

(19)



(11)

**EP 4 089 244 A1**

(12)

## EUROPEAN PATENT APPLICATION

(43) Date of publication:  
**16.11.2022 Bulletin 2022/46**

(51) International Patent Classification (IPC):  
**E04B 1/24 (2006.01) E04B 1/348 (2006.01)**

(21) Application number: **22172197.0**

(52) Cooperative Patent Classification (CPC):  
**E04B 1/2403; E04B 1/34807; E04B 2001/2406;**  
**E04B 2001/2415; E04B 2001/2448;**  
**E04B 2001/2454; E04B 2001/2457**

(22) Date of filing: **06.05.2022**

(84) Designated Contracting States:  
**AL AT BE BG CH CY CZ DE DK EE ES FI FR GB**  
**GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO**  
**PL PT RO RS SE SI SK SM TR**  
Designated Extension States:  
**BA ME**  
Designated Validation States:  
**KH MA MD TN**

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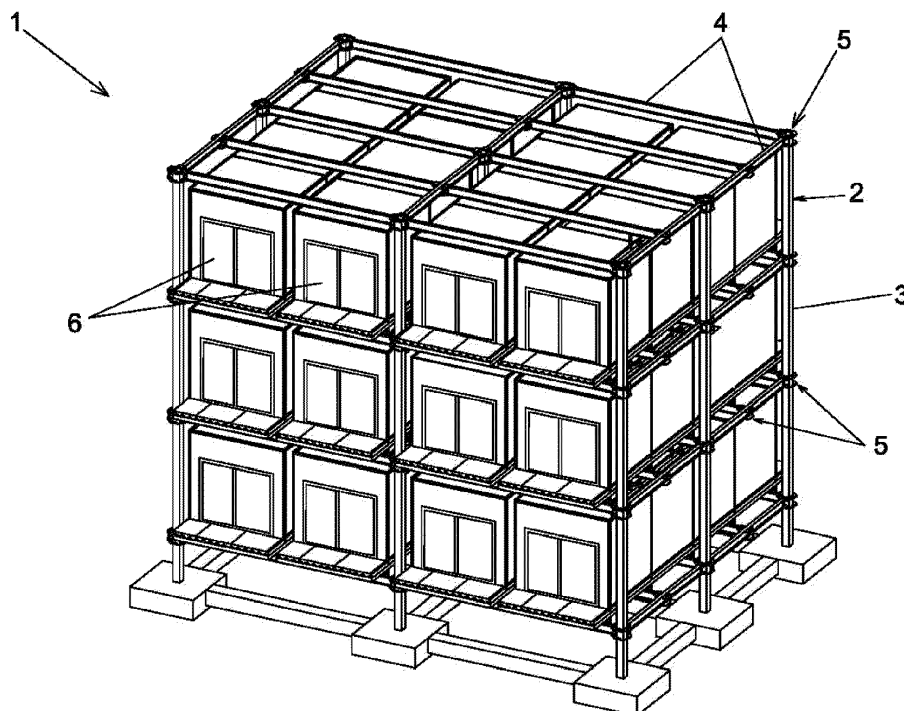
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(30) Priority: **10.05.2021 ES 202130951 U**

(54) **EXPANDABLE, REMOVABLE AND REUSABLE MODULAR HIGH-RISE BUILDING MADE UP OF PREFABRICATED ELEMENTS**

(57) The present invention relates to an expandable, removable and reusable modular high-rise building (1) made up of prefabricated elements, comprising a modular structure (2), comprising pillars (3), beams (4), and

quick coupling nodes (5) for joining between the pillars (3) and beams (4), and self-supporting modules (6) with dimensions greater than the light between beams (4) of the modular structure (2).



**Fig 3**

**EP 4 089 244 A1**

## Description

### OBJECT OF THE INVENTION

[0001] The present invention relates to an expandable, removable and reusable modular high-rise building made up of prefabricated elements, usable in construction, preferably, of living spaces (homes, hotels, lodgings, residences, etc.).

### BACKGROUND OF THE INVENTION

[0002] Buildings with prefabricated elements are currently known, which normally resemble traditional buildings, with erection of a structure that is fixed and immovable over time with the only option of removal by demolition, on which the prefabricated elements are in turn fixed, which are usually exterior envelope panels or inner partitions (for example, including plasterboard partitions therein).

