March 5, 1968 W. M. JOY 3,371,642

TRIM CONTROL DEVICE FOR BOATS

Filed Oct. 15, 1965 3 Sheets-Sheet 1

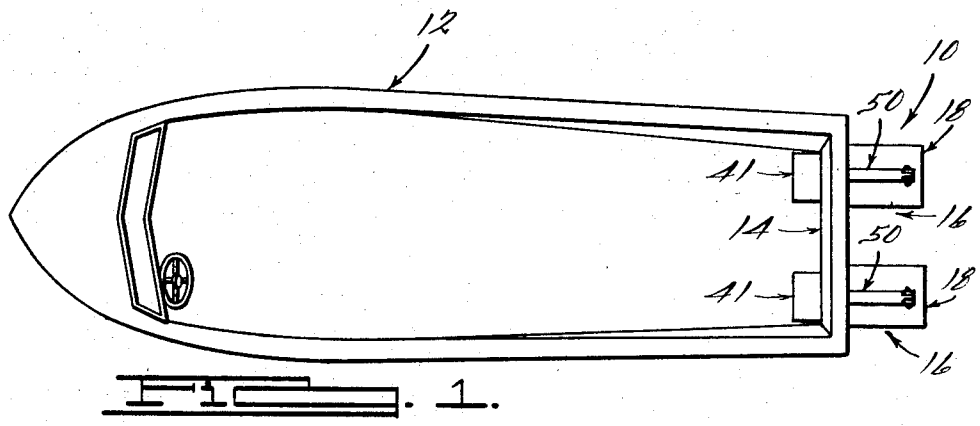


FIG. 1.

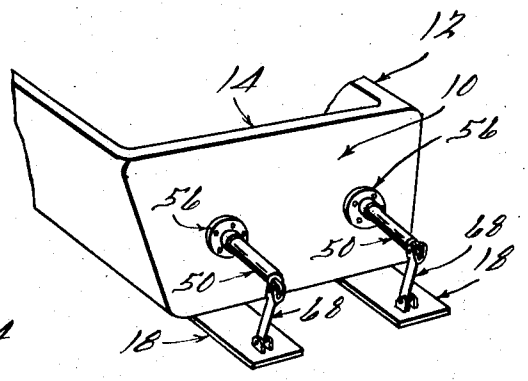


FIG. 2.

