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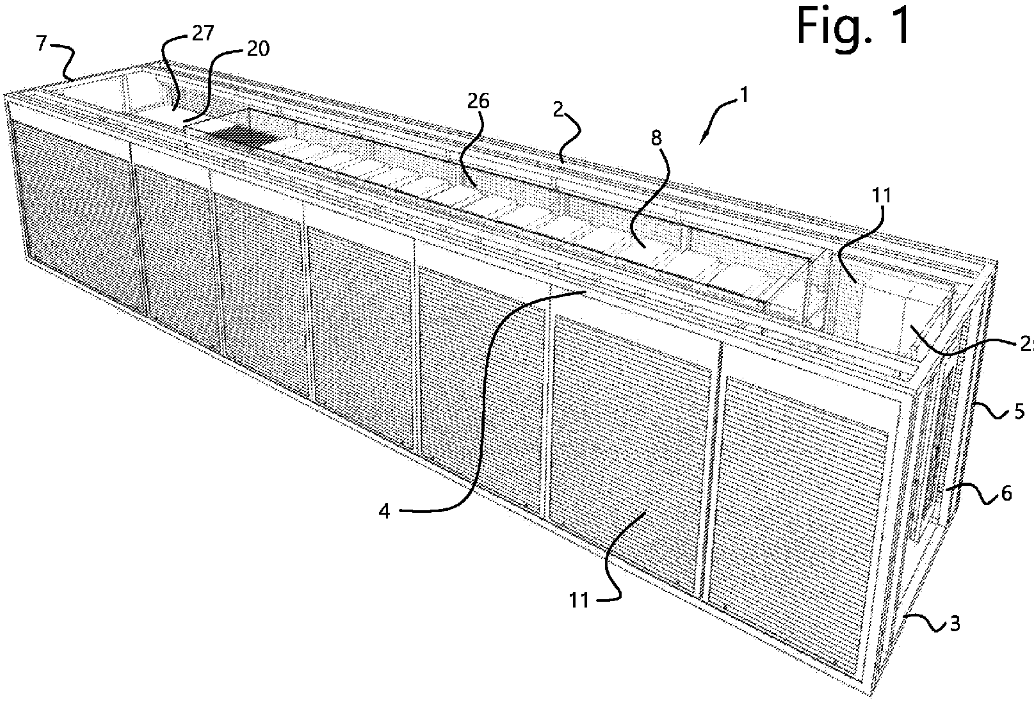
(54) **Title:** DATACENTRE

Fig. 1



(57) **Abstract:** A box-shaped datacentre module having a top wall, bottom wall, left side wall, right side wall, front wall, and back wall, which walls define the box-shape, wherein the module is provided with a right row of server racks and a left row of server racks, wherein the right row of server racks is arranged inside the module and extends along the right side wall, wherein the left row of server racks is arranged inside the module and extends along the left side wall, wherein the right and left row of server racks are arranged at a distance from each other to define, between the rows of server racks, an aisle allowing passage of a person; wherein the server racks have an aisle side facing the aisle and an opposing sidewall side facing the side wall, and wherein the right and left side wall are each provided with one or more doors, which doors can be opened to provide access to the sidewall side of the server racks facing the respective side wall.

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Datacentre

The present invention relates to a datacentre.

Companies or persons that want to have access to dedicated servers, generally have two options. The first option is to build a datacentre, which requires huge investments; the second option is to rent server space from a commercial company that owns a datacentre, which makes the company or person that wants to have access to dedicated servers dependent on that commercial company for reliability, maintenance, expansion of capacity, etcetera.

A datacentre is typically a building with several rows of servers, for example arranged in server racks, the server racks then comprising servers and other electronic equipment. This equipment generates heat, so the datacentre should also comprise a cooling installation. This cooling installation is significant: it may use as much energy as is required to run the servers and, thus, also requires a significant amount of space. A datacentre further requires a power source and an emergency power source. These latter four facilities of a datacentre are limitedly scalable. When building a new datacentre, one has to determine in advance how many servers are needed, and the datacentre is designed and built around these servers. Although it is possible to initially place only a part of the total amount of server racks and their accompanying installation equipment infrastructure such as power cables etc. to reduce the needed investments, these components make up just a small part of the huge investment costs of a datacentre. Before one can operate the datacentre, earning back the initial investments, one has to invest in the construction of a building, make arrangements for the cooling installation, provide a power source and provide an emergency power source. These four facilities are limitedly scalable. It is for example not possible, or at least not efficient, to construct half of the foreseen datacentre building, install a cooling installation in this building, make the datacentre operational, and only construct the other half of the building when the first half is making a profit or when more servers are needed. The complete building, including its cooling, power source and emergency power source, should be constructed, and thus invested upon, before the servers can be placed. This makes it a big financial risk / investment to start a new datacentre.

A part of the reason why the construction is expensive, is the fact that they can typically not be arranged in an existing building. There are strict requirements to a building that comprises a datacentre. .The ground floor area of a datacentre is usually optimized to allow the maximum amount of servers to be arranged. This can be difficult in an existing building. Thirdly, special computer floors are often used in datacentres, being raised with respect to the construction floor, allowing for example for the arrangement of cables, cooling and the spillage or leakage of liquids. Further, a cooling assembly is especially designed to optimally cool the electronic equipment. These requirements do not only make the construction of a datacentre costly in terms of money, but make the construction a time-intensive project, where the construction of a new datacentre typically takes at least six months, up to 24 months.

It is an object of the invention to provide a datacentre that can be developed with less initial investment costs.

[c1] This object is according to the invention achieved by providing a box-shaped datacentre module. This module has a top wall, a bottom wall, a left side wall, a right side wall, a front wall, and a back wall, which walls define the box-shape. The module according to the invention is provided with a right row of server racks and a left row of server racks, wherein the right row of server racks is arranged inside the module and extends along the right side wall and wherein the left row of server racks is arranged inside the module and extends along the left side wall. According to the invention, the right and left row of server racks are arranged at a distance from each other to define an aisle between the rows of server racks. Further, the right and left side wall are according to the invention each provided with one or more doors, which doors can be opened to provide access to the side of the server racks facing the respective side wall.
The invention thus relates to a datacentre that can be build up in different modules, i.e. the datacentre of the invention is scalable. One can initially start a datacentre with one or several datacentre modules and, when more capacity is desired, increase the size of the datacentre by providing additional datacentre modules. As the datacentre modules can be configured to be self-running, i.e. they can be configured to be self-supporting, running as a stand-alone module, they only require power from a power source and access to an internet connection.

Each datacentre module according to the invention is box-shaped, having a top wall, a bottom wall, a left side wall, a right side wall, a front wall, and a back wall, which walls define the box-shape. This box-shaped geometry makes the module optimally suited to arrange server racks or other equipment inside the module, making optimal use of the inner space of the module.

Each datacentre module according to the invention has a right row of server racks and a left row of server racks, wherein the right row of server racks is arranged inside the module and extends along the right side wall and wherein the left row of server racks is arranged inside the module and extends along the left side wall. The right and left row of server racks are arranged at a distance from each other to define, between the rows of server racks, an aisle allowing passage of a person. This configuration, with two rows of server racks arranged inside the module along the side walls and having an aisle in between the two rows through which a person can walk, provides a large amount of server racks for a given ground floor area of the module. The server racks must be accessible from the front side as well as the back side: servers and other electrical equipment must be installed, must be checked, must be maintained etcetera. Further, it must be possible to interchange, remove or add components, servers and other electronic equipment. Therefore, an aisle allowing passage of a person is provided in between the two rows of server racks and doors, to be discussed further below, are provided in the side walls. This aisle provides a mechanic sufficient space to move himself through the aisle in order to, for example, install server units, perform maintenance, etcetera.

Each datacentre module according to the invention comprises a right and left side wall, which are each provided with one or more doors, which doors can be opened to provide access to the sidewall side of the server racks facing the respective side wall. The server racks should not only be accessible from the aisle side, i.e. the ‘front' side of the server rack, but also from the opposing sidewall side, i.e. the ‘back' side of the server rack. Instead of arranging aisles also between the back sides of the server racks and the right or left adjacent sidewall , doors are arranged in the left and right side walls. These doors can be opened from outside the module when needed, allowing a mechanic access from outside the data centre module to the sidewall side of the server rack. By arranging these doors, it is not needed to provide substantial space between the side walls of the datacentre module and the back side of the server racks because the mechanic can reach the backside of the server racks from outside the container module through the open door. Further, the space inside the datacentre module can be optimally used, providing a maximum amount of server racks within a pre-defined ground floor area of the datacentre modules. The datacentre module further requires access to the internet and a power source.

The datacentre modules can for example be placed in an empty, already existing, building. This eliminates the need to especially construct a building when starting a datacentre, and thus a large part of the initial investment costs that are normally needed to construct a datacentre. Also, because the size of the datacentre can be increased by adding modules, with the possibility to place additional modules over time, and because the modules can be configured to be fully self-supporting, investments in cooling installations, power sources, and emergency generators can also be done over time, keeping the initially required investment costs to start the datacentre relatively low. The only needed investments to start a datacentre are the acquisition of an emptied, already existing building (or building a suitable building) a cooling installation adapted to cool only the initially desired datacentre modules, and the desired datacentre modules itself. This is a significant reduction, both in time and money, compared to the construction of a conventional datacentre, where the building must be constructed from scratch and where the cooling installation for the whole building should initially be arranged.

The racks as mentioned above can for example be 19-inch (482.6 mm) standard rack arrangements, as are commonly used throughout the telecommunication, computing, audio, video, entertainment, and other industries. Other racks often used are the 21-inch and/or the 23-inch Western Electric standard. Such a 19-inch, 21-inch, or 23-inch rack is a standardized frame or enclosure for mounting multiple rack mountable equipment modules, each having a front panel that is 19 inch, 21 inch, or 23 inch, respectively, wide (in the horizontal direction). A rack mountable equipment module may for example be a server, a computer system, associated components, or a combination of the aforementioned.

The term ‘rack’ is within the purpose of this invention not limited to the above discussed standard 19-inch rack, the 21-inch rack, and the standard 23-inch rack. Within the purpose of the present invention, the term ‘rack’ also covers other standardized racks used in data centres. More in general, the term ‘rack’ means, within the purpose of the present invention, a rack for housing modules of computer systems and/or servers and/or associated components. Within the purpose of the present invention, it is thus also possible to arrange several shelves, on top or next to each other, along the walls of the datacentre module, on which shelves rack mountable equipment modules may be arranged. It is noted that the term ‘rack’ within the purpose of this invention further encompasses a so-called cabinet, which is in fact a rack with two opposing side walls.

The term ‘row of server racks’, within the purpose of this invention, can cover a multiplicity of server racks that are placed next to each other. In one example of such a row of server racks, a left side of server rack faces a right side of a consecutive server rack. In another example of such a row of server racks, a back side of a server rack faces a front side of a consecutive server rack.

In yet another example of such a row of server racks, horizontal shelves are provided in a longitudinal direction of the datacentre module, possibly reinforced by vertical supporting members. These shelves then define the row of server racks.

[c11] According to an embodiment of the invention, the datacentre module has dimensions that allow it to be transported by road. As such, it is contemplated that the maximum outer height of the module is 4m and/or that the maximum outer width of the module is 4.5m, and/or that the maximum outer length is 25m, These dimensions allow the module to be transported relatively easily by road. Outer dimensions outside these maximum bounds are conceivable, but will complicate the logistics of transporting the module

There are also minimum dimensions to make optimal use of the ground floor surface of the datacentre module.

The depth of a standard 19-inch server rack varies between 80cm and 120cm, with the newest hardware often requiring a server rack of 100cm or 120cm in depth. To allow two rows of server racks to be arranged in the lateral direction of the module, to allow the provision of an aisle, the construction of outer walls, and some space for cables between the back of the server racks and the side walls, the minimum outer width of an embodiment of the module is about 2.5m for a server rack having a depth of 80 or 90 cm. However, if shorter server racks are used, it is beneficial to reduce the width of the datacentre module. For a server rack having a depth of 120 cm, the minimum outer width of the module will be about 3.1m. Taking into account server racks having a depth in the range of 80 to 120 cm, the outer width of the module will in practise be in the range of 2.5 to 4.5 meters. In case a module should be able to house server racks having a depth of 120 cm (i.e. also server racks having a smaller depth can be arranged inside this module), the outer width of the module will in practise be in the range of 3.5 to 4.5 meters.

The minimum outer height of an embodiment of the datacentre module is 2.7m. A standard server rack is approximately 2.1m in height. To allow the construction of the top and bottom wall, to allow some space between the top wall and the top of the server rack, and to place the bottom of the server rack somewhat above the bottom wall of the datacentre, which is a standard measure in the construction of datacentres, this outer height of 2.7m is quickly reached. However, if lower server racks are used, a lower outer height of the datacentre module is well conceivable. Modules having an outer height of 2.7 m to about 3 m can be transported by road on trucks having a loading floor height of about 1.2 m above the road. In case flatbed trailers are used for transportation by road, the maximum outer height of the module can be in the range of 3.7 to 4 m, for example about 3.7 m.

In principle, the longitudinal dimension of the datacentre module is not bound by a minimum. However, it will be understood by one skilled in the art that the initiation of a datacentre is not cost-efficient if a low number of server racks is initially used, for example when less than eight server racks are initially used. In one embodiment of the module according to the invention, the minimum length of the datacentre module is 5m, providing space for twenty 19-inch server racks arranged along the side walls of the module, i.e. ten 19-inch server racks arranged along the left side wall and ten 19-inch server racks arranged along the right side wall. It is possible to leave some of the rack units initially empty when less server racks are initially required, as will be explained in more detail below.

[c2 – c4] Regarding the inner layout of the datacentre module, it is beneficial when the back sides of the server racks are arranged at some distance from the side walls of the datacentre module. That is, according to an embodiment of the invention it is beneficial when the sidewall side of the right row of server racks is arranged at a distance from the right side wall to provide a right vertical ventilation interspace delimited between the right row of server racks and the right side wall, and wherein the sidewall side of the left row of server racks is arranged at a distance from the left side wall to provide a left vertical ventilation interspace delimited between the left row of server racks and the left side wall. These vertical ventilation interspaces may for example be used as buffers containing either a relatively hot or a relatively cold cooling medium, as will be explained further below with reference to the cooling of the datacentre module.