[0003] Although the introduction of prefabricated elements has streamlined the construction process, for example, it is only necessary to see how the use of inner plasterboard divisions has become almost universal, compared to the traditional brick construction despite the higher cost thereof, the method of construction is still very similar to the traditional one, since only some prefabricated elements are incorporated in the process, causing, in addition, a stable (not removable) building.

[0004] Likewise, the creation of living spaces by means of prefabricated modules, for example construction sheds, is known, but ultimately they are isolated elements of small size, which cannot be considered buildings as such by themselves, but which have the advantage of the ease of transport and reuse thereof and of the manufacture in factory, not in situ, thereof.

[0005] The applicant is unaware of the possible existence of buildings, as such, made entirely with prefabricated elements such as the one described in the present invention, having their added and differential value from the current ones, in that they are modular, expandable, removable and reusable anywhere else.

### DESCRIPTION OF THE INVENTION

[0006] The expandable, removable and reusable modular high-rise building made up of prefabricated elements of the invention comprises, in the most generic definition thereof:

- a modular structure, comprising pillars, beams, and quick-coupling nodes (i.e., having detachable assembly means by snapping, without welding) for joining between the pillars and the beams, and
- self-supporting modules (which in themselves have a supporting or structural configuration suitable for bearing their own loads and loads of use, resting on the modular structure) with dimensions greater than

the span between the beams of the modular structure (at least in one of the two main directions in plan view), for resting thereon.

[0007] In this way, after making an in-situ foundation from which the first sections of the pillars start -which is the only non-removable portion of the structure- the rest of the elements of the rigid orthogonal frame structure can be assembled. On the beams of this modular structure, the finished prefabricated living modules will be placed, and the roof, where appropriate, provided with photovoltaic panels if desired for self-consumption of the building. The last phase corresponds to the connection of installations through holes between modules and completion of holes in the facade.

[0008] Thus, an industrialised building is achieved, i.e., prefabricated in the factory, with great cost savings and which also exhibits the following advantages:

- it is modular,
- it is expandable,
- it is removable, and
- it is reusable.

[0009] Factory manufacturing, both of the modules and of the supporting structure, enables a reduction of execution times, a more exhaustive quality control and a reduction in accidents, noise and waste compared to a traditional system. One of the most important points is this reduction in manufacturing and assembly times, which entails a competitive edge over the traditional system.

[0010] In addition, dry construction in the factory and with more efficient materials enables more ecological homes to be built. On the roof of the building, as indicated, photovoltaic installations can be arranged that reduce electricity costs, and given the features of the invention and the ease of connection of the modules, the building is easily expandable both in plan and in height, and in the same way, disassembly and reuse in another location is feasible.

[0011] With the building of the invention, buildings of different uses can be created, such as: houses, hotels, residences, etc.

### DESCRIPTION OF THE DRAWINGS

[0012]

Figure 1 shows a view of the arrangement of beams of a base slab of a standard module of the building of the invention.

Figure 2 shows an exploded view of the main elements of a standard module of the building of the invention, and an enlarged detail of a vertical perimeter envelope.

Figure 3 shows a view of a modular building made according to the invention.

Figure 4 shows a view of a pillar meeting of the mod-

ular structure of the building of the invention and an enlargement of an area thereof.

Figure 5 shows a view of an intermediate meeting of one beam with another, without a pillar, of the modular structure of the building of the invention.

Figures 6, 7 and 8 show respective examples of inner distribution of modules of the building of the invention.

## PREFERRED EMBODIMENT OF THE INVENTION

**[0013]** The expandable, removable and reusable modular high-rise building (1) made up of prefabricated elements (see fig 3) of the invention comprises:

- a modular structure (2), comprising pillars (3), beams (4), and quick coupling nodes (5) for joining between the pillars (3) and the beams (4), and
- self-supporting modules (6) with dimensions greater than the span between beams (4) of the modular structure (2) (at least in one of the two main directions in plan view), for resting thereon.

**[0014]** It must be mentioned that the entire structure is calculated and the beams and pillars can vary in dimension according to height.

