

IMPROVED DOCKING APPARATUSTechnical Field

This invention relates to docking apparatus of the type which are capable of lifting marine craft above the surrounding water level for storage or
5 other purposes for example for maintenance or repair purposes.

Background Art.

A number of different designs of docking apparatus which lift water craft above the surrounding water level are currently available. Docking apparatus of this type normally comprises a pair of spaced apart bodies which
10 can contain air so that the bodies may float and support a water craft above the water level but which may be filled or partially filled with water to sink the bodies to enable the water craft to be launched or to enable a water craft to be located over the apparatus for subsequent lifting. A major disadvantage of the known apparatus is that they are generally rigid structures and therefore usually
15 only suitable for lifting water craft having a hull design which matches the structure unless a series of adjustments are made. Thus docking apparatus of this type, to overcome the above disadvantage, has to be manufactured to suit the particular water craft with which it is to be used.

The present invention aims to overcome or alleviate the above
20 disadvantages or at least provide an alternative to known docking apparatus by providing apparatus which is capable of lifting water craft above the water for storage or other purposes which will adjust to suit a range of water craft of different hull configurations.

Summary of the Invention

25 The present invention thus provides docking apparatus comprising a pair of spaced apart primary buoyancy bodies, said bodies being capable of floating to support a water craft above the water level or submerged to allow a water craft to be placed onto or released from said apparatus, and cradle means extending transversely between and supported to said buoyancy bodies, said
30 cradle means being adapted to adjust to the shape of the hull of said water craft



when subject to the weight of said water craft thereon.

The cradle means may be in the form of at least one member which is fixed at opposite ends to the respective buoyancy bodies but which will flex when subject to a load thereon to conform to the shape of the underside of the hull of the water craft.

Typically the at least one cradle member may be in the form of a semi-stiff sheet extending between and secured to the buoyancy bodies. The sheet may have a substantially V-shaped configuration to receive the V-shaped hull of a water craft, the sheet being formed of a material which flexes when subject to the weight of a water craft, whereby the sheet may conform substantially to the underside of the water craft when supported thereon.

Preferably the buoyancy bodies are joined together at their lower side by one or more transverse members. Preferably also the buoyancy bodies are somewhat hingedly movable about substantially horizontal axes relative to the transverse member or members when a load is applied to the cradle member so as to allow its adjustment to the shape of the hull of the water craft.

The hinged movement may be achieved by a hinge connection between the transverse member or members and each buoyancy body. Alternatively, the hinged movement may be achieved by live or integral hinges at or adjacent the connection between the transverse members and buoyancy bodies. The hinge connection may also provide for a degree of pivotal movement of the buoyancy bodies about a vertical axis so that the bodies which are normally substantially parallel to each other may adopt other than a substantially parallel attitude, again to match a water craft hull in the fore and aft direction.

Preferably the sheet of the cradle member is formed of a semi rigid non-corrosive sheet material which is flexible enough to flex when subject to the weight of the water craft. A particularly suitable material is a stiff plastics, for example high density polyethylene. Other plastics, however, may be suitable for this purpose. The buoyancy bodies may also be constructed of a similar material.

The primary buoyancy bodies may comprise two or more bodies



incorporating one or more compartments within each body. Such bodies may float or be submerged due to the interchange of air and water within those compartments by way of an air pumping and exhaust system. When air is forced into the primary buoyancy bodies, water is exhausted from the bodies through exhaust openings suitably provided in the underside of the bodies such that buoyancy and consequently lift is achieved. When air is released from the buoyancy bodies, water may enter through the underside exhaust openings to allow the primary buoyancy bodies to submerge.

For supporting the apparatus in a partially submerged state for locating of water craft thereon, the apparatus may also include secondary buoyancy bodies which support the primary buoyancy bodies when the latter are submerged.

The secondary buoyancy bodies remain buoyant and support the apparatus when the primary buoyancy bodies are submerged, thereby limiting the depth below the water surface of the supporting cradle members. For this purpose, the secondary buoyancy bodies comprise sealed bodies of one or more compartments. The primary and secondary buoyancy bodies may both be of elongated tubular form with the secondary buoyancy bodies extending substantially parallel to and being supported above and fixed to the primary buoyancy bodies. The secondary buoyancy bodies are normally substantially smaller in diameter than the primary buoyancy bodies.

For releasing air from the primary buoyancy bodies, valves may be connected to each buoyancy bodies, whereby when the valves are open, air is capable of being exhausted therefrom. Alternatively for this purpose, a single valve may be connected to each buoyancy body such that operation of the valve may simultaneously connect those bodies to atmosphere.

The exhaust openings of each buoyancy bodies may be connected to tubes or ducts which may be lowered so as to be in communication with the water in which the bodies are located or raised above the water level. When the tubes are lowered and the valve or valves are opened, the primary buoyancy



bodies will fill with water through the tubes to submerge the primary buoyancy bodies. When the tubes are raised above water level, opening of the valve or valves will not result in the primary buoyancy bodies submerging.

For elevating the docking apparatus and a water craft supported thereon, air is pumped into the primary buoyancy bodies suitably through the aforementioned valves to cause water in the bodies to be exhausted through the tubes. The tubes are suitably in the form of substantially rigid tubes which are connected through a pivot connection to each body so that they may be raised or lowered.

10 Brief Description of the Drawings

In order that the invention may be more readily understood and put into practical effect, reference will now be made to the accompanying drawings which illustrate a preferred embodiment of the invention and wherein:-

Fig. 1 is a perspective view from the rear of docking apparatus
15 according to the present invention;

Fig. 2 is a rear view of the apparatus of Fig. 1;

Fig. 2A is an enlarged sectional view of the region designated A in
Fig. 2;

Fig. 3 is a plan view of the docking apparatus of Fig. 1;

20 Fig. 4 illustrates a typical exhaust duct of the apparatus;

Figs. 5 to 7 illustrate schematically the operation of the apparatus
of the invention; and

Fig. 8 is a rear view of an alternative form of apparatus according
to the invention.

25 Detailed Description of the Invention

Referring to the drawings and firstly to Fig. 1 to 3, there is illustrated docking apparatus 10 according to the present invention, comprising a pair of elongated spaced apart substantially tubular primary buoyancy bodies 11. Extending between the bodies 11 are a pair of cradles 12, each of which includes
30 a sheet 13 which is of a V-shaped configuration about a valley 14 arranged



centrally of the bodies 11. The sheets 13, at each end, are provided with downwardly extending tubular sockets or skirts 15 which are adapted to locate over, in a telescopic fashion, upwardly directed hollow spigots 16 which extend from the buoyancy bodies 11, the spigots 16 being inclined inwardly towards
5 each other.

The bodies 11 are also joined on their lower side by one or more transversely extending members 17 which in this embodiment are of tubular form. A member 17 extends at each end into tubular sockets 18 which are fixed to a lower side of the buoyancy bodies 11 and extend somewhat tangentially
10 therefrom and towards each other. The tubular sockets 18 are of a larger diameter than the diameter of the member 17 such that the member 17 is free for some movement in the sockets 18. Pivot pins 19 extend transversely through each socket 18 and through openings 20 in an end of the member 17 located therein to form a pivot connection allowing hinged movements of the bodies 11
15 about substantially horizontal axes towards and away from each other. The pivot pins 19 are a relatively loose fit in the ends of the members 17 being smaller than the diameter of the openings 20.

