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[54] **BOATS AND OTHER DEVICES DRIVEN BY A SAIL**

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[51] **Int. Cl.** **B63h 9/04**

[58] **Field of Search** 114/39, 102, 103

[56] **References Cited**

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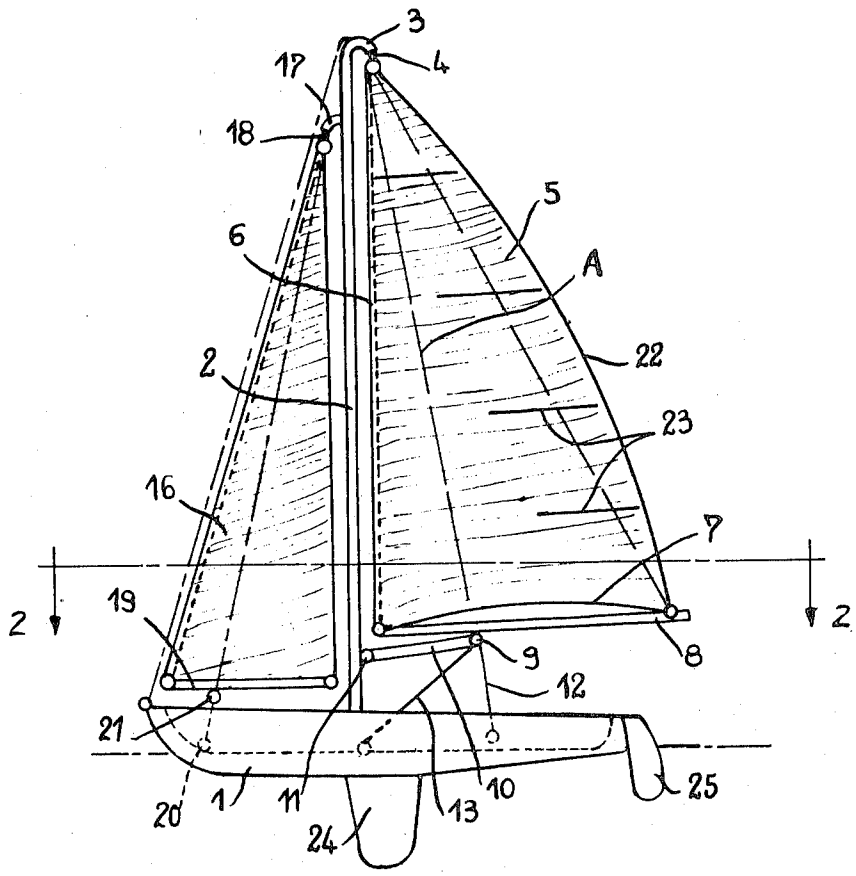
[57] **ABSTRACT**

A sailing boat with a mainsail pivotable about an axis extending obliquely to the mast. An upper end of the mainsail is pivotably connected to the mast and lower ends of the sail are attached to a yard pivoted intermediate its ends on an end of a boom pivoted at its other end on the mast.

