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(54) **MODULAR MOBILE TEMPORARY STRUCTURES AND METHOD OF FORMATION**

(57) A modular mobile temporary structure is provided with a plurality of primary modules (1). Each module includes a housing formed utilizing an intermodal shipping container, with the plurality of primary modules forming a base and an outside periphery of a temporary structure. A lightweight pneumatic frame consists of multiple inflatable elements (4), and a sealing tent (207,211). The pneumatic frame forms a dome of the temporary structure, and the inflatable elements are connected to each other and to the base. The sealing tent interconnects the inflatable elements and covers an exterior of the temporary structure to protect an interior of the structure from atmospheric factors.

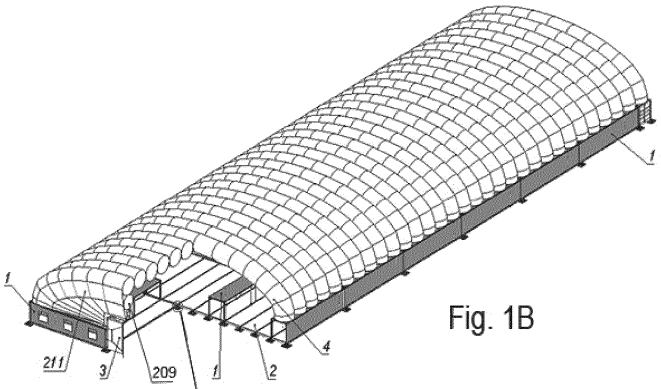


Fig. 1B

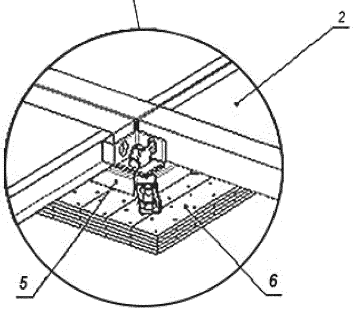


Fig. 1E

EP 4 461 905 A1

Description

FIELD OF THE INVENTION

[0001] The invention relates in general to the field of construction. In particular it relates to the construction of modular, rapidly erectable and transportable temporary structures.

BACKGROUND OF INVENTION

[0002] Constant relocation due to various reasons has defined the lifestyle of many people and their economies throughout all times. With the complexity of social structure and labor relations, similar requirements also began to be applicable to group relocations.

[0003] Various modular and rapidly deployable structures in general are well known and have been described many times. The periodicity, seasonality, and a distinctly temporary component of staying in specific locations have been and continue to be determined by numerous objective factors, the number of which only increases over time.

[0004] The aspect of temporary stay, besides the actual requirements for possible transportation, also defines the second important property of such buildings - the necessity of their relatively quick assembly/deployment and, accordingly, disassembly.

[0005] Since the time of the first movable tents, the technology for constructing rapidly deployable structures has advanced significantly and has been enriched with many new technologies. Today, rapidly deployable structures, for example from intermodal transport containers, also called sea containers, are well known and described.

[0006] The use of intermodal containers has been practiced for almost 100 years, and now it is estimated that there are about 20 million such containers worldwide. The term intermodal means that the cargo in this container is transported by various carriers without leaving the container, that is, staying in it all the time during the journey without unloading/reloading, but crossing seas and continents, for example, on ships, railway, and road transport. The obvious conveniences of this method of transportation have determined the widespread distribution of intermodal containers, as well as the accessible range of equipment for operating them all over the planet. These containers are convenient not only because of their sturdy construction but also because of the widely developed infrastructure for transporting and working with them.

[0007] The strength of the construction of intermodal containers, as well as the ability to stack them up to 7 pieces and above, determines their potential use as structural modular architectural elements for, among other things, temporary structures. Architects and designers have long paid attention to such properties of containers, and now this approach is widely spread, ranging from art objects to residential, commercial, office, production, and other structures.

[0008] For example, US Patent 10,633,877 B2 proposes a method for constructing a modular building consisting of at least three types of modified sea containers, each essentially representing a unique, albeit essentially superficial, modification of the main container structure. The modification mainly involves making holes in the container walls to create windows, doors, and other necessary openings. The resulting modules are intended to be joined together into one structure.

[0009] In US Patent Publication 2017/0121990 A1, an approach is described that involves modifying standard sea containers to create a universal standard construction module. The modification specifically involves making an equal number and size of holes in the container walls to obtain a kind of basic construction module, in which the resulting openings are either left unchanged or filled with standard inserts depending on its position in the future modular building.

[0010] US Patent 10,340,696 B2 discloses systems, methods, and building block modules for modular power generation installations. The method of constructing a modular power station includes manufacturing a number of primary modules, each comprising a housing adapted from an intermodal sea container with stanchions, rails, and thresholds connected to each other by sea container corner castings; delivering of the primary modules, including generator set modules and a distribution device module, to the installation site; placing the main modules in a vertical stack; connecting the main modules to each other in a vertical stack.

[0011] US Patent Publication 2016/0160515 A1 describes building systems for constructing scalable structures, which contain a multitude of prefabricated, interconnectable modular scalable blocks. Each block consists of frame elements and a multitude of nodes, each node positioned for selective connection with other elements, with nodes and the external dimensions of the frame meeting ISO transport requirements standards. Thus, each unit can be transported using the ISO intermodal transport system, and such that when units are interconnected, a construction structure is formed. Modular blocks are manufactured at a remote location and assembled there into semi-finished products, after which the semi-finished modular blocks are transported from the remote location to the worksite, where they are secured to form the structure, and then the semi-finished modular blocks are completed.

[0012] The frame structure of an intermodal container on one hand provides the necessary rigidity and load-bearing capacity, but on the other hand limits the size of its internal free space, creating inconvenience when attempting to construct structures with large open spaces (rooms). This difficulty is partly solved by using individual containers as a base (support) for an external, often metal structure that supports the vault (roof), to a necessary extent isolating the space above this structure from the external environment. For example, such an approach

has gained popularity in producing various sheds over rows of informal/seasonal markets, where the shelter is supported by the roofs of intermodal containers standing, as a rule, opposite each other, which act as trade pavilions/warehouses.

[0013] Patent AU 2018101639 A4 describes the assembly of a construction structure from standardized interrelated components, the size of which may correspond to any specific required size of the building and transport container, and includes at least one modular beam structure, at least one modular base structure, and at least one wall support in the form of a transport container and a method for assembling the construction structure. The modular beam structure and the modular base structure include a frame that interlocks with each other and the transport container through corner castings with twist lock nodes, which are positioned in a specific orientation to each other. The modular base structure is supported by the corner castings of the transport container, and the base structure supports the end portion of at least one modular beam structure. At least one modular beam structure spans the distance between spaced transport containers. Modular beam structures can be used as roof trusses, and their sizes allow them to be transported on top of each other or overlapped inside transport containers.

[0014] For the weight and span of such a structure, the limitation is usually the load-bearing capacity of the container. Therefore, such vault constructions are rarely heavy, meaning significant in height and/or length. To increase the span, additional supports are often required, which reduce the covered space and lowers the economic effect. Thus, the problem of creating voluminous and spacious structures based on intermodal containers in this way has significant limitations.

[0015] On the other hand, various kinds of temporary structures like tents made of soft materials, in particular pneumatic frame constructions, are well-known. Typically, such constructions consist of at least two supports, usually in the form of cylinders made of polymer materials, for example, reinforced polyvinyl chloride (PVC), which are filled with gas under pressure, for example, dry compressed air, when erecting the structure and acquire a predesigned calculated shape, usually in the form of arches of one size or another. Then, the frame obtained from the necessary number of such arches according to the project is covered with a waterproof film material, for example, polymer, reinforced PVC, which thus fences the internal space covered by the vault, from the external environment.

[0016] Among the obvious advantages of pneumatic frame temporary structures are their lightness, significant compactness, often relative transparency, as well as the ability to quickly erect the structure with minimal force without special knowledge and complex tools/techniques.

[0017] Significant compactness and low weight allow for the transportation of sizable pneumatic frame structures in folded form on one truck. The lightness of the final structure allows for the construction of structures almost without preparation of the bearing ground and without producing any foundation. The speed of construction - even large-sized structures can be erected within a few hours/days. Often, this does not require highly skilled personnel, many workers, or heavy construction equipment. In many countries, the erection of such types of structures also does not require numerous approvals in architectural and local authorities, i.e., practically eliminating the bureaucratic component, which further reduces the time between conception and realization. Technology also allows the use of materials that partially or significantly transmit daylight, which has a positive effect on the working climate inside the structure and can significantly reduce the costs of interior lighting.

[0018] It is not surprising that such structures, originally intended for emergency measures, passed the test as rapidly deployable temporary shelters in areas of natural disasters, refugee camps, field operating rooms, for military purposes, etc., and later began to be used for private and commercial construction, for example, as storage facilities, hangars for equipment, mobile productions, touring tents of entertainment enterprises, etc.

[0019] The walls of the structures, consisting predominantly of rows of cylinders, also have worthy indicators of resistance to heat transfer. The simplest and therefore most common model is the construction in the form of semi-circular arches (semicircles or semi-ovals), which are arranged in a row with a certain frequency, usually closely together, and thus form a semi-circular (semi-oval) in vertical section and rectangular (square) in horizontal section construction, for example, similar to Quonset huts. The solution is time-tested and has proven itself primarily due to the simplicity of the construction, stability to external loads, and reliability in operation.

[0020] Russian patent RU2145375C1 describes a rapidly deployable pneumatic frame large-scale structure, adapted for temporary operation in any climatic zones, including extreme conditions. A distinctive feature of the complex is that the pneumatic frame rapidly deployable structure is additionally equipped with an autonomously installed equipment unit, made in the form of a container room, with a base and walls, a closable entrance, with working and backup heating electro-units, an electric panel, and other devices of the microclimate support system rapidly deployable structure and life support installed inside the container room on the base. Inside the container room, a volume is allocated for the placement of all rapidly deployable structure stacks and a set of stacks of accompanying accessories during transportation. The volume in the container room, free from the mounted life support engineering units, is allocated to be no less than 50% of the internal volume of the container room and is used for placing the rapidly deployable structure section stacks and accompanying accessories set stacks during transportation and for creating a maintenance zone for the staff during the operation of the deployed rapidly de-

ployable structure. Thus, the pneumatic frame structure is placed in a container for transportation, which after the deployment of the structure is located outside and participates in maintaining the required conditions in the structure.

[0021] Despite all the merits, it is necessary to note a substantial number of disadvantages inherent in pneumatic frame structures. Firstly, there is a certain complexity in adjusting the height of the supporting cylinders-supports (arches), which is reflected in the requirement to choose relatively even sections of the ground surface on which the structure is supposed to be placed. With the growth of the building size, this requirement, as a rule, leads to an increasingly significant impact on the untouched natural relief and soil. Another important disadvantage is the increasing sail area of the structure with its size, conditioned by the impressive surface area of the structure with a comparatively small weight. Cases have been described when strong gusts of wind simply tore the structures from their anchoring anchors buried in the bearing soil beneath them, the structures lost their stability, and thereafter often their structural integrity. A further disadvantage includes some dependence on weather factors, expressed in that the building can be flooded and there is a significant heat loss directly through the ground, on which the temporary structure was deployed without any preparation, especially during periods of rain and/or frosts.

SUMMARY OF INVENTION

[0022] In a first aspect, the invention contemplates modular structural elements of a temporary structure, among which can be distinguished:

1. Base and support modules, conditionally rigid, made of materials like steel.
2. Vault (ceiling) modules, conventionally elastic, made of materials like polymer plastics.
3. Other, usually optional, elements made of various materials, including conditionally rigid and conditionally elastic.

[0023] The various base and support modules are made, for example, of weather-resistant steel, and are the result of partial or deep modification of the design of standard intermodal containers, which, at the same time, retain the possibility of transportation by one or more standard modes of delivery of transport intermodal (also called "sea") containers, for example, by road and/or rail and/or sea transport, and comply with the requirements and standards of international standards for this type of transport (ISO).

[0024] The base and support modules are of different varieties, of which two main types can be distinguished. The first type - container-type base and support modules (the main elements in the erection of a temporary structure), as a rule, have a frame box construction or other design, but meet the necessary international and local standards for the transportation of intermodal containers by at least one mode of transport. These modules have hermetically sealed enclosures from the outside environment (doors, walls, floor and ceiling).

[0025] The second main type of base and support modules (optional element) - are platforms with peripheral fixation nodes according to the ISO container transportation standard, without frame walls and ceiling and without partitions, transported stacked on top of each other, combined by the same peripheral fixation nodes using both common and special devices.

[0026] These modules, along with the main modules of the container-type base and support, may also contain in their design and composition additional, including removable elements and/or devices for quick attachment of such elements.

[0027] The flexible vault (ceiling) modules can be divided into load bearing, structural air-frame modular elements, as well as the unifying canopy and optional add-ons. Load-bearing, structural pneumatic frame modular elements are, for example, single- or multi-chambered cylinders made, for example, of single- or multi-layer light- and weather-resistant reinforced polymer plastics, which assume the shape designed for the erection of the temporary structure and load-bearing loads when their interior space is filled with pressurized gas.

[0028] There are also a number of other possible variants of pneumatic frame elements of various shapes, sizes and purposes.

[0029] The structural pneumatic frame elements, after being installed in the required sequence as part of the temporary structure, can be additionally covered, tightened, and thus united and sealed, e.g. by means of tent material by covering the entire structure with a single and/or multi-layer material (canvas), e.g. made of weather-resistant reinforced polymer plastic.

[0030] Other optional elements of the temporary structure are made of various materials and can, for example, speed up and/or simplify the erection/dismantling of the structure, improve the functionality and/or performance of the temporary structure.

[0031] The temporary structure elements, e.g. air-frame and/or additional elements, are designed to fit compactly into the interior of other elements of the structure, e.g. inside container-type base and support modules, while still meeting the requirements of international transportation and can be transported by at least the same means and/or method as conventional intermodal containers and directly among other intermodal containers.

[0032] In other aspects of the invention, the principles of assembly/disassembly of a temporary structure using a combination of base and support modules, vault (ceiling) modules, and examples of some optional additions are discussed.

