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(54) MODULAR WALL SYSTEM, MOUNTING FRAME AND WALL MODULE

(57) The disclosure pertains to a modular wall system that includes a set of wall modules and a set of mounting frames for mounting the wall modules, wherein each of the mounting frames has a unit size and unit shape, wherein each mounting frame of the set of mounting frames includes a mounting interface adapted to releasably mount a wall module, and wherein each wall module of the set of wall modules has a size and shape adapted to the unit size and unit shape of the set of mounting frames and includes a mounting structure for releasably connecting with the mounting interface of a mounting frame.

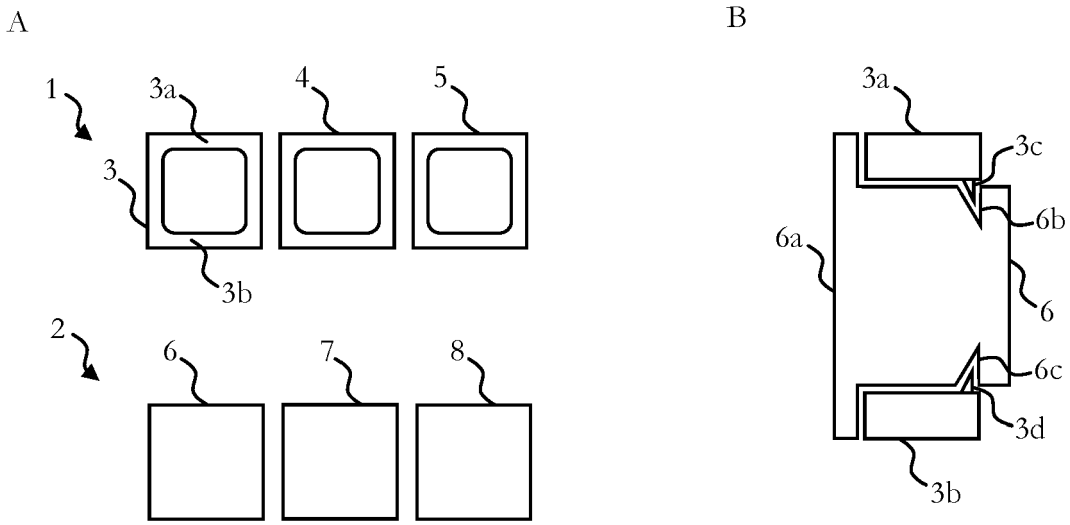

Fig. 1

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Description

TECHNICAL FIELD

[0001] The present disclosure generally pertains to a modular wall system, a mounting frame and a wall module.

TECHNICAL BACKGROUND

[0002] It is generally known to design a room, apartment or building. The designing may include providing a plastering and a paint on a wall or a ceiling, providing a floor covering, providing a door and a window and providing a fixture such as a luminaire or a screen. In some instances, designing a room apartment or building includes attaching an object or material to a wall, floor or ceiling.

[0003] An emerging field of designing a room or a building is home automation. For home automation, electronic devices are provided in the room, apartment or building, e.g. as fixtures, that can be automatically controlled. In some instances, electronic devices for home automation are connected to an electric power supply and/or conform to technical specifications, e.g., to communication protocols.

[0004] An example of a screen that may be provided in a room, apartment or building is The Wall manufactured by Samsung, which includes multiple screen modules that can be combined to a large screen.

[0005] Although there exist techniques for designing a room, apartment or building, it is generally desirable to provide a modular wall system.

SUMMARY

[0006] According to a first aspect the disclosure provides a modular wall system comprising a set of wall modules and a set of mounting frames for mounting the wall modules, wherein each of the mounting frames has a unit size and unit shape, wherein each mounting frame of the set of mounting frames includes a mounting interface adapted to releasably mount a wall module, and wherein each wall module of the set of wall modules has a size and shape adapted to the unit size and unit shape of the set of mounting frames and includes a mounting structure for releasably connecting with the mounting interface of a mounting frame.

[0007] According to a second aspect, the disclosure provides a mounting frame for the set of mounting frames of the modular wall system, wherein the mounting frame has a unit size and unit shape and includes a mounting interface adapted to releasably mount a wall module of the set of wall modules of the modular wall system.

[0008] According to a third aspect, the disclosure provides a wall module for the set of wall modules of the modular wall system, wherein the wall module has a size and shape adapted to the unit size and unit shape of the set of mounting frames of the modular wall system and includes a mounting structure for releasably connecting with a mounting interface of a mounting frame.

[0009] Further aspects are set forth in the dependent claims, the drawings and the following description.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] Embodiments are explained by way of example with respect to the accompanying drawings, in which:

Fig. 1 illustrates a modular wall system according to an embodiment;

Fig. 2 illustrates embodiments of a mounting interface configured to release a mounted wall module of a set of wall modules;

Fig. 3 illustrates frameworks on which a group of mounting frames of a set of mounting frames is arranged according to an embodiment;

Fig. 4 illustrates different sizes of wall modules of a set of wall modules according to an embodiment;

Fig. 5 illustrates an identification interface according to an embodiment;

Fig. 6 illustrates a power supply interface according to an embodiment;

Fig. 7 illustrates a network access interface according to an embodiment;

Fig. 8 illustrates a temperature-controlled water interface according to an embodiment;

Fig. 9 illustrates a water supply interface according to an embodiment;

Fig. 10 illustrates a wall module of a set of wall modules that is adapted to waterproofly seal a mounting frame of a set of mounting frames in which the wall module is mounted and an interspace between the wall module and a wall module mounted in an adjacent mounting frame according to an embodiment;

Fig. 11 illustrates a side view of a wall module of a set of wall modules adapted to reduce a thermal transfer through the wall module and to reduce a sound transmitted through the wall module according to an embodiment;

Fig. 12 illustrates a wall module of a set of wall modules with a closable opening and a size that corresponds to a unit size of a set of mounting frames according to an embodiment;

Fig. 13 illustrates a wall module of a set of wall modules with a closable opening and a size that corresponds to an integer multiple of a unit size of a set of mounting frames according to an embodiment;

Fig. 14 illustrates embodiments of wall modules of a set of wall modules with an anchorage for attaching an object;

Fig. 15 illustrates a wall module of a set of wall modules configured to receive electrical power from a power supply interface of a mounting frame of a set of mounting frames and provide the electrical power to a device coupled to the wall module according to an embodiment;

Fig. 16 illustrates a wall module of a set of wall modules that is configured to provide, to a device coupled to the wall module, access to a communication network according to an embodiment;

Fig. 17 illustrates a wall module of a set of wall modules that is configured to emit light according to an embodiment;

Fig. 18 illustrates a wall module of a set of wall modules that is configured to display an image according to an embodiment;

Fig. 19 illustrates a wall module of a set of wall modules configured to provide water from a water supply interface of a mounting frame of a set of mounting frames in which the wall module is mounted according to an embodiment;

Fig. 20 illustrates a wall module of a set of wall modules that is configured to measure a smoke concentration in surrounding air and detect an alarm event if the measured smoke concentration exceeds a predefined smoke threshold according to an embodiment;

Fig. 21 illustrates a wall module of a set of wall modules that includes a heatable surface and a water pipe for heating the heatable surface according to an embodiment;

Fig. 22 illustrates a wall module of a set of wall modules that includes a heatable surface and a heating wire for heating the heatable surface according to an embodiment;

Fig. 23 illustrates a wall module of a set of wall modules that includes a photovoltaic surface according to an embodiment; and

Fig. 24 illustrates a wall module of a set of wall modules that includes a planting portion with a substrate for growing a plant according to an embodiment.

DETAILED DESCRIPTION OF EMBODIMENTS

[0011] Before a detailed description of the embodiments is given under reference of Fig. 1, general explanations are made.

[0012] It is generally known to design a room, apartment or building, for example in a house, in a business room, in a hotel room, in a salesroom, in an office or the like. The designing may include providing a plastering and a paint on a wall or a ceiling, providing a floor covering, providing a door and a window and providing a fixture such as a luminaire or a screen.

[0013] In some instances, designing a room, apartment or building includes attaching an object or material to a wall, floor or ceiling. Therefore, designing a room may be laborious and time-consuming, and may require special tools and skills. Thus, in some instances, designing a room, apartment or building requires a craftsman. In some instances, attaching an object to a wall, floor or ceiling requires drilling a hole into the wall, floor or ceiling and may involve a risk of damaging a cable or tubing in the wall, floor or ceiling. Moreover, removing or exchanging an object or material attached to a wall, floor or ceiling may require closing drilled holes.

[0014] An emerging field of designing a room or a building is home automation. In some instances, elements of home automation include electronic devices and are provided in the room or building, e.g. as fixtures, that can be automatically controlled. In some instances, elements of home automation are connected to an electric power supply and/or conform to technical specifications, e.g., to communication protocols such as Ethernet, Wi-Fi, IEEE 802.11, Bluetooth, ZigBee, KNX, Homematic or Z-Wave.

[0015] Connecting a fixture that includes an electronic device to an electric power supply may require an electric power supply (e.g. a supply line) at the position where the fixture is attached. Thus, positions where electronic devices can be attached to a wall, floor or ceiling may be limited to positions where an electric power supply is available. Likewise, if a fixture requires access to a communication network or water supply, positions where such a fixture can be attached are limited to positions where an access to a communication network or to a water supply, respectively, is available.

[0016] As an electronic device may conform with a technical specification, e.g. a communication protocol, it may not be compatible with another electronic device that may be installed at a later time in the room or building if a standard for a communication protocol has changed meanwhile. If an update of the electronic device to a newer technical specification for compatibility with the other electronic device is not possible, replacement of the electronic may be necessary, which may involve the efforts of removing a fixture and installing a new fixture as described above.

[0017] In some instances, an integration of individual

elements for a home automation system in a room, apartment or building can be complex and expensive. Due to the obsolescence of the technology over time, problems with support and compatibility may arise. For example, a defective element of a home automation system may need to be replaced by a completely new electronic device that may be not compatible with other electronic devices that are still present in the home automation system.

[0018] Thus, elements of a home automation system may have to be updated bit by bit and may then no longer fit together.

[0019] Moreover, in a rental property, e.g. in a rental apartment, a home automation system may either be fully integrated already and therefore inflexible for being adapted to a need of a tenant in the rental property, or may not be available at all and, thus, may need to be laboriously installed by a tenant in the rental property.

[0020] Depending on tastes, demands and purchasing power, a change of owner or tenant of a residential unit, e.g. a house or apartment, may result in a high effort for "refitting" the smart home, i.e. for adapting a configuration of a home automation system in the residential unit to the needs of the new owner or tenant.

[0021] An example of a screen that may be provided in a room or building is The Wall manufactured by Samsung, which includes multiple screen modules that can be combined to a large screen.

General overview

[0022] Consequently, some embodiments of the present disclosure pertain to a modular wall system that includes a set of wall modules and a set of mounting frames for mounting the wall modules, wherein each of the mounting frames has a unit size and unit shape, wherein each mounting frame of the set of mounting frames includes a mounting interface adapted to releasably mount a wall module, and wherein each wall module of the set of wall modules has a size and shape adapted to the unit size and unit shape of the set of mounting frames and includes a mounting structure for releasably connecting with the mounting interface of a mounting frame.

[0023] The modular wall system may be modular in that each wall module of the set of wall modules may be mountable in any mounting frame of the set of mounting frames. For example, the mounting interface of each mounting frame of the set of mounting frames may comply with a specification such that the mounting interfaces of all mounting frames of the set of mounting frames may be equally shaped within specified manufacturing tolerances.

[0024] The mounting interfaces of the mounting frames of the set of mounting frames may allow to releasably mount a wall module of the set of wall modules. For example, a wall module mounted in a mounting frame may be released and taken out of the mounting frame without being destroyed, such that it can be mounted in the same or another mounting frame several times.

[0025] The mounting frames of the set of mounting frames may be open and may, for example, be provided at an outer portion surrounding a mounted wall module such that the mounted wall module (e.g., a mounting structure of the mounted wall module) extends through an opening of the mounting frame, or may be closed such that a mounted wall module is attached to one side of the mounting frame.

[0026] The wall modules may be as large or larger than the mounting frames such that a wall module mounted in a mounting frame covers the mounting frame, or may be smaller than the mounting frames such that the mounting frame remains visible around a mounting frame mounted therein.

[0027] The mounting frames and/or the wall modules may have a same shape, for example rectangular, quadratic, triangular, hexagonal, rhombic, round, or the like. The shape of the mounting frames and/or wall modules may be chosen such that an area can be covered with adjacent mounting frames and/or wall modules without gaps.

[0028] The unit size of the mounting frames and/or the size of the wall modules adapted to the wall modules may be chosen such that a wall module of the set of wall modules can be mounted in a mounting frame of the set of mounting frames by one person. For example, the mounting frames may have, as a unit size, a lateral length of 10 centimeters, of 30 centimeters, of 50 centimeters or of one meter, without limiting the disclosure to these values.

[0029] Some or all mounting frames of the set of mounting frames may include further interfaces, e.g., for providing a mounted wall module with electric power, network access or water, as described later. Such interfaces may be adapted such that a wall module of the set of wall modules that is adapted according to a corresponding interface specification (i.e., whose mounting structure includes a corresponding counter-interface) is automatically connected to the interface of the mounting frame when the wall module is mounted in the mounting frame, and that wall modules of the set of wall modules that are not adapted according to the corresponding interface specification, i.e., that do not support the corresponding interface, can be mounted in the mounting frame without interfering with the interface.

[0030] Some embodiments pertain to a mounting frame for the set of mounting frames of the modular wall system as described herein, wherein the mounting frame has a unit size and unit shape and includes a mounting interface adapted to releasably mount a wall module of the set of wall modules of the modular wall system.

[0031] For example, the mounting frame may be provided in a wall, floor or ceiling at a position where an object or material should be attached, and a wall module that includes the object or material to be attached may be mounted in the mounting frame. Thus, the object or

material may easily be removed or exchanged by unmounting and exchanging the wall module.

[0032] Some embodiments pertain to a wall module for the set of wall modules of the modular wall system as described herein, wherein the wall module has a size and shape adapted to the unit size and unit shape of the set of mounting frames of the modular wall system and includes a mounting structure for releasably connecting with a mounting interface of a mounting frame as described herein.

[0033] The wall module may include any object or material that may be attached to a wall, floor or ceiling. For example, a surface of a front side of the wall module, which is a side of the wall module opposite to a mounting direction such that it remains visible when the wall module is mounted in a mounting frame, may be covered with a material that should be attached to the wall, floor or ceiling.

[0034] For example, the surface of the front side of the wall module may be covered with wood, plastering, concrete, stucco, ceramics, cork, linoleum, polyvinyl chloride (PVC), carpet or the like. Thus, a whole wall, floor or ceiling or a portion thereof may be provided with mounting frames of the set of mounting frames, and wall modules with a front side of a desired material may be mounted in the mounting frames for attaching the desired material to the wall, floor or ceiling. If the material attached to the wall, floor or ceiling should be removed or exchanged, only the mounted wall modules may need to be removed or exchanged by wall modules with another desired material.

[0035] The wall module may also include any electronic device or fixture, such as a luminaire, a screen, a power socket or the like, as described below. A front side of such a wall module may be designed according to the electronic device or fixture included in the wall module. For example, a screen included in a wall module may extend over the whole surface of a front side of the wall module, or may extend only over a portion of the front side and a remaining portion of the front side of the wall module may be covered by a material as described above. A wall module that includes an electronic device may be provided with electric power, network access or the like via a corresponding interface of the mounting frame. Thus, the electronic device or fixture may easily be exchanged by unmounting the wall module from the mounting frame and mounting another wall module in the mounting frame.

[0036] Therefore, exchanging a wall module mounted in a mounting frame by another wall module may involve less effort than exchanging objects or materials attached to a wall, floor or ceiling without a mounting frame according to the present disclosure, and may be performed by a single person without help of a craftsman and/or without special tools.

[0037] Mounting frames according to the present disclosure may be provided at single positions in a building, apartment or room where a certain material, fixture or electronic device is desired, or may be provided to cover larger areas of a wall, floor or ceiling. The mounting frames may be attached to an existing wall, floor or ceiling of a building, apartment or room, or may be provided on a scaffold such that a wall, floor or ceiling is only formed by the mounting frames and the wall modules mounted therein.

[0038] For example, a room divider in an existing room may be created by installing a framework with mounting frames and by mounting wall modules in the mounting frames. Similarly, a room or even an apartment may be created in a larger room by installing a framework with mounting frames and by mounting wall modules in the mounting frames. Likewise, a building may be constructed by installing a framework with mounting frames and by mounting wall modules in the mounting frames.

[0039] Returning to Fig. 1, Fig. 1 illustrates a modular wall system according to an embodiment.

[0040] Part A of Fig. 1 shows the modular wall system in a front view. The modular wall system includes a set 1 of mounting frames and a set 2 of wall modules. The set 1 of mounting frames includes the mounting frames 3, 4 and 5. The set 2 of wall modules includes the wall modules 6, 7 and 8. Each mounting frame 3, 4 and 5 of the set 1 of mounting frames has a unit size and unit shape and includes a mounting interface adapted to releasably mount a wall module 6, 7 or 8 of the set 2 of wall modules. Each wall module 6, 7 and 8 of the set 2 of wall modules has a size and shape adapted to the unit size and unit shape of the set 1 of mounting frames and includes a mounting structure for releasably connecting with the mounting interface of a mounting frame 3, 4 or 5 of the set 1 of mounting frames.

[0041] Part B of Fig. 1 shows the wall module 6 mounted in the mounting frame 3 in a side view. The wall module 6 is mounted in the mounting frame 3 such that a front side 6a of the wall module 6 covers the mounting frame 3 and remains visible when the wall module 6 is mounted in the mounting frame 3.

[0042] The mounting frame 3 includes an upper portion 3a and a lower portion 3b. The upper portion 3a and the lower portion 3b include pins 3c and 3d, which are holding members of a mounting interface of the mounting frame 3. The wall module 6 has recesses 6b and 6c, which are part of a mounting structure of the wall module 6 and which correspond to the pins 3c and 3d of the mounting frame 3. When the wall module 6 is mounted in the mounting frame 3, the pins 3c and 3d of the mounting frame 3 snap into the recesses 6b and 6c, respectively, of the wall module 6 such that the wall module 6 is connected with the mounting frame 3. For releasing the wall module 6 from the mounting frame 3, the pins 6b and 6c are retracted out of the recesses 6b and 6c such that the wall module 6 can be removed from the mounting frame 3.

Mounting mechanism

[0043] In some embodiments, the mounting interface

of the mounting frame is configured to release a mounted wall module of the set of wall modules when a release action is received.

[0044] For example, the release action may be performed by a user who wants to remove the mounted wall module from the mounting frame.

[0045] In some embodiments, the releasing of the mounted wall module includes unlocking the mounted wall module such that it can be taken out of the mounting frame.

[0046] For example, a holding member of a mounting interface of the mounting frame may be retracted from a corresponding part of a mounting structure of the wall module. In the example of Fig. 1, the pins 3c and 3d of the mounting frame 3 may be retracted out of the recesses 6b and 6c of the wall module 6.

[0047] In some embodiments, the releasing of the mounted wall module includes ejecting the mounted wall module such that it is, at least partially, moved out of the mounting frame.

[0048] For example, the wall module may be moved out of the mounting frame until it protrudes among adjacent wall modules and can easily be gripped. In the example of Fig. 1, the pins 3c and 3d are tilted in an ejecting direction for ejecting the wall module 6.

[0049] In some embodiments, the release action includes moving, by a user, a holding member of the mounting interface. For example, the user may move the holding member by pressing a button or by pulling a Bowden cable that leads from the mounting frame to a position where it is easily accessible even when a wall module is mounted in the mounting frame.

[0050] In some embodiments, the release action includes driving an activator of the mounting interface. The actuator may include an electric motor, an electromagnet or the like.

[0051] In some embodiments, the release action includes applying a magnetic field to the mounting interface. For example, the user may bring a magnet into a vicinity of a predetermined portion of the mounting frame as release action.

[0052] Fig. 2 illustrates embodiments of a mounting interface configured to release a mounted wall module of the set of wall modules.

[0053] Part A of Fig. 2 shows a Bowden cable 11 that leads from the upper portion 3a of the mounting frame 3 to a position that can easily be reached when a wall module is mounted in the mounting frame 3 and covers the mounting frame 3. The upper portion 3a of the mounting frame 3 includes a lever 12 that is connected to the Bowden cable 11 and to the pin 3c such that the pin 3c is retracted into the upper portion 3a of the mounting frame 3 when a user pulls the Bowden cable 11.

[0054] Part B of Fig. 2 shows an electromotor 16, which is an example of an actuator. The electromotor 16 is provided in the upper portion 3a of the mounting frame 3 and is connected to a lever 17 via a transmission (not depicted). When the electromotor 16 is driven, the lever 17 is rotated such that the pin 3c is retracted into the upper portion 3a of the mounting frame 3. The electromotor 16 may, for example, be controlled by a control panel associated with the mounting frame 3 or by a smartphone application.

[0055] Part C of Fig. 2 shows a magnet 13 provided in a front portion of the upper portion 3a of the mounting frame 3. The magnet 13 is connected, via a connection 14, with a lever 15. When a user brings another magnet into a vicinity of the front portion of the upper portion 3a of the mounting frame 3, the magnet 13 moves towards the other magnet and pulls, via the connection 14, an arm of the lever 15, such that another arm of the lever 15, which is connected to the pin 3c, retracts the pin 3c into the upper portion 3a of the mounting frame 3. The magnet 13 may, for example, be strong enough that it is attracted by the other magnet even through a front portion of a mounted wall module, or the magnet 13 may be provided in a portion of the mounting frame 3 that is not covered by a mounted wall module.

Arrangement of mounting frames

[0056] In some embodiments, the modular wall system further comprises a framework on which a group of mounting frames of the set of mounting frames is arranged in an array.

[0057] For example, the framework may include a preinstalled array of mounting frames such that a plurality of mounting frames can be installed on a wall, floor, ceiling or roof without having to install each mounting frame separately. Instead, only the framework may need to be installed on the wall, floor, ceiling or roof, and the mounting frames arranged on the framework may be ready for mounting wall modules when the framework has been installed.

[0058] The framework may be delivered as one part, or may be delivered as parts that need to be assembled before or during installation.

[0059] A height and/or length of the framework, i.e., a number of rows and/or columns of mounting frames arranged on the framework, may be chosen based on typical room dimensions.

[0060] In some embodiments, the array includes at least two rows. The array may include one or more columns.

[0061] In some embodiments, the array includes at least two columns. The array may include one or more rows.

[0062] The framework may be adapted to be installed in a specific orientation.

[0063] In some embodiments, the framework is adapted to be installed vertically for providing a wall.

[0064] In some embodiments, the framework is adapted to be installed horizontally for providing a ceiling.

[0065] In some embodiments, the framework is adapted to be installed horizontally for providing a floor.

[0066] In some embodiments, the framework is adapt-

ed to be installed diagonally for providing a roof.

[0067] In some embodiments, the framework is adapted to be installed horizontally for providing a flat roof.

[0068] For example, a framework adapted to be installed hanging, e.g., on a wall or ceiling, may have more mounting pads than a framework adapted to be installed only in a lying position (e.g., on a floor or flat roof). A framework adapted to be installed in a lying position (e.g., on a floor or flat roof) may have reinforced mounting pads and/or a reinforced support for withstanding heavy loads from objects or persons standing on wall modules mounted in the lying framework. A framework adapted to be installed diagonally (e.g., on a roof) may include diagonal mounting pads such that it can be installed at vertical or horizontal portions of a building.