Hinged movement of the bodies 11 is accompanied by deformation of the sheet 13 providing a sharper or shallower V configuration to match the hull
20 21 of a water craft supported thereon as shown in Fig. 2. The V-shaped cradles 12 can thus conform to the shape of the hull 20 without any need for external adjustments.

Mounted above the bodies 11 via supports 22 are secondary buoyancy bodies 23 which are of tubular form and which extend longitudinally
25 of and substantially parallel to each body 11. The bodies 21 are sealed and limit the depth to which the apparatus 10 is submerged when the primary bodies 11 are flooded.

Exhaust openings 24 are provided on the lower side of each body 11 and are connected through a hollow pivot joint 25 to exhaust tubes 26. The
30 tubes 26 are thus capable of being pivoted between a lowered position illustrated



in dotted outline where the end 27 of a tube 26 is submerged and a raised position where the end 27 of the tube 26 is above the water level. Movement of the tubes 26 between these positions may be simply achieved by means of suitable manual means such as a boat pole to push the tube 26 downwardly and a rope or cable 28 connected to the tubes 26 which enables the tubes 26 to be pulled upwardly to the raised position.

In an alternative simplified arrangement, the exhaust openings 23 do not have the extending tubes 26 but are open all the time. A disadvantage of this arrangement however is that if an air leakage occurs in one of the bodies 11, water will fill that body 11 through the opening 23 and thus tipping the apparatus 10 to a possible unstable attitude.

Air valves for raising and lowering of the apparatus may be mounted on the apparatus 10 or adjacent thereto, such as on a jetty or pontoon. In one form, the air valves comprise a pair of manually actuable valves 29 connected to the respective primary buoyancy bodies 11 and to a common main air valve 30. The valves 29 and 30, as shown in Fig. 1 may be mounted on one of the secondary buoyancy bodies 23. This arrangement allows the user to select whether both bodies can receive air or release air simultaneously by opening both valves 29 and the main valve 30 or whether one valve 29 should be opened earlier than the other valve 29, for example to exhaust one body 11 of water to level the apparatus 10 in the event that excess weight is on one side. The valve 30 is connectable to a source of air, for example from a compressor, through an air supply line 31.

In use and as shown in Figs. 5 to 7, where it is desired to lift a water craft 32 having a V-shaped hull 21 from the water, the apparatus 10 is lowered by lowering the tubes 26 and opening the bodies 11 to the atmosphere through the valves 29 and 30. This will permit water to fill both the bodies 11 through the tubes 25 and exhaust openings 24 to submerge the bodies 11 to a level where the secondary buoyancy bodies 23 are at or adjacent the water level 33 and supporting the bodies 11.



The craft 32 is then moved over the apparatus 10 and cradles 12 and then air forced into the bodies 11 via the line 31 and valves 30 and 29 to expel water therefrom. This will increase the buoyancy of the bodies 11 causing the apparatus 10 to rise. In this movement, the keel of the water craft 32 will
5 locate initially in the valley 14. Further elevating of the apparatus 10 will cause the sheets 13 to flex and conform to the underside shape of the hull 21 of the water craft 32 as shown in Fig. 6 and 7. To allow this to occur the bodies 11 will move in a hinge like fashion toward each other about the pivot pins 19, whilst being restrained from moving outwardly by the members 17. Further or
10 continued application of air to the bodies 11 will cause the bodies 11 to elevate the water craft 32 clear of the water level 33 with the hull 21 nesting within the sheets 31 and being supported at the chines by the spigots 16. Lowering of the water craft 32 into the water is the reverse of the above procedure.

The docking apparatus illustrated in Fig. 1 and 2 is shown to have
15 two cradles 12. It may however incorporate more than two cradles or only a single cradle and a further means for example a fixed cradle to support the remainder of the hull. In yet an alternative configuration the sheet like cradle 12 may be extended to support the full length of the watercraft hull 29.

As stated above, the sheets 13 are provided with spaced apart
20 sockets or skirts 15 of tubular form which are capable of being located over the upstanding spigots 16 on the main buoyancy bodies 11. To hold the skirts 15 in position, bolts or screws 34 may be located in spaced apart circumferential positions around the skirt 15 to secure the skirt 15 to the spigots 16. Removal of the bolts 34 allows the skirts 15 to be detached from the spigots 16. Similarly,
25 the pivot pins or bolts 19 can be removed to enable detachment of the transverse members 17. This allows the apparatus 10 to be disassembled into a convenient form for transport and reassembly as required. All the components of the apparatus 10 are preferably formed of a plastics material such as polypropylene and permanent joints formed by plastics welding.

30 In an alternative arrangement shown in Fig. 8, in which like



components have been given like numerals, the transverse members 17 are replaced by a planar sheet or sheets 35, similar to the sheet 13 and joined to each body 11 at 36 by adhesives or welding. The sheet 35 is braced by an upstanding member 37 which terminates short of the bodies and at the bodies 11 by further
5 braces 38. The braced sheet 35 provides a relatively rigid support between the bodies 11 on their underside but permits some pivotal or hinged movement of the bodies 11 about the regions 39 which act as integral hinges, the regions 39 comprising regions of the sheet 35 which are unsupported. This is shown in dotted outline in Fig. 8 where the position of the bodies 11 prior to the supporting
10 of the water craft 32 is shown.

Whilst the above has been given by way of illustrative embodiment of the invention, all such modifications and variations thereto as would be apparent to persons skilled in the art are deemed to fall within the broad scope and ambit of the invention as herein defined in the appended claims.

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CLAIMS

1. Docking apparatus comprising a pair of spaced apart primary buoyancy bodies, said bodies being capable of floating to support a water craft above the water level or submerged to allow a water craft to be placed onto or
5 released from said apparatus, and cradle means extending transversely between and supported to said buoyancy bodies, said cradle means being adapted to adjust to the shape of the hull of said water craft when subject to the weight of said water craft thereon.
- 10 2. Docking apparatus according to Claim 1 wherein said cradle means comprises at least one member which is fixed at opposite ends to the respective buoyancy bodies but which will flex when subject to a load thereon to conform to the shape of the water craft hull.
- 15 3. Docking apparatus according to Claim 2 wherein said at least one cradle member is in the form of a semi-stiff sheet or sheets extending between and secured to the buoyancy bodies.
4. Docking apparatus according to Claim 3 wherein said sheet has a
20 substantially V-shaped configuration in cross-section, said sheet being formed of a material which flexes when subject to the weight of a water craft, whereby said sheet may conform substantially to the underside of the water craft supported thereon.
- 25 5. Docking apparatus according to Claim 1 wherein said buoyancy bodies are joined together on their lowerside by one or more transverse members.
6. Docking apparatus according to Claim 5 wherein said buoyancy
30 bodies are hingedly movable about substantially horizontal axes relative to the transverse member or members when a load is applied to said cradle means so as





to allow adjustment of said cradle means to the shape of the hull of the water craft.

