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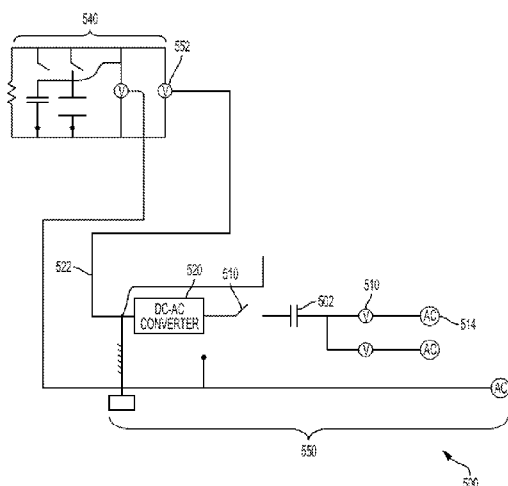
(54) **Title:** A HIGH-WATTAGE POWER APPLIANCE SYSTEM

FIG. 5

(57) **Abstract:** A high power appliance system to supply outlet electrical wattage is disclosed. The high power appliance system includes: a primary electrical power source to provide a primary electrical wattage; a secondary electrical power source configured to deliver a stored electrical wattage upon demand and configured to store the primary electrical wattage as the stored electrical wattage when not in demand; an outlet configured to provide the outlet electrical wattage. In the high power appliance system, the outlet electrical wattage is greater than the primary electrical wattage and includes the stored electrical wattage.

A HIGH-WATTAGE POWER APPLIANCE SYSTEM

[0001] The present disclosure relates to management of cooking power or wattage in a kitchen, and in particular to using a stored energy source, such as, a capacitor, a battery or a flywheel to supplement power provided to a kitchen appliance from a power line.

DESCRIPTION

[0002] The following disclosure relates to the use of stored energy in combination with a kitchen appliance. In some embodiments, the appliance may include a heat source, such as, a radiant element, a microwave, an impingement element (for example, a heating element and a fan to move fluids over the heated element), a convection element, and so on. In some embodiments, the appliance may be a cooling appliance, a dishwasher, a blender, a steamer or the like.

BACKGROUND

[0003] Demand exists for running a kitchen appliance with a single, two or three-phase power supply, where line peak power on the line may be insufficient to energize the appliance with the desired wattage, for example, at greater than 6000 Watts from a single-phase line. In addition, power line fluctuations, brownouts and intermediate breakdowns may cause a disruption in the use of the appliance.

[0004] Demand also exists for a High-Wattage Power Supply to provide electrical power via a very high direct current flow, generally in excess of 50 amperes, to a heating element to generate 8,000 to 50,000 Watts of heating power. The power supply is generally connected to an electrical grid supplying 6000 or less Watts of electric power over a single line. The high-wattage power supply supplies power greater than the wattage supplied by a line of the grid using a high direct current, for example, to allow for heating of items in periods 5-10 times faster than by heating items by using power supplied only by the grid.

[0005] The total power delivered to an electric appliance is inherently limited by the electrical grid connection and wiring from the electrical grid connection to the appliance. The total energy needed, for example, to toast a slice of bread or bagel ranges from about 25 to 50 W-hours. With typical home wiring, for example, 16, 14, and 12 gauge wire, the grid delivers energy at a maximum rate of 1200 to 1800 W, and as such, minimum toasting times range from 30 to 180 seconds. Even in a typical restaurant, the delivered electric power to an electric

appliance is about 6000 Watts.

[0006] Moreover, the need to increase cycle times for heating elements quickly and delivering large amounts of power is associated with limitations of time. Business establishments, for example, restaurants, in particular quick food restaurants, are also limited to how fast an item can be heated by the amount of power that can be delivered. Generally speaking, the more power delivered to an appliance, the faster an item can be prepared or heated. By shortening the time needed to use an appliance, a business establishment can service more customers. Moreover, business establishments usually leave ovens running even when there is nothing to be presently heated because the oven heat-up time is long and the heat-up time adds delay to delivering the desired item. In considering an approach to accomplishing faster and more appliances, the solution may be limited by the power line or grid, i.e., 25 to 200 W-hours at a power level of 8 to 50 kilowatts.

[0007] Another consideration is that for appliances to comply with the Underwriters Laboratory specification the appliances can generally only have one incoming powerline and as such power consumption by an appliance is limited to the rating of the incoming powerline. As such, there is a need to provide electrical energy storage that can supplement the electrical energy provided by a standard utility powerline. There is also a need to separate electrical components, such as, a power supply, a charger or a AC to DC converter, that have a high leakage current to be isolated from an appliance such as an oven.

SUMMARY

[0008] This Summary is provided to introduce a selection of concepts in a simplified form that is further described below in the Detailed Description. This Summary is not intended to identify key features or essential features of the claimed subject matter, nor is it intended to be used to limit the scope of the claimed subject matter.

[0009] A high power appliance system to supply outlet electrical wattage is disclosed. The high power appliance system includes: a primary electrical power source to provide a primary electrical wattage; a secondary electrical power source configured to deliver a stored electrical wattage upon demand and configured to store the primary electrical wattage as the stored electrical wattage when not in demand; an outlet configured to provide the outlet electrical wattage. In the high power appliance system, the outlet electrical wattage is greater than the primary electrical wattage and includes the stored electrical wattage.

[0010] A high power appliance system for use in a food service area is disclosed. The high power appliance system including: an energy storage and delivery system to store electrical energy from a power line; and a heating element capable of using electrical energy from the energy storage and delivery system, wherein the electrical energy delivered from the energy storage and delivery system to the heating element is delivered at a rate that is at least 110% of the rate delivered by the power line.

[0011] A process for cooking foods at accelerated rates is disclosed. The process uses a primary and a secondary energy storage system and in which the energy transfer between said primary and secondary energy storage system uses an inverter.

[0012] A counter equipped for delivering high current low voltage DC power to an appliance intended to cook or heat foods or liquid at accelerated times is disclosed.

[0013] The present teachings provide embodiments of heating system and methods, and features thereof, which offer various benefits. The system can employ multiple electrodes, systems, operations, and the like to promote safe, efficient, and effective use of the devices and methods disclosed herein.

[0014] It is to be understood that both the foregoing general description and the following detailed description are exemplary and explanatory and are intended to provide further explanation of the invention as claimed. Additional features will be set forth in the description that follows, and in part will be apparent from the description, or may be learned by practice of what is described.

BRIEF DESCRIPTION OF THE FIGURES

[0015] In order to describe the manner in which the above-recited and other advantages and features may be obtained, a more particular description is provided below and will be rendered by reference to specific embodiments thereof which are illustrated in the appended drawings. Understanding that these drawings depict only typical embodiments and are not therefore to be considered to be limiting of its scope, implementations will be described and explained with additional specificity and detail through the use of the accompanying drawings.

[0016] FIG. 1 is a schematic drawing describing the electrical circuit including an energy storage system, according to various embodiments.

[0017] FIG. 2 is a schematic drawing describing an electrical circuit including an energy storage system, according to various embodiments.

[0018] FIG. 3 is a schematic drawing describing the electrical circuit including an energy storage system, according to various embodiments.

[0019] FIG. 4A is a schematic drawing describing the electrical circuit including an energy storage system, according to various embodiments.

[0020] FIG. 4B is a schematic drawing describing the electrical circuit including an energy storage system, according to various embodiments.

[0021] FIG. 5 is a schematic drawings showing describing the electrical circuit including a primary energy storage system and a secondary energy storage system, according to various embodiments.

[0022] FIG. 6 is a process flow diagram for using a high-capacity power supply, according to various embodiments.

[0023] FIG. 7A, FIG. 7B, FIG. 7C, FIG. 7D and FIG. 7E illustrate a perspective view of an exemplary power supply, according to various embodiments.

[0024] FIG. 8A, FIG. 8B, FIG. 8C, 8D, FIG. 8E, FIG. 8F, FIG. 8G, FIG. 8H, FIG. 8I, FIG. 8J, FIG. 8K, FIG. 8L, FIG. 8M, FIG. 8N, FIG. 8O and FIG. 8P illustrate a perspective view of an exemplary power supply system, according to various embodiments.

DETAILED DESCRIPTION

[0025] Embodiments are discussed in detail below. While specific implementations are discussed, it should be understood that this is done for illustration purposes only. A person skilled in the relevant art will recognize that other components and configurations may be used without parting from the spirit and scope of the subject matter of this disclosure.

[0026] The terminology used herein is for describing particular embodiments only and is not intended to be limiting of the present disclosure. As used herein, the singular forms “a,” “an” and “the” are intended to include the plural forms as well, unless the context clearly indicates otherwise. Furthermore, the use of the terms a, an, etc. does not denote a limitation of quantity, but rather denotes the presence of at least one of the referenced item. The use of the terms “first,” “second,” and the like does not imply any particular order, but they are included to either identify individual elements or to distinguish one element from another. It will be further understood that the terms “comprises” and/or “comprising”, or “includes” and/or “including” when used in this specification, specify the presence of stated features, regions, integers, steps,

operations, elements, and/or components, but do not preclude the presence or addition of one or more other features, regions, integers, steps, operations, elements, components, and/or groups thereof. Although some features may be described with respect to individual exemplary embodiments, aspects need not be limited thereto such that features from one or more exemplary embodiments may be combinable with other features from one or more exemplary embodiments.

[0027] In order to deliver the energy at a rate of 8 to 50 kilowatts, the energy is stored during a time of non-use of an appliance and then quickly discharged (at a rate of 2 to 30 times faster than charging). Typical electrical storage methods include batteries, capacitors, and flywheels. Although the typical cost of delivered energy is about 100 times as much for flywheel and capacitors versus lead-acid batteries, lead-acid batteries have long recharge times and cannot discharge energy as readily as batteries. In contrast, capacitor recharge time is essentially zero and limited only by the energy available and the storage capacity of the capacitor. Similarly, capacitor discharge time is essentially zero if sufficient energy is demanded.

[0028] In attempting to make an appropriate decision of the most effective energy storage method to use for a particular application, for example, toasting, it is important to consider cycle times, total number of times the heating element is used in a day, the relative costs of each technology, the ability to scale production to high volumes for the appliance market, as well as the environmental and safety aspects of the technology. As such, in some embodiments, an energy storage system that combines the low costs of energy delivery by batteries with quick recharge times of capacitors is provided. In some embodiments, a secondary storage device is seconded to a primary storage device, where power is transferred between the primary and second secondary device using AC for distances greater than 1, 1.5, 2 meters, or the like.

[0029] In attempting to select the most viable heating element technology to use for the high power delivery and short cycle time necessary for high speed cooking, it is important to consider 1) the method of heating (radiant, convective, conductive or microwaves) 2) drive voltage necessities for the heating element, 3) element cycle times, and 4) element degradations.

[0030] In considering the drive voltage for the heating element, the higher the voltage, the more difficult, expensive, and dangerous electrical storage techniques will be. Typical capacitors that work at 200 V can only store 1 to 100 Joules (1,000 times less than is required for this application). The use of a heating element which operates at voltages between 12V and

110V is safest for consumer appliances.

[0031] The present teachings allow for using high energy consuming kitchen appliances, for example, high speed high energy ovens. In particular, the present teachings allow for quickly cooking with an appliance that can be operated from one or more standard household, commercial or industrial wall outlets.

[0032] The present teachings disclose an energy storage system to provide repeatable discharging at power levels greater than power levels from a power line, for example, 2,000 to 50,000 Watts, for short periods, for example, 10 minutes or less, 5 minutes or less, 4 minutes or less, 3 minutes or less, 1 minutes or less, or the like. In exemplary embodiments, an energy storage system may provide repeatable discharging at power levels greater than power levels from a power line, for example, 110%, 130%, 150%, 200%, 300%, 400%, 500%, 1000%, or the like of the power from the power line, for short periods, for example, 10 minutes or less, 5 minutes or less, 4 minutes or less, 3 minutes or less, 1 minutes or less, or the like.

[0033] The present teachings also disclose use of appliances that consume energy at a level greater than power levels from a power line, for example, 2,000 to 50,000 Watts, for short periods. In some embodiments, the appliance enables cooking of foods. In some embodiments, the appliance enables incineration of items. In some embodiments, the energy storage system can be adaptable for other consumer appliances such as clothes dryers, curling irons, or heaters.

[0034] FIG.1 is a schematic drawing illustrating circuitry 60 for use with a heating element. The circuitry 60 includes a direct current energy storage system 1. The direct current energy storage system 1 typically operates in a range from 12-150 volts depending on the voltage required by a heating element 8.

[0035] In some embodiments, the direct current energy storage system 1 may include lead acid batteries made using absorbed glass mat valve regulated lead acid technology ; these batteries may provide the least expensive solution for the batteries. This type of technology can be shipped by air and land with minimal restrictions and thus fits well within the context of an appliance. Choosing the correct battery size takes many factors into account; including the voltage requirement of the heating elements bulbs, the most number of continuous discharges required, the maximum weight of the batteries, the level of discharge, and the time between charging.

[0036] In some embodiments, the direct current energy storage system 1 may include a

capacitor or a flywheel. The capacitor may include multiple capacitors arranged in a capacitor array supported by a support to provide an integrated capacitor assembly. The integrated capacitor assembly may include a harmonizer/equalizer to ensure each capacitor in the array charges and discharges at the same level.

