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(54) Rowing apparatus

(57) Rowing apparatus (1) of the type in which at least one handle (63,68) gripped in use by a user follows a generally arcuate path about generally upright axis between forward and rearward positions, characterised in

that there are provided means (75,76) for reducing the transverse displacement of the handle (63,68) upon movement between its forward and its rearward positions.

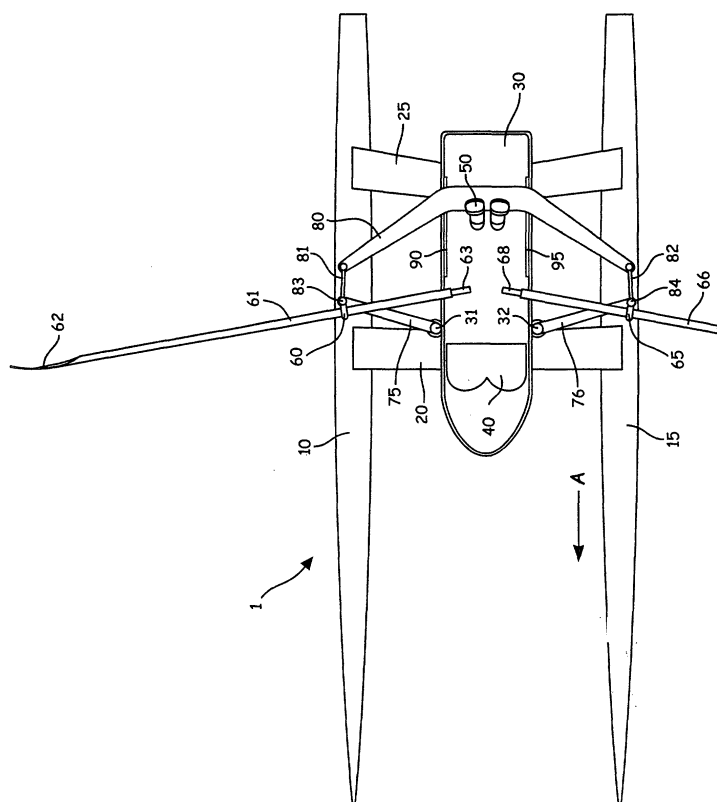


Fig 1

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Description

[0001] The present invention relates generally to rowing apparatus and specifically to improvements in the rowing mechanism thereof.

[0002] The present invention is concerned in part with the geometry of the riggers of rowing apparatus. In conventional rigger arrangements a rigger is fixed in relation to the apparatus and carries a rowlock at one end; the oar handle and the blade of the oar describe arcs which are centred around a swivelling rowlock. This means that the oar handle must move a considerable distance back and forth along the length of the apparatus and also that the oar handle moves laterally relative to the centreline of the apparatus. If the rower is using two oars, and the handles overlap when they are in line, then the positions of the oar blades cannot be symmetrical, and the oar strokes are uneven.

[0003] According to a first aspect of the present invention therefore there is provided rowing apparatus of the type in which at least one handle gripped in use by a user follows a generally arcuate path about a generally upright axis between forward and rearward positions, characterised in that there are provided means for reducing the transverse displacement of the handle upon movement between its forward and its rearward positions.

[0004] The act of rowing is a physically demanding process, and particularly so where a water vessel is being rowed and the body of water is not calm. Traditional rowing boats use a monohull construction with fixed seats and, either one or more pairs of oars mounted on opposite sides of the hull, or a plurality of single oars mounted alternately on opposite sides of the hull; all of the power required to move the oars through the water must be generated by the arms and back of the user. More efficient systems are available.

[0005] In some mechanisms a seat is slidable with respect to the hull parallel to the length of the vessel and a foot-engageable member is fixed with respect to the hull. The feet of the user are attached to a fixed footrest and, in order to use the power of the legs, the rower is placed on a seat that can slide back and forth along the length of the hull to assist in the rowing action. This type of system may be referred to as a fixed feet/sliding seat arrangement. Although efficient, one problem with such a system is that all the power generated travels through the rower's back, which is inherently weak. In addition the bulk of the rower's weight, which in some circumstances can be up to four times as much as the boat itself, moves rapidly back and forth during the rowing action. This movement of the longitudinal centre of gravity causes the boat to pitch, and changes in the boat's momentum causes it to accelerate and decelerate. In order to reduce the pitching of a boat the hull can be made very long which among other things reduces the portability of the boat.

[0006] In an alternative mechanism the foot-engage-

able member is slidable with respect to the hull parallel to the length of the vessel and the seat is fixed with respect to the hull. For example the seat in the vessel is fixed and the feet of the rower engage a slideable pedal means such as a bar. If the pedal means are attached to the rowlocks and the rowlocks can move relative to the hull, the legs can be used to help to drive the rowing action with the bulk of the weight of the rower remaining largely stationary with respect to the hull. With such a fixed seat/sliding feet arrangement the bulk of the rower's mass is static relative to the boat so that the boat moves steadily through the water and without pitching. This increases the boat speed and the absence of pitch means it can be made shorter.

[0007] The present invention also provides rowing apparatus comprising a seat, a foot engageable member and a rigger arm carrying a rowlock for receiving an oar, the rowlock being movable towards and away from one end of the apparatus upon relative separation and approach of the said seat and the said foot engageable member, the handle of the said oar following a generally arcuate path about a generally upright axis between forward and rearward positions in use of the apparatus, characterised in that the said rigger arm is turnable about an axis to cause the rowlock to follow an arcuate path of opposite curvature from that of the oar handle such that the transverse component of the motion of the oar handle is at least reduced between its forward and its rearward position.

[0008] The arc of the rigger arm and the arc of the handle end of the oar tend to cancel each other out, leaving the oar handle substantially stationary during the power stroke of the rowing action. In this way a class 1 lever system is converted into a class 2 lever system such that the effort is the same but the rowing action is very much easier.

