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(54) A SEA FASTENING SUPPORT FOR SECURING CARGO, IN PARTICULAR A LARGE STRUCTURE, ON A DECK OF A SEA-GOING VESSEL

(57) The present invention concerns a sea fastening support and a method for securing cargo, in particular a large heavy structure, on a deck of a sea-going vessel, said support comprising a rectangular base adapted to be placed on the deck of the vessel, and a load bearing structure on said base, wherein the load bearing structure comprises an upper flange provided parallel to the base, and which is smaller than the base, and four peripheral side flanges extending between said upper flange and the rectangular base, the side flanges comprising upper and lower side portions, wherein at least the upper side portions are inclined; and wherein the upper flange is provided with at least one top plate component, which is detachably mounted for receiving and supporting at least a portion of the large structure by fastening the large structure to the top plate component.

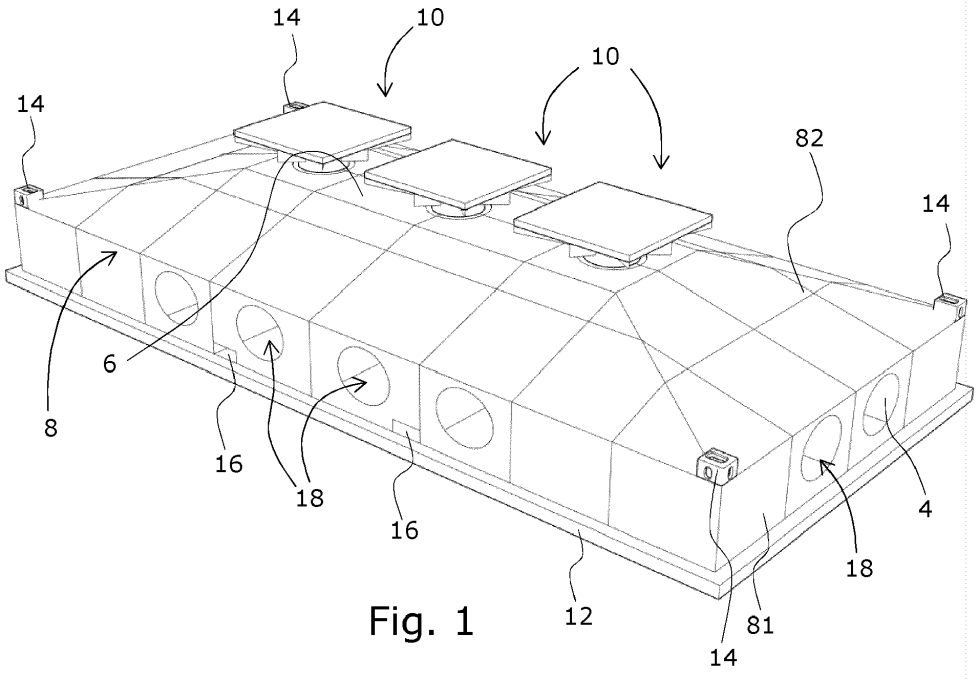

Fig. 1

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Description

FIELD OF THE INVENTION

[0001] The present invention relates to a sea fastening support for securing cargo, in particular a large structure, on a deck of a sea-going vessel, said support comprising a rectangular base adapted to be placed on the deck of the vessel, and a load bearing structure on said base,

BACKGROUND OF THE INVENTION

[0002] The deck of a ship is used to transport many different types of cargo - from containers to large structures, such as cranes or heavy modules of an offshore production plant. When such large structures are transported on a floating vessel or used offshore on a vessel, it must be secured against movements on the deck. This is to prevent the large structure from moving relative to the deck and thereby possibly damaging other equipment, the vessel or human beings.

[0003] The usual way of securing such a large and heavy structure on a deck of a vessel is by welding the structure to the deck using steel plates, which hold the structure, to steel beams which in turn are secured in a corresponding manner by means of a weld to the deck of the vessel. This method is time-consuming and expensive. Often the steel plates and steel beams that are used for the sea fastening of the structure to the deck are scrapped after the transport operation is finished. The adaptations of plates and beams are adapted in situ on deck when positioning the large structure on the deck in preparation for the transport operation. The method of today requires a long planning time and, in addition, is not flexible in relation to any need for changes that might arise.

[0004] In the prior art some sea fastening structures are known, which is capable of being re-used.

[0005] From WO 2020/035803 A1 there is known a portable and re-useable grillage for receiving and supporting the legs of an offshore structure during transportation.

[0006] The grillage is container-sized such that the combination of the base, load bearing structure and the framework forming the grillage has external dimensions and weight that conforms to ISO specifications for an intermodal container. The grillage provides for a load distribution of the concentrated loads of the heavy structure, such as offshore substructures, so that the bearing capacity of the support structure, i.e. the deck of the vessel, is lower than the concentrated heavy loads of the structure.

[0007] Although this grillage is designed to be reusable, it is designed for supporting a specific kind of heavy structure and can therefore only be used for transport operations of the same or similar structures.

[0008] In WO 2017/131529 A1 there is disclosed an apparatus for use in securing an object to a base, such as a deck on a floating vessel, where a supporting frame is made by means of the apparatus.

[0009] In order to ensure that the bearing capacity of the deck of a vessel is not exceeded, a large and heavy structure must be carefully positioned to avoid high-stress concentrations on the deck and so that the heavy load is distributed on the deck.

[0010] In view of the above, it is an object of the present invention to provide an improved re-usable sea fastening structure which is cost-effective and versatile in use.

SUMMARY OF THE INVENTION

[0011] This object is achieved by a sea fastening support of the initially mentioned kind, wherein the load bearing structure comprises an upper flange provided parallel to the base, and which is smaller than the base, and four peripheral side flanges extending between said upper flange and the rectangular base, the side flanges comprising upper and lower side portions, wherein at least the upper side portions are inclined; and wherein the upper flange is provided with at least one top plate component, which is detachably mounted for receiving and supporting at least a portion of the large structure by fastening the large structure to the top plate component.

[0012] Hereby, a multi-purpose sea fastening support is provided to which a heavy load can be welded or otherwise secured to the top plate or plates. The at least one top plate received the load of the cargo and the cargo can be secured by welding or other means of fixation to the top plate(s). The load of the cargo is then transferred via the load bearing structure onto the base plate. Due to the upper flange, wherein the top plate is provided, being smaller than the base, the load bearing structure will transfer and distribute the load to a larger area and thereby reduce the load on the deck.

[0013] By the invention there is provided a multi-purpose sea fastening support which by its versatility reduces he production time for sea fastening of heavy structures.

[0014] Preferably, the load bearing structure of the sea fastening support is an internal structure provided between the upper flange, the side flanges and the base. This is designed such that the load on the top plate(s) is substantially evenly distributed on the base. In particular, the internal structure preferably comprises a plurality of vertically extending flanges such that concentrated forces on the top flange from the heavy cargo can be distributed evenly onto the base. This ensures a stiff structure and a good flow of forces through the support structure.

[0015] In an advantageous embodiment, the top plate component is adjustable in height. Hereby, the cargo support surface can be adjusted to compensate for foundation tolerances or uneven surfaces on the cargo structure.

[0016] In the currently preferred embodiment, the top plate component is comprised of a top plate and a mounting leg, which is inserted into a receiving recess in the

upper flange. This is a simple design, which is inexpensive to manufacture and which can easily be changed if needed. The top plate is relatively easy and inexpensive to exchange and it is further found advantageous by the invention that the top plate can be sacrificial. Hereby, the cargo can be welded onto the top plate, shear stoppers can be welded to a top plate supporting an edge of a large structure. Further, holes can be drilled to anchor a cargo by chains or the like.

[0017] Thus, as it is apparent for these examples, the sea fastening support with this top plate component design provides for versatility in its use.

[0018] In a particularly preferred embodiment, a plurality of top plate components are provided, preferably three top plate components in a linear configuration.

[0019] In a preferred embodiment, a rubber mat is provided underneath the base. This compensates for deck tolerances and ensures an even pressure on the deck.

[0020] In a particularly preferred embodiment, the rectangular base is provided with dimensions of a standard container, such as a 20-foot or 40-foot container size. Furthermore, the sea fastening support is preferably provided with lifting sockets at each corner for lifting the support. This is advantageous as the sea fastening supports hereby can be handled using standardised equipment available in the harbours.

[0021] Preferably, the sea fastening support according to the invention is also provided with slices for truck transportation on at least one of the lower portions of the side flanges. This allows for truck transportation and the support can be handled by a forklift truck.