BRIEF DESCRIPTION OF THE DRAWINGS

[0033] In the following drawings, the same parts in the various views are afforded the same reference designators. Referring now to the drawings which are provided to illustrate and not to limit the invention, wherein:

Figs. 1A and 1D are general and detail views of a mobile modular temporary structure;
Figs. 1B and 1E represent schematic and section views of a mobile modular temporary structu re;
Fig. 1C is a schematic view with sections of a mobile modular temporary structure;
Fig. 2A illustrates an example of the embodiments of modified intermodal shipping containers;
Fig. 2B shows an example of variations of modified intermodal cargo containers;
Fig. 2C illustrates an example of the construction of a container-type base and support module;
Fig. 2D shows a further example of the construction of a container-type base and support module;
Fig. 3A is a general view of the base module which is a platform; with peripheral fixation/clamping units according to the container transport standard;
Fig 3B shows an example of the design of the base module and the platform-type support with the peripheral fixation/clamping units;
Fig 4A illustrates a supporting platform of an adjustable support;
Fig. 4B shows an example of the design of the adjustable support designed for the joint of the corners;
Fig. 4C illustrates an example of an embodiment of an adjustable support designed to fix and adjust a single angle;
Figs. 5, 5A and 5B illustrate an example and the details of a steel construction of an entrance gate;
Figs. 6 and 6A show an example and a detail of location and use of welded loops;
Fig. 7 illustrates an example of an arrangement of solar panels on the exterior of the vault (dome); and
Figs. 8 and 8A Illustrate an example and a detail of design of devices for tying and fixing on the outer surface of a pneumatic frame cylinder.

DETAILED DESCRIPTION OF THE INVENTION

[0034] Various aspects of the present invention are disclosed in the following description and related figures relating to specific embodiments of the invention. It will be understood by those skilled in the art that alternative embodiments may be devised without departing from the nature or scope of the claims. In addition, well-known elements of the illustrative embodiments of the invention will not be described in detail or will be omitted so as not to obscure relevant details of the invention.

[0035] The word "for example" as used herein means serving as an example, instance, or illustration. The embodiments described herein are not limiting, but rather are merely examples. The embodiments described herein are not necessarily to be regarded as preferable or advantageous over other embodiments. Furthermore, the terms embodiments of the invention, embodiments, or invention do not require that all embodiments include the feature, advantage, or mode of operation discussed.

[0036] Throughout the text, for the sake of brevity, the term "modular mobile temporary structure, including "micro transportable factories" may be abbreviated to phrases such as "temporary structure" or "temporary modular structure", but in all cases it is intended to be interpreted as the extended definition presented above.

[0037] The invention relates to construction, in particular to the construction of a modular, rapidly erectable transportable, temporary structure which can have many variations/combinations of its structural elements, which result in structures of various shapes and sizes, combining materials of different nature, such as steel and polymeric plastics, and intended to be housed within, for example, production facilities, warehouses, offices, temporary shelters and so on. The term "temporary" in this case means the ability of the building to be quickly assembled/disassembled, as well as compact and easy to store/transport in the disassembled state, but at the same time the temporary structure does not have a pronounced limitation on the period of operation in the erected state.

[0038] The purpose of the invention is to create a fast-erecting prefabricated mobile temporary structure by combining its individual modules, including in the immediate vicinity of consumers of goods/services etc. One example is a mobile micro-factory for the production of building structures installed in the immediate vicinity of a construction site. This approach in the described case contributes to accelerating construction processes, e.g. by shortening logistics chains and facilitating the delivery to the construction site of manufactured large-sized elements and/or parts with a high degree of readiness, e.g. with installed communication elements and/or finishing miles.

[0039] Any significant proximity of the production of goods or services consumed to the place of consumption, or of a processing plant to the source of raw materials, etc., may also be considered in this aspect. These temporary structures may be used, for example, as mobile micro transportable factories, warehouses, hangars for storage and maintenance of machinery and transport, including marine and/or aviation, as well as car service stations, car wash stations, refueling/charging stations, as well as offices, stores, bazaars, and supermarkets, shopping arcades and pavilions, educational and cultural institutions, temporary shelters, marquees for amusement rides or performances of all kinds, restaurants and bars, sanitation, quarantine, field hospitals, laboratories, storage for growing plants, including agrarian crops, flowers, mushrooms, for housing pets and/or livestock, including poultry and/or livestock enterprises, in fact any manufacturing and processing facilities for food, light

heavy, chemical and other industries, etc.

[0040] The invention is aimed at simplifying the erection of temporary structures, and allows, at the same level of technical equipment, to obtain structures of greater area and height, and thus capacity and volume, in comparison with methods of construction of temporary structures using, for example, only construction containers. On the other hand, the described technology also allows to open the potential of pneumatic frame structures more widely, giving them a reliable and solid base (support), which completely or substantially eliminates the influence of such important disadvantages as sailing and the need for additional measures of ground/landscape preparation before the installation of a temporary mobile structure. Thus, the "hybrid" technology under consideration combines the strengths of two different construction technologies, which also partially or completely solves some of the difficulties arising from the use of each of them separately.

[0041] The technology allows for the deployment of temporary structures on more "traditional" ("classical") foundations, e.g. open and/or compacted soil, concrete base, asphalt, paving stones, etc. or, for example, pile foundations. Optional elements can also be used, e.g. special adjustable supports, which allow the temporary structures to be located in areas with relatively small height differences without any prior ground/landscape leveling operations. Since no special and/or significant burial into the ground in the form of structures such as piles or foundations is required for the installation of the temporary structure, the adjustable supports can allow the base and support modules to be installed on relatively level ground without leveling and/or removal of the fertile layer, thereby reducing the environmental impact.

[0042] The resulting space between the ground and the mass of the base and support modules can accommodate communication lines, e.g. power and/or low-voltage electrical cables, water supply and sewage pipelines, compressed air and supply/extract ventilation ducts, etc. The presence and/or use of adjustable supports is not strictly required during the deployment of the temporary structure under discussion.

[0043] Modular structural elements necessary for erecting a temporary structure according to the described technology can be conditionally divided into relatively rigid base and support modules and conditionally elastic, flexible vault (ceiling) modules. It is also possible to consider separately many other elements that allow to supplement the design and expand the possibilities of the modular temporary building, the common feature of which can be called their optionality.

[0044] Referring now to **Figs. 1A and 1D** showing the mobile modular temporary structure which can be used as a mobile production facility. The structure utilizes a pneumatic frame which is formed on the basis of modified intermodal containers. The illustrated elements are: **1** - base and support module of container type, made of a modified intermodal cargo container; **3** - steel gate structure; **5** - adjustable support for installation of base and support modules; **6** - wooden shield for installation of adjustable support on the supporting ground and **207** - sealing awning of a pneumatic frame vault (dome).

[0045] Referring now to **Figs. 1B and 1E** illustrating the mobile modular temporary structure used in mobile production. This is a pneumatic frame structure based on modified intermodal containers (the main external unifying awning is not shown in the figure). The illustrated elements are: **2** - platform-type base and support modules (optional element); **4** - main airframe beam of the airframe structure in the form of an arch; **209** - reduced size airframe beam of the airframe structure in the form of an arch for closing the end spaces and **211** - additional, in this case end section of the awning.

[0046] The mobile modular temporary structure of **Fig. 1C** is also used as a mobile production facility, representing a pneumatic frame structure based on modified intermodal containers. This embodiment is provided with a concrete platform base, wherein **205** is a concrete platform base and **206** is an external centralized air conditioning unit.

[0047] **Figs. 1A, 1B and 1C** show the main elements of the construction of a temporary mobile modular structure, including structures used as a mobile mini plant. This arrangement utilizes a pneumatic frame structure based on a rectangular structure formed by base and support modules lined up one after another.

[0048] **Fig. 1A** shows the general view of the structure positioned on the adjustable supports. with **Fig. 1B** illustrates a cross-section of the temporary structure detailing the main elements of adjustable supports. **Fig. 1C** shows a cross-section of the temporary structure disposed on a compacted flat concrete foundation. The use of this kind of foundation allows the use of only container-type base modules and supports without the use of platform-type base modules and supports.

[0049] The base holding the pneumatic frame portion of the building of the mobile modular temporary structure is formed by interconnected modified intermodal containers of various configurations, i.e. base modules and container type support 1, base modules and platform type support **2** (optional element). The pneumatic frame portion of the structure is represented by cylinders **4** and **209**, as well as main awning **207** and an additional awning section **211**, and is also shown an optional element, a steel entry gate **3.** There are also depicted in the embodiments shown in **Figs. 1A and 1B** optional elements such as the adjustable supports **5**, which are installed on wooden boards **6** positioned directly on the supporting ground or waterproofing material. They are used for the controlled installation of the base and support modules of both types.

[0050] By utilizing the designs and/or basic principles of intermodal cargo containers, including the construction of platform-type base and support modules, it is not difficult to transport these modules to the intended assembly site, where they can be moved and set up by

commonly known and common means, such as container elevators of various types, cranes and/or other commonly known means for moving intermodal containers.

[0051] The variously designed base and support modules are made of steel, resistant to natural factors such as precipitation, and can be produced with or without a special external coating.

[0052] In the standard version of the temporary building directly in the support of the pneumatic frame structure of the vault (dome) and the distribution of the load of its mass are involved in the base modules and supports of container type, both specially manufactured designs, and the result of partial or deep modification of the design of standard products, in particular intermodal containers.

[0053] For example, containers with doors on both ends, with side doors, including removable doors, with one or two sides rising or opening, with partially or completely missing doors, walls and/or roof may be used. However, all of these modular elements have in common that they can be transported by one or more of the standard modes of transport intermodal (also called "sea") containers, e.g. road, rail and/or sea, and comply with the international transport requirements and standards (e.g. ISO) required for that mode of transport.

[0054] The base and support modules are represented by two main construction groups. Base and support modules of the first type can be classified as container type modules (see **Fig. 2A and Fig. 2B**), they usually have a frame construction or other construction, but withstand the necessary loads according to the requirements and standards of international transportation (e.g. ISO) for one or more standard modes of delivery of transport intermodal (also called "sea") containers, e.g. by road, rail and/or sea transport, they also have hermetically sealed enclosing structures from the external environment (acting as a barrier to the environment). The described base and support modules may also be used as directly intermodal containers for transporting other elements of the modular structure (e.g., flexible vault (ceiling) modules in folded form, communications, optional elements, etc.) during transportation and/or storage of the modular structure, as well as individual modules and/or parts, e.g., production lines, capable of being housed within mobile modular structures.

[0055] The production equipment in such modules can be operated both autonomously within said container and can be combined with other parts of the production line in neighboring containers to obtain, for example, a complete production section or line of considerable length. The resulting production lines are capable of performing the intended functions even without leaving the internal volume of the containers in which they are located. It is allowed to have removable walls and ceiling, double doors from opposite ends of the container, and other openings, including door, window and technological and other openings, in any permissible place of the container lining or doors, as well as the presence of other elements or prepared bases for their installation on the outside of the container, while not protruding beyond the established dimensions of a standard intermodal container. Thus, the base and support modules are externally fully compliant with the requirements for dimensions, shipping regulations, and securing systems for intermodal containers of, for example, 20, 40, 45 feet in length, with standard and extended dimensions.

[0056] To strengthen the steel frame structure of the base module and the container-type support, additional struts, beams, diagonal braces and other known elements, both removable and non-removable, are also allowed.

[0057] In the design of container-type base and support modules it is allowed to have removable partitions - walls (both external and dividing the internal space), roof, double doors from opposite ends of the container. In this case, the removed partitions can, for example, be used as ramps, decks, working surfaces and/or as part of other structures, including by attaching to the inner and/or outer parts of modules, including base and support modules. The said partitions may be made of any materials, including steel, wood, polymeric materials, etc., their dimensions, construction and nature of material being determined primarily by the parameters and functions of the given base and support module.

[0058] It is also possible to have and use various mechanisms for opening, folding, rolling, lowering, lifting, twisting of temporary partitions - both mechanical and working on other principles. Other openings, including door openings, window openings, technological openings, etc., are also allowed in the partitions in any place of the partition allowed for this purpose. For resistance to corrosion and abrasion by abrasive particles, additional and/or special coatings may be applied to all types of surfaces of this module with special coatings, including those of organic, inorganic, or mixed nature.

[0059] If necessary for the attachment of other elements, removable and non-removable external partitions (frame, walls, doors, ceiling floor, etc.) may have pre-prepared bases/fastenings for their mounting, also on the outside of the container. Non-removable elements/parts located on the outside of the container, for example for positioning and fixing the modules relative to each other, are located within the established dimensions of the intermodal container, and the removable elements are partially or completely dismantled at the time of transportation of the modules. Thus, the container-type base and support modules at the time of transportation fit within the dimensional requirements, fixation rules and transportation of intermodal containers of 20, 40, 45, etc. feet in length, with standard and extended dimensions.

[0060] Referring now to **Fig. 2C** showing an embodiment of the construction of a container-type base and support module with removable one side and one end outer wall. This embodiment is shown to include the following elements: **302** - side outer wall of the container, **305** - roof, **308** - spacer posts, **315** - plywood sheets, **316**

- lugs, **320** - tube frame, **321** - reinforced spacer post.

[0061] Referring now to **Fig. 2D** showing an embodiment of the construction of a container-type base and support module with removable two side and one end outer walls. This embodiment is shown to include the following elements: **303** - container outer gate, **304** - container outer end wall, **305** - roof, **308** - spacer posts, **315** - plywood sheets, **316** - lugs, **320** - tube frame, **321 -** reinforced spacer post.

[0062] Examples of container-type base and support module configurations obtained by modifying of a standard intermodal container, but which are not the only possible or exhaustive ones, are shown in **Fig. 2C** and **Fig. 2D**. In the configuration of the container-type base and support module in **Fig. 2C**, one side outer wall **302,** one end outer wall **304,** and a gate **303** are removable. In the configuration of the container-type base and support module in **Fig. 2D**, both outer side outer walls **302,** one end outer wall **304** and the gate **303** are removable. Tube frames **320** are welded to the support frame of the container-type base and support module (**Fig. 2C** and **Fig. 2D**). In some embodiments, spacer posts **308** and reinforced spacer posts **321** are provided between the framework **320** and the floor of the base module and container-type support on the side of the removable lateral outer wall. In the locations where the spacer posts **308** and **321** are installed, brackets with threaded holes are welded between the lags, the spacers are mated with them and secured with bolts and washers. As a floor of the container-type base and support module, for example plywood sheets **315** are laid. On the roof of the base and support module **305**, lugs 316 are welded on to the roof of the base and support module **1 (Fig.1B**). The heel of an arch (e.g., inflatable cylinder **4)** typically uses the roof of the base module and container type support **305** as a support when installing a vault (dome). The number of lugs **316** for securing the inflatable cylinder **4** may vary and may be up to four or more per arch heel, so that the total number thereof on the roof **305** may be up to more than 20.