[0037] According to various embodiments, a charging of the direct current energy storage system 1 is controlled by a microprocessor 5 and a charger 61. The charger 61 is connected to a power line (not shown). In some embodiments, the power line can be connected to the electrical grid, a solar array, a wind turbine, or the like.

[0038] The heating element 8 can include multiple heating elements. The multiple heated elements may, for example, be electrically connected or joined in parallel across the driving voltage provided by the direct current energy storage system 1. Electrical leads 62 from the direct current energy storage system 1 to the heating element 8 must be sized to carry the large currents required; the current passing through the leads a function of ohms law.

[0039] According to various embodiments, the on and off switching of the heating element 8 is controlled by a relay or multiple relays 4 with a coil 9. The relay 4 may be rated between 5 and 24 volts DC or 110 VAC. In some embodiments, the relay 4 may be rated for low voltage DC or low voltage AC applications between 2 Kilowatts (kW) to 10 kW, between 6 kW to 50 kW, between 20 kW to 50 kW, 40 kW to 100 kW, or more. For example, in industrial applications, a 14 kW power line feed can be used to energize one or more heating elements operating at 50 kW with suitable energy storage system.

[0040] In exemplary embodiments, the action of the relay 4 is controlled by a microprocessor system 5. The microprocessor system may receive input from a sensor 10 to detect the energy used by the heating element 8, and a condition of an item (not shown) to be heated. Sensor 10 may be based on light detection, frequency detection, vapor detection, chemical detection, or a combination thereof.

[0041] In some embodiments, a fan or filtering system 63 is also controlled by microprocessor 5 and is most generally attached to the oven to insure proper filter of the smoke produced. In some embodiments, the fan 5 may be positioned to impinge a fluid, for example, air, over and across the heating element 8 to convey heat to the item to be heated.

[0042] FIG. 2 is a logical drawing describing an electrical circuit including an energy storage system, according to various embodiments.

[0043] An electrical circuit 200 is energized by a power line 202 providing electrical energy in Watts that can be determined by multiplying the voltage in with the current in ($V_{IN} \times I_{IN}$). An energy storage system 204 can store energy proximate to an appliance 210 controlled by a control 208 and a switch 206 that electrically connects the energy storage system 204 with the appliance 210. In some embodiments, the appliance 210 can include a resistive heating element that is capable of operating at energy consumption levels greater than $V_{IN} \times I_{IN}$. In exemplary embodiments, the resistive heating element may have a resistance of less than 10 ohms. The energy storage system 204 provides electrical energy at a rate ($V_O \times I_O$) greater than $V_{IN} \times I_{IN}$. Heat 232 generated by the resistive heating element may be applied to a load or item 220, for example, an item to be cooked. Heat 232 maybe radiant heat. In some embodiments, heat 232 may be impingement heat, where a fluid 230, such as, air, may be blown via a switched airflow generator 212. The switched airflow generator 212 may be controlled by the control 208. The item or load 220 may also be heated/cooked via a secondary heater 216 providing a different kind of heat energy 234 than the appliance 210. In some embodiments, the secondary heater 216 may be a microwave and the heat energy 234 may be microwave radiation. In some embodiments, the secondary heater 216 may be energized by the energy storage system 204. In some embodiments, the secondary heater 216 may be controlled by the control 208.

[0044] FIG. 3 is a logical drawing describing the electrical circuit including an energy storage system, according to various embodiments.

[0045] An electrical circuit 300 is energized by a power line 302 providing electrical energy in Watts that can be determined by multiplying the voltage in with the current in ($V_{IN} \times I_{IN}$). An energy storage system 304 can store energy proximate to an appliance 310. In some embodiments, the appliance 310 can include a resistive heating element that is capable of operating at energy consumption levels greater than $V_{IN} \times I_{IN}$. In exemplary embodiments, the resistive heating element may have a resistance of less than 10 ohms. The energy storage system 304 provides electrical energy at a rate ($V_O \times I_O$) greater than $V_{IN} \times I_{IN}$. Heat 332 generated by the resistive heating element may be applied to a load or item 320, for example, an item to be cooked or heated. Heat 332 may be radiant heat. The item or load 320 may also be heated/cooked via a secondary heater 316 providing a different kind of heat energy 334 than the appliance 310. In some embodiments, the secondary heater 316 may be a microwave. In some embodiments, the secondary heater 316 may be energized by the energy storage system 304.

[0046] FIG. 4A is a schematic drawing describing the electrical circuit including an energy storage system, according to various embodiments.

[0047] An energy storage system 400 may include an energy storage 402, a high amp switch 408, an AC DC charger 410, an AC power line 414 connected to the AC/DC charger 410 and a heating element 404. The energy storage system 400 may optionally include a second high amp switch 406. When switches 406 and 408 are open, the heating element 404 is not energized but the energy storage 402 can be charged by the AC/DC charger 410 if desired. When switches 406 and 408 are closed, the heating element 404 is energized by an output of the AC/DC charger 410 and an output of the energy storage 402. In some embodiments, the AC DC charger 410 may charge the energy storage 402 even while the energy storage 402 is being discharged via the heating element 404.

[0048] FIG. 4B is a schematic drawing describing the electrical circuit including an energy storage system, according to various embodiments.

[0049] An energy storage system 400' may include a plurality of energy storages 402' and 402''; a plurality of high amp switches 408' and 408'' to selectively enable discharging of the plurality of energy storages 402' 402''; a plurality of AC power lines 414' and 414''; a plurality of AC/DC chargers 410' and 410''; and a plurality of heating elements 404', 404'' and 404'''. In some embodiments, a plurality of second switches 406', 406'' and 406''' may be selectively enabled to selectively energize heating elements 404', 404'' and 404'''. The selective enablement and disablement of the energy storages and/or heating elements can be provided by a controller (not shown). In some embodiments, the high amp switches can include a relay.

[0050] FIG. 5 is a schematic drawings showing describing the electrical circuit including a primary energy storage system and a secondary energy storage system, according to various embodiments.

[0051] An energy storage system 500 may include a primary storage 540 and a secondary storage 550 connected via an AC power line 522. According to some embodiments, the primary storage 540 can be provided as the energy storage system 400 of FIG. 4A, or as the energy storage system 400' of FIG. 4B. In some embodiments, the energy storage system 400 or 400' can be simultaneously connected to the AC power line 522 and the AC power line 414 (or 414' or 414'') in order to draw power from the utility and secondary storage system 550 at the same time. In the primary storage 540, the AC power line 522 may operate at a voltage and

current level that is different than the AC power line 414 (or 414' or 414''). In some embodiments, the AC power line 522 may be connected to an AC-DC converter 552 to energize the electrical energy storage components of the primary storage 540. In exemplary embodiments, the AC-DC converter 552 may energize the resistive elements connected to the primary storage 540.

[0052] The secondary storage 550 can include an AC/DC charger 510 connected to an AC power line 514 from an electric utility. The AC/DC charger 510 can charge an energy storage 502. When a switch 510 is closed, the energy storage 502 can energize a DC to AC converter (inverter) 520 to transmit via the AC line 522 to the primary storage 540.

[0053] FIG. 6 is a process flow diagram for using a high-capacity power supply, according to various embodiments.

[0054] A process 600 for using a high-capacity power supply is provided. The process 600 may be used to charge and/or discharge the high-capacity power supply. The process 600 may include a step for determining input values 610. The determining of the input values 610 may include receiving a recipe requiring operation of one or more heating elements. The recipe can be associated with a burst shot profile that includes timing and duration information for operating one or more heating elements. The recipe can be associated with how much electrical energy is consumed or discharged when one or more heating elements are operated according to the recipe. The determining of the input values 610 may include determining an operating voltage, for example, 21V DC. The determining of the input values 610 may include receiving and/or determining a capacitor capacity of the primary (Energy^A in FIG. 6), a battery capacity of the primary (Energy^C in FIG. 6), and power or energy available from any available secondary storage systems (Energy^B in FIG. 6).

[0055] The process 600 can include a step 602 for determining initial energy available. In some embodiments, the step 602 can add Energy^A and Energy^C. The process 600 may include a step 604 for determining used energy for operating the one or more heating elements. In some embodiments, the joules consumed by the recipe may be received or retrieved. The process 600 may include a step 606 for determining power supplied by secondary storage systems for operating the one or more heating elements, for example, Energy^B in FIG. 6. The energy consumptions may be integrated over time as the one or more heating elements are operated per the recipe. The process 600 may include a step 608 to determine an amount of end energy left in

the high-capacity power supply.

[0056] In exemplary embodiments, the high-capacity power supply may include a primary storage system, a secondary storage systems, a number of power lines, or a combination thereof. Various kinds of energy storage devices and chargers can be provided in an energy storage system to add different power characteristics to the appliances connected to the high-capacity power supply. The capacity of the high-capacity power supply may be calculated by using parameters that include a rate of production, a duration of a production run, downtime between each production run, minimum state of charge for energy storage devices such as batteries, power available from the utility, size of the heating element, a usage rate of the heating element and the like. As the secondary storage generally provides a higher energy storage capacity and is cheaper, energy requirements for maintaining the rate of production when using a high speed oven may be met by adding secondary storages as necessary.

[0057] FIG. 7A, FIG. 7B, FIG. 7C, FIG. 7D and FIG. 7E illustrate a perspective view of an exemplary power supply, according to various embodiments. A power supply 700 can include a housing 702, a controller/charger 704, a bank of capacitors 706, a bank of batteries 710, an appliance connection 708, a hinge 712 and a high ampere switch 714.

[0058] According to various embodiments, the housing 702 may include vents to cool components housed within the housing 702. The housing 702 may be made of heat conductive materials such as, metal. A cooling fan (not shown) may be disposed in the housing 702.

[0059] According to various embodiments, the controller/charger 704 may be connected to a power line (not shown). The power line may be connected to an electrical energy source, such as, a solar panel, a wind generator, electrical grid, or the like. When the power line provides electrical energy via an alternating current (AC), the controller/charger 704 may include an AC to Direct Current (DC) converter to charge storage devices in the power supply 700. In some embodiments, when the power line provides electrical energy via a DC, the controller/charger 704 may include a DC-to-DC converter to convert incoming voltage to a DC voltage needed by a charger in the controller/charger 704.

[0060] According to various embodiments, the charger/controller 704 may control the high current switch 714 to selectively pulse the power being supplied to appliance connector 708, for example, per a timing and duration profile for a recipe. The charger/controller 704 may monitor a voltage level of the storage devices (the bank of capacitors 706 and/or the bank of

batteries 710) to determine a charge state of the storage devices. The charger/controller 704 may pulse the power per a recipe or the like.

[0061] The bank of capacitors 706 may include one or more capacitors. The capacitors may be high-capacity capacitors or super conductive capacitors. The charger/controller 704 may charge and discharge the bank of capacitors prior to charging the bank of batteries 710. The bank of batteries 710 may include lead-acid, deep cycle (marine), or lithium batteries.

[0062] The appliance connection 708 may include a positive electrode, a negative electrode and a controller electrode. The appliance connection 708 may be hinged via the hinge 712. The hinge 712 may allow the appliance connection 708 to be disposed in a rest position and a usable position. In some embodiments, the appliance connection 708 may be energized when the appliance connection 708 is disposed in a usable position. The controller electrode may be used to identify an appliance electrically connection to the appliance connection 708. The controller electrode may be used to communicate energy requirement, for example, an energy pulse profile, maximum temperature, pre-heat condition or temperature, and the like. FIG. 7B illustrates the appliance connection 708 in the rest position as the hinge 712 is closed. FIG. 7C and FIG. 7D illustrate the appliance connection 708 in the usable position as the hinge 712 is open, and there is an appliance 716 (see FIG. 7C and FIG. 7D) connected with the appliance connection 708. FIG. 7E illustrates the power supply 700 disposed in a food preparation area 718. In exemplary embodiments, the high ampere switch 712 may include a relay. The high-ampere switch 712 may be enabled, disabled or pulsed by the charger/controller 704.

[0063] FIG. 8A, FIG. 8B, FIG. 8C, 8D, FIG. 8E, FIG. 8F, FIG. 8G, FIG. 8H, FIG. 8I, FIG. 8J, FIG. 8K, FIG. 8L, FIG. 8M, FIG. 8N, FIG. 8O and FIG. 8P illustrate a perspective view of an exemplary power supply system, according to various embodiments. The following markers will be used with respect to FIG. 8A, FIG. 8B, FIG. 8C, 8D, FIG. 8E, FIG. 8F, FIG. 8G, FIG. 8H, FIG. 8I, FIG. 8J, FIG. 8K, FIG. 8L, FIG. 8M, FIG. 8N, FIG. 8O and FIG. 8P.