According to an embodiment of the invention, the distance between the side walls and the sidewall sides of the server racks is smaller than 50 cm, for example smaller than 20 cm, such as in the range of 3 to 10 cm. In contrast to the aisle, these vertical ventilation interspaces are not intended as a (comfortable) work environment for a mechanic, and should thus be kept relatively narrow, to make optimal use of the available ground space, maximizing the number of servers per ground floor area of the module.

It is also conceivable that the electrical equipment that is installed in the server racks, has a depth smaller than the depth of the server racks so that an interspace is present between a sidewall side of the electrical equipment and the sidewalls of the datacentre module. This interspace can serve as a vertical ventilation interspace as well so that the sidewall sides of the server racks might even contact side walls of the datacentre module.

According to an embodiment of the invention, the server racks have an height that is smaller than an internal height of the datacentre module to provide a right horizontal ventilation interspace between the right row of server racks and the top wall, and to provide a left horizontal ventilation interspace between the left row of server racks and the top wall. These horizontal ventilation interspaces may for example be used as buffers containing either a relatively hot or a relatively cold cooling medium, as will be explained further below with reference to the cooling of the datacentre module.

As explained before, to make optimal use of the available space inside the datacentre module, the left and the right side wall are each provided with one or more doors, which doors can be opened to provide access to the side of the server racks facing the respective side wall. It is conceivable that there are as many doors as server racks, or that there are more server racks than doors, for example one door for every two, three, four, or any other number of server racks. A mixture of these possibilities is also possible, e.g. some doors providing access to one server rack, another door providing access to several server racks.

An advantage of having as many doors as server racks, is that the doors are relatively small and that the opening of a door, while the module is in its operational mode, only locally influences the environment of the datacentre. A disadvantage of having as many doors as server racks is that it makes the module more expensive, as more doors need to be arranged.

In an alternative embodiment, there are more server racks than there are doors. In this case, the module will become less expensive, as less doors need to be arranged. A disadvantages of having less doors than server racks, is that the opening of a door, while the module is in operational mode, affects a larger part of the environment of the datacentre compared to the situation where there are as many doors as server racks.

It is conceived that maintenance work, checks, or other work related to the sidewall side of the server racks is performed while the respective access door is opened. While there can be a vertical ventilation interspace arranged between the back side of the server racks and the side walls of the module, this interspace is conceived to be relatively narrow, and is not adapted to also serve as a working spot for an engineer.

Several different types of doors can be used in the datacentre module, including but not limited to roll down shutters, doors with a hinge line arranged substantially vertically, a hatch with a hinge line arranged substantially horizontally, or a folding door that can fold in a zig-zag manner with horizontal or vertical fold axes. It is preferred that similar doors are used for all access openings of the side walls of a datacentre module, in contrast to using different doors at different locations.

Regarding the optimal use of space, not only for (the ground floor surface of) a single datacentre module, but also for a park comprising several datacentre modules, the preferred option is the use of a roll down shutter. The space required to open a roll down shutter is relatively small, making it possible to place two datacentre modules relatively close next to each other, with a relatively narrow space between the outer walls of two datacentre modules. When the door is a door with a vertical hinge line, the space between two outer walls of two consecutive datacentres should equal at least the width of one door; when the door is a latch with a horizontally arranged hinge line, the space between two outer walls of two consecutive datacentres should equal at least the height of one door. The use of either of these doors is however a realistic option.

[c14 – c16] As known per se, a datacentre uses a lot of energy and produces a lot of heat. Therefore, a cooling assembly is needed to cool the inside of the datacentre module, more specifically, the rack-mountable equipment units must be cooled. Regarding the cooling of the module, there are two basic option: the module can either be connected, in fluid connection, with a cooling assembly outside the module, or a cooling assembly can be arranged inside the module. The working principle for a datacentre module comprising a cooling assembly is described below. However, when the module does not contain an internal cooling assembly but is fluidly connected with an external cooling assembly, the basic working principle is very much alike. When the module is fluidly connected with a cooling assembly, there should be an inlet in the datacentre module to supply a relatively cold cooling medium from an outlet of the cooling assembly to the module, and there should be an outlet in the datacentre module for the supply of relatively hot cooling medium from the module to an inlet of the cooling assembly.

When the cooling assembly is arranged inside the datacentre module, it can be arranged near the back wall of the module, separated from the rows of server racks and the aisle in between the server racks by a partition. This partition then comprises (at least) two openings: one opening to provide a fluid connection between the cooling assembly and the aisle, and one opening to provide a fluid connection between the vertical and/or horizontal ventilation interspaces and the cooling assembly.

In one embodiment, the partition comprises three openings: one opening to provide a fluid connection between the cooling assembly and the aisle, an opening to provide a fluid connection between the vertical and/or horizontal ventilation interspace of the right row of server racks and the cooling assembly, and an opening to provide a fluid connection between the vertical and/or horizontal ventilation interspace of the left row of server racks and the cooling assembly.

In an alternative embodiment, the partition comprises two openings: one opening to provide a fluid connection between the cooling assembly and the aisle, and one opening to provide a fluid connection between the vertical and/or horizontal ventilation interspaces and the cooling assembly. This opening to provide a fluid connection between the vertical and/or horizontal ventilation interspaces and the cooling assembly can be split inside the datacentre module, feeding a cooling medium to or extracting a cooling medium from both the left and the right vertical and/or horizontal ventilation interspaces.

The cooling assembly comprises an inlet for a cooling medium to be cooled, and an outlet for a cooling medium cooled by the cooling assembly. When the cooling assembly is a closed system, the inlet of the cooling assembly will be coupled to the outlet of the datacentre module, the inlet of the cooling assembly taking in the hot air from the datacentre module. This air is cooled inside the cooling assembly is introduced into the datacentre module via the outlet of the cooling module.

In another embodiment, the cooling assembly is an open system, the inlet of the cooling assembly taking in air from an outside environment. In one scenario, this air is hotter than a desired outlet temperature of the cooling medium of the cooling assembly. In that scenario, the cooling medium taken in by the inlet must be cooled. Such a system is advantageous when the outside air temperature is colder than the temperature of the hot air in the datacentre module.

In another scenario, the outside air is colder than the desired outlet temperature of the cooling medium of the cooling assembly. In this scenario, the relatively cold outside air can be mixed inside the cooling assembly with relatively hot air that is taken in from the datacentre module, resulting in air with the desired temperature to be introduced in the datacentre module via the outlet of the cooling assembly.

In yet another scenario where the outside air is colder than the desired outlet temperature of the cooling medium of the cooling assembly, this inlet air is heated before it is introduced in the datacentre module via the outlet of the cooling assembly.

A relatively cold cooling medium is supplied to an inlet of the module by the cooling assembly. This cold medium flows through the rack mountable equipment modules, to cool its hot components. As a result of this cold flow, the rack mountable equipment modules cool down, while the cooling medium heats up. The heated cooling medium is displaced towards an outlet of the module. Two principle flow directions are possible for this cooling medium: from the aisle, through the rack mountable equipment modules and through the server rack, to the vertical ventilation interspace(s) and/or horizontal ventilation interspace(s) above the cooling racks, or from the vertical ventilation interspace(s) and/or horizontal ventilation interspaces above the cooling racks, through the rack mountable equipment modules and through the server rack to the aisle.

According to an embodiment of the invention, the datacentre module comprises a cooling assembly with an inlet for a cooling medium to be cooled and an outlet for a cooling medium cooled by the cooling assembly, wherein the aisle is in fluid connection with the outlet of the cooling assembly for introducing said cooled cooling medium into the aisle or in fluid connection with the inlet of the cooling assembly for returning cooling medium to the cooling assembly, and wherein the left and right vertical ventilation interspaces are in fluid connection with the inlet of the cooling assembly for returning cooling medium to the cooling assembly or, respectively, with the outlet of the cooling device for introducing cooling medium into left and right vertical ventilation interspace.

It is possible that there is a switch arranged in or in relation to the cooling assembly, making it possible to switch between the two above described flow directions of the cooling medium.

It is conceivable that the cooling assembly is a relatively standard cooling assembly, available on the market. The cooling assembly as such is not a part of the invention and it will not be described in great detail. Some relatively elementary working principles of the cooling assembly will nevertheless be described further below, with reference the figures.

It is preferred that the temperature of the server racks is relatively constant as a function of time. The temperature of the server racks can for example be between 20° C (293K) and 30° C (303K), although tests show that a temperature of up to 40° C (313K) does not have a significant adverse effect on the electronic equipment. A cooler temperature than the aforementioned 293K will have little impact on the lifetime of the electronic components and will also have little impact on the performance of the electronic components, but will cost more energy to cool the module. A higher temperature than the aforementioned 313K will save energy, but can have a negative effect on the reliability of the electrical components.

The relatively cold temperature of the cooling medium should be colder than the desired temperature of the server racks. According to an embodiment of the invention, the temperature of the cooling medium, in its cold state, is between 288 and 298 K.

The relatively hot temperature of the cooling medium should be warmer than the desired temperature of the server racks. According to an embodiment of the invention, he temperature of the cooling medium, in its hot state, is between 300 and 310 K.

Preferably, there is a steady flow in the datacentre module, with a steady supply of cold cooling medium, and a steady drainage of hot cooling medium. A uniform flow field is desired throughout the inside of the module. Therefore, the flow should be relatively slow. However, it is also desired that the flow moves everywhere and that there are no ‘dead corners’ where the flow field is locally still. Therefore, the flow should not be too slow. According to one embodiment of the invention, the flow speed of the cooling medium, inside the datacentre module, is between 2 and 4 m/s.

According to an embodiment of the invention, the cooling medium is a gas, for example air. The advantage of using air as a cooling medium, is that it is readily available. As such, the cooling assembly may be a closed-loop system or an open-loop system when air is used as a cooling medium. For datacentres with more stringent requirements, for example extreme cooling, it is conceivable that other substances are used as a cooling medium, for example an inert gas, or a liquid cooling material. If a substance other than air is used, the cooling assembly will typically comprise a closed-loop system.

[c5 – c9] Further regarding the cooling of the datacentre module, it is preferred when the aisle is hermetically sealed from its environment, hot and cold cooling medium then being unable to mix, and the flow field being uniform.

According to an embodiment of the invention, a sealing assembly is provided that prevents a gas flow from bypassing around the server rack from the aisle to the side wall side of said server rack, or vice versa. The object of this sealing is to direct the flow of the cooling medium, in its entirety, through the server rack, to cool the rack mountable equipment modules. The cool flow should not flow around an underside the server rack, the flow should not flow around an upper side of the server rack, and the flow should not flow around an outer side of the server rack. More specifically, the sealing assembly may comprise a sealing plate between the bottom wall of the module and a lower side of the server rack or the row of server racks and/or a sealing plate between a top side of the server rack or the row of server racks and the top wall of the module and/or a sealing plate between the top sides of server racks or the rows of server racks arranged at opposite sides of the aisle and/or a sealing plate between a left side of a server rack and a right side of a consecutive server rack.

A standard server rack, such as the previously introduced 19-inch server rack or the 23-inch server rack, is – in vertical direction – divided in rack units or 1.75 inch (44.5 mm), called the standard U according to the EIA standard as well as according to other similar standards. Most equipment used in a datacentre has a height related to this standard U, for example a height of 1U, 2U, or 3U. According to an embodiment of the invention, the row of server racks comprises multiple server racks, arranged next to each other when viewed in length direction of the row, each server rack being arranged to accommodate one or more rack mountable equipment units.

Typically, not all rack units of all server racks will be filled with equipment modules at all times. Depending on the desired server capacity, it is well conceivable that some server racks are initially partly filled, adding more equipment modules at a later time. It is also conceivable that the demand for server units or specific equipment changes in time, due to which equipment is removed. To make optimal use of the available cooling medium, according to one embodiment of the invention, a server rack of a said row of server racks comprises two rack mountable equipment units arranged at a vertical distance with respect to each other, wherein the aisle side of the server rack comprises a blind panel, closing the vertical distance between said two rack mountable equipment units.

It is conceivable that the server racks comprise multiple rows of rack mountable equipment units, where some rack mountable equipment units are arranged directly above each other without any vertical distance between them, and where some rack mountable equipment units are arranged above each other with a vertical distance between them, for example a vertical distance of 1U, 2U, 3U or another integer number of U. The blind panel of WO 2016/126158 A1 may for example be used, but the use of other blind panels is also possible. The blind panel forces a cooling medium from one of the sidewall side or the aisle side of a server rack to the other of the sidewall side or the aisle side of the server rack to pass through the rack mountable equipment unit.

According to one embodiment of the invention, the datacentre module further comprises a multiplicity of blind panels that can be mounted on a server rack of a said row of server racks to blind a section of the server rack on the aisle side of the rack. The section spanned by a blind panel is preferably horizontal and preferably corresponds to the width of the server rack.

The datacentre module may comprise any number of blind panels, to optimally direct the flow through the rack mountable equipment modules.

According to one embodiment of the invention, two successive server racks in a row are spaced apart by a maximum distance of 20cm, such as a maximum distance of 10cm. This spacing between two consecutive server racks for example allows a space for cables and the like to be arranged in the datacentre module. Preferably, also the interspaces between the server racks are sealed from the aisle, to prevent the relatively hot and the relatively cold cooling medium from mixing.

[c13 – c14] The aisle that is present between the rows of server racks has multiple functions.

Firstly, it provides an access area in between the rows of server racks, which area can be used by an engineer to perform work on the electrical equipment comprised in the server racks, such as to perform maintenance, checks, replace parts, etcetera. According to one embodiment of the invention, a transverse dimension, i.e. the 'width' of the aisle is at least 0.7 m, such as at least 0.8m or at least 1 m, allowing sufficient space for the engineer to do his/her job.

