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Roeser

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[54] **MAST WITH MOVABLE SAIL ATTACHING MEANS**

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[52] **U.S. Cl.** **114/112**

[51] **Int. Cl.** **B63n 9/08**

[58] **Field of Search** 114/112, 90, 89, 102

[56] **References Cited**

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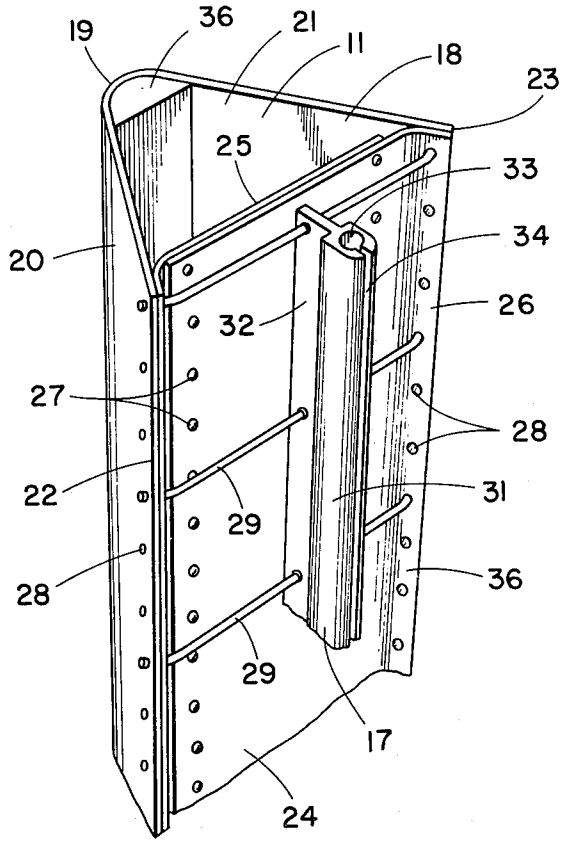
Primary Examiner—Trygve M. Blix

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[57] **ABSTRACT**

A mast is equipped with a series of attachment devices for permitting the sail to move to the leeward side of the mast as the direction of the wind relative to the mast changes. The mast includes an elongated body having a generally A-shaped cross section which includes a forward edge and a pair of diverging sides. An extended clip or a series of wire loops attach the sail to the mast and extend along the aft portion of the body, and a series of rod like structures extend laterally from one side of the body to the other to permit the luff attaching devices to move to the leeward side of the body.

