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(54) Nautical balance system

(57) A nautical balance system (10) for installation on small sailboats. The system improves the ability of a helmsman to counter the heeling force of the wind on the sails by providing a swinging seat (40) supported by semicircular rail (30) for supporting the weight of the helmsman outboard of the sailboat. The system enables the helmsman to easily use his weight to limit the heel of the sailboat. The system is independent of mast (20) location and provides for tacking under a low boom (22).

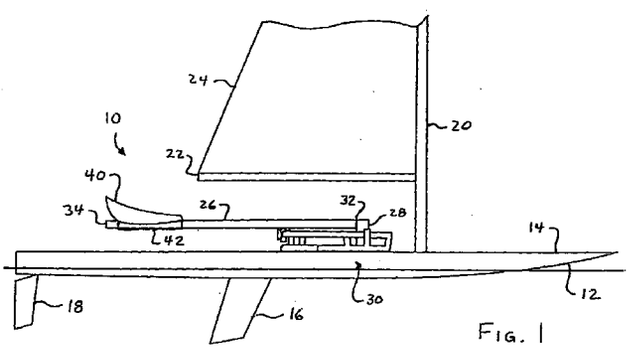

FIG. 1

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Description

BACKGROUND OF THE INVENTION

1. FIELD OF THE INVENTION

The present invention relates to a balance system for installation on small sailboats which improves the ability of a helmsman to counter the heeling force of the wind on the sails. More particularly, the system enables the helmsman to easily use his weight to limit the heel of the sailboat.

2. DESCRIPTION OF THE RELATED ART

It has long been recognized that the position of the weight of the crew is critical to the performance of small sailboats. For sailboats that are double or single handed, the position of the weight of the helmsman is also important. On such small boats, the weight of the crew and helmsman is the major force used to counter the heeling force of the wind on the sails. Thus, devices that assist the helmsman or crew in shifting and maintaining body weight near or beyond the sides of the boat enable the boat to be sailed upright and efficiently level.

One such a device is disclosed in the U.S. Patent No. 2,238,464 issued April 15, 1941, to W.G. Fletcher. Fletcher discloses a convertible sailing vessel including a swinging arm. The swinging arm is pivotally supported by a main frame at a single location. The arm permits a crew member, but not the helmsman, to use body weight to balance the vessel.

U.S. Patent No. 4,539,926, issued September 10, 1985, to J. Boffer, discloses a sailboat having an outrigger which is supported solely by a sleeve which encircles the foot of the mast. The helmsman is supported on a seat on the outrigger. A relatively high cut sail is attached to the mast to allow the helmsman to pass under the sail when tacking.

U.S. Patent No. 4,852,507, issued August 1, 1989, to R.C. Ryon et al., discloses a sail craft including a semicircular seat, foot rail and back stop used by a helmsman in maneuvering his body as a counterweight.

U.S. Patent No. 4,936,236, issued June 26, 1990, to F.W. Sinden, discloses a moment balancing rig for a sailboat. The rotatable rig includes a boom for supporting the helmsman. The boom is attached to a mast that is in turn attached to the hull of the boat.

U.S. Patent No. 4,986,202, issued January 22, 1991, to P. Mourgne et al. and British Patent Application No. 2195297 published April 7, 1988, show a fixed transverse rail extending between lateral hulls of a trimaran. A seat slides along the rail to permit crew members to counterbalance the boat.

French Application No. 79 11824 discloses a catamaran including a saddle permitting a helmsman seated in the saddle to balance the boat by pivoting the saddle. The saddle is mounted on a short arm that requires insignificant support.

None of the above inventions and patents, taken either singularly or in combination, is seen to describe the instant invention as claimed. Thus, nautical balance system solving the concerns encountered when attempting to counterbalance the heel of a small saiboat is desired.

SUMMARY OF THE INVENTION

When sailing a small sailboat, particularly upwind, it is desirable for helmsman to hike his body weight as fas as possible beyond the windward rail to counter the heeling force of the wind on the sails. The present nautical balance system is a device that assists the helmsman in moving his body weight to counteract this heeling force. The system also assists the helmsman to maintain his body weight beyond the windward rail for extended periods of time as the boat is sailed upwind.

The nautical balance system includes an outrigger that supports the helmsman. The outrigger pivots about a bearing on the centerline of the boat. The outrigger is supported by the pivot bearing and by a semicircular rail assembly fastened to the deck of the sailboat. The outrigger is slidably supported by the rail assembly as the outrigger pivots about the bearing. Rollers are included to promote the movement of the outrigger along the rail.

The additional support of the rail assembly limits the force borne by the pivot bearing and the deck supporting the bearing.

