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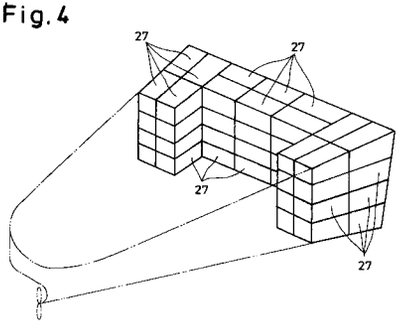
(54) Forming and arranging functional modules.

(57) The equipment (12) to be accommodated in the engine room (21) of a ship is divided in accordance with their function and some or all of the equipment with related functions is accommodated in a frame (11) to form a frame module. A plurality of such frame modules is arranged side by side and one above the other in a space (23,25) in the engine room (21).

Fig. 4



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The present invention relates to a method for forming functional modules and a method of arranging such modules.

Figure 9 is a schematic view of a conventionally fitted out ship's engine room a in which various types of machine or apparatus c are brought into the room a and are arranged on a hull structure b in the room a. Reference character d represents a piping arrangement; and e, a ventilation arrangement or an electric cable arrangement.

The machines or installations c are not necessarily installed in accordance with their particular functions and are arranged in scattered or random manner in the engine room a. As the result, when the components of a main engine lubricating and cooling system are to be operated or maintained or inspected, an operator or inspector must walk about in the engine room a, resulting in inefficient operation or maintenance and inspection.

Moreover, the installations c are arranged two-dimensionally over a relatively extensive area on the hull structure b of the engine room a, resulting in ineffective utilization of the space in the room a.

The conventional outfitting procedure, in which each of the machines or devices c is installed on the hull structure b, will cause various additional problems. Adjustment of detailed schedules for the design and outfitting steps are needed for the hull structure b and machines or installations c. Reinforcement members are required to furnish the installations c on the hull structure b. Designing must be effected with full consideration of the hull structure. Re-designing of the installations c is required if there is any change in the hull since the layout of the installations c depends upon the hull structure.

An object of the present invention is therefore to facilitate the operation and maintenance and inspection of various kinds of equipment, such as outfits, and to enable outfitting to be performed independently of the hull structure, thereby facilitating designing of an engine room or a plant and outfitting and operation of installations or plant elements as well as effectively utilizing the available space.

According to the present invention a method of forming modules is characterised by dividing equipment in accordance with their function and accommodating all or some of the equipment with related functions into a frame thereby forming frame module means. The frame module means will constitute one or more frame modules and these may be stacked or otherwise positioned as desired in an engine room of a ship or a plant.

The equipment may be outfits, that is to say devices, installations and machines with which a ship is fitted out, or plant elements, that is to say elements, devices or machines which form part of an industrial or chemical plant.

The present invention also embraces a method of arranging modules characterised by dividing or classifying equipment according to their function, accommodating all or some of the equipment with related functions in a frame, thereby forming frame module means, and arranging the frame module means in a space which may be within the engine room of a ship.

The frame modules with outfits accommodated therein may be sized to be placed between or in place of hull structure block modules and may be replaceably positioned between or in the hull structure block modules.

The present invention is particularly concerned with the equipment of the engine room of a ship and the invention therefore also embraces a ship having an engine room including a space which accommodates equipment, the equipment being divided or classified by function into a plurality of groups, each group having related functions and being accommodated in a frame or container to constitute a module, the modules being arranged three-dimensionally, that is to say side by side and one above the other, in the said space.

Thus in the present invention a wide variety of equipment can be modularised. One or more such modules may be arranged in a space side by side and/or one above the other in a replaceable manner thereby facilitating maintenance and inspection of the equipment, facilitating design of the engine room and facilitating fitting out and operation of the equipment and ensuring that the space is effectively utilised.

Further features and details of the invention will be apparent from the following description of certain preferred embodiments which is given by way of example with reference to Figures 1 to 8 of the accompanying drawings, in which:-

Figure 1 shows an embodiment of a method of forming modules in accordance with the present invention and is a flow chart showing a procedure for dividing the installations or devices according to their functions which have been classified in accordance with their fluid system;

Figure 2 is a perspective view of a frame module which is provided by accommodating into a frame the installations or devices, which have been divided according to their functions by the procedure shown in Figure 1;

Figure 3 shows a first embodiment of the method of arranging the modules in accordance with the present invention and is a perspective view showing the three-dimensional arrangement of frame modules as shown in Figure 2;

Figure 4 is a perspective view of a second embodiment of the method of arranging the modules in accordance with the present inven-

tion and shows the three-dimensional arrangement of the frame modules in an engine room of a ship;

Figure 5 is a perspective view showing spaces in an engine room of a ship shown in Figure 4;

Figure 6 is a perspective view of a third embodiment of the method of arranging modules in accordance with the present invention;

Figure 7 shows an example of a frame module used in the method of arranging modules shown in Figure 6; and

Figure 8 is a perspective view of a fourth embodiment of the method of arranging modules in accordance with the present invention.

Figures 1 and 2 relate to an embodiment of the method for forming modules according to the present invention as claimed in claims 1,2 and 3.

A "module" as described below is defined as a standard unit for facilitating operation, maintenance and inspection, designing and outfitting and for minimising dead space.

