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(54) **Title:** METHODS AND SYSTEMS FOR PROVIDING POWER

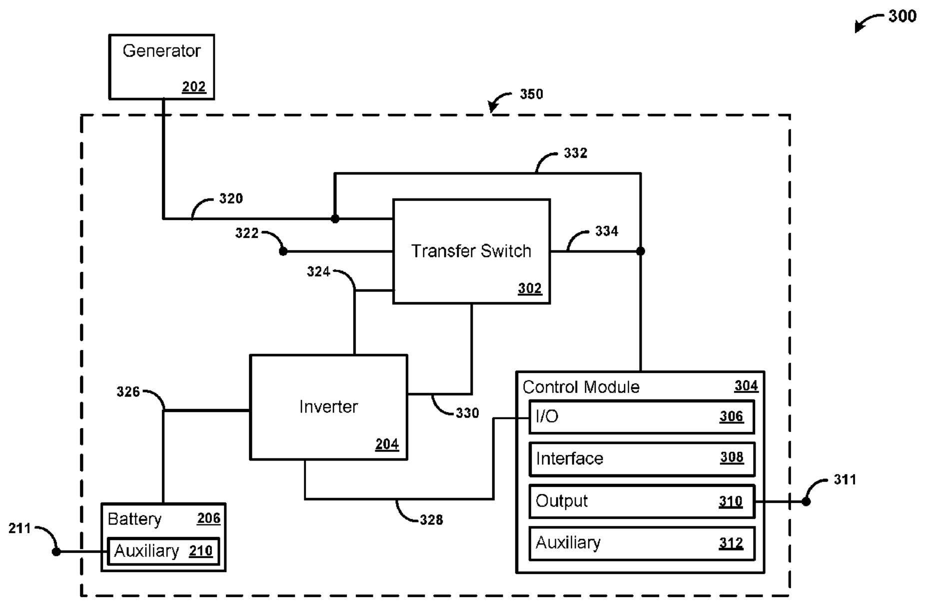

FIG. 3

(57) **Abstract:** Systems and methods are described for providing power. A system comprising a generator, an inverter, and a battery can be used to provide power. The system can also comprise a transfer switch. The system can provide power to another device.

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[Continued on next page]

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METHODS AND SYSTEMS FOR PROVIDING POWER

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This Application claims the benefit of U.S. Application No. 16/521,200, filed on July 24, 2019, which is incorporated herein by reference in its entirety.

BACKGROUND

[0002] Generally, electrical power is needed to control most functions within a commercial industrial plant/facility. Further, these plants and facilities have critical safety functions that must be maintained in the event of a loss of electrical power to avoid safety degradation or damage. For example, during postulated accident scenarios nuclear power plants need certain systems to continuously maintain power to safely shut the plant down and avoid the potential for core damage. As another example, industrial chemical plants need to maintain control of critical chemical process to avoid explosions and/or chemical spills. Thus, many commercial industrial plants/facilities require backup generators that provide emergency power to large portions of plant/facility equipment in case of a loss of normal electrical supply power. However, for many of these plants/facilities', emergency backup power is needed for various critical smaller electrical loads that operate at a range of AC and DC voltages and currents to control, operate, and monitor the most important critical equipment to facilitate safe shutdown and avoid large scale accident and damage. During these loss of power events time is of the essence and it is imperative to restore power to these critical smaller electrical loads as quickly and simply as possible to mitigate the event and minimize any damage caused by loss of power.

[0003] For example, during extreme accident scenarios and natural disaster events nuclear power plants have specific time requirements that electrical power must be returned to critical equipment (e.g., equipment that provides critical cooling functions to prevent damage or escalating the event). During extreme accident scenarios if the critical equipment loses offsite grid power and the installed backup generators also fail, a nuclear power plant may have a very short time frame, as in a matter of hours, before severe damage to the facility occurs. This scenario was exemplified in the 2011 Fukushima-Diachi earthquake and resultant nuclear accident. Therefore, there is a critical need to ensure that nuclear power plants do not go without main or backup emergency power to their critical safety equipment for a certain number of hours.

[0004] While nuclear power plants are designed with emergency backup power systems utilizing one or more large installed generators, the installations are complex and difficult to maintain, have limited fuel supply for prolonged events, and the installed large backup generator installations may be impacted in a natural disaster or hampered by an extended loss of electrical grid event. To address this concern, the US Nuclear Industry and U.S. Nuclear Regulatory Commission implemented a Diverse and Flexible Mitigation Capability ("FLEX") strategy to ensure that nuclear power plants receive power beyond their main and installed emergency power systems in a case of an extended loss of power event. Generally, the FLEX strategy provides for a third form of emergency power through large portable machinery and power generators that nuclear power plants can utilize in case of an extended loss of power. Additional FLEX equipment is dispersed throughout the United States in strategic locations to service as many nuclear power plants as possible, while at the same time ensuring that a natural disaster does not damage more than one FLEX storage location. However, the FLEX strategy is extremely expensive to maintain, somewhat complex to implement during an extreme event, and could experience a significant delay in mobilizing FLEX equipment to provide power to the nuclear facilities during a very large-scale natural disaster event or terrorist type event affecting regional or national power grids. Furthermore, the FLEX equipment is designed to provide power to the entire nuclear power plant (e.g., just like a large backup generator), and not just target critical pieces of equipment that need power to maintain the safety of the nuclear power plant. For example, a nuclear power plant may only need to provide power to three (3) pieces of equipment and /or components to maintain the safety of the core, while the rest of the nuclear power plant can safely remain without power.

[0005] Accordingly, there is a long felt need in the nuclear power industry to be able to provide emergency power response in a much more quick and efficient manner to the most critical pieces of equipment. Thus, the need for a targeted, quick response backup power for critical equipment in the nuclear plant and in other commercial plant/facilities is evident. These long felt needs are addressed by the disclosure herein. Specifically, the exemplary embodiments herein provide several systems and methods for rapidly deploying a portable power device to restore power to critical smaller electrical loads (both AC and DC power), regardless of status of industrial plant's/facility's main or installed backup up power source or distribution system. These system's and method's not only supply a targeted third tier backup power source but provide a means for prolonged power in the most severe accident and natural accident scenarios and can be applied for a variety of facilities and industrial plants.

SUMMARY

[0006] It is to be understood that both the following general description and the following detailed description are exemplary and explanatory only and are not restrictive. Provided are systems, apparatuses, and methods for protecting various critical instrumentation and control circuits, as well as power circuits, when a primary power source fails (e.g., is disrupted).

[0007] In an exemplary embodiment, a system comprises a generator, a rectifier, a battery, and a distribution hub. The generator can provide power to the rectifier. The rectifier can be an Alternating Current (AC) to Direct Current (DC) inverter and/or a DC to AC converter. The rectifier can provide power received from the generator to the battery, as well as the distribution hub. Additionally, the rectifier can receive power only from the supplied battery and provide the power received from the battery to the distribution hub. The distribution hub can distribute the power to one or more power providing devices.

[0008] In another exemplary embodiment, a system comprises a generator, a transfer switch, a rectifier, a battery, and a control module. The generator can provide power to the transfer switch. The transfer switch can provide power to the rectifier and the control module. The rectifier can be an AC to DC inverter and/or a DC to AC converter. The rectifier can provide power received from the transfer switch to the battery, as well as the control module. Additionally, the rectifier can receive power from the battery and provide the power received from the battery to the transfer switch and the control module. The control module can output the power received from the transfer switch. The control module can have two or more DC outputs. The control module can have two or more AC outputs.

[0009] In another exemplary embodiment, an apparatus comprises a battery, a rectifier, a variable frequency drive, and a reversing contactor. The battery can provide power to the rectifier. The rectifier can be an AC to DC inverter and/or a DC to AC converter. The rectifier can provide power to the variable frequency drive and can provide

control power to another device. The variable frequency drive can receive the AC power from the rectifier and convert the AC power to three-phase AC power. The variable frequency drive can provide the three-phase AC power to a reversing contactor switch, which can modify the polarity of the three-phase AC power. The reversing contactor switch can provide the three-phase AC power to an output.

[0010] Additional advantages will be set forth in part in the description which follows or can be learned by practice. The advantages will be realized and attained by means of the elements and combinations particularly pointed out in the appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] The accompanying drawings, which are incorporated in and constitute a part of this specification, show examples and together with the description, serve to explain the principles of the methods and systems:

Figures 1A-1C illustrate an exemplary system for providing power;
Figure 2 illustrates an exemplary system for providing power;
Figure 3 illustrates an exemplary system for providing power;
Figure 4 illustrates an exemplary system for providing power;
Figure 5 illustrates an exemplary system for providing power;
Figure 6 illustrates an exemplary system for providing power;
Figure 7 illustrates an exemplary system for providing power;
Figure 8 illustrates an exemplary system for providing power;
Figure 9 illustrates an exemplary system for providing power;
Figure 10 illustrates an exemplary system for providing power;
Figure 11 illustrates a flowchart of an exemplary method for providing power;
Figure 12 illustrates a flowchart of an exemplary method for providing power;
Figure 13 illustrates a flowchart of an exemplary method for providing power;
Figure 14 illustrates a flowchart of an exemplary method for providing power;
Figure 15 illustrates a flowchart of an exemplary method for providing power;
Figure 16 illustrates a flowchart of an exemplary method for providing power; and
Figure 17 illustrates a block diagram of an example computing device for providing power.

DETAILED DESCRIPTION

[0012] Before the present methods and systems are disclosed and described, it is to be understood that the methods and systems are not limited to specific methods, specific components, or to particular implementations. It is also to be understood that the terminology used herein is for the purpose of describing particular examples only and is not intended to be limiting.

[0013] As used in the specification and the appended claims, the singular forms “a,” “an,” and “the” include plural referents unless the context clearly dictates otherwise. Ranges may be expressed herein as from “about” one particular value, and/or to “about” another particular value. When such a range is expressed, another example includes from the one particular value and/or to the other particular value. Similarly, when values are expressed as approximations, by use of the antecedent “about,” it will be understood that the particular value forms another example. It will be further understood that the endpoints of each of the ranges are significant both in relation to the other endpoint, and independently of the other endpoint.

[0014] “Optional” or “optionally” means that the subsequently described event or circumstance may or may not occur, and that the description includes examples where said event or circumstance occurs and examples where it does not.

[0015] Throughout the description and claims of this specification, the word “comprise” and variations of the word, such as “comprising” and “comprises,” means “including but not limited to,” and is not intended to exclude, for example, other components, integers or steps. “Exemplary” means “an example of” and is not intended to convey an indication of a preferred or ideal example. “Such as” is not used in a restrictive sense, but for explanatory purposes.

[0016] Described herein are components that may be used to perform the described methods and systems. These and other components are described herein, and it is understood that when combinations, subsets, interactions, groups, etc. of these components are described that while specific reference of each various individual and collective combinations and permutation of these may not be explicitly described, each is specifically contemplated and described herein, for all methods and systems. This applies to all examples of this application including, but not limited to, steps in described methods. Thus, if there are a variety of additional steps that may be performed it is understood that each of these additional steps may be performed with any specific example or combination of examples of the described methods.

[0017] The present methods and systems may be understood more readily by reference to the following description of preferred examples and the examples included therein and to the Figures and their previous and following description.

[0018] The methods and systems are described below with reference to block diagrams and flowcharts of methods, systems, apparatuses and computer program products. It will be understood that each block of the block diagrams and flowcharts, and combinations of blocks in the block diagrams and flowcharts, respectively, may be implemented by computer program instructions. These computer program instructions may be loaded onto a general purpose computer, special purpose computer, or other programmable data processing apparatus to produce a machine, such that the instructions which execute on the computer or other programmable data processing apparatus create a means for implementing the functions specified in the flowchart block or blocks.

[0019] These computer program instructions may also be stored in a computer-readable memory that may direct a computer or other programmable data processing apparatus to function in a particular manner, such that the instructions stored in the computer-readable memory produce an article of manufacture including computer-readable instructions for implementing the function specified in the flowchart block or blocks. The computer program instructions may also be loaded onto a computer or other programmable data processing apparatus to cause a series of operational steps to be performed on the computer or other programmable apparatus to produce a computer-implemented process such that the instructions that execute on the computer or other programmable apparatus provide steps for implementing the functions specified in the flowchart block or blocks.

[0020] Accordingly, blocks of the block diagrams and flowcharts support combinations of means for performing the specified functions, combinations of steps for performing the specified functions and program instruction means for performing the specified functions. It will also be understood that each block of the block diagrams and flowcharts, and combinations of blocks in the block diagrams and flowcharts, may be implemented by special purpose hardware-based computer systems that perform the specified functions or steps, or combinations of special purpose hardware and computer instructions.

[0021] Described herein is a rapidly deployable portable battery powered backup power system providing targeted AC and DC control, indication and system supply power for a variety of critical systems and components. The rapidly deployable portable battery powered backup emergency power system is designed for prolonged operation with an integrated backup uninterruptable generator power system. The rapidly deployable portable battery powered backup emergency power system may be configured for prolonged operation such as for up to 30, 60, 90 days of operation and the like.

[0022] **FIGs. 1A-1C** illustrate an exemplary system **100** for providing power. As shown in **FIG. 1A**, the system **100** has a control module **102**, a battery **104**, a transfer switch **106**, and an inverter **108**. In an exemplary embodiment, the system **100** is coupled with a cart **110** such that the system **100** is a portable system.

[0023] The control module **102** can have an input/output interface (I/O), an interface, one or more outputs **103**, an auxiliary port, switches, and so forth. The I/O can allow the control module **102** to communicate with one or more devices. The I/O can include any type of suitable hardware for communication with devices. For example, the I/O can include direct connection interfaces such as Ethernet and Universal Serial Bus (USB), as well as wireless communications, including but not limited to, Wi-Fi, Bluetooth, cellular, Radio Frequency (RF), and so forth. The control module **102** can provide power to the output **103** of the control module **102**. For example, the control module **102** can receive power from at least one of the transfer switch **106** and/or the inverter **108**, and the control module **102** can provide the received power on the output **103** to power one or more devices. As an example, one or more cables can be connected to the output **103** to couple the control module **102** to the one or more devices, and the control module **102** can provide the one or more devices power via the one or more cables connected to the output **103**. The control module **102** can be removable from the cart **110** and still remain functional. For example, the control module **102** can be relocated a distance away from the cart **110**, and the control module **102** can be coupled to the system **100** via one or more cables (e.g., the electrical connection **112c**) coupled to the control module **102**.

