United States Patent [19]

Jastrab

[11] **3,802,371**

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[54] **SAILING RIG**

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[21] Appl. No.: **230,331**

[52] **U.S. Cl.** **114/102,** 114/39

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

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

[56] **References Cited**

UNITED STATES PATENTS

3,142,282	7/1964	Nichols	114/102
685,943	11/1901	Pool	114/39

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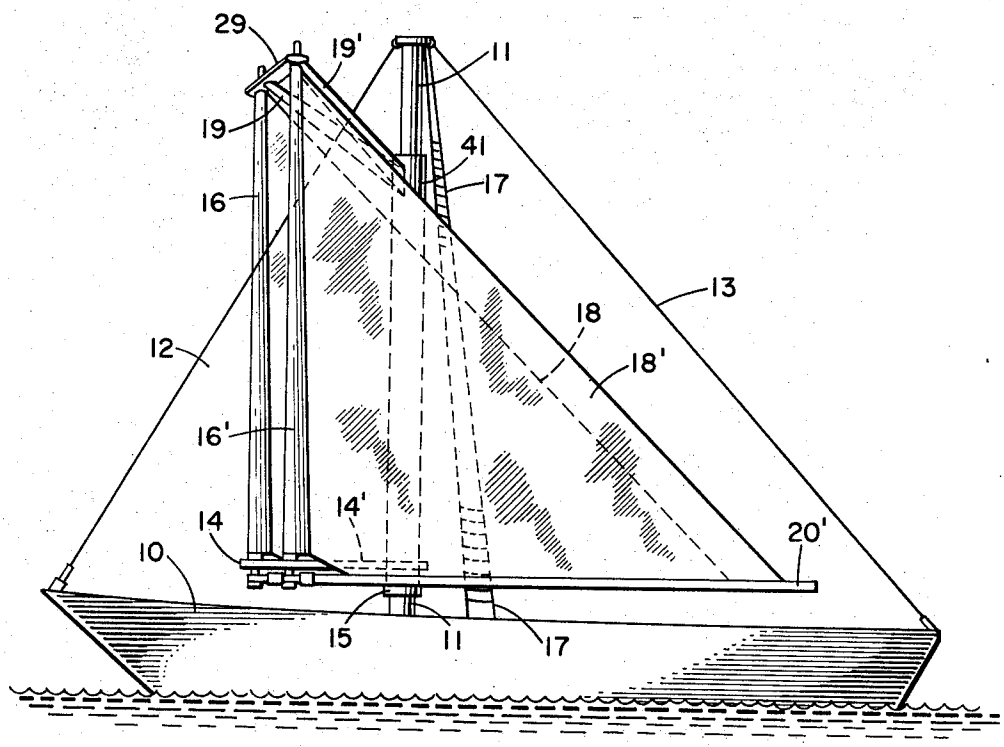
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Primary Examiner—Trygve M. Blix
Assistant Examiner—Stuart M. Goldstein
Attorney, Agent, or Firm—Haynes N. Johnson

[57] **ABSTRACT**

Sailing rig for a sailing vessel in which a pair of sails are transversely spaced from each other and on opposite sides of a main mast mounted on the centerline of the hull. These sails are both supported by the main mast by means whereby the sails may pivot relative to each other independently about their respective pivot axes, which pivot axes are fixed relative to each other and are rotatable as a unit about the main mast.

