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(54) **BUILDING BLOCK**

BAUSTEIN

BLOC DE CONSTRUCTION

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Description

Field of the Invention

[0001] The present invention relates to a building block for use in the construction of building structures such as walls, more in particular a building block for use in the building of housing, such as temporary or emergency housing or weirs, dams as well as to the building structures such as walls, more in particular housing, such as temporary or emergency housing or weirs, dams themselves. The invention also relates to a method for use in same.

Background

[0002] Disasters can be natural or manmade, the frequency of which may increase in the near future due to climate change, which are some of the known reasons why people are forced to leave their homes to seek safe shelter. Temporary shelter is often provided to these people in the form of tents, containers or temporary housing such as portable modular buildings. The latter has the advantage that the building parts are usually easier to transport than containers, and they provide a better shelter from weather conditions than tents. Temporary housing can be built by stacking lightweight building blocks.

[0003] Tents are well known to the skilled person. Portable modular buildings are often used as temporary site offices on building sites where they can be stacked two high with metal stairs to reach the upper level. Other uses for these and other types of portable buildings are as guard posts, in-plant offices, rural offices, on-site changing rooms, etc. Some portable buildings are very complex and by joining units can be formed into large office blocks. Disused containers can also be used to make temporary accommodation. The temporary shelter in Kilis, Turkey has been described as a perfect refugee camp with 2,053 identical containers spread out in neat rows. The containers are customised, e.g. provided with power and water. Each 7m-by-3m container trailer has three rooms, with a lockable front door. A bathroom is serviced by its own plumbing and hot-water tank; a kitchen is equipped with both a refrigerator and a stove. There is a living room, and television reception is possible e.g. by satellite TV.

[0004] In order to provide comprehensive fast response temporary housing supply centres, the building materials should ideally be

- a) Compact rather than including a large amount of bulky air space
- b) Of low added value such as that high value products are not stored
- c) Can be used in a wide variety of situations to provide a wide variety of different structures as it is never certain what the next disaster can be, such as an earthquake, a flood, a tornado or hurricane, the influx of refugees fleeing a war zone for example

- d) Be easily transportable
- e) Be easily assembled on site with as few as possible additional accessories like nuts and bolts
- f) Be demountable after installation for re-use
- g) Be made of materials that are self-extinguishing, cheap to produce and capable of producing load-bearing structures.

[0005] Patent application US 2008/0184649 discloses an interlocking stackable modular building block for making barriers, slabs and emergency living quarters. The block is a hollow container that can be placed adjacent to another block in an interlocking position by inserting a tongue on the one end of the block into a groove of the adjacent block. Blocks have a narrow ledge on the top and a wider extension on the bottom. The extension on the bottom fits the top of the narrow ledge when blocks are placed on top of each other, wherein both blocks are further held together with screws.

[0006] The building block as disclosed in US2008/0184649 has the disadvantage that it is difficult to use in creating corners. Furthermore, screws are needed to secure two blocks stacked one top of each other. Small building parts such as screws are however difficult and time consuming to use in emergency situations. A load-bearing building block according to the preamble of claim 1 is known from US 2016/0123004 A1.

Summary of the Invention

[0007] Embodiments of the present invention relate to a building block for use in a wide variety of applications such as being suitable for the quick and easy construction of a wall, whereby the wall can be part of an architectural structure such as a house, a house extension such as a garage or a garden shed, an inner wall, especially a movable inner wall, a temporary house or a weir, or a dam, wherein the block can be adapted to build corners. The building block can be lightweight, easy to manipulate in difficult environmental conditions and thermally isolating and protects against ingress by vermin or predators such as wolves, rats or snakes and gives also some protection against human intruders. The constructions that can be built with the blocks can be weather resistant, easy and quick to build, with a minimum of training, parts and equipment.

[0008] In comparison with the three main types of materials commonly used in emergency situations such as tents, portable modular building and modified containers, embodiments of the present invention have some or all of the following advantages:

- a) Stored in a compact form - not storing of large volume of "air" - this provides an advantage over containers
- b) Basic building blocks are stored - low added value products are stored - this provides an advantage over modular buildings and customised containers

which are high value-added products

c) Demountable and reusable - this provides an advantage over brick and mortar - removal of mortar usually takes a long time

d) Flexible in design of buildings - this provides an advantage over modular buildings and containers which have fixed predefined shape

e) Easy and quick to assemble - this provides an advantage over "raw" containers that have to be customized and metal framed portable buildings that require lots of nuts and bolts

f) Do not require hand applied mortar - this provides an advantage over bricks and mortar

g) Can be made locally by technically simple methods - this provides an advantage over modular buildings which are high value-added products typically made with complex manufacturing techniques in high tech countries

h) Light weight - density of the material can be 1.35 -1.45 g/cm² which is reduced by air space in the block - this provides an advantage over containers and brick and mortar

i) Blocks and the building are thermally insulated against hot/cold without need for additional materials/cladding - this provides an advantage over tents and containers

j) Mechanical protection, e.g. from wolves, rats, dogs, human intruders - this provides an advantage over tents

k) Can make walls that are water sealed immediately after installation, e.g. weirs or dams, or swimming pool walls - this provides an advantage over tents and brick and mortar with which mortar must set before wall is water tight. This provides an advantage over containers and modular buildings which cannot be used to make walls easily

l) Can be used to make toilet/shower/bathroom buildings (ablutions) which are easy to keep clean. This provides an advantage over tents

m) Material can be self-extinguishing. This provides an advantage over tents

n) Buildings meet at least basic seismic resistance requirements (e.g. after shocks) as the walls can withstand both tension and compression due to vertical support elements

o) Can be used to make inner walls in existing buildings. This provides an advantage over containers, tents.

p) Can be used to make demountable or movable inner walls in existing buildings - this provides an advantage over containers, tents and brick and mortar.

q) Can be used to make walls with standard windows - this provides an advantage over tents, and raw containers.

r) Storage space such as shelving and cupboards and other objects can be fixed to the wall. - this provides an advantage over tents

s) Walls can be load bearing. - this provides an advantage over tents

t) Walls can be installed underwater by divers - this provides an advantage over tents, brick and mortar.

5 u) No severe reduction in wireless communication reception quality (no metal Faraday cage) - this provides an advantage over containers

v) Walls can provide acoustic damping - this provides an advantage over containers, tents.

10 w) As the blocks can be used for many different applications and are economical to produce, the blocks are suitable for storing in depots ready for use in any of a variety of emergency situations generated by manmade or natural disasters - this provides an advantage over containers and modular buildings which are expensive to make and/or store.

15 **[0009]** According to an aspect of the present invention, there is provided a load-bearing building block for building mortarless demountable load-bearing walls, the building block comprising:

- interconnecting means in both short side surfaces and both long side surfaces of the building block for interconnecting the block adjacent to its side surface, with the interconnecting means of a similar block by use of a first complementary element, wherein said interconnecting means comprise a groove and the first complementary element is slidable in a first dimension along the groove and has a two-dimensional form closure when installed in the groove, wherein interconnecting means of adjacent building blocks forming a corner are situated in front of one another;
 - at least one vertical hole, extending from the top to the bottom surface of the block;
- wherein said at least one hole is vertically interconnectable with the at least one hole of a similar block, positioned above or below, by use of said first complementary element, the first complementary element being slidable in the first dimension through the hole and has two-dimensional form closure when installed in the hole,
- wherein the combination of said building blocks and said first complementary element allow the build-up of said wall, whereby said wall is part of an architectural structure.

20 **[0010]** It is an advantage of the present invention that a mortarless demountable load-bearing wall can be constructed by use of the building blocks according to the present invention, with a limited amount of building parts and without any need of advanced construction techniques. The walls are demountable, so that the building parts such as building blocks and any complementary elements can be stocked in a compact form. As these parts are basic parts with low-added value, they can be stocked locally, meaning near areas of possible flooding. The building blocks are used to build a mortarless wall,

having the advantage that the parts can be assembled rapidly, also in areas where the presence of water would impede the construction of traditional mortar-containing walls. The building blocks, when used for building temporary housing in emergency situations, have as additional advantage that it offers more protection than tents against the elements as well as security against possible intruders, or animals such as vermin. Due to the load-bearing capacities, the building blocks and walls can resist tension and compression, offering safer housing.

[0011] In an embodiment of the present invention, the building block has a first complementary element which is elongate and has a longitudinal seal. The first complementary element co-operates with the interconnecting means so that the longitudinal seal seals against the interconnecting means when the first complementary element is installed in the interconnecting means.

[0012] It is an advantage of this embodiment that a construction built by use of said building blocks can be made water sealing. It is a further advantage that the construction is water sealing directly after installation, as there is no mortar that has to set.

[0013] In an embodiment of the present invention, the first complementary element is sheathed by the interconnecting means when the first complementary element is installed in the interconnecting means.

[0014] It is an advantage of this embodiment that a stable and water sealing installation can be obtained, without a need for any additional elements such as bolts or rivets.

[0015] In an embodiment of the present invention, the first complementary element takes up a single unique functional position in the interconnecting means when the first complementary element is installed in the interconnecting means.

[0016] It is an advantage of this embodiment that construction workers do not need an extensive training, as they can easily assemble the building parts, including the blocks and any complementary parts, into a construction.

[0017] In an embodiment of the present invention, the first complementary element can take up more than one functional position in the hole when the first complementary element is installed in the hole or the first complementary element can take up a limited number of functional positions in the hole when the first complementary element is installed in the hole.

[0018] It is an advantage of this embodiment that this adds to stability of the construction as well as to user-friendliness for possibly poorly trained local construction workers.

[0019] In an embodiment of the present invention, the interior of the building block is hollow, said hollow block having a plurality of interior cavities.

[0020] It is an advantage of this embodiment that the basic building part - the building block - can be made lightweight which facilitates transport.

[0021] In an embodiment of the present invention, said plurality of interior cavities is formed by strengthening

elements for enhancing the rigidity of the building block.

[0022] In an embodiment of the present invention, a tubular element such as a pipe or conductor is insertable in at least one of said plurality of interior cavities.

5 **[0023]** It is an advantage of this embodiment that utility ducts and pipes can be provided in the walls of housing built with said building blocks - even temporary housing - so that utilities such as electricity and water can be provided to inhabitants, which is an advantage over the use of tents.

10 **[0024]** In an embodiment of the present invention, said plurality of interior cavities are at least partially filled with a thermal isolation and/or acoustic damping material.

15 **[0025]** It is an advantage of this embodiment that inhabitants of housing built with said building blocks are shielded against heat or cold.

[0026] In an embodiment of the present invention, the length of the building block is twice or about twice the width of the block.

20 **[0027]** It is an advantage of this embodiment that building blocks can be easily combined in a construction with desired shape, which can be built by possibly poorly trained construction workers.

25 **[0028]** In an embodiment of the present invention, said interconnecting means comprise a groove having a trapezoidal, dovetail shape in cross-section.

[0029] It is an advantage of this embodiment that said interconnecting means allows the building block to be interconnected by form closure.

30 **[0030]** In an embodiment of the present invention, said block is made from a material, selected from the group comprising a thermopolymer and a thermosetting polymer.

35 **[0031]** In an embodiment of the present invention, the building block is made from a composite material comprising recycled plastic material and a mineral additive with a hardness of 6 or less on Mohs scale of mineral hardness.

40 **[0032]** It is an advantage of this embodiment that the building block can be lightweight and resistant. As it is partially made from recycled material, it decreases a burden on raw resources.

45 **[0033]** In an embodiment of the present invention, said mineral additive has a hardness of 3 or more on Mohs scale of mineral hardness.

[0034] In an embodiment of the present invention, said mineral additive comprises bluestone.

50 **[0035]** In an embodiment of the present invention, said recycled plastic material comprises a thermoplastic polymer.

[0036] In an embodiment of the present invention, said thermoplastic polymer is poly vinyl chloride (PVC).

55 **[0037]** In an embodiment of the present invention, said recycled plastic material comprises at least 50 wt%, preferably at least 60 wt%, more preferably at least 70 wt%, even more preferably at least 80 wt% and most preferably at least 90 wt% plastic material recycled from a waste stream.

[0038] In an embodiment of the present invention, said recycled plastic material further comprises powered thermoset material.

[0039] In an embodiment of the present invention, the building block further comprises a gasket which seals between an upper surface of one block and the lower surface of a second block placed on the first block.

[0040] It is an advantage of this embodiment that a construction can be obtained which is water sealing. This is useful for the construction of temporary housing in areas experiencing a flood, or for applying the building blocks in the construction of a weir or a dam.

[0041] In an embodiment of the present invention, the first complementary element comprises a second complementary element, wherein said at least one hole is vertically interconnectable with the at least one hole of a similar block, positioned above or below, by use of said second complementary element, the second complementary element being slidable in the first dimension through the hole and has two dimensional form closure when installed in the hole, the second complementary element being sheathed by the hole when the second complementary element is installed in the hole, or the second complementary element have a unique functional position when the second complementary element is installed in the hole.

[0042] According to an aspect of the present invention, there is provided a kit of parts of a plurality of blocks and a plurality of first complementary elements for interconnecting the interconnecting means of a building first block with the interconnecting means of a second block placed adjacent to a side surface and/or the top surface of the first block.

[0043] In an embodiment of the present invention, each first complementary element of the kit of parts has a double trapezoidal shape in cross-section.

[0044] In an embodiment of the present invention, some of the first complementary elements of the kit of parts are second complementary elements.

[0045] According to an aspect of the present invention, there is provided a mortarless demountable load-bearing wall made with a plurality of blocks.

[0046] According to an aspect of the present invention, there is provided a method for constructing a mortarless demountable load-bearing wall, by use of building blocks, comprising

installing a first row of building blocks,

Installing a second row of building blocks on top of said first row of building blocks, Interconnecting the building blocks horizontally within the same row by installing said first complementary elements, and vertically by installing said first complementary elements or first and second complementary elements.

[0047] In an embodiment of the present invention, the method further comprises filling cavities in the blocks with a granular inert material to thermally isolate the building constructed by use of the blocks or to provide acoustic damping.

Brief Description of the Figures

[0048] These and other features and advantages of embodiments of the present invention will now be described in more detail with reference to the accompanying drawings, in which:

- Figures 1a and 1b schematically illustrate a building block according to an embodiment of the invention;
- Figure 2 schematically illustrates the building block according to another embodiment of the invention;
- Figure 3 schematically illustrates the building block according to another embodiment of the invention;
- Figure 4 schematically illustrates the building block according to another embodiment of the invention;
- Figure 5 schematically illustrates the building block according to another embodiment of the invention;
- Figures 6a and 6b schematically illustrate the arrangement of a tubular element according to an embodiment of the invention;
- Figure 7 shows a top view of an arrangement for interconnecting two adjacent building blocks according to an embodiment of the invention;
- Figure 8 shows a perspective view of an arrangement for interconnecting two adjacent building blocks according to an embodiment of the invention;
- Figure 9 shows a top view of a corner arrangement according to an embodiment of the invention;
- Figures 10a and 10b show a top view of a building block according to an embodiment of the invention, wherein the block is respectively cut in half laterally, or wherein a quarter of the block is cut transversally;
- Figure 11 shows a top view of an arrangement, interconnecting a full block with half a block;
- Figure 12 shows a perspective view of a first complementary element according to an embodiment of the invention;
- Figure 13 shows a perspective view of a stack of building blocks according to an embodiment of the invention;
- Figure 14 shows a perspective view of a second complementary element according to an embodiment of the invention;
- Figure 15 shows a perspective view of an arrangement of building blocks having a closed surface for top surface according to an embodiment of the invention;
- Figure 16 shows a perspective view of an arrangement of building blocks, said blocks being provided with vertical extensions on both the top and bottom surface according to an embodiment of the invention;
- Figure 17 shows a perspective view of a sealing according to an embodiment of the invention;
- Figure 18 shows a top view of an interior building block according to embodiments of the invention according to an embodiment of the invention;
- Figure 19 shows a top view of an arrangement for interconnecting a building block with an interior build-

ing block according to an embodiment of the invention.

