(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 4 343 070 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
**27.03.2024 Bulletin 2024/13**

(21) Application number: **23198838.7**

(22) Date of filing: **21.09.2023**

(51) International Patent Classification (IPC):
***E04B 1/00*** *(2006.01)* ***E04B 1/348*** *(2006.01)*

(52) Cooperative Patent Classification (CPC):
**E04B 1/34815; E04B 1/0023; E04B 1/3483;**
E04B 2001/8254

(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 ME MK MT NL NO PL PT RO RS SE SI SK SM TR**
Designated Extension States:
**BA**
Designated Validation States:
**KH MA MD TN**

(30) Priority: **22.09.2022 NL 2033101**

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(54) **MODULAR BUILDING UNIT**

(57) The present disclosure relates to modular building unit, comprising at least a floor frame, a ceiling frame and a plurality of uprights defining a vertical offset between the floor frame and the ceiling frame, wherein an outer circumference of one of the ceiling frame and the floor frame is undersized relative to an inner circumference of the other one of the ceiling frame and the floor frame, such that the one of the ceiling frame and the floor frame having the relatively undersized outer circumference may be internally received by the other one of the ceiling frame and the floor frame of an overlaying further modular building unit that is stacked on top of the modular building unit.

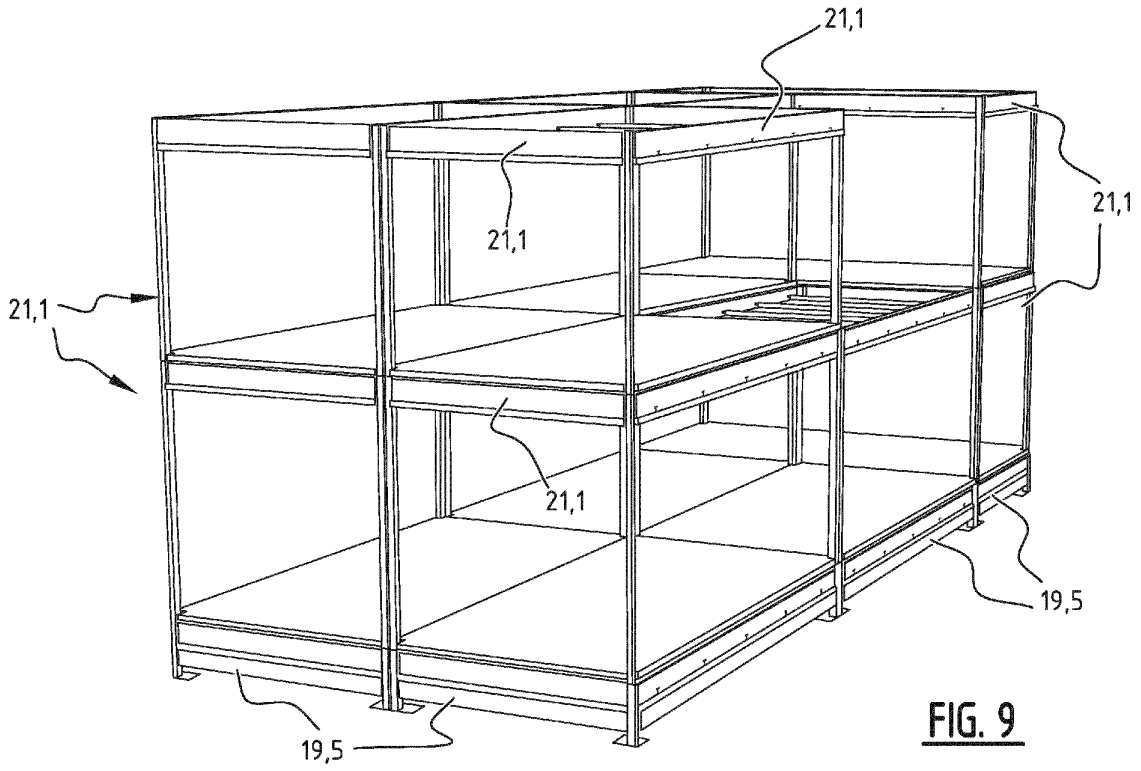


FIG. 9

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## Description

**[0001]** The present disclosure relates to a modular building unit and a system comprising at least one such a modular building unit.

**[0002]** Modular building units are building components that are utilised to construct buildings quickly and efficiently at relatively low costs. They typically consist of a prefabricated building section, such as a single room or an entire floor of a building, that may be arranged adjacent to and connected with other similar modular building sections at a construction site to thereby construct a building. Modular building units provide a solution when one or buildings must be constructed in a short amount of time and/or at reduced costs. Buildings constructed by means of modular building units may include building used for retail, buildings for providing (public) services and residential buildings.

**[0003]** Modular building units are currently being considered for realising large numbers of residential buildings. However, known modular building units are known to have certain limitations that thus far inhibited modular building units being used for this purpose at a large scale.

**[0004]** Firstly, because modular building units typically comprise a relatively light construction (which allows such modular building to be transported to a construction site), these modular building units tend to have a poor performance in terms of in particular acoustic isolation and fire safety. These limitations are further exacerbated when the scale of the building of which they form a part is increased. Adequate acoustic isolation is more relevant in the case of larger residential buildings housing more residents. Likewise, fire safety regulations are more stringent for larger, multistorey buildings.

**[0005]** Secondly, a further disadvantage of known modular building units relates to the fact that such modular building units are typically stacked on top of one another to construct a building. Modular building unit typically comprises both a floor part and a ceiling part, with the floor part of an overlaying modular building unit being stacked on top of the ceiling part of an underlaying modular building unit to assemble a building. Because both the floor part and the ceiling part of the modular building unit comprise a certain height - both of which contribute to the overall height of the building - the resultant building comprises an enlarged overall height relative to the number of storeys of the building. This has an adverse effect on the overall aesthetic appearance of the building, and moreover results in additional difficulties when passageways are constructed between the different storeys of the building.

**[0006]** The object of the present disclosure is to provide a modular building unit with which one or more, or other, of the hereabove described limitations of known modular building units are reduced or abated.

**[0007]** This object is achieved with a modular building unit, comprising a floor frame, a ceiling frame, and a plurality of uprights defining a vertical offset between the floor frame and the ceiling frame, wherein an outer circumference of one of the ceiling frame and the floor frame is undersized relative to an inner circumference of the other one of the ceiling frame and the floor frame, such that the one of the ceiling frame and the floor frame having the relatively undersized outer circumference may be internally received by the other one of the ceiling frame and the floor frame of an overlaying further modular building unit that is stacked on top of the modular building unit.

**[0008]** The hereabove described configuration of the modular building unit according to the present disclosure results in a decreased height dimension in a stacked state of the modular building units. This is because the (height dimension of the) ceiling frame of the lower modular building unit essentially coincides with the (height dimension of the) floor frame of the upper modular building unit stacked thereupon. Moreover, an interior space defined by the coinciding ceiling frame and the floor frame has a sound-insulating and fire-resistant effect, in particular when combined further features according to preferred embodiments of the present disclosure.

**[0009]** According to a further preferred embodiment of the modular building unit, the floor frame and the ceiling frame each comprise accommodations, preferably in the form of through holes, configured to receive at least one installation conduit, wherein the accommodations are arranged to align with one another in the internally received state of the floor frame and the ceiling frame.

**[0010]** These embodiments advantageously allow easy installation of installation conduits (e.g. wiring, plumbing and the like) in the hereabove described interior space having the advantageous acoustic and fire retardant properties; said installation conduits extending in between respective interior spaces of adjacently arranged modular building units.

**[0011]** According to a further preferred embodiment of the modular building unit, a relative difference between circumferential sizes of the respectively the ceiling frame and the floor frame defines a circumferential offset between the ceiling frame and the floor frame.

**[0012]** According to a further preferred embodiment of the modular building unit, the modular building unit further comprises a floorplate configured to be detachedly arranged onto or into the floor frame.

**[0013]** The detachedly arranged floorplate results in an acoustic decoupling of the floor plate from the rest of the modular building unit, thereby further enhancing the sound-insulating properties of the modular building unit.