[0063] Among the base and support modules, the platform type module **2** can also be distinguished. This module is an optional element in the construction of a mobile temporary structure. These modules do not have vertical posts, box frame, walls, ceiling and gates, as well as other fixed partitions during transportation and storage, but in principle do not exclude the temporary installation of such, for example, during the construction of the temporary structure and distribution of its interior space. The design of the module also includes standard intermodal container assemblies for gripping and securing the module by means characteristic of container transportation that comply with the requirements and standards of international transportation (e.g. ISO).

[0064] In order to facilitate the installation of any systems, including equipment and/or partitions of various constructions, the flooring material can be made of, for example, wear-resistant plywood. For resistance to corrosion and abrasion by abrasive particles, such as soil particles from soles or tires during production or other activities, special coatings, including organic, inorganic, or mixed, may be applied to all types of surfaces of the module. In order to facilitate the installation of various temporary systems on the described platform-type base and support module, it is also allowed to use removable and non-removable elements / fasteners, but not hindering its transportation and storage.

[0065] Referring now to **Fig. 3A** showing a general view of the base module which is a platform with peripheral fixing units according to the container transportation standard. The platform is provided with the following elements: **34** - base, **43** - side, **45** - end, **46** - fitting.

[0066] Referring now to **Fig. 3B** showing an example of the design of the base module and the platform-type support with peripheral fixing units according to the container transport standard. In this example the following elements are illustrated: **35** - longitudinal stiffeners, **36** - transverse stiffeners, **40** - groove in the longitudinal stiffener.

[0067] One example of the construction of a platform type base module **2**, shown in **Figs. 3A** and **3B,** comprises a base **34**, effectively serving as a floor of the modular structure. The base **34** is in the form of a set of, for example, laminated sheets of wear-resistant plywood of various configurations. The plywood sheets are butted together and installed on longitudinal **35** and transverse **36** stiffening ribs. This can be accomplished by means of, for example, self-tapping screws. At the ends of the longitudinal stiffeners **35** spikes can be provided, and in the transverse stiffeners - for example grooves can be formed. This allows quick and accurate joining of the stiffeners along the normal to each other.

[0068] To provide stiffness, a curved steel plate is inserted through the groove **40** in the longitudinal stiffening rib **35** and fixed, for example by welding. The stiffeners **35** and **36** may also be provided with a series of, for example, circular holes to lighten the structure without compromising the strength characteristics. On the sides of the structure, sides - e.g. welded together structural elements made of sheet steel **43** - are welded to the transverse stiffeners **36**, in which can be made, for example, technological holes and/or openings for reducing the weight of the structure. Ends may also be welded normally to the longitudinal stiffeners, e.g. welded together bent elements made of sheet steel **45**. At the corners of the structure there may be welded, for example fittings **46**, intended for mounting and fixing the platform-type base module. The sides may also be provided with the possibility of installing, for example, eyebolts to facilitate lifting and movement of the module.

[0069] Platform-type modular elements are transported and stored, e.g. stacked by lying on top of each other, aligned according to peripheral fixation units standard for intermodal containers. This can be accomplished by using both commonly used and special techniques, devices and appliances.

[0070] The pneumatic frame modular elements can be conditionally divided into lightweight, single and multi-chamber cylinders **4** and **209** (see **Fig. 1B** and **Fig. 8**), which are the basis of the pneumatic frame structure and provide stability of the structure. Further the cylinders facilitate formation of the sealing shell for the structure of the vault (dome). The dome is made of a set of pneumatic frame cylinders, for example, in the form of tents of all kinds of cuts and shapes, **207** and **211.**

[0071] In the absence of gas pressure inside said cylinders, they are flexible, compact enough, and are able to be folded like a fabric in several times and/or rolled up, thus, for example, so as to achieve a high density of stacking these elements in a relatively small volume during transportation and/or storage. Such properties in particular are possessed by cylinders made of weather-resistant polyvinyl chloride (PVC) roll fabric (membrane), e.g. translucent, reinforced, e.g. with polyester fibers (individual fibers, mesh or fabric). If necessary, such property can be modified with chemical additives, e.g. plasticizers, and if necessary, with additional coatings on the outer and/or inner surfaces to improve, for example, resistance to solar UV radiation. Individual membrane parts can be joined together, for example, a) by means of strong polymeric UV- and water-resistant threads, and/or b) by means of a special adhesive, for example a two-component system based on isocyanates, and/or c) by means of soldering, i.e. by heating the joined edges with the help of, for example, a professional thermos-fan to achieve the softening temperature of the material and pressing the heated edges tightly against each other with some overlap.

[0072] Preference is given to a method or a combination thereof that provides a strong and tight connection capable of withstanding gas pressure, for example up to 8-10 bar. Obtained by filling their internal space with gas, for example compressed air up to a pressure inside the cylinder of 3-10 bar (i.e. when the required design gas pressure is reached). Thus, the tubular cylinders **4, 209** (see **Figs. 1A** and **1B**) acquire a shape planned in the project, for example with a circular or oval cross-section (in a cross-sectional plane perpendicular to the surface of the cylinder).

[0073] In this case, the cylinders also take the shape calculated for the construction of the vault (dome) of the temporary structure and the bearing loads, such as an arch (close to a half-circle or half-oval). The form of the bearing cylinder of the pneumatic frame in the form of a tubular arch is quite common. However, this is not the only one possible form (as well as the geometric form of the perpendicular cross-section of the filled cylinder) within the framework of realization of this technology. In essence, the cylinders can be of any necessary shape to solve both primary and secondary tasks, for example, creating locking gates, creating internal partitions, as well as additional structures, including those outside the main temporary structure.

[0074] Referring now to **Figs. 6** and **6A** showing an example of location and use of welded loops for tying ropes (cables) for fixing the air-frame vault (dome) cylinders on the upper support surface of the container-type base (support) module. The elements illustrated in these figures are as follows: **212** - insert on the outer surface of the air-frame cylinder, **214** - fixing means used (rope (cable) is shown as an example), **316** - eyelet on the outer surface of the base and support module.

[0075] The design of the cylinders may also include options that allow for some sort of fixation and binding of the cylinders to each other and/or to other objects, such as base and support modules and/or anchors in the supporting base, etc. An example of linking the heel arches of pneumatic frame cylinders **4** with a base and support module of container type **1** is shown in **Fig. 6**. Such connection/linking can be realized, for example, by means of special lugs **212** on the outer side of the cylinder **4** having an eyelet **213** made, for example, of steel or sufficiently strong plastic. A rope (cable) **214**, for example (as well as staples, clamps, carabiners, ties, turnbuckles, wire, etc.), is inserted through the eyelets **213** of the cylinder and, for example, the eyelets **316** on the base and support modules and tightened with the necessary force. This makes it possible, for example by tightening/bending/snapping in a generally known or specific manner (either with or without the use of tools or machinery), to achieve a firm fixation of the airframe cylinder on the base and support module **1**.

[0076] Referring now to **Figs. 8** and **8A** Illustrating other examples of the design of devices of the invention for tying and fixing on the outer surface of the air-frame cylinder including a carabiner **213**. The binding of two pneumatic frame cylinders, for example **4**, to each other can be realized in a similar way (see Fig. 8). A rope (cable) **214**, for example, or staples, clamps, clamps, carabiners, ties, turnbuckles, wire, etc. is threaded through the eyelets **213** fixed on the outer sides of the cylinders **4** to be tied together and tightened with the required force. Devices for tightening and fastening the cylinders, for example eyelets **213**, can be placed both directly in the connecting seams during cylinder production, and in other places of the pneumatic frame cylinder, if necessary, with fixation to the cylinder by one of the known and/or previously described methods.

[0077] Fixation and fastening of the sealing tent elements, for example **207** and **211** on the construction of the erected temporary structure can be carried out, for example, by means of the above-described eyelets **213** (**Figs. 6** and **8**), located at a certain interval at least along the perimeter of the tent, and capable of connecting with such elements, for example on the outer side of the pneumatic frame cylinders. This can be also carried out with the eyelets **316** on the outer surface of the base and support modules, foundation elements or anchors buried in the bearing base (ground). It is allowed to implement any other method of fastening and fixation of sealing tent elements, which most fully meet the existing requirements of a particular design and/or situation, and which

can most fully realize the potential of the described method of construction of temporary structures.

[0078] Other ways of connecting individual pneumatic frame cylinders of any shape and size to each other and/or to other objects by means of, for example, tying loops of rope (cable) directly to the cylinders and/or objects located at a relatively close distance from each other. The connection can be also carried out by using various designs of clamps, brackets, ties and other variants and techniques of fixation and clamping are not excluded.

[0079] In some cases, such as when reinforced PVC in the form of a rolled material (membrane) is used as the main material for the cylinders, it is also possible to connect the cylinders to each other and/or to other objects using pieces of the same membrane. These pieces can be, for example, glued or soldered by the above-described methods to the cylinders/objects to be connected, including having the purpose, in addition to fixing the construction elements, to partially or completely perform the role of an external tightening and sealing tent. Other, more suitable for a particular case way of realization of cylinder connection are possible.

[0080] Arched pneumatic frame elements, once installed in the required sequence according to the project, typically do not provide the necessary sealing of the interior space from environmental factors. As mentioned above, there are variations, where the function of sealing tent can be performed by light- and weatherproof material inseparably connected (sewn, glued, soldered, etc.) with cylinders, but this method is not preferable, because it can limit the possibilities of structural changes/additions to the temporary structure, and also causes a number of difficulties in its erection/dismantling, operation, transportation and storage.

[0081] Such limitations can be avoided by using, for example, external sealing tent materials, examples of embodiments of which are shown as elements **207** and **211** in **Figs. 1A** and **1B.** Such an approach involves a detachable connection of the elements **207** and **211** to both the cylinders **4** and the base and support modules **1**. The above examples are not the only possible, mandatory or preferred examples, but merely demonstrate a general approach in creating an externally strong, airtight, in particular against wind and/or precipitation, shell.

[0082] Binding tents also often contribute further to the overall structural strength of the mobile temporary structure. In addition, the presence of an exterior sealing tent typically smooths the outer topography of the air-frame vault (dome), which simplifies the maintenance of the structure, in particular the washing of the exterior of the vault, and also substantially expands the possibilities of using the exterior of the vault (dome) for the installation of additional (optional) elements, such as flexible solar panels **208** (see **Fig. 7**).

[0083] The material of the sealing tent covering the airframe structure in the described method may be single or multi-layer, a single tent or sufficiently firmly connected (bonded) separate parts, be similar in nature to the material of airframe cylinders and/or have other properties. The material may also be, for example, transparent and/or colored, combined from pieces with identical or different properties, with or without additional layers, including various types of printing on the surface, etc. The methods of joining the individual parts of the tent may vary, but their choice should be based primarily on objective circumstances.

[0084] The sealing tent (or tent system) can cover only a part of the outer surface of the airframe vault (dome) or, on the contrary, it can cover the entire surface of the airframe vault (dome). In principle, the sealing tent can also cover not only the air-frame part of the structure, but also, for example, the outer (peripheral) walls of the base modules and supports that form the perimeter of the structure, as well as the space in the immediate vicinity next to or under the temporary structure, such as the foundation of the structure or adjustable supports.

[0085] In order to harmonize as well as to reduce the number of materials used, the material used to manufacture the tent, for example a reinforced PVC roll membrane, may also be used as a waterproofing gasket/membrane, for example between the supporting ground and the bases of the adjustable supports or directly between the supporting ground, for example open ground, and an external surface in contact therewith, for example the base and support modules. If necessary, the sealing tent layer can also be located inside the temporary structure, e.g. as an additional thermal insulation layer.

[0086] Referring now to **Fig. 4A** showing a supporting platform of an adjustable support with the possibility of mounting four neighboring mating modules of the base and support on it. **Fig. 4A** shows **49** - support base **50** - adjusting stud.

[0087] Referring now to **Fig. 4B** showing an example of design of adjustable support designed for the joint of the corners of four neighboring base and support modules. The elements illustrated in **Fig. 4B** are as follows: **51** - main beam, **52** - technological hole, **53** - hole for adjusting stud, **54** - rectangular slot, **55** - nut, **56** - stud, **57** - beam, **58** - rectangular stud, **59** - stacking cone.

[0088] Referring now to **Fig. 4C** showing an example of an adjustable support designed to fix and adjust a single angle of a base module and a support, for example located at an edge of a structure. **Fig. 4C** shows **68** - threaded support, **69** - rack, **70** - nut.

[0089] Secondary, optional elements of the modular temporary structure, which allow to supplement its design and expand its capabilities, may include, for example, steel structures of adjustable supports **5** (see **Figs. 4A, 4B, 4C**), entry gates **3** (see **Fig. 5**), life support systems **206** (see **Fig. 1C**), solar panels **208**, etc. The use or non-use of these elements is often not critical to the implementation of the described technology for erecting mobile modular temporary structures, but in some cases may be a very useful addition.

[0090] The main function of the optional elements, the so-called adjustable supports **5**, is to be able to adjust

the level of the position of the base and support modules relative to the surface of the supporting ground (base), to fix and control the position of the module, and to directly support the base and support modules during the existence of the deployed temporary structure. Thus, the adjustable support makes it possible to facilitate the erection of the temporary structure and to simplify certain aspects of its operation, for example by distributing a substantial or some part of the communication lines in the space between the ground surface and the outer surface of the floor of the temporary structure represented by the base and support modules **1** and **2**. Adjustable support is a rather general definition that combines a number of functions, the realization of which, both all at the same time and some separately, can be realized by a wide variety of methods, devices and appliances, therefore the constructions described herein (**Figs. 4A 4B** and **4C**) are not the only possible, preferable or exhaustive and can be considered only as an example of realization of such a principle.

[0091] The adjustable support can be designed to support either an individual module or two to four interlocking base and support modules. **Fig. 4A** shows, as an example, a general view of an adjustable support designed to work at the junction of four corners belonging to four different base and support modules. The structure can include the support pad **49** and the adjusting studs **50**, which are connected and adjusted by means of a threaded connection. The description is not exhaustive for this technology, but only illustrates the principle of operation of the support. These elements, when joined together, for example by welding, may constitute a support structure.