The outrigger includes a seat for the helmsman. When seated on the outrigger the helmsman is able to stabilize himself and the outrigger by placing his feet on the rail assembly. The helmsman also controls the angular position of the outrigger with his feet placed on the rail assembly. To ensure that the helmsman can manipulate and stabilize himself the outrigger rides along a rail that is raised above the deck. The rail also extends beyond the limit of rotation of the outrigger so that the helmsman may always put both feet on the rail while straddling the outrigger. The seat is adjustable along the outrigger to fit the length of the helmsman's legs.

The pivot bearing is located in a position independent of the location of the mast thereby allowing the weight of the helmsman to be located at the optimal position for performance of the sailboat. A pivot bearing located aft of the mast also permits the helmsman to swing behind the boom when tacking. This permits the boom to be positioned relatively lower on the mast and, therefore, the sail to be larger and more efficient.

Accordingly, it is a principal object of the invention to provide a nautical balance system on a sailboat to assist a helmsman using his body weight to counterbalance the heeling force of the wind on the sails.

Is is a further object of the invention to provide a nautical balance system having an outrigger supported at multiple points for holding a helmsman over the wind-

ward rail of a sailboat with minimal stress transmitted to the deck.

Another object of the invention is to provide a rail by which the helmsman can steady himself and manipulate the position of the outrigger with his feet on the rail.

Still a further object of the invention is to provide a seat for the helmsman which swings aft of a low boom when the boat is tacked.

It is an object of the invention to provide improved elements and arrangements thereof in a nautical balance system for the purposes described which is inexpensive, dependable and fully effective in accomplishing its intended purposes.

These and other objects of the presente invention wil become readily apparent upon further review of the following specification and drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a side view of a sailboat including the present nautical balance system.

Figure 2 is a plan view of the sailboat shown in Figure 1.

Figure 3 is an enlarged, partial side view of the present nautical balance system.

Figure 4 is a perspective view of the present nautical balance system.

Figure 5 is a diagrammatic view representing the forces on the present nautical balance system.

Figure 6 is a diagrammatic view representing the forces on a sailboat including the present nautical balance system.

Figure 7 is a diagrammatic view representing the righting forces on a sailboat using the presente nautical balance system.

Similar reference characters denote corresponding features consistently throughout the attached drawings.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

The present nautical balance system **(10)** installed on a small sailboat is shown in Figures 1 and 2. The main structural assembly of the sailboat includes a hull **(12)** and a deck **(14)**. A keel or centerboard **(16)** and a rudder **(18)** are attached to the underwater surface of hull **(12)**. On the longitudinal center line of the hull **(12)** and deck **(14)** is a mast **(20)** that supports a boom **(22)** and a sail **(24)**.

The nautical balance system **(10)** as shown in Figure 4 includes an outrigger **(26)**, a pivot bearing **(28)**, and a rail assembly **(30)**. Outrigger **(26)** is oriented primarily parallel to deck **(14)** and thus perpendicular to mast **(20)**. Outrigger **(26)** includes a pivot end **(32)** and an outboard end **(34)**. Pivot end **(32)** is pivotally supported by pivot bearing **(28)**. Rail assembly **(30)** slidably supports outrigger **(26)** at a point between pivot end **(32)** and outboard end **(34)**.

As shown in Figure 4, pivot bearing **(28)** includes a sleeve **(36)**. Sleeve **(36)** extends perpendicularly from deck **(14)** on the longitudinal centerline of hull **(12)** and deck **(14)**. Pivot end **(32)** of outrigger **(26)** includes a perpendicular tube **(38)** that fits within sleeve **(36)**. Tube **(38)** is free to rotate within sleeve **(36)** and outrigger **(26)** may therefore swing or rotate about pivot bearing **(28)**.

Proximate outboard end **(34)** of outrigger **(26)** is seat **(40)**. Seat **(40)** provides means for supporting a weight, specifically the body weight of the helmsman, outboard of deck **(14)**. Seat **(40)** is movably attached on outrigger **(26)** with bracket **(42)**.

Rail assembly **(30)** is fastened to deck **(14)** and further supports outrigger **(26)**. Rail assembly **(30)** is essentially semicircular in shape to support outrigger **(26)** as it rotates or swings about pivot bearing **(28)**. The semicircular shape has a constant radius of curvature but does not necessarily extend through precisely one half of a circle. Rail assembly **(30)** has an upper support rail **(44)** and a lower connection rail **(46)**. Upper support rail is supported above deck **(14)** by a plurality of generally vertical rail supports **(48)**. Rail supports **(48)** are connected to lower connection rail **(46)**, wich is in turn fastened to deck **(14)**. In the preferred embodiment upper rail **(44)** is supported about 4-5 inches above the deck and rail assembly **(30)** has a radius of about 1 foot 3¾ inches.