Definitions

[0049] "Form closure" refers to the number of degrees of freedom a connection has. One part of connection such as the interconnecting means 30 or the hole 60 is a female component of the connection and the first or second complementary element is the male component. The internal shape of the interconnecting means 30 or the hole 60 according to any of the embodiments of the present invention is complementary to the outer shape of the first or second complementary element so that the first or second complementary element cannot move in any direction in the horizontal plane but can move in the vertical plane. Not being able to move in the orthogonal axes of the horizontal plane means that the first or second complementary element forms a 2D form closure with the interconnecting means or the hole. In the third dimension, the first or second complementary element is free to slide.

[0050] "Sheathed" means in the present application that a male component of a connection such as the first or second complementary element is a snug fit in the interconnecting means or the hole. This means that the outer surface of the first or second complementary element is the inverse of the inner surface of the interconnecting means or the hole. A sheathed connection makes the formation of a seal easier and more reliable.

[0051] "Functional position" relates in the present invention relates to the one part of a connection such as the interconnecting means 30 or the hole 60 being a female component of the connection and the first or second complementary element being the male component. The internal shape of the interconnecting means 30 or the hole 60 according to any of the embodiments of the present invention is complementary to the outer shape of the first or second complementary element so that the first or second complementary element cannot move in any direction in the horizontal plane but can move in the vertical plane. The first complementary element can only assume one functional position in the interconnection means. If the first complementary element is a double dovetail, then this can assume two positions when inserted as the double dovetail is symmetrical. However once installed the two positions are indistinguishable which means they are functionally the same.

Detailed Description of Embodiments

[0052] It is an object of embodiments of the present invention to provide a building block for use in the building of structures especially architectural structure such as those comprising walls as well as to provide the structures especially architectural structure such as those comprising walls made with the building blocks. More in particular, it is an object of embodiments of the present invention to provide a building block for use in the building

of houses, home extensions, garages, garden sheds and other constructions, e.g. of the kind that can be used in emergency situations.

[0053] A specific application of the building block described herein concerns the building of temporary housing or temporary homes, such as emergency living quarters or ancillary structures for use therewith such as retaining walls, garages, storage sheds, toilets, showers, swimming pools etc. In cases of a natural or manmade disaster, safe shelter has to be provided for people fleeing the affected area. In such emergency situations, it is crucial to provide safe shelter in the shortest possible time. This can be done by providing accommodation in the form of temporary housing. An aspect of temporary housing and/or ancillary structures constructed in accordance with embodiments of the present invention is therefore that the building materials can be delivered to the site quickly and the housing constructed in a short period of time, preferably even under difficult environmental conditions, such as intense rains, floods, wind, heat or drought. Furthermore, embodiments of the present invention allow easily demounting or deconstruction of the temporary housing without damaging or destroying the building materials, so that these can be redeployed in a subsequent situation. As rescue helpers can be confronted with a variety of specific housing needs during their mission, the building materials according to embodiments of the present invention that make up the temporary houses are modular and can be used in a wide variety of situations.

[0054] A further specific application of the building block according to embodiments of the present invention as described herein concerns providing a building block for use in the construction of architectural structures subject to water such as swimming pools or in the construction of walls that are part of a weir, dam or water divergence guides. An aspect of this application is that the building block according to embodiments of the present invention has a high degree of water impermeability, being either completely impermeable or allowing water penetration below an allowable flow rate.

[0055] A further specific application of the building block according to embodiments of the present invention is the construction of barrier walls that separate highways from nearby habitation, with the purpose of reducing traffic noise for residential areas.

[0056] Figures 1-5 each show an embodiment of the building block 1 according to the present invention. The building block has a top surface 10, a bottom surface 11, a first short side surface 12 and a second short side surface 13, both side surfaces preferably being parallel, a first long side surface 14 and a second long side surface 15, both long side surfaces preferably being parallel. Although the block 1 is shown rectangular in horizontal cross-section, the shape is not limited there to but can include square or hexagonal.

[0057] According to an embodiment of the invention, the building block is completely filled, i.e. is a massive

solid material (not shown).

[0058] According to a preferred embodiment of the invention, the interior of the building block 1 is preferably hollow, having a plurality of interior cavities 20. Said plurality of interior cavities 20 are preferably mutually partitioned by strengthening elements 21, the purpose of which is to enhance the rigidity of the structure of the building block 1. Said strengthening elements 21 can have at least partially a planar shape, arcuate or a rounded shape. The strengthening elements 21 are preferably made in the same material as the sides of the building block 1 and form one piece with it. Advantageously, said strengthening elements can be shaped so as to allow the insertion of a tubular-shaped element (not shown in the figures) in a cavity of said plurality of interior cavities 20. This allows building a wall wherein ducts and tubes for electricity and water supply as well as water drainage can be installed inside the wall, while building the wall. Preferably, the strengthening elements 21 provide at least one cavity having a diameter of at least 90mm, which typically corresponds with the diameter of water drainage. The strengthening elements 21 can provide a plurality of cavities which can be configured for specific architectural elements such as water pipes, electricity cable, telecommunications cable, heating or cooling pipes, gas pipes, fibre optical cables etc.

[0059] An example of a building block arranged with a tubular element is shown in Figure 6a and 6b. Figure 6a shows that a hole is drilled in a side surface of the building block 1. The tube can then be installed through said hole in a cavity of said plurality of interior cavities 20 as indicated in Figure 6b.

[0060] The cavities of said plurality 20 can be filled with isolation material (not shown in the figures). The cavities are preferably filled with a material that is easy removable and that can be used for a subsequent construction or for another application. Said isolation material can be, for example cellular insulation, comprising glass, plastic or rubber; fibrous insulation, such as glass fibers, rock wool, slag wool or alumina silica; flake insulation, such as vermiculite; or granular insulation, such as expanded polymers such as expanded polystyrene (EPS). Preferably, the isolation material comprises EPS. The filling materials can be provided to improve the acoustic damping of the block.

[0061] The building block 1 according to any of the embodiments of the present invention can be made in a wide variety of sizes. Typically, the building blocks 1 will have a size similar to the dimensions of standard stones or concrete bricks that are used for the construction of traditional housing. The building block 1 can have a width that is at least 10 cm, preferably at least 15cm, more preferably at least 20 cm, and most preferably at least 25 cm. For the construction of housing or temporary housing, the building block 1 will usually have a width up to 50cm. Typically, the building block 1 will have a width of around 30cm, p. For particular applications, such as for building a weir, the width can be increased up to the

maximum size that can be manufactured such as up to 1 metre. Preferably, the width is in the range 30cm to 80 cm.

[0062] The building block 1 will have a length that is up to 100cm, preferably up to 90cm, more preferably up to 80cm, and most preferably up to 70cm. The building block 1 will have a length that is at least 20cm, typically at least 30 cm.

[0063] According to an advantageous embodiment of the invention, the length of the building block 1 advantageously is twice or about twice the width of the length. This allows a swift combination of building blocks for construction as will be described here below

[0064] The building block 1 will have a height that is up to 70cm, preferably at most 60cm, more preferably at most 50cm and most preferably at most 40cm. The minimum height can be 15cm, or 20 cm or 30 cm, for example

[0065] The side surfaces 12-15 can be planar. In a preferred embodiment, at least one side surface 12-15 is provided with an interconnecting means 30 for connecting the block sideways to an adjacent block. Said interconnecting means 30 can include a protrusion or groove. A groove is preferred in all embodiments of the present invention. The protrusion or groove preferably has a shape that provides part of a form closure between blocks, such as a tongue-and-groove connection. According to a preferred embodiment of the invention, said interconnecting means 30 is a groove extending perpendicularly to the top surface 10, i.e. being a vertical or substantially vertical groove in the side surface when installed.

[0066] The groove can have any geometric form in cross-section, for example including square, triangular or rectangular elements. It is preferred if the groove has a shape that provides part of a form closure between blocks. In particular the groove has a shape that provides part of a 2D form closure between blocks (including blocking rotation) whereby in the third dimension an elongate element with an outer surface matching the internal surface of the groove may slide in the groove. By matching is meant that preferably the interconnecting means sheaths the elongate element i.e. the elongate element is a snug fit in the interconnecting means but can slide therein. The outer surface of the elongate element is preferably the inverse shape of the inner surface of the interconnecting means. Figure 5 shows an embodiment wherein the groove has a T-shape. In Figure 4, the groove has the form which corresponds to the half of a plus sign (+). Preferably, the groove has a trapezoidal shape in cross-section. Such embodiments are shown in Figures 1-3. A groove according to this preferred embodiment is herein after referred to as a dovetail groove. Without limiting the invention, the invention will be further explained by use of dovetail grooves as interconnecting means 30. The interconnecting means 30 are suitable for a 2D form closure connection (including blocking rotation) between blocks with the ability to slide in the third dimension, i.e. along the groove. The dovetail, or T grooves are both

suitable for a 2D form closure but allow sliding in the third dimension, i.e. along the groove.

[0067] Typically, the first and the second short side surface 12,13 each have at least one dovetail groove, with the purpose of interconnecting adjacent building blocks 1. Preferably, the first and the second short side surface 12,13 each have one dovetail groove. Preferably, the first and second long side surfaces 14,15 each have at least one dovetail groove for similar purposes. According to an advantageous embodiment of the invention, the long side surfaces 14,15 each have two dovetail grooves. The dovetail grooves are provided on the side surfaces 12-15 in such a way that two building blocks 1, placed adjacently for building a wall according to this invention, will have at least one of their respective dovetail grooves in a corresponding position, allowing to interconnect both building blocks by use of a first complementary element 40 which is the elongate element mentioned above. The first complementary element 40 in combination with the groove provide a 2D form closure with the first complementary element 40 being slidable in the third dimension, i.e. along the groove. The interconnecting means preferably sheaths the first complementary element i.e. the first complementary element is a snug fit in the interconnecting means but can slide therein. The outer surface of the first complementary element is preferably the inverse shape of the inner surface of the interconnecting means. The first complementary element can assume only one position in the interconnecting means. The double dovetail allows two possible positions for insertion in the interconnecting means however the result is the same in both cases.

[0068] A first complementary element 40 is used for interconnecting two adjacent building blocks 1, by inserting the first complementary element 40 in the respective dovetail grooves of the two adjacent building blocks 1. An example of such an arrangement is shown in Figure 7, where it is clear that the element 40 fits the volume that is formed by the grooves when the blocks 1 are placed against each other. A perspective view showing how the insertion of the first complementary element 40 interconnects two adjacent blocks can be found in Figure 8. It is an advantage of the present invention that by laying the building blocks 1 in a series of rows according to the method of the present invention, interconnecting means 30 can be provided suitable for a 2D form closure connection between blocks with the ability to slide in the third dimension. For example, the dovetail grooves of adjacent blocks that were placed in the same row will be situated in front of one another. A specific advantage is that even interconnecting means such as dovetail grooves of adjacent building blocks forming a corner will be situated in front of one another. This is the direct result of the position the interconnecting means such as the dovetail grooves have on the side surfaces. Figure 9 shows a wall constructed with building blocks 1 according to the invention, wherein the blocks are combined to form a corner.

[0069] Moreover, a block can also be cut in half later-

ally, a top view of such a block according to an embodiment is shown in Figure 10a, or a quarter of a block can be cut transversally, a top view of such a block is shown in Figure 10b, and the pieces obtained can be combined in a row with complete building blocks. This can be done to locally complete a gap in a construction, thereby guaranteeing sufficient thermal isolation in all parts of the construction. An example of such an arrangement, combining a full block with half a block is shown in Figure 11.

[0070] In addition, said first complementary element 40 can be used to interconnect building blocks 1 vertically. Indeed, when laying series of rows, one row on top of another, according to the invention, interconnecting means such as dovetail grooves of one particular block, an underlying block and an upper block to this particular block, can be situated in a corresponding position, allowing to insert said first complementary element in these interconnecting means such as dovetail grooves, linking the particular block with its underlying and upper counterparts. The vertically placed first complementary element 40 provides minimum support for surviving tension in the wall e.g. during seismic activity, e.g. after shocks.

[0071] When connecting adjacent blocks in the same row as well as blocks in rows that are on top of one another, the first complementary element 40 will take a rod-shaped form. The first complementary element 40 is preferably made from a rigid material.

[0072] In general, the first complementary element 40 is made from a plastic or a plastic composite, wood or any other material that allows the element to be easily sawn lengthwise or crosswise. Preferably, said first complementary element is made from the same material as the building block.

[0073] Typically, the first complementary element 40 has a shape that is complementary to the shape of the interconnecting means 30 of the blocks it is interconnecting. When blocks having a dovetail groove in the side surfaces are used, the first complementary element 40 will have a shape that is double trapezoidal in cross-section, as it is complementary to two opposing dovetail grooves. A first complementary element 40 having such a shape will be referred herein after to as a double dovetail shape. Without limiting the invention, the first complementary element will be further referred to as a double dovetail rod. A representation of such a double dovetail rod is shown in Figure 12.

[0074] In an advantageous embodiment, sealing 50 is provided along the length of the first complementary element such as the double dovetail rod. Preferably, said sealing 50 is a sealing strip based on a rubber or elastomer. The sealing 50 is for sealing between the first complementary element and the interconnecting means 30 i.e. the groove. The seal 50 extends over the complete length of the interconnecting means and the first complementary element when the first complementary element is installed. The sealing 50 and a gasket between the top of one block and the bottom of the block immediately above makes a wall made with the blocks water

tight or with little leakage. The sealing 50 and the gasket avoid the use of mortar such that a wall produced with the blocks is mortarless. In Figure 12, the double dovetail rod is provided with four sealing strips. The sealing strips have the advantage that they avoid water seeping through the interconnection of the blocks while still allowing insertion of the rod. In other words, the sealing strips avoid water seeping from one side of the wall to another such as from the outside to the inside of a house, from a swimming pool to the surrounding earth, through a dam or weir. Furthermore, the sealing strips help to append the double dovetail rod to the building blocks.

[0075] According to a preferred embodiment of the invention, the building block 1 has at least one vertical or substantially vertical hole 60, extending from the top surface 10 to the bottom surface 11. The at least one hole 60 can have in cross-section of any geometric shape, including round, triangular, or rectangular elements. Particular to the shape of the hole 60 is that it is preferably interconnected to and co-defined by the shape of the first complementary element 40, in that said first complementary element 40 should fit in the hole 60. The first complementary element 40 in combination with the shaped hole 60 preferably provides a 2D form closure between blocks (including blocking rotation) with the first complementary element 40 being slidable in the third dimension, i.e. along the hole. Indeed, cutting the block 1 in half laterally, or cutting a quarter of the block 1 transversally, can result in a hole 60 in the block 1 to be divided among the obtained pieces. The geometrical shape of the hole should then be such that the piece can be interconnected with an interconnecting means 30 of another block 1 by use of a first complementary element 40, i.e. providing a 2D form closure with the first complementary element 40 being slidable in the third dimension, i.e. along the hole. The first complementary element 40 can take up a limited number of positions in the hole 60.

[0076] The geometrical features of the interconnecting means 30 will therefore have a similarity with the geometrical shape of the hole 60, i.e. the interconnecting means 30 will have the same geometrical shape of the hole 60 and the first complementary element 40 will have the complementary inverse geometrical shape of the hole 60.

[0077] The embodiment shown in Figure 4, has i.e. two holes 60 having the cross-sectional shape of a plus sign, the interconnecting means 30 being the half of a plus sign.

[0078] The building block according to the embodiments as shown in Figure 1-3 is provided with two holes 60 having a star-like shape in cross-section. Said shape comprises two double dovetails with a mutual angle of 90° and will be referred herein after to as a star shape. As Figures 10a-10b show, cutting the block as described hereabove, allows for the obtained pieces to be interconnected with other blocks, as the remaining part of the hole 60 can house a double dovetail rod.

