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(54) Hydrofoil rowing boat

(57) A rowing boat has a hull (10), a seat (12) for an operator and an associated rigger (17) and stretcher (18). The seat (12), rigger (17) and the stretcher (18) are movable relatively to one another fore and aft as the operator rows. The hull (10) has a hydrofoil (21) for raising the hull (10) above the water as the boat is propelled by the operator. The position of the centre of gravity of the boat and operator is maintained generally constant relative to the hydrofoil (21).

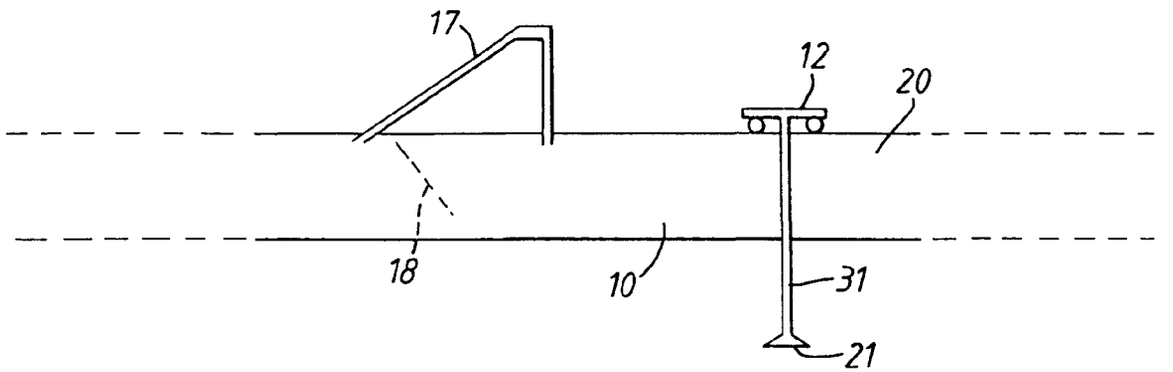

Fig.5

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Description

This invention relates to boats.

A conventional rowing boat comprises a hull, a seat for an operator and riggers fixed to the hull for carrying oars. In a form of such a boat designed for racing, the seat is slidable back and forth along the hull and a stretcher, fixed to the hull, is provided for securing the feet of an operator.

It is known from US-A-4711195 to provide a boat fitted with hydrofoils. The operator of the boat sits on a seat that is stationary relative to the hull. The operator propels the boat using pedals that drive propellers. In US-A-4867718, the hull has a slidable seat and a fixed stretcher with each oar being L-shaped with a hydrofoil mounted at the elbow.

According to the invention, there is provided a rowing boat comprising a hull, a seat for an operator and an associated stretcher, the seat and the stretcher being relatively movable fore and aft as the operator rows, the hull having a hydrofoil associated therewith for raising the hull above the water as the boat is propelled by the operator, the arrangement being such that the position of the centre of gravity of the boat and operator is generally constant relative to the hydrofoil.

In this specification

the word "boat" is used to encompass sculling boats and rowing boats

the word "operator" is used to encompass a person or persons engaged in sculling or rowing

the word "sculling" is used to encompass the actions of sculling (with two sculls) and rowing (with one oar)

the words "hydrofoil" and "hydrofoils" are used to encompass one hydrofoil or a plurality of hydrofoils which are provided and positioned to move through water, individually or together, to provide lift

the word "hull" is used to describe the outer shell of a boat which displaces water when the boat is floating

the word "seat" is used to describe the seat on which an operator sits

the word "rigger" is used to describe a frame fixed to a boat which supports a gate which holds an oar or scull and which serves as the fulcrum for the oar or scull and in this description the word is used to encompass one rigger for a rower or two riggers for a sculler

the word "stretcher" is used to describe the support for an operator's feet, which may include means to hold the feet in a chosen position

the term "seatdeck" is used to describe the component of a boat which supports the seat

the word "slide" is used to describe the means by which some components of a boat slide fore and aft relative to others during the actions of sculling

the term "workframe" is used to describe components or a boat, notably the rigger and the stretcher, which are normally in fixed positions relative to one another to enable an operator to apply power to drive the boat forward,

the word "fore" describes a position towards the front of a boat or a movement towards the front

the word "aft" describes a position towards the stern of a boat or a movement towards the stern

Other words and terms in this specification are applied in accordance with normal usage among those skilled in the arts of rowing and sculling.