It is upper rail **(44)** that comes in contact with and directly supports outrigger **(26)**. Therefore, it is the upper rail **(44)** that must have a constant radius of curvature and must be centered about pivot bearing **(28)** such that a single point along outrigger **(26)** contacts rail assembly **(30)** as outrigger swings or rotates about pivot bearing **(28)**. As can be seen in Figure 2, lower connection rail **(46)** need not be precisely semicircular, but may include flattened sections **(50)**. To provide the most effective support it is important that upper rail **(44)** have a large diameter. A diameter larger than the beam of the boat can be support by lower rail **(46)** with flattened sections **(50)** that extend along the sides of deck **(14)**.

As shown in Figure 3, outrigger **(26)** includes an upper roller **(52)** disposed above upper rail **(44)** to assist the outrigger **(26)** in sliding along upper rail **(44)**. Outrigger **(26)** also includes a lower roller **(54)** disposed below upper rail **(44)**. Lower roller **(54)** steadies outrigger **(26)** by ensuring that outrigger **(26)** is kept in continuous contact with rail assembly **(30)** during any motion of the sailboat that tends to raise outrigger **(26)**. To permit both upper roller **(52)** and lower roller **(54)** to slide unobstructed along upper rail **(44)**, rail supports **(48)** are attached to the inside edge of upper rail **(44)**.

Rail assembly **(30)** also includes stops **(56)** to limit to rotation or swing of outrigger **(26)**. Stops **(56)** extend above upper rail **(44)** to engage outrigger **(26)** upon reaching the point of maximum rotation. In the preferred embodiment, stops **(56)** are positioned to stop outrigger **(26)** when it has rotated 90° from the centerline of hull

(12) and deck (14). The outrigger (26) in a position 90° from the centerline produces the maximun heel resisting moment by holding the weight of the helmsman the maximum distance from the center of the hull. Rail assembly (30) extends beyond stops (56) to provide a resting surface for the helmsman's foot when the outrigger (26) engages stop (56). Thus rail assembly (30) is not precisely a semicircle but extends through an arc greater than 180°, with stops (56) disposed a substantial distance from the ends of upper rail (44).

In use seat (40) is positioned such that the helmsman's legs comfortably reach rail assembly (30) when the helmsman is seated in seat (40). The helmsman sits in seat (40) and controls the sailboat from this position. Controls, such as the tiller and the sheets, are led to the helmsman seated in seat (40). The helmsman controls the rotation or swing of outrigger (26) with his feet placed on rail assembly (30). As the force of the wind heels the sailboat, the helmsman swings himself outboard on outrigger (26) thereby using his weight to counteract the heeling force. The outrigger (26) easily supports the weight of the helmsman as the helmsman moves his weight outboard to counter the heeling force of the wind on the sails. The outrigger permits the helmsman to sail the boat from a steady secure position seated in seat (40) with his feet firmly placed on rail assembly (30). The helmsman can easily swing his weight inboard and outboard on outrigger (26) to maintain the most efficient sailing configuration. The helmsman weight is supported by outrigger (26) at all times permitting the helmsman to keep his weight outboard for extended periods of time.

Adjustably supporting the weight of the helmsman with nautical balance system (10) described above has a number of significant advantages. As shown in Figure 5, the use of rail assembly (30) to support outrigger (26) significantly reduces the forces transmitted to structural members of deck (14). Assuming a helmsman with a weight of 176 *lbs* (W_h) supported 2,7 *ft* (a) from rail assembly (30) and an upper rail with a radius of 1.3 *ft* (b). The force F of pivot bearing (28) will can be calculated as follows:

$$F = \frac{W_h(a)}{b}$$

$$F = \frac{176\,lbs(2.7\,ft)}{1.3\,ft}$$

$$F = 365\,lbs$$

The force on rail assembly (30) at point B is:

$$F + W_h = 365\,lbs + 176\,lbs = 541\,lbs$$

This force is distributed around the deck by the rail assembly (30). These loads can be easily supported by the structure of deck (14).

Without rail assembly (30) the deck under pivot bearing (28) must support the entire weight of outrigger (26) and the helmsman. Also the deck supporting the pivot must resist the moment of:

$$W_h(a+b) = 176\,lbs(2.7\,ft + 1.3\,ft) = 704\,ftlbs$$

This moment cannot be resisted by most deck structures.