[0009] Such a swingarm rigger can be applied equally to rowing boats that have one or two oars per person. Where one oar is used with several rowers the foot engageable members and/or the seats may be connected to balance the driving forces. The swingarm rigger principle may also be used on stationary machines for simulation, training and exercise.

[0010] In addition to ergonomic advantages, where two oars are used, if the handles do not overlap this will help in the evenness of the oar pull.

[0011] The rigger arms may comprise or include the foot-engageable member. Where this is the case it may be possible for the vessel to be propelled with the rower facing in the same direction as the motion of the vessel.

[0012] The seat and/or the foot-engageable member may be slidable with respect to the apparatus parallel to the length thereof and connected to the rigger arms by link members which are pivotally connected at one end to the rigger arms and at the other to the seat and/or the foot-engageable member. The presence of the link members allows rectilinear separation and approach of the seat and the foot-engageable member to drive the

arcuate movement of the rowlock.

[0013] Recreational and competitive rowing has been enjoyed for many years. Fast rowing is generally confined to smooth waters because traditional sculling boats are very long and narrow and thus notoriously unstable. Boats capable of coping with conditions which may be found in open waters tend to be broad, slow and generally less stimulating to row. There is a need for a relatively fast craft that can be rowed easily and safely in conditions that are untenable for existing fast sculling boats or the like.

[0014] The advantages of multihull over monohull boats are clearly documented. Multihull boats can achieve good stability without the use of ballast or wide beam.

[0015] Also, the reduction in wave-making resistance (through the use of slim hulls) and surface drag (through reduced displacement and wetted surface area) tend to result in greater speed for a given energy input. To date, catamaran or other multihull structures have been widely used for boats propelled by wind or engine, but not for boats employing a rowing mechanism for propulsion. Rowing boats are traditionally monohulled.

[0016] A multihull comprising at least two slim hulls is especially suitable for a displacement craft with limited motive power, such as rowing vessel. The separation of the hulls provides high form stability without the concomitant increase in surface and wave-making drag. The separation of the hulls also provides a more constant relationship between the oars and the surface of rough water.

[0017] The present invention also provides a rowable vessel comprising a hull and a seat for an occupant, a foot-engageable member slidable with respect to the hull parallel to the length of the vessel, and rowlocks for receiving oars, the said rowlocks being mounted for movement with the foot-engageable member, characterised in that the seat is slidable with respect to the hull parallel to the length of the vessel, the seat and the foot-engageable member being selectively lockable in position with respect to the hull. The arrangement allows selection of a conventional rowing mechanism and a choice of either a sliding seat/fixed feet or a sliding feet/fixed seat mechanism as hereinbefore described.

[0018] In either of the above aspects a vessel may comprise a cabin enclosure for accommodating a user.

[0019] The vessel further may comprise buoyancy means for providing a righting moment should the vessel capsize.

[0020] The buoyancy means may be a fluid filled buoyancy bag. The bag may be permanently inflated, or inflatable if the vessel begins to turn over.

[0021] The vessel may be a catamaran, although monohulls or other multihull vessels such as trimarans are not beyond the scope of the invention. In a preferred embodiment, for the reasons given above, the vessel is a catamaran.

[0022] Preferably the vessel is easily portable and

may comprise a plurality of constituent parts which can be easily dismantled and assembled.

[0023] Suitable materials for such vessels include fibre reinforced plastic composites with, for example carbon or glass fibre reinforcement and moulded thermoplastics such as polyethylene. The components of the vessel may be hollow or may, for example, be foam-filled.

[0024] The rowing apparatus may further comprise a restrainer member for maintaining the longitudinal position of the oar handle relative to the apparatus at least as the said seat and the said foot engageable member are separated. The restrainer member may be a substantially inextensible strap attached at one end to the seat and at its other end to the oar handle.

[0025] Various embodiments of the invention will now be more particularly described, by way of example, with reference to the accompanying drawings, in which:

Figure 1 is a plan view of a rowing catamaran incorporating swingarm riggers according to a first aspect of the present invention;

Figure 2a is a schematic representation of a prior art rowing mechanism using fixed rigging arms;

Figure 2b is a schematic representation of the rowing mechanism of the present invention incorporating swingarm riggers;

Figure 3 is a schematic representation of the rowing mechanism which, by altering the position of the swingarm rigger pivot point, enables the rower to face the direction of travel;

Figure 4 shows the simplified rowlock and link to the drive means;

Figure 5 is a plan view of a rowing catamaran incorporating a fixed seat/sliding feet rowing mechanism;

Figures 5a and 5b are a plan view and side (sectional) elevation respectively of a rowing catamaran including a cabin enclosure;

Figures 6a-6h is a series of drawings illustrating a method for righting the rowing catamaran of Figures 5a and 5b; and

[0026] Referring first to Figure 1 there is shown a rowable catamaran generally indicated 1. The catamaran comprises two parallel elongate hulls 10, 15. The hulls 10, 15 are joined by two cross members 20, 25 which carry a support 30 the length of which runs parallel to the hulls 10, 15. The support 30 carries a fixed seat 40. A shallow U-shape member 80 is slidably mounted to the support 30 by rails 90, 95 and has a foot rest 50. The

ends of the member 80 are pivotally connected to one end of link members 81, 82 which are pivotally connected to pivot points 83, 84 at their other ends, or directly to the rowlocks. The pivot points 83, 84 also serve as pivotal connection points for rowlocks 60, 65 and swingarm riggers 75, 76. The swingarm riggers 75, 76 are in turn pivotally connected to the support 30 at pivot points 31, 32. The rowlocks 60, 65 receive oars 61, 66.

[0027] In use the blades 62 (only one shown) of the oars 61, 66 are moved towards the rear (to the right as shown in the figure) of the catamaran 1 in the power stroke by holding oar handles 63, 68 and pushing the member 80 away from the seat 40. The rower holds the oar handle in position, against the forces generated by the movement of the oar by the legs. In alternative embodiments (not shown) the oar handle may be attached to the backrest by a restrainer such as a strap or the like. In this way all thrust in the power stroke may be transmitted solely by the legs, with the rower's arms simply guiding the oars in and out of the water. In either case the stroke may be finished with the arms by pulling oar handles 63, 68 towards the seat 40. Because the rowlocks 60, 65 are displaceable with respect to the length of the catamaran 1 the length of the arc of the oar blades 62 is increased. The direction of travel is indicated by the arrow A.