[0079] In any of the embodiments of the present inven-

tion a second complementary element 70 can be used for vertically connecting building blocks 1 that are stacked on top of one another by inserting said second complementary element 70 vertically in a hole 60 of each of the interconnecting stacked building blocks 1. The second complementary element 70 can be sheathed by the hole 60 when inserted, i.e. the second complementary element is a snug fit in the hole but can slide therein. The outer surface of the second element is preferably the inverse shape of the inner surface of the hole.

[0080] Figure 13 shows a stack of blocks 1 arranged according to this embodiment of the present invention, wherein a second complementary element 70 is vertically inserted through holes 60 of said vertically stacked building blocks 1. The building blocks 1 according to the invention are thereby preferably stacked in such a way that the holes 60 of the blocks 1 are situated in extension of each other, allowing the insertion of said second complementary element 70. The advantage of using said second complementary element 70 is that stacked building blocks 1 can be securely held together, thereby making the need for additional elements such as nails or screws superfluous. The second complementary element 70 in combination with the shaped hole 60 preferably provides a 2D form closure (including blocking rotation) with the second complementary element 40 being slidable in the third dimension, i.e. along the hole.

[0081] According to a preferred embodiment of the invention, the second complementary element 70 has a rod-like shape. The cross-sectional shape of the second complementary element 70 is complementary to the cross-sectional shape of the holes of the building blocks, i.e. the second complementary element 70 will have the complementary inverse geometrical shape of the hole 60. If the holes have a star shape, as defined here above, the second complementary element will be complementary to this shape. Without limiting the invention, the second complementary element will be further referred to as a star-shaped rod. A representation of such a star-shaped rod is shown in Figure 13. In an advantageous embodiment, sealing 50 is provided along the length of the star-shaped rod. Preferably, said sealing 50 is a sealing strip based on a rubber. In Figure 14, the star-shaped rod is provided with eight sealing strips, the aim of which is to avoid water seeping through.

[0082] The star-shaped rod as well as the dovetail rod can be sawed to the desired length.

[0083] The inventors have now found that the combination of stackable, modular building blocks as described here above with first and second complementary elements having an interconnected or complementary shape, such as double dovetail rods and star rods, allow for the rapid and easy build-up of walls for temporary housing, wherein said walls meet all requirements regarding stability and bearing capacity.

[0084] According to any of the embodiments of the present invention, the top surface 10 and the bottom surface 11 of said building block 1 can be open. Stacking

open blocks has the advantage that isolation and/or acoustic damping material can be added into a wall after construction has been finished or during construction. Also, ducts and tubes are easy to install in a wall with open blocks, due to the fact that such a stack, having cavities of each block lying in the extension of one another, can result in open spaces that extend from the floor level to the top level of the wall in which ducts and tubes can be inserted.

[0085] Alternatively, the top surface 10 is a closed surface, an example of which is shown in Figure 15. A building block 1 with a closed top surface 10 can be used for constructing a complete wall. Preferably, a building block 1 according to this alternative embodiment will be used in the arrangement of a top layer of a wall, the other blocks in the wall being blocks with an open top surface, thereby closing off the constructed wall and any isolation material therein.

[0086] According to another alternative, the bottom surface 11 is a closed surface. A building block 1 having a closed bottom surface 11 can be used as part of a bottom layer of building blocks on top of which the wall is erected.

[0087] According to any of the embodiments of the present invention, the top part of the building block 1 can be made raised and slightly narrower than the bottom of the building block 1 (forming a shoulder around the periphery of the upper surface), so that the narrower top part of a first building block fits or slots into a wider recessed bottom part of a second block that is placed on top of said first building block. This can be done by indenting the ledge of the top part of the building block 1 and by widening the ledge of the bottom part of the block 1.

[0088] An alternative embodiment is shown in Figure 16, wherein the building block is provided with vertical extensions on both the top and bottom surface 10-11. Preferably, said vertical extensions are provided either on the top surface or on the bottom surface, allowing two superposed blocks to fit.

[0089] Features such as indentations or extensions have the advantage that they facilitate stacking of the blocks, as the blocks are as it were guided towards their right position. As a result, it becomes easier for the user to insert the first and second complementary elements 40, 70 in their positions.

[0090] According to any of the embodiments of the present invention, a gas or water sealing 50 can be provided on the building block 1, preferably encircling at least partially the building block 1 on the side. An example of such a sealing 50 is shown in Figure 17. A sealing 50 can be placed on the inside of an indented ledge forming a sealing gasket between an upper and lower block when stacked. Typically, a sealing 50 encircling the building block will be arranged on the inside of the building block 1, at the bottom part of the block, where the sealing 50 can be arranged in a ledge. The advantage of placing the sealing 50 in this ledge is that stacking the block on

top of another block will make the interconnection waterproof (in conjunction with the sealing strips along the first complementary element) and prevent or reduce water penetration. Any of the sealings 50 are preferably a rubber-based or elastomer-based sealing. A wall made using blocks 1 of any of the embodiments of the present invention is sealed and mortarless when the sealings 50 are in place. Alternatively, the sealing 50 can be omitted when a wall made using blocks 1 has no need for being water sealing. This can be the case when a wall is built with the purpose of diverting water. The water sealing requirements of e.g. a dam built by said blocks can therefore be less stringent than when the blocks are used for the construction of housing.

[0091] The building block 1 can be made from a material that ensures an acceptable degree of mechanical rigidity, enabling the building block 1 to bear at least the load of the wall and a roof. A wall made using blocks 1 of any of the embodiments of the present invention can be load-bearing. The building block 1 can further be weatherproof and UV-resistant. At the same time, construction workers can cut the material of the block 1 without the need for advanced machines. The material preferably has a thermal conductivity k that is acceptably low. The material of the building block 1 should also be insect-resistant and resist insects such as termites.

[0092] The building block 1 can be made from a material that is chosen from the group consisting of wood, metal, mineral materials, concrete, ceramic materials such as glass, or plastic-based materials. The building block 1 can be made as a composite of said materials, wherein some components can be present as fillers or fibres.

[0093] According to a particular embodiment, the building block 1 is a composite material, comprising a plastic material and a mineral additive and/or a powder made of a cross-linked thermoset polymer.

[0094] The composite material comprises at least 60wt%, preferably at least 65wt%, more preferably at least 70wt% and most preferably at least 75wt% of said plastic material, with reference to the total weight of the composite material. It is further understood that the composite material comprises at most 95wt%, preferably at most 90wt%, and more preferably at most 85wt% of said plastic material, with reference to the total weight of the composite material.

[0095] A first part of the plastic material can be a recycled plastic material that is recovered from a plastic waste stream. A second part of the plastic material can comprise new plastic material, meaning material that is polymerized from raw materials for use in said plastic material. From an ecological point of view, making the building block 1 at least partly from waste stream plastic material has the advantage of relieving the burden on the consumption of natural resources.

[0096] The plastic material can comprise at least 50 wt%, preferably at least 60 wt%, more preferably at least 70 wt%, even more preferably at least 80 wt% and most

preferably at least 90 wt% of said recycled plastic material recovered from a waste stream, with reference to the total weight of the plastic material. The remaining part of the plastic material consists preferably of said new plastic material.

[0097] According to a particular advantageous embodiment of the invention, the plastic material comprises only recycled plastic material.

[0098] The plastic material can be a thermoplastic material. By preference, the plastic material comprises poly vinyl chloride polymer (PVC) or copolymer. PVC is self-extinguishing. Hence PVC can be used for the blocks according to any of the embodiments of the present invention, so that the building materials provided by any of the embodiments of the present invention can be self-extinguishing. PVC has a density of 1.35 to 1.45 g/cm². Hence PVC can be used for the blocks according to any of the embodiments of the present invention, so that the building materials provided by any of the embodiments of the present invention are heavier than water. Preferably, the PVC is foamed.

[0099] In addition to the plastic material, the composite material can further comprise a mineral additive. Preferably, the composite material consists only of said plastic material and said mineral additive. The mineral additive is typically used in powder or flake form.

[0100] Mohs scale of hardness is a known and often used classification for mineral hardness. The mineral additive preferably has a hardness of 6 or less on Mohs scale of mineral hardness. Preferably, the mineral additive has a hardness of 3 or more on Mohs scale of mineral hardness.

[0101] Preferably, the additive is based on material from the Carboniferous Limestone Group, or minerals comprising: CaMg (CO₃)₂, SiO₂, FeS₂, CaF₂ and/or CaCO₃. Preferably, the mineral additive comprises blue-stone. Alternatively, a soft marble species can be used. PVC is self-extinguishing. Hence PVC with a mineral additive can be used for the blocks according to any of the embodiments of the present invention, so that the building materials provided by any of the embodiments of the present invention can be self-extinguishing.

[0102] The building block 1 can be produced by use of typical processing techniques for plastic composite materials, including injection moulding, rotation moulding, extrusion and 3D printing techniques. Preferably, the building block is foamed.

[0103] According to embodiments of the invention, the building block 1 is made from a material having a Young's modulus E, measured according to ISO 527-2:2012, which is at least 4200 MPa, preferably at least 4400 MPa, more preferably at least 4600 MPa, even more preferably at least 4800 MPa, more preferably at least 5000 MPa, even more preferably at least 5200 MPa, more preferably at least 5400 MPa, even more preferably at least 5600 MPa and most preferably at least 5800 MPa. Preferably, the building block 1 is made from a composite material as described here above, having a Young's modulus E

which is at least 4200 MPa, preferably at least 4400 MPa, more preferably at least 4600 MPa, even more preferably at least 4800 MPa, more preferably at least 5000 MPa, even more preferably at least 5200 MPa, more preferably at least 5400 MPa, even more preferably at least 5600 MPa and most preferably at least 5800 MPa.

[0104] According to an aspect of the invention, there is provided a method for building a mortarless demountable load-bearing wall, by use of building blocks 1 according to any of the embodiments of the present invention.

[0105] Optionally, trenches can be dug in a first step according to a planned position of the wall or walls. Plastic foils and plates can be provided for blocking groundwater. A first row of building blocks 1 is then installed in said trench and the trench is filled up at least partially with concrete, preferably leaving the top part of the row building blocks 1 visible to allow further building on top of said row. Alternatively, the first step consists of placing said first row of building blocks 1 on the ground according to the planned position of the walls. Preferably, a form of anchorage is provided for anchoring said row to the ground. Building blocks 1 can be combined with cut parts of other blocks, as described here above, to obtain the desired shape.

[0106] A second row of building blocks 1 can be placed on top of said first row of building blocks 1. According to certain embodiments, for adding a row, the blocks are shifted 50%, or half a length of a block, with respect to the underlying blocks. According to an alternative embodiment, each individual block of said second row is placed on top of an individual block of the underlying row. The building blocks 1 are interconnected horizontally, meaning within the same row, and vertically by said first and second complementary elements. Advantageously, whether the rows have been shifted or not, said elements can be inserted vertically in holes and/or interconnecting means of a plurality of blocks, thereby interconnecting this plurality of blocks. A high degree of freedom is given to the user or construction worker to decide the length of each complementary element. The user can i.e. choose to interconnect stapled blocks belonging to a series of rows with a limited amount of long complementary elements. On the other hand, the complementary elements can be sawn to a desired length, with the purpose of interconnecting fewer blocks.

[0107] According to certain embodiments, the cavities in the building blocks, which are interconnected can be filled by use of a granular inert material with the purpose of thermally isolate the building the blocks are part of, e.g. to provide thermal isolation or acoustic damping. This can be done by pouring said granular inert material in the open top surface 10 of the highest blocks in the constructed wall. Preferably, only the cavities of said plurality of interior cavities 20, situated on that part of the building blocks 1 facing the outside, are filled. As a consequence, two elements contribute to thermal insulation or acoustic damping: the granular inert material as well

as the air that is permanently trapped in the other cavities 20.

[0108] The building block according to any of the embodiments of the present invention are furthermore provided for the construction of an interior wall.

[0109] According to certain embodiments, building blocks 1 can be used for the interior walls, wherein the blocks making up the interior wall can form an angle of 90° with respect to an exterior wall, as described here above. The advantage of using the same blocks for the interior and exterior walls is that only one type of block is necessary for the construction of all the walls.

[0110] Preferably, an interior building block 100 is used, embodiments of which are shown in Figure 18. The interior building blocks 100 are typically more elongated and less wide compared to the building block 1. The interior building blocks 100 can be interconnected with building blocks 1 forming an exterior wall, forming an angle of 90° therewith, by use of said first complementary element such as a double dovetail rod. The principle for an alternative mechanism for interconnecting the blocks is shown in figure 19, showing a top view, wherein said building block 1 is provided with an interconnecting means 30, which has a cross-section having a rounded shape, such as a rounded groove. Consequently, the first complementary element 40 is arranged to fit in both the interconnecting means 30, having said rounded groove, and interconnecting means 30 of the interior building block, having for example a trapezoidal cross-section (not shown in Figure 19).

[0111] A specific application of said building block 1 according to any of the embodiments of the present invention is the construction of wall to divert the course of water, to provide a weir wall or a dam wall according to a further embodiment of the present invention. Even when water is present the wall can be constructed as all materials are waterproof. This even allows walls to be installed under water e.g. by divers.

[0112] With respect to the three main types of materials commonly used in emergency situations such as tents, portable modular building and modified containers the skilled person will appreciate that embodiments of the present invention have some or all of the following advantages:

- aa) Stored in a compact form - not storing of large volume of "air" - this provides an advantage over containers
- bb) Basic building blocks are stored - low added value products are stored - this provides an advantage over modular buildings and customized containers which are high value-added products
- cc) Demountable and reusable - this provides an advantage over brick and mortar - removal of mortar usually takes a long time when demounting
- dd) Flexible in design of buildings - this provides an advantage over modular buildings and containers which have fixed predefined shapes

ee) Easy and quick to assemble - this provides an advantage over "raw" containers that have to be customized and metal framed portable buildings that require lots of nuts and bolts to assemble or disassemble

ff) Do not require hand applied mortar - this provides an advantage over bricks and mortar

gg) Can be made locally by technically simple methods - this provides an advantage over modular buildings which are high value-added products typically made with complex manufacturing techniques in high tech countries

hh) Light weight - density of the material can be 1.35 -1.45 g/cm² which is reduced by air space in the block - this provides an advantage over containers and brick and mortar

ii) Blocks and the building are thermally insulated against hot/cold without need for additional materials/cladding - this provides an advantage over tents and containers

jj) Mechanical protection, e.g. from wolves, rats, dogs, human intruders - advantage over tents

kk) Can make walls that are water sealed immediately after installation, e.g. weirs or dams, or swimming pool walls - this provides an advantage over tents and brick and mortar with which mortar must set before wall is water tight. This provides an advantage over containers and modular buildings which cannot be used to make walls easily

ll) Can be used to make toilet/shower/bathroom buildings (ablutions) which are easy to keep clean. This provides an advantage over tents

mm) Material can be self-extinguishing. This provides an advantage over tents

nn) Buildings meet at least basic seismic resistance requirements (e.g. after shocks) as the walls can withstand both tension and compression due to vertical support elements

oo) Can be used to make inner walls in existing buildings. This provides an advantage over containers, tents.

pp) Can be used to make demountable or movable inner walls in existing buildings - this provides an advantage over containers, tents and brick and mortar.

qq) Can be used to make walls with standard windows - this provides an advantage over tents, and raw containers.

rr) Storage space such as shelving and cupboards and other objects can be fixed to the wall. - this provides an advantage over tents

ss) Walls can be load bearing. - this provides an advantage over tents

tt) Walls can be installed underwater by divers - this provides an advantage over tents, brick and mortar.

uu) No severe reduction in wireless communication reception quality (no metal Faraday cage) - this provides an advantage over containers

vv) Walls can provide acoustic damping - this provides an advantage over containers, tents.
 ww) As the blocks can be used for many different applications and are economical to produce, the blocks are suitable for storing in depots ready for use in any of a variety of emergency situations generated by manmade or natural disasters this provides an advantage over containers and modular buildings.