**[0014]** According to a further preferred embodiment of the modular building unit, the modular building unit further comprises one or more than one acoustic damping device arranged between floor frame and the floorplate received therein or thereupon.

**[0015]** According to a further preferred embodiment of the modular building unit, the one or more than one acoustic damping device is arranged along a circumferential support surface of at least one of the floor frame and the floorplate.

**[0016]** According to a further preferred embodiment of the modular building unit, the at least one of the floor frame and the floorplate comprises one or more than one cross beam.

**[0017]** According to a further preferred embodiment of the modular building unit, the one or more than one cross-beam comprises at least one accommodation configured to receive an installation conduit.

**[0018]** According to a further preferred embodiment of the modular building unit, the at least one accommodation is configured to receive at least one installation conduit from a group of installation conduits, said group of installation conduits comprising at least a water pipeline, a gas pipeline, an electricity cable and an air shaft.

**[0019]** The cross beam according to the hereabove embodiments on the one hand reinforces the floorplate and on the other hand provides a means to installation conduits in, preferably, a suspended fashion to mitigate the propagation of (acoustic) vibrations via these conduits.

**[0020]** The object of the present disclosure is moreover achieved with a system comprising at least a support unit and a modular building unit according to one or more than one of the hereabove described embodiments.

**[0021]** According to a further preferred embodiment of the system according to the present disclosure, the support unit is a ceiling frame as defined hereabove.

**[0022]** According to a further preferred embodiment of the system, the system further comprises one or more than one further modular building unit arranged on top of the base unit.

**[0023]** According to a further preferred embodiment of the system, the system further comprises at least one additional support unit arranged adjacent to the support unit, and at least one additional modular building unit arranged on top of the additional support unit and adjacent to the modular building unit defining the base unit.

**[0024]** According to a further preferred embodiment of the system, the system further comprises at least one connector laterally connecting at least one of the support unit with the additional support unit arranged adjacently thereto and the modular building unit with the additional modular building unit arranged adjacently thereto.

**[0025]** According to a further preferred embodiment of the system, the connector laterally connects the modular building unit and the additional modular building unit and defines a connection between respective ceiling frames comprised by the modular building unit and the additional modular building unit or respective floor frames comprised by the modular building unit and the additional modular building unit. Moreover, the connector advantageously provide a means for installing cross braces for enhancing the rigidity and stability of the overall structure constituted by a plurality of modular building units.

**[0026]** According to a further preferred embodiment of the system, the respective ceiling frames or the respective floor frames connected to one another by means of the connector are oversized relative to an outer circumference of the respective ceiling frames or the respective floor frame not connected to one another by means of the connector.

**[0027]** According to a further preferred embodiment of the system, the connector comprises a first connector member connected to one of the modular building unit and the support unit, a second connector member connected to one of the additional modular building unit and the additional support unit, and an intermediate connecting member connecting the first connector member and the second connector member.

**[0028]** According to a further preferred embodiment of the system, the connector further comprises an acoustic decoupler arranged between at least one of the first connector member and the intermediate connector member, and the second connector member and the intermediate connector member.

**[0029]** The object of the present disclosure is moreover achieved with a method of building a system, said method comprising at least the steps of placing a support unit, and arranging a modular building unit defining a base unit on top of the support unit, wherein an outer circumference of one of the support unit and a floor frame of the modular building unit is undersized relative to an inner circumference of the other one of the support unit and said floor frame, so that the one of the support unit and the floor frame having the relatively undersized outer circumference may be internally received by the other one of the support unit and the floor frame.

**[0030]** According to a preferred embodiment of the method according to the present disclosure, the step of placing a support unit comprises placing a ceiling frame as defined hereabove.

**[0031]** According to a preferred embodiment of the method, the method further comprises the step of arranging a further modular building unit on top of the base unit, wherein a floor frame of said further modular building is internally received by a ceiling frame of the of the base unit or vice versa.

**[0032]** According to a preferred embodiment of the method, the method further comprises detachedly arranging a floorplate onto or into a floor frame comprised by at least one modular building unit, thereby define an intermediate space between said floor frame and the support unit or the base unit.

**[0033]** According to a preferred embodiment of the method, the method further comprises the step of arranging at least one installation conduit from a group of installation conduits in the interior space defined by the floor frame and the support unit or the base unit, said group of said group of installation conduits comprising at least a water pipeline, a gas pipeline, an electricity cable and an air shaft.

**[0034]** The modular building unit, the system and the method according to the present disclosure will be elucidated here below with reference to the appended drawing, in which:

Fig. 1 shows a perspective view of a modular building unit according to the present disclosure;
Fig. 2 shows a floor frame comprised by the modular building unit depicted in Fig. 1;
Fig. 3 shows a ceiling frame comprised by the modular building unit depicted in Fig. 1;
Fig. 4 shows a top side of a floorplate comprised by the modular building unit depicted in Fig. 1;
Fig. 5 shows a bottom side of the floorplate depicted in Fig. 4 and comprised by the modular building unit depicted in Fig. 1;
Fig. 6 shows an alternative embodiment of the floor frame of Fig. 2;
Fig. 7 shows a plurality of support units comprised by a system according to the present disclosure;
Fig. 8 shows a system comprising the plurality of support units depicted in Fig. 7 and base units;
Fig. 9 shows the system of Fig. 8 comprising further modular building units;
Fig. 10 shows a lateral cross-sectional view of stacked and adjacently arranged modular building units comprised by the system of Fig. 7 to Fig. 8; and
Fig. 11 shows a top-down cross-sectional view of the adjacently arranged modular building units of Fig. 10.

**[0035]** Referring now to Fig. 1 to Fig. 3 there is depicted a modular building unit 1, which may be considered a prefabricated building component and intended as e.g. a room or a storey of a building. The modular building unit 1 may be combined with other substantially identical modular building units 1 to thereby form a building or system 20.

**[0036]** The modular building unit 1 comprises at least a floor frame 3, a ceiling frame 5 and a plurality of uprights 7. The floor frame 3 defines a floor part of the modular building unit 1 and the ceiling frame 5 defines a ceiling part of the modular building unit 1. The uprights 7 define a vertical offset D between the floor frame 3 and the ceiling frame 5, and thus define an overall height of the modular building unit 1. While the present disclosure is not limited to the modular building unit 1 having any exactly defined dimensions, the vertical offset D defined by the plurality of uprights 7 may be e.g. three meters.

**[0037]** Additional building components such walls, doors and windows, and various utilities including plumbing and electrical wiring may be added to the modular building unit 1, in particular when the modular building unit 1 is arranged adjacently to substantially identical modular building units 1 to thereby define a building. Fig. 7 to Fig. 9 depict an example of such a building, or system 20, at various stages of construction.

**[0038]** The ceiling frame 5 depicted in Fig. 3 preferably comprises a ceiling plate 8 defining a ceiling of the modular building unit 1. The ceiling plate 8 may be fixedly connected to the ceiling frame 5, although it is conceivable that the ceiling frame 5 and the ceiling plate 8 are distinct units and configured to be connected with one another during an assembly process of the modular building unit. One or more reinforcing crossbeams 6 may be comprised by the ceiling plate 8 to enhance its rigidity. The ceiling frame 5 moreover comprises recesses 4 located at the corners of the ceiling frame 5 to accommodate the uprights 7.

**[0039]** The floor frame 3 depicted in Fig. 2 preferably comprises a substantially rectangular or square shape corresponding to the shape of the ceiling frame 5. Upright accommodations 12 are arranged at the corners of the floor frame 3 to accommodate the uprights 7, with which the floor frame 3 is preferably fixedly connected. The floor frame 3 moreover comprises a circumferential support surface 13 configured to support a floorplate 9.