[0092] **Fig. 4B** is a detailed representation of the main elements of the construction of an adjustable support designed to operate at the junction of four corners belonging to four different modules of the base and the support. As part of the support platform, it is possible to identify the main beam **51**, made, for example, in the form of a tube of rectangular cross-section from a welded steel and having, for example, a technological hole **52**, a hole for an adjusting stud **53**, as well as rectangular grooves **54** for precise connection with the counterparts. Nuts **55** are welded along the holes **53**, to allow adjustment studs **50** to be fitted. On the normal to the main beam **51** from both sides by alignment of studs 56 and grooves **54** and fixation by welding are installed beams **57**, made of rectangular section pipe from well-welded steel and having, for example, a technological cut **52**, a hole for the adjusting stud **53**, as well as rectangular studs **58** for precise jointing with the main beam. To the main beam **51** and beams **57** are welded, for example, brackets made in the form of rectangular pipes **58** cut at a certain angle and designed to strengthen the structure and give it rigidity. Stacking cones **59** may be fixed on top of the pipes (they may be removable with the possibility of replacement by elements of other shape and/or design). In the simplest case, the adjusting stud **50** may comprise a stud and a nut welded thereto.

[0093] The single support pad in **Fig. 4C** can fix only one corner of the base and support module, whether of containerized or platform type, and is therefore preferably located at the extreme points (perimeter corners) of a mobile temporary structure where the need for such a pad arises. The single support pad comprises a threaded support **68**, a stand **69**, and a nut **70**. An intermediate option between a single support pad and a support pad for four adjacent modules at once, for example, is a pad for supporting two adjacent modules.

[0094] As noted earlier, various constructions can be used as a locking partition (gate) for an opening in the construction of a temporary structure, for example in the end(s) of the rectangular temporary structure considered in **Figs. 1A** and **1B**, which is intended, for example, for traffic. For example, pneumatic frame gate structures may be universal. However, a matter of inconveniences may be associated with their operation, primarily a low degree of protection against intrusion.

[0095] Therefore, when erecting temporary air-frame structures, such optional elements as steel structures of entrance gates **3**, shown in more detail in **Figs. 5, 5A** and **5B** can be used. The installation of such a structure requires the presence of solid supports, the role of which can be performed, for example, by base modules and container-type supports **1** standing at some distance. Thus, the entrance gate **3** is mounted between the two base and support modules and secured by means of fasteners, for example a threaded retainer **94**, washers **95**, and a nut **96**. The threaded fastener may comprise, for example, a threaded rod to which a plate made of well-welded sheet steel is welded.

[0096] The basic and optional elements of the temporary building can be further modified. For example, a special coating can be used to partially reflect infrared radiation (heat energy) coming outward from the internal volume of the temporary structure in the cold season. The reflective coating layer of inorganic, organic or mixed nature can be created by one of the known methods, for example applied to the surface of the cylinders of the airframe supporting arches. The reflective layer may be applied to the inner and/or either the outer surface of the air-frame ceiling (vault) cylinders or to a separate material, such as a thin polymer film, and then placed at a suitable location in the temporary structure.

[0097] The film with the applied reflective layer may be placed either inside the interior volume of the air-framed ceiling cylinders (vault) or outside the interior volume of the air-framed ceiling cylinders (vault), for example suspended from an inwardly oriented surface of the air-framed ceiling cylinders (vault) of the temporary structure. This approach allows a portion of the infrared radiation (heat energy) lost to heat the air-frame ceiling (vault) to be reflected into the interior volume of the temporary structure, thereby reducing heating costs. The thin elastic reflective material (film) can be removed after the end of the heating season using both standard methods and

specially developed means.

[0098] Other optional elements and modifications of the temporary structure may also include a variety of interior partitions, various window and door openings, and other structures located both inside and outside the temporary structure, such as an external unit of the centralized air conditioning system **206**, other ventilation systems, heating, water supply, sewage systems, etc. Optional elements and modifications may be placed directly on the exterior surfaces of the temporary structure.

[0099] An important option of the outer surface of the vault (dome) of an arched temporary structure is the possibility of placing on various types of systems that store renewable energy, such as sunlight. Such technologies reduce energy consumption from external sources up to the level of electric power self-sufficiency of the structure.

[0100] Referring now to **Fig. 7** showing an example of arrangement of solar panels on the outside of the vault (dome) a pneumatic frame structure: **208** - solar panel system.

[0101] One of the solutions may be, for example, flexible solar panels **208** (**Fig. 7**), on the vaults (domes) of temporary structures with relatively hollow configuration. Such placement of panels allows for a more rational use of the surrounding space, which is especially important in areas with intensive low-rise buildings.

[0102] Solar power plants can be either stand-alone or connected to the municipal grid. With the current state of the art, it is possible to generate, store and consume sufficient electricity to operate, for example, a fully equipped machine shop, a medium-sized manufacturing industry, etc. The bearing capacity of the pneumatic frame vault (dome) is able to withstand its own weight, the weight of the external tent material, cells of modern flexible solar panels with fasteners, as well as to resist wind and snow loads.

[0103] Equipped with a sufficiently powerful solar power plant, the temporary structure may be relatively or completely autonomous from municipal water and electricity supply and partially autonomous in terms of sewerage and drainage.

[0104] In other aspects of the invention, the principles of erecting a temporary structure using a combination of base and support modules and vault (dome) modules are discussed.

[0105] Before starting the erection of a temporary structure, some preparation of the supporting soil is necessary. In particular, leveling to a level that allows safe installation of the base and support modules, as well as ensuring the bearing capacity. In the case of adjustable supports **5**, height differences of e.g. 150 mm or more are permitted. Waterproofing plays an important role, so it is recommended to use a sealed continuous layer of durable waterproofing material over the entire area of the temporary structure between the ground and the steel elements in contact with it.

[0106] It is provided that the base modules and supports of all types can be arranged in rows (both horizontally and vertically) when the temporary modular structure is unfolded in order to obtain a basic future by bringing them close together (and also by placing them on top of each other) and firmly connecting them to each other using both common and special techniques, devices and appliances. In this way it is possible to modify the construction - to add new parts, to change or dismantle the current configuration. For adjusting the height of all the base and support modules in question relative to the ground surface, for example, adjustable supports **5** can be used. This is also a measure of protection against waterlogging (in temperate climatic zones) and also provides additional resistance to heat transfer of the structure to the supporting ground.

[0107] Adjustable supports also generally eliminate the need for foundations, terrain preparation or ground bearing capacity. This type of installation is used to describe the possibilities of the technology in detail, but is not necessary, obligatory or exhaustive. In this case it is allowed to install the base and support modules directly on the ground (both with and without a waterproofing sub-layer, e.g. elastic waterproofing membrane layer), on crushed stone, clay, sand on board or panel structures made of wooden or polymer boards, etc., as well as supports, including those with the possibility of height adjustment, made of steel and other suitable materials and their combinations, as well as without them.

[0108] When erecting the temporary structure, the base and support modules **1** are lined up in rows in the horizontal plane (if necessary, also in the vertical plane), forming the perimeter of the future temporary structure, for example, of rectangular shape as shown in **Fig. 1.** Simultaneously it can be the support for further installation of the pneumatic frame vault. On the surface formed by the roofs of the base and support modules, the airframe vault (ceiling) of the temporary structure is installed. The cylinders of the pneumatic frame vault (dome) are connected with each other and the base and support modules, for example, in the way described for **Figs. 6** and **8**.

[0109] To move large-sized objects, e.g. transport at ground level, a gate can be installed as part of the temporary structure, which is attached either to the adjacent (from above) pneumatic frame cylinders, e.g. to **209** (more often for the pneumatic frame version of the gate) or to the base and support modules **1** (usually steel version of the gate). It is possible to locate the gate as part of either side of the temporary structure. Door, window and other openings in the walls of the base and support **1** modules can be provided for movement and activities of people, including emergency evacuation.

[0110] It is also possible to use these base and support modules **1**, which do not participate in supporting the pneumatic frame vault (dome) to create enclosed rooms inside the covered space of the temporary structure (see **Fig. 1**), i.e. to arrange them in horizontal and/or vertical rows using the same methods and means. Container-type base and support modules, participating only in fill-

ing of the inner space, can be installed both before erection of the pneumatic frame vault (dome) and after its erection.

[0111] The main purpose of such modules inside the space of the modular structure may be, for example, as office space, huts and gatehouses, warehouses, utility rooms, laboratories, insulation boxes, temperature-controlled chambers, chambers for painting and/or other coatings, separate production areas with high level of danger, noise, dust, splashes, sparks, chips, smoke or gases harmful for inhalation, and so on. The modules not involved in the attachment/support of the airframe structures and located within the space of the temporary structure, including the base and support modules 1, have a wide range of possibilities to be moved, repositioned, and removed and/or replaced by other modules, in particular the base and support modules.

[0112] During the unfolding of the modular building, platform-shaped base modules may also be used, which are mainly involved in enclosing the interior space of the temporary structure from the supporting ground surface. In order to adjust the height of all used platform base modules relative to the ground surface, it is convenient to use adjustable supports 5 (optional elements), which also help to create a space under the temporary building where, for example, utility lines can be located. The platform modules are arranged tightly to each other and to other base modules, including those involved in the installation of the pneumatic frame vault (ceiling), and thus form a sealed floor of the structure, while being arranged on the adjustable supports at some distance from the supporting ground. The presence and/or use of adjustable supports is not strictly necessary in the process of deployment of the temporary structure under discussion.

[0113] It is also possible to use platform type **2** base and support modules, including for reinforcing the ground surface outside the perimeter of the temporary structure by creating temporary or permanent decks from them, including those lying separately and/or tightly together, for building vertical partitions inside or outside the temporary structure, for creating a closed contour of the pneumatic frame vault (dome) support, as well as in the composition of structures with other base and support modules, including those not participating in the support of the vault, e.g. such as freestanding within a temporary structure to create enclosed spaces within the encompassing space of the temporary structure, including arrangement in horizontal and/or vertical rows.

[0114] In addition, possible options for using the described construction technology are the installation of modular base and support elements exclusively of platform type **2**. This can be used for the support for the subsequent installation of the pneumatic-frame vault (dome) or the use of platform-type base and support modules not on the entire internal area of the temporary structure being erected. The base and support modules of platform type **2** are optional. If, for example, a concrete base is used, the use of this type of base and support modules is not necessary.

[0115] The described construction technology also permits the construction of a modular temporary structure solely from container-type base and support modules or a combination of base and support modules of different types, in which case the total area of the structure is limited by the scale of production.

[0116] After the perimeter of the future temporary structure, for example rectangular in shape, is constructed from the respective base and support modules, it becomes possible to erect a pneumatic frame ceiling (vault), for example by installing pneumatic frame arches **4** and **209** filled with gas to the required pressure inside cylinders. This can be arranged on the upper peripheral surface of the contour of the support modules and then installed between them or directly on them parts of a waterproof tent, for example **207** and **211.**

[0117] The pneumatic frame cylinders **4**, considered as an example, may have the form of a curved tube with a conventionally flat section ("heel") **222** at both ends thereof (see **Fig. 6**, **Fig. 8**). The "heel" **222** in the construction of the cylinder 4 provides additional stability on a flat surface. Thus, it can be mounted, for example, on the roof of the base and support module 1 (see **Fig. 1B, Fig. 6**). Reliable attachment of the cylinder **4** to the base and support module 1 is achieved, for example, by using a cable **214** to link the cylinder 4 available near the heel **222**, the eyelets **213** and the eyelets 316 available on the roof of the base and support module 1 (see **Fig. 6**).

[0118] The row of arches made of airframe module cylinders can be continuous, depending, for example, on the purpose of the structure, the climatic zone, the size of the structure or the intended load on the vault outside the structure.

[0119] It is also possible to use smaller arch cylinders to fill the space at the end of the building between the main, load-bearing cylinder and, for example, the entrance gate. It is also possible to use such smaller cylinders to build walls and partitions inside the building. As an example, the cylinder **209** is shown as part of an end wall of a temporary structure.

[0120] After installation, if necessary, additional binding of pneumatic frame cylinders to each other is performed by, for example, firmly and rigidly tying the cylinders to each other with a rope passing through special eyelets **213** on the outer surface of the tied cylinders of the arched ceiling (vault) (Fig. 8).

[0121] After installation of the pneumatic frame ceiling (vault) arches, for example by the method described above, and their binding to each other forming a solid frame, the elements of the awning material, for example **207** and **209**, are stretched over the arches on the resulted construction. In doing so, the tent material elements are fixed, for example, along the line of location of the welded eyelets **316** on the outwardly facing side of the base and support modules **1**.

[0122] The tent elements are secured, for example, by firmly and rigidly tying them with a rope passing through

the rope insertion devices arranged in a row along the edge of the tent elements and the steel, for example welded, eyelets **316** on the roof or on the peripheral side of the base and support module 1. The installation of the tent materials thus completely encloses the interior space of the temporary structure from the external environment, thus allowing the formation of a microclimate inside the temporary structure.

[0123] The use of the separable tent elements is mainly dictated by the stereo-metric parameters of the structure to be erected. For example, in the case described in the figures, in addition to the main awning **207**, additional awnings are also used, e.g. **211** on both ends of the arched air-frame structure.

[0124] It is also possible to use the tent material to cover, for example, the peripheral walls of the base and support modules, and to use it as vapor barrier and waterproofing materials when creating an additional barrier, for example between the surface of the supporting ground and the outer surface of the base and support modules, and as a canopy material on the outside and inside of the temporary structure.

[0125] To erect and maintain in functional condition a pneumatic-frame vault (dome) of a structure, for example, a pressure injection and control system is used, which allows to maintain the set pressure parameters inside the pneumatic-frame cylinders. The pressure inside such pneumatic frame structure may be decreased or increased as needed. Such systems, as well as other systems for maintaining the required microclimate inside the temporary structure, may be located inside or outside the temporary structure, including as freestanding units, as part of freestanding base and support modules, or as part of adjacent air-frame temporary structures.

[0126] The described mobile temporary structure can be used in any climatic zone, in moderate winds, under moderate and intensive snow loads. When dismantling the modular structure, the described operations are carried out in reverse order. After dismantling of the temporary structure, the elements of the structure, in particular the pneumatic frame and optional elements, are brought to the most compact state and placed inside the container-type base and support modules, the design and type of which allows the placement of other objects inside.

