



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
05.03.2008 Bulletin 2008/10

(51) Int Cl.:
B63B 9/04 (2006.01) **B63B 3/20 (2006.01)**
B63B 3/22 (2006.01) **B63B 25/00 (2006.01)**

(21) Application number: **07017210.1**

(22) Date of filing: **03.09.2007**

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IS IT LI LT LU LV MC MT NL PL PT RO SE SI SK TR
Designated Extension States:
AL BA HR MK YU

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(30) Priority: **01.09.2006 EP 06018377**

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(54) **Method for converting a single-walled vessel into a double-walled vessel, and a thus formed double-walled vessel**

(57) The present invention relates to the construction and the conversion of vessels. The invention relates specifically to a method for converting a single-walled vessel into a double-walled vessel, comprising of:

- creating a recess in the single-walled vessel for placing of a tank compartment,
- providing plate material,

- connecting the plate material to form a tank compartment outside the vessel,
- placing the tank compartment in the recess, characterized in that at least two frame elements, which are placed substantially parallel and spaced apart and to which the plate material is connected, are used to form the tank compartment.

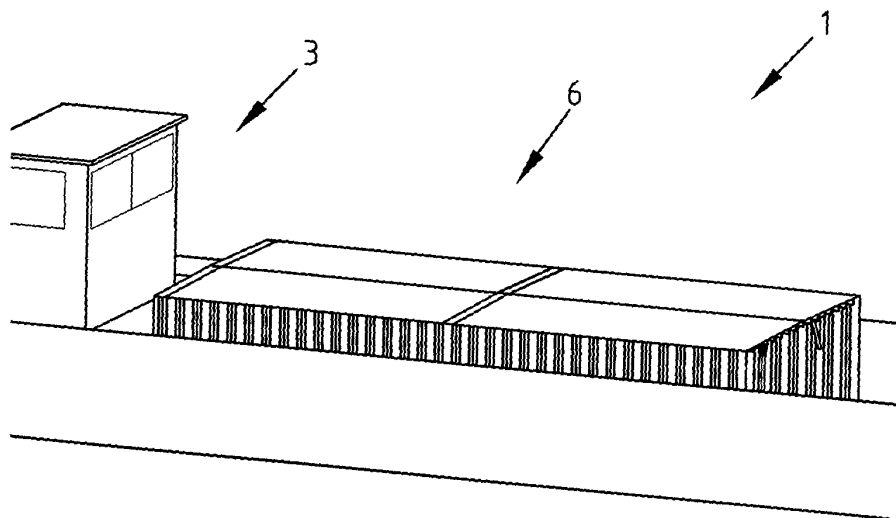


FIG. 8

Description

[0001] The present invention relates to the construction and the conversion of vessels. The present invention relates more particularly to the conversion of a single-walled vessel into a double-walled vessel. The invention relates specifically to a method for converting a single-walled vessel into a double-walled vessel as described in the preamble of claim 1, and a vessel as described in the preamble of claim 15. Such a method and such a vessel are known from US 6,637,359.

[0002] In the inland navigation sector vessels are used to transport all kinds of products, also including liquid products. These products are usually transported in the hold of the vessel, wherein the hold can be divided into a number of compartments. In the case of a collision of the vessel a crack or break can occur in the hull of the vessel. This creates the danger of part of the cargo leaking out. This is particularly the case if the cargo consist of liquids. An already known solution which attempts to alleviate this problem is to form a double-walled hull during the construction of the vessel. A space is hereby created between the outer wall of the vessel and the inner wall. Transverse bulkheads are further placed in this space. Watertight compartments are hereby created in the vessel. In the case of a break in the outer wall of such a vessel the corresponding compartment will fill up. However, if the inner wall of the vessel and the transverse bulkheads are still intact, there is no immediate danger to either the vessel or the cargo being transported thereby.

[0003] A problem in double-walled vessels is the increased weight compared to a single-walled vessel. The transport capacity is hereby reduced, which will unavoidably have economic consequences.

[0004] In addition to the construction of double-walled vessels, solutions are known in the prior art wherein single-walled vessels are converted into double-walled vessels. This is important since a great number of the current inland navigation vessels is single-walled. In the light of the present legislation, in particular the transport of hazardous liquid substances, wherein the use of double-walled vessels becomes mandatory in Europe as of 2018, such solutions are further of crucial economic importance.

[0005] A great drawback of the conversion of a single-walled vessel is the time required for the purpose. During this time, which can run into several months or more, the vessel cannot participate in commercial activities. One of the main causes of the long duration of the conversion process is the amount of work which has to take place in the vessel.

[0006] A usual method for converting a single-walled vessel begins with the removal of parts of the deck in order to provide access to the hold. Plate material is then placed at a distance from the outer wall in order to thus create a second wall. A drawback of this method is the amount of welding work required in the vessel. The great-

er part of the plate material must moreover be made to size in situ. As a result the vessel is out of operation for a long time.

[0007] In US 6,637,359 is discussed a method for converting a single-walled vessel into a double-walled vessel, which attempts to obviate a number of problems of the above stated method. The method described in this patent makes use of prefabricated components. Each of these components comprises a number of wall parts. After placing in the vessel, the different wall parts are mutually connected so that tank compartments are formed.

[0008] A component comprises only a limited number of walls. This is partly related to the plate material used. In order to achieve the required strength this material is provided with a profiling means in the form of ribs and stiffening members which are fixed to the plate material. As a result of the increase in weight, it is impractical to accommodate a large number of wall parts in one component.

[0009] In addition to the weight increase, the alignment is another factor which determines the size of the components. The connection between the different components and the outer wall is realized by mutually connecting the profiling means, which are present on both surfaces, by means of a connecting construction as shown in figures 15 and 16 of the document in question. If a component were to comprise many wall parts, and thereby also a large number of contact points for the connection to the outer wall of the vessel, the alignment between the component and the outer wall would become practically impossible.

[0010] A further drawback is that the structure of the single-walled vessel must be measured precisely so as to obtain a correct dimensioning of the components in order to obtain a good fit.

[0011] It is an object of the present invention to provide a method for converting single-walled vessels into double-walled vessels, wherein the above stated drawbacks do not occur, or at least to a lesser extent.

[0012] According to a first aspect of the present invention, this object can be achieved by means of a method comprising of:

- creating a recess in the single-walled vessel for placing of a tank compartment,
- providing plate material,
- connecting the plate material to form a tank compartment outside the vessel,
- placing the tank compartment in the recess, characterized in that at least two frame elements, which are placed substantially parallel and spaced apart and to which the plate material is connected, are used to form the tank compartment.

