(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
01 April 2021 (01.04.2021)

WIPO | PCT

(10) International Publication Number
WO 2021/058833 A1

(51) International Patent Classification:
F02B 63/04 (2006.01) *F01P 5/06* (2006.01)

(21) International Application Number: PCT/EP2020/077149

(22) International Filing Date: 28 September 2020 (28.09.2020)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
1914013.6 27 September 2019 (27.09.2019) GB

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(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, IT, JO, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, WS, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

(54) **Title:** TEMPERATURE CONTROL SYSTEM FOR CONTAINERIZED POWER SUPPLY

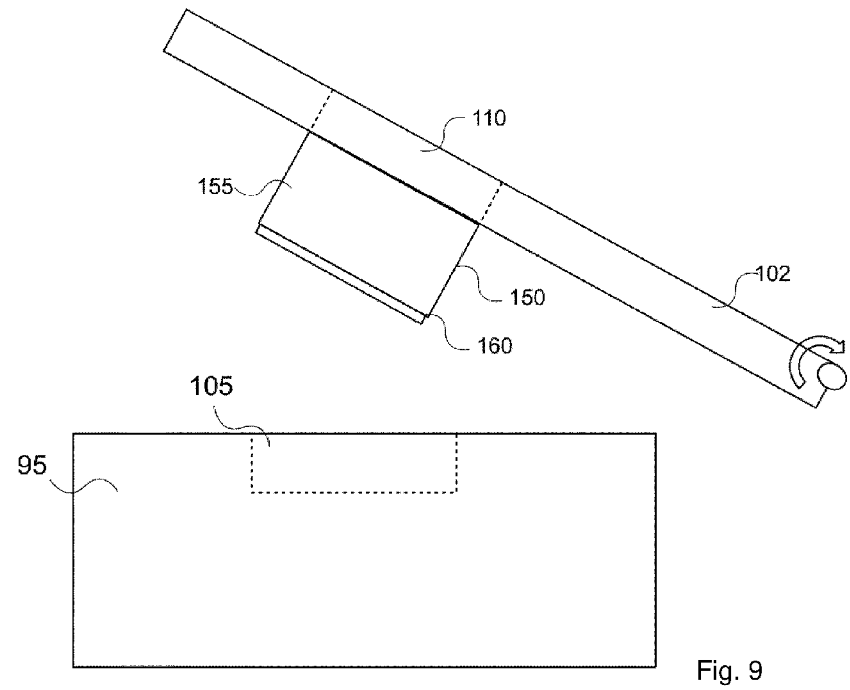

Fig. 9

(57) **Abstract:** A containerized electrical supply unit, the supply unit comprising a container; an electrical storage system or electrical generation system in, e.g. wholly in, the container; and a temperature control system within the container; wherein the container is provided with one or more airflow channels that extend from an exterior of the container to the interior of the container and a shroud mounted on an inside of the container at least partially or wholly around the one or more airflow channels and configured to guide airflow between the one or more airflow channel and at least part of the temperature control system.

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Published:

— *with international search report (Art. 21(3))*

— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))*

TEMPERATURE CONTROL SYSTEM FOR CONTAINERIZED POWER SUPPLY

FIELD

The present disclosure describes temperature control systems for containerized power supply units. Optionally, but not essentially, the containerized power supply unit may comprise an electrical storage system, such as a battery or other electrochemical or electrostatic storage system.

BACKGROUND

Containerised power supply systems are readily transportable, and can be deployed at sites at which supply of electric power to the site from a power distribution network is not available, prohibitive or insufficient for the needs at site. Such generator systems may also be used where there is an absence of power networks, or indeed where a typically-used power network has been disrupted in some manner (e.g. due to acts of nature). In some cases, the system may be used to feed power to an existing network.

Such transportable generator systems may be stand alone, or may be modular in so far as the power output at site can be provided cumulatively from multiple transportable generator systems, e.g. where a single power output is provided.

Typically, such generator systems can be deployed and operated from containers that meet standardised shipping container requirements (e.g. dimensions, etc.). Those containers may be modified from a standard container in so far as access panels, air inlet panels, or the like may be provided. In some cases, the generator systems may be deployed for a period of time, and then removed from site and used elsewhere. These standardised shipping containers are sometimes referred to as ISO containers, which have predefined sizes, shipping weight constraints, etc.

Traditionally, such containerized power supplies have contained an electrical generator operated by a diesel or other fossil fuel engine and these units work well for a wide range of applications. However, some applications may benefit from a containerized power supply based on electrical storage rather than generation or users may simply prefer an electrical storage based containerized power supply, for example, if they require a containerized power supply unit with less on site emissions or that is more environmentally friendly, amongst other possible reasons. In this case, containerized power supplies that use a generator driven by an engine that uses fossil fuels may be replaced by electrical storage solutions that use batteries or other electrical storage devices. However, a containerized power supply unit based on electrical storage systems may present different challenges to generator based systems. In addition, providing an electrical storage system in a container, such as a standard ISO shipping container, having limited volume, presents challenges over providing such systems in unconstrained footprints.

Regulating the temperature inside the container of the containerized power supply system is important, but particularly important for containerized power supplies that use electrical storage, as the performance of the electrical storage units (e.g. batteries) used can be highly sensitive to temperature.

This background serves only to set a scene to allow a skilled reader to better appreciate the following description. Therefore, none of the above discussion should necessarily be taken as an acknowledgement that that discussion is part of the state of the art or is common general knowledge. One or more aspects/embodiments of the invention may or may not address one or more of the background issues.

SUMMARY

Aspects of the present disclosure are defined by the independent claims appended herewith. Optional features are defined by the dependent claims appended herewith.

In some examples there are described containerised generator systems, and methods for power supply.

According to a first example is a containerized electrical supply unit, the supply unit comprising:

a container;

an electrical storage system or electrical generation system in, e.g. wholly within, the container; and

a temperature control system in, e.g. wholly within, the container; wherein

the container is provided with one or more airflow channels that extend from an exterior of the container to the interior of the container and a cowling, guide or shroud mounted on an inside of the container at least partially or wholly around the one or more airflow channel and configured to guide airflow between the one or more airflow channel and at least part of the temperature control system.

The temperature control system may comprise a heating, ventilation and/or cooling, e.g. air conditioning, system, such as a HVAC system. The temperature control system may be configured to run off electricity supplied by the electrical storage system or electrical generation system.

The cowling, guide or shroud may be mounted on or comprised in the container. The cowling, guide or shroud may be separate from and/or unattached to the temperature control system.

At least one of the one or more airflow channels may be through a door or other wall or outer surface of the container. The cowling, guide or shroud may be mounted on or comprised in the inside of the door. The cowling, guide or shroud may be configured such that it moves with the door, e.g. with the opening and closing of the door. The cowling, guide or shroud may be configured such that it extends from the container, e.g. from an inside of the door, to a position abutting, adjacent or proximate at least part of the temperature control system, e.g. when the door is closed.

The cowling, guide or shroud may comprise a seal or gasket, which may be provided on a distal end of the cowling, guide or shroud, e.g. an end furthest from the wall of the container or container door. The cowling, guide or shroud may be configured such that the seal or gasket abuts, is adjacent or is proximate at least part of the temperature control system, e.g. when the door is closed.

The temperature control system may comprise at least one fan, such as a centrifugal fan. The fan may be configured to draw air into the container and/or expel air out from the container through at least one of the one or more airflow channels. That is the cowling, guide or shroud may be and configured to guide airflow between the one or more airflow channel and at least part of the temperature control system. The fan may be configured to draw air into the container through at least one other airflow channel, which may extend through a door or other wall or outer surface of the container. The fan may be configured to expel air through a different airflow channel to the airflow channel through which air is drawn into the container. The airflow channel through which air is drawn into the container may be on a different surface of the container to the airflow channel through which air is expelled from the container.

The cowling, guide or shroud may be provided around the airflow channel, e.g. the airflow channel through which air is drawn into or expelled from the container. The cowling, guide or shroud may be configured to separate or isolate the air being drawn into the container through the at least one of the one of more airflow channels from the air being expelled through the at least one other airflow channel.

The cowling, guide or shroud may surround the at least one of the one of more airflow channels. The cowling, guide or shroud may be configured to surround the fan, e.g. when the door is closed. The cowling, guide or shroud may extend around the outside of a perimeter of the fan, e.g. when the door is closed. The cowling, guide or shroud, e.g. the seal or gasket on the cowling, guide or shroud, may be configured to engage, abut or lie proximate or adjacent to a part of the temperature control system that surrounds the fan, e.g. when the door is closed.

In this way, incoming cooler airflow entering the container from the exterior of the container can be kept separate from warmer airflow to be expelled from the container. However, since the cowling, guide or shroud may be mounted on, or comprised in, the door, the cowling, guide or shroud is automatically swung away from the fan and/or temperature control system when the door is opened. This may allow easier access to the fan and/or temperature control system. The provision of the seal or gasket may improve the airflow, whilst still allowing the cowling, guide or shroud to be swung away from the temperature control system, e.g. by opening the door.

The container may be compartmentalized. The container may comprise a primary compartment for housing at least one or each of: the electrical storage system or electrical generation system, the controller and/or at least part of the electrical conditioning system, e.g. the transformer and/or inverter. The container may comprise a secondary compartment for housing at least part of the temperature control system, e.g. for housing the fan and/or the heat exchanger of the temperature control system. At least part of a suppression system, e.g. a reservoir of the suppression system, may also be provided in the secondary compartment. The primary compartment may be separated, sealed and/or isolated from the secondary compartment, e.g. by an internal wall of the container.

The temperature control system may comprise at least one distribution duct that defines a flowpath therein. The temperature control system may be a closed system, e.g. a closed fluid system, such as a closed air system. The flowpath may be separated or isolated from an interior of the secondary compartment. The temperature control system may be configured to circulate fluid such as air through the at least one distribution duct and/or the primary compartment. The temperature control system may be configured to circulate the fluid, e.g. air, using a further fan.

The temperature control system may comprise a heat exchanger. The heat exchanger may be provided at an interface between the primary and secondary compartments, e.g. on or in the internal wall separating the primary and secondary compartments. The heat exchanger may be configured to exchange heat between the fluid, e.g. air, in the closed fluid system and/or in the primary compartment of the container and air in the secondary compartment, e.g. that is drawn or received from the exterior of the container, e.g. using the fan. The heat exchanger may be configured to exchange heat from the fluid in the distribution duct to ambient. The temperature control system may be configured to pass the fluid within the distribution duct over the heat exchanger, e.g. using the further fan. The temperature control system may be configured such that fluid in the distribution duct and/or in the primary compartment of the container is isolated from the air in the secondary compartment, which may have been drawn or received from the exterior of the container, e.g. using the fan. The temperature control system may be configured to pass the air drawn in by the fan across the heat exchanger in manner in which it is isolated from the fluid used to cool the primary compartment. The heat exchanger may comprise a heat exchange liquid, which may be circulated, and may be configured to receive heat from the air in the distribution duct and/or in the primary compartment of the container and may be configured to provide the heat to the air in the secondary compartment and/or the air drawn in through the one or more airflow channel and/or cowling, guide or shroud.