7. Docking apparatus according to Claim 6 wherein said bodies are
5 hingedly connected to said transverse member or members to facilitate said hinge movement.

8. Docking apparatus according to Claim 6 wherein an integral hinge
is defined adjacent the connection between said transverse members and
10 buoyancy bodies to facilitate said hinged movement.

9. Docking apparatus according to Claim 7 wherein said hinge
connection provides for pivotal movement of said buoyancy bodies about a
vertical axis whereby said bodies may adopt other than a substantially parallel
15 attitude relative to each other.

10. Docking apparatus according to Claim 3 wherein said sheet or
sheets are formed of a stiff plastics material.

20 11. Docking apparatus according to Claim 3 wherein said primary
buoyancy bodies are formed of a stiff plastics material.

12. Docking apparatus according to Claim 11 wherein said stiff plastics
material comprises a high density polyethylene.

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13. Docking apparatus according to Claim 1 and including secondary
buoyancy bodies which support the primary buoyancy bodies when the latter are
submerged.

30 14. Docking apparatus according to Claim 13 wherein said primary





and secondary buoyancy bodies are of elongated tubular form and wherein said secondary buoyancy bodies extend substantially parallel to and are supported above and fixed to said primary buoyancy bodies.

5 15. Docking apparatus according to Claim 1 wherein said primary buoyancy bodies include exhaust openings for exhausting water from said primary buoyancy bodies.

16. Docking apparatus according to Claim 15 wherein said exhaust
10 openings are connected to tubes which may be lowered so as to be in communication with the water in which the bodies are located or raised above the water level.

17. Docking apparatus according to Claim 16 wherein said tubes are
15 substantially rigid tubes which are connected through a pivot connection to each primary body whereby they may be pivotally raised or lowered.

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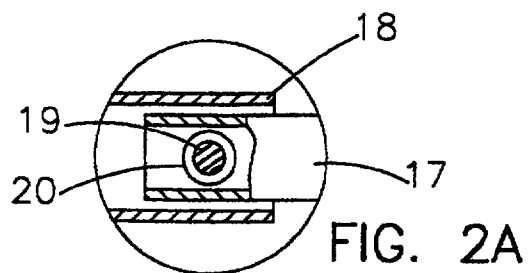
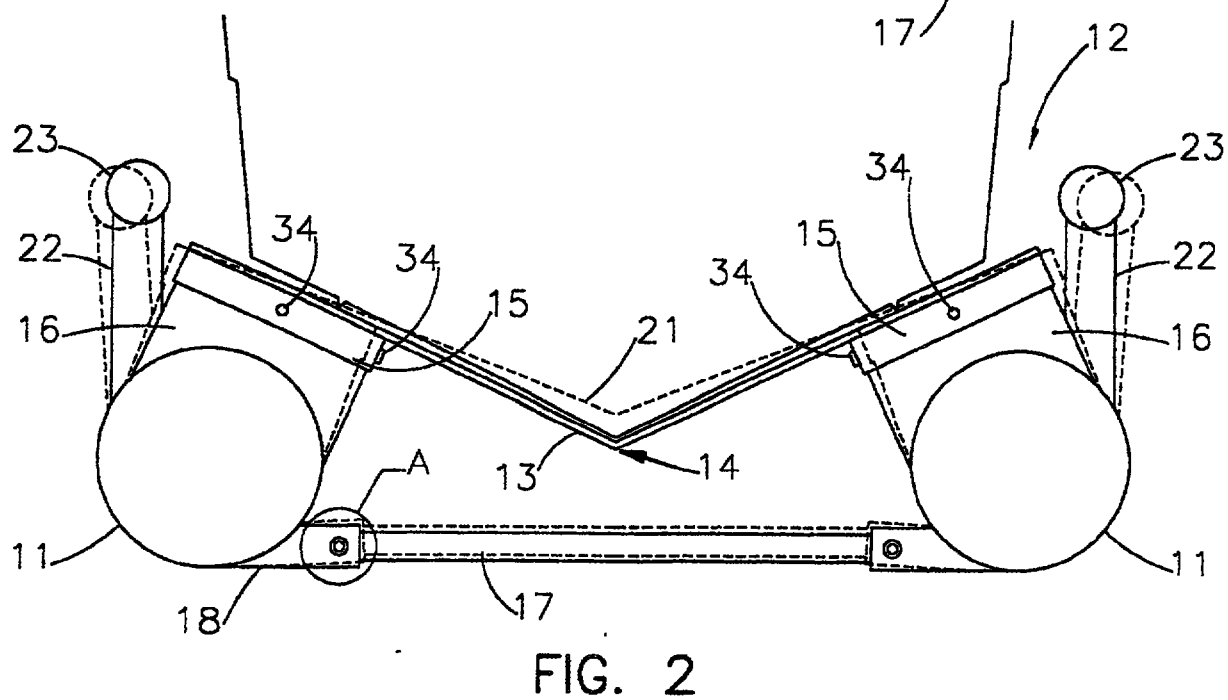
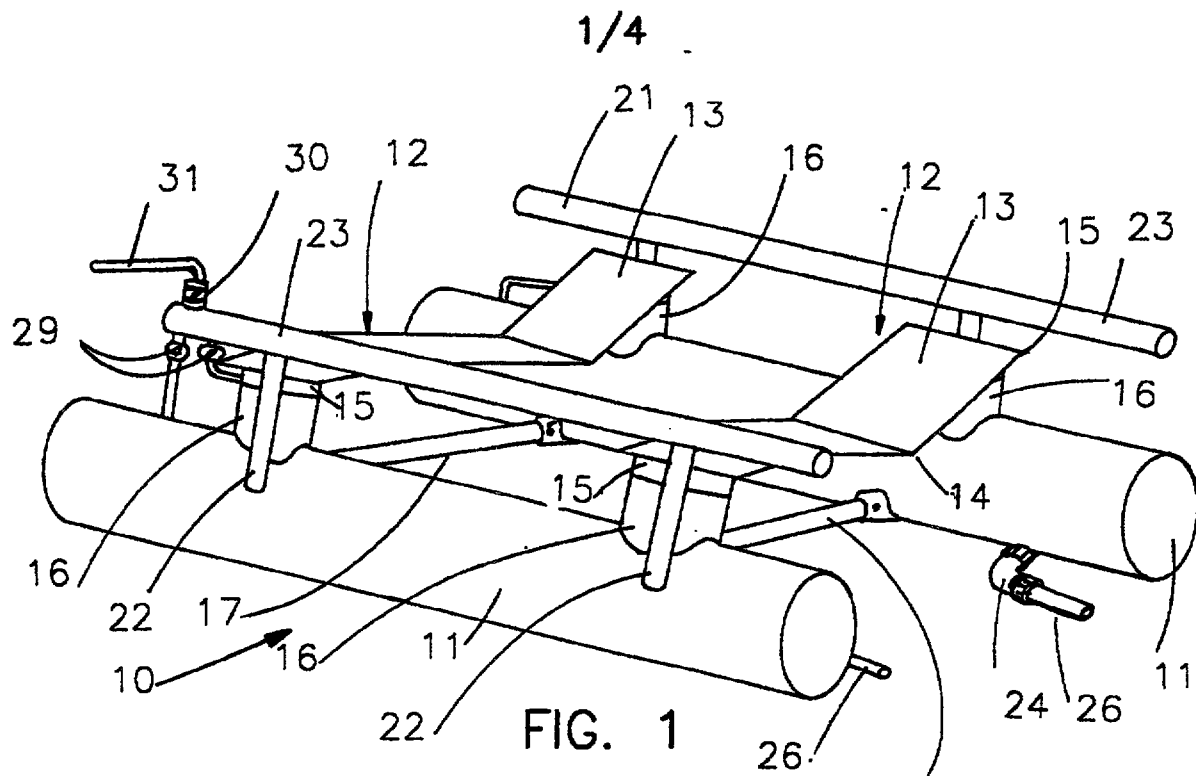
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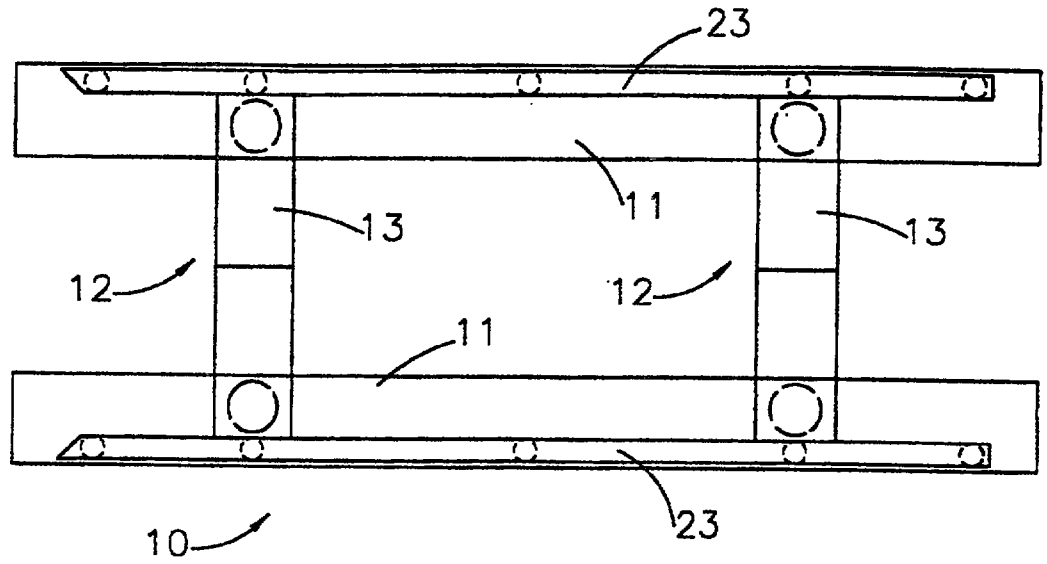


