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(54) Ship building method

(57) In a building method for a large multideck structure(1) such as a passenger ship, at least one intermediate space is formed in the structure by at least partly dividing the structure (1) in at least two parts. A transport or transfer system, for example comprising a tower crane (3a, 3b) and a lifting platform (5, 5a, 5b) is provided for delivering furnishings and equipment to desired decks (9) of the structure through the intermediate space. The structure (1) is then assembled into an integral unit, either by combining or completing the separated parts. The method is carried out at a building site such as a building berth (6).

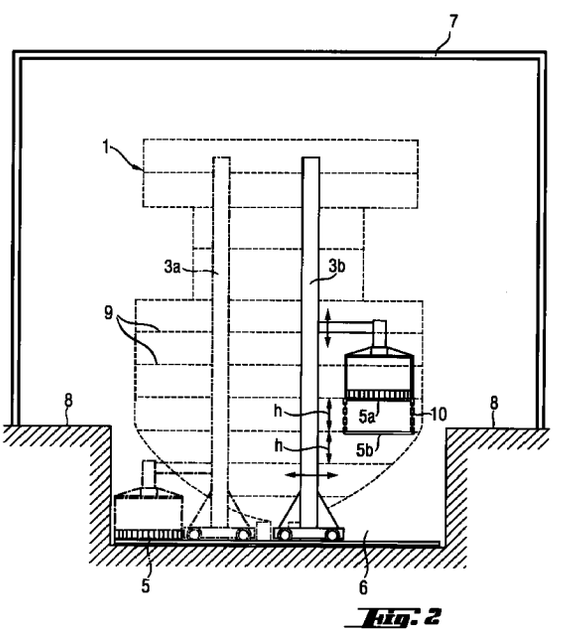

Fig. 2

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Description

[0001] This invention relates to a building method for a large multideck structure, such as a passenger ship or the like, particularly for use at sea. The invention is particularly described herein as a building method for a passenger ship, building taking place at a typical shipbuilding site, for example in a building berth, but it is to be understood that the same principle also can be applied with advantage to other large multideck structures, such as for example an offshore structure, a floating hotel and a car/passenger ferry.

[0002] Furnishing a large passenger ship is a very demanding task. The amount of work required may be in the order of one million working hours and a total of about one thousand workers may be employed for the furnishing work. A large number of cabins or cabin elements, furniture, technical equipment and different building materials have to be brought aboard the ship. Transferring these parts, equipment and units aboard the ship takes a number of months and requires highly developed logistics in order that the equipment arrives in the correct order and at the right place and without the delivered material loads forming a barrier for subsequent loads. A large passenger ship is labyrinthine and delivering the material to the different decks of the ship, of which there may be over ten, is difficult, if only the normal passages of the ship are available. A known way to facilitate transportation is to open one or more transport openings in the side of the ship, through which openings the delivery takes place. A transport opening like this, however, does not lessen the transport problems to any great extent since it only opens the way to some decks and the transport routes are still very difficult.

[0003] The object of the present invention is to overcome the above described disadvantages and to provide a method by which building may be carried out in an efficient manner and by simple means. This object is achieved by the invention as defined in claim 1.

[0004] The invention is based on the idea that during the furnishing work easily usable transport routes have to be opened directly to the different decks of a large passenger ship. By dividing a ship under construction into two or more parts so that they are apart from each other a suitable intermediate space can be opened between them for transporting the furnishing material into the ship. In this way numerous easily usable straight routes are opened into the inner spaces of the ship. All kinds of material can be efficiently transferred through the intermediate space to the parts of the ship on both sides of the intermediate space. Straight connections to all the decks of the ship are achieved through the intermediate space, substantially shortening the transport routes. Either at the beginning of the end stage of the transport work necessitated by the furnishing or when the transport work is finished the parts of the ship are combined into a floating unit.

[0005] If the structure under construction is a ship or unit in the form of a ship, it is preferable that the intermediate space defines a plane perpendicular to a lengthwise direction of the ship. If the structure is a unit for offshore use without a clear lengthwise direction, the dividing has to be done based on the general planning of the structure and furnishing needs.