In this way, efficient temperature control of the compartment of the container may be carried out without introducing contaminants, or external material form the exterior of the container than might pose a fire or electrical hazard or erroneously trigger the suppression system.

The containerized electrical supply unit may further comprise an electrical conditioning system for converting an electrical output of the electrical storage system or electrical generation system to a different electrical output of the containerized electrical supply unit. The distribution duct may be configured to guide the fluid, e.g. air, in the flowpath to at least part of the electrical conditioning system, e.g. between the heat exchanger and at least part of the electrical conditioning system.

The at least one distribution duct may extend from an area proximate or around the heat exchanger to an upper or upmost portion of the interior of the container, where the distribution duct may extend along, e.g. laterally along, the upper or upmost portion of the interior of the container. The at least one distribution duct may extend along and through the upper or upmost portion of the interior of the container, e.g. of the interior of the primary compartment, to at least a position or positions above one or more of: the electrical storage system or electrical generation system and/or the electrical conditioning system. The at least one distribution duct may be configured to deliver the fluid, e.g. cooling air, to the electrical storage system or electrical generation system and/or the electrical conditioning system and/or other components inside the container (e.g. inside the primary compartment) from above.

The above configuration in which the distribution duct is routed along an upper or upmost area, e.g. along the ceiling, of the interior of the container, e.g. of at least the primary compartment of the container, provides a good airflow path, provides good utilization of the limited interior volume of the container and allows components of the containerized electrical supply unit to be easily inserted (as the distribution duct is out of their way), thereby making the containerized electrical supply unit easier to assemble.

The containerized electrical supply unit may comprise a controller. The controller may be provided in the primary compartment, e.g. proximate the energy storage system.

The containerized electrical supply unit may comprise a second temperature control system. The second temperature control system may be configured to control the temperature, e.g. cool, at least part of the conditioning system, e.g. the inverter. The second temperature control system may be provided in a further compartment in the container, which may be separate from the primary and secondary compartments. The further compartment may be thermally insulated, e.g. from the primary compartment, e.g. by a suitably insulated internal wall. The further compartment may comprise at least one compartment vent that may vent or define a flow passage directly between the further compartment and the exterior of the container. The compartment vent and the flow passage defined thereby may extend through an external wall or door of the compartment to the exterior of the container. .

The second temperature control system may comprise a heating, ventilation and/or cooling, e.g. air conditioning, system, such as a HVAC system. The second temperature control system may be configured to run off electricity supplied by the electrical storage system or electrical generation system. The second temperature control system may comprise at least one fan, such as a centrifugal fan. The second temperature control system may be configured to draw air into the compartment from the exterior of the container via the compartment vent, e.g. using the at least one fan.

The second temperature control system may comprise a heat exchanger core, and may be configured to draw the air through the heat exchanger core. The second temperature control system may comprise a shroud, cowling or guide to guide air from the compartment vent to the fan of the second temperature control system. The cowling, guide or shroud may be the same or similar to the cowling, guide or shroud used to guide air to the fan of the main temperature control system. The second temperature control system may be an air to liquid cooling system. That is, the air drawn in from the exterior of the container may be used to cool the heat exchanger of the second temperature control system, which in turn cools a liquid coolant that is in turn used to cool at least a portion of the conditioning system, e.g. the inverter. The further compartment may be isolated and/or sealed from the primary compartment, e.g. by an internal wall between the further compartment and the primary compartment. A conduit, e.g. a closed conduit, that carries the circulating liquid coolant may extend between the heat exchanger core of the second temperature control system, e.g. in the further compartment to the part of the conditioning system, e.g. the inverter. The further compartment that houses the second temperature control system and the secondary compartment that houses the main temperature control system may be provided at opposite ends of the container.

By providing the second temperature control system as detailed above, thermal management of the interior of the container may be improved and the strain on the main temperature control system may be reduced.

The containerized electrical supply unit may further comprise a protection unit and/or a suppression system, which may be provided, e.g. wholly provided, within the container. That is, one or more or each of the electrical storage system or electrical generation system; the temperature control system; the controller, the electrical conditioning system, the protection unit and/or the suppression system may be provided in, e.g. wholly within, the container.

The electrical storage system may comprise and/or be configured to receive one or more, e.g. a plurality of, electrical storage units. The electrical storage units may be configured to hold or store electrical charge. The electrical storage units may be or comprise electrochemical and/or electrostatic electrical storage units. One or more or each of the electrical storage units may be or comprise a battery or electrochemical cell, such as by way of example a lithium, lithium ion, lithium-air, lithium-sulphur, NiCd, NiMH, or lead-acid battery or cell, and/or the like. Optionally at least one of the electrochemical storage units may comprise a fuel cell, capacitor, super-capacitor, and/or the like.

The electrical storage system may comprise at least one and preferably a plurality of racks for holding or receiving the electrical storage units. The at least one rack may be configured with contacts for electrically connecting the one or more electrical storage units. The at least one rack may comprise wiring to electrically connect the one or more electrical storage units, e.g. to electrical connections (such as inputs and/or outputs) of the containerized electrical supply unit, which may comprise indirect connection via one or more other electrical components of the containerized electrical supply unit, such as the electrical conditioning system, one or more bus bars, the protection system (e.g. circuit breakers) and/or the like.

The electrical generation system may comprise an electrical generator, which may be operated by a motor, such as a diesel or other fossil fuel driven motor.

The distribution duct of the temperature control system may be configured to direct airflow to the electrical storage system or electrical generation system, the electrical conditioning system, and/or the like.

The electrical conditioning system may be configured to convert the electrical output of the electrical storage system or electrical generation system into an electrical output of the containerized electrical supply unit and/or vice versa. The electrical output of the containerized electrical supply unit may be different to the electrical output of the electrical storage system or electrical generation system, e.g. it may have a different voltage or current and/or the electrical output of the containerized electrical supply unit may be alternating current (AC) and the electrical output of the electrical storage system may be direct current (DC). The electrical conditioning system may comprise one or more inverters, e.g. to convert the DC output of the electrical storage system to the AC output of the containerized electrical supply unit. The electrical conditioning system may be comprised, e.g. wholly comprised, inside the container. The electrical conditioning system may be provided in an electrical circuit between the electrical storage system or electrical generation system and the external electrical connections of the containerized electrical supply unit.

The electrical conditioning system may comprise a transformer, e.g. for changing the voltage of the electrical output of the electrical storage system or electrical generation system into a different voltage for the electrical output of the containerized electrical supply unit. The transformer may have a plurality of ratings, e.g. voltages, as outputs. The transformer may be configured such that the output ratings are selectable, e.g. by physically changing a tap point. The transformer may be configured to provide isolation, e.g. galvanic isolation, of the controller.

The electrical conditioning system may be configured to receive the electrical output from the electrical storage system or electrical generation system and may be configured to output an electrical output to the one or more electrical connections, e.g. via the protection system and/or one or more bus bars.

The controller may be configured with a user interface or control panel. The controller may comprise at least one processing unit. The controller may be provided in the primary compartment, e.g. proximate the electrical storage system. The controller may be configured to control the operation of the containerized electrical supply unit, e.g. responsive to user input via the control panel or user interface. The controller may be configured to control the level of output of the electrical storage system or electrical generation system and/or the containerized electrical supply unit, e.g. by controlling the electrical conditioning system. At least part or all of the controller may be comprised in the container and/or at least part of the controller (e.g. the user interface or control panel) may be accessible from the outside of the container.

The containerized electrical supply unit may comprise the at least one external electrical connection, which may comprise or be connected to at least one bus bar, e.g. two or more bus bars. The at least one external electrical connection may be configured to output an electrical supply derived from the electrical storage system or electrical generation system. The at least one external electrical connection may be configured to receive a charging electrical supply to charge the electrical storage units of the electrical storage system or electrical generation system. The at least one external electrical connection may be comprised in, or located on a wall of, the compartment that houses the controller.

The at least one protection unit may be or comprise an overcurrent or over voltage protection unit. The at least one protection unit may comprise one or more circuit breakers, such as air circuit breakers (ACBs). The at least one protection unit may be provided in the electrical circuit between the electrical storage system or electrical generation system and the electrical connections of the containerized electrical supply unit. The at least one protection unit may be comprised in, e.g. wholly located within, the container. The at least one protection unit may be comprised in, e.g. wholly located within, the same compartment as the controller or alternatively may be provided in a separate compartment or module. The module may be selectively insertable into the container, e.g. into a recess or opening the container and/or may be selectively mountable on the container. The module may be an enclosed or sealed module.

The at least one suppression system may be or comprise a fire suppression system. The suppression system may comprise at least one supply of suppressant material, e.g. fire suppressant liquid, gas or powder. The suppression system may comprise at least one sensor for detecting a fire or other thermal event. The suppression system may comprise at least one delivery system for delivering the suppressant material into the container, e.g. responsive to detection of the fire or other thermal event using the at least one sensor. The at least one delivery system may comprise pipeline or conduit. The supply of suppressant material may be located at one end of the container, e.g. in the secondary compartment. The at least one delivery system may extend upwardly from the supply of suppressant material, e.g. to an upper or upmost portion of the container and may then extend laterally within the container, e.g. within the primary compartment, within the upper or upmost portion of the container, e.g. within the primary compartment. The at least one delivery system may sealably pass through the internal wall between the secondary and primary compartments. The delivery system may be configured to deliver at least part or all of the suppressant material downwardly into the interior of the container, e.g. onto the electrical storage system or electrical generation system, the electrical conditioning system and/or the controller. This arrangement may better utilize space within the container, may result in better delivery of suppressant material and/or may be easier to install.

The container may comprise the electrical circuit comprising electrical coupling (e.g. wiring) between the one or more electrical connections of the containerized electrical supply unit and the electrical storage system or electrical generation system. The electrical circuit may comprise control couplings (e.g. wiring) between the controller and the electrical conditioning system and/or the electrical storage unit, e.g. for carrying control signals from the controller to, and for controlling, the electrical conditioning system and/or the electrical storage unit. At least part of the electrical coupling and/or the control couplings may extend upwards from at least one or each of: the electrical storage system or electrical generation system, the electrical connections of the containerized electrical supply unit, the controller and/or the electrical conditioning system, e.g. to an upper or upmost portion of the interior of the container and may then extend laterally within the upper or upmost portion of the interior of the container. This arrangement may facilitate easier connection and/or better utilization of space within the container.