4 Claims, 5 Drawing Figures



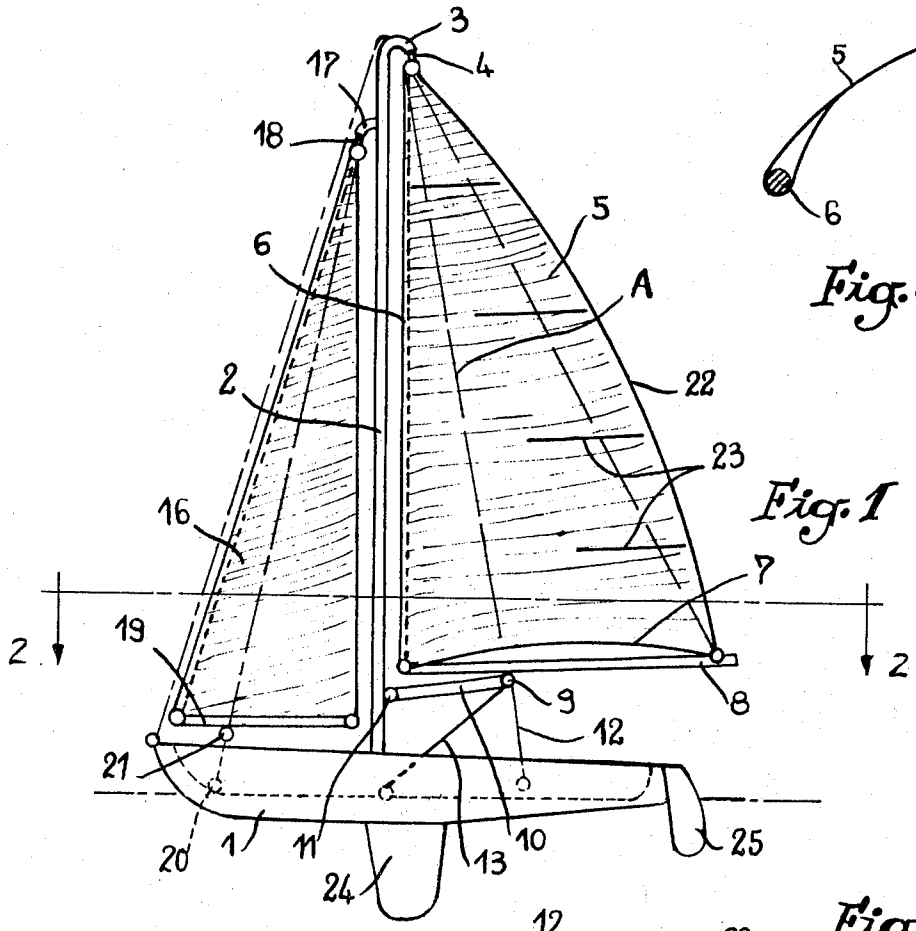


Fig. 1

Fig. 3

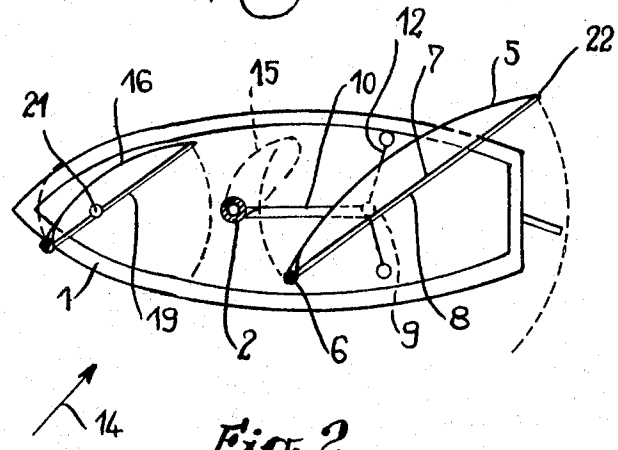


Fig. 2

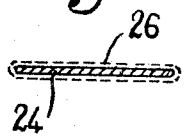


Fig. 4

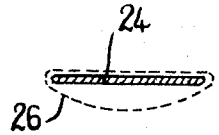


Fig. 5

BOATS AND OTHER DEVICES DRIVEN BY A SAIL

The present invention relates to sailing-boats or other sailing craft driven by the action of a sail.

It is known that the use of a sail requires the presence of a mast which unfortunately causes eddy-currents harmful to the operation. Thus, when sailing with aerodynamic efficiency, these eddy-currents constitute a very considerable source of disturbance in the action of the wind on the sail and may be compared with that which frost gives rise to on an aircraft wing. It should be noted that this drawback is independent of the orientation of the boom to which the bolt-rope of the lower edge of the sail is attached, since this boom pivots about the mast.

It is the object of the present invention to remedy the preceding drawback and to make it possible to construct a sailing-boat or other device with a sail in which the action of the wind on this sail is not affected by the presence of the mast.

Furthermore, it is the object of the invention to produce a sailing-boat in which the increase in power resulting from the elimination of disturbances caused by the mast, does not involve a risk of drifting or overturning.

According to a first feature of the invention, in a sailing-boat or other device comprising at least one sail, the latter no longer pivots about the mast, but around a pivot point remote from the latter.

In a preferred embodiment, the top of the sail is pivoted to a pivot arranged at a certain distance from the top of the mast, whereas the bolt-rope of its lower edge is attached by its ends to a yard in turn appropriately pivoted at a point located at an appropriate distance from the base of the mast. It will be understood that the two aforesaid pivot points define an oblique axis with respect to the mast, such that the leading edge of the sail is normally located outside the eddy zone created by the latter.