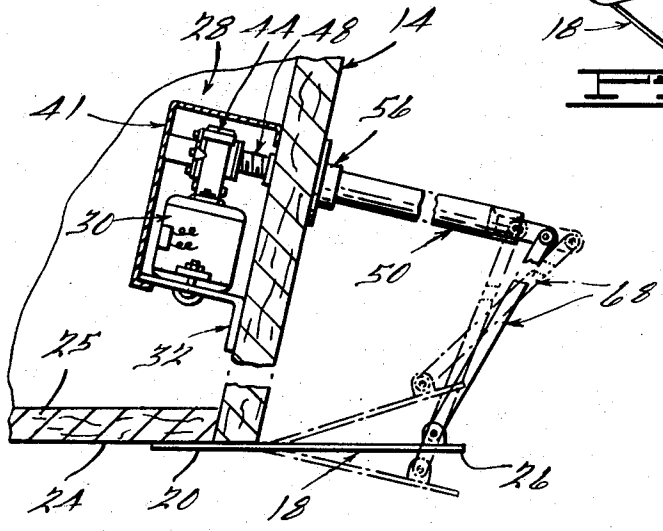


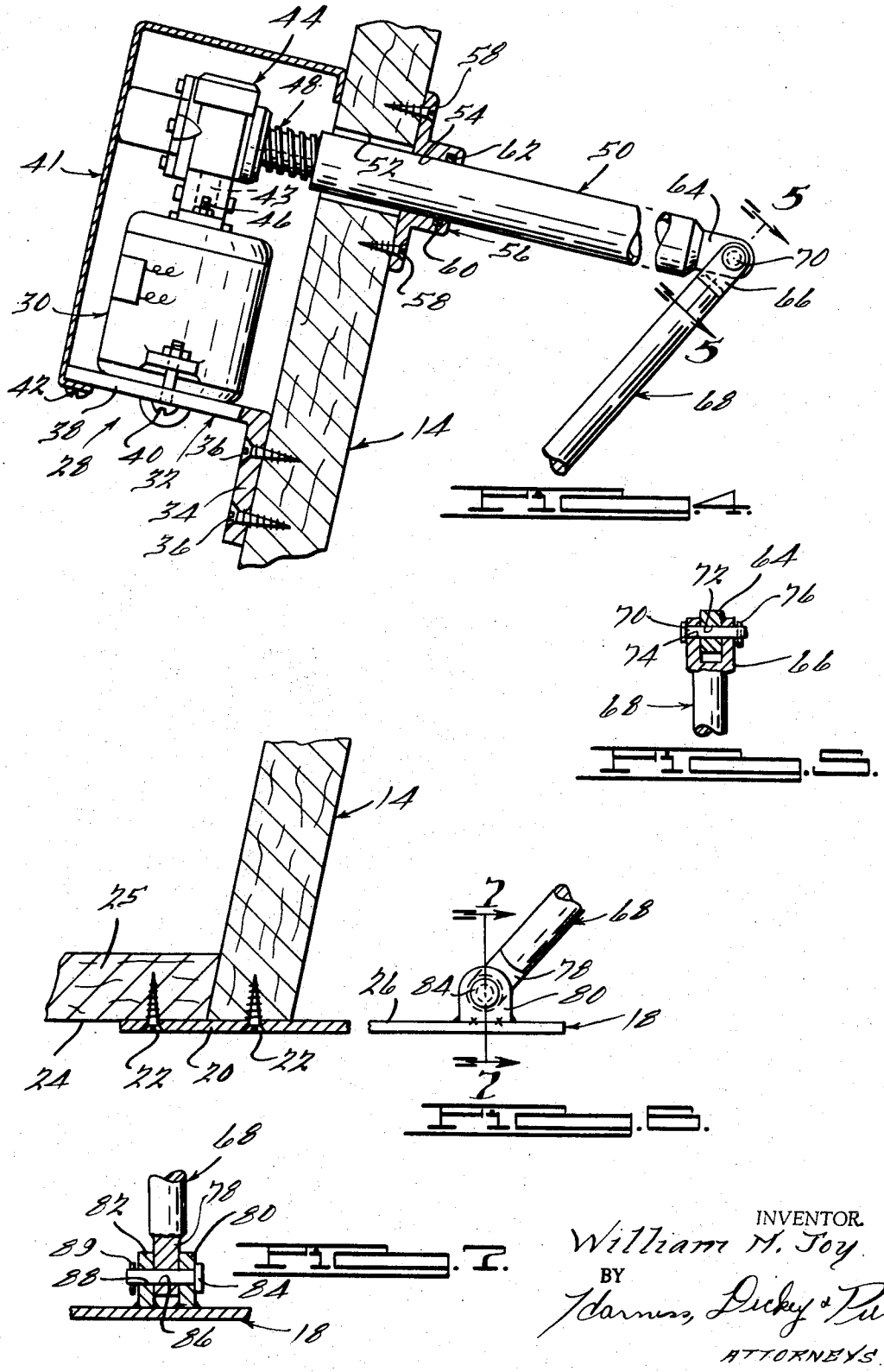
FIG. 3.

INVENTOR.
William M. Joy.
BY
Darness, Dicky & Pierce
ATTORNEYS.

March 5, 1968 W. M. JOY 3,371,642

TRIM CONTROL DEVICE FOR BOATS

Filed Oct. 15, 1965 3 Sheets-Sheet 2



INVENTOR.
William M. Joy
BY
Harness, Dickey & Pierce
ATTORNEYS.