The container may be in a generally cuboid form, e.g. having two long or elongate sides and two shorter ends, i.e. the container is longer than it is wide. The container may be or comprise an ISO container.

The container may be sealed. That is, the container may be provided with seals around each door and/or external opening. The container may be provided with seals and/or shrouds at air intakes, airflow channels and/or vents. The container may be compartmentalised. Internal secondary seals may be provided within the container, e.g. between compartments and sections. Internal secondary seals may assist in keeping any deployed suppressant material in desired areas of the inside of the container, e.g. around the electrical storage system or electrical generation system, the electrical conditioning system, and/or the like. This may permit a suitably high concentration of suppressant to be more surely maintained inside the container.

The containerized electrical supply unit may comprise one or more thermally insulating walls provided adjacent or at least partly around the electrical storage system or electrical generation system. The one or more thermally insulating walls may be provided between the electrical storage system or electrical generation system and at least part of the electrical conditioning system and/or the controller and/or the temperature control system and/or the suppression system and/or the at least one protection unit.

The one or more thermally insulating walls may reduce heat transfer to the electrical storage system from other components of the containerized electrical supply unit. Furthermore the thermally insulating walls may define a chamber or receptacle, which may be open at the top and may receive cooling airflow from the at least one distribution duct and which may “pool” cool air in the chamber or receptacle. In this way, the temperature control system may more surely cool the electrical storage system, which may be particularly sensitive to temperature variations.

In a second example described herein, there is a method of assembling, repairing or producing a containerized electrical supply unit according to the first example.

The method may comprise providing a container.

The method may comprise locating an electrical storage system or electrical generation system in, e.g. wholly within, the container.

The method may comprise locating a temperature control system in, e.g. wholly within, the container.

The container may be provided with one or more airflow channels that extend between an interior and an exterior of the container, e.g. through a wall or door of the container. The container may comprise a cowling, guide or shroud mounted on an inside of the wall or door of the container at least partially around the airflow channel. The method may comprise arranging the temperature control system relative to the container such that the cowling, guide or shroud is configured to guide airflow between the one or more airflow channel and at least part of the temperature control system, e.g. when the door is closed.

In a third example described herein, there is a method of operating the containerized electrical supply unit according to the first example. The method may comprise operating the containerized electrical supply unit so as to provide power from the electrical storage system, or operating the electrical generation system so as to supply electrical power, to an external load via the one or more electrical connections (e.g. the one or more bus bars) of the containerized electrical supply unit. The method may comprise converting the voltage or current output by the electrical storage system to a different voltage or current for output by the one or more electrical connections of the containerized electrical supply unit, e.g. using the transformer. The method may comprise converting a DC electrical output by the electrical storage system to an AC electrical output by the one or more electrical connections of the containerized electrical supply unit, e.g. using the inverter.

According to a fourth example described herein, there is provided a container for a containerized electrical supply unit, the container comprising:

a region for receiving an electrical storage system or an electrical generation system, e.g. within or wholly within the container;

fittings for receiving a temperature control system for maintaining a temperature of the electrical storage system control system, e.g. within the container;

a door, wherein the door may be provided proximate the fittings for receiving the temperature control system;

one or more airflow channels that extend through the door of the container; and

a cowling, guide or shroud mounted on an inside of the door of the container at least partially around the airflow channel and configured to guide airflow between the one or more airflow channel and at least part of the temperature control system.

According to a fifth example described herein, there is provided a containerized electrical supply unit, the supply unit comprising:

a container;

an electrical storage system or electrical generation system in, e.g. wholly in, the container; and

a temperature control system for controlling the temperature of at least part of the interior of the container; wherein

at least part of the temperature control system is provided in a secondary compartment within the container that is isolated from at least a primary compartment within the container.

The containerized electrical supply unit may comprise an electrical conditioning system and/or a second temperature control system. The electrical storage system or electrical generation system may be provided in the primary compartment. At least part of the electrical conditioning system may be provided in the primary compartment. At least part of the second temperature control system may be provided in a further compartment. The secondary compartment within the container may be separate from the primary and/or further compartments in which the electrical storage system or electrical generation system and/or the electrical conditioning system and/or the second temperature control system are provided.

The secondary compartment in which the temperature control system is provided may be thermally insulated, e.g. from the primary compartment in which the electrical storage system or electrical generation system and/or the electrical conditioning system are provided, e.g. by a thermally insulated wall of the compartment. The secondary compartment in which the temperature control system is provided may comprise a compartment vent that defines a through channel that extends between the interior of the compartment and the exterior of the container. The compartment vent may extend through an external wall or door of the compartment to the exterior of the container.

The second temperature control system may comprise a heating, ventilation and/or cooling system. The second temperature control system may comprise a heat exchanger, such as a liquid to air heat exchanger. The heat exchanger may be located in the further compartment. The second temperature control system may be configured to run off electricity supplied by the electrical storage system or electrical generation system. The second temperature control system may comprise at least one fan, such as a centrifugal fan, which may be provided in the further compartment. The second temperature control system may be configured to draw air over the heat exchanger from the exterior of the container via the compartment vent, e.g. using the at least one fan. The fan may be configured to expel air out of the compartment to the exterior of the container after it has passed over the heat exchanger. The second temperature control system may be configured to draw air into the compartment, over the heat exchanger and out from the further compartment again without entering the primary compartment in which the electrical storage system is comprised.

The second temperature control system may be an air to liquid cooling system. That is, the air drawn in from the exterior of the container may be used to cool the heat exchanger of the second temperature control system, which cools a liquid coolant that is in turn used to cool at least a portion of the conditioning system, e.g. the inverter.

The further compartment may be isolated and/or sealed from the primary compartment, e.g. by an internal wall between the further compartment and the primary compartment. A conduit, e.g. a closed conduit, that carries the circulating liquid coolant may extend between the heat exchanger of the secondary temperature control system, e.g. in the further compartment to the part of the conditioning system, e.g. the inverter. The further compartment that houses the second temperature control system and the secondary compartment that houses the main temperature control system may be provided at opposite ends of the container.

According to a sixth example described herein, there is provided a containerized electrical supply unit, the supply unit comprising:

a container;

an electrical storage system or electrical generation system in, e.g. wholly in, the container;

an electrical conditioning system for converting an electrical output of the electrical storage system or electrical generation system to a different electrical output of the containerized electrical supply unit; and

one or more thermally insulating walls provided adjacent or at least partly around the electrical storage system or electrical generation system.

The containerized electrical supply unit may comprise a temperature control system and/or at least one protection unit. The one or more thermally insulating walls may be provided between the electrical storage system or electrical generation system and at least part of the electrical conditioning system and/or the temperature control system and/or the suppression system and/or the at least one protection unit.

It will be appreciated that features analogous to those described in relation to any of the above aspects may be individually and separably or in combination applicable to any of the other aspects.

Apparatus features analogous to, or configured to implement, those described above in relation to a method and method features analogous to the use and fabrication of those described above in relation to an apparatus are also intended to fall within the scope of the present invention.

Description of the Drawings

Embodiments of the present invention will now be described, by way of example only, with reference to the accompanying drawings, which are:

Figure 1 an external perspective view of a containerized electrical supply unit in a closed configuration;

Figures 2 an external perspective view of the containerized electrical supply unit of Figure 1, with part of the exterior of the container cut away to show part of the interior of the container;

Figure 3 a side view of the containerized electrical supply unit of Figure 1, with one side exterior removed to show the interior of the container;

Figure 4 a cross-sectional plan view of the containerized electrical supply unit of Figure 1;

Figure 5 a perspective view of the contents of the container of the containerized electrical supply unit of Figure 1 with a side and top walls removed;

Figure 6 a view of a shroud for channelling airflow into the container of the containerized electrical supply unit of Figure 1;

Figure 7 a schematic showing the relative arrangement of the shroud of Figure 6 and a fan when a door on which the shroud is supported is closed;

Figure 8 a plan view of the shroud of Figure 6 when the door is closed; and

Figure 9 a plan view of the shroud of Figure 6 when the door is open.

Detailed Description of the Drawings

Figure 1 shows a perspective view of an exterior of a containerized electrical supply unit 5 in a closed or “in use” configuration. The containerized electrical supply unit 5 comprises a container 10, which in this example is an ISO container having an elongate, generally cuboid form. The container 10 is formed from metal, particularly metal walls and doors suspended from a metal skeleton frame, as will be described later. Figure 2 shows the same containerized electrical supply unit 5 but with a portion of one of the doors cut away to reveal the contents of the container 10.

The containerized electrical supply unit 5 also comprises respective pairs of double hinged doors 15a, 15b that extend over a majority of each long side 20a, 20b of the container 10, e.g. over at least 80% of the length of each long side 20a, 20b of the container 10. Each of the doors 15a, 15b is hinged 22a, 22b on opposite sides such that distal opening edges 24a, 24b of the doors 15a, 15b meet when closed. Each door 15a, 15b, is formed of two door sections 25a, 25b, 25c, 25d that are hinged together, with one door section 25a, 25c of each door 15a, 15b being hinged 22a, 22b to an upright 30a, 30b of the frame (see Fig. 3), and another door section 25b, 25d of each door 15a, 15b being hinged 32a, 32 to the other door section 25a, 25c of each door 15a, 15b. In this way, each door 15a, 15b can be opened by unlatching the door sections 25b, 25d and pivoting them open on the hinges 22a, 22b between door sections 25a and 25b and between sections 25c and 25d. Further, the door sections 25a and 25c can also be unlatched and opened by pivoting them (and consequently also door sections 25b and 25d) about the respective hinges 32a, 32b between door section 25a and the frame upright 30a and between door section 25c and frame upright 30b. As can be seen particularly in Fig. 3, this multi-hinged, multi-sectioned door 15a, 15b arrangement, in conjunction with a skeleton frame, allows for a very wide opening in each side 20a, 20b of the container 10 for ease of access into the interior of the container 10, e.g. for assembly, operation, maintenance, repair, inspection and/or the like. However, due to the presence and construction of the frame, integrity is maintained.

The container 10 is provided with a plurality of mount pads 35 (e.g. at least three per side) in order to prevent sag of the container 10 and to ensure reliable operation of the wide doors 15a, 15b. At least some of the mount pads 35 may be configured to receive forks of a fork lift truck.