9 Claims, 11 Drawing Figures



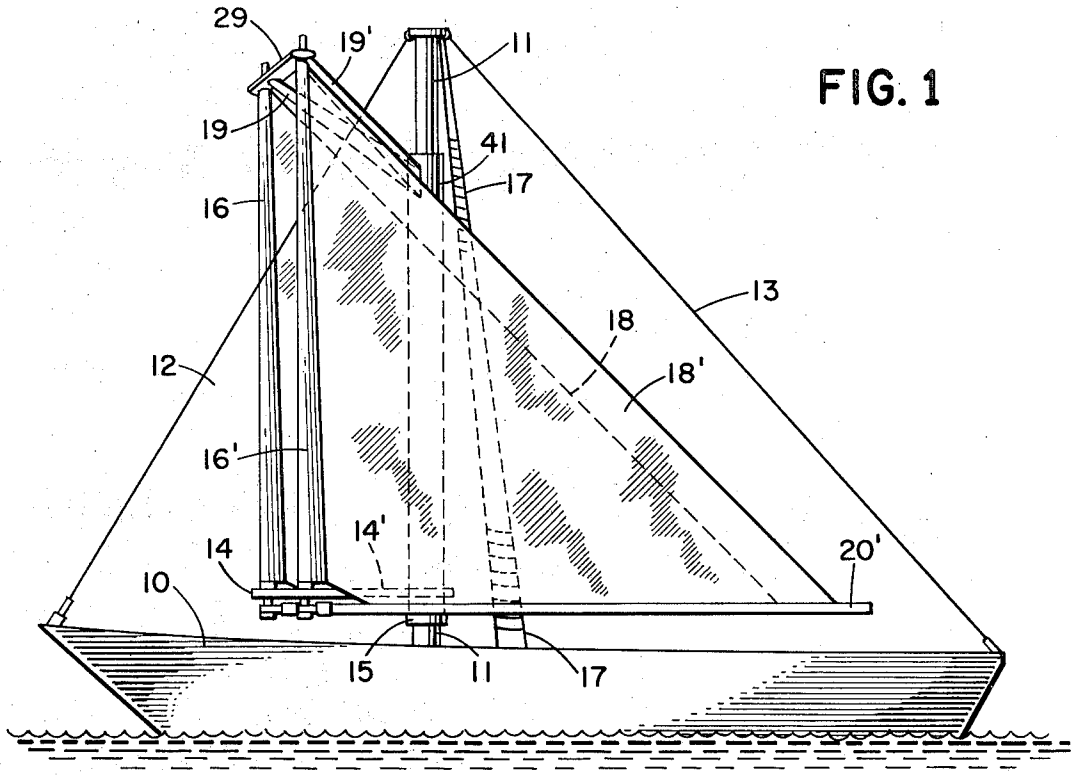


FIG. 1

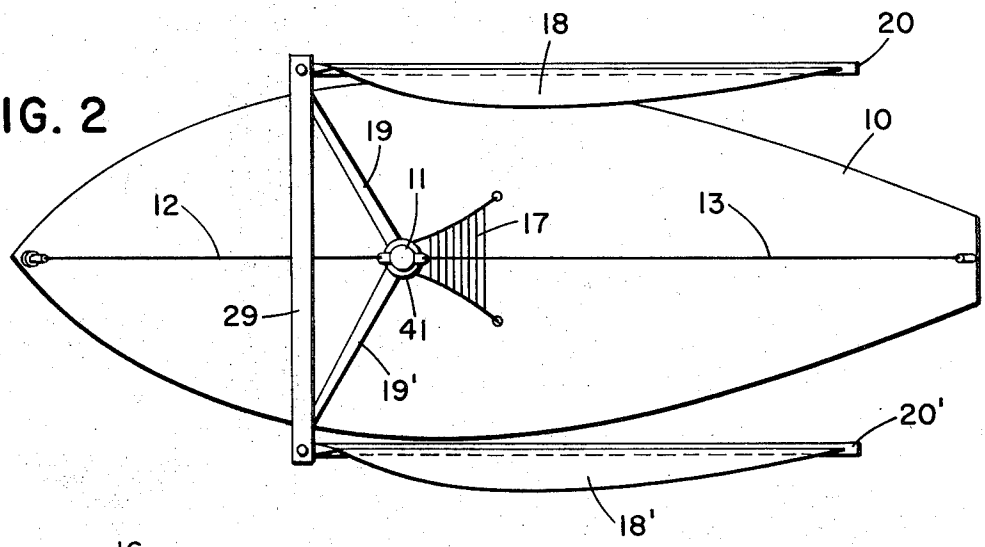


FIG. 2

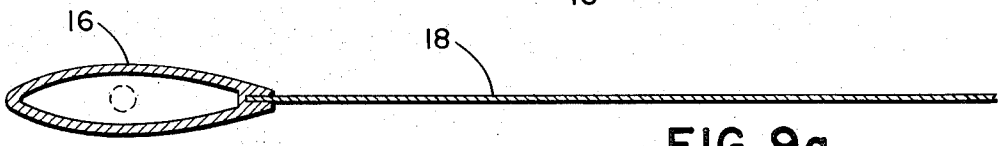