[0006] The combining of parts of a structure, e.g. a ship, that are separated from each other may be done by moving one part into engagement with the other part and fastening the parts to each other for example by welding. Moving a part of a ship weighing thousands of tonnes five to ten metres takes about one hour. If this combining method is used, it is preferable that the ship is divided into parts of different size so that the part that is to be moved is substantially lighter than the part that remains in place. In this way the moving work is easier. If one wants to avoid moving very heavy units horizontally in combining of the separated parts, a section or other structural part suitable for combining the parts may be placed between them. The section may advantageously be a section comprising the whole width of the ship. Alternatively the ship may be partially divided so that a fixed combining part remains the middle and on the sides two areas of a size of for example five times five metres are left open, both of which areas are used as the intermediate spaces of the invention.

[0007] Combining the parts separated from each other by a section that is placed in the intermediate space is best done so that the intermediate space and the corresponding section are made slightly wedge-shaped in the mounting direction of the section. If the wedge-shaped form comprises a difference of about ten millimetres to each metre, this substantially helps the arrangement of the section in a correct position.

[0008] A transport and transfer system may be arranged in the intermediate space according to the invention, having, for example, lifting levels moving in a vertical direction by which material can be brought to different decks. If for some reason an intermediate space having enough room for a lifting system cannot be provided, the transfer system can be built so that its lifting devices are in the immediate vicinity of the intermediate space outside the unit under construction and the intermediate space comprises temporarily installed fixed passage levels serving the transfer system. This solution also advantageously shortens the passage routes.

[0009] In the transfer system according to the invention it is advantageous to use at least one level or platform, preferably movable to different heights, which extends or may be moved close enough to both of the mutually separated parts so that the platform can function as a connecting bridge between the parts. Transport may then also be carried out from one part to another by utilising the passage connections thus formed between the parts.

[0010] Depending on the dimensioning and structure

of the transport system very simple solutions can be reached according to the invention. If the extent of the lifting platforms in the directions of width and length of the intermediate space(s) is sufficiently large, the lifting system only requires one main direction of movement. In other words the lifting system functions as an elevator. If the unit to be built is very wide, transfer movements in the horizontal direction are perhaps also needed, but even in this case the lifting system has only two main directions of movement in the direction of the dividing plane defined by the intermediate space(s). Usually it is possible to dimension the transport system and the intermediate space(s) so that transport movements in the direction from one side of the intermediate space to the other side of the intermediate space are not needed or are needed only seldom.

[0011] If a lifting system in which there is at least two lifting platforms at different heights is used in the system according to the invention, the lifting platforms may easily be arranged so that the vertical distance between them corresponds to one or more deck spacings. By using two lifting platforms in this way at the same time for moving the material the capacity of the transfer system may be increased. One lifting platform may be suitable for personnel transport and the other may be simpler and only suitable for material transport. Another way to raise the capacity of the lifting system is to arrange in the intermediate space or in its immediate vicinity auxiliary platforms via which material may be brought independently of the working stages of the transfer system and from which the transfer system can pick up material in connection with a movement to the vicinity of the auxiliary platform.

[0012] The simplest way to achieve a suitable lifting system in the intermediate space is to install in this space a tower crane with at least one lifting platform movable to the height of the different decks. The tower crane may for example be of the type generally used at building sites, perhaps only the dimensioning and form of the lifting platforms being changed to some degree.

[0013] In the method according to the invention a robot crane may also be used in the transfer system, which robot crane has devices for moving material units provided with address markings to desired decks of the structure. Thus the transfer function may be automated at least to some degree so that the movable material is placed in boxes or other transport units with necessary address markings guiding the transport function of the robot.

[0014] The invention is described below in more detail, by way of example only, with reference to the attached drawings, in which

- Figure 1 schematically shows the invention applied to a ship divided in two parts;
- Figure 2 schematically shows the invention applied in a basin hangar typical for shipbuilding; and
- Figure 3 schematically shows the invention applied so that the ship is only partly divided in two.

[0015] In the drawings 1 refers to the hull of the ship which in Figure 1 is divided into a lighter front part 1a and a heavier rear part 1b. Between these parts there is an intermediate space 2 in which a tower crane 3 moves on rails 4. The crane 3 has one or more haulage or lifting platforms 5. As may be seen from Figure 1, the lifting platform 5 may function as a connecting bridge between parts 1a and 1b.