[0013] The use of frame elements for the construction of tank compartments is an approach which differs from what is usual in the prior art. The manufacture of a tank compartment is facilitated by first creating a frame of

frame elements in parallel spaced apart relationship.

[0014] At least four walls of the tank compartment are preferably formed by connecting the plate material to the frame elements. The connection can be realized by means of known techniques such as welding. In a preferred method a substantially box-like tank compartment with a top and bottom wall and two side walls is formed by this connection. The two frame elements form herein a front and rear wall. It will be apparent to the skilled person that other solutions are possible within the scope of this invention, wherein a frame element for instance forms a side wall.

[0015] In a further preferred method the plate material is placed between the frame elements. A further advantageous function of the frame element is achieved if it is provided during prefabrication with a support construction on the underside. After placing in the vessel, the tank compartment supports on this support construction. Because the support construction protrudes downward, there is a height difference on the underside of the tank compartment. It is advantageous if the outer wall of the vessel is adjusted such that this height difference is compensated before placing of the tank compartment. This is for instance possible by partially removing the strengthening transverse beams which are attached to the inner side of the outer wall of the vessel, so that the resulting recess provides space for the support construction. It is also advantageous to choose the height of the support construction such that, after placing in the vessel, the bottom wall of the tank compartment comes to lie in the at least very close vicinity of the other transverse beams or other strengthening means attached to the inner side of the outer wall of the vessel. This creates the option of attaching the bottom wall of the tank compartment to these beams or means, whereby a strong construction is acquired.

[0016] The above discussed use of a frame element and the support construction connected thereto emphasises the particular role of the frame element. The methods which are known from the prior art are mainly characterized in that a tank compartment is constructed wall by wall. This is in contrast to the present invention, wherein a skeleton of the tank compartment is first formed.

[0017] In a preferred method the plate material comprises corrugated plate material. The corrugations arranged in the material, preferably metal, have a strengthening effect. The corrugation direction is defined here as the direction wherein the section of the plate, as taken perpendicularly of this direction, does not change in this direction. The corrugation direction is preferably substantially parallel to the frame element. The corrugated plate can withstand better than a flat plate forces which cause bending around an axis perpendicular to the corrugation direction. It is hereby possible to opt for a thinner plate which provides the same strength as a flat plate. Such a plate has a lower weight, whereby the vessel comes to lie less deep in the water and can transport more cargo.

[0018] Use is preferably made of a sheet pile wall pro-

file. This profile is characterized in that it has no acute angles, whereby the whole plate can be reached for processes such as welding. A sheet pile wall profile is comparable to a block profile, except that those parts which connect the substantially parallel parts to each other are not perpendicular to these parallel parts, but at an angle thereto. The angle between an obliquely placed part and a first horizontal part can herein be different from the angle between the oblique part and a second horizontal part not situated in the same plane as the first horizontal part. Successive oblique parts are preferably at the same angle relative to the corresponding horizontal parts.

[0019] A light construction is obtained by manufacturing the tank compartment at least partly from corrugated plate material, preferably plate material provided with a sheet pile wall profile. It hereby becomes possible to mutually connect a plurality of tank compartments and place them integrally in the vessel. More work can hereby be carried out outside the vessel, whereby the vessel is out of operation for less time. After connection of at least two tank compartments a frame element forms a wall for two adjacent tank compartments.

[0020] Inland navigation vessels usually have an elongate form with a substantially constant frame section. It is hereby possible to use substantially identical tank compartments. This simplifies the production process considerably because the number of different components required for the conversion of the vessel is very limited. The operations for producing each compartment are also identical. This also reduces the time that the vessel is out of operation.

[0021] The frame element is preferably made by connecting separate parts of plate material. The frame element can also be formed by connecting tubular elements. The frame element is preferably sealed with plate material so that the tank compartments are separated from each other. It is further advantageous to realize this sealing with corrugated plate material, such as material with a sheet pile wall profile.

[0022] According to a second aspect of the present invention, the intended advantages can be achieved by means of providing a vessel comprising a single-walled hull and a hold which is formed therein and in which at least one prefabricated tank compartment is accommodated. This tank compartment is characterized in that it comprises a front and rear wall, which are formed respectively by a first and second frame element which are placed substantially parallel to and spaced apart from each other. The tank compartment further comprises a bottom and top wall and two side walls, which are formed by connecting plate material to the frame elements.

[0023] In a preferred embodiment the vessel comprises a prefabricated assembly of mutually connected tank compartments, wherein at least one frame element forms a wall for two adjacent tank compartments.

[0024] Despite the fact that it is not the wish to limit the present invention to originally single-walled vessels, it is precisely for this type of vessel that the application and

implementation of the present invention is extremely advantageous. This is certainly the case if the plate material used at least partially comprises corrugations, preferably in the form of a sheet pile wall profile.

[0025] Said frame element can comprise an assembly of tubular elements.

[0026] In a preferred embodiment the frame element comprises a first elongate, substantially flat strip of plate material, to which a plate with a sheet pile wall profile is connected. This plate has a first and second edge with profile, which, in contrast to the other two edges, do not form a substantially straight line. The above mentioned flat strip is connected to a first edge of the plate such that it fully encloses the edge. A second elongate, substantially flat strip of plate material is further connected to the second edge of the plate in a manner comparable to the connection between the first edge and the first strip.

[0027] The sheet pile wall profile close to the outer ends of the plate which are not connected to the flat strips is adapted such that the outer ends each form a surface lying perpendicularly of the elongate strips. Together with the flat strips, the edges of the formed flat parts at the outer ends of the plate with the sheet pile wall profile form a frame to which the plate material of the side walls and the top and bottom wall is connected.

[0028] In a further preferred embodiment the frame elements comprise a metal support construction.

[0029] The tank compartment can be further strengthened by placing a pull rod. Such a rod is situated at a distance from the frame elements, between the top and bottom wall of the tank compartment. The pull rod is preferably connected at the top to a transverse beam. The construction of pull rod and transverse beam fixes the bottom and top wall relative to each other.