Figure 1 is a flow chart showing the procedure for dividing the installations or units into modules according to their function, the Roman numerals indicating the conventional classification according to the fluid system. I represents a first fluid system (e.g. cooling fresh water system); II, a second fluid system (e.g. lubricant system); and III, a third fluid system (.e.g. cooling seawater system). There are many other fluid systems but these are not shown in the figure.

Each fluid system I,II,III contains various types of equipment, such as outfits or plant elements, with different functions (uses and equipments). The equipment or units in each of the fluid systems I,II,III etc are divided or classified according to their functions A,B,C, etc. Thus, equipment having common functions are grouped from the fluid systems I,II,III etc into A function module 1 (e.g. main engine lubricating and cooling module), B function module 2 (e.g. stern tube lubricating module), C function module 3 (.e.g. steam generation module) etc.

The equipment is divided into A,B,C etc function modules 1,2,3, etc and the equipment with related functions is accommodated in a standard frame with a predetermined size, say, about the size of 20 ft/40 ft container and a frame module is made up. If the units can be accommodated in a standard frame only by dividing them into A,B,C,...function modules 1,2,3,... there is no need to subdivide these function modules, but in the case of a ship, they can scarcely be accommodated into the standard frames even when they are divided into main engine lubricating and cooling module, stern tube lubricating module and steam generation module.

For this reason, each of the function modules 1,2,3, etc may be further subdivided by function. A function module may be subdivided into A_1 function module (e.g. cooling fresh water system) 1-1, A_2 function module (e.g. cylinder oil system) 1-2, and so on. Similarly, B function module 2 may be subdivided into B_1 function module 2-1, B_2 function module 2-2, and so on and C function module 3, into C_1 function module 3-1, C_2 function module 3-2, etc.

If necessary, the A_1, A_2,...function modules 1-1, 1-2,...the B_1, B_2,...function modules 2-1, 2-2,...and the C_1, C_2,...function modules 3-1, 3-2,...may be further subdivided. For example, the A_1 function module 1-1 may be subdivided into A_1-1 function module (e.g., tank module) 1-1-1, A_1-2 function module (e.g. pump module) 1-1-2; the A_2 function module 1-2, into A_2-1 function module 1-2-1 and A_2-2 function module 1-2-2 and so on.

The equipment of each function module as described above are accommodated in the standard frame of, for example, 20 ft/40 ft. The combination of the modules varies according to the volumes of the A_1-1 function module 1-1-1, the A_1-2 function module 1-1-2, the A_2-1 function module 1-2-1, the A_2-2 function module 1-2-2 etc. For example, as shown by the chain dotted line X in Figure 1, the A_1-1 and A_1-2 function modules 1-1-1 and 1-1-2 may be accommodated as a module into a frame to form a frame module, and as shown by the chain dotted line Y in Figure 1, the A_2-2 function module 1-2-2 may be accommodated in a frame by itself to form a frame module.

Figure 2 shows a frame module 13 in which the units 12, classified according to their functions by the procedure of Figure 1, are accommodated in a standard frame 11, such as a container. Such a frame module may be lifted as a unit and a plurality of frame modules 13 are prepared and are accommodated three-dimensionally in a space.

Figure 3 shows a first embodiment of the method of arrangement of modules in accordance with the present invention as claimed in claims 4 to 6 and 8. In this embodiment, the frame modules 13 of Figure 2 are three-dimensionally arranged in a space 14, such as an engine room as shown in the perspective view. The three-dimensional arrangement of the frame modules 13 is determined by giving full consideration to operational requirements and convenience in maintenance and inspection of the equipment.

As described above, in the embodiment of the present invention, the various devices and units are divided according to their functions (uses and equipments) and the divided devices and units are accommodated in frames as modules to form frame modules. The frame modules thus made up are three-dimensionally arranged in a predetermined space, having particular regard to function.

This will enhance operation of the equipment, facilitate maintenance and inspection and result in effective utilisation of the space. When the performance or functional characteristics of the equipment are to be changed, this is accomplished by replacing the frame modules 13.

Figures 4 and 5 show a second embodiment 2 of the method of arranging modules in accordance with the present invention as claimed in claims 4,5 and 8.

In Figure 5, reference numeral 21 represents the engine room of a ship 22; 23, a space aft of a transverse bulkhead 24 in the front portion of the engine room 21; and 25, spaces inside shell plates 26 near the bulkhead 24.

The frame modules are arranged three-dimensionally in the spaces 23 and 25 and are formed similarly to the frame modules of Figure 3 in the first embodiment. More specifically, the outfits having the same functions (uses and equipments) are accommodated in a frame so that frame modules 27 as shown in Figure 4 are formed.

Such frame modules 27 are arranged three-dimensionally in the spaces 23 and 25 in the engine room 21 of Figure 5. The three-dimensional arrangement of the frame modules 27 is as shown in Figure 4. By three-dimensionally arranging the frame modules 27 in the vertical and horizontal directions, the outfits can be freely arranged regardless of the hull structure and the spaces 23 and 25 in the engine room 21 can be effectively utilised.

In the case of a small ship, the available spaces 23 and 25 are behind transverse bulkhead 24 and part of the internal spaces inside the shell plates 26, as shown in Figure 5, while in the case of a large ship, spaces 28 behind the spaces 25 can be utilised for the three-dimensional arrangement of the frame modules, as shown in Figure 5.