[0028] The effect of the altering geometry of the rowing mechanism in this way will now be more particularly described with reference to Figures 2a and 2b.

[0029] Figure 2a shows a conventional rowing rigger arrangement, commonly used in conjunction with a sliding seat/fixed feet arrangement. The main body 130 of a rowing vessel is shown with its centreline indicated X. The rigging arrangement includes a fixed arm 175 which is connected at the inboard end to the body 130 of the boat and at the outboard end to a rowlock 160 which pivots about a point 183. The rowlock 160 receives an oar 161 the position of which at three stages of the rowing action are indicated 161a, 161b and 161c. As the oar 161 is moved from position 161a to 161c the oar handle 163 describes a long arc centred on the pivot point 183 through the stroke and moves laterally relative to the centreline as shown by lines Y and Z and may overlap with a corresponding oar handle (not shown) on the opposite side of the boat.

[0030] Figure 2b shows an improved rowing rigger arrangement as fitted to the rowing catamaran of Figure 1. As described in relation to Figure 1 the inboard end of the rigger arm 75 pivots about a pivot point 31 on the support 30 and the outboard end of the arm 75 pivotally supports the rowlock 60. Combined with the sliding foot member 80 (also pivotally attached to the rowlocks via link member 81) the geometry of the rigging is such that the arcs of the swingarm rigger 75 and the handle end of the oar 61 effectively cancel each other out. This leaves the oar handle 63 substantially stationary during the power stroke as the oar 61 moves from position 61a to position 61c. The rower's arms finish the stroke to po-

sition 61d whereupon the blades of the oars are removed from the water and the arrangement is returned to position 61a ready for another stroke. In this way a class 1 lever is converted into a class 2 lever in which the effort is the same but the rowing action is easier. Further, the distance the rower's upper body and arms must move with respect to the boat is greatly reduced. It will be appreciated that the rowing mechanism of the invention also reduces the longitudinal displacement of the oar handle.

[0031] Such a rowing arrangement has been shown in tests to produce almost twice the amount of thrust of a conventional sliding seat rowing boat this is believed to be because of the more efficient use of the leg muscles.

[0032] Figure 3 shows an alternative embodiment in which the pivotal attachment of the swingarm rigger 275 to the support 230 is moved outboard to point 231 at the end of a fixed arm 274. The swingarm is then pivotally connected to this point approximately midway along its length. The rowlock 260 is pivotally attached at the outboard end of the swingarm 283 and a foot-engageable pedal 287 is pivotally attached to the inboard end 286. Where two oars are used, the pedals may be slidably attached to a sliding footbar to synchronise drive to both oars. For the power stroke (oar positions 261a to 261c) the rower holds the oar handle 263 and uses the leg muscles to push on the pedal 287. The rower's arms are used to finish the stroke as above.

[0033] Because this arrangement reverses the direction of effort at the rowlock it enables the rower to row facing the direction of travel A, pushing the oar handle instead of pulling it.

[0034] Figure 4 shows a simplified rowlock which may be used in combination with the swingarm rigging of the present invention which comprises a stainless steel rod bent in the shape of a question mark 360. Attached to the side of the main body, concentric with the ring and offset towards the oar handle is the oar locator ring 359, a quadrant of wire which locates the oar longitudinally and limits its axial rotation to 90 degrees.

[0035] The rowlock rotates vertically about the stem 383 which is pivotally attached in a bearing 384 to the outboard end of the swingarm rigger 375. A retaining clip 385 holds it in place.

[0036] The vertical displacement of the blade requires the oar to rotate about the horizontal axis by approximately 16 degrees. If the rowlock is tilted 8 degrees off the vertical towards the oar blade, a slack fit between oar and rowlock is sufficient to accommodate the rotation about the horizontal axis.

[0037] To mount the oar, the handle is passed through the rowlock 360 and the oar location pin 363 (spring-loaded in this embodiment) engages in the oar location ring 359.

[0038] The rowlock is pivotally attached at one end 388 to the link rod 381 which is pivotally attached at the other end to the footbar 380. By pulling the oar at its

longitudinal centreline, the normal torsional loads on the rigging are eliminated.

[0039] In contrast to simple rowlocks, which comprise an upwardly open U-shape bracket that only positively locate the oar downwardly and laterally, the rowlock locates the oar against disturbing forces in all potential directions of movement.

[0040] Referring now to Figures 5a and 5b there is shown a plan view and sectional side elevation of a rowing catamaran which is adapted for use in more extreme conditions such as in an ocean as opposed to inland or coastal waters.

[0041] The catamaran 501 is of the same general construction as the catamaran shown in Figures 1 and 5 inasmuch as two hulls 510, 515 are joined by two cross members 520, 525 which carry a support 530. In this embodiment the support 530 is in the form of a cabin enclosure 530.

[0042] The cabin 530 is shown here to incorporate a fixed seat 540 and a fixed feet 550 arrangement; however, a fixed seat/sliding feet or fixed feet/sliding seat arrangement may equally well be applied. Rowlocks 560, 565 are positioned to accept oars (not shown).

[0043] In view of the extended duration and isolated nature of open sea rowing the catamaran 501 has hollow hulls which include drinking water tanks 502, sealed buoyancy bags 504, and accommodation for spare oar shafts 503. Additionally, the roof of the cabin 530 houses photovoltaic cells 532 for electricity generation and an inflatable air bag 531, the purpose of which will be described in more detail in relation to Figure 6.

[0044] The enclosed rowing position protects the rower from exposure to external weather condition so that fatigue is reduced. Openings on both sides 535, 536 can be closed using roll-down transparent panels 537, 538.