[0030] In order to save weight and working hours, the side walls of the tank compartment consist of plates with a sheet pile wall profile. Such plates can also be used for the top and bottom walls. If a flat top and bottom wall are desired, substantially flat plate material can be used. A profiling means is then arranged on this plate material for the purpose of the required strength. This profiling means can for instance consist of beams which are attached to the plates in the longitudinal direction. The use of flat plates has the advantage that the removal of the cargo from a tank compartment is easier than in the case of a bottom with corrugations. The above mentioned profiling means is therefore preferably arranged on the outside of the bottom wall. The upper wall of the tank compartment further usually forms part of the deck of the vessel. The use of corrugations reduces accessibility for the user. In this wall the profiling means is therefore preferably arranged on the inside. This latter profiling means further provides an engaging option for the above stated pull rod. It is possible to create a large contact surface by arranging in the transverse beam recesses corresponding with the profiling of the upper wall. The transverse beam can thus be connected to the upper wall along a great length, for instance by means of a welding

technique.

[0031] In a preferred embodiment the metal support constructions of the frame elements are connected to the outer wall of the vessel. A great strength can further be obtained if, at the position of the pull rod in the tank compartment after placing of the tank compartment in the vessel, the bottom wall is connected to a transverse beam fixed to an outer wall of the vessel. The forces occurring in the pull rod can in this case be efficiently transmitted. Such a beam can have formed part of the original construction of the vessel. The beam can however also be arranged specially in the vessel. In order to achieve this object, it is necessary to adapt the placing of the pull rod in the tank compartment to the locations of the transverse beams in the vessel.

[0032] The tank compartment, and the connection of the tank compartment to the outer wall of the vessel, can be further strengthened by arranging metal support plates between the side walls and the bottom wall of the tank compartment and the outer wall of the vessel. Close to the bottom wall of the tank compartment such plates can be attached to the profiling means located there. Such a profiling means is usually also present on the outer wall of the vessel.

[0033] The frame elements are preferably connected to the outer wall by means of transverse bulkheads. If these bulkheads and the metal support constructions of the frame elements are watertight, the space between the frame element and the outer wall is divided into watertight compartments. These spaces can optionally serve as ballast holds. The space will generally be left unused, and serves primarily as safety measure.

[0034] Pipes can be arranged in the frame elements, preferably in the corrugations, for the supply and discharge of liquid cargo. Heating conduits can also be incorporated into the corrugations. These conduits debouch into a conduit system in the tank compartment. Viscosity of the cargo can be prevented by heating the liquid cargo by means of this conduit system.

[0035] According to a third aspect of the present invention, the stated advantages can be achieved by means of using a vessel as described above or which results from any of the methods as set forth above.

[0036] The present invention will be discussed in more detail hereinbelow with reference to the figures, in which:

Figure 1 is a view of a single-walled vessel of conventional construction.

Figure 2 is a view of the single-walled vessel of figure 1 in which the present invention is applied.

Figure 3 is a view of a part of the single-walled vessel of figure 1 after a recess has been created.

Figure 4 shows a preferred embodiment of a frame element.

Figures 5 and 6 show intermediate stages of the conversion of the single-walled vessel of figure 1.

Figure 7 is a detail view of a sheet pile wall profile.

Figure 8 shows a further view of a tank compartment

placed in a vessel.

[0037] Figure 1 shows an inland navigation vessel 1 of conventional construction. The present invention can however be applied to any vessel at random in which cargo is stored in a hold. The invention is particularly advantageous when applied to a single-walled vessel serving for the transport of liquid cargo such as for instance oil. Vessel 1 has a bow 2, a bridge 3 and a hold 4 extending therebetween in lengthwise direction. A different structure of vessel 1 is possible. Bridge 3 can for instance be placed in the centre of vessel 1.

[0038] Tanks or loading spaces can be formed in hold 4 of vessel 1. Hold 4 can be provided with partitions, for instance longitudinal bulkheads or transverse bulkheads. Hold 4 is divided into multiple parts by these partitions.

[0039] In a prior art single-walled vessel 1 the cargo is arranged in the hold which is enclosed by outer wall 5 of the vessel. In the case of damage occurring to outer wall 5 in the form of a break or hole, there is a possibility of cargo flowing out herethrough.

[0040] Figure 2 shows single-walled vessel 1 of figure 1 to which the present invention is applied. Hold 4 comprises several tank compartments 6 in which the cargo can be transported. In this embodiment the tank compartments 6 protrude above the original deck 7. The reduced capacity of hold 4 can hereby be compensated.

[0041] The first step in the conversion of single-walled vessel 1 is to create a recess in which tank compartments 6 can eventually be placed. Parts of deck 7 and parts in hold 4 must be removed for this purpose.

[0042] Figure 3 shows single-walled vessel 1 once a recess has been created. The inner side of outer wall 5 of vessel 1 is herein exposed. Outer wall 5 of vessel 1 is generally strengthened with transverse profiling means 8 and longitudinal profiling means 9, 9'. Transverse beams 10 are also present in the vessel. These strengthening means are known prior art techniques and therefore present in most single-walled vessels. The present invention does not however preclude such profiling means still having to be arranged prior to the tank compartments being placed in the vessel.

[0043] Figure 3 shows remnants 11 of the removed transverse bulkheads of the single-walled vessel. The metal plates shown here can also be placed after removal of the transverse bulkheads. At the position 12 of the new transverse bulkheads to be constructed the base of outer wall 5 is cleared locally of profiling means 9, 9'. This is necessary because the frame element, which is provided with a downward protruding support construction, will be placed at this position at a later stage.

[0044] The tank compartments are manufactured outside the vessel. A compartment comprises two frame elements 13, one of which is shown in figure 4. In this preferred embodiment frame element 13 consists of two flat horizontal strips 14, 14'. Corrugated plate material 15 provided with a sheet pile wall profile is received therebetween. Metal plates 16 are arranged in the corruga-

tions in order to further strengthen the plate.

[0045] Corrugated plate 15 has a profiled edge 17, 17' on its bottom and top side. These edges are designated as edges with profile. It must be noted that this profile is fully enclosed by horizontal strips 14, 14'. This is an important aspect because the frame elements form a wall of the tank compartment. If the profile is not fully enclosed, the tank compartment is not watertight.

[0046] The other edges 18, 18' of the corrugated plate are adapted so that they form two parallel surfaces, each lying perpendicularly of horizontal strips 14, 14'. A frame is thus formed which consists of the edges of horizontal strips 14, 14' and the edges of surfaces 18, 18' lying perpendicularly thereof. Plates are connected to this frame at a later stage so as to thus form the side walls and the top and bottom wall of the tank compartment.

[0047] A metal support construction 19 is connected to a side of a horizontal strip 14' remote from the corrugated plate. This construction comprises a flat plate 20 which is placed perpendicularly of horizontal strip 14'. Metal components 21, which strengthen the plate 20 to which they are connected, are placed on the flat plate. These components also provide support for the corrugated plate 15 placed thereabove.