10 Claims, 6 Drawing Figures



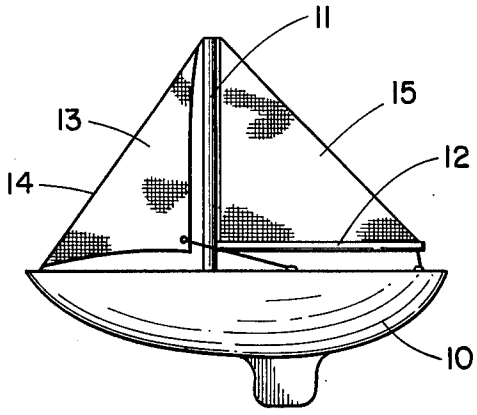


FIG.1

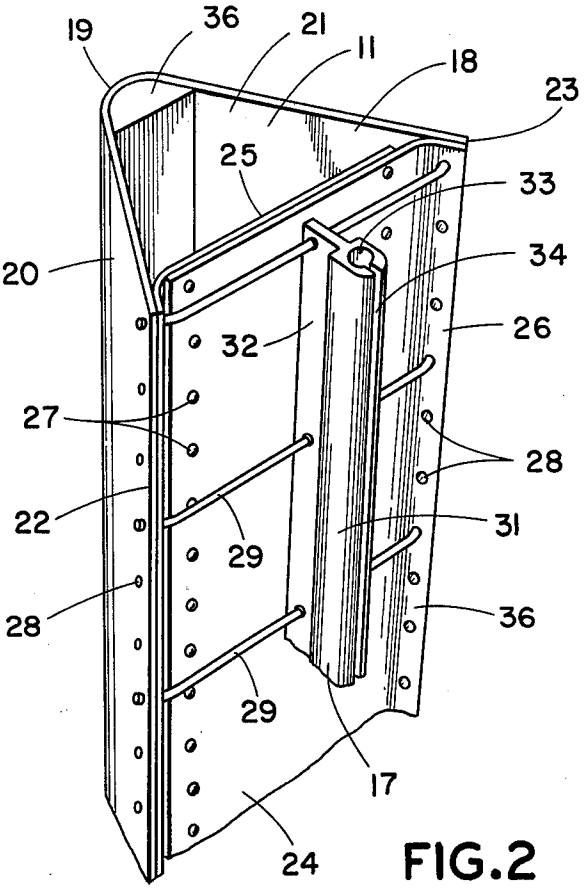


FIG.2

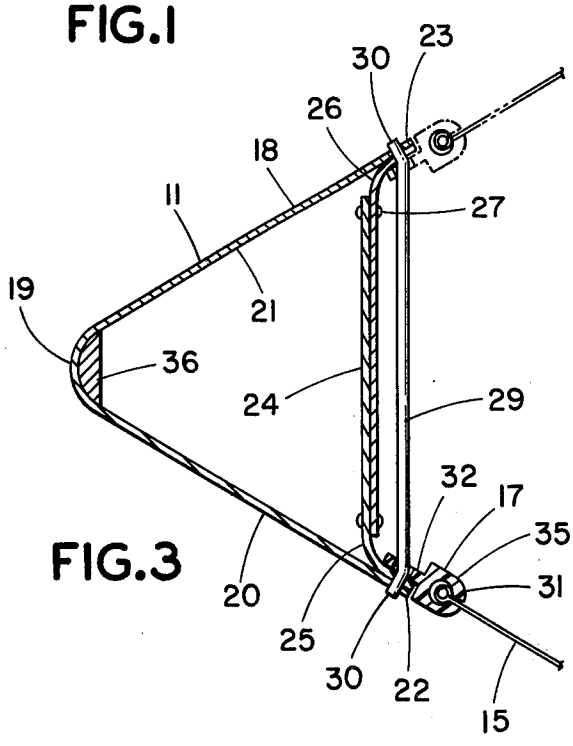


FIG.3

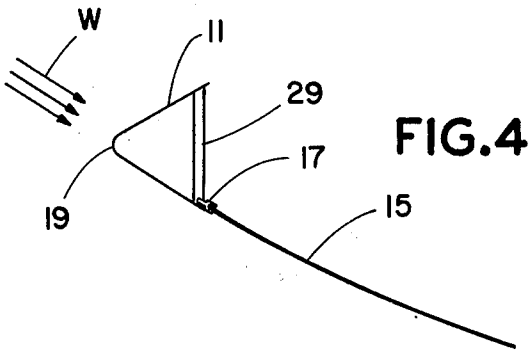


FIG.4

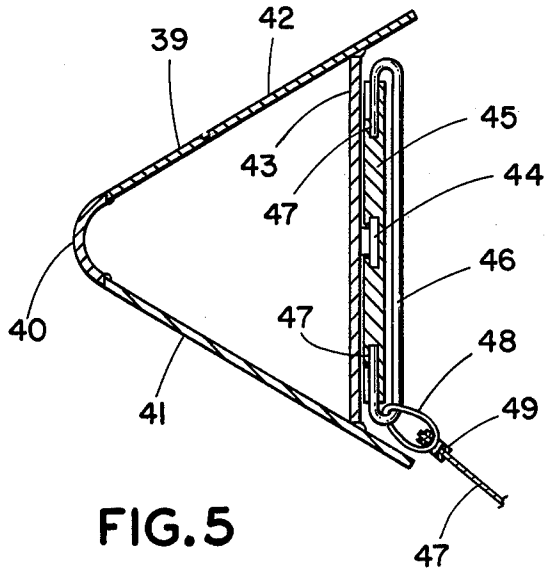


FIG.5

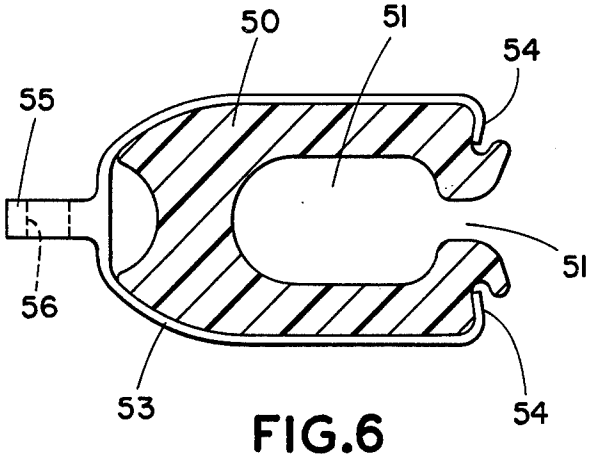


FIG.6

MAST WITH MOVABLE SAIL ATTACHING MEANS

BACKGROUND

This invention relates to masts, and, more particularly, to a mast which is equipped with means for permitting the sail to move from one side of the mast to the other.

The mast of a sailboat provides a turbulent wake which is disturbing to the air flow over the mainsail and which greatly reduces the efficiency of the sail. It is now known that the position of the mast in relation to the sail is extremely important, and adverse effects of the mast can be reduced by positioning the mast to windward of the sail i.e., the sail should extend from the leeward side of the mast. Further, it is desirable to minimize the gap between the mast and the sail to provide a smooth air flow over the mast and the sail.

However, any means for permitting the sail to be positioned on the leeward side of the mast should not unduly increase the weight of the mast since weight aloft affects the pitching action of the boat. The moment of enertia of any weight is proportional to the square of its distance from the center of gravity of the boat, and one pound of weight at a masthead 32 feet from the center of gravity has about 1,000 times the effect a one pound weight that is one foot above the center of gravity.

Sails comprised of two sections or wings which are secured on opposite sides of the mast have been provided, each wing being secured to a separate luff which is secured to the mast by suitable luff-attaching means. However, double luffs are illegal in most racing competition, and it may be desirable to have a mast which can be used for both competitive and pleasure sailing.

SUMMARY