[0024] The battery **104** can be one or more batteries configured to store power, as well as provide the stored power. The battery **104** can provide DC power. The battery **104** can have an associated voltage, such as a 12 V, 24 V, 48 V, 125 V, 250 V, 400 V, etc. battery. Further, the battery **104** can have an output current. For example, the battery

104 can output 5 A, 50 A, 150 A, 300 A, etc. In an exemplary embodiment, the battery **104** can be a 12 V battery with a rated output of up to 150 A. In another exemplary embodiment, the battery **104** can be a 24 V battery with a rated output of up to 300 A. As will be appreciated by one skilled in the art, the battery **104** can be a battery with any voltage and/or current characteristics.

[0025] The battery **104** can be any battery, such as rechargeable batteries or non-rechargeable batteries. The battery **104** can be a Lithium Ion (Li+) battery, a lead acid (Pb) battery, a Lithium Iron Phosphate (LiFePo) battery, or any type of rechargeable battery. The battery **104** comprises an auxiliary output. The auxiliary output can be capable of receiving and/or providing DC power to another device. For example, an apparatus capable of running on DC power can be coupled to the battery **104** to receive power from the battery **104**. As an example, a light can be coupled to the battery **104**. As another example, an apparatus capable of providing DC power can be coupled to the **104**. As an example, a maintenance battery charger can be coupled to the battery **104** to charge the battery **104**.

[0026] The battery **104** can be one or more batteries configured to store power from the inverter **108**. For example, the battery **104** can receive power from the inverter **108** via an electrical connection and store the power from the inverter **108**. Stated differently, the inverter **108** can charge the battery **104** via the electrical connection. Additionally, the battery **104** can provide power to the inverter **108**. For example, the battery **104** can discharge (e.g., provide power) to the inverter **108** via the electrical connection. Accordingly, the battery **104** is capable of receiving power from the inverter **108**, as well as providing power to the inverter **108**.

[0027] The transfer switch **106** can comprise any switch capable of switching between two or more power sources. For example, the transfer switch **106** can receive power from a generator (not shown) that is coupled with the transfer switch **106** via one or more electrical connections **112a,b**. The transfer switch **106** can provide the received power to the inverter **108** via an electrical connection. Alternatively, the transfer switch **106** can provide the received power to the control module **102** via an electrical connection. The transfer switch **106** can comprise an adjustable voltage proving time delay module. The adjustable voltage proving time delay module can be configured to variably set at least one of a voltage delay trigger or a time delay trigger when an AC presence is detected on the electrical connection. That is, the adjustable voltage proving time delay module can be configured to set a voltage delay trigger upon receiving power from the generator. The transfer switch **106** can provide power to the control module **102** after triggering the adjustable voltage proving time delay module. That is, once the transfer switch **106** detects power from the generator via the electrical connection, the transfer switch **106** can provide power to the control module **102** via a different electrical connection.

[0028] The transfer switch **106** can have electrical connections **112a**,**b**,**c**,**d**,**e** that are capable of providing power to, or receiving power from, another device. For example, the electrical connections **112a**,**b**,**c**,**d**,**e** can provide power to, or receive power from, the control module **102**, the battery **104**, and/or the inverter **108**. The electrical connections **112a**,**b**,**c**,**d**,**e** can be any suitable DC and/or AC electrical connection. For example, the electrical connection **112a** can be configured to provide power to another device. As an example, the electrical connection **112a** can provide power to an auxiliary device, such as a work light or another electrical device. In an exemplary embodiment, the electrical connection **112a** provides power to power providing device (e.g., a distribution hub) that facilitates providing AC and/or DC power to one or more other devices. The electrical connection **112b** can be configured to receive power from a generator (not shown). The electrical connection **112c** can be configured to provide power to the control module **102**. The electrical connections **112d**,**e** can be configured to provide power to, or receive power from, the inverter **108**. Thus, the transfer switch **106** can utilize the electrical connections **112a**,**b**,**c**,**d**,**e** to provide power to, or receive power from, another device.

[0029] Additionally, the transfer switch **106** can receive power from the inverter **108**. In an exemplary embodiment, the transfer switch **106** can switch receiving power between the generator and the inverter **108**. Stated differently, the transfer switch **106** can auctioneer between the generator and the inverter **108**. That is, the transfer switch **106** can automatically switch between the generator and the inverter **108**. For example, if the generator runs out of fuel, the transfer switch **106** can switch to receiving power from the inverter **108**, which is receiving power from the battery **104**. In this manner, the transfer switch **106** can continue to output power to the control module **102** even if one of the power sources of the transfer switch **106** (e.g., the generator, the battery **104**) stops providing power to the transfer switch **106**.

[0030] The inverter **108** can be any device capable of converting AC power to DC power, as well as DC power to AC power. The inverter **108** can receive power from a generator via an electrical connection or can receive power from the transfer switch **106**. For example, the inverter **108** can receive AC power directly from the generator or from the transfer switch **106**. The inverter **108** can provide the received AC power to the control module **102** via an electrical connection. The inverter **108** can convert the received AC power to DC power. The inverter **108** can provide (e.g., output) the DC power to the battery **104** via an electrical connection. As an example, the inverter **108** can charge the battery **104** via the electrical connection. The inverter **108** can charge the battery **104**, while also providing AC power to an output, such as the control module **102**. That is, the inverter **108** is capable of charging the battery **104**, while simultaneously providing power to the control module **102**.

[0031] Further, the inverter **108** can receive DC power from the battery **104**. For example, the inverter **108** can receive 12 VDC 24 VDC, 48 VDC, 72 VDC, as well as voltages ranging from 100 VDC to 800 VDC. The inverter **108** can invert (e.g., convert) the received DC power to AC power. The inverter **108** can output the inverted AC power. For example, the inverter **108** can output 110 VAC, 120 VAC, 208 VAC three-phase, 480 VAC three-phase, or any suitable output. The inverter **108** can provide the inverted AC power to the control module **102** via an electrical connection. For example, the inverter **108** can comprise an internal transfer switch. The internal transfer switch can be capable of auctioneering AC power output to the control module **102** between two or more electrical inputs. For example, one electrical input may be a generator (not shown), and the other may be provided by the battery **104**. Stated differently, the inverter **108** is capable of switching (e.g., automatically) between power inputs in order to maintain a constant output to the control module **102**. The inverter **108** can have one or more indicators that indicate the status of the inverter **108**. For example, the inverter **108** can have one or more lights and/or displays that indicate the status of the inverter. In an exemplary embodiment, the lights comprise Light Emitting Diodes (LEDs).

[0032] **FIG. 1B** illustrates a front view of the system **100**. As shown, the control module **102** has outputs **103a**,**b**, a plurality of switches **114**, two displays **116a**,**b**, and a control interface **118**. The outputs **103a**,**b** can output DC power and/or AC power. The outputs **103a**,**b** can output the same or different type of power, as well as the same or different amount of power. For example, the output **103a** can be associated with a first power output (e.g., DC power and/or AC power), and the output **103b** can be associated with a second power output (e.g., DC power and/or AC power). As an example, the output **103a** can output a first DC voltage, and the output **103b** can output a second DC voltage. As another example, the output **103a** can output a first AC voltage, and the output **103b** can output a second AC voltage. As further example, the output **103a** can output a DC voltage, and the output **103b** can output an AC voltage.

[0033] The switches **114** can toggle the output provided by the control module **102**. That is, the outputs **103a**,**b** can be controlled by the switches **114**. For example, the switches **114** can be associated with breakers that determine whether the control module **102** provides power to the outputs **103a**,**b**. As an example, the switches 114 can be individually flipped to control the outputs 103a,b such that the output of the control module 102 can be modified based on the position of the switch 114. Further, one of the switches **114** may be a power switch that toggles the control module **102** between an off state and an on state.

[0034] The control module **102** can have two displays **116a**,**b**. The two displays **116a**,**b** can indicate the status of the control module **102**. For example, the two displays **116a**,**b** can indicate the output of the control module **102**. As an example, the two displays **116a**,**b** can be associated with a specific output of the control module **102**, and the two displays **116a**,**b** can indicate the voltage and current presently being supplied by the respective output.

[0035] The control module **102** can have a control interface **118**. The control interface **118** can have any capability for controlling operation of the inverter **108**. For example, the control interface **118** can control the power provided to the inverter **108**. That is, the control interface **118** can have the capability to turn the inverter **108** ON and OFF. The control interface **118** can also indicate the status of the inverter **108**. For example, the control interface **118** can indicate whether the inverter **108** is receiving power from the battery **104** or a generator (not shown). As another example, the control interface **118** can indicate whether the battery **104** is being charged by the power being provided by the generator via the transfer switch **106**. The control interface **118** can dictate the operation of the inverter **108**. For example, the control interface **118** can instruct the inverter **108** to draw power from the battery **104**, rather than the generator. Similarly, the control interface **118** can instruct the inverter **108** to draw power from the generator, rather than the battery **104**. While the control interface **118** is described as controlling operation of the inverter, a person of ordinary skill in the art would appreciate that the control interface **118** can be capable of controlling operation of the control module **102**, the battery **104**, and/or the transfer switch **106**.

[0036] **FIG. 1C** illustrates a side view of the system **100**. Specifically, **FIG. 1C** illustrates the electrical connections **112a**,**b**,**c**,**d**,**e**,**f** between the control module **102**, the battery **104**, the transfer switch **106**, and the inverter **108**. As shown, the transfer switch **106** is coupled to the inverter **108** via two electrical connections **112e**,**d**. Further, the control module **102** is coupled with the transfer switch **106** via a single electrical connection **112c**. Similarly, the battery **104** is coupled with the transfer switch **106** via a single electrical connection **112f**.

[0037] **FIG. 2** illustrates an exemplary system **200** for providing power. As shown, the system **200** has a generator **202**, an inverter **204**, a battery **206**, and a distribution hub **208**. Further, the system **200** comprises an apparatus **250**. The apparatus **250** can comprise the inverter **204** and the battery **206**. Additionally, the apparatus **250** can comprise any of the components of the system **200**. For example, the apparatus **250** comprises the cart **110** of **FIGs. 1A-1C**. In an exemplary embodiment, each of the components of the system **200** are separate devices that are not contained within an apparatus.

[0038] The generator **202** can be any generator capable of providing power. For example, the generator **202** can be capable of Alternating Current (AC). The generator **202** can output between 100 VAC and 250 VAC, as well as higher voltages. For example, the generator **202** can output 120 VAC and/or 240VAC. The generator **202** can operate on any suitable fuel, such as gasoline, diesel, Liquid Propane Gas (LPG), natural gas, and so forth. The generator **202** can operate on two or more fuels. For example, the generator **202** can be capable of operating on both gasoline and LPG. The generator **202** can be capable of switching between the two fuels either manually or automatically. As an example, the generator **202** can default to running on gasoline stored within a gas tank associated with the generator **202**. Once the generator **202** runs out of gasoline within the gas tank, the generator **202** can switch over to the LPG. As another example, the generator **202** can switch between two or more LPG tanks coupled with the generator **202**. That is, when a first of the two or more LPG tanks runs out of the LPG, the generator **202** can manually, or automatically, switch to a second of the two or more LPG tanks. The generator **202** can provide (e.g., output) power to the inverter **204** via an electrical connection **220**. For example, the generator **202** can provide AC power to the inverter **204** via the electrical connection **220**. Further, the generator **202** can provide power to the distribution hub **208** via the electrical connection **220** and an electrical connection **226**. Stated differently, the generator **202** can bypass the inverter **204** and provide power directly to the distribution hub **208**.

[0039] The inverter **204** can be any device capable of converting AC power to DC power, as well as DC power to AC power. For example, the inverter **204** can be a rectifier. The inverter **204** can receive power from the generator **202** via the electrical connection **222**. For example, the inverter **204** can receive AC power from the generator **202** via the electrical connection **222**. The inverter **204** can provide the received AC power to the distribution hub **208** via an electrical connection **226**. The inverter **204** can convert the received AC power to DC power. The inverter **204** can provide (e.g., output) the DC power to the battery **206** via an electrical connection **224**. As an example, the inverter **204** can charge the battery **206** via the electrical connection **224**. The inverter **204** can charge the battery **206**, while also providing AC power to the distribution hub **208**. That is, the inverter **204** is capable of charging the battery **206**, while simultaneously providing power to the distribution hub **208**.

[0040] Further, the inverter **204** can receive DC power from the battery **206**. For example, the inverter **204** can receive 12 VDC 24 VDC, 48 VDC, 72 VDC, as well as voltages ranging from 100 VDC to 800 VDC. The inverter **204** can invert (e.g., convert) the received DC power to AC power. The inverter **204** can output the inverted AC power. For example, the inverter **204** can output 110 VAC, 120 VAC, 208 VAC three-phase, 480 VAC three-phase, or any suitable output. The inverter **204** can provide the inverted AC power to the distribution hub **208** via an electrical connection **224**. For example, the inverter **204** can comprise an internal transfer switch. The internal transfer switch can be capable of auctioneering AC power output to the distribution hub **208** between the electrical connection **220** (e.g., that is provided by the generator **202**) and the electrical connection **222** (e.g., that is provided by the battery **206**). Stated differently, the inverter **204** is capable of switching (e.g., automatically) between power inputs received from the generator **202**, via the electrical connection **220**, and from the battery **206**, via the electrical connection **222**, in order to maintain a constant output to the distribution hub **208**, via the electrical connection **224**. The inverter **204** can have one or more indicators that indicate the status of the inverter **204**. For example, the inverter **204** can have one or more lights and/or displays that indicate the status of the inverter. In an exemplary embodiment, the lights comprise Light Emitting Diodes (LEDs).

