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71 Applicant: **Mayall, Phillip Lincoln, 19 Garden Grove, Carrara Queensland 4211 (AU)**
Applicant: **Whitten, Edward Maxwell, 105 Tarawara Avenue, Mudgeeraba Queensland 4213 (AU)**

72 Inventor: **Mayall, Phillip Lincoln, 19 Garden Grove, Carrara Queensland 4211 (AU)**
Inventor: **Whitten, Edward Maxwell, 105 Tarawara Avenue, Mudgeeraba Queensland 4213 (AU)**

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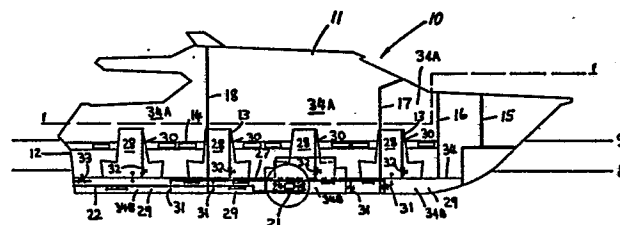
74 Representative: **Hulse, Thomas Arnold et al, Hulse & Co. Cavendish Buildings West Street, Sheffield S1 1ZZ (GB)**

54 **Marine craft for viewing under water.**

57 A marine observatory craft (10) for viewing of under-water locations includes one or more planing type hulls (12) with spaced viewing ports (14) associated with the or each hull, which is also provided with one or more transverse bulkheads (15 to 18) dividing the or each hull into a plurality of separate internal compartments (34A, 34B), which are sealed from each other and include one or more ballast tanks (28) that function as supports for seats (13), a control cabin superstructure (11) located above the plurality of internal compartments, and means (21 to 27) for selectively flooding the ballast tanks (28), whereby the craft (10) may move in.

(i) a travelling mode wherein the viewing ports (14) are located above the waterline (8); and

(ii) an observing mode in which the viewing ports (14) are located below the waterline (9), the flooding means including pump means (21), valve means (23, 24) controlling flow of water through the pump means and an inlet and outlet (22) and there also being provided a feed conduit (27) having separate communication conduits with each ballast tank (28) and venting means (30) associated with the or each ballast tank.



TITLE MODIFIED

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MARINE OBSERVATORY CRAFT

This invention relates to a marine observatory craft.

Hitherto marine observatory craft have been useful in relation to the observation of
5 underwater locations such as coral reefs and also marine life especially of the type that abounds in sub-tropical and tropical climates. Usually such locations are relatively close to mainland resorts and it was necessary to
10 transport tourists from the mainland to the underwater location of interest whereafter it was essential for tourists to transfer to small craft having glass bottoms in order to view the underwater location. The transport
15 craft was normally a motorboat having an inboard or outboard engine. The use of small glass bottom boats was found to be generally satisfactory if the weather was fine, the tourists were reasonably young and
20 agile, and the underwater locations were relatively close to the mainland.

It therefore will be appreciated that not all of the above conditions for use of small glass bottom boats were present on a
25 particular day and thus use of glass bottom

boats was not appropriate.

It further will be appreciated that the majority of less developed and therefore more interesting marine areas are inaccessible to the majority of tourists who are not scuba divers capable of operating off larger conventional vessels in the inaccessible or remote underwater locations.

United Kingdom Specification 2 046 673 to Rambridge describes a partly submersible boat with a ballast tank or tanks in which water can be passed and viewing windows which lie partly or wholly below the surface of the water at least when the boat is partly submerged. The control cabin is located forwardly and on the same level as the passenger level and thus will always be at least partly submerged in the travelling mode. The water may be pumped into the ballast tanks or alternatively it may be scooped while the boat is in motion into the ballast tank(s) via an inclined pipe. While mention is made in U.K. Specification 2 046 673 of the fact that more than one ballast tank may be included in each hull there is no specific description of same in the drawings. Also there is no

specific description of how the water may be pumped into or out of the ballast tanks.

U.K. Specification 2 046 673 only discloses a displacement hull which must at all times be located below the waterline when in a travelling mode. This means that the invention of U.K. Specification 2 046 673 is only applicable to small boats and thus is not suitable for medium to large charter vessels because the boat of U. K. Specification 2 046 673 may only travel in a ballasted state due to water always being present in the ballast tank(s). It is also believed that the Rambridge boat in having a control cabin on the same level as the passengers included in the or each hull will provide problems in relation to steering and handling as the driver or operator will not be in an elevated position to thereby provide effective handling control when either in the submerged mode or the travelling mode.

The Rambridge boat also requires the use of stabilizing floats for effective flotation and thus this provides a boat which is very unconventional in appearance and it is believed speculative in nature especially when

no structural components such as bulkheads and the like are disclosed.

It is also noted in regard to the Rambridge boat that the ballast tanks are
5 located on the bottom portion of each hull or alternatively in a bridging portion interposed between each hull and effectively the ballast cannot be carried in a position approximately centrally or middle of the height of the boat
10 and it is therefore believed that will adversely affect submerging operations because the ballast tanks are therefore of limited storage capacity.

A further problem with the Rambridge
15 boat is that each of the passenger viewing areas are fully enclosed and thus this will be deleterious to passenger comfort because of the fact that some passengers may experience a claustrophobic feeling when the boat is in a
20 submerged condition.

The object of the present invention is to provide a marine observatory craft which alleviates the abovementioned disadvantages associated with the prior art.

25 The marine observatory craft of the invention includes:

one or more planing type hulls;
viewing means associated with the or each
hull;

5 one or more transverse bulkheads dividing the
or each hull into a plurality of separate
internal compartments which are sealed from
each other;

one or more ballast tanks included in each
internal compartment which function as seat
10 supports wherein each internal compartment
includes a viewing area having one or more of
said seat supports,

a control superstructure located above said
plurality of internal compartments,
15 means for selectively flooding said ballast
tanks whereby the craft may move in

(i) a travelling mode wherein the viewing
means is located above the waterline; and
(ii) an observing mode in which the viewing
20 means is located below the waterline;
said flooding means including

pump means;
valve means controlling flow of water through
the pump means;
25 inlet and outlet;
a feed conduit having separate communication

conduits with each ballast tank and venting means associated with the or each ballast tank.