FIG. 9a

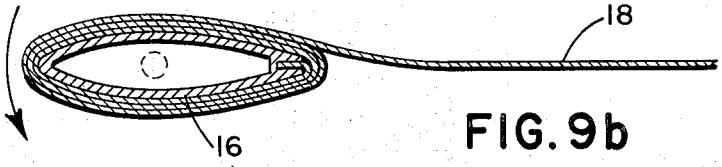


FIG. 9b

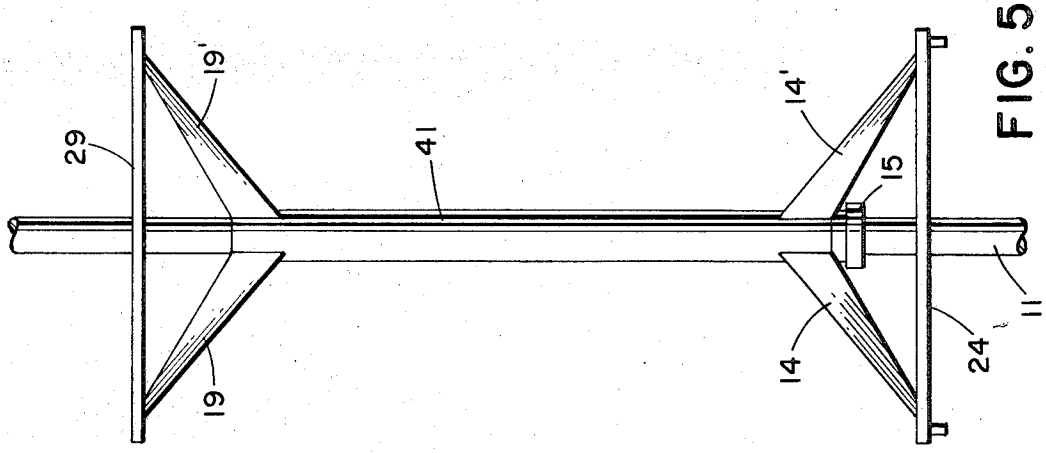


FIG. 5

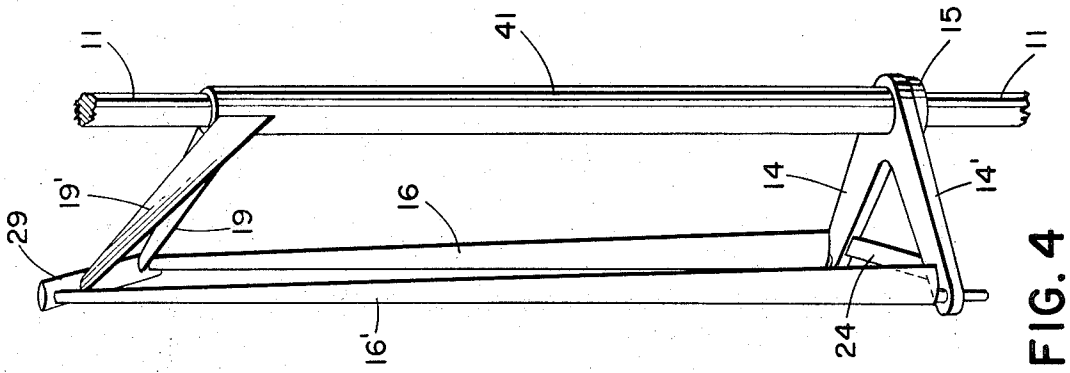