[0022] According to a second aspect of the invention, a plurality of sea fastening supports may advantageously be arranged in an array on the deck in a predetermined configuration adapted for supporting a specific large structure. The sea fastening support or support spud according to the invention is reusable as well as versatile as it can be used for different kinds of heavy structures that needs to be supported and fastened to the deck of a sea-going vessel for transport. It is particularly advantageous that a multiple of sea fastening supports may be used to distribute the load of very heavy structures, such as furnace modules or the like.

[0023] According to a third aspect of the invention there is provided a method for securing cargo, in particular a large heavy structure, on a deck of a sea-going vessel, which includes the steps of providing a plurality of sea fastening supports of the kind of the first aspect, in a predetermined pattern on the deck of a sea-going vessel, wherein this predetermined pattern is determined by the cargo; positioning the cargo on the deck by resting the cargo on the sea fastening supports; and securing said cargo to the sea fastening supports.

[0024] In an advantageous embodiment, the sea fastening supports are laid out on the deck in lines and so that the step of positioning the cargo on the deck comprises moving the cargo onto the deck by one or more SPMTs (SPMT: Self-propelled Modular Transporter). The predetermined pattern of supports allow for a SPMT to roll the cargo on and off the deck.

[0025] In one embodiment of the method according to the invention, the step of securing includes welding shear stoppers to the top plate components of the peripheral group of sea fastening supports supporting the boundary edges of the cargo. The cargo may also be welded directly onto the top plate or a combination of direct welding fixations and shear stoppers as well as potentially other means of fixations may be used.

DETAILED DESCRIPTION

[0026] In the following, the invention is described in more detail with reference to the accompanying figures, in which:

Figures 1 and 2 are perspective views of a sea fastening support according to an embodiment of the invention;
Figure 3 is an exploded perspective view of same;
Figure 4 is detailed perspective view of the top section of the sea fastening support according to the invention;
Figures 5 and 6 show perspective view showing the inner structure of the sea fastening support according to the invention;
Figure 7 shows an example of a predetermined configuration of sea fastening supports according to the invention;
Figure 8 shows an example of predetermined configuration of a plurality of sea fastening supports according to the invention on the deck of a sea-going vessel;
Figures 9 and 10 show a heavy cargo structure being transported onto the deck of a sea-going vessel with an array of sea fastening supports in the predetermined configuration of fig. 8; and
Figures 11-14 are illustrations of the heavy cargo structure being positioned on the sea fastening supports on the deck of the sea-going vessel, and
Figure 15 shows detailed view of the heavy cargo structure supported by a plurality of sea fastening supports according to the invention.

[0027] With reference to figures 1 to 6, an embodiment of a sea fastening support according to the invention is shown, which can be positioned on the deck of a sea-going vessel and to which cargo, in particular a large heavy structure, can be secured. The sea fastening support comprises a rectangular base 2 (see in particular fig. 5), an internal load bearing structure 4 on said base 2. The load bearing structure 4 is enclosed by an upper flange 6 and side flanges 8 that in the present embodiment includes vertical lower side flange portions 81 and inclined upper side flange portions 82 extending from the rectangular upper flange 6 to the top of the vertical side flange portions 81.

[0028] The upper flange 6, which is smaller than the rectangular base 2, is resting on the inner load bearing structure 4. The upper flange 6 is provided with three top plate components 10 in a linear configuration. These top plates 10 are adapted to receive and support a cargo load (see fig. 9) which then transfers the forces of the load through the inner structure 4 and distributes the load substantially evenly to the base 2. This also reduces the load pressure on the deck as the cargo load is distributed over a larger area. Hereby, the critical maximum deck pressure, which for a cargo vessel is typically 20 tons per square meter, is not exceeded even with very large and heavy structures as such structures can be supported by as many as required of the sea fastening supports according to the invention.

[0029] The sea fastening support is preferably placed on a rubber mat 12 so that any unevenness on the deck of the sea-going vessel is absorbed.

[0030] The rectangular base 2, and thereby the footprint of the sea fastening support according to the invention, may in some preferred embodiments be dimensioned in accordance with one of the ISO standard intermodal container sizes, for [instance 3200x6900 mm]$_{[CE1]}$. In the upper corners of the side flanges 8, container sockets 14 are provided for lifting the sea fastening support with. Furthermore, there are provided slider openings 16 on the lowermost portion 81 of the side flanges 8. These features allows for lifting and handling the sea fastening supports by already available equipment at the cargo handling sites, such as container cranes at container terminals, or forklifts, reach stackers, straddle carriers or cranes outside of container terminals.

[0031] As apparent from the figures, in the upper flange 6 there are accommodated three top plate components 10 each comprising a top plate 101 and a mounting leg 102, which is inserted into an associated receiving recess 61 in the upper flange 6. This recess 61 is - as shown in figs. 5 and 6, where the sea fastening support is shown with the upper flange 6 removed - provided as a tubular piece welded into the internal load bearing structure 4. In the tubular recess 61 the mounting leg 102 of a top plate component 10 is received and the mounting leg 102 can be secured to the recess 61, e.g. by welding. When securing the mounting leg 102, the height of the top plate 101 can be adjusted so that any unevenness in the surface(s) of the cargo to be supported can be accommodated for.

[0032] The top plate 101 of the top plate component 10 is welded onto the mounting legs 102 and supported by radially arranged support flanges 103 (see fig. 4) on the underside of the top plate 101. The top plate 101 can be used to secure the cargo, which can be welded to the top plate 101 or otherwise secured, for instance by drilling holes in the top plate and securing the cargo by bolting it to the top plate or by strapping the cargo down using straps or chains. The top plate 101 can relatively easily be cut free from the leg structure 102, 103 and replaced.

[0033] In the vertical side portions 81 there are provided openings 18 in order to save weight whilst ensuring that the load distribution is achieved by the internal structure 4 as well as the outer skin, i.e. the vertical lower side flanges 81 and the sloping upper side portions 82. In figures 5 and 6, the load bearing structure 4 is shown in more detail. As it is apparent in figs. 5 and 6, the load bearing internal structure 4 comprises a grid of upright transverse flanges 41 and longitudinal upright flanges 42. In the central sections of the longitudinal flanges 42 openings 43 are provided to divert the force flow from the upper flange 6 to the base 2. The sloping upper portions of the side flanges 82 are provided as four sheet panels, preferably sloping at an angle of 20° relative to the horizontally positioned upper flange 6. The upper flange 6 is provided at a height of e.g. 1000 mm above the base in a congruent orientation with both a transverse and a longitudinal symmetry line. This ensures an even force flow through the structure from the top plates receiving the cargo load through the upper flange, the side flanges and the internal load bearing structure 4 to the base 2.

[0034] The upright transverse flanges 41 and the longitudinal upright flanges 42 of internal load bearing structure 4 extend from one side to the other side, and from one end to the other end, respectively, forming a grid of cubes inside the structure. In the upright flanges 41, 42 holes 43 may be provided, just as holes 18 may be provided on the vertical portions of the side flanges 81. The number of and the positions of these holes 43 and openings 18 ensures that the load force is evenly distributed onto the base 2 and thereby onto the deck 30 underneath.

[0035] In an embodiment of the invention, the sea fastening support - also called a support spud - is made with a base footprint of 3200 x 6900 mm. The height of the lower vertical side portions 81 is 600 mm and the horizontal upper flange 6 is provided 1000 mm above the base 2. In the upper flange 6 there are three top plates 10 positioned along the longitudinal symmetry line of the support and the inclined upper portions of the sides are sloping downwards from the upper flange with approx. 20°. The support is made of steel plates and weighs in this configuration 19 tons and has a support capacity of 442 tons in order to observe the maximum deck loading of 20 tons per square meter.

[0036] As shown in figure 7, a plurality of the sea fastening supports are to be used for supporting and securing a heavy cargo. The supports are advantageously provided in rows 20 with passage paths 22 in between. In fig. 8, a configuration is shown with six rows 20 of supports according to the invention is provided on the deck 30 of a sea-going vessel 32. The rows 20 are such that four transport paths 22 oriented in the longitudinal direction of the ship 32. This configuration of sea fastening supports on the deck allows for the transport of very heavy structures. With an array of 30 sea fastening supports according to the described and depicted embodiment of the invention, a total load capacity of 13,260 tons may be achieved.