- 800 system
- 802 capacitor
- 804 high current switch (relay)
- 806 batteries
- 810 AC-DC converter/charger
- 812 large capacity battery

- 814 AC-line/power line
- 816 power/control line
- 820 DC-line
- 822 Radiant Energy Flow
- 824 Heating Element Travel Direction
- 826 DC power bar
- 830 heating element system
- 831 heated element
- 832 heating element supply
- 833 heat reflector
- 834 element take-up reel
- 835 conductor
- 836 rollers
- 838 element motor
- 840 primary power supply
- 842 primary first storage
- 844 primary second storage
- 846 appliance (continuous wire mesh oven)
- 850 secondary/remote power supply
- 852 secondary charger and inverter
- 860 large high speed oven
- 862 heated elements
- 864 conveyor system
- 866 cavity
- 868 item

[0064] FIG. 8A illustrates the power supply system 800 including a primary power supply 840 and a secondary power supply 850. The system 800 can include an electrical energy storage device, for example, a capacitor 802, a battery 806 or the like. The system 800 can include an AC – DC converter/charger 810. In some embodiments, the capacitor 802, the battery 806, and the converter/charger 810 may be included in the primary power supply 840. The

secondary power supply 850 may include large capacity batteries 812 and a secondary charger and inverter 852. An AC power line 814 can provide electrical energy from a power source, for example, a utility, a solar panel, a generator or the like, to the AC DC converter/charger 810. The AC power line 814 can provide electrical energy from a power source, for example, a utility, a solar panel, a generator or the like, to the secondary charger and inverter 852. In some embodiments, each charger disposed in the system 800 may be connected to one or more AC power lines.

[0065] In some embodiments, the system 800 may include only the primary power supply 840, see for example, FIG. 8F, FIG. 8G, FIG. 8H, FIG. 8I and FIG. 8J. In some embodiments, the system 800 may include a plurality of primary power supplies connected to one or more appliances.

[0066] In some embodiments, the system 800 may include the primary power supply 840 connected to the secondary power supply 850, see for example, FIG. 8K, FIG. 8L, FIG. 8M, FIG. 8N, FIG. 8O and FIG. 8P. In some embodiments, the system 800 may include a plurality of primary power supplies connected to one or more secondary power supplies. In some embodiments, the system 800 may include a plurality of secondary power supplies connected to a primary power supply 840.

[0067] The secondary power supply 850 can provide energy to the primary power supply 840 via a power/control line 816. Due to the power losses associated with transmitting a high amperage DC current at a low-voltage, in some embodiments, the system 800 can utilize an AC current to transmit power from the secondary power supply 850 to the primary power supply 840. AC transmission is utilized when the secondary power supply 850 is remote from the primary power supply 840, for example, when the distance between the secondary and the primary power supplies is greater than 4 feet, 5 feet, 7 feet, 10 feet or the like. To transmit power using an AC current the secondary power supply 850 can use the secondary charger/inverter 852. By using the inverter, the secondary power supply 850 can store electrical energy with a DC current.

[0068] Components within the primary power supply 840 can be interconnected using a DC extendable busbar 820. In some embodiments, the secondary system 850 can also use a DC extendable busbar (not shown). Electrical energy from the primary power supply 840 and or the secondary power supply 850 may be supplied to an appliance, for example, a heating element

system 830.

[0069] The various energy storage devices, for example, the capacitors 802, the batteries 806, the large capacity batteries 812, may be added as an expansion module to add different power characteristics to the heater or a pack of heaters. In some embodiments, the various control devices, for example, the AC-DC converter/charger 810, the secondary charger and inverter 852, may be added as an expansion module to add different power characteristics to the heater or a pack of heaters.

[0070] According to various embodiments, the primary power supply 840 may include a primary first storage 842 and a primary second storage 844. The primary first storage 842 can be integrated into an appliance 846. The appliance 846 can include the primary for storage 842 and a heating element system 830. In exemplary embodiments, the appliance 846 can provide a continuous wire mesh high speed oven.

[0071] In exemplary embodiments, the primary first storage 842 can be disposed closest to or within the appliance 846. The primary second storage 844 can be disposed further from the appliance 846 than the primary first storage 842. The secondary power supply 850 can be disposed furthest from the appliance 846, for example, in an area outside the food preparation area. The secondary power supply 850 can be utilized to recharge the primary power supply 840 when electrical energy received from the AC line 814 is insufficient to recharge the primary power supply 840 as frequently as the appliance and/or operator demands its use. The system 800 can utilize electrical energy from one or more of the AC line 814, the primary first storage 842, the primary second storage 844 or the secondary storage 850 to energize the appliance 846.

[0072] According to various embodiments, the system 800 can utilize electrical energy from one or more of the AC line 814 or the secondary storage 850 to charge the primary storage 840. The system 800 can utilize electrical energy from one or more of the AC line 814, the primary second storage 844 or the secondary storage 850 to charge the primary first storage 842. The system 800 can utilize electrical energy from one or more of the AC line 814, or the secondary storage 850 to charge the primary second storage 844. The system 800 can utilize electrical energy from one or more of the AC line 814 to charge the secondary storage 850. In some embodiments, the transmission of electrical energy from the secondary storage 852 to the primary storage 840 can use an AC current. In some embodiments, the transmission of electrical energy from the primary second storage 844 to the primary first storage 842 uses an AC current.

[0073] FIG. 8B illustrates an appliance 846, a high-speed continuous wire mesh oven. The appliance 846 includes the primary first storage 842 and the heating element system 830. According to his embodiments the primary first storage 842 includes an internal capacitor bank 802, a high amp switch 804, and a DC power bar 826. In some embodiments, the primary first storage 842 may include a charger/controller (not shown). According to various embodiments, the heating element system 830 may include a heating element supply 832, an element take-up reel 834, an element motor 838, a heat shield or a reflector 833, a roller 836, a conductor 835 and the heated element 831. Radiant energy generated by the heated element 831 can be reflected as indicated by waves 822. The continuous wire mesh element can travel in the direction indicated by arrow 824. The heating element system 830 may include an oven controller (not shown), and an operator console (not shown).

[0074] FIG. 8C illustrates a perspective view of a large high speed oven 860 including a plurality of continuous wire mesh ovens disposed in two side-by-side rows. In some embodiments, the continuous wire mesh ovens are the appliance 846 described above. FIG. 8D illustrates a perspective view of the large high speed oven 860 and the heated elements 862 that may radiate on a cavity wherein the item to be heated may be disposed.

[0075] FIG. 8E illustrates a perspective view of two large speed ovens 860 disposed around a conveyor system 864 and adapted to radiate energy on a cavity 866 from more than one direction, for example, when heating primarily over two surfaces of an item 868 to be heated is desired. According to some embodiments, only one of the two large speed ovens may be utilized when radiating energy primarily from one direction, for example, when heating primarily over one surface of an item 868 to be heated is desired.

[0076] Although the subject matter has been described in language specific to structural features and/or methodological acts, it is to be understood that the subject matter in the appended claims is not necessarily limited to the specific features or acts described above. Rather, the specific features and acts described above are disclosed as example forms for implementing the claims. Other configurations of the described embodiments are part of the scope of this disclosure. Further, implementations consistent with the subject matter of this disclosure may have more or fewer acts than as described, or may implement acts in a different order than as shown. Accordingly, the appended claims and their legal equivalents should only define the invention, rather than any specific examples given.

CLAIMS

1. A high power appliance system to supply outlet electrical wattage comprising:
a primary electrical power source to provide a primary electrical wattage;
a secondary electrical power source configured to deliver a stored electrical wattage upon demand and configured to store the primary electrical wattage as the stored electrical wattage when not in demand;
an outlet configured to provide the outlet electrical wattage,
wherein the outlet electrical wattage is greater than the primary electrical wattage and comprises the stored electrical wattage.
2. The system of claim 1, wherein the outlet electrical wattage is at least twice the primary electrical wattage.
3. The system of claim 1, wherein the outlet electrical wattage comprises the primary electrical wattage.
4. The system of claim 1, wherein the outlet electrical wattage comprises a Direct Current (DC) that is at least 100 Amperes.
5. The system of claim 1, wherein the outlet electrical wattage is greater than 2000 Watts and the primary electrical wattage is provided using a 110 Volt AC line,
6. A high power appliance system for use in a food service area, the high power appliance system comprising:
an energy storage and delivery system to store electrical energy from a power line; and
a heating element capable of using electrical energy from the energy storage and delivery system,
wherein the electrical energy delivered from the energy storage and delivery system to the heating element is delivered at a rate that is at least 110% of the rate delivered by the power line.

7. The system of claim 6, wherein the power delivered to and used by the appliance is at least 3600 watts when the power delivered by the power line is 1800 Watts (120V X 15 Amps).

8. The system of claim 6, wherein the power delivered to and used by the appliance is at least 14400 watts when the power delivered by the power line is 7200 Watts (240 Volts X 30 Amps).

9. The system of claim 6, wherein the power delivered to and used by the appliance is at least 26400 watts when the power delivered by the power line is 14400 Watts (480 Volts X 30 Amps).

10. The system of claim 6, wherein the energy storage and delivery system comprises one or more of a capacitor or a battery.

11. The system of claim 6, wherein the energy storage and delivery system comprises a primary and a secondary energy storage system.

12. The system of claim 11, wherein the primary storage system is configured to deliver power to the electrical grid.

13. The system of claim 11, wherein the primary storage system is configured to deliver power to a normally powered appliance in the food service area.

14. The system of claim 11, wherein the primary storage system is configured to be charged using one or more of an electrical energy sources selected from a power plant, a generator, a wind generator, a solar generator, a geothermal generator, or other electrical energy source.

15. The system of claim 11, wherein the primary storage system is configured to

charge the primary storage system at a voltage that is lower than the source delivering the power.

16. The system of claim 11, wherein the primary storage system is configured to charge the primary storage system with rectified AC power or DC power.

17. The system of claim 11, wherein the primary storage system is configured to deliver electrical energy via a DC electrical current.

18. The system of claim 11, further comprising an inverter to transform a DC voltage from the primary storage system to AC voltage.

19. The system of claim 11, further comprising a sensor to detect a use of the appliance to control an electrical current output and charging of the primary storage system.

20. The system of claim 19, wherein an output of the primary storage system is transferred over a distance to a secondary charger and storage system configured to deliver high power to the appliance.

21. The system of claim 6 further comprising an AC to DC converter.

22. The system of claim 6, further comprising a switch disposed between the storage and delivery system, and the appliance.

24. A process for cooking foods at accelerated rates using a primary and a secondary energy storage system and in which the energy transfer between said primary and secondary energy storage system uses an inverter.

25. A counter equipped for delivering high current low voltage DC power to an appliance intended to cook or heat foods or liquid at accelerated times.

26. The counter of claim 25 further comprising a positive, negative, and controller

connection.

27. The counter of claim 25 wherein an energy storage system to power the appliance is located on, underneath, or beside the counter.

28. The counter of claim 25, further comprising a snap or magnetic connection between the appliance and the high current energy source.

29. An appliance configured to receive a high current discharge intended for cooking, heating, or cooling at accelerated times wherein the appliance comprises an easy connection able to connect to a counter.

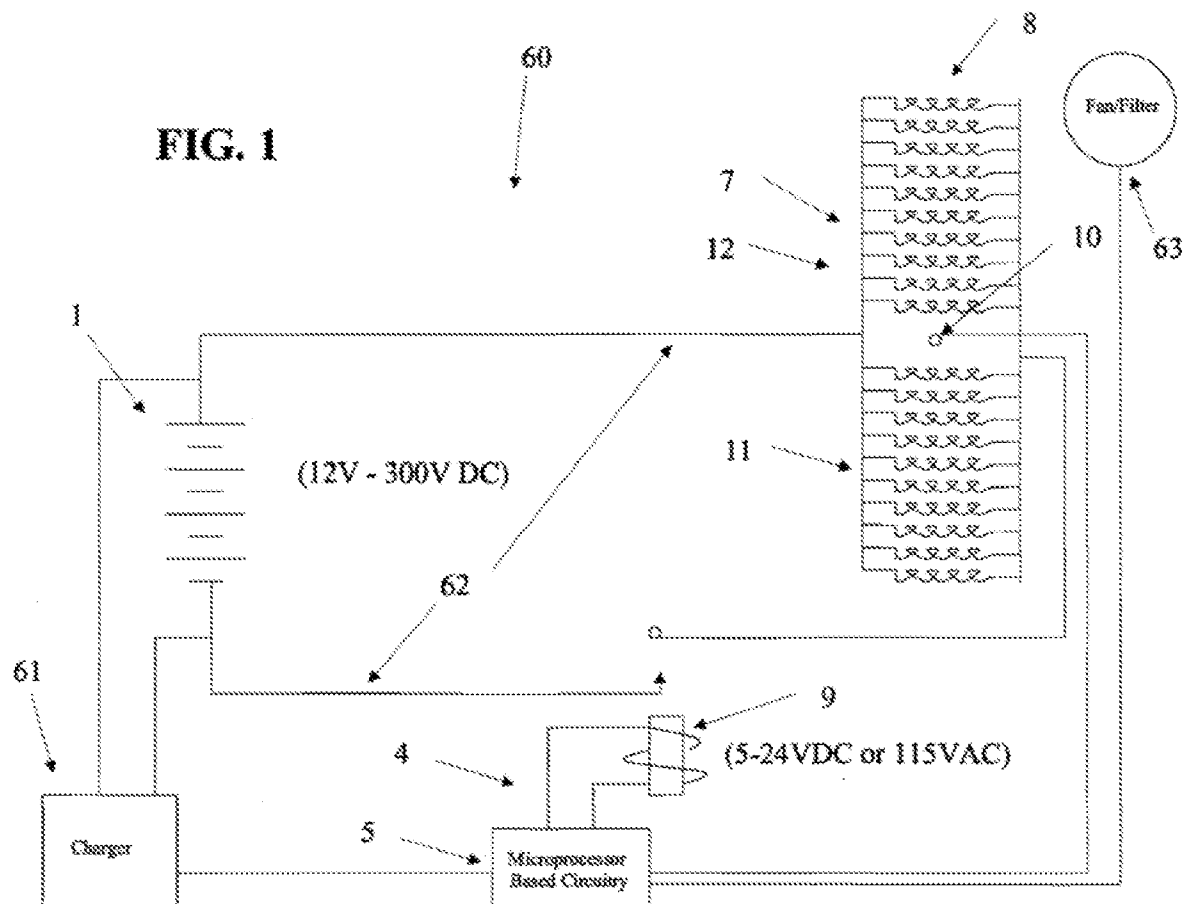
30. The heating system of claim 1, wherein the power supply supplies a DC voltage to the heating element.