FIG. 3

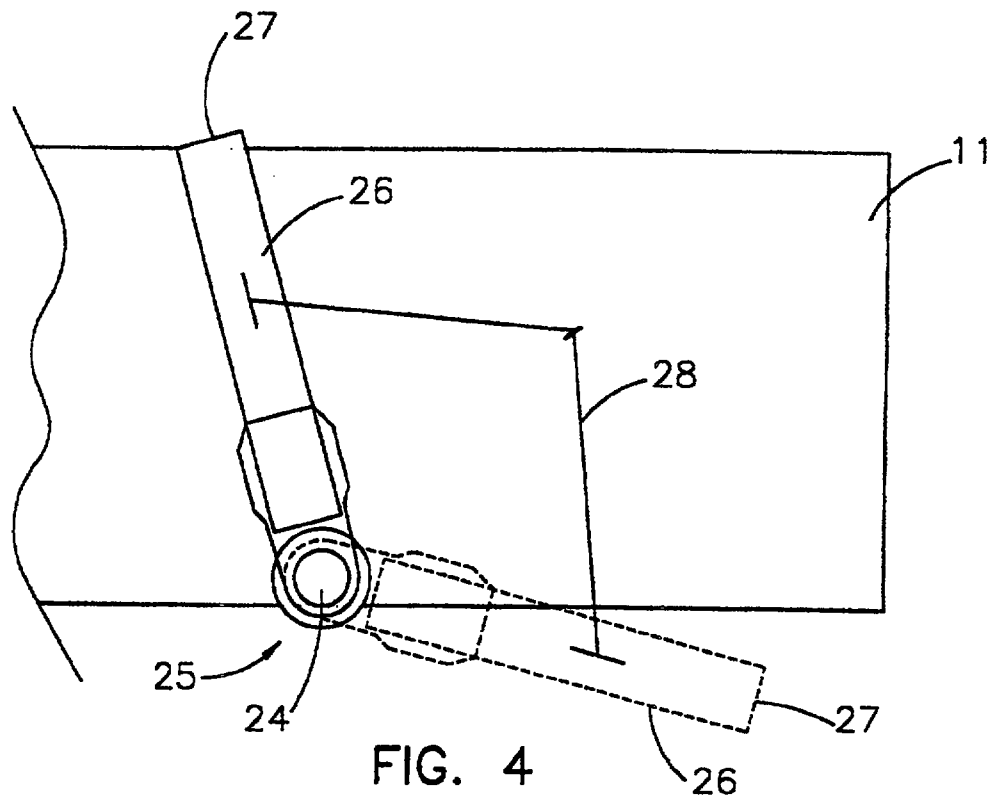


FIG. 4

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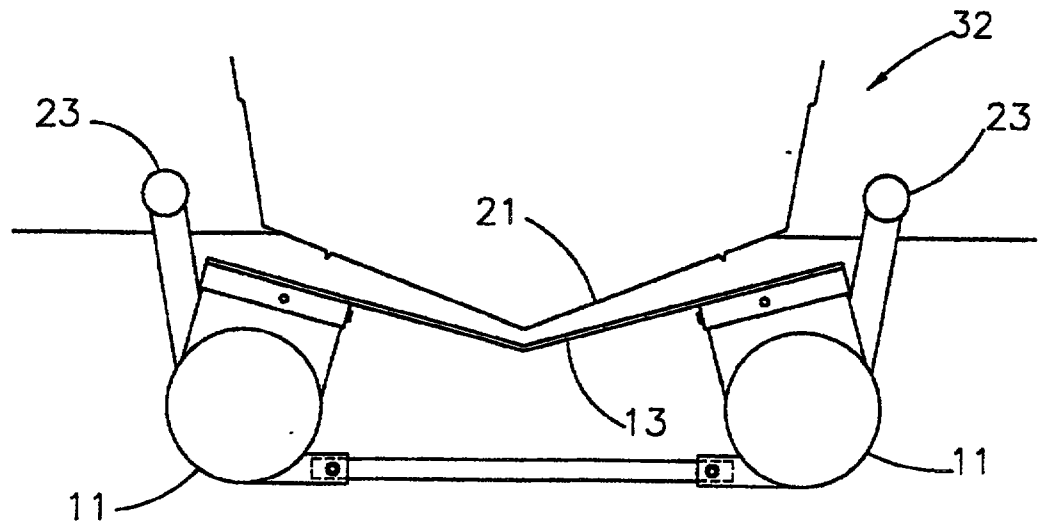