Further, the aisle can be used to place server racks. When the datacentre module is filled with server racks and becomes more occupied, it can become difficult to add more servers, server racks, or electrical equipment, especially when the aisle is narrow with respect to the depth of the server racks, wherein this depth of the server rack is typically measured along the transverse direction of the module. Difficulties specifically arise when, in the operational lifespan of the module, a server rack needs to be taken out of the row of server racks, the server rack being replaced by another server rack. To allow such maintenance work to be carried out efficiently, the transverse dimension of the aisle can be equal to or longer than a depth of a server rack, according to an embodiment of the invention.

Further, the aisle acts as a buffer zone for the cooling medium, either in the relatively cold or in the relatively hot state of the cooling medium. This depends on the circulation direction of the cooling medium, as described before.

[c17 – 21] To allow access to this aisle from outside of the datacentre module, according to one embodiment of the invention, the front wall of the module comprises an access opening, the access opening providing entrance to the aisle of the datacentre module.

Typically, each server unit or rack mountable equipment module arranged inside the server rack, comprises at least one fan, said fan directing the relatively cold cooling medium through the server racks, cooling hot components of the rack mountable equipment modules. Typically, not all rack-mountable equipment units will operate at the same intensity level. Typically, one rack-mountable equipment unit will also not operate at a substantially constant intensity level as a function of time, the rack mountable equipment unit experiencing fluctuations in its required capacity, power usage, and cooling requirements. To account for these fluctuations, each fan directs the cooling medium through the server rack or rack unit. As such, the fans can be adapted to blow air, to suck air, or a fan can be adopted to be able to blow and suck air depending on its operational mode. In one embodiment, the rotational speed of this fan is coupled to the operational requirements of the electrical equipment, i.e. when the electrical equipment is working more intensively, it heats up faster, resulting in the fan to speed up, directing more of the cooling medium towards the electrical equipment, to also cool it more intensively, or, vice versa, when the electrical equipment is idle, it requires less cooling, the rotational speed of the fan slowing down.

To have a substantially constant airflow speed in the datacentre module, fans of the rack mountable equipment units can be coupled to the cooling assembly, to control the flow of the cooling medium in the datacentre module, according to one embodiment of the invention. Thus, when the average rotational speed of the fans increases, the fans directing more cooling medium towards the electrical equipment, also more cooling medium is be supplied to the datacentre module by the cooling assembly. Vice versa, if less cooling medium is required by the fans, less cooling medium can be supplied by the cooling assembly.

According to an embodiment of the invention, the module comprises at least one sensor to measure the temperature of the cooling medium when it enters the module in its relatively cold state and/or to measure the temperature of the cooling medium when it exits the module in its relatively hot state and/or to measure the temperature of the outside air, and wherein said at least one sensor is coupled to a control of the cooling assembly to control at least one operating parameter of the cooling assembly. This operational parameter can for example be the flow direction inside the cooling assembly, a position of a valve inside the cooling assembly, the operating level of a condenser or an evaporator inside the cooling assembly, or any other parameter related to the cooling assembly. This will be explained in more detail with reference to the figures.

According to an embodiment of the invention, the module is electrically connected to a generator, the generator providing current to the datacentre when its regular power source falls away. When a datacentre comprises several datacentre modules, there may be one generator feeding all datacentre modules, or there may be several generators, each feeding one or more datacentre modules in case of emergency.

In a possible embodiment, the generator is integrated in the datacentre module, the module then being fully self-supporting. This is for example advantageous when the module is especially adapted to be used temporarily, such as when the module is especially adapted to be used in areas where a disaster such as an earthquake, a hurricane, or the like occurred.

It is noted that, when dimension of a server rack or a rack mountable equipment unit are referred to in this text, the server rack is defined as having a height, a width, and a depth. When dimensions of the datacentre module are referred to in this text, the module is defined as having a length, a height, and a width. In the preferred embodiment, the height direction of the server racks and the rack mountable equipment units substantially coincides with the height direction of the datacentre module, the width direction of the server racks and the rack mountable equipment units substantially coincides with the length direction of the datacentre module, and the depth direction of the server racks and the rack mountable equipment units substantially coincides with the width direction of the datacentre module

The invention further relates to a method for performing maintenance on a datacentre module, such as a datacentre module according to the invention,, wherein the method comprises the steps of:

- opening at least one door of the row of one or more doors;
- performing maintenance to a sidewall side of a server rack that is arranged in front of said opened door, wherein the maintenance is performed through said opened door by a person whilst the person is outside the datacentre module;
- closing the opened door after performing maintenance.

The person thus stands outside the datacentre module and reaches with his arms through the doorway of the opened door.

In an embodiment, the module is arranged on an underground and the person performing said maintenance is located on said underground outside of the module during the step of performing maintenance to a sidewall side of a server rack that is arranged in front of said opened door through said opened door. The person performing the maintenance thus does not stand on the floor of another part of the datacentre module, but stands outside the datacentre module on the underground onto which the datacentre module is placed as well.

These and other aspects of the invention will be more readily appreciated as the same becomes better understood by reference to the following detailed description and considered in connection with the accompanying drawings in which like reference symbols designate like parts.

Figure 1 schematically shows an isometric view of a first embodiment of a datacenter module 1 according to the invention, with the doors in the sidewalls of the module closed.

Figure 2 schematically shows an isometric view of a second embodiment of a datacenter module according to the invention, with the doors in the sidewalls of the module closed.

Figure 3 schematically shows an isometric view of a third embodiment of a datacenter module according to the invention, with the doors in the sidewalls of the module closed.

Figure 4 schematically shows a cross-sectional view of a side of a datacentre module according to the invention, with the doors opened.

Figure 5 schematically shows a cross-sectional view of a top side of a datacentre module according to the invention.

Figure 6 schematically shows an isometric view of a third embodiment of a datacentre module according to the invention, with doors of the module opened.

Figure 7 schematically shows a cross-sectional view of a datacentre module according to the invention, along a line VII as indicated in Figure 5.

Figure 8A schematically shows a first operational mode of regarding the cooling of the datacentre module according to the invention.

Figure 8B schematically shows a second operational mode of regarding the cooling of the datacentre module according to the invention.

Figure 9A schematically shows a first operational mode of a cooling assembly of the datacentre module according to the invention.

Figure 9B schematically shows a second operational mode of a cooling assembly of the datacentre module according to the invention.

Figure 9C schematically shows a third operational mode of a cooling assembly of the datacentre module according to the invention.

Figure 10 schematically shows a possible embodiment of a server rack of the datacentre module according to the invention.

[c1] With reference to Figures 1, 4, 5, and 6, a first embodiment of a box-shaped datacentre module 1 is shown that has a top wall 2, bottom wall 3, left side wall 4, right side wall 5, front wall 6, and back wall 7, which walls 2, 3, 4, 5, 6, 7 define the box-shape. A right row 8 of server racks 14 and a left row 9 of server racks 14 are provided; the right row 8 of server racks 14 being arranged inside the module 1 and extending along the right side wall 5 and the left row 9 of server racks 14 being arranged inside the module and extending along the left side wall 4. The right 8 and left 9 row of server racks 14 are arranged at a distance A from each other to define, between the rows 8, 9 of server racks 14, an aisle 10 allowing passage of a person, such as a mechanic. The server racks 14 have an aisle side 14F facing the aisle 10 and an opposing sidewall side 14F, facing the side wall 4, 5; and the right 8 and left 9 side wall are each provided with one or more doors 11, which doors 11 can be opened to provide access to the sidewall side 14F of the server racks 14 facing the respective side wall 4, 5.

In Figure 1, an isometric view of the module is shown with open-worked top wall 2 and front wall 6. Doors 11, in the embodiment of Figure 1 shutters, more specifically roll-down shutters, are arranged in the left 4 and right 5 side walls. The doors 11 provide access to sidewall sides 14F of the server racks 14. A right row 8 of these server racks 14 is visible in the isometric view of Figure 1, the left row 9 is hidden from sight in Figure 1. The right row 8, in this specific embodiment, comprises fifteen individual server racks 14. This number of fifteen is however not fixed; it is well conceivable that any other number of server racks 14 is arranged in a row, such as five, ten, twenty, thirty, or another number.

Not shown in Figure 1, or any other Figure, is a connection between the datacentre module and the internet. Also not shown in Figure 1, or any other Figure, is a connection between the datacentre module and a power source.

With reference to Figure 4, the module in the shown embodiments comprises three areas: an entrance area 25, a server area 26 and a cooling area 27. These areas 25, 26, 27 are preferably separated from each other. In Figure 4, the separation between the different areas 25, 26, 27 is provided by partitions 28, 29. Between the front wall 6 of the module and the server area 26, an entrance area 25 is visible. This entrance area 25 is for example separated from the server area 26 with a glass wall. The entrance area 25 can for example comprise some monitors that allow an engineer to check the status of the server racks 14, without physically entering the server area 26.

[c4] Visible in Figure 4 is a side view of the module, with the roll-down shutters 11 opened. The module has front 6, back 7, top 2, and bottom 3 walls, wherein the distance between the back wall 7 and the front wall 6 defines an outer length LO. The outer length LO minus the wall thickness of the front 6 and back 7 wall defines an inner length LI. Similarly, the distance between the top 2 and bottom 3 wall defines an outer height HO, while the outer height HO minus the wall thickness of the top 2 and bottom 3 wall defines an internal height HI.

Further visible in Figure 4 is a row 9 of server racks 14. Each server rack 14 has a height HS. This height HS is smaller than the internal height HI of the module in the embodiment of Figure 4. As such, a horizontal ventilation interspace is provided between the row 9 of server racks 14 and the top wall 2. In het embodiment of Figure 4, the left row 9 of server racks 14 is shown, the particular horizontal ventilation interspace thus being the left horizontal ventilation interspace LLI. Not shown is the right row 8 of server racks 14. It is conceivable that the height HS of the server racks 14 in the right row 8 is also smaller than the internal height HI of the module. A right horizontal ventilation interspace RLI is then provided between the right row 8 of server racks 14 and the top wall 2.

[c23] Further visible in Figure 4, are seven doors 11. One door is arranged in the side wall 4 of the entrance area 25. The presence of this door is however not required; alternatively or simultaneously an access opening, such as an entrance door, may be present in the front wall 6 of the module.

[C10] Further visible in Figure 4 are five more doors 11, arranged in the side wall 4 of the server area 26. Each door provides access to the sidewall sides 14F of server racks 14. In the specific embodiment of Figure 4, there are fifteen server racks 14, and five doors 11, each door providing access to the sidewall sides 14F of three server racks 14. Alternatively, there are more or less doors 11 and/or server racks 14, each door 11 providing access to any number of server racks 14. Two possible alternatives are the embodiment where the number of doors 11 is equal to the number of server racks 14, each door providing access to a sidewall side 14F of one server rack 14, and the embodiment where there is one door 11 in the side wall 4 of the server area 26, the one door 11 providing access to the all sidewall sides 14F of all servers racks 14 in the row 9. The skilled person can conceive any other ratio of doors 11 and server racks 14, where it is also conceivable that some doors 11 provide access to a different number of server racks 14 than other doors 11 in one module.

[c17] Further visible in Figure 4 is a cooling assembly 20, arranged inside the module, more specifically arranged in the cooling area 27 of the module. The operational mode of the cooling assembly 20 will be described in some detail further below with reference to Figures 8A and 8B.

[c2,3] With reference to Figure 5, a top view of an embodiment of the datacentre module is shown, where the top wall 2 is worked open, to show the contents of the module. Visible in the server area 26 are two rows 8, 9 of server racks 14, arranged along the right 5 respectively the left 4 side wall. The rows 8, 9 are arranged at a distance A from each other, to define an aisle 10 between them, said aisle 10 allowing passage of a person.

Visible in the embodiment of Figure 5, is that the sidewall sides 14F of the rows 8, 9 of server racks 14 are arranged at a distance B, C from the side walls 4, 5. This displacement of the server racks 14 with respect to the side walls 4, 5 of the module provides a right vertical ventilation interspace RVI respectively a left vertical ventilation interspace LVI delimited between the right 8 and left 9 row of server racks 14 and the right 5 respectively left 4 side wall.

These vertical ventilation interspaces LVI, RVI are relatively narrow, and are substantially smaller than the aisle 10. While the aisle 10 is arranged within the module with the object to allow persons to perform maintenance work and the like, this is not intended for the vertical ventilation interspaces LVI, RVI. The distance between the side walls 4, 5 and the sidewall sides 14F of the server racks 14 is for example smaller than 50 cm, such as smaller than 20 cm.

[c13,14] Further visible in Figure 5 is the aisle 10. As stated above, this aisle 10 is arranged in the datacentre module with the object to allow various kinds of installation works, maintenance works, and other activities by a person in the datacentre module. More specifically, aisle sides 14E of the server racks 14, and possibly also top sides 14A, bottom sides 14B, left sides 14C and right sides 14D should be accessible via the aisle 10. In an embodiment of the datacentre module according to the invention, the transverse dimension A, the direction perpendicular to the longitudinal direction of the aisle 10, is at least 80 centimetre

Where a width WS of a server rack 14 is relatively standard, a depth LS of a server rack 14 is more flexible. Please note that, in Figure 5, the depth LS of a server rack 14 is measured in the transverse direction of the datacentre module. Available on the market are server racks with a depth of anywhere between 80 and 120 cm, where it is well conceivable that server racks with a depth outside of this range become available in the future. To allow a server rack 14 to be substituted by another server rack 14, or to allow a rack mountable equipment unit, it is preferred that the transverse dimension A of the aisle 10 is equal to or longer than the depth LS of a server rack 14. It should be noted that it is well conceivable, but not necessary, that the left row 9 of server racks 14 comprises server racks 14 that are of a different depth LS compared to the server racks 14 of the right row 8. In an exemplary embodiment, the left row 9 of server racks 14 comprises server racks 14 with a depth LS of 120 cm, while the server racks 14 of the right row 8 are 80 cm. In that case, it is preferred when the transverse dimension A of the aisle 10 is equal to or longer than the depth LS of the longest server rack 14, in this example thus 120 cm.

