(54) Title: A SHIP INCLUDING A TANK SPACE

Figure 11

(57) Abstract: A ship utilising gas as a fuel, the ship including a tank space (580) holding at least one gas storage tank (590), the tank space being open on one side (582), the open side extending from said tank space to the open air outside said ship for allowing the venting of gas in the event of a leak from said gas storage tanks held in said tank space, the ship further including a gas consumer (500) in a gas consumer room (505), wherein the gas consumer room and tank space collectively provide only one potentially hazardous ventilation point outside the ship per tank space.
Description

Title of Invention: A SHIP INCLUDING A TANK SPACE

[0001] The present invention relates generally to a ship including a tank space (gas storage tank holding chamber) and finds particular, although not exclusive, utility in ships which are commercial ferries.

[0002] In this regard, the various ways in which tanks may be stored may be defined as in a "tank room" meaning an enclosed space with bulkheads on all sides such that, in the absence of artificial ventilation, the natural ventilation will be limited and any explosive atmosphere will not be dispersed naturally; in a "tank space" meaning a semi-enclosed space with no bulkhead on at least one side such that natural ventilation may be unrestricted and therefore notably different from those obtained on open deck; or in an "open space" meaning with substantially no bulkheads around it, such as on the open deck of a ship.

[0003] There are many different types of fuel available to drive ships including coal, diesel and gas. For the latter, the gas is often LNG (liquid natural gas) stored in its liquid form. The use of the term "gas" throughout this specification is taken to mean any gas used as fuel whether natural, liquefied, compressed or otherwise, and includes hydrogen and methane and low flash point liquid fuels such as methanol, dimethyl ether, biogas.

[0004] Storage of this gas on board ships is typically achieved by the use of pressurised storage tanks. These tanks are typically located within the body of the ship substantially near to the base of the hull, for the reasons of stability and availability of space.

[0005] If a leak from these tanks, or infrastructure associated with these tanks, occurs then there is potential for gas to collect within the ship leading to the possibility of explosion and/or fire, and brittle fracture of the ship's structure due to low temperatures, causing severe damage to the ship's hull, primary structure and personnel and possibly its sinking.

[0006] To mitigate this it is known to site gas storage tanks on the deck of a ship, in an "open space". However, this itself can lead to problems such as reducing available space for other requirements such as passengers, freight and the like. If sited within the ship then forced ventilation is required to eliminate the build-up of any leaking gas. Such ventilation is reliant on electricity or another source of power which may not be reliable.

[0007] Accordingly, it is desirable to have another option for the siting of gas storage tanks on ships which minimises the possibility of gas collecting within the ship due to leaks, leading to damage such as brittle fracture of the ship's structure.
In a first aspect, the invention provides a ship utilising gas as a fuel, the ship including a tank space holding at least one gas storage tank, the tank space being open on one side, the open side extending from said tank space to the open air outside said ship for allowing the venting of gas in the event of a leak from said gas storage tank held in said tank space, the ship further including a gas consumer in a gas consumer room, wherein the gas consumer room and tank space collectively provide only one potentially hazardous ventilation point outside the ship per tank space.

In this regard, the term "per tank space" means that if the there are two tank spaces then there may be two potentially hazardous ventilation point outside the ship.

The only one potentially hazardous ventilation point outside the ship may be at the open side immediately outside the ship.

The gas consumer may be an engine or a fuel cell. The engine may be driven directly or indirectly by the gas. Each engine may be arranged in an engine room. The engine room may be the same as the gas consumer room.

In this specification, the term "ship" is to be understood as any water borne craft, unless stated otherwise.

The open side may extend from the tank space to the open air at substantially the top of said ship.

The open side may be substantially level with the top of any superstructure present on the ship.

The tank space may include no forced ventilation. In this regard the term "forced" may be taken to mean ventilated by fans. It may not preclude the possibility that the tank space is ventilated by air forced into it through a conduit from outside the ship due to the movement of the ship, possibly by the Venturi effect.