[0045] Rowing into the wind or waves in a conventional monohull ocean rowing boat can be very difficult. The enclosure 530 has an aerodynamic shape to reduce this problem and the hulls are easily driven. Also, the enclosure 530 is preferably constructed so as to be independently buoyant to allow it to be detached from the members 520, 525 in an emergency and used as a solid life-raft.

[0046] The hulls 510, 515 have rudders 533, 534 (only one is shown) to aid in steering the catamaran 501 and a compass or wind-controlled self-steering gear mechanism may be included to help navigation.

[0047] The catamaran form and general construction of the boat provide for extreme stability, essential in open sea rowing. The presence of water tanks 502 in the hull 515 serve further to lower the centre of gravity. Tall-masted sailing catamarans, driven at considerable speed can turn over. In the case of relatively slow moving rowing catamarans with a low centre of gravity it is regarded as extremely unlikely that such a structure will turn over, however this possibility should not be ignored. Figures 6a-6h illustrate a righting sequence for such circumstances.

[0048] Figures 6a-6c show the catamaran 501 as wave and wind (shown as arrow W) action turn the catamaran over to the position shown at Figure 6c. To ensure that the cabin enclosure 530 remains above the water and does not turn completely upside down and to partially right the catamaran, the air bag 531 on the roof of the cabin 530 inflates automatically, by positional sensor, as shown in Figure 6d.

[0049] The cabin 530 is slidably mounted on the cross members 520, 525 to allow it to be moved towards the hull 510 that remains in the water as shown in Figure 6e. In doing so the catamaran turns further in the required direction and the hull 515 not in the water is raised into the wind. Wave motion and wind action shown in Figure 6f serve to turn the catamaran in the direction shown by arrow B to the position shown in Figure 6g. The cabin 530 is then slid across the members 520, 525 to its original position, shown in Figure 6h and the air bag deflated.

Claims

1. Rowing apparatus (1) of the type in which at least one handle (63,68) gripped in use by a user follows a generally arcuate path about generally upright axis between forward and rearward positions, **characterised in that** there are provided means (75,76) for reducing the transverse displacement of the handle (63,68) upon movement between its forward and its rearward positions
2. Rowing apparatus (1) comprising a seat (40), a foot engageable member (80) and a rigger arm (75,76) carrying a rowlock (60,65) for receiving an oar (61,66), the rowlock (60,65) being movable towards and away from one end of the apparatus upon relative separation and approach of the said seat (40) and the said foot engageable member (80), the handle (63,68) of the said oar (61,66) following a generally arcuate path about a generally upright axis between forward and rearward positions in use of the apparatus, **characterised in that** the said rigger arm is turnable about an axis to cause the rowlock (60,65) to follow an arcuate path of opposite curvature from that of the oar handle (63,68) such that the transverse component of the motion of the oar handle (63,68) is at least reduced between its forward and its rearward position.
3. Rowing apparatus (1) according to Claim 1 or Claim 2, **characterised in that** the said rigger arm (75,76) comprises or includes the said foot-engageable member (80).
4. Rowing apparatus (1) according to any of Claims 1 to 3, **characterised in that** the said seat (40) and/or the said foot-engageable member (80) is or are

slidable with respect to the apparatus parallel to the length thereof and is or are connected to the said rigger arm (75,76) by a link member (81,82) which is pivotally connected at one end to the said rigger arm (75,76) and at the other to the said seat (40) and/or the said foot-engageable member (80). 5

5. Rowing apparatus (1) comprising a seat (40) for an occupant, a foot-engageable member (80) slidable with respect thereto, and rowlocks (60,65) for receiving oars (61,66), the said rowlocks (60,65) being mounted for movement with the foot-engageable member, **characterised in that** the seat (40) is slidable with respect to the apparatus, the seat (40) and the foot-engageable member (80) being selectively lockable in position with respect to the hull. 10 15
6. Rowing apparatus (1) according to any preceding Claim, **characterised in that** the apparatus is or is mounted to a rowable vessel. 20
7. Rowing apparatus (1) according to Claim 6. **characterised in that** the vessel is a catamaran.
8. Rowing apparatus (501) according to Claim 6 or Claim 7, **characterised in that** the vessel further comprises a cabin (530) for accommodating a rower. 25
9. Rowing apparatus (501) according to any of Claims 6 to 8, **characterised in that** the vessel further comprises buoyancy means (531) for providing a righting moment should the vessel capsize. 30
10. Rowing apparatus (501) according to any of Claims 6 to 8 **characterised in that** the buoyancy means is a fluid-filled buoyancy bag (531). 35
11. Rowing apparatus according to any of Claims 2 to 10, further comprising a restrainer for maintaining the longitudinal position of the oar handle relative to the apparatus at least as the said seat and the said foot engageable member are separated. 40