March 5, 1968 W. M. JOY 3,371,642

TRIM CONTROL DEVICE FOR BOATS

Filed Oct. 15, 1965 3 Sheets-Sheet 3

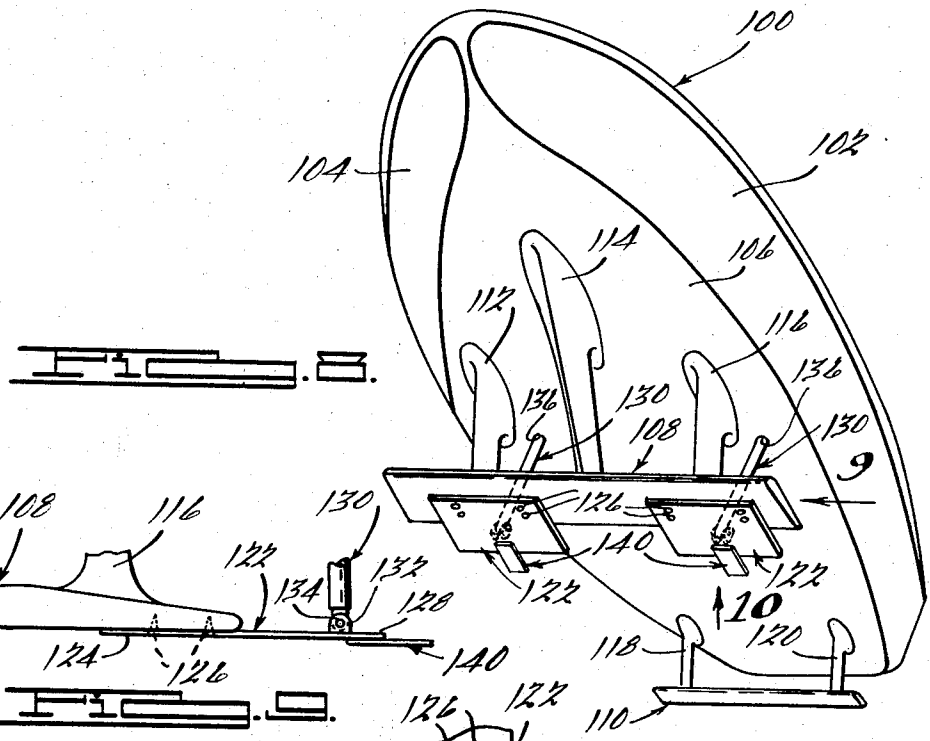


FIG. 8.

FIG. 9.

FIG. 10.

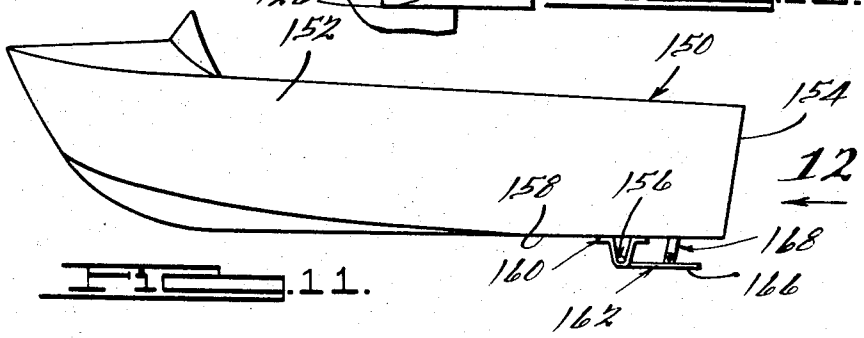


FIG. 11.

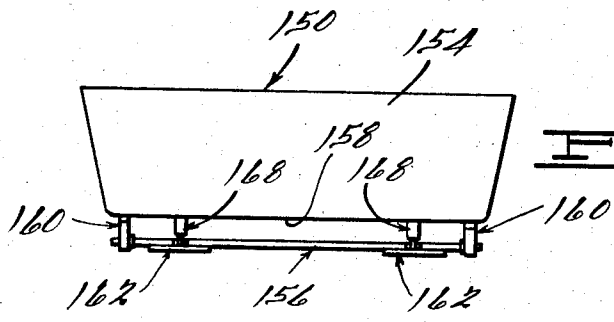


FIG. 12.

INVENTOR.
William M. Joy.
BY
Harness, Dickey & Pierce
ATTORNEYS.

United States Patent Office 3,371,642 Patented Mar. 5, 1968

3,371,642

TRIM CONTROL DEVICE FOR BOATS

William M. Joy, 1615 N. River Road,
St. Clair, Mich. 48079

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8 Claims. (Cl. 114—66.5)

This invention relates generally to improvements in boat trimming stabilizers and, more particularly, to a new and improved boat stabilizer which is adapted to be attached or mounted on the stern of a boat and be selectively positioned for coaction with the water during forward movement of the boat to control the longitudinal attitude of the boat.

The attitude, stability and movement of a boat during its propulsion through the water is affected by various factors, such as the shape of the hull, the area and symmetry and surface of the hull which is in contact with the water and the draft or depth to which the boat extends beneath the surface of the water. The operation of boats may also be greatly affected by the amount of power which is used to propel them such that a boat which is designed to operate satisfactorily with a motor of one particular size will assume one attitude in the water under optimum operating conditions; however, the operational efficiency of this same boat will be greatly reduced when the boat is provided with a motor of increased power due to the boat assuming a much greater attitude in the water.