The yard may in particular be pivoted to a boom whereof one end is attached to the mast, whilst the other is kept in a fixed position by an appropriate system of downhauls.

Pivoting the top of the sail to the mast may advantageously be achieved by making the latter tubular and giving it an upper end in the shape of a swan's neck of appropriate radius. It is thus sufficient to make fast the top of the sail to a rope passing inside the mast constructed in this manner.

The invention is applicable not only to the main sail of the device, but possibly also to its jib. In this case, owing to the lesser surface area of the latter, the pivoting of the lower yard may take place directly to the hull of the device, without using an intermediate boom.

According to another feature of the invention, with a view to increasing the stability of a sailing-boat making use of the first feature above-described without at the same time having to increase the dimensions of its stabilizer members (keel, rudder cheek), a resilient film is applied to the latter which, when sailing with aerodynamic efficiency, separates from the wall on the side forming the extrados, thus producing a much more favourable profile for flow without eddy-currents. Naturally, the space comprised between the film and the surface of the member must be connected to the outside to allow expansion, preferably at the top and at the bottom in order to ensure the removal of gases possibly occluded.

The accompanying drawing, given as an example, will make it easier to understand the invention, the features which it comprises and the advantages which it is able to provide:

FIG. 1 is a side view of a sailing-boat to which the invention is applied,

FIG. 2 is a horizontal section on line 2—2 (FIG. 1).

FIG. 3 is a detailed section of the leading edge of the sail,

FIG. 4 is a diagrammatic section of the keel, the sailing-boat being assumed to be moving forwards before the wind,

FIG. 5 is the same view as FIG. 4 but with the sailing-boat moving forwards with a side wind.

The sailing craft shown in FIG. 1 comprises a hull **1** on which is mounted a mast **2.** The latter is tubular and its upper end is curved rearwards in the shape of a swan's neck as shown at **3,** Passing inside the mast **2** is a halyard **4** to which is attached the top corner of a sail **5.** As shown, the front bolt-rope **6** of the latter is otherwise completely independent of the mast **2.** As regards the lower bolt-rope **7,** its ends are attached in the vicinity of the leading and trailing corners of the sail to a yard **8** which is in turn pivoted at a point **9** along its length (at approximately one third of the latter from the front in the example shown) to a boom **10** in turn pivoted on the mast **2** at **11.** The end of this boom **10** remote from the mast **2** is held by a double downhaul **12.** In the example shown, a third downhaul **13** has also been provided between this end and the base of the mast to facilitate the orientation of the boom **10** as will be described hereafter.

It will be understood that when sailing with aerodynamic efficiency, with the wind coming from the side (arrow **14** in FIG. 2) it is possible to orientate the sail **5** at the desired angle by rotation of the yard **8** about the pivot point **9** in the manner shown in FIG. **2,** this yard being kept at the orientation by any appropriate means not shown, for example by a sheet system. Under these conditions, the sail **5** rotates about the geometric axis A and its leading edge, i.e., the bolt-rope **6** is not in the eddy zone **15** produced by the mast **2** in the wind's eye. The efficiency of this sail is thus considerably increased.

Naturally, the halyard **4** leaves the mast **2** at the bottom of the latter in order to be able to hoist the sail and spread it.

It is also possible to pivot the boom **10** by a limited angle about the mast for moving the bolt-rope **6** further away from the latter if it is considered necessary. To this end, any appropriate boom sheet device may be used.

At the front, the sailing-boat illustrated in FIGS. **1** and **2** also comprises a jib **16,** pivotally mounted in a manner similar to that described for the main sail.

In order to support the top of this jib so that it is able to rotate, the mast comprises, at the desired height, a second swan's neck **17** orientated forwards and from which emerges a halyard **18** to which the jib is attached. The lower bolt-rope of the latter is attached to a yard **19** pivoted on the hull at **20** by means of a single downhaul **21.** Here too, the orientation of this yard may be ensured by any appropriate means not shown. Thus, a better counter-balancing and greater overall efficiency of the wind is obtained.

Naturally, the same pivoting device could be provided for the jib **16** as for the sail **5** and conversely, at least for small sailing-boats, the main sail could be pivoted in the manner described for the jib.