The invention provides a mast which is equipped with lightweight luff-attaching means which permit the luff to move easily from one side of the mast to the other depending upon the direction of the wind relative to the mast. The mast has a generally A-shaped cross section, and the aft edges of the mast extend rearwardly beyond the luff-attaching means to provide a smooth air stream over the point where the sail is attached to the mast. The mast becomes part of the sail in an aerodynamic sense, i.e., its area flows into the sail when beating, and the flat aft wall adds to the mainsail when running before the wind and provides a cupped edge which is more efficient on the run than the usual rounded mast section. The mast can be formed from sheet aluminum to minimize the weight, and a tapered mast can be provided by overlapping and securing individual tapered sections. My mast is stiffer laterally than conventional masts but more flexible in a fore and aft direction. Flexibility is desirable for high performance boats since it is been found helpful to have the middle of the mast bow forward in high winds.

DESCRIPTION OF THE DRAWING

The invention will be explained in conjunction with illustrative embodiments shown in the accompanying drawing, in which

FIG. 1 is an elevational view of a conventional sailboat equipped with a mast, a jib, and a mainsail;

FIG. 2 is a fragmentary perspective view of a mast formed in accordance with my invention;

FIG. 3 is a sectional view taken through the mast of FIG. 2;

FIG. 4 is a schematic view illustrating the sail positioned on the leeward side of the mast;

FIG. 5 is a view similar to FIG. 3 shown showing another embodiment of the mast; and

FIG. 6 is an enlarged sectional view of a modified luff.

DESCRIPTION OF SPECIFIC EMBODIMENTS

Referring first to FIG. 1, the numeral 10 designates a sailboat which is equipped with a generally vertically extending mast 11 and a boom 12 which extends aft from the mast above the deck of the boat. A jib sail 13 is secured to a forestay 14 which extends from the bow of the boat to the masthead, and a mainsail 15 is secured to the mast and the boom.

Referring now to FIGS. 2 and 3, the mast 11 includes an elongated body 16 and an elongated luff or sail-attaching member 17 which extends longitudinally along the body and is movably mounted thereon. The body 16 is generally A-shaped in transverse cross section and is formed from a V-shaped metal sheet 18 which includes a leading or forward edge 19 and a pair of sides 20 and 21 which diverge at an angle of about 60° and terminate in aft edges 22 and 23.