[0016] After the material necessary for furnishing the ship parts 1a and 1b has been taken aboard the ship, the ship may be assembled into a floating unit, for example with the lighter front part 1a, carried by suitable supports (not shown in the figure), being moved into engagement with part 1b, after which parts 1a and 1b are welded together. An alternative way to combine parts 1a and 1b is to mount in the intermediate space 2 a section, which is built to be compatible with parts 1a and 1b and which is brought into the intermediate space either by cranes from above or by a carriage system from the side. For easy success in fitting the section into the intermediate space, the section should be slightly wedge-shaped in its direction of movement. The intermediate space of course also has to have a corresponding wedge-shaped form.

[0017] According to Figure 2 the hull 1 of the ship is built in a building basin 6, which is surrounded by a hangar structure 7. The floor level 8 of the hangar is substantially higher than the bottom of the building basin 6. The hull 1 has a large number of decks 9 and the material needed for furnishing the ship has to be brought to all of these decks. According to the figure the material is delivered by a tower crane which in the figure is shown in two different working positions 3a and 3b. In the crane at working station 3b there is shown, by way of example, how two lifting platforms 5a and 5b may be mounted on the crane, for example so that the upper platform 5a is suitable for personnel transport, whilst the lower platform 5b is a simple platform which may be used only for transport of material. Platform 5b is supported by flexible means, for example by chains 10 from platform 5a, whereby the lower platform does not prevent moving the upper platform near the bottom level of the ship. The distance between the lifting levels 5a and 5b is the same as the distance h between the decks 9. There may also be two tower cranes, preferably arranged so that material can be brought to one of the cranes from one side of the ship and to the other crane from the other side of the ship.

[0018] In the embodiment according to Figure 3 the hull 1 of the ship is only partly divided into two parts so that intermediate spaces 2a and 2b, with a fixed part 1c of the hull between them, are left on either side of the ship. The dimensioning of the intermediate spaces 2a and 2b may be for example about four metres in the lengthwise direction of the ship and six metres in the

transverse direction of the ship. In the figure a tower crane 3 and its lifting platform 5 is shown in one of the intermediate spaces. A similar crane may be mounted in the intermediate space 2b. At the final stage of the furnishing work the cranes are removed and the sections are inserted into the intermediate spaces 2a and 2b from the side or by crane from above so that the hull 1 becomes a complete unit.

[0019] The invention is not limited to the embodiments described, but a number of modifications may be conceived within the ensuing claims.

Claims

1. A building method for a large multideck structure (1), particularly intended for use at sea, such as a passenger ship or the like, said structure being manufactured at a building site, for example in a building berth (6), characterised in that said method comprises

   - forming at least one intermediate space (2, 2a, 2b) in the structure by at least partly dividing the structure in at least two parts (1a, 1b),
   - providing a transport or transfer system for delivering furnishings and equipment to desired decks (9) of the structure (1) through said intermediate space(s) (2, 2a, 2b), and
   - assembling the structure (1) into an integral unit after said deliveries have been substantially completed by combining the at least partly separated parts (1a, 1b).

2. A method according to claim 1, characterised in that the intermediate space(s) (2, 2a, 2b) define(s) a plane perpendicular to the lengthwise direction of the structure (1).

3. A method according to claim 1 or 2, characterised in that dividing the structure (1) into two or more parts (1a, 1b) is carried out so that of two parts that are combined at the end stage one part (1a) is of substantially less weight than the other part (1b).

4. A method according to claim 1, 2 or 3, characterised in that combining two parts (1a, 1b) of the structure separated from each other is carried out by moving the parts into engagement with each other and by fastening the parts (1a, 1b) to each other firmly, for example by welding.

5. A method according to one of the preceding claims, characterised in that completing the intermediate space(s) (2, 2a, 2b) in the structure is done by mounting a section or other similar structure in said intermediate space(s).

6. A method according to one of the preceding claims, characterised in that the transport or transfer system comprises at least one platform (5, 5a, 5b) movable to different heights which preferably moves in the intermediate space (2, 2a, 2b) and which preferably reaches or can be moved close enough to the parts (1a, 1b) at least partly separated from each other so that the platform (5, 5a, 5b) can function as a connection bridge between said parts.