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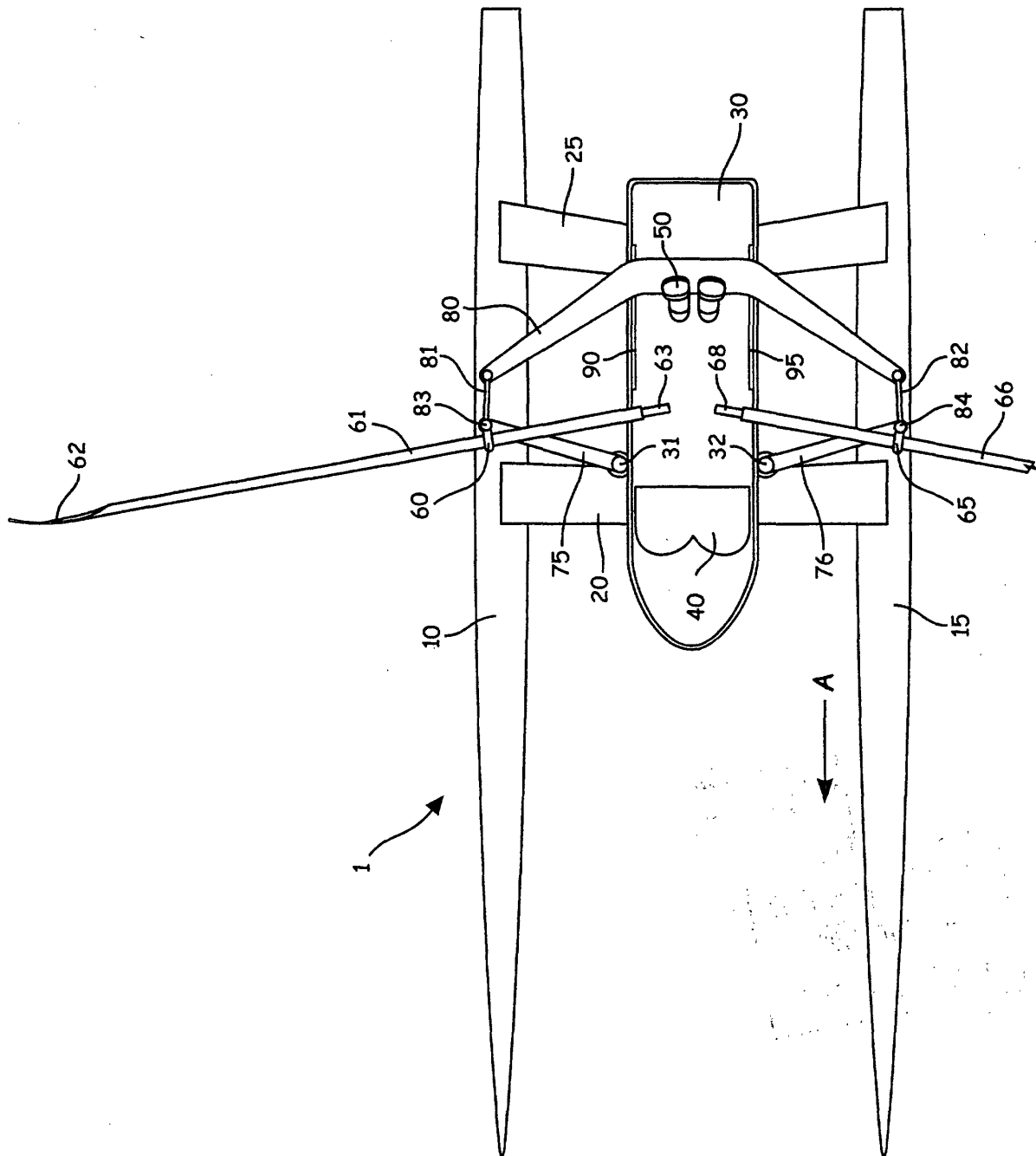
