(19) DANMARK

(10) DK/EP 2715480 T3

(12) Oversættelse af europæisk patentskrift

Patent- og Varemærkestyrelsen

(51) Int.Cl.: *G 06 F 1/20 (2006.01)* *G 06 F 1/16 (2006.01)* *G 06 F 1/18 (2006.01)* *H 05 K 7/20 (2006.01)*

(45) Oversættelsen bekendtgjort den: **2018-08-13**

(80) Dato for Den Europæiske Patentmyndigheds bekendtgørelse om meddelelse af patentet: **2018-07-04**

(86) Europæisk ansøgning nr.: **12756793.1**

(86) Europæisk indleveringsdag: **2012-08-27**

(87) Den europæiske ansøgnings publiceringsdag: **2014-04-09**

(86) International ansøgning nr.: **FR2012051938**

(87) Internationalt publikationsnr.: **WO2013030501**

(30) Prioritet: **2011-09-01 FR 1157760**

(84) Designerede stater: **AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR**

(73) Patenthaver: **OVH, 2 Rue Kellermann, 59100 Roubaix, Frankrig**

(72) Opfinder: **KLABA, Miroslaw, c/o OVH SAS, 2 rue Kellerman, F-59100 Roubaix, Frankrig**

(74) Fuldmægtig i Danmark: **Plougmann Vingtoft A/S, Rued Langgaards Vej 8, 2300 København S, Danmark**

(54) Benævnelse: **CONTAINER UDSTYRET TIL EN TEKNISK INFRASTRUKTUR**

(56) Fremdragne publikationer:
WO-A1-2010/040868
FR-A1- 2 895 209
US-A1- 2006 187 636
US-A1- 2010 110 626
US-B1- 7 278 273
US-B1- 7 430 118

Description

The present invention relates to technical infrastructures and more particularly to the arrangement of these infrastructures.

In this document, the term "technical infrastructure" describes any building or facility used to house information and communication technologies, such as a computing centre/data centre, a hosting centre, a back-up site, a telecom/carrier hotel or a server farm. Generally, these infrastructures are configured as computer rooms (or buildings) that comprise, as an example and not limited thereto, telecommunication equipment, servers, storage systems, power systems, cooling systems, inverters, electrical distribution systems and workstations.

Furthermore, the term "arrangement" of a technical infrastructure describes the manner in which it is conditioned in order to meet all the requirements it will face throughout its lifecycle (i.e. design, deployment, operations, and maintenance). These requirements include:

- Energy efficiency and environmental compliance: increasing the PUE (Power Usage Effectiveness) of a technical infrastructure to reach optimised ratios, for economic and environmental purposes;
- Deployment speed: being able to respond quickly to urgent and temporary requests by optimising the time required for the commissioning of a technical infrastructure;
- Portability/mobility: being able to transport a technical infrastructure from or to any location as a result of natural hazards, or of political and social events (for example riots, earthquakes, snowstorms, cyclones, floods, fires);
- Modularity: being able to restructure/extend a technical infrastructure at any moment.

These requirements have given rise to new designs for technical infrastructures, and in particular for data centres.

In this field, the containerisation (i.e. placing into containers) of data centres stands out. In this document, the term "container" describes a normal metal chamber designed in a parallelepiped form for the transport of goods. Computer rooms arranged in containers equipped with cooling systems are indeed already available.

More generally, metal container units (described as modules in the state of the art) specially designed to house computer rooms and equipped with cooling centres are also proposed.

However, current solutions are imperfect, in particular as these are not optimal in nature. These containers/modules are limited, in particular in terms of energy efficiency and environmental compliance.

For example, document US2010110626 A1 relates to an information system arranged in a container, itself arranged as a technical infrastructure. This document tackles the energy efficiency issue, in particular in terms of the cooling of the technical infrastructures placed inside containers and, for this purpose, proposes a specific arrangement of the container.

As computer equipment is becoming increasingly energy-hungry, and as power density is forever growing, while cooling systems are being pushed to their limits in terms of capacity,

- Arranging a computer room inside a container for its transportability, without considering its PUE; or
- Arranging a container as if it were a traditional computer room risks compromising the global cost (PUE) of data centres and have a negative environmental impact.

A purpose of the present invention is to remedy the abovementioned disadvantages.

Another purpose of the present invention is to improve the energy efficiency of a data centre arranged inside a container.