As shown in Figure 6 it is important that the pivot bearing (28) be located independently from mast (20). While sailing in a straight line, the position of the center of lateral resistance (CLR) of the hull in the water must correspond to the center effort (CE) of the wind on the sails. Due to the effect of the waves produced along the hull of a moving sailboat and the effect of the shape of the sails, the CE and CLR continuously change. To design a balanced boat, the center of the sail plan is typically placed forward of the static lateral center of the underwater surface of the hull by 15 to 20 percent of the length of the load water line (LWL) as shown in Figure 6. Also, the center of gravity (CG) of the sailboat must correspond with the center of buoyancy (CB) of the hull to keep the trim and heel of the boat correct. For small sailboats the weight of the helmsmam has a significant effect on the center of gravity. Thus, the combined center of gravity (CCG) is the combination of the centers of gravity of the helmsman and the hull. Using the nautical balance system, the helmsman's weight is positioned to produce a CCG corresponding to the CB of the hull. Outrigger (26) does not pivot about the mast, because to do so would require the mast location to be dependent on the CCG rather than on the efficient placement of the CE. If CE is displaced, thereby destroying the relationship between the CE and the CLR, the rudder must be turned to keep the sailboat sailing in a straight line. This excessive rudder displacement causes unwanted excessive drag, wich slows the sailboat.

Another significant advantage of nautical balance system (10) is the ability to use a low boom. As the sailboat is tacked through the wind on a traditional small sailboat, the helmsman shifts his weight from one side of the sailboat to the other by ducking under the boom. The booms of traditional sailboats must therefore be located high enough to accommodate the helmsman. With the nautical balance system (10) the helmsman does not duck under the boom (22), but rather swings behind boom (22) on seat (40). This is possible, as shown in Figure 1, since seat (40) is aft of the end of boom (22) when the boom and outrigger are both centered along the centerline. The advantage of a low boom is illustrated in Figure 7. The sail (24) having a low boom (22) is shown in solid lines. A traditional sail (24') having a high boom (22') is shown in dashed lines. The center of effort CE of sail (24) is lower than would be the center of effort CE' of a traditional sail (24'). The tradi-

tional sail thus has a greater heeling moment arm H_m'. The heeling moment is countered by the displacement GZ of the center of gravity (CCG) from the center of buoyancy (CB). This displacement GZ or the weight of the helmsman must be increased if H_m is increased to H_m'. A lower boom thus allows a lighter helmsman to carry a larger sail while countering the heeling force of the wind on the sail.

It is to be understood that the present invention is not limited to the embodiment described above, but encompasses any and all embodiments within the scope of the following claims.

Claims

1. A nautical balance system (10) comprising:

   an outrigger (26) having a pivot end (32) and an outboard end (34);
   a pivot bearing (28) supporting the pivot end (32) of said outrigger (26), said outrigger (26) rotatable about said pivot bearing (28);
   a rail assembly (30) supporting said outrigger (26) between the pivot end (32) and the outboard end (34), said outrigger (26) slidable along said rail assembly (30); and
   support means for supporting a weight, said support means connected to said outrigger (26) proximate the outboard end (34).

2. The nautical balance system (10) as defined in claim 1 wherein said support means comprises a seat (40) for supporting a helmsman.

3. The nautical balance system (10) as defined in claim 1 wherein said support means is disposed at a distance from said pivot end (32) and said outrigger (26) includes adjustment means (42) for adjusting the distance from said pivot end (32) to said support means.

4. The nautical balance system (10) as defined in claim 1 wherein said rail assembly (30) includes a rail (44) having two ends.

5. The nautical balance system (10) as defined in claim 4 wherein said rail assembly (30) further includes a pair of stops (56) for limiting rotation of said outrigger (26) about said pivot bearing (28), one of said stops (56) disposed a substantial distance from each one of the ends of said rail (44).

6. The nautical balance system (10) as defined in claim 4 wherein said outrigger (26) includes:

   a first roller (52) disposed above said rail (44) for supporting said outrigger (26) on said rail (44), said first roller (52) permitting said outrigger (26) to slide along said rail (44); and
   a second roller (54) disposed below said rail (44) for maintaining said outrigger (26) proximate said rail (44).

7. The nautical balance system (10) as defined in claim 4 wherein said rail assembly (30) further includes a plurality of rail supports (48) depending from said rail for supporting said rail (44) above a surface.

8. The nautical balance system (10) as defined in claim 7 wherein said rail assembly (30) further includes a lower connection rail (46) attached to each of said rail supports (48), said bottom connection rail (46) for fastening to a supporting surface.