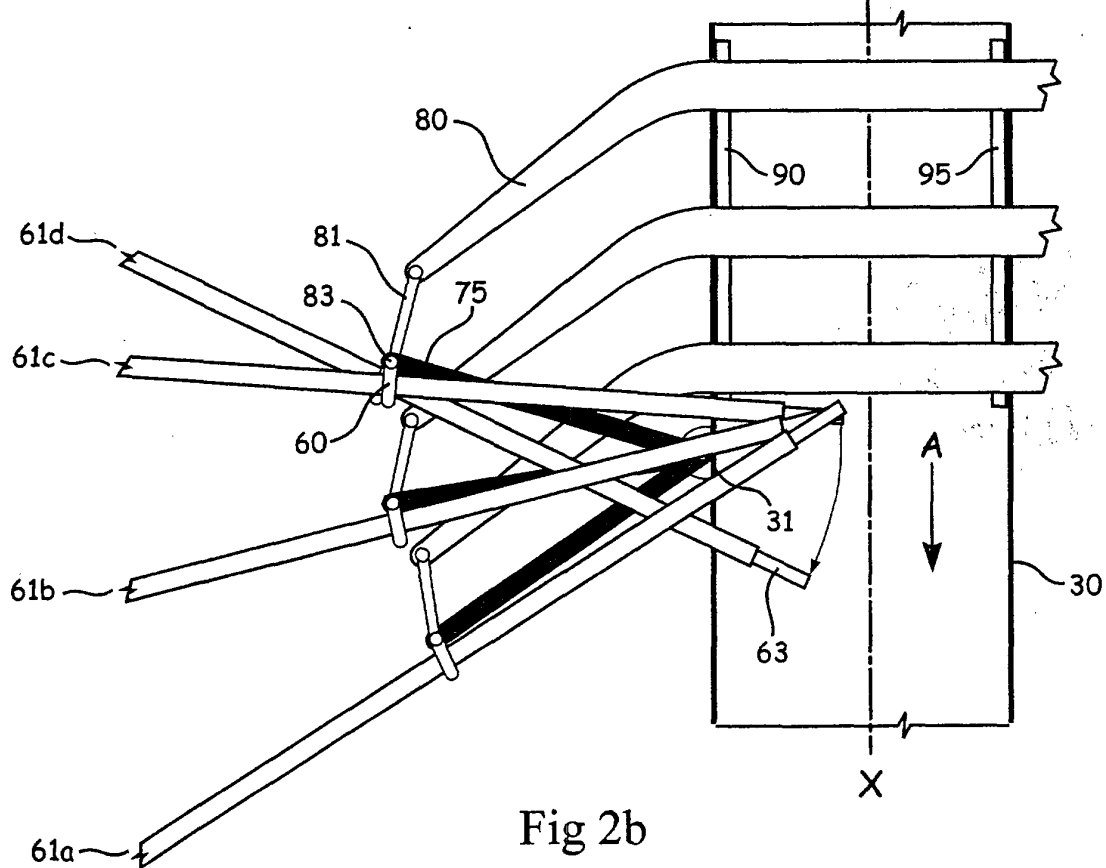
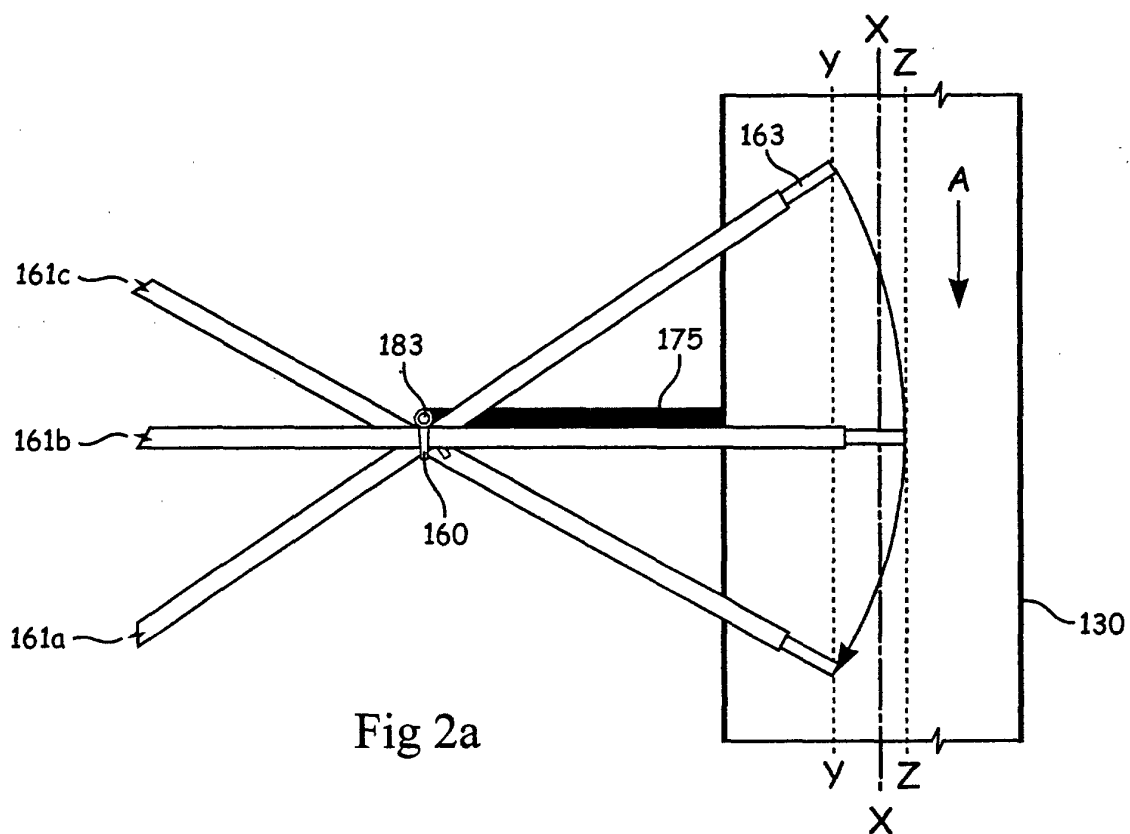