[c12] With respect to the outer dimensions LO, WO, HO, these are preferable adapted to allow transportation of the datacentre module by public road, allowing the module to be produced at a first location, to be transported, and to be installed for use at a second location, different from the first location. The maximum outer width WO of the module is then preferably 4.5 meter; the maximum outer height HO of the module is then preferably 4 meter, and the maximum outer length LO is then preferably 25 meter. However, in some embodiments, these outer dimensions LO, WO, HO may be increased.

The minimal outer dimensions LO, WO, HO are related to the dimensions of a server rack 14. Two rows 8, 9 of server racks 14 must be arranged along the side walls 4, 5 of the module, with an aisle between the rows 8, 9. As such, the minimal outer width WO that is conceivable is 2.5 meter, and the minimal outer height HO that is conceivable is 2.7 meter.

The principle minimal outer length LO is 1 meter, the module then containing rows 8, 9 of two 19-inch racks arranged next to each other; a left side 14C of one server rack 14 facing a right side 14D of a consecutive server rack 14. However, from a practical perspective, the minimal outer length LO is more likely to be 5 meter, the module then comprising approximately twenty server racks.

[c11] With reference to Figures 1, 2, and 3, different embodiments of a datacentre module according to the invention are shown. Figure 1 shows an isometric view of a datacentre module 1, wherein the door 11 is a shutter 11, more specifically a roll-down shutter. Figure 2

shows an isometric view of a datacentre module 100, wherein the door is a hatch 110 with a substantially horizontally arranged hinge line. Figure 3 shows an isometric view of a datacentre module 200, wherein the door is a door 120 with a substantially vertically arranged hinge line. Alternatively, the door can be a folding door that can fold in zig-zag manner with respect to horizontal or vertical axes.

[c15-c18] The electrical equipment comprised in the server racks 14 will typically generate a vast amount of heat. Therefore, the datacentre module is preferably in a fluid connection with a cooling assembly 20. Two different operating principles regarding the cooling of the datacentre module are described with reference to Figures 8A and 8B.

One possible way to cool the hot components of the equipment modules, is to displace a cooling medium from one of the aisle side 14E or the sidewall side 14F of the server racks 14 to the other of the aisle side 14E or the sidewall side 14F.

The cooling assembly 20 comprises an inlet 28A for a cooling medium to be cooled by the cooling assembly 20, and an outlet 28B for a cooling medium cooled by the cooling assembly 20.

In the embodiment of Figure 8A, the datacentre module is in fluid connection with a cooling assembly 20, the cooling assembly 20 being arranged inside the module, i.e. the cooling assembly 20 being arranged in between the back wall 7 of the module and the server area 26. The cooling assembly 20 is separated from the server area 26 with a partition 28, wherein the partition 28 comprises an outlet 28B of the cooling assembly 20 that allows the introduction of the cooling medium, in a cold state C, from the cooling assembly 20 into the server area 26 and wherein the partition 28 comprises inlets 28A of the cooling assembly 20 that allow the introduction of cooling medium, in a hot state H, from the server area 26 into the cooling assembly 20. Preferably, these inlets 28A and outlets 28B are coupled to each other, coupling the massflow through the inlets 28A to the massflow through the outlets 28B, such that a substantially constant amount of cooling medium is contained in the server area 26.

The cooling assembly 20 is able to introduce a cooling medium in its cold state C into the aisle 10 of the module via an outlet 28B. The cooling medium is displaceable from the aisle 10 towards the left 4 and right 5 side walls of the module and towards the vertical ventilation interspaces LVI, RVI and/or the horizontal ventilation interspaces LLI, RLI, through the rows 8, 9 of server racks 14. The aisle 10 and the ventilation interspaces LVI, RVI, LLI, RLI are then also in fluid connection with each other. As the cooling medium, in its cold state C, enters the aisle sides 14E of the server racks 14, hot components of the electric equipment are cooled and the cooling medium is heated up via a convective process. The cooling medium that is displaced from the aisle 10 to the ventilation interspaces LVI, RVI, LLI, RLI at the sidewall sides 14F of the server racks 14 has heated up and is in a hot state H. An inlet 28A of the cooling assembly 20 is arranged in the partition 28 to enable the cooling assembly 20 to take the relatively hot cooling medium in from the vertical ventilation interspaces RVI, LVI and/or the horizontal ventilation interspaces RLI, LLI, wherein the inlet 28A of the cooling assembly 20 and the datacentre module are fluidly connected.

The cooling principle shown in Figure 8B is different. In Figure 8B, the cooling assembly 20 is able to introduce a cooling medium in its cold state C into the vertical ventilation interspaces LVI, RVI and/or the horizontal ventilation interspaces LLI, RLI of the module via an outlet 28B. The cooling medium is displaceable from the vertical ventilation interspaces LVI, RVI and/or the horizontal ventilation interspaces LLI, RLI towards the aisle 10, through the rows 8, 9 of server racks 14. The aisle 10 and the ventilation interspaces LVI, RVI, LLI, RLI are then also in fluid connection with each other. As the cooling medium, in its cold state C, enters the sidewall sides 14F of the server racks 14, hot components of the electric equipment are cooled and the cooling medium is heated up via a convective process. The cooling medium that is displaced from the ventilation interspaces LVI, RVI, LLI, RLI to the aisle 10 at the aisle sides 14E of the server racks 14 has heated up and is in a hot state H. An inlet 28A of the cooling assembly 20 is arranged in the partition 28 to enable the cooling assembly 20 to take the relatively hot cooling medium in from the aisle 10, wherein a fluid connection is provided between the cooling assembly 20 and the inlet 28A.

Further visible in Figure 8B is that the cooling assembly 20 is arranged outside of the datacentre module, while being in fluid connection with the datacentre module, more specifically while being in fluid connection with the server area 26 of the datacentre module. Outlets 28B and inlets 28A are arranged in the back wall 7 of the datacentre module, allowing the introduction of the cooling medium, in a cold state C, from the cooling assembly 20 into the server area 26 respectively the introduction of cooling medium, in a hot state H, from the server area 26 into the cooling assembly 20. Preferably, these inlets 28A and outlets 28B are coupled to each other, coupling the massflow through the inlets 28A to the massflow through the outlets 28B, such that a substantially constant amount of cooling medium is contained in the server area 26.

Only the flow path of the cooling medium is shown in Figures 8A and 8B. The cooling medium itself will typically be a gas, the medium being invisible to a human eye. A preferred cooling medium is air, as this is readily available. However, when the cooling assembly 20 is a closed system, different kinds of cooling medium are also conceivable, for example an inert gas such as nitrogen or argon.

In its hot state H, the cooling medium can have a temperature of between 300 K and 310 K, for relatively standard applications where the cooling medium is air. For more exotic applications, where a cooling medium different than air is used, this temperature range may be different.

In its cold state C, the cooling medium can have a temperature of between 288 K and 298 K, for relatively standard applications where the cooling medium is air. For more exotic applications, where a cooling medium different than air is used, this temperature range may be different.

The flow speed of the cooling medium can be between 2 m/s and 4 m/s. Preferably, this flow speed is substantially constant as a function of time. Also, it is preferred that the flow speed is substantially constant throughout the server area 26, without local spots having a higher or lower flow speed.

Figure 7 shows a partial view of the row 8 of server racks 14 along the cross-sectional line VII indicated in Figure 5. Shown in Figure 7 is an aisle 10, and six server racks 14. The server racks 14 each have a bottom 14B, a left side 14C, a right side 14D, a top side 14A, a aisle side 14E facing the aisle 10 and a sidewall side (not indicated in Figure 7) facing a side wall 5 of the module. Further visible in Figure 7 is a right horizontal ventilation interspace RLI between the top side 14A of the row 8 of server racks 14 and the top wall 2 of the datacentre module, and a right vertical ventilation interspace RVI between the sidewall side of the server racks 14 and the right side wall 5 of the datacentre module.

[c5, c9] The server racks 14 are arranged in a row 8, with the left side 14C of one server rack facing the right side 14D of a consecutive server rack 14. There is an interspace between the server racks 14; left sides 14C of one server rack 14 being displaced with respect to right sides 14D of consecutive server racks. Alternatively, these sides 14C, 14D of two consecutive server racks 14 are arranged adjacent each other, sides 14C, 14D of two neighbouring server racks 14 contacting each other.

A sealing plate 12A is provided between the left side 14C of one server rack 14 and the right side 14D of a neighbouring server rack 14 in the embodiment of Figure 7. This sealing plate 12A prevents a cooling medium from bypassing around the server rack 14, from the aisle 14E to the sidewall 14F side of said server rack 14, or vice versa, to cool hot components of the electronic equipment arranged in the server rack 14, directing cooling medium from the aisle side 14E of the server rack 14, through the server rack 14, towards the sidewall side 14F of the server rack 14, or vice versa. Preferably, the maximum distance by which two neighbouring server racks 14 in a row 8, 9 are spaced apart is 20 cm, for example this maximum distance is 10 cm.

A further sealing plate 12B is provided between the right side 14D of one server rack 14 and the left side 14C of a neighbouring server rack 14 in the embodiment of Figure 7. This sealing plate 12B prevents a cooling medium to bypass around the server rack 14, the sealing plate 12B directing the cooling medium through the server rack 14 to cool hot components of the electronic equipment arranged in the server rack 14, directing cooling medium from the aisle side 14E of the server rack 14, through the server rack 14, towards the sidewall side 14F of the server rack 14, or vice versa. Preferably, the maximum distance by which two neighbouring server racks 14 in a row 8, 9 are spaced apart is 20 cm, for example this maximum distance is 10 cm.

A further sealing plate 12C is provided between the top side 14A of a server rack 14 and the top wall 2 of the datacentre module in the embodiment of Figure 7. This sealing plate 12C prevents a cooling medium to bypass around the server rack 14, displacing the cooling medium through the server rack 14 to cool hot components of the electronic equipment arranged in the server rack 14, the sealing plate 12C displacing cooling medium from the aisle side 14E of the server rack 14, through the server rack 14, towards the sidewall side 14F of the server rack 14, or vice versa. In the embodiment of Figure 7, this sealing plate 12C is arranged above all server racks 14, the sealing plate 12C being a continuous plate.

In the embodiment of Figure 7, the bottom side 14B of the server rack 14 is arranged on the bottom wall 3 of the datacentre module. It is however conceivable that this bottom side 14B is somewhat above the bottom wall 3, leaving a gap below the bottom side 14B of the server rack 14. In this case, a further sealing plate (not shown) can be provided between the bottom side 14B of a server rack 14 and the bottom wall 3 of the datacentre module. This sealing plate (not shown) then would prevent a cooling medium to bypass around the server rack 14, displacing the cooling medium through the server rack 14 to cool hot components of the electronic equipment arranged in the server rack 14, the sealing plate (not shown) displacing cooling medium from the aisle side 14E of the server rack 14, through the server rack 14, towards the sidewall side 14F of the server rack 14, or vice versa.

The sealing plates 12A, 12B, 12C together form a sealing assembly 12. It is however well conceivable that a further sealing plate is arranged as a part of the sealing assembly 12, or that some of the mentioned sealing plates are absent in alternative embodiments. Purely as an example, the top sealing plate 12C may be absent when the top side 14A of the server racks 14 contacts the inner side of the top wall 2 of the datacentre module. Similarly, again as an example, when the sides 14C, 14D of two neighbouring server racks 14 are arranged adjacent each other and are in contact with each other, sealing plates 12A, 12B may be absent in the sealing assembly.

[c6] Further visible with respect to Figure 7, the row 8 of server racks 14 comprises multiple server racks 14, arranged next to each other when viewed in length direction of the row 8. The third server rack 14 in Figure 7, when counting from the right, but conceivable for other server racks 14 as well, is arranged to accommodate one or more rack mountable equipment units 16. These rack mountable equipment units 16 may for example be servers, computer systems, associated components, or a combination thereof. Typically, the width of a rack mountable equipment unit 16 corresponds to the width of a server rack 14, the width being for example 19, 21, or 23 inch, and the height of a rack mountable equipment unit 16 is a multiplicity of a pre-defined standard size U, 1U corresponding to a height of 1.75 inch (44.5 mm), to allow multiple rack mountable equipment units 16 to be arranged in a server rack 14, in vertical direction on top of each other. The height HS of the server racks 14 can for example be up to 50U, although this is height is principally not limited to an upper or lower bound. The height HS of the server racks 14 can be higher or lower in alternative embodiments.

[c7] Further visible in the embodiment of Figure 7, is that the server rack 14 is not completely filled with rack mountable equipment units 16. At several places, a server rack 14 of the row 8 of server racks comprises two rack mountable equipment units 16A, 16B arranged at a vertical distance with respect to each other, where the server rack 16 is free of equipment in between said two rack mountable equipment units 16A, 16B, i.e. the server rack 16 being empty between said two rack mountable equipment units 16A, 16B. In the embodiment of Figure 7, the aisle side 14E of the server rack 14 comprises a blind panel 17 in between said two rack mountable equipment units 16A, 16B, the blind panel 17 closing the vertical distance between the two rack mountable equipment units 16A, 16B. The blind panel 17 forces the cooling medium, that is displaced from the aisle side 14E of the server rack 14 to

the sidewall side 14F of the server rack 14, or vice versa, to pass through the rack mountable equipment units 16, the cooling medium not being displaced through the empty spaces of the server rack 14 and thus optimally used to cool the hot components of the rack mountable equipment units 16.

[c8] In the embodiment of Figure 7, a multiplicity of blind panels 17 is provided that are each mounted on a server rack 14 of the row 8 of server racks 14 to blind a section of the server rack 14 on the aisle side 14E of the server rack 14, said section spanning a horizontal portion of the server rack 14. In the particular embodiment of Figure 7, the blind panels 17 span the full width of a server rack 14.

In a conceivable embodiment, a server rack 14 only contains blind panels 17, at each horizontal row, the server rack 14 being free of equipment. In another conceivable embodiment, multiple blind panels 17 are provided separately from the server rack 14, where the blind panels 17 can be mounted on the server rack 14.