31. The heating system of claim 1, wherein the power supply comprises a battery.

32. The heating system of claim 1, wherein the power supply comprises a capacitor.

33. The heating system of claim 1, wherein the heating element has a combined resistance of less than 10 ohms.

FIG. 1



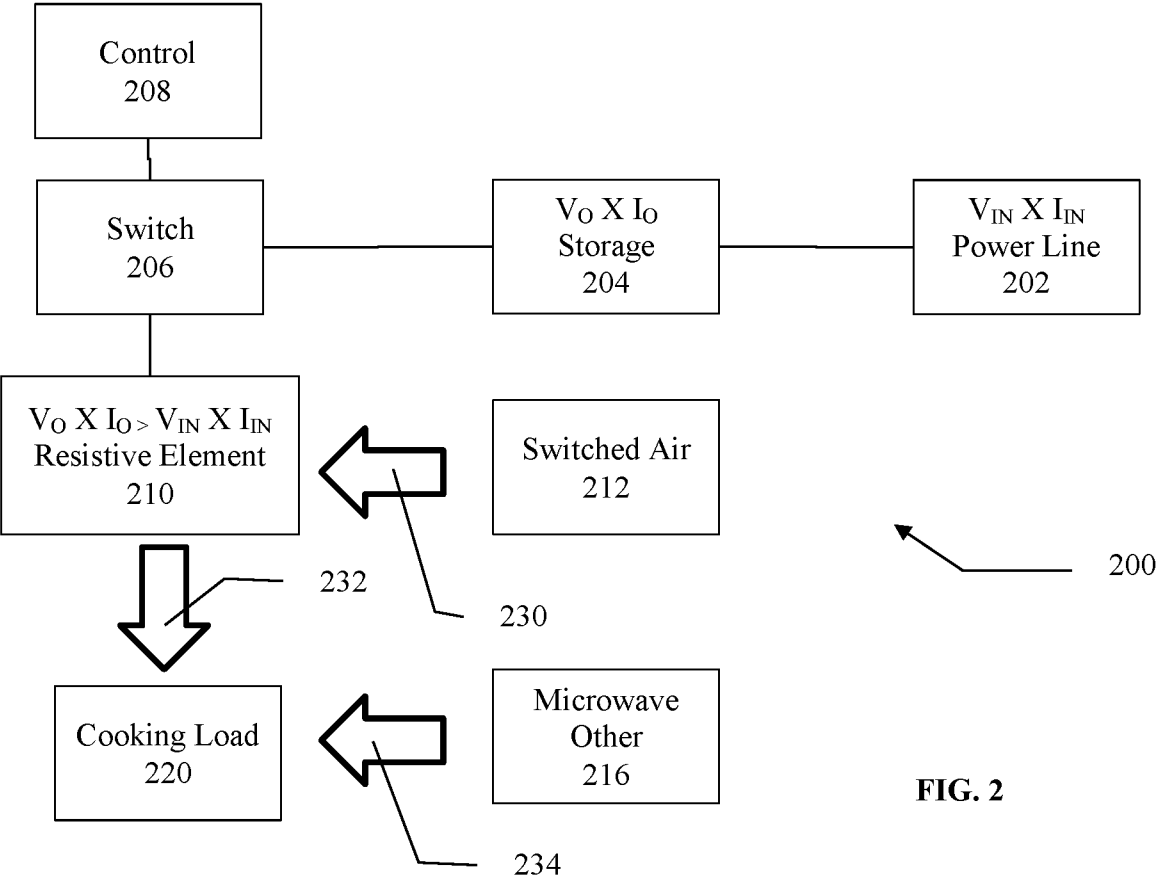


FIG. 2

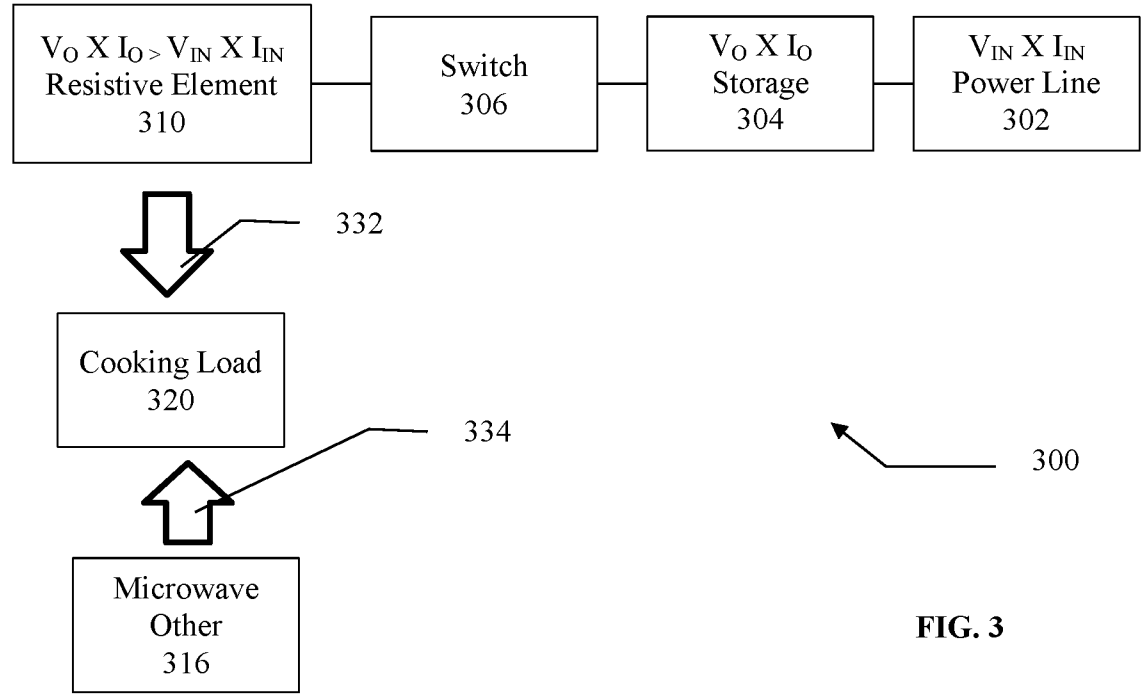


FIG. 3

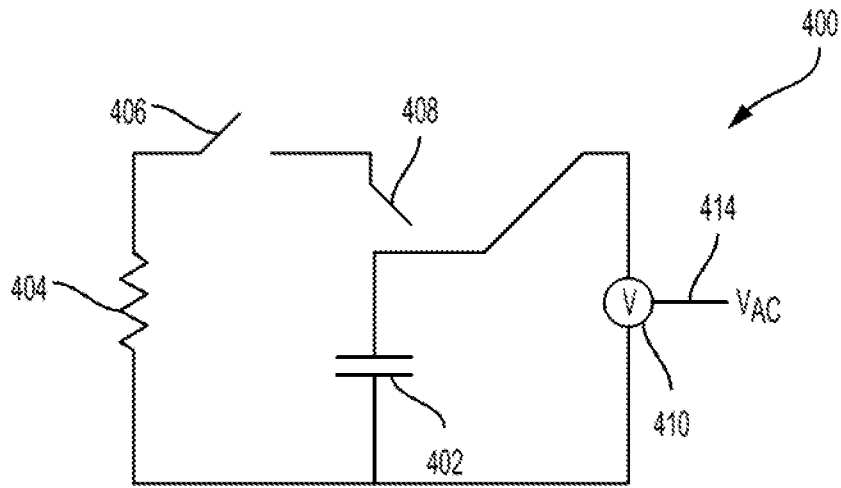


FIG. 4A

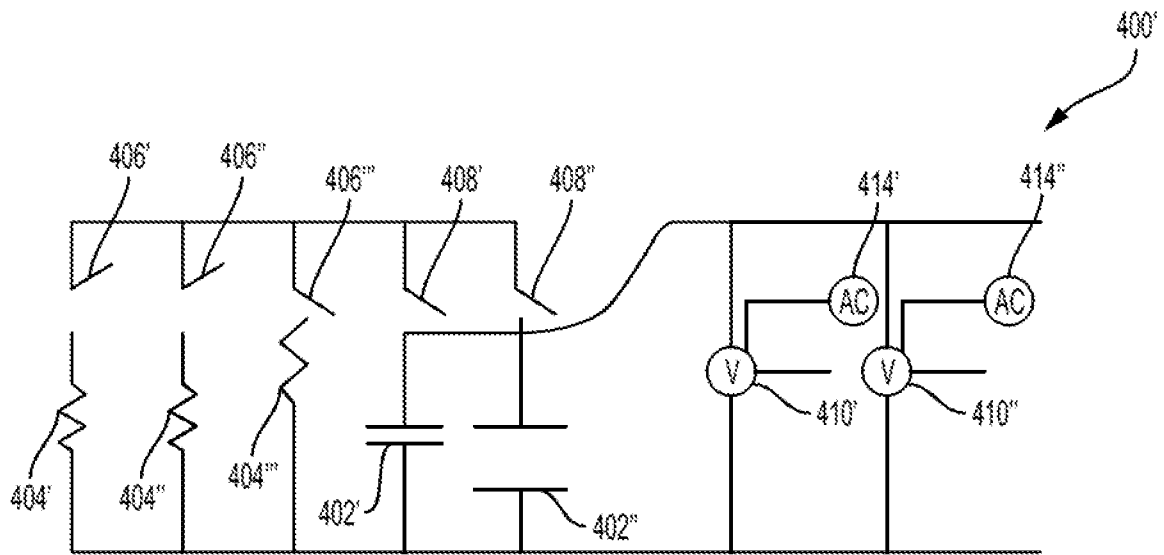


FIG. 4B

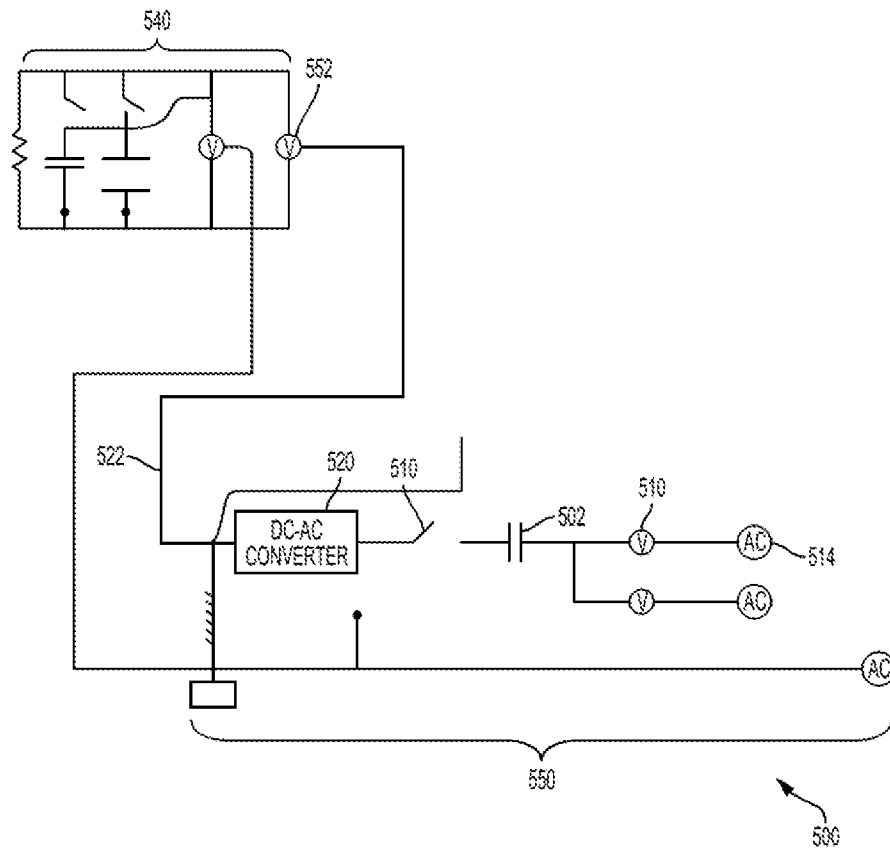