Claims

1. A load-bearing building block (1) for building mortarless demountable load-bearing walls, the building block (1) having a first short side surface (12), a second short side surface (13), a first long side surface (14), and a second long side surface (15); the building block (1) comprising:

- interconnecting means (30) in said first short side surface (12), said second short side surface (13), said first long side surface (14), and said second long side surface (15) of the building block (1) for interconnecting the block (1) adjacent to its side surface (12-15), with the interconnecting means (30) of a similar block (1) by use of a first complementary element (40), wherein said interconnecting means (30) comprise a groove and the first complementary element (40) is slidable in a first dimension along the groove and has a two-dimensional form closure when installed in the groove, wherein interconnecting means (30) of adjacent building blocks (1) forming a corner are situated in front of one another;

wherein the combination of said building blocks (1) and said first complementary element (40) allows the build-up of said wall, whereby said wall is part of an architectural structure,

characterized in that the building block (1) further comprises

- at least one vertical hole (60), extending from the top (10) to the bottom surface (11) of the block (1);

wherein said at least one hole (60) is vertically interconnectable with the at least one hole (60) of a similar block (1), positioned above or below, by use of said first complementary element (40), the first complementary element (40) being slidable in the first dimension through the hole (60) and having two-dimensional form closure when installed in the hole (60).

2. The building block (1) of claim 1 wherein the first complementary element (40) is elongate and has a longitudinal seal (50), the first complementary element (40) co-operating with the interconnecting means (30) so that the longitudinal seal (50) seals

against the interconnecting means (30) when the first complementary element (40) is installed in the interconnecting means (30).

3. The building block (1) of claim 1 or 2 wherein the first complementary element (40) is sheathed by the interconnecting means (30) when the first complementary element (40) is installed in the interconnecting means (30), and/or wherein the first complementary element (40) takes up a single unique functional position in the interconnecting means (30) when the first complementary element (40) is installed in the interconnecting means (30), and/or wherein the first complementary element (40) can take up more than one functional position in the hole (60) when the first complementary element (40) is installed in the hole (60) or the first complementary element (40) can take up a limited number of functional positions in the hole (60) when the first complementary element (40) is installed in the hole (60).

4. The building block (1) of any previous claim, wherein the interior of the building block (1) is hollow, said hollow block having a plurality of interior cavities (20).

5. The building block (1) of claim 4, wherein said plurality of interior cavities (20) is formed by strengthening elements (21) for enhancing the rigidity of the building block (1), and/or a tubular element such as a pipe or conductor is insertable in at least one of said plurality of interior cavities (20), and/or said plurality of interior cavities (20) are at least partially filled with a thermal isolation and/or acoustic damping material.

6. The building block (1) according to any previous claim, wherein said interconnecting means (30) comprise a groove having a trapezoidal, dovetail shape in cross-section.

7. The building block (1) according to any previous claim, wherein said block (1) is made from a composite material comprising recycled plastic material and a mineral additive with a hardness of 6 or less on Mohs scale of mineral hardness.

8. The building block (1) according to claim 7, wherein said mineral additive has a hardness of 3 or more on Mohs scale of mineral hardness, and/or said mineral additive comprises bluestone, and/or said recycled plastic material comprises a thermoplastic polymer.

9. The building block (1) according to claim 8, wherein said thermoplastic polymer is poly vinyl chloride (PVC), and/or said recycled plastic material comprises at least 50 wt%, preferably at least 60 wt%, more preferably at least 70 wt%, even more preferably at

least 80 wt% and most preferably at least 90 wt% plastic material recycled from a waste stream, and/or said recycled plastic material further comprises powdered thermoset material.

10. The building block (1) according to any previous claim, further comprising a gasket which seals between an upper surface (10) of one block (1) and the lower surface (11) of a second block (1) placed on the first block (1). 5
11. The building block (1) according to any previous claim, wherein the first complementary element (40) comprises a second complementary element (70), said at least one hole (60) being vertically interconnectable with the at least one hole (60) of a similar block (1), positioned above or below, by use of said second complementary element (70), the second complementary element (70) being slidable in the first dimension through the hole (60) and has two dimensional form closure when installed in the hole (60), the second complementary element (70) being sheathed by the hole (60) when the second complementary element (70) is installed in the hole (60), or the second complementary element (70) have a unique functional position when the second complementary element (70) is installed in the hole (60). 10 15 20 25
12. A kit of parts of a plurality of blocks (1) according to any of the claims 1 to 11 and a plurality of first complementary elements (40) for interconnecting the interconnecting means (30) of a first building block (1) according to any of claims 1 to 10 with the interconnecting means (30) of a second block (1) placed adjacent to a side surface (12-15) and/or the top surface (10) of the first block (1). 30 35
13. The kit of parts of claim 12 wherein each first complementary element (40) has a double trapezoidal shape in cross-section, and/or wherein some of the first complementary elements (40) are second complementary elements (70). 40
14. A mortarless demountable load-bearing wall made with a plurality of blocks (1) according to any of the claims 1 to 11. 45
15. A method for constructing a mortarless demountable load-bearing wall, by use of building blocks (1) according to any of the claims 1 to 11, comprising 50 installing a first row of building blocks (1), installing a second row of building blocks (1) on top of said first row of building blocks (1), interconnecting the building blocks (1) horizontally within the same row by installing said first complementary elements (40), and vertically by installing said first complementary elements (40) or first and second complementary elements (40,70). 55

Patentansprüche

1. Lasttragender Baustein (1) zum Bauen von mörtellosen demontierbaren lasttragenden Wänden, wobei der Baustein (1) eine erste kurze Seitenoberfläche (12), eine zweite kurze Seitenoberfläche (13), eine erste lange Seitenoberfläche (14) und eine zweite lange Seitenoberfläche (15) aufweist; wobei der Baustein (1) umfasst:
- Verbindungsmittel (30) in der ersten kurzen Seitenoberfläche (12), der zweiten kurzen Seitenoberfläche (13), der ersten langen Seitenoberfläche (14) und der zweiten langen Seitenoberfläche (15) des Bausteins (1) zum Verbinden des Bausteins (1) seiner Seitenoberfläche (12-15) benachbart mit den Verbindungsmitteln (30) eines ähnlichen Bausteins (1) durch Verwendung eines ersten komplementären Elements (40), wobei die Verbindungsmittel (30) eine Nut umfassen und das erste komplementäre Element (40) in einer ersten Dimension entlang der Nut verschiebbar ist und bei Anbringung in der Nut einen zweidimensionalen Formschluss hat, wobei Verbindungsmittel (30) von benachbarten Bausteinen (1), die eine Ecke bilden, vor einander angeordnet sind; wobei die Kombination aus den Bausteinen (1) und dem ersten komplementären Element (40) das Aufbauen der Wand ermöglicht, wobei die Wand Teil einer architektonischen Struktur ist, **dadurch gekennzeichnet, dass** der Baustein (1) ferner umfasst:
- mindestens ein senkrecht Loch (60), das sich von der oberen (10) zu der unteren Oberfläche (11) des Bausteins (1) erstreckt; wobei das mindestens ein Loch (60) mit dem mindestens einen Loch (60) eines oberhalb oder unterhalb angeordneten ähnlichen Bausteins (1) durch Verwendung des ersten komplementären Elements (40) senkrecht verbindbar ist, wobei das erste komplementäre Element (40) in der ersten Dimension durch das Loch (60) verschiebbar ist und bei Anbringung in dem Loch (60) einen zweidimensionalen Formschluss hat.
2. Baustein (1) nach Anspruch 1, wobei das erste komplementäre Element (40) länglich ist und eine Längsdichtung (50) aufweist, wobei das erste komplementäre Element (40) mit dem Verbindungsmittel (30) zusammenwirkt, so dass die Längsdichtung (50) gegen das Verbindungsmittel (30) abdichtet, wenn das erste komplementäre Element (40) in dem Verbindungsmittel (30) angebracht ist.
3. Baustein (1) nach Anspruch 1 oder 2, wobei das erste komplementäre Element (40) durch das Verbind-

- dungsmittel (30) umhüllt wird, wenn das erste komplementäre Element (40) in dem Verbindungsmittel (30) angebracht ist, und/oder wobei das erste komplementäre Element (40) eine einzige einzigartige Funktionsposition in dem Verbindungsmittel (30) einnimmt, wenn das erste komplementäre Element (40) in dem Verbindungsmittel (30) angebracht ist, und/oder wobei das erste komplementäre Element (40) mehr als eine Funktionsposition in dem Loch (60) einnehmen kann, wenn das erste komplementäre Element (40) in dem Loch (60) angebracht ist, oder das erste komplementäre Element (40) eine begrenzte Anzahl von Funktionspositionen in dem Loch (60) einnehmen kann, wenn das erste komplementäre Element (40) in dem Loch (60) angebracht ist.
4. Baustein (1) nach einem beliebigen vorhergehenden Anspruch, wobei das Innere des Bausteins (1) hohl ist, wobei der hohle Baustein eine Vielzahl von inneren Hohlräumen (20) aufweist.
5. Baustein (1) nach Anspruch 4, wobei die Vielzahl von inneren Hohlräumen (20) durch Verstärkungselemente (21) zum Verstärken der Steifigkeit des Bausteins (1) gebildet werden und/oder ein röhrenförmiges Element wie etwa ein Rohr oder ein Leiter in mindestens einen von der Vielzahl von inneren Hohlräumen (20) einführbar ist und/oder die Vielzahl von inneren Hohlräumen (20) mindestens teilweise mit einem Wärmeisolier- und/oder Schalldämmmaterial gefüllt sind.
6. Baustein (1) nach einem beliebigen vorhergehenden Anspruch, wobei die Verbindungsmittel (30) eine Nut mit einem Querschnitt von einer trapezförmigen Schwalbenschwanzform umfassen.
7. Baustein (1) nach einem beliebigen vorhergehenden Anspruch, wobei der Baustein (1) aus einem Verbundstoff hergestellt ist, der rezyklierten Kunststoff und ein Mineraladditiv mit einer Härte von 6 oder weniger auf der Mohsschen Härteskala umfasst.
8. Baustein (1) nach Anspruch 7, wobei das Mineraladditiv eine Härte von 3 oder mehr auf der Mohsschen Härteskala aufweist und/oder das Mineraladditiv Baustein umfasst und/oder der rezyklierte Kunststoff ein thermoplastisches Polymer umfasst.
9. Baustein (1) nach Anspruch 8, wobei das thermoplastische Polymer Polyvinylchlorid (PVC) ist und/oder der rezyklierte Kunststoff mindestens 50 Gew.-%, vorzugsweise mindestens 60 Gew.-%, insbesondere mindestens 70 Gew.-%, noch bevorzugter mindestens 80 Gew.-% und am bevorzugtesten mindestens 90 Gew.-% aus einem Abfallstrom rezyklierten Kunststoff umfasst und/oder der rezyklier-
- te Kunststoff ferner pulverförmiges duroplastisches Material umfasst.
10. Baustein (1) nach einem beliebigen vorhergehenden Anspruch, ferner umfassend eine Dichtung, die zwischen einer oberen Oberfläche (10) eines Bausteins (1) und der unteren Oberfläche (11) eines auf den ersten Baustein (1) aufgegebenen zweiten Bausteins (1) abdichtet.
11. Baustein (1) nach einem beliebigen vorhergehenden Anspruch, wobei das erste komplementäre Element (40) ein zweites komplementäres Element (70) umfasst, wobei das mindestens eine Loch (60) mit dem mindestens einen Loch (60) eines oberhalb oder unterhalb angeordneten ähnlichen Bausteins (1) durch Verwendung des zweiten komplementären Elements (70) senkrecht verbindbar ist, wobei das zweite komplementäre Element (70) in der ersten Dimension durch das Loch (60) verschiebbar ist und bei Anbringung in dem Loch (60) zweidimensionalen Formschluss hat, wobei das zweite komplementäre Element (70) durch das Loch (60) umhüllt wird, wenn das zweite komplementäre Element (70) in dem Loch (60) angebracht ist, oder das zweite komplementäre Element (70) eine einzigartige Funktionsposition aufweist, wenn das zweite komplementäre Element (70) in dem Loch (60) angebracht ist.
12. Teilesatz aus einer Vielzahl von Bausteinen (1) nach einem beliebigen der Ansprüche 1 bis 11 und einer Vielzahl von ersten komplementären Elementen (40) zum Verbinden der Verbindungsmittel (30) eines ersten Bausteins (1) nach einem beliebigen der Ansprüche 1 bis 10 mit den Verbindungsmitteln (30) eines zweiten Bausteins (1), der einer Seitenoberfläche (12-15) und/oder der oberen Oberfläche (10) des ersten Bausteins (1) benachbart angeordnet ist.
13. Teilesatz nach Anspruch 12, wobei jedes erste komplementäre Element (40) eine dem Querschnitt nach doppelte Trapezform aufweist und/oder wobei einige der ersten komplementären Elemente (40) zweite komplementäre Elemente (70) sind.
14. Mörtellose demontierbare lasttragende Wand, die mit einer Vielzahl von Bausteinen (1) nach einem beliebigen der Ansprüche 1 bis 11 hergestellt ist.
15. Verfahren zum Bauen einer mörtellosen demontierbaren lasttragenden Wand durch Verwendung von Bausteinen (1) nach einem beliebigen der Ansprüche 1 bis 11, umfassend:
- Anbringen einer ersten Reihe von Bausteinen (1),
Anbringen einer zweiten Reihe von Bausteinen (1) oben auf der ersten Reihe von Bausteinen

(1), Verbinden der Bausteine (1) waagrecht innerhalb derselben Reihe durch Anbringen der ersten komplementären Elemente (40) und senkrecht durch Anbringen der ersten komplementären Elemente (40) oder der ersten und zweiten komplementären Elemente (40, 70).

Revendications

1. Bloc de construction porteur (1) pour construire des murs porteurs démontables sans mortier, le bloc de construction (1) ayant une première surface latérale courte (12), une seconde surface latérale courte (13), une première surface latérale longue (14) et une seconde surface latérale longue (15); le bloc de construction (1) comprenant :

- des moyens d'interconnexion (30) dans ladite première surface latérale courte (12), ladite seconde surface latérale courte (13), ladite première surface latérale longue (14) et ladite seconde surface latérale longue (15) du bloc de construction (1) pour interconnecter le bloc (1) adjacent à sa surface latérale (12-15), avec les moyens d'interconnexion (30) d'un bloc similaire (1) par l'utilisation d'un premier élément complémentaire (40), dans lequel lesdits moyens d'interconnexion (30) comprennent une rainure et le premier élément complémentaire (40) peut coulisser dans une première dimension le long de la rainure et a une fermeture de forme bidimensionnelle quand il est installé dans la rainure, dans lequel des moyens d'interconnexion (30) de blocs de construction adjacents (1) formant un angle sont situés les uns devant les autres ;

dans lequel la combinaison desdits blocs de construction (1) et dudit premier élément complémentaire (40) permet la montée dudit mur, de sorte que ledit mur fait partie d'une structure architecturale

caractérisé en ce que le bloc de construction (1) comprend en outre

- au moins un trou vertical (60), s'étendant à partir du sommet (10) jusqu'à la surface inférieure (11) du bloc (1) ;

dans lequel ledit au moins un trou (60) peut être verticalement interconnecté avec l'au moins un trou (60) d'un bloc similaire (1), positionné au-dessus ou au-dessous, par l'utilisation dudit premier élément complémentaire (40), le premier élément complémentaire (40) pouvant coulisser dans la première dimension à travers le trou (60) et ayant une fermeture de forme bidimensionnelle quand il est installé dans le trou (60).