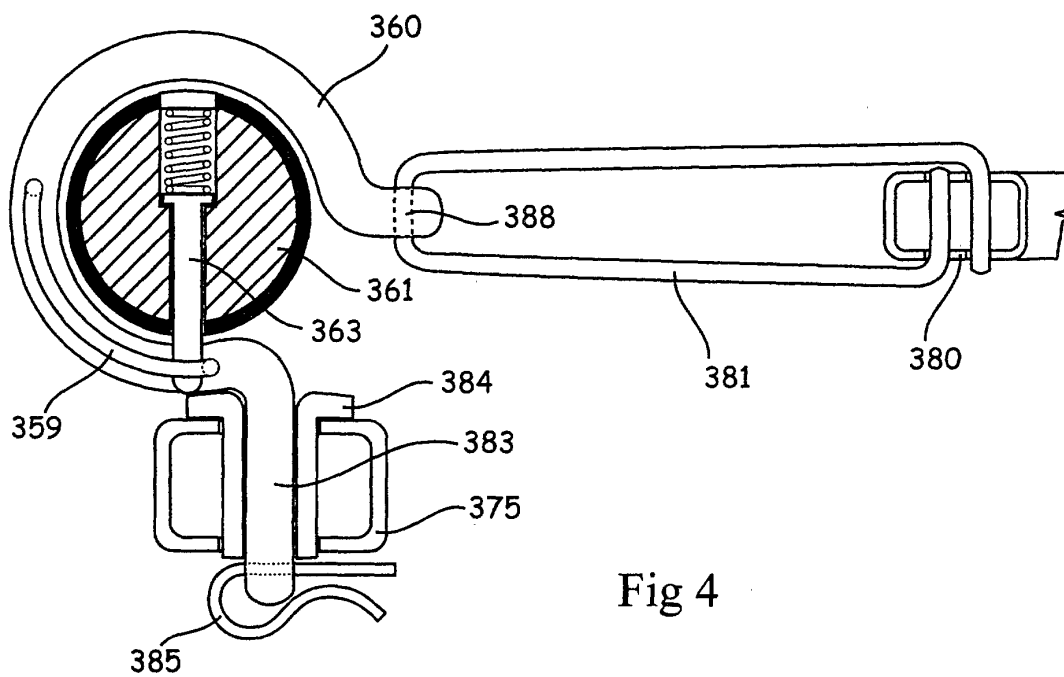
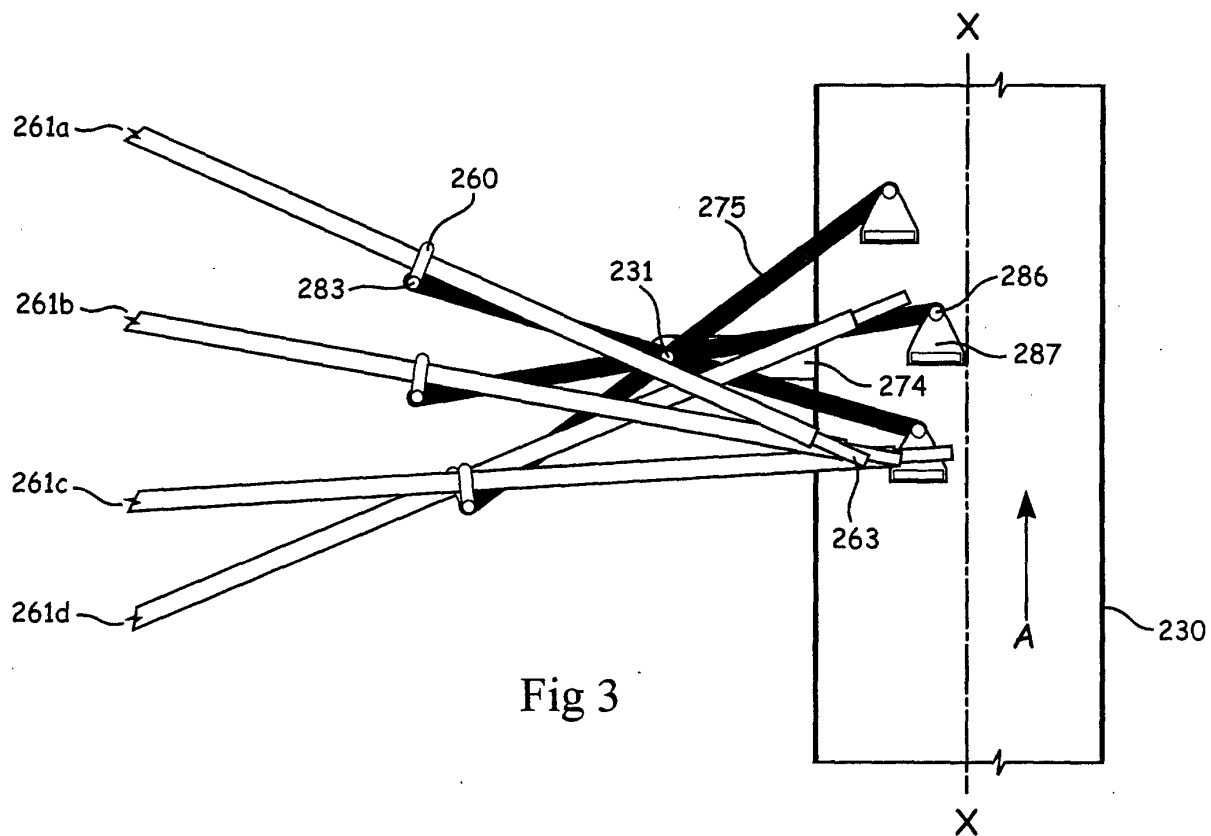