9. A sailboat comprising:

   a hull and deck structure having a longitudinal centerline;
   a pivot bearing attached to said hull and deck structure;
   an outrigger having a pivot end and an outboard end, the pivot end supported by said pivot bearing, said outrigger rotatable about said pivot bearing:
   a rail assembly supporting said outrigger between the pivot end and the outboard end, said outrigger slidable along said rail assembly, said rail assembly attached to said hull and deck structure; and
   support means for supporting a weight, said support means connected to said outrigger proximate the outboard end.

10. The sailboat as defined in claim 9 wherein said pivot bearing is attached to said hull and deck structure on the centerline.

11. The sailboat as defined in claim 9 further comprising a mast for supporting at least one sail, said mast attached to said hull and deck structure, said pivot bearing attached to said hull and deck structure independently from said mast.

12. The sailboat as defined in claim 11 wherein said outrigger rotates about said pivot bearing in a plane substantially perpendicular to said mast.

13. The sailboat as defined in claim 9 wherein said hull and deck structure includes a deck and said outrigger rotates about said pivot bearing in a plane substantially parallel to said deck.

14. The sailboat according to claim 13 wherein the rail assembly has a generally semicircular shape and extends across substantially the entire deck.

15. The sailboat according to claim 9 wherein said support means comprises a seat for supporting a helmsman.

16. The sailboat according to claim 15 further comprising:

a mast attached to said hull and deck structure; and
a boom attached to said mast; wherein

said seat is aft of said boom when both said outrigger and said boom are parallel to said centerline.

17. The sailboat according to claim 15 wherein said rail assembly includes a rail supported above said hull and deck structure, said rail supporting said outrigger said rail having two ends, whereby a helmsman seated in said seat is able to place his feet on said rail for stability and to control the rotation of said outrigger about said pivot bearing.

18. The saiboat according to claim 15 wherein said rail assembly includes a pair of stops for limiting rotation of said outrigger said stops disposed a substantial distance from the ends of said rail, whereby upon engagement of said outrigger with one of said stops the helmsman is able to place feet on said rail on both sides of said outrigger.

19. The sailboat according to claim 15 further including adjustment means for moving said seat along said outrigger.

20. A sailboat comprising:

a deck covering a hull to form an floating assembly having a longitudinal centerline;
a mast fastened to said deck on the longitudinal centerline, said mast for supporting at least one sail;
a boom attached to said mast;
a pivot bearing attached to said deck on the centerline at a location independent of said mast; a rail assembly including,
an upper support rail raised above said deck, said support rail having two ends,
a lower connection rail fastened to said deck,
a plurality of rail supports extending between said support rail and said connection rail, and
a pair of stops fastened to said support rail a substantial distance from the ends of said support rail, said rail assembly having a generally semicircular shape centered about said pivot bearing and extending across said deck;
an outrigger having a pivot end and an outboard end, the pivot end supported by said pivot bearing, said outrigger including a roller assembly enabling said outrigger to slide along said upper support rail of said rail assembly, said roller assembly including,

an upper roller disposed above said support rail for supporting said outrigger on said support rail, and
a lower roller disposed below said support rail for maintaining said outrigger proximate said rail assembly;
an adjustable seat attached to said outrigger proximate the outboard end, said seat movable along said outrigger, said seat located aft of said boom when both said boom and said outrigger are aligned along the centerline.

