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(54) Title: METHODS, SYSTEMS, APPARATUSES, AND DEVICES FOR FACILITATING POWERING OF BUILDINGS WITH ENERGY SOURCES ASSOCIATED WITH THE BUILDINGS

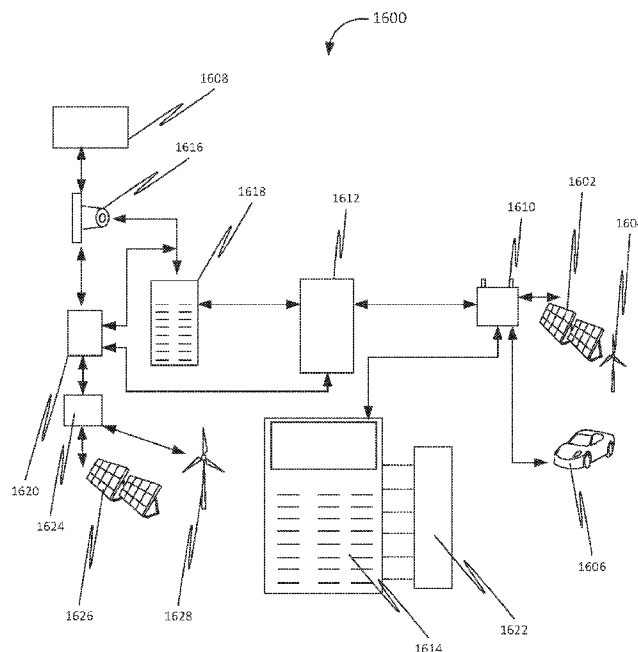


FIG. 16

(57) Abstract: A system for facilitating powering of buildings with energy sources includes an electric panel configured to be disposed in a location of a building. The electric panel includes an input port configured to be electrically coupled with an electrical power source, output ports configured to be electrically coupled with an electrical circuit including an electrical load, and a converter unit electrically coupled with the input port and the output ports. The converter unit is configured for receiving the electrical power input from the electrical power source, converting the electrical power input to direct current (DC) power outputs based on a command, and supplying the DC power outputs to the electrical circuit through the output ports. The electric panel includes a processing device operatively coupled with the converter unit and configured for analyzing an information, determining the output power values for the



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DC power outputs, and generating the command.

INTERNATIONAL SEARCH REPORT

International application No.

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A. CLASSIFICATION OF SUBJECT MATTER IPC - INV. H02B 1/015, H02H 3/087, H02H 7/22, H02H 7/26, H02J 3/32 (2024.01) ADD. H02H 3/08, H02J 3/28, H02J 3/38, H02J 7/02 (2024.01) CPC - INV. H02B 1/015, H02H 3/087, H02H 7/22, H02H 7/26, H02H 7/268, H02J 3/32 ADD. H02H 3/08, H02J 3/28, H02J 3/38, H02J 7/02 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) See Search History document Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched See Search History document Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) See Search History document		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2011/0254372 A1 (HAINES et al.) 20 October 2011 (20.10.2011), abstract, Fig. 1-11, para. [0032]-[0106]	1-20
A	US 2020/0112199 A1 (SPAN.IO, INC.) 09 April 2020 (09.04.2020), abstract, Fig. 1-30, para. [0040]-[0144]	1-20
A	US 2022/0247175 A1 (EATON INTELLIGENT POWER LIMITED) 04 August 2022 (04.08.2022), abstract, Fig. 1-16, para. [0028]-[0085]	1-20
A	US 2019/0348838 A1 (ENTRUST SMART HOME MICROGRID LTD.) 14 November 2019 (14.11.2019), entire document	1-20
A	US 2022/0153148 A1 (DCBEL INC.) 19 May 2022 (19.05.2022), entire document	1-20
☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.		
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INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 24/32797

(Continuation of Box No. III, Observations where unity of invention is lacking.)

This application contains the following inventions or groups of inventions which are not so linked as to form a single general inventive concept under PCT Rule 13.1. In order for all inventions to be searched, the appropriate additional search fees must be paid.

Group I: Claims 1-17, drawn to a system for facilitating powering of buildings with energy sources associated with the buildings comprising additional ports, and port connection units.

Group II: Claims 1-14 & 18-20, drawn to a system for facilitating powering of buildings with energy sources associated with the buildings comprising monitoring devices for monitoring a characteristic of power usage.