[0041] The battery **206** can be one or more batteries configured to store power, as well as provide the stored power. The battery **206** can provide DC power. The battery **206** can have an associated voltage, such as a 12 V, 24 V, 48 V, 125 V, 250 V, 400 V, etc. battery. Further, the battery **206** can have an output current. For example, the battery **206** can output 5 A, 50 A, 150 A, 300 A, etc. In an exemplary embodiment, the battery **206** can be a 12 V battery with a rated output of up to 150 A. In another exemplary embodiment, the battery **206** can be a 24 V battery with a rated output of up to 300 A. As will be appreciated by one skilled in the art, the battery **206** can be a battery with any voltage and/or current characteristics.

[0042] The battery **206** can be any battery, such as rechargeable batteries or non-rechargeable batteries. The battery **206** can be a Lithium Ion (Li+) battery, a lead acid (Pb) battery, a Lithium Iron Phosphate (LiFePo) battery, or any type of rechargeable battery. The battery **206** comprises an auxiliary output **210**. The auxiliary output **210** is capable of receiving and/or providing DC power to another device. For example, an apparatus capable of running on DC power can be coupled to the auxiliary output **210**. As an example, a light can be coupled to the auxiliary output **210**. As another example, an apparatus capable of providing DC power can be coupled to the auxiliary output **210**. As an example, a maintenance battery charger can be coupled to the auxiliary output **210** to charge the battery **206**.

[0043] The battery **206** can be one or more batteries configured to store power from the inverter **204**. For example, the battery **206** can receive power from the inverter **204** via the electrical connection **222** and store the power from the inverter **204**. Stated differently, the inverter **204** can charge the battery **206** via the electrical connection **222**. Additionally, the battery **206** can provide power to the inverter **204**. For example, the battery **206** can discharge (e.g., provide power) to the inverter **204** via the electrical connection **222**. Accordingly, the battery **206** is capable of receiving power from the inverter **204**, as well as providing power to the inverter **204**. The distribution hub **208** can receive power from the generator **202** via the electrical connections **222** and **228**. Additionally, the distribution hub **208** can receive power from the inverter via the electrical connection **226**. The distribution hub **208** can comprises two or more outputs **212a**,**b** and an auxiliary **214**.

[0044] The distribution hub **208** can provide AC power to the outputs **212a**,**b**. For example, the distribution hub **208** can provide between 100-250 VAC power to the outputs **212a**,**b**. The outputs **212a**,**b** provide power to two or more power providing devices **216a**,**b**. Specifically, the output **212a** can provide power to the power providing device **216a** via the electrical connection **228**, and the output **212b** can provide power to the power providing device **216b** via the electrical connection **230**. In an exemplary embodiment, the electrical connections **228**, **230** comprise cables coupled with the distribution hub **208** and the power providing devices **216a**,**b**. The power providing devices **216a**,**b** can provide a variety of different power outputs. For example, the power providing devices **216a**,**b** can provide AC power and DC power. As an example, the power providing device **216a**,**b** can provide AC power and DC power simultaneously. The power output provided by the power providing devices **216a**,**b** can be between 0-260 VDC, such as 24 VDC, 48 VDC, 125 VDC, as well as 0-250 VAC, such as, 120 VAC, 240 VAC, or any suitable DC and/or AC output. The power providing devices **216a**,**b** can have more than one output port associated with each of the power providing devices **216a**,**b** such that the power providing devices **216a**,**b** can provide power to a plurality of devices simultaneously.

[0045] The distribution **208** can have an auxiliary **214**. The auxiliary **214** can provide power to one or more additional devices via an output connection **215**. For example, the auxiliary **214** can couple the distribution hub **208** to another distribution hub. Stated differently, the auxiliary **214** provides the distribution hub **208** the capability to power one or more additional distribution hubs in order to provide additional power providing devices **216a**,**b**. That is, the auxiliary **214** can have the capability to act as a pass through that matches the voltage of the AC input provided to the distribution hub **208**. The auxiliary **214** can provide 120 VAC, 240 VAC, and/or any AC power output. The auxiliary **214** can be an auxiliary output for providing power to an auxiliary device, such as a light, a power tool, or any electrical device. As another example, the auxiliary **214** can be an interface (e.g., a display, a light, etc.) that provides information associated with the distribution hub **208**. As a further example, the auxiliary **214** can be an Input/Output (I/O) interface for communicating with one or more additional electronic devices.

[0046] While the electrical connections **220-230** are shown as direct connections between the various components of the system **200** for ease of explanation, a person skilled in the art would appreciate that the electrical connections **220-230** can comprise additional components, such as resistors, capacitors, inductors, breakers, switches, and so forth.

[0047] **FIG. 3** illustrates an exemplary system **300** for providing power. Specifically, the system **300** has the generator **202**, a transfer switch **302**, an inverter **204**, a battery **206**, and a control module **304**. Further, the system **300** has an apparatus **350** that can comprise the functionality of the transfer switch **302**, the inverter **204**, the battery **206**, and the control module **304**. The apparatus **350** (e.g., the cart **110** of **FIGs. 1A-1C**) can comprise a wheeled container configured to mount the one or more of the transfer switch **302**, the inverter **204**, the battery **206**, and the control module **304**.

[0048] The generator **202** provides power to the transfer switch **302** via the electrical connection **320**. The generator **220** also provides power to the control module **304** via the electrical connection **320** and an electrical connection **332**. While the control module **304** is illustrated as being within the apparatus **350**, the control module **304** is capable of being removed from the apparatus and still function appropriately. For example, the control module **304** can receive power from one or more cables that are connected to the transfer switch **302**, the generator **202**, and/or the inverter **204**. Thus, the control module **304** can be located outside of the apparatus **350** and still function as described herein.

[0049] The transfer switch **302** can comprise any switch capable of switching between two or more power sources. As shown, the transfer switch **302** can receive power from the generator **202**. The transfer switch **302** can provide the received power to the inverter **204** via an electrical connection **324**. Alternatively, the transfer switch **302** can provide the received power to the control module **304** via an electrical connection **334**. The transfer switch **302** can comprise an adjustable voltage proving time delay module. The adjustable voltage proving time delay module can be configured to variably set at least one of a voltage delay trigger or a time delay trigger when an AC presence is detected on the electrical connection **320**. That is, the adjustable voltage proving time delay module can be configured to set a voltage delay trigger upon receiving power from the generator **202**. The transfer switch **302** can provide power to the control module **304** after triggering the adjustable voltage proving time delay module. That is, once the transfer switch **302** detects power from the generator **202** via the electrical connection **320**, the transfer switch **302** can provide power to the control module **304** via the electrical connection **334**.

[0050] The transfer switch **302** can have an auxiliary electrical connection **322** that is capable of providing power to another device. The auxiliary electrical connection **322** can provide power to one or more additional devices. For example, the auxiliary electrical connection **322** can couple the transfer switch **302** to a distribution hub (e.g., the distribution hub **208** of **FIG. 2**) or another control module (e.g., another control module **304**). Stated differently, the auxiliary electrical connection **322** provides the transfer switch **302** the capability to power one or more additional distribution hubs in order to provide additional power providing devices. The auxiliary electrical connection **322** can provide 120 VAC, 240 VAC, and/or any AC power output. The auxiliary electrical connection **322** can be an auxiliary output for providing power to an auxiliary device, such as a light, a power tool, or any electrical device.

[0051] Additionally, the transfer switch **302** can receive power from the inverter **204** via the electrical connection **330**. In an exemplary embodiment, the transfer switch **302** can switch receiving power between the generator **202** and the inverter **204**. Stated differently, the transfer switch **302** can auctioneer between the generator **202** and the inverter **204**. That is, the transfer switch **302** can automatically switch between the generator **202** and the inverter **204**. For example, if the generator **202** runs out of fuel, the transfer switch **302** can switch to receiving power from the inverter **204**. In this manner, the transfer switch **302** can continue to output power to the control module **304** via the electrical connection **334** even if one of the power sources of the transfer switch **302** (e.g., the generator **202**, the battery **206)** stops providing power to the transfer switch **302**.

[0052] The inverter **204** can provide power to the battery **206**, as well as receive power from the battery **206** via the electrical connection **326**. The inverter **204** can provide the power received from the battery **206** to the transfer witch **302** via the electrical connection **330**. Additionally, the inverter **204** can be coupled with the I/O **306** of the control module **304** via an electrical connection **328**. The inverter **204** can be controlled via the electrical connection **328**. For example, the inverter **204** can be toggled on/off. Further, the inverter **204** can provide data via the connection **328**. As an example, the inverter **204** can provide alarms and/or operating status indications to the control module **304**. The control module **304** can modify the operation of the inverter **204** based on the alarms and/or the operating status indications.

[0053] The control module **304** can have an input/output interface (I/O) **306**, an interface **308**, an output **310**, and the auxiliary port **312**. The control module **304** can provide power to, or receive power from, the auxiliary port **312**. The I/O **306** can allow the control module **304** to communicate with one or more devices. The I/O **306** can include any type of suitable hardware for communication with devices. For example, the I/O **306** can include direct connection interfaces such as Ethernet and Universal Serial Bus (USB), as well as wireless communications, including but not limited to, Wi-Fi, Bluetooth, cellular, Radio Frequency (RF), and so forth.

[0054] The interface **308** can comprise any interface capable of displaying information. For example, the interface **308** can be a digital display that indicates the power usage of the control module **304**. As an example, the interface **308** can indicate the current and voltage being output by the control module **304** via the output **310**. The output **310** can provide either AC or DC power to one or more devices via an output connection **311**. For example, the output **310** can provide be 0-24 VDC, 48 VDC, 125 VDC, 120 VAC, 240 VAC, and so forth power to the one or more devices.

[0055] While the electrical connections **320-334** are shown as direct connections between the various components of the system **300** for ease of explanation, a person skilled in the art would appreciate that the electrical connections **320-334** can comprise additional components, such as resistors, capacitors, inductors, breakers, switches, and so forth.

[0056] **FIG. 4** illustrates an exemplary system **400** for providing power. The system **400** is the same as system **300** of **FIG. 3**, except that the control module **304** of the apparatus **350** has been replaced with control module **402** of the apparatus **450**. For example, the apparatus **450** comprises the cart **110** of **FIGs. 1A-1C**.The control module **402** can have an interface **404**, DC outputs **406a**,**b**, and an auxiliary port **408**.

[0057] The inverter **204** can be coupled with the interface **404** of the control module **402** via an electrical connection **328**. The inverter **204** can be controlled via the electrical connection **328**. For example, the inverter **204** can be toggled on/off. Further, the inverter **204** can provide data via the connection **328**. As an example, the inverter **204** can provide alarms and/or operating status indications to the control module **402**. The control module **402** can modify the operation of the inverter **204** based on the alarms and/or the operating status indications.

[0058] The interface **404** can comprise any interface capable of displaying information. For example, the interface **404** can be a digital display that indicates the power usage of the control module **402**. As an example, the interface **404** can indicate the current and voltage being output by the control module **402** via the DC outputs **406a**,**b**. The DC outputs **406a**,**b** can provide any amount of DC power to one or more devices via output connections **407a**,**b**. For example, the DC outputs **406a**,**b** can provide be 0-24 VDC, 48 VDC, 125 VDC, 240 VDC, 400 VDC, and so forth. The DC outputs **406a**,**b** can provide the same or different power outputs. For example, one of the DC outputs **406a**,**b** outputs a DC voltage between 115-130 VDC, while the other outputs 240-260 VDC. The DC outputs **406a**,**b** can provide power to a variety of DC powered devices, such as DC motors, DC motor operated valves, DC solenoids, DC control power logic circuits, and so forth.

[0059] The control module **402** can provide power to, or receive power from, the auxiliary port **408**. The auxiliary port **408** can provide power to one or more additional devices. For example, the auxiliary port **408** can couple the control module **402** to another device (e.g., a distribution hub, a control module, etc.). That is, the auxiliary port **408** can have the capability to act as a pass through that matches the voltage of the AC input provided to the control module **402**. The auxiliary port **408** can provide 120 VAC, 240 VAC, and/or any AC power output. The auxiliary port **408** can be an auxiliary output for providing power to an auxiliary device, such as a light, a power tool, or any electrical device.

[0060] While the electrical connections **320-334** are shown as direct connections between the various components of the system **400** for ease of explanation, a person skilled in the art would appreciate that the electrical connections **320-334** can comprise additional components, such as resistors, capacitors, inductors, breakers, switches, and so forth.

[0061] **FIG. 5** illustrates an exemplary system **500** for providing power. The system **500** is the same as the system **300** of **FIG. 3** and the system **400** of **FIG. 4**, except that the control module **304** of the apparatus **350** and the control module **402** of the apparatus **450** has been replaced with the control module **502** of the apparatus **550**. For example, the apparatus **550** comprises the cart **110** of **FIGs. 1A-1C**.The control module **502** can have an interface **504**, AC outputs **506a**,**b**, and an auxiliary port **508**.

[0062] The inverter **204** can be coupled with the interface **504** of the control module **502** via an electrical connection **328**. The inverter **204** can be controlled via the electrical connection **328**. For example, the inverter **204** can be toggled on/off. Further, the inverter **204** can provide data via the connection **328**. As an example, the inverter **204** can provide alarms and/or operating status indications to the control module **502**. The control module **502** can modify the operation of the inverter **204** based on the alarms and/or the operating status indications.

[0063] The interface **504** can comprise any interface capable of displaying information. For example, the interface **504** can be a digital display that indicates the power usage of the control module **502**. As an example, the interface **504** can indicate the current and voltage being output by the control module **502** via the AC outputs **506a**,**b**. The AC outputs **406a**,**b** can provide any amount of AC power to one or more devices via output connections **507a**,**b**. For example, the AC output **506a** can be a single phase

AC output, whereas the AC output **506b** can be a three-phase AC output. The AC outputs **506a,b** can provide the same or different output. For example, the AC outputs **506a,b** can provide be 120 VAC, 240 VAC, 400 VAC, and so forth. The AC outputs **506a,b** can provide power to a variety of AC powered devices such as any AC load, AC motors, AC motor operated valves, communication equipment, and so forth.