As shown in Figures 6 and 7, the outfits or devices 34 necessary for the engine room 31 are grouped according to their functions (uses and equipments) and are accommodated in frames 32, such as containers, and are utilised into frame modules 33. The frame module or modules 33 are then arranged as a single unit or as two or more units at required point or points in the engine room 31 to complete the outfitting thereof.

More specifically, some outfits 34 with related functions (uses and equipments) necessary for the engine room 31 are accommodated in the frame 32, such as a 20 ft/40 ft general-purpose container. Lifting means 35, passage means 36, ventilation means 37, lighting means 38, piping means 39, etc. are also accommodated in the frame 32, thus providing the frame module 33 with the grouped outfits 34. The frame modules 33 for the grouped outfits 34 are arranged in predetermined outfit sections 40 to 49, thus completing the outfitting of the engine room 31. In Figure 6, reference numeral 40 represents a propulsion section; 41, a bilge processing section; 42, an oil tank section; 43, an oil processing section; 44, a lubricant section; 45, a steam generation section; 46, a fresh water section; 47, an option space; 48, a seawater section; and 49, an elevator section. In the frame modules 33, therefore, the outfits 34 related to each of the outfit sections 40 to 49 are accommodated in the respective frames 32.

As described above, the outfitting of the engine room 31 is completed by the use of the frame modules 33 with the outfits 34 of related functions necessary for the engine room 31 being accommodated in the frames 32, such as containers. This will eliminate the work of installing the outfits on the hull structure using reinforcement members as in the prior art and eliminate the necessity of adjusting the details of the design and outfitting schedule thus facilitating the handling of the outfits. Since the fitting out can be performed independently of the hull structure by the use of the above frame modules 33, it may be performed in a place other than a module factory or a shore-based fitting out station of a shipyard. Owing to modularisation of the related outfits 34, the design of the fitting out may be effected using the frame 32 as origin coordinates, thereby enhacing the applicability to other ships. This contributes to the improvement of basic, functional and production design as well as the fitting out process.

In Figure 8, reference numeral 51 represents a hull structure module which comprises hull deck modules 52 and hull structure block modules (skeleton structure modules) 53.

Outfits 56 having related functions (uses and equipments) are accommodated in the frames 54 which are sized to be placeable between or in place of the hull structure block modules 53, thus forming the frame modules 55. The frame modules 55 are placed replaceably between or in place of the hull structure block modules 53, as shown by the arrow 57 or 58.

The hull structure module 51 is thus subdivided into hull deck modules 52 and hull structure block modules 53 which are fabricated separately. The replaceability of the hull structure block modules 53 will expand the engineering range and enhance the applicability to other ships. Subdivision of the hull structure module 51 in fabrication will shorten the time required for fabrication of the modules 51. Outfits 56 having related functions are accommodated in a frame 54 with a predetermined volume to make up a frame module 55 which is then placed replaceably between or in place of the hull structure block modules 53. The replaceable arrangement of the frame modules 55 will widen

the engineering range and increase the applicability to other ships.

This facilitates designing of a ship's engine room and fitting out.

As described above, the method for forming modules in accordance with the present invention as claimed in claims 1,2 and 3 has the advantageous effects of improving handling of equipment, such as outfits, and facilitating maintenance and inspection.

The method of arranging modules in accordance with the present invention as claimed in claims 4 to 9 has the advantageous effects of

I. improving handling of the outfits and facilitating maintenance and inspection; and

II. being capable of freely fitting the outfits regardless of the hull structure.

III. In the case where the method is used for fitting out a ship, it has the advantages that

(i) the fitting out can be performed independently of the hull structure;

(ii) the design can be effected with the frame being used as the origin coordinate and the applicability of the outfits to other ships can be increased;

(iii) that handling is facilitated and fitting out can be performed at a place other than a module factory or a shore-based fitting out station in a shipyard; and

(iv) the designing, fitting out method and operational efficiency in the engine room are improved and the production engineering is facilitated.

The method of arranging modules in accordance with the present invention as claimed in claim 8 has the advantage of effective utilisation of the space in addition to the effects I to III as described above with reference to claims 4 to 9.

Claims

1. A method of forming modules characterised by dividing equipment (12) in accordance with their functions and accommodating all or some of the equipment (12) with related functions in a frame (11), thereby forming frame module means (13).

2. A method as claimed in claim 1 characterised in that the equipment is outfits.

3. A method as claimed in claim 1 characterised in that the equipment is plant elements.

4. A method of arranging modules characterised by dividing equipment (12) according to their function, accommodating all or some of the equipment (12) with related functions in a frame (11), thereby forming frame module means (13), and arranging the frame module means (13) in a space (14;23,25).

5. A method as claimed in claim 4 characterised in that the equipment (12) is outfits and the space (14;23,25) is a space in an engine room (21).

6. A method as claimed in claim 4 characterised in that the equipment (12) is plant elements.

7. A method as claimed in any one of claims 4 to 6 characterised in that the frame module means is a single frame module (13) arranged in the space.

8. A method as claimed in any one of claims 4 to 6 characterised in that the frame module means is a plurality of frame modules (13) arranged three-dimensionally in the space.