FIG. 5

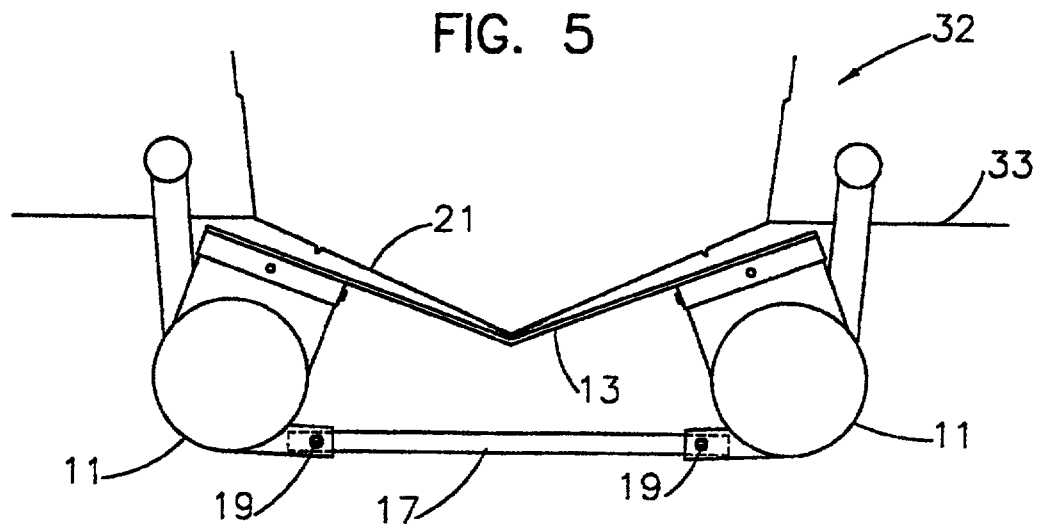


FIG. 6

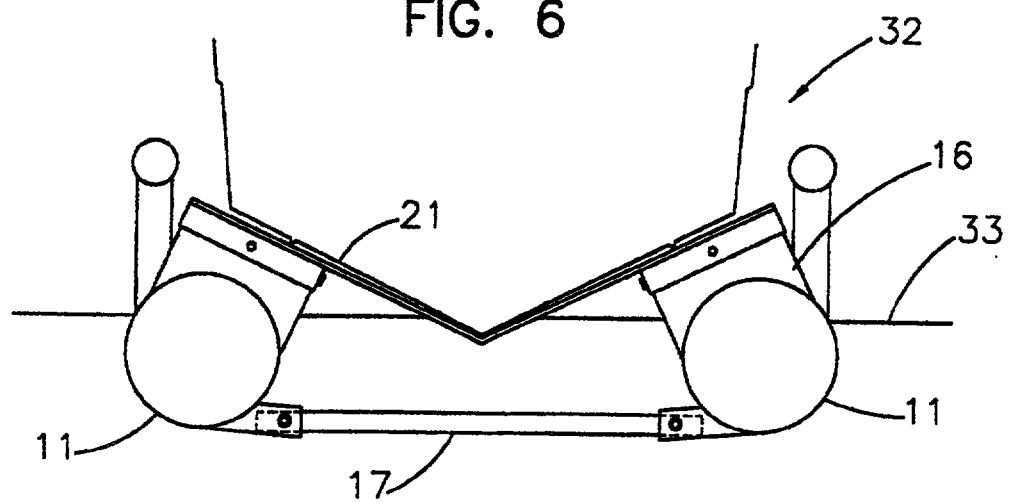
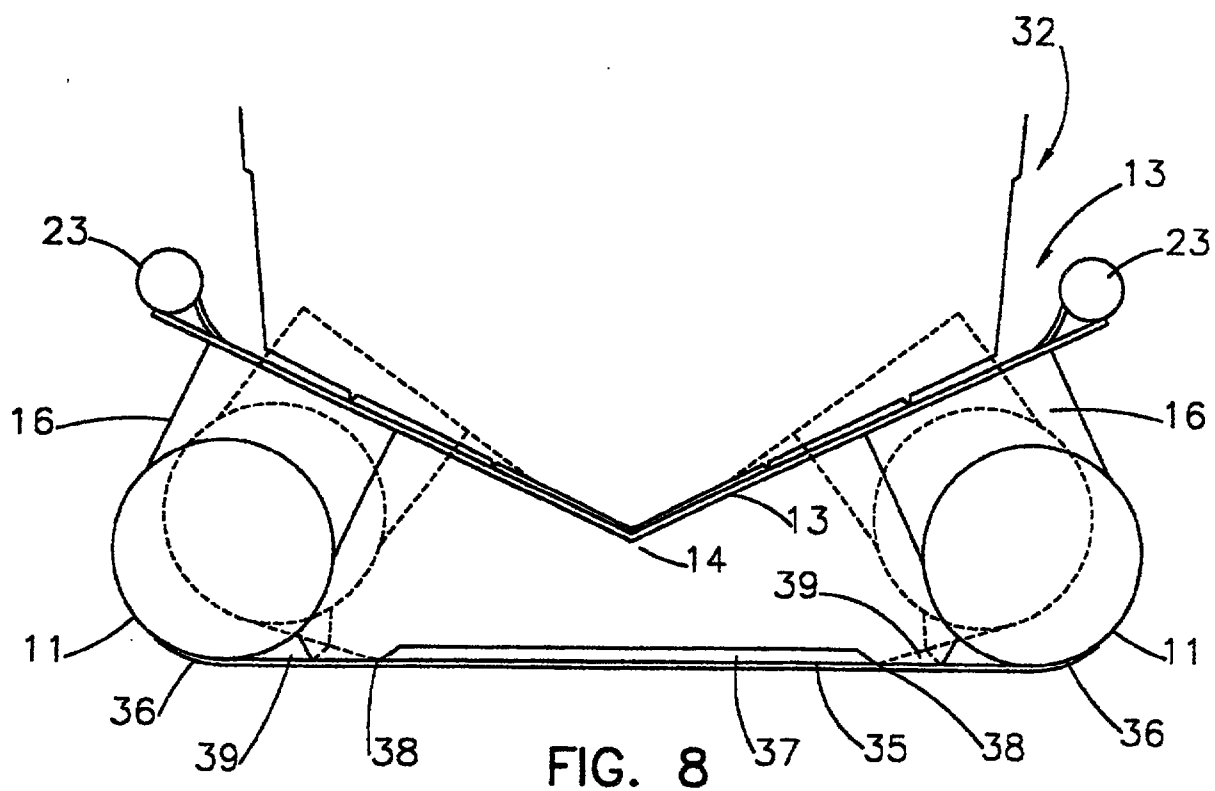


FIG. 7

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IMPROVED DOCKING APPARATUS

Technical Field

This invention relates to docking apparatus of the type which are capable of lifting marine craft above the surrounding water level for storage or other purposes for example for maintenance or repair purposes.