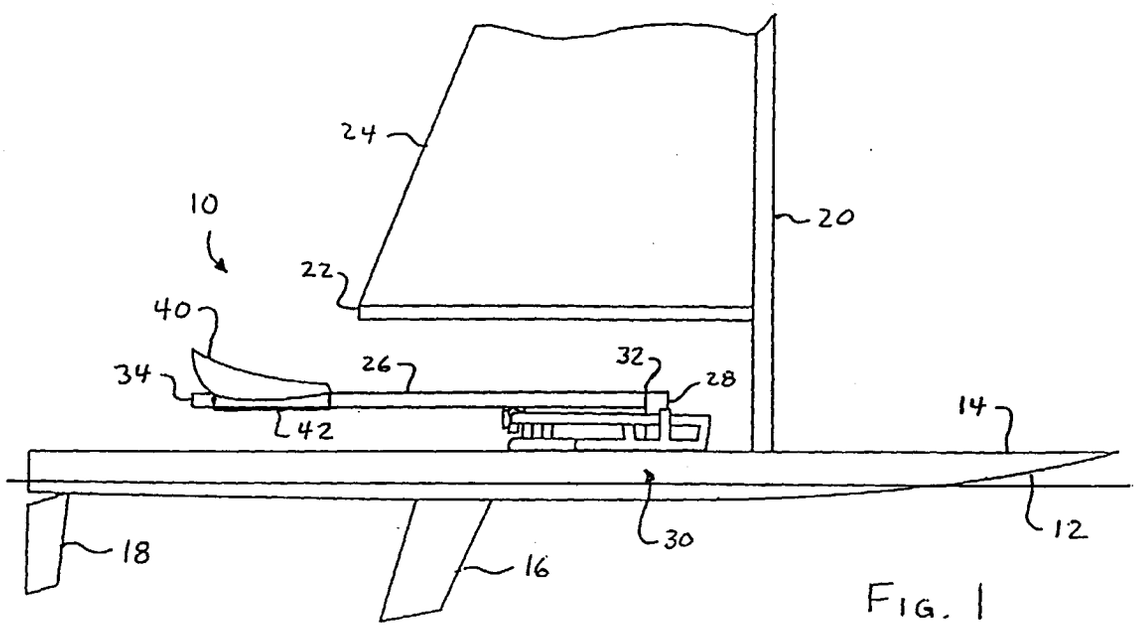


FIG. 1

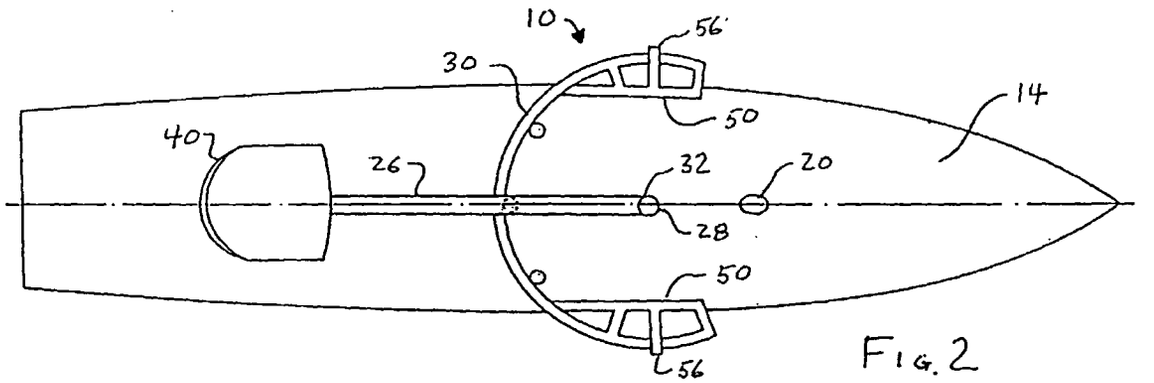


FIG. 2

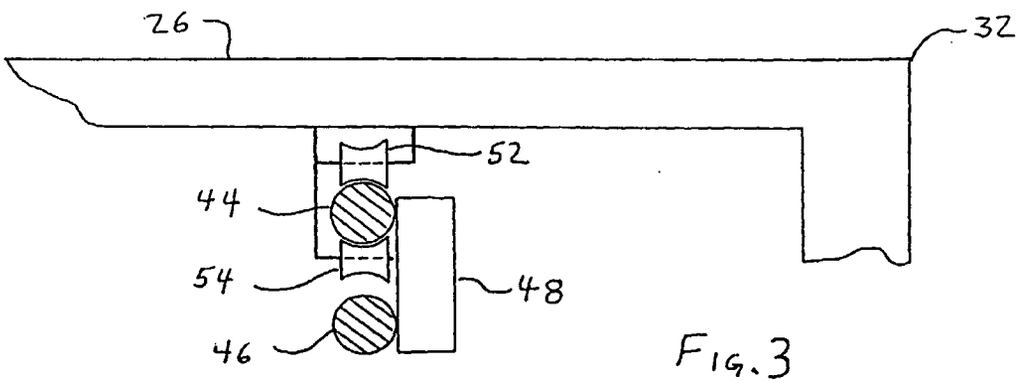
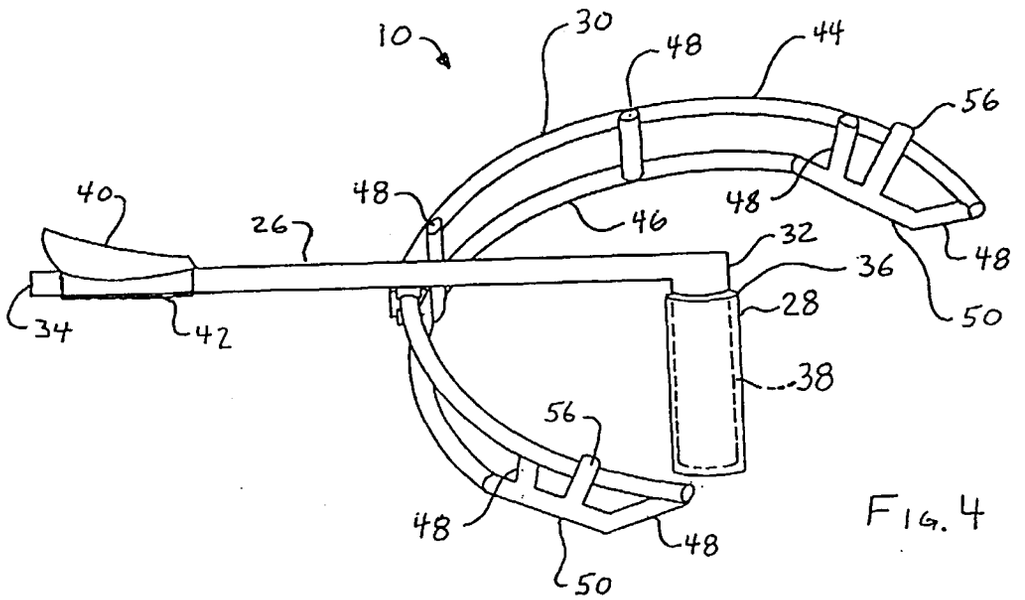


