the guides so that it can have no other than lengthwise sliding motion. This sliding motion is produced by the gear 24 keyed to the shaft 20 journaled in posts 21 and 22, when rotated in one direction or the other by the crank 25, the said gear engaging the rack 28 on the upper edge of the outrigger bar 17.

The outer portions of this bar are tapered so as to give them a limited spring, the bar being made preferably of tempered steel. It will be observed that the outrigger bar is arcuate in form, its curvature being on a arc described as a radius by the mast between the point of shroud securements and its socket. It will also be seen that the lowest portion of the curved outrigger bar is close to the deck and in the same plane as the socket of the mast. In this way it is provided that the shiftable outrigger, mast and shroud can all work in unison. The main function of the shiftable outrigger 17 is to increase the distance between the pivotal mounting of the mast and the points of engagement 15, 16 of the shrouds on the windward side of the vessel, so that the pull of the mast on the shrouds is better resisted by them and the strain reduced.

The shrouds are made extensible to a limited degree by incorporating in them springs 29, so that under a sudden blast or pressure of wind the mast will be permitted to yield to a certain extent as the springs expand, and under the slight flexibility of the outrigger ends. However, when material canting of the mast is required the lengthening of the stays on one side and shortening on the other is employed, in connection with the springs.

Various other modifications may also be made without departing from the scope of the present improvements.

In the diagram of Fig. 4, which is in perspective, the jib sheet 32' of the jib 35 is run through an eye bolt or small pulley 34 secured to the deck at one side of the mast, thence through another similar eye or pulley 35 on the opposite side and thence to the mast well above its pivot where it is secured as indicated at 36. The duplicate sheet 32' is similarly run and secured. The result of this arrangement is that when the mast is canted to one side or the other, thereby slacking off the jib sheet, this slack is taken up immediately and automatically by the pull of the mast thereon, and the jib thereby held snug and in proper position with respect to the mast and the mainsail 43.

In the modified construction shown in Fig. 5 the shrouds 5 and 6 are run from the ends of the shifting outrigger 17 through the guides 18 to and through eyes or blocks 37 on the opposite side of the deck and thence to the mast at 38, so that when the mast is forced to one side or the other the leeward shroud will be taken in and the windward shroud let out automatically, and any suitable means may be employed to brake or check this movement and the movement of the mast, and also to take in any slack in the leeward shroud, if necessary. The springs 29, however, will take care of this slack in all ordinary cases.

In this figure there are also shown devices for absorbing and diverting the thrust of the mast when it is canted. The post or stump of the mast 39 in this case may be made of rectangular cross section and to each of its four sides is bolted, as shown at 40, a flexible brace 41 adapted to bear against one of the flat outer sides of the mast sleeve 42, all these parts being preferably made of metal. The result of this is that when the mast is tilted to one side or the other or fore or aft, it presses against and flexes one of the braces 41, relieving sudden tension on the shroud or stay and causing the members to impart lateral pressure to the post 39 so that the jointed mast acts largely after the manner of an ordi-

nary one piece mast stepped on the keel and the thrust or pressure of the mast on the post in a direction opposite to that to which it is canted is opposed.

The shrouds and stays are secured to a ring 30 fixed to the masthead and a clamping device 31 operated by a line 32 running to the deck may be provided.

What I claim is:

1. A sailing vessel comprising a hull, a mast with which it is fitted, a sail carried by said mast, a flexible joint for the mast near its base and between it and said hull so that it may be moved to incline forward or backward or to either side, stays fore and aft of the mast and shrouds on either side thereof by which said mast is held in the desired position and by the taking in and slacking of which the mast may be so moved, the said stays and shrouds being secured to the upper part of the mast and to the hull and said stays secured to the hull at points which are approximately in the horizontal plane passing through the joint for the mast.

2. A sailing vessel comprising a hull, a mast with which it is fitted, a sail carried by said mast, a universal joint for the mast near its base and adjacent the deck of said hull so that it may be moved to incline forward or backward or to either side, stays fore and aft of the mast secured to the hull at points which are approximately in the horizontal plane passing through the mast joint and shrouds on either side thereof by which said mast is held in the desired position and by the taking in and slacking of which the mast may be so moved.

3. A sailing vessel comprising a hull, a mast with which it is fitted, a sail carried by said mast, a universal joint for the mast near its base and above and adjacent the deck of said hull so that it may be moved to incline forward or backward or to either side, stays fore and aft of the mast secured to the hull at points which are approximately in the horizontal plane passing through the mast joint and shrouds on either side thereof by which said mast is held in the desired position and by the taking in and slacking of which the mast may be so moved.

4. A sailing vessel comprising a hull, a mast with which it is fitted, a sail carried by said mast, a joint for the mast near its base and between it and said hull on which it can move to incline forward or backward or to either side, stays fore and aft of the mast and shrouds on either side thereof by which said mast is held in the desired position and by the taking in and slacking of which the mast may be so moved, the said stays and shrouds being secured to the upper part of the mast and to the hull.