[0127] It was discussed above that the invention discloses a modular transportable quickly erectable/disassembled mobile temporary structures, mobile micro-factories, consisting of a variety of structural modules. These include elements of the temporary structure both ready for use in construction and/or in need of preparation), the necessary arrangements for deployment and ensuring the stability of the temporary structure. The modules include the necessary facilities for maintaining conditions for human occupancy and/or activities inside the erected structure (e.g. ventilation systems, etc.) and, for example, facilities for carrying out the planned activities inside and/or outside the said temporary structures (e.g. production equipment, etc.). The modules during transportation and storage of the temporary structure in a compact state, are stacked so as to be transportable by one or more standard modes of transport intermodal (also called "maritime") containers, e.g. road, rail and/or sea, and which comply with the requirements of the International Transport Standard (ISO) for that mode of transport. In the invention this is achieved, among other things, by having a majority of the elements of the temporary structure that do not comply with international transportation regulations to be disposed inside other elements of the temporary structure, such as intermodal (also called "sea") containers.

Claims

1. A modular mobile temporary structure, comprising:

   a plurality of primary modules, each said primary module having a housing formed utilizing an intermodal shipping container, said plurality of the primary modules forming a base and an outside periphery of a temporary structure;
   a lightweight pneumatic frame consisting of multiple inflatable elements, and a sealing tent; and said lightweight pneumatic frame forms a dome of said mobile temporary structure, and said inflatable elements are connected to each other and to the base;
   wherein the sealing tent connects at least the inflatable elements to each other and covers an exterior of the temporary structure to protect an interior of the structure from climatic and atmospheric factors.

2. The modular mobile temporary structure according to claim 1, wherein the base is selected from the group including: a compacted soil, concrete, an asphalt, a paving stone and other solid substrates, and the base supports the temporary structure and said solid substrate serves as a finished floor.

3. The modular mobile temporary structure according to claim 1 or 2, wherein the base further comprises multiple adjustable supports provided under the primary modules and the adjustable supports are placed under the primary modules around the outside periphery of the temporary structure.

4. The modular mobile temporary structure according to one of the claims 1 to 3, further comprising a reflective layer to reflect a heat energy and to return a part of the reflected energy back to the interior of the structure.

5. The modular mobile temporary structure according to claim 4, wherein the reflective layer is provided at one side of the structural modules or provided at a

material placed on the exterior surfaces of the temporary structure.

6. The modular mobile temporary structure according to one of the claims 1 to 5, wherein the inflatable elements are formed having cylindrically shaped configuration.

7. The modular mobile temporary structure according to one of the claims 1 to 6, wherein flexible solar panels are provided at the exterior of the dome to generate electricity based on sunlight.

8. A method of formation a modular mobile temporary structure, comprising:

producing a plurality of primary modules, each said primary module having a housing formed utilizing an intermodal shipping container, said a plurality of primary modules forming a base and an outside periphery of the temporary structure;
producing a lightweight pneumatic frame consisting of multiple inflatable elements, and producing a sealing tent;
wherein said lightweight pneumatic frame forms a dome of said mobile temporary structure, and said inflatable elements are connected to each other and to the base;
wherein the sealing tent connects at least the inflatable elements to each other and covers an exterior of the temporary structure to protect an internal area of the structure from climatic and atmospheric factors.

9. The method according to claim 8, wherein the base is selected from the group including:
a compacted soil, concrete, an asphalt, a paving stone and other solid substrates, and wherein the base supports the temporary structure and said solid substrate serves as a finished floor.

10. The method according to claim 8 or 9, wherein the inflatable elements are formed having cylindrically shaped configuration, and the base of the temporary structure further comprises multiple adjustable supports provided under the primary modules and the method further comprises the step of placement the adjustable supports under the primary modules around the outside periphery of the temporary structure.

11. The method according to one of the claims 8 to 10, further comprising the step of providing a reflective layer to reflect heat energy and to return a part of the reflected energy back to the internal area of the structure.

12. The method according to claim 11, wherein the reflective layer is provided at one side of the structural modules or provided at a material placed on the exterior surfaces of the temporary structure.

13. The method according to one of the claims 8 to 12, further comprising the step of providing flexible solar panels at the exterior of the dome of said mobile temporary structure to generate electricity based on sunlight.

14. The method according to one of the claims 8 to 13, wherein the temporary mobile structure the intermodal shipping containers of the primary modules are utilized directly as transportation containers for other elements of the temporary mobile structure for convenience of transportation and storage.