[0037] As indicated in figs. 9 and 10, the heavy cargo structure 40, such as a furnace module, is arranged on transport foundation 42 which is lifted up by four lines of SPMTs (SPMT: Self-propelled Modular Transporter). Thus, by the invention it is possible to roll on and roll off a very heavy cargo from a ship. In the figures 11 and 12 the heavy cargo structure, such as a furnace module, is rolled into position by the SPMTs and ready to be lowered so that the foundation structure 42 of the cargo 40 will rest on the top plates of the sea fastening supports on the deck 30.

[0038] In the figures 13 and 14 the cargo is shown installed on the deck 30 of the ship 32 while the ship 32 is stilled docketed by the harbour key 60, but where the SPMTs have been rolled off the deck after having delivered the cargo 40.

[0039] In fig. 15 there is shown a detailed view of the foundation structure resting on the top plate 101 of the top plate components 10 of the support spud according to the invention.

[0040] In the present disclosure, terms are used like "vertical", "horizontal" and the like. Such term are to be understood as relative directional terms between the relevant elements, flanges or the like.

Claims

1. A sea fastening support for securing cargo, in particular a large heavy structure, on a deck of a sea-going vessel, said support comprising:

a rectangular base adapted to be placed on the deck of the vessel, and
a load bearing structure on said base,

characterised in that the load bearing structure comprises

an upper flange provided parallel to the base, and which is smaller than the base, and
four peripheral side flanges extending between said upper flange and the rectangular base, the side flanges comprising upper and lower side portions, wherein at least the upper side portions are inclined; and wherein
the upper flange is provided with at least one top plate component, which is detachably mounted for receiving and supporting at least a portion of the large structure by fastening the large structure to the top plate component.

2. A sea fastening support according to claim 1, wherein the load bearing structure is an internal structure provided between the upper flange, the side flanges and the base.

3. A sea fastening support according to claim 2, wherein the internal structure comprises a plurality of vertically extending flanges such that concentrated forces on the top flange from the heavy cargo can be distributed evenly onto the base.

4. A sea fastening support according to any one of the preceding claims, wherein the top plate component is adjustable in height.

5. A sea fastening support according to any one of the preceding claims, wherein said top plate component is comprised of a top plate and a mounting leg, which is inserted into a receiving recess in the upper flange.

6. A sea fastening support according to claim 5, wherein the top plate is sacrificial.

7. A sea fastening support according to any one of the preceding claims, wherein a plurality of top plate components are provided, preferably three top plate components in a linear configuration.

8. A sea fastening support according to any one of the preceding claims, wherein a lower side portion with substantially vertical side flanges.

9. A sea fastening support according to any one of the preceding claims, wherein a rubber mat is provided underneath the base.

10. A sea fastening support according to any one of the preceding claims, wherein the rectangular base is provided with dimensions of a standard container.

11. A sea fastening support according to any one of the preceding claims, wherein lifting sockets are provided at each corner for lifting the support.

12. A sea fastening support according to any one of the preceding claims, wherein slices for truck transportation are provided on at least one of the lower portions of the side flanges.

13. A plurality of sea fastening supports according to any one of claim 1-12, said arranged in an array on the deck in a predetermined configuration adapted for supporting a specific large structure.

14. A method for securing cargo, in particular a large heavy structure, on a deck of a sea-going vessel, said method comprising the steps of

- providing a plurality of sea fastening supports according to any one of claims 1-12, in a predetermined pattern on the deck of a sea-going vessel, said predetermined pattern being determined by the cargo;
- positioning the cargo on the deck by resting

the cargo on the sea fastening supports; and
- securing said cargo to the sea fastening supports.

15. A method according to claim 14, whereby the sea fastening supports are laid out on the deck in lines and wherein the step of positioning the cargo on the deck comprises moving the cargo onto the deck by one or more SPMTs (SPMT: Self-propelled Modular Transporter).

16. A method according to claim 14 or 15, wherein the step of securing includes welding shear stoppers to the top plate components of the peripheral group of sea fastening supports supporting the boundary edges of the cargo.