[0069] In some embodiments, the group of mounting frames is arranged on the framework such that wall modules of the set of wall modules mounted in adjacent mounting frames of the group of mounting frames are in direct contact to each other.

[0070] For example, the wall modules mounted in the group of mounting frames may form a closed wall, floor, ceiling or roof such that an area of the wall, floor, ceiling or roof is sealed by the wall modules. Thus, a wall, a room, an apartment or a whole building may be provided by arranging frameworks accordingly and mounting wall modules in the mounting frames of the frameworks.

[0071] In some embodiments, the wall module has a size and shape corresponding to the unit size and unit shape of the set of mounting frames of the modular wall system.

[0072] For example, the wall module may be adapted as a "single-size module" that can be mounted in one mounting frame such that other wall modules can be mounted in adjacent mounting frames.

[0073] In some embodiments, the wall module has a size and shape corresponding to an integer multiple of the unit size and unit shape of the set of mounting frames of the modular wall system.

[0074] For example, the wall module may be adapted as a "multi-size module" that extends over several mounting frames. A multi-size module may include a large object such as a screen, a window or a door that is larger than the unit size of the mounting frames. A multi-size module may include a certain material for covering a wall, floor, ceiling or roof and may have a larger layout such that a number of wall modules that need to be mounted for covering a certain area with wall modules is reduced as compared to "single-size modules".

[0075] In some embodiments, the wall module includes another mounting structure for releasably connecting with a mounting interface of another mounting frame.

[0076] For example, a multi-size module may include a mounting structure for each mounting frame it covers, or may include a mounting structure in each corner. For example, a multi-size module may have a rectangular shape and may include four mounting structures, one in each corner, such that the multi-size module can be fixed robustly in an array of mounting frames. Mounting structures may also be provided at various portions of a multi-size module that are apparent to the skilled person.

[0077] Fig. 3 illustrates frameworks on which a group of mounting frames of the set of mounting frames is arranged according to an embodiment.

[0078] Part A of Fig. 3 shows a framework 20 on which a group of twelve mounting frames is arranged in an array with four rows and three columns.

[0079] Part B of Fig. 3 shows frameworks 21, 22 and 23, on which groups of mounting frames are arranged in an array, respectively. The framework 21 is adapted to be installed vertically for providing a wall. The framework 22 is adapted to be installed horizontally for providing a floor, a ceiling and/or a flat roof. The framework 23 is adapted to be installed diagonally for providing a roof.

[0080] Fig. 4 illustrates different sizes of wall modules of the set of wall modules according to an embodiment.

[0081] Part A of Fig. 4 shows a back side of a single-size module 30, which is a wall module of the set of wall modules that has a size and shape corresponding to the unit size and unit shape of the set of mounting frames. The single-size module 30 includes a mounting structure 31 for being mounted in a mounting interface of a mounting frame of the set of mounting frames.

[0082] Part B of Fig. 4 shows a back side of a multi-size module 32, which is a wall module of the set of wall modules that has a size and shape corresponding to an integer multiple of the unit size and unit shape of the set of mounting frames. The multi-size module 32 has a size and shape that corresponds to a size and shape of an array of three rows and three columns of mounting frames, i.e., to three unit sizes and unit shapes in a horizontal and in a vertical direction. The multi-size module 32 includes four mounting structures 33, 34, 35 and 36 arranged in the four corners of the multi-size module 32 for being mounted in four mounting interfaces of mounting frames of the set of mounting frames.

Identification interface

[0083] In some embodiments, the mounting frame includes an identification interface configured to receive identification information of a wall module of the set of wall modules mounted in the mounting frame.

[0084] In some embodiments, the wall module is configured to transmit identification information of the wall module to a mounting frame of the set of mounting frames in which the wall module is mounted.

[0085] For example, the wall module may include, in its mounting structure, an identification interface that is configured to communicate with the identification interface of the mounting frame and to transmit the identification information of the wall module to the identification interface of the mounting frame. The identification information may include information that is necessary for an interaction between the mounting frame and the wall

module mounted therein or for a correct functioning of the wall module.

[0086] Transmitting the identification information of the wall module from the identification interface of the wall module to the identification interface of a mounting frame in which the wall module is mounted may allow to automatically recognize the wall module when the wall module is mounted in the mounting frame.

[0087] In some embodiments, the identification information of the mounted wall module indicates at least one of a type of the mounted wall module and specifications of the mounted wall module.

[0088] In some embodiments, the type of the mounted wall module includes a size of the mounted wall module; and the mounting frame is configured to provide an indication of the size of the mounted wall module to a control unit that controls at least the mounting frame for determining a mounting frame covered by the wall module.

[0089] For example, the identification information may indicate, as size of the mounted wall module, whether the mounted wall module is a single-size module or a multi-size module, and in the latter case, which size and shape the multi-size module has and at which position(s) its mounting structure(s) is/are provided. The mounting frame may forward an indication of the size of the mounted wall module to a control unit that controls at least the mounting frame (and may control one or more other mounting frames of the set of mounting frames), and the control unit may determine, based on the indication of the size of the mounted wall module, which mounting frames of the set of mounting frames can provide the mounted wall module with functionality via their interfaces, and/or at which positions (or mounting frames) a functionality (e.g. emission of light, emission of sound, display of an image and/or detection of smoke) of the mounted wall module is available.

[0090] In some embodiments, the specifications of the mounted wall module include an indication of an interface of the mounted wall module; and the mounting frame is configured to activate a corresponding interface of the mounting frame.

[0091] For example, the identification information may indicate which interfaces the wall module has (e.g., an interface for receiving or supplying electricity, an interface for accessing a communication network etc.). Based on the interfaces indicated by the identification information of the wall module, an electrical power supply of the wall module (e.g. via a power supply interface of the mounting frame in which the wall module is mounted), an access of the wall module to a communication network (e.g. via a network access interface of the mounting frame in which the wall module is mounted), and/or a supply of the wall module with freshwater and/or with water that has a predetermined temperature (e.g. via a water supply interface and/or a temperature-controlled water interface, respectively, of the mounting frame in which the wall module is mounted) may be activated automatically when the wall module is mounted in a mounting frame of the set of mounting frames.

[0092] In some embodiments, the specifications of the mounted wall module include a weight of the mounted wall module; and the mounting frame is configured to provide an indication of the weight of the mounted wall module to a control unit that controls the mounting frame for determining whether the weight of the mounted wall module exceeds a weight limit of the mounting frame.

[0093] For example, a control unit of the mounting frame or of the set of mounting frames may determine, based on the identification information of the wall module, that the weight of the wall module exceeds a weight limit of the mounting frame such that the mounting frame, a framework on which the mounting frame is arranged and/or a wall, ceiling or floor on which the mounting frame is installed may be damaged due to the weight of the wall module, and the control unit may issue a warning to a user that may instruct the user to unmount the wall module from the mounting frame.

[0094] Thus, based on a weight of the wall module indicated by the identification information, an excess of a weight limit of the mounting frame in which the wall module is mounted may be detected and damage may be avoided.

[0095] In some embodiments, the specifications of the mounted wall module include a wattage of the mounted wall module; and the mounting frame is configured to provide an indication of the wattage of the mounted wall module to a control unit that controls the mounting frame for determining whether the wattage of the mounted wall module exceeds an electrical power limit of the mounting frame.

[0096] For example, a control unit of the mounting frame or of the set of mounting frames may determine, based on the identification information of the wall module, that the wattage (e.g. a nominal electrical power consumption or a planned electrical power consumption) of the wall module exceeds an electrical power limit of the mounting frame in which the wall module is mounted such that the mounting frame and/or a power distribution box that supplies the wall module with electrical power may be damaged due to the electrical power consumption of the wall module, and the control unit may switch off a switch or fuse to prevent a damage and/or may issue a warning to a user that may instruct the user to unmount the wall module from the mounting frame. The electrical power limit of the mounting frame may be based on an electrical power limit of the power distribution box that supplies the wall module with electrical power or on an electrical power limit of a power cable that supplies the mounting frame with electrical power.

[0097] Thus, based on a wattage of the wall module indicated by the identification information, an excess of an electrical power limit of the mounting frame in which the wall module is mounted may be detected and damage may be avoided.

[0098] In some embodiments, the specifications of the mounted wall module include a communication protocol

supported by the mounted wall module; and the mounting frame is configured to provide an indication of the communication protocol supported by the mounted wall module to a communication unit of the modular wall system for establishing a communication connection with the mounted wall module.

[0099] The communication unit of the modular wall system may include any entity of the modular wall system that is configured to communicate with the mounted wall module such as, for example, the mounting frame in which the mounted wall module is mounted, another mounting frame of the set of mounting frames, another wall module of the set of wall modules or a control unit of the modular wall system that controls at least one mounting frame of the set of mounting frames and/or at least one wall module of the set of wall modules.

[0100] For example, based on the identification information of the wall module, a control unit of the mounting frame or of the set of mounting frames and/or another wall module mounted in a mounting frame of the set of mounting frames may establish a communication connection to the wall module based on a communication protocol indicated by the identification information of the wall module as a communication protocol that is supported by the wall module.

[0101] In some embodiments, the mounting frame includes an identification interface configured to transmit identification information of the mounting frame to a wall module of the set of wall modules mounted in the mounting frame.

[0102] The wall module may include, in its mounting structure, an identification interface that is configured to communicate with the identification interface of the mounting frame and to receive the identification information of the mounting frame. The identification information may include information that is necessary for an interaction between the mounting frame and the wall module mounted therein or for a correct functioning of the wall module.

[0103] In some embodiments, the identification information of the mounting frame indicates at least one of a relative position of the mounting frame among the set of mounting frames and specifications of the mounting frame.

[0104] For example, the identification information may indicate a row and a column of an array of mounting frames in which the mounting frame is arranged. If the mounting frame is arranged on a framework, the identification information may include a unique identifier of the framework.

[0105] For example, the identification information may indicate a communication protocol that is supported by the mounting frame for communicating with the wall module mounted in the mounting frame.

[0106] The identification information may indicate a load-carrying capacity of the mounting frame, an indication which interfaces the mounting frame has (e.g., an interface for supplying or receiving electricity, an interface for providing access to a communication network etc.) and/or an indication which communication protocols the mounting frame supports.

[0107] In some embodiments, the identification interface of the mounting frame includes an electrode for establishing an electrical contact to an electrode of an identification interface of the mounted wall module. Likewise, the identification interface of the wall module may include an electrode for establishing an electrical contact to an electrode of the identification interface of the mounting frame.

[0108] For example, the identification interfaces of the mounting frame and of the wall module may be adapted such that their respective electrodes come into contact with each other when the wall module is mounted in the mounting frame. Thus, the mounting frame may identify the wall module when the wall module is mounted in the mounting frame, and the wall module may identify the mounting frame when the wall module is mounted in the mounting frame.

[0109] In some embodiments, the identification interface of the mounting frame includes a radio-frequency identification (RFID) transponder for wireless communication with an identification interface of the mounted wall module. Likewise, the identification interface of the wall module may include an RFID transponder for wireless communication with the identification interface of the mounting frame.

[0110] The RFID transponder of the mounting frame and/or of the wall module may include a dedicated chip is configured to transmit hard coded information as identification information. For example, a wall module that provides wooden floor covering and includes no further electronics may include an RFID chip whose sole purpose is to identify the wall module as wooden floor covering wall module. On the other hand, a wall module that includes an electronic device, such as a television set, may generate the identification information based on a current system configuration (indicating, e.g., a communication protocol whose support has been introduced only by a recent update), and transmit the generated identification information to the mounting frame.

[0111] Likewise, in an embodiment where the identification information is not transmitted via an RFID transponder but via electrodes of the mounting interface and of the mounting structure, the identification information may be hard coded and may be transmitted by a dedicated chip, or the identification information may be generated by an integrated circuit configured to control an electronic device included in the wall module.

[0112] Fig. 5 illustrates an identification interface according to an embodiment.

[0113] Part A of Fig. 5 shows an embodiment of a mounting frame 40 of the set of mounting frames in a front view. The mounting frame 40 includes a mounting interface 41 and an RFID transponder 42 at a predetermined position of the mounting interface 41. The RFID transponder 42 is configured to receive identification in-

formation of a wall module mounted in the mounting frame 40 from an RFID transponder of the mounted wall module and to transmit identification information of the mounting frame 40 to the mounted wall module.

[0114] Part B of Fig. 5 shows an embodiment of a wall module 43 of the set of wall modules in a back view. The wall module 43 includes a mounting structure 44 for being mounted in a mounting interface of a mounting frame, e.g. in the mounting interface 41 of the mounting frame 40. The mounting structure 44 includes an RFID transponder 45 at a predetermined position that is configured to receive identification information of a mounting frame in which the wall module 43 is mounted from an RFID transponder of the mounting frame, e.g. the RFID transponder 42 of the mounting frame 40, and to transmit identification information of the wall module 43 to the mounting frame.

[0115] As mentioned, Fig. 5 shows the mounting frame 40 in a front view and the wall module 43 in a back view. Therefore, when the wall module 43 is mounted in the mounting interface 41 of the mounting frame 40 (with the back side of the wall module 43 directed towards the mounting frame 40), the RFID transponder 42 of the mounting frame and the RFID transponder 45 of the wall module come into close proximity and can exchange identification information via a wireless RFID connection.

Power supply interface

[0116] In some embodiments, the mounting frame includes a power supply interface configured to provide electrical power to a wall module of the set of wall modules mounted in the mounting frame.

[0117] Likewise, the wall module may include a power supply interface configured to receive electrical power from a power supply interface of a mounting frame in which the wall module is mounted.

[0118] The wall module may receive the electrical power for operating an electric device included in the wall module. For example, the wall module may include a luminaire, a screen, and/or an integrated circuit that receive electrical power via the power supply interface of the mounting frame and the corresponding power supply interface of the wall module.

[0119] In some embodiments, the framework includes a power cable for providing at least one mounting frame of the group of mounting frames with electrical power.

[0120] For example, the power cable may connect a power supply interface of a mounting frame with a distribution box. The distribution box may include switches and/or fuses for a plurality of power supply interfaces of a plurality of mounting frames, and may be connected via cables to the plurality of power supply interfaces. The distribution box may further include a transformer, a rectifier and/or an inverter for providing electrical power with any one of a plurality of voltages and/or frequencies.

[0121] In some embodiments, the power supply interface of the mounting frame is configured to provide mains power to a wall module of the set of wall modules mounted in the mounting frame.

[0122] For example, the mains power may include an alternating current with a voltage of 100 V, 110 V, 120 V, 220 V, 230 V or 240 V and with a frequency of 50 HZ or 60 Hz, without limiting the disclosure to these values.

[0123] In some embodiments, the power supply interface of the mounting frame is configured to provide an Extra-Low Voltage (ELV) power to a wall module of the set of wall modules mounted in the mounting frame.

[0124] The ELV power may include a direct current with a voltage of 3.3 V, 5 V and/or 12 V, without limiting the disclosure to these values. For example, the ELV power may be provided by the mounting frame based on converting a mains power received from a distribution box to the ELV power, or a distribution box may convert a mains power to the ELV power and provide the ELV power to the mounting frame.

[0125] The power supply interface of the wall module may be configured to receive the mains power and/or the ELV power from the power supply interface of the mounting frame. For example, an electric device that is included in the wall module and has a high power uptake may receive a mains power via the power supply interface of the wall module, and an electric device that is included in the wall module and has a low power uptake (e.g., a processor and/or a control Light Emitting Diode (LED)) may receive an ELV power via the power supply interface of the wall module.

[0126] In some embodiments, the power supply interface of the mounting frame includes a power supply control interface configured to receive a voltage request from a wall module of the set of wall modules mounted in the mounting frame, wherein the voltage request indicates a voltage of a plurality of predefined voltages; and wherein the power supply interface is configured to provide to the wall module mounted in the mounting frame the voltage indicated by the voltage request.

[0127] Likewise, the power supply interface of the wall module may include a power supply control interface configured to transmit the voltage request to a mounting frame in which the wall module is mounted.

[0128] For example, the power supply interface of the mounting frame may be configured to provide a mains power and/or an ELV power to the power supply interface of the wall module based on the voltage request from the wall module.

[0129] The mounting frame may forward the voltage request to a distribution box and the distribution box may be configured to provide the requested mains power and/or ELV power to the mounting frame based on the voltage request, or the mounting frame may (possibly convert and) provide a voltage to the power supply interface of the wall module based on the voltage request.

[0130] The power supply interface of the wall module may be configured to receive both a mains power and an ELV power or may be configured to receive only one of the mains power and the ELV power, based on power

requirements of an electric device included in the wall module.

[0131] Fig. 6 illustrates a power supply interface according to an embodiment.

[0132] Part A of Fig. 6 shows a front side of a mounting frame 50 of the set of mounting frames according to an embodiment with a mounting interface 50a that includes a power supply interface 51. The power supply interface 51 includes a power supply control interface 52, a mains power supply interface 53 and an ELV power supply interface 54.

[0133] The power supply control interface 52 includes an RFID transponder and is configured to receive a voltage request from a power supply control interface of a wall module mounted in the mounting interface 50a of the mounting frame 50. Based on a received voltage request, the power supply control interface 52 controls the mains power supply interface 53 and/or the ELV power supply interface 54 to provide mains power and/or ELV power, respectively, to a power supply interface of the mounted wall module.

[0134] The mains power supply interface 53 includes a phase conductor slot 55, a protective conductor slot 56 and a neutral conductor slot 57. The phase conductor slot 55 includes a contact that is connected to a phase conductor of the mains power. The protective conductor slot 56 includes a contact that is grounded. The neutral conductor slot 57 includes a contact that is connected to a neutral conductor of the mains power.

[0135] The ELV power supply interface 54 includes a voltage slot 58 and a ground slot 59. The voltage slot 58 is connected to a supply voltage of the ELV power. The ground slot 59 is grounded.

[0136] Part B of Fig. 6 shows a back side of a wall module 60 of the set of wall modules according to an embodiment with a mounting structure 60a for being mounted in a mounting interface of a mounting frame of the set of mounting frames, e.g. in the mounting interface 50a of the mounting frame 50. The mounting structure 60a includes a power supply interface 61. The power supply interface 61 includes a power supply control interface 62, a mains power supply interface 63 and an ELV power supply interface 64.

[0137] The power supply control interface 62 includes an RFID transponder and is configured to transmit a voltage request to a power supply control interface of a mounting frame in which the wall module 60 is mounted.

[0138] The mains power supply interface 63 includes a phase conductor pin 65, a protective conductor pin 66 and a neutral conductor pin 67. When the wall module 60 is mounted in a mounting frame with a power supply interface, e.g. in the mounting frame 50 with the power supply interface 51, the phase conductor pin 65 engages with the phase conductor slot 55, the protective conductor pin 66 engages with the protective conductor slot 56 and the neutral conductor pin 67 engages with the neutral conductor slot 57.

[0139] The ELV power supply interface 64 includes a voltage pin 68 and a ground pin 69. When the wall module 60 is mounted in the mounting frame 50 with the power supply interface 51, the voltage pin 68 engages with the voltage slot 58 and the ground pin 69 engages with the ground slot 69.

[0140] When the wall module 60 is mounted in the mounting frame 50, the power supply control interface 62 of the wall module 60 sends a voltage request via RFID to the power supply control interface 52 of the mounting frame 50. The voltage request sent by the power supply control interface 62 of the wall module 60 represents a request for a mains power and for an ELV power of 5 V, without limiting the disclosure to this value. When the power supply control interface 52 of the mounting frame 50 receives the voltage request, the mains power supply interface 53 of the mounting frame 50 provides a mains power and the ELV power supply interface 54 provides an ELV power of 5 V.

[0141] Thus, the phase conductor pin 65 is electrically connected to the phase conductor slot 55 and receives a phase voltage from the phase conductor slot 55 according to the voltage request, and the neutral conductor pin 67 is electrically connected to the neutral conductor slot 57, such that the requested mains power voltage is provided in the wall module 60 between the phase conductor pin 65 and the neutral conductor pin 67. The protective conductor pin 66 is electrically connected to the protective conductor slot 56 for increasing a safety by allowing a residual-current device in a distribution box to detect a residual current.

[0142] Further, the voltage pin 68 is electrically connected to the voltage slot 58 and receives an ELV of 5 V according to the voltage request, and the ground pin 69 is electrically connected to the ground slot 59, such the requested ELV is provided in the wall module 60 between the voltage pin 68 and the ground pin 69.

[0143] The wall module 60 includes an RFID transponder (not depicted) similar to the RFID transponder 45 of Fig. 5 as an identification interface for automatically identifying the wall module 60 when the wall module 60 is mounted in a mounting frame that includes an identification interface, e.g. the RFID transponder 42 of Fig. 5.

Network access interface

[0144] In some embodiments, the mounting frame includes a network access interface configured to provide communication network access to a wall module of the set of wall modules mounted in the mounting frame. Likewise, the wall module includes a network access interface configured to access a communication network via a network access interface of a mounting frame of the set of mounting frames in which the wall module is mounted.

[0145] The communication network may include the internet, a Wide Area Network (WAN), a Local Area Network (LAN), a Virtual Private Network (VPN) or the like.

[0146] The network access interface of the mounting

frame and the network access interface of the wall module may be connected to each other via electric contacts, e.g., via eight electric contacts for providing full-duplex ethernet or via four electric contacts for providing half-duplex ethernet, or may be connected via an optical fiber connection. The network access interfaces of the mounting frame and of the wall module may be adapted and arranged such that they are connected to each other when the wall module is mounted in the mounting frame.

[0147] The mounting frame that includes the network access interface may also include a power supply interface as described above for providing an electric device of the wall module that communicates via the network access interface with the communication network with electrical power. The network access interface of the mounting frame and the network interface of the wall module may support Power over Ethernet (PoE) such that an electric device included in the wall module may receive its required electrical power via PoE from the network access interface and a separate power supply interface may not be necessary.

[0148] In some embodiments, the framework includes a network cable for providing at least one mounting frame of the group of mounting frames with communication network access.

[0149] For example, the network cable may include a twisted-pair ethernet cable with two or four wire pairs or may include an optical fiber. The network cable may connect the network access interface of the mounting frame with a network switch. The framework may include as many network cables as there are mounting frames with a network access interface arranged on the network, and each network access interface may be connected via a separate network cable to the network switch. The network switch may be connected to a building connection line.

[0150] Fig. 7 illustrates a network access interface according to an embodiment.

[0151] Part A of Fig. 7 shows a front side of a mounting frame 70 of the set of mounting frames according to an embodiment. The mounting frame 70 includes a mounting interface 71. The mounting interface 71 includes a network access interface 72 that is connected to a communication network. The network access interface 72 includes eight contact slots 73 for providing a network access interface of a wall module mounted in the mounting frame 70 with full-duplex ethernet network access to the communication network. The mounting interface 71 further includes a power supply interface 74 such as the power supply interface 51 of Fig. 6 for providing an electric device of a wall module mounted in the mounting frame 70 with electrical power.