5 Suitably the craft is multi hulled and thus may be in the form of a trimaran or catamaran. However, this does not preclude the fact that the craft may be mono-hulled if desired.

10 Preferably the craft is a catamaran having a pair of hulls separated by a body portion incorporating the control superstructure and the viewing means is located on each side of each hull. The craft may be powered by an inboard or outboard
15 engine or engines. Preferably there is a row of seats provided on each side of each hull.

20 The viewing means may comprise an elongate window located in each side of both hulls but more suitably the viewing means comprises a row of spaced viewing ports in an associated wall of the or each hull. The viewing means preferably slopes outwardly and upwardly so as to facilitate viewing of
25 underwater locations directly beneath the craft.

Each ballast tank may extend above the

waterline when the craft is in the travelling mode and may communicate with a base reservoir located in each compartment and which may be flooded before water may enter the ballast tanks.

The pump means may be of any suitable type. The inlet and outlet may be separate but more preferably there is provided a conduit that functions both as an inlet and an outlet.

A preferred embodiment of the present invention will now be described, by way of example only, with reference to the accompanying diagrammatic drawings, in which:-

Figure 1 is a sectional view of a marine observatory craft constructed in accordance with the present invention and taken along the line b-b of Figure 2;

Figure 2 is a sectional view taken along the line a-a of Figure 1;

Figure 3 corresponds to Figure 1 on a smaller scale and showing the craft in an unflooded state and in the travelling mode;

Figure 4 corresponds to Figure 3 but shows the ballast tanks in a partially flooded state and thus between the travelling

mode and an observing mode;

Figure 5 also corresponds to Figure 3 but shows the ballast tanks in almost fully flooded state and in an observing mode;

5 Figures 3A to 5A are sectional views taken along the line c-c of Figures 3 to 5;

Figure 6 is a sectional view of the craft taken along the line e-e of Figure 7 and showing the ballast tanks fully flooded;

10 Figure 7 is a half plan view of the craft taken along the line d-d of Figure 6;

Figure 8 is a sectional view of the craft taken along the line g-g of Figure 9 and showing the flooding means for the ballast tanks;

15

Figure 9 is a half plan view of the craft taken along the line f-f of Figure 8,

Figure 10 is an enlarged fragmentary view of part of Figure 9 illustrating the method of operation of flooding; and

20

Figure 11 is an enlarged fragmentary sectional view along the line h-h of Figure 6.

In the drawings the marine craft 10 includes a control superstructure 11 and hulls 12. Each hull 12 on each side thereof is provided with a row of seats 13 and a row of

25

viewing ports 14. Each port 14 as shown in Figure 2 extends outwardly and upwardly and is located immediately adjacent to an associated seat 13. There is also provided
5 bulkheads 15, 16, 17 and 18 as shown. Bulkhead 15 is a collision bulkhead and there is shown a door 19 communicating between the interior of each hull 12 and the interior of the front or bow of the craft 10. The
10 cockpit includes windscreen 20.

As best shown in Figures 8-10 there is a pump 21 which may be of any suitable type such as a centrifugal pump or gear pump and a network of conduits comprising an inlet-outlet
15 conduit 22, solenoid valves 23 and 24, conduits 25A, 25B, 26A and 26B and a feed conduit 27 to ballast tanks 28 which form the interior of the hollow seats 13. There is also shown pump conduits 27A and 27B. Each
20 solenoid valve 23 and 24 operate in unison and are actuated electronically from a control station (not shown) in the cabin 11. In Figure 10 the flow of water for flooding is shown by curved arrows in full outline wherein
25 the water flows sequentially through conduits 25A, 27A, 27B and 26B to the conduit 27 and

for deflooding or draining of water the flow of water is shown by curved arrows in dotted outline travelling through conduits 27, 25B, 27A, 27E and 26 to the conduit 22.

5 There are also shown in the drawings base reservoir or bilge tanks 29 into which water enters when the solenoid valves 23 and 24 are actuated to cause operation of the pump 21 to draw water into the reservoir tanks 29
10 through the inlet-outlet conduit 22. In fact the inlet-outlet conduit 22 is open to the sea and is kept permanently full of water so that the pump 21 is self-priming.

 There are also shown breather pipes 30
15 which are included in the ballast tanks 28 which communicate with the reservoir tanks 29. The breather pipes are useful in that they allow for venting of air from each ballast tank 28. The feed conduit 27 may deliver
20 water as shown in Figures 8-9 through reservoir conduits 31 to the reservoir tanks 29 and subsequently to the ballast tanks 28. There is also shown spring loaded or pressure relief valves 32 which are associated with
25 each breather pipe 30. The valves 32 are regulated initially in trials before being

locked or set in position.

There is also shown a spring loaded pressure relief valve 33 for the tanks 28 and 29 which may be actuated when the pressure in the tanks exceeds a predetermined safety level. The bulkheads 15, 16, 17 and 18 together with a partition 34 divide the craft into upper compartments 34A and lower compartments 34B which are fully sealed from each other in the event of the hulls being penetrated or holed. There is also shown a housing 36 for the pump 21 and struts 36 interconnecting the hulls 12.

In operation of the flooding of the ballast tanks the solenoid valves 23 and 24 are actuated which actuate the pump 21 to draw water from the conduit 22 into the feeder conduit 27 as previously described and hence through the conduits 31 to the reservoir tanks 29 and hence into the ballast tanks 28.

By operation of the solenoid valves 23 and 24 it will be appreciated that the ballast tanks may only be partially flooded if required as shown in Figures 4 and 4A. In Figures 3 and 3A the craft 10 is in the travelling mode indicated by the waterline 8

when the reservoir tanks 29 and ballast tanks 28 are unflooded. From Figures 4 and 4A to Figures 5 and 5A tanks 28 are progressively flooded and thus the craft 10 has effectively undergone a downward displacement until achieving the almost fully flooded position shown in Figures 5 and 5A when the craft 10 is in an observing mode indicated by the waterline 9 where the location of the ports under the waterline facilitates the viewing of undersea locations by passengers sitting on the seats 13.