The invention overcomes obstacles and limitations experienced in using hydrofoils on boats: if a hydrofoil is fixed to the hull of a conventional boat, the boat becomes unstable when the hydrofoil lifts because an operator carrying out the actions of sculling moves his or her body weight alternately fore and aft in the boat on a sliding seat, therefore moving weight fore and aft relative to the hydrofoil position. Moreover if a hydrofoil is fixed to the hull of a conventional boat, any lift from the hydrofoil raises the seat and workframe above the levels at which the operator can most efficiently carry out the actions of sculling.

Embodiments of the invention are now described by way of example only with reference to the accompanying drawings in which:-

Figure 1 is a plan view of a central section of a boat showing a position occupied by an operator and the means used by that operator in sculling,

Figure 2 is a longitudinal section through the part of the boat of Figure 1,

Figures 3a, 3b and 3c are transverse sections through the part of the boat of Figures 1 and 2 showing a hydrofoil and a control means of the boat in three different configurations,

Figure 4 is a similar view to Figure 1 but showing an alternative form of frame of the boat,

Figure 5 is a similar view to Figure 2 but showing an alternative form of seat and hydrofoil, and

Figure 6 is a similar view to Figure 5 but showing a double slide arrangement of the seat and hydrofoil.

In order to provide a clear view of the essential components of the embodiments shown the drawings, the drawings omit some components of boats which are non-essential to a description of the embodiments.

Referring first to Figure 1, the broken lines extending fore and aft show where the hull 10 continues. This continuation may comprise one or more additional operator positions with the bow and stern of the boat beyond or, in the case of a boat with a single operator, the continuation comprises the bow and stern of the boat. The forward direction of movement of the boat produced by sculling is shown by arrow 11.

A seat 12 is fixed on a seatdeck 13 which has one pin 14 projecting at its fore end and one pin 15 at the aft end. The seatdeck 13 is supported on the pins 14,15 as described later.

Mounted on each side of the seatdeck 13 is a bar 16 which slides fore and aft relative to the seatdeck 13. Fixed to the bars 16 are riggers 17 and a stretcher 18. The bars 16, the riggers 17 and the stretcher 18 form a workframe.

The operator's feet on the stretcher 13 are lower in the hull 10 than the seat 12. Therefore an opening or well 19 is provided through the seatdeck so that the operator's feet and legs can project through the well 19 to the stretcher 13.

As mentioned above, there may be additional positions for operators fore and/or aft of the position shown in the diagram. Alternatively there may be spray covers 20 over the hull fore and aft of the seatdeck, to prevent waves or spray entering the hull 10.

In Figures 3a, 3b and 3c, the approximate water level on the outer surface of the hull is indicated at 33. A hydrofoil 21 extending beneath the hull 10 is supported by two vertical rods 22 which connect at respective pivot points 23 to respective arms 24 which move on respective hinges 25 connected to the hull 10. The inner ends 26 of the arms 24 can thus fall relative to the hull and press a spring or compression means 27 when lift on the hydrofoil 21 increases (see Figure 3b) and can be raised relative to the hull 10 by the spring or compression means 27 when lift on the hydrofoil 21 reduces (see Figure 3c). Since the distance between the hinges 25 and the inner ends 26 of the arms 24 changes as the arms 24 move, the arms 25 may have elbow or sliding joints (not shown) between the hinges 25 and the inner ends 26 of the arms 25. The vertical rods 22, the pivot points 23, the arms 24, the hinges 25 and the inner ends 26, and variations of them for example as described below, to support a hydrofoil are together called a hydrofoil frame.