[c19] As visible in Figure 10, each rack mountable equipment unit 16 comprises at least one fan 21. The fan 21 directs the cooling medium, in its relatively cold state C, through the server rack 14, from the aisle side 14E towards the sidewall side 14F, or vice versa, to cool hot components of the rack mountable equipment units 16. Each fan 21 is preferably coupled to a rack mountable equipment unit 16, monitoring the energy usage and/or temperature of its components, and adapting the amount of cooling medium directed through the server rack 14 to the measured energy usage and/or temperature of the components of the rack mountable equipment unit 16, to optimally use the available cooling medium and to keep energy usage of the datacentre module (relatively) low.

[c20] It was previously described that it is preferred when the inlet 28A and the outlet 28B of the cooling assembly 20 are coupled, to keep the amount of cooling medium arranged inside the datacentre module substantially constant. Preferably, the fans 21 arranged in combination with the rack mountable equipment units 16 are coupled to the inlet 28A and/or the outlet 28B of the cooling assembly 20, to control the displacement of and the amount of cooling medium in the datacentre module.

Although the cooling assembly 20 does not form a part of the invention and is known per se, some rudimentary working principles of the cooling assembly 20 are described with reference to Figures 9A to 9C.

Figure 9A shows a side view of an operational modus of the cooling assembly 20, where the cooling assembly 20 is an open-loop system, in fluid connection with a datacentre module 1 arranged on the right side of Figure 9A and in fluid connection with the outside environment O arranged on the left side of Figure 9A. The cooling assembly 20 comprises an inlet 28A for a cooling medium, in the open-looped system of Figure 9A most likely air. Figure 9A shows a conceived operational mode of the cooling assembly 20 when the temperature of the outside air is equal to or below the temperature of the cold state C of the cooling. The cooling assembly 20 comprises inlets 28A to take in a cooling medium, and outlets 28B for the introduction of the cooling medium in its cold state C in the datacentre module 1 and/or expel the cooling medium in its hot state H to the outside environment O.

When the outside air is of the same temperature as the desired temperature of the cold state C of the cooling medium, air can be taken in from an inlet 28A connected to the outside O and directly introduced in the datacentre module 1. Air taken in from an inlet 28A connected to the datacentre module 1 can then directly be expelled towards the outside environment O. The flow of the cooling medium in its cold state C can be strictly separated from the flow of the cooling medium in its hot state H in the described operational mode where the temperature of the outside environment O is equal to the desired cold state C temperature of the cooling medium.

When the outside air is of a lower temperature than the desired temperature of the cooling medium in its cold state C, air that is taken in from an inlet 28A connected to the outside O should be heated up before it is introduced in the datacentre module 1. This can principally be done in two (non-shown) ways.

In one operational mode, the air in its cold state C from the inlet 28A connected to the outside environment O is mixed with the air from the inlet 28A connected to the datacentre module 1 in its hot state H, the flow of the cooling medium in its cold state C thus being mixed with the flow of the cooling medium in its hot state H inside the cooling assembly 20. Only a part of the air taken in from the inlet 28A connected to the datacentre module is then expelled to the outside environment O, the other part of the air taken in from the inlet 28A connected to the datacentre module being recycled to pre-heat the air taken in from the inlet 28A fluidly connected to the outside environment O.

In an alternative operational mode, a heating element is provided in the cooling assembly 20, to bring the relatively cold outside air to the desired temperature of the cold state C of the cooling medium, the flow of the cooling medium in its cold state C being separated from the flow of the cooling medium in its hot state H.

Figure 9B shows a side view of an operational modus of the cooling assembly 20, where the cooling assembly 20 is an open-loop system, in fluid connection with a datacentre module 1 arranged on the right side of Figure 9B and in fluid connection with the outside environment O arranged on the left side of Figure 9B. The cooling assembly 20 comprises an inlet 28A for a cooling medium, in the open-looped system of Figure 9B most likely air. Figure 9B shows a conceived operational mode of the cooling assembly 20 when the temperature of the outside air is in between the temperature of the cooling medium in its cold state C and the temperature of the cooling medium in its hot state H. The cooling assembly 20 comprises inlets 28A to take in a cooling medium, and outlets 28B for the introduction of the cooling medium in its cold state C in the datacentre module 1 and/or expel the cooling medium in its hot state H to the outside environment O.

When the temperature of the outside air is above the desired temperature of the cooling medium in its cold state C, the air taken in from the inlet 28A connected to the outside environment O must be cooled. Therefore, in the embodiment of Figure 9B, a cooling unit 30 is arranged, for example an evaporator. This cooling unit cools the cooling medium between the inlet 28A fluidly connected to the outside O and the outlet 28B fluidly connected to the datacentre module 1, to bring the cooling medium to the desired cold state C temperature. It is conceivable that the cooling unit 30 has a number of discrete operational settings. Depending on the mass flow taken in from the outside environment O, the temperature of the outside air, and the setting of the cooling unit 30, the cooling unit 30 may cool the air to a temperature below the desired cold state C temperature. In that case, it is advantageous if the flow from the outside O and the flow H1 from the datacentre module 1 can be mixed, to heat up the air before it is cooled by the cooling unit 30 and to obtain the desired temperature in the cold state C of the cooling medium. This mixing of air from the two inlets 28A is shown in Figure 9B.

The cooling unit 30 can also have a continuous range of settings, omitting the necessity to mix the relatively cold and the relatively hot flows, flows being separated from each other inside the cooling assembly 20.

In Figure 9C is shown a side view of an operational mode of the cooling assembly 20, where the cooling assembly 20 is a closed-loop system, in fluid connection with a datacentre module 1 on the right side of Figure 9C. The cooling assembly 20 comprises an inlet 28A for a cooling medium, which can be any cooling medium, not limited to air, such as a gaseous or a liquid cooling medium. Figure 9C for example shows an embodiment of the operational mode of the cooling assembly 20 when the temperature of the outside environment O is above the hot state H temperature of the cooling medium. The cooling assembly 20 comprises inlets 28A to take in a cooling medium from the datacentre module 1 in its hot state H, and outlets 28B for the introduction of the cooling medium in the datacentre module 1 in its cold state C.

In the embodiment of Figure 9C, a cooling unit 30 is arranged in combination with the cooling assembly 20, for example an evaporator. This cooling unit 30 cools the cooling medium between the inlet 28A fluidly connected to the datacentre module 1 and the outlet 28B fluidly connected to the datacentre module 1, to bring the cooling medium, taken in by the inlet 28A in its hot state H, to the desired temperature in its cold state C.

It is conceivable that the cooling assembly 20 has different settings, for example but not limited to some of the settings shown in and described in relation to Figures 9A to 9C. It is conceivable that the cooling assembly 20 is automatically able to switch between the different settings, such that it is always able to provide the desired amount of cooling medium, at the desired temperature.

In one embodiment, the datacentre module comprises at least one sensor 22A, 22B, 22C to measure the temperature of the cooling medium when it enters the module 1 in its relatively cold state C and/or to measure the temperature of the cooling medium when is exits the module in its relatively hot state H and/or to measure the temperature of the outside air, and wherein said at least one sensor 22A, 22B, 22C is coupled to a control of the cooling assembly 20 to control at least one operating parameter of the cooling assembly 20, such as the setting of the cooling unit 30, the mixture ration between the air taken in from the outside O and the datacentre module 1, or any other operating parameter in relation to the cooling assembly 20. These sensors 22A, 22B, 22C can facilitate the switching between different operational modes of the cooling assembly 20. The sensors 22A, 22B, 22C can be arranged in and/or on the cooling assembly 20, but alternatively also in and/or on the datacentre module 1, or a combination of both.

To allow operation of the datacentre module, it must be provided with electrical power. This power supply can suffer a fallout, which is highly undesired for the datacentre module. Therefore, it is advantageous if the datacentre module is electrically connected to a generator, said generator able to provide for emergency power when the regular power source of the datacentre modules falls away.

Embodiments of the present invention can also be expressed according to the following clauses:

1) A box-shaped datacentre module 1, 100, 200 having a top wall 2, bottom wall 3, left side wall 4, right side wall 5, front wall 6, and back wall 7, which walls 2, 3, 4, 5, 6, 7 define the box-shape; wherein the module is provided with a right row 8 of server racks 14 and a left row 9 of server racks 14; wherein the right row 8 of server racks 14 is arranged inside the module and extends along the right side wall 5; wherein the left row 9 of server racks 14 is arranged inside the module and extends along the left side wall 4; wherein the right 8 and left 9 row of server racks 14 are arranged at a distance A from each other to define, between the rows 8, 9 of server racks 14, an aisle 10 allowing passage of a person; wherein the server racks 14 have an aisle side 14E facing the aisle 10 and an opposing sidewall side 14F facing the side wall 4, 5; and wherein the right 8 and left 9 side wall are each provided with one or more doors 11, 110, 120, which doors 11, 110, 120 can be opened to provide access to the sidewall side 14F of the server racks 14 facing the respective side wall 4, 5.

2) Datacentre module according to clause 1, wherein the one or more doors in the right 8 and left 9 side wall are provided as a row of one or more doors 11, 110, 120 extending along the entire row of right respectively left server racks.

3) Datacentre according to one of the preceding clauses, wherein the doors of a said row of doors are moveable from a closed position to an open position in which access is provided to the sidewall side 14F of the server racks 14 facing the respective side wall 4, 5 thereby allowing a mechanic access from outside the datacentre module to the entire said sidewall side 14F.

4) Datacentre module according to one of the preceding clause 1-3, wherein the sidewall side 14F of the right row 8 of server racks 14 is arranged at a distance B from the right side wall 5 to provide a right vertical ventilation interspace RVI delimited between the right row 8 of server racks 14 and the right side wall 5, and wherein the sidewall side 14F of the left row 9 of server racks 14 is arranged at a distance C from the left side wall 4 to provide a left vertical ventilation interspace LVI delimited between the left row 9 of server racks 14 and the left side wall 4.

5) Datacentre module according to one of clauses 1-4, wherein the distance between the side walls 4, 5 and the sidewall sides 14F of the server racks 14 is smaller than 50 cm, for example smaller than 20 cm, such as in the range of 3 to 10 cm.

6) Datacentre module according to one of the preceding clauses, wherein the server racks 14 have a height HS that is smaller than an internal height HI of the datacentre module to

provide a right horizontal ventilation interspace RLI between the right row 8 of server racks 14 and the top wall 2, and to provide a left horizontal ventilation interspace LLI between the left row 9 of server racks 14 and the top wall 2.

7) Datacentre module according to one of the preceding clauses, wherein a sealing assembly 12 is provided that prevents a cooling medium from bypassing around the server rack 14, from the aisle 14E to the sidewall 14F side of said server rack 14.

8) Datacentre module according to one of the preceding clauses, wherein the row 8, 9 of server racks 14 comprises multiple server racks 14, arranged next to each other when viewed in length direction of the row 8, 9, each server rack 14 being arranged to accommodate one or more rack mountable equipment units 16.

9) Datacentre module according to one of the preceding clauses, wherein a server rack 14 of said row 8 of server racks comprises two rack mountable equipment units 16A, 16B arranged at a vertical distance with respect to each other, wherein the aisle side 14E of the server rack 14 comprises a blind panel 17, closing the vertical distance between said two rack mountable equipment units 16A, 16B.

10) Datacentre module according to one of the preceding clauses, further comprising a multiplicity of blind panel 17 that can be mounted on a server rack 14 of said row 8 of server racks to blind a section of the server rack 14 on the aisle side 14E of the rack.

11) Datacentre module according to one of the preceding clauses, wherein two successive server racks 14 in a row 8, 9 are spaced apart by a maximum distance of 20cm, such as a maximum distance of 10cm.

12) Datacentre module according to one of the preceding clauses, wherein the door 11 is of at least one of the following types:

- a shutter 120, for example a roll down shutter;

  and/or

- a door 11 with a hinge line arranged substantially vertically;

  and/or

- a hatch 110 with a hinge line arranged substantially horizontally.

13) Datacentre module according to one of the preceding clauses, wherein the module has an outer height HO, an outer width WO, and an outer length LO, wherein the outer height HO of the module is between 2.7 and 4 meters, such as between 3 and 4 meters, for example about 3.7 meters.

14) Datacentre module according to one of the preceding clauses, wherein the outer width WO of the module is between 2.5 and 4.5 meters, such as between 3.5 and 4.5 meters.

15) Datacentre module according to one of the preceding clauses, wherein the outer length LO of the module is between 5 and 25 meters, such as between 10 and 20 meters.

16) Datacentre module according to one of the preceding clauses, wherein a transverse dimension A of the aisle 10 is at least 70 cm.

17) Datacentre module according to one of the preceding clauses, wherein the transverse dimension A of the aisle 10 is equal to or longer than a depth LS of a server rack 14.

18) Datacentre module according to one of the preceding clauses 1-17,
wherein the datacentre module comprises a cooling assembly with an inlet for a cooling medium to be cooled and an outlet for a cooling medium cooled by the cooling assembly, wherein the aisle is in fluid connection with the outlet of the cooling assembly for introducing said cooled cooling medium into the aisle or in fluid connection with the inlet of the cooling assembly for returning cooling medium to the cooling assembly, and
wherein the left and right vertical ventilation interspaces are in fluid connection with the inlet of the cooling assembly for returning cooling medium to the cooling assembly or, respectively, with the outlet of the cooling device for introducing cooling medium into left and right vertical ventilation interspace.

19) Datacentre module according to clause 18, wherein the cooling assembly 20 is arranged inside the module.

20) Datacentre module according to clause 18 or 19, wherein the cooling medium is characterised by at least one of the following operational parameters:

- the temperature of the cooling medium, in its cold state, is between 288 and 298 K;

and/or

- the temperature of the cooling medium, in its hot state, is between 300 and 310 K;

and/or

- the flow speed of the cooling medium, inside the datacentre module, is between 2 and 4 m/s;

and/or

- the cooling medium is a gas, for example air.

21) Datacentre module according to one of the clauses 18-20, wherein fans 21 of the rack mountable equipment units 16 are coupled to the cooling assembly 20, to control the flow of the cooling medium in the datacentre module.