To further improve the aerodynamic efficiency of the sail (or of the jib) it is also possible to adopt the arrangement shown in FIG. **3.** According to this arrangement, the sail **5** has been folded around the bolt-rope **6** in order to produce a profile similar to that of an aircraft wing. The efficiency of the sail is thus considerably improved.

Otherwise, the sail **5** may comprise any desired shape inscribed in the geometric triangle of tension or projecting therefrom at the rear, as shown at **22** in FIG. **1,** with or without stiffening battens such as **23.**

The devices which have been described make it possible to considerably increase the efficiency of any device comprising a sail whether floating or on wheels. Nevertheless, when they are applied to an existing sailing-boat, they have the drawback of considerably increasing the tendency of the latter to drift and overturn.

To remedy this without requiring an expensive transformation of the sailing-boat, it is provided to equip the stabilizer members and anti-drift device (namely the so-called keel **24** and rudder cheek **25** in FIG. **1**) with a casing made from a thin resilient film normally located against the useful surfaces of these members.

When sailing forwards (with a leading wind) the film **26** (FIG. **4**) remains uniformly flat against the corresponding member, namely the keel **24** in the example shown. Thus, the resistance to forwards movement is not modified.

On the other hand, as soon as one is sailing with aerodynamic efficiency (FIG. **5**) this film is moved away under the effect of the drop in pressure prevailing on the corresponding side of the keel until a profile is achieved which reduces and makes this drop in pressure uniform. One thus obtains a uniform flow of water around the keel, without the formation of eddy-currents, i.e. with a minimum resistance to forwards movement.

Naturally, in order that the film **26** may adopt the shape shown in FIG. **5,** it is necessary that the space which it defines with respect to the keel is able to fill with water from a zone which is not under reduced pressure. To this end, several holes are provided in said film in the vicinity of the lower end of the keel. Since, on the other hand, it is appropriate that the aforesaid space cannot fill with gas, which would make it elastic and would give it the possibility of vibrating inopportunely, holes are also provided in the upper part of the casing constituted by the film, above the useful area of the keel.

The film **26** may form a bag in one piece in which the keel **24** or other stabilizing member and/or anti-drift device is placed. It may also be made from several pieces stuck to this keel or the like, along its front edge and rear edge.

Furthermore, it must be understood that the preceding description is only given as an example and that it in no way limits the scope of the invention, from which one would not diverge by replacing the details of the embodiments described by any other equivalents. Thus, as has been pointed out, the invention may be applied not only to sailing-boats but also to any mobile or stationary devices using one or more sails, for example to sail-carts. It can also be used to advantage in the field of aerial navigation and for constructing wind-mills comprising several sets of masts and sails mounted on a common hub, these wind-mills also being able to serve as fans if provided with mechanical energy instead of requiring them to produce same.

What is claimed is:

1. An improved sail arrangement for sailing craft having a mast, comprising:

a sail having a leading edge extending substantially upwardly and having a lower edge extending approximately horizontally, the upper end of the sail being pivotally supported in the vicinity of the head of the mast,

a yard underlying said lower edge of the sail and attached thereto at least at the leading and trailing corners of the sail,

a boom pivotally supported at its forward end near the base of the mast below the yard, and the boom being connected near its other end to the yard at a pivot point intermediate the ends of the yard, and

downhaul means connected between the boom and the sailing craft and operative to pivot the boom through an angle about the mast to selectively move said pivot point transversely of the craft.

2. The sail arrangement as set forth in claim **1,** wherein the head of the mast has a swan-neck portion extending from the mast in a direction to overlie said boom, and the upper end of the sail terminating in an upper corner fixed to said swan-neck portion to form a second pivot point, and said pivot points defining an oblique axis about which said sail can pivot.

3. The sail arrangement as set forth in claim **2,** wherein said mast and swan-neck portion are hollow, and a halyard extending through the mast and through said swan-neck portion and fixed to said upper corner of the sail, and the sail pivoting about said halyard.

4. The sail arrangement as set forth in claim **2,** said sail having a bolt-rope extending the length of its leading edge and the sail comprising a fabric material folded about said bolt-rope to form a pocket to receive the rope, whereby the leading edge of the sail is provided with a thickened aerodynamic profile when viewed in cross-section.

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