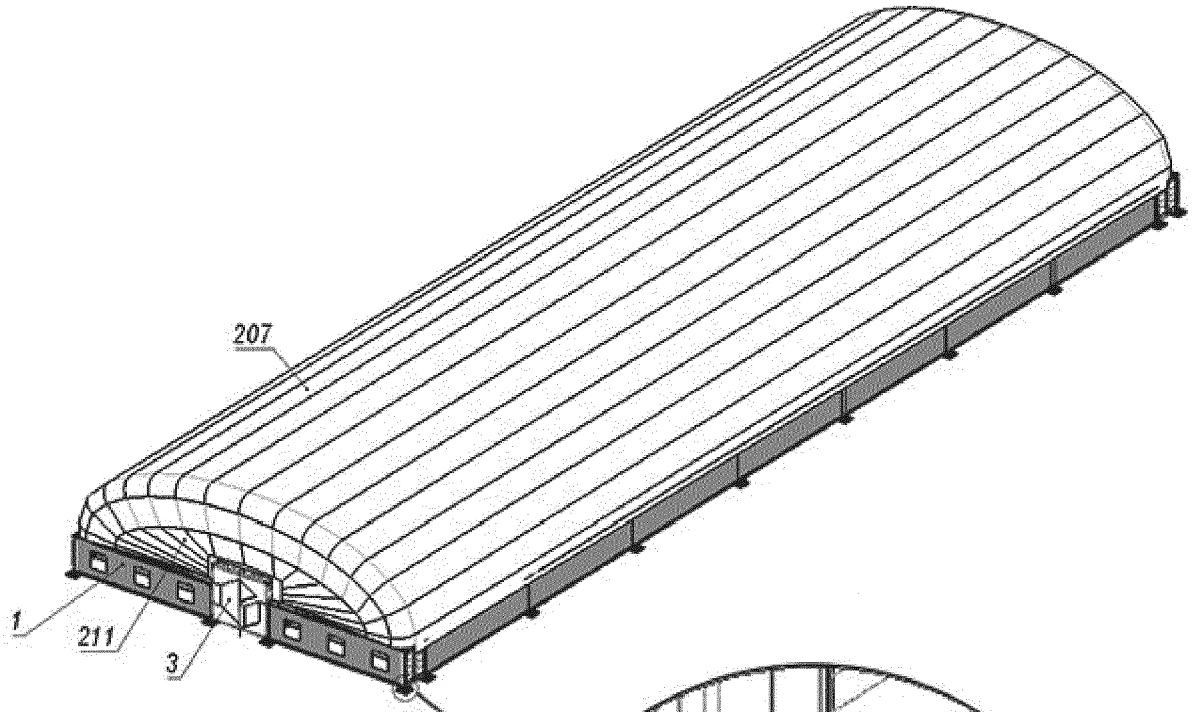


Fig. 1A

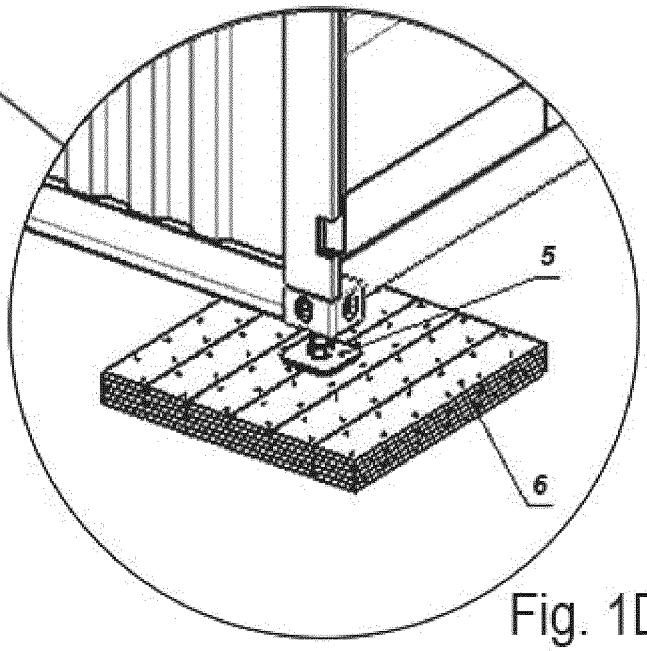


Fig. 1D

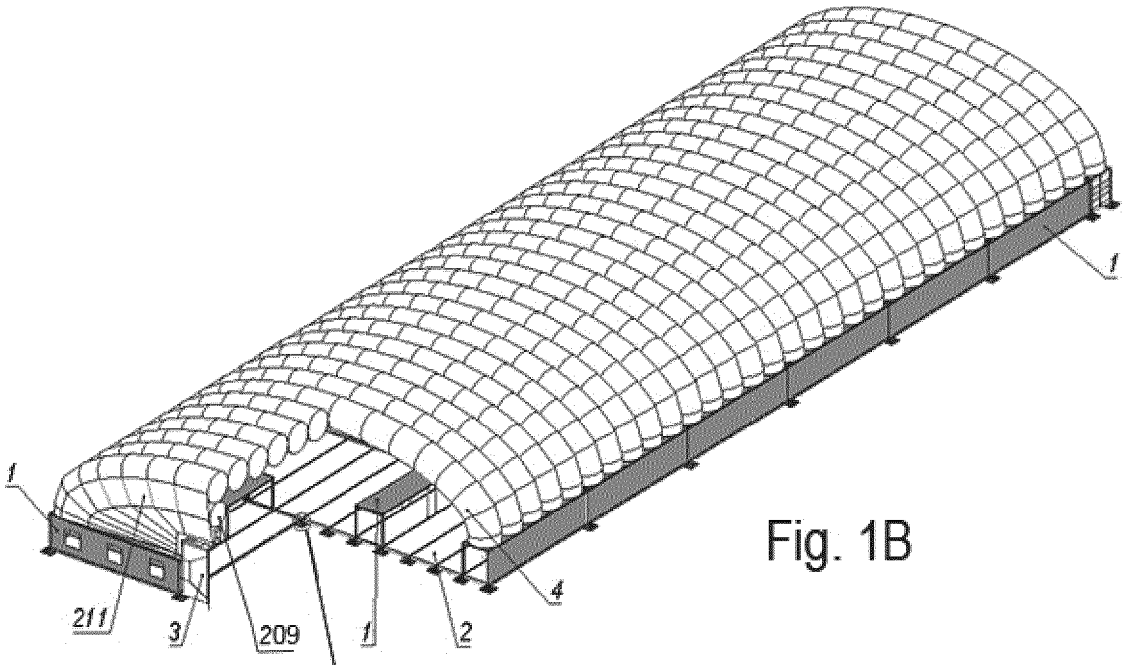


Fig. 1B

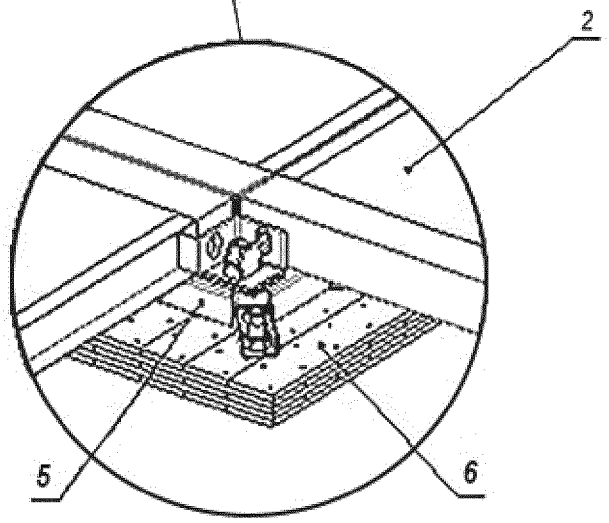


Fig. 1E

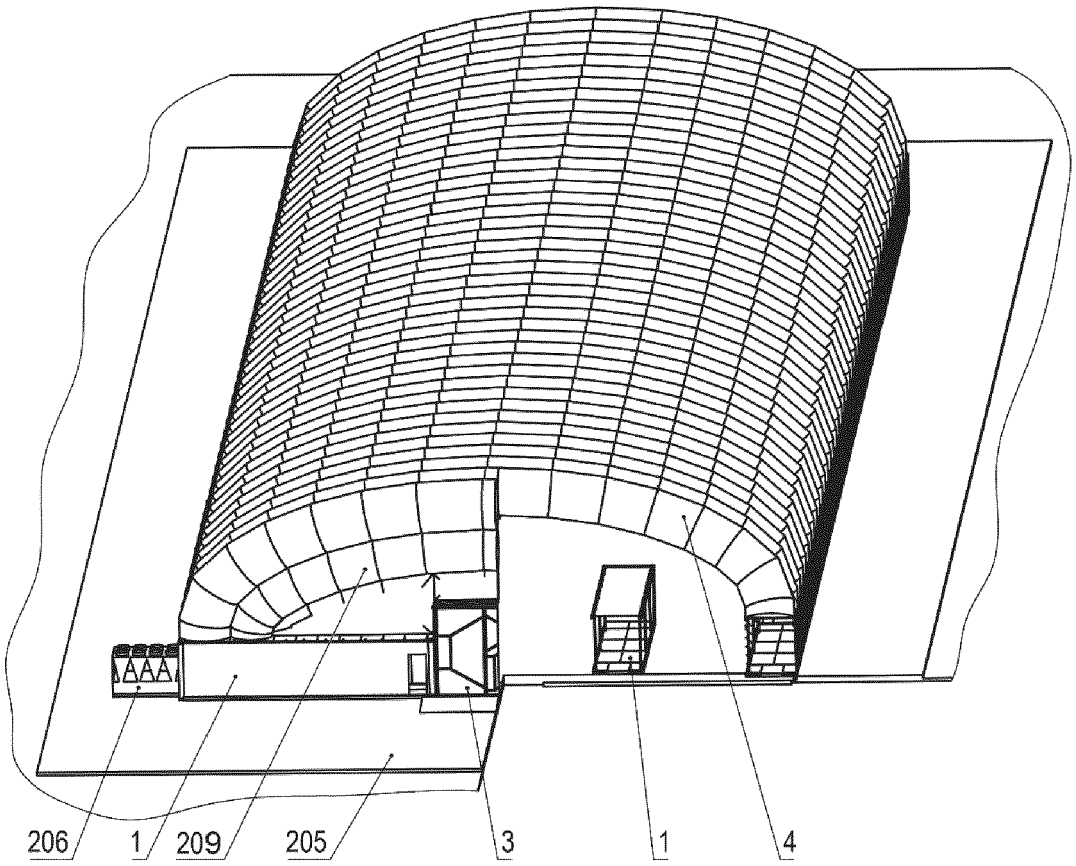


Fig. 1C

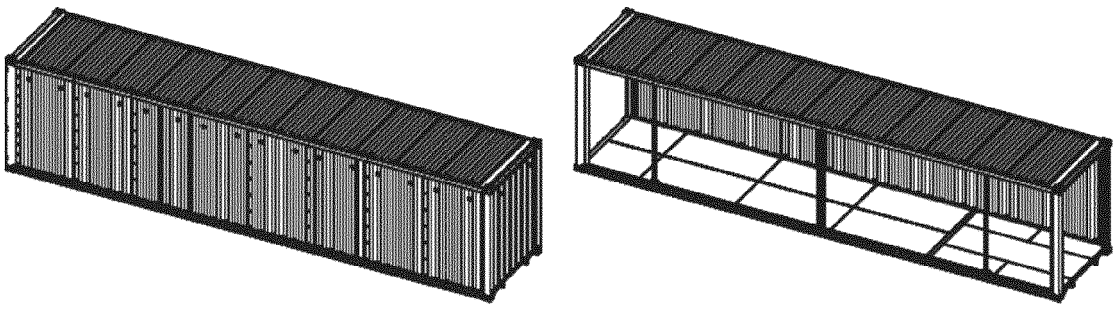


Fig. 2A

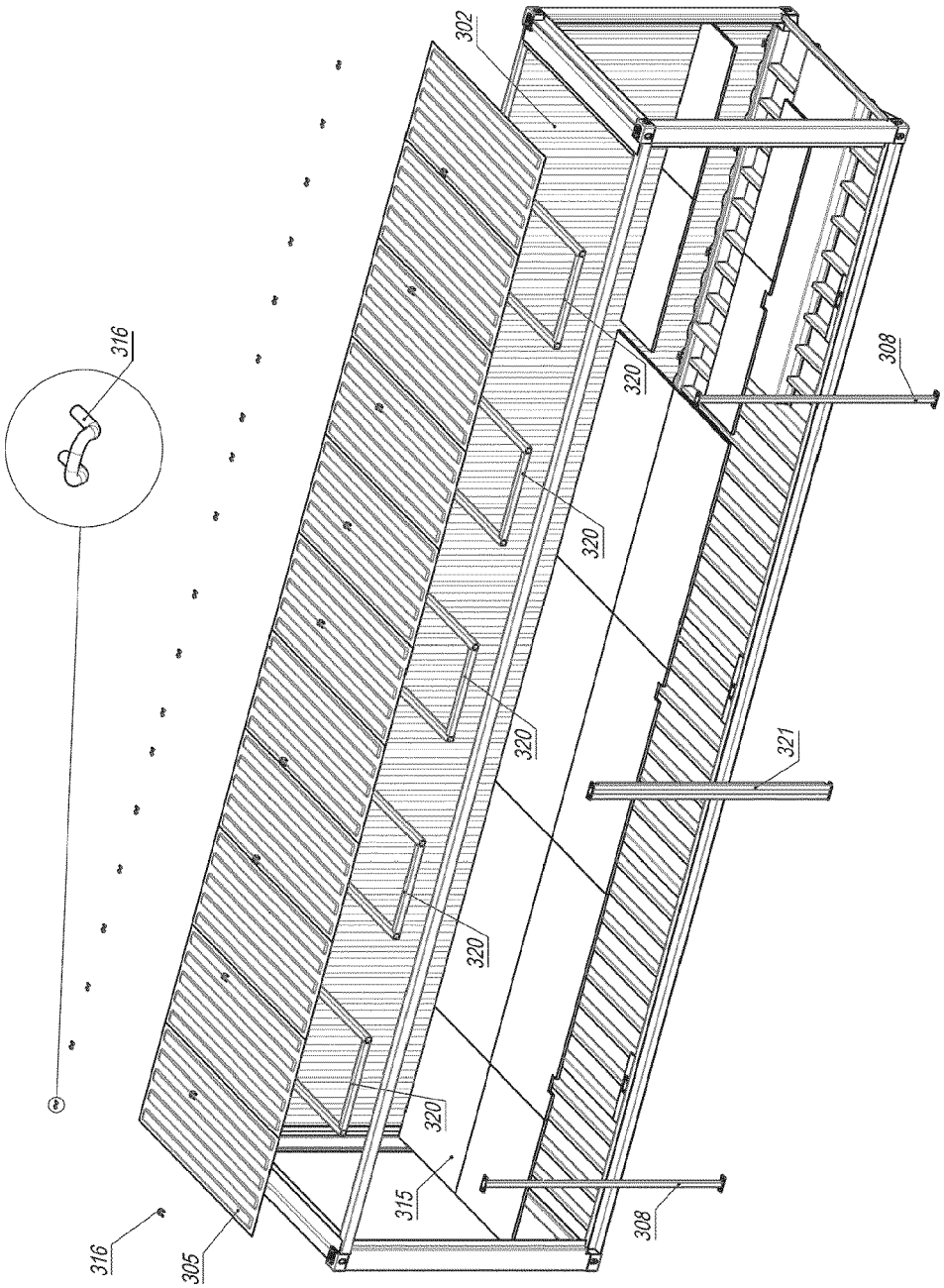


Fig. 2C

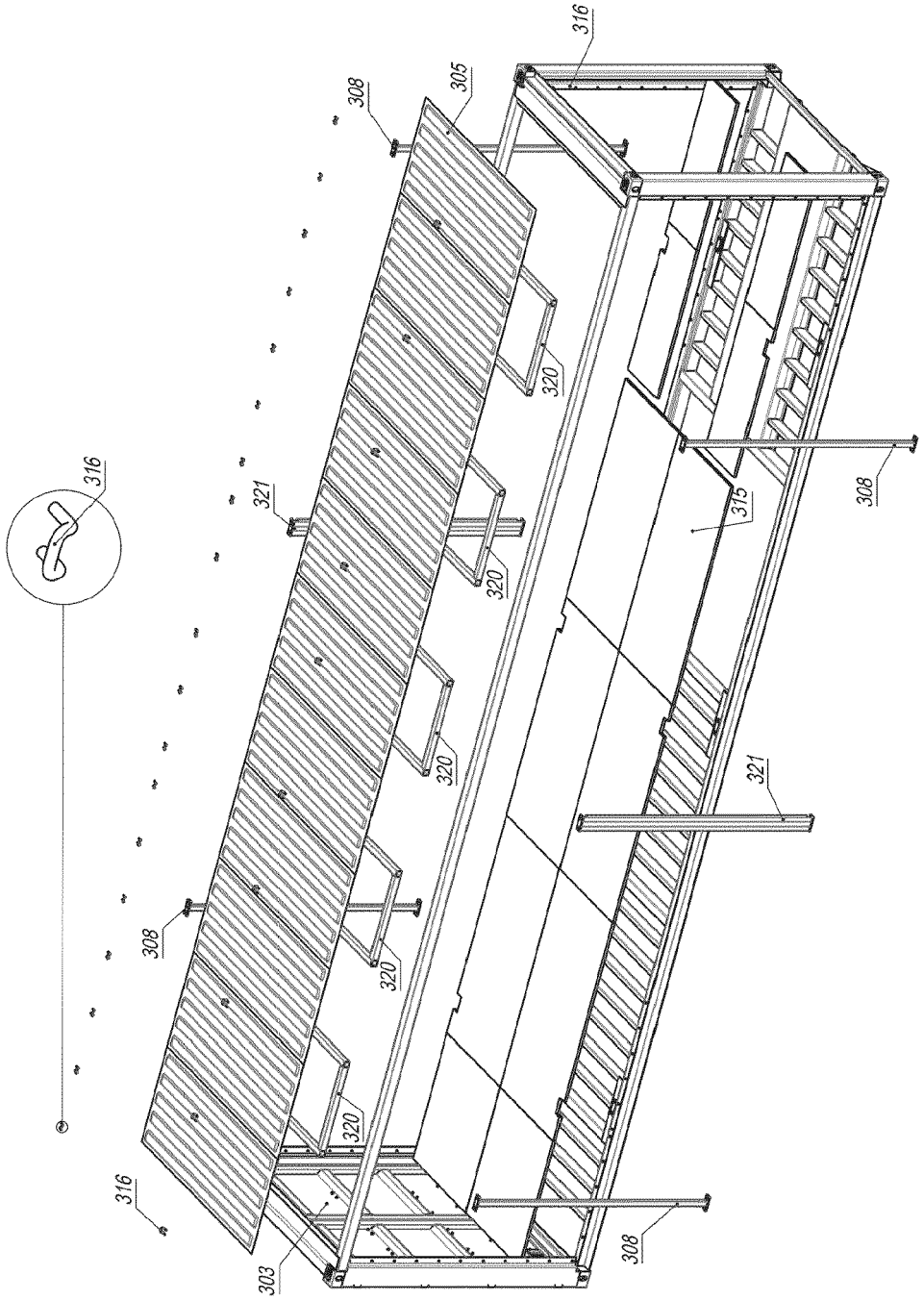


Fig. 2D

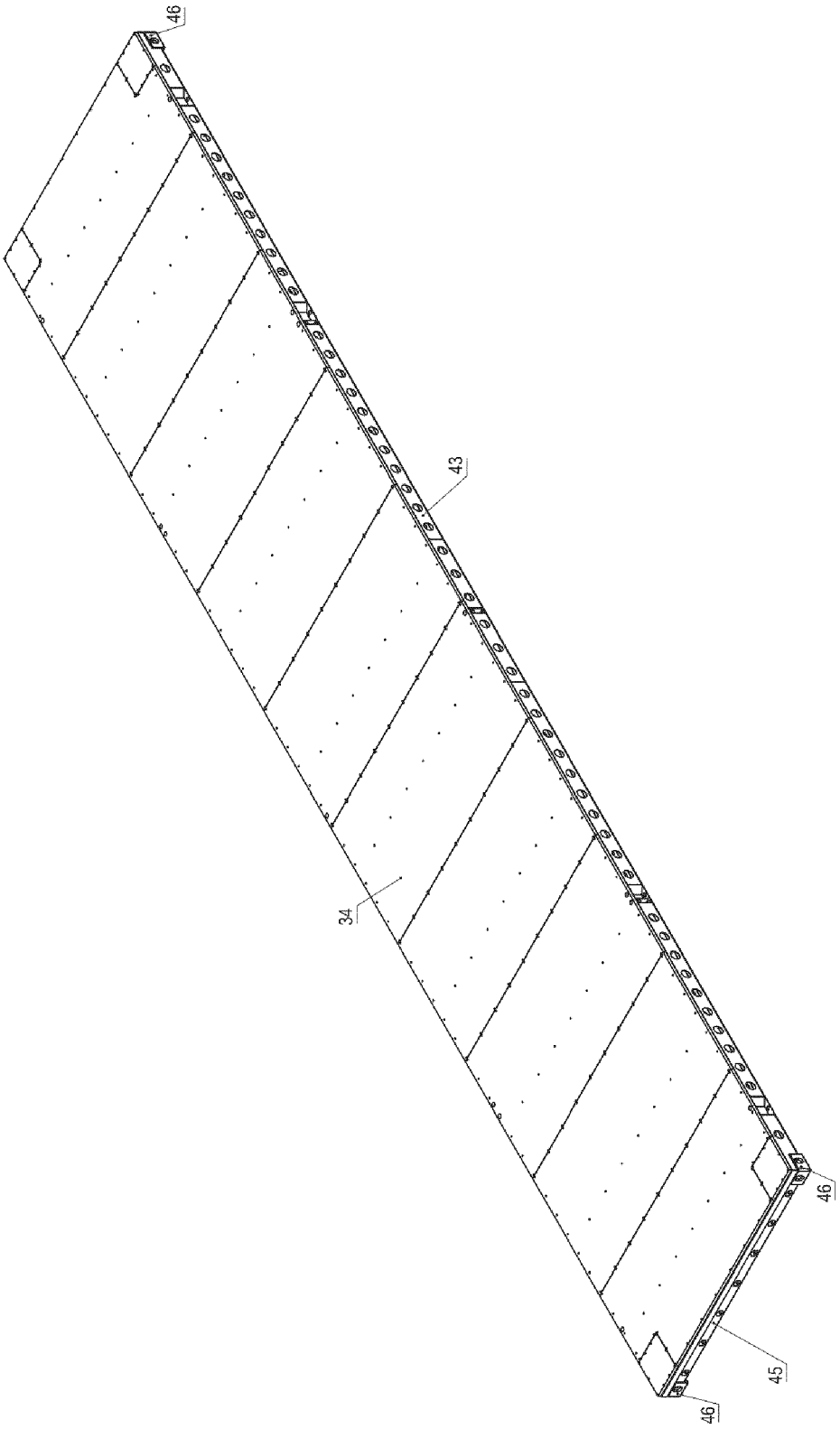


Fig. 3A

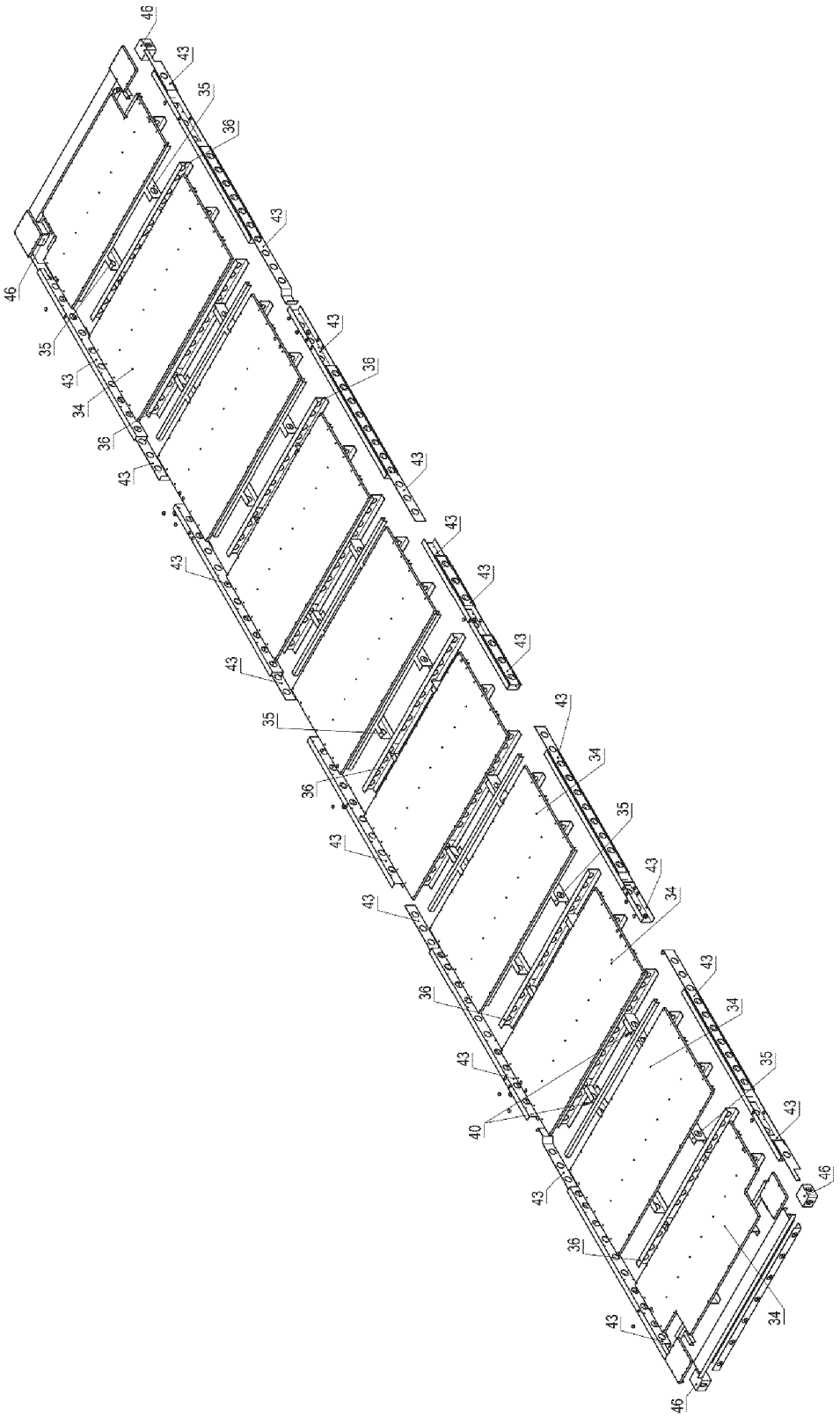


Fig. 3B

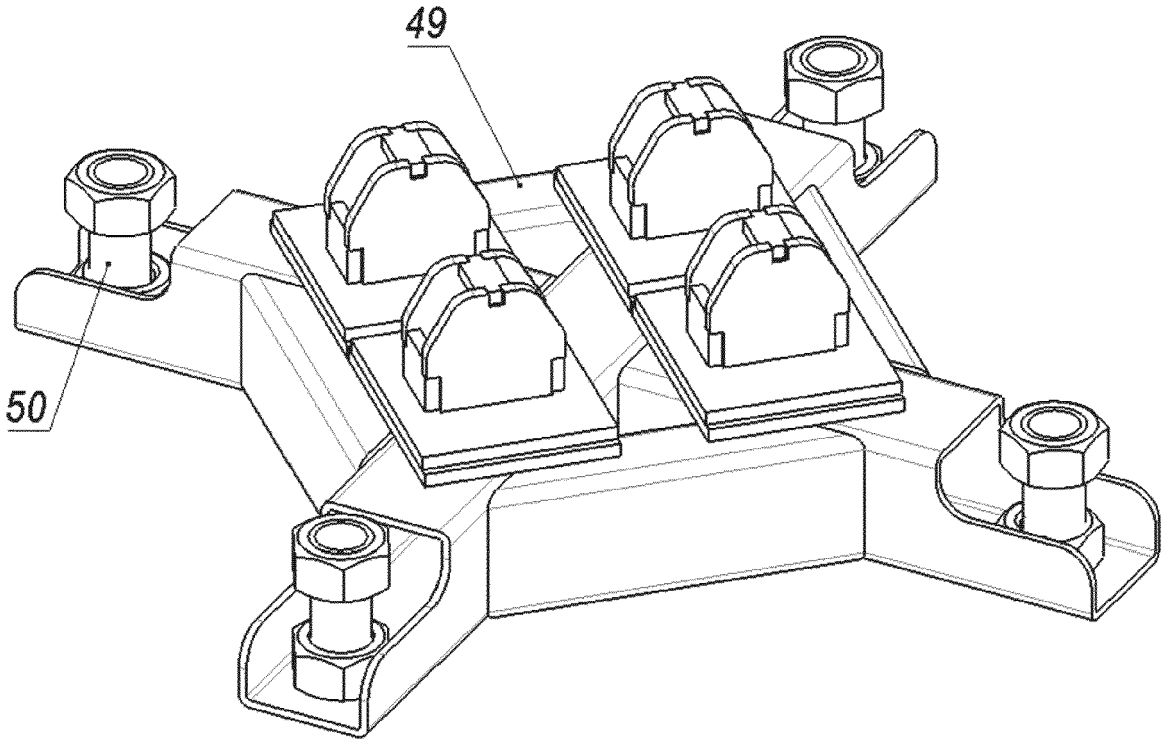


Fig. 4A

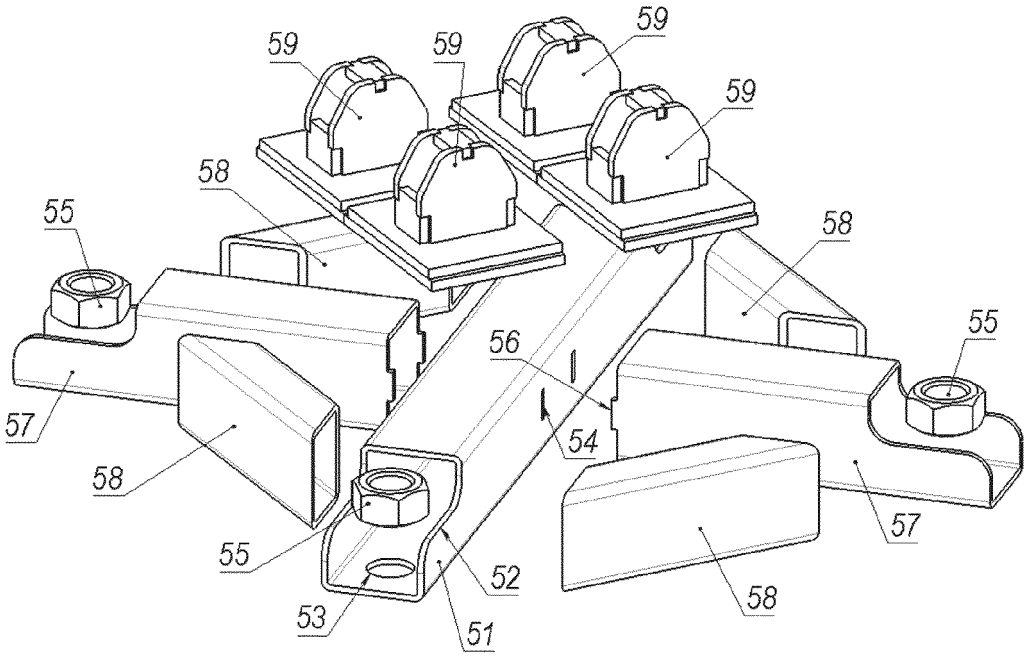


Fig. 4B

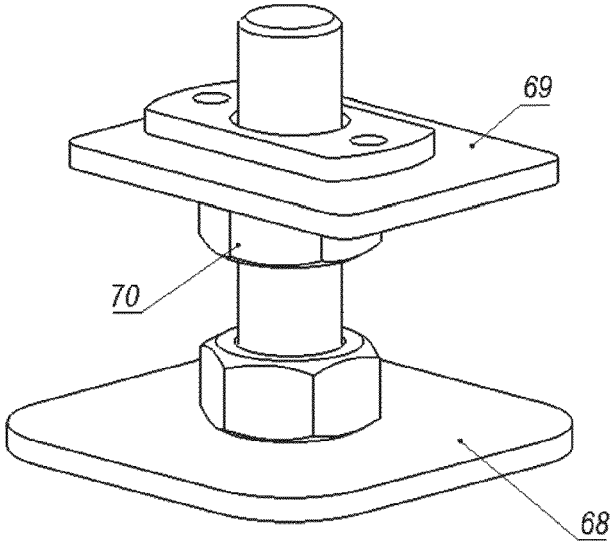


Fig. 4 C

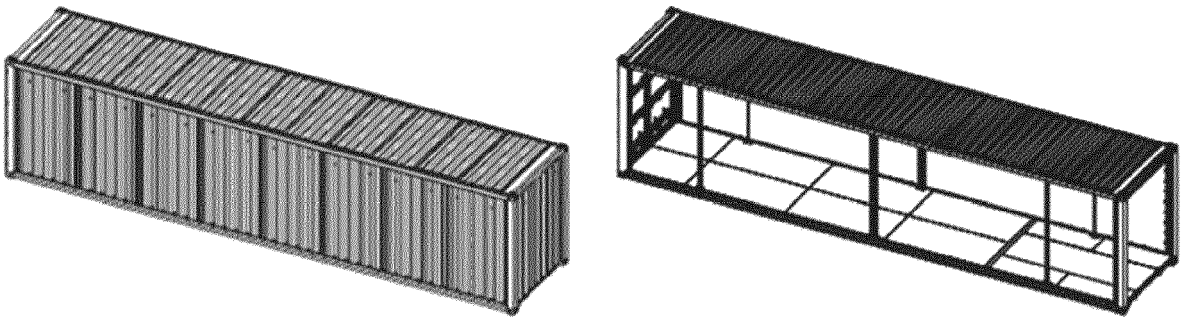


Fig. 2 B

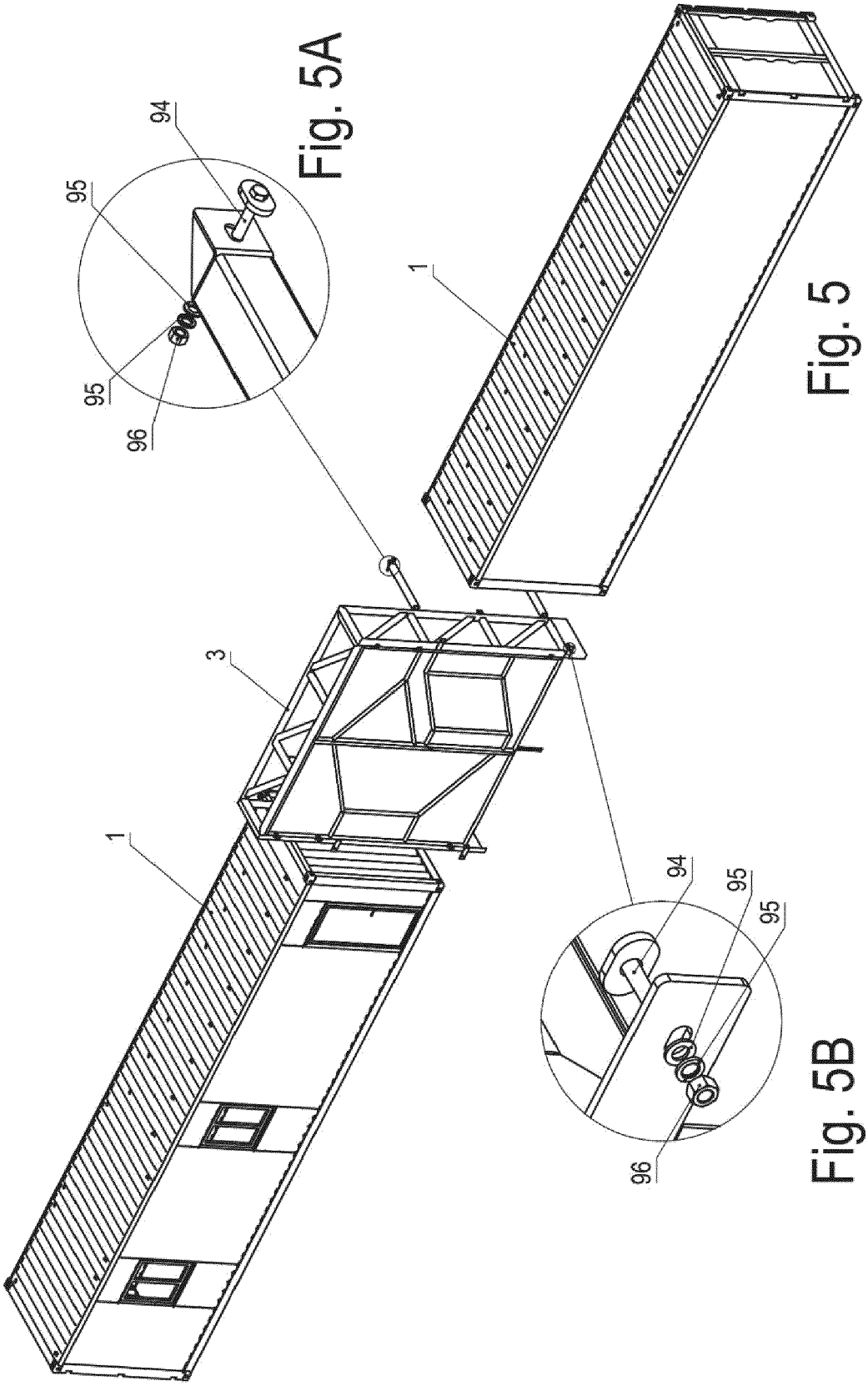


Fig. 5

Fig. 5A

Fig. 5B

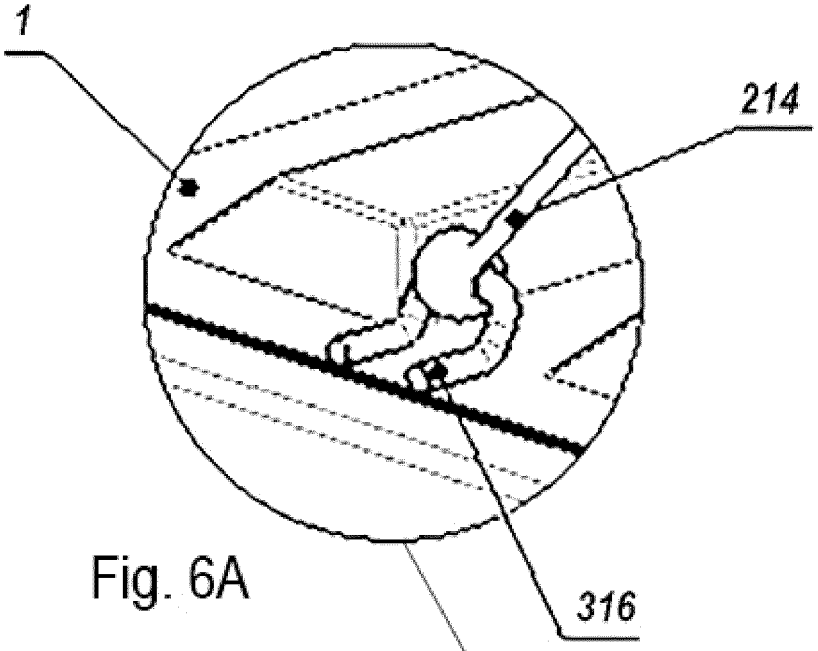


Fig. 6A

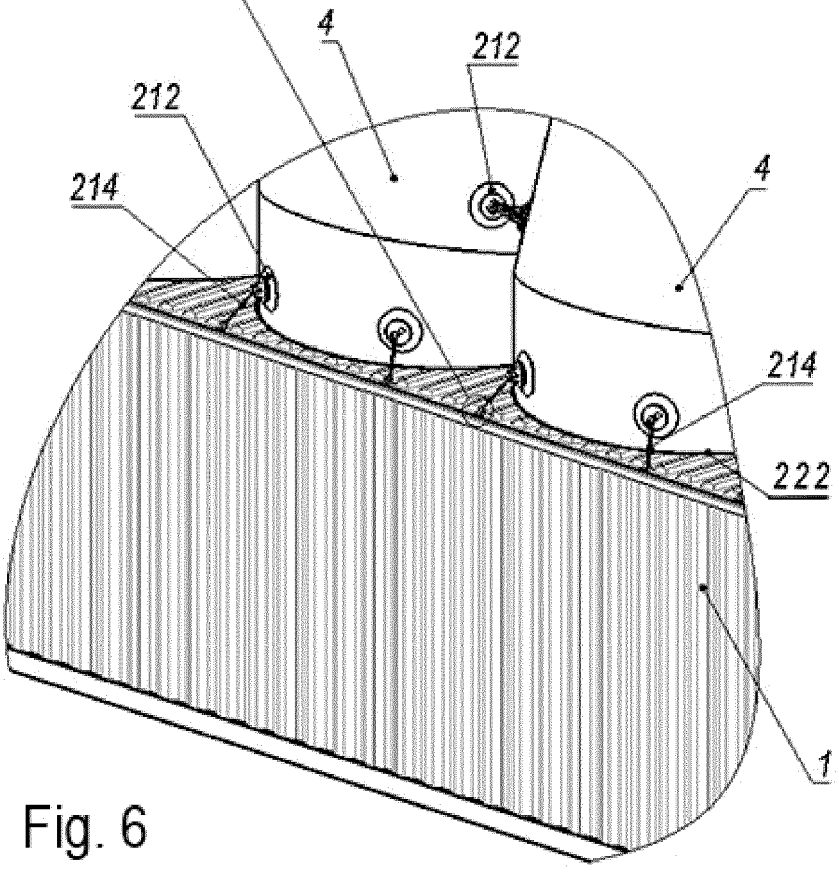


Fig. 6

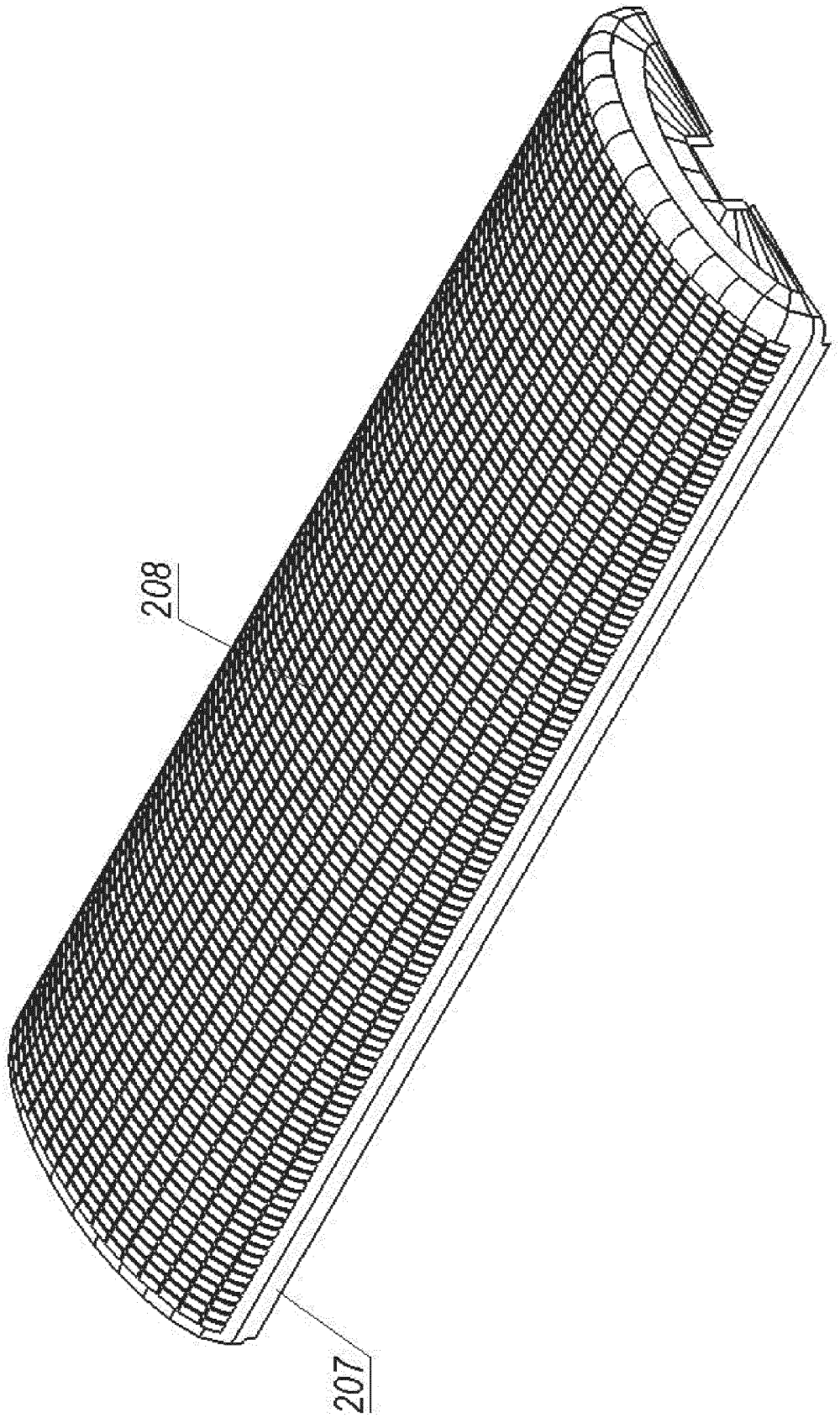


Fig. 7

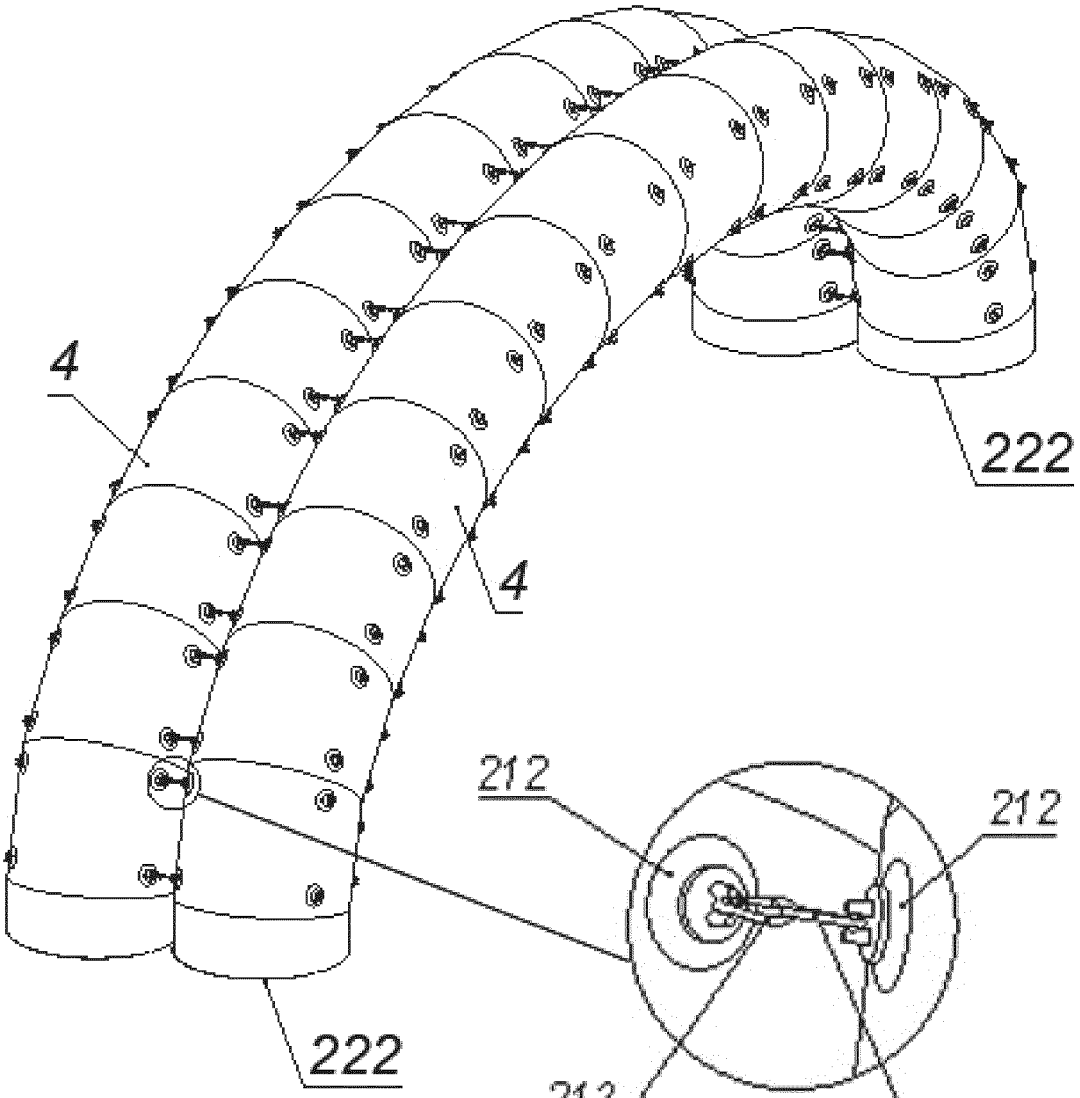


Fig. 8

Fig. 8A