Referring to Figures 1 and 2 in this embodiment, the pins 14 and 15 are linked to the inner ends 26 of the hydrofoil frame, at their connection to the compression means 27 or to a plurality of frames. The link is direct but this need not be the case. Alternatively, the link may be as shown in Figure 4. In this embodiment a hydrofoil frame with arms 25 has each arm 25 attached to a respective rod 28 extending along a respective side of the hull 10 and pivoted at points 29 (equivalent to the hinges 25 referred to above). The rods 28 are rotated by movement of the arms 24. Arms 30 fixed between the rods 28 and the pins 14,15 raise and lower the seat deck 13 as the rods 28 rotate in different directions.

Figure 3c shows the hydrofoil frame with the rigger 17, the seat 12, the bars 16 and the pin 14. The pin 14 is connected to the spring or compression means 27. This Figure also shows the rigger 17 shaped to project over the side of the hull 10.

In use, an operator sits in the hull 10 on the seat 12 with their feet on the stretcher 13. A pair of oars are fitted to the rigger 17 and the operator sculls the boat in conventional fashion. When the hydrofoil moves through the water and generates lift, the operation of the hydrofoil frame causes the hull to lift up towards or above the surface of the water, thus reducing drag or resistance to forward movement. At the same time, however, the action of the hydrofoil frame causes the seat 12 and the work frame to move down relative to the hull 10 so that the seat 12 and the work frame remain at an approximately constant height above the water. Thus the position of the operator relative to the water remains constant or nearly constant.

When lift generated by the hydrofoil reduces, as the boat slows down, the function of the hydrofoil frame is reversed. The hull 10 moves downwardly, driven, for example, by the spring or compression means 27. The seat 12 and the work frame move upwardly relative to the hull 10 so that the seat 12 and work frame remain at approximately constant height above water level 33. This control of the level of the seat 12 and the work frame thus enables the operator to drive the boat forwards with minimum change in the sculling movements while lift from the hydrofoil 21 increases or decreases.

Reference is made below to variations, which individually or together lie within the scope of the invention.

The speed and extent of movements of the spring or compression means 27 may be regulated and adjustable so that when lift is generated by the hydrofoil 21, the hull 10 rises and the seatdeck falls simultaneously rather than one after the other. It may also be adjustable so that the opposite movements occur simultaneously as lift generated by the hydrofoil 21 decreases.

The hydrofoil frame may comprise a plurality of arms 24 and rods 22 to provide the required strength and to serve additional functions. For example, a hydrofoil 21 may be supported under two pairs of arms 25 and two pairs of rods 22, one pair forward of the other, to provide strength and so that the angle of attack of the hydrofoil 21 can be changed by adjusting the relative lengths of the fore and aft rods 22.

The position of the hydrofoil 21 may be adjusted fore or aft by moving the arms 24 or the rods 28 fore or

aft.

Some components may flex (the word "flex" being used to mean that the component changes shape under stress, with such change being reversed when the stress is reduced by elastic recovery of the former shape) at one or more positions as well as or instead of components moving on pivots or hinges. For example, flexing or other controlled movement at the positions of the hinges 25 may replace the hinges 25. The flexing of the arms 25 as the seatdeck 13 moves down, may reduce the number of components required and may serve instead of the spring or compression means 27 to lift the seatdeck 13 up relative to the hull 10 when lift generated by the hydrofoil 21 reduces.

The boat may have one hydrofoil 21 or a plurality of hydrofoils 21 supported by one hydrofoil frame or a plurality of hydrofoil frames.

Figure 2 shows that the stretcher 18 may be lower than the seatdeck 13 and in this case part of the stretcher 13 may need to be lower than the bottom of the hull 10 when the seatdeck 13 is lowered by the spring or compression means 27. This may be accommodated by a depression in the hull 10 below the stretcher 13 (not shown in Figure 2). This may also serve to keep the boat balanced on the hydrofoil 21 by providing a point of flotation aft of the hydrofoil 21. Alternatively the stretcher 13 may be located higher relative to the seat 12 and the rigger 17 than in most conventional boats, this being acceptable because stability which may be lost by this may be recovered through stability provided by the hydrofoil 21 and/or by the provision of a hull wider than a conventional hull.