[0152] Part B of Fig. 7 shows a back side of a wall module 75 of the set of wall modules according to an embodiment. The wall module 75 includes a mounting structure 76 for being mounted in a mounting interface of a mounting frame of the set of mounting frames, e.g. in the mounting interface 71 of the mounting frame 70. The mounting structure 76 includes a network access interface 77 with eight contact pins 78 for accessing a communication network via full-duplex ethernet. The mounting structure 76 further includes a power supply interface 79 such as the power supply interface 61 of Fig. 6 for providing an electric device of the wall module 75 with electrical power.

[0153] When the wall module 75 is mounted in a mounting frame with a network access interface, e.g. in the mounting frame 70 with the network access interface 72, the eight contact pins 78 engage with (and are electrically connected to) the respective eight contact slots 73 such that the wall module 75 can access the communication network via the eight contact pins 78 and the eight contact slots 73.

[0154] The wall module 75 includes an RFID transponder (not depicted) similar to the RFID transponder 45 of Fig. 5 as an identification interface for automatically identifying the wall module 75 when the wall module 75 is mounted in a mounting frame that includes an identification interface, e.g. the RFID transponder 42 of Fig. 5.

Temperature-controlled water interface

[0155] In some embodiments, the mounting frame includes a temperature-controlled water interface configured to provide a flow line of water with a predetermined temperature to a wall module of the set of wall modules mounted in the mounting frame and receive a return flow of used water from the mounted wall module. Likewise, the wall module may include a temperature-controlled water interface configured to receive a flow line of water with a predetermined temperature (temperature-controlled water) from a mounting frame in which the wall module is mounted and return a return flow of used water to the mounting frame.

[0156] The temperature-controlled water may have a temperature in a predetermined temperature range. The predetermined temperature range may be chosen to be, for example, warmer than a typical room temperature or cooler than a typical room temperature such that a wall module that receives the temperature-controlled water via its temperature-controlled water interface may use the temperature-controlled water for heating or for cooling.

[0157] For example, a wall module that receives, via its temperature-controlled water interface, water with a temperature that is warmer than a room temperature may include a heating pipe through which the temperature-controlled water flows for providing an underfloor heating, a panel heating and/or a ceiling heating.

[0158] For example, a wall module that receives, via its temperature-controlled water interface, water with a temperature that is lower than a room temperature may include a cooling pipe through which the temperature-controlled water flows for providing an underfloor cooling, a panel cooling and/or a ceiling cooling, or may dissipate waste heat from an electric device included in the wall

module into the temperature-controlled water.

[0159] In the wall module, the temperature-controlled water may flow from a flow line connection of the temperature-controlled water interface of the wall module through the heating pipe, cooling pipe or a cooling unit of the electric device to a return flow connection of the temperature-controlled water interface of the wall module.

[0160] In some embodiments, the framework includes a tubing for providing at least one mounting frame of the group of mounting frames that has a flow line of water with a predetermined temperature and receiving from the at least one mounting frame a return flow of used water.

[0161] The tubing may connect the temperature-controlled water interface of the mounting frame with a distributor. For example, each mounting frame of the group of mounting frames arranged on the framework that includes a temperature-controlled water interface may be connected separately to the distributor via corresponding tubing included in the framework. The distributor may be connected to a heating circuit or cooling circuit, respectively, of a building.

[0162] The tubing may be isolated to reduce a temperature bias of the temperature-controlled water, e.g. a warming of water from a cooling circuit or a cooling of water from a heating circuit.

[0163] Alternatively, the tubing may connect the temperature-controlled water interfaces of the mounting frames arranged on the framework in series, in which case the distributor may be omitted and the tubing may be connected directly to the heating circuit or cooling circuit, respectively, of the building.

[0164] The temperature-controlled water interface, the tubing and the distributor may be adapted such that both warm water and cool water can be provided via the flow line. Thus, for example, a wall module with a temperature-controlled water interface may be operated as an underfloor heating and as an underfloor cooling without exchanging the wall module, the mounting frame or the tubing. The temperature of the water provided via the flow line may be controlled by a central heating or cooling facility of the building in which the mounting frame is installed.

[0165] Fig. 8 illustrates a temperature-controlled water interface according to an embodiment.

[0166] Part A of Fig. 8 shows a front side of a mounting frame 80 of the set of mounting frames according to an embodiment. The mounting frame 80 includes a mounting interface 81. The mounting interface 81 includes a temperature-controlled water interface 82. The temperature-controlled water interface 82 includes a connector 83 for a flow line of water with a predetermined temperature and a connector 84 for a return flow of used water. The connectors 83 and 84 for a flow line and a return flow, respectively, include valves that are shut when no wall module with a temperature-controlled water interface is mounted in the mounting frame 80 such that no water may escape from the temperature-controlled water interface 81. When a wall module with a temperature-controlled water interface is mounted in the mounting frame 80, the valves of the connectors 83 and 84 for the flow line and the return flow, respectively, may be opened automatically such that the temperature-controlled water interface 82 can provide the mounted wall module with water that has a predetermined temperature.

[0167] Part B of Fig. 8 shows a back side of a wall module 85 of the set of wall modules according to an embodiment. The wall module 85 includes a mounting structure 86 for being mounted in a mounting interface of a mounting frame of the set of mounting frames, e.g. in the mounting interface 81 of the mounting frame 80. The mounting structure 86 includes a temperature-controlled water interface 87. The temperature-controlled water interface 87 includes a connector 88 for a flow line of water with a predetermined temperature and a connector 89 for a return flow of used water.

[0168] The connectors 88 and 89 for the flow line and the return flow, respectively, include connecting pieces 88a and 89a, respectively.

[0169] When the wall module 85 with the temperature-controlled water interface 87 is mounted in a mounting frame with a temperature-controlled water interface, such as the mounting frame 80 with the temperature-controlled water interface 82, the connecting piece 88a of the connector 88 engages with the connector 83 and opens its valve, and the connecting piece 89a of the connector 89 engages with the connector 84 and opens its valve. Thus, the wall module 85 may be automatically provided with water that has a predetermined temperature via the temperature-controlled water interfaces 82 and 87 of the mounting frame 80 and of the wall module 85, respectively, when the wall module 85 is mounted in the mounting frame 80.

[0170] The connector 83 for the flow line receives water with a predetermined temperature from a circulation of temperature-controlled water installed in a building in which the mounting frame 80 is installed. The connector 83 provides the received water via its valve and via the connecting piece 88a to the connector 88. From the connector 88, the water with the predetermined temperature flows through a predetermined portion of the wall module 85 and causes the predetermined portion of the wall module 85 to assume a temperature closer to the temperature of the received water. At the same time, the temperature of the received water assimilates the temperature of the predetermined portion of the wall module 85 and, thus, becomes used water whose temperature does not comply with the predetermined temperature anymore. The used water flows from the predetermined portion of the wall module 85 to the connector 89 for the return flow. From the connector 89, the used water flows through the connecting piece 89a, the valve of the connector 84 and the connector 84 of the mounting frame 80 back into the circulation of the building.

[0171] The temperature-controlled water interfaces 82 and 87 of the mounting frame 80 and of the wall module

85, respectively, are adapted to receive both warm water and cold water (i.e., water with a higher or lower temperature, respectively, than a typical room temperature) such that a heating and a cooling operation of the wall module 85 can easily be switched by changing the temperature of the water provided from the circulation to the connector 83 for the flow line of the temperature-controlled water interface 82.

[0172] The wall module 85 includes an RFID transponder (not depicted) similar to the RFID transponder 45 of Fig. 5 as an identification interface for automatically identifying the wall module 85 when the wall module 85 is mounted in a mounting frame that includes an identification interface, e.g. the RFID transponder 42 of Fig. 5.

Water supply interface

[0173] In some embodiments, the mounting frame includes a water supply interface configured to provide water to a wall module of the set of wall modules mounted in the mounting frame. Likewise, the wall module may include a water supply interface configured to receive water from a mounting frame of the set of mounting frames in which the wall module is mounted.

[0174] The water supply interface of the mounting frame may receive water from a water main or from a reservoir. The received water may or may not be potable. The received water may be freshwater.

[0175] For example, the wall module may include a water outlet such as a water-tap, a shower head, a sprinkler nozzle or a toilet tank, and may provide the water received via the water supply interfaces of the mounting frame and of the wall module to the water outlet.

[0176] In some embodiments, the framework includes a tubing for providing at least one mounting frame of the group of mounting frames with water.

[0177] For example, the tubing may be connected to a water main or a reservoir and may provide water from the water main or reservoir to the water supply interface of the mounting frame. The framework may include a tubing for providing each mounting frame that is arranged on the framework and includes a water supply interface with water.

[0178] Fig. 9 illustrates a water supply interface according to an embodiment.

[0179] Part A of Fig. 9 shows a front side of a mounting frame 90 of the set of mounting frames according to an embodiment. The mounting frame 90 includes a mounting interface 91. The mounting interface 91 includes a water supply interface 92. The water supply interface 92 is connected to a tubing and receives, via the tubing, water from a water main. The water supply interface 92 includes a valve that is shut when no wall module with a water supply interface is mounted in the mounting frame 90 to prevent water from escaping the water supply interface 92.

[0180] Part B of Fig. 9 shows a back side of a wall module 95 of the set of wall modules according to an embodiment. The wall module 95 includes a mounting structure 96 for being mounted in a mounting interface of a mounting frame of the set of mounting frames, e.g. in the mounting interface 91 of the mounting frame 90. The mounting structure 96 includes a water supply interface 97. The water supply interface 97 is adapted to receive water via a connecting piece 98.

[0181] When the wall module 95 with the water supply interface 97 is mounted in a mounting frame with a water supply interface, such as the mounting frame 90 with the water supply interface 92, the connecting piece 98 of the water supply interface 97 of the wall module 95 engages with the water supply interface 92 of the mounting frame 90 and opens the valve of the water supply interface 92 such that water flows from the water supply interface 92 of the mounting frame 90 to the water supply interface 97 of the wall module 95 via the connecting piece 98. From the water supply interface 97 of the wall module 95, the water flows through the wall module 95 to a water outlet (not shown) of the wall module 95.

[0182] The wall module 95 includes an RFID transponder (not depicted) similar to the RFID transponder 45 of Fig. 5 as an identification interface for automatically identifying the wall module 95 when the wall module 95 is mounted in a mounting frame that includes an identification interface, e.g. the RFID transponder 42 of Fig. 5.

Sealing and insulation modules

[0183] In some embodiments, the wall module is adapted to waterproofly seal a mounting frame of the set of mounting frames in which the wall module is mounted.

[0184] The waterproof sealing of the mounting frame may include closing any gap between the wall module and the mounting frame in which the wall module is mounted such that water is prevented from penetrating into the mounting frame.

[0185] In some embodiments, the wall module is adapted to waterproofly seal an interspace between the wall module and another wall module mounted in an adjacent mounting frame.

[0186] The waterproof sealing of the interspace may include closing any gap between the wall module and the other wall module such that water is prevented from penetrating into the interspace between the wall module and the other wall module.

[0187] For example, the waterproof sealing of the mounting frame or of the interspace may be provided by a rubber lip or an elastic tube provided at a back side or at a lateral portion of the wall module.

[0188] For example, the wall module adapted to waterproofly seal the mounting frame or the interspace may be installed at a wall or floor in a damp room (e.g. a bathroom) to prevent shower water from penetrating into the wall or floor.

[0189] For example, the wall module adapted to waterproofly seal the mounting frame or the interspace may be installed as covering of an outer wall or a roof of a

building to prevent rain water from penetrating into the wall or roof or into the building.

[0190] In some embodiments, the wall module is adapted to reduce a thermal transfer through the wall module.

[0191] For example, the wall module may include foamed polystyrene, mineral wool, cellulose or any other thermal insulation material.

[0192] For example, the wall module adapted to reduce a thermal transfer may be installed at an outer wall or a roof of a building for thermal insulation of an inside of the building against the surrounding air temperature (e.g., against cold air in the winter).

[0193] In some embodiments, the wall module is adapted to reduce a sound transmitted through the wall module.

[0194] For example, the wall module may include foamed polystyrene, mineral wool, cellulose or any other sound insulation material.

[0195] For example, the wall module may be installed at an outer wall of a building to reduce an amount of noise from outside (e.g. a traffic noise) that penetrates into the building. The wall module may also be installed in a wall between rooms to reduce an amount of sound (e.g. a conversation, music or a machine) spread through the wall from one room into another room.

[0196] Fig. 10 illustrates a wall module 100 of the set of wall modules that is adapted to waterproofly seal a mounting frame of the set of mounting frames in which the wall module 100 is mounted and an interspace between the wall module 100 and a wall module mounted in an adjacent mounting frame according to an embodiment.

[0197] Part A of Fig. 10 shows a back side of the wall module 100 according to an embodiment. The wall module 100 includes a mounting structure 101 for being mounted in a mounting interface of a mounting frame of the set of mounting frames. Around the mounting structure 101, a first elastic tube 102 is provided at the back side of the wall module 100 for waterproof sealing a mounting frame in which the wall module is mounted. Around a lateral portion of the wall module 100, a second elastic tube 103 is provided for waterproof sealing an interspace between the wall module 100 and another wall module mounted in an adjacent mounting frame.

[0198] Part B of Fig. 10 shows a side view of the wall module 100 mounted with its mounting structure 101 in a mounting frame 104. The first elastic tube 102 is in contact with both the back side of the wall module 100 and a front side of the mounting frame 104 such that the first elastic tube 102 prevents water from penetrating into the mounting frame 104 through a gap between the wall module 100 and the mounting frame 104.

[0199] In another mounting frame 105 adjacent to the mounting frame 104, another wall module 106 is mounted with its mounting structure 107. The other wall module 106 also has a first elastic tube 108 provided at its back side that waterproofly seals the other mounting frame 105 in which the other wall module 106 is mounted.

[0200] The second elastic tube 103 of the wall module 100 is in contact with a second elastic tube 109 provided around a lateral portion of the other wall module 106 such that an interspace between the wall module 100 and the other wall module 106 is waterproofly sealed, i.e., water is prevented from entering from the front side of the wall modules 100 and 106 into the interspace between the wall modules 100 and 106.

[0201] Fig. 11 illustrates a side view of a wall module 110 of the set of wall modules adapted to reduce a thermal transfer through the wall module 110 and to reduce a sound transmitted through the wall module 110 according to an embodiment. The wall module 110 includes a body 111 of foamed polystyrene and, at a back side of the wall module 110, an elastic tube 112 surrounding a mounting structure 113 of the wall module 110. The body 111 of foamed polystyrene reduces a thermal transfer through the wall module 110 and an amount of noise transmitted through the wall module 110. The elastic tube 112 seals a gap between the wall module 110 and a mounting frame in which the wall module 110 is mounted such that a circulation of (warm or cold) air through the gap between the wall module 110 and the mounting frame is reduced and that an amount of noise transmitted through the gap between the wall module 110 and the mounting frame is reduced. The mounting structure 113 is adapted for mounting the wall module 110 in a mounting interface of a mounting frame of the set of mounting frames.

[0202] The wall modules 100 and 110 include an RFID transponder (not depicted) similar to the RFID transponder 45 of Fig. 5 as an identification interface for automatically identifying the wall module 100 or 110, respectively, when the respective wall module 100 or 110 is mounted in a mounting frame that includes an identification interface, e.g. the RFID transponder 42 of Fig. 5.

Opening module

[0203] In some embodiments, the wall module is adapted to provide a closable opening through the wall module.

[0204] In some embodiments, the closable opening includes at least one of a door and a window.

[0205] For example, the wall module that includes a closable opening such as a door or a window may be installed when a room, an interior of a building or a whole building are constructed based on the modular wall system according to the present disclosure. An opening such as a door or a window provided in the wall module may be exchanged or moved to another position with less effort than an opening provided in a conventional wall. Thus, a wall module with a closable opening may allow changes in a room layout more flexibly.

[0206] In some embodiments, a size of the wall module corresponds to the unit size of the set of mounting frames; and the opening extends through a mounting frame of

the set of mounting frames in which the wall module is mounted.

[0207] In some embodiments, a size of the wall module corresponds to an integer multiple of the unit size of the set of mounting frames; and the opening is provided in a portion of the wall module in which no mounting structure is provided.

[0208] Fig. 12 illustrates a wall module 120 of the set of wall modules with a closable opening 122 and a size that corresponds to the unit size of the set of mounting frames according to an embodiment.

[0209] Part A of Fig. 12 shows a cross section of the wall module 120. The wall module 120 includes a mounting structure 121 adapted to be mounted in a mounting interface of a mounting frame of the set of mounting frames. A size of the wall module 120 corresponds to the unit size of the set of mounting frames, i.e., the wall module 120 can be mounted with its mounting structure 121 in a mounting frame arranged in an array of mounting frames without preventing other wall modules from being mounted in adjacent mounting frames. The wall module 120 includes an opening 122 that extends through the wall module 120. When the wall module 120 is mounted in a mounting frame, the opening 122 also extends through the mounting frame in which the wall module 120 is mounted. The opening 122 can be covered with a window 123 for closing the opening 122. The window 123 can be closed and opened with a handle 124 provided at a front side of the wall module 120, i.e., at a side opposite to a mounting direction of the wall module 120.

[0210] Part B of Fig. 12 shows a front view of the wall module 120 with the window 123 that covers the opening 122 and with the handle 124 for opening and closing the window 123.

[0211] Part C of Fig. 12 shows a back view of the wall module 120 with the mounting structure 121 and the window 123. The handle 124 is not visible from the back side in the embodiment of Fig. 12.

[0212] Fig. 13 illustrates a wall module 130 of the set of wall modules with a closable opening 131 and a size that corresponds to an integer multiple of the unit size of the set of mounting frames according to an embodiment.

[0213] Part A of Fig. 13 shows a cross section of the wall module 130. The wall module 130 includes a closable opening 131 that can be covered with a door 132 for closing the opening 131. The door 132 includes a handle 133 for opening and closing the door 132. The wall module 130 further includes mounting structures 134, 135, 136 and 137 for mounting the wall module 130 in mounting frames of the set of mounting frames. A size of the wall module 130 corresponds to an integer multiple of the unit size of the set of mounting frames, i.e., when the wall module 130 is mounted with its mounting structures 134, 135, 136 and 137 in mounting frames of the set of mounting frames that are arranged in an array, the wall module 130 covers an integer multiple number of the mounting frames arranged in the array and does not prevent other wall modules from being mounted in adjacent mounting frames not covered by the wall module 130. The opening 131 and the door 132 are provided in a portion of the wall module 130 where no mounting structure 134, 135, 136 or 137 is provided, and the wall module 130 is mounted such that no mounting frame (and no wall) is behind the portion of the wall module 130 in which the opening 131 is provided such that the door can be passed through.

[0214] Part B of Fig. 13 shows a front view of the wall module 130 with the door 132 that covers the opening 131 and with the handle 133 for opening and closing the door 132.

[0215] Part C of Fig. 13 shows a back view of the wall module 130 with the door 132, the handle 133 and the mounting structures 134, 135, 136 and 137. Part C of Fig. 13 shows that the door 132 (and, thus, the closable opening 131) is provided in a portion of the wall module 130 in which no mounting structure 134, 135, 136 or 137 is provided. The mounting structures 134, 135, 136 and 137 are adapted for mounting the wall module 130 in four mounting interfaces of mounting frames of the set of mounting frames.

[0216] The wall modules 120 and 130 include an RFID transponder (not depicted) similar to the RFID transponder 45 of Fig. 5 as an identification interface for automatically identifying the wall module 120 or 130, respectively, when the respective wall module 120 or 130 is mounted in a mounting frame that includes an identification interface, e.g. the RFID transponder 42 of Fig. 5.

Anchorage module

[0217] In some embodiments, the wall module the wall module is adapted to provide an anchorage for attaching an object.

[0218] For example, the wall module may include, as the anchorage for attaching the object, a hook for attaching an eye of the object, an eye for attaching a hook of the object, a threaded hole for attaching the object with a screw, a bayonet mount for attaching the object with a complementary bayonet mount of the object, or the like.

[0219] For example, the wall module that is adapted to provide an anchorage for attaching an object may be mounted in a mounting frame that is installed at a wall, ceiling, floor or roof where the object should be attached. Thus, the object may easily be attached to the wall module without drilling a hole into the wall, ceiling, floor or roof, and the object may easily be removed from the wall module without leaving a hole in the wall, ceiling, floor or roof that needs to be covered. Therefore, less tools and less time may be necessary for mounting and/or unmounting the object in/from the wall module than for attaching and/or removing the object directly at/from the wall, ceiling, floor or roof.

[0220] In some embodiments, the attaching of the object includes hanging the object to a surface of the wall module.

[0221] For example, the object may be a picture frame,

a coat hook, a shelf, a luminaire, a screen, a television set, a loudspeaker, a Wi-Fi access point or the like and may be attached to the anchorage of the wall module.

[0222] In some embodiments, the object is standing on a floor, and the attaching of the object includes preventing the object from tilting.

[0223] For example, the object may be a cupboard, and an upper portion of the cupboard may be attached to the anchorage of the wall module for preventing the cupboard from tilting.

[0224] Fig. 14 illustrates embodiments of wall modules 140 and 145 of the set of wall modules with an anchorage for attaching an object.

[0225] Part A of Fig. 14 shows a cross section of a wall module 140 with a mounting structure 141 for mounting the wall module 140 in a mounting interface of a mounting frame of the set of mounting frames. At a front side of the wall module 140, a hook 142 is provided as an anchorage for attaching an object.

[0226] Part B of Fig. 14 shows a cross section of a wall module 145 with a mounting structure 146 for mounting the wall module 145 in a mounting interface of a mounting frame of the set of mounting frames. At a front side of the wall module 145, a threaded hole 147 is provided as an anchorage for attaching an object. An object can be attached to the wall module 145 by inserting a screw with a corresponding thread into the threaded hole 147.

[0227] The wall module 140 includes an RFID transponder (not depicted) similar to the RFID transponder 45 of Fig. 5 as an identification interface for automatically identifying the wall module 140 when the wall module 140 is mounted in a mounting frame that includes an identification interface, e.g. the RFID transponder 42 of Fig. 5.

Power supply module

[0228] In some embodiments, the wall module is configured to receive electrical power from a power supply interface of a mounting frame of the set of mounting frames in which the wall module is mounted; and provide the received electrical power to a device coupled to the wall module.

[0229] For example, some or all mounting frames arranged in a framework may include a power supply interface for providing a wall module mounted therein with electrical power, and the wall module that is configured to receive electrical power from the power supply interface and provide the electrical power to a device coupled to the wall module may be mounted in any one of the mounting frames with a power supply interface for providing electrical power to a device coupled to the wall module. Thus, an electrical power supply for a device may easily be provided by mounting the wall module in a mounting frame with a power supply interface.

[0230] In some embodiments, the wall module includes a plug socket; and coupling the device to the wall module includes inserting a power plug of the device into the plug socket of the wall module.

[0231] Thus, a plug socked may easily be installed by mounting the wall module in a mounting frame with a power supply interface instead of installing a cable and/or a plug socket in a wall.

[0232] In some embodiments, the wall module includes an induction coil; and coupling the device to the wall module includes placing a reception coil of the device in a coverage range of the induction coil.

[0233] Thus, a mobile device that supports wireless charging may only need to be brought into proximity of the wall module for charging. For example, the wall module may be configured as a transmitter according to the Qi, Powermat or Rezence standard for wireless charging and may provide any device configured as a receiver according to the Qi, Powermat or Rezence standard, respectively, with electrical power via the induction coil.

[0234] In some embodiments, the wall module is configured to receive, from a device coupled to the wall module, a request of an electrical power characteristic including at least one of a voltage, a current, a power and a frequency; and provide, to the coupled device, electrical power based on the requested electrical power characteristic.