The tank space may have a vertical height substantially greater than its horizontal width. In one embodiment, the tank space may be a converted lift shaft.

The open space may include a funnel above it (i.e. at its upper end).

The open side may have substantially the same cross-sectional area as the cross-sectional area of the tank space.

The base and sides of the tank space may be defined by walls, the walls being gas-tight and fire resistant. In this regard the term "wall" may also be regarded as a bulkhead.

The gas storage tank may have a cross-sectional shape and size smaller than the cross-sectional shape and size of the tank space. This allows for the gas tank to be lowered into, and raised out of, the tank space relatively easily thus improving maintenance, repair and/or replacement thereof and enabling retrofit.

The tank space may be substantially horizontal with the open side being on the upper side thereof. Alternatively, the tank space may lie at an angle between the horizontal
and vertical.

In one embodiment, the tank space may be considered to be a shaft within the structure of the ship.

The tank space may be provided at a higher level inside the ship than the engine room.

The ship may comprise more than one tank space. Each tank space may include one or more gas storage tanks.

The gas consumer room may include apparatus to provide forced ventilation into the room from outside the ship. This may take the form of one or more fans.

The air pressure in the gas consumer room may be higher than the ambient air pressure outside the ship.

The ship may include a gas supply pipe for supplying gas from the gas storage tank to the gas consumer, wherein a conduit is provided substantially enclosing the gas supply pipe, and an inlet to the space between the gas supply pipe and the conduit is provided in the gas consumer room.

The outlet to the space between the gas supply pipe and the conduit may be provided in the tank space.

Apparatus may be provided to draw air through the space between the conduit and the gas supply pipe from the gas consumer room to the tanks space. This may be in the form of one or more fans.

The ship may include valves to open and close the inlet and outlet.

The ship may include flood control apparatus for flooding the tank space and/or the gas consumer room and/or any space containing intervening gas carrying/handling equipment in the event of a gas leak so as to avoid brittle fracture of metalwork and/or to facilitate evaporation of the leaked gas.

In this regard, intervening gas carrying/handling equipment may mean the gas supply pipe and/or evaporator.

Also in this regard, LNG may have a temperature of is -163 degrees Centigrade. Accordingly, if it spills on steel it may crack it. Typically leaked LNG is allowed to evaporate. By flooding the compartments, spaces or rooms, with water, then not only may the steel work be protected but also evaporation of the gas is facilitated as the water will be of a higher temperature.

In a second aspect, the invention provides a ship utilising gas as a fuel, the ship including a tank space holding at least one gas storage tank and a gas consumer in a gas consumer room, the ship further including flood control apparatus for flooding the tank space and/or the gas consumer room and/or any space containing intervening gas carrying/handling equipment in the event of a gas leak so as to avoid brittle fracture of metalwork and/or to facilitate evaporation of the leaked gas.
In a third aspect, the invention provides a ship utilising gas as a fuel, the ship including a tank space holding at least one gas storage tank, the tank space being open on one side, the open side extending from said tank space to the open air outside said ship for allowing the venting of gas in the event of a leak from said gas storage tank held in said tank space, wherein the open side has substantially the same cross-sectional area as the cross-sectional area of the tank space.

Any of the optional features described above with regard to the first aspect of the invention may be combined with the second and/or third aspects of the invention as will be understood.

The ship may be any commercial ship such as a ferry, container ship, tanker, bulk carrier, general cargo ship, Ro-Ro ship, and pure car truck carriers. It also may be a naval ship, in that it is has a military duty.

The above and other characteristics, features and advantages of the present invention will become apparent from the following detailed description, taken in conjunction with the accompanying drawings, which illustrate, by way of example, the principles of the invention. This description is given for the sake of example only, without limiting the scope of the invention. The reference figure quoted below refers to the attached drawing.