[0064] The control module **502** can provide power to, or receive power from, the auxiliary port **508**. The auxiliary port **508** can provide power to one or more additional devices. For example, the auxiliary port **508** can couple the control module **502** to another device (e.g., a distribution hub, a control module, etc.). That is, the auxiliary port **508** can have the capability to act as a pass through that matches the voltage of the AC input provided to the control module **502**. The auxiliary port **508** can provide 120 VAC, 240 VAC, and/or any AC power output. The auxiliary port **508** can be an auxiliary output for providing power to an auxiliary device, such as a light, a power tool, or any electrical device.

[0065] While the electrical connections **320-334** are shown as direct connections between the various components of the system **500** for ease of explanation, a person skilled in the art would appreciate that the electrical connections **320-334** can comprise additional components, such as resistors, capacitors, inductors, breakers, switches, and so forth.

[0066] **FIG. 6** illustrates an exemplary system **600** for providing power. The system **600** comprises a battery **602**, an inverter **604**, a variable frequency drive **606**, and a reversing contactor **608**. In an exemplary embodiment, the system **600** comprises an apparatus **650** which comprises the inverter **604**, the variable frequency drive **606**, and the reversing contractor **608**. Additionally, while the battery **602** is illustrated as not being a part of the apparatus **650**, in an exemplary embodiment, the apparatus **650** comprises the battery **602**, as well as all the capabilities of the battery **602**. For example, the apparatus **600** can comprise a portable container that is capable of providing power.

[0067] The battery **602** can be one or more batteries configured to store power, as well as provide the stored power. The battery **602** can provide DC power. The battery **602** can have an associated voltage, such as a 12 V, 24 V, 48 V, 125 V, 250 V, 400 V, etc. battery. Further, the battery **602** can have an output current. For example, the battery **602** can output 5 A, 50 A, 150 A, 300 A, etc. In an exemplary embodiment, the battery **602** can be a 12 V battery with a rated output of up to 150 A. In another exemplary embodiment, the battery **602** can be a 24 V battery with a rated output of up to 300 A. As will be appreciated by one skilled in the art, the battery **602** can be a battery with any voltage and/or current characteristics.

[0068] The battery **602** can be any battery, such as rechargeable batteries or non-rechargeable batteries. The battery **602** can be a Lithium Ion (Li+) battery, a lead acid (Pb) battery, a Lithium Iron Phosphate (LiFePo) battery, or any type of rechargeable battery. The battery **602** comprises an auxiliary output **603**. The auxiliary output **603** can be capable of receiving and/or providing DC power to another device. For example, an apparatus capable of running on DC power can be coupled to the battery **602** to receive power from the battery **602** via the auxiliary output **603**. As an example, a light can be coupled to the battery **602**. As another example, an apparatus capable of providing DC power can be coupled to the battery **602**. As an example, a maintenance battery charger can be coupled to the battery **602** via the auxiliary output **603** to charge the battery **602**. Additionally, the battery **602** can provide power to the inverter **604**. For example, the battery **602** can discharge (e.g., provide power) to the inverter **604** via the electrical connection **628**.

[0069] The inverter **604** can be any device capable of converting DC power to AC power. The inverter **604** can receive DC power from the battery **602** via the electrical connection **620**. The inverter **604** can convert (e.g., invert) the received DC power to AC power. The inverter **604** can provide the converted AC power to the electrical connection **622**. The inverter **604** can have one or more indicators that indicate the status of the inverter **604**. For example, the inverter **604** can have one or more lights and/or displays that indicate the status of the inverter. In an exemplary embodiment, the lights comprise Light Emitting Diodes (LEDs).

[0070] The electrical connection **622** can be coupled to a breaker **612**. The inverter **604** can provide power to the breaker **612** via the electrical connection **622**. The breaker **612** can be coupled to an electrical connection **624**. The electrical connection **624** can be coupled to an electrical connection **626** that is coupled with the variable frequency drive **606**, as well coupled to an electrical connection **628** that is coupled to a step-down transformer **616**. The step-down transformer **616** can reduce (e.g., step-down) the power provided by the inverter **604** to provide a lower power to one or more devices that require a different voltage than the voltage output by the inverter **604**. The step-down transformer **616** is coupled to an electrical connection **630** that is coupled to an output **632**. The output **632** can be a control power output. Thus, the output **632** can receive power from the inverter **604** after the inverter **604** has converted the DC power from the battery **602** to AC power, and step-down the received AC power to provide a lower power output on the output **632**.

[0071] The variable frequency drive **606** receives the AC power from the inverter **604**. The variable frequency drive **606** converts the AC power to three-phase AC power. That is, the variable frequency drive **606** receives single phase AC power from the inverter **604**, and converts the single phase AC power to three-phase AC power. The variable frequency drive **606** can output the three-phase AC power to the electrical connection **632**. The variable frequency drive **606** can provide AC power from 0-480 VAC. Further, the variable frequency drive **606** can be configured to limit inrush current when a load (e.g., an AC load) coupled to the output **640** turns on. The operation of the variable frequency drive **606** can be modified by programming. For example, a ramp rate of the variable frequency drive **606** can be modified, as well as a terminal voltage of the variable frequency drive **606**.

[0072] The electrical connection **634** can be coupled with a breaker **614**. The breaker **614** can be coupled to an electrical connection **636**. The electrical connection **636** can be coupled to the reversing contactor **608**. The reversing contactor **608** can be configured to modify (e.g., shift) the phase of the power output by the variable frequency drive **606**. Specifically, the reversing contactor **608** can shift the power output to ensure the frequency of the three-phase AC power is in the proper phase. The reversing contactor **608** can be coupled with a switch **610** that indicates the phase of the three-phase AC power. A user can manipulate the switch **610** to modify the operating mode of the reversing contactor **608**. For example, the switch **610** can have a forward mode and a reverse mode. Flipping the switch **610** between the two modes reverse the direction of the three-phase AC power. For example, flipping the switch **610** can shift the three-phase AC power by 120 degrees. The reversing contactor **608** can provide an output to the electrical connection **638**, which is coupled to an output **640**. The output **640** can be coupled to a device that operates on three-phase AC power. For example, the output **640** can provide power to a variety of AC powered devices such as any AC load, AC motors, AC motor operated valves, communication equipment, and so forth. While the reversing contactor **608** is illustrated as being separate from the variable frequency drive **606** for ease of explanation, a person of ordinary skill in the art would appreciate that the reversing contactor **608** can be incorporated into the variable frequency drive **606**. Stated differently, the variable frequency drive **606** can include the capabilities of the reversing contactor **608**. Thus, the variable frequency drive **606** can include the capability to modify the phase of the power output by the variable frequency drive **606**.

[0073] Further, the apparatus **600** can comprise one or more indicators (not shown). For example, the one or more indicators can indicate the power output of one or more outputs (e.g., the output **632**, and/or the output **640**). As an example, a first indicator could indicate the AC voltage and/or AC current output by the output **632**, and a second indictor could indicate the three-phase AC voltage and/or AC current output by the output **640**.

[0074] While the electrical connections **620-638** are generally shown as direct connections between the various components of the system **600** for ease of explanation, a person skilled in the art would appreciate that the electrical connections **620-638** can comprise additional components, such as resistors, capacitors, inductors, breakers, switches, and so forth.

[0075] **FIG. 7** illustrates an exemplary system **700** for providing power. The system **700** has a generator **702**, a three-phase power supply **704**, a transfer switch **706**, an inverter **708**, a battery **710**, and a variable frequency drive **716**. Additionally, the system **700** comprises step-down transformers **712a**,**b** and DC to AC inverters **714a**,**b**. Further, the system **700** comprises an apparatus **750**. The apparatus **750** can comprise the transfer switch **706**, the inverter **708**, the battery **710**, the variable frequency drive **716**, the step-down transformers **712a**,**b**, and the DC to AC inverters **714a**,**b**. For example, the apparatus **750** can be a single device (e.g., enclosure) that comprises the components of the system **700** except for the generator **702** and the three-phase power supply **704**.

[0076] The generator **702** can be any generator capable of providing power. For example, the generator **702** can be capable of Alternating Current (AC). The generator **702** can output between 100 VAC and 250 VAC, as well as higher voltages. For example, the generator **702** can output 120 VAC and/or 240VAC. The generator **702** can provide (e.g., output) power to the transfer switch **706** via an electrical connection **720**. For example, the generator **702** can provide AC power to the transfer switch **706** via the electrical connection **720**.

[0077] The generator **702** can operate on any suitable fuel, such as gasoline, diesel, Liquid Propane Gas (LPG), natural gas, and so forth. The generator **702** can operate on two or more fuels. For example, the generator **702** can be capable of operating on both gasoline and LPG. The generator **702** can be capable of switching between the two fuels either manually or automatically. As an example, the generator **702** can default to running on gasoline stored within a gas tank associated with the generator **702**. Once the generator **702** runs out of gasoline within the gas tank, the generator **702** can switch over to the LPG. As another example, the generator **702** can switch between two or more LPG tanks coupled with the generator **702**. That is, when a first of the two or more LPG tanks runs out of the LPG, the generator **702** can manually, or automatically, switch to a second of the two or more LPG tanks.

[0078] The three-phase power supply **704** can be any suitable three-phase power supply **704**. For example, the three-phase power supply **704** can be coupled with a power distribution network that receives power from a power plant. The three-phase power supply **704** can output between 100 VAC and 250 VAC, as well as higher voltages. For example, the three-phase power supply **704** can output 120 VAC and/or 240VAC. The three-phase power supply **704** can provide (e.g., output) power to the transfer switch **706** via an electrical connection **722**. For example, the three-phase power supply **704** can provide AC power to the transfer switch **706** via the electrical connection **722**.

[0079] The transfer switch **706** can comprise any switch capable of switching between two or more power sources. As shown, the transfer switch **706** can receive power from the generator **702** and/or the three-phase power supply **704**. The transfer switch **706** can provide the received power to the inverter **708** via an electrical connection **724**. Alternatively, the transfer switch **706** can provide the received power to an output **707** via an electrical connection **738**. The transfer switch **706** can comprise an adjustable voltage proving time delay module. The adjustable voltage proving time delay module can be configured to variably set at least one of a voltage delay trigger or a time delay trigger when an AC presence is detected on the electrical connection **720**. That is, the adjustable voltage proving time delay module can be configured to set a voltage delay trigger upon receiving power from the generator **702**.

[0080] Additionally, the transfer switch **706** can receive power from the variable frequency drive **716** via the electrical connection **736**. In an exemplary embodiment, the transfer switch **706** can switch between receiving power from the generator **702**, the three-phase power supply **704**, and the variable frequency drive **716**. Stated differently, the transfer switch **706** can auctioneer between the generator **702**, the three-phase power supply **704**, and the variable frequency drive **716**. That is, the transfer switch **706** can automatically switch between the generator **702**, the three-phase power supply **704**, and the variable frequency drive **716**. For example, if the generator **702** runs out of fuel, the transfer switch **706** can switch to receiving power from the variable frequency drive **716**. In this manner, the transfer switch **706** can continue to output power to the output **707** via the electrical connection **738** even if one of the power sources of the transfer switch **706** (e.g., generator **702**, the three-phase power supply **704**, and the variable frequency drive **716**) stops providing power to the transfer switch **706**.

[0081] The inverter **708** can be any device capable of converting AC power to DC power, as well as DC power to AC power. For example, the inverter **708** can be a rectifier. The inverter **708** can receive power from the generator **702** and/or the three- phase power supply **704** via the electrical connection **724**. For example, the inverter **708** can receive AC power from the generator **702** and/or the three- phase power supply **704** via the transfer switch **706** by receiving the power via the electrical connection **724**. The inverter **708** can convert the received AC power to DC power. The inverter **708** can provide (e.g., output) the DC power to the battery **710** via an electrical connection **726**. As an example, the inverter **708** can charge the battery **710** via the electrical connection **726**. The inverter **708** can charge the battery **710**, while also providing power to one or more additional devices. For example, the inverter **708** can provide power to the step-down transformers **712a**,**b** and the DC to AC inverters **714a**,**b**, while also charging the battery **710**.

[0082] Further, the inverter **708** can receive DC power from the battery **710**. For example, the inverter **708** can receive 12 VDC 24 VDC, 48 VDC, 72 VDC, as well as voltages ranging from 100 VDC to 800 VDC. The inverter **708** can invert (e.g., convert) the received DC power to AC power. The inverter **708** can output the inverted AC power. For example, the inverter **708** can output 110 VAC, 120 VAC, or any suitable output AC output. The inverter **708** can provide the inverted AC power to the variable frequency drive **716** via an electrical connection **734**. For example, the inverter **708** can comprise an internal transfer switch. The internal transfer switch can be capable of auctioneering AC power output to the variable frequency drive **716** between the electrical connection **724** (e.g., that is provided by the transfer switch **706**) and the electrical connection **726** (e.g., that is provided by the battery **710**). Stated differently, the inverter **708** is capable of switching (e.g., automatically) between power inputs received from the transfer switch **706**, via the electrical connection **724**, and from the battery **710**, via the electrical connection **726**, in order to maintain a constant output to the variable frequency device **716** via the electrical connection **734**. The inverter **708** can have one or more indicators that indicate the status of the inverter **708**. For example, the inverter **708** can have one or more lights and/or displays that indicate the status of the inverter. In an exemplary embodiment, the lights comprise Light Emitting Diodes (LEDs).

[0083] The battery **710** can be one or more batteries configured to store power, as well as provide the stored power. The battery **710** can provide DC power. The battery **710** can have an associated voltage, such as a 12 V, 24 V, 48 V, 125 V, 250 V, 400 V, etc. battery. Further, the battery **710** can have an output current. For example, the battery **710** can output 5 A, 50 A, 150 A, 300 A, etc. In an exemplary embodiment, the battery **710** can be a 12 V battery with a rated output of up to 150 A. In another exemplary embodiment, the battery **710** can be a 24 V and/or a 48 V battery with a rated output of up to 300 A. As a further exemplary embodiment, the battery **710** can be a 410 V battery. As will be appreciated by one skilled in the art, the battery **710** can be a battery with any voltage and/or current characteristics.