**[0040]** Fig. 2 moreover shows the floor frame 3 comprising accommodations 17 in the form of through holes for facilitating the installation of installation conduits (not shown) in a preferably suspended fashion. The accommodations 17 are configured to align with corresponding accommodations 17 comprised by at the ceiling frame 5 of Fig. 3 in an internally received state of the floor frame 3 and the ceiling frame 5. This internally received state of the floor frame 3 and the ceiling frame 5 will be elucidated further here below. The accommodations 17 of the floor frame 3 and the ceiling frame 5 are configured to receive and accommodate an installation conduit, such as a plumbing (water) pipe, an electricity cable, a ventilation (air) shaft, or any other type of installation conduit commonly found in buildings. In the depicted embodiment, the accommodations 17 are embodied by through holes disposed extending through the crossbeams 15. Nevertheless, it is conceivable that the accommodations 17 are additionally comprise clamps (not shown), or the like. The accommodations 17 preferably accommodate the installation conduit in a suspended fashion, which advantageously reduces the propagation of acoustic or mechanical vibrations. It is moreover noted that the number and specific locations of correspondingly arranged accommodations 17 are not limited to the exemplary embodiments of the figures, but may selected by the skilled person based on various considerations, such as the number of installation conduits that must be installed, or aesthetic considerations.

**[0041]** The floorplate 9 is depicted in Fig. 4 and Fig. 5 and may comprise, for example, a concrete material. The floorplate 9 preferably comprises recesses 10 arranged at the corners of the floorplate 9 to provide space for the plurality of uprights 7 when the floorplate 9 is detachably arranged on the support surface 13 of the floor frame 3. As is best elucidated in Fig. 5, according to certain embodiments the floorplate 9 optionally comprises a plurality of reinforcing crossbeams 15, which may protrude from a bottom side of the floorplate 9.As is best depicted in Fig. 5, the crossbeams 15 may comprise further accommodations 17. The further accommodations 17 may be arranged to align with the accommodations of the floor frame 3 and the ceiling frame 5, simplifying the installation of in particular rigid installation conduits (e.g. plumbing

pipes).

**[0042]** Fig. 6 shows an alternative embodiment of the floor frame 3 that additionally comprises at least one crossbeam 15'. Like the crossbeams 15 comprised by the floor plate 9 of in the embodiment of Fig. 5, this crossbeam 15' enhances the overall rigidity of the modular building unit 1 and may thus serve as a substitute therefore. The crossbeam 15' likewise comprises accommodations 17 facilitating installation of installation conduits as described hereabove, which likewise preferably align with the accommodations 17 arranged in the floor frame 3 and the ceiling frame 5. One particular advantage of this embodiment is that all installation conduits can be installed prior to installation of the floor plate 9, which has been found to result in a more efficient construction process when building a system 20 of modular building units 1 .Referring now to Fig. 2, the floor frame 3 preferably comprises one or more than one acoustic damping device 11. The acoustic damping device 11 is disposed on the support surface 13 of the floor frame 3, so that it is arranged between floor frame 3 and the floorplate 9 when the floorplate 9 is on or in the floor frame 3 and rests on the support surface 13. In Fig. 2 the acoustic damping device 11 is embodied by a strip of, for example, a rubber-like material that extends along the respective lengths of the four sides of the support surface 13 of the floor frame 3. Alternatively, there may be provided a plurality of acoustic damping device 11 at intermediate distances along the support surface 13 of the floor frame 3. The acoustic damping device 11 absorbs acoustic and mechanical vibrations, thereby further enhancing the advantageous acoustic properties of the modular building unit 1.

**[0043]** As stated hereabove, the modular building unit 1 may be stacked with substantially identical modular building units 1 by arranging the respective floor frame 3 of an overlaying modular building unit 1 on top of the ceiling frame 5 of an underlaying modular building unit 1. In accordance with a main aspect of the present disclosure, an outer circumference of one of the ceiling frame 5 and the floor frame 3 is undersized relative to an inner circumference of the other one of the ceiling frame 5 and the floor frame 3. As such, the one of the ceiling frame 5 and the floor frame 3 having the relatively undersized outer circumference may be internally received by the other one of the ceiling frame 5 and the floor frame 3 of said overlaying further modular building unit 1, which is stacked on top of the modular building unit 1, during assembly of a system 20 that defines the constructed building. This system 20 will be elucidated here below with reference to Fig. 7 to Fig. 8 and in particular Fig. 10.

**[0044]** In other words, at least one of the floor frame 3 and the ceiling frame 5 is dimensioned to fit and slide into the other one of the floor frame 3 and the ceiling frame 5. As such, a height dimension of two subsequently stacked modular building units 1 is reduced because the (height of the) ceiling frame 5 of the lower modular building unit 1 and the (height of the) floor frame 3 of the upper modular building unit 1 at least partially coincide, as can be discerned from e.g. Fig. 8. Moreover, as is best depicted in Fig. 10 an interior space 14 is defined by the coinciding floor frame 3 and ceiling frame 5, which is moreover delimited by the ceiling plate 8 and the detachable floorplate 9.The interior space 14 advantageously results a sound-insulating effect that significantly limits the propagation of sound between the different storeys of the building (i.e. system 20) defined by stacked modular building units 1. This sound insulating effect may moreover be enhanced by the floorplates 9 being acoustically decoupled from their respective floor frames 3 by being detachably arranged thereon and resting on the acoustic damping devices 11, as is described hereabove. It is noted that in Fig. 10, the respective inner circumferences of the depicted ceiling frames 5 are oversized relative to the outer circumferences of the respective floor frames 3, which are stacked onto and received into said ceiling frames 5. The skilled person will nevertheless acknowledge that alternatively the floor frames 3 and ceiling frames 5 could be dimensioned such that the ceiling frames 5 are received internally by the floor frames 3; it being acknowledged that further (minor) adjustments must be made to realise such a construction.

**[0045]** Still referring to Fig. 10, the interior space 14 defined by the respective floor frame 3 and ceiling frame 5 of two stacked modular building units 1 may optionally be filled with a sound-insulating material (not shown) to yet further enhance the aforementioned sound-insulating effect, or be filled with a fire retardant material (not shown) to improve fire safety of the resulting composite building. These two types of material may also be combined with one another.

**[0046]** The relative difference between circumferential sizes of the ceiling frame 5 and the floor frame 3 defines a circumferential offset O between the ceiling frame 5 and the floor frame 3.

**[0047]** Fig. 7, Fig. 8 and Fig. 9 consecutively illustrate a system 20 defining a modular building according to the present disclosure, while said system 20 is being assembled in accordance with a method according to the present disclosure.

**[0048]** Fig. 7 shows an early stage of the assembly process in which a number of support units 19 are arranged adjacent to one another. In a system 20 of modular building units 1 according to the present disclosure, the support units 19 form the lowest units and make direct contact with a ground level. The support units 19 can be arranged parallel and/or perpendicular to one another, to thereby collectively define a footprint of the system 20 constituting the modular building.

**[0049]** Each of the support units 19 may be substantially identical to the hereabove described ceiling frames 5. Consequently, the ceiling frames 5 and the support units 19 may be manufactured using the same manufacturing process and are substantially interchangeable, which reduces costs and allows for a greater degree of flexibility during an assembly process of the system 20.

One notable difference between the support units 19 and the hereabove described ceiling frames 5 is that the support units 19 do not comprise the uprights 7 as described hereabove, but rather uprights 7' with a reduced length contacting the ground.

**[0050]** Fig. 8 shows a plurality of base units 21 arranged on each respective one of the support units 19 of Fig. 7. The base units 21 collectively define a ground storey of the system 20 constituting the modular building. In Fig. 8, it is assumed that the outer circumferences of each of the floor frames 3 comprised each by the base units 21 (i.e. modular building units 1) are undersized relative to the respective inner circumferences of each of the support units 19. As such, the respective floor frames 3 are each received within the inner circumferences of the base units 21, and thus define interior spaces 14 as described hereabove and depicted in Fig. 10.

**[0051]** Fig. 9 shows the system 20 of Fig. 8 now having further modular building units 1 arranged adjacent to one another and on top of the aforementioned base units 21. The number of layers of adjacently arranged modular building units 1 may be increased until an intended height, corresponding to a predetermined number of storeys, of the system 20 constituting the modular building is achieved. Each time a layer of modular building units 1 is added to the system 20, an interior space 14 as described hereabove is defined between each pair of stacked modular building units 1.