Background Art

A number of different designs of docking apparatus which lift water craft above the surrounding water level are currently available. Docking apparatus of this type normally comprises a pair of spaced apart bodies which can contain air so that the bodies may float and support a water craft above the water level but which may be filled or partially filled with water to sink the bodies to enable the water craft to be launched or to enable a water craft to be located over the apparatus for subsequent lifting. A major disadvantage of the known apparatus is that they are generally rigid structures and therefore usually only suitable for lifting water craft having a hull design which matches the structure unless a series of adjustments are made. Thus docking apparatus of this type, to overcome the above disadvantage, has to be manufactured to suit the particular water craft with which it is to be used.

The present invention aims to overcome or alleviate the above disadvantages or at least provide an alternative to known docking apparatus by providing apparatus which is capable of lifting water craft above the water for storage or other purposes which will adjust to suit a range of water craft of different hull configurations.

Summary of the Invention

The present invention thus provides docking apparatus including:-

cradle means for elevating a watercraft above the water;
laterally spaced apart elongate buoyancy chambers

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supporting said cradle means, said buoyancy chambers by themselves being able to support the cradle means and the watercraft in the elevated position;

flooding means for submerging the buoyancy chambers;

5 discharging means for discharging water from the flooded chambers;

a buoyant body attached to each buoyancy chamber for providing the docking apparatus with positive buoyancy when the buoyancy chambers are submerged.

10 The cradle means may be in the form of at least one resiliently deformable support member which is fixed at opposite ends to the respective buoyancy chambers but which will flex when subject to a load thereon to conform to the shape of the underside of the hull of the water craft.

15 Typically the at least one support member may be in the form of a semi-stiff sheet or strap extending between the buoyancy chambers. The sheet or strap preferably extends downwardly and inwardly from its opposite ends. The sheet or strap may have a substantially V-shaped configuration to
20 receive the V-shaped hull of the water craft. The sheet or strap is preferably of a material which flexes when subject to the weight of the water craft, whereby the sheet or the strap substantially conforms to the underside of the water craft when supported thereon.

25 The support members may extend from pedestal members mounted on each said buoyancy chamber. The pedestal members may incline inwardly of said buoyancy chambers. The support members preferably extend from the upper surface of the pedestal members and substantially at right angles to the
30 axis of the pedestal members.

Preferably the buoyancy chambers are joined together by one or more transverse spacing members. The one or more transverse spacing members are joined to a lower portion of each of the buoyance chambers. Preferably the buoyancy
35 chambers are hingedly connected to said buoyancy chambers. The hinge connections provides pivotal movement of said buoyancy chambers about respective longitudinal axes.

Alternatively, the hinged movement may be achieved by live or integral hinges at or adjacent the connection between the transverse spacing members and buoyancy chambers. The hinge connection may also provide for a degree of pivotal movement of the buoyancy chambers about a vertical axis so that the chambers which are normally substantially parallel to each other may adopt other than a substantially parallel attitude, again to match the water craft hull in the fore and aft direction.

Preferably the sheet or strap of the support member is formed of a semi rigid non-corrosive sheet material which is flexible enough to flex when subject to the weight of the water craft. A particularly suitable material is a stiff plastics, for example high density polyethylene. Other plastics, however, may be suitable for this purpose. The buoyancy chambers may also be constructed of a similar material. The buoyancy chambers are preferably rigid. The buoyancy chambers are preferably widely spaced apart. The buoyancy chambers may be disposed adjacent the lateral extremities of the docking apparatus.

The buoyancy chambers may comprise two or more chambers incorporating one or more compartments within each chamber. Such chambers may float or be submerged due to the interchange of air and water within those compartments by way of an air pumping and exhaust system. When air is forced into the buoyancy chambers, water is discharged from the chambers through exhaust openings suitably provided in the underside of the chambers such that buoyancy and consequently lift is achieved. When air is released from the buoyancy chambers, water may enter through the underside exhaust openings to allow the buoyancy chambers to submerge.

The flooding means includes the exhaust openings through which water passes into and out of the buoyance chambers during flooding and discharge. The exhaust openings may be connected to tubes which may be lowered so as to be in communication with the water in which the chambers are located or raised above the water level. The tubes may be

substantially rigid tubes which are connected through a pivot connection to each chamber whereby they may be pivotally raised or lowered.

5 The discharging means includes air valves through which air is pumped into the buoyancy chambers for discharging water therefrom.

10 The buoyant bodies remain buoyant and support the apparatus when the buoyancy chambers are submerged, thereby limiting the depth below the water surface of the support member. For this purpose, the buoyant bodies comprise sealed bodies of one or more compartments. The buoyant bodies may be of elongated form and extend fixedly substantially parallel to the buoyancy chambers. The buoyant bodies are normally substantially smaller in diameter than the buoyancy chambers.

15 The buoyant bodies are supported on substantially vertical struts mounted on said buoyancy chambers at the lateral extremities thereof.

20 For releasing air from the buoyancy chambers, air valves may be connected to each buoyancy chamber, whereby when the valves are open, air is capable of being exhausted therefrom. Alternatively for this purpose, a single valve may be connected to each buoyancy chamber such that operation of the valve may simultaneously connect those chambers to atmosphere.

25 When the tubes are lowered and the valve or valves are opened, the buoyancy chambers will fill with water through the tubes to submerge the buoyancy chambers. When the tubes are raised above water level, opening of the valve or valves will not result in the buoyancy chambers submerging.

30 For elevating the docking apparatus and the water craft supported thereon, air is pumped into the buoyancy chambers through the aforementioned valves to cause water in the chambers to be discharged through the tubes.

35 Brief Description of the Drawings

In order that the invention may be more readily

understood and put into practical effect, reference will now be made to the accompanying drawings which illustrate a preferred embodiment of the invention and wherein:

- 5 Fig. 1 is a perspective view from the rear of docking apparatus according to the present invention;
Fig. 2 is a rear view of the apparatus of Fig. 1;
Fig. 2A is an enlarged sectional view of the region designated A in Fig. 2;
Fig. 3 is a plan view of the docking apparatus of Fig. 1;
10 Fig. 4 illustrates a typical exhaust duct of the apparatus;
Figs. 5 to 7 illustrate schematically the operation of the apparatus of the invention; and
Fig. 8 is a rear view of an alternative form of apparatus
15 according to the invention.