There has heretofore been proposed various methods of overcoming the above stability problems whereby a particular boat may be efficiently operated with motors of varying power capacities. One very popular method of overcoming these problems is by providing one or more rearwardly extending plates or brackets on the stern of the boat which form extensions on the bottom surface area thereof, these plates or brackets being arranged at a preselected position relative to the bottom and transom of the boat for coaction with the water, whereby the boat will move through the water at a proper attitude under particular loading and power conditions. It will be noted, however, that such heretofore commonly employed devices have the inherent disadvantage that they only operate efficiently under particular loading conditions, i.e., certain fuel and passenger loads. More recently, devices have been proposed which are capable of being adjustable to accommodate various loading conditions but such devices heretofore known and used have been relatively complex in operation and construction and are accordingly difficult to install and operate, along with being relatively expensive to commercially produce.

It is accordingly a general object of the present invention to provide a new and improved stabilizing device of the above character which is extremely simple in construction and operation and which may be readily adjusted to accommodate various loading conditions to which a particular boat may be subjected.

It is a more particular object of the present invention to provide a new and improved boat trimming device of the above character which may be readily adjusted to accommodate relatively heavy or light bow loading of the boat.

It is another object of the present invention to provide a new and improved boat trimming device of the above character which obviates the necessity of providing relatively complex support brackets and the like on the bottom or transom of a boat for the support of the trimming device.

It is still another object of the present invention to provide a new and improved boat trimming apparatus of the above character that is adapted to be used on marine hydrofoil systems.

It is yet another object of the present invention to provide a new and improved boat trimming device of the above character which is of an extremely simple design, rugged construction, is easy to assemble and economical to commercially produce.

Other objects and advantages of the present invention will become apparent from the following detailed description taken in conjunction with the accompanying drawings, wherein:

FIGURE 1 is a top elevational view of the boat trimming apparatus of the present invention, as shown operatively installed on a conventional motor boat or the like;

FIGURE 2 is an elevated perspective view of the stern portion of the boat illustrated in FIGURE 1;

FIGURE 3 is a fragmentary side elevational view of the boat trimming apparatus illustrated in FIGURE 1;

FIGURE 4 is an enlarged fragmentary cross-sectional view of the structure illustrated in FIGURE 3;

FIGURE 5 is a fragmentary cross-sectional view taken along the line **5—5** of FIGURE 4;

FIGURE 6 is an enlarged fragmentary side elevational view of the boat trimming apparatus of the present invention;

FIGURE 7 is a fragmentary cross-sectional view taken along the line **7—7** of FIGURE 6;

FIGURE 8 is an elevated perspective view of a slightly modified embodiment of the boat trimming apparatus of the present invention, as shown operatively installed on a marine hydrofoil system;

FIGURE 9 is an enlarged side elevational view of a portion of the structure illustrated in FIGURE 8, as seen in the direction of the arrow **9** thereof;

FIGURE 10 is a bottom elevational view of a portion of the structure illustrated in FIGURE 8, as seen in the direction of the arrow **10** thereof;

FIGURE 11 is a side elevational view of another embodiment of the boat trimming apparatus of the present invention; and

FIGURE 12 is a side elevational view of the structure illustrated in FIGURE 11, as seen in the direction of the arrow **12** thereof.

Referring now to FIGURES 1 through 3 of the drawings, the boat trimming apparatus of the present invention, generally designated by the numeral **10**, is shown in operative association with a boat **12** of conventional construction, such as an outboard motor boat of the pleasure or racing type having a transom **14** at its stern to which a portable outboard motor (not shown) of the usual kind may be conveniently attached. The boat trimming apparatus **10** of the present invention comprises a pair of identical trim assemblies, generally designated by the numeral **16**, which are adapted to be mounted on the port and starboard sides of the transom **14** and extend rearwardly therefrom to provide portions of considerable area extending rearwardly or aft of the bottom of the boat **12** and in the general plane thereof, whereby to resist lateral and longitudinal tilting of the boat as the same is propelled through the water under various operating and loading conditions. It may be noted that, together with the above described method of securing the forward portions **20** of the trim tab elements **18** to the boat bottom **25**, it may be possible to bend the elements **18** approximately 90° parallel to their transverse axes, whereby the elements **18** will be generally L-shaped. The upwardly projecting portions of the elements **18** defined by these bends may then be rigidly secured to the outer surface of the boat transom **14** in a manner such that the rear portions **26** of the tabs **18** project rearwardly or aft of the transom **14** in substantial coplanar relation with the boat bottom **25**.