Fig 1





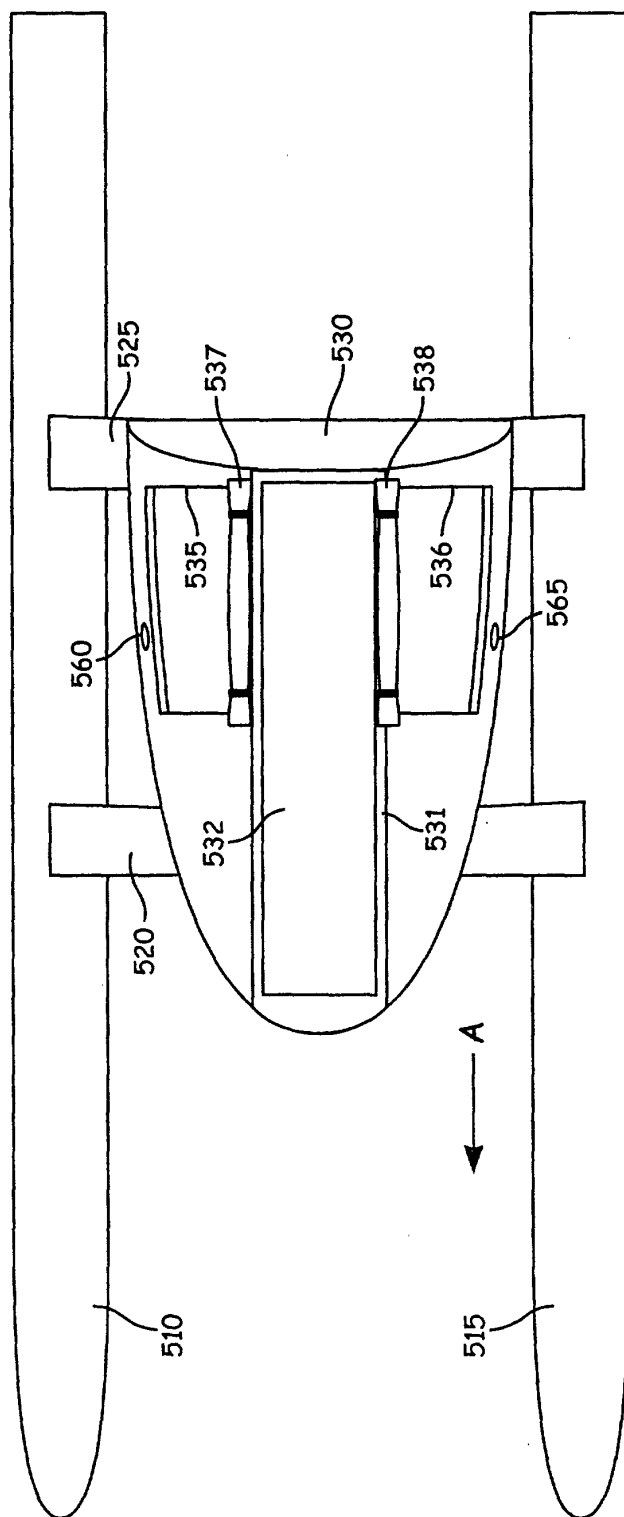


Fig 5a

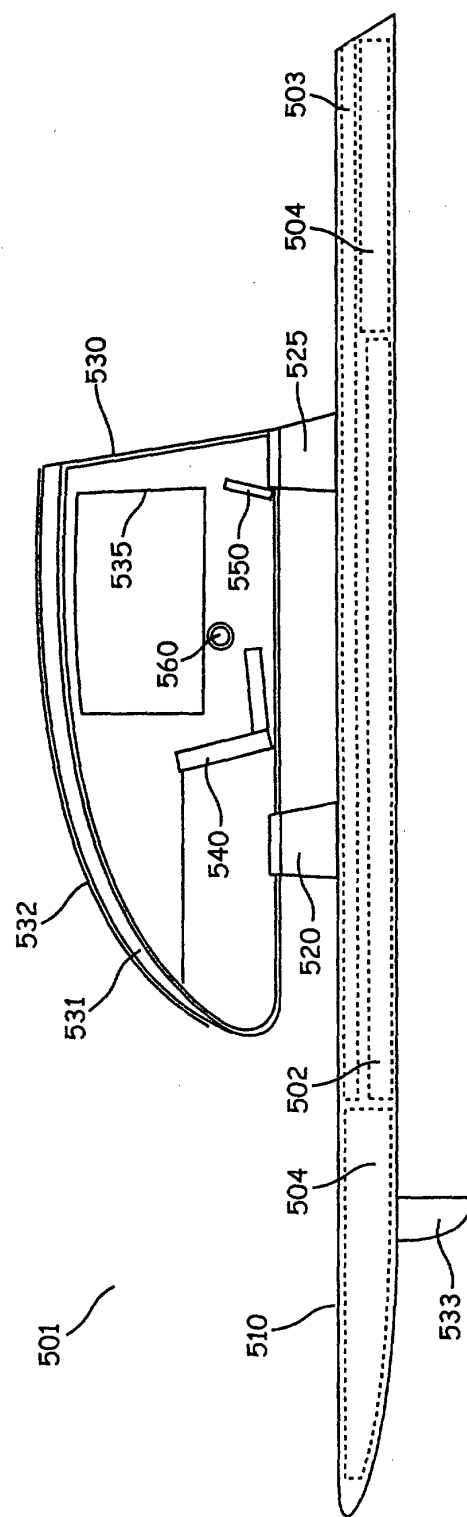


Fig 5b

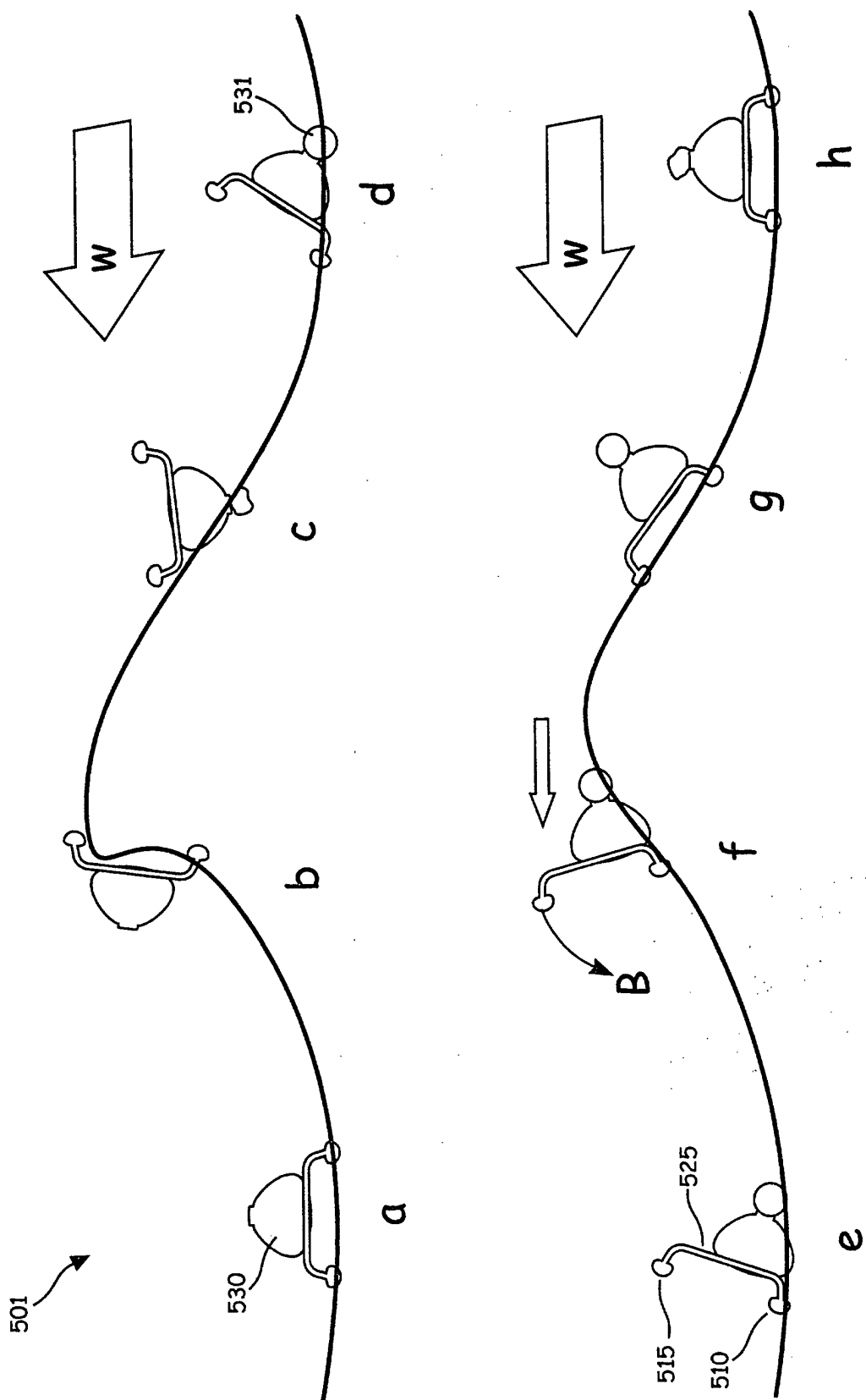


Fig 6



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EUROPEAN SEARCH REPORT

Application Number
EP 00 30 6753

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The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 16 January 2001	Examiner DE SENA HERNAND... A
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**ANNEX TO THE EUROPEAN SEARCH REPORT
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EP 00 30 6753

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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