Detailed Description of the Invention

Referring to the drawings and firstly to Fig. 1 to 3, there is illustrated docking apparatus 10 according to the present invention, comprising a pair of elongated spaced
20 apart substantially tubular primary buoyancy bodies 11. Extending between the bodies 11 are a pair of cradles 12, each of which includes a sheet 13 which is of a V-shaped configuration about a valley 14 arranged centrally of the bodies 11. The sheets 13, at each end, are provided with
25 downwardly extending tubular sockets or skirts 15 which are adapted to locate over, in a telescopic fashion, upwardly directed hollow spigots 16 which extend from the buoyancy bodies 11, the spigots 16 being inclined inwardly towards each other.

30 The bodies 11 are also joined on their lower side by one or more transversely extending members 17 which in this embodiment are of tubular form. A member 17 extends at each end into tubular sockets 18 which are fixed to a lower side of the buoyancy bodies 11 and extend somewhat tangentially
35 therefrom and towards each other. The tubular sockets 18 are of a larger diameter than the diameter of the member 17 such

that the member 17 is free for some movement in the sockets 18. Pivot pins 19 extend transversely through each socket 18 and through openings 20 in an end of the member 17 located therein to form a pivot connection allowing hinged movements of the bodies 11 about substantially horizontal axes towards and away from each other. The pivot pins 19 are a relatively loose fit in the ends of the members 17 being smaller than the diameter of the openings 20.

Hinged movement of the bodies 11 is accompanied by deformation of the sheet 13 providing a sharper or shallower V configuration to match the hull 21 of a water craft supported thereon as shown in Fig. 2. The V-shaped cradles 12 can thus conform to the shape of the hull 20 without any need for external adjustments.

Mounted above the bodies 11 via supports 22 are secondary buoyancy bodies 23 which are of tubular form and which extend longitudinally of and substantially parallel to each body 11. The bodies 23 are sealed and limit the depth to which the apparatus 10 is submerged when the primary bodies 11 are flooded.

Exhaust openings 24 are provided on the lower side of each body 11 and are connected through a hollow pivot joint 25 to exhaust tubes 26. The tubes 26 are thus capable of being pivoted between a lower position illustrated in dotted outline where the end 27 of a tube 26 is submerged and a raised position where the end 27 of the tube 26 is above the water level. Movement of the tubes 26 between these positions may be simply achieved by means of suitable manual means such as a boat pole to push the tube 26 downwardly and a rope or cable 28 connected to the tubes 26 which enables the tubes 26 to be pulled upwardly to the raised position.

In an alternative simplified arrangement, the exhaust openings 24 do not have the extending tubes 26 but are open all the time. A disadvantage of this arrangement however is that if an air leakage occurs in one of the bodies 11, water will fill that body 11 through the opening 24 and thus tipping the apparatus 10 to a possible unstable attitude.

Air valves for raising and lowering of the apparatus may be mounted on the apparatus 10 or adjacent thereto, such as on a jetty or pontoon. In one form, the air valves comprise a pair of manually actuatable valves 29 connected to the respective primary buoyancy bodies 11 and to a common main air valve 30. The valves 29 and 30, as shown in Fig. 1 may be mounted on one of the secondary buoyancy bodies 23. This arrangement allows the user to select whether both bodies can receive air or release air simultaneously by opening both valves 29 and the main valve 30 or whether one valve 29 should be opened earlier than the other valve 29, for example to exhaust one body 11 of water to level the apparatus 10 in the event that excess weight is on one side. The valve 30 is connectable to a source of air, for example from a compressor, through an air supply line 31.

In use and as shown in Figs. 5 to 7, where it is desired to lift a water craft 32 having a V-shaped hull 21 from the water, the apparatus 10 is lowered by lowering the tubes 26 and opening the bodies 11 to the atmosphere through the valves 29 and 30. This will permit water to fill both the bodies 11 through the tubes 26 and exhaust openings 24 to submerge the bodies 11 to a level where the secondary buoyancy bodies 23 are at or adjacent the water level 33 and supporting the bodies 11.

The craft 32 is then moved over the apparatus 10 and cradles 12 and then air forced into the bodies 11 via the line 31 and valves 30 and 29 to expel water therefrom. This will increase the buoyancy of the bodies 11 causing the apparatus 10 to rise. In this movement, the keel of the water craft 32 will locate initially in the valley 14. Further elevating of the apparatus 10 will cause the sheets 13 to flex and conform to the underside shape of the hull 21 of the water craft 32 as shown in Fig. 6 and 7. To allow this to occur the bodies 11 will move in a hinge like fashion toward each other about the pivot pins 19, whilst being restrained from moving outwardly by the members 17. Further or continued application of air to the bodies 11 will cause

the bodies 11 to elevate the water craft 32 clear of the water level 33 with the hull 21 nesting within the sheets 13 and being supported at the chines by the spigots 16. Lowering of the water craft 32 into the water is the reverse of the above procedure.

The docking apparatus illustrated in Fig. 1 and 2 is shown to have two cradles 12. It may however incorporate more than two cradles or only a single cradle and a further means for example a fixed cradle to support the remainder of the hull. In yet an alternative configuration the sheet like cradle 12 may be extended to support the full length of the water craft hull 21.

As stated above, the sheets 13 are provided with spaced apart sockets or skirts 15 of tubular form which are capable of being located over the upstanding spigots 16 on the main buoyancy bodies 11. To hold the skirts 15 in position, bolts or screws 34 may be located in spaced apart circumferential positions around the skirt 15 to secure the skirt 15 to the spigots 16. Removal of the bolts 34 allows the skirts 15 to be detached from the spigots 16. Similarly, the pivot pins or bolts 19 can be removed to enable detachment of the transverse members 17. This allows the apparatus 10 to be disassembled into a convenient form for transport and reassembly as required. All the components of the apparatus 10 are preferably formed of a plastics material such as polyethylene and permanent joins formed by plastics welding.

In an alternative arrangement shown in Fig. 8, in which like components have been given like numerals, the transverse members 17 are replaced by a planar sheet or sheets 35, similar to the sheet 13 and joined to each body 11 at 36 by adhesives or welding. The sheet 35 is braced by an upstanding member 37 which terminates short of the bodies and at the bodies 11 by further braces 38. The braced sheet 35 provides a relatively rigid support between the bodies 11 on their underside but permits some pivotal or hinged movement of the bodies 11 about the regions 39 which act as integral hinges, the regions 39 comprising regions of the sheet 35

which are unsupported. This is shown in dotted outline in Fig. 8 where the position of the bodies 11 prior to the supporting of the water craft 32 is shown.

5 Whilst the above has been given by way of illustrative embodiment of the invention, all such modifications and variations thereto as would be apparent to persons skilled in the art are deemed to fall within the broad scope and ambit of the invention as herein defined in the appended claims.



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CLAIMS:

1. Docking apparatus including:-

cradle means for elevating a watercraft above the water;

laterally spaced apart elongate buoyancy chambers supporting said cradle means, said buoyancy chambers by themselves being able to support the cradle means and the watercraft in the elevated position;

flooding means for submerging the buoyancy chambers;

discharging means for discharging water from the flooded chambers;

a buoyant body attached to each buoyancy chamber for providing the docking apparatus with positive buoyancy when the buoyancy chambers are submerged.