The walls of the container 10 are provided with vents 110, e.g. adjacent either ends of the container 10, to allow cooling air to be drawn in and hot air to be expelled, as will be described later. Separate vents 110 can be provided for drawing air in and for expelling air out.

Fig. 3 shows a side view of the inside of the container 10 of the containerized electrical supply unit 5 with the doors 15a, 15b removed. The interior of the container 10 comprises a secondary compartment 40 at one end for housing a temperature control system 95 and a suppression system 100 (not shown in Fig. 3, see Figs. 4 and 5). The container 10 comprises a further compartment 45 at the other end of the container 10 for housing a secondary cooling system 127 for cooling at least part of the conditioning system, e.g. an inverter (not shown in Fig. 3, see Figs. 4 and 5). .

A primary compartment 47 in a central portion of the interior of the container 10 houses an electrical storage system 50. The electrical storage system 50 is configured to *store* electrical charge, in contrast to generator units that *generate* electrical charge by operation of a generator by a motor, typically fuelled by fossil fuels.

The electrical storage system 50 comprises a plurality of racks 70, in which multiple racks 70 can be optionally bolted or otherwise fixed together to form banks 55 of racks 70 (in this example eight racks 70 are provided as two banks 55 of four racks 70 provided back to back, but it will be appreciated that more or less banks 55 and/or racks 70 may be provided). Each bank 55 also comprises associated wiring for receiving and connecting a plurality of electrical storage units 75. The banks 55 of racks 70 allow wiring to be connected outside of the container 10 and thereby more easily connected. The use of banks 55 of racks 70 allows the racks 70 to be installed quicker and more easily than by installing each rack 70 individually. In this case, each bank 55 comprising a plurality of separate racks 70 fixed together can simply be lifted into the container 10 during assembly.

In this example the energy storage units 75 comprise rechargeable batteries such as lithium ion rechargeable batteries, but could comprise any other suitable form or electrochemical or electrostatic storage, such as but not limited to: lithium-air batteries, lithium-sulphur batteries, nickel-cadmium (NiCd) batteries, nickel-metal hydride (NiMH) batteries, lead acid batteries, super capacitors, fuel cells (e.g. hydrogen fuel cells, proton electrolyte membrane (PEM) fuel cells, solid state fuel cells, direct carbon fuel cells, ethanol fuel cells, or the like), flow cells, and/or other suitable electrical storage units. The wiring from each of the electrical storage units 75 is routed upwards through the racks to an upper space 80 provided in an upmost portion of the interior of the container 10, e.g. into a cable tray provided on top of the racks 70 and electrical storage units 75, in which the wiring can extend laterally inside the container 10 to connect with a controller 125 and/or an electrical conditioning system 60.

The primary compartment 47 of the interior of the container 10 houses the controller 125 provided adjacent the racks 70 for controlling operation of the energy storage units 75 and the electrical conditioning system 60. The controller 125 controls operation of the energy storage units 75 and the electrical conditioning system 60 to provide a required output at electrical connections 92 of the containerized electrical supply unit 5 and to manage safe condition and operation of the energy storage units 75.

The controller 125 comprises a processing system, having a processor, memory, and a communications system configured to relay control commands to the electrical storage system 50 and electrical conditioning system 60 and to receive sensor and operating data therefrom. Optionally, the controller 125 comprises a network interface, e.g. a wireless network interface such as a cellular network or Wi-Fi interface for conveying operating data to a remote site for condition monitoring and diagnostics and for receiving control commands for operating the containerized electrical supply unit 5. Although the controller 125 is provided in the primary compartment with the electrical storage system 50, the controller 125 is also in communication with a control panel for receiving user commands for operating the containerized electrical supply unit 5 and for providing operational data, such as parameters, conditions and alarms or alerts relating to operation of the containerized electrical supply unit 5. The control panel can be accessed via an end of the container 5, whereas the electrical connections 92 are provided on a different surface (e.g. side) 20a of the container 5, so as to minimize unwanted interaction between an operator and the electrical connections 92 and associated cables.

The primary compartment 47 of the interior of the container 10 also houses at least part of the electrical conditioning system 60 provided on one or more removable conditioning system sub-frames 65. In this case, the part of the electrical conditioning system 60 comprises a transformer 90 and the sub-frame 65 is a transformer sub-frame. In addition, the inverter 85 is optionally also provided on its own sub-frame (not shown). By providing the transformer 70 and inverter 85 on respective sub-frames , the transformer 70 and inverter 85 can be assembled and wiring connected with the transformer 70 and inverter 85 and their respective sub-frames outside of the container 10 where there is more room to work. Thereafter, the respective sub-frames 65 with the transformer 70 and inverter 85 respectively mounted thereon, are simply inserted into place and secured inside the container 10, leaving fewer electrical connections to be made inside the container 10.

The electrical conditioning system 60 is configured to convert the electrical output of the electrical storage system 50 into a different electrical output of the containerized electrical supply unit 5. The electrical conditioning system 60 comprises the inverter 85 and the transformer 90. The inverter 85 is configured to convert the DC output of the electrical storage system 50 to the AC output of the containerized electrical supply unit 5. The transformer 90 is configured to selectively change the voltage of the electrical output of the electrical storage system 50 into a different voltage for the electrical output of the containerized electrical supply unit 5. The voltage output by the transformer 90 may be variable and selectable, e.g. responsive to the controller 125. The transformer 90 also galvanically isolates the controller 125. The inverter 85 and controller 125 are provided together on their own sub-frames (not shown) for ease of assembly and installation.

The electrical conditioning system 60 is electrically connected to receive the electrical output from the electrical storage system 50, responsive to control by the controller 125. The electrical conditioning system 60 is further configured to output a modified electrical supply to electrical connections 92 via one or more bus bars (not shown). In this example, the electrical connections 92 are provided on a side 20a of the container 10, whereas access 135 to a control panel providing an interface for the controller 125 and/or the protection unit 130 is provided on a different face of the container 10 (in this case an end face of the container 10). In this way, a user using the control panel is distanced from the electrical connections 92 and associated cabling, which may minimize the risk of accidents, e.g. due to tripping.

Figs. 4 to 5 further show the components of the containerized electrical supply unit 5 that are provided inside the container 10.

The temperature control system 95 and suppression system 100 are provided in the secondary enclosure 40 at one end of the container 10. The secondary enclosure 40 is provided with a door 102 forming at least part of an end face of the container 10. The walls of the container 10 that form the secondary enclosure 40 are provided with a plurality of vents 110 for direct venting of the secondary enclosure 40 to the exterior of the container 10.

The temperature control system 95 comprises a heating, ventilation and air conditioning or cooling (HVAC) system. In particular, the temperature control system 95 comprises at least one centrifugal cooling fan 105 arranged to face one of the vents 110 provided in the door 102 of the secondary enclosure 40. The fan 105 is configured to force air from the secondary enclosure 40 out through the vent 110 in the door 102 of the secondary enclosure 40, wherein air is received into the secondary enclosure from the exterior of the container 10 directly via other vents 110 in the exterior side wall of the secondary enclosure. In this way, cooling ambient air from the exterior of the container 10 can be circulated within the enclosure 40, but is not provided to the central portion of the interior of the container 10 that houses the electrical storage system 50 and the electrical conditioning system 60.

The vent 110 is provided with a shroud or cowling (not shown) configured to direct the air directly from the fan 105 to the exterior of the container 10. The cowling or shroud is fixed around the vent 110 (e.g. to the door 102 of the enclosure 40) but is not fixed to the fan 105 or the rest of the temperature control system 95 but instead optionally engages a surface of the temperature control system 95 around the fan 105 with a gasket seal. In this way, the door 102 of the enclosure 40 may be opened for easy access to the temperature control system 95 but a reasonably airtight channel for providing air with minimal losses may be provided. Furthermore, the cowling or shroud may act to separate inflow air from outflow air, which may result in more efficient cooling and/or airflow.

The fan 105 of the temperature control system 95 is configured to suck air from the exterior of the container 10 through the vents in the side wall and over a heat exchanger 112 and out through the vent 110 in the door in order to exchange heat from the heat exchanger 112 to ambient. In other examples, the air could be sucked in through vents in the door and our through vents in the side of the container, and the location of the vents is not limited to any particular arrangement. However, by having the air intake for the second compartment 40 on a different face of the container to the air outlet for the second compartment 40, the amount of warmer expelled air being drawn in via the intake vent may be reduced.

The heat exchanger 112 is operable to cool air (and/or optionally cooling fluid) in a closed circuit. In particular, a cooling fluid is provided within the heat exchanger 112 that acts to transfer heat from the air in the primary compartment that houses the electrical storage system 50 to air in the secondary compartment 40. The temperature control system 95 comprises a conduit 115 that extends from the heat exchanger 112 into the upper space 80 at the top of the interior of the primary compartment 47 of the container 10, where it extends along the inside of primary compartment 47 of the container 10 to locations above the electrical storage system 50 and the electrical conditioning system 60 to direct the air thereto. As such, the temperature control system 95 is operable to circulate air within the primary compartment 47 that houses the electrical storage system 50 in a closed loop via the conduit 115 and that is cooled by the heat exchanger 112. The circulation of air within the primary compartment 47 is driven by a fan (not shown). With the above arrangement, the airflow can be routed in a relatively efficient pathway that also best utilizes space inside the container 10 and is easy to install. Furthermore, as a closed air circuit is used to cool the primary compartment in the container 10 that contains the electrical storage system 50, and which is sealed from the secondary compartment 40 in which the heat exchanger 112 is mounted, the risk of introducing outside contaminants into the chamber in the container 10 that contains the electrical storage system 50 that could otherwise lead to fires or the incorrect release of the suppressant if there is a smoke filled ambient.

The suppression system 100 comprises a pressurized tank 120 of fire supressing material, e.g. a fire suppressing fluid (e.g. liquid or gas) or powder that is selectively releasable responsive to a fire sensor (e.g. a smoke or heat detector, not shown) into a delivery system 122 that also runs upwardly from the tank 120 into the upper space 80 at the top of the interior of the container and along the upper space 80 to the regions above the electrical storage system 50 and the electrical conditioning system 60 and then downwardly into voids or spaces in the central compartment that surround the electrical storage system 50 and the electrical conditioning system 60 to direct the fire suppressing material thereto, when released. In this way, the fire suppressing material can be routed in a relatively efficient pathway that also best utilizes space inside the container 10 and is easy to install.