5. A sailing vessel comprising a hull, a mast with which it is fitted, a sail carried by said mast, a joint for the mast near its base and between it and the said hull on which it can move to incline forward or backward or to either side, stays fore and aft of the mast and shrouds on either side thereof by which said mast is held in the desired position and by the taking in and slacking of which the mast may be so moved, the said stays and shrouds being secured to the upper part of the mast and to the hull, and resilient members in said shrouds above the hull.

6. In a spar and rigging construction of a sailing vessel, a mast, a flexible joint for connecting said mast to the hull of a vessel and permitting it to incline either to starboard or port as desired, a fore or jib stay and a back stay con-

structed and arranged to be so attached to the vessel that each of said points of attachment and the said joint of the mast will all lie in substantially the same plane and will be substantially aligned, so that when the mast is inclined to either side the sails of the vessel will retain the same relative positions and so that neither the fore-stay nor the back stay will be slackened or tightened by the movement of the mast from side to side, the construction and arrangement being such that the several points mentioned being in the same plane the mast with the sails and the fore and aft rigging thereon will turn on a line drawn through the several points as on a hinge.

7. In a vessel, a mast mounted thereon to swing laterally toward both sides thereof, an arcuate member longer than the width of the vessel at the point where the mast is located, shrouds connected therewith and to the upper part of the mast, said member being so constructed and arranged that it can be readily shifted from side to side so that it can be made to protrude beyond the side of the vessel on the windward side on any tack, thereby providing a greater angle for the support of said shrouds and mast on the windward side without substantially tightening or loosening the shrouds on either side.

8. In a vessel, a mast pivoted thereon to swing laterally toward both sides thereof, a laterally movable member at least equal to the width of the vessel at the point where the mast is located, shrouds connected therewith and to the upper part of the mast, said member being so constructed and arranged that it can be readily shifted from side to side so that it can be made to extend beyond the side of the vessel in the windward side on any tack, thereby providing a greater angle for the support of said shrouds and mast on the windward side without substantially tightening or loosening the shrouds on either side.

9. In a vessel, a mast pivoted thereon to swing laterally toward both sides thereof, a laterally movable member at least equal to the width of the vessel at the point where the mast is located, shrouds connected therewith and to the upper part of the mast, said member being so constructed and arranged that it can be readily shifted from side to side so that it can be made to extend beyond the side of the vessel on the windward side of any tack, thereby providing a greater angle for the support of said shrouds and mast on the windward side without substantially tightening or loosening the shrouds on either side, means for mounting said member movably on the vessel and means for shifting it from side to side while so mounted.

10. In combination with the hull of a vessel, a mast pivoted thereon to swing athwartship, a sail carried by said mast, stays fore and aft of the mast, shrouds on either side of the mast and connected with the hull and the upper part of the mast by which the mast is held in the desired positions, the shroud on each side having an extension running from a point near one side of

the hull to the opposite side of the mast and thence to the mast above the hull, means for connecting each shroud with the hull at said point, opposite side and with the mast, whereby when the mast is canted to leeward the leeward shroud will be taken in and the windward shroud let out automatically.

11. In combination with the hull of a vessel, a mast thereon, a sail carried by said mast, a support for said mast mounted in the hull and extending to the upper part thereof, a flexible joint between said mast and support permitting the former to swing on the latter, extensible shrouds secured to the hull and to the mast permitting said mast to swing and spring members connected with said support and extending above the mast joint to bear against the mast when it is canted, said yielding members being constructed and arranged to produce a lateral thrust on the support when moved by pressure of the mast opposite in direction to that of the mast's movement and to distribute said pressure, and said members acting to retard oscillatory movement of the mast.

12. In combination with the hull of a vessel, a mast pivoted thereon to swing athwartship, a sail supported by said mast, stays fore and aft of the mast, shrouds on either side of the mast and connected with the hull and the upper mast by which the mast is held in the desired positions, the said sail having two lines connected with its lower part running to different sides of the hull then to the opposite sides and thence to the mast above the hull, whereby tilting of the mast laterally toward one side causes the lower part of the sail to be drawn toward that side with the mast.

13. In a vessel, a hull, a mast pivoted thereon to swing laterally toward both sides thereof, a laterally movable member mounted athwart the hull and at least equal to the width of the hull at the point where the mast is located, shrouds slidably connected therewith and secured to the upper part of the mast, said member being so constructed and arranged that it can be readily shifted from side to side so that it can be made to extend beyond either side of the vessel thereby providing a greater angle for the support of said shrouds and mast on one side than on the other, each of said shrouds extending laterally beyond the mast to a point on the hull on the side thereof opposite the location of the connection of the shroud with the laterally movable member, a fixed connecting member between each shroud and the hull in which connection said shroud is slidable said connecting member located at said opposite point, each said shroud extending beyond said connecting member and upwardly to the mast above the pivot of the mast, and a connection there between the shroud and the mast, whereby when the mast is canted to one side of the vessel the shroud on that side is automatically taken in and the shroud on the opposite side paid out.

EDWARD L. BLACKMAN.