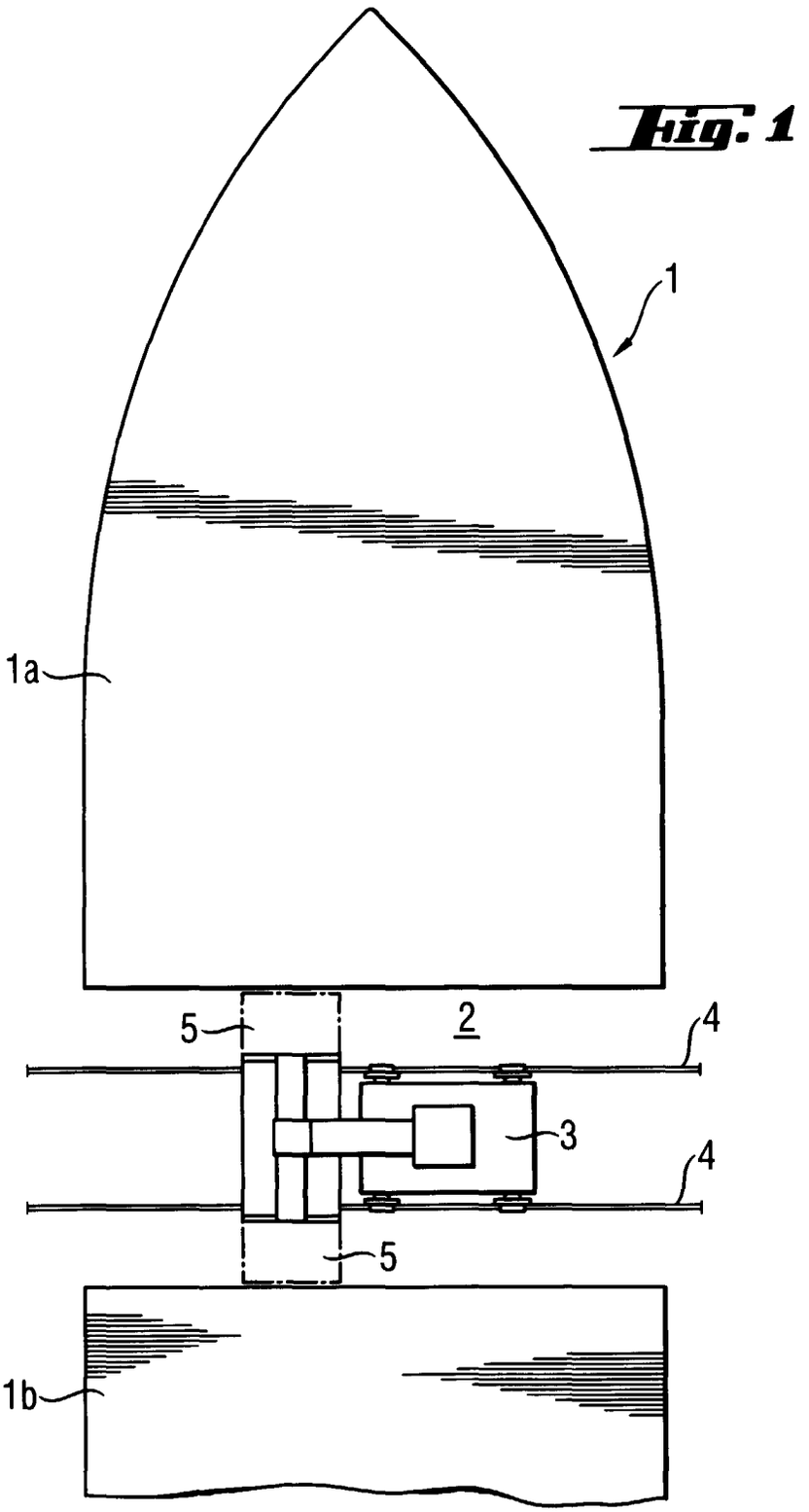
7. A method according to one of the preceding claims, characterised in that the intermediate space(s) (2, 2a, 2b) define(s) a dividing plane of the structure (1) and in that the transport or transfer system comprises a platform system with at the most two main directions of movement, which are in the direction of said dividing plane.

8. A method according to one of the preceding claims, characterised in that the transport or transfer system comprises a platform system with at least two platforms (5a, 5b), the vertical distance between the platforms corresponding to one or more deck spacings.

9. A method according to one of the preceding claims, characterised in that the transport or transfer system at the intermediate space(s) (2, 2a, 2b) comprises a tower crane (3, 3a, 3b) with at least one platform (5, 5a, 5b) which is movable to the height of the different decks (9).