The further compartment 45 for housing the secondary temperature control system 127 that is used to cool at least some of the electrical conditioning system 60, e.g. the inverter 85, is provided at an opposite end of the interior of the container to the secondary compartment 40. The further compartment 45 has a direct vent to the exterior of the container 10 through the walls or door of the enclosure 45 so that the secondary temperature control system 127 can exchange heat with the exterior / ambient air. By providing the secondary temperature control system 127 in this arrangement, the load on the main temperature control system 95 can be reduced.

The protection system 130 comprises one or more circuit breakers, such as air circuit breakers (ACBs). The electrical connections 92 that provide the electrical output of the containerized electrical supply unit 5 and to which supply/output cables can be connected are coupled to the protection system 130, in order to protect the containerized electrical supply unit 5 and/or the load from unwanted electrical events, such as a short circuit and/or over-voltage. The protection system 130 is in turn electrically connected to the conditioning system 60, which is in turn electrically connected to the electrical storage system 50. In this way, electrical charge can be discharged from the electrical storage system 50 to the load connected to the electrical connectors 92 and/or the electrical storage units 75 of the electrical storage system 50 can be recharged via electrical supply received via the electrical connectors 92. Optionally, the protection system 130 is provided in its own dedicated enclosure, which can be fixed or inserted into a corresponding recess in the container 10. Optionally, the protection system 130, can also be provided with its own temperature control system.

The further compartment 45 and/or the secondary compartment 40 may be thermally insulated. For example, a thermally insulated wall of the further and secondary compartments 40, 45 may extend between the interiors of the further and secondary compartments 40, 45 and the primary compartment 47 that houses the electrical storage system 50 and the electrical conditioning system 60. In this way, the amount of heat produced by the systems housed in the enclosures 40, 45 that reaches the electrical storage system 50 may be reduced.

Furthermore, a thermally insulating wall 140 may be provided between the electrical storage system 50 and the electrical conditioning system 60. In this way, the amount of heat produced by the electrical conditioning system 60 that reaches the electrical storage system 50 may be reduced. Furthermore, the wall 140 may define part of a chamber around the electrical storage system 50 and that receives cool air from temperature control system 95 via the conduit 115 running in the upper space 80. This may effectively form a pool of cool air around the electrical storage system 50, which may help keep the electrical storage units 75 at optimum temperature.

As can be seen particularly from Figs. 3, 5 and 6, the container 10 is an ISO container that is formed from a metal skeleton frame 145 that supports metal doors 15a, 15b, 102 and walls that close the container 10. The frame 145 is formed of metal beams having a 2D cross sectional profile. Beams having a generally C-shaped sectional profile have been found to be particularly beneficial, but other beam sections such as box section, I-section, T-section or L-section could potentially be used. The use of such sections can provide the additional strength required to compensate for the very large doors 15a, 15b that allow wide access to the interior of the container 5. The use of such a frame 145 provides the required structural strength and stacking ability, e.g. nine high stacking, but still allows a large degree of easy access into the interior of the container 10 for ease of assembly, manufacture, repair, and/or the like.

Beneficially, all of the components of the containerized electrical power supply 5 are provided inside or at least within the footprint of the container 10 and no components are ‘hung’ on or bolted onto the outside wall of the container 10 (with the possible exception of the control panel, albeit, this can be recessed) or extend out from the basic cuboid ISO container form. In this way, the containerized electrical power supply 5 is easier to ship and store.

Furthermore, the containerized electrical power supply 5 has all or most of the components to be run without extensive set-up and connections being made. As such, the system operates almost as a “plug and play” or “drop and use” system.

It will be appreciated that variations to the above example of Figs. 1 to 5 are possible.

More detailed views of the mechanism by which airflow is managed by the temperature control system 95 is shown in Figures 6 to 9.

Figure 6 shows a detail view of part of the enclosure door 102 of the secondary compartment 40 that houses the temperature control system 95 and the suppression system 100. In particular, Figure 6 shows a part of the inside of the door 102 of the secondary compartment 40 that contains the vent 110 through which air from the interior of the container 10 that has just been passed over the heat exchanger 112 can be expelled from the container 10 by the fan 105 of the temperature control system 95 (or in an alternative arrangement, through which air from the exterior of the container 10 can be drawn into the container 10).

The inside surface door 102 is provided with a shroud 150 that extends around the vent 110 in the door 102 and projects from the inner surface of the door 102 towards the interior of the secondary compartment 40 and in particular towards the fan 105 of the temperature control system 95. The shroud 150 defines a through passage 155 that is in register with openings in the vent 110 so that cooling air can be exchanged between the heat exchanger 112 and the exterior of the container 10 (e.g. such that air from the heat exchanger 112 can pass through the through passage 155 and out of the container 10). Optionally, one or more fins, guide plates and the like can be provided in the passage 155 in order to direct the air flow.

Optionally a distal end of the shroud 150, i.e. a free end that is furthest from the door 102 and that defines the other end of the through passage 155, is provided with a seal 160 or gasket, e.g. a rubber or other elastomeric seal, that extends around the perimeter of the distal end opening of the passage 155.

As shown in Figures 7 and 8, which show the relative arrangement of the shroud 150 and the fan 105 when the door 102, is closed, the seal 160 is configured to seal around the outside of a perimeter of the fan 105 when the door 102 is closed. In this way, airflow from the fan 105 and thereby to the exterior of the container 10, is improved. Furthermore, the shroud 11 effectively isolates the relatively colder air from the exterior of the container 10 that is sucked in through the vent in the side from the relatively warmer air that has been passed over or drawn through the heat exchanger 112 and is vented from the container via the through passage 155 of the shroud 150 and the vent 110. In this way, the air provided to the conduit 115 is cooler and the resulting cooling effect is improved.

However, it is desirable to have easy access to the fan 105 and the temperature control system 95, e.g. for maintenance and repairs. In this case, as shown in Figure 9, when the door 102 of the secondary compartment 40 is opened, e.g. to gain access to the secondary compartment 40 for maintenance, then, since the shroud 150 is fixed to the door 102 and not the temperature control system 95, the shroud 150 is swung away from the temperature control system 95 and the fan 105 in particular to allow easier access as the door 102 is opened. Since the fan 105 and temperature control system is unlikely to be in use at this time, then this doesn’t significantly adversely impact the cooling.

The specific examples are given in order to provide understanding and variations thereon would be apparent from the teaching provided herein. As such, the scope of protection is defined by the claims and not limited to the specific examples provided herein.

Claims

1. A containerized electrical supply unit comprising:

   a container;

   an electrical storage system or electrical generation system within the container; and

   a temperature control system within the container; wherein

   the container is provided with one or more airflow channels that extend from an exterior of the container to the interior of the container and a shroud mounted on an inside of the container at least partially or wholly around the one or more airflow channels and configured to guide airflow between the one or more airflow channel and at least part of the temperature control system.

2. The containerized electrical supply unit of claim 1, wherein the electrical storage system or electrical generation system is provided in a primary compartment and the temperature control system comprises a fan located in a secondary compartment, wherein the primary compartment is separated or isolated from the secondary compartment, and the fan is configured to draw air into the secondary compartment and/or expel air out from the secondary compartment through the one or more airflow channels, and the shroud is configured to guide airflow between the one or more airflow channel and the fan.

3. The containerized electrical supply unit of claim 1 or claim 2, wherein the shroud comprises a passage therethrough and the fan is configured to draw air into the container or expel air out of the container through at least one of the one or more airflow channels and through the passage of the shroud.

4. The containerized electrical supply unit of any preceding claim, wherein the shroud is configured to separate or isolate the air being drawn into the container from other air in the rest of the container and/or from air being expelled from the container.

5. The containerized electrical supply unit of any preceding claim, wherein the shroud is mounted on, or comprised in, the container and is separate from and/or unattached to the temperature control system.

6. The containerized electrical supply unit of any preceding claim, wherein at least one of the one or more airflow channels is through a door of the container and the shroud is mounted on, or comprised in, the inside of the door such that the shroud moves with the door.

7. The containerized electrical supply unit of claim 6, wherein the shroud is configured such that it extends from the container, e.g. from an inside of the door, to a position abutting, adjacent or proximate at least part of the temperature control system when the door is closed.

8. The containerized electrical supply unit of claim 6 or claim 7, wherein the shroud is configured such that it seals or is located around a region that is outside of an outer perimeter of the fan when the door is closed.

9. The containerized electrical supply unit of any preceding claim, wherein the shroud comprises a seal or gasket on a distal end of the shroud that is an end furthest from the wall of the container or container door.

10. The containerized electrical supply unit of claim 9 when dependent on claim 6, wherein the shroud is configured such that the seal or gasket abuts, is adjacent or is proximate at least part of the temperature control system when the door is closed.

11. The containerized electrical supply unit of any preceding claim, wherein the shroud surrounds at least one of the one of more airflow channels.

12. The containerized electrical supply unit of any preceding claim, wherein the temperature control system comprises at least one distribution duct that defines a flowpath therein and is configured to guide air to at least one other component inside the container via the flowpath, wherein the at least one other component inside the container includes at least one of: the electrical storage system or electrical generation system and/or an electrical conditioning system for converting an electrical output of the electrical storage system or electrical generation system to a different electrical output of the containerized electrical supply unit.

13. The containerized electrical supply unit of any preceding claim, wherein the temperature control system comprises a heat exchanger configured to receive heat from the interior of the container and/or the primary compartment and transfer the heat to air in the secondary compartment and/or drawn in by the fan to cool the interior of the container and/or the primary compartment.

14. The containerized electrical supply unit of claim 13, wherein the at least one distribution duct extends from an area proximate or around the heat exchanger to an upper or upmost portion of the interior of the container, and along the upper or upmost portion of the interior of the container to at least a position or positions above the at least one other component inside the container, wherein the at least one distribution duct is configured to deliver cooling air to the at least one other component inside the container from above.

15. The containerized electrical supply unit of any preceding claim, wherein at least part of the temperature control system, e.g. the fan, is located in a secondary compartment in the container that is separate from a primary compartment or compartments in which the electrical storage system or electrical generation system and/or the electrical conditioning system are provided.

16. The containerized electrical supply unit of claim 15, wherein the secondary compartment in which at least the part of the temperature control system is provided is thermally insulated from the primary compartment in which the electrical storage system or electrical generation system and/or the electrical conditioning system are provided.

17. The containerized electrical supply unit of any of claims 15 or 16, comprising a second temperature control system provided in a further compartment and configured to control the temperature of at least part of the electrical conditioning system, e.g. the inverter.

18. The containerized electrical supply unit of any of claims 15 to 17, wherein the containerized electrical supply unit further comprises a protection unit that is provided with a dedicated temperature control system.