**[0052]** It is emphasised here that while Fig. 8 and Fig. 9 shows an embodiment of the system 20 in which all modular building units 1 have identical length, width and height dimensions, the present disclosure is not limited thereto. It is entirely conceivable that modular building units 1 having different dimensions are combined with one another to thereby realise a desired overall design of the system 20. Evidently, in these embodiments at least some of the base units 21 depicted in Fig. 7 must be correspondingly dimensioned to facilitate modular building units 1 having such different dimensions to be stacked thereon.

**[0053]** The support units 19, the base units 21 and the further modular building units 1 depicted in Fig. 7 to Fig. 9 are preferably laterally connected to one another by means of at least one connector 23. Fig. 10 shows an exemplary embodiment of a connector 23 laterally connecting two components of the above described system 20.

**[0054]** Fig. 10 shows two adjacently arranged ceiling frames 5 each comprising a ceiling plate 8. The ceiling frames 5 may be comprised by modular building units 1 as described hereabove, which may be base units 21 or support units 19 as described with reference to Fig. 7. The two ceiling frames 5 may be arranged to abut one another with their respective floor plates 8, after which the two ceiling frames 5 are connected to one another by means of the connector 23. In the depicted embodiment the connector 23 is constituted by a plurality of nut and bolt connectors 26. Subsequently, two further modular building units 1 are stacked on top of each of the two ceiling frames 5, with their respective floor plates 3 - having outer circumferences that are undersized relative to the inner circumferences of the ceiling frames 5 on which they are stacked - being received into the two ceiling frames 5 to define two interior spaces 14. Lastly, floor plates 9 may be arranged on the respective floor frames 3 of the further modular building units 1; with preferably an acoustic damping device 11 being arranged therebetween.

**[0055]** The relative difference between the inner circumference of the ceiling frames 5 and the outer circumference of the floor frames 3 define a circumferential offset O that extends along substantially the entire outer circumference of the floor frames 3. It is noted that in an alternative (non-depicted) embodiment, respective inner circumference of the floor frame 3 may be oversized relative to respective outer circumference of the ceiling frames 5, such that the ceiling frames 5 are received into the floor frames 3 to thereby define the interior spaces 14. In such embodiments, the connector 23 may connect the adjacently arranged floor frames 3.

**[0056]** The non-numbered vertical components depicted in the center of Fig. 10, and respectively interposed in between the two floorplates 9 and ceiling plates 8, are parts of reinforcing diagonal braces arranged being adjacently arranged modular building units 1. Such reinforcing diagonal braces may be optionally installed in between two adjacently arranged modular building units 1 that each define distinct rooms of the overall system 20, thereby enhancing its overall rigidity.

**[0057]** Fig. 11 shows a top-down cross-sectional of a connector 23 substantially similar to the embodiment of the connector depicted in Fig. 10. The connector 23 a first connector member 24A, which in the exemplary embodiment of Fig. 11 is connected to a ceiling frame 5 constituted by a support unit 19 or comprised by a modular building unit 1. The connector 23 moreover comprises a second connector member 24B connected to a ceiling frame 5 arranged adjacent to the aforementioned ceiling frame 5. The first connector member 24A and the second connector member 24B may be connected to their respective ceiling frames 5 by means of nut and by nut and bolt connectors 26. An intermediate connecting member 24C connects the first connector member 24A and the second connector member 24B, to thereby establish the lateral connection between the two adjacently arranged ceiling frames 5.

**[0058]** It is noted that the (parts of the) reinforcing diagonal brace(s) depicted in Fig. 10 are not depicted in Fig. 11. Nevertheless, such a reinforcing diagonal brace may be included in the connector 23 according to Fig. 11 and connected around the central nut and bolt connector 26, and interposed between first and second connector members 24A, 24B. In these embodiments, the first and second connector members 24A, 24B may moreover comprise a beveled surface in the direct vicinity of the central nut and bolt connectors 26 to facilitate arrange-

ment of connecting part of the reinforcing diagonal brace.

**[0059]** The connector 23 moreover preferably comprises acoustic decouplers 25, which may comprise an acoustic damping material such as rubber or the like. The acoustic decouplers 25 are preferably arranged between the respective ceiling frames 5, 5' and the first and second connector members 24A, 24B as depicted in Fig. 11, although it is conceivable that a further acoustic decoupler 25 (not shown) is arranged between the first connector member 24A and the second connector member 25B. The acoustic decouplers 25 absorb and attenuate mechanical and/or acoustic vibrations that would otherwise propagate between adjacently arranged modular building units 1, and thereby further enhance the sound insulating properties of the modular building unit 1 and system 20 according to the present disclosure.

**[0060]** Further ring shaped decouplers 28 are arranged underneath rings of the nut and bolt connectors 26, which in the depicted embodiment of Fig. 11 each comprise a thickness corresponding to the rings of said nut and bolt connectors. In Fig. 5 the central nut and bolt connector 26 does not comprise such a ring, which is not required for the central nut and bolt connector 26 because of the acoustic decouplers 25.

**[0061]** Hereabove a modular building unit 1 and a system 20 comprising one or more of such modular building units 1 is disclosed. The present disclosure moreover relates to a method of building this system 20, comprising at least the steps of placing a support unit 19 (which is preferably a ceiling frame 5 as described hereabove) and arranging a modular building unit 1 defining a base unit 21 on top of said support unit 19. The method may moreover comprise the step of arranging a further modular building unit 1 on top of the base unit 21, wherein a floor frame 3 of said further modular building unit 1 is internally received by a ceiling frame 5 of the base unit 21 or vice versa.

**[0062]** The method may moreover comprise the step of detachedly arranging the hereabove described floorplate 9 onto or into the floor frame 3 of the at least one modular building unit 1, and/or arranging at least one installation conduit from a group of installation conduits in the aforementioned interior space 14 underneath said floor frame 9, said group of said group of installation conduits comprising at least a water pipeline, a gas pipeline, an electricity cable and an air shaft.

**[0063]** Following the above embodiment description of aspects of the present disclosure, it's noted that details are exhibited, which are not all to be limiting on the scope of the present disclosure. The present disclosure provides a modular building unit and system of which the various features as disclosed hereabove result in a fast yet versatile construction process combined with improved acoustic and fire-retardant properties of the resultant building. The scope of the present disclosure is by no means limited to any preferred aspect or any one of said features, but only by the limiting definitions of the appended independent claims, and may include in or for particular jurisdictions also obvious alternatives for features defined even in independent claims.

## Claims

1. A modular building unit, comprising:

   - a floor frame;
   - a ceiling frame; and
   - a plurality of uprights defining a vertical offset between the floor frame and the ceiling frame,

   wherein an outer circumference of one of the ceiling frame and the floor frame is undersized relative to an inner circumference of the other one of the ceiling frame and the floor frame, such that the one of the ceiling frame and the floor frame having the relatively undersized outer circumference may be internally received by the other one of the ceiling frame and the floor frame of an overlaying further modular building unit that is stacked on top of the modular building unit, wherein optionally

   the floor frame and the ceiling frame each comprise accommodations configured to receive at least one installation conduit, wherein the accommodations are arranged to align with one another in the internally received state of the floor frame and the ceiling frame.

2. Modular building unit according to claim 1, wherein a relative difference between circumferential sizes of the respectively the ceiling frame and the floor frame defines a circumferential offset between the ceiling frame and the floor frame.

3. Modular building unit according to any one of the foregoing claims, further comprising a floorplate configured to be detachedly arranged onto or into the floor frame, wherein optionally

   the modular building unit further comprises one or more than one acoustic damping device arranged between floor frame and the floorplate received therein or thereupon, wherein optionally

   the one or more than one acoustic damping device is arranged along a circumferential support surface of at least one of the floor frame and the floorplate.

4. Modular building unit according to claim 3, wherein at least one of the floor frame and the floorplate comprises one or more than one cross beam, wherein optionally

   the one or more than one crossbeam comprises at least one further accommodation configured

to receive an installation conduit, wherein optionally
the at least one further accommodation is configured to receive at least one installation conduit from a group of installation conduits, said group of installation conduits comprising at least a water pipeline, a gas pipeline, an electricity cable and an air shaft.

**5.** System comprising at least:

- a support unit;
- a modular building unit according to one or more than one of the foregoing claims arranged on the support unit and defining a base unit, wherein optionally:
the support unit is a ceiling frame as defined in claim 1 and/or the system further comprises one or more than one further modular building unit arranged on top of the base unit.

