

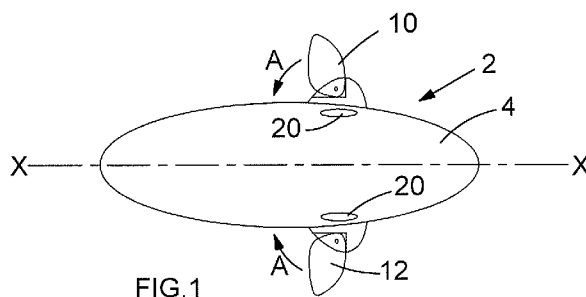


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(54) **Title:** FIN ASSEMBLY FOR A WATER BOARD AND USER PROPELLED WATER BOARD APPARATUS



(57) **Abstract:** A user propelled water board apparatus (2) is described and comprises a hull, portio.xi (4) defining a longitudinal axis x-x. The hull portion (4) is buoyant, to enable a user (6) to rest on hull portion (4) and be supported on the surface of a body of water (8). First and second lateral fin members (10) and (12) are pivotably mountable to the hull portion (4) in a position to project into the body of water in use. The first and second lateral fin members (10) and (12) are mounted in use on opposite sides of the hull portion 4 and are pivotable towards and away from the hull portion in the direction of arrow A. A user (6) rocking the hull portion in water about the longitudinal axis x-x causes the first and second lateral fin members (10) and (12) to pivot outwardly from the hull portion and drive the hull portion through the body of water in use.



**Fin Assembly for a Water Board and User Propelled Water Board
Apparatus**

The present invention relates to a fin assembly for a water
5 board. The present invention also relates to a user propelled
water board apparatus, and relates particularly, but not
exclusively, to a user propelled water board apparatus on
which a user is supportable and wherein rocking the apparatus
form side to side provides propulsion through a body of
10 water.

There is a desire to provide floatable water board
apparatuses for both recreational and professional use. For
example, there are different types of body board, surf board
15 and stand-up-paddleboards (SUPs) which are used in
recreational water sports. However, learning to use such
devices in water can be difficult and time consuming and
there is therefore a desire to provide a water board
apparatus which can be used in a more straightforward manner
20 by both the recreational user and also by professionals such
as lifeguards to provide a rapid means of moving through
water.

A known type of water board is described in US3722015. A
25 buoyant float is disclosed which is designed to carry a
person on water. Longitudinal supports extend from the body
portion and provide support to vanes of flexible fabric
material. Rocking the body from side to side flexes the
vanes to propel the float forward. This apparatus suffers
30 from the drawback that it is of relatively complicated
construction and has a rather large width dimension which
makes the apparatus unwieldy and difficult to use in crowded

conditions. Also, the fabric vanes are at risk of tearing which increases maintenance costs.

A boat having a similar propulsion means is disclosed in
5 US3845733. This document describes attaching fins under the hull of a boat which are able to flap about axes projecting downwardly from the boat. A user rocking the hull from side to side therefore causes propulsion. This apparatus suffers from the drawback that it is rather large and is less
10 suitable for recreational use because the hull of a small boat is difficult to transport around.

TWM431128U, US2011/005451A1, US2013/183152A1 and WO87/04399A1 describe water boards having fin members which are pivotally
15 mounted in various ways such that the fin members project into water from the undersides of the respective water boards. These fins suffer from the drawback that they are either unsuitable for propelling the water boards through the water or if used to provide propulsion, require complicated
20 mechanisms to cause propulsion through movement of the fins.

Preferred embodiments of the present invention seek to overcome the above disadvantages of the prior art.

25 According to an aspect of the present invention, there is provided a fin assembly for a water board, the fin assembly comprising:

a fin member pivotally mountable to a bracket portion;

30

wherein the bracket portion is mountable to a water board in a configuration in which the fin member projects laterally outwardly from the water board and is pivotable towards and

away from the hull portion of a water board in use such that
a user rocking the water board in water about the
longitudinal axis of the water board causes the fin member to
pivot outwardly from the water board and drive the water
5 board through the body of water in use.

This provides the advantage of a fin assembly mountable to a
water board which can be used to enable a user to propel the
water board through a body of water. If first and second fin
10 members are mounted to opposite lateral sides of a water
board, rocking the water board about its longitudinal axis
causes the fin members to pivot outwardly from the hull
portion of the water board and drive the water board through
the water.

15

This also provides the advantage that the fin members are
moveable out of the way of obstructions such as swimmers, or
when the user is using a paddle in conjunction with the fin
assembly, by virtue of being pivotable towards and away from
20 the hull of the water board in use. The pivoting of the fin
members also provides a reduction in drag when the board is
moving at speed through water.

Furthermore, this provides the advantage that when the fin
25 members are pivoted inwardly towards the water board, rocking
the water board causes the fins to propel water and the
reaction force created causes the fins to pivot outwardly to
their forwardmost position.

30 In a preferred embodiment, said fin member comprises a
leading edge portion and a trailing edge portion, and wherein
said leading edge portion has a lower flexibility than said
trailing edge portion.

This provides the advantage of a fin construction which has been found to be most effective at outward pivoting.

5 Said bracket portion may comprise upper and lower support portions defining a recess therebetween for receiving an end of said fin member, and wherein upper and lower holes are formed through the upper and lower support portions to receive a pin mountable in said fin member.

10

Said bracket portion may comprise upper and lower support portions defining a socket therebetween for receiving a ball shaped end of said fin member in an interference fit.

15 This provides the advantage of enabling different sized fins to be mounted to the bracket portion to enable different fins to be used for different configurations and sizes of water board.

20 The assembly may further comprise:

a first fin member pivotally mountable to a first bracket portion;

25 a second fin member pivotally mountable to a second bracket portion;

a strap portion connecting the first and second bracket portions to enable the assembly to be mounted to a water
30 board such that the first and second fin members are located on opposite lateral sides of the water board in use.