FIG. 5

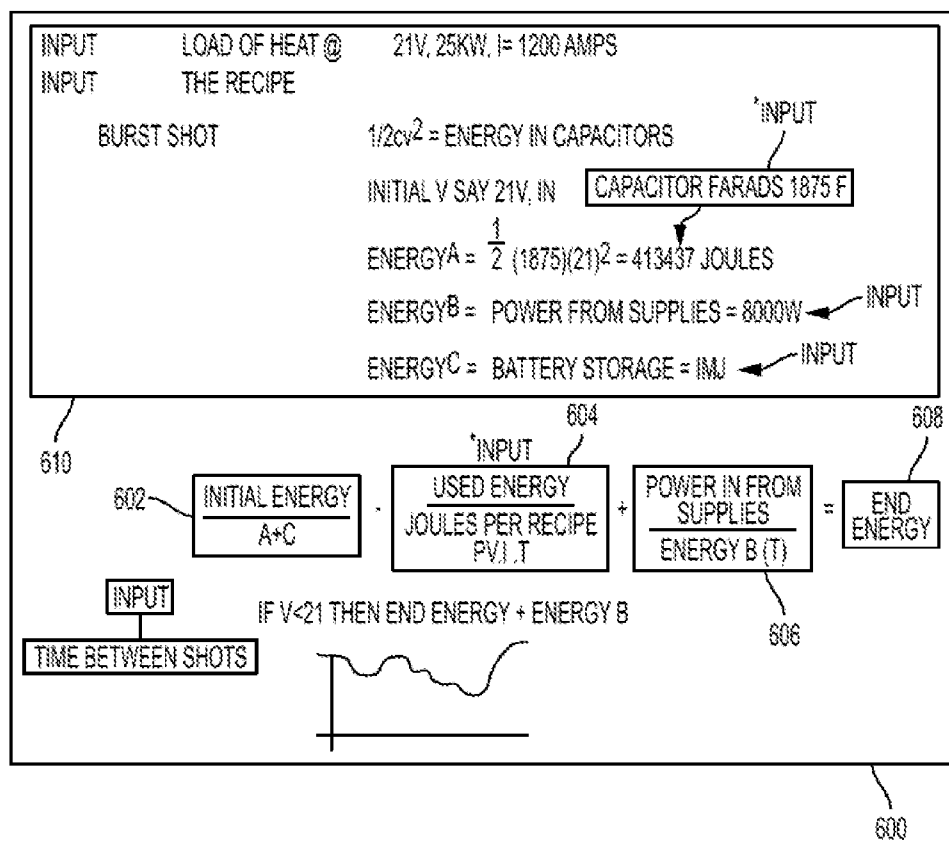


FIG. 6

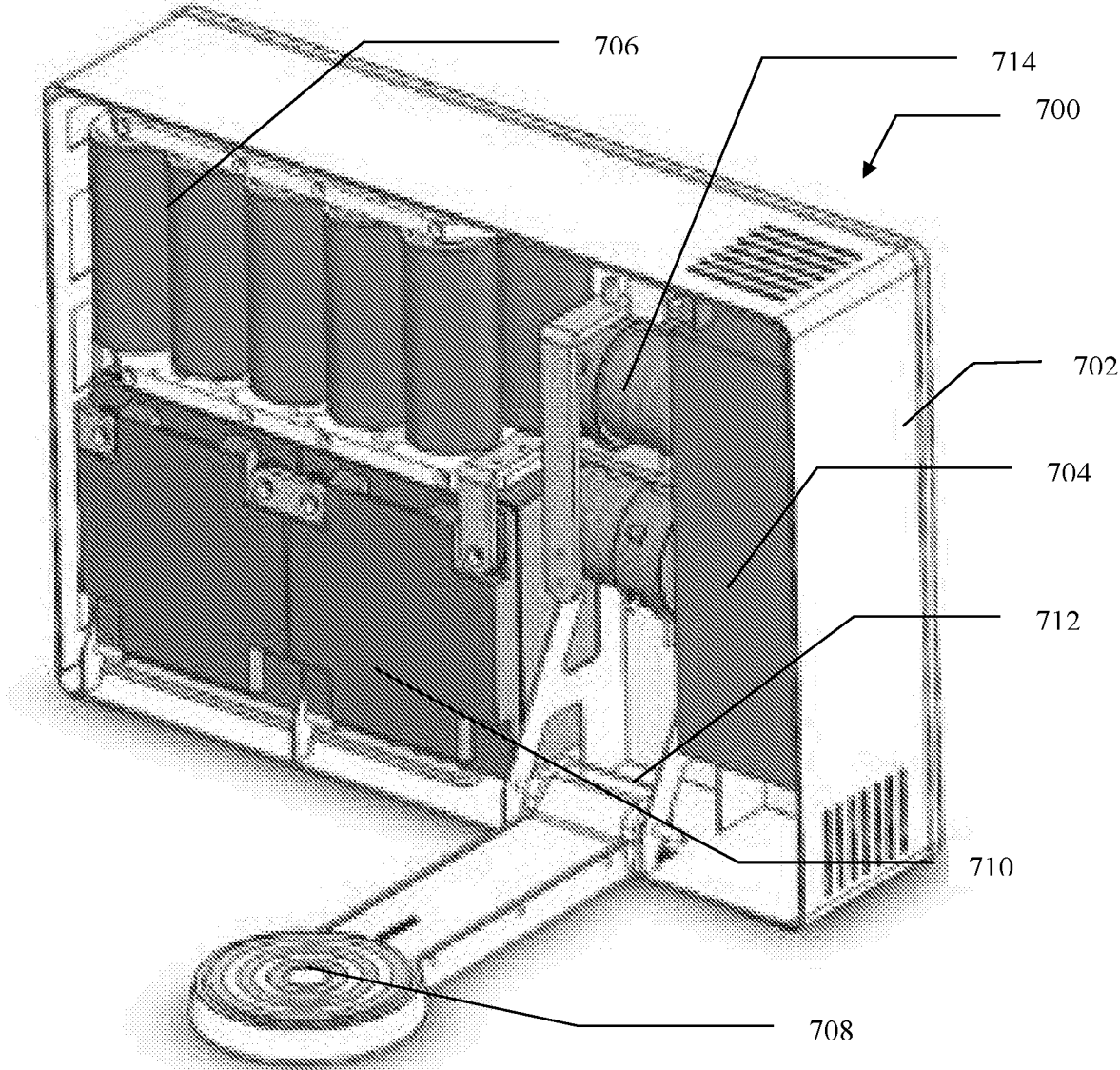


FIG. 7A

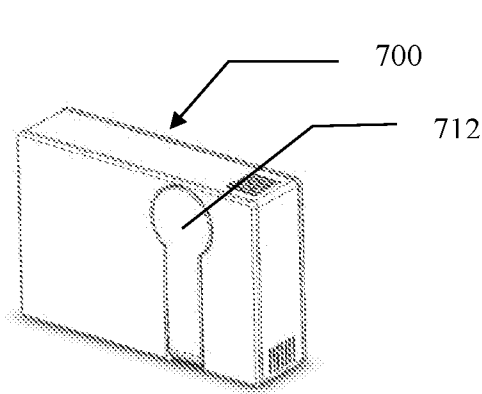


FIG. 7B

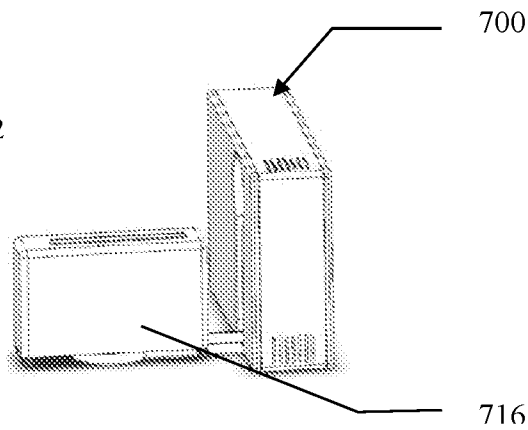


FIG. 7C

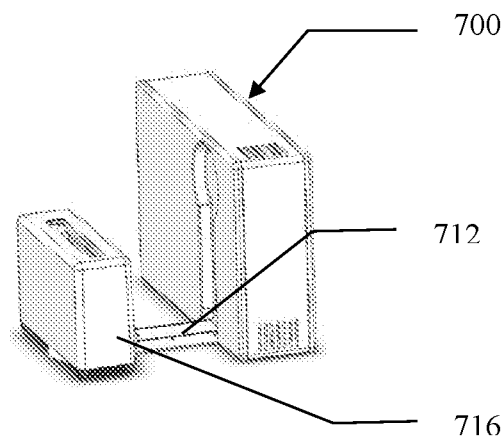


FIG. 7D

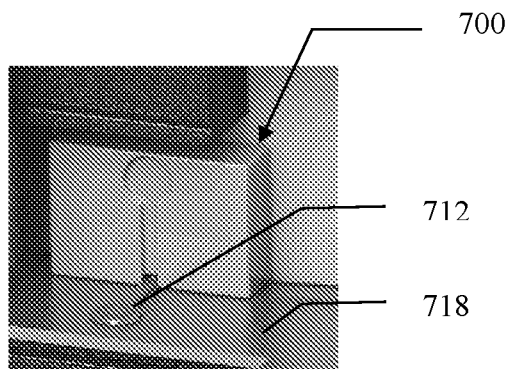


FIG. 7E

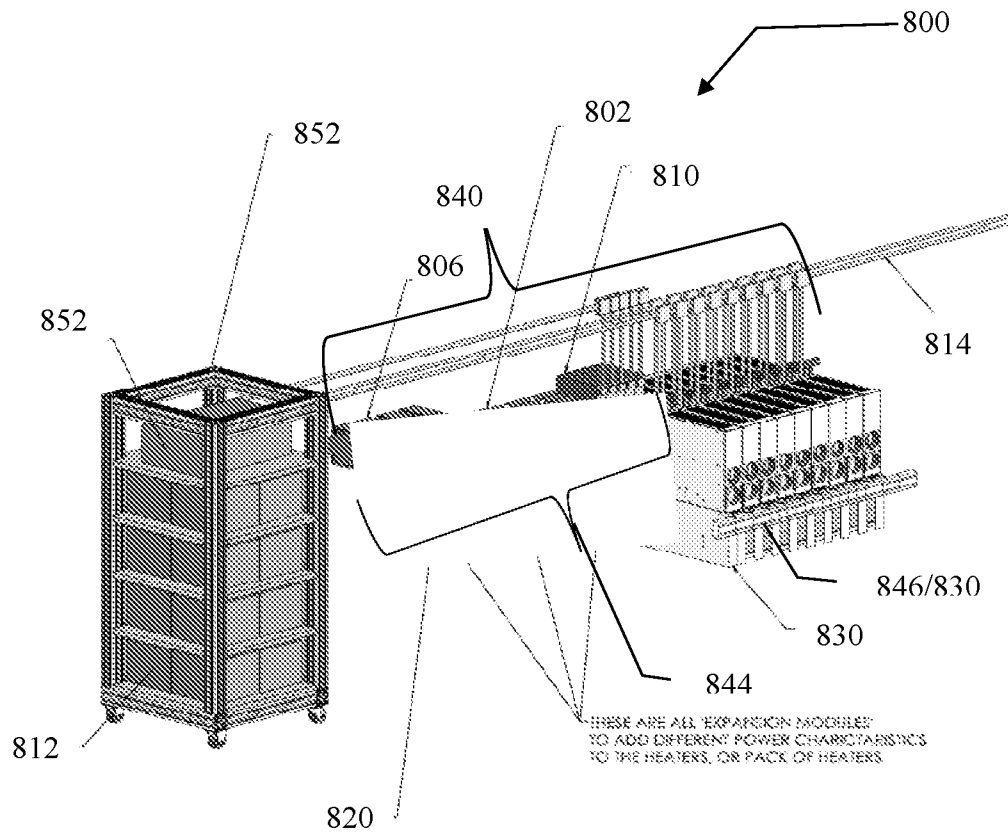


FIG. 8A

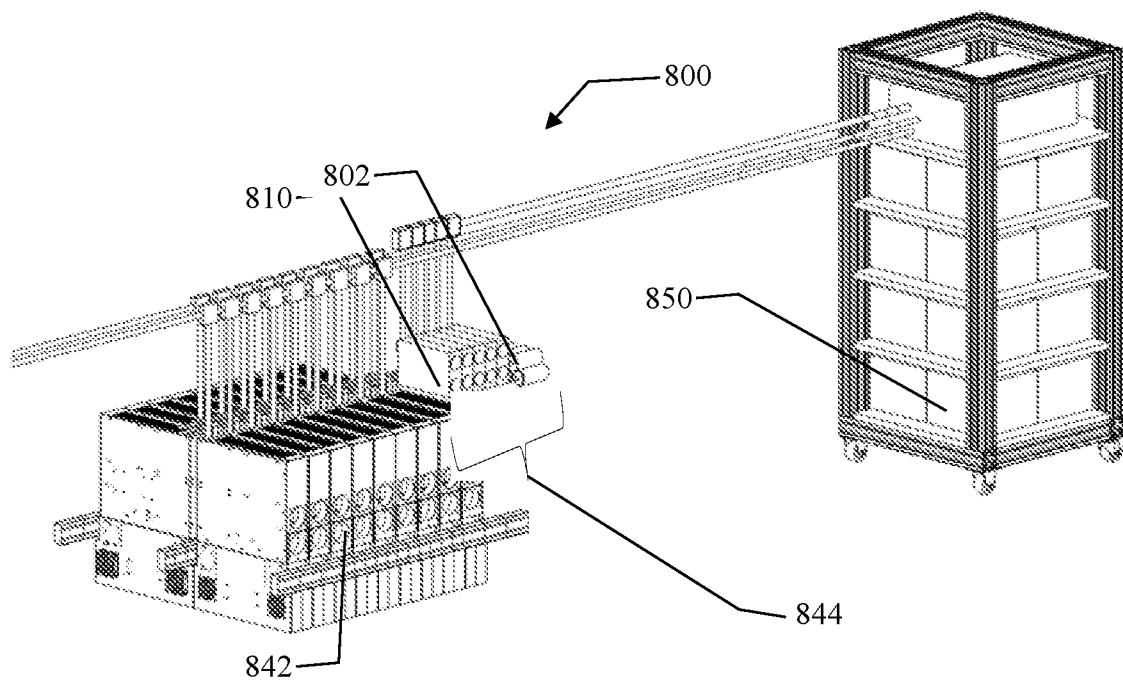
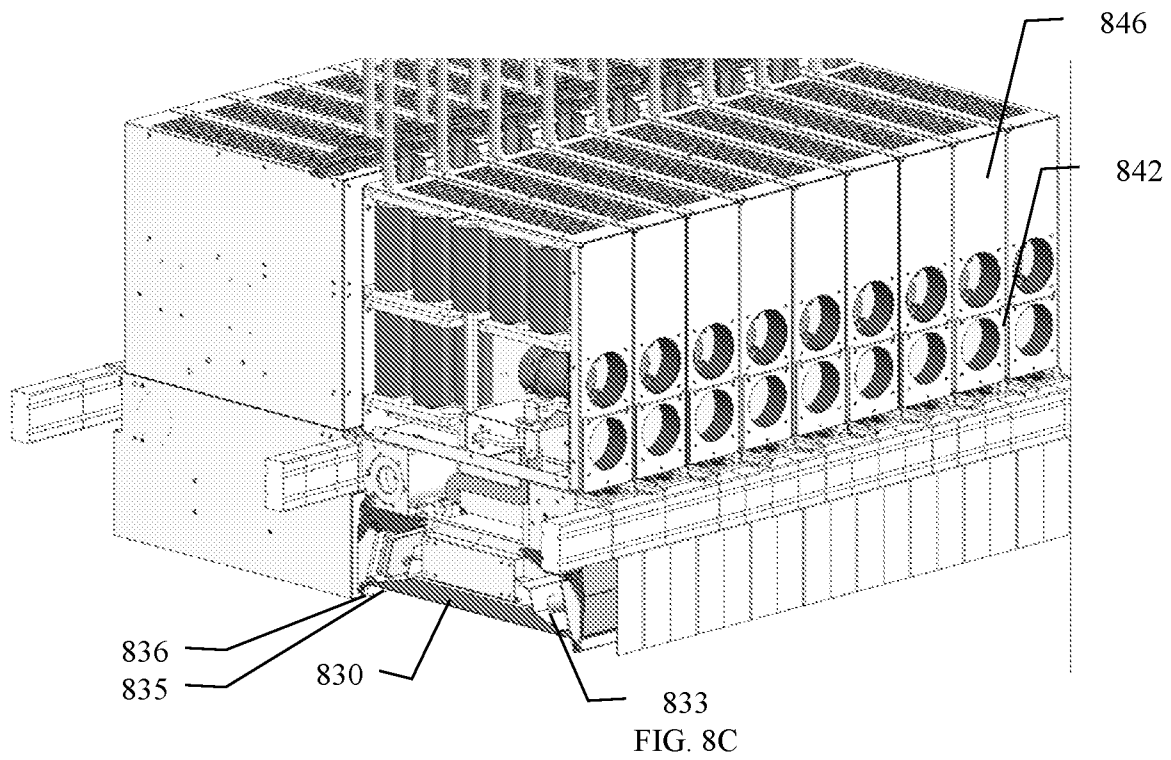
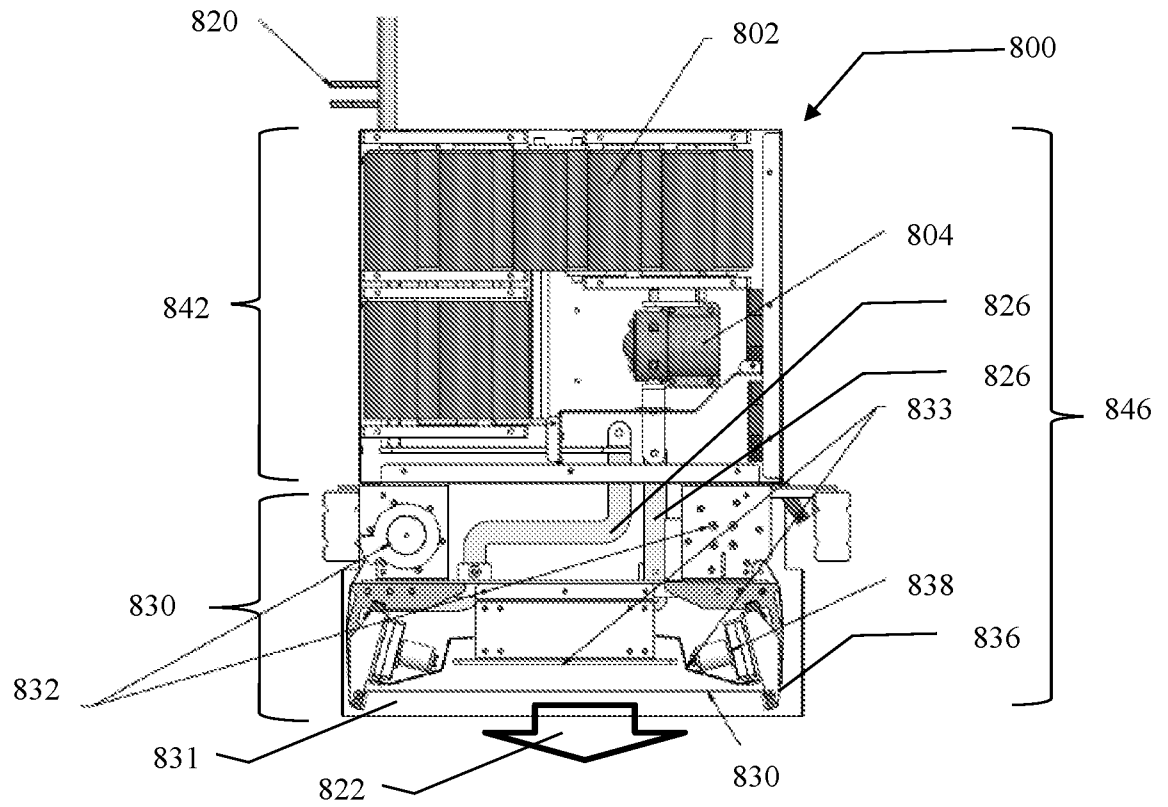