22) Datacentre module according to one of the clauses 18 - 20, wherein the module comprises at least one sensor 22 to measure the temperature of the cooling medium when it enters the module in its relatively cold state and/or to measure the temperature of the cooling medium when it exits the module in its relatively hot state and/or to measure the temperature of the outside air, and wherein said at least one sensor 22 is coupled to a control of the cooling assembly 20 to control at least one operating parameter of the cooling assembly 20.

23) Datacentre module according to one of the preceding clauses, wherein the module is electrically connected to a generator 23, the generator 23 providing current to the datacentre when its regular power source falls away.

24) Datacentre module according to one of the preceding clauses, wherein the front wall 6 of the module comprises an access opening 24.

25) Method for performing maintenance on a datacentre module according to one of the preceding clauses, wherein the method comprises the steps of:

- opening at least one door of the row of one or more doors;
- performing maintenance to a sidewall side of a server rack that is arranged in front of said opened door, wherein the maintenance is performed through said opened door by a person;
- closing the opened door after performing maintenance.

26) Method according to clause 25, wherein the module is arranged on an underground, and wherein the person performing said maintenance is located or standing on said underground outside of the module during the step of performing maintenance to a sidewall side of a server rack that is arranged in front of said opened door through said opened door.

CLAIMS

1] A box-shaped datacentre module (1, 100, 200) having a top wall (2), bottom wall (3), left side wall (4), right side wall (5), front wall (6), and back wall (7), which walls (2, 3, 4, 5, 6, 7) define the box-shape;
wherein the module is provided with a right row (8) of server racks (14) and a left row (9) of server racks (14);
wherein the right row (8) of server racks (14) is arranged inside the module and extends along the right side wall (5);
wherein the left row (9) of server racks (14) is arranged inside the module and extends along the left side wall (4);
wherein the right (8) and left (9) row of server racks (14) are arranged at a distance (A) from each other to define, between the rows (8, 9) of server racks (14), an aisle (10) allowing passage of a person;
wherein the server racks (14) have an aisle side (14E) facing the aisle (10) and an opposing sidewall side (14F) facing the side wall (4, 5);
wherein the right (5) and left (4) side wall are each provided with a row of one or more doors (11, 110, 120) extending along the entire row of right respectively left server racks, which doors (11, 110, 120) are moveable from a closed position to an open position in which access is provided to a sidewall side (14F) of the server racks (14) facing the respective side wall (4, 5) thereby allowing a mechanic access from outside the datacentre module to the entire said sidewall side (14F); and
wherein the sidewall side (14F) of the rows (8, 9) of the server racks (14) is arranged at a distance (B, C) from the respective side wall (4, 5), said distance (B, C) being smaller than 50 cm.

2] Datacentre module according to claim 1, wherein the sidewall side (14F) of the right row (8) of server racks (14) is arranged at a distance (B) from the right side wall (5) to provide a right vertical ventilation interspace (RVI) delimited between the right row (8) of server racks (14) and the right side wall (5), and wherein the sidewall side (14F) of the left row (9) of server racks (14) is arranged at a distance (C) from the left side wall (4) to provide a left vertical ventilation interspace (LVI) delimited between the left row (9) of server racks (14) and the left side wall (4).

3] Datacentre module according to claim 1 or 2, wherein the distance between the side walls (4, 5) and the sidewall sides (14F) of the server racks (14) is smaller than 20 cm, such as in the range of 3 to 10 cm.

4] Datacentre module according to one of the preceding claims, wherein the server racks (14) have a height (HS) that is smaller than an internal height (HI) of the datacentre module to provide a right horizontal ventilation interspace (RLI) between the right row (8) of server racks (14) and the top wall (2), and to provide a left horizontal ventilation interspace (LLI) between the left row (9) of server racks (14) and the top wall (2).

5] Datacentre module according to one of the preceding claims, wherein a sealing assembly (12) is provided that prevents a cooling medium from bypassing around the server rack (14), from the aisle (14E) to the sidewall (14F) side of said server rack (14).

6] Datacentre module according to one of the preceding claims, wherein the row (8, 9) of server racks (14) comprises multiple server racks (14), arranged next to each other when viewed in length direction of the row (8, 9), each server rack (14) being arranged to accommodate one or more rack mountable equipment units (16).

7] Datacentre module according to one of the preceding claims, wherein a server rack (14) of said row (8) of server racks comprises two rack mountable equipment units (16A, 16B) arranged at a vertical distance with respect to each other, wherein the aisle side (14E) of the server rack (14) comprises a blind panel (17), closing the vertical distance between said two rack mountable equipment units (16A, 16B).

8] Datacentre module according to one of the preceding claims, further comprising a multiplicity of blind panel (17) that can be mounted on a server rack (14) of said row (8) of server racks to blind a section of the server rack (14) on the aisle side (14E) of the rack.

9] Datacentre module according to one of the preceding claims, wherein two successive server racks (14) in a row (8, 9) are spaced apart by a maximum distance of 20cm, such as a maximum distance of 10cm.

10] Datacentre module according to one of the preceding claims, wherein the door (11) is of at least one of the following types:

- a shutter (120), for example a roll down shutter;

and/or

- a door (11) with a hinge line arranged substantially vertically;

and/or

- a hatch (110) with a hinge line arranged substantially horizontally.

11] Datacentre module according to one of the preceding claims, wherein the module has an outer height (HO), an outer width (WO), and an outer length (LO), wherein

- the outer height (HO) of the module is between 2.7 and 4 meters, such as between 3 and 4 meters, for example about 3.7 meters;

and/or

- the outer width (WO) of the module is between 2.5 and 4.5 meters, such as between 3.5 and 4.5 meters;

and/or

- the outer length (LO) of the module is between 5 and 25 meters, such as between 10 and 20 meters.

12] Datacentre module according to one of the preceding claims, wherein a transverse dimension (A) of the aisle (10) is at least 70 cm.

13] Datacentre module according to one of the preceding claims, wherein the transverse dimension (A) of the aisle (10) is equal to or longer than a depth (LS) of a server rack (14).

14] Datacentre module according to one of the preceding claims 2-13 ,
wherein the datacentre module comprises a cooling assembly with an inlet for a cooling medium to be cooled and an outlet for a cooling medium cooled by the cooling assembly, wherein the aisle is in fluid connection with the outlet of the cooling assembly for introducing said cooled cooling medium into the aisle or in fluid connection with the inlet of the cooling assembly for returning cooling medium to the cooling assembly, and
wherein the left and right vertical ventilation interspaces are in fluid connection with the inlet of the cooling assembly for returning cooling medium to the cooling assembly or, respectively, with the outlet of the cooling device for introducing cooling medium into left and right vertical ventilation interspace.

15] Datacentre module according to claim 14, wherein the cooling assembly (20) is arranged inside the module.

16] Datacentre module according to claim 14 or 15, wherein the cooling medium is characterised by at least one of the following operational parameters:

- the temperature of the cooling medium, in its cold state, is between 288 and 298 K;

and/or

- the temperature of the cooling medium, in its hot state, is between 300 and 310 K;

and/or

- o the flow speed of the cooling medium, inside the datacentre module, is between 2 and 4 m/s;

and/or

- o the cooling medium is a gas, for example air.

17] Datacentre module according to one of the claims 14-16, wherein fans (21) of the rack mountable equipment units (16) are coupled to the cooling assembly (20), to control the flow of the cooling medium in the datacentre module.

18] Datacentre module according to one of the claims 14 - 17, wherein the module comprises at least one sensor (22) to measure the temperature of the cooling medium when it enters the module in its relatively cold state and/or to measure the temperature of the cooling medium when it exits the module in its relatively hot state and/or to measure the temperature of the outside air, and wherein said at least one sensor (22) is coupled to a control of the cooling assembly (20) to control at least one operating parameter of the cooling assembly (20).

19] Datacentre module according to one of the preceding claims, wherein the module is electrically connected to a generator (23), the generator (23) providing current to the datacentre when its regular power source falls away.

20] Datacentre module according to one of the preceding claims, wherein the front wall (6) of the module comprises an access opening (24).

21] Method for performing maintenance on a datacentre module (1, 100, 200) according to one of the preceding claims, wherein the method comprises the steps of:

- opening at least one door (11, 110, 120) of the row of one or more doors;
- performing maintenance to a sidewall side (14F) of a server rack (14) arranged in front of said opened door (11, 110, 120), wherein the maintenance is performed through said opened door (11, 110, 120) by a person;
- closing the opened door (11, 110, 120) after performing maintenance.

22] Method according to claim 21, wherein the module is arranged on an underground, and wherein the person performing said maintenance is located on said underground, outside of the module, during the step of performing maintenance to a sidewall side (14F) of a server rack (14) arranged in front of said opened door (11, 110, 120) through said opened door (11, 110, 120).