One of the features of the invention as described above is the building in of the ballast tanks 28 as a normal part of the seating accommodation in the underwater viewing area, and in such a manner as to provide effective flood bulkheading of each individual viewing area 34A so that in the event of holing the craft on a reef or the impacting of a viewing port against a reef only that individual area 34A will flood without any further danger to the craft 10.

The provision of ports having a sloping orientation as shown relative to the sea surface is useful in that it enables the

viewer to obtain a sight of underwater areas directly under the vessel without the need to provide viewing ports on the hull base which would otherwise present an undesirable safety hazard in vessels used in reef areas.

Figure 11 shows ports 35 located in the partition 34 allowing flow of water from the reservoir tanks 29 to the ballast tanks 28 in each compartment 34B. Also shown is a floor portion 37 of partition 34.

Furthermore the hull shape is contoured both to provide marine stability and to prevent halation or clouding effect due otherwise to direct sunlight effects upon the glass water interface which would prevent clear viewing. The craft 10 may include a system of freely rotatable underwater spotlights for night viewing or by the ships crew from a master panel.

In order to allow activities such as underwater feeding of fish by scuba divers or to provide easy access for tourist scuba divers to the water a hydraulically operated self contained fold away ladder system may be integrated into the bow interior if required.

The craft 10 is suitably designed with

planing hulls utilising engines of the correct horsepower to provide a cruising speed of at least 15 knots. While a catamaran type hull is described in the preferred embodiment

5 because it offers maximum viewing areas, an ability to plane in reasonably heavy seas, a good upper tourist servicing and accommodation area, and the ability to be easily bulkheaded to conform to Lloyds codes for

10 charter vessels, along with excellent safety factors in the event of accidental impact with reef areas, it should be understood that the semi submarine principle for bulk transportation and combined underwater viewing

15 facilities could be applied to hydrofoils, mono-hulls, trimaran hulls or similar embodiments designed in such a manner as to take advantage of the specific technical features and advantages to charter operators

20 and passengers. While it is intended to cover the building of the craft 10 in marine grade aluminium it should be understood that it is not intended that the preferred or optional embodiments shall be limited to this

25 material but could be produced in fibreglass, steel, other metals, ferro cement, ferralite,

plastic or any known and acceptable form of seagoing vessel construction.

Figure 11 also shows roof 38 enclosing the control superstructure to form a cabin 39 located above upper compartments 34A of each hull 12. Cabin 39 has seats 40 as shown and passengers sitting on seats 40 may look into compartment 34A through an opening.

As shown in Figure 8 the tops of the breather pipes 30 stop just short of the tops of ballast tanks 28 to allow displaced air to flow downwardly into the reservoir or bilge tanks 29. Thus the valves 33 in the transoms of the craft 10 will be operable upon attainment of a pressure in excess of the recommended safety level.

Figure 10 also shows conduits 42, 43, 46 and 47 which provide for lateral jets of water to be exited from the craft 10 when in a submerged mode for lateral or sideways movement when required. The forward conduit 42 exits through an outlet port 49 and the rear conduit 43 exits through an outlet port 48 shown in Figure 1. Thus the conduits 46 and 47 provide for jets of water to exit outwardly of each hull 12 and the conduits 42

and 43 provide for jets of water to exit inwardly from each hull 12. The conduits 42 and 43 are optional and may be dispensed with if required. Movement of water through the
5 conduits 42, 43, 46 and 47 may be controlled by valves 44 and 45 when water flows through the conduits 27A and 27B as shown.

The present invention by being limited to planing type hulls thus provides a vessel
10 of medium to large size for use as a charter vessel and thus in the cruising mode may travel in an unballasted condition which is contrary to the prior art described previously. This also provides an extremely
15 fast craft which is quickly semi-submerged as described previously when required.

Also by providing a cockpit or control cabin superstructure 11 above the hulls 12 this enables passengers in compartments 34A to sit
20 in a fully open situation without obtaining any closed in or claustrophobic feeling as would be the case with a fully enclosed compartment or capsule. This also provides a craft which may be readily handled or
25 controlled when required and provides a high observation point for passengers when

required.

The term "planing type hull" as used herein means hulls which may rise above their normal stationary waterline under the influence of power. Thus in this manner the wetted surface of the or each hull is reduced in a travelling mode.

Another advantage of the craft of the invention is that provision is made for lateral movement when required especially when in an observing mode.

It should also be noted that flooding or ballasting operations may be controlled automatically if desired by levelling sensors of any suitable type such as electronic, mechanical, electrical, hydraulic or gyroscopic sensors. The sensors may actuate operation of the valves as previously discussed which may be gate valves but are more suitably rotary valves.

CLAIMS

1. A marine observatory craft (10)
for viewing of underwater locations including:
one or more planing type hulls (12);
viewing means (14) associated with the or each
5 hull;
one or more transverse bulkheads (15 to 18)
dividing the or each hull into a plurality of
separate internal compartments (34A, 34B)
which are sealed from each other;
10 one or more ballast tanks (28) included in
each internal compartment which function as
supports for seats (13) with each of the seat
supports associated with the viewing means;
a control superstructure (11) located above
15 said plurality of internal compartments;
means (21 to 27) for selectively flooding said
ballast tanks (28) whereby the craft may move
in
(i) a travelling mode wherein the viewing
20 means (14) is located above the waterline (8);
and
(ii) an observing mode in which the viewing
means (14) is located below the waterline (9);
said flooding means including
25 pump means (21);

valve means (23, 24) controlling flow of water
through the pump means;
inlet and outlet (22);
a feed conduit (27) having separate
30 communication conduits with each ballast tank
(28) and venting means (30) associated with
the or each ballast tank.

2. A marine observatory craft as
claimed in Claim 1, wherein said craft (10) is
a catamaran having a pair of hulls (12)
separated by a body portion incorporating the
5 control superstructure (11), and the viewing
means (14) is located on each side of each
hull.

3. A marine observatory craft as
claimed in Claim 1 or Claim 2, wherein the
viewing means (14) comprises a row of spaced
viewing ports in an associated wall of the or
5 each hull.