As best seen in FIGURES 1, 2 and 6, each of the trim

assemblies **16** comprises a flat or planar plate-like element or trim tab **18** which is generally rectangular in shape and is preferably constructed of stainless steel or a similar strong, corrosion-resistant material. The trim tabs **18** are preferably of uniform thickness which is selected such that the tabs **18** are somewhat flexible about their transverse or lateral axes, as will be described. The trim tab **18** of both of the assemblies **16** is adapted to be mounted on the boat **12** by having the forward portion thereof, herein designated **20**, rigidly secured by means of a plurality of countersunk screws, bolts or the like **22** to the exterior surface **24** of the bottom **25** of the boat **12**, whereby the rear portions, herein designated **26**, of each of the tabs **18** projects aft of the boat transom **14** and in substantial coplanar relation with the bottom of the boat **12**, as best seen in FIGURE 6. By virtue of the flexible construction of the trim tabs **18**, the rear portions **26** thereof are adapted to pivot or flex angularly upwardly and downwardly relative to the forward portions **20** thereof and thus relative to the plane of the bottom of the boat **12**. By thus angularly raising or lowering the rear portions **26** of the trim tabs **18**, the tabs **18** will serve to minimize both longitudinal and lateral tilting of the boat **12** such that the same may be propelled through the water at a desirable attitude under various operational and loading conditions, as will later be described.

Referring now to FIGURES 3, 4, 5 and 7, each of the trim assemblies **16** comprises an actuating mechanism **28** for independently raising and lowering the rear portions **26** of the associated trim tab **18** and thus for controlling the stability of the boat **12**. As best seen in FIGURE 4, each of the mechanisms **28** comprises a reversible electric motor **30** of conventional design which is adapted to be actuated by electrical energy from any suitable source, such as batteries or an outboard motor powered generator or the like. The motor **30** of each mechanism **28** is adapted to be supported on the interior side of the boat transom **14** by an L-shaped mounting bracket **32** which has a downwardly extending leg section **34** secured to the transom **14** by suitable screws, bolts or the like **36**, and an upper leg section **38** that is secured to the lower side of the motor **30** by suitable screws or bolts **40**. The motors **30** may be housed within suitable covers **41** which are secured at their lower ends to the brackets **32** by suitable screws **42**. The motors **30** of each of the trim assemblies **16** have a drive shaft **43** which is connected to a right angle drive unit **44** that is secured to the top of the associated motor **30** by suitable screws or bolts **46**. The right angle drive units **44** include externally threaded output shafts **48** which, upon actuation of the motors **30**, are adapted to move internally threaded shafts **50** that are threadably mounted upon the output shafts **48** in directions axially or longitudinally thereof. As seen in FIGURE 4, the shafts **50** extend through openings **52** in the upper end of the transom **14** and through central bores **54** formed in a pair of sealing collars **56** that are secured to the exterior side of the transom **14** coaxially of the openings **52** by suitable screws **58**. Suitable O-ring sealing members or the like **60** are retained within semi-circular shaped grooves **62** formed around the bores **54** of the collars **56**, the sealing members **60** serving to prevent any water from entering into the boat **12** between the outer periphery of the shaft **50** and the inner periphery of the openings **52**.

The outer ends of the shafts **50** are formed with generally rectangular shaped end sections **64** which are adapted to be pivotably connected within bifurcated or yoke-shaped end sections **66** that are formed on the upper ends of a pair of actuating rods **68** by suitable pivot pins or the like **70**. As seen in FIGURE 5, the pins **70** may be retained within suitable axially aligned bores **72** and **74** that are formed in the end sections **64** and **66**, respectively, by conventional cotter keys or the like **76**.

Referring now to FIGURE 7, the lower ends of the actuating rods **68** are formed with rectangular shaped end sections **78** which are adapted to be pivotably secured between a pair of spaced parallel bosses **80** and **82** that are secured to the tops of the rearmost portions of the end sections **26** of each of the trim tabs **18** as by welding or the like, the end sections **78** being pivotably connected to the bosses **80** and **82** by suitable pivot pins or the like **84** which extend through axially aligned bores **86** and **88** formed in the end section **78** and bosses **80**, **82**, respectively. The pins **84** may be retained within the bores **86** and **88** by suitable cotter keys **89**.