The inventions listed in the above-mentioned groups do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features for the following reasons:

Special Technical Features:

Group I includes the special technical feature of: an additional port coupled with an electrical device, and a port connection unit, not included in the other groups.

Group II includes the special technical feature of: a first monitoring device for monitoring a characteristic of a power usage; determining at least one power requirement; and a storage device, not included in the other groups.

Common Technical Features:

The only technical features shared by Groups I & II that would otherwise unify the groups are: a system for facilitating powering of buildings with energy sources associated with the buildings, the system comprising: an electric panel configured to be disposed in at least one location of at least one building, wherein the electric panel comprises: at least one input port configured to be electrically coupled with at least one electrical power source, wherein the at least one electrical power source supplies at least one electrical power input; a plurality of output ports configured to be electrically coupled with at least one electrical circuit comprising at least one electrical load; at least one converter unit electrically coupled with the at least one input port and the plurality of output ports, wherein the at least one converter unit is configured for: receiving the at least one electrical power input from the at least one electrical power source through the at least one input port; converting the at least one electrical power input to at least one of a plurality of direct current DC power outputs based on the receiving and at least one command, wherein the plurality of DC power outputs is associated with a plurality of output power values; and supplying at least one of the plurality of DC power outputs to the at least one electrical circuit through at least one of the plurality of output ports based on the converting; and a processing device operatively coupled with the at least one converter unit, wherein the processing device is configured for: analyzing at least one information; determining at least one of the plurality of output power values for at least one of the plurality of DC power outputs based on the analyzing of the at least one information; and generating the at least one command based on the determining.

However, this shared technical feature does not represent a contribution over prior art, because the shared technical feature is disclosed by US 2019/0348838 A1 to Entrust Smart Home Microgrid Ltd. (hereinafter Entrust).

Entrust discloses: a system (apparatus 100 for use in a microgrid) for facilitating powering of buildings (building) with energy sources (20, 21) associated with the buildings (building) (Fig. 1-3, para. [0052], [0103]: Microgrid comprises a DC bus 1, at least one DC power source 21 which is configured to connect to the DC bus 1 and feed power from the at least one DC power source 21 to the DC bus 1, an AC bus 2 which is configured to connect the mains power grid 20...Microgrid as illustrated in FIG. 2A may be used for a building), the system (100) comprising: an electric panel (AC load center) configured to be disposed in at least one location of at least one building (building), wherein the electric panel (AC load center) comprises:

at least one input port (node from 2 to 3) configured to be electrically coupled with at least one electrical power source (20), wherein the at least one electrical power source (20) supplies at least one electrical power input (AC power input) (Fig. 1-3, para. [0045], [0048], [0052]: Plurality of AC load centres 90 may be connected to the distribution network 201 directly (not shown) or through transformers 203...For each of the renewable power systems illustrated by FIGS. 1A to 1D, the power capacity of all the grid connection devices, including the DC/AC converters 3 (as in FIGS. 1A, 1B and 1C) for strings 211 of solar photovoltaic modules and the power electronic converters 215...Microgrid comprises a DC bus 1, at least one DC power source 21 which is configured to connect to the DC bus 1 and feed power from the at least one DC power source 21 to the DC bus 1, an AC bus 2 which is configured to connect the mains power grid 20, a DC/AC converter 3 which is configured to couple the DC bus 1 and the AC bus 2 and feed power from the DC bus 1 to the AC bus 2, and an apparatus 100.);

a plurality of output ports (node from 1 to 4) configured to be electrically coupled with at least one electrical circuit comprising at least one electrical load (41) (Fig. 1-3, para. [0044]: Apparatus 100 comprises number of (at least one) DC power converters 4 and a control system 10. Each of the number of DC power converters 4 is configured to couple a respective controllable DC load 41 and the DC bus 1.);

at least one converter unit (4) electrically coupled with the at least one input port (from 1) and the plurality of output ports (node from 1 to 4), wherein the at least one converter unit (4) is configured for:

receiving the at least one electrical power input (AC power input) from the at least one electrical power source (20) through the at least one input port (node from 2 to 3) (Fig. 1-3, para. [0061], [0070]: Controllable DC loads 41...DC motor or an AC motor or even the batteries of an electric vehicle may be a controllable DC load 41...Specific DC power converter 4 may be configured as a DC/DC charging converter (e.g. a DC EV charger), and the DC EV charger may be configured to control the power flowing from the DC bus 1 to the controllable DC load 41 (e.g. the EV batteries) to fulfill its functions...to charge the EV batteries.);

(See Extra Sheet, below)