Figures 1, 3, 5 and 7 are elevational cross-sectional views of different ships including gas storage tanks;

Figures 2, 4, 6 and 8 are plan views of the ships of Figures 1, 3, 5 and 7 respectively;

Figure 9 is a diagram showing the arrangement of a tank space and engine room as already known;

Figure 10 is a diagram showing one possible arrangement of a tank space and engine room, and

Figure 11 is a diagram showing another possible arrangement of a tank space and engine room.

The present invention will be described with respect to particular embodiments and with reference to certain drawings but the invention is not limited thereto but only by the claims. The drawings described are only schematic and are non-limiting. In the drawings, the size of some of the elements may be exaggerated and not drawn to scale for illustrative purposes. The dimensions and the relative dimensions do not correspond to actual reductions to practice of the invention.

The terms upper, horizontal, vertical and the like in the description and the claims are used for describing relative positions with the ship in its usual orientation in use.

It is to be noticed that the term "comprising", used in the claims, should not be interpreted as being restricted to the means listed thereafter; it does not exclude other elements or steps. It is thus to be interpreted as specifying the presence of the stated
features, integers, steps or components as referred to, but does not preclude the presence or addition of one or more other features, integers, steps or components, or groups thereof. Thus, the scope of the expression "a device comprising means A and B" should not be limited to devices consisting only of components A and B. It means that with respect to the present invention, the only relevant components of the device are A and B.

Reference throughout this specification to "one embodiment" or "an embodiment" means that a particular feature, structure or characteristic described in connection with the embodiment is included in at least one embodiment of the present invention. Thus, appearances of the phrases "in one embodiment" or "in an embodiment" in various places throughout this specification are not necessarily all referring to the same embodiment, but may refer to different embodiments. Furthermore, the particular features, structures or characteristics may be combined in any suitable manner, as would be apparent to one of ordinary skill in the art from this disclosure, in one or more embodiments.

Similarly it should be appreciated that in the description of exemplary embodiments of the invention, various features of the invention are sometimes grouped together in a single embodiment, figure, or description thereof for the purpose of streamlining the disclosure and aiding in the understanding of one or more of the various inventive aspects. This method of disclosure, however, is not to be interpreted as reflecting an intention that the claimed invention requires more features than are expressly recited in each claim. Rather, as the following claims reflect, inventive aspects lie in less than all features of a single foregoing disclosed embodiment. Thus, the claims following the detailed description are hereby expressly incorporated into this detailed description, with each claim standing on its own as a separate embodiment of this invention.

Furthermore, while some embodiments described herein include some features included in other embodiments, combinations of features of different embodiments are meant to be within the scope of the invention, and form yet further embodiments, as will be understood by those skilled in the art. For example, in the following claims, any of the claimed embodiments can be used in any combination.

In the description provided herein, numerous specific details are set forth. However, it is understood that embodiments of the invention may be practised without these specific details. In other instances, well-known methods, structures and techniques have not been shown in detail in order not to obscure an understanding of this description.

The use of the term "at least one" may, in some embodiments, mean only one.

The invention will now be described with reference to one or more of the following drawings.
In Figure 1 an elevational cross-sectional view of a notional ship 10 is shown. The ship includes a hull 20 and decks 30, 40, 50 in ascending order, on top of the hull 20. Superstructure 60 is arranged at the top of the ship 10 above the uppermost deck 50.

The ship 10 includes two funnels 70 arranged above the super structure 60.

Within the structure of the ship 10, two chambers (or tank spaces) 80 are provided. These are elongate (in a vertical direction) and extend from approximately the interface between the hull 20 and the first deck 30 to the top of the superstructure 60. The chambers 80 are substantially or completely open at their upper ends 82 to allow for the venting of any leaking gas.

Within each chamber 80 a gas storage tank 90 is arranged. These tanks 90 may be held in place within the chambers 80 by well known means such as brackets etc.

The storage tank 80 on the left of Figure 1 has a vertical height less than the height of the chamber 90 such that the length of chamber 90 above the tank 80 acts as a conduit 85. The storage tank 80 on the right of Figure 1 has a height substantially equal to the height of the chamber 90 such that there is effectively no conduit.