This provides the advantage of an assembly that is straightforward to mount to an existing off-the-shelf water board to convert the water board into an apparatus that can be propelled through the water. By providing two fin
5 assemblies connected with a strap that is mountable to a water board, mounting the assembly to the board enables a user to propel the board through water by rocking the board about its longitudinal axis.

10 The strap member may form a loop arranged to be disposed around a water board, and wherein the size of the loop is adjustable.

This provides the advantage of enabling the assembly to be
15 used with different sizes of water board.

The assembly may further comprise a plate member mounted between the ends of said strap portion.

20 This provides the advantage of a more rigid way of strapping a pair of fin members to the board to prevent the bracket portions twisting relative to the board.

The bracket portion may be mounted to a first mounting plate
25 adapted to receive a first end of a securing bolt, the securing bolt arranged to pass through a hole formed in a water board in use; and

further comprising a second mounting plate adapted to receive
30 a second end of the securing bolt and be mountable on the upper surface of said water board.

This provides the advantage of enabling the fin assembly to be removably mounted to a rigid board.

According to another embodiment of the present invention,
5 there is provided a user propelled water board apparatus comprising:

a hull portion defining a longitudinal axis, wherein the hull portion is buoyant to enable a user to rest thereon and be
10 supported on the surface of a body of water;

first and second lateral fin members, each said fin member pivotally mountable to the hull portion in a position to project into the body of water in use, wherein the first and
15 second lateral fin members are mounted in use on opposite sides of the hull portion and are pivotable towards and away from the hull portion; and

wherein the first and second lateral fin members are arranged
20 such that a user rocking the hull portion in water about the longitudinal axis causes the first and second lateral fin members to pivot outwardly from the hull portion and drive the hull portion through the body of water in use.

25 By providing first and second lateral fin members arranged to pivot towards and away from the hull portion such that rocking the hull portion in water causes the first and second lateral fin members to pivot outwardly from the hull portion and drive the hull portion through the body of water in use,
30 this provides the advantage of an apparatus that is very straightforward to use. This also provides the advantage that the lateral fin members are moveable out of the way of obstructions, such as swimmers, or when the user is using a

paddle in conjunction with the fin assembly, by virtue of being pivotable towards and away from the hull portion. Furthermore, the pivoting of the lateral fin members allows a reduction in drag when the board is moving at speed through
5 water.

Moreover, this provides the advantage that when the lateral fin members are pivoted inwardly towards the hull, simply rocking the hull causes the fins to propel water which
10 naturally causes the fins to pivot back outwardly to their forwardmost position.

In a preferred embodiment, the respective axis about which each said lateral fin member pivots is non-parallel to said
15 longitudinal axis.

In a preferred embodiment, the respective axis about which each said lateral fin member pivots is substantially perpendicular to said longitudinal axis.
20

In a preferred embodiment, each said lateral fin member comprises a leading edge portion and a trailing edge portion, and wherein said leading edge portion has a lower flexibility than said trailing edge portion.
25

This provides the advantage of a lateral fin construction which has been found to be most effective at outward pivoting when the hull portion of the apparatus is rocked in water.

30 In a preferred embodiment, the apparatus further comprises a handle member defining a handle for gripping by a user, the handle member further comprising a bracket portion for receiving an end of one of said lateral fin members.

This provides the advantage of an assembly of handle and bracket for the fin which has been found most effective at transferring force applied by a user to the fin to provide
5 efficient propulsion through the water.

Said bracket portion may comprise upper and lower support portions defining a recess therebetween for receiving an end of one of said lateral fin members, and wherein upper and
10 lower holes are formed through the upper and lower support portions to receive a pin mountable in said lateral fin member.

Said bracket portion may comprise upper and lower support
15 portions defining a socket therebetween for receiving a ball shaped end of one of said lateral fin members in an interference fit.

In a preferred embodiment, said bracket member defines a stop
20 portion arranged to limit pivotal movement of a lateral fin member mounted therein outwardly from the hull portion.

In a preferred embodiment, said bracket portion is formed from a single piece of material.

25

In a preferred embodiment, said hull portion is formed from a semi-rigid inflatable body.

This provides the advantage of enabling the hull portion to
30 be reduced in size for transportation.

Preferred embodiments of the present invention will now be described, by way of example only and not in any limitative sense, with reference to the accompanying drawings in which:

5 Figure 1 is a plan view of a user propelled water board apparatus of a first embodiment of the present invention;

Figure 2 is a side view of the apparatus of Figure 1;

10 Figure 3 is a front view of the apparatus of Figures 1 and 2;

Figure 4 is a side view of the apparatus at Figures 1 to 3 showing use of a cord to enable a user to operate the board in a standing position;

15

Figure 5 is a close up view from the rear of the handle, lateral fin and bracket assembly of the apparatus of Figures 1 to 4;

20 Figure 6 is a side view corresponding to Figure 5;

Figure 7 is a plan view corresponding to Figures 5 and 6;

Figure 8 is a partially cut-away plan view of a fin assembly
25 of a second embodiment of the present invention;

Figure 9 is a side view of the fin assembly of Figure 8;

Figure 10 is a view from the front of a water board having
30 the fin assembly of Figure 8 connected thereto;

Figure 11 is a plan view of a water board having two fin assemblies connected thereto using a strap;

Figure 12 is a front view of the water board of Figure 11;

Figure 13 is a side view of the water board of Figure 11
5 showing a user riding the water board in a first
configuration of use;

Figure 14 is a side view of the water board of Figure 11
showing a user riding the water board in a second
10 configuration of use;

Figure 15 is a front view of a water board having a pair of
fin assemblies mounted thereto of a third embodiment of the
present invention;

15

Figure 16 is a side view of the board of Figure 15;

Figure 17 is a close-up front view of one of the fin
assemblies of Figure 15;

20

Figure 18 is a front view of a fin assembly of a fourth
embodiment of the present invention; and

Figure 19 is a front view of the water board of Figure 18.