4. A marine observatory craft as
claimed in any preceding Claim wherein, the
viewing means (14) is sloped outwardly and
upwardly so as to facilitate viewing of
5 underwater locations directly beneath the
craft.

5. A marine observatory craft as

claimed in any preceding Claim, wherein each
compartment (24B) also includes a base
reservoir tank (29) which communicates with
5 the or each ballast tank (28) so as to be
flooded before water may enter the ballast
tank.

6. A marine observatory craft as
claimed in any preceding Claim, wherein the
valve means includes first and second valves
(23, 24) arranged to operate in unison whereby
5 upon flooding of the ballast tanks (28) water
passes through the first valve (23), then
through the pump means (21) and subsequently
through the second valve (24) to the feed
conduit (27), and upon draining of the ballast
10 tanks (28) water flows through the feed
conduit (27) to the first valve (23), then
through the pump means (21) to the second
valve (24) and thence to an inlet-outlet
conduit (22).

FIG. 1

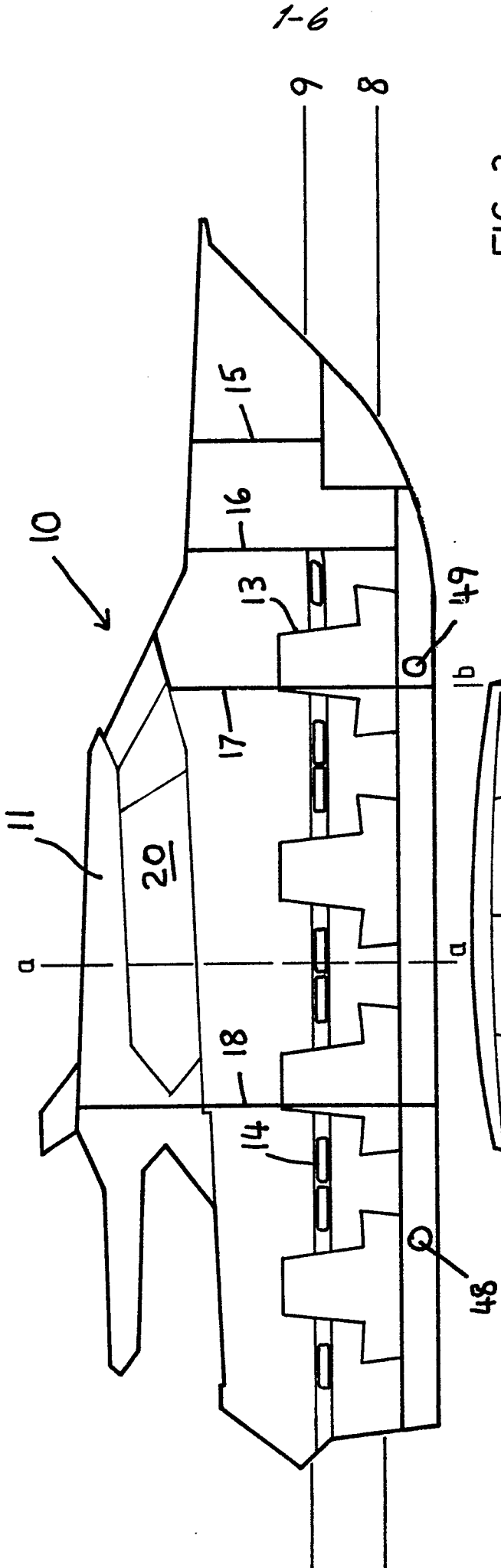


FIG. 2

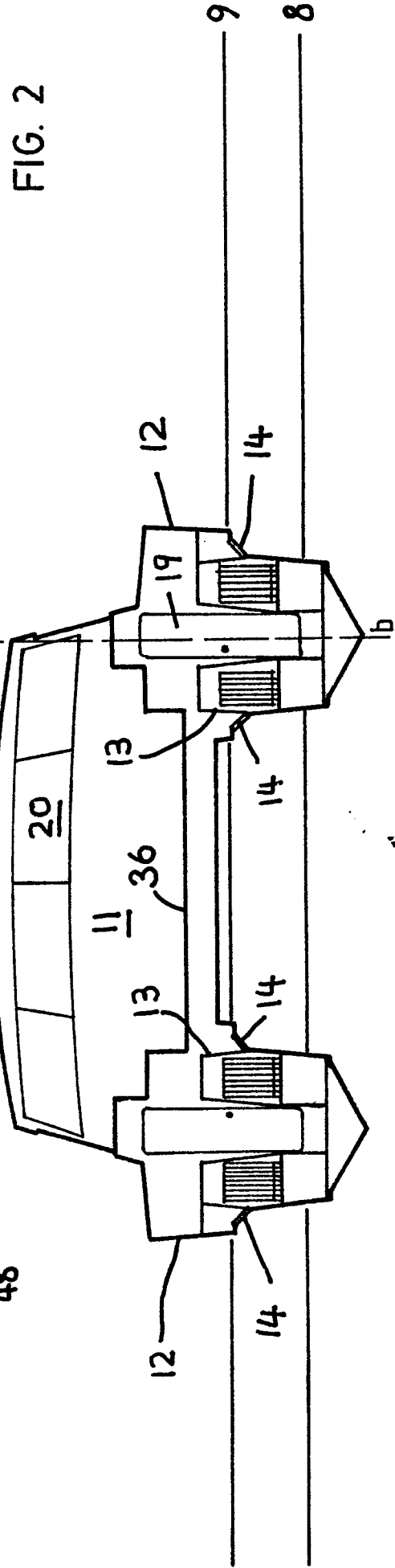


FIG 3

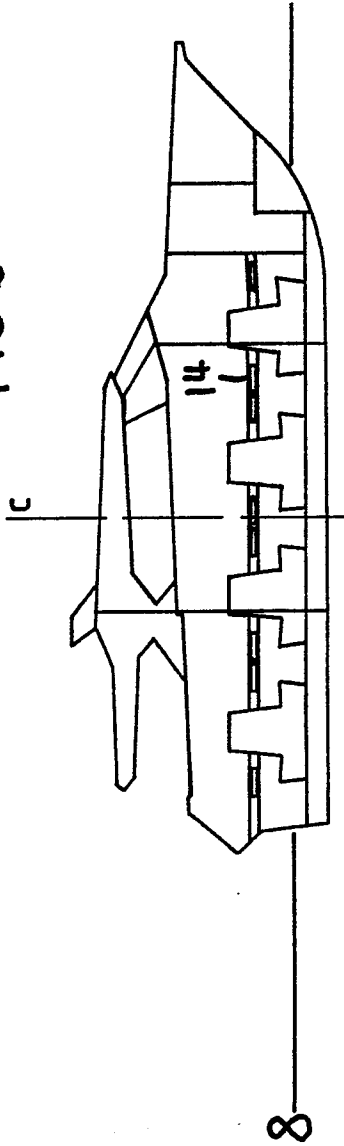


FIG.3A

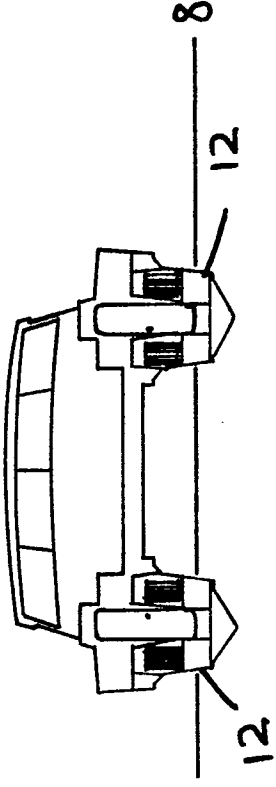


FIG 4

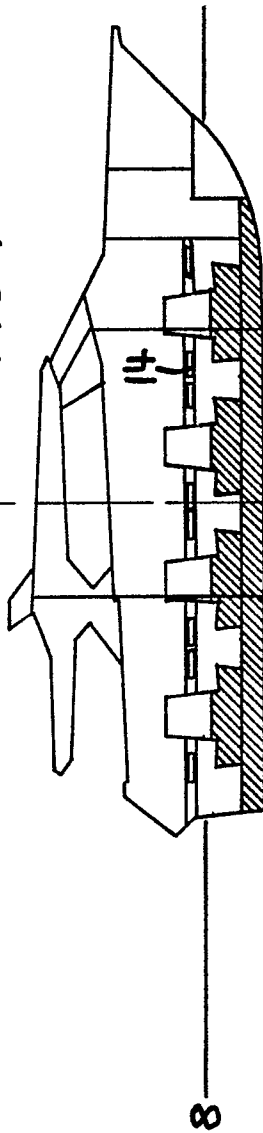


FIG.4A

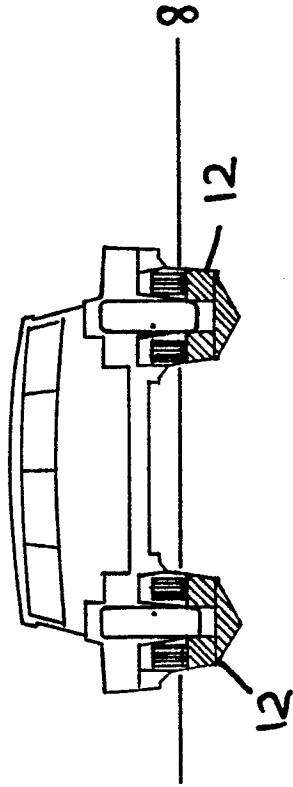


FIG 5

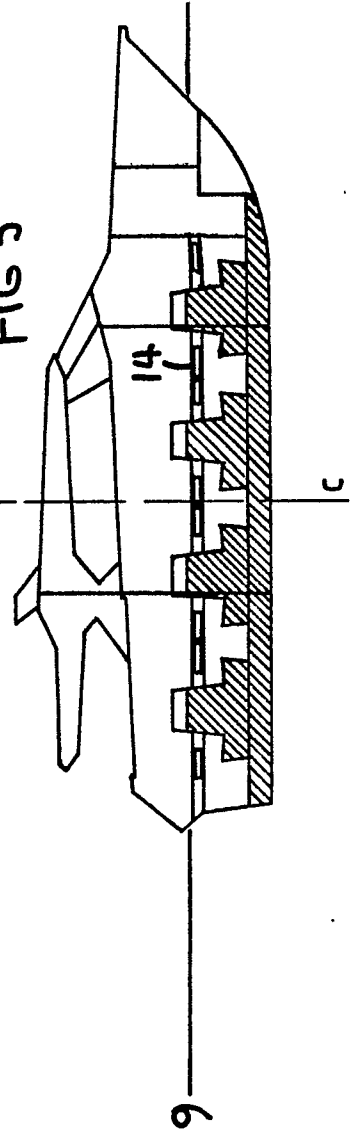
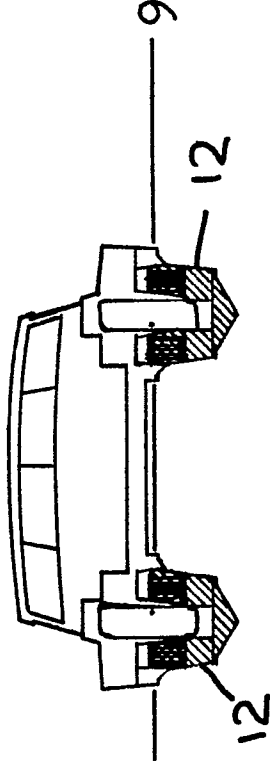