19. The containerized electrical supply unit of any preceding claim, comprising one or more thermally insulating walls provided:

adjacent or at least partly around the electrical storage system or electrical generation system; and/or

between the electrical storage system or electrical generation system and at least part of the electrical conditioning system and/or the temperature control system and/or the at least one protection unit.

20. A method of assembling, repairing or producing a containerized electrical supply unit according to any preceding claim, the method comprising:

providing a container that comprises one or more airflow channels that extend between an interior and an exterior of the container;

locating an electrical storage system or electrical generation system within the container;

locating a temperature control system within the container; and.

providing a shroud mounted on, or comprised in, an inside of the container at least partially around the airflow channel.

21. The method of claim 20, further comprising arranging the temperature control system relative to the container such that the shroud is configured to guide airflow between the one or more airflow channel and at least part of the temperature control system, at least when the door is closed.

22. A method of operating the containerized electrical supply unit of any of claims 1 to 19, the method comprising:

operating the containerized electrical supply unit so as to provide power from the electrical storage system, or operating the electrical generation system so as to supply electrical power, to an external load via the one or more electrical connections of the containerized electrical supply unit.

23. A container for a containerized electrical supply unit, the container comprising:

a region for receiving an electrical storage system or an electrical generation system within the container;

fittings for a temperature control system for maintaining a temperature of the electrical storage system control system within the container;

a door provided proximate the fittings for receiving the temperature control system;

one or more airflow channels that extend through the door of the container; and a cowling, guide or shroud mounted on or comprised in an inside of the door of the container at least partially around at least one of the one or more airflow channels and configured to guide airflow between the one or more airflow channel and at least part of the temperature control system.

24. A containerized electrical supply unit, the supply unit comprising:

a container;

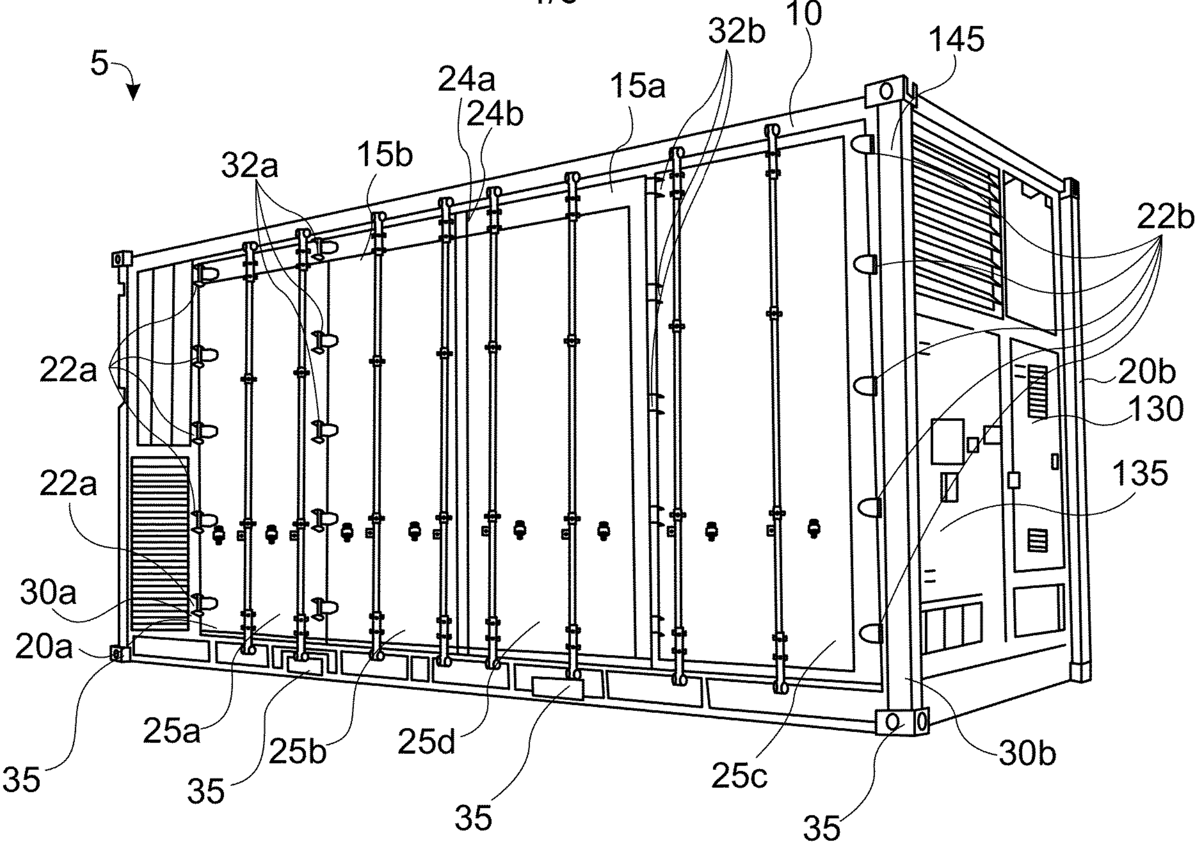
an electrical storage system or electrical generation system within the container;

a temperature control system for maintaining a temperature of the electrical storage system control system within the container; and

optionally an electrical conditioning system; wherein

the temperature control system is provided in a compartment within the container that is different from a compartment in which the electrical storage system or electrical generation system and the electrical conditioning system is provided.

25. The containerized electrical supply unit of claim 24, wherein the compartment in which the temperature control system is provided is thermally insulated by a thermally insulated wall of the compartment from the compartments in which the electrical storage system or electrical generation system and/or the electrical conditioning system are provided.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35
35

Fig. 1

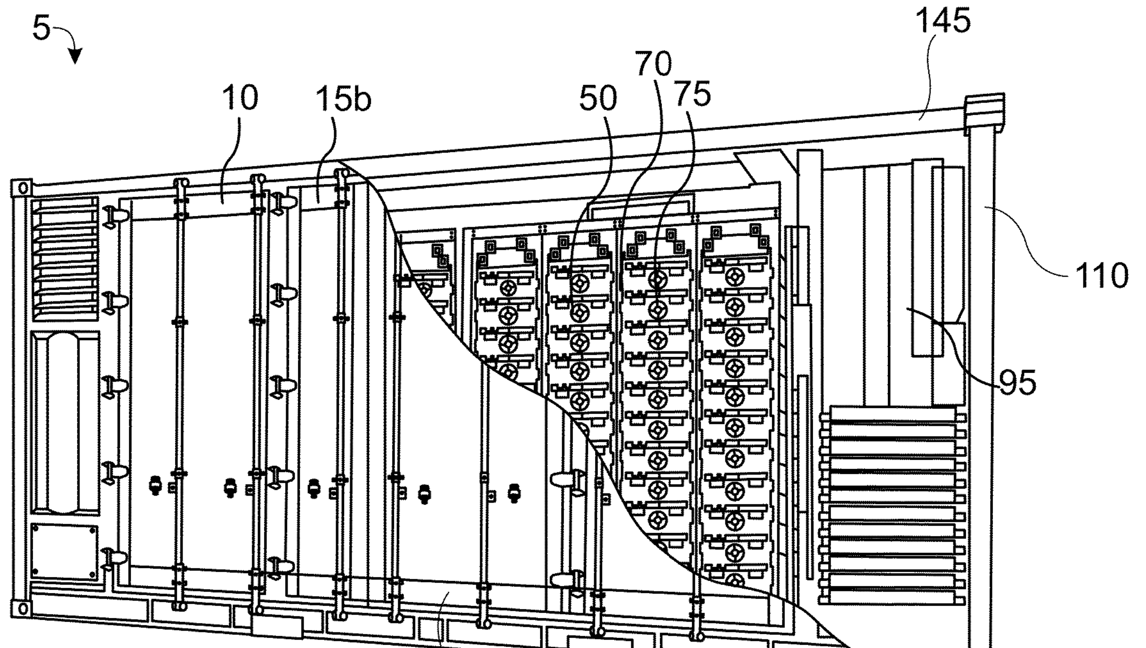
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Fig. 2