25

Referring to Figures 1 to 3, a user propelled water board
apparatus 2 comprises a hull portion 4 defining a
longitudinal axis x-x. The hull portion 4 is buoyant to
enable a user 6 to rest on hull portion 4 in either a
30 kneeling or standing position and be supported on the surface
of a body of water 8. Referring to Figures 1, 2 and 5, first
and second lateral fin members 10 and 12 are pivotably
mountable to the hull portion 4 in a position to project into

-11-

the body of water in use as shown in Figure 5. The first and second lateral fin members 10 and 12 are mounted in use on opposite sides of the hull portion 4 and are pivotable towards and away from the hull portion in the direction of arrow A (Figures 1 and 7).

The first and second lateral fin members 10 and 12 are arranged such that a user 6 rocking the hull portion in water about the longitudinal axis x-x causes the first and second lateral fin members 10 and 12 to pivot outwardly from the hull portion (ie any direction opposite to arrow A) and drive the hull portion through the body of water in use. Referring to Figure 5, each lateral fin member 10, 12 is pivotably mounted by use of a fixing pin 14 held in a bracket portion 16 of handle member 18 which also defines handle 20. Handle member 8 is either glued or welded to hull portion 4. The bracket portion 16 comprises upper and lower support portions 22 and 24 defining a recess 26 into which an end of lateral fin member 12 is inserted. To complete the assembly, upper and lower holes are formed through the upper and lower support portions 22 and 24 in which fixing pin 14 can be inserted. Alternatively, upper and lower support portions 22 and 24 could define a socket into which a ball shaped end of fin member 26 is received in an interference fit which allows at least partial rotation of the ball shaped end.

Fixing pin 14 may be threaded or have other means to enable removal and replacement of lateral fin members of different sizes and shapes. Different lateral fin designs allow users to choose fins meeting their demands, for example speed versus long distance or a small rider versus a heavier rider.

Referring to Figure 7, the handle member also defines a stop portion 28 defining the forwardmost point to which fin member

-12-

12 can pivot. The lateral fin member 12 is formed from a rigid leading edge 30 and more flexible trailing edge 32. As a result, trailing edge 32 is formed from a material having a greater flexibility than leading edge 30. In the preferred
5 embodiment, lateral fin member 12 is formed from two different types of plastic material having different flexibilities. It has been found that this type of assembly is best at pivoting outwardly about pin 14 when the lateral fin member is rocked in water. Alternatively, a single piece
10 of the same material may be used having a gradient of flexibility increasing from the stiffest at leading edge portion 30 to the most flexible at the trailing edge portion 32.

15 The fixing pin 14 defines a pivoting axis for lateral fin members 10 and 12 which is non-parallel and preferably perpendicular to longitudinal axis x-x. The hull portion 4 is formed from a semi-rigid inflatable material.

20 With reference to Figures 1, 2 and 7, the operation of the user propelled apparatus 2 will now be described.

A user 6 crouches or stands on the hull portion 4 which floats in water 8. The user can grip handles 20 and shift
25 his weight to rock the hull 4 about longitudinal axis x. The rocking motion causes the trailing edge 32 of lateral fin members 10 and 12 to oscillate in water which propels the lateral fin members 10 and 12 forward. This forward propulsion causes the lateral fin members to swing outwardly
30 about the axis defined by fixing pins 14 in a direction opposition to arrow A. This sets the lateral fin members outwardly in their outermost position against stops 28 and

further rocking the hull 4 causes the board to be propelled through the water.

Should one of the lateral fin members 10 and 12 be driven into for example a swimmer in water, the lateral fin member 10 or 12 can pivot about arrow A towards the hull 4 to move out of the way and decrease the likelihood of injury to a swimmer. Alternatively, when the board 2 is moving at speed through water, the lateral fin members 10 and 12 pivot inwardly to reduce drag.

An alternative arrangement for use is shown in Figure 4 in which a cord 34 is attached to the front of the hull 4. The user 6 can stand on the board and hold cord 34 for support while rocking the board with his or her feet. Alternatively, the user may use a paddle in conjunction with the fin assembly to assist with balance and propulsion. Since the hull portion is formed from semi-rigid inflatable material, the board can be readily deflated for transport.

20

A fin assembly of a second embodiment of the present invention will now be described with reference to Figures 8 to 14 with parts common to the embodiment of Figures 1 to 7 shown with like reference numerals but increased by 100.

25

Referring to Figures 8 to 10, fin assembly 150 for a water board 102 comprises a fin member 110 pivotally mountable to a bracket portion 116 wherein the bracket portion 116 is mountable to a water board in a configuration in which the fin member projects laterally outwardly from the water board as shown in Figure 10 and is pivotable towards and away from the hull portion of a water board 102 such that a user rocking the water board in water about the longitudinal axis

30

x-x of the water board causes the fin member to pivot outwardly from the water board and drive the water board through the body of water in use.

5 The bracket portion 116 comprises an upper support portion 122 and a lower support portion 124. An end of the fin member 110 is mounted between the upper and lower support portions 122, 124 by use of a removable fixing pin 114 in the same manner as the fin member of the embodiment of Figures 1
10 to 7. The upper support portion 122 and a lower support portion 124 define a recess 126 in which the fin member 110 is received. The recess 126 can be angled such that the fin member 110 projects downwardly at an angle of 15 degrees from the horizontal, although other angles are possible.