2. Bloc de construction (1) selon la revendication 1,

dans lequel le premier élément complémentaire (40) est allongé et a un joint longitudinal (50), le premier élément complémentaire (40) coopérant avec le moyen d'interconnexion (30) de sorte que le joint longitudinal (50) jointe contre les moyens d'interconnexion (30) quand le premier élément complémentaire (40) est installé dans les moyens d'interconnexion (30).

3. Bloc de construction (1) selon la revendication 1 ou 2, dans lequel le premier élément complémentaire (40) est engainé par les moyens d'interconnexion (30) quand le premier élément complémentaire (40) est installé dans les moyens d'interconnexion (30), et/ou dans lequel le premier élément complémentaire (40) prend une position fonctionnelle unique simple dans les moyens d'interconnexion (30) quand le premier élément complémentaire (40) est installé dans les moyens d'interconnexion (30), et/ou dans lequel le premier élément complémentaire (40) peut prendre plus d'une position fonctionnelle dans le trou (60) lorsque le premier élément complémentaire (40) est installé dans le trou (60) ou le premier élément complémentaire (40) peut prendre un nombre limité de positions fonctionnelles dans le trou (60) quand le premier élément complémentaire (40) est installé dans le trou (60).

4. Bloc de construction (1) selon l'une quelconque des revendications précédentes, dans lequel l'intérieur du bloc de construction (1) est creux, ledit bloc creux ayant une pluralité de cavités intérieures (20).

5. Bloc de construction (1) selon la revendication 4, dans lequel ladite pluralité de cavités intérieures (20) est formée par des éléments de renfort (21) pour améliorer la rigidité du bloc de construction (1), et/ou un élément tubulaire tel qu'un tuyau ou un conducteur peut être inséré dans au moins une de ladite pluralité de cavités intérieures (20), et/ou ladite pluralité de cavités intérieures (20) est au moins partiellement remplie d'une matière d'isolation thermique et/ou d'amortissement acoustique.

6. Bloc de construction (1) selon l'une quelconque des revendications précédentes, dans lequel lesdits moyens d'interconnexion (30) comprennent une rainure ayant une forme trapézoïdale, de queue d'aronde en coupe transversale.

7. Bloc de construction (1) selon l'une quelconque des revendications précédentes, dans lequel ledit bloc (1) est fait à partir d'une matière composite comprenant une matière plastique recyclée et un additif minéral avec une dureté de 6 ou moins sur l'échelle de dureté minérale de Mohs.

8. Bloc de construction (1) selon la revendication 7,

- dans lequel ledit additif minéral a une dureté de 3 ou plus sur l'échelle de dureté minérale de Mohs, et/ou ledit additif minéral comprend de la chalcantithe, et/ou ladite matière plastique recyclée comprend un polymère thermoplastique.
- 9.** Bloc de construction (1) selon la revendication 8, dans lequel ledit polymère thermoplastique est du chlorure de polyvinyle (PVC), et/ou ladite matière plastique recyclée comprend au moins 50 % en poids, de préférence au moins 60 % en poids, plus de préférence au moins 70 % en poids, même plus de préférence au moins 80 % en poids et le plus de préférence au moins 90 % en poids de matière plastique recyclée provenant d'un flux de déchets, et/ou ladite matière plastique recyclée comprend en outre une matière thermodurcie en poudre.
- 10.** Bloc de construction (1) selon l'une quelconque des revendications précédentes, comprenant en outre une garniture d'étanchéité qui jointe entre une surface supérieure (10) d'un bloc particulier (1) et la surface inférieure (11) d'un second bloc (1) placé sur le premier bloc (1).
- 11.** Bloc de construction (1) selon l'une quelconque des revendications précédentes, dans lequel le premier élément complémentaire (40) comprend un second élément complémentaire (70), ledit au moins un trou (60) pouvant être verticalement interconnecté avec l'au moins un trou (60) d'un bloc similaire (1), positionné au-dessus ou au-dessous, par l'utilisation dudit second élément complémentaire (70), le second élément complémentaire (70) pouvant coulisser dans la première dimension à travers le trou (60) et a une fermeture de forme bidimensionnelle quand il est installé dans le trou (60), le second élément complémentaire (70) étant engainé par le trou (60) lorsque le second élément complémentaire (70) est installé dans le trou (60), ou le second élément complémentaire (70) a une position fonctionnelle unique lorsque le second élément complémentaire (70) est installé dans le trou (60).
- 12.** Kit de pièces d'une pluralité de blocs (1) selon l'une quelconque des revendications 1 à 11 et d'une pluralité de premiers éléments complémentaires (40) pour interconnecter les moyens d'interconnexion (30) d'un premier bloc de construction (1) selon l'une quelconque des revendications 1 à 10 avec les moyens d'interconnexion (30) d'un second bloc (1) placé adjacent à une surface latérale (12-15) et/ou la surface supérieure (10) du premier bloc (1).
- 13.** Kit de pièces selon la revendication 12, dans lequel chaque premier élément complémentaire (40) a une forme trapézoïdale double en coupe transversale, et/ou dans lequel certains des premiers éléments complémentaires (40) sont des seconds éléments complémentaires (70).
- 14.** Mur porteur démontable sans mortier fait avec une pluralité de blocs (1) selon l'une quelconque des revendications 1 à 11.
- 15.** Procédé pour construire un mur porteur démontable sans mortier, par l'utilisation de blocs de construction (1) selon l'une quelconque des revendications 1 à 11, comprenant l'installation d'une première rangée de blocs de construction (1), l'installation d'une seconde rangée de blocs de construction (1) au sommet de ladite première rangée de blocs de construction (1), l'interconnexion des blocs de construction (1) horizontalement à l'intérieur de la même rangée en installant lesdits premiers éléments complémentaires (40), et verticalement en installant lesdits premiers éléments complémentaires (40) ou lesdits premiers et seconds éléments complémentaires (40,70).

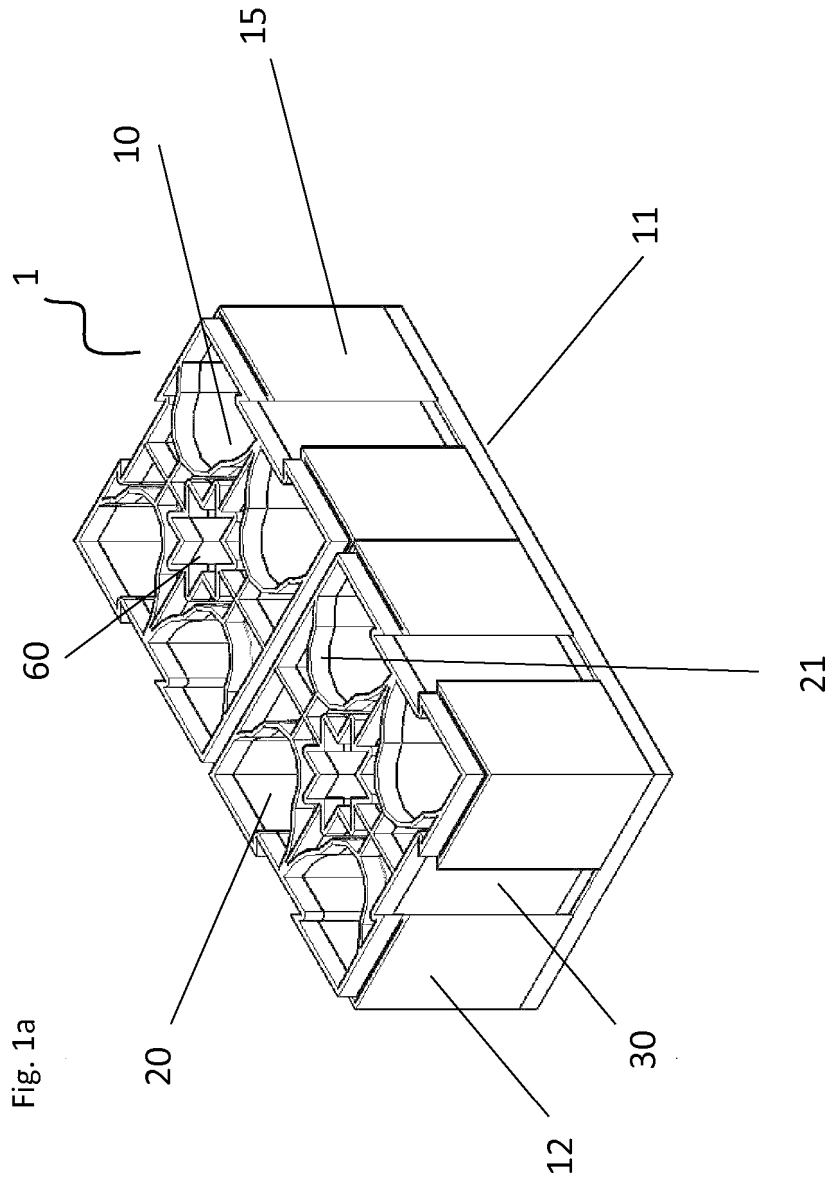


Fig. 1a

Fig. 1b

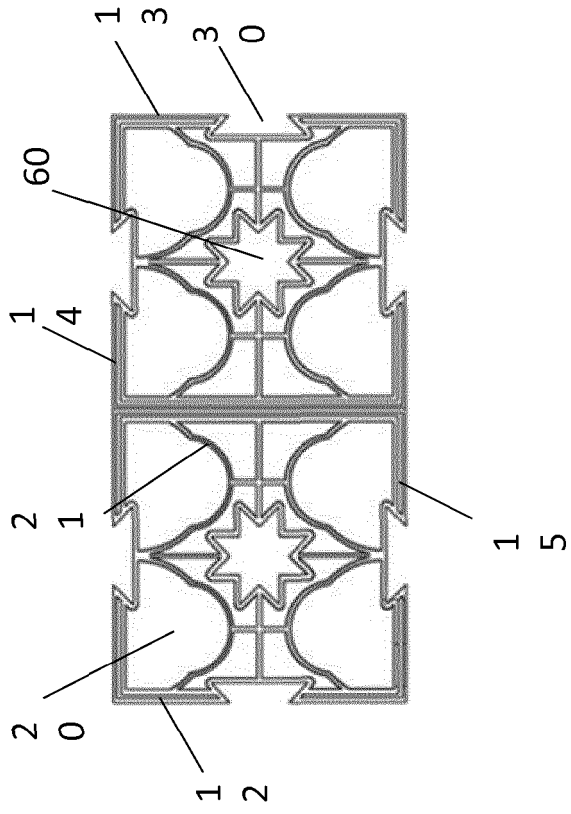
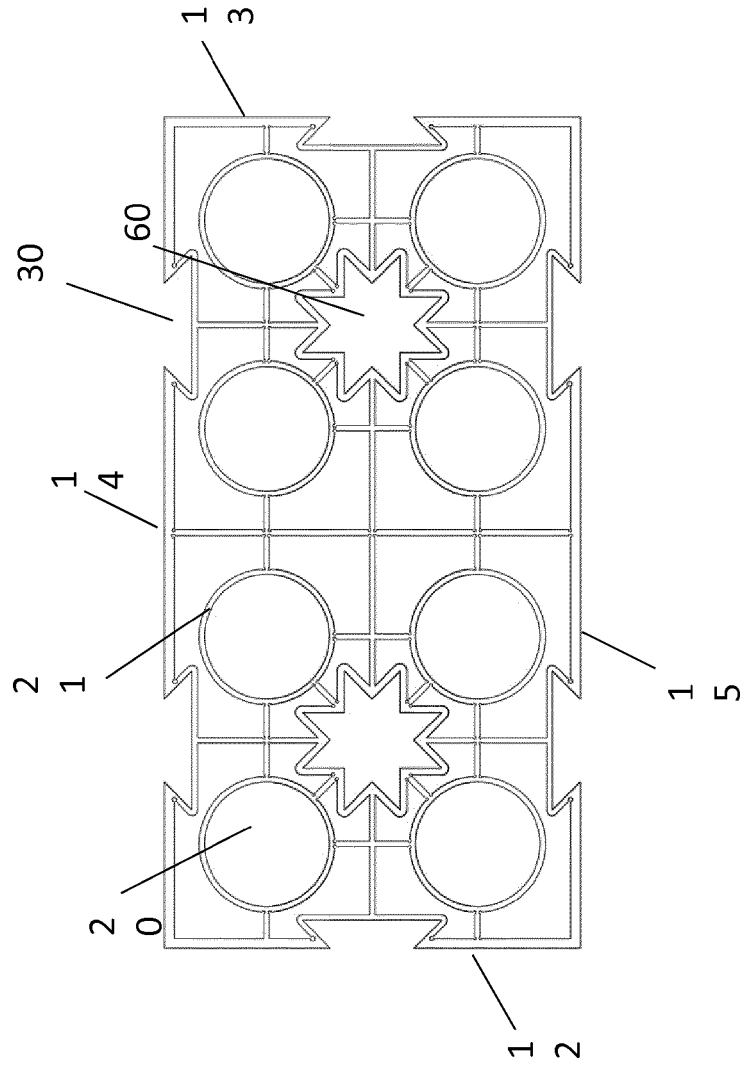
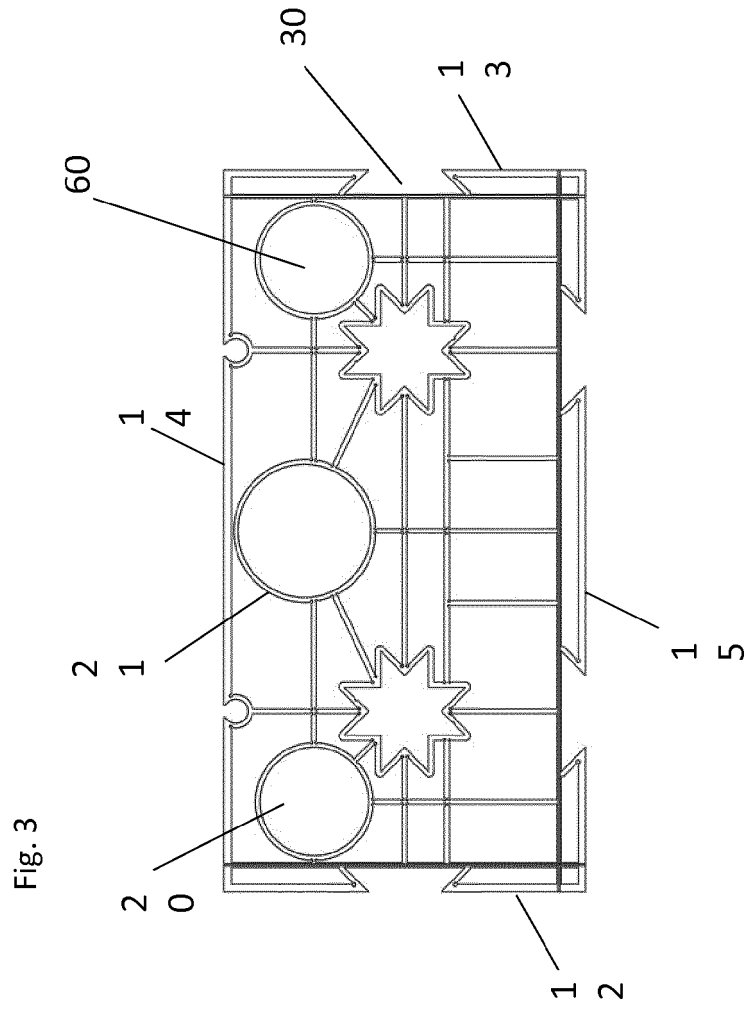