[0084] The battery **710** can be any battery, such as rechargeable batteries or non-rechargeable batteries. The battery **710** can be a Lithium Ion (Li+) battery, a lead acid (Pb) battery, a Lithium Iron Phosphate (LiFePo) battery, or any type of rechargeable battery. The battery **710** can be one or more batteries configured to store power from the inverter **708**. For example, the battery **710** can receive power from the inverter **708** via the electrical connection **726** and store the power from the inverter **708**. Stated differently, the inverter **708** can charge the battery **710** via the electrical connection **726**. Additionally, the battery **710** can provide power to the inverter **708**. For example, the battery **710** can discharge (e.g., provide power) to the inverter **708** via the electrical connection **726**. Accordingly, the battery **710** is capable of receiving power from the inverter **708**, as well as providing power to the inverter **708**.

[0085] Further, the battery **710** can have an auxiliary output (not shown). The auxiliary output can be capable of receiving and/or providing DC power to another device. For example, an apparatus capable of running on DC power can be coupled to the battery **710** to receive power from the battery **710** via the auxiliary output. As an example, a light can be coupled to the battery **710**. As another example, an apparatus capable of providing DC power can be coupled to the battery **710**. As an example, a maintenance battery charger can be coupled to the battery **710** via the auxiliary output to charge the battery **710**.

[0086] The variable frequency drive **716** receives AC power from the inverter **708** via the electrical connection **734**. The variable frequency drive **716** converts the AC power to three-phase AC power. That is, the variable frequency drive **716** receives single phase AC power from the inverter **708**, and converts the single phase AC power to three-phase AC power. The variable frequency drive **716** can output the three-phase AC power to the transfer switch **706** via an electrical connection **736**. The variable frequency drive **716** can provide AC power from 0-480 VAC. The operation of the variable frequency drive **716** can be modified by programming. For example, a ramp rate of the variable frequency drive **716** can be modified, as well as a terminal voltage of the variable frequency drive **716**.

[0087] The step-down transformers **712a**,**b** can reduce (e.g., step-down) the power provided by the inverter **708** and/or the battery **710** to provide a lower power to one or more devices that require a different voltage than the voltage output by the inverter **708** and/or the battery **710**. That is, the step-down transformers **712a**,**b** step-down the voltage provided by the inverter **708** and/or the battery **710** to provide a step-downed voltage to outputs **713a**,**b**. The step-down transformer **712a** can receive DC power via the electrical connection **728** and provide the stepped-down voltage to the output **713a**. The step-down transformer **712b** can receive DC power via the electrical connection **730** and provide the stepped-down voltage to the output **713b**. The outputs **713a**,**b** can receive power from the inverter **708** after the inverter **708** has inverted the AC power from the transfer switch **706** to DC power, and step-down the received DC power to provide a lower power output on the outputs **713a**,**b**. Additionally, the outputs **713a**,**b** can receive DC power from the battery **710** and step-down the received DC power to provide a lower power output on the outputs **713a**,**b**. The outputs **713a**,**b** can output voltages of 12 VDC 24 VDC, 48 VDC, 72 VDC, as well as voltages ranging from 100 VDC to 800 VDC. In an exemplary embodiment, one of the outputs **713a**,**b** outputs 125 VDC, while the other output outputs 250 VDC. The step-down transformers **712a**,**b** can have one or more indicators that indicate the status of the step-down transformers **712a**,**b**. For example, the step-down transformers **712a**,**b** can have one or more lights and/or displays that indicate the status of the step-down transformers **712a**,**b**. In an exemplary embodiment, the lights comprise Light Emitting Diodes (LEDs).

[0088] The DC to AC inverters **714a**,**b** can receive DC power from the inverter **708** and/or the battery **710**. The DC to AC inverters **714a**,**b** can receive DC power from the inverter **708** and/or the battery **710** via an electrical connection **732**. For example, the DC to AC inverters **714a**,**b** can receive 12 VDC 24 VDC, 48 VDC, 72 VDC, as well as voltages ranging from 100 VDC to 800 VDC. The DC to AC inverters **714a**,**b** can invert (e.g., convert) the received DC power to AC power. The DC to AC inverters **714a**,**b** can output the inverted AC power. For example, the DC to AC inverters **714a**,**b** can output AC power between 0-800 VAC or any suitable output. In an exemplary embodiment, the DC to AC inverters **714a**,**b** can output between 110-240 VAC. The DC to AC inverter **714a** can provide the inverted AC power to a device via an output **715a**, and the DC to AC inverter **714b** can provide the inverted AC power to a device via an output **715b**. The DC to AC inverters **714a**,**b** can have one or more indicators that indicate the status of the DC to AC inverters **714a**,**b**. For example, the DC to AC inverters **714a**,**b** can have one or more lights and/or displays that indicate the status of the DC to AC inverters **714a**,**b**. In an exemplary embodiment, the lights comprise Light Emitting Diodes (LEDs).

[0089] While the electrical connections **720-738** are generally shown as direct connections between the various components of the system **700** for ease of explanation, a person skilled in the art would appreciate that the electrical connections **720-738** can comprise additional components, such as resistors, capacitors, inductors, breakers, switches, and so forth.

[0090] **FIG. 8** illustrates an exemplary system **800** for providing power. Specifically, as is explained in more detail below, the system **800** is the same as system **700** of **FIG.** 7 except that the inverter **802** comprises the functionality of the variable frequency drive of **716** of **FIG.** 7.

[0091] The inverter **802** can be any device capable of converting AC power to DC power, as well as DC power to AC power. For example, the inverter **802** can be a rectifier. The inverter **802** can receive power from the generator **702** and/or the three- phase power supply **704** via the electrical connection **724**. For example, the inverter **802** can receive AC power from the generator **702** and/or the three- phase power supply **704** via the transfer switch **706** by receiving the power via the electrical connection **724**. The inverter **802** can convert the received AC power to DC power. The inverter **802** can provide (e.g., output) the DC power to the battery **710** via an electrical connection **726**. As an example, the inverter **802** can charge the battery **710** via the electrical connection **726**. The inverter **802** can charge the battery **710**, while also providing power to one or more additional devices. For example, the inverter **802** can provide power to the step-down transformers **712a**,**b** and the DC to AC inverters **714a**,**b**, while also charging the battery **710**.

[0092] Further, the inverter **802** can receive DC power from the battery **710**. For example, the inverter **802** can receive 12 VDC 24 VDC, 48 VDC, 72 VDC, as well as voltages ranging from 100 VDC to 800 VDC. The inverter **802** can invert (e.g., convert) the received DC power to AC power. The inverter **802** can output the inverted AC power. The inverter **802** can output the inverted AC power to the transfer switch **706** via an electrical connection **820**. For example, the inverter **802** can output 110 VAC, 120 VAC, or any suitable output AC output to the transfer switch **706**.

[0093] The inverter **802** can comprise an internal transfer switch. The internal transfer switch can be capable of auctioneering AC power output to the transfer switch **806** between the electrical connection **724** (e.g., that is provided by the transfer switch **706)** and the electrical connection **726** (e.g., that is provided by the battery **710)**. Stated differently, the inverter **802** is capable of switching (e.g., automatically) between power inputs received from the transfer switch **706**, via the electrical connection **724**, and from the battery **710**, via the electrical connection **726**, in order to maintain a constant output to the transfer switch **706** via the electrical connection **820**. The inverter **802** can have one or more indicators that indicate the status of the inverter **802**. For example, the inverter **802** can have one or more lights and/or displays that indicate the status of the inverter. In an exemplary embodiment, the lights comprise Light Emitting Diodes (LEDs).

[0094] The inverter **802** can be capable of outputting three-phase AC power. That is, the inverter **802** can convert the inverted AC power to three-phase AC power, and output the three-phase AC power to the transfer switch **706** via the electrical connection **820**. The inverter **802** can provide three-phase AC power from 0-480 VAC. The operation of the inverter **802** can be modified by programming. For example, a ramp rate of the inverter **802** can be modified, as well as a terminal voltage of the inverter **802**.

[0095] While the electrical connections **820-836** are generally shown as direct connections between the various components of the system **800** for ease of explanation, a person skilled in the art would appreciate that the electrical connections **820-836** can comprise additional components, such as resistors, capacitors, inductors, breakers, switches, and so forth.

[0096] **FIG. 9** illustrates an exemplary system **900** for providing power. The system **900** has a generator **902**, a three-phase power supply **904**, AC to DC converters **906a**,**b**, a power distribution device **908**, a battery **910**, a variable frequency drive **916**, and a transfer switch **918**. Additionally, the system **900** comprises step-down transformers **912a**,**b** and DC to AC inverters **914a**,**b**. Further, the system **900** comprises an apparatus **950**. The apparatus **950** can comprise the AC to DC converters **906a**,**b**, the power distribution device **908**, the battery **910**, the variable frequency drive **916**, the transfer switch **918**, the step-down transformers **912a**,**b**, and the DC to AC inverters **914a**,**b**. For example, the apparatus **950** can be a single device (e.g., enclosure) that comprises the components of the system **900** except for the generator **902** and the three-phase power supply **904**.

[0097] The generator **902** can be any generator capable of providing power. For example, the generator **902** can be capable of producing Alternating Current (AC). The generator **902** can output between 100 VAC and 250 VAC, as well as higher voltages. For example, the generator **902** can output 120 VAC and/or 240VAC. The generator **902** can provide (e.g., output) power to the AC to DC converter **906a** via an electrical connection **920**. For example, the generator **902** can provide AC power to the AC to DC converter **906a** via the electrical connection **920**.

[0098] The generator **902** can operate on any suitable fuel, such as gasoline, diesel, Liquid Propane Gas (LPG), natural gas, and so forth. The generator **902** can operate on two or more fuels. For example, the generator **902** can be capable of operating on both gasoline and LPG. The generator **902** can be capable of switching between the two fuels either manually or automatically. As an example, the generator **902** can default to running on gasoline stored within a gas tank associated with the generator **902**. Once the generator **902** runs out of gasoline within the gas tank, the generator **902** can switch over to the LPG. As another example, the generator **902** can switch between two or more LPG tanks coupled with the generator **902**. That is, when a first of the two or more LPG tanks runs out of the LPG, the generator **902** can manually, or automatically, switch to a second of the two or more LPG tanks.

[0099] The three-phase power supply **904** can be any suitable three-phase power supply **904**. For example, the three-phase power supply **904** can be coupled with a power distribution network that receives power from a power plant. The three-phase power supply **904** can output between 100 VAC and 480 VAC, as well as higher voltages. For example, the three-phase power supply **904** can output 120 VAC and/or 240VAC. The three-phase power supply **904** can provide (e.g., output) power to the AC to DC converter **906b** via an electrical connection **924**. For example, the three-phase power supply **904** can provide AC power to the AC to DC converter **906b** via the electrical connection **924**.

[00100] The AC to DC converters **906a**,**b** can convert AC power to DC power. For example, the AC to DC converters **906a**,**b** can be rectifiers. The AC to DC converters **906a**,**b** can receive power from the generator **902** and/or the three- phase power supply **904** via the electrical connections **920**,**924**. For example, the AC to DC converter **906a** can receive AC power from the generator **902**, and the AC to DC converter **906b** can receive AC power from the three- phase power supply **904**. Specifically, the AC to DC converter **906a** can receive AC power from the generator **902** via the electrical connection **920**, and the AC to DC converter **906b** can receive AC power from the three- phase power supply **904** via the electrical connection **924**. The AC to DC converters **906a**,**b** can convert the received AC power to DC power. The AC to DC converters **906a**,**b** can provide (e.g., output) the DC power to the power distribution device **908**. Specifically, the AC to DC converter **906a** can provide AC power to the power distribution device **908** via the electrical connection **922**, and the AC to DC converter **906b** can provide AC power to the power distribution device **908** via the electrical connection **926**.

[00101] The power distribution device **908** can be any device capable of distributing power. Specifically, the power distribution device **908** can be configured to receive power from the AC to DC converters **906a**,**b** and to provide the received power to the battery **910**, the step-down transformers **912a**,**b**, the DC to AC inverters **914a**,**b**, and/or the variable frequency drive **916**. The power distribution device **908** can receive power from the generator **902** and/or the three-phase power supply **904** via the AC to DC converters **906a**,**b**. The power distribution device **908** can receive 12 VDC 24 VDC, 48 VDC, 72 VDC, as well as voltages ranging from 100 VDC to 800 VDC. For example, the power distribution device **908** can receive DC power from the AC to DC converter **906a** via the electrical connection **922**, as well as receive DC power from the AC to DC converter **906b** via the electrical connection **926**. The power distribution device **908** can provide (e.g., output) the DC power to the battery **910** via an electrical connection **928**. As an example, the power distribution device **908** can charge the battery **910** via the electrical connection **928**. The power distribution device **908** can charge the battery **910**, while also providing power to one or more additional devices. For example, the power distribution device **908** can provide power

to the step-down transformers **912a**,**b** and the DC to AC inverters **914a**,**b**, while also charging the battery **910**.