**6.** System according to claim 5, further comprising:

- at least one additional support unit arranged adjacent to the support unit; and
- at least one additional modular building unit arranged on top of the additional support unit and adjacent to the modular building unit defining the base unit.

**7.** System according to claim 6, further comprising at least one connector laterally connecting at least one of:

- the support unit with the additional support unit arranged adjacently thereto; and
- the modular building unit with the additional modular building unit arranged adjacently thereto.

**8.** System according to claim 7, wherein the connector laterally connects the modular building unit and the additional modular building unit and defines a connection between:

- respective ceiling frames comprised by the modular building unit and the additional modular building unit; or
- respective floor frames comprised by the modular building unit and the additional modular building unit.

**9.** System according to claim 8, wherein the respective ceiling frames or the respective floor frames connected to one another by means of the connector are oversized relative to an outer circumference of the respective ceiling frames or the respective floor frame not connected to one another by means of the connector.

**10.** System according to any one of the foregoing claims 7-9, wherein the connector comprises:

- a first connector member connected to one of the modular building unit and the support unit;
- a second connector member connected to one of the additional modular building unit and the additional support unit; and
- an intermediate connecting member connecting the first connector member and the second connector member, wherein optionally

the connector further comprises an acoustic decoupler arranged between at least one of:

- the first connector member and the intermediate connector member; and
- the second connector member and the intermediate connector member.

**11.** Method of building a system, comprising the steps of:

- placing a support unit; and
- arranging a modular building unit defining a base unit on top of the support unit,

wherein an outer circumference of one of the support unit and a floor frame of the modular building unit is undersized relative to an inner circumference of the other one of the support unit and said floor frame, so that the one of the support unit and the floor frame having the relatively undersized outer circumference may be internally received by the other one of the support unit and the floor frame.

**12.** Method of building a system according to claim 11, wherein the step of placing a support unit comprises placing a ceiling frame as defined in claim 1.

**13.** Method of building a system according to claim 11 or 12, further comprising the step of arranging a further modular building unit on top of the base unit, wherein a floor frame of said further modular building is internally received by a ceiling frame of the of the base unit or vice versa.

**14.** Method of building a system according to any one of the foregoing claims 11 - 13, the method further comprising:

- detachedly arranging a floorplate onto or into a floor frame comprised by at least one modular building unit, thereby delimiting an intermediate space between said floor frame and the support unit or the base unit.

**15.** Method of building a system according to claim 14, further comprising the step of arranging at least one installation conduit from a group of installation conduits in the interior space defined by the floor frame and the support unit or the base unit, said group of said group of installation conduits comprising at least a water pipeline, a gas pipeline, an electricity cable and an air shaft.