2. Docking apparatus according to Claim 1, wherein said cradle means includes one or more resiliently deformable support members fixed at opposite ends to the respective buoyancy chambers.

3. Docking apparatus according to Claim 2, wherein each of said one or more of said support members is in the form of a semi-stiff sheet or strap extending between the buoyancy chambers.

4. Docking apparatus according to Claim 3, wherein each said sheet or strap extends downwardly and inwardly from its opposite ends.

5. Docking apparatus according to any one of the Claims 2 to 4, wherein said support members extend from pedestal members mounted on each said buoyancy chamber.

6. Docking apparatus according to Claim 5, wherein said pedestal members incline inwardly of said buoyancy



chambers.

7. Docking apparatus according to Claim 5 or 6, wherein said support members extend from the upper surface of said pedestal members and substantially at right angles to the axis of said pedestal members.

8. Docking apparatus according to any one of the preceding claims and including one or more transverse spacing members attached to said buoyancy chambers.

9. Docking apparatus according to Claim 8, wherein each transverse spacing member is attached to a lower portion of each of the buoyancy chambers.

10. Docking apparatus according to Claim 8 or 9, wherein said transverse member is hingedly connected to said buoyancy chambers.

11. Docking apparatus according to Claim 10, wherein said hinge connections provides pivotal movement of said buoyancy chambers about respective longitudinal axes.

12. Docking apparatus according to any one of the preceding claims, wherein said buoyancy chambers are rigid.

13. Docking apparatus according to Claim 12, wherein said buoyancy chambers and said cradle means are formed of stiff plastics material.

14. Docking apparatus according to Claim 13, wherein said stiff plastics material comprises a high density polyethylene.

15. Docking apparatus according to any one of the



preceding claims wherein the buoyancy chambers are widely spaced apart.

16. Docking apparatus according to Claim 15, wherein the buoyancy chambers are disposed adjacent the lateral extremities of the docking apparatus.

17. Docking apparatus according to any one of the preceding claims wherein the flooding means includes exhaust openings through which water passes into and out of the buoyancy chambers during flooding and discharge.

18. Docking apparatus according to Claim 17, wherein said exhaust openings are connected to tubes which may be lowered so as to be in communication with the water in which the chambers are located or raised above the water level.

19. Docking apparatus according to Claim 18 wherein said tubes are substantially rigid tubes which are connected through a pivot connection to each chamber whereby they may be pivotally raised or lowered.

20. Docking apparatus according to any one of the preceding claims wherein the discharging means includes air valves through which air is pumped into the buoyancy chambers for discharging water therefrom.

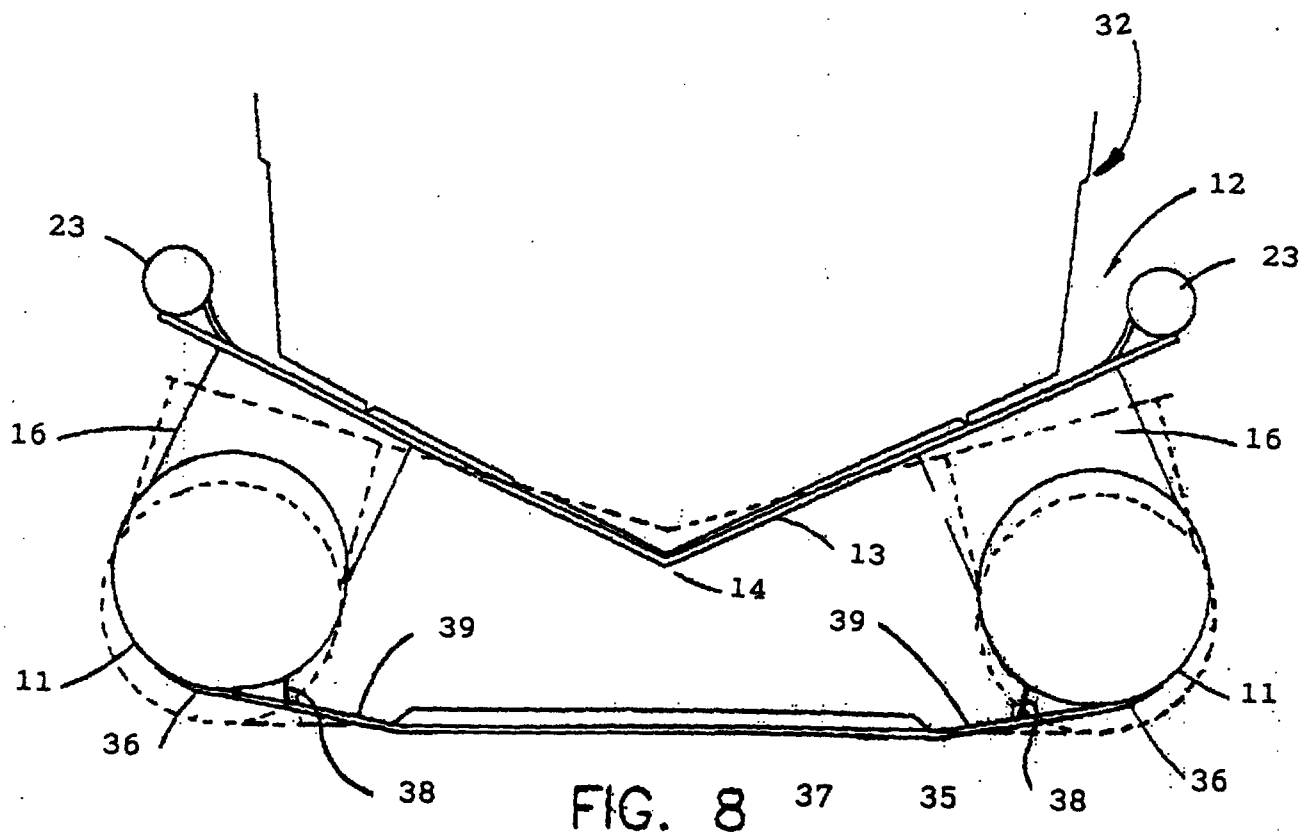
21. Docking apparatus according to any one of the preceding claims, wherein the buoyant bodies are of elongated form and extend fixedly substantially parallel to the buoyancy chambers.

22. Docking apparatus according to any one of the preceding claims, wherein the buoyant bodies are supported on substantially vertical struts mounted on



said buoyancy chambers at the lateral extremities thereof.

4/4



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(54) Title: IMPROVED DOCKING APPARATUS ✓ (57) Abstract Docking apparatus (10) including a pair of spaced apart primary buoyancy bodies (11) and cradle assemblies (12) extending between the bodies (11), the primary buoyancy bodies (11) being capable of being filled with water and thus submerged to enable a water craft to be positioned over the cradle assemblies (12) and lifted clear of the water when water is expelled from the bodies (11). The cradles (12) include flexible sheets (13) of a V-shape configuration which adjust to the shape of a water craft seating thereon to enable the docking apparatus (11) to be used with a range of hulls of different form.		