The boat may have a hydrofoil and/or fin and/or form suitable for planing on the surface of water fitted near the bow or stern of the boat which rises towards or to the surface of the water when the boat moves forward. This therefore lifts the bow or stern of the boat so that the boat remains approximately level when the hydrofoil 21 provides lift.

In a boat in which the workframe is fixed relative to the hull 10 and in which the operator slides relative to the hull 10, the centre of gravity of the boat and the operator may be maintained in approximately constant position relative to the hydrofoil 21 by linking the hydrofoil to the seat 12. An example of this embodiment of the invention is shown in Figure 5. As seen in this Figure, the hydrofoil 21 is connected by a pair of arms, one of which is shown at 31 to the seat 12 which is mounted on the hull 10 for sliding movement.

Alternatively, referring to Figure 6, the hydrofoil 21 may slide relative to the hull 10, for example being fixed to a hydrofoil slide 32 which may function like a conventional sliding seat and with the seat 12 sliding relative to the hydrofoil 21 by sliding on the hydrofoil slide 32. Thus the hydrofoil 21 slides fore and aft and the seat 12 slides further fore and further aft. The sliding of the hydrofoil slide 32 and the seat 12 can be designed to provide that the centre of gravity of the operator and the boat combined remain in an approximately constant position relative to the hydrofoil 21 during the actions of sculling. Either of the examples of Figures 5 and 6 may be combined with a level control means as described above, which may be actuated by a separate hydrofoil, to adjust and control the level of the seatdeck, the hydrofoil support means, the rigger and the stretcher together or to adjust and control the level of one or more of these.

Claims

1. A rowing boat comprising a hull (10), a seat (12) for an operator and an associated stretcher (18), the seat (12) and the stretcher (18) being relatively movable fore and aft as the operator rows, the hull (10) having a hydrofoil (21) associated therewith for raising the hull (10) above the water as the boat is propelled by the operator, the arrangement being such that the position of the centre of gravity of the boat and operator is generally constant relative to the hydrofoil (21).

2. A rowing boat according to claim 1 wherein the seat (12) and the hydrofoil (21) are fixed relatively to the hull (10) in a fore and aft direction and the associated stretcher (18) is movable fore and aft as the operator rows.

3. A rowing boat according to claim 2 wherein the stretcher (18) is connected to a rigger (17) movable with the stretcher (18).

4. A rowing boat according to claim 2 or claim 3 wherein the seat (12) and the stretcher (18) are movable up and down relative to the hull (10) in a vertical direction, means (22-27) being provided for maintaining the seat (12) and stretcher (18) at a generally constant height above water level as the hydrofoil (21) raises the hull (10) above the water.

5. A rowing boat according to claim 4 wherein the seat (12) is mounted on a substructure that carries said stretcher (18), the substructure being movable in said vertical direction, the hydrofoil (21) being connected to said substructure by a linkage (22-25) such that, as the hull (10) rises out of the water as the boat is propelled, the linkage (22-25) lowers the substructure relative to the hull.

6. A rowing boat according to claim 5 wherein the linkage (22-25) lowers the substructure by generally the same distance as the hydrofoil (21) raises the hull (10) from a position in which the hull (10) is floating in water.

7. A rowing boat according to claim 6 wherein means (27) are provided acting between the substructure

and the hull (10) tending to raise the substructure relative to the hull (10).

8. A rowing boat according to any one of claims 5 to 7 wherein the hydrofoil (21) is connected to a pair of spaced vertical rods (22), each vertical rod (22) being arranged on a respective side of the hull (10), each vertical rod (22) having an upper end pivotally connected to a first end of a respective arm (25) mounted for pivotal movement intermediate the ends thereof, as the hull (10) is raised or lowered, said pivotal movement causing said lowering and raising of the substructure.

9. A rowing boat according to claim 8 wherein each said arm (24) has a second end (26), said second end (26) being pivotally connected to the substructure and said pivotal mounting (25) intermediate the ends thereof being a pivotal connection to the hull (10).

10. A rowing boat according to any one of claims 5 to 9 wherein said hydrofoil (21) is one of two such hydrofoils (21), each hydrofoil (21) being connected to the substructure by a respective linkage (22-25) at respective spaced positions therealong.