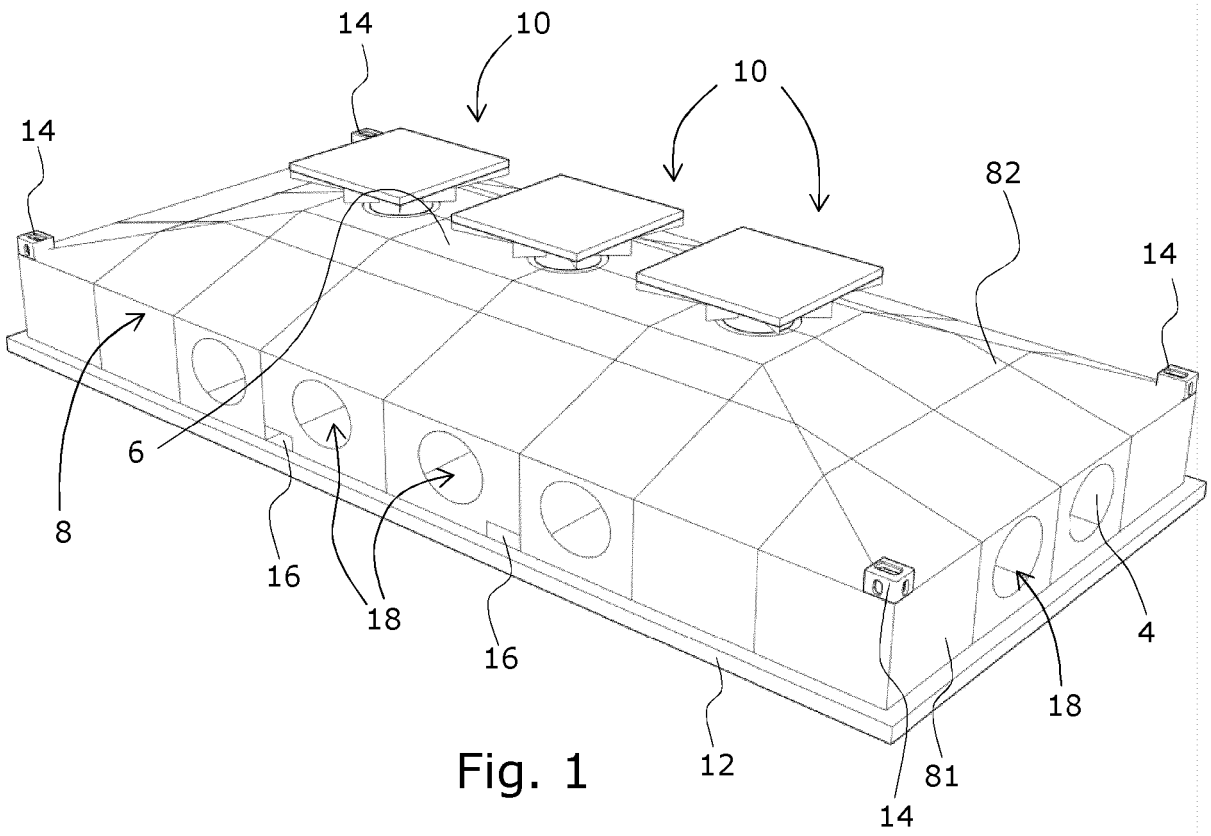

Fig. 1

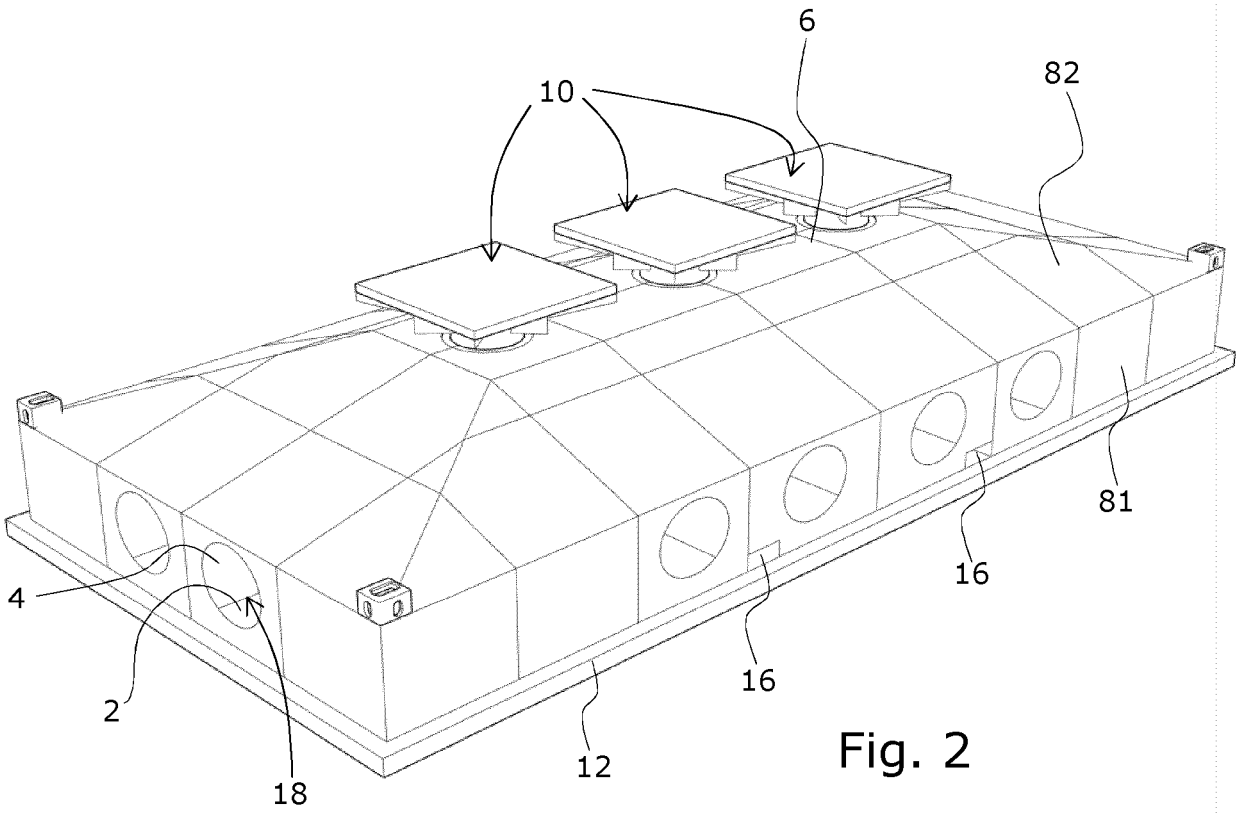

Fig. 2

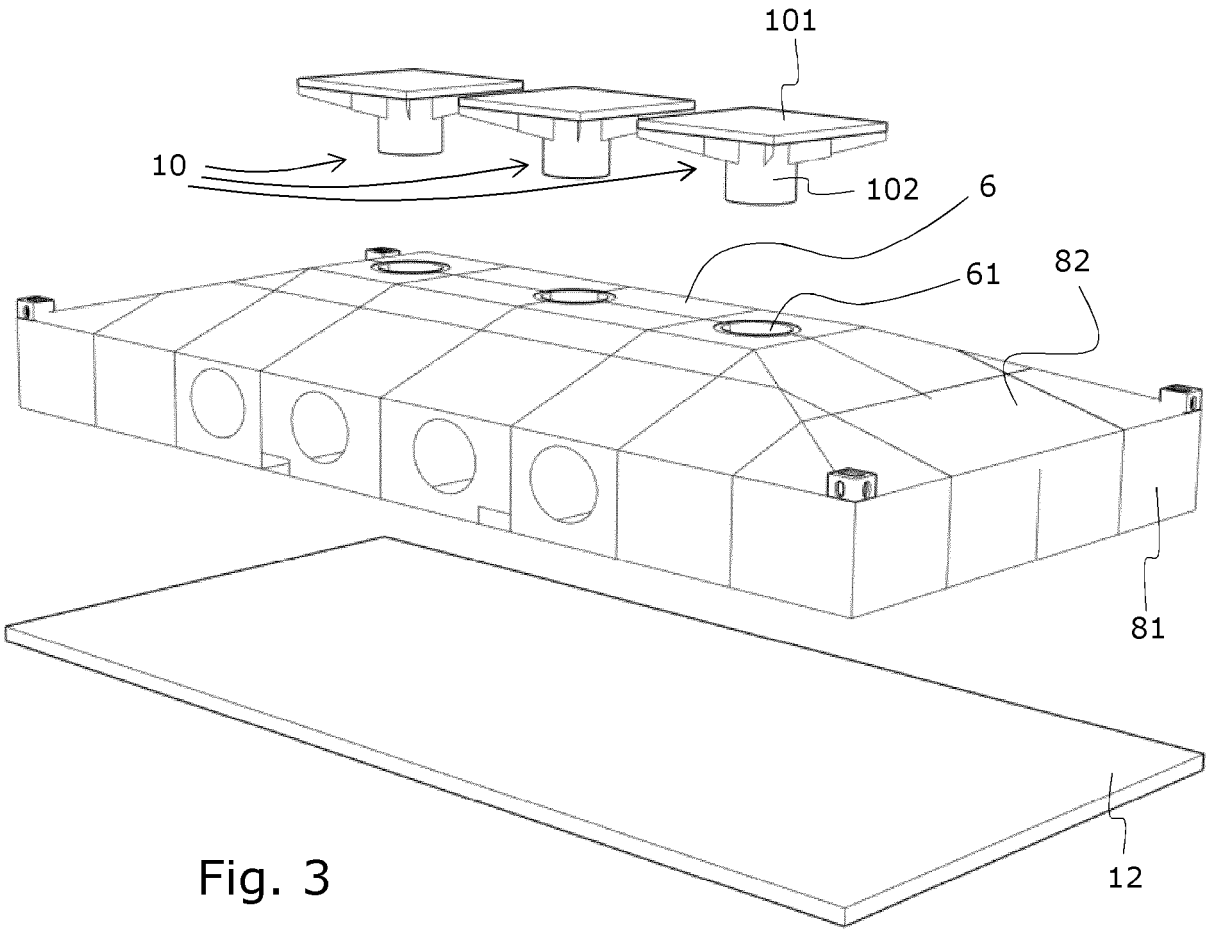

Fig. 3

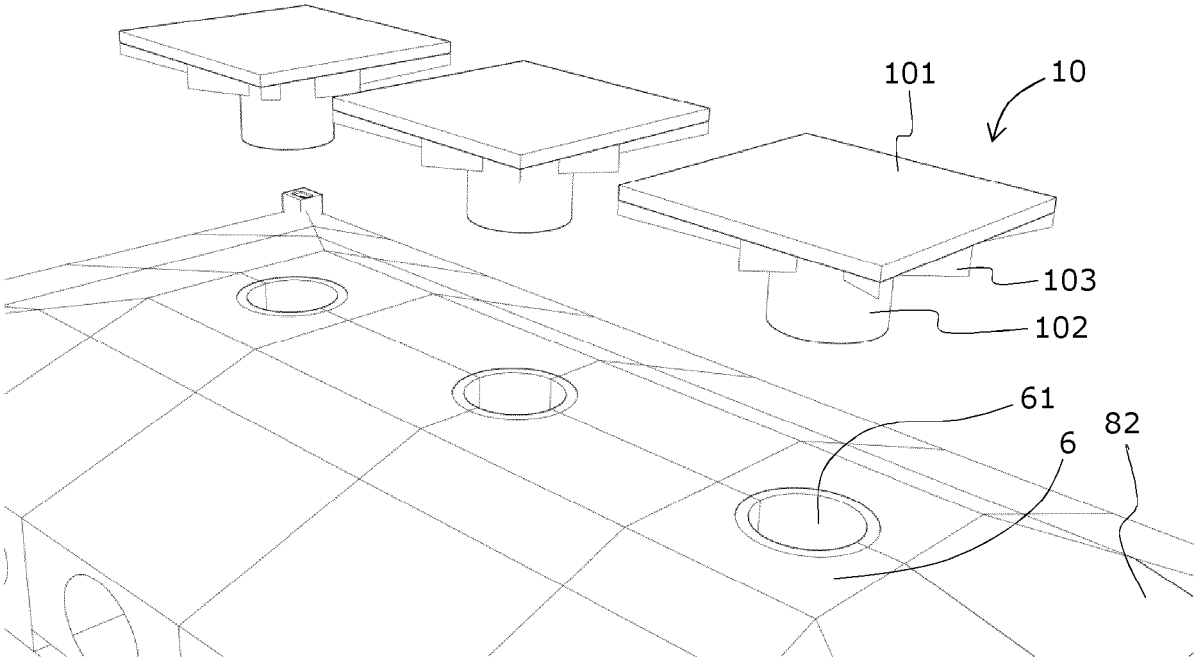

Fig. 4

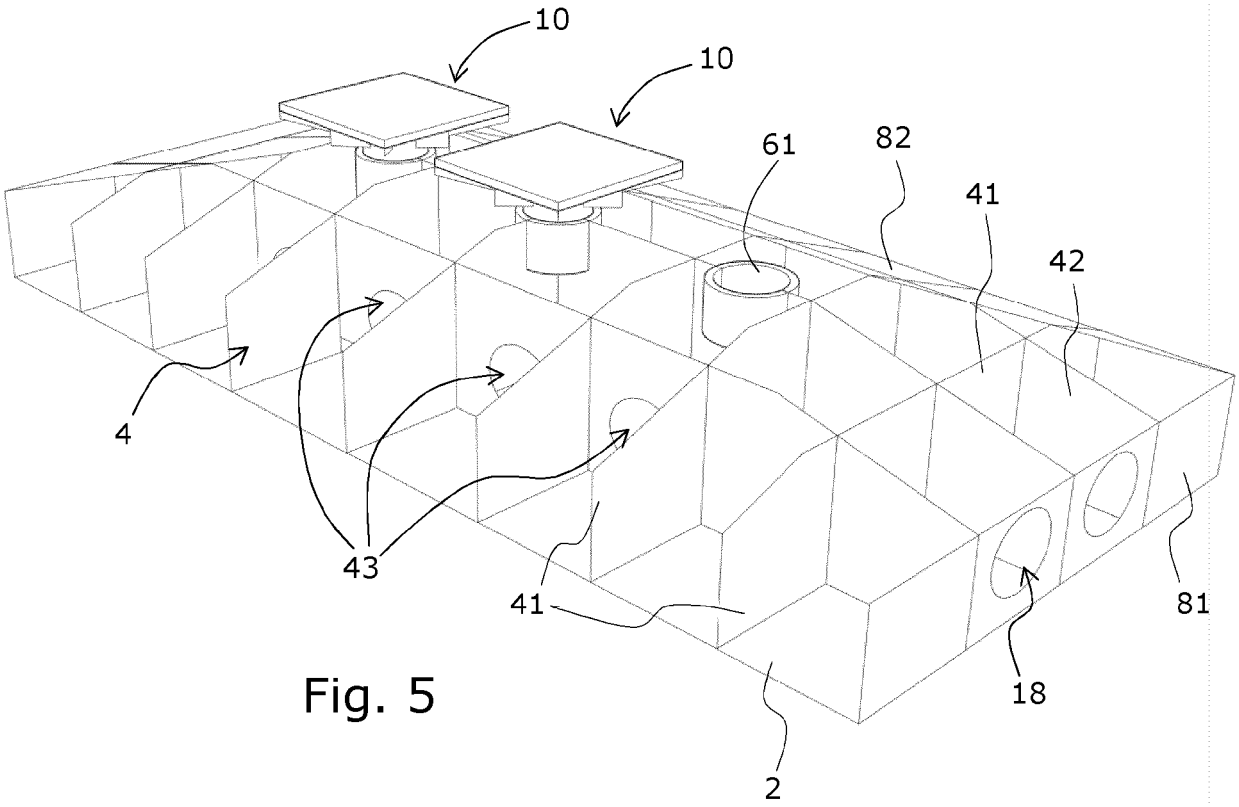

Fig. 5

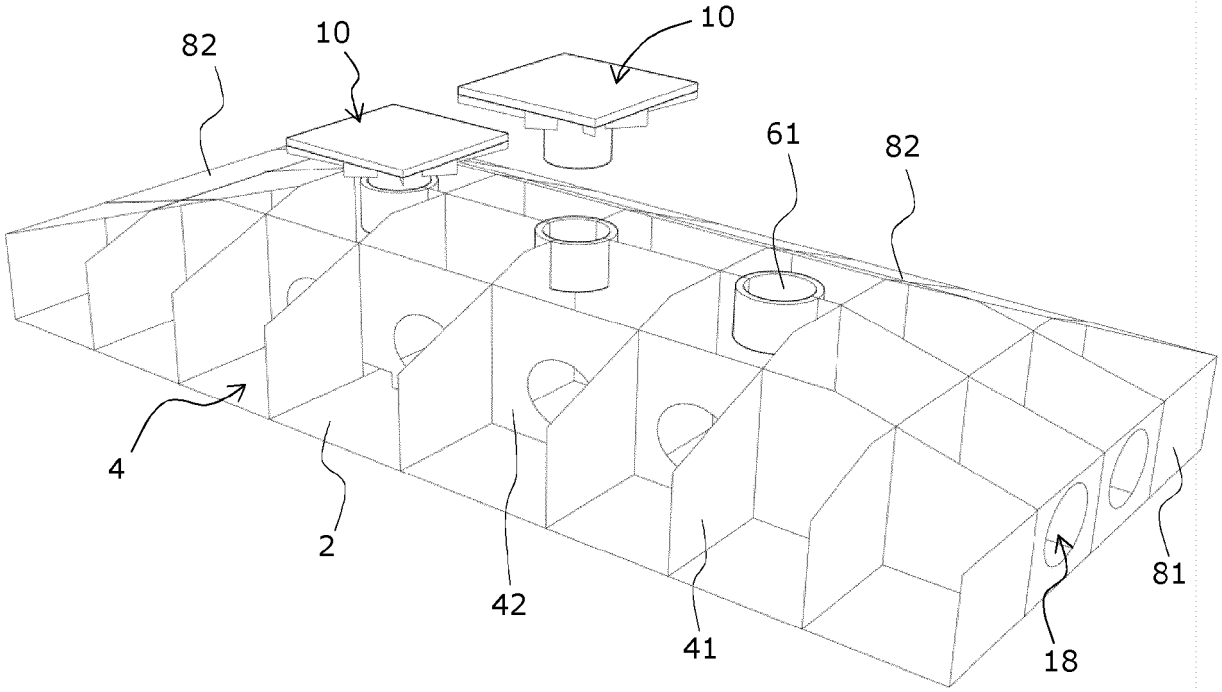

Fig. 6

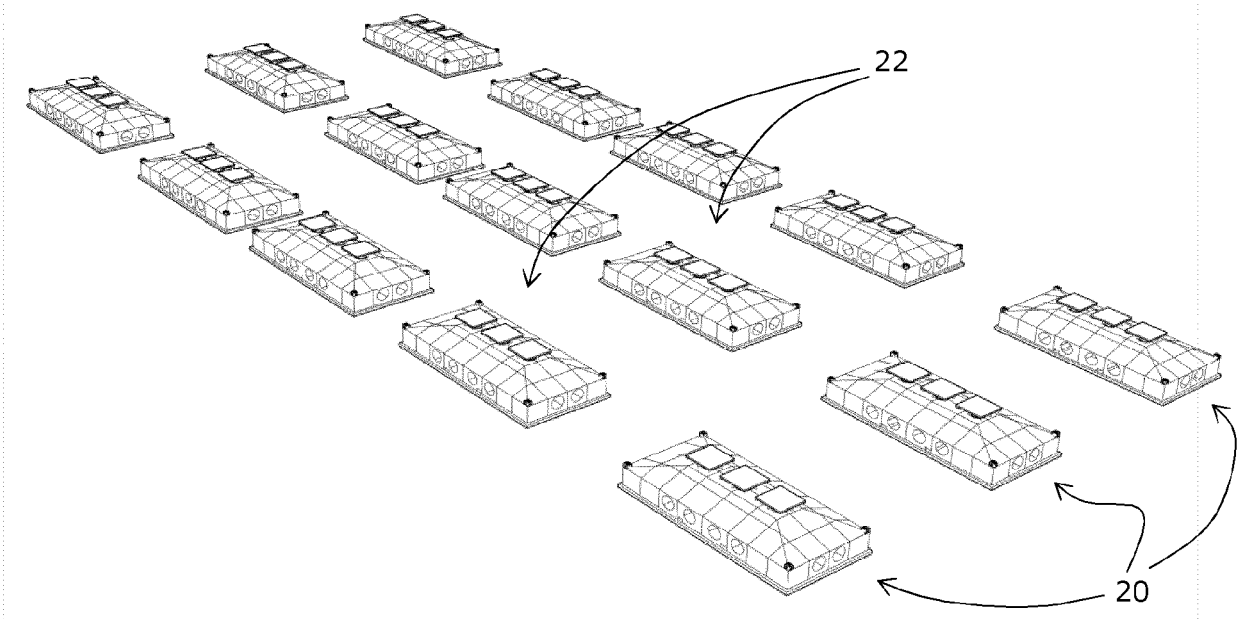

Fig. 7

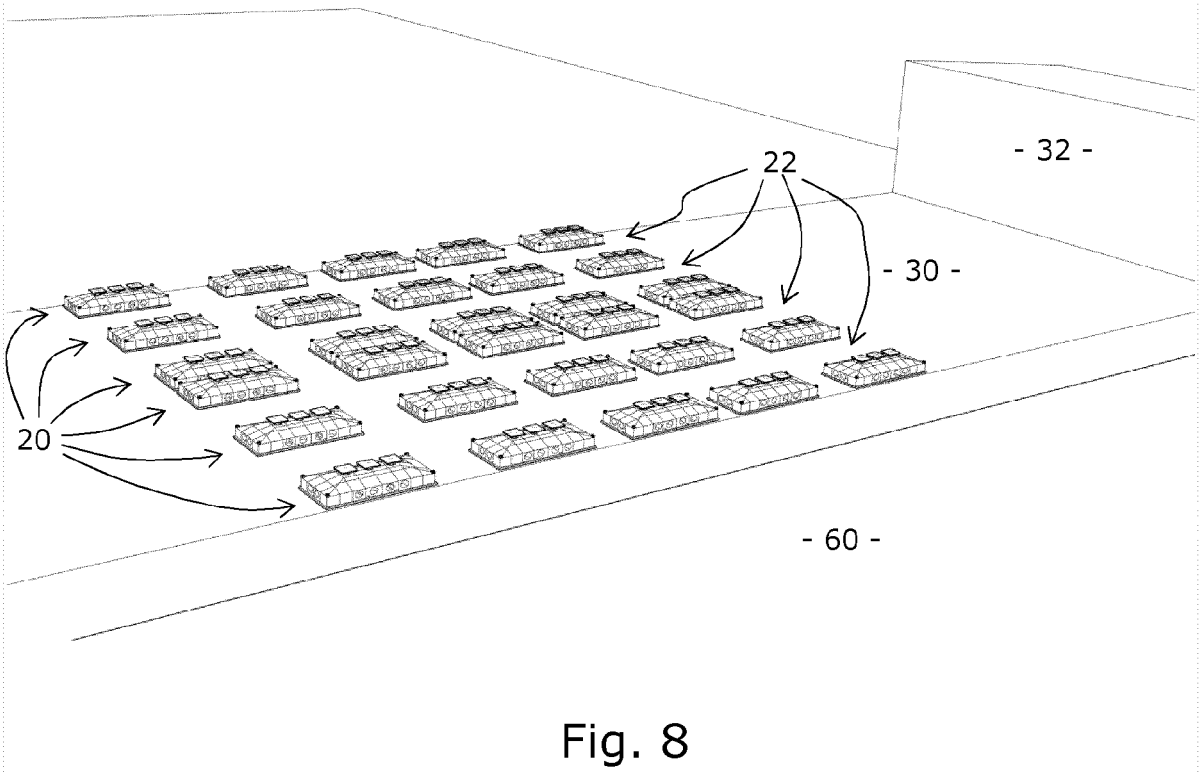