FIG.5A



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FIG. 6

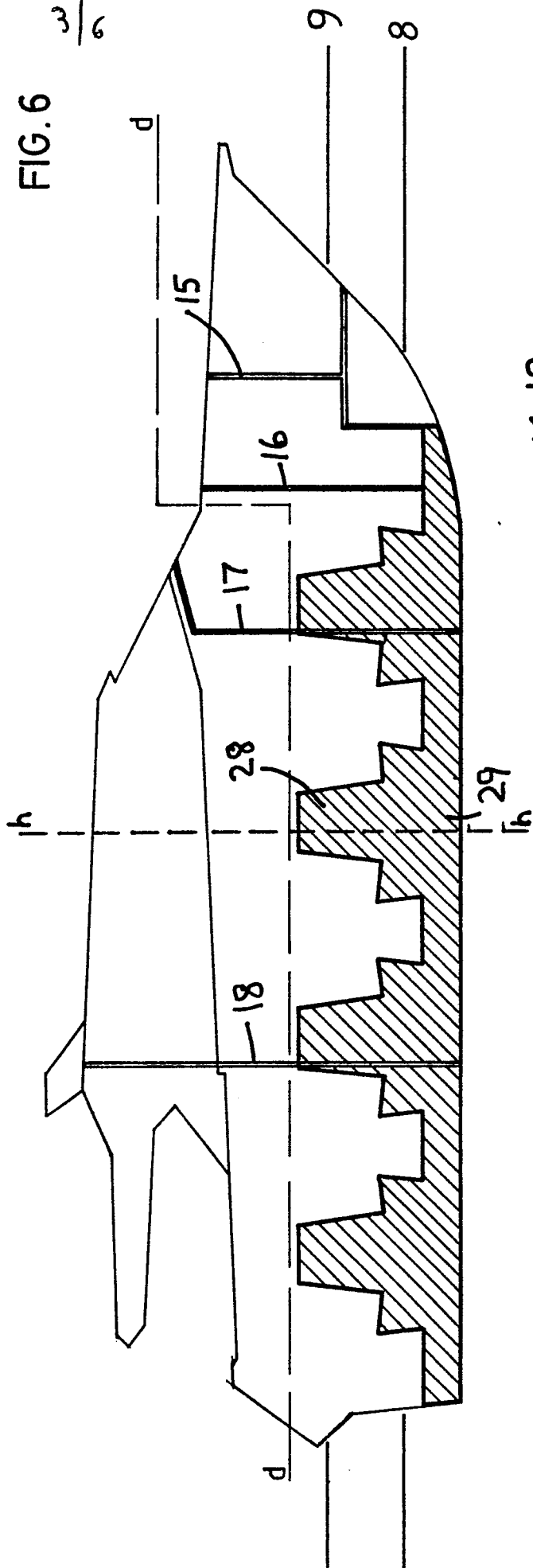


FIG. 7

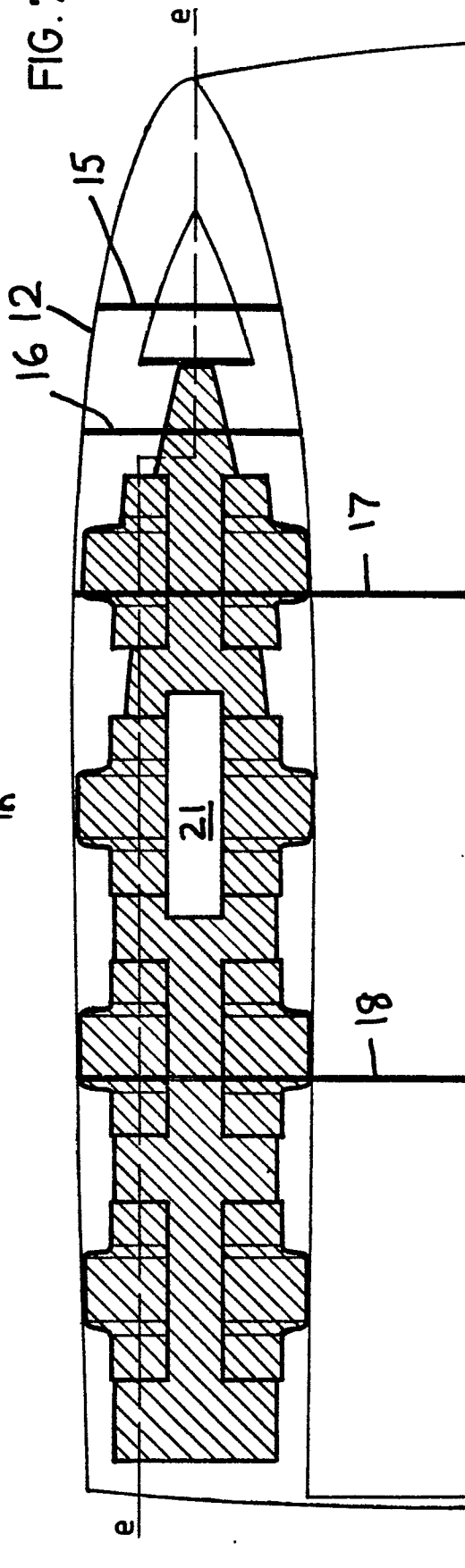


FIG. 8

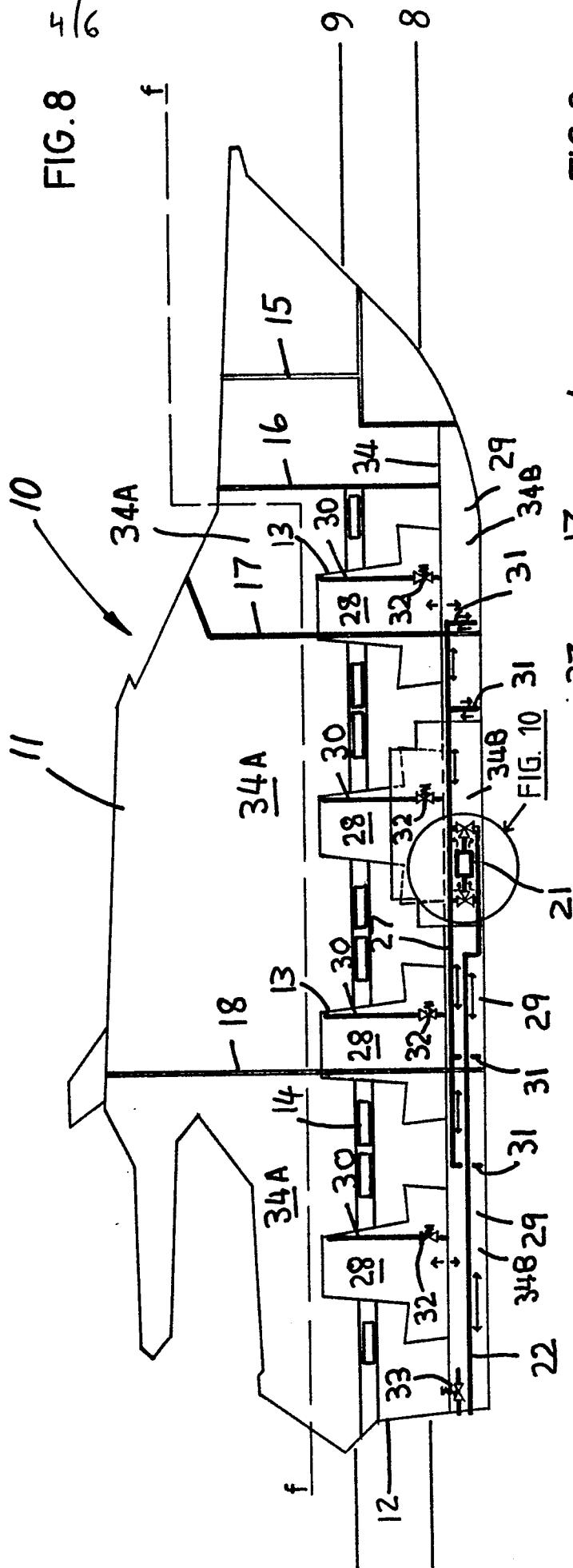


FIG. 9

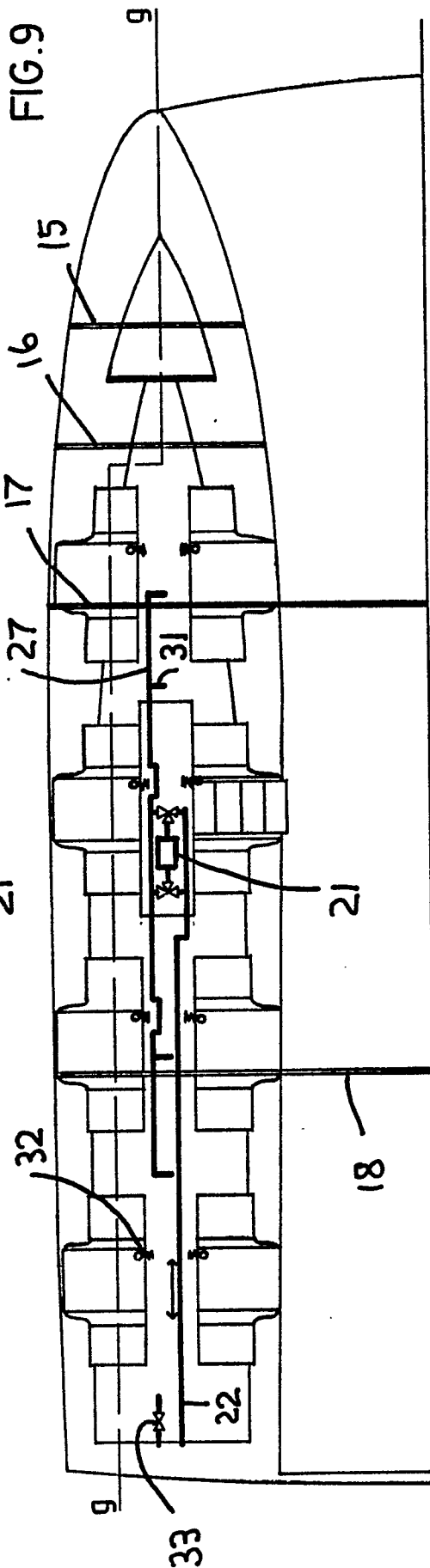


FIG. 10

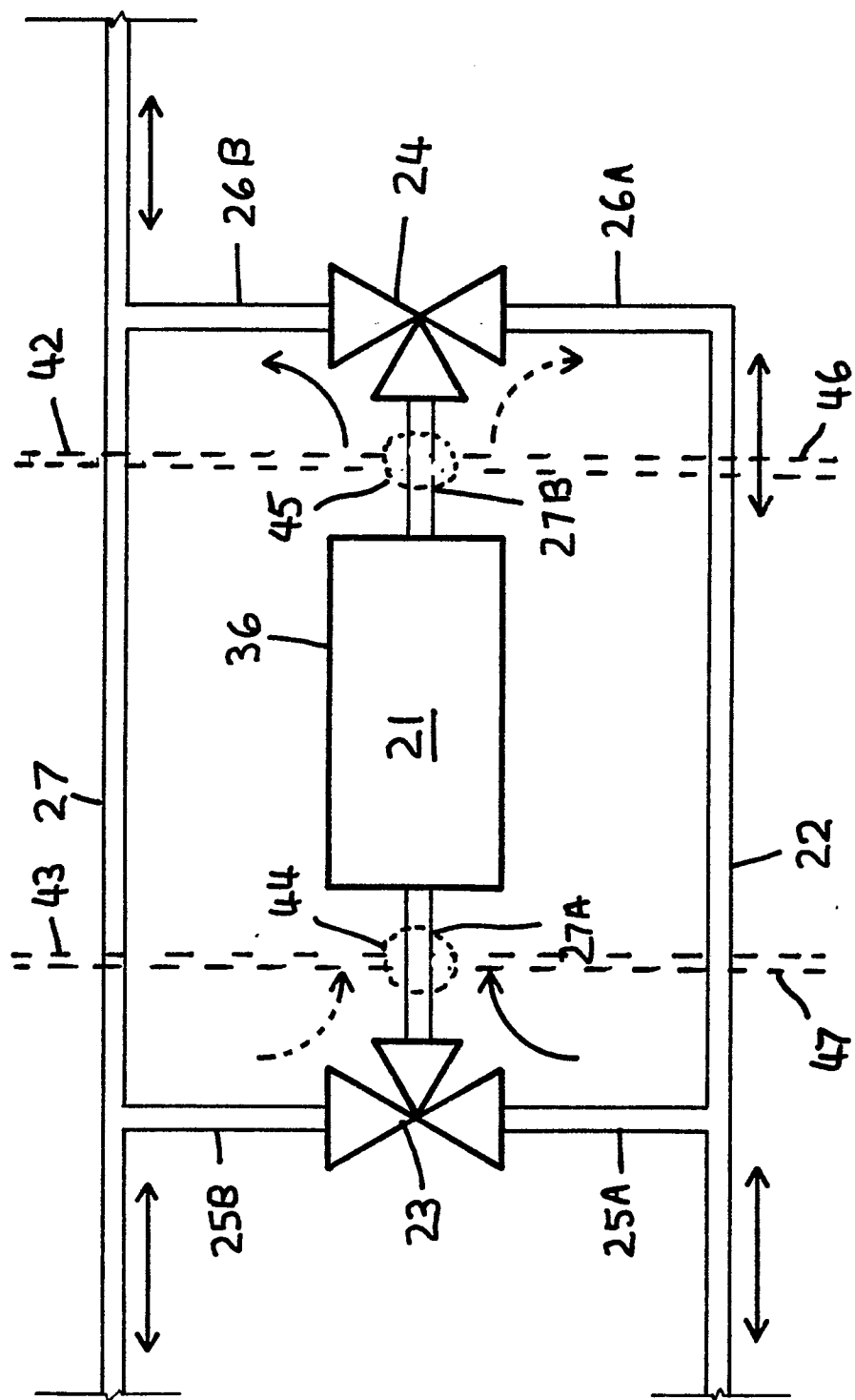
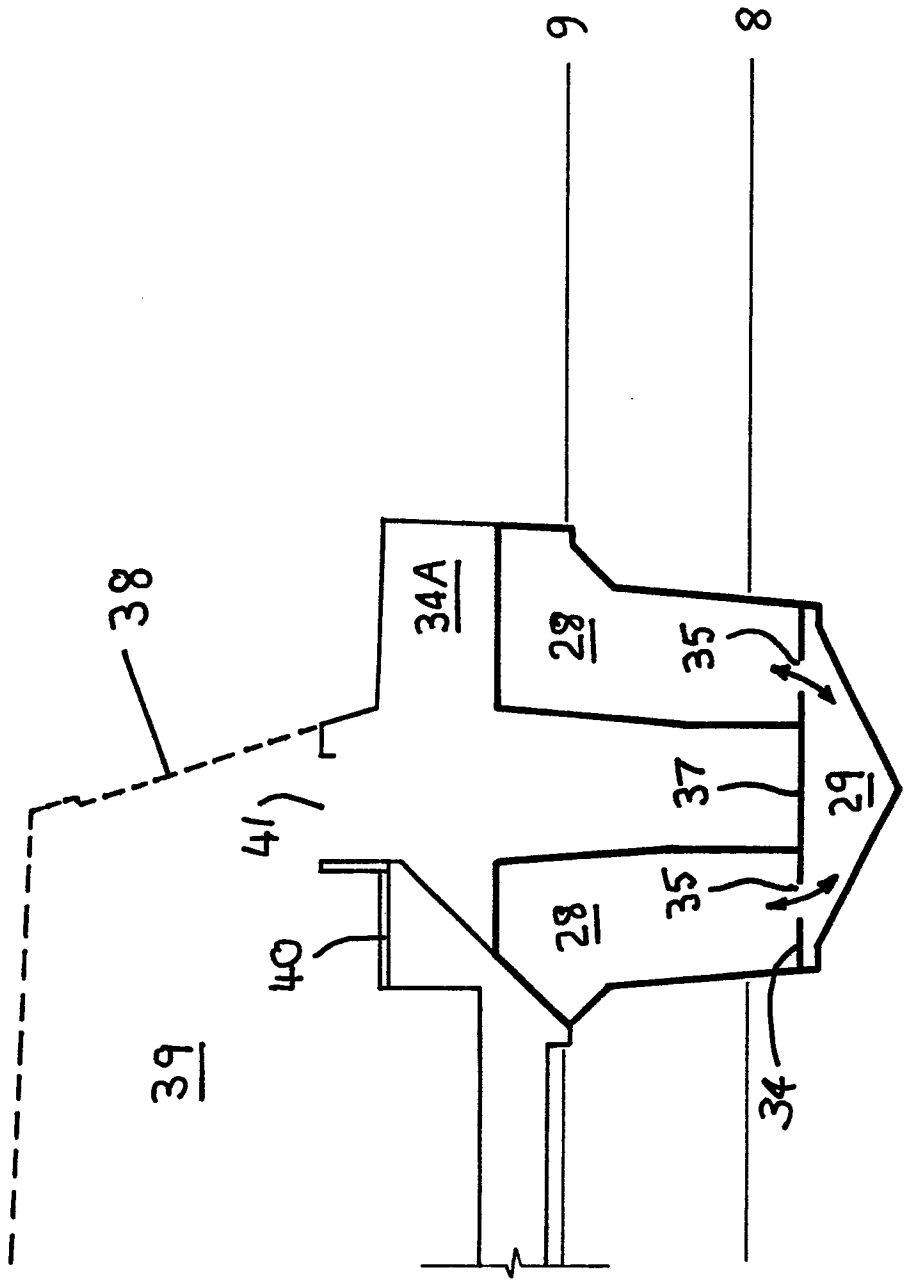


FIG. 11





European Patent
Office

EUROPEAN SEARCH REPORT

0161356
Application number

EP 84 30 2970

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.4)
A	GB-A-2 046 673 (RAMBRIDGE) * Page 1, line 119 - page 2, line 61; figures 1-3 *	1-3	B 63 C 11/48
A	FR-A-2 499 934 (ROUGERIE) * Page 5, lines 3-16; page 12, lines 8-26, 35-37; page 14, lines 1-15; figures 1-4 *	1,3,4	
A	FR-A-2 463 049 (ROUGERIE) * Page 5, line 27 - page 6, line 15; page 8, line 22 - page 9, line 29; figures 1-4 *	1,3,4	
A	US-A-3 680 515 (YONEDA et al.)		
			TECHNICAL FIELDS SEARCHED (Int. Cl.4)
			B 63 C B 63 B
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 12-12-1984	Examiner BRUMER A.M.
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			