11. A rowing boat according to claim 8 wherein each said arm (24) has a second end connected to a rod (28) intermediate the ends of the rod (28), the rod (28) extending parallel to the length of the hull (10) and lying within the hull (10) adjacent a respective side of the substructure, the rods (28) being rotatable to mount the arms (24) pivotally and the rods (28) having respective ends connected to the substructure by links (30) so that, as the hydrofoil (21) raises the hull (10), the arms (24) pivot the rods (28) which, in turn, lower the substructure via the links (30).

12. A rowing boat according to any one of claims 1 to 11 wherein the hull has a bow and a stern, an additional lift producing device being provided at the bow or at the stern.

13. A rowing boat according to claim 12 wherein said additional lift producing device is such that the lift producing device provides lift that increases as the lift producing device is more deeply immersed.

14. A rowing boat comprising a hull (10), a seat (12) for an operator and an associated stretcher (18), the seat (12) and the stretcher (18) being relatively movable fore and aft as the operator rows, the hull (10) having a hydrofoil (21) associated therewith for raising the hull (10) above the water as the boat is propelled by the operator, the seat (12) and the stretcher (18) being movable up and down relative to the hull (10) in a vertical direction, means (27) being provided for maintaining the seat (12) and stretcher (18) at a generally constant height above water level as the hydrofoil (21) raises the hull (10) above the water.