FIG. 4

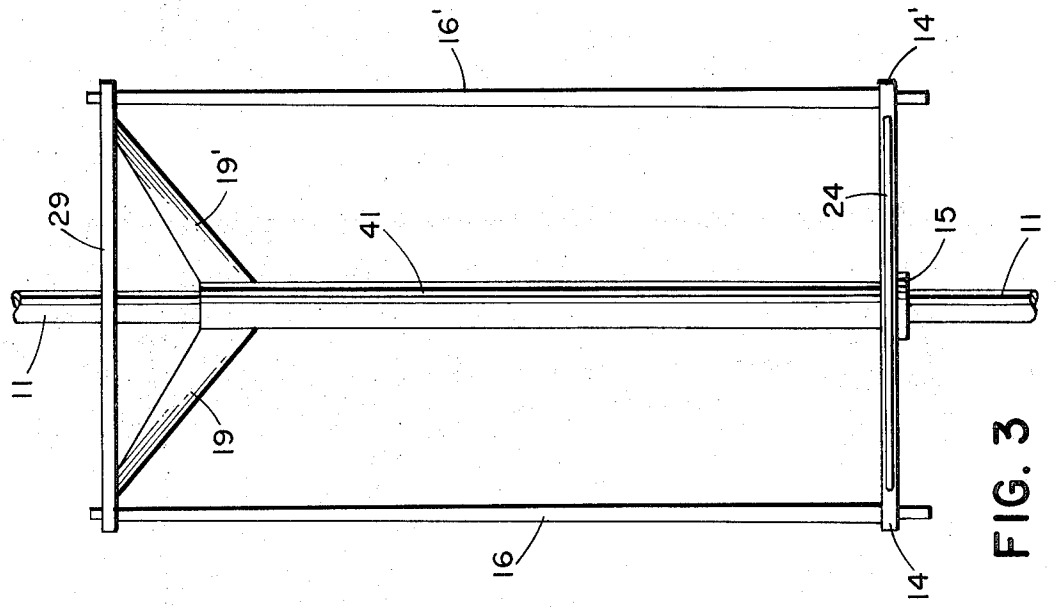


FIG. 3

FIG. 7

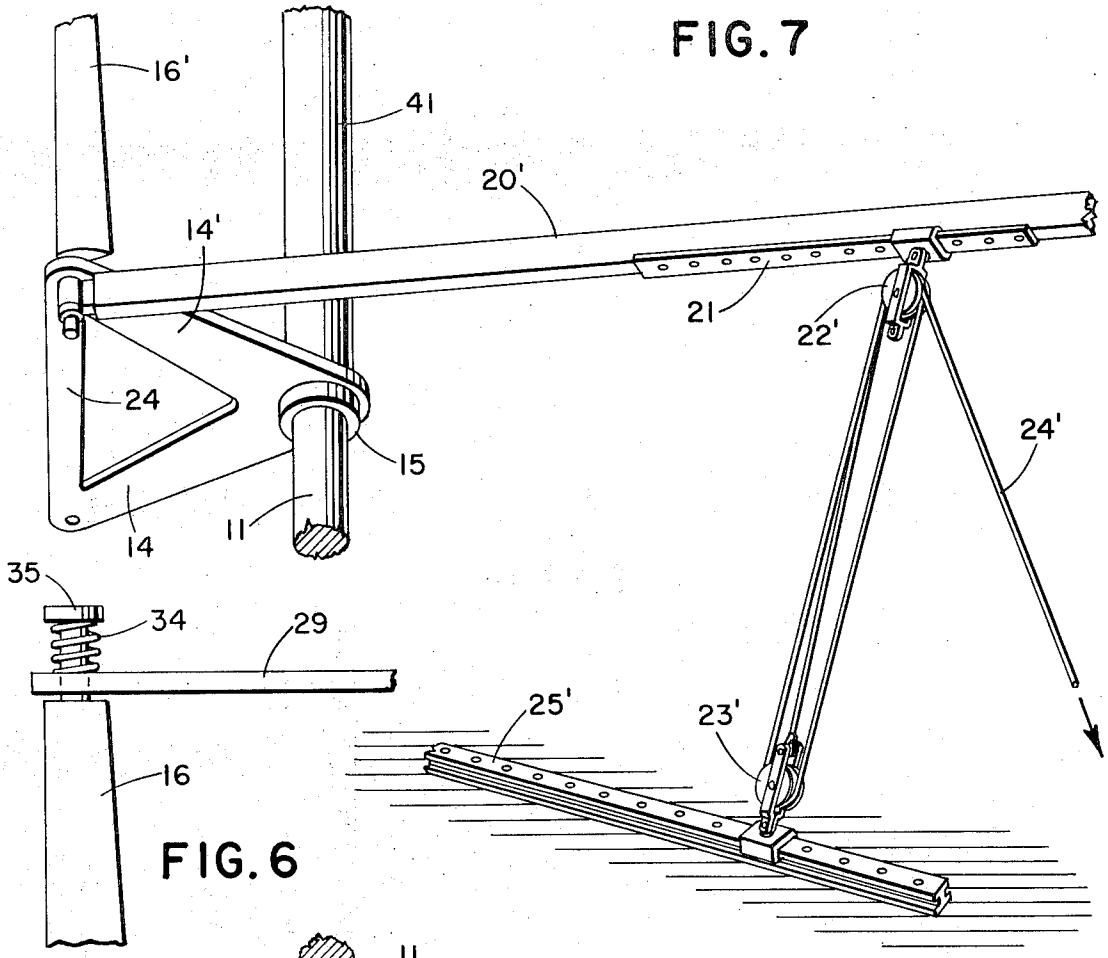
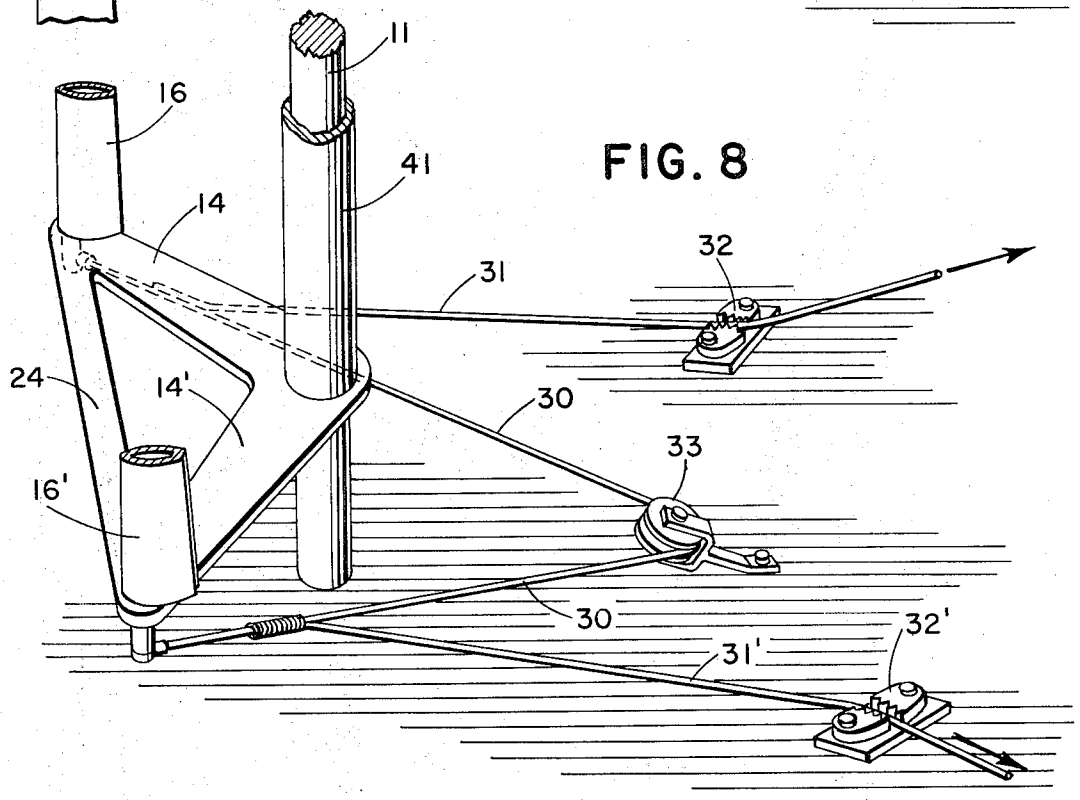