Fig. 2





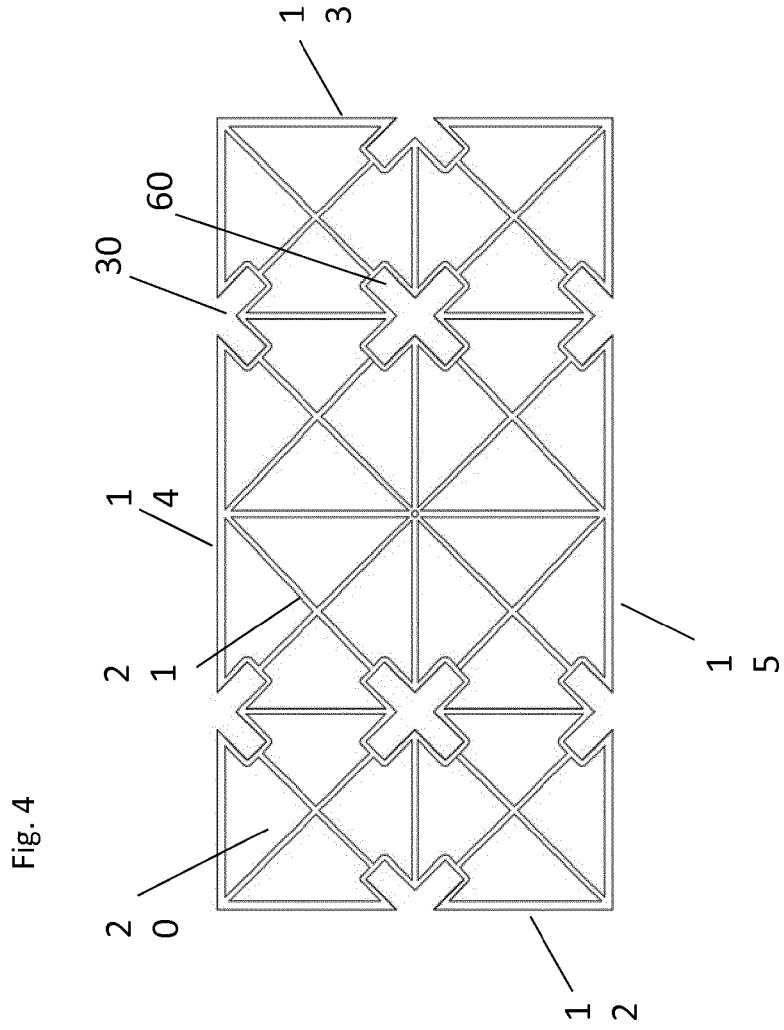


Fig. 5

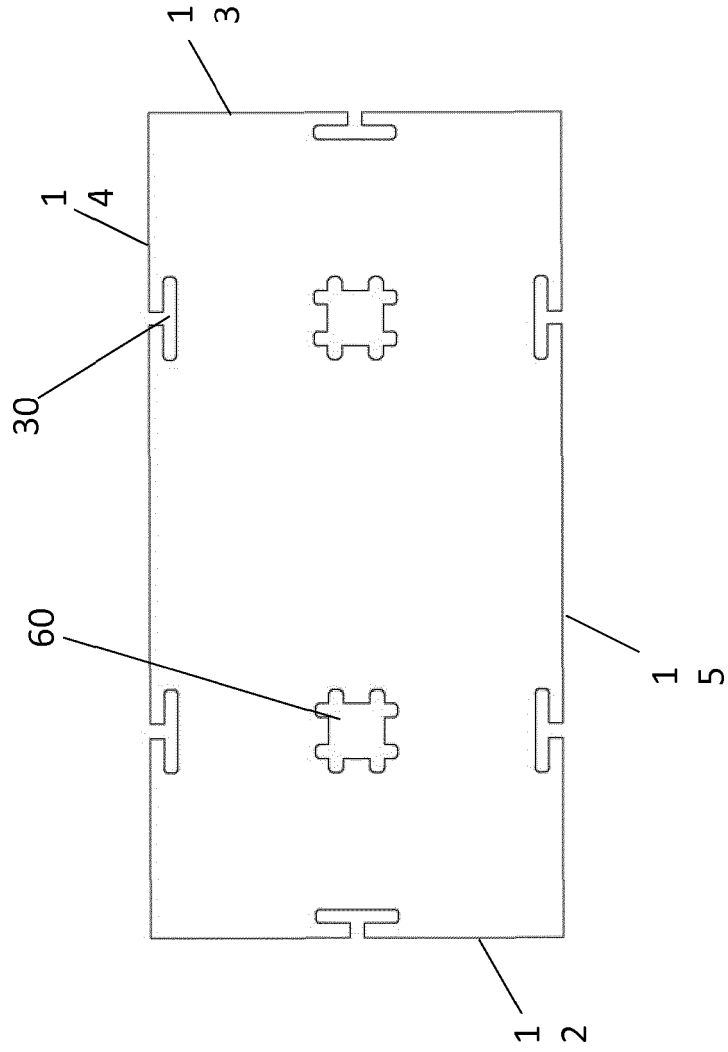
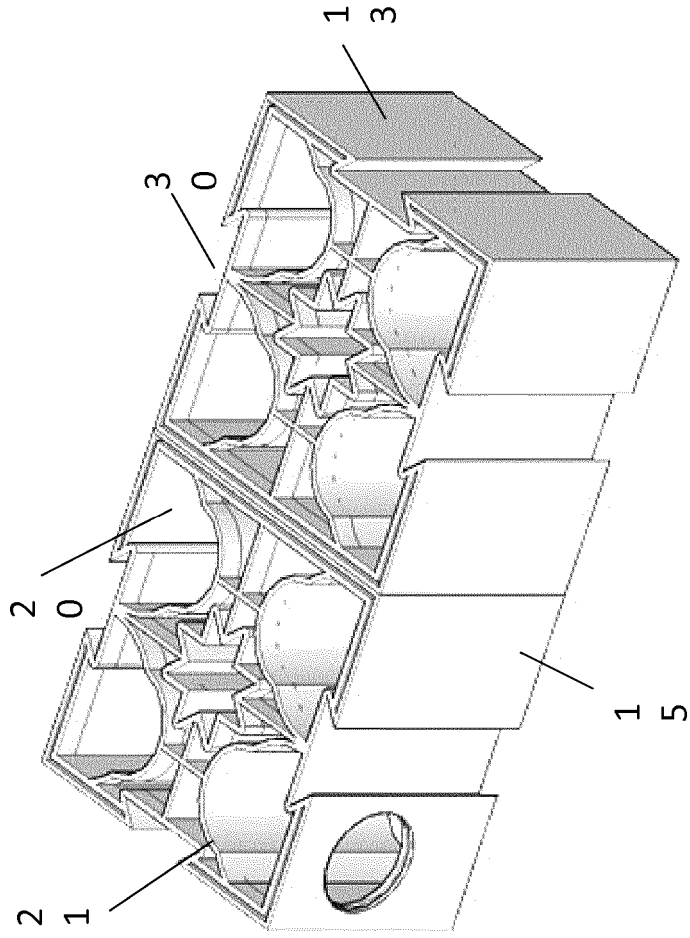


Fig. 6a



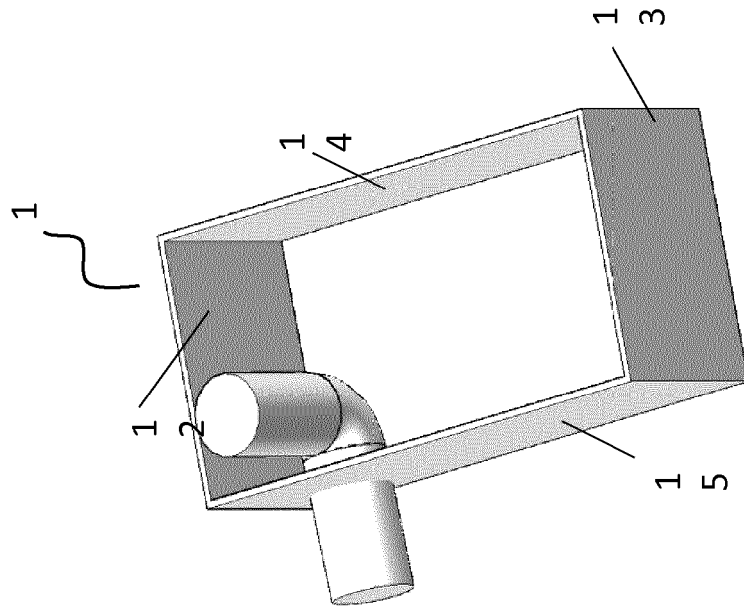
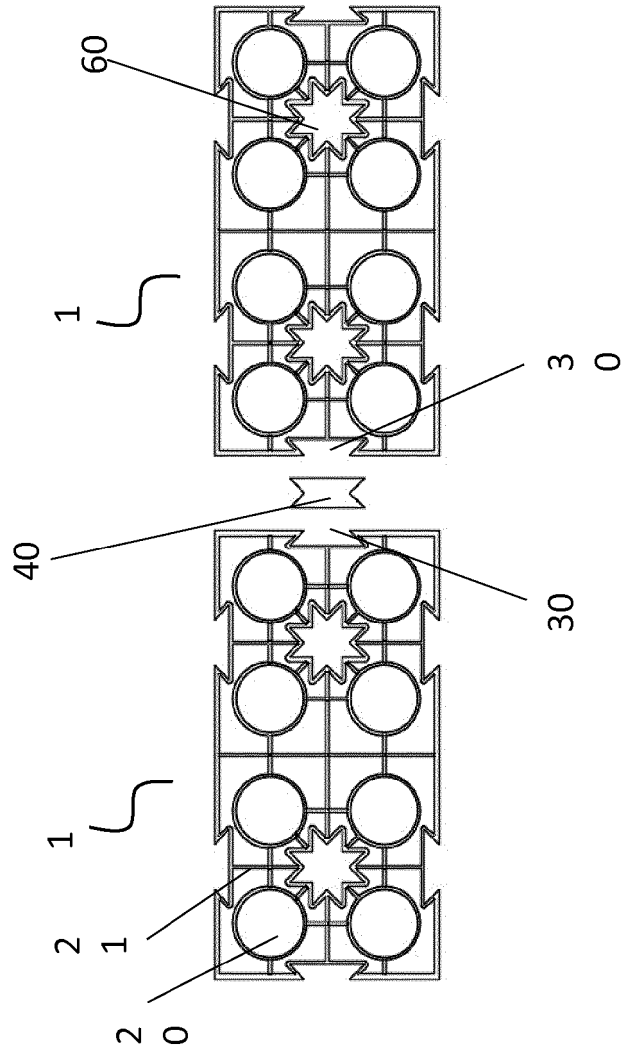