[0100] Further, the power distribution device **908** can receive DC power from the battery **910**. For example, the power distribution device **908** can receive 12 VDC 24 VDC, 48 VDC, 72 VDC, as well as voltages ranging from 100 VDC to 800 VDC. The power distribution device **908** can invert (e.g., convert) the received DC power to AC power. That is, the power distribution device **908** can invert the DC power received from the battery **910**, as well as the AC to DC converters **906a**,**b**. The power distribution device **908** can output the inverted AC power. For example, the power distribution device **908** can output AC power between 0-800 VAC or any suitable output. In an exemplary embodiment, the power distribution device **908** can output between 110-240 VAC. The power distribution device **908** can provide the inverted AC power to the variable frequency drive **916** via an electrical connection **936**. The power distribution device **908** can comprise an internal transfer switch. The internal transfer switch can be capable of auctioneering DC power that is received from the electrical connection **922** (e.g., that is provided by the AC to DC converter **906a**), the electrical connection **926** (e.g., that is provided by the AC to DC converter **906b**), and the electrical connection **928** (e.g., that is provided by the battery **910**). Stated differently, the power distribution device **908** is capable of switching (e.g., automatically) between power inputs received from the AC to DC converter **906a**, via the electrical connection **922**; from the AC to DC converter **906b**, via the electrical connection **926**; and from the battery **910**, via the electrical connection **928**, in order to maintain a constant output to the variable frequency device **916** via the electrical connection **936**. The power distribution device **908** can have one or more indicators that indicate the status of the power distribution device **908**. For example, the power distribution device **908** can have one or more lights and/or displays that indicate the status of the inverter. In an exemplary embodiment, the lights comprise Light Emitting Diodes (LEDs).

[0101] The variable frequency drive **916** receives AC power from the power distribution device **908** via the electrical connection **936**. The variable frequency drive **916** converts the AC power to three-phase AC power. That is, the variable frequency drive **916** receives single phase AC power from the power distribution device **908**, and converts the single phase AC power to three-phase AC power. The variable frequency drive **916** can output the three-phase AC power to the transfer switch **906** via an electrical connection **938**. The variable frequency drive **916** can provide AC power from 0-480 VAC. The operation of the variable frequency drive **916** can be modified by programming. For example, a ramp rate of the variable frequency drive **916** can be modified, as well as a terminal voltage of the variable frequency drive **916**.

[0102] The transfer switch **918** can comprise any switch capable of switching between two or more power sources. As shown, the transfer switch **918** can receive power from the variable frequency drive **916**, as well as the three-phase power supply **904**. Specifically, the transfer switch **918** receives three-phase AC power from the variable frequency drive **916** via the electrical connection **938**, and the transfer switch **918** receives three-phase AC power from the three-phase power supply **904** via the electrical connection **940**. The transfer switch **918** can output the received power. Specifically, the transfer switch **918** can output the receive power to an output **919**.

[0103] Additionally, the transfer switch **918** can switch between receiving power from the three-phase power supply **904**, and the variable frequency drive **916**. Stated differently, the transfer switch **918** can auctioneer between the three-phase power supply **904** and the variable frequency drive **916**. That is, the transfer switch **918** can automatically switch between receiving power from the three-phase power supply **904** and the variable frequency drive **916**. For example, if the three-phase power supply **904** is unable to provide power, the transfer switch **918** can switch to receiving power from the variable frequency drive **916**. In this manner, the transfer switch **918** can continue to output power to the output **919** even if one of the power sources of the transfer switch **916** (e.g., the three-phase power supply **904**, or the variable frequency drive **916**) stops providing power to the transfer switch **918**.

[0104] The battery **910** can be one or more batteries configured to store power, as well as provide the stored power. The battery **910** can provide DC power. The battery **910** can have an associated voltage, such as a 12 V, 24 V, 48 V, 125 V, 250 V, 400 V, etc. battery. Further, the battery **910** can have an output current. For example, the battery **910** can output 5 A, 50 A, 150 A, 300 A, etc. In an exemplary embodiment, the battery **910** can be a 12 V battery with a rated output of up to 150 A. In another exemplary embodiment, the battery **910** can be a 24 V and/or a 48 V battery with a rated output of up to 300 A. As a further exemplary embodiment, the battery **910** can be a 410 V battery. As will be appreciated by one skilled in the art, the battery **910** can be a battery with any voltage and/or current characteristics.

[0105] The battery **910** can be any battery, such as rechargeable batteries or non-rechargeable batteries. The battery **910** can be a Lithium Ion (Li+) battery, a lead acid (Pb) battery, a Lithium Iron Phosphate (LiFePo) battery, or any type of rechargeable battery. The battery **910** can be one or more batteries configured to store power from the power distribution device **908**. For example, the battery **910** can receive power from the power distribution device **908** via the electrical connection **928** and store the power from the power distribution device **908**. Stated differently, the power distribution device **908** can charge the battery **910** via the electrical connection **928**. Additionally, the battery **910** can provide power to the power distribution device **908**. For example, the battery **910** can discharge (e.g., provide power) to the power distribution device **908** via the electrical connection **928**. Accordingly, the battery **910** is capable of receiving power from the power distribution device **908**, as well as providing power to the power distribution device **908**.

[0106] Further, the battery **910** can have an auxiliary output (not shown). The auxiliary output can be capable of receiving and/or providing DC power to another device. For example, an apparatus capable of running on DC power can be coupled to the battery **910** to receive power from the battery **910** via the auxiliary output. As an example, a light can be coupled to the battery **910**. As another example, an apparatus capable of providing DC power can be coupled to the battery **910**. As an example, a maintenance battery charger can be coupled to the battery **910** via the auxiliary output to charge the battery **910**.

[0107] The step-down transformers **912a,b** can reduce (e.g., step-down) the power provided by the power distribution device **908** and/or the battery **910** to provide a lower power to one or more devices that require a different voltage than the voltage output by the power distribution device **908** and/or the battery **910**. That is, the step-down transformers **912a,b** step-down the voltage provided by the power distribution device **908** and/or the battery **910** to provide a step-downed voltage to outputs **913a,b**. The step-down transformer **912a** can receive DC power via the electrical connection **930** and provide the stepped-down voltage to the output **913a**. The step-down transformer **912b** can receive DC power via the electrical connection **932** and provide the stepped-down voltage to the output **913b**. The outputs **913a,b** can receive power from the power distribution device **908**, and step-down the received DC power to provide a lower power output on the outputs **913a,b**. Additionally, the outputs **913a,b** can receive DC power from the battery **910** and step-down the received DC power to provide a lower power output on the outputs **913a**,**b**. The outputs **913a**,**b** can output voltages of 12 VDC 24 VDC, 48 VDC, 72 VDC, as well as voltages ranging from 100 VDC to 800 VDC. In an exemplary embodiment, one of the outputs **913a**,**b** outputs 125 VDC, while the other output outputs 250 VDC. The step-down transformers **912a**,**b** can have one or more indicators that indicate the status of the step-down transformers **912a**,**b**. For example, the step-down transformers **912a**,**b** can have one or more lights and/or displays that indicate the status of the step-down transformers **912a**,**b**. In an exemplary embodiment, the lights comprise Light Emitting Diodes (LEDs).

[0108] The DC to AC inverters **914a**,**b** can receive DC power from the power distribution device **908** and/or the battery **910**. The DC to AC inverters **914a**,**b** can receive DC power from the power distribution device **908** and/or the battery **910** via an electrical connection **934**. For example, the DC to AC inverters **914a**,**b** can receive 12 VDC 24 VDC, 48 VDC, 72 VDC, as well as voltages ranging from 100 VDC to 800 VDC. The DC to AC inverters **914a**,**b** can invert (e.g., convert) the received DC power to AC power. The DC to AC inverters **914a**,**b** can output the inverted AC power. For example, the DC to AC inverters **914a**,**b** can output the inverted AC power. For example, the DC to AC inverters **914a**,**b** can output AC power between 0-800 VAC or any suitable output. In an exemplary embodiment, the power distribution device **908** can output between 110-240 VAC. The DC to AC inverter **914a** can provide the inverted AC power to a device via an output **915a**, and the DC to AC inverter **914b** can provide the inverted AC power to a device via an output **915b**. The DC to AC inverters **914a**,**b** can have one or more indicators that indicate the status of the DC to AC inverters **914a**,**b**. For example, the DC to AC inverters **914a**,**b** can have one or more lights and/or displays that indicate the status of the DC to AC inverters **914a**,**b**. In an exemplary embodiment, the lights comprise Light Emitting Diodes (LEDs).

[0109] While the electrical connections **920-940** are generally shown as direct connections between the various components of the system **900** for ease of explanation, a person skilled in the art would appreciate that the electrical connections **920-940** can comprise additional components, such as resistors, capacitors, inductors, breakers, switches, and so forth.

[0110] **FIG. 10** illustrates an exemplary system **1000** for providing power. Specifically, as is explained in more detail below, the system **1000** is the same as system **900** of **FIG. 9** except that the power distribution device **1002** comprises the functionality of the variable frequency drive of **916** of **FIG. 9**.

[0111] The power distribution device **1002** can be any device capable of distributing power. Specifically, the power distribution device **1002** can be configured to receive power from the AC to DC converters **906a**,**b** and to provide the received power to the battery **910**, the step-down transformers **912a**,**b**, the DC to AC inverters **914a**,**b**, and/or the variable frequency drive **916**. The power distribution device **1002** can receive power from the generator **902** and/or the three-phase power supply **904** via the AC to DC converters **906a**,**b**. The power distribution device **1002** can receive 12 VDC 24 VDC, 48 VDC, 72 VDC, as well as voltages ranging from 100 VDC to 800 VDC. For example, the power distribution device **1002** can receive DC power from the AC to DC converter **906a** via the electrical connection **922**, as well as receive DC power from the AC to DC converter **906b** via the electrical connection **926**. The power distribution device **1002** can provide (e.g., output) the DC power to the battery **910** via an electrical connection **928**. As an example, the power distribution device **1002** can charge the battery **910** via the electrical connection **928**. The power distribution device **1002** can charge the battery **910**, while also providing power to one or more additional devices. For example, the power distribution device **1002** can provide power to the step-down transformers **912a**,**b** and the DC to AC inverters **914a**,**b**, while also charging the battery **910**.

[0112] Further, the power distribution device **1002** can receive DC power from the battery **910**. For example, the power distribution device **1002** can receive 12 VDC 24 VDC, 48 VDC, 72 VDC, as well as voltages ranging from 100 VDC to 800 VDC. The power distribution device **1002** can invert (e.g., convert) the received DC power to AC power. That is, the power distribution device **1002** can invert the DC power received from the battery **910**, as well as the AC to DC converters **906a**,**b**. The power distribution device **1002** can output the inverted AC power. For example, the power distribution device **1002** can output 110 VAC, 120 VAC, or any suitable output AC output. The power distribution device **1002** can provide the inverted AC power to the transfer switch **1016** via an electrical connection **1020**. The power distribution device **1002** can comprise an internal transfer switch. The internal transfer switch can be capable of auctioneering DC power that is received from the electrical connection **922** (e.g., that is provided by the AC to DC converter **906a**), the electrical connection **926** (e.g., that is provided by the AC to DC converter **906b**), and the electrical connection

928 (e.g., that is provided by the battery **910**). Stated differently, the power distribution device **908** is capable of switching (e.g., automatically) between power inputs received from the AC to DC converter **906a**, via the electrical connection **922**; from the AC to DC converter **906b**, via the electrical connection **926**; and from the battery **910**, via the electrical connection **928**, in order to maintain a constant output to the transfer switch **1016** via an electrical connection **1020**. The power distribution device **1002** can have one or more indicators that indicate the status of the power distribution device **1002**. For example, the power distribution device **1002** can have one or more lights and/or displays that indicate the status of the inverter. In an exemplary embodiment, the lights comprise Light Emitting Diodes (LEDs).

[0113] The power distribution device **1002** can be capable of outputting three-phase AC power. That is, the power distribution device **1002** can invert the received DC power to AC and convert the inverted AC power to three-phase AC power, and output the three-phase AC power to the transfer switch **1016** via the electrical connection **1020**. The power distribution device **1002** can provide three-phase AC power from 0-480 VAC. The operation of the power distribution device **1002** can be modified by programming. For example, a ramp rate of the power distribution device **1002** can be modified, as well as a terminal voltage of the power distribution device **1002**.

[0114] While the electrical connections **1020-1038** are generally shown as direct connections between the various components of the system **1000** for ease of explanation, a person skilled in the art would appreciate that the electrical connections **1020-1038** can comprise additional components, such as resistors, capacitors, inductors, breakers, switches, and so forth.

[0115] **FIG. 11** illustrates a flowchart of an exemplary method **1100** for providing power. At step **1110**, power is received from at least one of a generator (e.g., the generator **202** of **FIGs. 2-5**, the generator **702** of **FIGs. 7** & **8**, and/or the generator **902** of **FIGs. 9** & **10**) or a battery (e.g., the battery **206** of **FIGs. 2-5**, the battery **602** of **FIG. 6**, the battery **710** of **FIGs. 7** & **8**, and/or the battery **910** of **FIGs. 9** & **10**). The power can be received from the generator or the battery by an inverter (e.g., the inverter **204** of **FIGs. 2-5**, the inverter **604** of **FIG. 6**, the inverter **708** of **FIG. 7**, the inverter **802** of **FIG. 8**, the power distribution device **908** of **FIG. 9**, and/or the power distribution device **1002** of **FIG. 10**).

[0116] At step **1120**, if AC power is received from the generator, providing the AC power to a distribution hub (e.g., the distribution hub **208** of **FIG. 2**, the control module). For example, the inverter can receive the AC power from the generator, and provide the AC power to the distribution hub. As another example, the generator can provide the AC power directly to the distribution hub. The distribution hub may provide the power to one or more devices. For example, the distribution hub can provide the power to one or more power providing devices (e.g., the power providing device **216a**,**b** of **FIG. 2**).

[0117] At step **1130**, the received AC power is converted to DC power, and the DC power is provided to the battery. For example, the inverter can convert the AC power to DC power, and provide the DC power to the battery. The battery can receive the DC power, and can charge the battery with the received DC power. The battery can provide power to one or more devices. For example, the battery can provide power to one or more devices coupled with an auxiliary output of the battery (e.g., the auxiliary output **210** of **FIG. 2**).

[0118] At step **1140**, if DC power is received, the received DC power is inverted to AC power. The DC power can be received from the battery by the inverter. The inverter can convert the received DC power to AC power. For example, if the generator is unable to provide power, the inverter may switch to receiving power from the battery.