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EUROPEAN SEARCH REPORT

Application Number
EP 24 17 4523

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 Y	WO 2014/179865 A1 (SOLAR SHIP INC [CA]) 13 November 2014 (2014-11-13) * paragraphs [0042], [0050] - [0053]; figure 12 *	1-3, 6-10,13, 14 4,5,11, 12	INV. E04H1/12 E04H15/20
X	EP 2 468 984 A1 (TMT MAN GMBH [AT]) 27 June 2012 (2012-06-27) * paragraphs [0020], [0061], [0065]; claims 1,5; figures 7-16d *	1-3, 6-10,13, 14	
X	US 2002/129566 A1 (PICCOLO ROBERT [US] ET AL) 19 September 2002 (2002-09-19) * paragraph [0055]; figures 1,2,13,18 *	1-3, 6-10,13, 14	
X	US 3 497 606 A (CAMINKER BERNARD ET AL) 24 February 1970 (1970-02-24) * figures 1-3 *	1-3,6-9, 13,14	
Y	GB 2 443 821 A (EMERGENCY SOLUTIONS LTD [GB]) 21 May 2008 (2008-05-21) * page 4, lines 4-22 *	4,5,11, 12	TECHNICAL FIELDS SEARCHED (IPC) E04H
A	US 2015/101258 A1 (MILO THOMAS KEVIN [US] ET AL) 16 April 2015 (2015-04-16) * paragraph [0043] *	4	
A	US 2021/348405 A1 (HADINGER DARIN [US]) 11 November 2021 (2021-11-11) * paragraph [0032] *	7,13	
A	US 2009/173377 A1 (MEININGER JUSTIN [US] ET AL) 9 July 2009 (2009-07-09) * claims 1,2,3 *	7,13	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	26 September 2024	Rosborough, John

CATEGORY OF CITED DOCUMENTS

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26-09-2024

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2014179865 A1	13-11-2014	NONE	
EP 2468984 A1	27-06-2012	EP 2468984 A1	27-06-2012
		WO 2012085044 A1	28-06-2012
US 2002129566 A1	19-09-2002	NONE	
US 3497606 A	24-02-1970	NONE	
GB 2443821 A	21-05-2008	NONE	
US 2015101258 A1	16-04-2015	US 2015101258 A1	16-04-2015
		WO 2015057710 A1	23-04-2015
US 2021348405 A1	11-11-2021	NONE	
US 2009173377 A1	09-07-2009	NONE	

EPO FORM P0459

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Patent documents cited in the description

- US 10633877 B2 **[0008]**
- US 20170121990 A1 **[0009]**
- US 10340696 B2 **[0010]**
- US 20160160515 A1 **[0011]**
- AU 2018101639 A4 **[0013]**
- RU 2145375 C1 **[0020]**