15

The fin member comprises a leading edge portion 130 and a trailing edge portion 132. The trailing portion is formed from a material of a lower flexibility than the leading edge portion 130. For example, two different types of plastics
20 having different flexibilities may be used and the trailing edge portion 132 could be welded or connected by other means to the stiffer leading edge portion 130. Alternatively, a single piece of the same material may be used having a gradient of flexibility increasing from the stiffest at
25 leading edge portion 130 to the most flexible at the trailing edge portion 132. The bracket portion 116 also defines a forward stop portion 128 to limit the forward pivotal movement of the fin member 110.

30 In use, the fin assembly 150 can be mounted to a water board in several ways. For example, water board 102 could have a pair of holes formed therein to enable two bracket portion 116 to be inserted into the holes in an interference fit.

First and second holes would be formed on opposite lateral sides of the water board. Alternatively, temporary fixing means such as screws could be used to mount a pair of fin members 150 to a water board which would be formed with
5 suitable receiving holes formed therein.

In a preferred embodiment, first and second fin assemblies 150, 152 are interconnected by means of a strap 154. The strap forms a closed loop (Figure 12) to fit around the hull
10 104 of water board 102. The length of the strap and therefore the size of the loop may be adjustable by use of buckle type plastic strap adjusters of the type used to adjust the length of straps on bags and backpacks.

15 The strap enables first and second fin assemblies 150, 152 to be securely mounted to the hull 104 such that the first and second fin assemblies 150, 152 are held on the underside of the water board 102 to project into a body of water.

20 Rocking the water board firstly produces outward pivoting of the fin members 110 and then propulsion of the board through the water in common with the embodiment of Figures 1 to 7. A user can use either handles 120 in a crouched configuration as shown in Figure 13 or use a cord 134 in a standing
25 position to rock the board with his feet as shown in Figure 14. Alternatively, the user may use a paddle in conjunction with the fin assembly to assist with balance and propulsion.

A third embodiment of the present invention will now be
30 described with reference to Figures 15 to 17 with parts common to the embodiment of Figures 8 to 14 shown with like reference numerals but increased by 100.

Referring to Figures 15 to 17, a fin assembly 250 for a water board 202 comprises a fin member 210 pivotally mountable to a bracket portion 217. Fin assembly 250 is substantially the same as fin assembly 150. First and second fin assemblies 5 250 and 252 are mounted to a base plate 260. The base plate 260 is formed from a rigid material such as polypropylene. The ends of base plate 260 are mounted to a strap 254 which is substantially the same in construction to strap 154. The rigid base plate 260 therefore enables the fin assemblies 250 10 and 252 to be mounted to the underside of board 202 in a more rigid fashion.

A fin assembly of a fourth embodiment of the present invention will now be described with reference to Figures 18 15 and 19 with parts common to the embodiment of Figures 15 to 17 shown with like reference numerals but increased by 100.

Referring to Figures 18 and 19, fin assembly 350 for water board 302 comprises a fin member 310 pivotally mountable to a 20 bracket portion 316. The bracket portion 316 is mounted to a first mounting plate 370 which receives a first end 380 of securing bolt 382. A second mounting plate 372 is mountable to the top surface of board 302 and receives the second end 384 of securing bolt 382. A hole 386 is formed through the 25 water board 302 to receive the securing bolt 382.

In use, two fin assemblies 350 and 352 are mounted to the water board 302 in this manner. This method of mounting the fin assemblies to the water board is particularly suitable 30 for rigid boards.

It will be appreciated by persons skilled in the art that the above embodiment has been described by way of example only

and not in any limitative sense, and that various alterations and modifications are possible without departure from the scope of the invention as defined by the appended claims.

CLAIMS

1. A fin assembly for a water board, the fin assembly comprising:

5

a fin member pivotally mountable to a bracket portion;

wherein the bracket portion is mountable to a water board in a configuration in which the fin member projects laterally
10 outwardly from the water board and is pivotable towards and away from the hull portion of a water board in use such that a user rocking the water board in water about the longitudinal axis of the water board causes the fin member to pivot outwardly from the water board and drive the water
15 board through the body of water in use.

2. An assembly according to claim 1, wherein said fin member comprises a leading edge portion and a trailing edge portion, and wherein said leading edge portion has a lower
20 flexibility than said trailing edge portion.

3. An assembly according to claim 1 or 2, wherein said bracket portion comprises upper and lower support portions defining a recess therebetween for receiving an end of said
25 fin member, and wherein upper and lower holes are formed through the upper and lower support portions to receive a pin mountable in said fin member.

4. An assembly according to claim 1 or 2, wherein said
30 bracket portion comprises upper and lower support portions defining a socket therebetween for receiving a ball shaped end of said fin member in an interference fit.

5. An assembly according to claim 3 or 4, wherein said bracket member defines a stop portion arranged to limit pivotal movement of the fin member outwardly from the hull portion of a water board in use when the assembly is mounted
5 to a water board.

6. An assembly according to any one of the preceding claims, further comprising:

10 a first fin member pivotally mountable to a first bracket portion;

a second fin member pivotally mountable to a second bracket portion;

15

a strap portion connecting the first and second bracket portions to enable the assembly to be mounted to a water board such that the first and second fin members are located on opposite lateral sides of the water board in use.

20

7. An assembly according to claim 6, wherein the strap portion forms a loop arranged to be disposed around a water board, and wherein the size of the loop is adjustable.

25 8. An assembly according to claim 6 or 7, further comprising a plate member mounted between the ends of said strap portion.

9. An assembly according to any one of claims 1 to 5, wherein
30 the bracket portion is mounted to a first mounting plate adapted to receive a first end of a securing bolt, the securing bolt arranged to pass through a hole formed in a water board in use; and

further comprising a second mounting plate adapted to receive a second end of the securing bolt and be mountable on the upper surface of said water board.