[0235] For example, the wall module may include a plug socket, and a device plugged into the plug socket may request a voltage, e.g. 110 V, 120 V, 220 V, 230 V or 240 V, and/or a frequency, e.g. 50 Hz or 60 Hz, of an alternating current supplied via the plug socket, without limiting the disclosure to these values.

[0236] For example, the device plugged into the plug socket may request a power of an alternating current supplied via the plug socket, and the wall module may be configured to provide the device with the requested power. The wall module may be configured to not supply electrical power via the plug socket before receiving a request of an electrical power characteristic from a device plugged into the plug socket and may be configured to not supply electrical power via the plug socket after the device has been unplugged from the plug socket. For example, the wall module may determine that the device is unplugged if the wall module receives, from the device, a cancellation of the request of an electrical power characteristic or if the wall module fails to receive, from the device, a heartbeat message that is sent periodically by the device. Thus, a danger of an electrical accident may be reduced.

[0237] For example, the request of an electrical power characteristic may be transmitted via a power wire of the plug socket as a modulated signal, and the wall module may be configured to provide a small electrical power via the plug socket even if no request of an electrical power characteristic has been received. The small electrical power may be sufficient for a device plugged into the plug socket to generate and transmit a request of an electrical power characteristic. The small electrical power may be provided as a low voltage that may be low enough to avoid electrical accidents such as, e.g., 5 V or 12 V, with-

out limiting the disclosure to these values.

[0238] For example, the request of an electrical power characteristic may be transmitted via a separate contact, via Near-Field Communication (NFC), via Radio-Frequency Identification (RFID), via Bluetooth, via Bluetooth Low Energy or the like.

[0239] For example, the wall module may include an induction coil and may be configured according to at least one of the Qi, Powermat and Rezence standard, and the request of an electrical power characteristic may include a request of a wireless power transmission standard and/or a request of a power transmission frequency for wireless power transmission.

[0240] Fig. 15 illustrates a wall module 150 of the set of wall modules configured to receive electrical power from a power supply interface of a mounting frame of the set of mounting frames and provide the electrical power to a device coupled to the wall module 150 according to an embodiment.

[0241] Part A of Fig. 15 shows a front view of the wall module 150. The wall module 150 includes a plug socket 151 for providing a device plugged into the plug socket 151 with electrical power. The wall module 150 also includes an induction coil 152 for providing a device with electrical power when a reception coil of the device is brought into proximity of the induction coil 152.

[0242] Part B of Fig. 15 shows a back view of the wall module 150. The wall module 150 includes a mounting structure 153 for mounting the wall module 150 in a mounting interface of a mounting frame of the set of mounting frames. The wall module 150 includes a power supply interface 154 for receiving electrical power from a power supply interface (e.g. from the power supply interface 51 of Fig. 6) of a mounting frame of the set of mounting frames in which the wall module 150 is mounted. The wall module 150 includes a control unit 155 for providing a device coupled to the wall module 150 via the plug socket 151 or via the induction coil 152 with electrical power according to a request of an electrical power characteristic received from the device. The wall module 150 includes an RFID transponder 156 similar to the RFID transponder 45 of Fig. 5 as an identification interface for automatically identifying the wall module 150 and electrical power characteristics supported by the wall module 150 when the wall module 150 is mounted in a mounting frame that includes an identification interface, e.g. the RFID transponder 42 of Fig. 5.

Network access module

[0243] In some embodiments, the wall module is configured to provide, to a device coupled to the wall module, access to a communication network via a network access interface of a mounting frame of the set of mounting frames in which the wall module is mounted.

[0244] For example, a network access may be provided at any mounting frame of the set of mounting frames that includes a network access interface, e.g. at the mounting frame 70 of Fig. 7 with the network access interface 72, and whose network access interface is connected to a communication network. The network access may be provided by mounting the wall module in the mounting frame with a network access interface, which may be easier and may involve less effort than installing a network cable, a network socket and/or a network access point in a wall for providing a network access.

[0245] In some embodiments, the wall module includes a network socket; and coupling the device to the wall module includes inserting a network plug of the device into the network socket.

[0246] For example, the network socket may include a socket for a modular connector with eight positions and eight contacts (8P8C, "RJ-45") and/or a socket for an optical fiber connector such as a subscriber connector (SC) or a lucent connector (LC) such that the wall module may provide wired network access via Ethernet.

[0247] In some embodiments, the providing of access to the communication network includes providing a wireless access point.

[0248] The wireless access point may, for example, span a wireless local area network (WLAN) according to a standard of the IEEE 802.11 family, and any device that supports the same standard may be coupled to the wall module by connecting with the WLAN spanned by the wireless access point.

[0249] The wall module may include two or more network sockets and/or may provide a wireless access point and include at least one network socket. The wall module may also include a network switch that connects the network socket(s) and, if present, the wireless access point to a network access interface of the wall module.

[0250] Fig. 16 illustrates a wall module 160 of the set of wall modules that is configured to provide, to a device coupled to the wall module, access to a communication network according to an embodiment.

[0251] Part A of Fig. 16 shows a front view of the wall module 160. The wall module 160 includes an antenna 161 that spans a wireless local area network (WLAN) according to the IEEE 802.11ac standard, which is a standard of the IEEE 802.11 family. Therefore, the wall module 160 provides a wireless access point. The wall module 160 includes two network sockets 162 and 163 that are sockets for a modular connector with eight positions and eight contacts (8P8C, "RJ-45"). Thus, a device capable of connecting to a WLAN according to the IEEE 802.1 1ac standard can be coupled to the wall module 160 via the WLAN spanned by the antenna 161, and a device capable of connecting to an Ethernet network via a twisted pair patch cable can be coupled to the wall module 160 via a twisted pair patch cable plugged with an 8P8C modular connector into any one of the network sockets 162 and 163.

[0252] Part B of Fig. 16 shows a back view of the wall module 160. The wall module 160 includes a mounting structure 164 for mounting the wall module 160 in a mounting interface of a mounting frame of the set of

mounting frames that includes a network access interface and a power supply interface, e.g. in the mounting frame 70 of Fig. 7 that includes the network access interface 72 and the power supply interface 74. The wall module 160 includes a network access interface 165 similar to the network access interface 77 of Fig. 7 for connecting to a communication network via the network access interface 72 of the mounting frame 70. The wall module 160 includes a power supply interface 166 similar to the power supply interface 61 of Fig. 6 for receiving electrical power from the power supply interface 74 of the mounting frame 70 and an RFID transponder 167 similar to the RFID transponder 45 of Fig. 5 as an identification interface for automatically identifying the wall module 160 and network specifications supported by the wall module 160 when the wall module 160 is mounted in a mounting frame that includes an identification interface, e.g. the RFID transponder 42 of Fig. 5. The wall module 160 includes a circuitry 168 that is supplied with electrical power via the power supply interface 166.

[0253] The circuitry 168 is configured to operate the antenna 161. The circuitry 168 is also configured as a network switch that forwards data between the WLAN spanned by the antenna 161, the network sockets 162 and 163, and the network access interface 165.

Light emission module

[0254] In some embodiments, the wall module is configured to emit light.

[0255] For example, the wall module may include an illuminant such as a light-emitting diode (LED) lamp, a halogen lamp, a fluorescent lamp, a bulb or the like. The wall module may include a plurality of illuminants. The illuminant(s) may be arranged as point light source(s), as laminar light source(s) or may be focused, e.g. in a light cone with a defined opening angle.

[0256] The wall module may be mounted at a ceiling for providing a ceiling lamp, at a wall for providing a wall lamp or at a floor for providing a floor lamp.

[0257] In some embodiments, the wall module is configured to generate light based on an electrical power received from a power supply interface of a mounting frame of the set of mounting frames in which the wall module is mounted.

[0258] In some embodiments, the wall module is configured to control a characteristic of the emitted light based on a received control instruction; wherein the characteristic of the emitted light includes at least one of a brightness, a color temperature, a color and a hue of the emitted light.

[0259] For example, a brightness, a color temperature, a color and/or a hue of light emitted by the illuminant(s) of the wall module may be controllable by varying a voltage and/or a current provided to the illuminant(s) and may be controlled by a controller included in the wall module.

[0260] In some embodiments, the wall module is configured to receive the control instruction by detecting a change of an electrical power provided by a power supply interface of a mounting frame of the set of mounting frames in which the wall module is mounted.

[0261] For example, the control instruction may be transmitted to the wall module by modulating a supply voltage provided by the power supply interface of the mounting frame.

[0262] In some embodiments, the wall module is configured to receive the control instruction via a network access interface of a mounting frame of the set of mounting frames in which the wall module is mounted.

[0263] For example, the wall module may include a network card. The network card may be connected to a communication network via a network access interface of the wall module and the network access interface of the mounting frame in which the wall module is mounted, and the wall module may receive the control instruction from another device connected to the communication network.

[0264] In some embodiments, the wall module is configured to receive the control instruction via an infrared communication interface.

[0265] For example, the infrared communication interface may include an infrared sensor that is configured to detect a modulated brightness of infrared light emitted from a remote control, and a modulation pattern of the modulated brightness of the infrared light may represent the control instruction.

[0266] In some embodiments, the wall module is configured to receive the control instruction via a wireless communication network.

[0267] For example, the wall module may include an antenna and may be configured to receive, with the antenna, the control instruction via a wireless local area network (WLAN) according to a standard of the IEEE 802.11 family, to ZigBee, to Bluetooth, to Bluetooth Low Energy or the like.

[0268] In some embodiments, the wall module is configured to receive the control instruction based on a spoken command from a user.

[0269] For example, the wall module may include a microphone for recording speech of a user and a circuitry configured to determine the control instruction based on the recorded speech of the user.

[0270] Fig. 17 illustrates a wall module 170 of the set of wall modules that is configured to emit light according to an embodiment.

[0271] Part A of Fig. 17 shows a front view of the wall module 170. The wall module 170 includes a LED lamp 171. Characteristics of light emitted by the LED lamp 171, including a brightness, a color and a color temperature, can be controlled by varying a supply voltage of the LED lamp 171. The wall module 170 includes an antenna 172 for receiving a control instruction.

[0272] Part B of Fig. 17 shows a back view of the wall module 170. The wall module 170 includes a mounting structure 173 for mounting the wall module 170 in a

mounting interface of a mounting frame of the set of mounting frames that includes a power supply interface, e.g. in the mounting frame 50 of Fig. 6 that includes the power supply interface 51. The wall module 170 includes a power supply interface 174 similar to the power supply interface 79 of Fig. 7 for receiving electrical power from the power supply interface 51 of the mounting frame 50 in which the wall module 170 is mounted and for supplying the LED lamp 171 with electrical power. The wall module 170 includes an RFID transponder 175 similar to the RFID transponder 45 of Fig. 5 as an identification interface for automatically identifying the wall module 170 and a protocol for controlling the characteristics of the light emitted by the LED lamp 171 when the wall module 170 is mounted in a mounting frame that includes an identification interface, e.g. the RFID transponder 42 of Fig. 5. The wall module 170 includes a circuitry 176 for controlling the characteristics of the light emitted by the LED lamp 171.

[0273] The circuitry 176 is supplied with electrical power via the power supply interface 174. The circuitry 176 is configured to receive via the antenna 172 a control instruction according to ZigBee or Bluetooth and to control a supply voltage of the LED lamp 171 for controlling the characteristics of the LED lamp 171 according to the control instruction.

Display module

[0274] In some embodiments, the wall module is configured to display an image.

[0275] The image may be a static image or a movie. The wall module may be configured to display a black-and-white image, a grayscale image or a color image (e.g. an Red-Green-Blue (RGB) image). The wall module may include a light-emitting diode (LED) display, an organic LED (OLED) display, a liquid-crystal display (LCD), an electronic ink display, a cathode-ray tube (CRT) or the like for displaying the image.

[0276] The wall module may be mounted at a wall, a ceiling, a floor or a roof. The wall module may include a power supply interface and may receive, via its power supply interface, electric power for displaying the image from a power supply interface of a mounting frame of the set of mounting frames in which the wall module is mounted.

[0277] In some embodiments, the image is based on image data received by the wall module via a network access interface of a mounting frame of the set of mounting frames in which the wall module is mounted.

[0278] For example, the wall module may be connected, via the network access interface of the mounting frame in which the wall module is mounted, to a communication network from which it receives the image data.

[0279] In some embodiments, the image is based on image data received by the wall module via a wireless communication connection.

[0280] For example, the wireless communication connection may be based on a standard of the IEEE 802.11 family and may connect the wall module to a communication network such as a wireless local area network (WLAN) from which the wall module receives the image data.

[0281] For example, the wireless communication connection may be based on Bluetooth, Bluetooth Low Energy, near-field communication (NFC), Wi-Fi Direct, ZigBee or the like, and may connect the wall module to another device from which the wall module receives the image data.

[0282] For example, the image data may include an image in the JPEG File Interchange Format (JFIF), in the Portable Network Graphics (PNG) format, in the Scalable Vector Graphics (SVG) format, in the PostScript format or in the Portable Document Format (PDF).

[0283] For example, the image data may include a movie in the MPEG-4 format, in the Advanced Video Coding (H.264) format, in the High Efficiency Video Coding (H.265) format, in the QuickTime (MOV) format, in the Audio Video Interleave (AVI) format or in the Flash Video (FLV) format.

[0284] For example, the image data may include a video stream in the Real-Time Transport Protocol (RTP), in the Web Real-Time Communication (WebRTC) protocol or in the Network Device Interface (NDI) protocol.

[0285] In some embodiments, the image is based on image data received by the wall module via a display cable plugged into a display plug socket of the wall module.

[0286] For example, the wall module may include a High Definition Media Interface (HDMI) plug socket, a DisplayPort plug socket, a Digital Visual Interface (DVI) plug socket, a Video Graphics Array (VGA) plug socket, a Serial Digital Interface (SDI) plug socket, an RCA jack or a SCART plug socket, and may be configured to display an image or movie received via a cable plugged into the wall module.

[0287] In some embodiments, the wall module is configured to control a characteristic of the image based on a control signal; wherein the characteristic of the image includes a brightness, a luminance, a color saturation and a gamma correction.

[0288] In some embodiments, the wall module is configured to receive the control signal via a network access interface of a mounting frame of the set of mounting frames in which the wall module is mounted.

[0289] For example, the wall module may include a network card. The network card may be connected to a communication network via a network access interface of the wall module and the network access interface of the mounting frame in which the wall module is mounted, and the wall module may receive the control signal from another device connected to the communication network.

[0290] In some embodiments, the wall module is configured to receive the control signal via a wireless communication connection.

[0291] For example, the wall module may include an antenna and may be configured to receive, with the antenna, the control signal via a wireless local area network (WLAN) according to a standard of the IEEE 802.11 family, to ZigBee, to Bluetooth, to Bluetooth Low Energy or the like.

[0292] In some embodiments, the wall module is configured to receive the control signal via an infrared communication interface.

[0293] For example, the infrared communication interface may include an infrared sensor that is configured to detect a modulated brightness of infrared light emitted from a remote control, and a modulation pattern of the modulated brightness of the infrared light may represent the control signal.

[0294] In some embodiments, the wall module is configured to receive the control signal based on a spoken command from a user.

[0295] For example, the wall module may include a microphone for recording speech of a user and a circuitry configured to determine the control signal based on the recorded speech of the user.

[0296] In some embodiments, the wall module is configured to display a portion of the image based on a relative position of the wall module to another wall module of the set of wall modules configured to display an image.

[0297] For example, the wall module may detect, based on a wired or a wireless communication network, position(s) of one or more other wall modules that is/are configured to display an image and that is/are mounted in a proximity of the wall module, and may compare the position(s) of the one or more other wall modules to its own position. The position may, for example, include a row and a column of an array of mounting frames in which the wall module is mounted. The wall module may calculate a portion of the image based on the relative portion (and size) of the wall module relative to the position(s) (and size(s)) of the one or more other wall modules, and may display the calculated portion. Thus, two or more wall modules mounted in adjacent mounting frames may be combined as a large screen.

[0298] In some embodiments, the wall module is configured to emit dissipated heat through a display surface of the wall module.

[0299] For example, a surrounding air may be heated. Thus, the wall module may be cooled passively, which may save energy, may reduce a noise caused by the wall module and/or may allow to omit a ventilation slot for using a surface of the wall module more efficiently, e.g. for providing a display means.

[0300] In some embodiments, the wall module is configured to receive, via a temperature-controlled water interface of a mounting frame of the set of mounting frames in which the display module is mounted, a flow line of water with a predetermined temperature for leading off dissipated heat; and return a return flow of used water to the temperature-controlled water interface of the mounting frame.

[0301] For example, the wall module may receive cooling water via the temperature-controlled water interface. Cooling the wall module with water may avoid heating up surrounding air (and a room in which the wall module is mounted), may allow to omit a ventilation slot for using a surface of the wall module more efficiently, e.g. for providing display means, and/or may reduce a noise caused by the wall module as compared to air cooling because the cooling water may allow a lower flow velocity.

[0302] Fig. 18 illustrates a wall module 180 of the set of wall modules that is configured to display an image according to an embodiment.

[0303] Part A of Fig. 18 shows a front view of the wall module 180. The wall module 180 includes, as a display means, a liquid-crystal display 181 for displaying an image or video. The wall module 180 includes an antenna 182 for receiving image data that represent the image to be displayed by the wall module 180 and a control signal that indicates a characteristic of the image, which includes a brightness, a luminance, a color saturation and a gamma correction, via a wireless communication connection according to the IEEE 802.1 1ac standard (which is a standard of the IEEE 802.11 family), to Bluetooth or to ZigBee. The antenna 182 is illustrated with a dotted line because it is arranged in a layer behind the liquid-crystal display 181 such that a portion of the front surface in which the liquid-crystal display 181 is provided can be increased.

[0304] Part B of Fig. 18 shows a back view of the wall module 180. The wall module 180 includes a mounting structure 183 for mounting the wall module 180 in a mounting interface of a mounting frame of the set of mounting frames. The wall module 180 includes at its back side a HDMI plug socket 183 for receiving image data that represent an image or movie to be displayed by the wall module 180 via a HDMI cable plugged into the HDMI plug socket 183. The wall module 180 includes a network access interface 185 similar to the network access interface 77 of Fig. 7 for receiving image data that represent the image to be displayed by the wall module 180 and a control signal that indicates a characteristic of the image, which includes a brightness, a luminance, a color saturation and a gamma correction, via a network access interface, such as the network access interface 72 of Fig. 7, of a mounting frame in which the wall module 180 is mounted from a communication network. The wall module 180 includes a power supply interface 186 similar to the power supply interface 61 of Fig. 6 for receiving electrical power from a power supply interface, such as the power supply interface 51 of Fig. 6, of a mounting frame in which the wall module 180 is mounted. With the electrical power received by the power supply interface 186, electrical parts of the wall module 180 such as the liquid-crystal display 181 and the antenna 182 are powered. The wall module 180 includes an RFID transponder 187 similar to the RFID transponder 45 of Fig. 5 as an identification interface for automatically identifying the wall module 180 and a protocol for transmitting the image

signal or the control signal to the wall module 180 when the wall module 180 is mounted in a mounting frame that includes an identification interface, e.g. the RFID transponder 42 of Fig. 5. The wall module 180 includes a temperature-controlled water interface 188 similar to the temperature-controlled water interface 87 of Fig. 8 for leading off waste heat from the wall module 180. The wall module 180 includes a circuitry 189 for controlling the wall module 180.

[0305] The circuitry 189 controls the liquid-crystal display 181 to display an image according to the image data received via any one of the antenna 182, the HDMI plug socket 184 and the network access interface 185 and according to the control signal received via the antenna 182 or the network access interface 185.

[0306] The circuitry 189 controls a cooling mode of the wall module 180 according to a control signal that indicates a cooling mode of the wall module 180 and that is received via the antenna 182 or via the network access interface 185 similar to the control signal that indicates a characteristic of the image.

[0307] The controlling of the cooling mode of the wall module 180 includes switching between a passive cooling mode and an active cooling mode.

[0308] In the passive cooling mode, waste heat generated in the wall module 180 is dissipated through the front surface of the wall module 180, i.e. through the liquid-crystal display 181, and heats a room in which the wall module 180 is mounted by heating air surrounding the wall module 180 and by emitting infrared radiation, thus supporting a heating of the room, e.g. at cold winter weather. The passive cooling mode reduces an energy consumed for cooling the wall module 180, reduces a noise generated by the wall module 180 and allows to use the waste heat of the wall module 180 for heating the room in which the wall module 180 is mounted.

[0309] In the active cooling mode, waste heat generated in the wall module 180 is led off by heating cool water received via a flow line 188a of the temperature-controlled water interface 188 and returning the heated water to a return flow 188b of the temperature-controlled water interface 188. Thus, as compared to the passive cooling mode, the active cooling mode avoids heating a room in which the wall module 180 is mounted with the waste heat of the wall module 180, thus avoiding additional heating of the room, e.g. at warm summer weather. The active cooling mode allows to dissipate the waste heat of the wall module 180 at a more suitable location than in the room in which the wall module 180 is mounted. The active cooling mode requires that the wall module 180 is mounted in a mounting frame of the set of mounting frames that includes a temperature-controlled water interface such as the temperature-controlled water interface 82 of Fig. 8.

[0310] The circuitry 189 determines, based on identification information of the mounting frame in which the wall module 180 is mounted that is received by the RFID transponder 187, whether the wall module 180 is mounted in a mounting frame with a temperature-controlled water interface and allows switching into the active cooling mode only if the circuitry 189 determines that the wall module 180 is mounted in a mounting frame with a temperature-controlled water interface. If the wall module 180 is mounted in a mounting frame that does not include a temperature-controlled water interface, the circuitry 189 does not allow switching into the active cooling mode but enforces the passive cooling mode.

[0311] The circuitry 189 is further configured to receive via the antenna 182 or via the network access interface 185, similar to the control signal that indicates a characteristic of the image, an indication of one or more other wall modules configured to display an image that is/are mounted in a proximity of the wall module 180 and corresponding positions. The circuitry 189 is configured to control, based on a control signal received via the antenna 182 or via the network access interface 185 similar to the control signal that indicates a characteristic of the image, the liquid-crystal display 181 to display only a portion of the image that corresponds to a position of the wall module 180 among the one or more other wall modules configured to display an image such that the wall module 180 is combined with the one or more other wall modules configured to display an image to a large display.

Water tap module

[0312] In some embodiments, the wall module is configured to provide water from a water supply interface of a mounting frame of the set of mounting frames in which the wall module is mounted.

[0313] For example, mounting the wall module configured to provide water from the water supply interface of the mounting frame in which the wall module is mounted may involve less effort than installing water tubing and a water tap directly in a wall, and the wall module may be removed or relocated more flexibly.

[0314] Fig. 19 illustrates a wall module 190 of the set of wall modules configured to provide water from a water supply interface of a mounting frame of the set of mounting frames in which the wall module is mounted according to an embodiment.

[0315] Part A of Fig. 19 shows a front side of the wall module 190. The wall module 190 includes a water tap 191. When the wall module 190 is mounted in a mounting frame of the set of mounting frames that includes a water supply interface, e.g. in the mounting frame 90 of Fig. 9 with the water supply interface 92, a user can obtain water from the water tap 191 when the user opens the water tap 191.