9. A method of arranging modules characterised by subdividing a hull structure module (51) into hull deck modules (52) and hull structure block modules (53) which are fabricated separately, accommodating outfits (56) having related functions in frames (54) of a size placeable in or between the hull structure block modules (53), thus forming frame module means (55), and replaceably placing said frame module means (55) in or between the hull structure block modules (53).

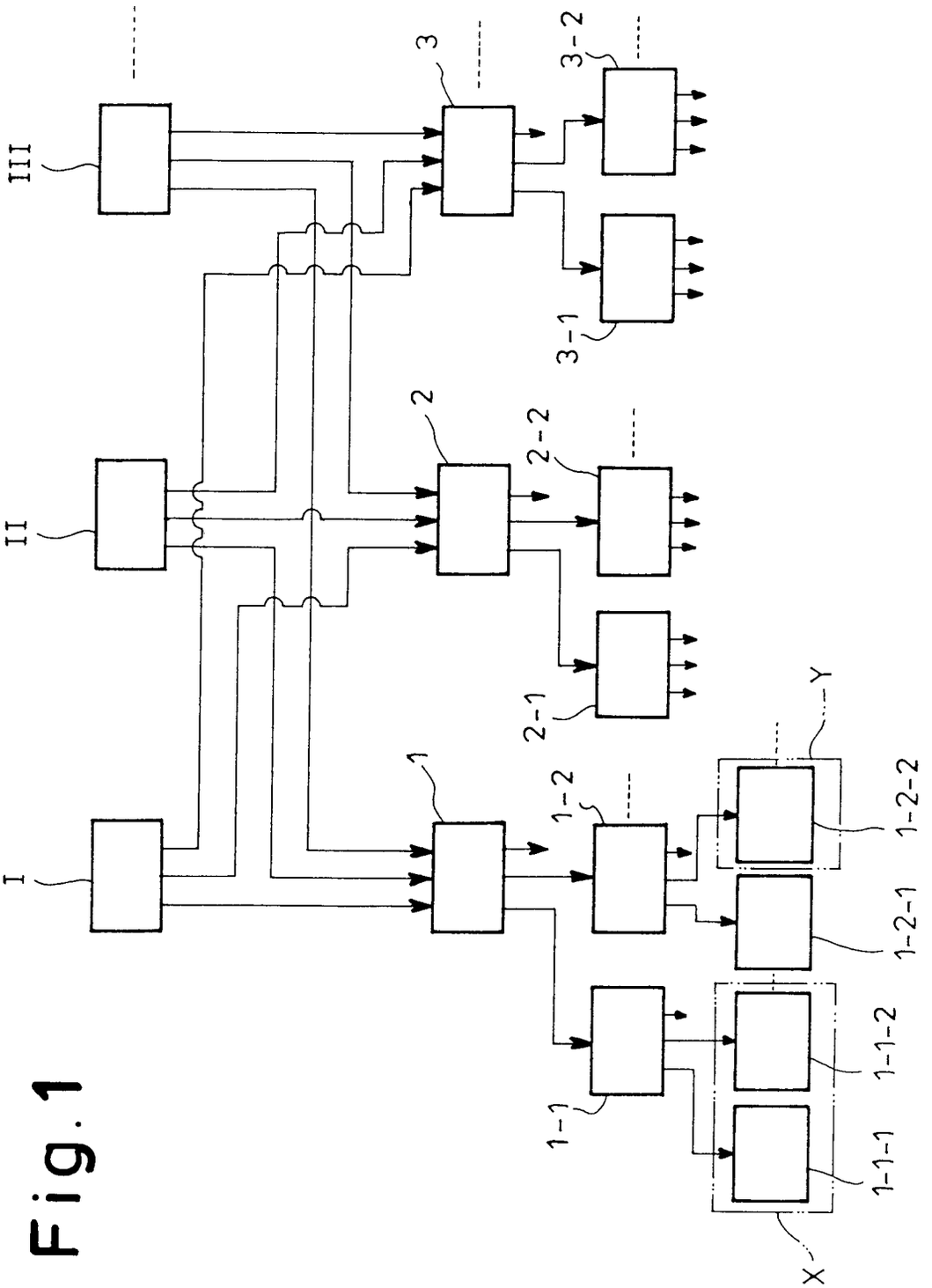


Fig.1

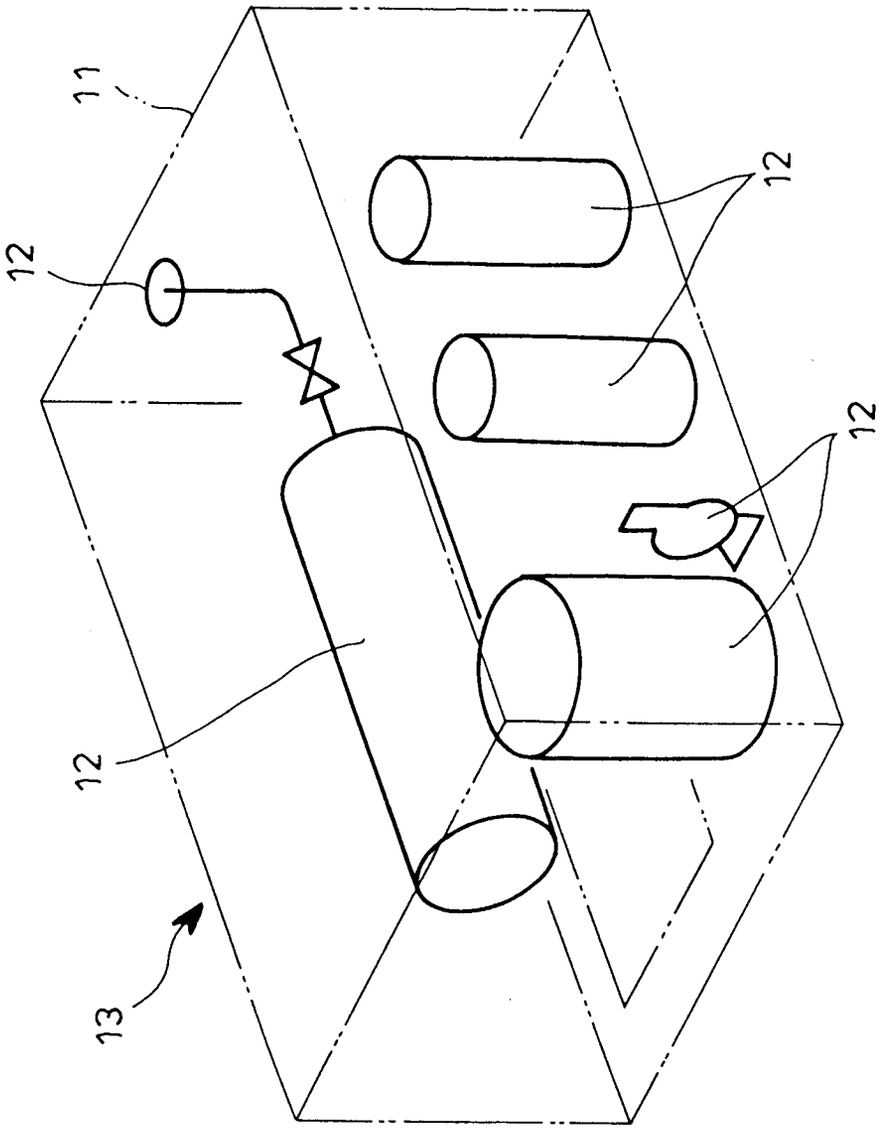
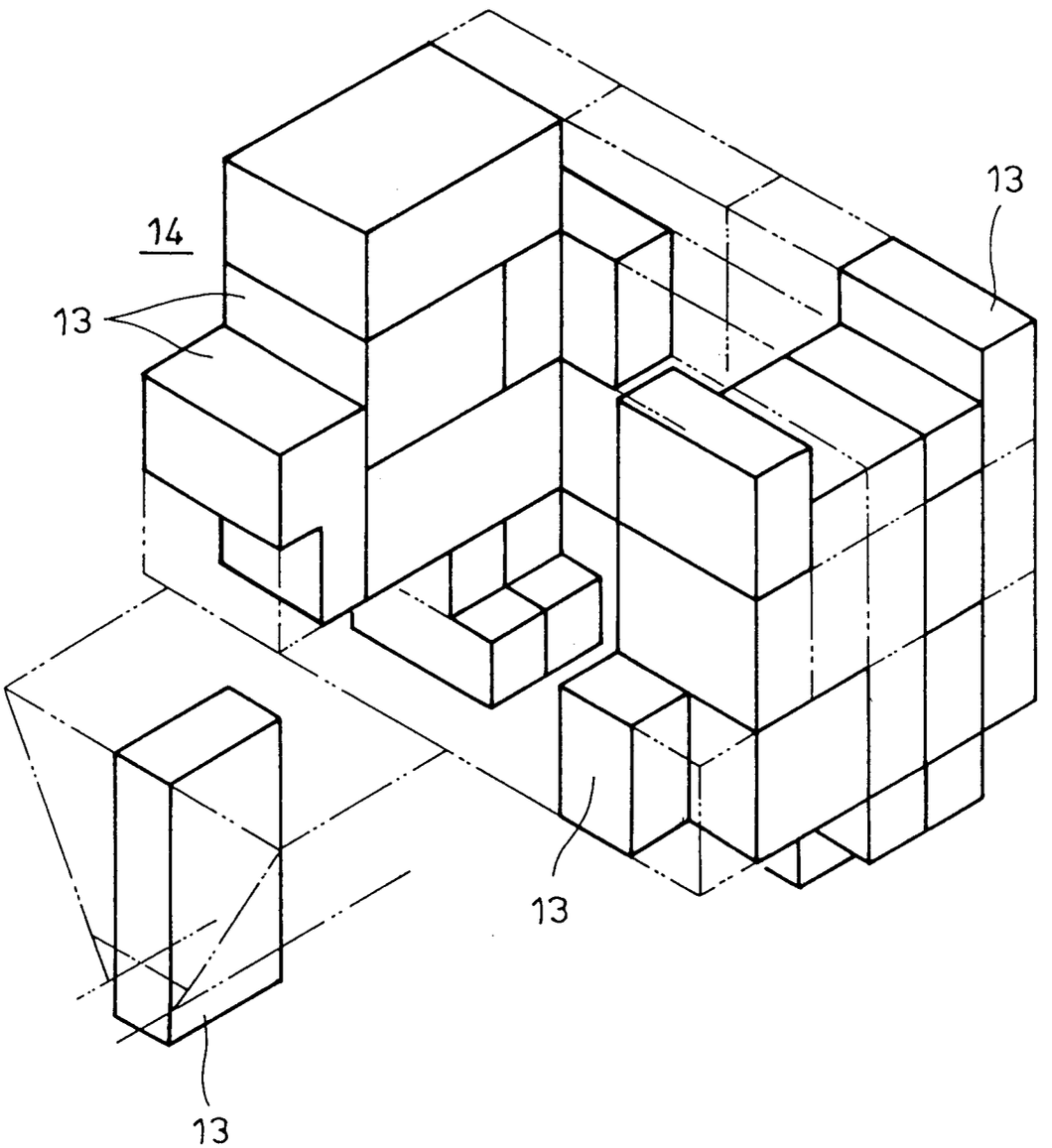