5

10. A fin assembly for a water board, the fin assembly substantially as hereinbefore described with reference to the accompanying drawings.

10 11. A user propelled water board apparatus comprising:

a hull portion defining a longitudinal axis, wherein the hull portion is buoyant to enable a user to rest thereon and be supported on the surface of a body of water;

15

first and second lateral fin members, each said fin member pivotally mountable to the hull portion in a position to project into the body of water in use, wherein the first and second lateral fin members are mounted in use on opposite
20 sides of the hull portion and are pivotable towards and away from the hull portion; and

wherein the first and second lateral fin members are arranged such that a user rocking the hull portion in water about the
25 longitudinal axis causes the first and second lateral fin members to pivot outwardly from the hull portion and drive the hull portion through the body of water in use.

12. An apparatus according to claim 11, wherein the
30 respective axis about which each said lateral fin member pivots is non-parallel to said longitudinal axis.

13. An apparatus according to claim 11 or 12, wherein the respective axis about which each said lateral fin member pivots is substantially perpendicular to said longitudinal axis.

5

14. An apparatus according to any one of claims 11 to 13, wherein each said lateral fin member comprises a leading edge portion and a trailing edge portion, and wherein said leading edge portion has a lower flexibility than said trailing edge
10 portion.

15. An apparatus according to any one claims 11 to 14, further comprising a handle member defining a handle for gripping by a user, the handle member further comprising a
15 bracket portion for receiving an end of one of said lateral fin members.

16. An apparatus according to claim 15, wherein said bracket portion comprises upper and lower support portions
20 defining a recess therebetween for receiving an end of one of said lateral fin members, and wherein upper and lower holes are formed through the upper and lower support portions to receive a pin mountable in said lateral fin member.

25 17. An apparatus according to claim 15, wherein said bracket portion comprises upper and lower support portions defining a socket therebetween for receiving a ball shaped end of one of said lateral fin members in an interference fit.

30 18. An apparatus according to claim 15 or 16, wherein said bracket member defines a stop portion arranged to limit pivotal movement of a lateral fin member mounted therein outwardly from the hull portion.

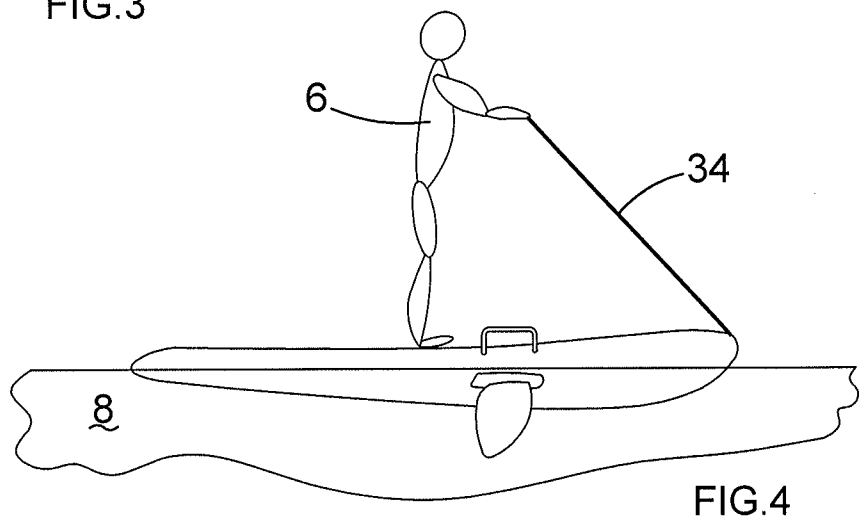
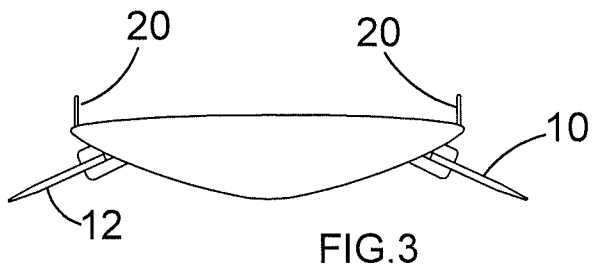
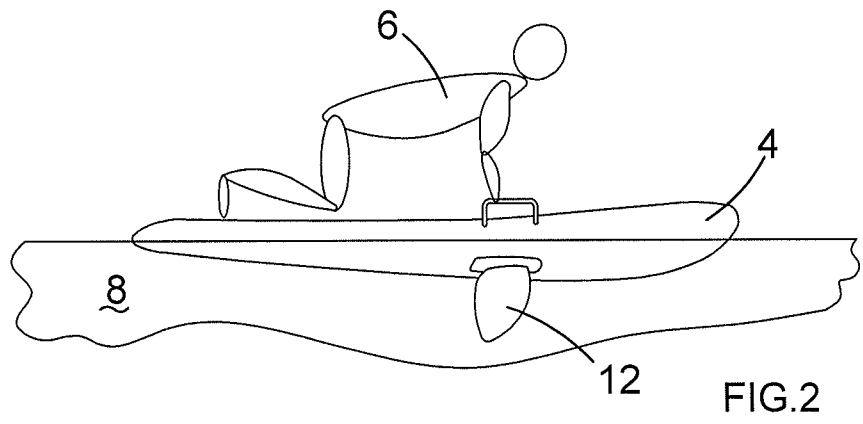
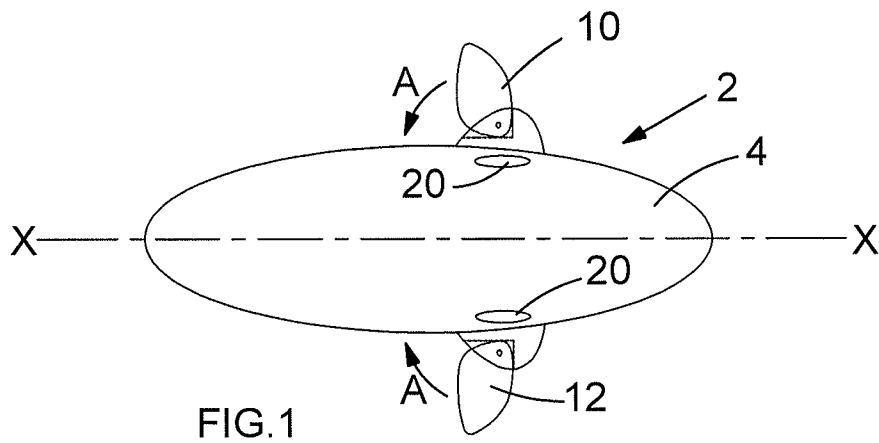
19. An apparatus according to any one of claims 15 to 17, wherein said bracket portion is formed from a single piece of material.