[0119] At step **1150**, the AC power can be provided to the distribution hub. The inverter can provide the AC power to the distribution hub. The distribution hub may provide the power to one or more devices. For example, the distribution hub can provide the power to one or more power providing devices (e.g., the power providing device **216a**,**b** of **FIG. 2**).

[0120] **FIG. 12** illustrates a flowchart of an exemplary method **1200** for providing power. At step **1210**, power is received from at least one of a generator (e.g., the generator **202** of **FIGs. 2-5**, the generator **702** of **FIGs. 7 & 8**, and/or the generator **902** of **FIGs. 9 & 10**) or a battery (e.g., the battery **206** of **FIGs. 2-5**, the battery **602** of **FIG. 6**, the battery **710** of **FIGs. 7 & 8**, and/or the battery **910** of **FIGs. 9 & 10**). The power can be received from the generator or the battery by a transfer switch (e.g., the transfer switch **302** of **FIG. 3-5**).

[0121] At step **1220**, if AC power is received from the generator, providing the AC power to a control module (e.g., the control module **304** of **FIG. 3**, the control module **402** of **FIG. 4**, the control module **502** of **FIG. 5**). For example, the transfer switch can receive the AC power from the generator, and provide the AC power to the control module. As another example, the generator can provide the AC power directly to the control module. The control module may provide the power to one or more devices. For example, the control module can provide DC power to one or more devices, as well as can provide AC power to one or more devices.

[0122] At step **1230**, if AC power is received from the generator and the battery is not fully charge, the AC power is provided to an inverter (e.g., the inverter **204** of **FIGs. 2-5**, the inverter **604** of **FIG. 6**, the inverter **708** of **FIG. 7**, the inverter **802** of **FIG. 8**, the power distribution device **908** of **FIG. 9**, and/or the power distribution device **1002** of **FIG. 10**). For example, the transfer switch can provide the power to the inverter.

[0123] At step **1240**, the AC power is converted to DC power by the inverter, and the DC power is provided to the battery. For example, the inverter can convert the AC power to DC power, and provide the DC power to the battery. The battery can receive the DC power, and can charge the battery with the received DC power. The battery can provide power to one or more devices. For example, the battery can provide power to one or more devices coupled with an auxiliary output of the battery (e.g., the auxiliary output **210** of **FIG. 2**).

[0124] At step **1250**, if DC power is received, the received DC power is inverted to AC power. The DC power can be received from the battery by the inverter. The inverter can convert the received DC power to AC power. For example, if the generator is unable to provide power, the inverter may switch to receiving power from the battery. The inverter may output the inverted AC power. For example, the inverter may output the inverted AC power to the transfer switch.

[0125] At step **1260**, the inverted AC power is received from the inverter. For example, the transfer switch receives the inverted AC power from the inverter. At step **1270**, the AC power can be provided to the control module. The transfer switch can provide the inverted AC power received from the inverter to the control module. The control module may provide the power to one or more devices. For example, the control module can provide the power to one or more power providing devices (e.g., the power providing device **216a,b** of **FIG. 2**). Additionally, the control module can output either DC power, AC power, and/or three-phase power via an output (e.g., the output **310** of **FIG. 3**; the DC outputs **406a,b** of **FIG. 4**; the AC single phase output **506a**, and/or the three-phase AC output **506b** of **FIG. 5**).

[0126] **FIG. 13** illustrates a flowchart of an exemplary method **1300** for providing power. At step **1310**, DC power is received from a battery (e.g., the battery **602** of **FIG. 6**). For example, the DC power can be received by an inverter (e.g., the inverter **604** of **FIG.**

6). At step **1320**, the DC power can be inverted to AC power. For example, the DC power can be inverted to AC power by the inverter. At step **1330**, the AC power can be provided to a variable frequency drive (e.g., the variable frequency drive **606** of **FIG. 6**.) For example, the inverter can provide the AC power to the variable frequency device. The variable frequency drive can convert the received AC power from single-phase AC power to three-phase AC power. At step **1340**, three-phase power is output. For example, the variable frequency drive can output the three-phase power.

[0127] **FIG. 14** illustrates a flowchart of an exemplary method **1400** for providing power. At step **1410**, power is received from at least one of a generator (e.g., the generator **702** of **FIGs. 7 & 8**), a three-phase power supply (e.g., the three-phase power supply **704** of **FIGs. 7 & 8**) or a battery (e.g., the battery **710** of **FIGs. 7 & 8**). The power can be received from the generator, the three-phase power supply, or the battery by a transfer switch (e.g., the transfer switch **706** of **FIG 7 & 8**).

[0128] At step **1420**, if AC power is received from the three-phase power supply, the received three-phase power is output. For example, the transfer switch (e.g., the transfer switch **706** of **FIG 7 & 8)** may output the three-phase power.

[0129] At step **1430**, if AC power is received from the generator, the received AC power is provided to a variable frequency drive (e.g., the variable frequency drive **716** of **FIG. 7)** and the three-phase power is output. For example, the inverter can provide AC power to the variable frequency drive, which converts the single-phase AC power to three-phase AC power. The variable frequency drive can output the three-phase AC power. The variable frequency drive can output the three-phase AC power to one or more devices.

[0130] At step **1440**, if AC power is received from the generator, providing the AC power to an inverter (e.g., the inverter **708** of **FIG. 7** and/or the inverter **802** of **FIG. 8**). For example, the transfer switch can receive the AC power from the generator, and provide the AC power to the inverter. The inverter can convert the received AC power to DC power. The inverter may provide the power to one or more devices. For example, the inverter can convert the AC power to DC power, and provide the DC power to the battery The battery can receive the DC power, and can charge the battery with the received DC power. The battery can provide power to one or more devices. For example, the battery can provide power to one or more devices coupled with an auxiliary output of the battery (e.g., the auxiliary output **210** of **FIG. 2**).

[0131] At step **1450**, the DC Power is output, and if the battery is not fully charged, provide the DC power to the battery. The DC power may be output to one or more devices. For example, the DC power may be output to a step-down transformer (e.g., the step-down transformers **712a**,**b** of **FIGs. 7** & **8**) or to a DC to AC inverter (e.g., the DC to AC inverters **714a**,**b** of **FIGs. 7** & **8**).

[0132] At step **1460**, if power is received from the battery, the received DC power is inverted to AC power by the inverter. The inverter can provide the inverted AC power to one or more devices. For example, the inverter can provide the inverted AC power to the variable frequency drive. At step **1470**, the variable frequency drive can receive the inverted AC power from the inverter. The variable frequency drive can convert the single-phase AC power to three-phase AC power. The variable frequency drive can output the three-phase AC power. The variable frequency drive can output the three-phase AC power to one or more devices.

[0133] **FIG. 15** illustrates a flowchart of an exemplary method **1500** for providing power. At step **1510**, power is received from at least one of a generator (e.g., the generator **902** of **FIGs. 9** & **10**), a three-phase power supply (e.g., the three-phase power supply **904** of **FIGs. 9** & **10**) or a battery (e.g., the battery **910** of **FIGs. 9** & **10**). The power can be received from the generator, the three-phase power supply, or the battery by a transfer switch (e.g., the transfer switch **706** of **FIG** 7 & **8**). The power can be received from the generator, the three-phase power supply, or the battery by a power distribution device (e.g., the power distribution device **908** of **FIGs. 9** & **10**).

[0134] At step **1520**, if AC power is received from the generator or the three-phase power supply, the AC power is converted to DC power. For example, the generator or the three-phase power supply can provide the AC power to the power distribution device (e.g., the power distribution device **908** of **FIG. 9** and/or the power distribution device **1002** of **FIG. 10**). The power distribution device can convert the AC power to DC power.

[0135] The AC power can be provided to an inverter (e.g., the inverter **708** of **FIG.** 7, the inverter **802** of **FIG. 8**, the power distribution device **908** of **FIG. 9**, and/or the power distribution device **1002** of **FIG. 10**). For example, the transfer switch can receive the AC power from the generator, and provide the AC power to the inverter. The inverter can convert the received AC power to DC power. The inverter may provide the power to one or more devices. For example, the inverter can convert the AC power to DC power, and provide the DC power to the battery The battery can receive the DC power, and can charge the battery with the received DC power. The battery can provide power to one or more devices. For example, the battery can provide power to one or more devices coupled with an auxiliary output of the battery (e.g., the auxiliary output **210** of **FIG. 2**).

[0136] At step **1530**, if power is received from the battery, DC power is received. At step **1540**, the received DC power can be inverted to AC power by the inverter. The inverter can provide the inverted AC power to one or more devices. For example, the inverter can provide the inverted AC power to the variable frequency drive. The variable frequency drive can receive the inverted AC power from the inverter. The variable frequency drive can convert the single-phase AC power to three-phase AC power. The variable frequency drive can output the three-phase AC power. The variable frequency drive can output the three-phase AC power to one or more devices.

[0137] At step **1550**, the DC power can be provided to a step down transformer and output DC power. The DC power may be output to one or more devices. For example, the DC power may be output to a step-down transformer (e.g., the step-down transformers **912a**,**b** of **FIGs. 9 & 10**).

[0138] At step **1560**, the DC power is provided to a DC to AC inverter (e.g., the DC to AC inverters **914a**,**b** of **FIGs. 9 & 10**). The DC to AC inverter may output the AC power. The DC to AC inverter may output the AC power to one or more devices.

[0139] At step **1570**, if AC power is received from the generator or the three-phase power supply and the battery is not fully charged, the AC power is converted to DC Power and the DC power is provided to the battery. For example, the AC power received from the generator or the three-phase power supply can be provided to the inverter. The inverter can convert the received AC power to DC power. The inverter can provide the power to one or more devices. For example, the inverter can convert the AC power to DC power, and provide the DC power to the battery The battery can receive the DC power, and can charge the battery with the received DC power.

[0140] **FIG. 16** illustrates a flowchart of an exemplary method **1600** for providing power. At step **1610**, determine the loss of power of a device. For example, a critical piece of equipment can lose power. At step **1620**, one or more cables associated with the device are spliced. For example, the one or more cable may provide power to the device, and the one or more cables can be spliced by one or more cable clamps.

[0141] At step **1630**, a portable power providing device (e.g., the system **100** of **FIG. 1**, the system **200** of **FIG. 2**, the system **300** of **FIG. 3**, the system **400** of **FIG. 4**, the system **500** of **FIG. 5**, the system **600** of **FIG. 6**, the system **700** of **FIG. 7**, the system **800** of **FIG. 8**, the system **900** of **FIG. 9**, and/or the system **1000** of **FIG. 10)** is coupled to the one or more spliced cables. For example, the portable power providing device can be electrically connected to the one or more cable clamps.

[0142] At step **1640**, power is provided to the device via a battery (e.g., the battery **206** of **FIGs. 2-5**, the battery **602** of **FIG. 6**, the battery **710** of **FIGs. 7 & 8**, and/or the battery **910** of **FIGs. 9 & 10)** or a generator (e.g., the generator **202** of **FIGs. 2-5**, the generator **702** of **FIGs. 7 & 8**, and/or the generator **902** of **FIGs. 9 & 10)** associated with the portable power providing device.

[0143] **FIG. 17** shows an exemplary system **1700**. The control module **102**, the transfer switch **106**, and/or the inverter **108** of **FIG. 1**; the inverter **204** and/or the distribution hub **208** of **FIG. 2**; the control module **304** of **FIG. 3**; the control module **402** of **FIG. 4**; and/or the control module **502** of **FIG. 5**; the inverter **604** and/or the variable frequency drive **606** of **FIG. 6**; the inverter **708**, the transfer **706**, and/or the variable frequency drive **716** of **FIG. 7**; the inverter **802** of **FIG. 8**; the power distribution device **908**, the variable frequency drive **916**, and/or the transfer switch **918** of **FIG. 9**; and/or the power distribution device **1002** of **FIG. 10** may be a computer **1701** as shown in **FIG. 17** or can be controlled by the computer **1701**.

[0144] The computer **1701** may comprise one or more processors **1703**, a system memory **1712**, and a bus **1713** that couples various system components including the one or more processors **1703** to the system memory **1712**. In the case of multiple processors **1703**, the computer **1701** may utilize parallel computing. The bus **1713** is one or more of several possible types of bus structures, including a memory bus or memory controller, a peripheral bus, an accelerated graphics port, or local bus using any of a variety of bus architectures.

[0145] The computer **1701** may operate on and/or comprise a variety of computer readable media (e.g., non-transitory). The readable media may be any available media that is accessible by the computer **1701** and may include both volatile and non-volatile media, removable and non-removable media. The system memory **1712** has computer readable media in the form of volatile memory, such as random access memory (RAM), and/or non-volatile memory, such as read only memory (ROM). The system memory **1712** may store data such as the power data **1707** and/or program modules such as the operating system **1705** and the power software **1706** that are accessible to and/or are operated on by the one or more processors **1703**.

[0146] The computer **1701** may also have other removable/non-removable, volatile/non-volatile computer storage media. **FIG. 17** shows the mass storage device **1704** which may provide non-volatile storage of computer code, computer readable instructions, data structures, program modules, and other data for the computer **1701**. The mass storage device **1704** may be a hard disk, a removable magnetic disk, a removable optical disk, magnetic cassettes or other magnetic storage devices, flash memory cards, CD-ROM, digital versatile disks (DVD) or other optical storage, random access memories (RAM), read only memories (ROM), electrically erasable programmable read-only memory (EEPROM), and the like.

[0147] Any quantity of program modules may be stored on the mass storage device **1704**, such as the operating system **1705** and the power software **1706**. Each of the operating system **1705** and the power software **1706** (or some combination thereof) may have elements of the program modules and the power software **1706**. The power data **1707** may also be stored on the mass storage device **1704**. The power data **1707** may be stored in any of one or more databases known in the art. Such databases may be DB2®, Microsoft® Access, Microsoft® SQL Server, Oracle®, MySQL, PostgreSQL, and the like. The databases may be centralized or distributed across locations within the network **1715**.