A rear wall 24 extends between the sides of the body adjacent the aft edges, and, in the embodiment illustrated in FIGS. 2 and 3, the rear wall 24 is formed from a pair of overlapping metal sheets 25 and 26. The sheets overlap over the major portion thereof and are secured by vertically spaced rivets 27 adjacent each overlapped edge. The outer edge of the sheet 25 curves rearwardly adjacent the inner surface of the side 20 and the outer edge of the sheet 26 curves rearwardly adjacent the inner surface of the side 21. These rearwardly curved edges are suitably secured to the side, as by rivets 28.

A plurality of longitudinally spaced rods 29 are spaced rearwardly of the rear wall 24 and extend transversely between the legs of the A-shaped body. The major portion of each rod extends parallel to the major portion of the rear wall 24, and the end portions 30 of each rod are bent forwardly and extend through openings in the end portions of the sheets 25 and 26 and the sides 20 and 21. Although the bent end portions 30 will secure the rods against any rearward force which is likely to be exerted on the rods, additional securing means can be used if desired to anchor the rods to the body.

The luff 17 comprises an elongated extruded plastic member having a body 31 and an attaching portion 32 through which rods 29 extend. The size of the openings in the attaching portion 32 are such that the luff can slide freely on the rods from one side of the mast to the other. The body 31 is provided with a central groove 33 and a rearwardly extending slot or mouth 34.

The mainsail 15 includes a conventional luff rope 35 which is attached to the sail, and the sail is attached to the mast by inserting the luff rope into the groove 33 at the bottom of the luff so that the sail extends through the slot 34. The luff rope slides freely within the groove, and the sail can be quickly hoisted up the mast.

If desired, a nose stiffener 36 which can be formed of wood or other suitable material can be secured to the inner surface of the leading edge 19 to reinforce the mast.

FIG. 4 schematically illustrates the mast and the sail during beating, the wind indicated by the arrows W. The luff 17 moves freely under the influence of the wind along the rods 29 to the leeward side of the mast, and the body portion 31 of the luff forms a smooth continuation of the outer surface of the side 20 of the mast (FIG. 3). The sail streams smoothly from the luff, and the attaching portion 32 of the luff closes any gap which might otherwise exist between the body portion and the aft edge of the mast to prevent air from flowing therebetween.

If the wind changes direction or if the boat tacks, the luff is free to slide along the rods 29 to the other side of the mast, as illustrated in phantom in FIG. 3, so that the sail can assume the most efficient postion relative to the mast. If the boat is running before the wind, the flat rear wall 24 adds additional area to the mainsail, and the rear edges of the side 20 and 21 and the plates 25 and 26 which extend rearwardly beyond the central portion of the plates 25 and 26 provide a cupped configuration which is more efficient than the usual rounded mast.

The particular mast illustrated in FIGS. 2 and 3 is formed of sheet aluminum. Since sheet aluminum is only 12 feet long, a plurality of sections 37, 38, etc. can be formed and then joined together. If it is desired to have a tapered mast, each section can be tapered by tapering the V-shaped sheet 18 and the rear sheets 26 and 27 individually before assembling. Each section is then joined to adjacent sections by lap plates which are suitably secured to each section, as by rivets. The smaller upper section of a tapered mast gives less wind drag and provides a more efficient sail in the important upper parts which can be effected so severely by mast wake since the sail chord is short up high and the mast is larger in proportion.

By using sheet aluminum rather than the usual extruding grade of aluminum, aluminum having greater tensile strength can be used. For example, in one specific embodiment sheet aluminum 2024 T3 having a tensile strength of 70,000 psi was used. Extruding aluminum 6061 T6 has a tensile strength of only 45,000 psi. Although the mast section could be extruded, the weight of the resulting mast would be greater than forming the mast from aluminum sheet, and providing a tapered mast would be more difficult. The mast could also be assembled from suitable aluminum alloys which are welded together.