10. A method according to one of the preceding claims, characterised in that the transport or transfer system at the intermediate space(s) (2, 2a, 2b) comprises a robot crane with a system for transferring material units provided with address markings automatically to the desired decks (9) of the structure (1).

Fig. 1



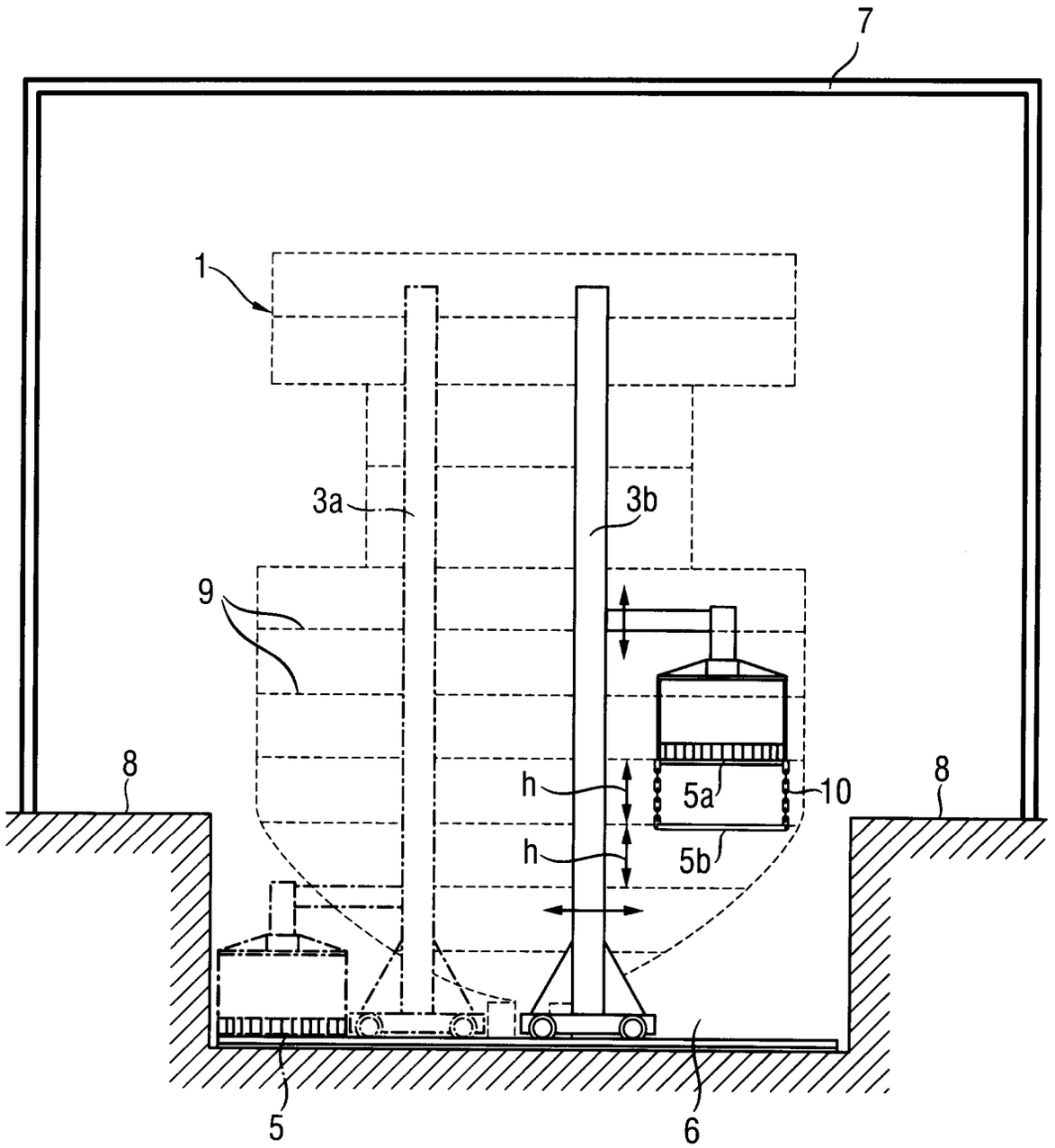


Fig. 2

Fig. 3