FIG. 8P



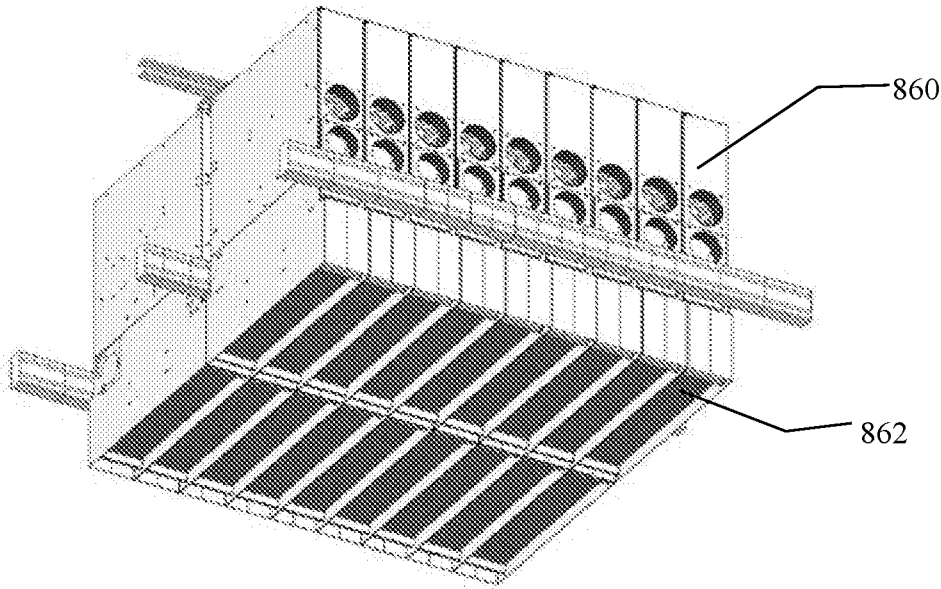


FIG. 8D

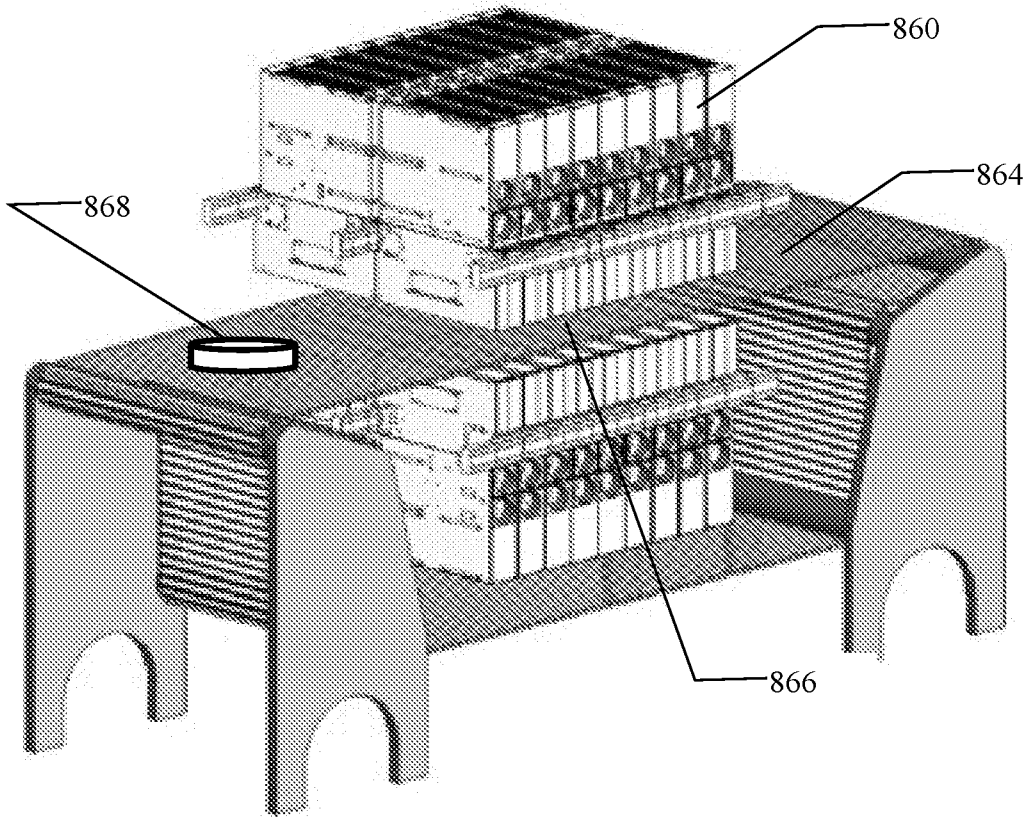


FIG. 8E

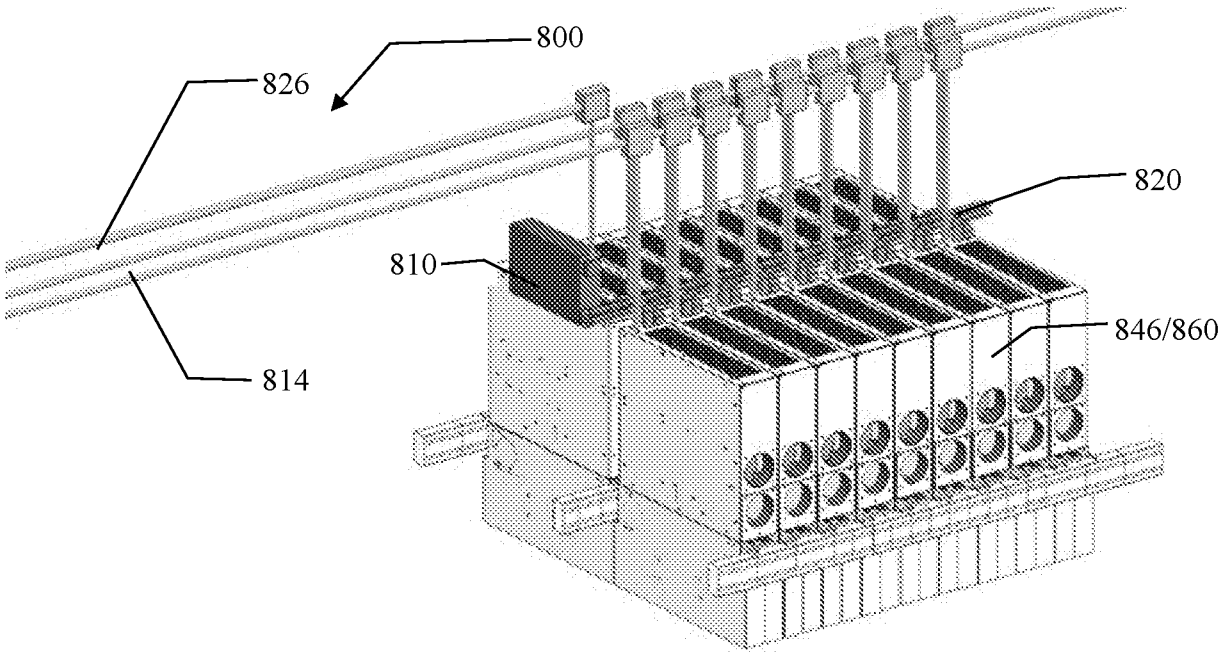


FIG. 8F

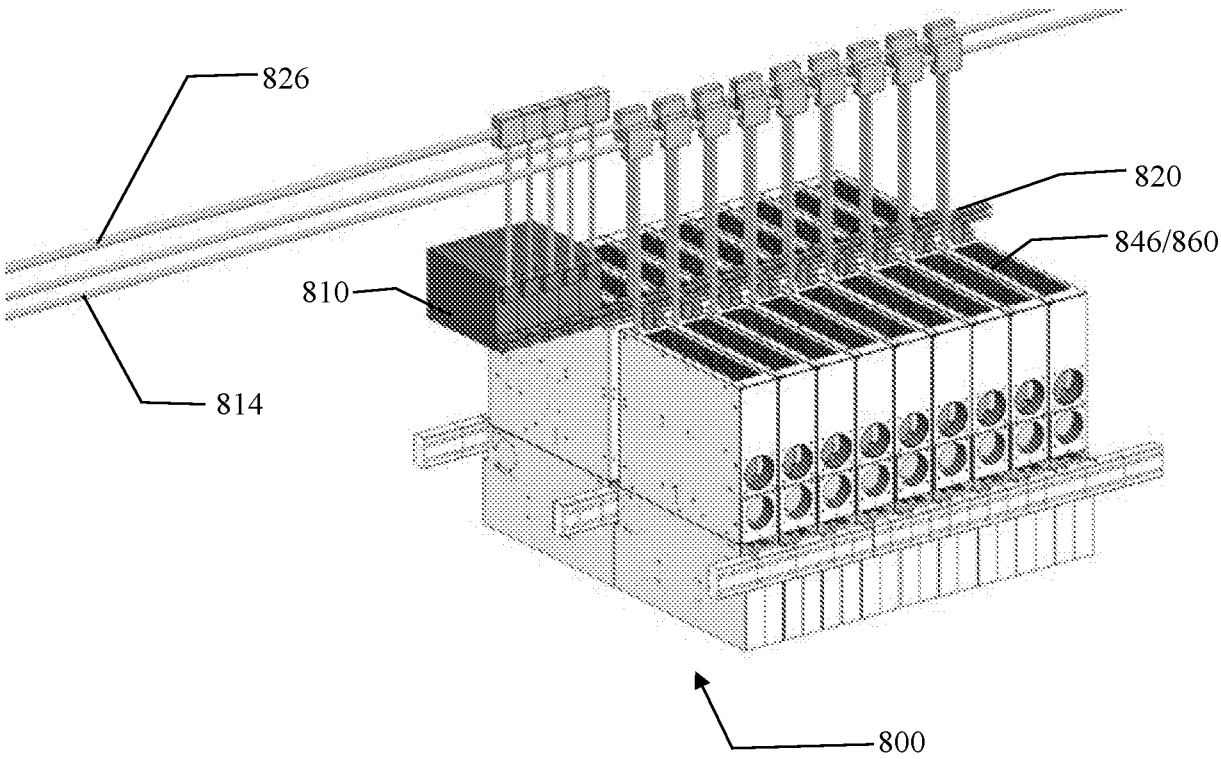


FIG. 8G

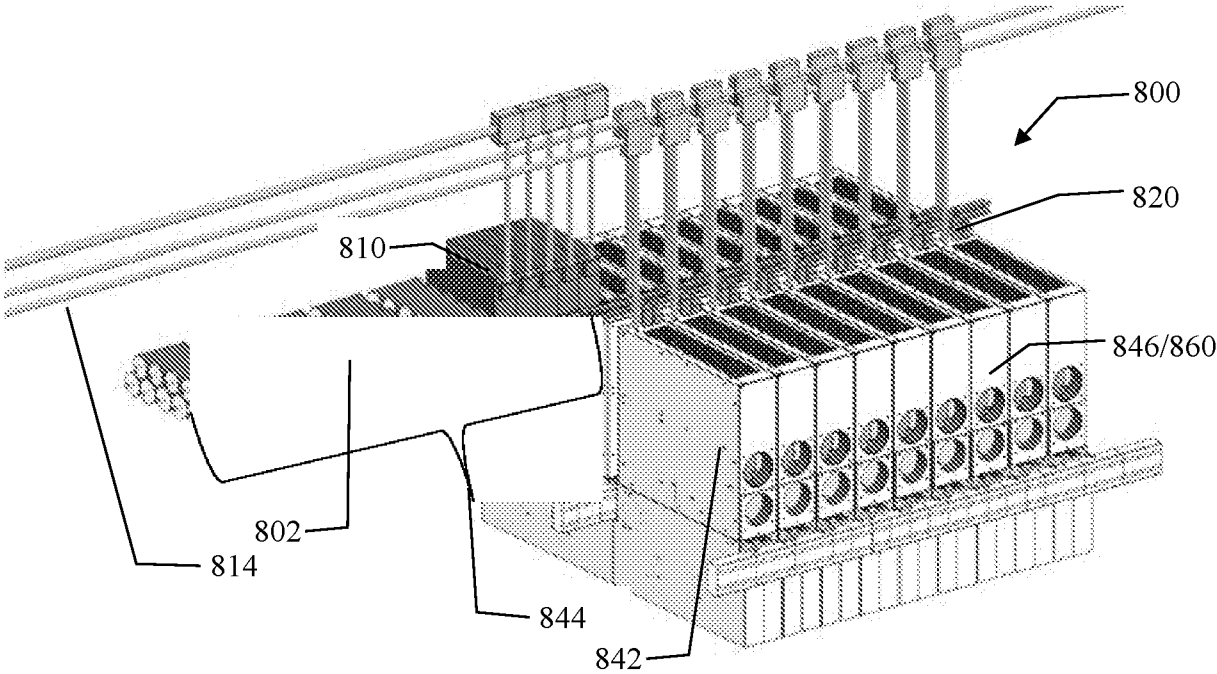


FIG. 8H

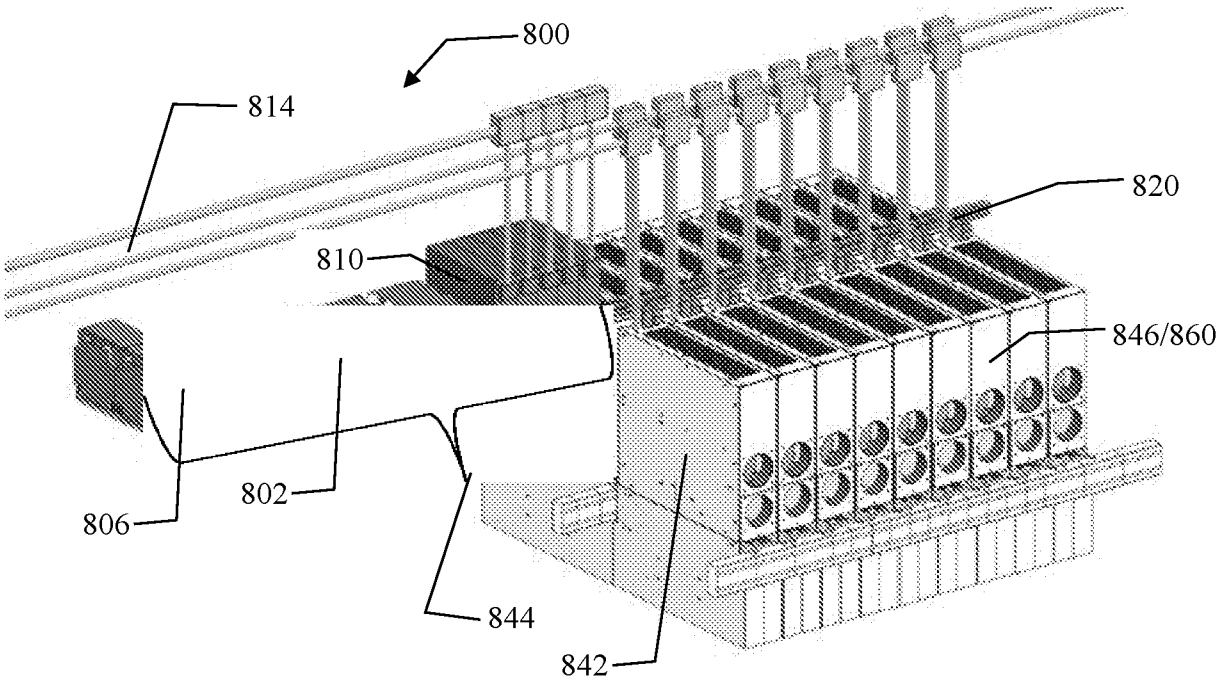


FIG. 8I

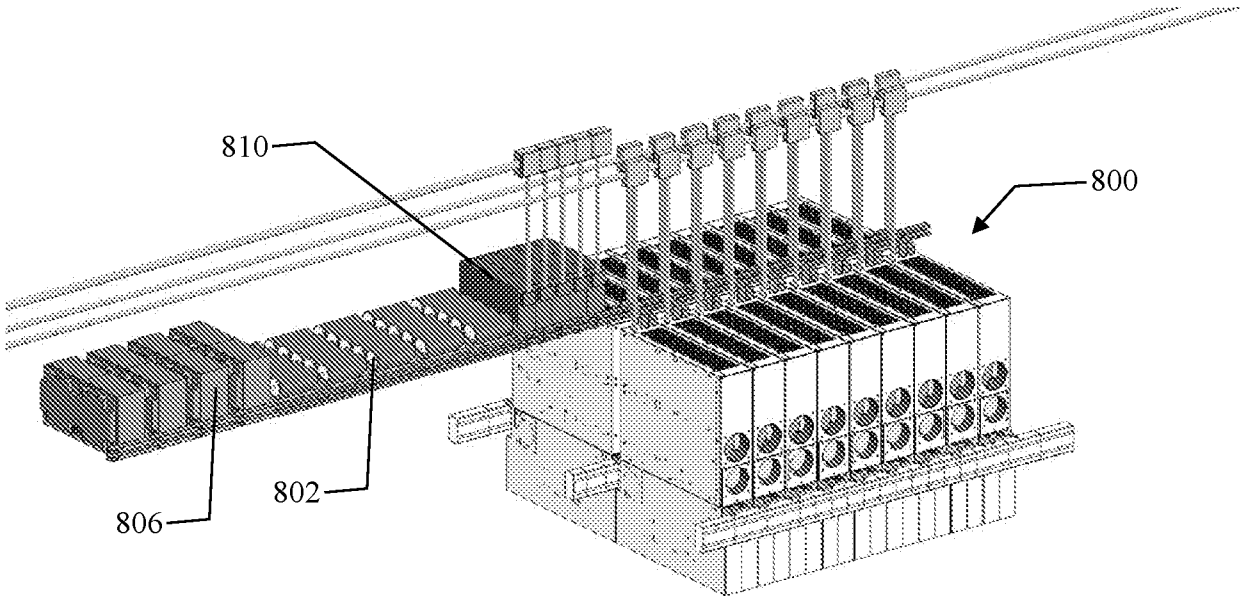


FIG. 8J

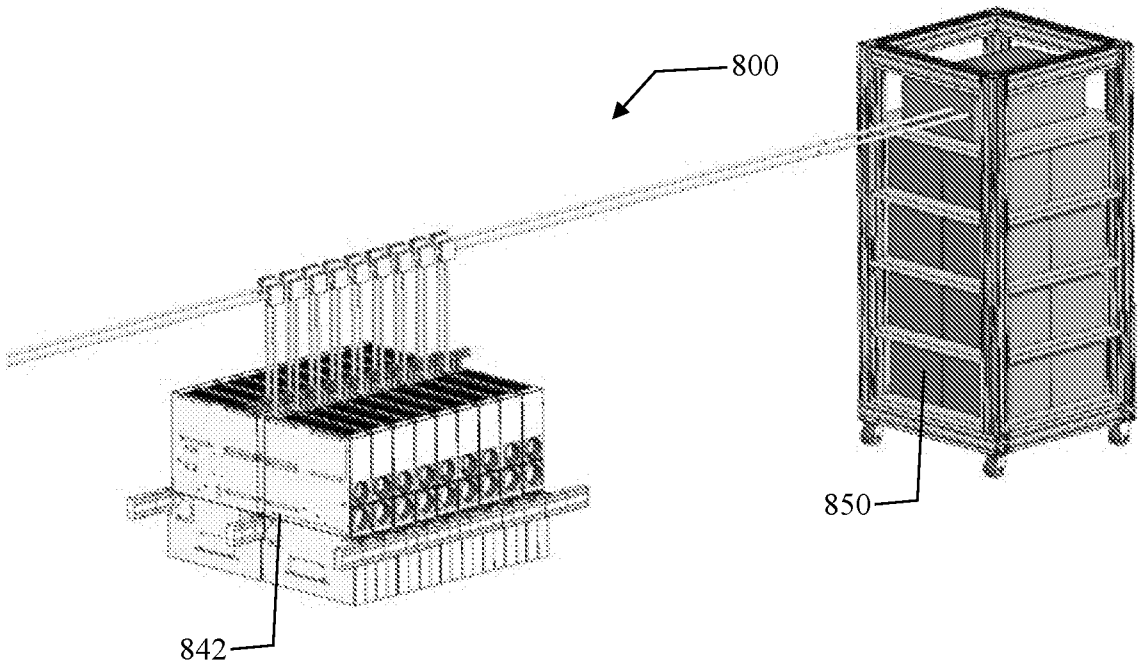


FIG. 8K

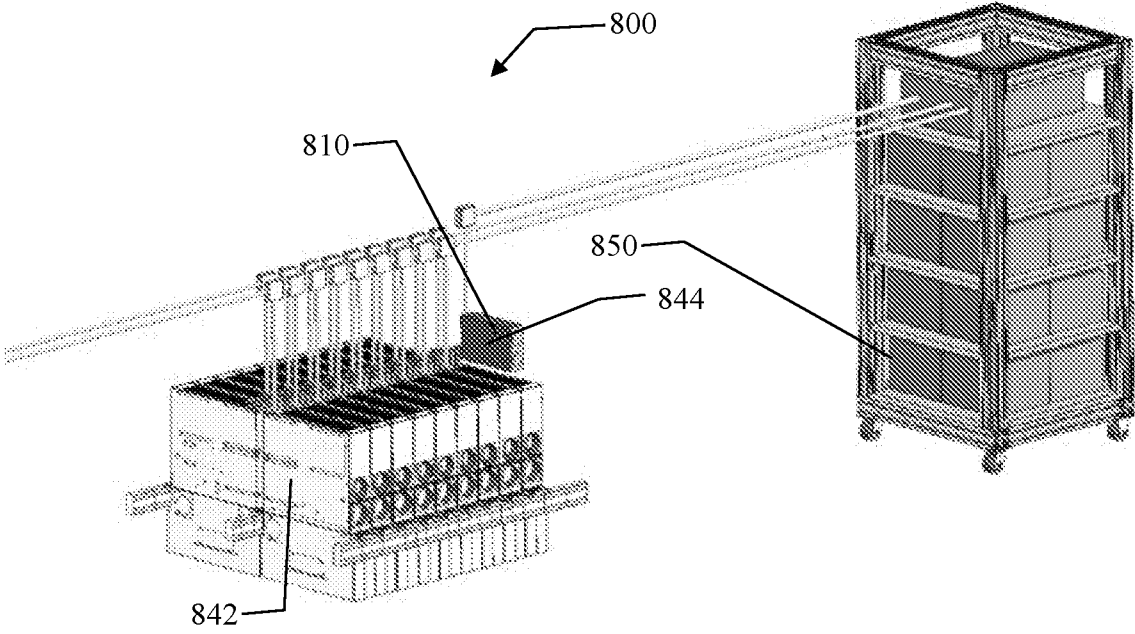


FIG. 8L

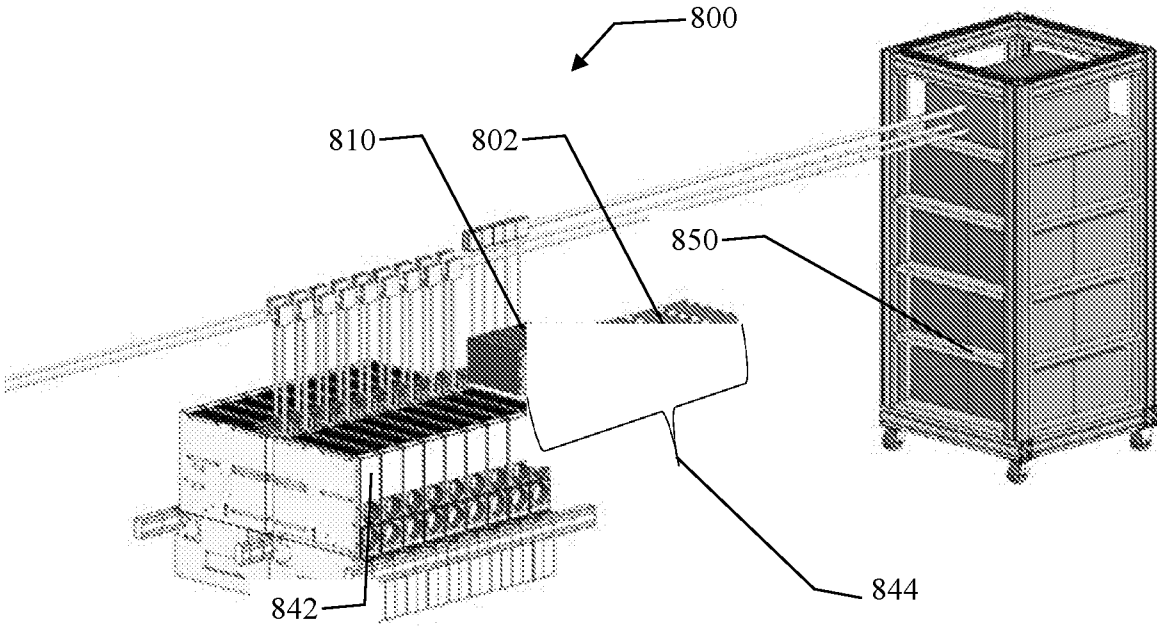


FIG. 8M

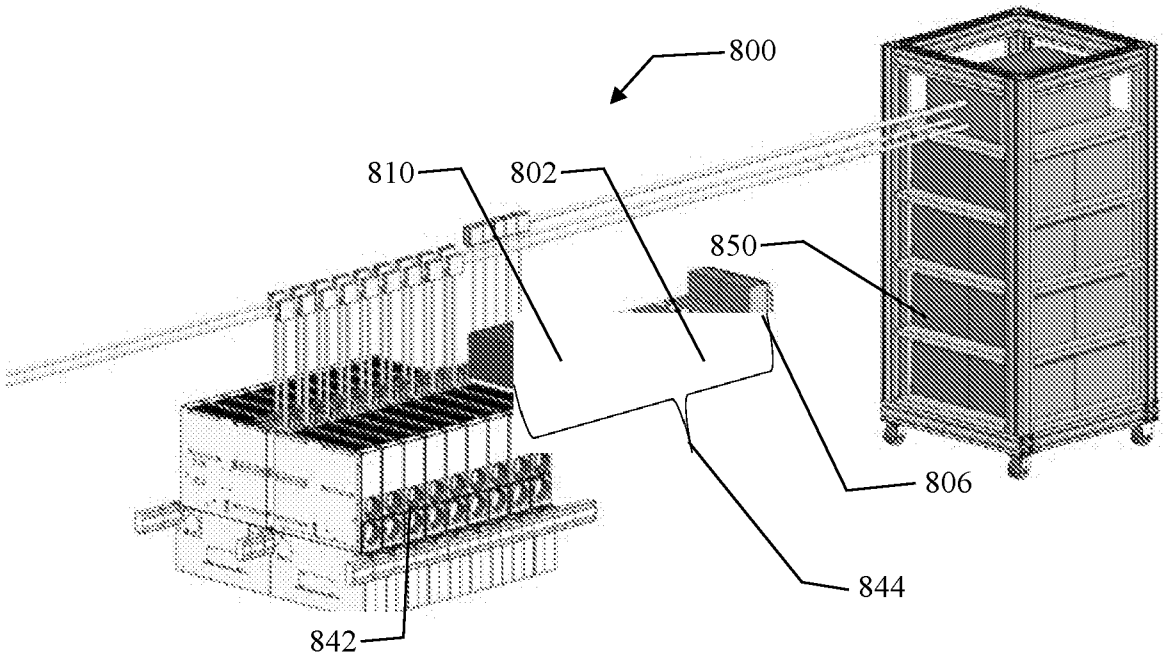


FIG. 8N

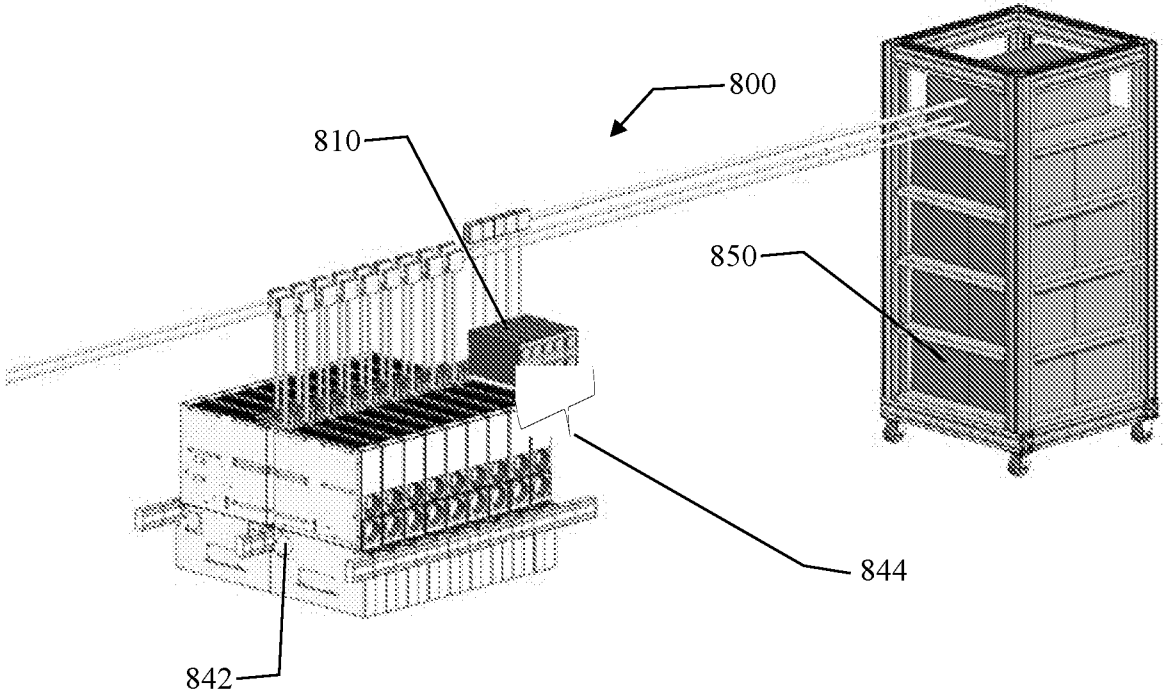


FIG. 8O

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 16/3/939

A. CLASSIFICATION OF SUBJECT MATTER

IPC(8) - H01R 13/453; H01G 9/00 (2016.01)

CPC - Y10S4 39/911, H01R 13/4534

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)

IPC(8) - H01R 13/453; H01G 9/00 (2016.01)

CPC - Y10S439/911, H01R13/4534

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