**[0015]** In a very preferred embodiment of the modular structure (2), the quick coupling nodes (5) comprise (see figs. 4 and 5):

- horizontal plates (50) protruding from each face of the pillars (3), or on opposite faces of the beams (4), at heights corresponding to each floor level of the modular structure (2), and provided with upper recesses or openings (51), and
- support wings (52) for supporting on said plates (50), protruding from the ends of each beam (4), and provided with lower coupling protrusions (53) in the upper recesses or openings (51) of the plates (50). This enables, by simply inserting and fitting the lower protrusions (53) into the openings (51), the structure to be stiffened. Seeking to enhance this effect, it is preferred that each node (5) comprises two protruding horizontal plates (50) for each vertical face (30) of each pillar (3) or beam (4), and two corresponding support wings (52) protruding from the end of each beam (4). In this way, the wings (52) (and their protrusions) are in continuity with the actual wings of the beams, solidly joining said wings to the plates and stiffening the structure without the need for welding. In addition, screwed joints (54) are provided between the plates (50) and the wings (52) to increase stiffness.

**[0016]** For its part, the preferred embodiment of each module (6) will comprise (see figs. 1 and 2):

- a base slab (60) comprising lower longitudinal

beams (61) (straight and/or pitched) joined by lower transversal beams (62) and the corresponding concrete compression layer,

- upper longitudinal beams (64) joined by upper transversal beams (65),
- pillars (66) that are joined to the lower longitudinal beams (61) and the upper longitudinal beams (64), and
- perimeter (67a, 67b) and upper (68) envelopes;
- in the perimeter envelopes (67a, 67b) of which there are holes (69a, 69b) made for passage, illumination and ventilation. This configuration is easy to manufacture to scale, replicating the arrangement of the upper and lower longitudinal beams and with good supporting strength. The perimeter (67a, 67b) and upper (68) envelopes will be made with several layers with insulation and drywall. The use of sandwich panel is preferred due to the lightness, ease of assembly, good finish and ease of cutting and handling thereof, and excellent insulation qualities. In particular, it is preferred that the perimeter (67a, 67b) and upper (68) envelopes comprise one or more layers (7) of sandwich panels fixed to intermediate profiles (8a) joined to the beams (61, 62, 64, 65) and/or pillars (66) of the module to facilitate assembly and offer a double enveloping layer.

**[0017]** The arrangement of the illumination and ventilation holes (69a) in the smaller perimeter envelopes (67a) is preferred (see figs. 6 and 7), since in this way the modules can be placed parallel with these holes facing the outside, and it is also possible to arrange intermediate holes (69b) in the larger perimeter envelopes (67b) for passage (communication between adjacent modules or for exterior access).

**[0018]** The arrangement in the modules (6) of at least one intermediate narrowing (8) for the passage of the vertical elements of the structure and utility ducts for installations is also preferred.

**[0019]** The most common living arrangement for the aforementioned arrangement of holes will comprise arranging the bathroom, storage and/or installation rooms in the centre of the module (6), and the living spaces at the ends (so they have more natural light, cross ventilation, privacy and views are achieved). In addition, a terrace can be arranged at one or both ends of the modules.

**[0020]** Having sufficiently described the nature of the invention, it is indicated that the description of it and of the preferred embodiment thereof should be interpreted in a non-limiting manner, and that it encompasses all the possible variant embodiments that may be deduced from the contents of the present specification and the claims.

## Claims

1. An expandable, removable and reusable modular high-rise building (1), made up of prefabricated ele-

ments; **characterised in that** it comprises:

- A modular structure (2), comprising pillars (3), beams (4), and quick coupling nodes (5) for joining between the pillars (3) and the beams (4), and
  - Self-supporting modules (6) with dimensions greater than the span between beams (4) of the modular structure (2).
2. The expandable, removable and reusable modular high-rise building (1), made up of prefabricated elements according to claim 1, **wherein** the quick coupling nodes (5) comprise:
- horizontal plates (50) protruding from each face of the pillars (3), or on opposite faces of the beams (4), at heights corresponding to each floor level of the modular structure (2), and provided with upper recesses or openings (51), and
  - support wings (52) for supporting on said plates (50), protruding from the ends of each beam (4), and provided with lower coupling protrusions (53) in the upper recesses or openings (51) of the plates (50).
3. The expandable, removable and reusable modular high-rise building (1), made up of prefabricated elements according to claim 2, **wherein** each node (5) comprises two horizontal plates (50) protruding from each vertical face (30) of each pillar (3) or beam (4), and two corresponding support wings (52) protruding from the end of each beam (4).
4. The expandable, removable and reusable modular high-rise building (1), made up of prefabricated elements according to any of claims 2 or 3, **wherein** screwed joints (54) are arranged between the plates (50) and the wings (52).
5. The expandable, removable and reusable modular high-rise building (1), made up of prefabricated elements according to any of the preceding claims, **wherein** each module (6) comprises:
- a base slab (60) comprising lower longitudinal beams (61) joined by lower transversal beams (62) and the corresponding compression layer,
  - upper longitudinal beams (64) joined by upper transversal beams (65),
  - pillars (66) that are joined to the lower longitudinal beams (61) and the upper longitudinal beams (64), and
  - perimeter (67a, 67b) and upper (68) envelopes;
  - in the perimeter envelopes (67a, 67b) of which there are holes (69a, 69b) made for passage, illumination and ventilation.
6. The expandable, removable and reusable modular high-rise building (1), made up of prefabricated elements according to claim 5, **wherein** the perimeter (67a, 67b) and upper (68) envelopes are made of sandwich panel.
7. The expandable, removable and reusable modular high-rise building (1), made up of prefabricated elements according to claim 6, **wherein** the perimeter (67a, 67b) and upper (68) envelopes comprise one or more layers (7) of sandwich panels fixed to intermediate profiles (8a) joined to the beams (61, 65) of the module.
8. The expandable, removable and reusable modular high-rise building (1), made up of prefabricated elements according to any of claims 5 to 7, **wherein** the smaller perimeter envelopes (67a) comprise illumination and ventilation holes (69a).
9. The expandable, removable and reusable modular high-rise building (1), made up of prefabricated elements according to claim 8, **wherein** the larger perimeter envelopes (67b) comprise intermediate holes (69b) for passage.
10. The expandable, removable and reusable modular high-rise building (1), made up of prefabricated elements according to any of the preceding claims, **wherein** the modules (6) comprise, at least, an intermediate narrowing (8) for the passage of the vertical elements of the structure and utility ducts for installations.
11. The expandable, removable and reusable modular high-rise building (1), made up of prefabricated elements according to any of the preceding claims, **wherein** the bathroom, storage and/or installation rooms are arranged in the centre of the module (6), and the living spaces are arranged at the ends.
12. The expandable, removable and reusable modular high-rise building (1), made up of prefabricated elements according to any of the preceding claims, **which** comprises a terrace at one or both ends.