5

20. An apparatus according to any one of claims 11 to 18, wherein said hull portion is formed from a semi-rigid inflatable body.

10 21. A user propelled water board apparatus substantially as hereinbefore described with reference to the accompanying drawings.

1/6



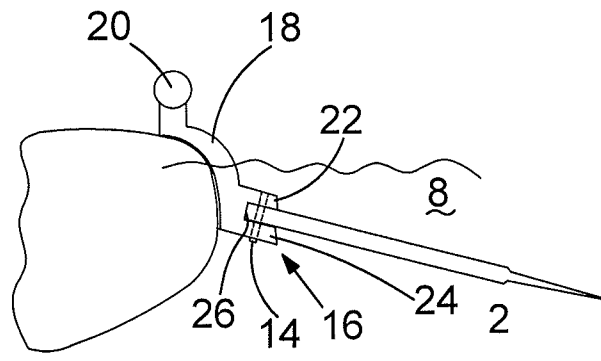


FIG. 5

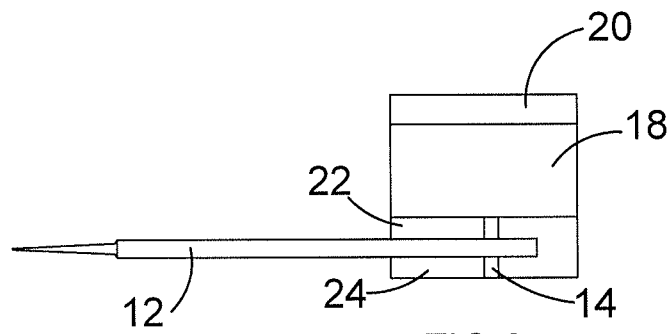