A purpose of the present invention is to optimise the arrangement of a container, so as to design data centres that feature improved energy efficiency.

Another purpose of the present invention is to improve the ecological footprint of a data centre.

Another purpose of the present invention is to take into account environmental parameters in the arrangement of technical infrastructures.

Another purpose of the present invention is to avoid having to rely on a heavy electrical infrastructure for the cooling of a technical infrastructure.

Another purpose of the present invention is to rethink, in terms of the power constraints we are faced with, the layout of computer rooms arranged in containers.

Another purpose of the present invention is to propose technical infrastructure architectures that integrate sustainable resources.

Another purpose of the present invention is to integrate the environmental dimension in the design of data centres.

For this purpose and in a first embodiment, the invention relates to a container arranged as a technical infrastructure comprising

- On a longitudinal lateral surface, at least one opening arranged for allowing the entry of air to the interior of the container;
- On an opposite longitudinal lateral surface, at least one fan arranged for taking the air out from the interior to the exterior of the container, said at least one opening and said at least one fan being vertically offset at two different heights of the two opposite longitudinal lateral surfaces, said at least one fan being at a greater height with respect to said at least one opening;
- Computer bays arranged in the middle of the container along its longitudinal axis.

In a second embodiment, the invention proposes a data centre comprising a plurality of containers arranged to form a technical infrastructure such as defined above, these containers being arranged in a chimney configuration, the cavity of which opens upwards.

Other features and advantages of the invention will appear more clearly and tangibly upon reading the following description of preferred embodiments, with reference to the appended drawings, in which:

- Figures 1 and 2 schematically show, respectively, a profile view and a side cross-section view of a container arranged according to one embodiment;
- Figure 3 schematically shows a data centre architecture achieved by arranging containers according to one embodiment.

With reference to figures 1 and 2, transformations are made on container 1 so that it comprises:

- On a longitudinal lateral surface, a plurality of quadrangular openings 2 (in particular in the form of vents) arranged for allowing the entry of air into the interior of the container 1;
- On the opposite longitudinal lateral surface, a plurality of fans 3 arranged to evacuate the air from the interior to the exterior of the container 1; and
- At least one door 4.

As shown on the profile view of the container 1 featuring in figure 2, the computer bays 5 (or computer racks) are arranged in the middle of the container along its longitudinal axis, so as to form two empty longitudinal corridors. Consequently, there is a corridor on either side of the computer bays 5, thereby

providing an easy access to the computer equipment. In particular, there is no limitation as to the type of computer bays 5, nor is there any limitation regarding its origin.

As is shown in figure 2, the fans 3 and the openings 2 are vertically offset at two different heights of the two opposite longitudinal lateral surfaces. The fans 3 are at a greater height so as to evacuate hot air, and the openings 2 are at a lesser height in order to better cool the bays with the incoming air, which is assumed to be colder than the air inside the container.

The figure 2 further shows the upstream to downstream intake of air in the arranged container 1, i.e. from the right to the left of figure 2. This configuration enables

- The entry of ambient air, under the effect of wind or low pressure generated by the fans 3;
- The flow of air through the computer equipment of the racks 5;
- The evacuation of hot air from the container 1 driven by the fans 3.

Advantageously, the corridors on either side of the computer bays 5 favour, respectively,

- The homogeneous inlet of air flows perpendicular to the direction in which the computer bays 5 are arranged, thereby representing an exposure that is favourable to the cooling of the computer equipment;
- The evacuation of hot air through the fans 3, which operate in the direction and orientation of the hot air flows.

As a result, the low pressure generated by the fans 3 at the inlet of the openings 2 (i.e. the vents), the two empty corridors on either side of the computer racks 5 and the fans 3 on the opposite surface ensure the natural ventilation of the computer room arranged inside the container 1.

Advantageously, the inter-arrangement of the openings 2, the fans 3, the computer bays 5 provide for the optimal cooling of the ambient air in the computer room of the container 1.

The inter-arrangement of the openings 2, the fans 3 and the computer bays 5 has the technical effect of improving the ventilation of the racks arranged perpendicular to direction of propagation of the incoming air flow. The arrangement of the fans 3 on the surface opposite that of the openings 2 generates an air flow that provides for the natural ventilation of the computer bays 5.

Consequently, by contributing to improving the energy efficiency of the data centre, the inter-arrangement of these items (openings, fans, computer bays) is particularly functional.