FIG. 6

FIG. 8



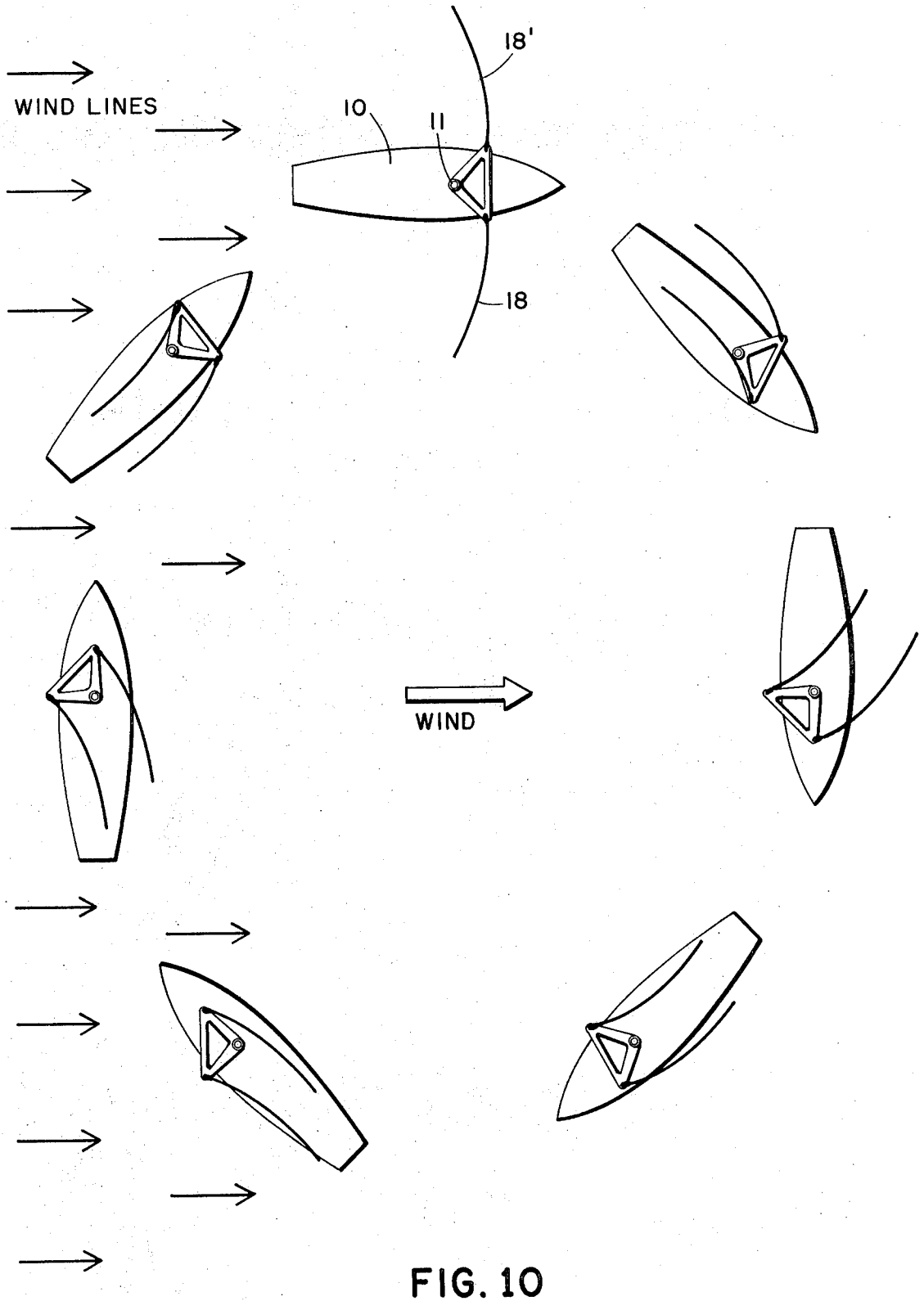


FIG. 10

SAILING RIG

BACKGROUND OF THE INVENTION

This invention relates to sailing vessels, more particularly, to an improved arrangement of masts, spars, sails and rigging for such vessels.

In modern sailing craft, the usual sailing rig includes a mainsail carried by the main mast mounted intermediate the ends of the vessel and on the centerline thereof, and a jib sail hoisted forwardly of the mast on a forestay. With greater knowledge of aerodynamics and the practical application thereof to sailing vessels there has occurred a marked increase in the size of the jib sail, culminating in the "Genoa" type of overlapping jib wherein the airstream between the overlapping portions of the jib and main sails substantially increases the driving power of these sails. Such rigs, however, despite their increased performance, are inefficient in that the optimum profile for the slot between the sails cannot be maintained because in actual operation excessive camber is developed higher up, which may cause backwinding of the mainsail. Moreover, serious problems in handling occur such as, in tacking, the sheets of the jib must be loosened and the sail shifted to the other side of the mast and mainsail.

Various proposals have been made in efforts to improve the efficiency of sailing rigs and/or to improve the handling characteristics without loss of efficiency as provided by the Genoa jib. Among these are the provisions of a pair of transversely spaced masts, each carrying a mainsail such as are shown in U.S. Pat. No 3,142,282 and U.S. Pat. No. 3,223,064.

In the former, the respective booms of the mainsails are usually linked together at their outer ends by means of a tie rod whose length is approximately equal to the spacing of the twin masts at the deck lines, whereby the booms swing together in either direction to a fully outboard position. A small, or working jib sail is provided with its trailing edge extending rearwardly toward the masts and adapted for alignment with either mast in accordance with the tack of the vessel. With such a rig, the leeward sail is at least partially blocked on a beam reach and the limited lateral travel of the jib tends to backwind the windward sail with consequent lowering of its efficiency.

In the latter assembly, on a beam reach there is likewise a substantial loss of efficiency due to blocking of the leeward sail, and the limited lateral travel of the jib will backwind the windward sail with attendant loss of efficiency.

An even earlier balanced double sail rig of this general type is disclosed in U.S. Pat. No. 685,943 wherein the main mast carries a pair of arms, each swingably mounted thereon for independent movement about the mast at the lower section of the mast and a pair of arms similarly mounted at the upper section of the mast. Each of these upper arms is connected at its outer end with the outer end of one of the lower arms by a stay or rod, thus forming a frame within which is suspended a sail. The outer edge of the sail is attached to the stay by means of a set of loops or rings with the lower edge of the sail secured to a rigid member which is provided with an eye at its outer end through which the associated stay passes and on which the member freely swings. The top of the sail is likewise attached to a similar member.