FIG. 6

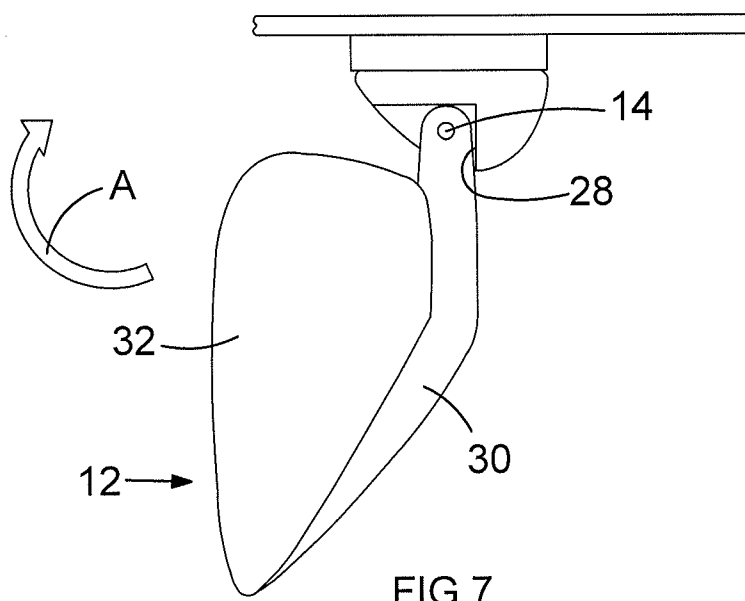
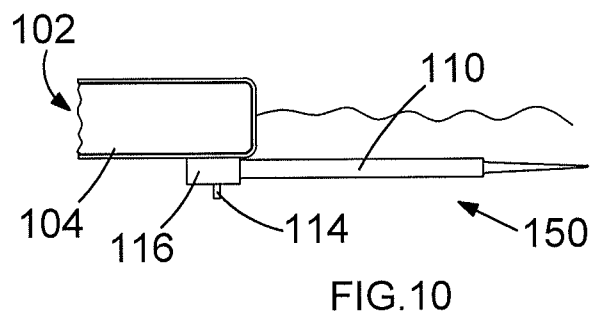
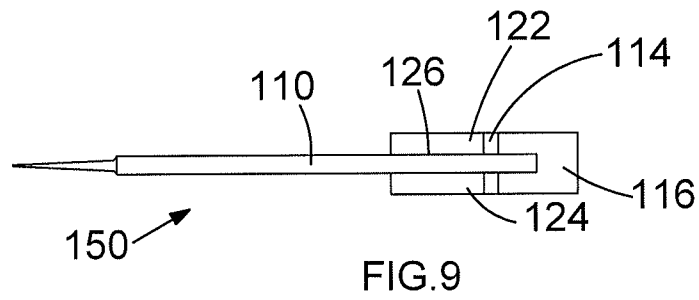
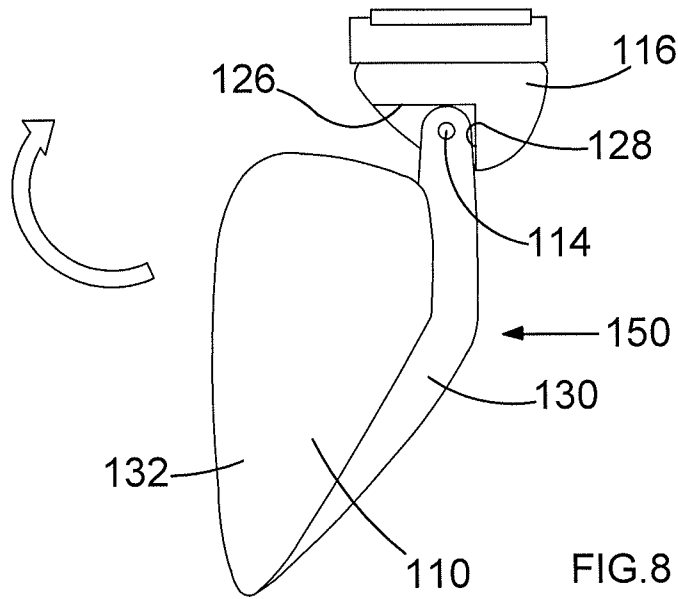
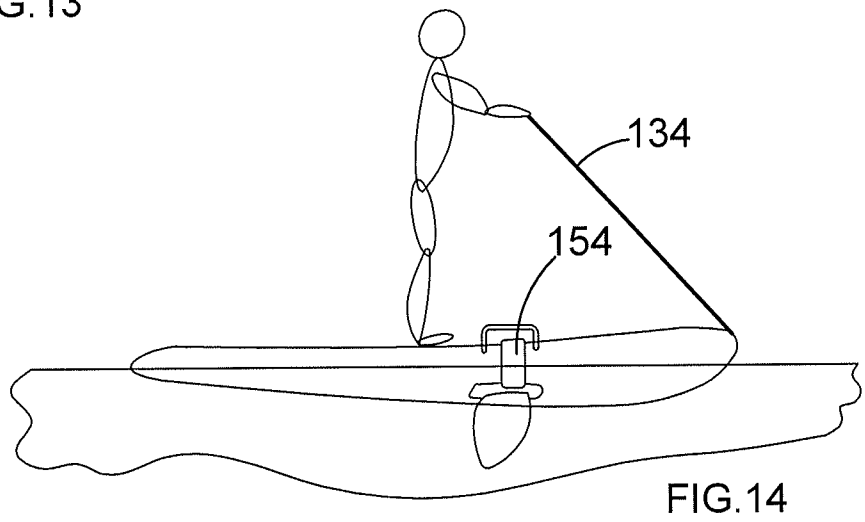
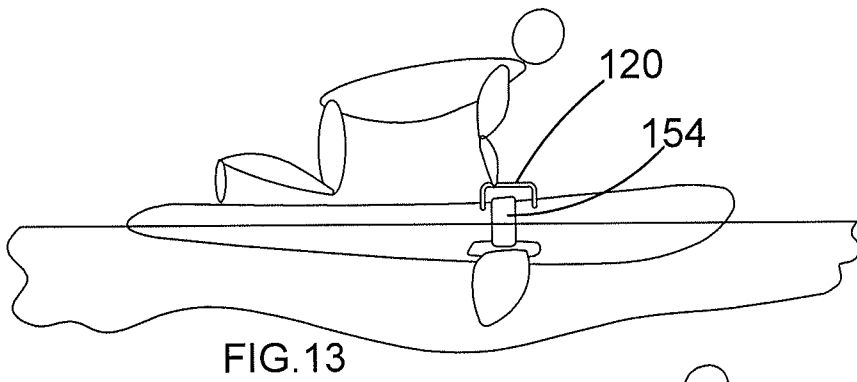
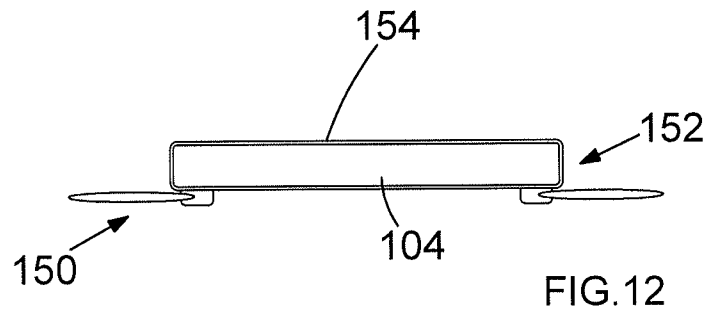
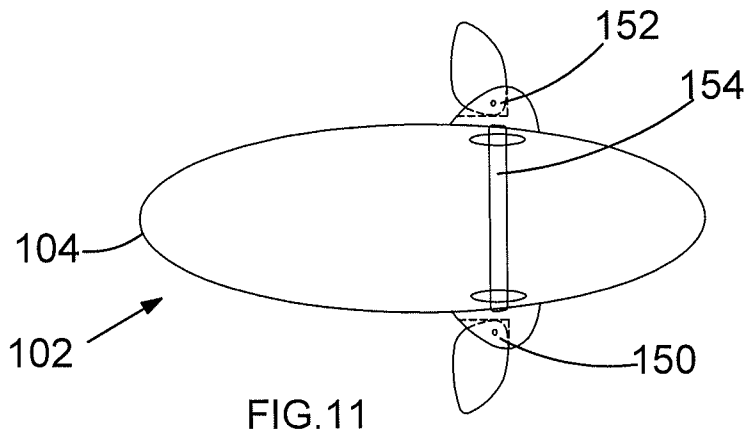