Each tank 90 is connected by associated pipework 95 to a gas consumer unit 100. These gas consumer units are located within the hull 20 of the ship 10. However, the gas consumer units 100 could be located elsewhere in the ship 10 and there may be more than the two shown.

The location of each of the uppermost ends of the chambers 80 is arranged such that the distance from them to personnel and/or equipment is greater than a predefined distance such as 3 metres. Accordingly, if any explosion occurs the effect of that explosion will be directed upwardly and will not reach said personnel and/or equipment located on or in the superstructure 60 of the ship 10. The arrangement/composition of the chamber walls may also aid directing any blast upwardly and prevent it from extending laterally through the ship 10.

Figure 2 shows a plan view of the ship 10 wherein the chambers 80 are shown located approximately on an imaginary line extending between the apex of the stern and apex of the bow. The chambers 80 are further arranged such that one is arranged approximately one third of the distance between the bow and stern as measured from the bow, and the other one is arranged one third of the same distance as measured from the stern.

The storage tanks 90 are shown within each chamber 80. The chamber 80 are shown as being cylindrical, however, other shapes are contemplated. The tanks 90 are also shown as being cylindrical but again, other shapes are contemplated.

Figure 3 shows a different ship 110 but which has similar features as described in relation to Figure 1. In particular the conduit 85 from the upper end of the chamber 80 is substantially open to the atmosphere at its upper end 82. Only one chamber 80 is
provided in this example as is seen more clearly in Figure 4 which shows a plan view of the same ship 110.

[0063] Figure 5 shows another different ship 210 but which has similar features as described in relation to Figures 1 and 3. It also has additional decks 51, 52 above deck 50. In particular the conduit 85 from the upper end of the chamber 80 is substantially open to the atmosphere at its upper end 82. Two chambers 80 are provided in this example as is seen more clearly in Figure 6 which shows a plan view of the same ship 210.

[0064] Figure 7 shows yet another different ship 310 but which has similar features as described in relation to Figures 1, 3 and 5. It also has an additional deck 51 above deck 50. In particular the conduit 85 from the upper end of the chamber 80 is substantially open to the atmosphere at its upper end 82. Two chambers 80 are provided in this example as is seen more clearly in Figure 8 which shows a plan view of the same ship 310.

[0065] Figure 9 shows a possible schematic layout of part of a ship. It includes an engine room 405 comprising an engine 400. It also shows a tank space 406 comprising a gas storage tank 490. The gas tank 490 supplies gas to the engine 400 via a supply pipe 495; the direction of gas flow being indicated by an arrow referenced 497. The supply pipe 595 may extend all the way to the manifold inside the engine.

[0066] The gas supply pipe 295 is surrounded by a conduit 410 for preventing any leaking gas from the supply pipe 495 entering into either room 405, 406 or any other part of the ship internally. The conduit 410 surrounds the supply pipe 495 such that there is an approximate annulus between the outside of the pipe 495 and the inside of the conduit 410.

[0067] This annulus is ventilated by means of air being forced into it at one point near the engine 400 from outside the ship. The air is forced in, in the direction referenced 426, via an air inlet 420 by means of a fan 425. Air then travels along the conduit 410, in the direction referenced 415, and exits via an outlet 429, which leads to the outside of the ship in the direction of the arrow referenced 428.

[0068] Accordingly, any leaking gas will not collect inside the ship but will be ventilated to the outside atmosphere thus preventing the risk of explosion, fire or brittle damage.

[0069] The engine room 405 is also ventilated itself via a forced air inlet 430 comprising a fan 432 which pulls air into the engine room in the direction referenced 434. Further, the engine room includes an outlet 435 for this air to be exhausted in the direction referenced 436. The air inlet 430 and outlet 435 are both provided on the surface of the ship such that the air is pulled from, and exhausted to, the air outside the ship.