The two frames and sail assemblies so constructed are adapted to be swung independently of each other. In addition, each sail can be adjusted angularly about a vertical axis at its outer edge and independently of the position of its supporting frame relative to the mast or the other frame and sail.

Such double sail assembly does not provide for sailing to windward and even in sailing before the wind in order to achieve a tack to port or starboard, two large fins are utilized to change direction of the hull contrary to hydrodynamic principles, i.e., only a round hull could move using this rig. This double sail assembly does not embody the aerodynamic principles that affect the driving force of sails since its sails are set crosswise to its hull. This assembly involves considerable top-side weight which adversely affects the balance and handling of the craft.

DESCRIPTION OF THE INVENTION

It is an object of this invention to increase the driving force available from a given sail area and, at the same time, to permit the craft to sail closer to the wind.

It is a further object of this invention to provide a twin rig having two sails of identical size and shape, each of which is adjustable to serve as foresail with the other as the mainsail, depending upon the reach.

Another object of the invention is to provide effective air flow over all of the mainsail area.

It is a further object of the invention to provide a general direction of air flow on the leeward side of the mainsail in the region overlapped by the foresail which is tangential to the surface of the mainsail.

These and other objects of the invention will be apparent from the following description and accompanying drawings, in which:

FIG. **1** is a side view in elevation of a sailing vessel embodying the invention;

FIG. **2** is a plan view of the boat shown in FIG. l;

FIG. **3** is an enlarged front view in elevation of the mast structure or nucleus of the twin rig, hereinafter referred to as "Gemini Rig";

FIG. **4** is a perspective side view of the mast assembly shown in FIG. **3**;

FIG. **5** is a front elevation of another form of the Gemini Rig;

FIG. **6** is an enlarged detail view illustrating a modified form of connection between the top of a sail mast and the upper assembly;

FIG. **7** is an enlarged broken perspective view showing the port boom and rigging for the Gemini Rig;

FIG. **8** is an enlarged broken perspective view showing the mast lines for controlling the position of the sail masts;

FIG. **9***a* is an enlarged horizontal cross section of a sail mast of the Gemini Rig with its sail fully spread;

FIG. **9***b* shows in horizontal cross section a sail mast with its sail partially roller reefed about the mast;

FIG. **10** shows more or less diagramatically the angle of the sails of applicant's twin rig as the vessel sails to windward, reaching and running.

Referring now to the drawings, the sailing vessel of FIGS. **1** and **2** is represented with a single hull **10** of conventional design, but the invention is not limited thereto and the hull of the craft may be of any suitable configuration and fabrication technique including multiple hull construction such as a catamaran.

The vessel is equipped with a main mast **11** mounted on the transverse centerline of the hull somewhat forwardly thereof and maintained in the desired vertical position by one or more forestays **12**, one or more aftstays **13**, and shrouds **17**. A cylindrical sleeve **41** is fitted about main mast **11** and is adapted to turn freely as described more fully below. Sleeve **41** carries at its lower end a cross piece formed by the equal starboard and port arms, **14** and **14'** respectively extending outwardly and forwardly of sleeve **41** as shown, with brace **24** connecting the extremities of arms **14, 14'** as shown in perspective side view FIG. **4**. Cross piece **14, 14'** and brace **24** form a rigid structure which is firmly fixed to sleeve **41** and turns with it.

The upper end of sleeve **41** is provided with cross piece formed by the two equal starboard and port arms, **19** and **19'** respectively extending outwardly and forwardly of sleeve **41**. The brace **29** connects the ends of arms **19, 19'** and also extends beyond the ends of said arms. The projections of brace **29** are provided with holes for receiving the upper ends of sail masts **16, 16'**. Preferably arms **19, 19'** form an angle with the horizontal for the purpose of realizing greater strength of the juncture of the arms with the sleeve. This angle preferably is 45°. This sleeve and upper and lower cross piece assembly is supported on mast **11** by bearing member **15** of any suitable construction. Such means are well-known and a detailed description is not necessary to an understanding of the invention.

A starboard sail mast **16** is placed between arm **14** and the starboard end of the upper assembly, being supported upon and by arm **14** and extending through the extremity of cross brace **29** so as to swivel freely about its vertical axis as explained more fully below. A like sail mast **16'** is provided for the port side, between lower arm **14'** and the port end of the upper brace **29**. The primary function of masts **16, 16'** is to form the leading edges of their respective sails, since mast **11** provides the support for the entire Gemini Rig and sail assembly and its relative diameter has little effect upon air flow over the sails.

Where it is desired to provide for bowing of the sail masts, the upper ends thereof may be resiliently mounted in brace **29** as indicated by the spring **34** and retainer **35** in FIG. **6**. Other devices permitting a limited and controlled movement of the sail masts at these points may be used in place of such conventional spring and retainer assembly.

Starboard and port sails, **18** and **18'** respectively are supported along the luff by sail masts **16** and **16'**, respectively, which thereby provide in effect rigid streamlined leading edges to the sails.

The streamlined shape of the sail masts thus presents a clean, uncluttered edge to the wind and with their ability to swivel into the wind contributes substantially to the efficiency of the sails of the Gemini Rig. Thus, sail mast drag loss and dead air are virtually eliminated.

In this connection, sleeve **41** in addition to carrying the sail assembly also serves to strengthen the portion of mast **11** enclosed therein.