CPC - H01G9/12, H01G9/008, Y02T10/7061, Y02T10/7005

USPC - 361/15, 361/42

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

Electronic Database Searched: Patbase, Google Patents, Google Scholar

Search Terms Used: High power appliance, outlet, electrical wattage, primary/secondary power, DC, AC, food service, heating element, battery/capacitor, power plant/generator, cooking food process, accelerated rate, inverter, counter, snap/magnetic, high current etc.,

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X ----- Y	US 2012/0111857 A1 (McKee et al.) 10 May 2012 (10.05.2012); especially, Abstract, Fig. 5b, para [0019], [0022], [0041], [0043], [0044], [0047]	29 ----- 24-28, 30-33
X ----- Y	US 2011/0125337 A1 (Zavatsky et al.) 26 May 2011 (26.05.2011); entire document, especially, Abstract, Fig. 1b, 3, 4, 6, 8 and 40, para [0056]-[0058], [0063], [0067], [0078], [0107]-[0108], [0149], [0151]-[0153], [0162], [0166], [0172], [0174], [0176], [0177], [0216] and claim 2	1-3 ----- 4-22, 24, 30-32
Y	US 2010/0274407 A1 (Creed) 28 October 2010 (28.10.2010); entire document, especially, Abstract, FIG. 1, para [0060], [0062], [0070], [0089]	4,5, 7-9, 25-28
Y	US 6,528,770 B1 (Akel et al.) 04 March 2003 (04.03.2003); entire document, especially, Abstract, col. 5, ln 17-50, col. 6, ln 26-30	6-22, 24
Y	US 2010/0166397 A1 (De Luca) 01 July 2010 (01.07.2010); especially, Abstract, para [0061] and claim 44.	33
Y	US 2007/0276547 A1 (Miller) 29 November 2007 (29.11.2007); especially, Abstract, para [0008]	12
Y	US 3,713,077 A (Leonard) 23 January 1973 (23.01.1973); especially, Abstract, col.1, ln 45-52	28

☐ Further documents are listed in the continuation of Box C.

* Special categories of cited documents:

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

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"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

17 August 2016 (17.08.2016)

Date of mailing of the international search report

16 SEP 2016

Name and mailing address of the ISA/US

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