[0070] In a similar manner, the tank space 406 is also ventilated itself via a forced air inlet 445 comprising a fan 447 which pulls air into the engine room in the direction referenced 448. Further, the tank space includes an outlet 440 for this air to be
exhausted in the direction referenced 442. The air inlet 445 and outlet 440 are both provided on the surface of the ship such that the air is pulled from, and exhausted to, the air outside the ship.

[0071] This arrangement means that there are four potentially hazardous ports on the surface of the ship; the air inlet 445 to, and outlet 440 from, the tank space 406, and the air inlet 420 to, and outlet 429 from, the conduit 410. These may be considered hazardous because gas could be emitted from them. This would occur, in the case of the inlets 445, 420, if the fans stopped running.

[0072] The engine 400 also includes an exhaust system (not shown) for ventilating the burnt gases to atmosphere.

[0073] The inlet 430 and outlet 435 ports from the engine room 405 are not typically considered to be potentially hazardous because any gas leaking inside the engine 400 will leak into the conduit 510 and not into the engine room. This is because the engine room 405 is maintained at a greater pressure than atmosphere due to the fan 432 and inlet 430.

[0074] In this regard, although only one fan 432 and one inlet 430 are shown, in reality, there may be more than one fan and more than one inlet. In a similar manner, although only one outlet 435 is shown, more than one may be provided.

[0075] Figure 10 shows some of the benefits of the present invention in that the tank space 580 and engine room 505 may collectively only have one or a maximum of two potentially hazardous ports on the surface of the ship as will be explained below. This arrangement may be for use with gas at relatively low pressure (such as less than 10 bar).

[0076] The engine room 505 includes an engine 500 connected to a gas storage tank 590 provided in a tank space 580 by a supply pipe 595 such that gas travels in the direction referenced 597. The supply pipe 595 is surrounded by a conduit 510 in a similar manner as described with reference to Figure 9 above. The tank space 580 is ventilated at its upper end 582 by being connected directly to an upper surface of the ship.

[0077] The conduit 510 is ventilated in a similar manner to the one described above with reference to Figure 9 in that air is pulled in via an inlet 520 in the direction referenced 526 from outside the ship and travels along the conduit 510 in the direction referenced 515 around the supply pipe 595. The air is pulled in by means of the fan 583 located in the engine room, although it could be at another location, in association with an air outlet 586, such that air exits the conduit 510 in the direction referenced 584 into the tank space 580 itself.

[0078] The tank space 580 is open to atmosphere, as has already been explained, and therefore any gas from the supply pipe 595 will be purged to the tank space 580 and then be exhausted to atmosphere in the direction 585 along with any gas which may leak from the gas tank 590 itself.
[0079] The engine room 505 is also ventilated in the same manner as described above with regard to Figure 9 in that there is an inlet 530 including a fan 532 pulling air into the room 505 in the direction referenced 534 and exiting the room 505 via an outlet 535 in the direction referenced 536. Accordingly, the engine room 505 may have an air pressure greater than atmospheric pressure.

[0080] The one potentially hazardous port on the surface of the ship is the top of the tank space 582. The additional hazardous port may be the inlet 520, however, this would only become hazardous if fan 583 stops running as otherwise and gas leaking into the conduit 510 will be drawn out of the conduit 510 and into the tank space 580 for exhausting out of the top 582.

[0081] An alternative arrangement is shown in Figure 11. This arrangement may be for use with gas at relatively high pressure (such as greater than 10 bar).

[0082] This arrangement is identical to that described above with regard to Figure 10 except that the inlet 521 to the conduit 510 is not located outside the ship but is located inside the engine room 505; the air coming in via inlet 530. Air thus travels in the direction referenced 534, 527, 515, 584, 585 to reach the atmosphere at the upper end 582 of the tank space 580. Air is forced into inlet 521 from the engine room 505 because the engine room 505 is maintained at a greater pressure than atmosphere as discussed above with reference to Figure 10. Moreover, the cross-sectional area of the inlet 532 may be substantially greater than the total cross-sectional area of the inlet 521 and outlet 535.