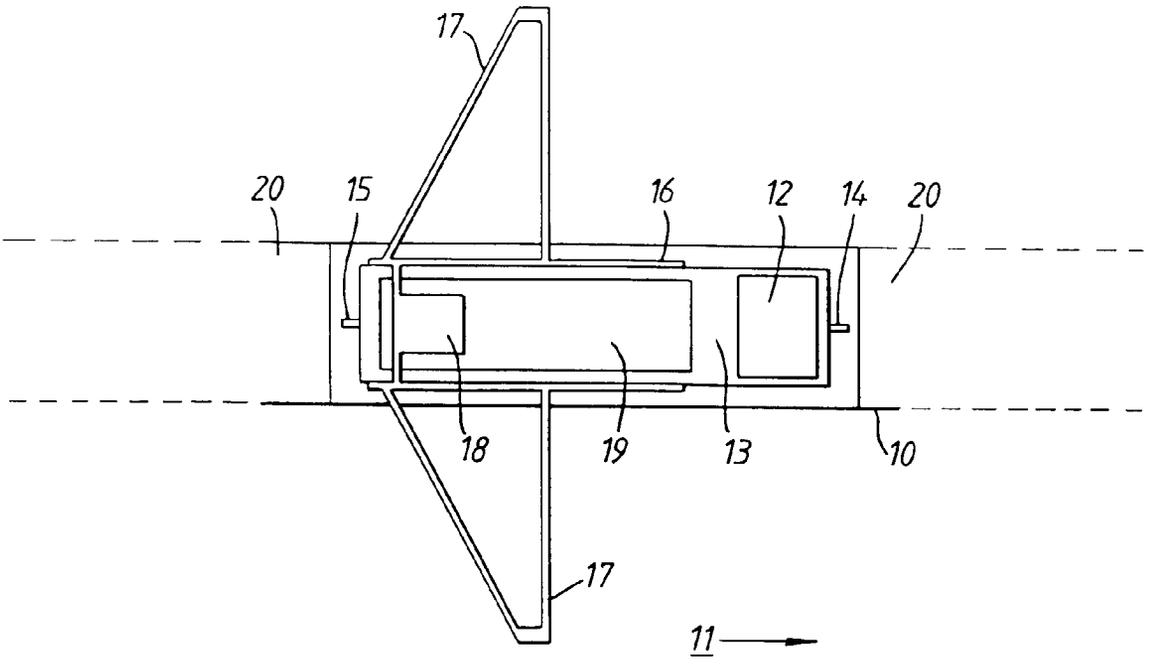

Fig.1

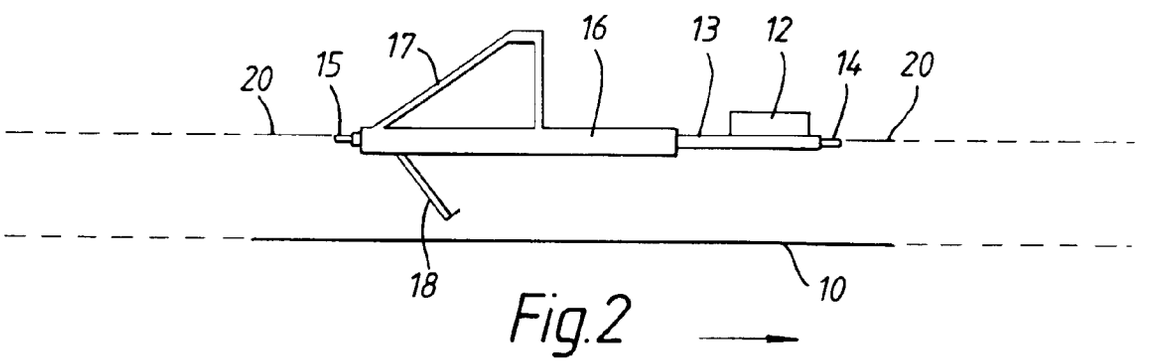

Fig.2

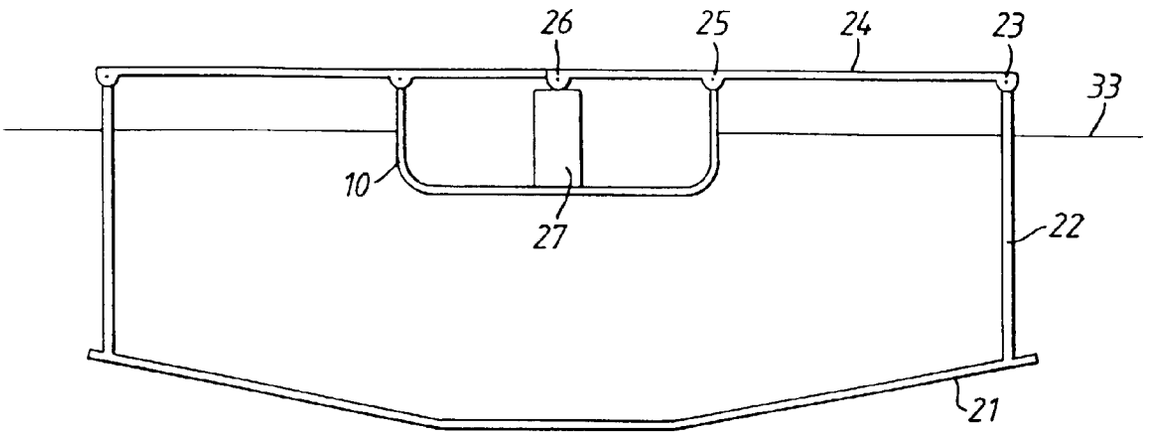