Fig. 8

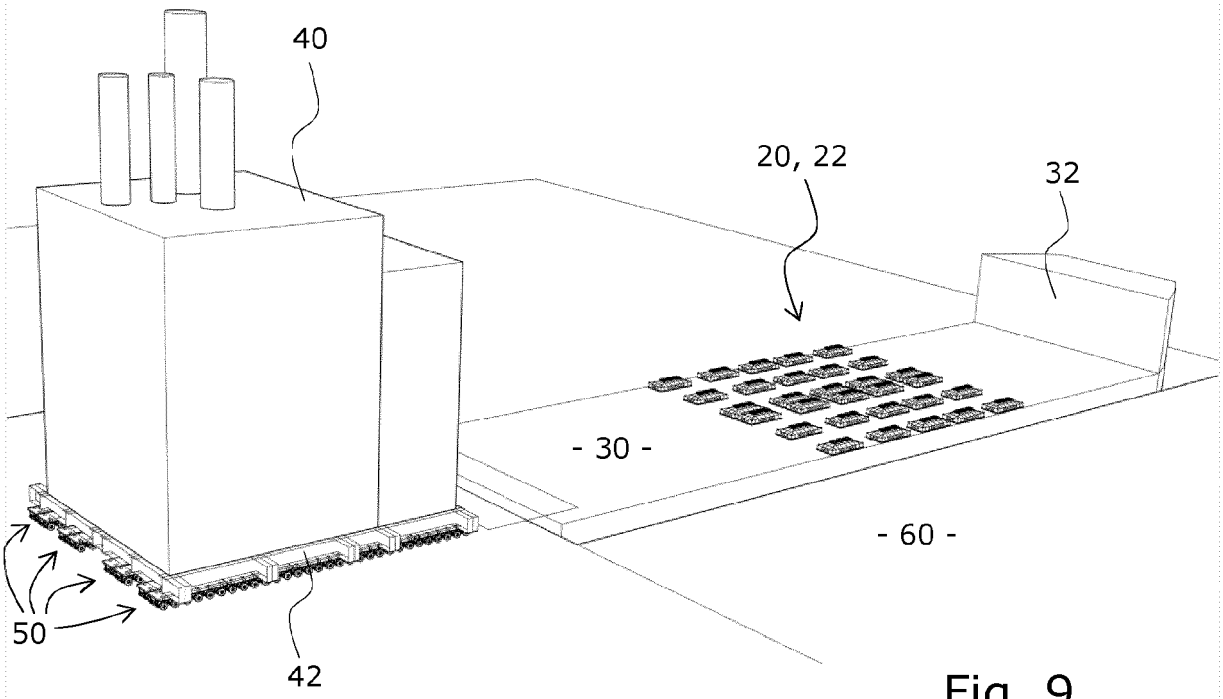

Fig. 9

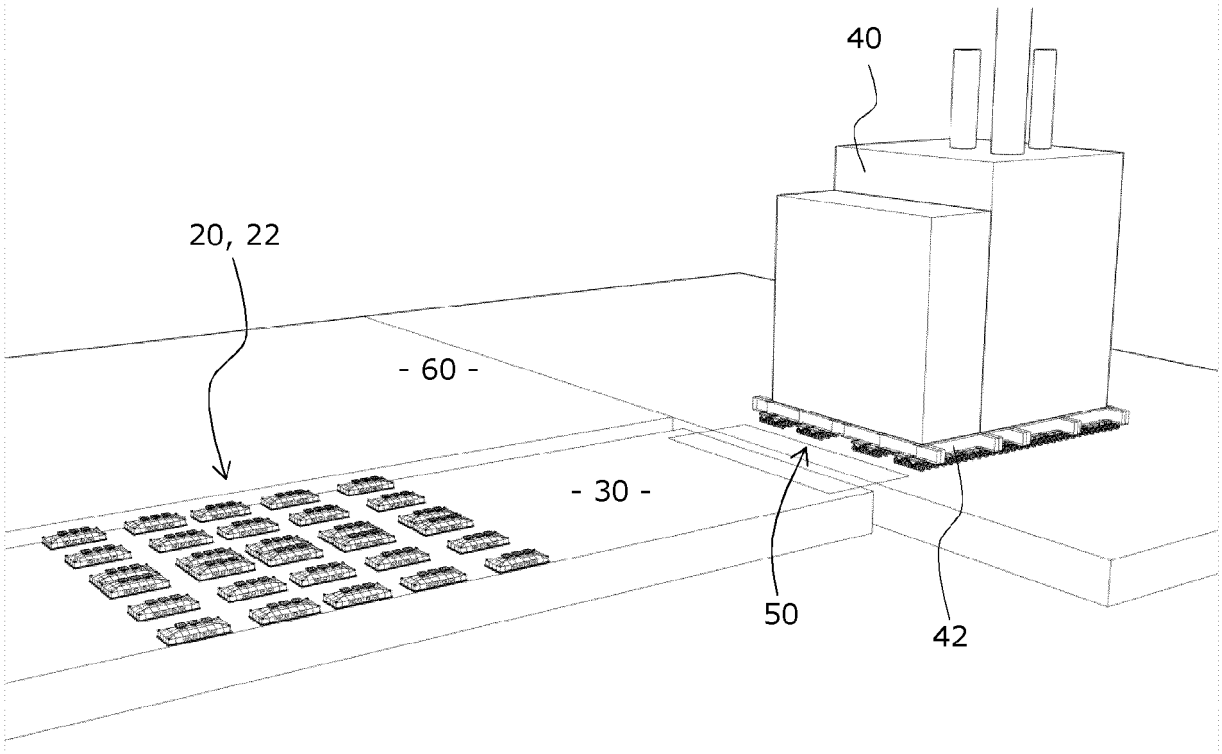

Fig. 10

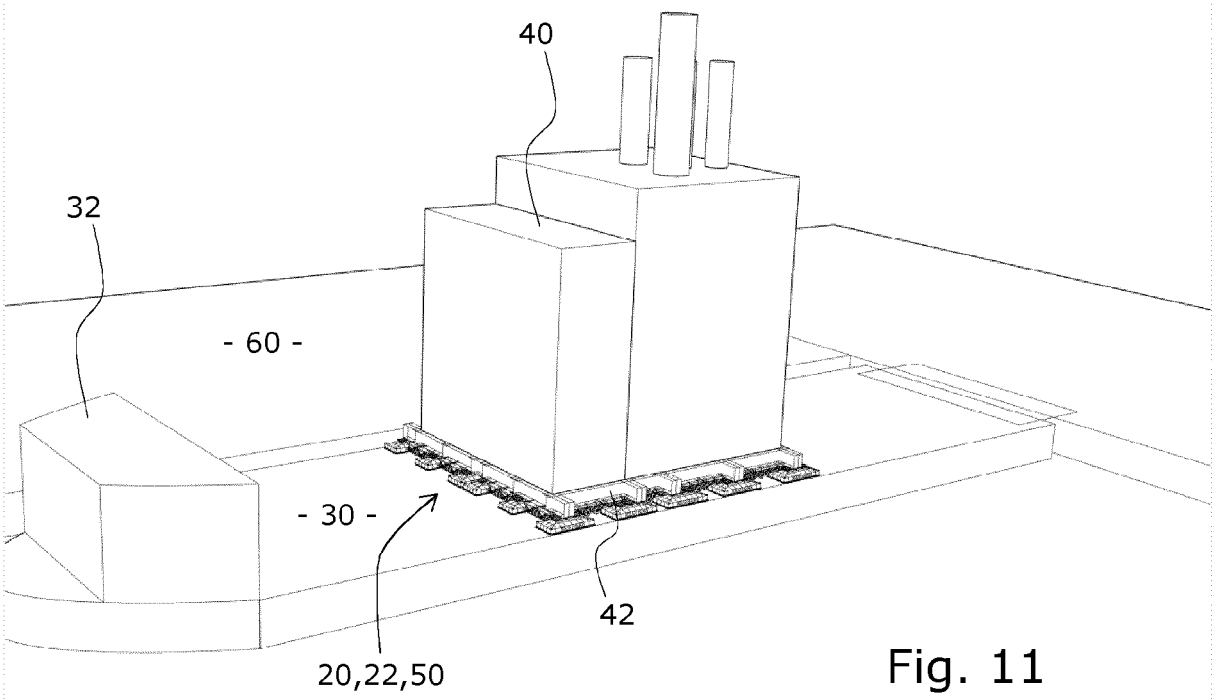

Fig. 11

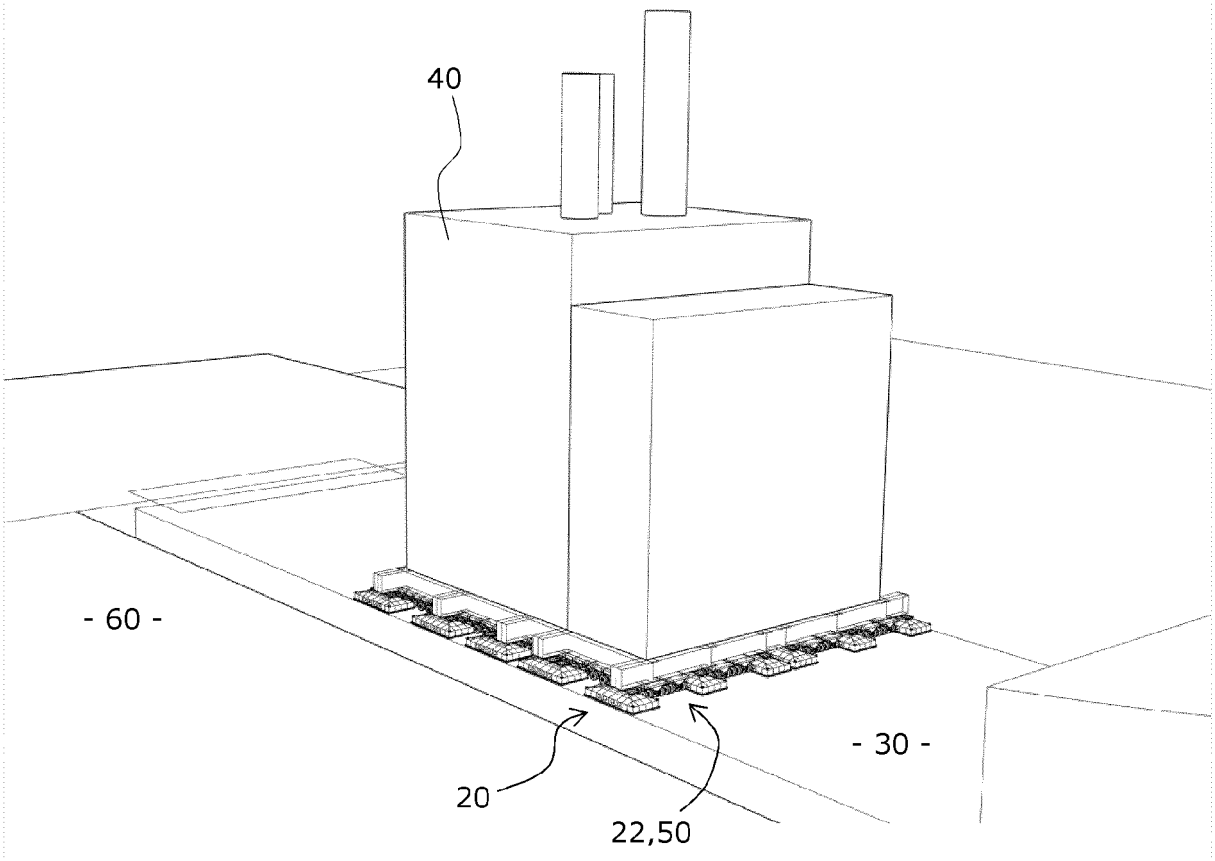

Fig. 12

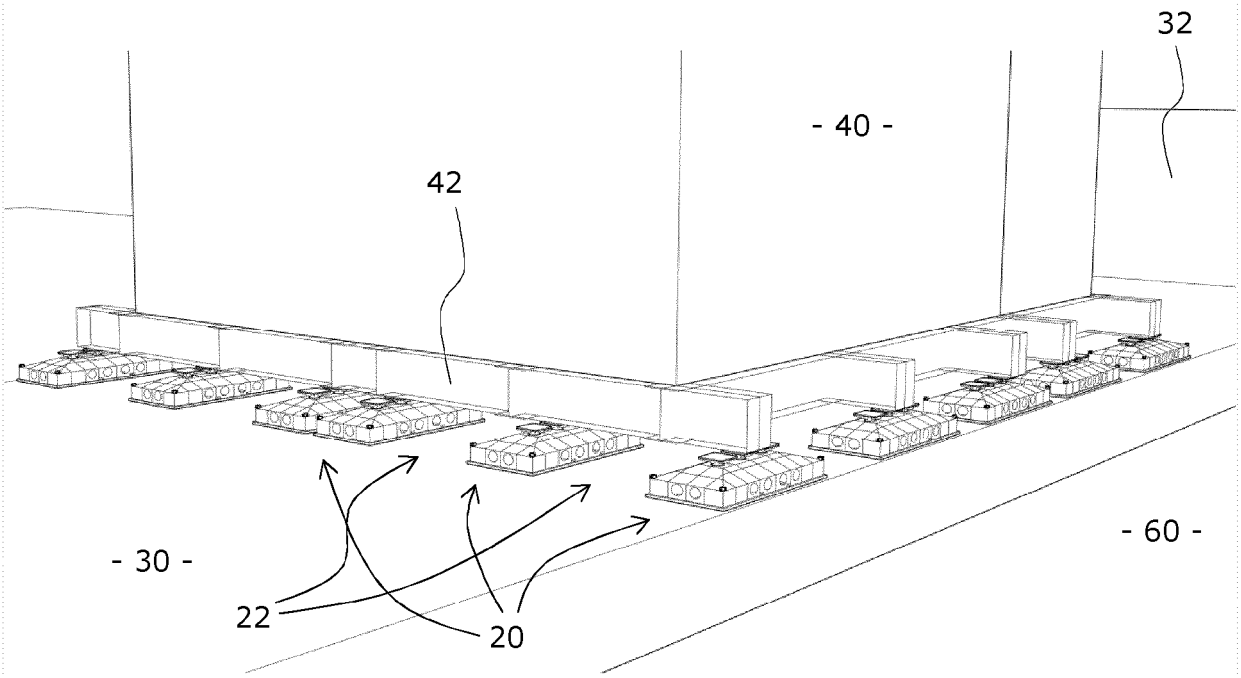

Fig. 13

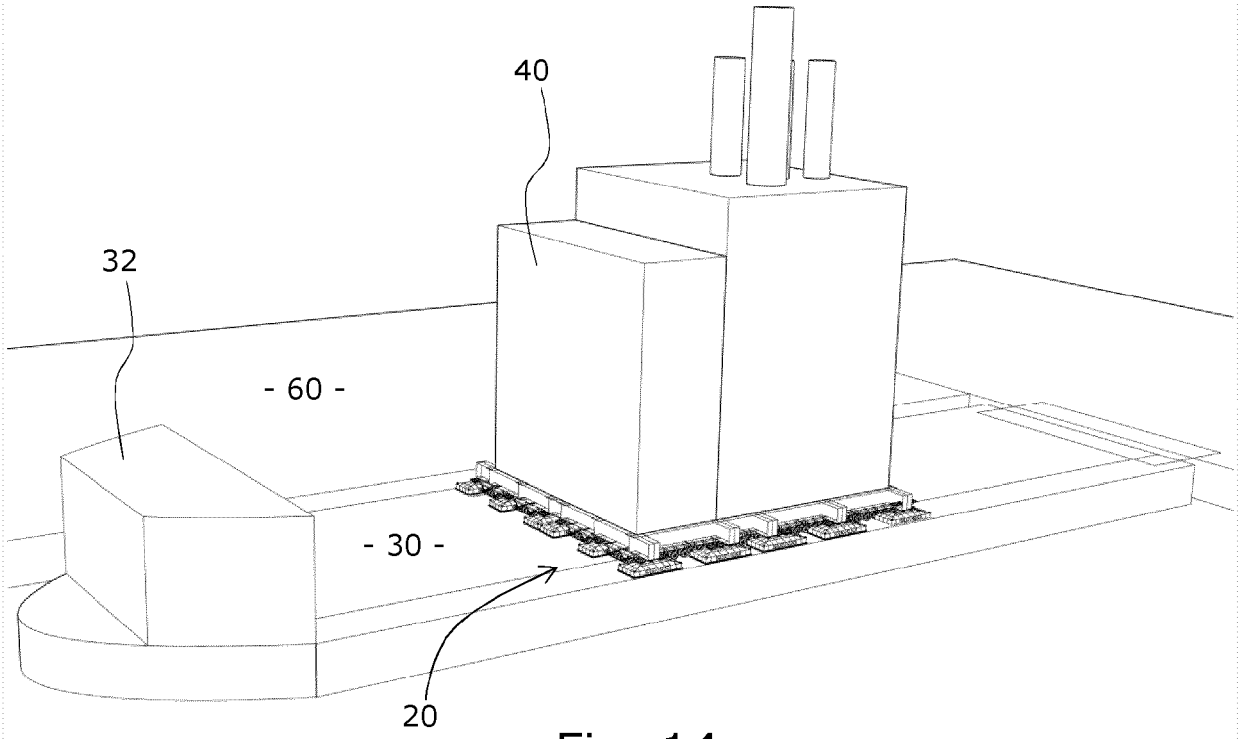

Fig. 14

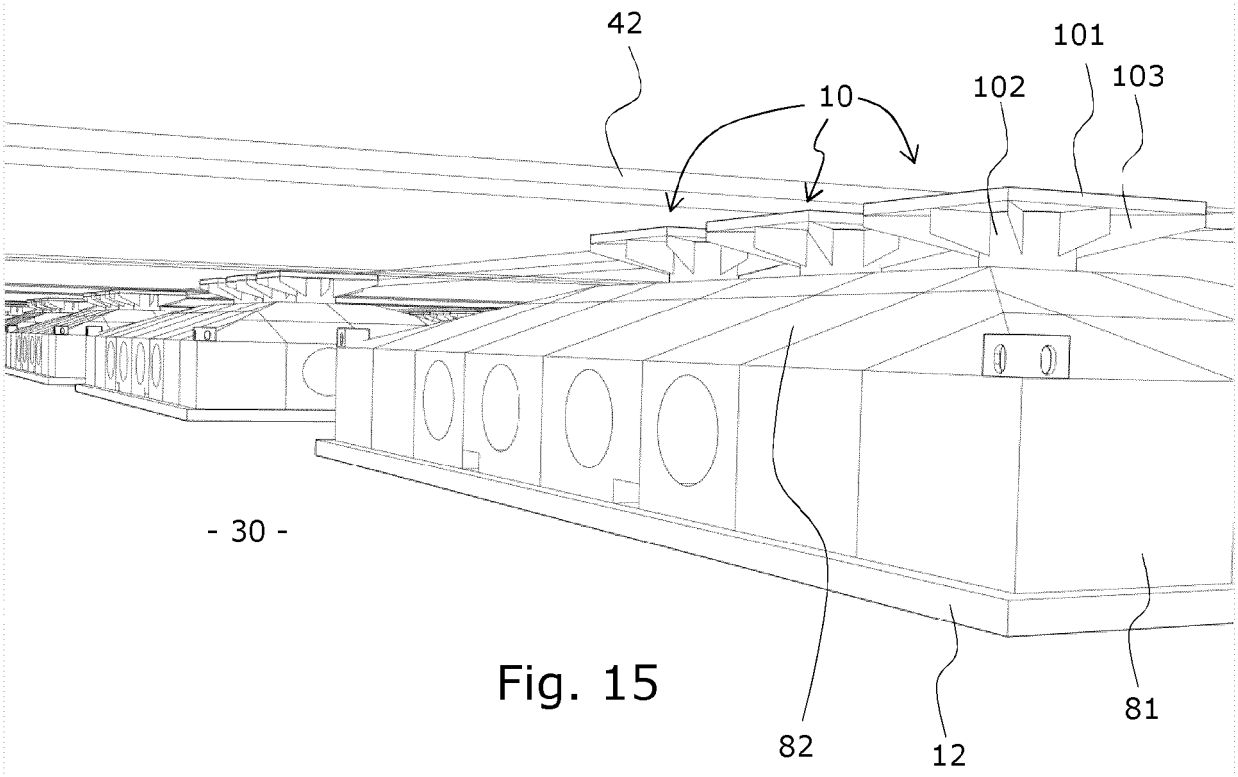

Fig. 15

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EUROPEAN SEARCH REPORT

Application Number
EP 20 19 6312

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X A	JP S57 37698 U (UNKNOWN) 27 February 1982 (1982-02-27) * paragraph [0001]; figures 1-3,8,9 *	1-4,8,9, 11-16 5-7,10	INV. B63B25/00 B63B25/28 B63B35/00
X	JP H03 159897 A (NIPPON KOKAN KK) 9 July 1991 (1991-07-09) * abstract; figures 3,4 *	1,4-7, 10-15	
X	CN 104 553 955 A (KUNSHAN LUCKY SEA IND CO LTD) 29 April 2015 (2015-04-29) * abstract; figures *	1,14	
X	EP 0 001 462 A1 (LANDEN ARIE V D) 18 April 1979 (1979-04-18) * page 7, line 16 - line 19; figures 4-6 *	1,14	
X A	BE 522 432 A (R. DE BIEVRE) 15 September 1953 (1953-09-15) * the whole document *	1,2,4-6, 12,13 14-16	
			TECHNICAL FIELDS SEARCHED (IPC) B63B B63C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	4 March 2021	Barré, Vincent

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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EPO FORM 1503 03.82 (P04C01)

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04-03-2021

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