[0048] The frame elements are preferably provided with a bend 35, 35' in the centre of the structure. Such a bend ensures that, when it is pumped out, liquid cargo flows to a location, i.e. the bend line, in the tank compartment. Little cargo hereby remains behind. Providing the upper wall with a bend prevents rainwater remaining on the upper wall of the tank compartment.

[0049] The frame elements are then placed parallel to each other at a pre-calculated distance, as shown in Figure 5. This distance corresponds to the positions in the single-walled vessel 1 where profiling means 9, 9' has been removed. The other walls of the tank compartment are formed by fixing plate material between corresponding frames of the frame elements.

[0050] Figures 5 and 6 show intermediate stages of the manufacture of a tank compartment. For manufacture of the walls of the tank compartment the bottom wall 22 is first fixed between the frame elements. Already known techniques such as welding can be used for this purpose. In order to simplify the assembly use is made of support beams which correspond to the transverse beams in the vessel. This also guarantees a good fit. Metal knee-plates (not shown) can be used to strengthen the connection between the frame element and the bottom wall.

[0051] In a preferred embodiment profiled plates are used for the top and bottom wall 23, 22, see figures 5 and 6. These are substantially flat plates which are connected on one side to a thin beam 24 running in longitudinal direction. By fixing these beams at the underside of the bottom and top wall, the bottom and the deck part of the tank compartment are substantially flat.

[0052] The side walls 25 which are then placed preferably consist at least partially of corrugated plate material. These plates are placed with the corrugation direc-

tion perpendicularly of bottom wall 22. This wall comprises the whole profile of the edge of the side wall so that a watertight connection is once again realized.

[0053] Pull rods 26 can then be placed. These pull rods 26 are connected on the top side to a transverse beam 27. This beam has recesses 28 which correspond with the profiling means 24, 29 of the top wall. Metal knee-plates 30 are also placed in order to fix the beam to the side walls of the tank compartment. In order to achieve maximum strength, pull rods 26 are preferably placed such that they come to lie above the already present transverse beams 10 after placing of the tank compartment.

[0054] Finally, top wall 23 is formed by attaching profiled plate material between the frame elements.

[0055] The embodiment in figure 5 shows an assembly of tank compartments. As shown in this figure, frame element 31 herein forms a wall for two adjacent tank compartments.

[0056] The assembly is manufactured integrally and placed as such in the vessel. If a plurality of assemblies are placed, at least one side of the assembly is not closed with a frame element. This latter does after all form part of another assembly.

[0057] The reason why it is possible to use assemblies of multiple tank compartments is to be found in the simple operations required to connect the tank compartments to the outer wall of the vessel and the relatively low weight due to the use of corrugated plate material. Compared to prior art methods and devices, the present invention thus results in a reduction in the time that the vessel is out of operation.

[0058] Figure 7 shows a detail view of a corrugated plate 32 comprising a sheet pile wall profile. This profile is characterized in that the profile is situated between two horizontal surfaces 33, 33'. The parts in these surfaces are connected by oblique parts 34, 34'. Important for the strength of such a plate are the width of the horizontal parts w_1 , w_2 and the angles a_1 , a_2 at which the oblique parts are placed, as well as the thickness t of the plate. These values preferably lie within the following ranges (all dimensions in millimetres and angles in degrees) $100 < w_1 < 200$, $300 < w_2 < 400$, $100 < a_1 < 120$ and $50 < a_2 < 85$, with a thickness of $5 < t < 9$. Specifically opted for is the combination $w_1 = 140$, $w_2 = 325$, $a_1 = 107$, $a_2 = 72$ at a thickness $t = 7$, wherein it will be apparent to the skilled person that slight variations can be made in these options without actually losing the advantages resulting from these options.

[0059] Figure 8 shows a view of a tank compartment 6 placed in the vessel. After being placed, the tank compartment must be fixed to the outer wall of the vessel. Partitions are placed for this purpose between the remnants of the original transverse bulkheads and the frame elements. Partitions can also be placed between the outer wall of the vessel and the bottom wall of the tank compartment.

[0060] The partitions between frame element 13 and

outer wall 5, and the support construction are preferably watertight. An artificially watertight transverse bulkhead is hereby formed. The space formed by the outer wall of the vessel, the side walls of the tank compartment and the partitions between the frame element and the outer wall is hereby also watertight. The desired safety of a double-walled vessel is hereby achieved.

[0061] In a further preferred embodiment (not shown) a metal support construction is arranged on the deck of the converted single-walled vessel between parts of the original deck and a top wall of a tank compartment. Such a support construction distributes the forces between the tank compartment, or an assembly of a plurality of tank compartments, and parts of the original deck. Instead of such a construction, the outer frame elements can be given a smaller form, whereby the top wall comes to lie obliquely and a gradual transition is effected between the tank compartments and the original deck. Such a construction also results in the desired distribution of forces.

[0062] It will be apparent to the skilled person that a number of measurements must be carried out on the original vessel in order to implement the above discussed method. These measurements can be taken on the vessel itself, or the required information can be extracted from the construction drawings of the vessel. It is not necessary to explain that these operations can be carried out while the vessel is still travelling on the water. Because the tank compartments are of simple structure and components are prefabricated, the time that the vessel is out of operation is reduced to a minimum.

[0063] The above description of preferred embodiments of the present invention are not intended to limit the invention. It will be apparent to the skilled person that diverse modifications are possible without departing from the scope of the invention as set forth in the following claims.

Claims

1. Method for converting a single-walled vessel into a double-walled vessel, comprising of:
 - creating a recess in the single-walled vessel for placing of a tank compartment,
 - providing plate material,
 - connecting the plate material to form a tank compartment outside the vessel,
 - placing the tank compartment in the recess, **characterized in that** at least two frame elements, which are placed substantially parallel and spaced apart and to which the plate material is connected, are used to form the tank compartment.
2. Method as claimed in claim 1, **characterized in that** at least four walls of the tank compartment are formed by connecting the plate material to the frame

elements.

3. Method as claimed in claim 1 or claim 2, **characterized in that** by connecting the plate material to the frame elements the tank compartment comprises the following walls:

- a front and rear wall formed respectively by a first and second frame element,
- a bottom and top wall formed by the plate material,
- two side walls formed by the plate material.

4. Method as claimed in any of the claims 1-3, **characterized in that** the plate material is placed between the frame elements.

5. Method as claimed in any of the claims 1-4, **characterized in that** the frame element is prefabricated and herein provided on the underside with a support construction on which the tank compartment supports after placing in the vessel.

6. Method as claimed in any of the claims 1-5, **characterized in that** the plate material comprises corrugated plate material.