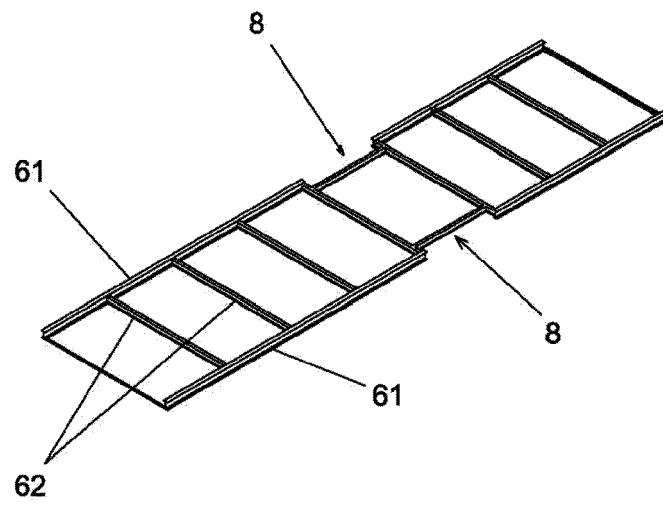


Fig 1

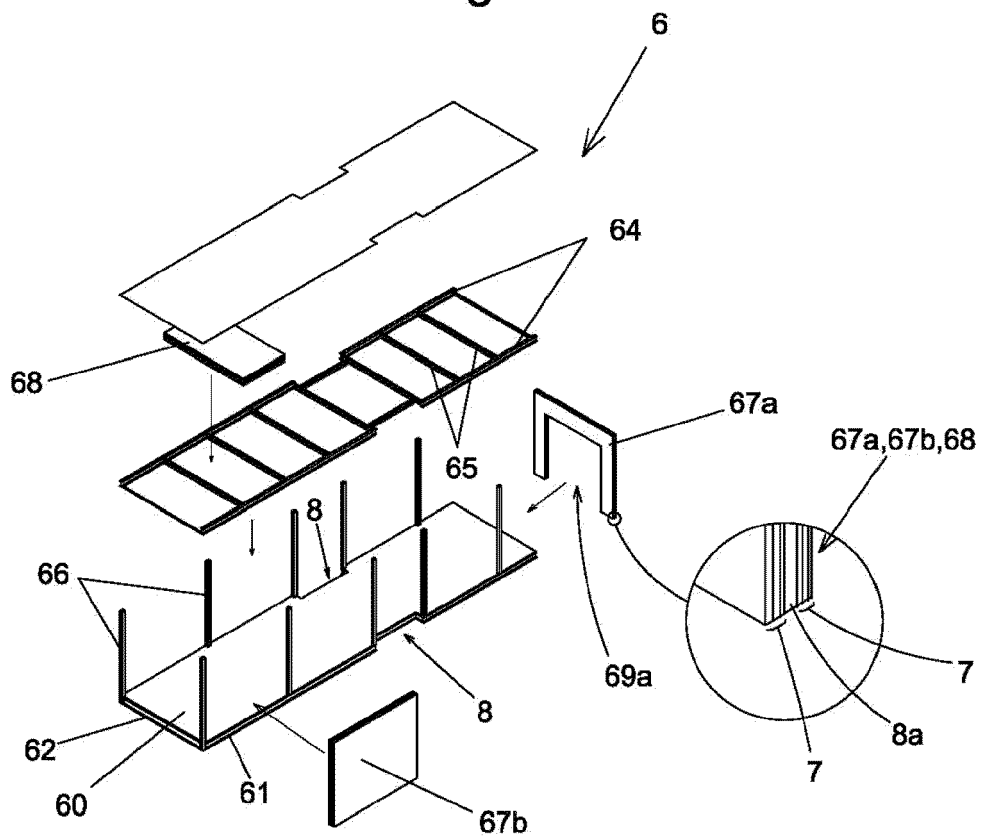


Fig 2

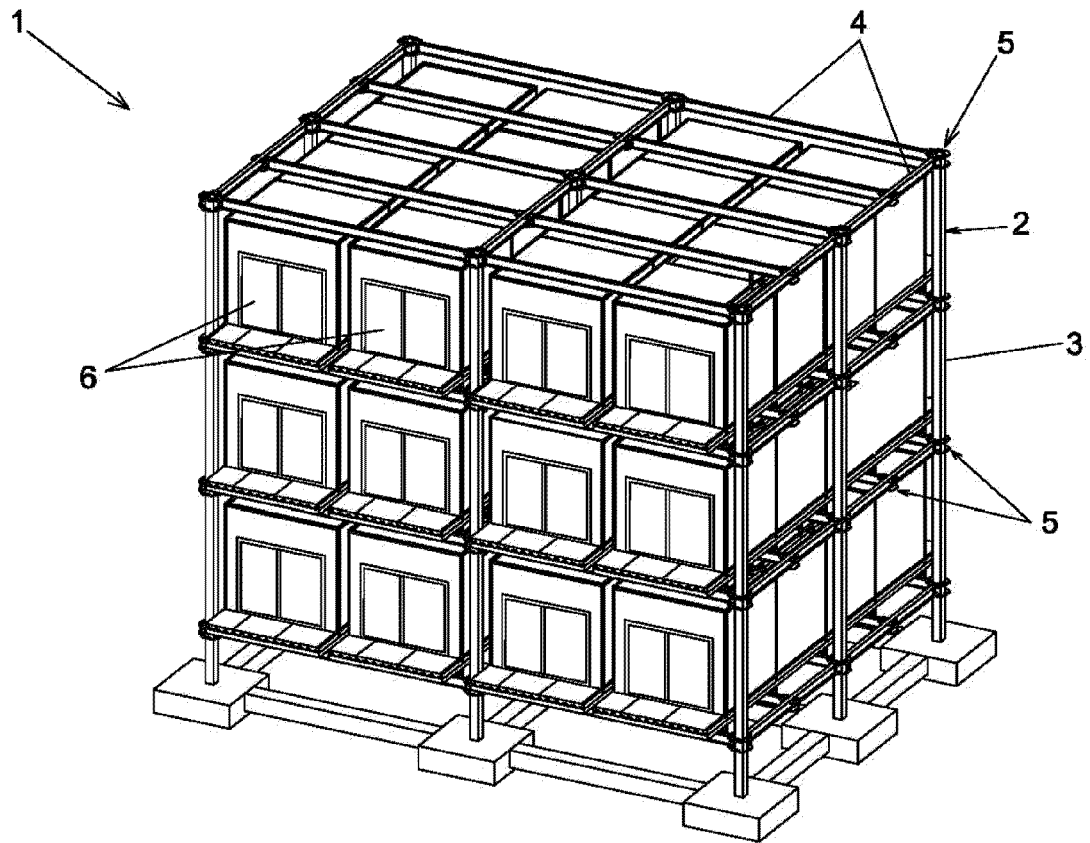


Fig 3

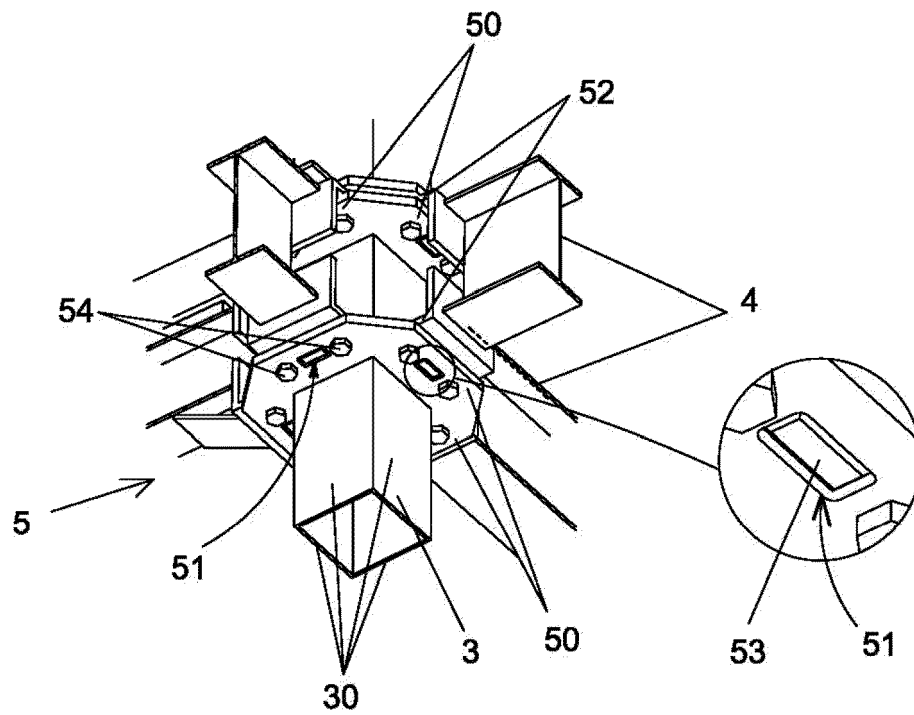


Fig 4

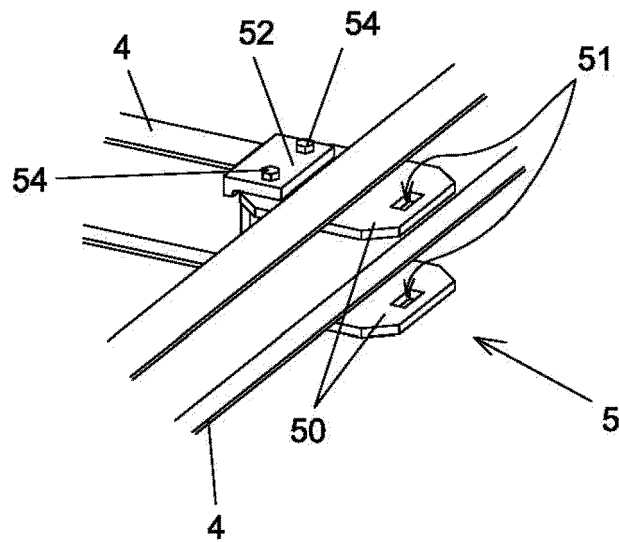


Fig 5

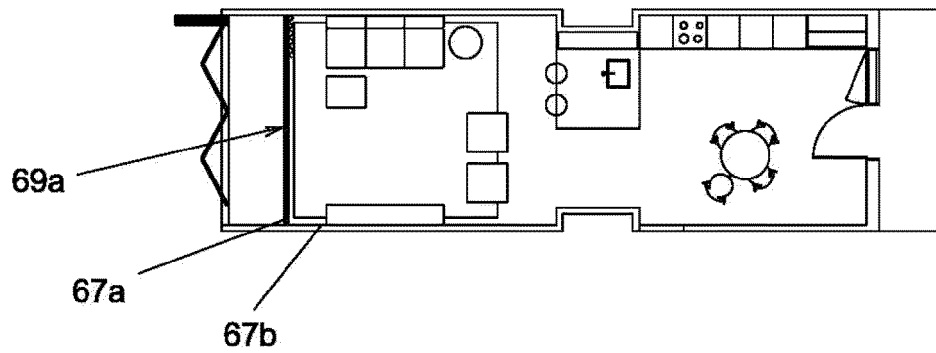


Fig 6

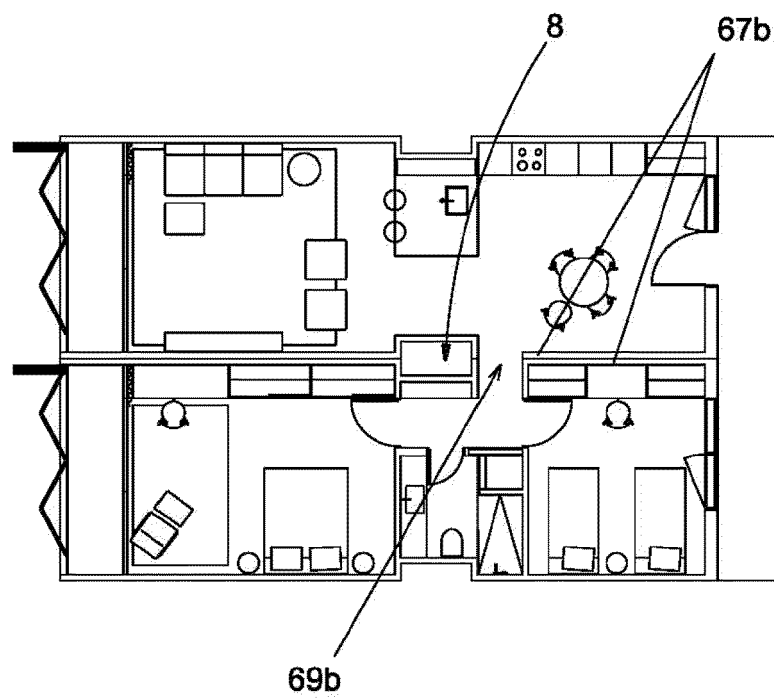


Fig 7



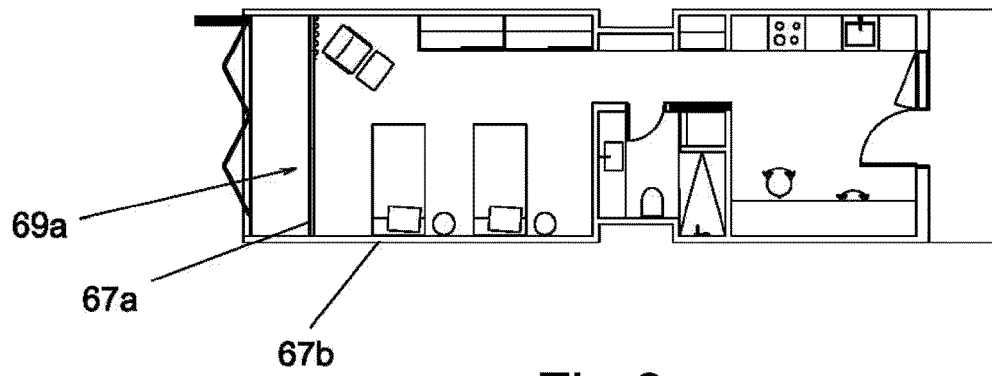


Fig 8



## EUROPEAN SEARCH REPORT

Application Number

EP 22 17 2197

## DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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The present search report has been drawn up for all claims			

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EPO FORM 1503 03.82 (P04C01)

Place of search	Date of completion of the search	Examiner
The Hague	27 September 2022	Couprie, Brice
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons ..... & : member of the same patent family, corresponding document		

**ANNEX TO THE EUROPEAN SEARCH REPORT  
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EP 22 17 2197

5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.  
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27-09-2022

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