[0083] This means that the number of potentially hazardous ports on the outside of the ship is only one; the outside of the ship at the upper end 582 of the tank space. The outlet 535 from the engine room is not considered to be hazardous because any gas leaking in the conduit will be drawn through the conduit 510 by fan 583 into the tank space 580.

[0084] If all fans 532, 583 stop then due to the greater pressure in the engine room any gas leaking from the supply pipe 595 will be held within the conduit 510 and will be forced by the pressure into the tank space. Moreover, if the fans stop then there may be a system in place to close valves (not shown) provided at each end of the supply pipe 595 and/or the inlet 530 and outlet 535, and to flush the supply pipe with nitrogen.

[0085] With regard to Figure 10 and 11 it will be noted that the cross-sectional area of the space surrounding any route of gas leaking from any point in the system increases in the direction of flow. For instance, if gas leaks from the supply pipe 595 immediately adjacent the engine 500 it will escape into a substantially small conduit 510. It will then be blown along the conduit 510 where it will enter into a substantially larger space conduit or space; the tank space 580. Finally, it will be ventilated to atmosphere at an upper surface of the ship where it will enter into a substantially infinitely larger space. This increasing volume helps to reduce the concentration of the gas thus
reducing the risk of explosion fire or brittle fracture.

Figure 11 shows apparatus for flooding the engine room 505 and/or the tank space 580 if there is a gas leak.
Claims

[Claim 0001] A ship utilising gas as a fuel, the ship including a tank space (580) holding at least one gas storage tank (590), the tank space being open on one side (582), the open side extending from said tank space to the open air outside said ship for allowing the venting of gas in the event of a leak from said gas storage tank held in said tank space, the ship further including a gas consumer (500) in a gas consumer room (505), wherein the gas consumer room and tank space collectively provide only one potentially hazardous ventilation point outside the ship per tank space.

[Claim 0002] The ship of claim 1, wherein the open side, extends from said tank space to the open air at substantially the top of said ship.

[Claim 0003] The ship of either of claims 1 and 2, wherein the open side is substantially level with the top of any superstructure present on said ship.

[Claim 0004] The ship of any preceding claim, wherein the gas consumer room includes apparatus (532) to provide forced ventilation into the room (505) from outside the ship.

[Claim 0005] The ship of claim 4, wherein the air pressure in the gas consumer room is higher than the ambient air pressure outside the ship.

[Claim 0006] The ship of any preceding claim, including a gas supply pipe (595) for supplying gas from the gas storage tank (590) to the gas consumer (500), wherein a conduit (510) is provided substantially enclosing the gas supply pipe, and an inlet (521) to the space between the gas supply pipe and the conduit is provided in the gas consumer room.

[Claim 0007] The ship of claim 6, wherein an outlet (586) to the space between the gas supply pipe and the conduit is provided in the tank space.

[Claim 0008] The ship of claim 7, wherein apparatus (583) is provided to draw air through the space between the conduit and the gas supply pipe from the gas consumer room to the tanks space.

[Claim 0009] The ship of either one of claims 7 and 8, including valves to open and close the inlet and outlet.

[Claim 0010] The ship of any preceding claim, wherein the tank space (580) has a vertical height substantially greater than its horizontal width.

[Claim 0011] The ship of any preceding claim, wherein the open side has substantially the same cross-sectional area as the cross-sectional area of the tank space.

[Claim 0012] The ship of any preceding claim, wherein the tank space is a converted
lift shaft.

[Claim 0013] The ship of any preceding claim, wherein a funnel is provided above the open space.

[Claim 0014] The ship of any preceding claim, wherein the base and sides of the tank space are defined by walls, said walls being gas-tight and fire resistant.

[Claim 0015] The ship of any preceding claim, wherein the gas storage tank has a cross-sectional shape and size smaller than the cross-sectional shape and size of the tank space.