7. Method as claimed in claim 6, **characterized in that** the plate material is at least partially provided with a sheet pile wall profile.

8. Method as claimed in any of the claims 1-7, **characterized in that** a plurality of mutually connected tank compartments are placed integrally in the vessel, wherein at least one frame element forms a wall for two adjacent tank compartments.

9. Method as claimed in any of the claims 1-8, **characterized in that** all tank compartments to be placed in the vessel are substantially identical.

10. Method as claimed in any of the claims 1-9, **characterized in that** the frame element is formed by connecting separate parts of plate material.

11. Method as claimed in any of the claims 1-9, **characterized in that** the frame element is formed by connecting tubular elements.

12. Method as claimed in claim 10 or claim 11, **characterized in that** an opening in the frame element is sealed with plate material.

13. Method as claimed in claim 12, **characterized in that** the plate material comprises corrugated plate material.

14. Method as claimed in claim 13, **characterized in**

that at least a part of the corrugated plate material comprises a sheet pile wall profile.

15. Vessel comprising a single-walled hull and a hold which is formed therein and in which at least one prefabricated tank compartment is accommodated, **characterized in that** the tank compartment comprises the following walls:

- a front and rear wall formed respectively by a first and second frame element which are placed substantially parallel to and spaced apart from each other,
- a bottom and top wall and two side walls which are formed by connecting plate material to the frame elements.

16. Vessel as claimed in claim 15, **characterized in that** the vessel comprises a prefabricated assembly of mutually connected tank compartments, wherein at least one frame element forms a wall for two adjacent tank compartments.

17. Vessel as claimed in claim 15 or claim 16, **characterized in that** the plate material comprises corrugated plate material.

18. Vessel as claimed in claim 17, **characterized in that** at least a part of the corrugated plate material comprises a sheet pile wall profile.

19. Vessel as claimed in any of the claims 15-18, **characterized in that** the frame element comprises an assembly of tubular elements.

20. Vessel as claimed in any of the claims 15-18, **characterized in that** the frame element comprises:

- first elongate, substantially flat strip of plate material,
- a plate connected thereto with a sheet pile wall profile which comprises a first and second edge with profile and two edges without profile, wherein the elongate flat strip is connected to the first edge with profile and fully encloses said edge,
- a second elongate, substantially flat strip of plate material which is connected to the second edge and fully encloses said edge,

wherein the sheet pile wall profile close to the outer ends of the plate which are not connected to the flat strips is adapted such that the outer ends each form a surface lying perpendicularly of the elongate strips.

21. Vessel as claimed in claim 20, **characterized in that** the plate material of the side walls and the top and bottom wall is connected to edges of the horizontal strips and the flat outer ends of the plate with sheet

pile wall profile.

22. Vessel as claimed in any of the claims 15-21, **characterized in that** the frame element comprises a metal support construction. 5
23. Vessel as claimed in any of the claims 15-22, **characterized in that** the tank compartment comprises a pull rod which is disposed in substantially vertical direction at a distance from the frame elements and which is connected at the top to a transverse beam. 10
24. Vessel as claimed in any of the claims 15-23, **characterized in that** the side walls of the tank compartment consist substantially of plates with a sheet pile wall profile. 15
25. Vessel as claimed in any of the claims 15-24, **characterized in that** the bottom and top wall of the tank compartment consist substantially of flat plate material which is provided respectively on a side remote from the tank compartment and a side directed toward the tank compartment with a profiling means protruding out of the plane of the plate material. 20
25
26. Vessel as claimed in claim 25, **characterized in that** the transverse beam connected to the pull rod comprises a recess corresponding with the profiling means of the top side of the tank compartment. 30
27. Vessel as claimed in any of the claims 22-26, **characterized in that** the metal support construction of the frame element is connected to an outer wall of the vessel. 35
28. Vessel as claimed in any of the claims 23-27, **characterized in that** the bottom wall of the tank compartment is connected at the position of the pull rod to a transverse beam which is connected to the outer wall of the vessel. 40
29. Vessel as claimed in any of the claims 15-28, **characterized in that** the bottom wall of the tank compartment is connected to the outer wall of the vessel by means of metal support plates. 45
30. Vessel as claimed in any of the claims 15-29, **characterized in that** the frame element is connected to the outer wall by means of a transverse bulkhead. 50
31. Vessel as claimed in claim 30, **characterized in that** a space defined by the outer wall of the vessel, the walls of the tank compartment, the corresponding transverse bulkheads between the frame elements and the outer wall of the vessel and the metal support construction of the frame elements is substantially watertight. 55
32. Vessel as claimed in any of the claims 15-31, **characterized in that** at least one of the frame elements comprises pipes for the supply and discharge of liquid.
33. Vessel as claimed in any of the claims 15-32, **characterized in that** the tank compartment comprises a pipe system for the purpose of heating liquid.
34. Use of a vessel as claimed in any of the claims 15-33 or which results from a method as claimed in any of the claims 1-14.