Fig.3a

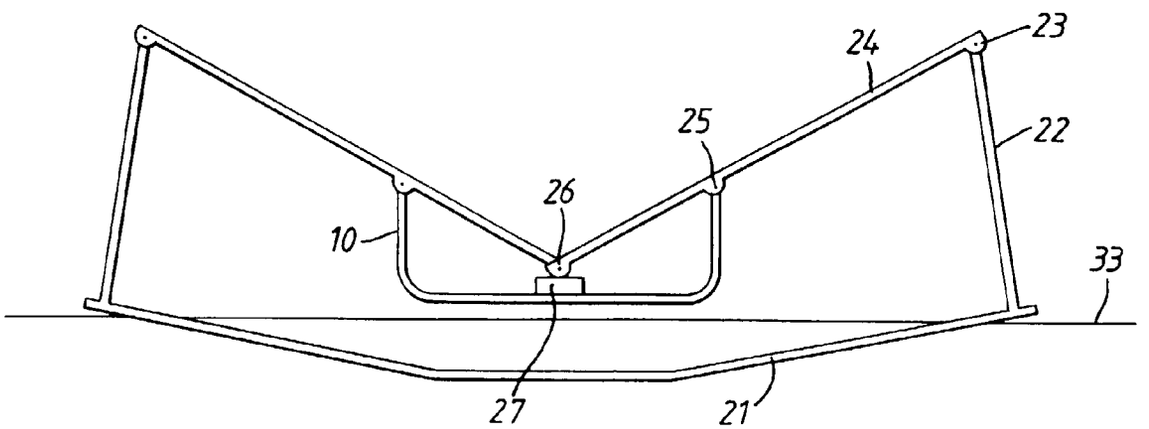

Fig.3b

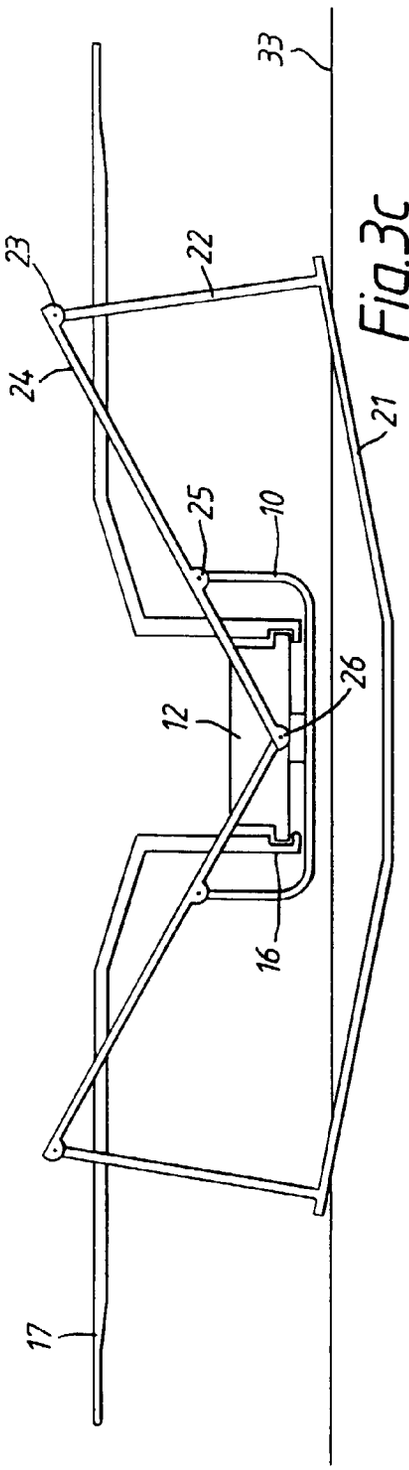

Fig.3c