The sails **18** and **18'** may be hoisted on their respective sail masts **16, 16'** in the conventional manner. Alternatively, in a preferred embodiment of the invention each sail is affixed to the trailing edge of its sail mast along the luff and the sail may then be roller reefed, that is, wound about its respective sail mast by rotation of that mast as shown in FIGS. *9a* and *9b*.

This combination of streamlined sail masts and sails prevents shaking or luffing in the sail so that the desired smooth contour of the sail is preserved and the sail as a whole functions effectively while pointing closer to the wind than is possible with known rigs.

The sail masts **16, 16'** carry, respectively booms **20, 20'** with conventional mounting means whereby each boom may be swung in a horizontal direction about its sail mast. Each boom **20, 20'** is independently mounted and controlled, as shown in FIG. **7**, thereby permitting the angle between the sails and the resulting overlap to be adjusted to any desired degree to provide the optimum slot effect for a given wind direction and course.

FIG. **7** shows the rigging for the port boom **20'**, wherein **21'** is a track mounted upon the underside of the boom and **25'** is a corresponding track upon the deck of the craft. Pulleys, **22'** and **23'** are slidably mounted, respectively upon tracks **21'** and **25'** with the main sheet **24'** for the port sail roved between. As main sheet **24'** is paid out, boom **20'** will swing outwardly on the port side of the vessel, whereas pulling on sheet **24'** will draw the pulleys closer together thereby drawing boom **20'** inboard to the desired position relative the centerline of the vessel.

The rigging for the starboard boom, not shown, includes a boom track, deck track, pulleys and main sheet corresponding to those for the port boom, and functions in the same manner.

Thus, the sails **18, 18'** may be parallel, slightly converging or swung independently outboard to their respective starboard and port sides, as indicated in FIG. **10**.

With sails of identical shape, maximum freedom in the relative positions of the booms and the unique mast structure whereby the sails move in an arcuate path, one sail serves as the foresail with the other as mainsail. When on the opposite reach, the position of the two sails is so adjusted that the former mainsail becomes the foresail and the former foresail becomes the mainsail. By being identical in shape and size, the interaction of the sails one to the other is improved considerably. For example, a higher angle of incidence can be carried with less dead air created on the lee side of the mainsail because the foresail increases the flow of air over the entire surface of the lee side of the mainsail. At the same time the foresail remains an efficient sail in its own right.

Unlike a regular jib or a Genoa, which has dissimilar shape from the mainsail, the Gemini Rig provides an effective air flow over the entire mainsail area which other sails cannot duplicate. Also, conventional jibs and Genoas are restricted in angle of incidence to where the clew is fastened to the boat rail but the Gemini Rig has no restriction since the foresail boom extends beyond the side of the boat as far as necessary to form a slot with the mainsail. In fact, the Gemini Rig is versatile enough to create any desired effective angle between the sails whether to windward, reaching or running.

A Genoa of large area is difficult to reposition when changing tacks whereas the Gemini Rig requires only the repositioning of the sail masts. The capacity of the Gemini Rig for adjustment of the positions of the sail masts in an arcuate path around the central support

mast makes it possible for the wind to reach both sails without being blanketed by either one.

Thus, there is no limit to the effective angles to which the sails may be adjusted, and this is accomplished by the provision of but one set of lines in addition to those of conventional rigs, namely, the lines for setting the position of the sail masts in relation to the main mast. As shown in FIG. **8**, these additional lines are line **30** of fixed length and extending between the outer ends of arms **14, 14'** beneath said masts **16, 16'** through a pulley **33**, spaced behind the sleeve **41** by a distance somewhat greater than that from the sleeve to either sail mast. Two lines **31, 31'** are fixed to line **30** near starboard sail mast **16** and port sail mast **16'** respectively, whereby in pulling upon line **31** and paying out line **31'**, sleeve **41** with integral top and bottom assemblies will be swung clockwise about mast **11** with sail mast **16'** moving toward the bow and sail mast **16** moving rearward toward the stern. Conversely, drawing upon line **31'** and paying out line **31** will cause sail mast **16** to move forward and sail mast **16'** to move toward the stern of the craft. Lines **31** and **31'** are held in position by cleat clamps **32, 32'** respectively. If desired, movement of lines **31, 31'** may be effected by a winch not shown.

This Gemini Rig provides greater stability than any other rig with comparable sail area because of its anti-healing qualities. The driving power of Gemini sails is greater and will be maintained because of less heeling force. This results from positioning the windward sail well to windward of the centerline of the boat. Thus, the forces which tend to heel a boat to leeward and diminish the aerodynamic efficiency of the sails are far less with this new rig than in a boat with prior rigs having these forces to the leeward of its centerline. A comparison of Gemini Rig with conventional rigs will show that its moment arm is far more resistant to heeling than in a vessel with sail masts rigidly mounted on the centerline.

Additionally, the sail area of Gemini being divided into two highly efficient air foils makes for a substantially lower center of effort than is possible with an equal area single mainsail of a Bermudian rig, thereby further reducing the heeling effect.

Although not shown, conventional head sails and spinnakers may be used with the Gemini Rig as desired without any sacrifice in the advantages thereof.

In summary, the Gemini Rig provides the following advantages and improvements over conventional rigs:

sailing closer to the wind;

a more effective slot between sails, controllable to any desired angle; identical shape, size, and camber of the sails;

freedom from blocking of one sail by the other regardless of course;

backwinding of mainsail eliminated;

convenience of tuning foresail to mainsail;

streamlined and rigid leading edges of sails virtually eliminate sail mast drag and dead air;

shock absorption in gusts from flexibility of sail masts;

diminished heeling to windward thereby maintaining sail efficiency; and

sail masts may be rigged for bowing to leeward for improved catamaran performance.