Consequently, the data centre arranged in the container 1 is fully cooled by the ambient outside air.

Preferably, filters, superimposed on the openings 2, filter out the dust and toxic gases from the incoming air, and regulate its dampness. The filters are in particular useful when the container 1 is located in an excessively humid area or in an area where dust or toxic gases are circulated (coastal area, work site, industrial zone for instance). The filters are configured, in particular, to maintain the level of dampness of the incoming air within a predefined range or, as necessary, to trigger a control device to maintain the level of dampness within said range.

Preferably, the openings 3 are controlled by an automatic system regulating the aperture (of the vents for example), and consequently the incoming air flow, depending on the required cooling.

It should be noted that the number and size of the openings 2, as well as of the fans 3, are selected to take into account a plurality of factors, including the deployment environment, and the computational load of the technical infrastructure.

It should be noted that additional cooling systems can be combined with the outside air-based cooling system described above. As an example, cooling systems based on gas/liquid expansion, freezing water, or water can be combined, as an added option or as a backup solution, with the outside air-based cooling system. When combined with a liquid-based cooling system (with water for example), both cooling systems of the data centre (or hosting centre) can coexist in the container 1.

The container 1 further comprises means for the security, fire safety and hazard management (sensors, water leaks and smoke detecting systems for example).

In one embodiment, the container 1 is arranged so that its interior communicates with the interior of at least one other container 1 and is, therefore, extensible.

In one embodiment shown in figure 3, a plurality of containers 1 are arranged in a chimney configuration. The resulting technical infrastructure 10 therefore forms a hollow building featuring a cavity 11 that opens upwards.

The fans 3 that open into the cavity 11 of the data centre 1 can be used to evacuate hot air towards the cavity 11, which, by chimney effect, expels it outwards. The chimney effect is due to the temperature difference between the hot air inside the data centre (the resulting technical infrastructure) 10 and the outside cold air, which generates an upwards motion 12 of the air coming from the fans 3.

Advantageously, the combined effect of the chimney created by the cavity 11 and the force of the wind at the inlet of the openings 2, arranged in the lateral surfaces of the containers 1, ensures the natural

ventilation of the data centre 10. In other words, air is naturally set in motion through the containers 1 of the technical infrastructure 10. The air blown through the wall openings 2 towards the exterior of the infrastructure 10 exits, through the fans, by stack effect towards the cavity 11.

Preferably, the cavity 11 features a convex polygon shape, in particular rectangular or square. In another version, the cavity 11 is a concave or cross-shaped polygon.

The system described above features several advantages. It ensures:

- The quick availability of a technical infrastructure featuring good performance levels at a low cost;

- If the ambient temperature of the deployment environment is below a predefined value, a significant improvement of the energy efficiency of technical infrastructures;

- Reduced installation and operational costs compared with traditional data centres;

- The construction of environmentally-friendly computational facilities.

It should be noted that the term “container” used herein covers any metallic chamber similar to a traditional container, without necessarily featuring the standard dimensions of a container used for the transport of goods.

The above description makes reference to a computer room or a data centre, but this example is obviously not limiting and can relate to any other facility or infrastructure housing information and communication technologies.

Patentkrav

1. Container (1) udstyret til en teknisk infrastruktur, omfattende:

- på en langsgående lateral flade, mindst en åbning (2) anbragt til at tillade indtræden af luft til det indre af containeren (1);

- på en modstående langsgående lateral flade, mindst en ventilator (3) anbragt til at tage luften ud af det indre til det udvendige af containeren (1), hvor nævnte mindst ene åbning (2) og nævnte mindst ene ventilator (3) er vertikalt forskudt ved to forskellige højder af de to modstående langsgående laterale flader, hvor nævnte mindst ene ventilator er ved en større højde i forhold til nævnte mindst ene åbning;

- computerfag (5) anbragt i midten af containeren (1) langs dens langsgående akse.

2. Container ifølge det foregående krav, **kendetegnet ved, at** den endvidere inkluderer mindst et filter anbragt til at filtrere den indtrædende luft.

3. Container ifølge det foregående krav, **kendetegnet ved, at** filteret er anbragt til at regulere fugtindholdet af den indtrædende luft.

4. Container ifølge et hvilket som helst af de foregående krav, **kendetegnet ved, at** den endvidere inkluderer et system til afkøling med vand.