FIG. 7





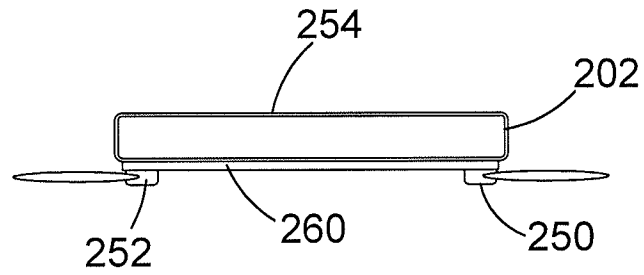


FIG.15

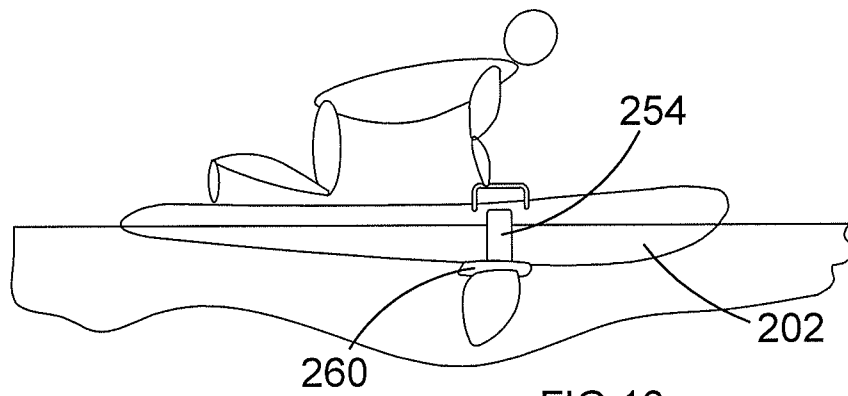


FIG.16

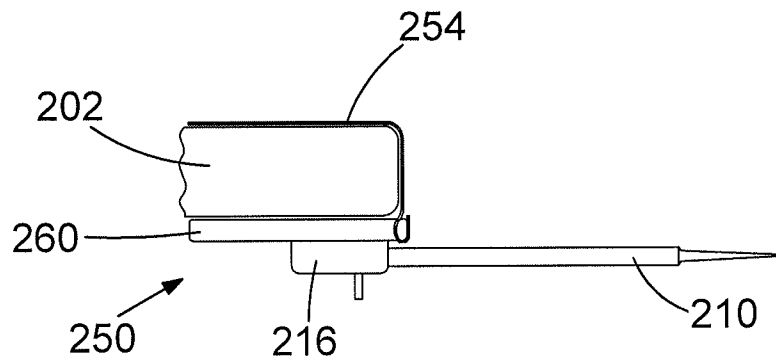


FIG.17

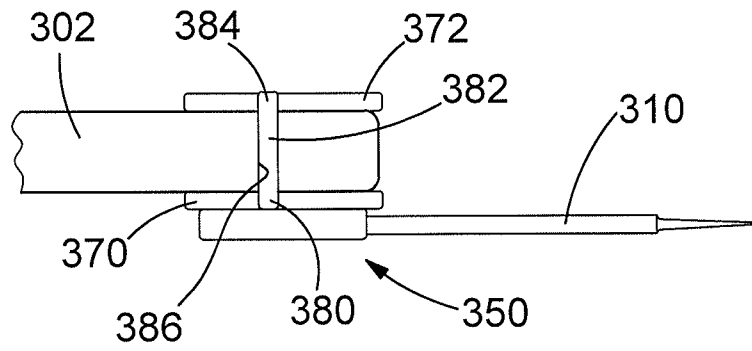


FIG. 18

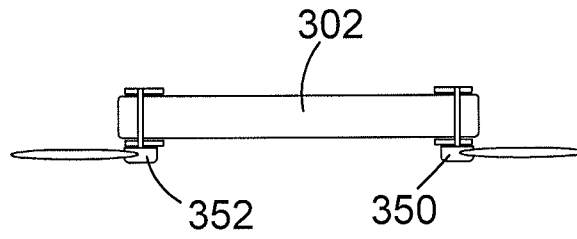


FIG. 19

INTERNATIONAL SEARCH REPORT

International application No
PCT/GB2016/050805

A. CLASSIFICATION OF SUBJECT MATTER
INV. B63B35/73 B63H1/36 B63H16/08
ADD.
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED
Minimum documentation searched (classification system followed by classification symbols)
B63B B63H

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	FR 2 449 591 A1 (URAM JULES) 19 September 1980 (1980-09-19)	1-3,5, 9-15, 18-21
A	page 2, line 25 - line 30 page 3, line 5 - line 30; figures	4,6-8, 16,17
X	DE 297 20 003 U1 (WIEST FRANZ [DE]) 23 April 1998 (1998-04-23) the whole document	1,6-8,11
X	US 3 845 733 A (JACKMAN R) 5 November 1974 (1974-11-05) column 4, line 20 - line 30; figure 11	1,11
X	US 2007/032144 A1 (KETTERMAN GREGORY S [US] ET AL) 8 February 2007 (2007-02-08)	1,2,5, 10,21
A	paragraph [0017]; figures	11
	-/--	

Further documents are listed in the continuation of Box C.

See patent family annex.

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Date of the actual completion of the international search 1 July 2016	Date of mailing of the international search report 11/07/2016
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Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Authorized officer Barré, Vincent
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INTERNATIONAL SEARCH REPORT

International application No
PCT/GB2016/050805

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	GB 1 304 397 A (HEPATEX A.G.) 24 January 1973 (1973-01-24) abstract; figures 2,9,10 -----	1

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International application No PCT/GB2016/050805

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		WO 2007019552 A2	15-02-2007

GB 1304397	A	24-01-1973	NONE