[0316] Part B of Fig. 19 shows a back side of the wall module 190. The wall module 190 includes a mounting structure 192 for mounting the wall module 190 in a mounting interface of a mounting frame of the set of mounting frames. The wall module 190 includes a water supply interface 193 similar to the water supply interface

97 of Fig. 9 for receiving water from the water supply interface 92 of the mounting frame 90 in which the wall module 190 is mounted. Water received by the water supply interface 193 of the wall module 190 from the water supply interface 92 of the mounting frame 90 is provided to the water tap 191. The wall module 190 includes an RFID transponder 194 similar to the RFID transponder 45 of Fig. 5 as an identification interface for automatically identifying the wall module 190 when the wall module 190 is mounted in a mounting frame that includes an identification interface, e.g. the RFID transponder 42 of Fig. 5.

Smoke detection module

[0317] In some embodiments, the wall module is configured to measure a smoke concentration in surrounding air and detect an alarm event if the measured smoke concentration exceeds a predefined smoke threshold.

[0318] For example, the wall module may be mounted at a ceiling of a room for warning people present in the room in case of a fire or smoke emission to reduce a risk of smoke poisoning and to increase a chance of the people to escape from the fire or smoke. Mounting the wall module may involve less effort than installing a smoke detector directly at a ceiling.

[0319] The wall module may be powered by a battery, an accumulator and/or a capacitor for being able to detect an alarm event even during a power outage. The wall module may also include a power supply interface for receiving electrical power from a corresponding power supply interface of a mounting frame in which the wall module is mounted. The wall module may charge its accumulator and/or capacitor with the electrical power received via the power supply interface.

[0320] In some embodiments, the wall module is configured to measure a carbon monoxide concentration in the surrounding air and detect an alarm event if the measured carbon monoxide concentration exceeds a predefined carbon monoxide threshold.

[0321] For example, the wall module may be configured to warn people present in the room in which the wall module is mounted in case of a high carbon monoxide concentration for reducing a risk of a carbon monoxide poisoning.

[0322] In some embodiments, the wall module is configured to emit an alarm sound if an alarm event is detected.

[0323] For example, the alarm sound may be as loud as possible without causing a hearing damage to reduce a risk that people present in the room in which the wall module is mounted miss the alarm sound.

[0324] The alarm sound may include a predetermined sound pattern. The alarm sound may include a first predetermined sound pattern for an alarm based on a high smoke concentration and a second predetermined sound pattern for an alarm based on a high carbon monoxide concentration. The predetermined sound pattern(s) may include a plurality of audible frequencies. The predetermined sound pattern(s) may include a speaking voice that indicates that an alarm event has been detected, indicates whether the alarm is based on a high smoke concentration or on a high carbon monoxide concentration and/or gives safety instructions such as leaving a room or building.

[0325] In some embodiments, the wall module is configured to cause another wall module of the set of wall modules that is configured to emit light to emit light if an alarm event is detected.

[0326] For example, the wall module may cause the other wall module to emit light via a wired or wireless connection to a communication network according to, for example, Ethernet, Wi-Fi, a standard of the IEEE 802.11 family, Bluetooth, Bluetooth Low Energy, ZigBee, KNX, Homematic or Z-Wave. The wall module may cause the other wall module to emit light by sending a message that is directly addressed to the other wall module, by sending a broadcast message into the network and/or by sending a message to a control unit in the network that controls at least one wall module configured to emit light. The wall module may uphold the connection to the communication network even if no alarm event is detected, or may establish the connection to the communication network when an alarm event is detected.

[0327] For example, the other wall module that is configured to emit light may be caused, by the wall module, to emit light with high brightness when an alarm event is detected such that people can see an escape route and can identify an obstacle in the escape route even without having to switch on lights manually.

[0328] Fig. 20 illustrates a wall module 200 of the set of wall modules that is configured to measure a smoke concentration in surrounding air and detect an alarm event if the measured smoke concentration exceeds a predefined smoke threshold according to an embodiment.

[0329] Part A of Fig. 20 shows a front view of the wall module 200. The wall module 200 includes a sensor 201 that is configured to measure a smoke concentration and a carbon monoxide concentration in air surrounding the wall module 200. The wall module 200 includes a loudspeaker 202 configured to emit an alarm sound if the wall module 200 detects an alarm event due to a high concentration of smoke or carbon monoxide in the surrounding air. The wall module 200 includes an antenna 203 for connecting to a wireless communication network according to IEEE 802.1 1ac (a standard of the IEEE 802.11 family) or according to ZigBee and for causing, by a message sent to the wireless communication network, another wall module to emit light when the wall module 200 detects an alarm event.

[0330] Part B of Fig. 20 shows a back view of the wall module 200. The wall module 200 includes a mounting structure 204 for mounting the wall module 200 in a mounting interface of a mounting frame of the set of mounting frames. The wall module 200 includes a power

supply interface 205 similar to the power supply interface 61 of Fig. 6 for receiving electrical power from a power supply interface of a mounting frame in which the wall module 200 is mounted. The wall module 200 includes an accumulator 206 that is charged with the electrical power received by the power supply interface 205. The wall module 200 includes an RFID transponder 207 similar to the RFID transponder 45 of Fig. 5 as an identification interface for automatically identifying the wall module 200 and the protocols (IEEE 802.1 1ac and ZigBee) supported by the wall module 200 when the wall module 200 is mounted in a mounting frame that includes an identification interface, e.g. the RFID transponder 42 of Fig. 5. The wall module 200 includes a circuitry 208 for controlling the wall module 200.

[0331] Electrical parts of the wall module 200, including the sensor 201, the loudspeaker 202, the antenna 203 and the circuitry 208, are provided with electric power by the power supply interface 205 if the wall module 200 is mounted in a mounting frame that includes a power supply interface such as the power supply interface 51 of Fig. 6. If the power supply interface 205 does not receive electrical power from the mounting frame in which the wall module 200 is mounted, e.g. due to a power outage or because the mounting frame does not include a power supply interface, the electrical parts of the wall module 200 are provided with electrical power from the accumulator 206.

[0332] The circuitry 208 is configured to determine, based on a measurement of the sensor 201, if a smoke concentration in air surrounding the wall module 200 exceeds a predetermined smoke threshold and if a carbon monoxide concentration in air surrounding the wall module 200 exceeds a predetermined carbon monoxide threshold. The circuitry 208 is configured to detect an alarm event if the smoke concentration or the carbon monoxide concentration exceeds the corresponding threshold, and, if it detects an alarm event, to control the loudspeaker to emit a predetermined alarm sound. When the circuitry 208 detects an alarm event, the circuitry 208 further controls the antenna 203 to transmit a broadcast message to a IEEE 802.11ac WLAN (if credentials for connecting to the WLAN have been deposited in a memory of the circuitry 208) and to transmit a control message to a ZigBee network (if the wall module 200 has been coupled with the ZigBee network) for causing another wall module that is capable of emitting light to emit light.

Heating module

[0333] In some embodiments, the wall module includes a heatable surface for heating a room.

[0334] For example, the wall module may be mounted on a floor, at a wall or at a ceiling for providing an underfloor heating, a panel heating or a ceiling heating, respectively. The wall module may include a heatable surface arranged at a front side of the wall module that is directed towards a room in which the wall module is mounted. The wall module may heat the room by thermal conduction from the heatable surface to surrounding air and/or by thermal radiation from the heatable surface into the room.

[0335] In some embodiments, the wall module is configured to receive, from a temperature-controlled water interface of a mounting frame of the set of mounting frames in which the wall module is mounted, a flow line of water with a predetermined temperature for heating the heatable surface; and return a return flow of used water to the temperature-controlled water interface of the mounting frame.

[0336] For example, the water with the predetermined temperature may be conducted through a water pipe that is provided behind the heatable surface of the wall module. A pump for pumping the water through the water pipe may be provided in the wall module or separately from the wall module.

[0337] The predetermined temperature of the water may be chosen equal to or higher than a requested room temperature. A temperature of the room in which the wall module is mounted may be controlled to assume a requested room temperature by controlling a water flow velocity through the water pipe based on a thermostat or valve, by controlling a water flow velocity through the water pipe based on a pumping power of the pump for pumping the water through the water pipe and/or by controlling the predetermined temperature of the temperature-controlled water.

[0338] A thermostat, valve or pump for controlling the water flow velocity through the water pipe may be manually controlled via a control means provided at a surface of the wall module, may be automatically controlled via a wired communication network, e.g. Ethernet, to which the wall module may be connected through a network access interface of the wall module, similar to the network access interface 77 of Fig. 7, and through a network access interface of a mounting frame in which the wall module is mounted, similar to the network access interface 72 of Fig. 7, or may be automatically controlled via a wireless communication network, e.g. Wi-Fi, a standard of the IEEE 802.11 family, Bluetooth, Bluetooth Low Energy, ZigBee, KNX, Homematic or Z-Wave, to which the wall module may be connected through an antenna of the wall module.

[0339] In some embodiments, the wall module is configured to receive, from a power supply interface of a mounting frame of the set of mounting frames in which the wall module is mounted, electrical power for heating the heatable surface with an electrical heating element.

[0340] For example, the wall module may include a heating wire that is provided behind the heatable surface of the wall module and may heat the heating wire with the electrical power received from the power supply interface of the mounting frame in which the wall module is mounted.

[0341] An electrical power for heating the heating wire may be manually controlled via a control means provided

at a surface of the wall module, may be automatically controlled via a wired communication network, e.g. Ethernet, to which the wall module may be connected through a network access interface of the wall module, similar to the network access interface 77 of Fig. 7, and through a network access interface of a mounting frame in which the wall module is mounted, similar to the network access interface 72 of Fig. 7, or may be automatically controlled via a wireless communication network, e.g. Wi-Fi, a standard of the IEEE 802.11 family, Bluetooth, Bluetooth Low Energy, ZigBee, KNX, Homematic or Z-Wave, to which the wall module may be connected through an antenna of the wall module.

[0342] In some embodiments, the wall module is configured to control, based on a received control signal, at least one of a temperature of air surrounding the wall module, a temperature of the heatable surface and a schedule for heating the heatable surface.

[0343] For example, the control signal may include a control instruction for controlling the thermostat, valve or pump of the wall module for controlling the water flow velocity through the water pipe or for controlling the electrical power for heating the heating wire of the wall module, respectively, and may be received via the wired communication network, e.g. Ethernet, to which the wall module may be connected through a network access interface of the wall module, similar to the network access interface 77 of Fig. 7, and through a network access interface of a mounting frame in which the wall module is mounted, similar to the network access interface 72 of Fig. 7, or may be received via the wireless communication network, e.g. Wi-Fi, a standard of the IEEE 802.11 family, Bluetooth, Bluetooth Low Energy, ZigBee, KNX, Homematic or Z-Wave, to which the wall module may be connected through the antenna of the wall module.

[0344] Fig. 21 illustrates a wall module 210 of the set of wall modules that includes a heatable surface and a water pipe for heating the heatable surface according to an embodiment.

[0345] Part A of Fig. 21 shows a front view of the wall module 210. At a front side of the wall module 210, i.e. a side of the wall module 210 that is directed towards a room in which the wall module 210 is mounted, a heatable surface 211 is provided. A water pipe 212 is provided behind the heatable surface 211 such that, when warm water is conducted through the water pipe 212, a heat of the warm water is transferred through the water pipe 212 to the heatable surface 211 and the heatable surface 211 transfers the heat to the room in which the wall module 210 is mounted through heat conduction and through thermal radiation. The wall module 210 further includes an antenna 213 for receiving a control signal via IEEE 802.11ac (a standard of the IEEE 802.11 family), Bluetooth or ZigBee.

[0346] Part B of Fig. 21 shows a back view of the wall module 210. The wall module 210 includes a mounting structure 214 for mounting the wall module 210 in a mounting interface of a mounting frame of the set of mounting frames. The wall module 210 includes a temperature-controlled water interface 215 for receiving water with a predetermined temperature. When the wall module 210 is mounted in a mounting frame that includes a temperature-controlled water interface such as the temperature-controlled water interface 82 of Fig. 8, water with a predetermined temperature flows from the temperature-controlled water interface 82 of the mounting frame in which the wall module 210 is mounted through a flow line 215a of the temperature-controlled water interface 215 of the wall module 210, flows through a thermostat 216 of the wall module 210 for controlling a flow velocity of the water, flows through the water pipe 212 for heating the heatable surface 211 and flows back through a return flow 215b of the temperature-controlled water interface 215 of the wall module 210 to the temperature-controlled water interface 82 of the mounting frame in which the wall module 210 is mounted. A pump for causing the water to flow is provided separate from the wall module 210 and separate from the mounting frame in which the wall module 210 is mounted. The wall module 210 includes an RFID transponder 217 similar to the RFID transponder 45 of Fig. 5 as an identification interface for automatically identifying the wall module 210 and the protocols (IEEE 802.11ac, Bluetooth and ZigBee) supported by the wall module 210 when the wall module 210 is mounted in a mounting frame that includes an identification interface, e.g. the RFID transponder 42 of Fig. 5. The wall module 210 includes a power supply interface 218 similar to the power supply interface 61 of Fig. 6. When the wall module 210 is mounted in a mounting frame that includes a power supply interface, e.g. the power supply interface 51 of Fig. 6, the power supply interface 218 of the wall module 210 receives electrical power from the power supply interface 51 of the mounting frame. The wall module 210 includes a circuitry 219 for controlling the thermostat 216 based on a control signal received via the antenna 213. The circuitry 219 and the antenna 213 are provided with electrical power from the power supply interface 218.

[0347] Fig. 22 illustrates a wall module 220 of the set of wall modules that includes a heatable surface and a heating wire for heating the heatable surface according to an embodiment.

[0348] Part A of Fig. 22 shows a front view of the wall module 220. At a front side of the wall module 220, i.e. a side of the wall module 220 that is directed towards a room in which the wall module 220 is mounted, a heatable surface 221 is provided. A heating wire 222 is provided behind the heatable surface 221 such that, when an electrical current is conducted through the heating wire 222, the heating wire 222 heats the heatable surface 221, and the heatable surface 221 transfers the heat to the room in which the wall module 220 is mounted through heat conduction and through thermal radiation. The wall module 220 further includes an antenna 223 for receiving a control signal via IEEE 802.11ac (a standard of the IEEE 802.11 family), Bluetooth or ZigBee.

[0349] Part B of Fig. 22 shows a back view of the wall module 220. The wall module 220 includes a mounting structure 224 for mounting the wall module 220 in a mounting interface of a mounting frame of the set of mounting frames. The wall module 220 includes a power supply interface 225 similar to the power supply interface 61 of Fig. 6. When the wall module 220 is mounted in a mounting frame that includes a power supply interface, e.g. the power supply interface 51 of Fig. 6, the power supply interface 225 of the wall module 220 receives electrical power from the power supply interface 51 of the mounting frame. With the electrical power received by the power supply interface 225 of the wall module 220, the heating wire 222 is heated. The wall module 220 includes a circuitry 226 for controlling an electrical current that flows through the heating wire 222 and, accordingly, a heating power of the wall module 220, based on a control signal received via the antenna 223. The circuitry 226 and the antenna 223 are provided with electrical power from the power supply interface 225. The wall module 220 includes an RFID transponder 227 similar to the RFID transponder 45 of Fig. 5 as an identification interface for automatically identifying the wall module 220 and the protocols (IEEE 802.1 lac, Bluetooth and ZigBee) supported by the wall module 220 when the wall module 220 is mounted in a mounting frame that includes an identification interface, e.g. the RFID transponder 42 of Fig. 5.

Photovoltaic module

[0350] In some embodiments, the wall module includes a photovoltaic surface configured to generate electricity based on incident light.

[0351] The photovoltaic surface may be adapted to generate electricity upon exposure to light, e.g. daylight or direct sunlight, based on the photovoltaic effect, and may include a semiconductor such as silicon (e.g. monocrystalline or polycrystalline), cadmium telluride, copper indium gallium selenide, gallium arsenide, a perovskite, a quantum dot, an organic semiconductor or the like.

[0352] For example, the wall module may be mounted at a roof or at an outer wall of a building where it is exposed to direct sunlight.

[0353] For example, the wall module may be configured to feed the generated electricity through a power supply interface of the wall module and through a power supply interface of a mounting frame in which the wall module is mounted into a power supply system of a building in which the wall module is mounted and/or into a public power grid.

[0354] The wall module may include a transformer, an alternating current converter or the like for converting the generated electricity to a voltage, frequency and/or phase required by the power supply system and/or power grid into which the wall module feeds the generated electricity.

[0355] Fig. 23 illustrates a wall module 230 of the set of wall modules that includes a photovoltaic surface according to an embodiment.

[0356] Part A of Fig. 23 shows a front view of the wall module 230. At a front side of the wall module 230, i.e. a side of the wall module 230 opposite to a wall or roof at which the wall module 230 is mounted, a photovoltaic surface 231 is provided. The photovoltaic surface 231 includes a semiconductor that generates electricity upon exposure to light.

[0357] Part B of Fig. 23 shows a back view of the wall module 230. The wall module 230 includes a mounting structure 232 for mounting the wall module 230 in a mounting interface of a mounting frame of the set of mounting frames. The wall module 230 includes a conversion unit 233 that is powered by the electricity generated by the photovoltaic surface 231. The conversion unit 233 converts, with a transformer and an alternating current converter included in the conversion unit 233, the electricity generated by the photovoltaic surface 231 to a voltage, frequency and phase required by a power supply system of the building in which the wall module 230 is mounted. The wall module 230 includes a power supply interface 234 similar to the power supply interface 61 of Fig. 6. When the wall module 230 is mounted in a mounting frame that includes a power supply interface, e.g. the power supply interface 51 of Fig. 6, the conversion unit 233 determines a voltage, frequency and phase of the electrical power provided from the power supply interface 51 of the mounting frame to the power supply interface 234 of the wall module 230, converts the electricity generated by the photovoltaic surface 231 to the determined voltage, frequency and phase, and feeds the converted electrical power through the power supply interface 234 of the wall module 230 and through the power supply interface 51 of the mounting frame in which the wall module 230 is mounted into a power supply system of the building in which the wall module 230 is mounted. The wall module 230 includes an RFID transponder 235 similar to the RFID transponder 45 of Fig. 5 as an identification interface for automatically identifying the wall module 230 when the wall module 230 is mounted in a mounting frame that includes an identification interface, e.g. the RFID transponder 42 of Fig. 5.

Planting module

[0358] In some embodiments, the wall module includes a planting portion with a substrate for growing a plant.

[0359] For example, the wall module may be mounted on a floor, at a wall or on a roof for providing a living plant on the floor, at the wall or on the roof, respectively. The planting portion may include a compartment that is filled with the substrate and that has an opening at an upper side for planting a living plant in the substrate.

[0360] For example, the plant may include a tree, a climbing plant such as ivy or wine, a shrub such as box-

wood or privet, bamboo, a flower, grass or crops.

[0361] For example, the substrate may include potting soil, sand, gravel, expanded clay aggregate, rock wool, pumice, wood wool, polystyrene packing peanuts or the like.

[0362] In some embodiments, the wall module is configured to receive, from a water supply interface of a mounting frame of the set of mounting frames in which the wall module is mounted, water for humidifying the substrate.

[0363] In some embodiments, the wall module is configured to measure a humidity of the substrate and humidify the substrate if the measured humidity is below a predefined threshold.

[0364] For example, the wall module may allow to provide a living plant at a height or place that is difficult to access because the plant may be watered automatically such that the plant need not be accessed regularly for watering. Moreover, automatic watering may reduce an effort of maintaining the plant.

[0365] In some embodiments, the wall module is configured to measure a temperature of the substrate and heat the substrate with a heating unit of the wall module if the measured temperature is below a predefined threshold.

[0366] For example, the wall module may be mounted at an outer wall or on a roof and, thus, at an outdoor position, and may be exposed to cold weather. Heating the substrate may allow to prevent a frost damage to the plant if an outdoor temperature becomes too low, or may accelerate a plant growth if an outdoor temperature is lower than an optimal growth temperature of the plant.

[0367] In some embodiments, the wall module is configured to receive, from a temperature-controlled water interface of a mounting frame of the set of mounting frames in which the wall module is mounted, a flow line of water with a predetermined temperature for heating the substrate with the heating unit, and return a return flow of used water to the temperature-controlled water interface of the mounting frame.

[0368] The predetermined temperature of the water may be chosen higher than a minimum temperature below which the plant may be damaged or impeded in its growth.

[0369] In some embodiments, the wall module is configured to receive, from a power supply interface of a mounting frame of the set of mounting frames in which the wall module is mounted, electrical power for heating the substrate with the heating unit.

[0370] Thus, the substrate may be heated electrically to a predetermined temperature.

[0371] In some embodiments, the wall module includes a fertilizer reservoir and is configured to provide fertilizer from the fertilizer reservoir to the substrate based on a predetermined instruction.

[0372] For example, a fertilizer may be provided automatically for improving a growth and/or a vitality of a plant planted in the substrate without having to physically visit the wall module. This may facilitate providing a plant at a height and/or position that is difficult to access.

[0373] The wall module may receive the predetermined instruction for providing the fertilizer to the substrate via a connection to a wired communication network such as Ethernet or via a connection to a wireless communication network such as Wi-Fi, a standard of the IEEE 802.11 family, Bluetooth, Bluetooth Low Energy, ZigBee, KNX, Homematic or Z-Wave. The predetermined instruction for providing the fertilizer to the substrate may be stored in a control circuitry of the wall module, e.g. for providing the fertilizer based on a time schedule.

[0374] Fig. 24 illustrates a wall module 240 of the set of wall modules that includes a planting portion with a substrate for growing a plant according to an embodiment.

[0375] Part A of Fig. 24 shows a front view of the wall module 240. The wall module 240 includes a compartment 241 that is filled with a substrate 242 and that has an opening at an upper side for growing a living plant 243 in the substrate 242. The substrate 242 includes potting soil. The plant 243 is planted in the substrate 242. The wall module 240 includes a water outlet 244 for humidifying the substrate 242. The wall module 240 includes a humidity and temperature sensor 245 in the substrate 242 for measuring a humidity and a temperature of the substrate 242. The wall module 240 further includes a water pipe 246 in a shell of the compartment 241 for heating the substrate 242 with warm water that flows through the water pipe 246. The wall module 240 includes a photovoltaic unit 247 configured to generate electricity from incident daylight or sunlight, a fertilizer reservoir 248 and an antenna 249 configured to communicate with a wireless communication network according to the IEEE 802.11ac standard, Bluetooth, Bluetooth Low Energy or ZigBee.