5. Datacenter (10), som inkluderer en flerhed af omdannede containere (1) i formen af en teknisk infrastruktur som defineret i et hvilket som helst af kravene 1 til 4.

6. Datacenter (10) ifølge det foregående krav, **kendetegnet ved, at** de omdannede containere (1) er anbragt i formen af en skakt af hvilken hulrummet (11) er åben opadtil.

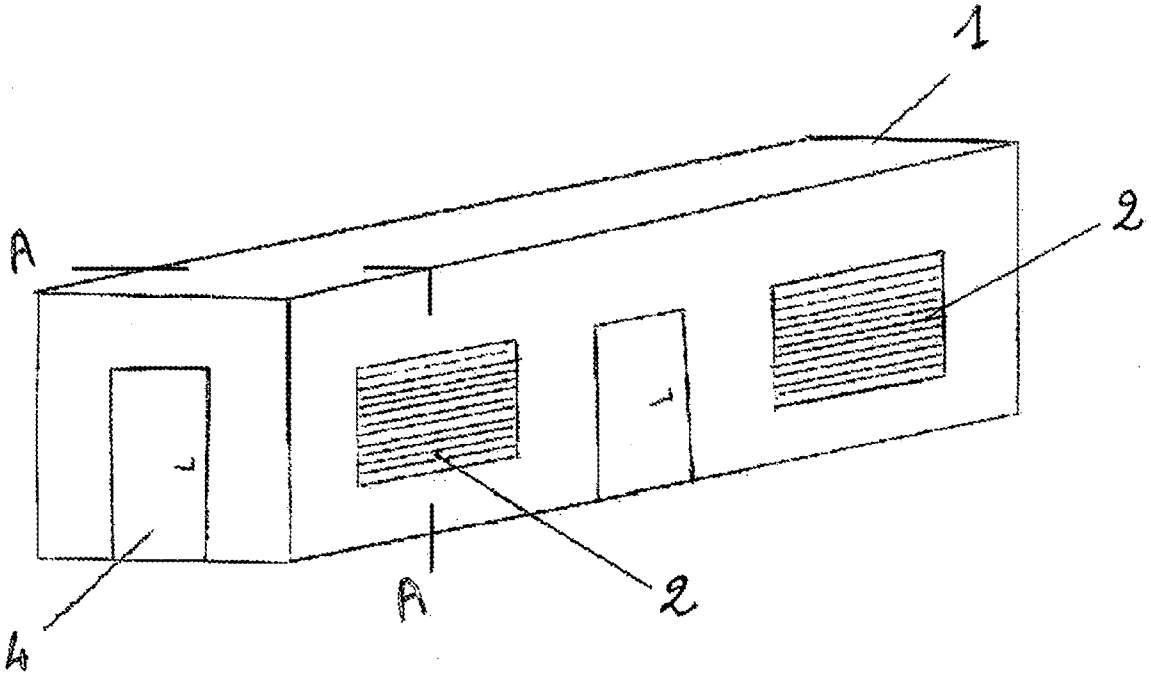

FIG.1

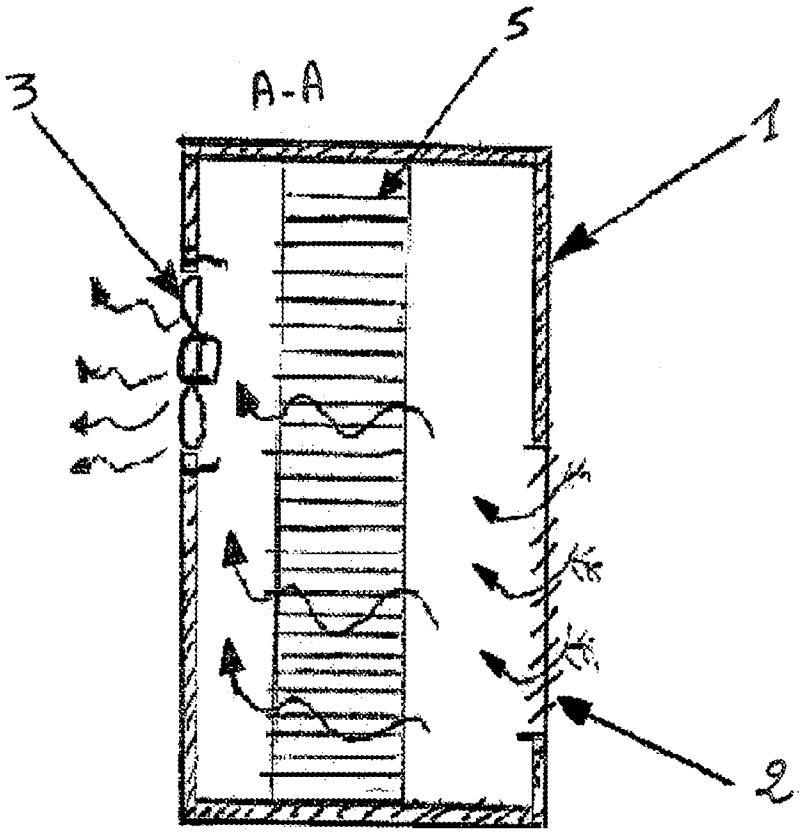

FIG.2

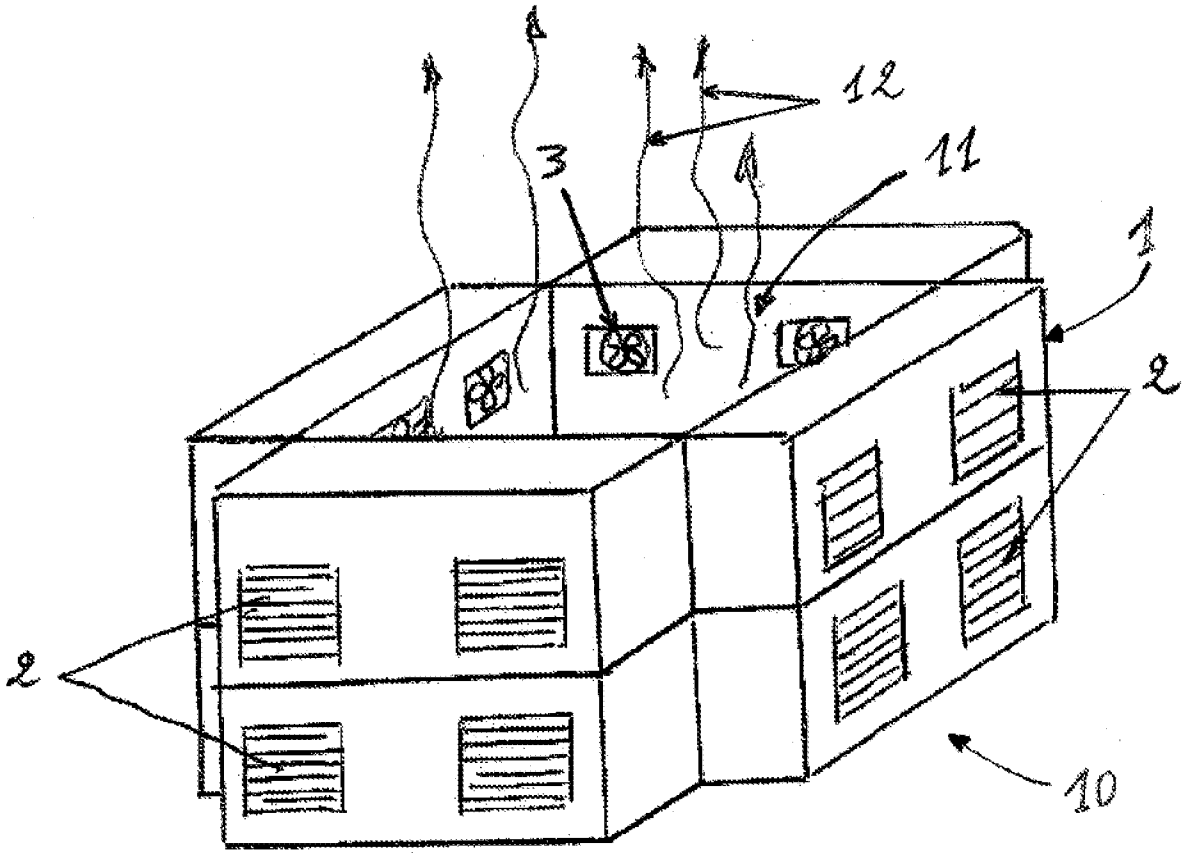

FIG.3