Another embodiment of the mast is illustrated in FIG. 5. The mast 39 includes a leading edge 40 which is formed from a longitudinally cut section of pipe and a pair of rearwardly extending diverging side walls 41 and 42 which are suitably secured to the leading edge portion, as by welding, and which form an included angle of 60°. A rear wall 43 extends between the sides 41 and 42 forwardly of the rear edges thereof and carries an elongated track 44 which is generally T-shaped in cross section. The track 44 extends for the entire length of the mast, and a plurality of slides 45 having central grooves corresponding to the cross sectional shape of the track can slide vertically along the track. Each slide 45 carries a generally C-shaped rod 46 which extends laterally from adjacent one of the sides 41 to adjacent the other side 42, and each rod includes laterally inwardly extending end portions 47 which are secured in the slide.

A mainsail 47 is secured to the rods 46 by wire loops 48 which extend through eyelets 49 secured to the luff of the sail. The sail is secured to the mast by slipping the slides 45 onto the bottom of track 44 as the sail is raised. After the sail is raised, the sail can slide freely along the rods 46 to either side of the mast. In one specific embodiment each slide was 4½ inches wide and 3½ inches long, and a total of twelve slides were attached to the mast.

Another embodiment of luff means which can be used with either of the masts is illustrated in FIG. 6. The elongated extruded luff 50 is similar to the luff described in my copending application entitled "Attaching Apparatus For Sail," Ser. No. 352,899, filed Apr. 20, 1973, to which reference may be had for details. The luff includes a central groove 51 and a slot 52 through which the sail may extend. The clip 53 is similar to the clip described in the aforementioned application and includes a pair of rearwardly extending ends 54 which extend inwardly around rear shoulders on the extruded member and a forward attaching portion 55 which is provided with an opening 56 for the rods 29 or 46. A clip is secured to the luff for each rod, and the clips and the luff can slide freely along the rods.

While in the foregoing specification a detailed description of specific embodiments of the invention was set forth for the purpose of illustration, it is to be understood that many of the details herein given may be varied considerably by those skilled in the art without departing from the spirit and scope of the invention.

I claim:

1. A mast comprising an elongated body having a top and a bottom and a forward portion and an aft portion, a pair of sides extending rearwardly from the forward portion, and sail-attaching means extending longitudinally adjacent the aft portion of the body and attached thereto for attaching a sail to the mast, the sail-attaching means including luff-attaching means for holding the luff of a sail and slide means extending transversely across the aft portion of the mast for slidably supporting the luff-attaching means for lateral movement said luff attaching means whereby the luff-attaching means and the luff can move laterally from one side of the mast to the other on the slide means as the direction of the wind relative to the mast changes.

2. The structure of claim 1 in which the slide means includes a plurality of longitudinally spaced rods which extend transversely between the sides of the body of the mast.

3. The structure of claim 2 in which each rod is secured to the body of the mast at a fixed position along the length thereof.

4. The structure of claim 3 in which the luff-attaching means is formed of extruded plastic.

5. The structure of claim 3 in which each of the rods extends through the side of the body.

6. The structure of claim 2 in which the luff-attaching means includes an elongated attaching portion through which the rods extend, the attaching portion being engageable with each side of the mast body when the sail moves to that side to substantially close any air gap between the sail-attaching means and the mast.

7. The structure of claim 1 in which the luff-attaching means is provided with a longitudinally extending groove for slidably receiving the luff of the sail.

8. The structure of claim 1 in which the aft portion of the body includes a rear wall extending between the

sides of the mast and longitudinally extending track means mounted on the rear wall, the sail-attaching means comprising a plurality of slides slidably mounted on the track means for longitudinal movement therealong, the slide means comprising a tranversely extending rod secured to each slide and extending laterally between the sides of the mast body.

9. In combination, an elongated mast and a sail having a luff, the sail being slidably attached to the mast for transverse sliding movement, the mast having a top and a bottom and a forward portion and an aft portion, a pair of sides extending rearwardly from the forward portion, a plurality of longitudinally spaced rods extending transversely between the sides, and elongated luff-attaching means for holding the luff of the sail, the luff-attaching means being slidably mounted to the rods for transverse movement between the sides of the mast and being provided with a longitudinally extending groove which receives the luff of the sail whereby the luff-attaching means and the luff can move laterally from one side of the mast to the other on the rod as the direction of the wind relative to the mast changes.

10. The structure of claim **9** in which the luff-attaching means includes an elongated attaching portion through which the rods extend, the attaching portion baing engageable with each side of the mast body when the sail moves to that side to substantially close any air gap between the luff-attaching means and the mast.

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