[0376] Part B of Fig. 24 shows a back view of the wall module 240. The wall module 240 includes a mounting structure 250 for mounting the wall module 240 in a mounting interface of a mounting frame of the set of mounting frames. The wall module 240 includes a water supply interface 251 similar to the water supply interface 97 of Fig. 9 for receiving water from a water supply interface such as the water supply interface 92 of Fig. 9 included in a mounting frame in which the wall module 240 is mounted. The wall module 240 includes a regulation and mixing unit 252 for regulating an amount of water received by the water supply interface 251 that flows through the water outlet 244 to the substrate 242 and for mixing a predetermined amount of fertilizer from the fertilizer reservoir 248 into the water that flows from the water supply interface 251 to the water outlet 244. The wall module 240 includes a temperature-controlled water interface 253 similar to the temperature-controlled water interface 87 of Fig. 8 for receiving, at a flow line 253a of the temperature-controlled water interface 253, water with a predetermined temperature that is warm enough for heating the substrate 242 to a predetermined mini-

mum temperature that is necessary for a vitality of the plant 243. When the wall module 240 is mounted in a mounting frame that includes a temperature-controlled water interface such as the temperature-controlled water interface 82 of Fig. 8, water with the predetermined temperature flows from the temperature-controlled water interface 82 of the mounting frame through the flow line 253a of the temperature-controlled water interface 253 to a thermostat 254 of the wall module 240. The thermostat 254 regulates a flow velocity of the water with the predetermined temperature. From the thermostat 254, the water with the predetermined temperature flows through the water pipe 246 for heating the substrate 242. From the water pipe 246, the water flows through a return flow 253b of the temperature-controlled water interface 253 of the wall module 240 back to the temperature-controlled water interface 82 of the mounting frame. The water with the predetermined temperature is brought to the predetermined temperature by a heating unit provided separately from the wall module 240 and is caused to flow through the temperature-controlled water interface 253, through the thermostat 254 and through the water pipe 246 by a pump that is provided separately from the wall module 240. The wall module 240 includes an accumulator 255 that stores the electrical energy generated by the photovoltaic unit 247 and supplies electrical power to the humidity and temperature sensor 245, the antenna 249, the regulation and mixing unit 252, the thermostat 254 and a control circuitry 256 of the wall module 240. The wall module 240 includes an RFID transponder 257 similar to the RFID transponder 45 of Fig. 5 as an identification interface for automatically identifying the wall module 240 and the protocols (IEEE 802.11ac standard, Bluetooth, Bluetooth Low Energy or ZigBee) supported by the antenna 249 when the wall module 240 is mounted in a mounting frame that includes an identification interface, e.g. the RFID transponder 42 of Fig. 5.

[0377] The control circuitry 256 receives via the antenna 249 from the wireless communication network an indication of a predefined threshold of a humidity of the substrate 242, an indication of a predefined threshold of a temperature of the substrate 242 and a predetermined instruction for providing fertilizer to the substrate 242. The control circuitry 256 causes the regulation and mixing unit 252 to control an amount of water provided to the water outlet 244 in accordance with the received predefined threshold of the humidity of the substrate 242 and based on the humidity of the substrate 242 measured by the humidity and temperature sensor 245. The control circuitry 256 causes the thermostat 254 to control the flow velocity of the water with the predetermined temperature in accordance with the received predefined threshold of the temperature of the substrate 242 and based on the temperature of the substrate 242 measured by the humidity and temperature sensor 245. The control circuitry 256 causes the regulation and mixing unit 252 to provide fertilizer from the fertilizer reservoir 248 to the water from the water supply interface 251 in accordance with the received predetermined instruction.

[0378] Due to the photovoltaic unit 247 and the accumulator 255, the wall module 240 does not require an external electrical power supply.

[0379] It is noted that in some embodiments, the wall module 240 includes, instead of the water pipe 246, a heating wire for heating the substrate 242 and includes, instead of the temperature-controlled water interface 253, a power supply interface similar to the power supply interface 79 of Fig. 7 for receiving electrical power from a power supply interface such as the power supply interface 74 of Fig. 7 of a mounting frame in which the wall module 240 is mounted. In such a case, the photovoltaic unit 247, the accumulator 255 and/or the thermostat 254 may be omitted.

General remarks

[0380] It should be recognized that the embodiments describe mounting frames and/or wall modules that include an exemplary combination of interfaces. The specific combinations of interfaces in a mounting frame and/or in a wall module is however given for illustrative purposes only and should not be construed as binding. For example, all mounting frames of the set of mounting frames may include any of an identification interface such as the identification interface 42 of Fig. 5, a power supply interface such as the power supply interface 51 of Fig. 6, a network access interface such as the network access interface 72 of Fig. 7, a temperature-controlled water interface such as the temperature-controlled water interface 82 of Fig. 8, and a water supply interface such as the water supply interface 92 of Fig. 9. In some embodiments, all mounting frames of the set of mounting frames include an identification interface such as the identification interface 42 of Fig. 5. In some embodiments, a mounting frame of the set of mounting frames does not include an identification interface such as the identification interface. Also, all wall modules of the set of wall modules may include any of an identification interface such as the identification interface 45 of Fig. 5, a power supply interface such as the power supply interface 61 of Fig. 6, a network access interface such as the network access interface 77 of Fig. 7, a temperature-controlled water interface such as the temperature-controlled water interface 87 of Fig. 8, and a water supply interface such as the water supply interface 97 of Fig. 9. In some embodiments, all wall modules of the set of wall modules include an identification interface such as the identification interface 45 of Fig. 5. In some embodiments, a wall module of the set of wall modules does not include an identification interface. A combination of interfaces included in a mounting frame of the set of mounting frames and/or in a wall module of the set of wall modules may be apparent to the skilled person.

[0381] In some embodiments, a wall module of the set of wall modules that includes a specific interface may be mounted in a mounting frame of the set of mounting

frames that does not include a corresponding interface. A behaviour and/or function of the wall module in such a case may be apparent to the skilled person. For example, the wall module may provide all functions that do not depend on the specific interface, may issue a warning or may not work at all. In some embodiments, a mounting frame of the set of mounting frames that includes a specific interface may accept mounting in the mounting frame a wall module of the set of wall modules that does not include a corresponding interface. In some embodiments, it may not be possible to mount a wall module of the set of wall modules that includes a specific interface in a mounting frame of the set of mounting frames that does not include a corresponding interface. In some embodiments, it may not be possible to mount, in a mounting frame of the set of mounting frames that includes a specific interface, a wall module of the set of wall modules that does not include a corresponding interface.

[0382] Please note that the control unit 155 of Fig. 15, the circuitry 168 of Fig. 16, the circuitry 176 of Fig. 17, the circuitry 189 of Fig. 18, the circuitry 208 of Fig. 20, the circuitry 219 of Fig. 21, the circuitry 226 of Fig. 22, and the control circuitry 256 of Fig. 24 are not limited to any specific division of functions in specific units. For instance, the control unit 155 of Fig. 15, the circuitry 168 of Fig. 16, the circuitry 176 of Fig. 17, the circuitry 189 of Fig. 18, the circuitry 208 of Fig. 20, the circuitry 219 of Fig. 21, the circuitry 226 of Fig. 22, and the control circuitry 256 of Fig. 24 could be implemented by a respective programmed processor, field programmable gate array (FPGA) and the like.

[0383] Note that the present technology can also be configured as described below.

(1) A modular wall system, comprising:

a set of wall modules; and
a set of mounting frames for mounting the wall modules, wherein each of the mounting frames has a unit size and unit shape;
wherein each mounting frame of the set of mounting frames includes a mounting interface adapted to releasably mount a wall module; and
wherein each wall module of the set of wall modules has a size and shape adapted to the unit size and unit shape of the set of mounting frames and includes a mounting structure for releasably connecting with the mounting interface of a mounting frame.

(2) The modular wall system of (1), further comprising a framework on which a group of mounting frames of the set of mounting frames is arranged in an array.

(3) The modular wall system of (2), wherein the array includes at least two rows.

(4) The modular wall system of (2) or (3), wherein the array includes at least two columns.

(5) The modular wall system of any one of (2) to (4), wherein the framework is adapted to be installed vertically for providing a wall.

(6) The modular wall system of any one of (2) to (4), wherein the framework is adapted to be installed horizontally for providing a ceiling.

(7) The modular wall system of any one of (2) to (4), wherein the framework is adapted to be installed horizontally for providing a floor.

(8) The modular wall system of any one of (2) to (4), wherein the framework is adapted to be installed diagonally for providing a roof.

(9) The modular wall system of any one of (2) to (4), wherein the framework is adapted to be installed horizontally for providing a flat roof.

(10) The modular wall system of any one of (2) to (9), wherein the group of mounting frames is arranged on the framework such that wall modules of the set of wall modules mounted in adjacent mounting frames of the group of mounting frames are in direct contact to each other.

(11) The modular wall system of any one of (2) to (10), wherein the framework includes a power cable for providing at least one mounting frame of the group of mounting frames with electrical power.

(12) The modular wall system of any one of (2) to (11), wherein the framework includes a network cable for providing at least one mounting frame of the group of mounting frames with communication network access.

(13) The modular wall system of any one of (2) to (12), wherein the framework includes a tubing for providing at least one mounting frame of the group of mounting frames with a flow line of water with a predetermined temperature and receiving from the at least one mounting frame a return flow of used water.

(14) The modular wall system of any one of (2) to (13), wherein the framework includes a tubing for providing at least one mounting frame of the group of mounting frames with water.

(15) A mounting frame for the set of mounting frames of the modular wall system of any one of (1) to (14), wherein the mounting frame has a unit size and unit shape and includes a mounting interface adapted to

releasably mount a wall module of the set of wall modules of the modular wall system.

(16) The mounting frame of (15), wherein the mounting interface of the mounting frame is configured to release a mounted wall module of the set of wall modules when a release action is received.

(17) The mounting frame of (16), wherein the releasing of the mounted wall module includes unlocking the mounted wall module such that it can be taken out of the mounting frame.

(18) The mounting frame of (16) or (17), wherein the releasing of the mounted wall module includes ejecting the mounted wall module such that it is, at least partially, moved out of the mounting frame.

(19) The mounting frame of any one of (16) to (18), wherein the release action includes moving, by a user, a holding member of the mounting interface.

(20) The mounting frame of any one of (16) to (19), wherein the release action includes driving an activator of the mounting interface.

(21) The mounting frame of any one of (16) to (20), wherein the release action includes applying a magnetic field to the mounting interface.

(22) The mounting frame of any one of (15) to (21), wherein the mounting frame includes an identification interface configured to receive identification information of a wall module of the set of wall modules mounted in the mounting frame.

(23) The mounting frame of (22), wherein the identification information of the mounted wall module indicates at least one of a type of the mounted wall module and specifications of the mounted wall module.

(24) The mounting frame of (23),

wherein the type of the mounted wall module includes a size of the mounted wall module; and

wherein the mounting frame is configured to provide an indication of the size of the mounted wall module to a control unit that controls at least the mounting frame for determining a mounting frame covered by the mounted wall module.

(25) The mounting frame of (23) or (24),

wherein the specifications of the mounted wall module include an indication of an interface of the mounted wall module; and

wherein the mounting frame is configured to activate a corresponding interface of the mounting frame.

(26) The mounting frame of any one of (23) to (25),

wherein the specifications of the mounted wall module include a weight of the mounted wall module; and
wherein the mounting frame is configured to provide an indication of the weight of the mounted wall module to a control unit that controls the mounting frame for determining whether the weight of the mounted wall module exceeds a weight limit of the mounting frame.

(27) The mounting frame of any one of (23) to (26),

wherein the specifications of the mounted wall module include a wattage of the mounted wall module; and
wherein the mounting frame is configured to provide an indication of the wattage of the mounted wall module to a control unit that controls the mounting frame for determining whether the wattage of the mounted wall module exceeds an electrical power limit of the mounting frame.

(28) The mounting frame of any one of (23) to (27),

wherein the specifications of the mounted wall module include a communication protocol supported by the mounted wall module; and
wherein the mounting frame is configured to provide an indication of the communication protocol supported by the mounted wall module to a communication unit of the modular wall system for establishing a communication connection with the mounted wall module.

(29) The mounting frame of any one of (15) to (28), wherein the mounting frame includes an identification interface configured to transmit identification information of the mounting frame to a wall module of the set of wall modules mounted in the mounting frame.

(30) The mounting frame of (29), wherein the identification information of the mounting frame indicates at least one of a relative position of the mounting frame among the set of mounting frames and specifications of the mounting frame.

(31) The mounting frame of any one of (22) to (30), wherein the identification interface includes an electrode for establishing an electrical contact to an electrode of an identification interface of the mounted wall module.

(32) The mounting frame of any one of (22) to (31), wherein the identification interface includes a radio-frequency identification transponder for wireless communication with an identification interface of the mounted wall module.

(33) The mounting frame of any one of (15) to (32), wherein the mounting frame includes a power supply interface configured to provide electrical power to a wall module of the set of wall modules mounted in the mounting frame.

(34) The mounting frame of (33), wherein the power supply interface is configured to provide mains power to a wall module of the set of wall modules mounted in the mounting frame.

(35) The mounting frame of (33) or (34), wherein the power supply interface is configured to provide an Extra-Low Voltage power to a wall module of the set of wall modules mounted in the mounting frame.

(36) The mounting frame of any one of (33) to (35),

wherein the power supply interface includes a power supply control interface configured to receive a voltage request from a wall module of the set of wall modules mounted in the mounting frame, the voltage request indicating a voltage of a plurality of predefined voltages; and
wherein the power supply interface is configured to provide to the wall module mounted in the mounting frame the voltage indicated by the voltage request.

(37) The mounting frame of any one of (15) to (36), wherein the mounting frame includes a network access interface configured to provide communication network access to a wall module of the set of wall modules mounted in the mounting frame.

(38) The mounting frame of any one of (15) to (37), wherein the mounting frame includes a temperature-controlled water interface configured to:

provide a flow line of water with a predetermined temperature to a wall module of the set of wall modules mounted in the mounting frame; and
receive a return flow of used water from the mounted wall module.

(39) The mounting frame of any one of (15) to (38), wherein the mounting frame includes a water supply interface configured to provide water to a wall module of the set of wall modules mounted in the mounting frame.

(40) A wall module for the set of wall modules of the modular wall system of any one of (1) to (14), wherein the wall module has a size and shape adapted to the unit size and unit shape of the set of mounting frames of the modular wall system and includes a mounting structure for releasably connecting with a mounting interface of a mounting frame according to any one of (15) to (39).

(41) The wall module of (40), wherein the wall module has a size and shape corresponding to the unit size and unit shape of the set of mounting frames of the modular wall system.

(42) The wall module of (40), wherein the wall module has a size and shape corresponding to an integer multiple of the unit size and unit shape of the set of mounting frames of the modular wall system.

(43) The wall module of (42), wherein the wall module includes another mounting structure for releasably connecting with a mounting interface of another mounting frame according to any one of (15) to (39).

(44) The wall module of any one of (40) to (43), wherein the wall module is adapted to waterproofly seal a mounting frame of the set of mounting frames in which the wall module is mounted.

(45) The wall module of any one of (40) to (44), wherein the wall module is adapted to waterproofly seal an interspace between the wall module and another wall module mounted in an adjacent mounting frame.

(46) The wall module of any one of (40) to (45), wherein the wall module is adapted to reduce a thermal transfer through the wall module.

(47) The wall module of any one of (40) to (46), wherein the wall module is adapted to reduce a sound transmitted through the wall module.

(48) The wall module of any one of (40) to (47), wherein the wall module is adapted to provide a closable opening through the wall module.

(49) The wall module of (48), wherein the closable opening includes at least one of a door and a window.

(50) The wall module of (48) or (49),

wherein a size of the wall module corresponds to the unit size of the set of mounting frames; and

the opening extends through a mounting frame of the set of mounting frames in which the wall module is mounted.

(51) The wall module of (48) or (49),

wherein a size of the wall module corresponds to an integer multiple of the unit size of the set of mounting frames; and
the opening is provided in a portion of the wall module in which no mounting structure is provided.

(52) The wall module of any one of (40) to (51), wherein the wall module is adapted to provide an anchorage for attaching an object.

(53) The wall module of (52), wherein the attaching of the object includes hanging the object to a surface of the wall module.

(54) The wall module of (52),

wherein the object is standing on a floor; and
wherein the attaching of the object includes preventing the object from tilting.

(55) The wall module of any one of (40) to (54), wherein the wall module is configured to transmit identification information of the wall module to a mounting frame of the set of mounting frames in which the wall module is mounted.

(56) The wall module of (55), wherein the identification information of the wall module indicates at least one of a type of the wall module and specifications of the wall module.

(57) The wall module of (56), wherein the type of the wall module includes a size of the wall module.

(58) The wall module of (56) or (57), wherein the specifications of the wall module include an indication of an interface of the wall module.

(59) The wall module of any one of (56) to (58), wherein the specifications of the wall module include a weight of the wall module.

(60) The wall module of any one of (56) to (59), wherein the specifications of the wall module include a wattage of the wall module.

(61) The wall module of any one of (56) to (60), wherein the specifications of the wall module include a communication protocol supported by the wall module.

(62) The wall module of any one of (40) to (61), wherein the wall module is configured to:

receive electrical power from a power supply interface of a mounting frame of the set of mounting frames in which the wall module is mounted; and
provide the received electrical power to a device coupled to the wall module.

(63) The wall module of (62),

wherein the wall module includes a plug socket; and
wherein coupling the device to the wall module includes inserting a power plug of the device into the plug socket of the wall module.

(64) The wall module of (62) or (63),

wherein the wall module includes an induction coil; and
wherein coupling the device to the wall module includes placing a reception coil of the device in a coverage range of the induction coil.

(65) The wall module of any one of (62) to (64), wherein the wall module is configured to:

receive, from a device coupled to the wall module, a request of an electrical power characteristic including at least one of a voltage, a current, a power and a frequency; and
provide, to the coupled device, electrical power based on the requested electrical power characteristic.

(66) The wall module of any one of (40) to (65), wherein the wall module is configured to provide, to a device coupled to the wall module, access to a communication network via a network access interface of a mounting frame of the set of mounting frames in which the wall module is mounted.

(67) The wall module of (66),

wherein the wall module includes a network socket; and
coupling the device to the wall module includes inserting a network plug of the device into the network socket.

(68) The wall module of (66) or (67), wherein the providing of access to the communication network includes providing a wireless access point.

(69) The wall module of any one of (40) to (68), wherein the wall module is configured to emit light.

(70) The wall module of (69), wherein the wall module is configured to generate light based on an electrical power received from a power supply interface of a

mounting frame of the set of mounting frames in which the wall module is mounted.

(71) The wall module of (69) or (70), wherein the wall module is configured to control a characteristic of the emitted light based on a received control instruction;
wherein the characteristic of the emitted light includes at least one of a brightness, a color temperature, a color and a hue of the emitted light.

(72) The wall module of (71), wherein the wall module is configured to receive the control instruction by detecting a change of an electrical power provided by a power supply interface of a mounting frame of the set of mounting frames in which the wall module is mounted.

(73) The wall module of (71) or (72), wherein the wall module is configured to receive the control instruction via a network access interface of a mounting frame of the set of mounting frames in which the wall module is mounted.

(74) The wall module of any one of (71) to (73), wherein the wall module is configured to receive the control instruction via an infrared communication interface.

(75) The wall module of any one of (71) to (74), wherein the wall module is configured to receive the control instruction via a wireless communication network.

(76) The wall module of any one of (71) to (75), wherein the wall module is configured to receive the control instruction based on a spoken command from a user.

(77) The wall module of any one of (40) to (76), wherein the wall module is configured to display an image.

(78) The wall module of (77), wherein the image is based on image data received by the wall module via a network access interface of a mounting frame of the set of mounting frames in which the wall module is mounted.

(79) The wall module of (77) or (78), wherein the image is based on image data received by the wall module via a wireless communication connection.

(80) The wall module of any one of (77) to (79), wherein the image is based on image data received by the wall module via a display cable plugged into a display plug socket of the wall module.

(81) The wall module of any one of (77) to (80), wherein the wall module is configured to control a characteristic of the image based on a control signal;
wherein the characteristic of the image includes a brightness, a luminance, a color saturation and a gamma correction.

(82) The wall module of (81), wherein the wall module is configured to receive the control signal via a network access interface of a mounting frame of the set of mounting frames in which the wall module is mounted.

(83) The wall module of (81) or (82), wherein the wall module is configured to receive the control signal via a wireless communication connection.

(84) The wall module of any one of (81) to (83), wherein the wall module is configured to receive the control signal based on a spoken command from a user.

(85) The wall module of any one of (77) to (84), wherein the wall module is configured to display a portion of the image based on a relative position of the wall module to another wall module of the set of wall modules configured to display an image.

(86) The wall module of any one of (77) to (85), wherein the wall module is configured to emit dissipated heat through a display surface of the wall module.

(87) The wall module of any one of (77) to (86), wherein the wall module is configured to:

receive, via a temperature-controlled water interface of a mounting frame of the set of mounting frames in which the display module is mounted, a flow line of water with a predetermined temperature for leading off dissipated heat; and
return a return flow of used water to the temperature-controlled water interface of the mounting frame.

(88) The wall module of any one of (40) to (87), wherein the wall module is configured to provide water from a water supply interface of a mounting frame of the set of mounting frames in which the wall module is mounted.

(89) The wall module of any one of (40) to (88), wherein the wall module is configured to:

measure a smoke concentration in surrounding air; and
detect an alarm event if the measured smoke concentration exceeds a predefined smoke

threshold.

(90) The wall module of (89), wherein the wall module is configured to:

measure a carbon monoxide concentration in the surrounding air; and
detect an alarm event if the measured carbon monoxide concentration exceeds a predefined carbon monoxide threshold.

(91) The wall module of (89) or (90), wherein the wall module is configured to emit an alarm sound if an alarm event is detected.

(92) The wall module of any one of (89) to (91), wherein the wall module is configured to cause another wall module of the set of wall modules that is configured to emit light to emit light if an alarm event is detected.

(93) The wall module of any one of (40) to (92), wherein the wall module includes a heatable surface for heating a room.

(94) The wall module of (93), wherein the wall module is configured to:

receive, from a temperature-controlled water interface of a mounting frame of the set of mounting frames in which the wall module is mounted, a flow line of water with a predetermined temperature for heating the heatable surface; and
return a return flow of used water to the temperature-controlled water interface of the mounting frame.

(95) The wall module of (93) or (94), wherein the wall module is configured to receive, from a power supply interface of a mounting frame of the set of mounting frames in which the wall module is mounted, electrical power for heating the heatable surface with an electrical heating element.

(96) The wall module of any one of (93) to (95), wherein the wall module is configured to control, based on a received control signal, at least one of a temperature of air surrounding the wall module, a temperature of the heatable surface and a schedule for heating the heatable surface.

(97) The wall module of any one of (40) to (96), wherein the wall module includes a photovoltaic surface configured to generate electricity based on incident light.

(98) The wall module of any one of (40) to (97), wherein the wall module includes a planting portion with a substrate for growing a plant.

(99) The wall module of (98), wherein the wall module is configured to receive, from a water supply interface of a mounting frame of the set of mounting frames in which the wall module is mounted, water for humidifying the substrate.

(100) The wall module of (99), wherein the wall module is configured to:

measure a humidity of the substrate; and
humidify the substrate if the measured humidity is below a predefined threshold.

(101) The wall module of any one of (98) to (100), wherein the wall module is configured to:

measure a temperature of the substrate; and
heat the substrate with a heating unit of the wall module if the measured temperature is below a predefined threshold.

(102) The wall module of (101), wherein the wall module is configured to:

receive, from a temperature-controlled water interface of a mounting frame of the set of mounting frames in which the wall module is mounted, a flow line of water with a predetermined temperature for heating the substrate with the heating unit, and
return a return flow of used water to the temperature-controlled water interface of the mounting frame.

(103) The wall module of (101) or (102), wherein the wall module is configured to receive, from a power supply interface of a mounting frame of the set of mounting frames in which the wall module is mounted, electrical power for heating the substrate with the heating unit.

(104) The wall module of any one of (98) to (103), wherein the wall module includes a fertilizer reservoir and is configured to provide fertilizer from the fertilizer reservoir to the substrate based on a predetermined instruction.