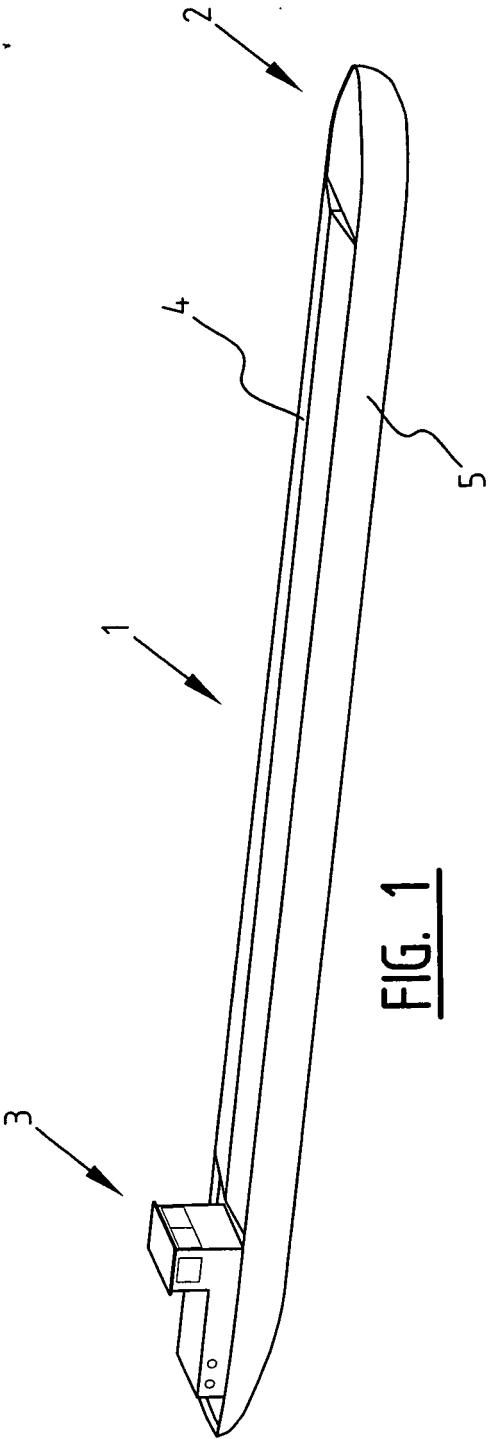


FIG. 1

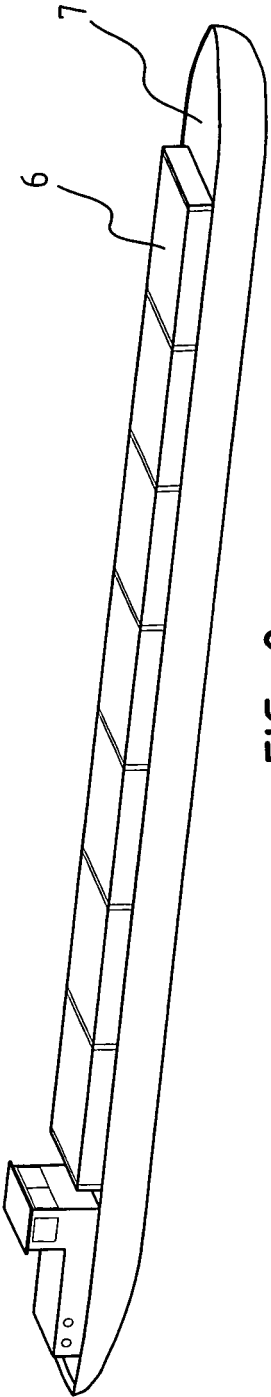


FIG. 2

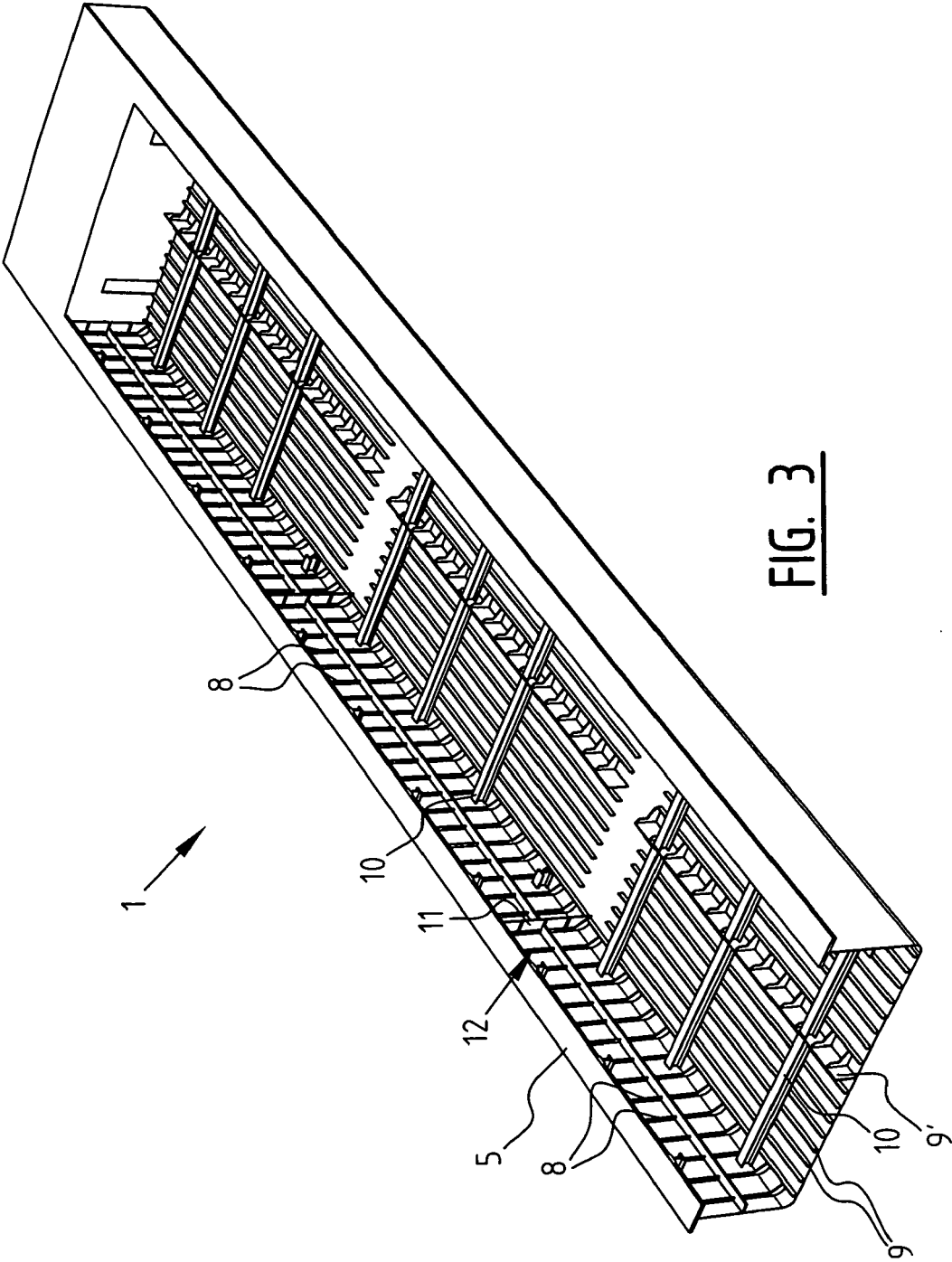


FIG. 3

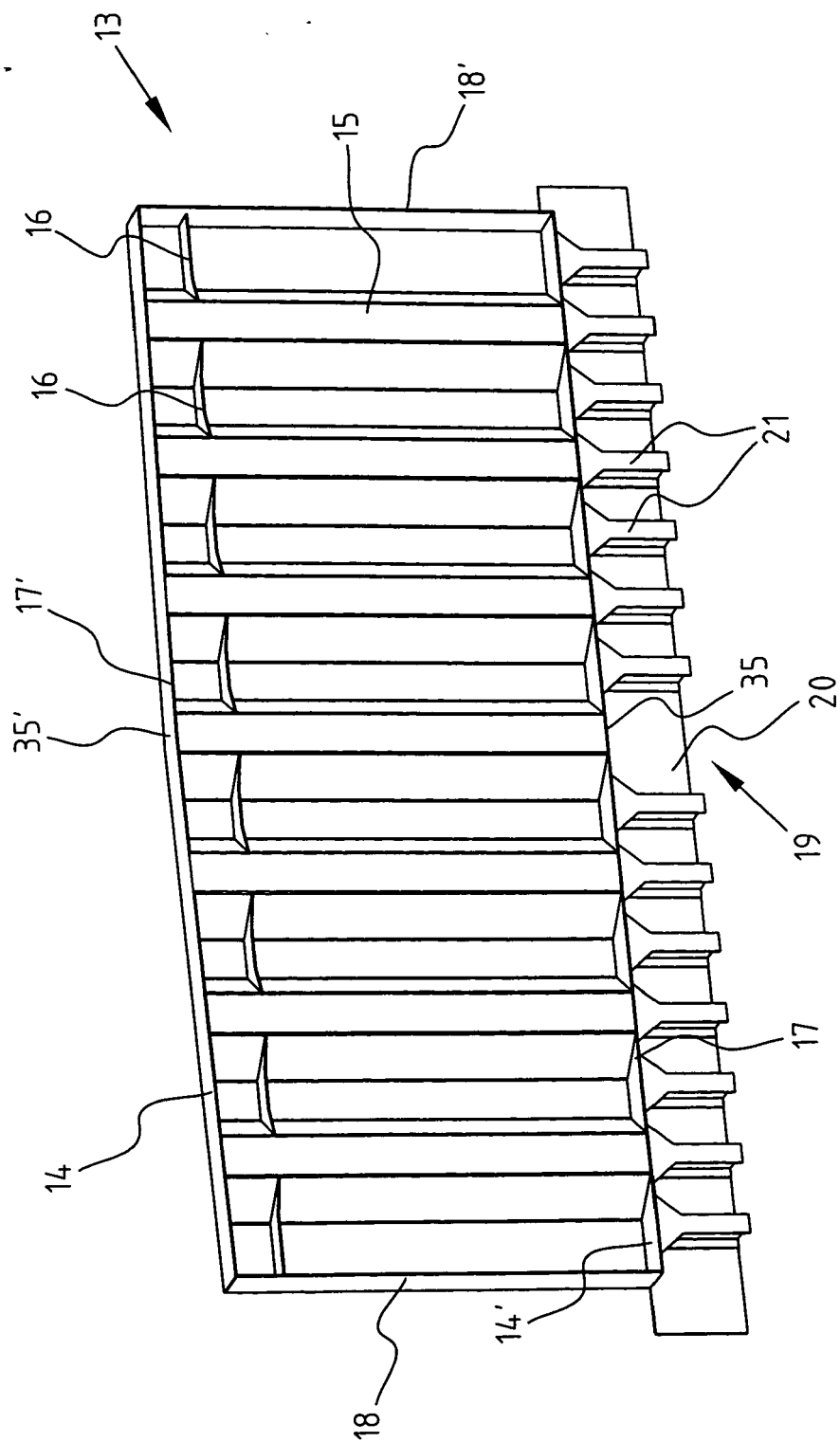
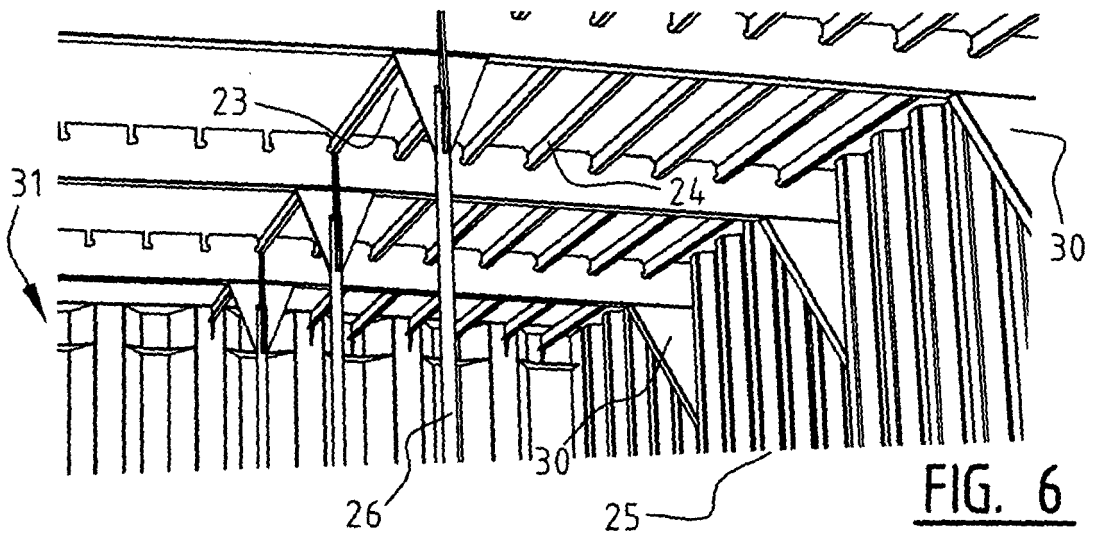