The dimension of the shafts **50** and actuating rods **68** of each of the trim assemblies **16** are selected such that as the shafts **50** move axially away from the exterior surface of the transom **14**, upon appropriate energization of the associated motors **30**, the rods **68** will be biased upwardly and outwardly, as indicated by the phantom lines in FIGURE 3, resulting in the rear end portions **26** of the trim tabs **18** being flexed upwardly relative to the plane of the bottom of the boat **12**. In a similar manner, as the shafts **50** move axially in a direction toward the interior surface of the transom **14**, the associated rods **68** will be biased downwardly, resulting in the rear end portions **26** of the trim tabs **18** being biased downwardly relative to the plane of the bottom of the boat **12**, as also indicated by the phantom lines in FIGURE 3.

In operation of the boat stabilizing apparatus **10** of the present invention, assuming that the boat **12** is being initially propelled or accelerated, for example, when moving away from a dock or similar mooring structure, the bow of the boat **12** will tend to rise out of the water. At such time as any appreciable amount of waves are encountered, the boat will be subjected to substantial bouncing and pounding, resulting in unpleasant jarring of the boat **12** and its occupants. To overcome such unpleasant effects resulting from the improper attitude of the boat **12** moving through the water, the electric motors **30** of each of the trim assemblies **16** may be appropriately energized such that the shafts **50** are biased inwardly or toward the interior surface of the transom **14** resulting in the rear end portions **26** of the trim tabs **18** being biased or flexed downwardly relative to the plane of the bottom of the boat **12**. As the end portions **26** are thus moved, the hydrodynamic effect of the water impinging against the lower surfaces of the portions **26** will tend to raise the stern of the boat **12** sufficient to attain a proper attitude and thus obviate the aforementioned bouncing and pounding of the boat **12** and unpleasant effects resulting therefrom.

When the load distribution in the boat **12** is such that the bow or front end thereof rides lower in the water than the stern or rear end of the boat, the motors **30** of each of the trim assemblies **16** may be energized such that the shafts **50** are biased outwardly or away from the outer surface of the transom **14**, resulting in the rear end portions **26** of the trim tabs **18** being biased or flexed upwardly relative to the plane of the bottom of the boat **12**. The hydrodynamic effect of the water on the end portions **26** disposed in their raised positions will cause the stern of the boat **12** to be lowered in the water as the boat **12** is propelled, whereby the boat **12** will attain a desirable horizontal attitude.

It may be noted that by virtue of the fact that each of the trim assemblies **16** is independently operable, it may be possible to raise the rear end portion **26** of one of the trim tabs **18** and simultaneously lower the rear end portion **26** of the other of the trim tabs **18**, whereby to achieve lateral stabilizing of the boat **12** under various loading and operating conditions and thus prevent the boat from tilting toward one side or the other as the same is propelled through the water.

It will thus be seen that the boat stabilizing apparatus **10** of the present invention provides means for controlling both the longitudinal and lateral stability of a boat in the water, which apparatus, as hereinabove described, may be installed in a minimum amount of time and be controlled by relatively simple manipulation of any suitable

control such as electrically operated switches or the like for appropriately energizing the motors **30** of the trim assemblies **16**.

Referring now to FIGURES 8 through 10, a slightly modified construction of the boat trimming apparatus of the present invention is shown in operative association with a boat **100** of conventional construction including port and starboard sides **102** and **104**, respectively, and a bottom section **106**. The boat **100** is provided with forwardly and rearwardly positioned hydrofoils **108** and **110**, respectively, which are disposed below the bottom section **106** of the boat **100** and extend transversely of the longitudinal axis thereof. The forward hydrofoil **108** is attached to the bottom section **106** by a plurality of substantially vertical struts **112**, **114** and **116**. In a similar manner, the rear hydrofoil **110** is secured to the bottom section **106** of the boat **100** by a pair of laterally spaced struts **118** and **120**.

In accordance with the principles of the present invention, the forward hydrofoil **108** is provided with a pair of laterally spaced plate-like elements or trim tabs **122** which are preferably of the same general construction as the trim tabs **18** hereinabove described. It may be noted that during most loading and operating conditions, it is not necessary to provide the rear hydrofoil **110** with the trim tabs **122** since the rear hydrofoil **110** tends to seek the same level of submersion as the front hydrofoil **108** to maintain the boat **100** at a substantially level keel; however, it will be apparent that the rear hydrofoil **110** may be provided with such trim tabs when the design of the boat and the operating conditions therefor so warrant.