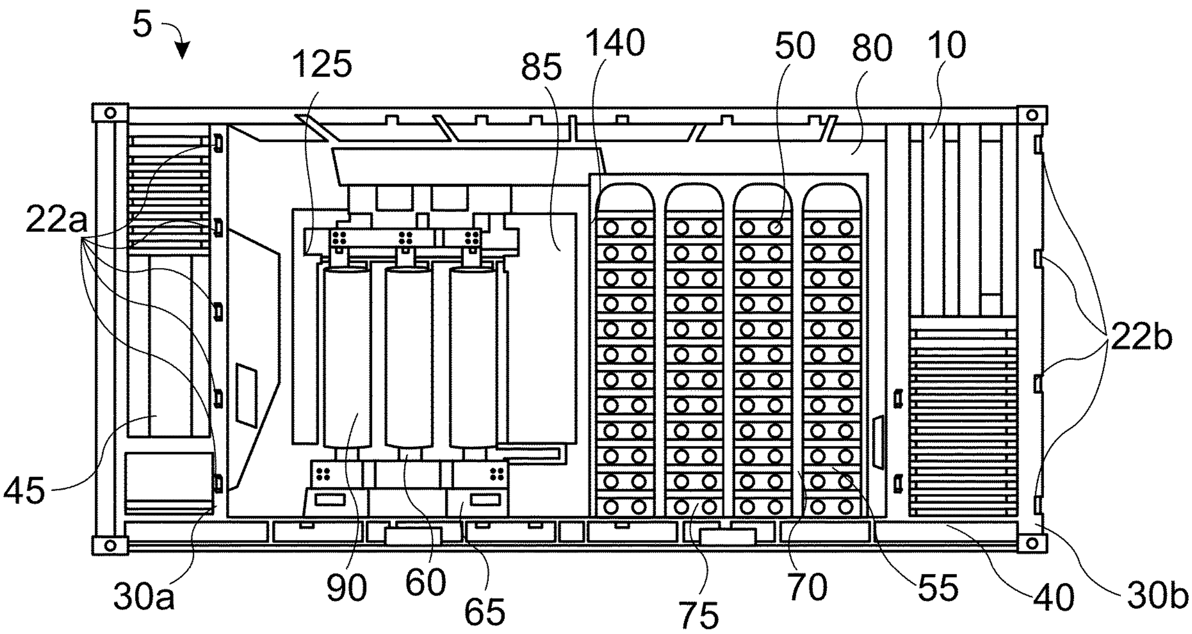

Fig. 3

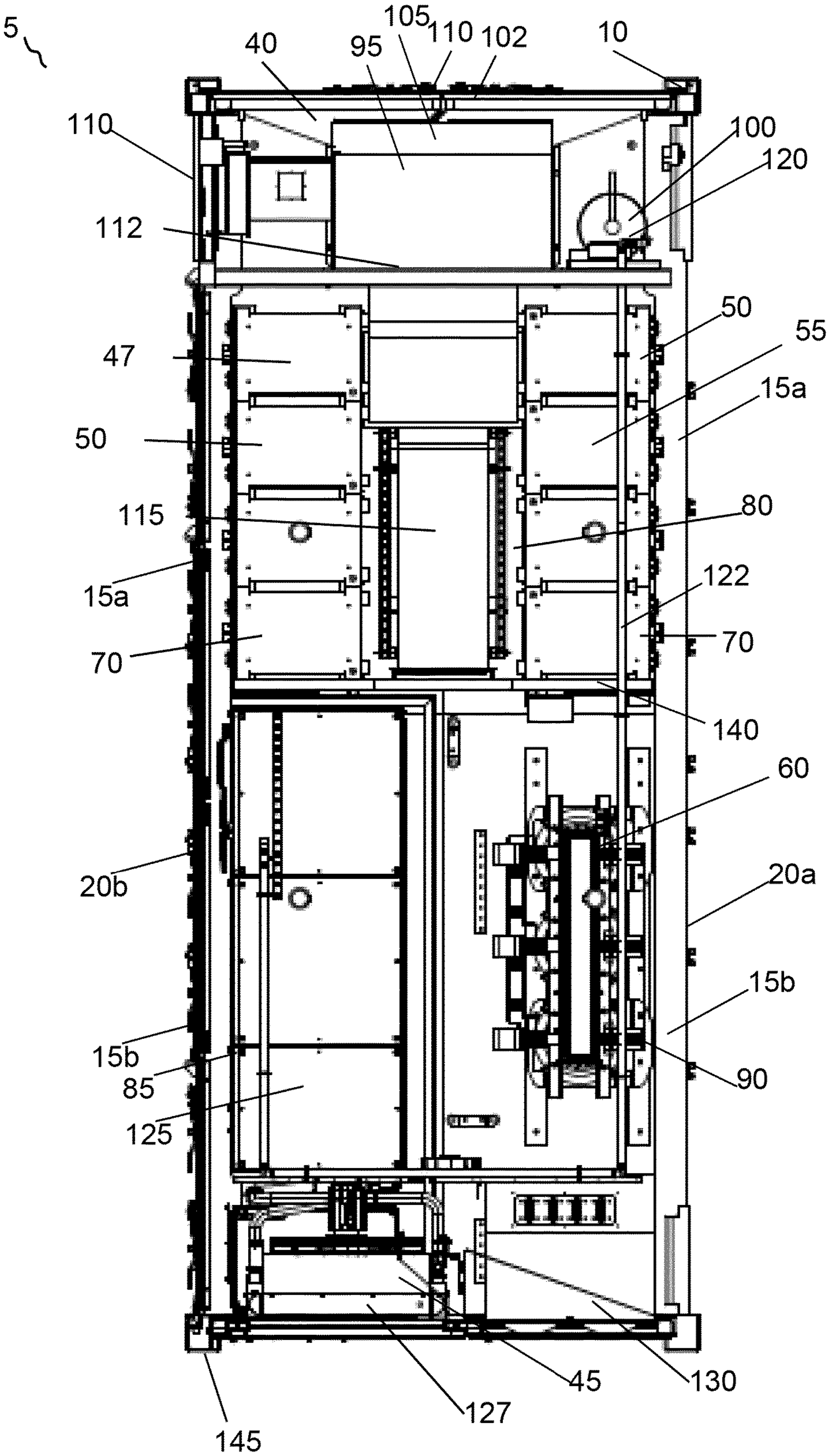
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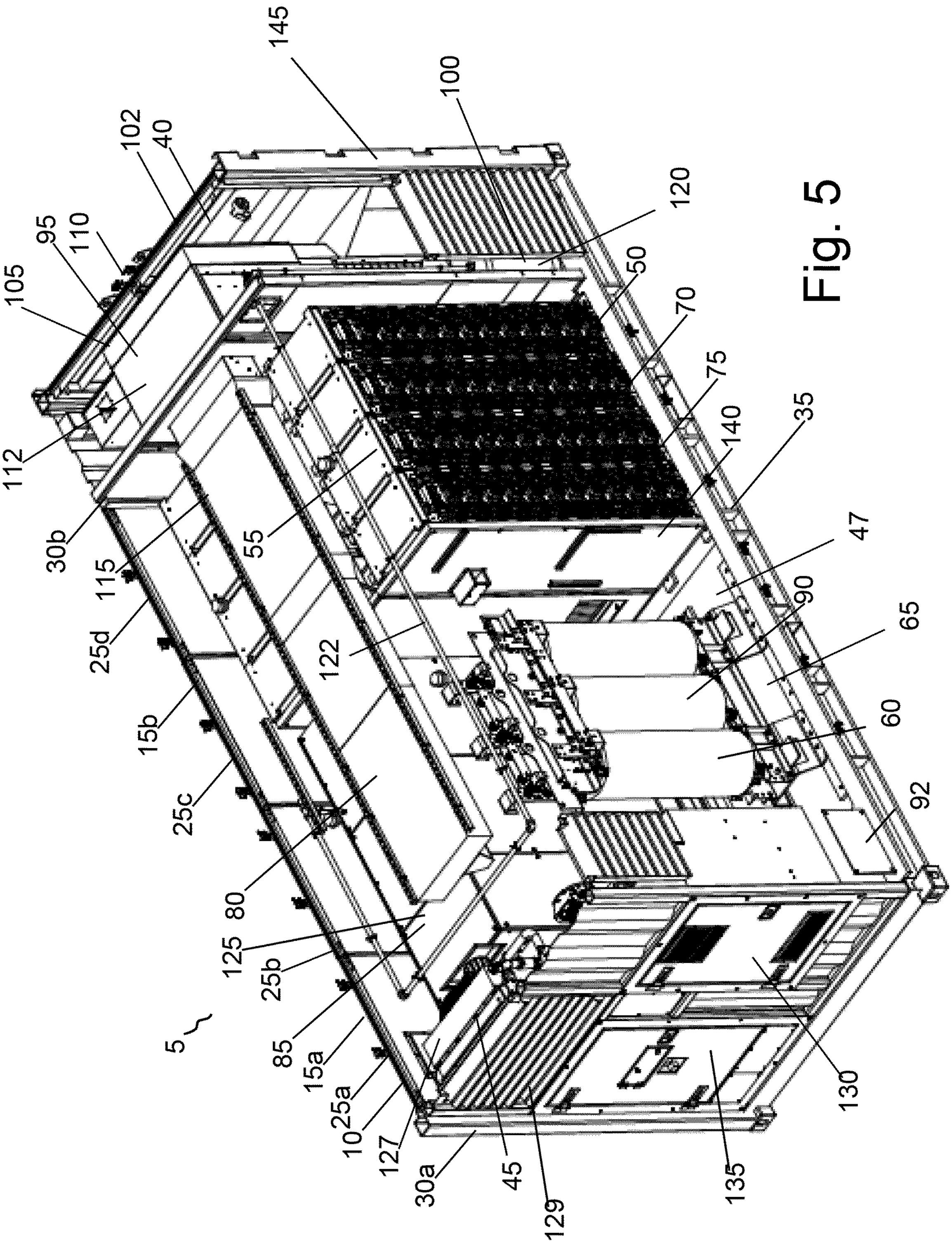
Fig. 4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122
60
15b
92
25c
80
125
25b
5
85
15a
130
25a
10
127
30a
45
135
129