FIG. 3


10
30
48
44
56
40
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26
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36
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50

FIG. 4

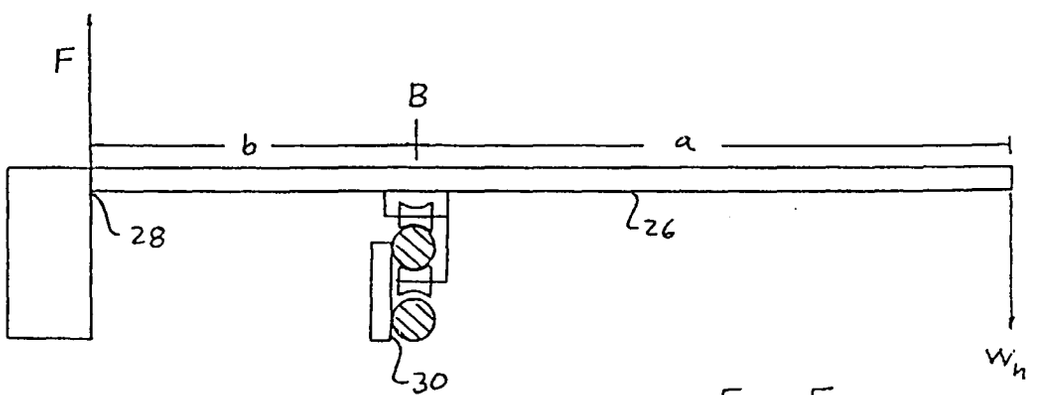
F
B
b
a
28
26
30
W_h

FIG. 5

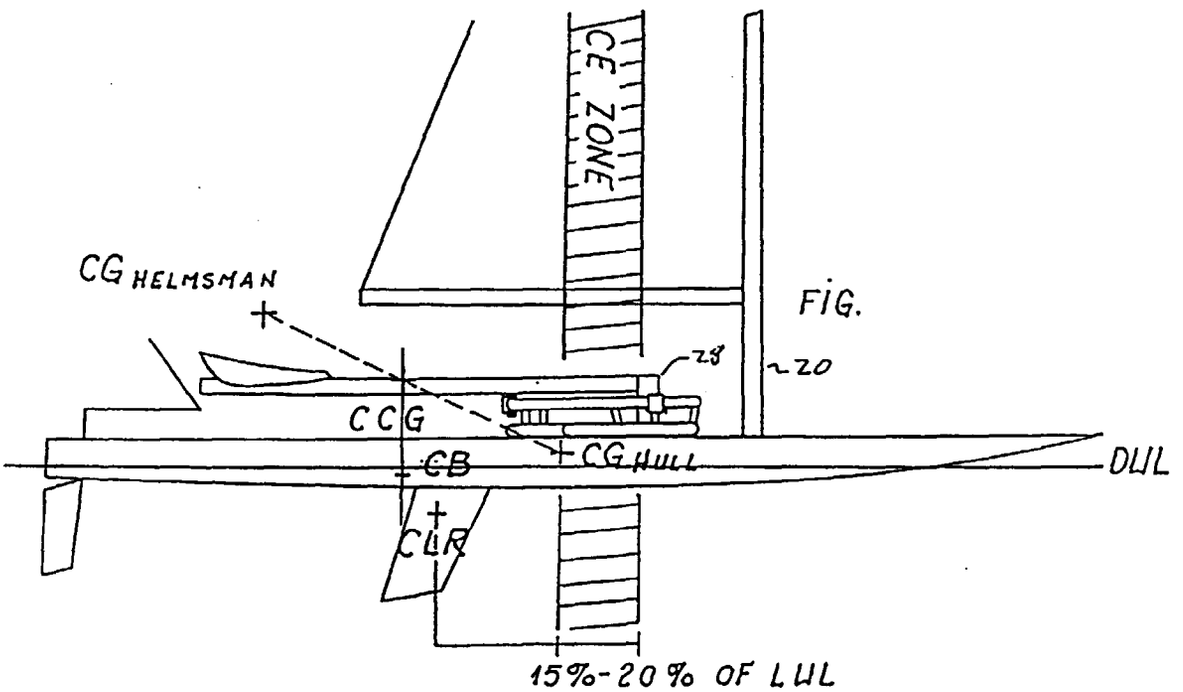

FIG. 6.

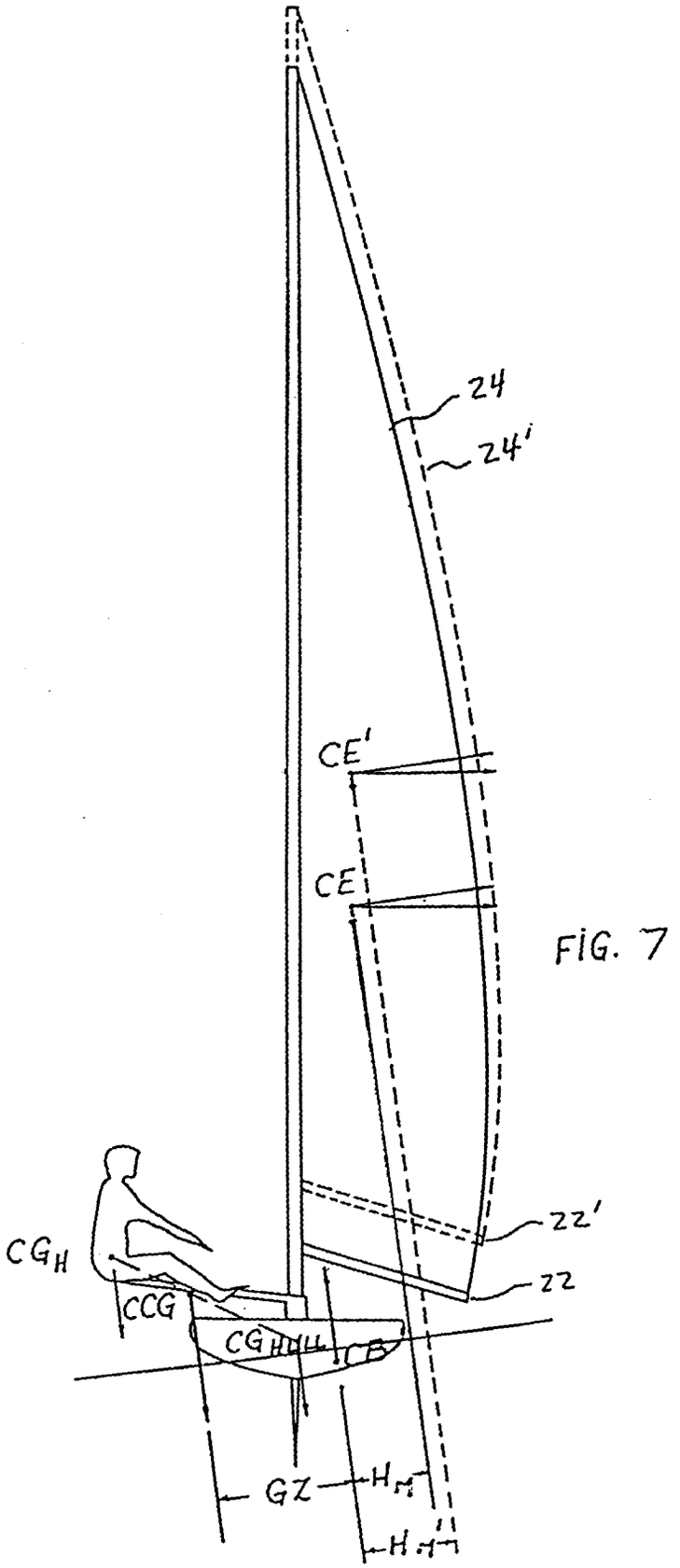

FIG. 7