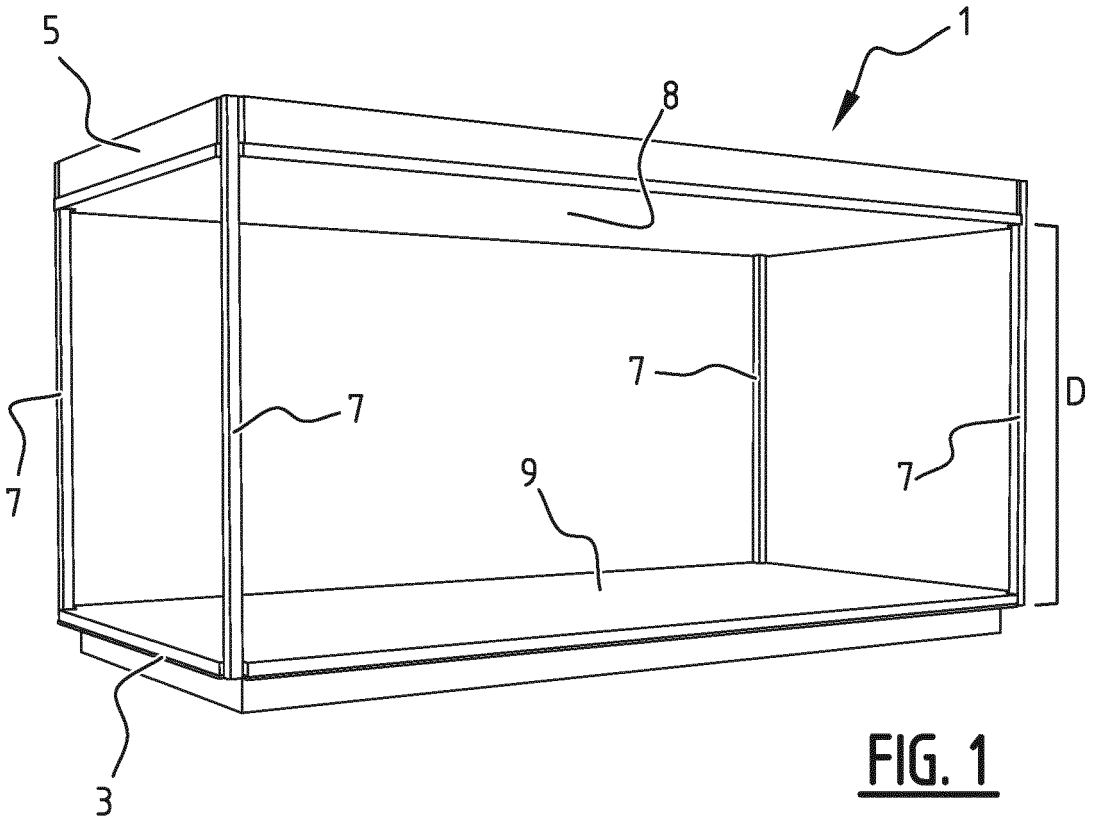


FIG. 1

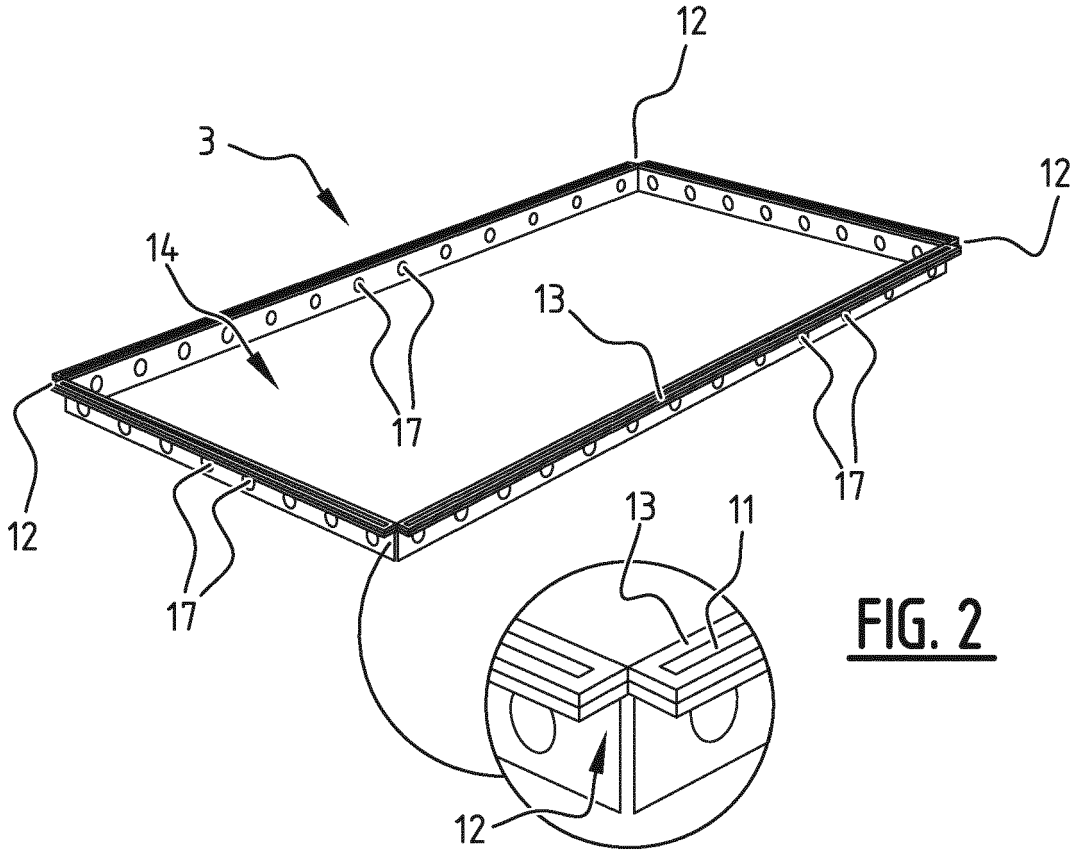


FIG. 2

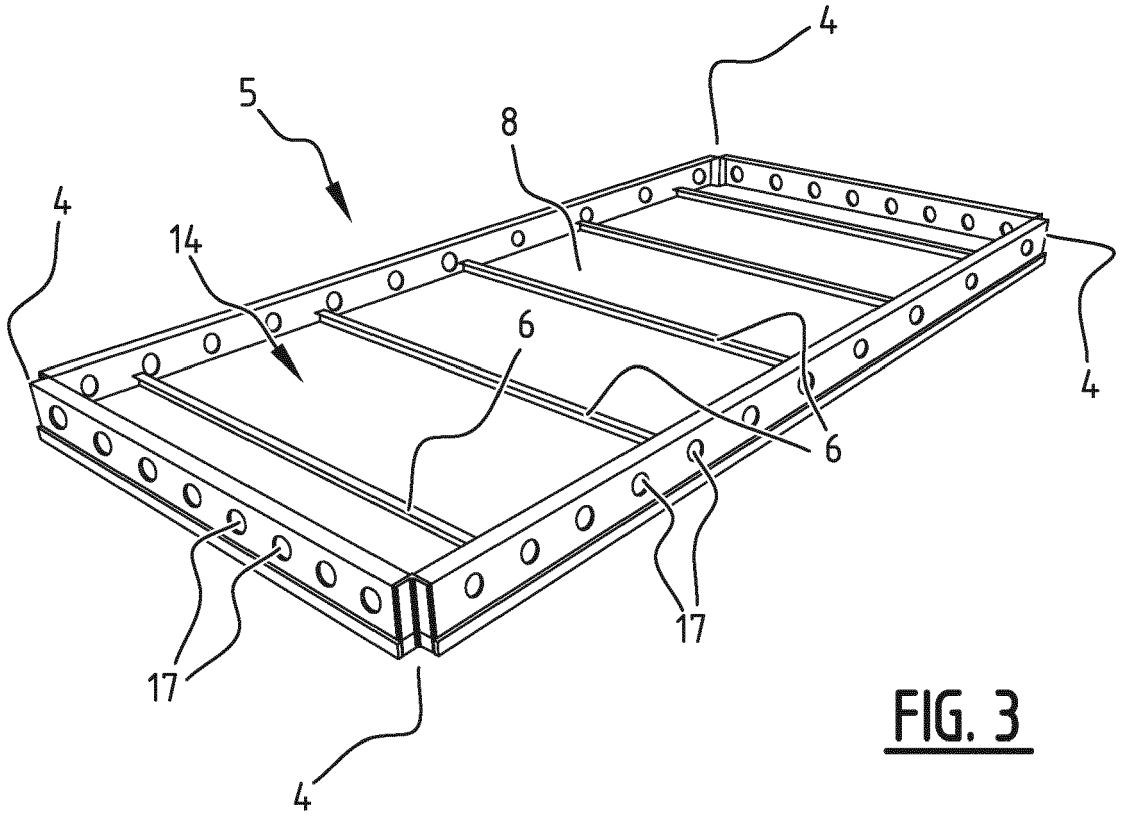


FIG. 3

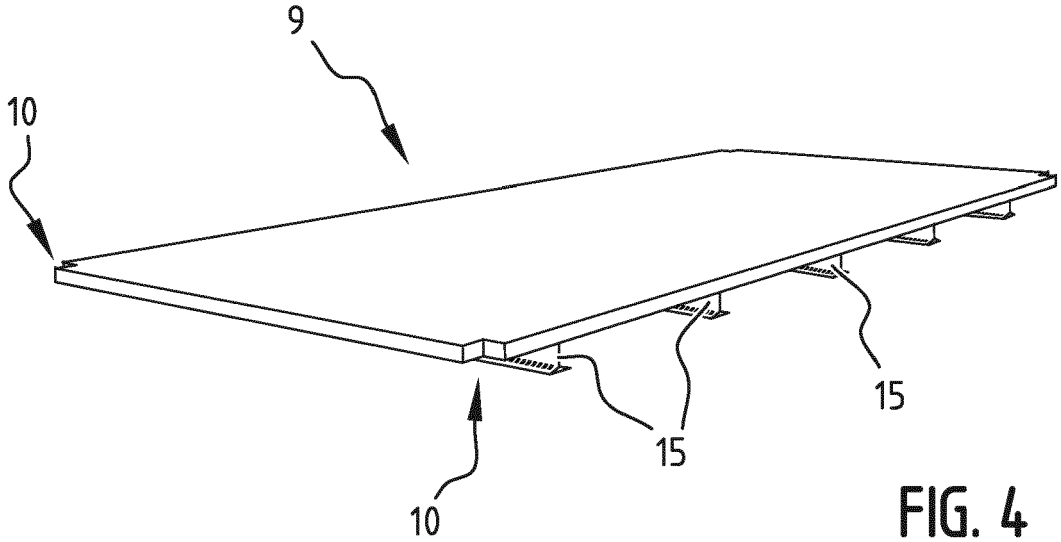


FIG. 4

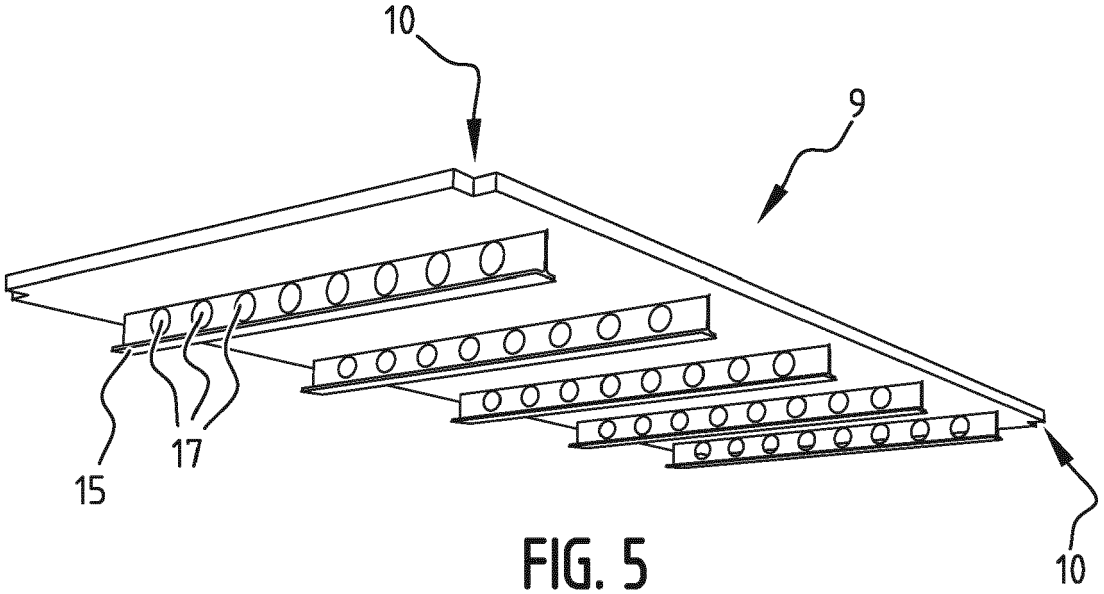


FIG. 5

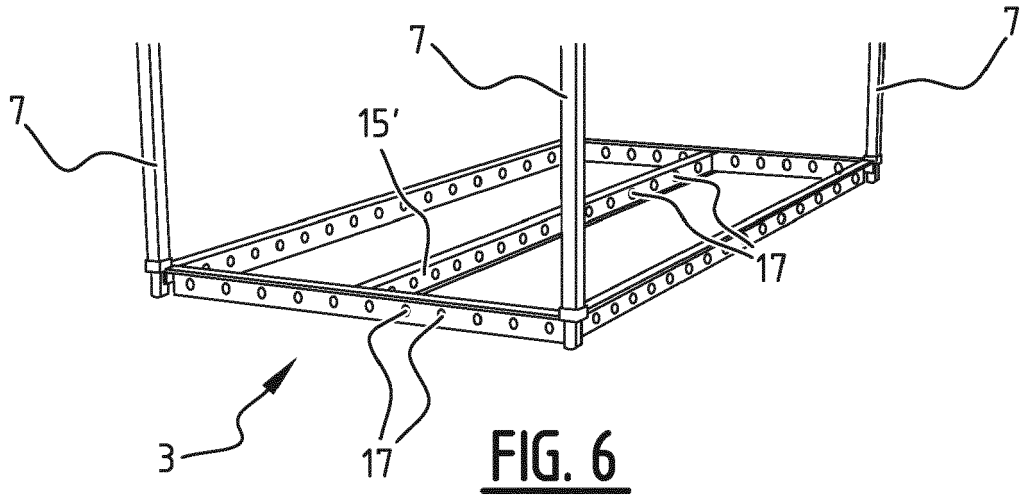


FIG. 6