Claims

1. A modular wall system, comprising:

a set of wall modules; and
a set of mounting frames for mounting the wall modules, wherein each of the mounting frames has a unit size and unit shape;

wherein each mounting frame of the set of mounting frames includes a mounting interface adapted to releasably mount a wall module; and
wherein each wall module of the set of wall modules has a size and shape adapted to the unit size and unit shape of the set of mounting frames and includes a mounting structure for releasably connecting with the mounting interface of a mounting frame.

2. The modular wall system of claim 1, further comprising a framework on which a group of mounting frames of the set of mounting frames is arranged in an array.

3. A mounting frame for a set of mounting frames of a modular wall system,

wherein the modular wall system comprises:

a set of wall modules; and
the set of mounting frames for mounting the wall modules, wherein each of the mounting frames has a unit size and unit shape;
wherein each mounting frame of the set of mounting frames includes a mounting interface adapted to releasably mount a wall module; and
wherein each wall module of the set of wall modules has a size and shape adapted to the unit size and unit shape of the set of mounting frames and includes a mounting structure for releasably connecting with the mounting interface of a mounting frame; and

wherein the mounting frame has a unit size and unit shape and includes a mounting interface adapted to releasably mount a wall module of the set of wall modules of the modular wall system.

4. The mounting frame of claim 3, wherein the mounting frame includes an identification interface configured to receive identification information of a wall module of the set of wall modules mounted in the mounting frame.

5. The mounting frame of claim 3, wherein the mounting frame includes a power supply interface configured to provide electrical power to a wall module of the set of wall modules mounted in the mounting frame.

6. The mounting frame of claim 3, wherein the mounting frame includes a network access interface configured to provide communication network access to a wall module of the set of wall modules mounted in the mounting frame.

7. The mounting frame of claim 3, wherein the mounting frame includes a temperature-controlled water interface configured to:

provide a flow line of water with a predetermined temperature to a wall module of the set of wall modules mounted in the mounting frame; and
receive a return flow of used water from the mounted wall module.

8. The mounting frame of claim 3, wherein the mounting frame includes a water supply interface configured to provide water to a wall module of the set of wall modules mounted in the mounting frame.

9. A wall module for a set of wall modules of a modular wall system,

wherein the modular wall system comprises:

the set of wall modules; and
a set of mounting frames for mounting the wall modules, wherein each of the mounting frames has a unit size and unit shape;
wherein each mounting frame of the set of mounting frames includes a mounting interface adapted to releasably mount a wall module; and
wherein each wall module of the set of wall modules has a size and shape adapted to the unit size and unit shape of the set of mounting frames and includes a mounting structure for releasably connecting with the mounting interface of a mounting frame; and

wherein the wall module has a size and shape adapted to the unit size and unit shape of the set of mounting frames of the modular wall system and includes a mounting structure for releasably connecting with a mounting interface of a mounting frame of the set of mounting frames.

10. The wall module of claim 9, wherein the wall module is adapted to waterproofly seal a mounting frame of the set of mounting frames in which the wall module is mounted.

11. The wall module of claim 9, wherein the wall module is adapted to waterproofly seal an interspace between the wall module and another wall module mounted in an adjacent mounting frame.

12. The wall module of claim 9, wherein the wall module is adapted to reduce a thermal transfer through the wall module.

13. The wall module of claim 9, wherein the wall module is adapted to reduce a sound transmitted through the wall module.

14. The wall module of claim 9, wherein the wall module is adapted to provide a closable opening through the wall module.

15. The wall module of claim 9, wherein the wall module is adapted to provide an anchorage for attaching an object.

16. The wall module of claim 9, wherein the wall module is configured to:

receive electrical power from a power supply interface of a mounting frame of the set of mounting frames in which the wall module is mounted; and
provide the received electrical power to a device coupled to the wall module.

17. The wall module of claim 9, wherein the wall module is configured to provide, to a device coupled to the wall module, access to a communication network via a network access interface of a mounting frame of the set of mounting frames in which the wall module is mounted.

18. The wall module of claim 9, wherein the wall module is configured to emit light.

19. The wall module of claim 9, wherein the wall module is configured to display an image.

20. The wall module of claim 19, wherein the wall module is configured to display a portion of the image based on a relative position of the wall module to another wall module of the set of wall modules configured to display an image.

21. The wall module of claim 9, wherein the wall module is configured to provide water from a water supply interface of a mounting frame of the set of mounting frames in which the wall module is mounted.

22. The wall module of claim 9, wherein the wall module is configured to:

measure a smoke concentration in surrounding air; and
detect an alarm event if the measured smoke concentration exceeds a predefined smoke threshold.

23. The wall module of claim 9, wherein the wall module includes a heatable surface for heating a room.

24. The wall module of claim 9, wherein the wall module includes a photovoltaic surface configured to generate electricity based on incident light.

25. The wall module of claim 9, wherein the wall module includes a planting portion with a substrate for growing a plant.

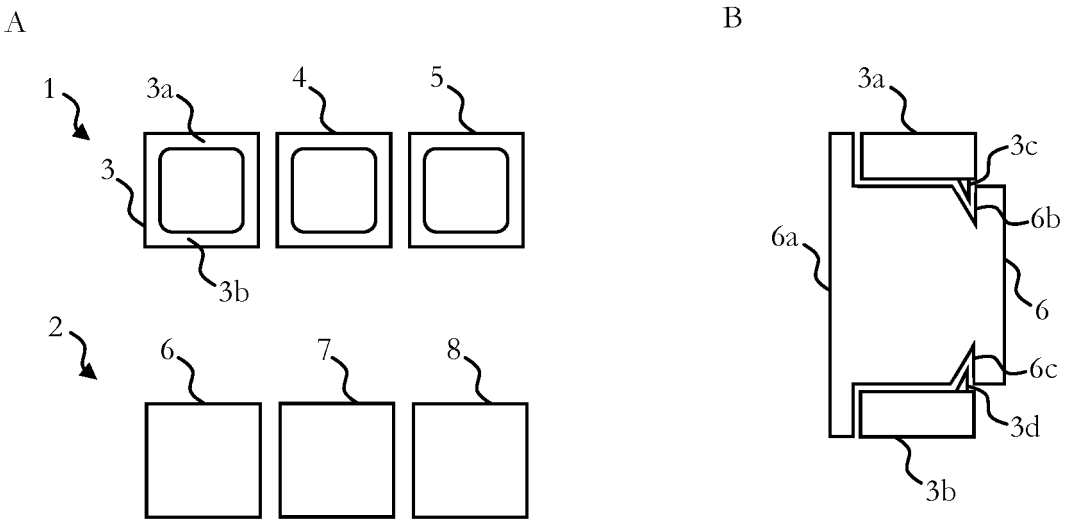
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Fig. 1

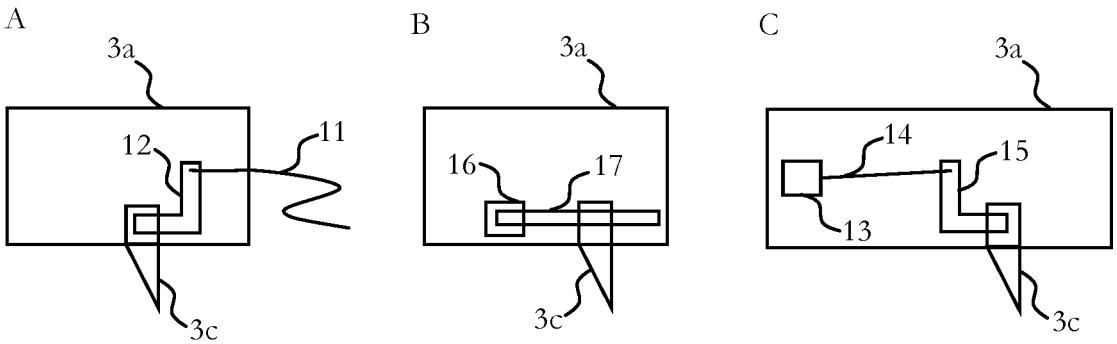
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Fig. 2

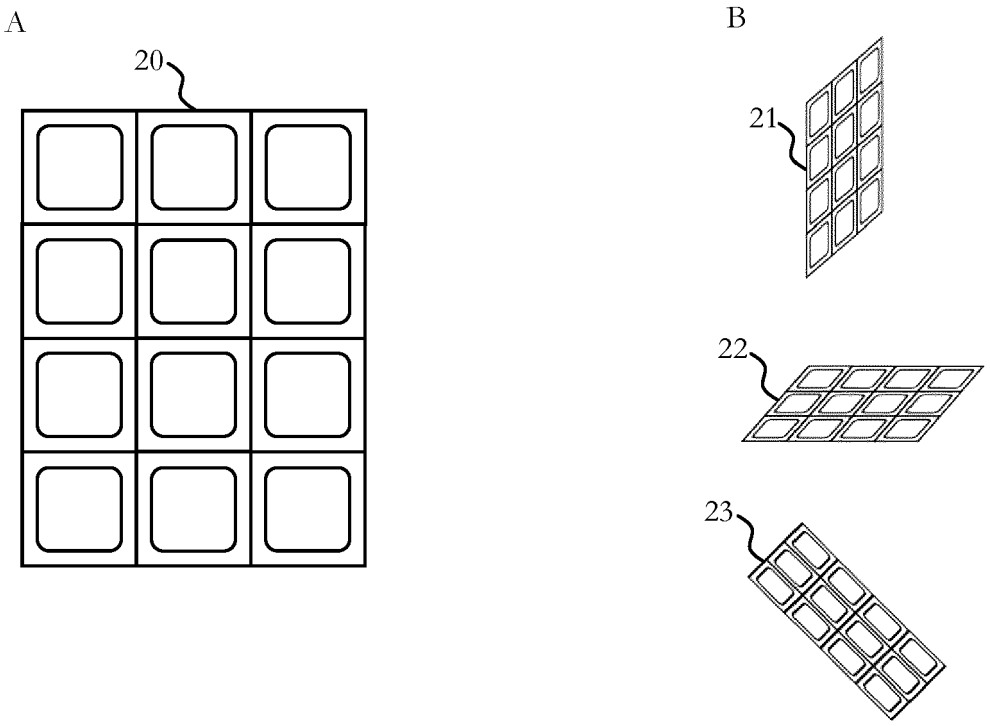


Fig. 3

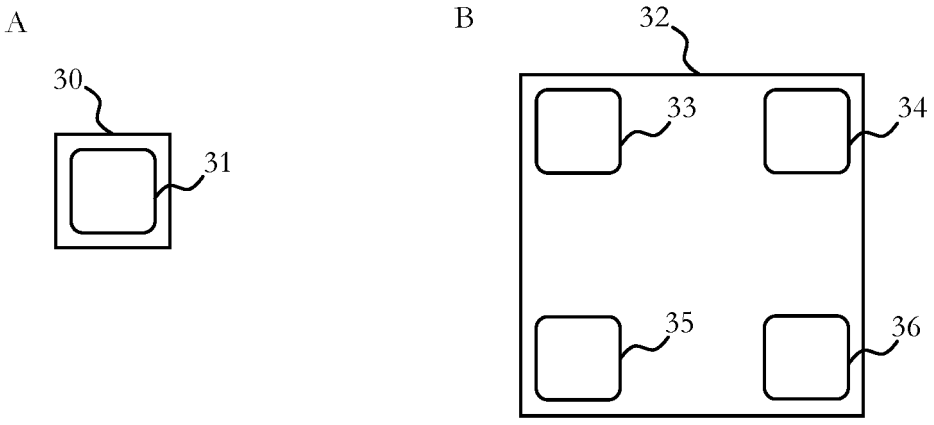


Fig. 4

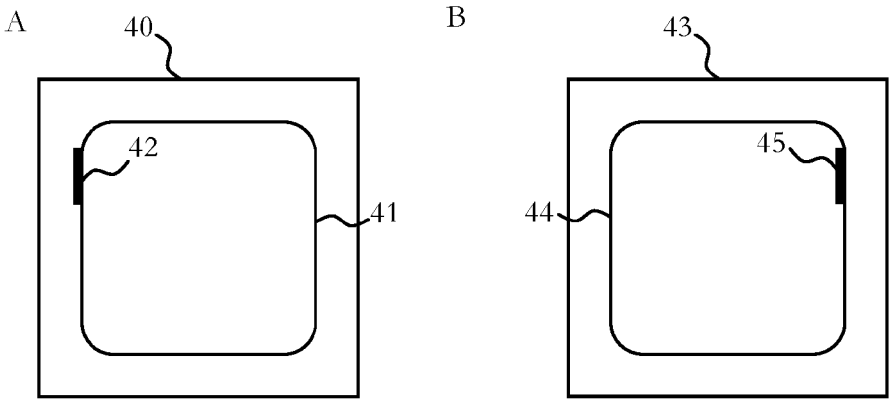


Fig. 5

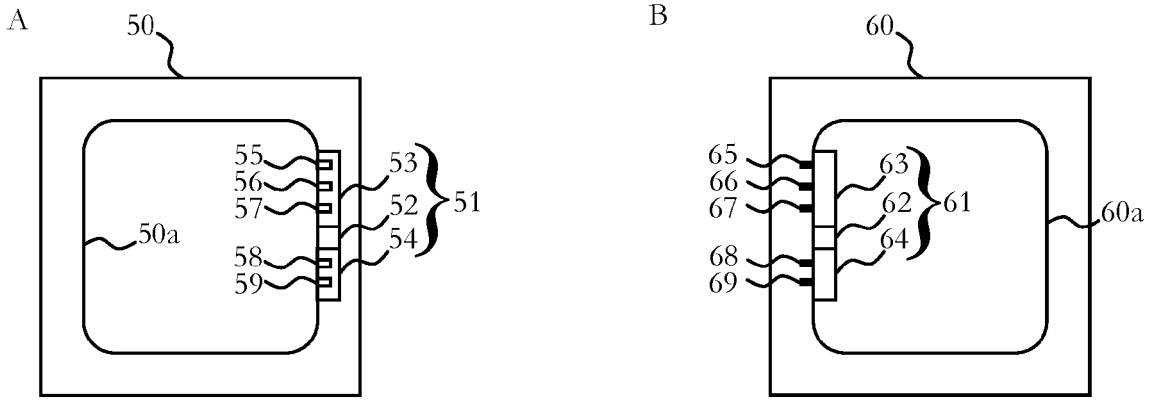


Fig. 6

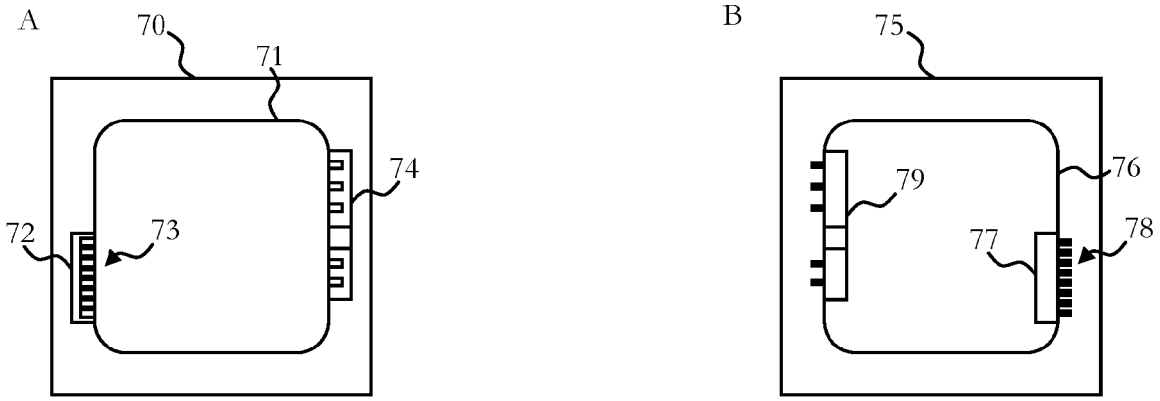
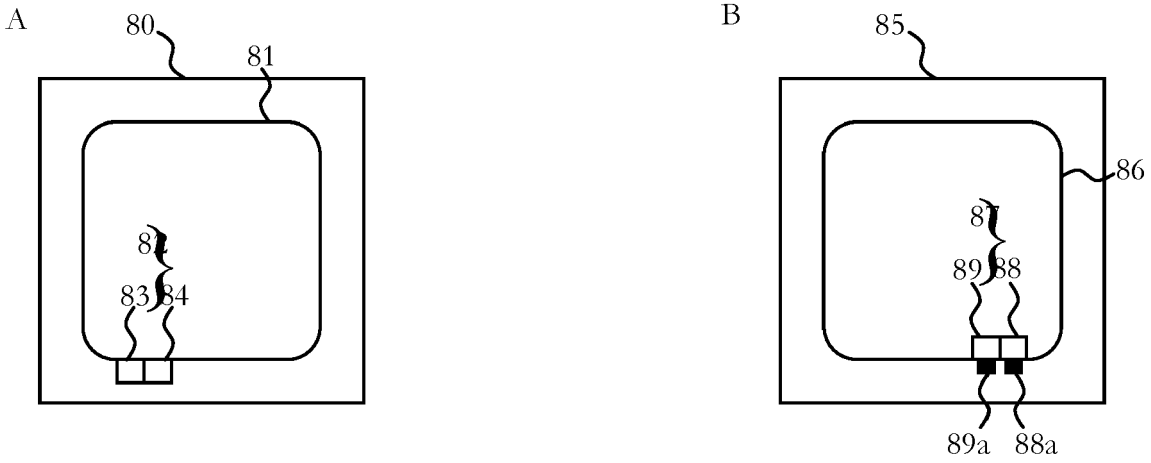


Fig. 7



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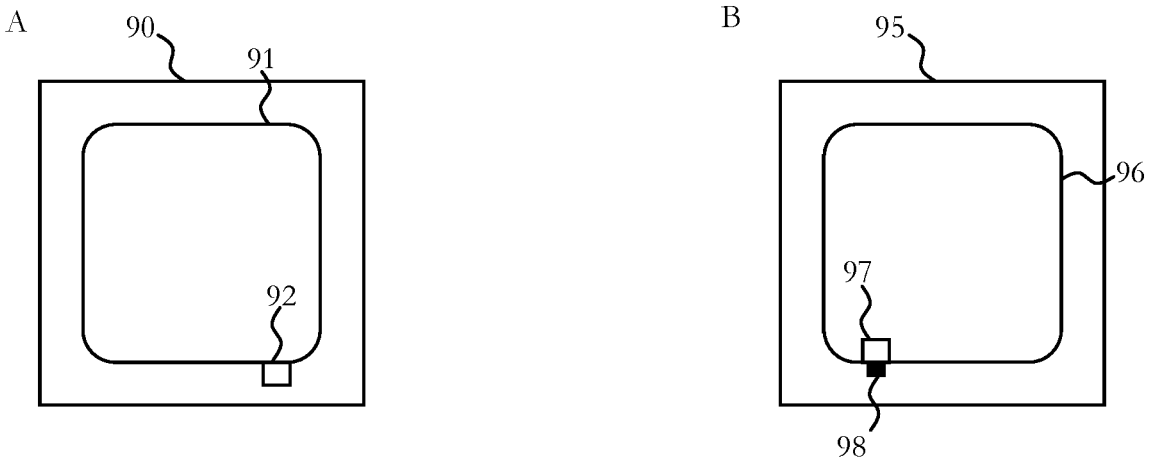