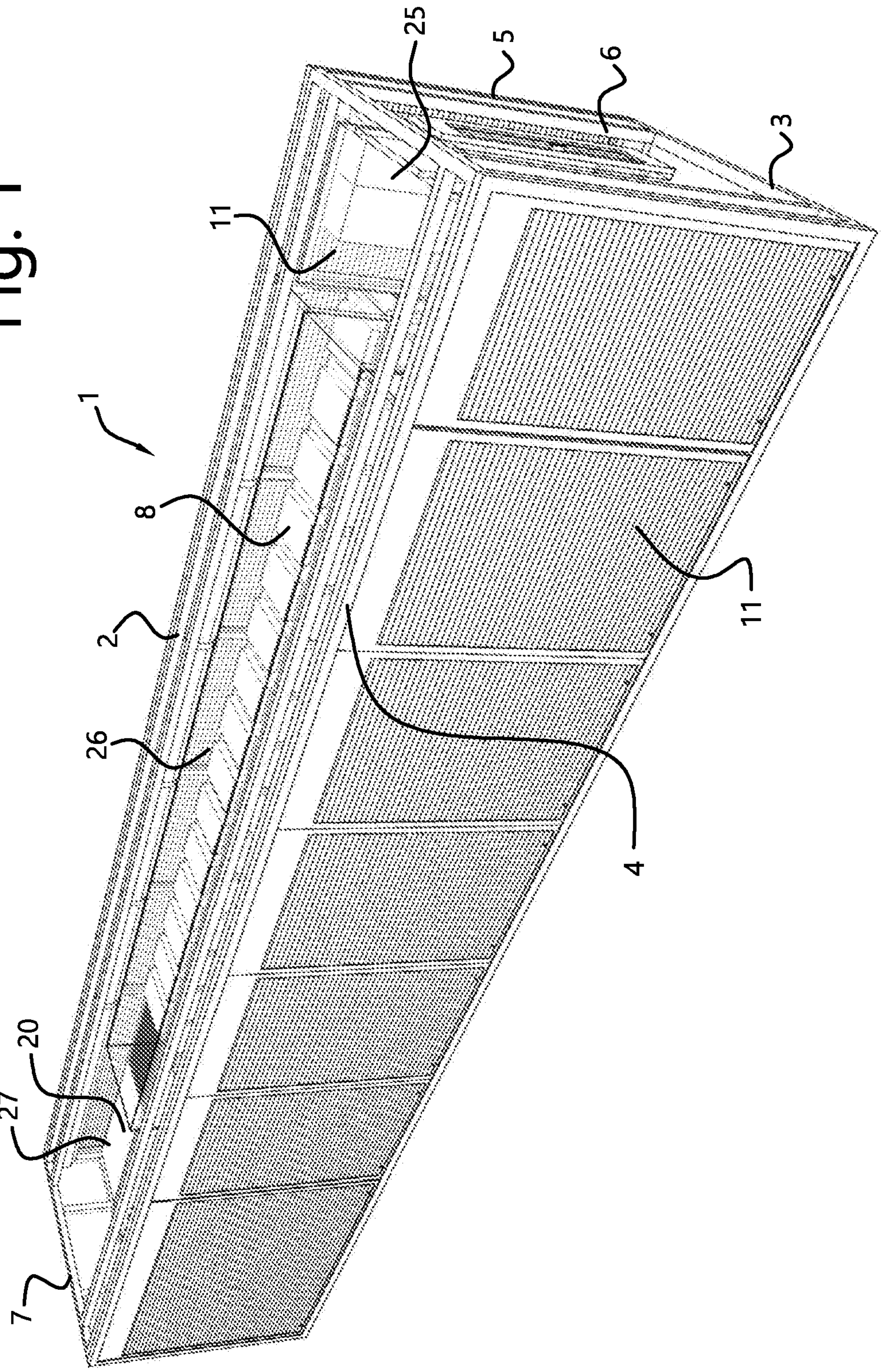


Fig. 1

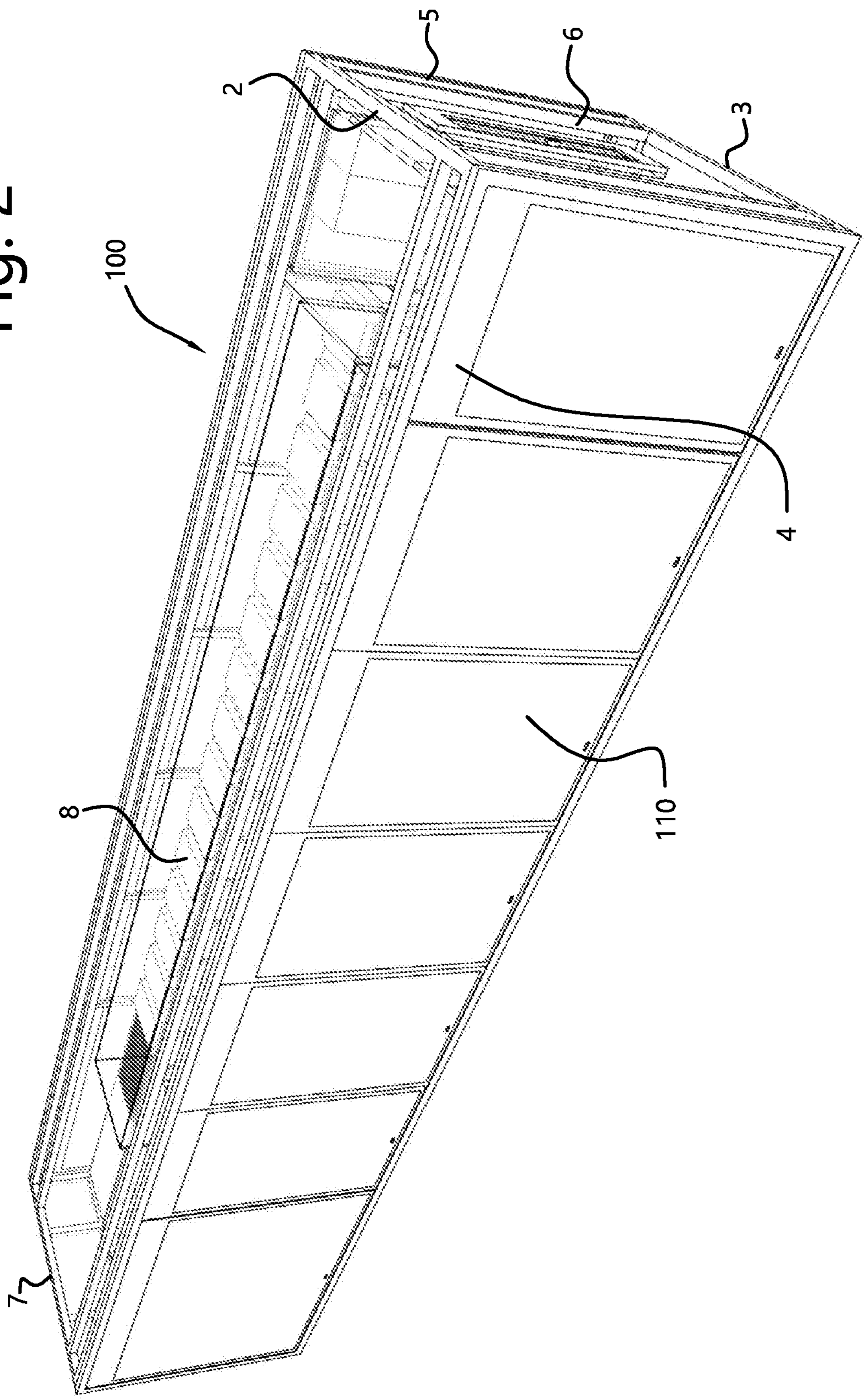


Fig. 2

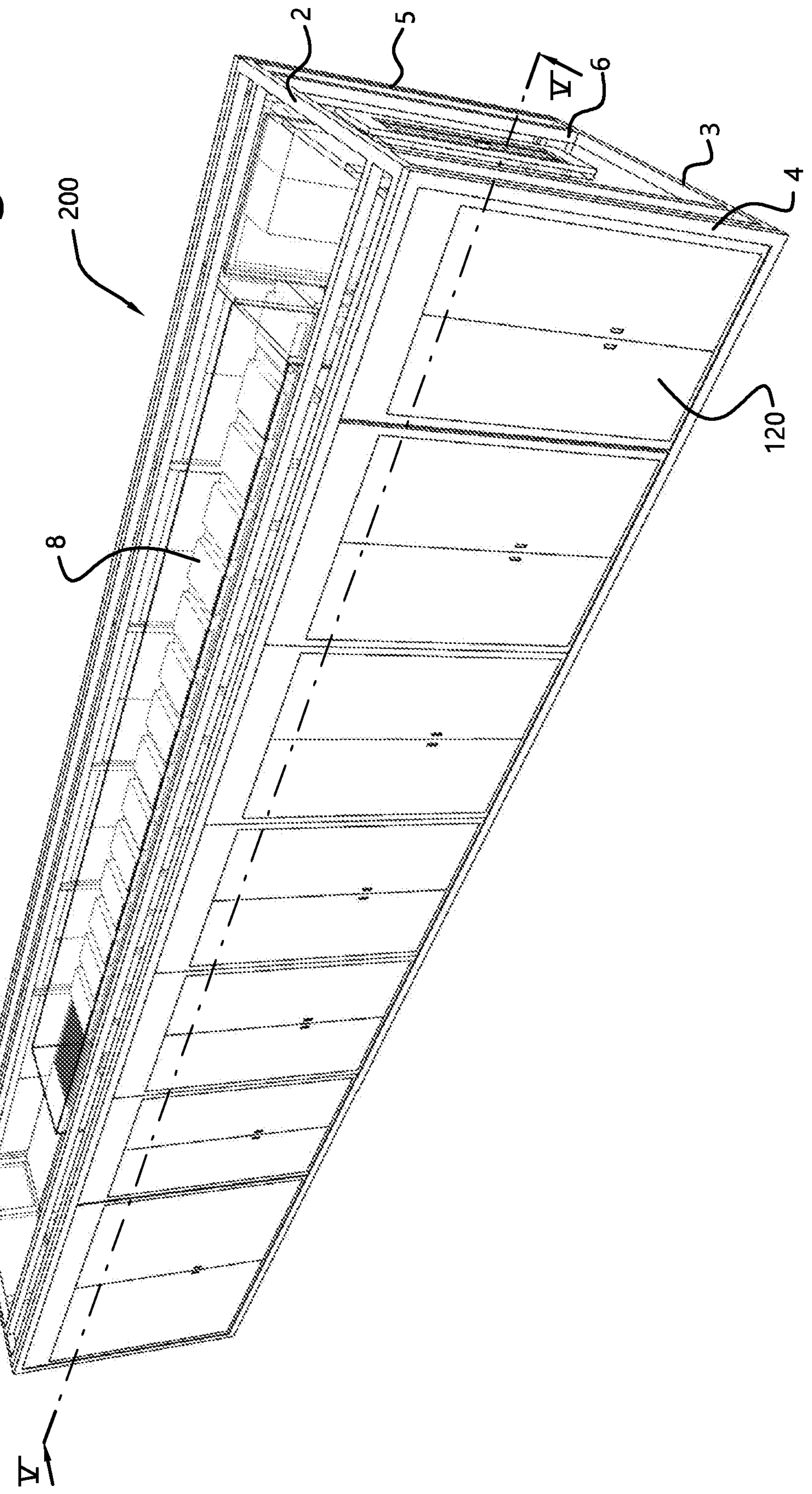


Fig. 3

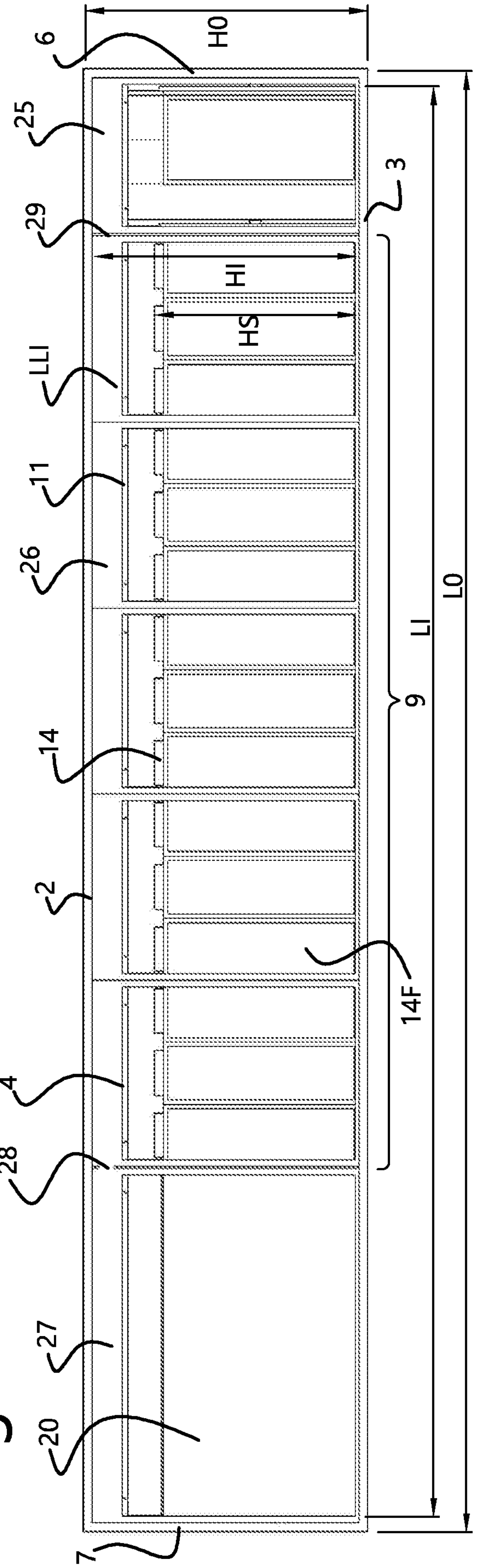
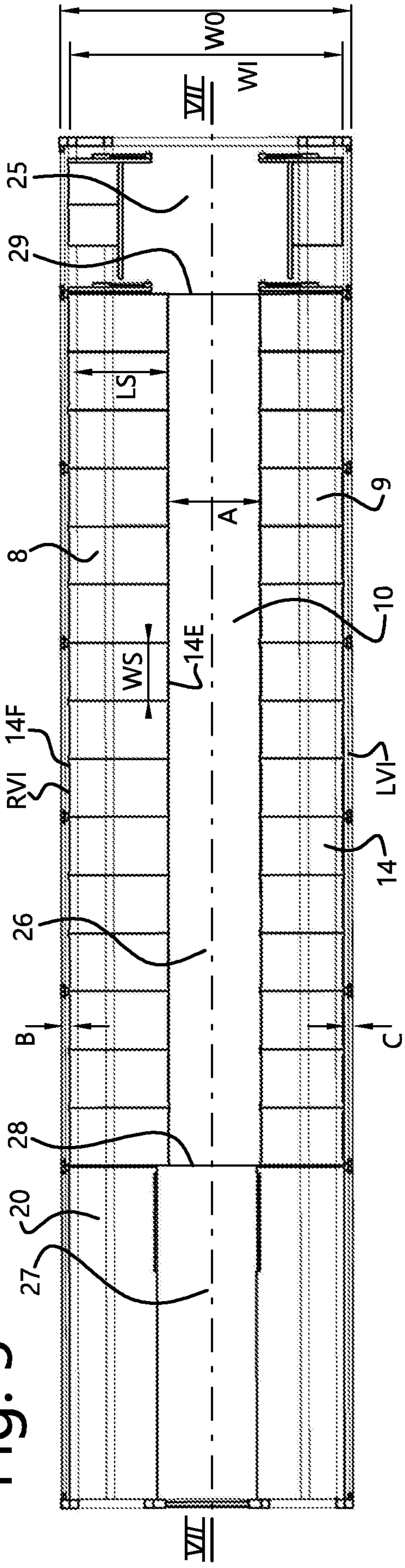

H0
6
25
3
29
HI
HS
LLI
11
26
9
LI
L0
14
2
14F
4
28
27
20
7

Fig. 4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WI
VII
25
29
LS
A
8
9
10
14E
WS
14F
RVI
LVI
14
26
B
C
28
20
27
VII