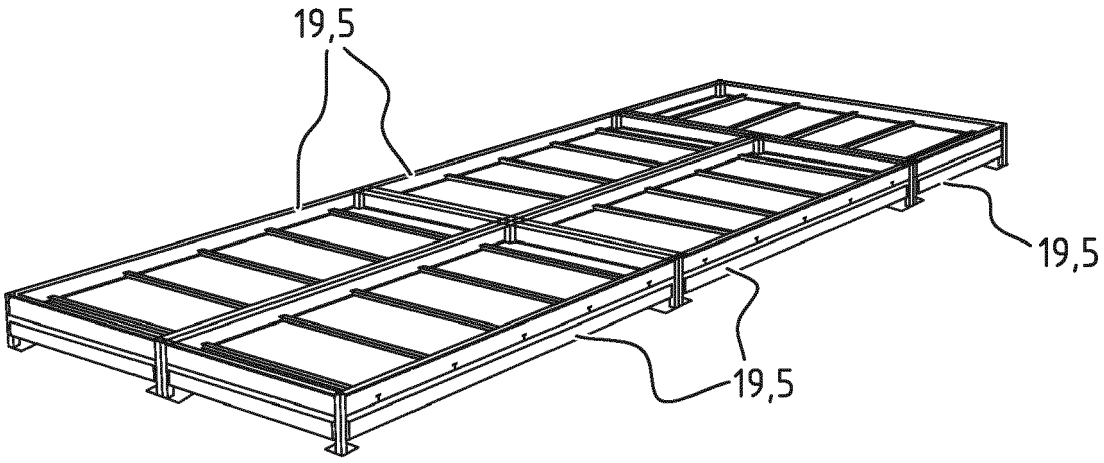


FIG. 7

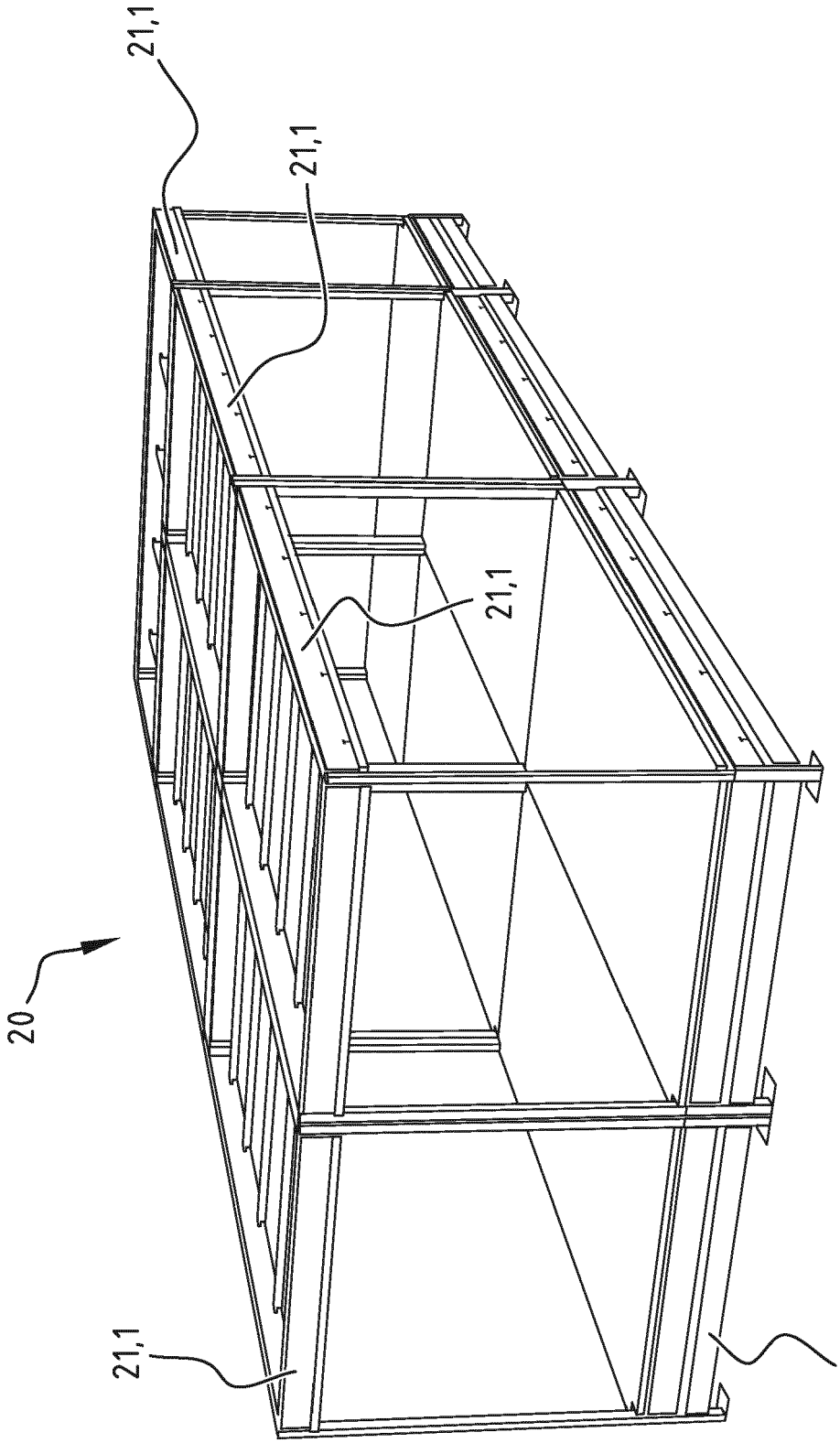


FIG. 8

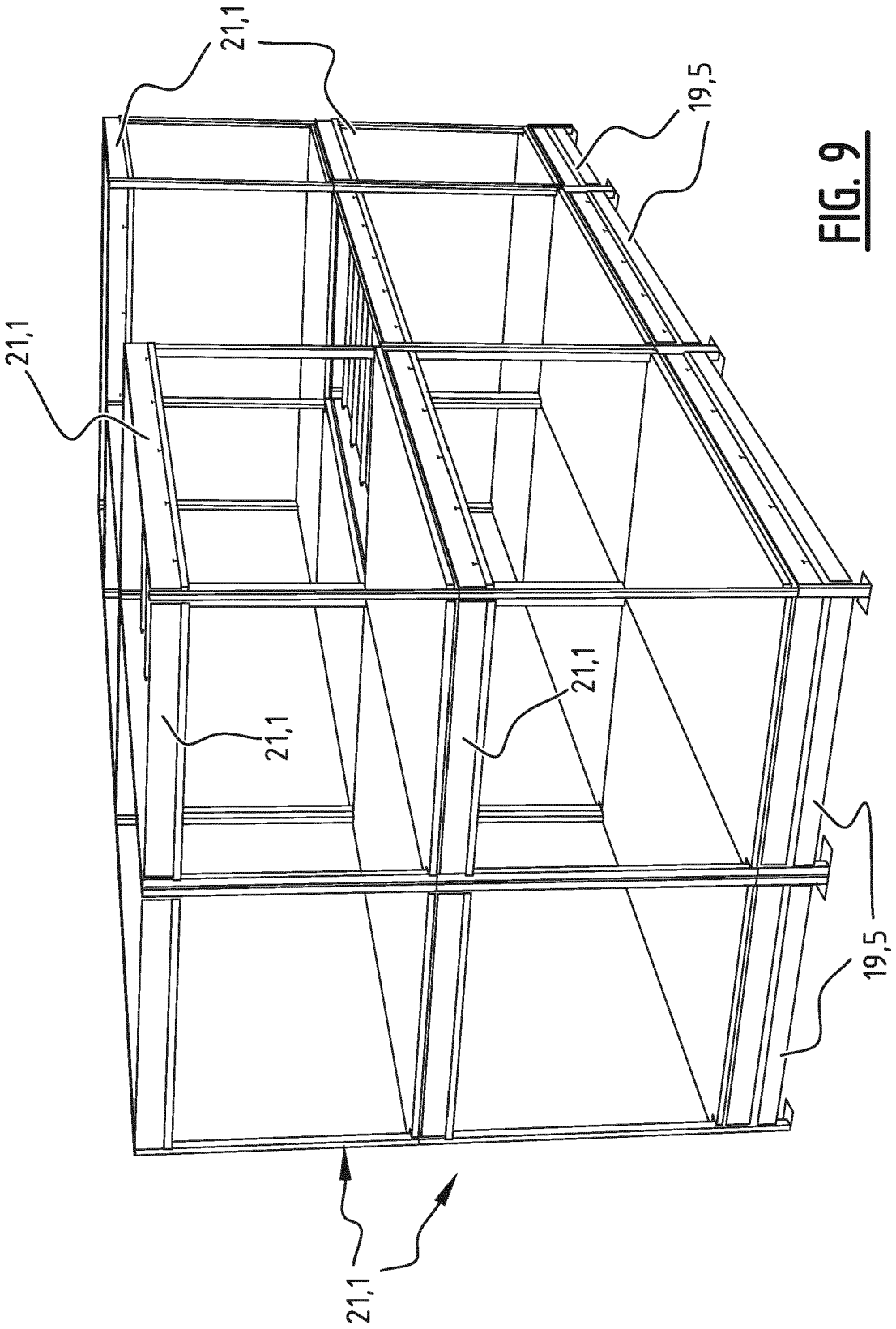


FIG. 9

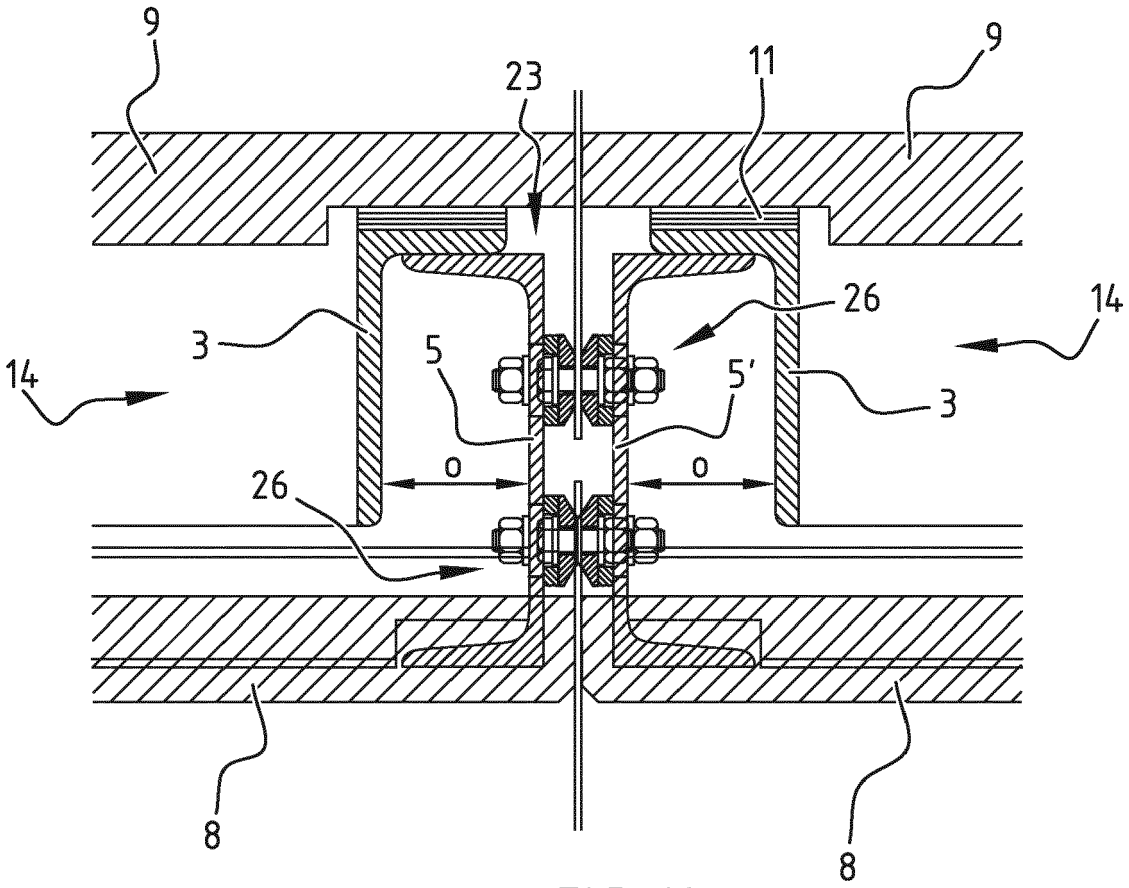


FIG. 10

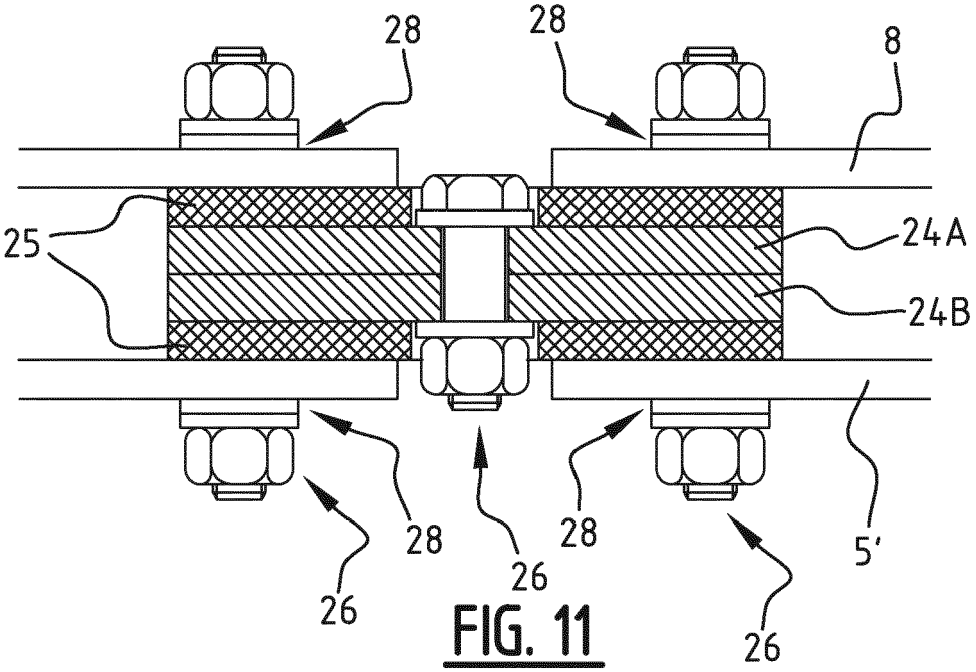


FIG. 11

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# EUROPEAN SEARCH REPORT

Application Number
EP 23 19 8838

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The present search report has been drawn up for all claims

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|---|---|---|
| The Hague | 11 October 2023 | Melhem, Charbel |

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