Fig. 9

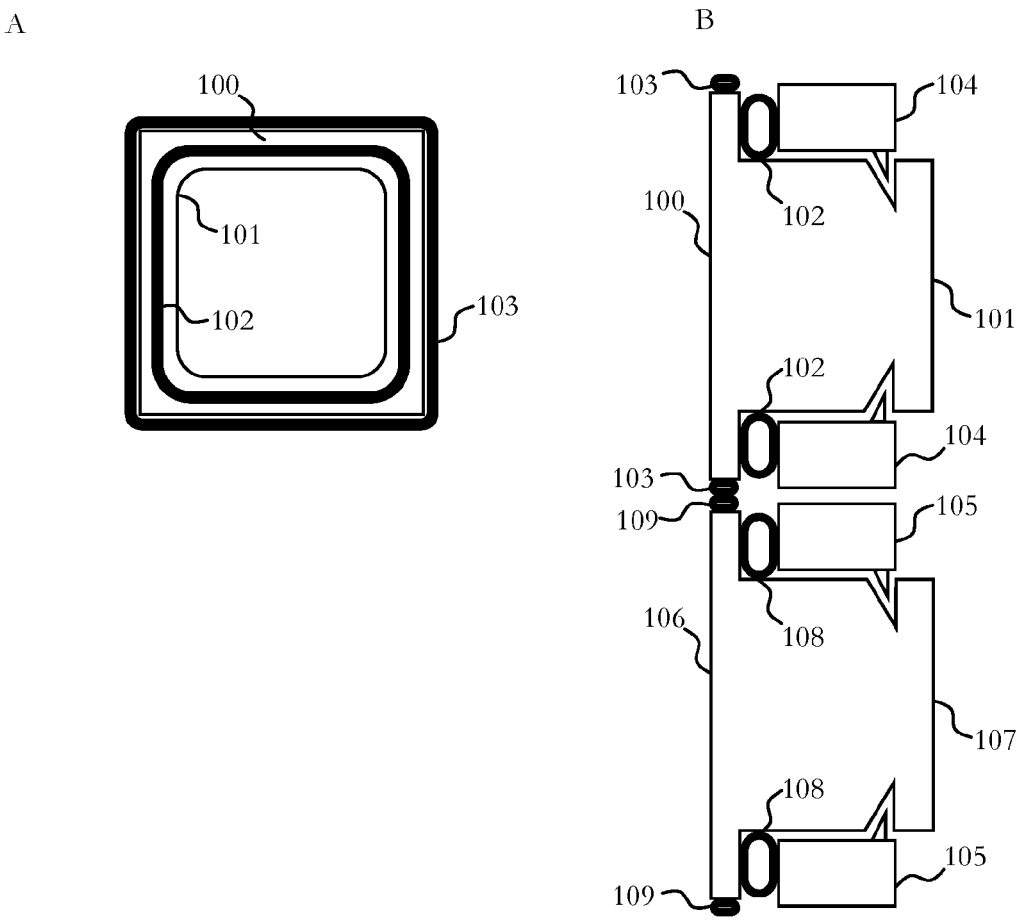

Fig. 10

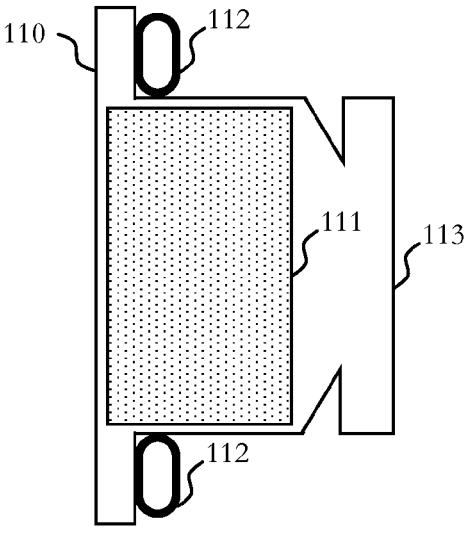

Fig. 11

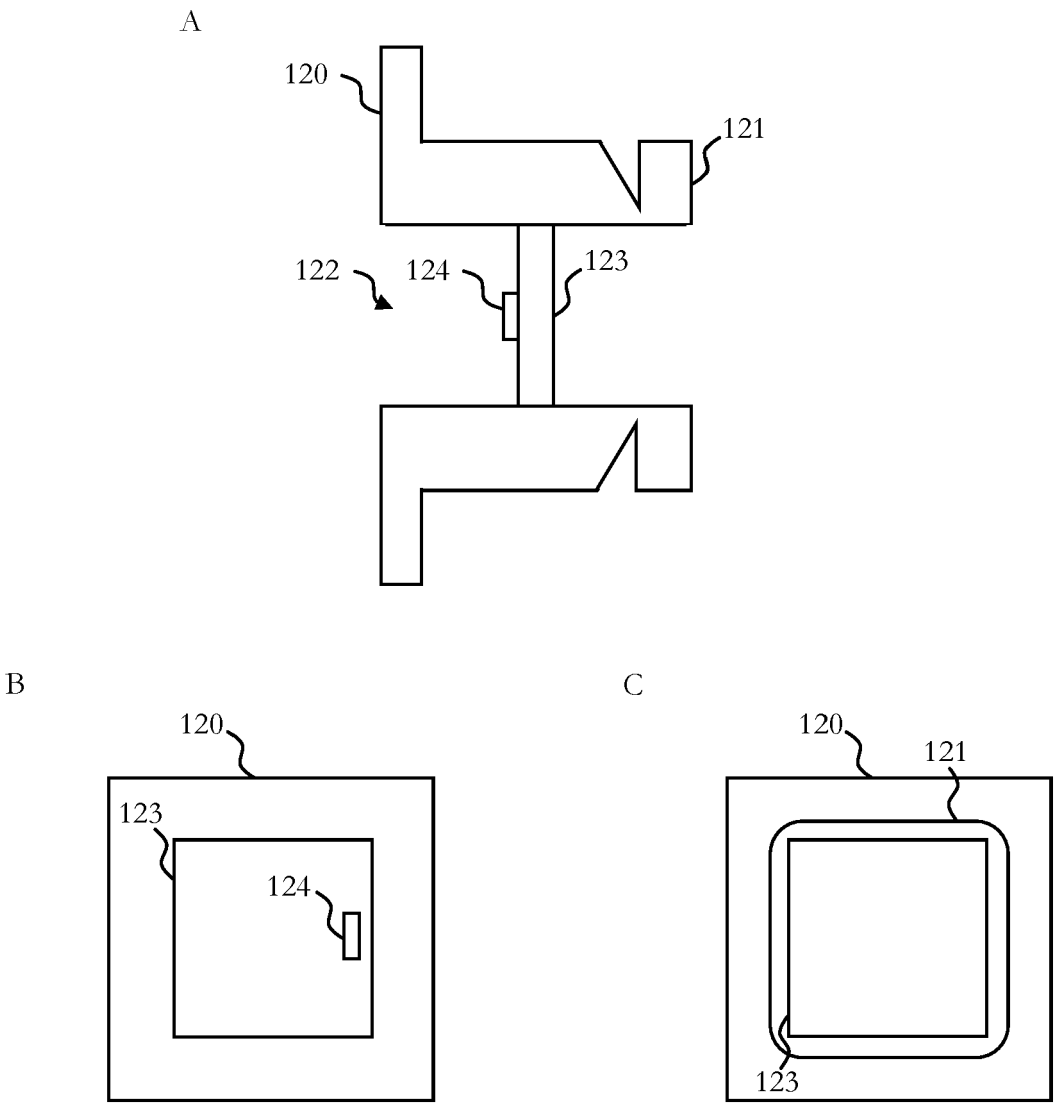

Fig. 12

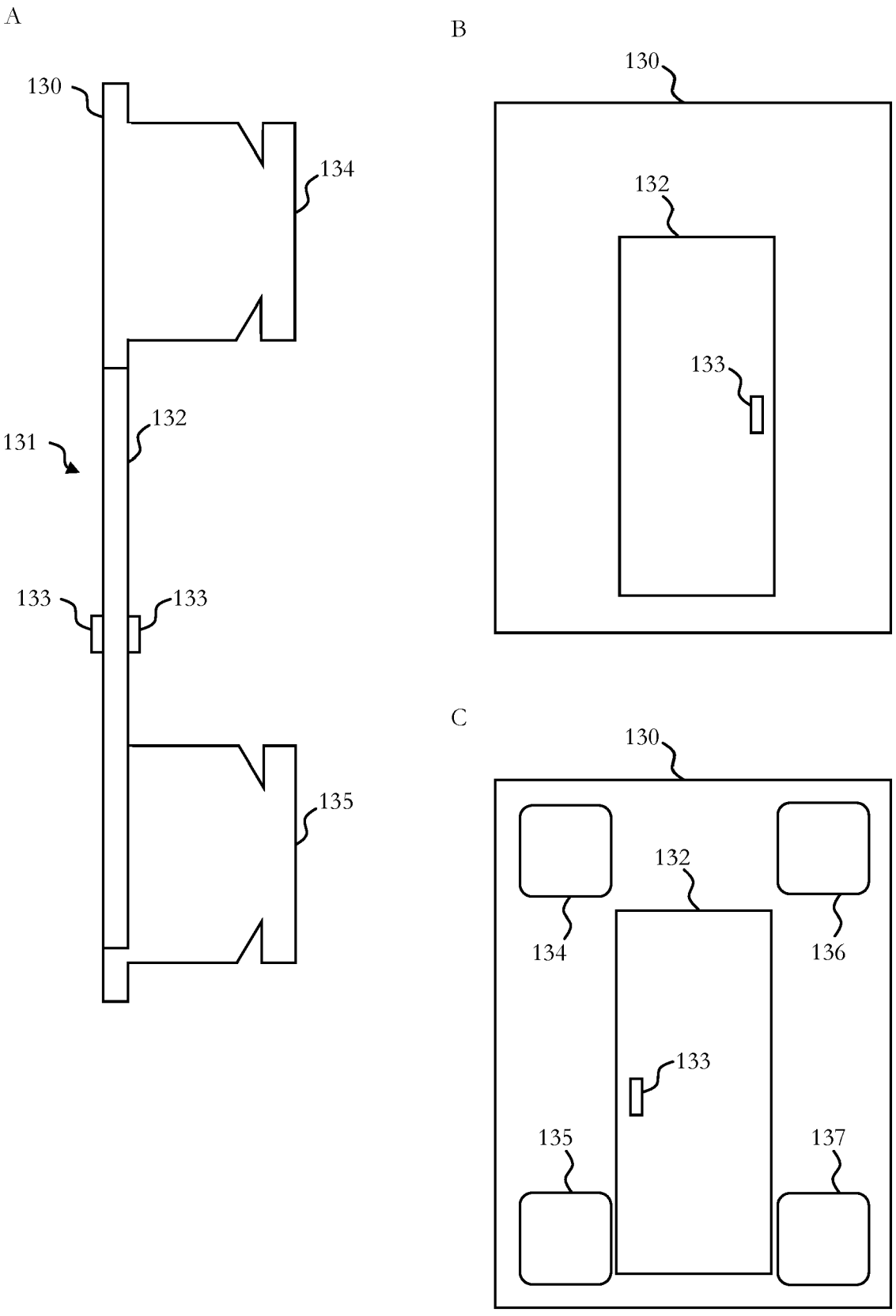
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Fig. 13

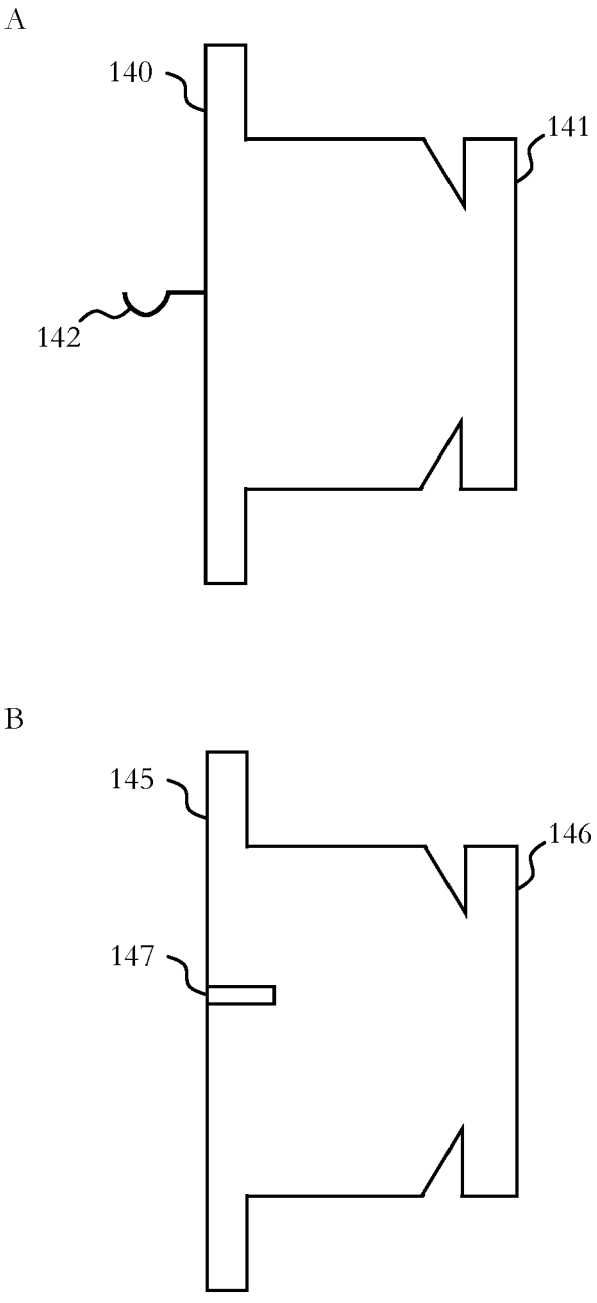

Fig. 14

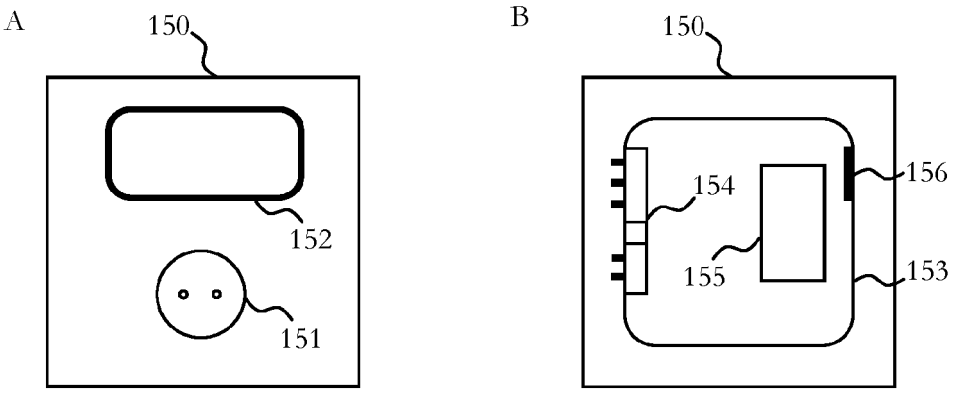

Fig. 15

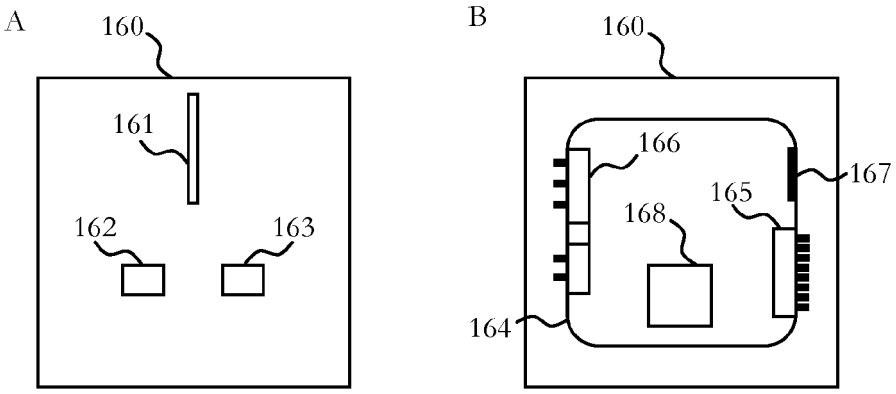

Fig. 16

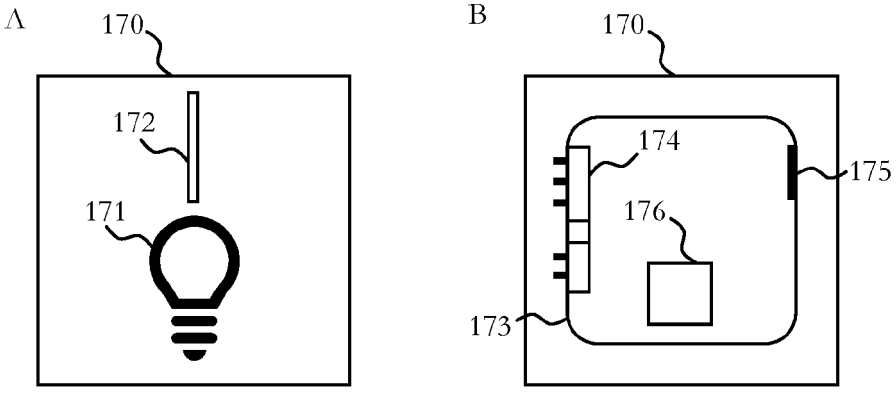

Fig. 17

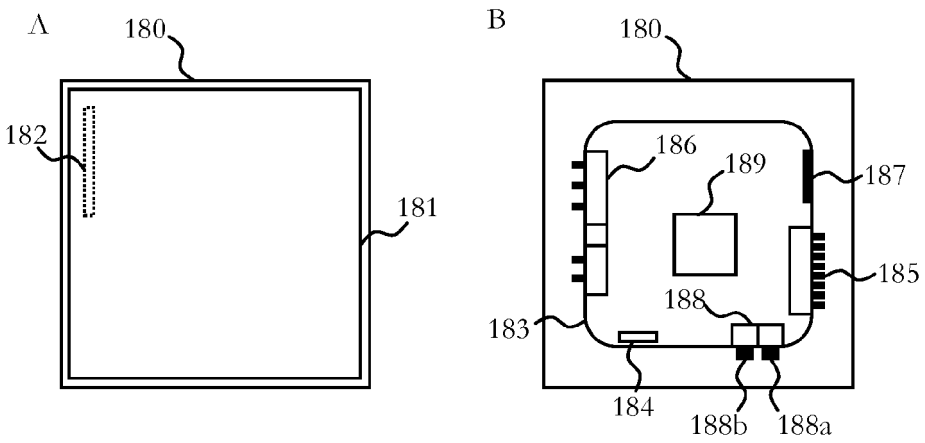

Fig. 18

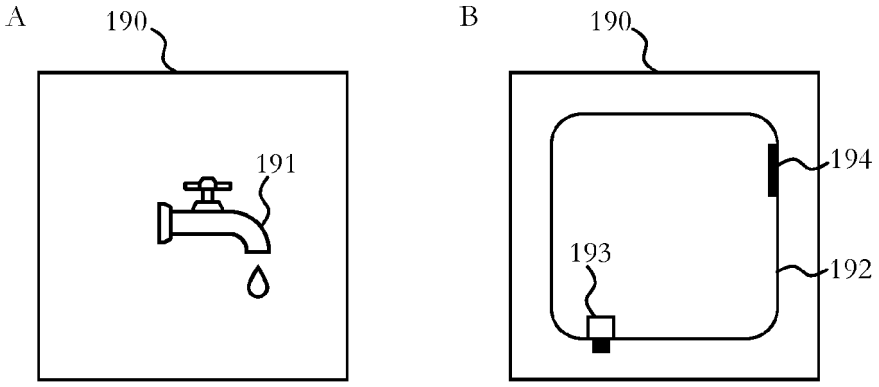

Fig. 19

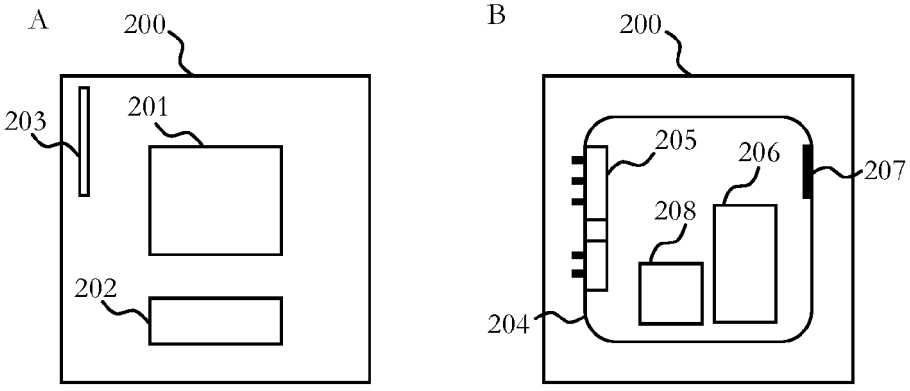

Fig. 20

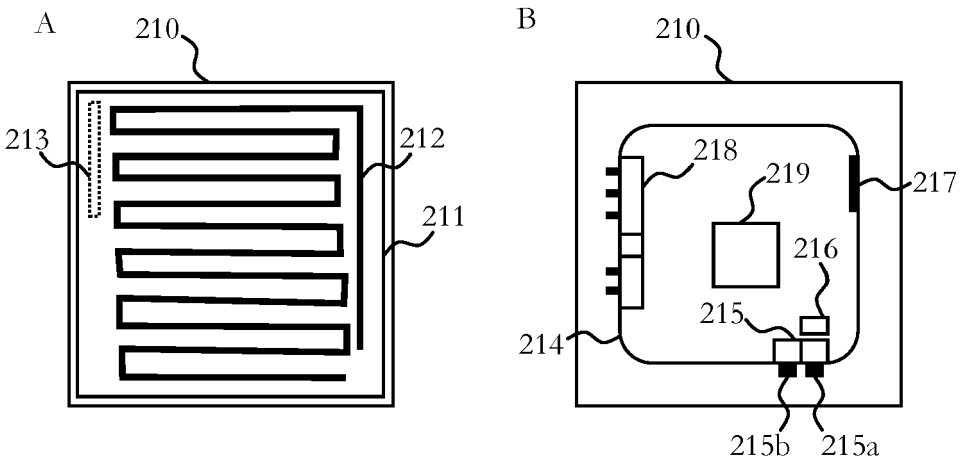
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Fig. 21

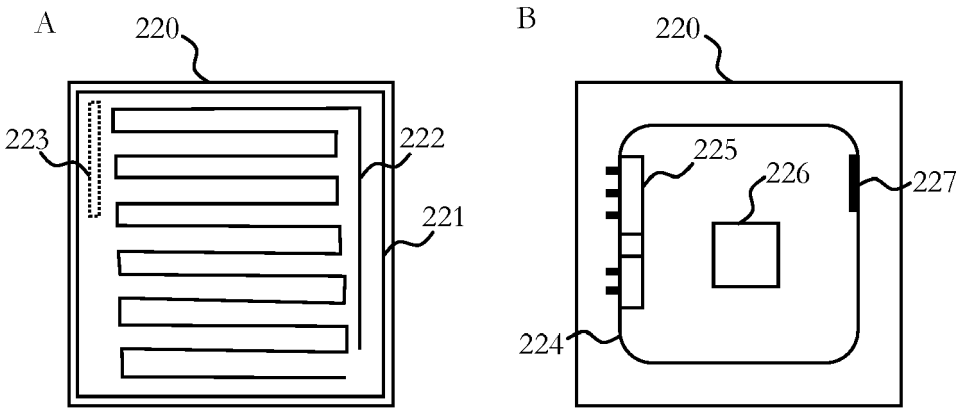
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Fig. 22

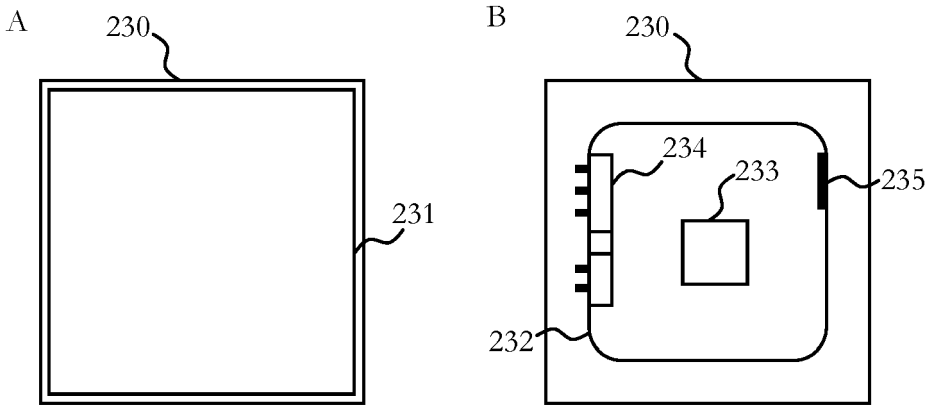
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Fig. 23

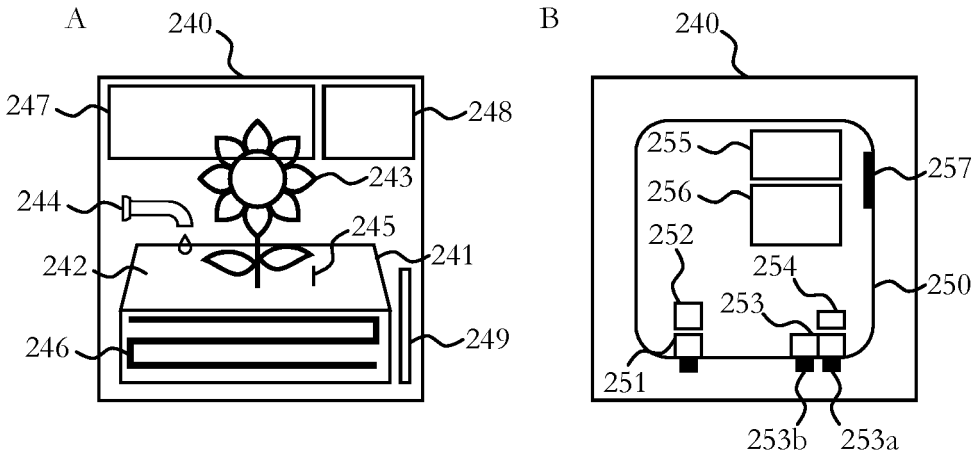
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Fig. 24

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EUROPEAN SEARCH REPORT

Application Number
EP 22 17 5886

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Y	* figures 1-5 * * column 8, lines 50-61 * * column 12, lines 29-57 * * column 17, lines 51-56 * * column 18, line 52 - column 19, line 3 * * column 20, lines 42-57 * * column 11, lines 54-67 *	4-8, 14-17,21	E04F13/00
Y	US 11 000 126 B1 (LG ELECTRONICS INC [KR]) 11 May 2021 (2021-05-11) * figures 1,2,4-7 * * column 8, lines 24-28 *	4-6,16, 17	
Y	US 8 499 503 B2 (GALLANT DENNIS J [US]; LANCI DENNIS M [US] ET AL.) 6 August 2013 (2013-08-06) * figures 1,2,17 *	7,8,14, 21	
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	18 November 2022	Demoor, Kristoffel

CATEGORY OF CITED DOCUMENTS

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