Fig. 5

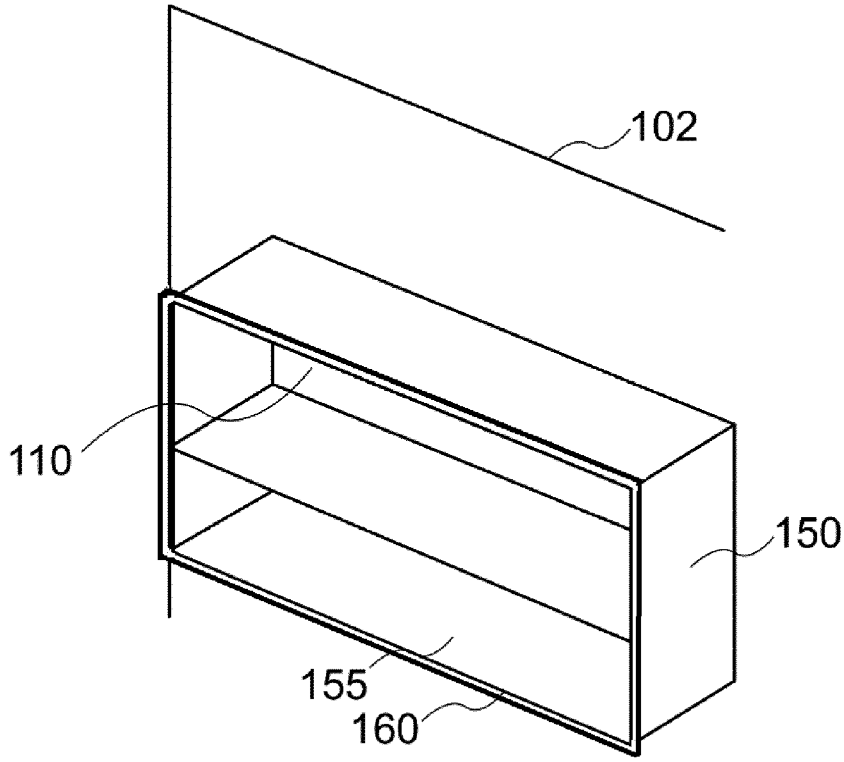

Fig. 6

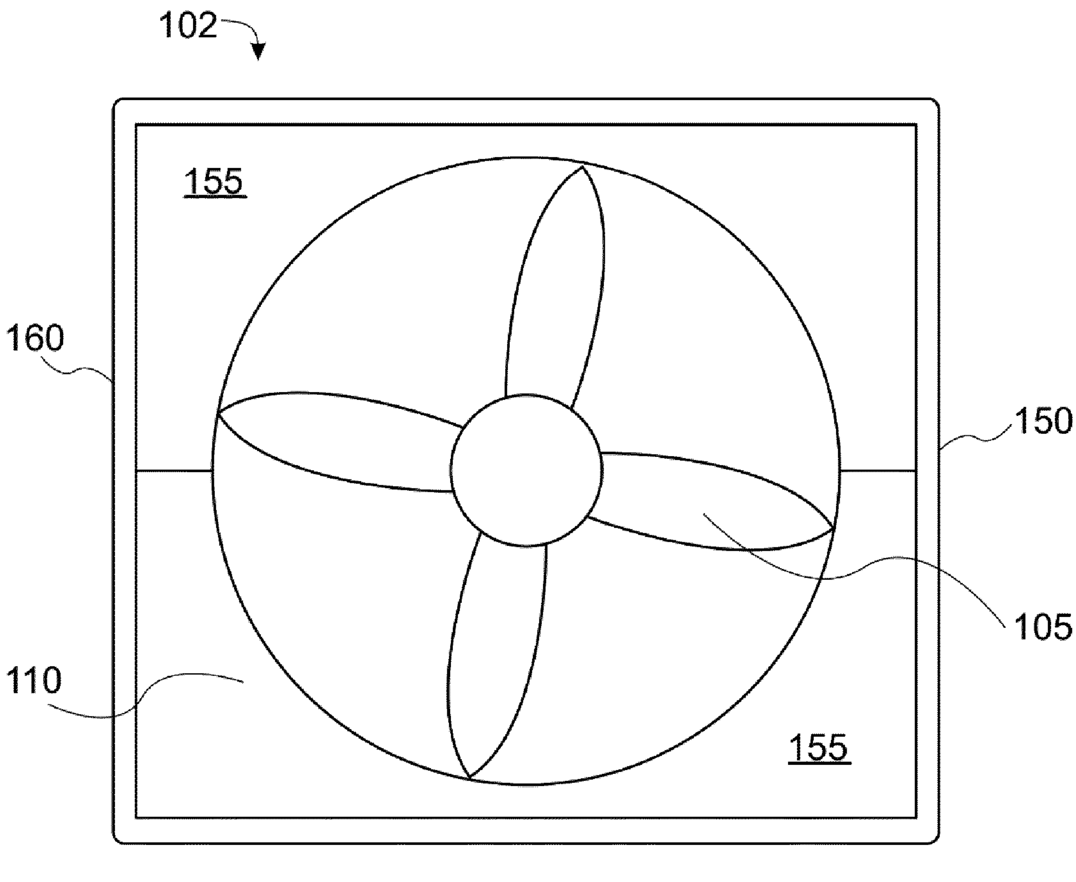

Fig. 7

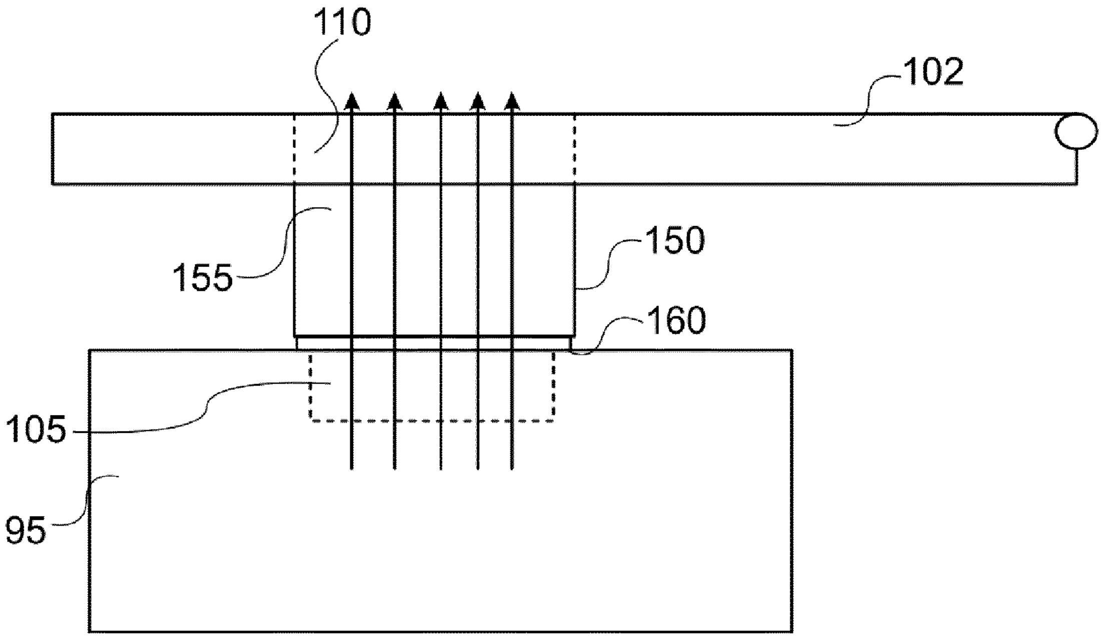

Fig. 8

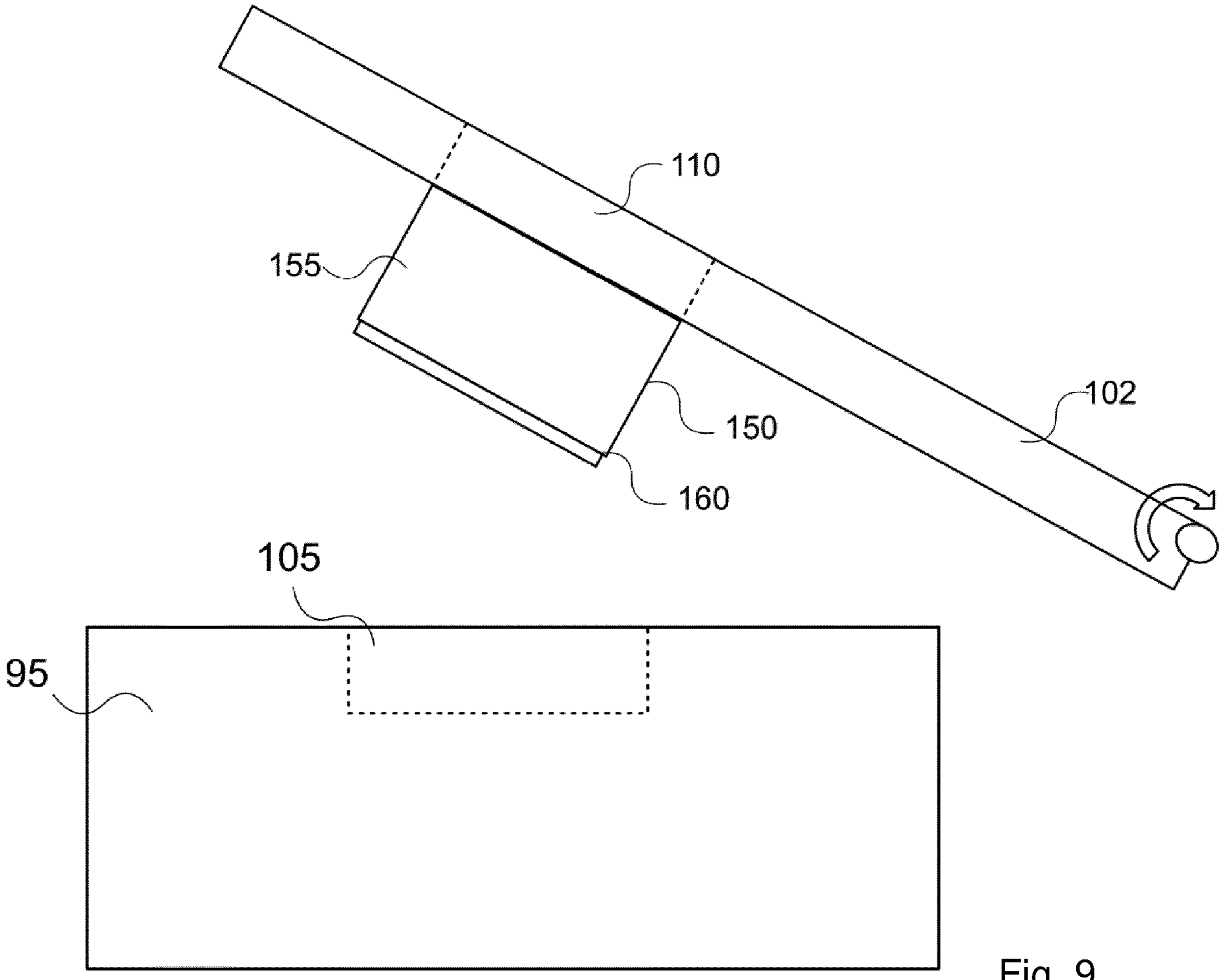

Fig. 9

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2020/077149

A. CLASSIFICATION OF SUBJECT MATTER
INV. F02B63/04 F01P5/06
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)
F02B F01P

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

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2016/294255 A1 (SCHMIT IAN [US] ET AL) 6 October 2016 (2016-10-06) paragraph [0034] - paragraph [0036]; figures 5,13	1-17, 19-22
X	EP 3 070 819 A1 (ARUANÃ EN S A [BR]) 21 September 2016 (2016-09-21) paragraph [0013] - paragraph [0023]; figures 1-13	1-8,11, 12, 15-17, 19-22
X	CN 108 104 944 A (SHENZHEN JENSONN POWER SYSTEMS CO LTD) 1 June 2018 (2018-06-01) the whole document	1-6,12, 15,18-22

-/--

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

[X] See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
18 December 2020	09/03/2021

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	Tietje, Kai

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INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2020/077149

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 7 107 943 B2 (DENYO CO LTD [JP]) 19 September 2006 (2006-09-19) column 5, line 28 - column 6, line 55; figures 1-5 -----	1-4,12, 20-22

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/EP2020/077149

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. ☐ As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of additional fees.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

1-22

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.

☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.

☐ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-22

   Containerized unit having airflow channels and shroud between these channels and a temperature control system and method of operating this unit

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2. claim: 23

   Container with door having airflow channels and cowling, guide or shroud

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3. claims: 24, 25

   Containerized unit with temperature control system

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2020/077149

Patent document cited in search report		Publication date	Patent family member(s)			Publication date
US 2016294255	A1	06-10-2016	CA	2919822	A1	02-10-2016
			CN	105626251	A	01-06-2016
			US	2016294255	A1	06-10-2016
EP 3070819	A1	21-09-2016	AR	102243	A4	15-02-2017
			BR	202014026458	U2	26-04-2016
			CN	205945312	U	08-02-2017
			EP	3070819	A1	21-09-2016
			ES	2778203	T3	10-08-2020
			JP	3217277	U	02-08-2018
			KR	20160002692	U	02-08-2016
			US	2016273211	A1	22-09-2016
			WO	2016061648	A1	28-04-2016
			ZA	201603649	B	27-09-2017
CN 108104944	A	01-06-2018	NONE			
US 7107943	B2	19-09-2006	NONE			