Fig. 6b

Fig. 7



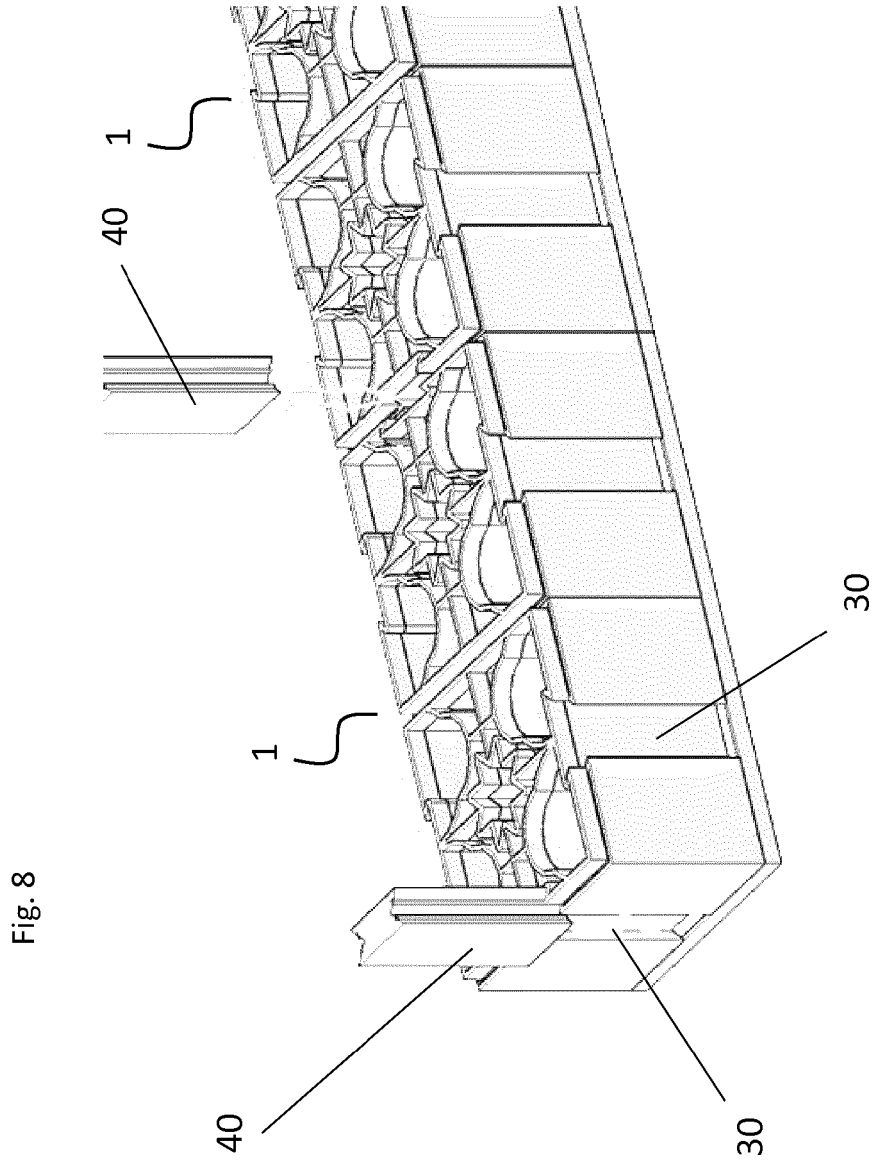


Fig. 8

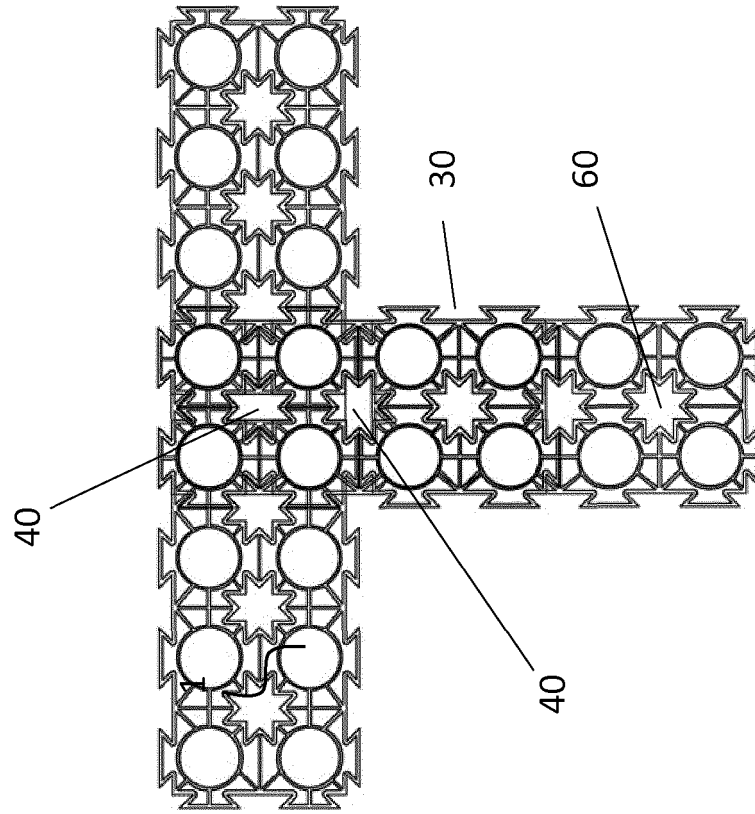
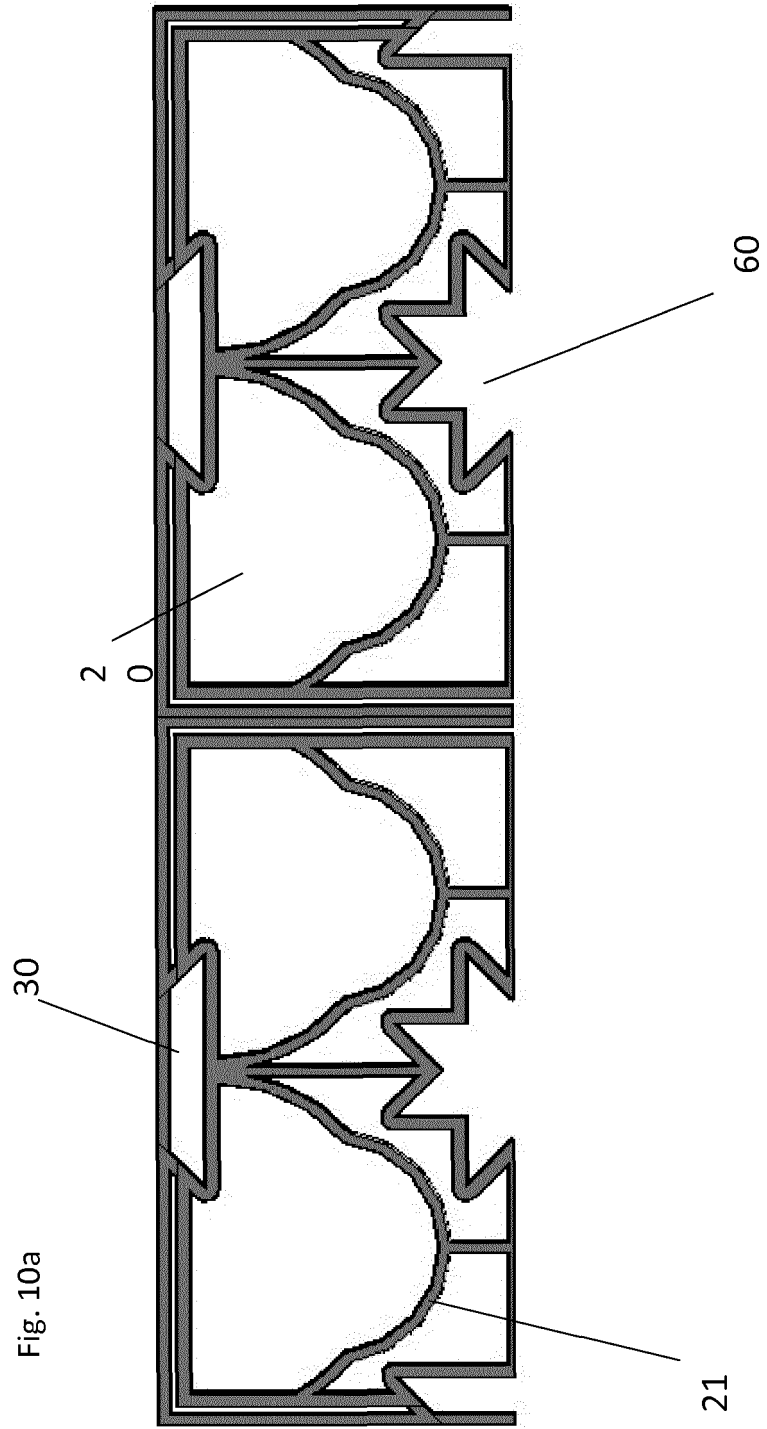