Details of hull fittings, eyes, halyards and like items have been omitted from the foregoing description since such are unnecessary for an understanding of the invention and are well known to boat builders and other workers in the art.

It should be understood, of course, that the foregoing disclosure relates to only a preferred embodiment of the invention and that it is intended to cover all changes and modifications of the examples of the invention herein chosen for the purposes of the disclosure, which do not constitute departures from the spirit and scope of the invention.

What is claimed is:

1. In a sailing vessel adapted for efficient sail use including hull means, a main mast having upper and lower portions, and at least two sails, the improvement permitting interchangeable sail positions variable by the user under different sailing conditions, comprising:

substantially identical starboard and port sails, each having a luff portion,

starboard and port sail masts, said starboard sail mast being for said starboard sail and said port sail mast being for said port sail, and

means for mounting said sail masts for rotational movement about said main mast in a circular path, said mounting means including a pair of cross piece members rotatably mounted at the upper and lower portions of said main mast, each comprising arms projecting from said main mast, one arm of each of said cross pieces being secured to each of said sail masts toward the ends thereof, said arms on each of said cross pieces being substantially equal in length and arranged to rotate in fixed relation relative to one another about the main mast,

said sails being capable of being secured to said respective sail masts along the luff portions thereof,

means for pivoting said sail mast mounting means to simultaneously rotate said sail masts about said main mast in a circular path for variably positioning the luff of one of said sails forward of the luff of the other of said sails, said pivoting means making each of said sails adjustible to serve as a foresail with the other of said sails serving as a mainsail depending upon the reach, and

means associated with each of said sails for positioning said sails to trail aft in generally mutually parallel relation, to converge, and to independently swing laterally outboard of said hull means in opposite directions.

2. A sailing rig for use on a sailing vessel having hull means, comprising:

a starboard sail having a luff,

a port sail also having a luff,

a main mast mounted on said hull means,

an upper cross piece having a starboard and a port arm relatively rotatably fixed with respect to each other, said upper cross piece arms being rotatably mounted on and extending radially outwardly from said main mast,

a lower cross piece also having a starboard and a port arm relatively rotatably fixed with respect to each other, said lower cross piece arms being rotatably mounted on and extending radially outwardly from said main mast,

a starboard sail mast, on which said starboard sail is supported along its luff, mounted between said upper cross piece and said lower cross piece, and

a port sail mast, on which said port sail is supported along its luff, also mounted between said upper cross piece and said lower cross piece,

said upper cross piece, said lower cross piece and said starboard and port sail masts forming a sail mounting means

means for pivoting said sail mounting means to simultaneously rotate said sail masts about said main mast in a circular path for variably positioning the luff of one of said sails forward of the luff of the other of said sails, said pivoting means making each of said sails adjustible to serve as a foresail with the other of said sails serving as a mainsail depending upon the reach, and

means associated with each of said sails for positioning said sails to trail aft in generally mutually parallel relation, to converge, or to independently swing laterally outboard of said hull means in opposite directions.

3. The sailing rig as claimed in claim **2,** wherein said port and said starboard sail masts are mounted in fixed relation to each other and pivot about said main mast in the circular path while maintaining this fixed relation,

and wherein said pivoting means include:

a line of fixed length extending between the outer ends of said lower cross piece starboard and port arms, beneath said starboard and port sail masts,

a pulley fixedly mounted on said hull means through which said line is guided, and

means for paying said line through said pulley for pivoting said sail mounting means about the main mast.

4. The sailing rig as claimed in claim **2,** wherein said sail mounting means also comprises:

a brace connecting said upper cross piece starboard and port arms, and

said starboard sail mast being mounted between said lower cross piece starboard arm and said brace, and said port sail mast being mounted between said lower cross piece port arm and said brace.

5. The sailing rig as claimed in claim **4,** wherein said upper and lower cross piece arms are integrally supported on and carried by a sleeve rotatably encircling said main mast.

6. The sailing rig as claimed in claim **4,** wherein each of said sail masts has an upper and a lower end and is streamlined in cross-section, tapers upwardly toward its upper end, and is pivotally mounted between said respective lower cross piece arms and said brace.

7. The sailing rig as claimed in claim **3,** wherein each of said sail masts has an upper and a lower end, said upper end being resiliently retained in said upper cross piece thereby permitting said sail mast to bow to the leeward in operation.

8. The sailing rig as claimed in claim **4,** wherein said upper cross piece arms extend upwardly.

9. A sailing rig for use on a sailing vessel having hull means, comprising

a starboard sail having a luff,

a port sail also having a luff, and

means for mounting said sails including a starboard sail mast on which said starboard sail is supported along its luff and a port sail mast on which said port sail is supported along its luff,

said sail masts being mounted on said mounting means in fixed relation to each other,

means for pivoting said sail mounting means to simultaneously rotate said sail masts about said main mast in a circular path while maintaining said sail masts in fixed relation, said pivot means being for variably positioning the luff of one of said sails forward of the luff of the other of said sails to make each of sails adjustible for serving as a foresail with the other of said sails serving as a mainsail depending upon the reach, and

means associated with each of said sails for positioning said sails to trail aft in generally mutually parallel relation, to converge, or to independently swing laterally outboard of said hull means in opposite directions.

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