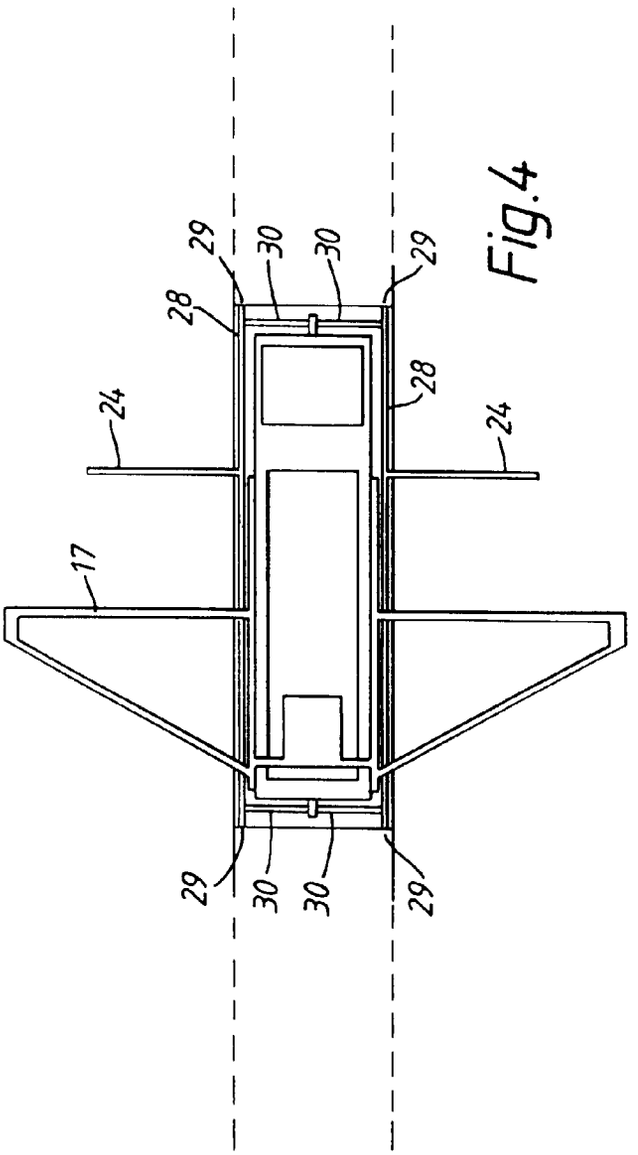

Fig.4

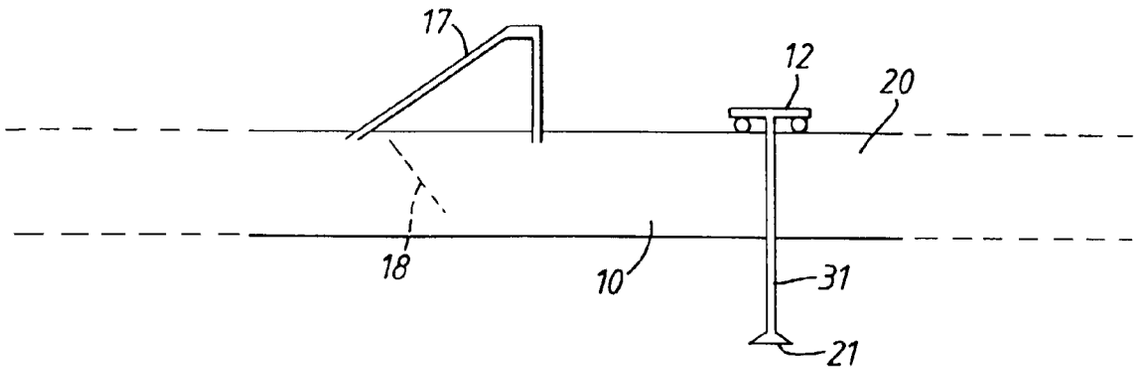

Fig.5

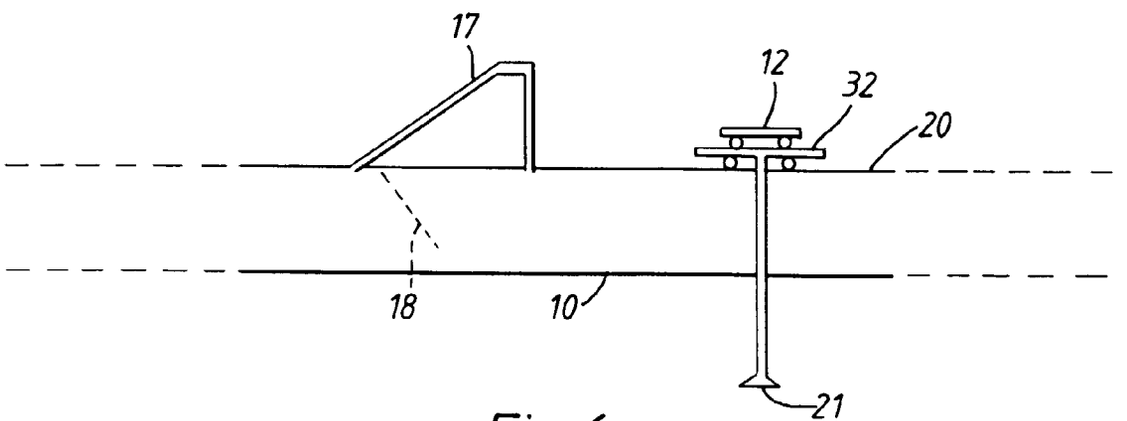

Fig.6