Fig. 9



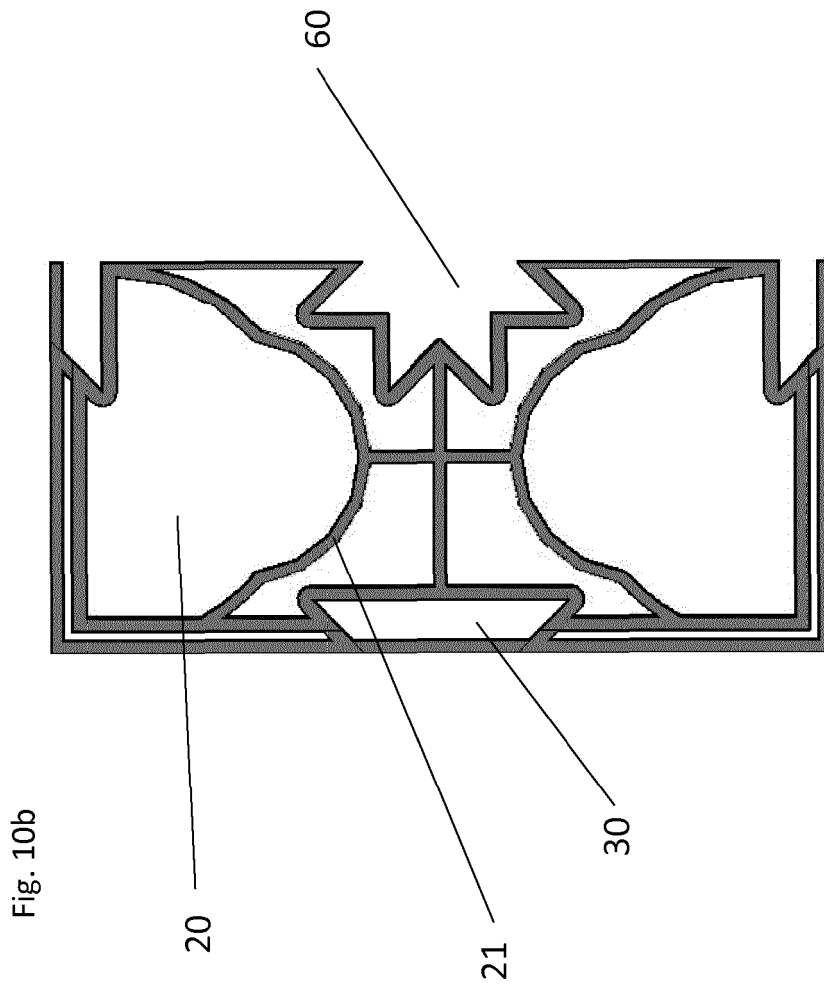


Fig. 10b

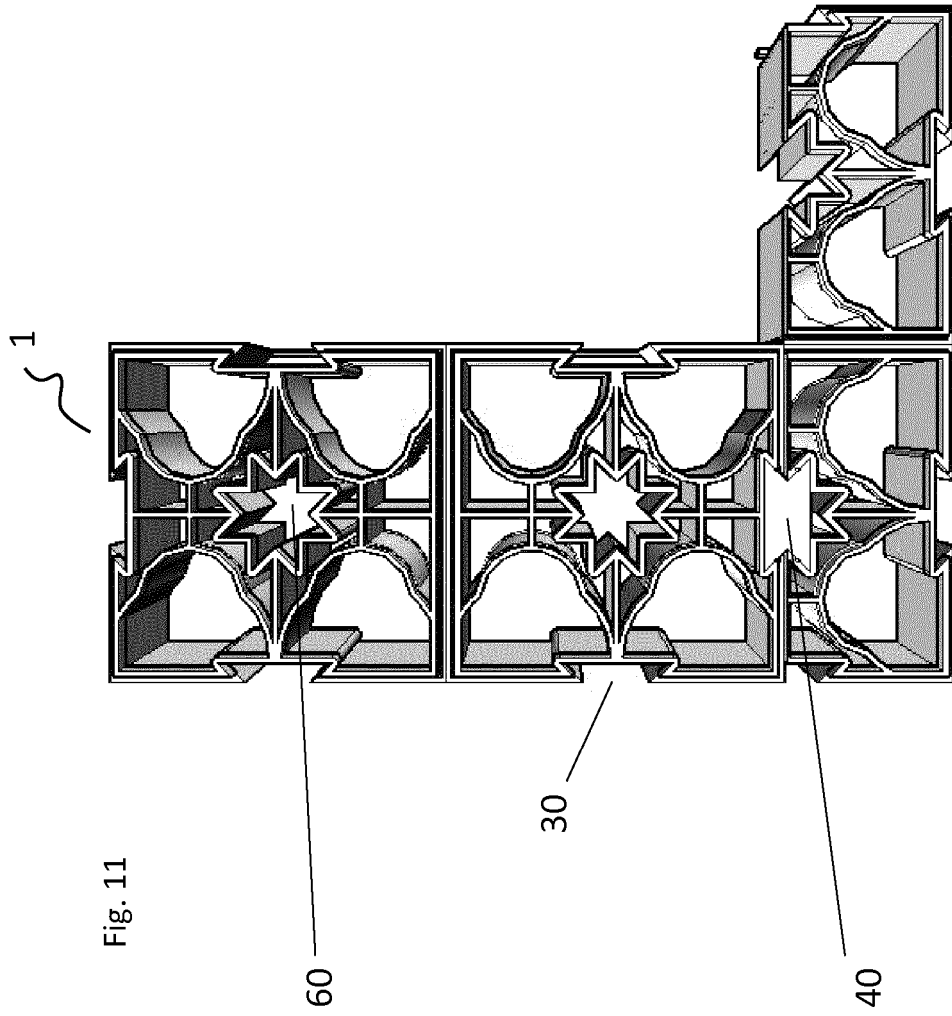


Fig. 11

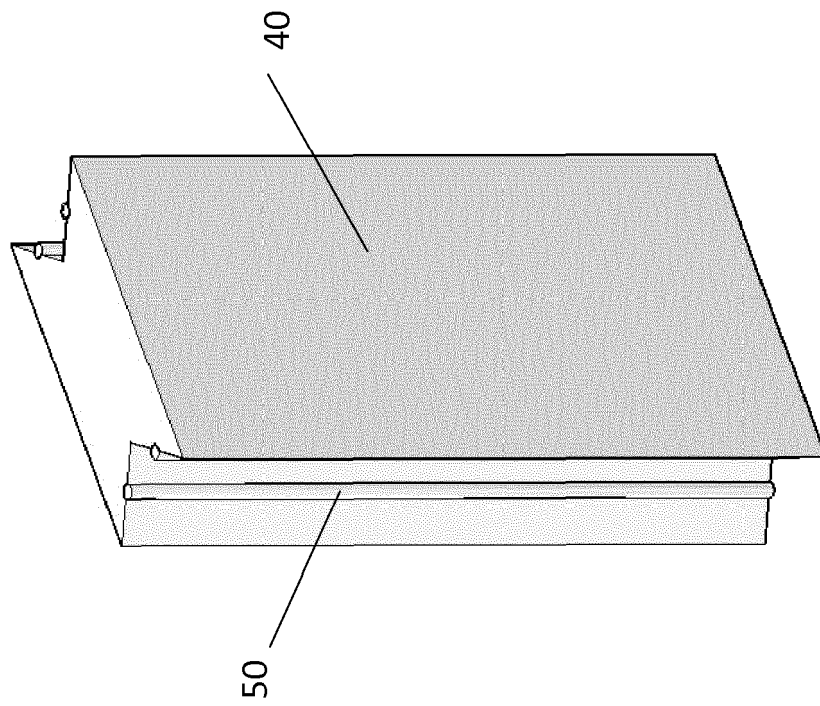


Fig. 12

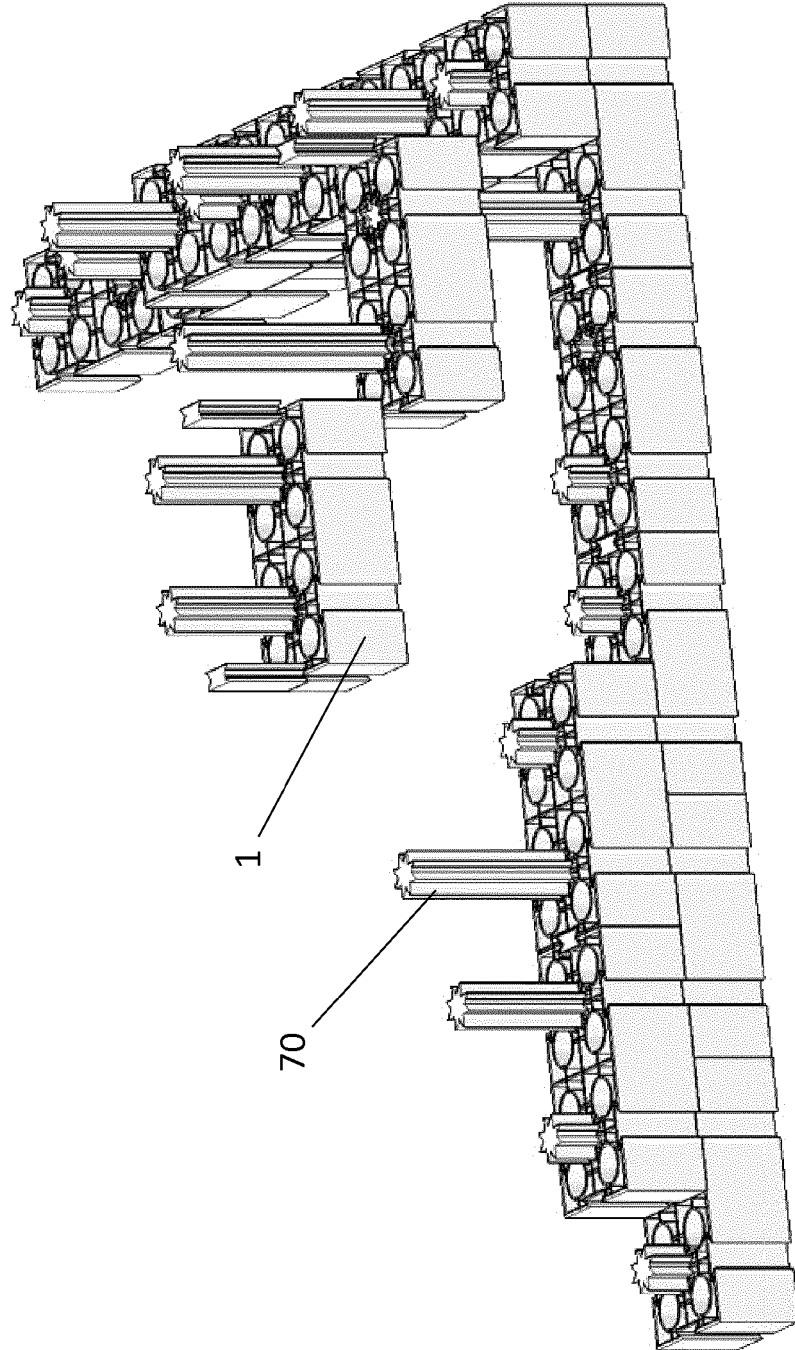


Fig. 13

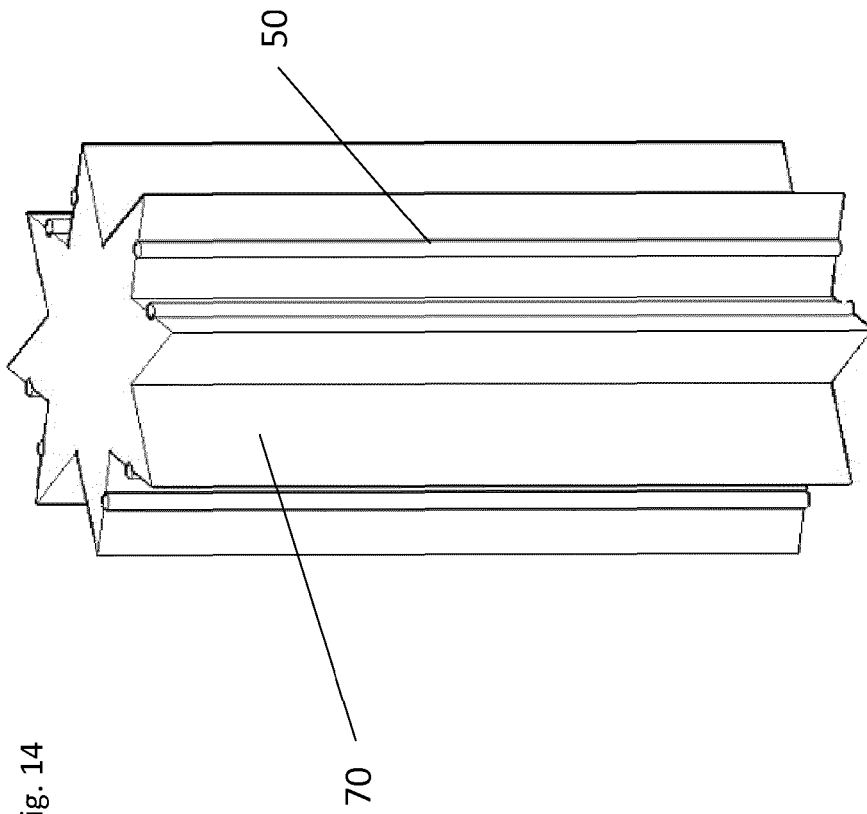


Fig. 14

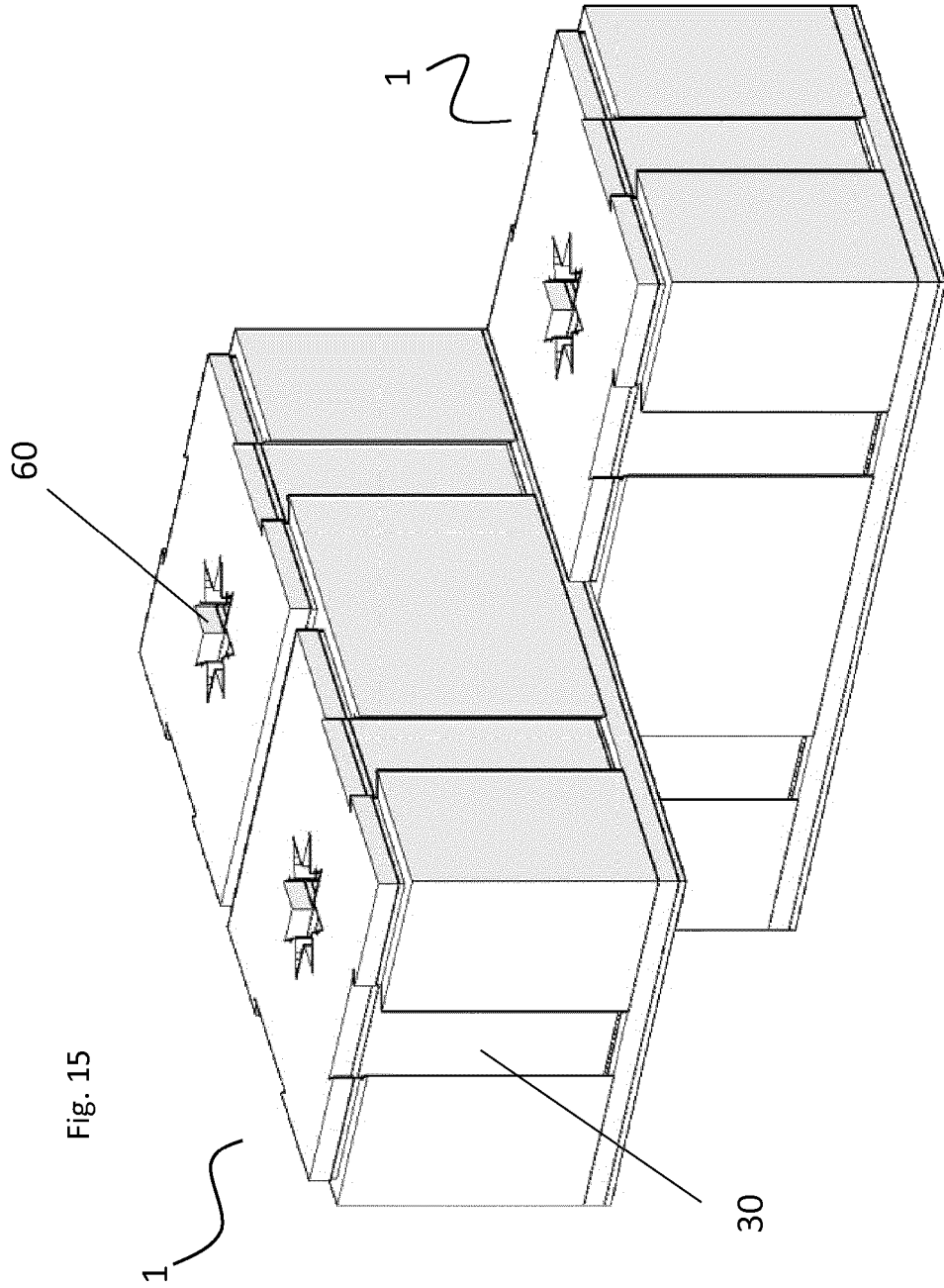


Fig. 15

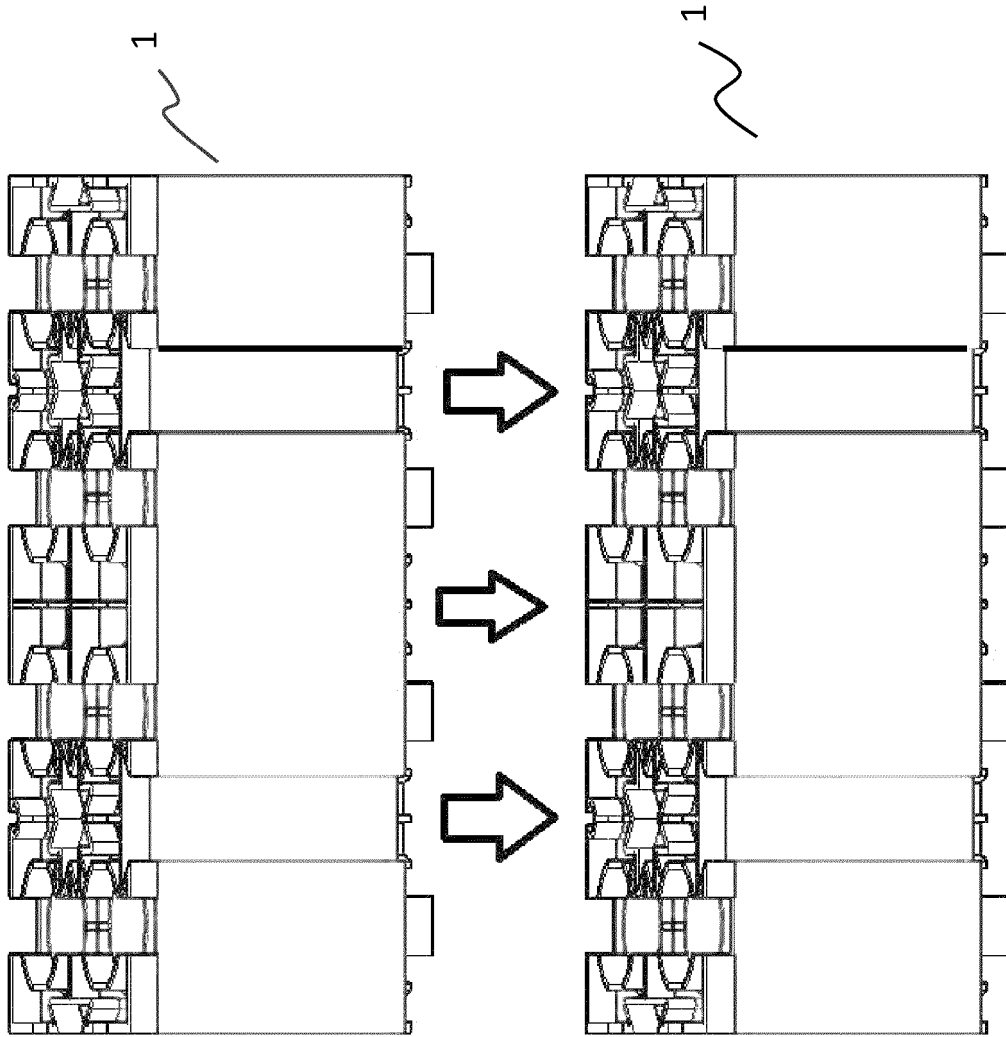
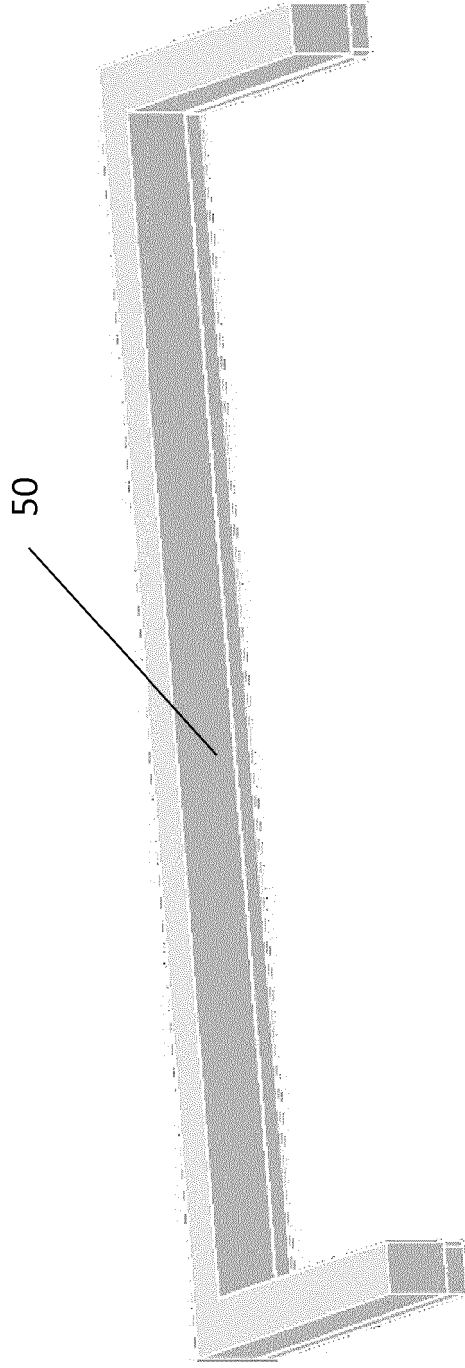


Fig. 16

Fig. 17



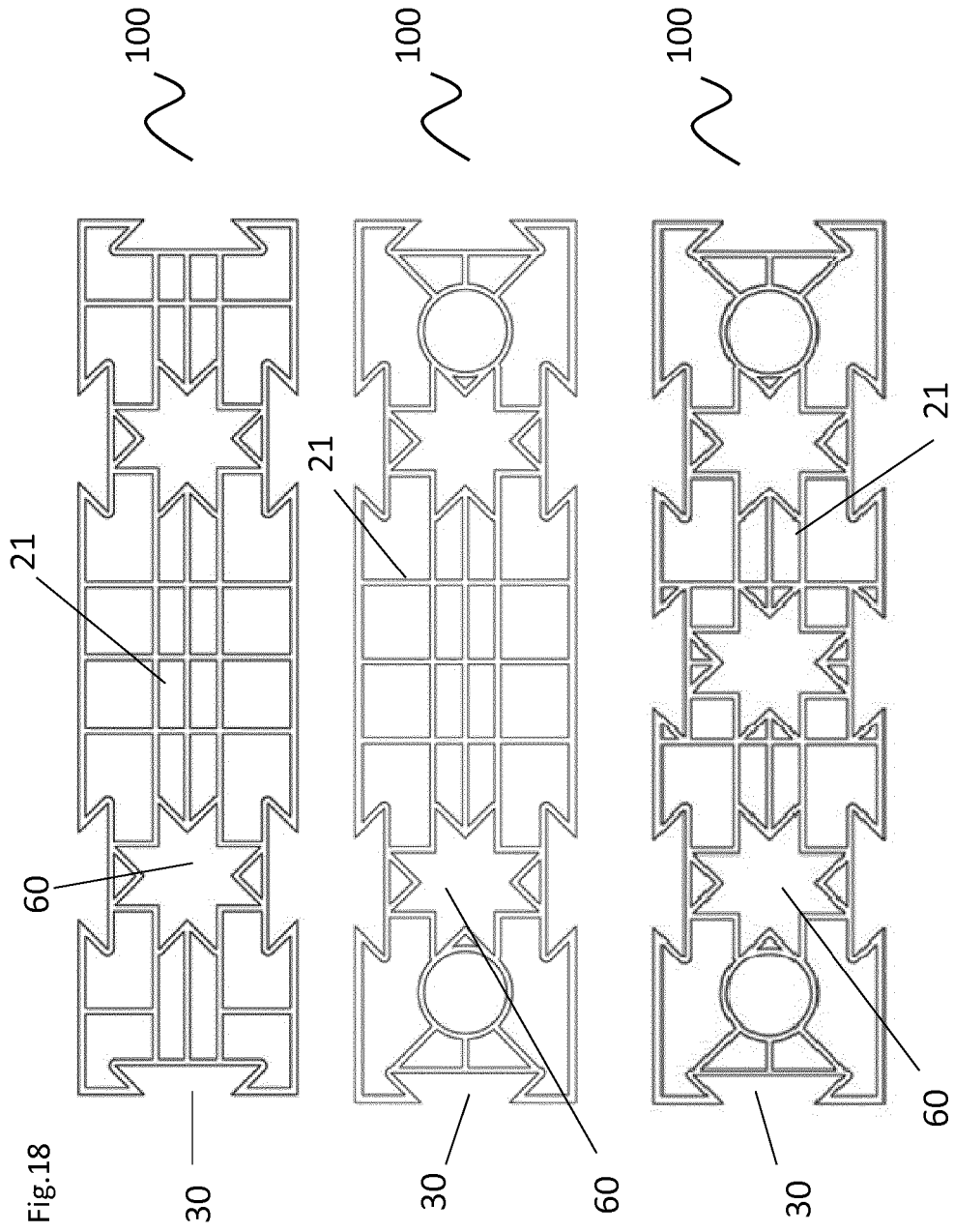
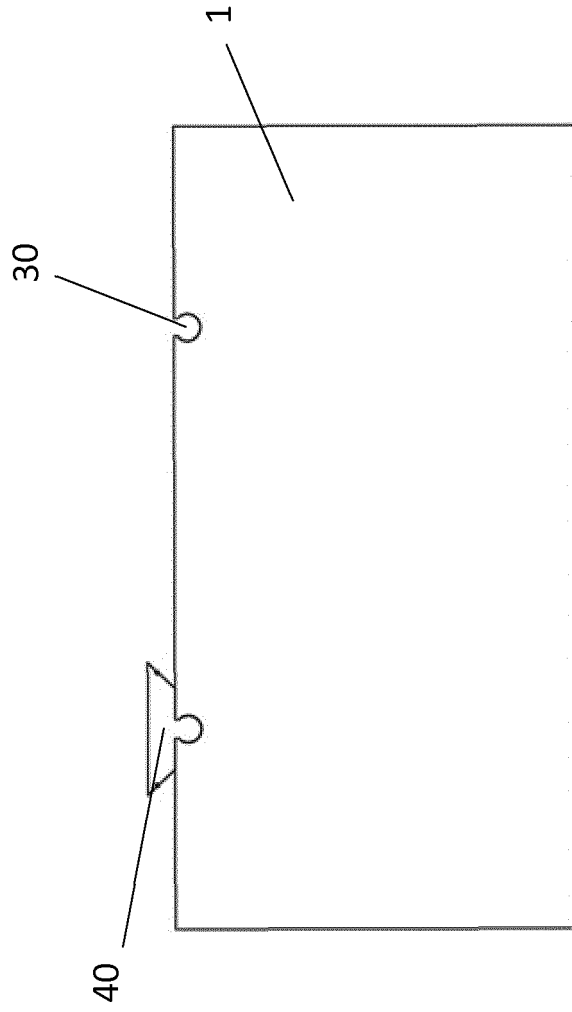


Fig.19



REFERENCES CITED IN THE DESCRIPTION

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