Fig.2

Fig.3



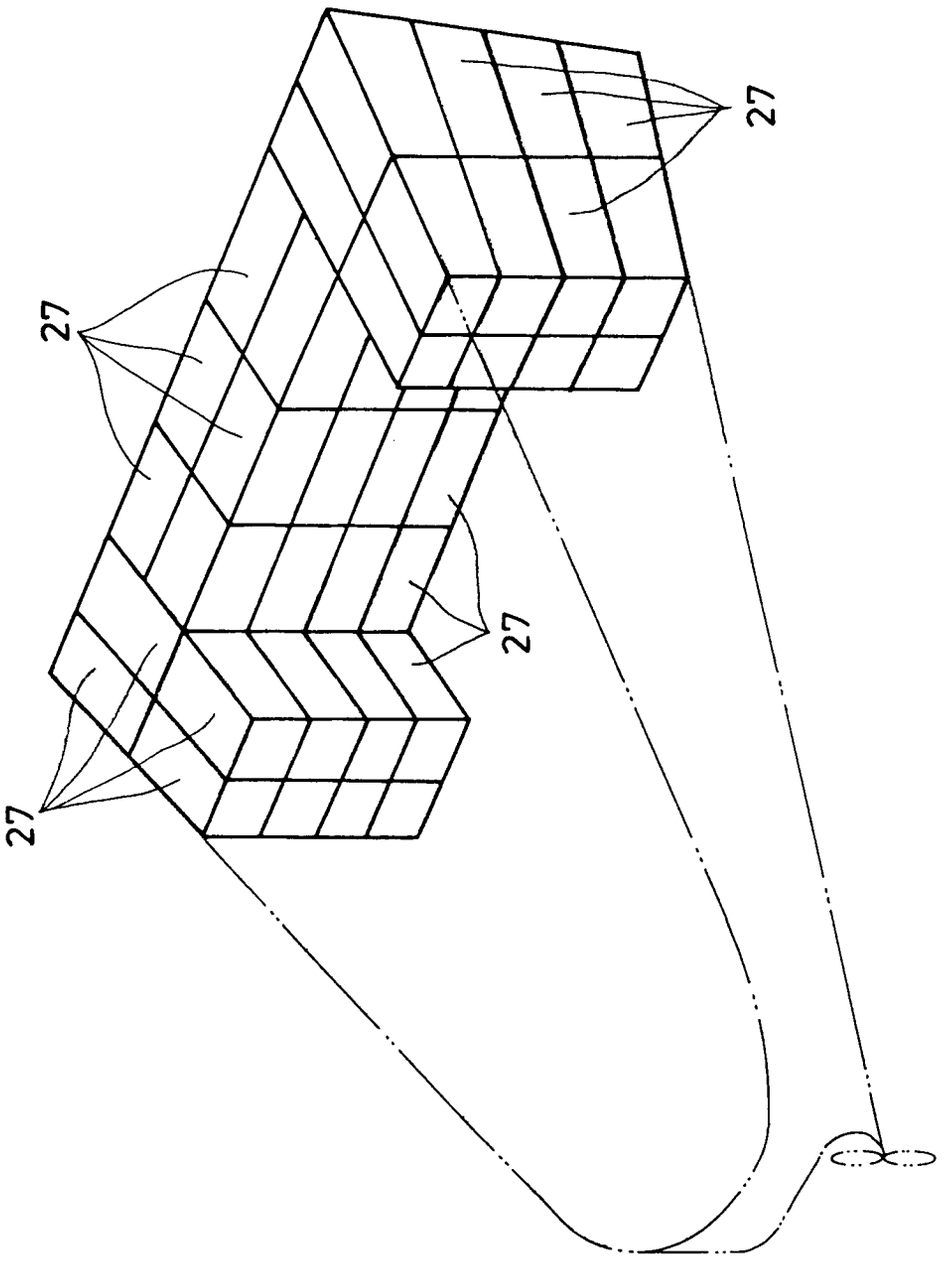


Fig. 4

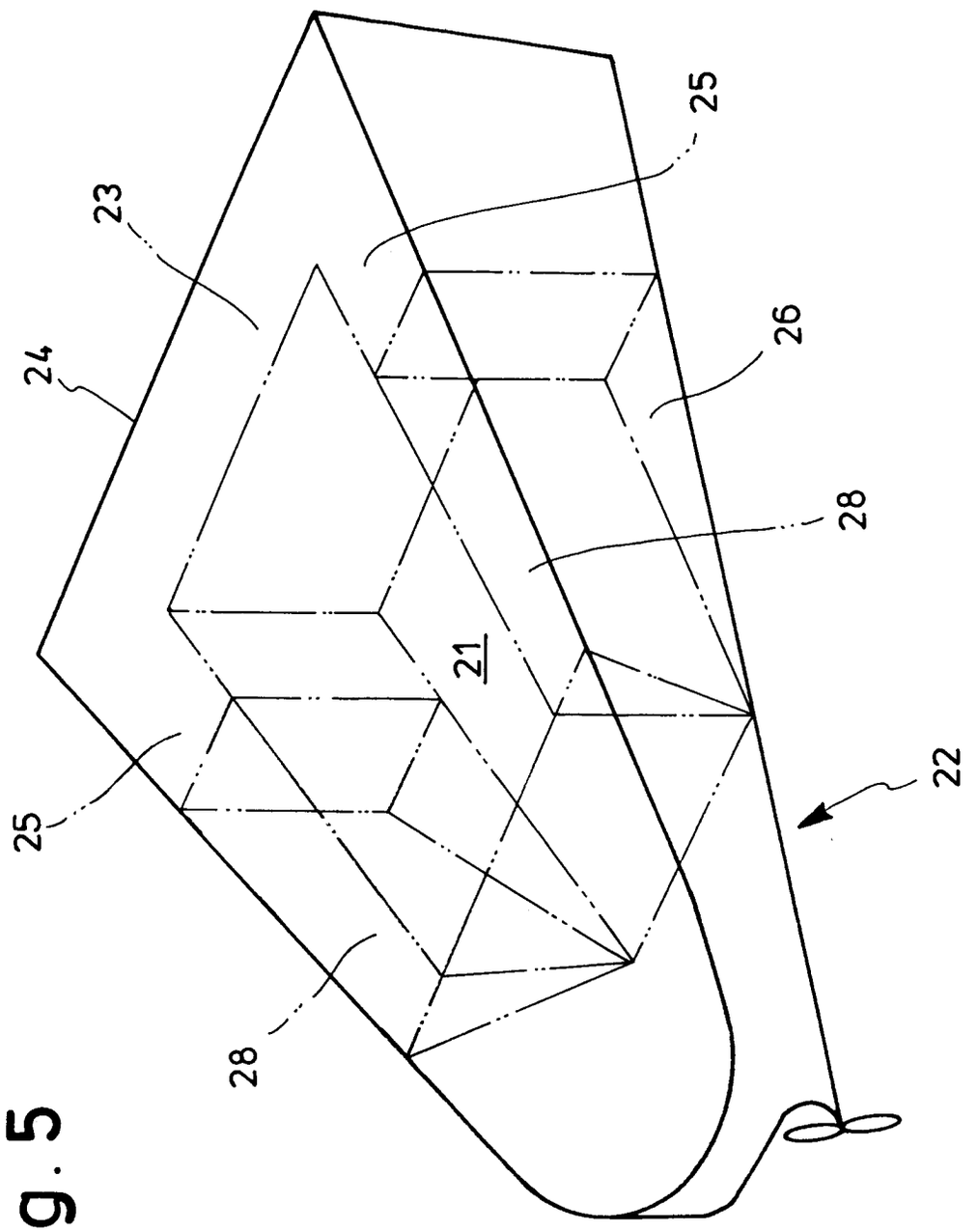


Fig. 5

Fig.6

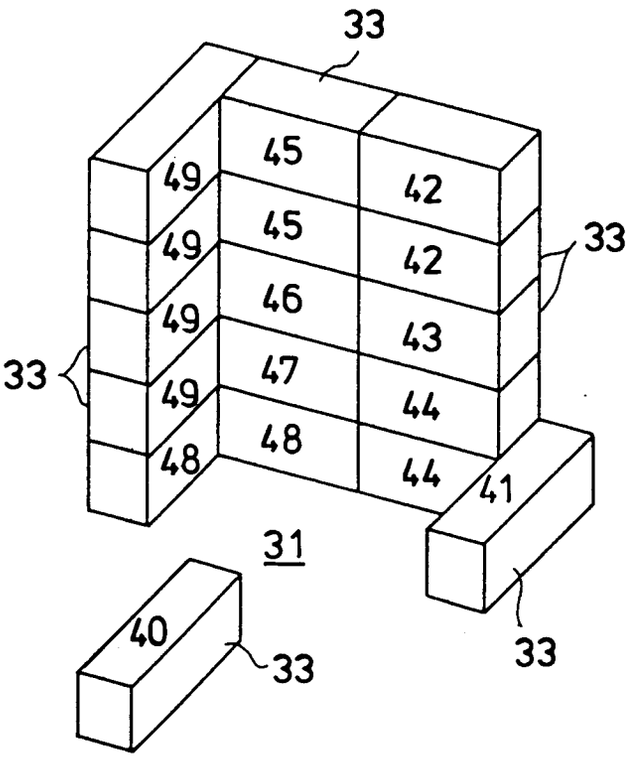

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Fig.7

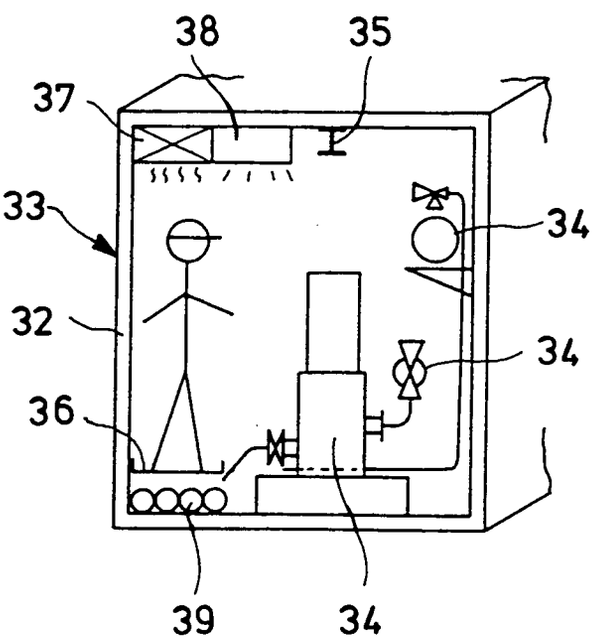
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Fig. 8

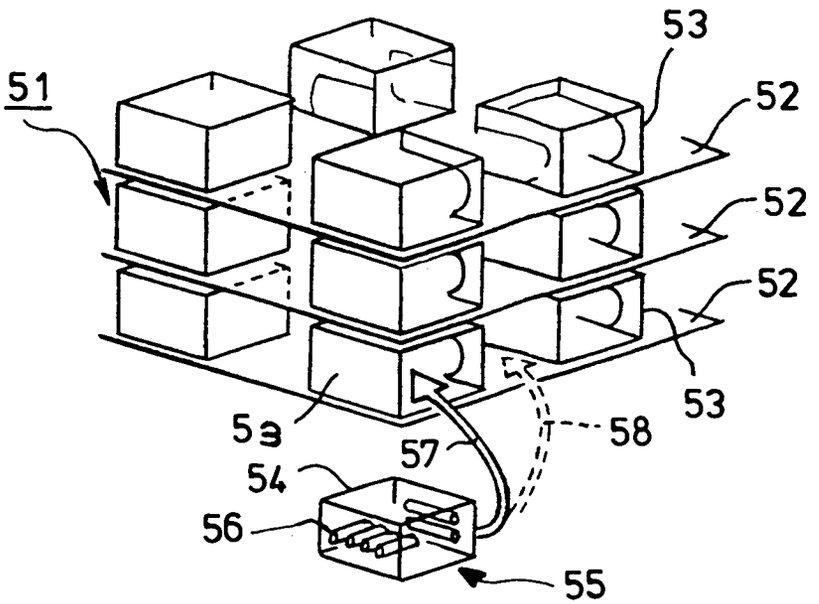
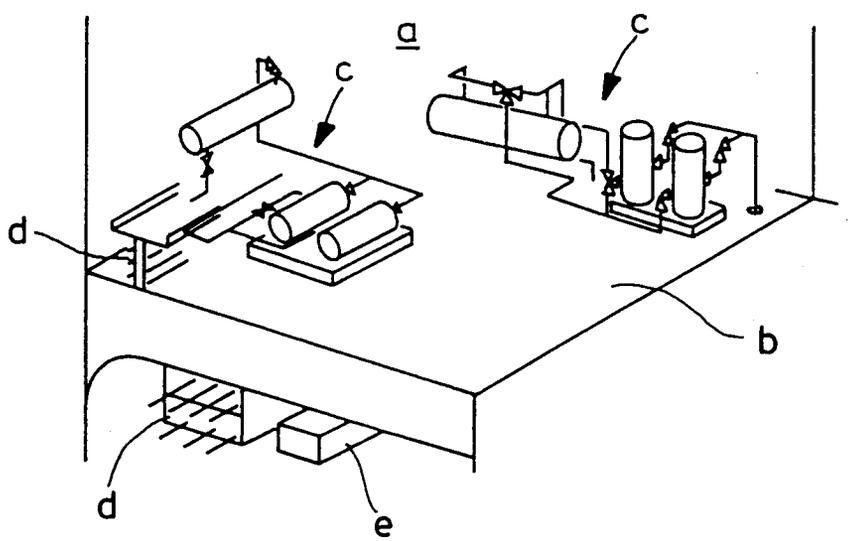


Fig. 9



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EUROPEAN SEARCH REPORT

Application Number

EP 91 30 6473

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
X	NAVAL ENGINEERS JOURNAL vol. 83, no. 5, October 1971, WASHINGTON pages 45 - 52; & GREENE: 'A PHILOSOPHY OF NAVAL SHIP DESIGN AND CONSTRUCTION' * the whole document * *	1-9	B 63 B 3/06
X	US-A-3 363 597 (ZEIEN) * column 7, line 38 - line 50; figures 1,2 * *	1-9	
X	FR-A-1 483 757 (PLASTISCHE PLANUNG) * the whole document * *	1-9	

TECHNICAL FIELDS SEARCHED (Int. Cl.5)

B 63 B
B 63 H

The present search report has been drawn up for all claims

Place of search	Date of completion of search	Examiner
The Hague	19 November 91	DE SENA Y HERNANDORE

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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