Fig. 5

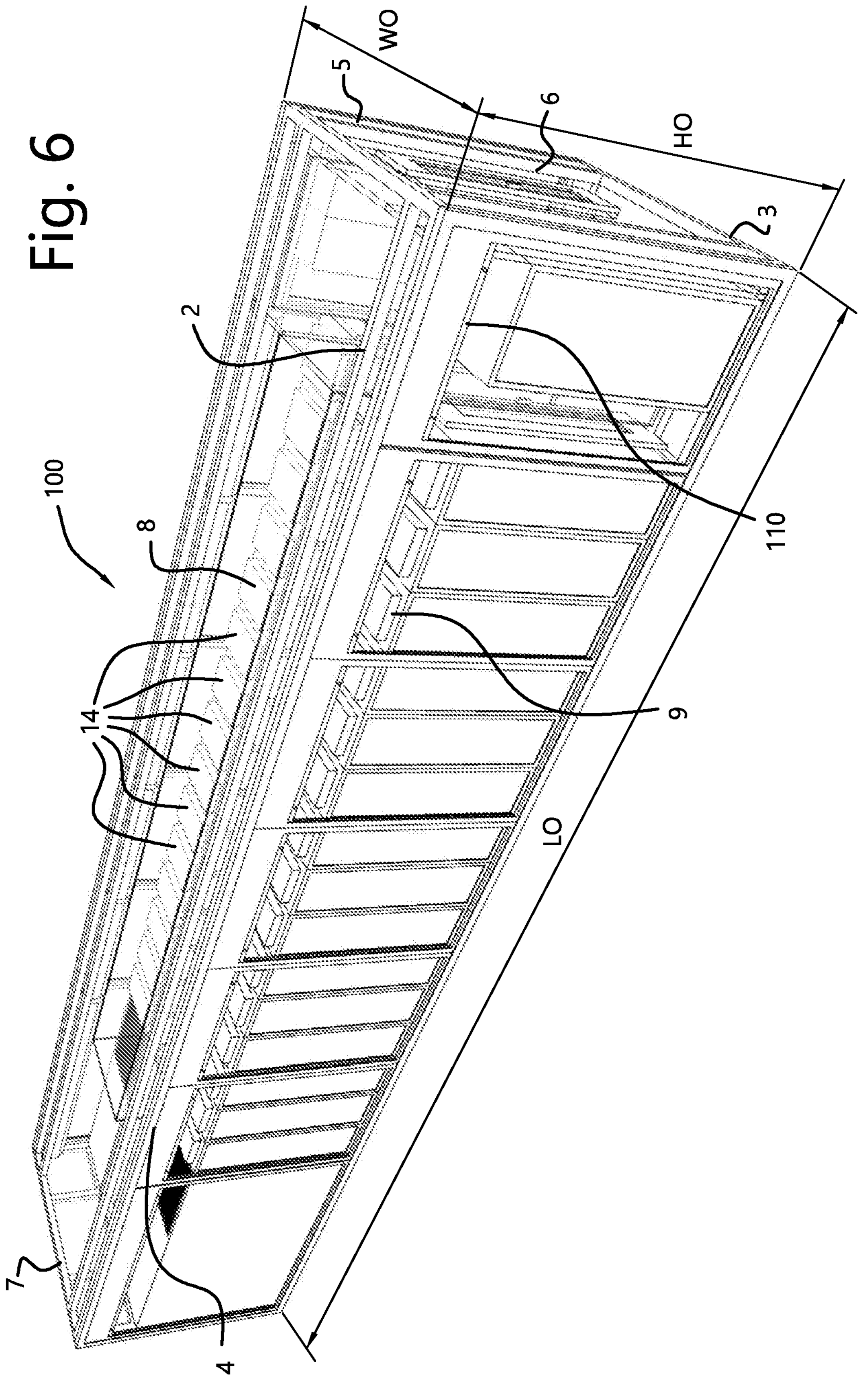
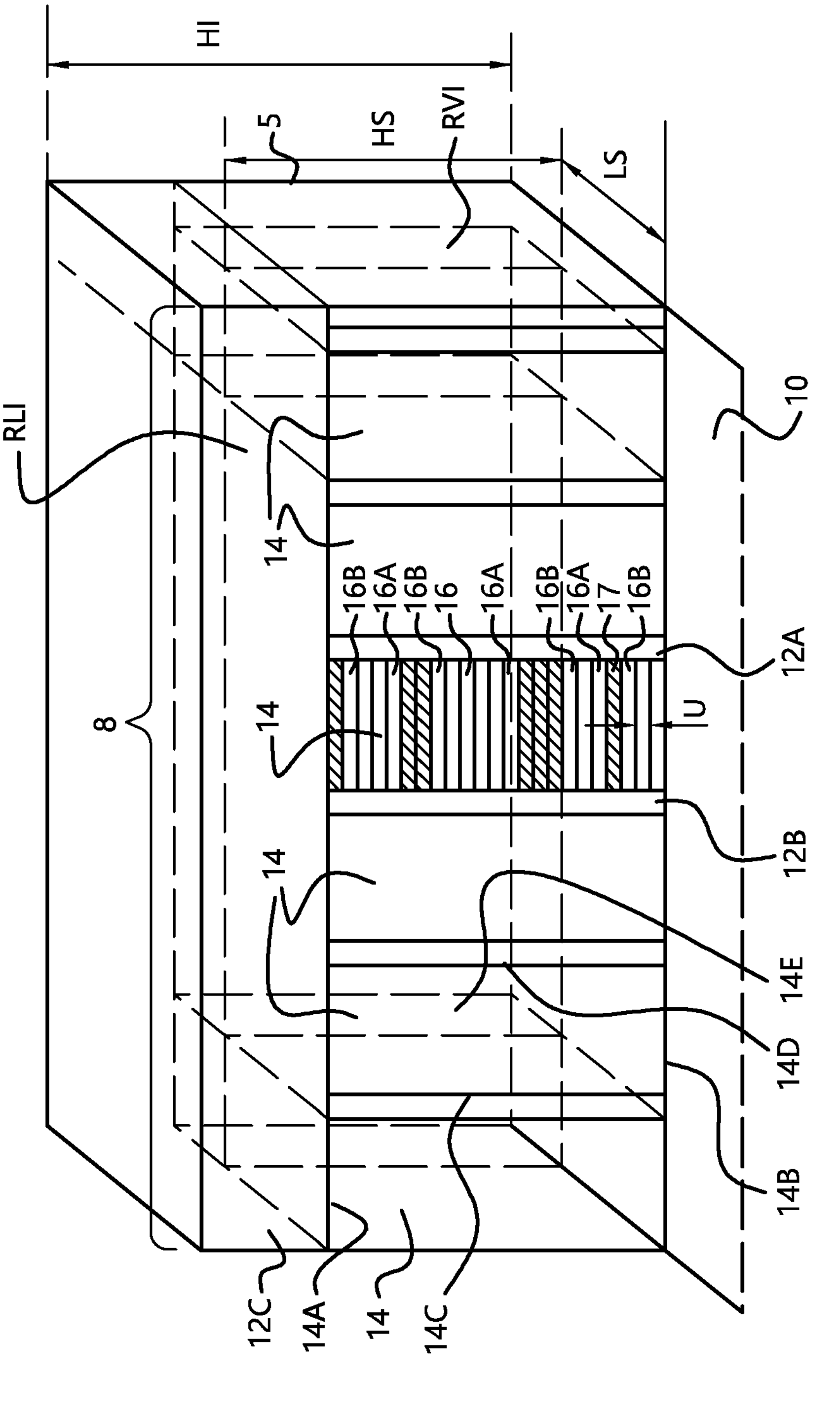


Fig. 6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RVI
LS
RLI
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14
14
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16A
16B
16A
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16B
U
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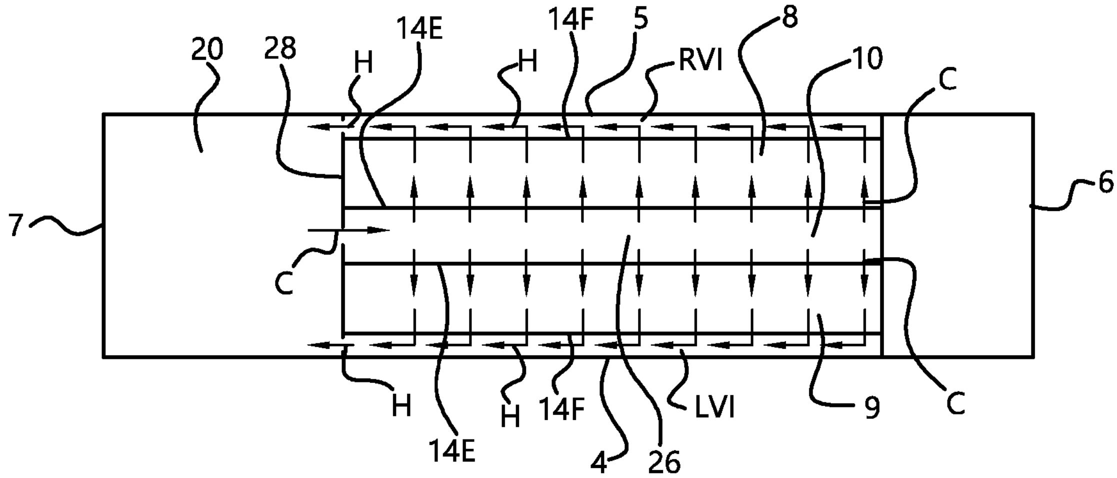
14
14
14E
14D
14B
12C
14A
14
14C

Fig. 7

Fig. 8A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H
14F
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RVI
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C
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C
C
H
H
14F
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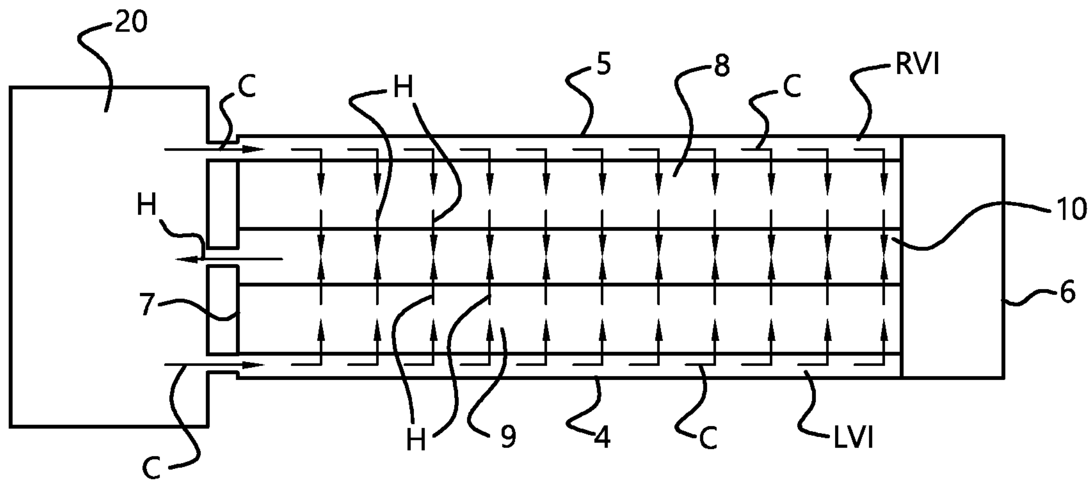
14E
4
26

Fig. 8B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C
H
5
8
C
RVI
10
H
7
6
H
9
4
C
LVI
C

Fig. 9A

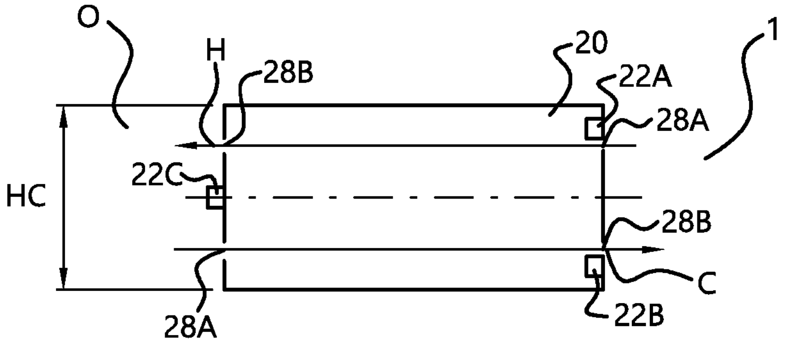


Fig. 9B

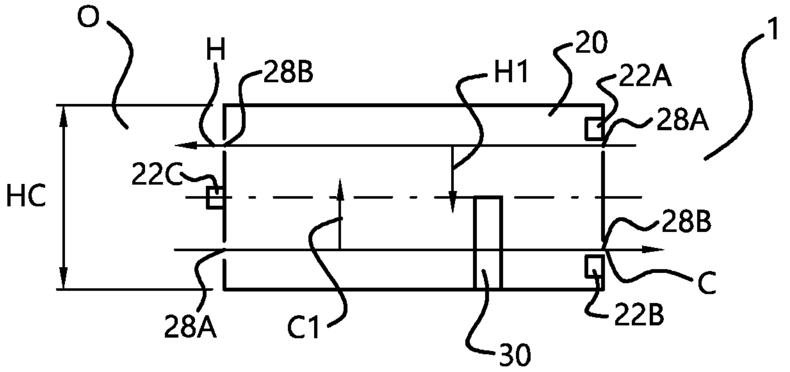


Fig. 9C

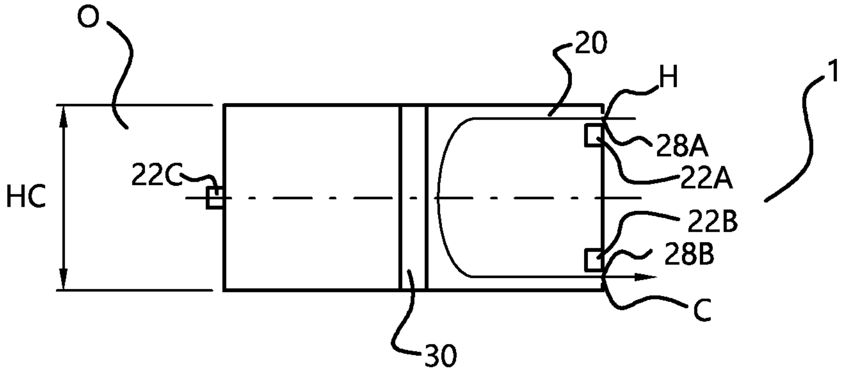
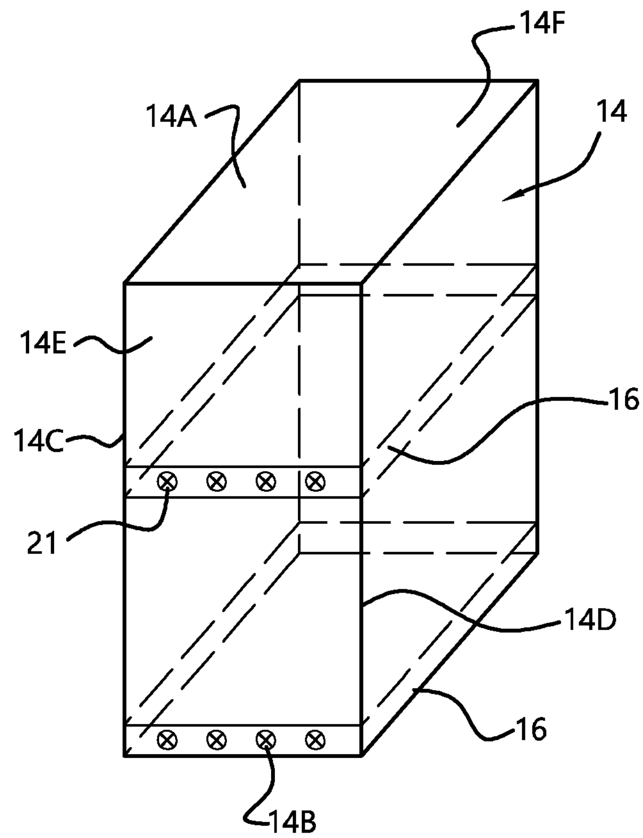


Fig. 10



INTERNATIONAL SEARCH REPORT

International application No
PCT/NL2017/050790

A. CLASSIFICATION OF SUBJECT MATTER
INV. H05K7/14 H05K7/20
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
H05K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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X Y	US 2012/019115 A1 (DUNWOODY JOHN CRAIG [US] ET AL) 26 January 2012 (2012-01-26) figures 1-3,6-8 alinea [0020], [0022], [0024], [0034], [0043] paragraph [0050] - paragraph [0059] claims 1-4 -----	1-22 1-22
Y	US 2009/050591 A1 (HART DAVID MICHAEL [AU] ET AL) 26 February 2009 (2009-02-26) figures 1,4B,5B,6 paragraph [0008] - paragraph [0015] paragraph [0029] - paragraph [0035] paragraph [0050] - paragraph [0058] alineas [0061], [0064], [0067], [0085], [0096], [0097], [0105] paragraph [0114] - paragraph [0129] paragraph [0133] -----	1-22

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[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
8 March 2018	16/03/2018

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Jorna, Pieter

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International application No
PCT/NL2017/050790

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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INTERNATIONAL SEARCH REPORT

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