As best seen in FIGURE 9, each of the trim tab members **122** comprises a forward portion **124** which is adapted to be secured to the lowermost side of the hydrofoil **108** by means of suitable screws, bolts or the like **126**, whereby the rear portions **128** of the trim tabs **122** project toward the rear end of the boat **100** in substantial coplanar relation with the bottom surface of the hydrofoil **108**. By virtue of the flexible construction of the trim tabs **128**, is hereinabove described, the rear portions **128** are adapted to pivot or flex angularly upwardly and downwardly relative to the forward portions **124** thereof and thus relative to the plane of the lower surface of the hydrofoil **108**. By thus varying the angular relation of the rear portions **128** of the trim tabs **122** relative to the plane of the lower surface of the hydrofoil **108**, the boat operator may control the attitude of the boat **100** as the same is propelled through the water, and may also maintain the hull of the boat **100** at a predetermined distance above the surface of the water.

Means for thus biasing the rear portions **128** of the trim tabs **122** angularly upwardly and downwardly is provided by a pair of actuating shafts **130** which extend upwardly from the rear portions **128** of the trim tabs **122** and are secured at their lower ends to the upper surfaces of the portions **128** by means of suitable pairs of bosses **132** and pivot pins **134** that are substantially identical in construction and operation to the bosses **80** and pivot pins **84** hereinbefore described in connection with the trim tab **18** and shafts **68**.

The upper ends of the shafts **130** extend through suitable openings **136** in the bottom section **106** of the boat **100** and are connected to suitable actuating mechanisms (not shown) adapted to selectively bias the shafts **130** axially upwardly or downwardly, whereby to pivot the rear portions **128** of the trim tabs **122** upwardly or downwardly, as above described. One suitable mechanism for selectively biasing the shafts **130** is the hereinbefore described actuating mechanism **28** which includes a suitable electric motor **30**, drive unit **44** and externally threaded shaft **148**. Suitable sealing means (not shown) such as O-rings or the like are preferably interposed between the outer periphery of the shafts **130** and the inner periphery of the openings **136** to prevent water from passing between these surfaces into the interior of the boat **100**.

Referring now to FIGURE 10, the rear portions **128** of each of the trim tab members **122** are provided with generally rectangular shaped flaps or tabs **140** which are adapted to have their forward end portions secured as by spot-welding, screws, bolts or the like to the lower surface of the rear portions **128**, the rear portions of the flaps or tabs **140** extending rearwardly of the trim tabs **122** and being adapted to be manually bent upwardly or downwardly in accordance with the operating conditions to which the boat **100** is to be subjected. More particularly, the rear ends of the flaps **140** are adapted to be bent upwardly or downwardly to compensate for drag, motor size and various other parameters.

Referring now to FIGURES 11 and 12, a slightly modified embodiment of the boat trim apparatus illustrated in FIGURES 8 through 10 is shown in operative association with a boat **150** of conventional design and comprising a hull portion **152** which terminates at its stern end in a substantially vertical transom section **154**. In accordance with the principles of the present invention, the boat **150** is provided with a trim tab support bar **156** which extends transversely of the bottom **158** of the hull **152** slightly forward of the transom **154**. The bar **156** is supported at a position spaced from and substantially parallel to the bottom **158** by a pair of laterally spaced, generally U-shaped support brackets **160** which are secured at their upper ends by suitable screws, bolts or the like (not shown) to the boat bottom **158**, the opposite ends of the bar **156** being fixedly secured within the lower ends of the brackets **160**, as best seen in FIGURE 11.

The bar **156** is adapted to support a pair of laterally spaced trim tab members **162** which are substantially identical in construction and operation to the hereinbefore described trim tabs **122** and **18**. As best seen in FIGURE 11, the forward portions of the trim tabs **162** are secured by suitable screws, bolts or the like (not shown) to the lower side of the bar **156**, the rear portions of the trim tabs **162** extending rearwardly of the bar **156** at positions spaced from and substantially parallel to the bottom section **158** of the boat hull **152**. In a preferred construction of the present invention, the rear ends of the trim tabs **162** preferably terminate slightly forward of the plane of the boat transom **154**. The rear portions, herein designated **166**, of the trim tab members **162** are adapted to pivot or flex angularly upwardly and downwardly relative to the plane of the forward portions thereof, as described in connection with the trim tabs **18** and **122**, whereby to control the longitudinal tilting of the boat **150** such that the same may be propelled through the water at a desirable attitude under various operational and loading conditions, as above described.

Means for thus angularly raising or lowering the rear portions **166** of the trim tabs **162** is provided by suitable actuating shafts **168** that are attached to the upper surfaces of the portions **162** in the above described manner and which extend through suitable openings (not shown) in the bottom section **158** of the boat **150**, these shafts being operatively connected to suitable actuating mechanisms (not shown) for selectively biasing the same axially upwardly or downwardly, as was hereinbefore described.