[Claim 0016] The ship of any preceding claim, wherein the gas consumer is an engine or a fuel cell.

[Claim 0017] The ship of any preceding claim including flood control apparatus (600) for flooding the tank space (580) and/or the gas consumer room (505) and/or any space containing intervening gas carrying/handling equipment in the event of a gas leak so as to avoid brittle fracture of metalwork and/or to facilitate evaporation of the leaked gas.

[Claim 0018] A ship utilising gas as a fuel, the ship including a tank space (580) holding at least one gas storage tank (590) and a gas consumer (500) in a gas consumer room (505), the ship further including flood control apparatus (600) for flooding the tank space and/or the gas consumer room and/or any space containing intervening gas carrying/handling equipment in the event of a gas leak so as to avoid brittle fracture of metalwork and/or to facilitate evaporation of the leaked gas.

[Claim 0019] A ship utilising gas as a fuel, the ship including a tank space (580) holding at least one gas storage tank (590), the tank space being open on one side (582), the open side extending from said tank space to the open air outside said ship for allowing the venting of gas in the event of a leak from said gas storage tank held in said tank space, wherein the open side has substantially the same cross-sectional area as the cross-sectional area of the tank space.

[Claim 0020] The ship of any preceding claim being a commercial ferry.

[Claim 0021] The ship of any preceding claim being a container ship.

[Claim 0022] The ship of any preceding claim being a naval ship.
INTERNATIONAL SEARCH REPORT

A. CLASSIFICATION OF SUBJECT MATTER

INV. B63H21/14 B63J2/08

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)
B63H B63J B63B

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 practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
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<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
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<td>Y</td>
<td>paragraphs [0023] - [0027]; figures 1,2</td>
<td>17, 18</td>
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<td>GB 1 318 204 A (LASKEY N V) 23 May 1973 (1973-05-23)</td>
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<td>page 3, lines 46-61; 111-119</td>
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<td>A</td>
<td>US 5 803 005 A (STENNING DAVID G [CA] ET AL) 8 September 1998 (1998-09-08) page 4, line 50 - page 6, line 48</td>
<td>1, 11</td>
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<tr>
<td>A</td>
<td>US 3 830 180 A (BOLTON H) 20 August 1974 (1974-08-20) column 3, line 50 - column 6, line 48; figures 1-4</td>
<td>1, 11</td>
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Further documents are listed in the continuation of Box C.

See patent family annex.

* Special categories of cited documents:

**A** document defining the general state of the art which is not considered to be of particular relevance

**E** earlier document but published on or after the international filing date

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**P** document published prior to the international filing date but later than the priority date claimed

**T** later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

**X** document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

**Y** document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

**S** document member of the same patent family

Date of the actual completion of the international search

9 November 2011

Date of mailing of the international search report

24/11/2011

Name and mailing address of the ISA/
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Fax: (+31-70) 340-3016

Authorized officer

Brumer, Alexandre
<table>
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<td>A</td>
<td>US 2 721 529 A (ANTON JAHNSEN RAGNAR) 25 October 1955 (1955-10-25) column 2, lines 41-43; figure 1</td>
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This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. □ Claims Nos.: because they relate to subject matter not required to be searched by this Authority, namely:

2. □ Claims Nos.: because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. □ Claims Nos.: because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. □ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. X As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of additional fees.

3. □ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. □ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest □ The additional search fees were accompanied by the applicant’s protest and, where applicable, the payment of a protest fee.

□ The additional search fees were accompanied by the applicant’s protest but the applicable protest fee was not paid within the time limit specified in the invitation.

No protest accompanied the payment of additional search fees.
This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. Claims: 1-17, 19-22

Ship with fuel tank and consumer space and collective ventilation therefor.

2. Claim: 18

Ship with fuel tank and consumer space and flooding control apparatus therefor.
<table>
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<th>Patent document cited in search report</th>
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