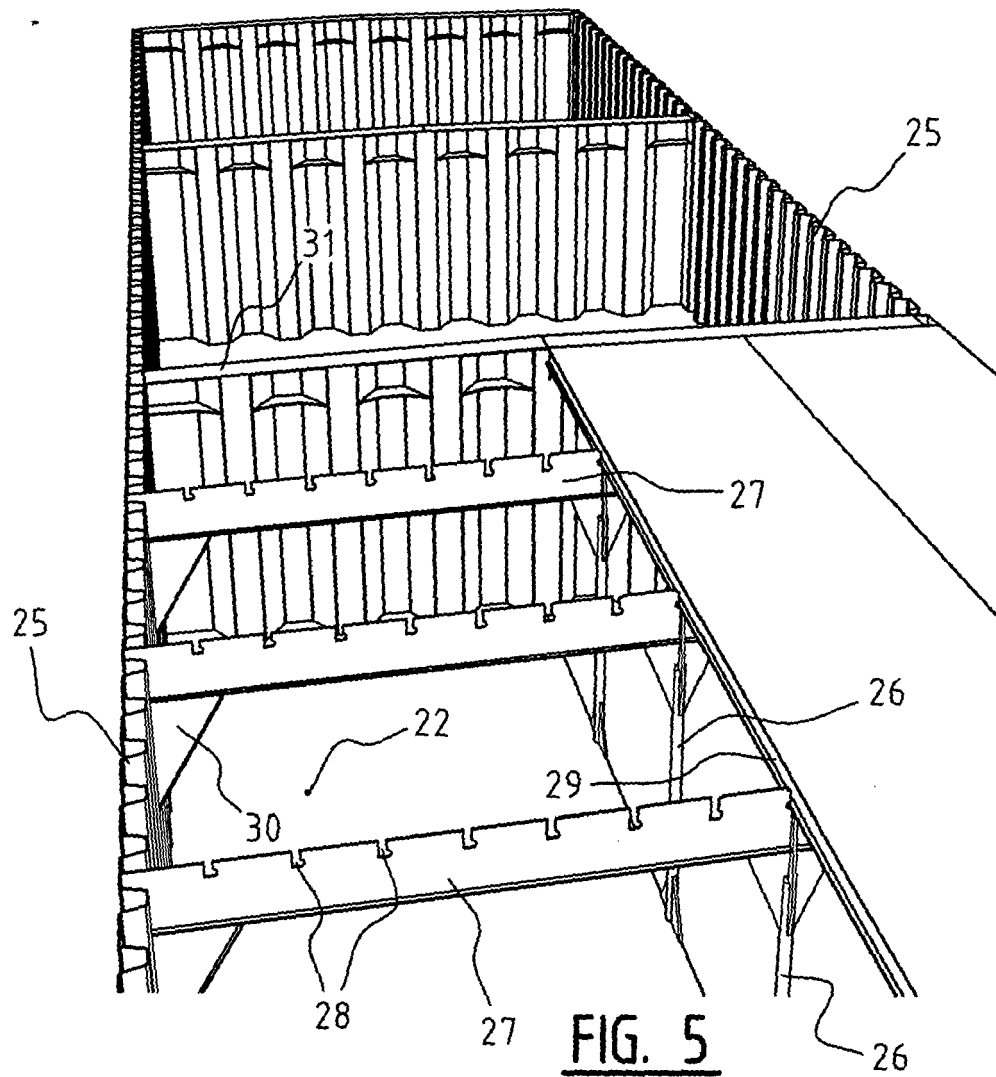
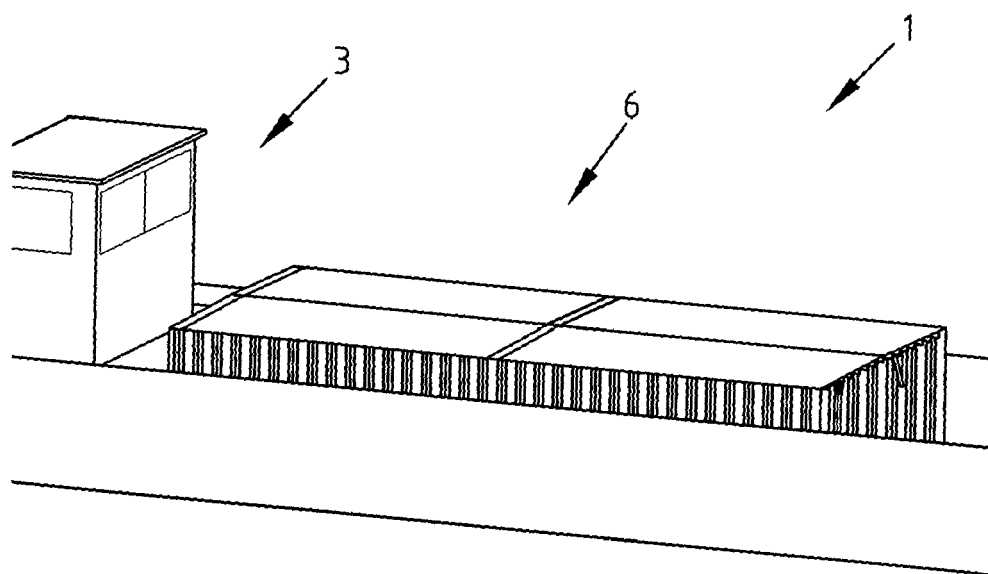
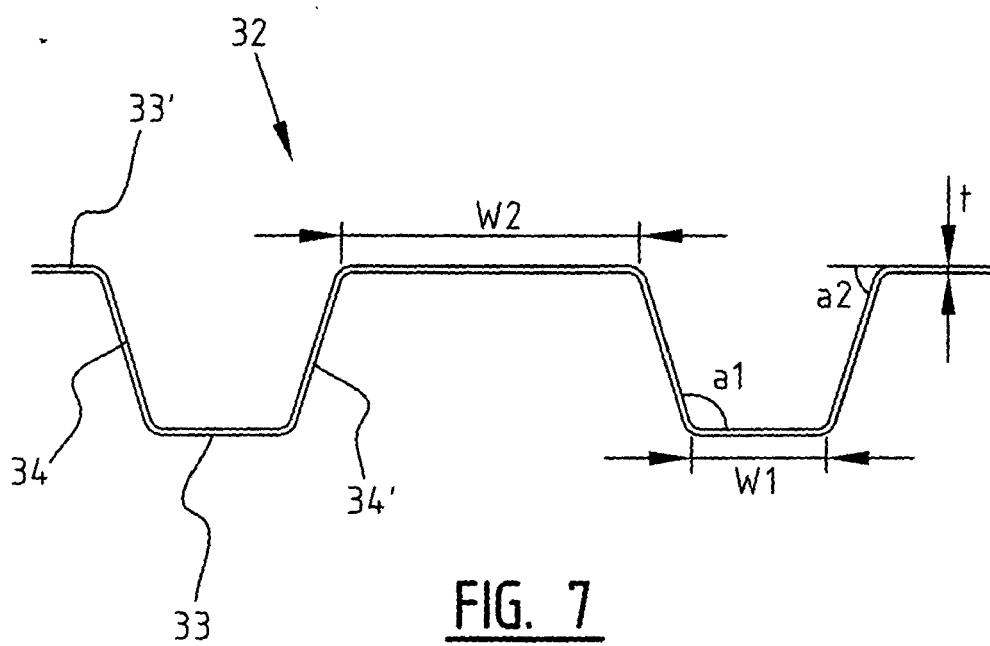


FIG. 4







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EUROPEAN SEARCH REPORT

Application Number
EP 07 01 7210

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Place of search The Hague		Date of completion of the search 10 December 2007	Examiner van Rooij, Michael
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