While it will be apparent that the preferred embodiments herein illustrated are well calculated to fulfill the objects above stated, it will be appreciated that the present invention is susceptible to modification, variation and change without departing from the proper scope or fair meaning of the subjoined claims.

What is claimed is:

1. In an apparatus for stabilizing a boat having a hull which terminates at its stern end in an upwardly extending transom section,

a pair of flat rectangular shaped trim tab elements constructed of a relatively flexible material and having a first portion secured to the underside of the hull at the opposite ends of the transom section and a

second portion extending rearwardly of the transom section and disposed in substantially coplanar relation with the underside of the hull,

a pair of actuating motors mounted on said transom section,

a pair of shafts aligned with said trim tab elements and extending through laterally spaced openings in said transom section,

drive means connected to said motors and adapted to move said shafts along the longitudinal axes thereof, and

a pair of actuating rods pivotably connected at their upper ends to said shafts and at their lower ends to the upper sides of said second portions of said trim tab elements,

energization of said motors being adapted to move said shafts longitudinally thereof whereby to vary the inclination of said second portions of said trim tab elements relative to the plane of the underside of the hull.

2. The invention as set forth in claim **1** wherein said trim tab elements are constructed of stainless steel.

3. The invention as set forth in claim **1** wherein said drive units are threadably connected to said shafts.

4. In a boat stabilizing apparatus,

means defining a substantially flat elongated trim tab element having a first section rigidly secured to a portion of the underside of the boat which is in contact with the water as it is propelled through the water and a second section integral with said first section and extending rearwardly of said first section and disposed in substantial coplanar relation with said portion of the boat, and

means for varying the inclination of said second section of said trim tab element relative to said first section thereof including first shaft means pivotably connected at the lower end thereof to said second section and second shaft means pivotably connected to the upper end of said first shaft means and motor means for longitudinally biasing one of said shaft means.

5. In combination with a marine craft having a hydrofoil system,

means defining a substantially flat elongated trim tab element having a first portion rigidly secured to the hydrofoil and a second portion extending rearwardly of the hydrofoil and disposed in substantial coplanar relation with said first portion, and

means for varying the inclination of said second portion of said trim tab element relative to the hydrofoil including first shaft means pivotably connected at the lower end thereof to said second section and second shaft means pivotably connected to the upper end of said first shaft means and motor means for longitudinally biasing one of said shaft means.

6. In an apparatus for stabilizing a boat having a hull which terminates at its stern end in an upwardly extending transom section,

a pair of flat rectangular shaped trim tab elements constructed of a relative flexible material and each having first and second portions,

a trim tab support bar extending laterally of the hull at a position spaced slightly below the underside thereof,

means including support bracket means for supporting said bar at said position spaced below the underside of the hull,

means for rigidly securing said first portions of said trim tab elements to said bar in a manner such that said second portions thereof extend rearwardly toward said transom below and substantially parallel to the underside of the hull, and

means pivotably connected directly to the upper sides of said second portions and including shaft means extending upwardly through the hull for varying the inclination of said second portions of said trim tab elements relative to the plane of the underside of the hull.

7. In a boat stabilizing apparatus,

a pair of trim tab elements constructed of a relatively flexible material and having first portions rigidly secured to the stern end of the boat and second portions extending rearwardly of the boat and disposed in substantial coplanar relation with the underside thereof;

means for independently varying the inclination of said second portions of said trim tab elements relative to the plane of the underside of the boat, said last mentioned means comprising first shaft means pivotably connected to said second portions of said elements, said second shaft means movably connected to said first shaft means, and power means for axially moving said second shaft means.

8. A stabilizing device for a boat having a bottom section and a transom section extending upwardly from said bottom section, said device including,

a trim tab element comprising an elongated, uniformly thick, relatively flexible member having a first portion rigidly secured to one of said boat sections and a second portion extending rearwardly of the transom section in substantial coplanar relation with the bottom section,

an actuating element secured to said second portion of said member adjacent the rear end thereof and operable to bend said second portion both upwardly and downwardly relative to the plane of the bottom section,

upward bending movement of said member being operable to create a downward force on the stern of the boat during forward movement thereof whereby the bow of the boat will be raised, and downward bending movement of said member being operable to create an upward force on the stern of the boat during forward movement thereof whereby the bow of the boat will be lowered.

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ANDREW H. FARRELL, *Primary Examiner.*