[0148] A user may enter commands and information into the computer **1701** via an input device (not shown). Examples of such input devices comprise, but are not limited to, a keyboard, pointing device (*e.g.*, a computer mouse, remote control), a microphone, a joystick, a scanner, tactile input devices such as gloves, and other body coverings, motion sensor, and the like These and other input devices may be connected to the one or more processors **1703** via a human machine interface **1702** that is coupled to the bus **1713**, but may be connected by other interface and bus structures, such as a parallel port, game port, an IEEE 1394 Port (also known as a Firewire port), a serial port, network adapter **1708**, and/or a universal serial bus (USB).

[0149] The display device **1711** may also be connected to the bus **1713** via an interface, such as the display adapter **1709**. It is contemplated that the computer **1701** may have more than one display adapter **1709** and the computer **1701** may have more than one display device **1711**. The display device **1711** may be a monitor, an LCD (Liquid Crystal Display), light emitting diode (LED) display, television, smart lens, smart glass, and/or a projector. In addition to the display device **1711**, other output peripheral devices may be components such as speakers (not shown) and a printer (not shown) which may be connected to the computer **1701** via the Input/Output Interface **1710**. Any step and/or result of the methods may be output (or caused to be output) in any form to an output device. Such output may be any form of visual representation, including, but not limited to, textual, graphical, animation, audio, tactile, and the like. The display device **1711** and computer **1701** may be part of one device, or separate devices.

[0150] The computer **1701** may operate in a networked environment using logical connections to one or more remote computing devices **1714a,b,c**. A remote computing device may be a personal computer, computing station (e.g., workstation), portable computer (e.g., laptop, mobile phone, tablet device), smart device (e.g., smartphone, smart watch, activity tracker, smart apparel, smart accessory), security and/or monitoring device, a server, a router, a network computer, a peer device, edge device, and so on. Logical connections between the computer **1701** and a remote computing device **1714a,b,c** may be made via a network **1715**, such as a local area network (LAN) and/or a general wide area network (WAN). The network **1715** may utilize one or more communication protocols such as Wi-Fi, Bluetooth, or may be cellular network (e.g., a Long Term Evolution (LTE) network, a 4G network, a 5G network, etc.). Such network connections may be through the network adapter **1708**. The network adapter **1708** may be implemented in both wired and wireless environments. Such networking environments are conventional and commonplace in dwellings, offices, enterprise-wide computer networks, intranets, and the Internet.

[0151] Application programs and other executable program components such as the operating system **1705** are shown herein as discrete blocks, although it is recognized that such programs and components reside at various times in different storage components of the computing device **1701**, and are executed by the one or more processors **1703** of the computer. An implementation of the power software **1706** may be stored on or sent across some form of computer readable media. Any of the described methods may be performed by processor-executable instructions embodied on computer readable media.

[0152] While specific configurations have been described, it is not intended that the scope be limited to the particular configurations set forth, as the configurations herein are intended in all respects to be possible configurations rather than restrictive.

[0153] Unless otherwise expressly stated, it is in no way intended that any method set forth herein be construed as requiring that its steps be performed in a specific order.

Accordingly, where a method claim does not actually recite an order to be followed by its steps or it is not otherwise specifically stated in the claims or descriptions that the steps are to be limited to a specific order, it is in no way intended that an order be inferred, in any respect. This holds for any possible non-express basis for interpretation, including: matters of logic with respect to arrangement of steps or operational flow; plain meaning derived from grammatical organization or punctuation; the number or type of configurations described in the specification.

[0154] It will be apparent to those skilled in the art that various modifications and variations may be made without departing from the scope or spirit. Other configurations will be apparent to those skilled in the art from consideration of the specification and practice described herein. It is intended that the specification and described configurations be considered as exemplary only, with a true scope and spirit being indicated by the following claims.

[0155] **Embodiments**

[0156] Embodiment 1. An apparatus, comprising: one or more batteries; a transfer switch, configured to: receive AC power from an external power source via a first electrical connection, provide AC power to an inverter via a second electrical connection, receive AC power from the inverter via a third electrical connection, provide AC power to an external device via a fourth electrical connection, and provide AC power to a control module via a fifth electrical connection; the inverter, configured to: receive DC power from the one or more batteries via a sixth electrical connection, invert the received DC power to AC power, and provide the AC power to the transfer switch via the third electrical connection; and the control module, configured to: control operation of the inverter, provide a first power output via a first output, and provide a second power output via a second output.

[0157] Embodiment 2. The apparatus of embodiment 1, wherein the first electrical output comprises AC power or DC power, and wherein the second power output comprises AC power or DC power.

[0158] Embodiment 3. The apparatus of embodiment 1, wherein the inverter is further configured to provide the AC power to the transfer switch via the third electrical connection when AC power is not present on the first electrical connection.

[0159] Embodiment 4. The apparatus of embodiment 1, wherein the transfer switch comprises an adjustable voltage proving time delay module configured to variably set at least one of a voltage delay trigger or a time delay trigger when AC power presence is detected on the first electrical connection, and wherein the transfer switch is further configured to override a power selection of the inverter.

[0160] Embodiment 5. The apparatus of embodiment 1, wherein when AC power is not available via the first electrical connection, the transfer switch is configured to provide the AC power to the control module via the fifth electrical connection.

[0161] Embodiment 6. The apparatus of embodiment 1, wherein the inverter is further configured to: receive an AC input from the second electrical connection, convert the received AC input to DC power, provide the DC power to the one or more batteries, wherein the one or more batteries are configured to be charged by the provided DC power.

[0162] Embodiment 7. The apparatus of embodiment 6, wherein the inverter is further configured to provide AC power to the transfer switch via the third electrical connection while simultaneously providing the DC power to the one or more batteries via the sixth electrical connection.

[0163] Embodiment 8. The apparatus of embodiment 1, wherein the external power source comprises an AC power generator configured to be powered by at least one of gasoline, liquid propane gas, natural gas, or diesel fuel.

[0164] Embodiment 9. The apparatus of embodiment 1, further comprising a wheeled container configured to hold the one or more batteries, the transfer switch, the inverter, and the control module.

[0165] Embodiment 10. The apparatus of embodiment 1, wherein at least one battery of the one or more batteries comprises an auxiliary port configured to provide external DC power or to receive external DC power, and wherein the one or more batteries comprise one or more of a Lithium Ion (Li+) battery, a lead acid (Pb) battery, or a Lithium Iron Phosphate (LiFePo) battery.

[0166] Embodiment 11. An apparatus, comprising: one or more batteries; an inverter, configured to: receive DC power from the one or more batteries via a first electrical connection, invert the received DC power to AC power, provide the inverted AC power to a distribution hub via a second electrical connection, receive AC power from an external power source via a third electrical connection, and provide the received AC power to the distribution hub via the second electrical connection, wherein the inverter is configured to auctioneer AC power from the first electrical connection and the third electrical connection; the distribution hub, configured to: receive AC power via the second electrical connection, provide a first power output via a first output, and provide a second power output via a second output.

[0167] Embodiment 12. The apparatus of embodiment 11, wherein the distribution hub comprises a voltage indicator configured to indicate an AC voltage received via the second electrical connection, and an ampere indicator configured to indicate an AC current passing through the distribution hub.

[0168] Embodiment 13. The apparatus of embodiment 11, further comprising a power providing device coupled to the first output via a cable, the power providing device configured to: receive power from the first output via the cable, provide DC power to a first output of the power providing device, and provide AC power to a second output of the power providing device.

[0169] Embodiment 14. The apparatus of embodiment 13, wherein a first power extension cable is coupled to the first output of the power providing device, and wherein a second power extension cable is coupled to the second output of the power providing device.

[0170] Embodiment 15. The apparatus of embodiment 13, wherein the first output of the power providing device comprises a first plurality of power outlets configured to couple to one or more electrical devices, and wherein the second output of the power providing device comprises a second plurality of power outlets configured to couple to the one or more electrical devices.

[0171] Embodiment 16. The apparatus of embodiment 11, wherein the external power source comprises an AC power generator configured to be powered by at least one of gasoline, liquid propane gas, natural gas, or diesel fuel.

[0172] Embodiment 17. The apparatus of embodiment 11, further comprising a wheeled container configured to hold the one or more batteries, the transfer switch, the inverter, and the distribution hub.

[0173] Embodiment 18. The apparatus of embodiment 11, wherein at least one battery of the one or more batteries comprises an auxiliary port configured to provide external DC power or to receive external DC power, and wherein the one or more batteries comprise one or more of a Lithium Ion (Li+) battery, a lead acid (Pb) battery, or a Lithium Iron Phosphate (LiFePo) battery.

[0174] Embodiment 19. The apparatus of embodiment 11, wherein the inverter is further configured to: receive an AC input from the second electrical connection, convert the received AC input to DC power, provide the DC power to the one or more batteries, wherein the one or more batteries are configured to be charged by the provided DC power.

[0175] Embodiment 20. The apparatus of embodiment 11, further comprising a removeably connected jumper cable, configured to: receive power from the external power source via a fourth electrical connection, and provide the received power to the distribution hub via a fifth electrical connection by bypassing the inverter.

[0176] Embodiment 21. An apparatus, comprising: one or more batteries; an inverter, configured to: receive DC power from the one or more batteries via a first electrical connection, invert the received DC power to AC power, provide the inverted AC power to a step-down transformer and a variable frequency drive via a second electrical connection; the step-down transformer, configured to: receive AC power from the inverter via the second electrical connection, reduce the received AC power to a lower AC voltage, and provide the reduced AC power to a first output; and a variable frequency drive, configured to: receive AC power from the inverter via a third electrical connection, convert the received AC power to three-phase AC power, and provide the three-phase AC power to a second output.

[0177] Embodiment 22. The apparatus of embodiment 21, further comprising a reversing contactor configured to: receive the three-phase AC power from the variable frequency drive, modify a phase of the three-phase AC power, and output the modified three-phase AC power to the second output.

[0178] Embodiment 23. The apparatus of embodiment 22, wherein the reversing contactor further comprises a switch, wherein the reversing contactor modifies the phase of the three-phase AC power based on the switch.

[0179] Embodiment 24. The apparatus of embodiment 21, wherein the variable frequency drive is further configured to limit an inrush current received via the second electrical output when a load coupled to the second output activates.

[0180] Embodiment 25. The apparatus of embodiment 21, wherein one or more operating parameters of the variable frequency drive can be modified, and wherein the one or more operating parameters comprise a ramp rate of the variable frequency drive and a terminal voltage of the variable frequency drive.

[0181] Embodiment 26. The apparatus of embodiment 21, wherein the inverter is further configured to provide AC power to the step-down transformer via the second electrical connection while simultaneously providing AC power the variable frequency drive via the third electrical connection.

[0182] Embodiment 27. The apparatus of embodiment 21, further comprising a container configured to hold the one or more batteries, the inverter, the step-down transformer, and the variable frequency drive.

[0183] Embodiment 28. The apparatus of embodiment 21, wherein at least one battery of the one or more batteries comprises an auxiliary port configured to provide external DC power or to receive external DC power, and wherein the one or more batteries comprise one or more of a Lithium Ion (Li+) battery, a lead acid (Pb) battery, or a Lithium Iron Phosphate (LiFePo) battery.

[0184] Embodiment 29. The apparatus of embodiment 21, further comprising a voltage indicator configured to indicate an AC voltage output via the first output, and an ampere indicator configured to indicate an AC current output via the first output.

[0185] Embodiment 30. The apparatus of embodiment 21, further comprising a voltage indicator configured to indicate a three-phase AC voltage output via the second output, and an ampere indicator configured to indicate a three-phase AC current output via the second output.

[0186] Embodiment 31. An apparatus, comprising: a transfer switch, configured to: receive AC power from an external power source via a first electrical connection, provide AC power to an inverter via a second electrical connection, receive AC power from an inverter via a third electrical connection, and provide AC power to an external device via a fourth electrical connection; the inverter, configured to: receive AC power from the transfer switch via the second electrical connection, convert the received AC power to DC power, and provide the converted DC power to one or more batteries, one or more step-down transformers, and one or more DC to AC inverters via a fifth electrical connection; and the one or more batteries, configured to: receive the converted DC power from the inverter via the fifth electrical connection, and provide DC power to the one or more step-down transformers, and provide DC power to the one or more DC to AC inverters.

[0187] Embodiment 32. The apparatus of embodiment 31, further comprising a variable frequency drive configured to: receive AC power from the inverter via a sixth electrical connection, convert the received AC power to three-phase AC power, and provide the three-phase AC power to the transfer switch via the third electrical connection.

[0188] Embodiment 33. The apparatus of embodiment 31, wherein the inverter is further configured to provide the AC power to the transfer switch via the third electrical connection when AC power is not present on the first electrical connection.

[0189] Embodiment 34. The apparatus of embodiment 31, wherein the inverter is further configured to: convert AC power to three-phase AC power, and provide the three-phase AC power to the transfer switch via the third electrical connection.

[0190] Embodiment 35. The apparatus of embodiment 31, wherein the transfer switch comprises an adjustable voltage proving time delay module configured to variably set at least one of a voltage delay trigger or a time delay trigger when AC power presence is detected on the first electrical connection, and wherein the transfer switch is further configured to override a power selection of the inverter.

[0191] Embodiment 36. The apparatus of embodiment 31, wherein the inverter is further configured to: receive DC power from the one or more batteries via the fifth electrical connection, invert the received DC power to AC power, and provide the AC power to the transfer switch via the third electrical connection.

[0192] Embodiment 37. The apparatus of embodiment 31, wherein the inverter is further configured to provide AC power to the transfer switch via the third electrical connection while simultaneously providing the DC power to the one or more batteries, the one or more step-down transformers, and the one or more DC to AC inverters via a second electrical connection via the fifth electrical connection.

[0193] Embodiment 38. The apparatus of embodiment 31, wherein the external power source comprises at least one of a three-phase power supply or an AC power generator configured to be powered by at least one of gasoline, liquid propane gas, natural gas, or diesel fuel.

[0194] Embodiment 39. The apparatus of embodiment 31, further comprising a wheeled container configured to hold the one or more batteries, the transfer switch, the inverter, the one or more step-down transformers, and the one or more DC to AC inverters; and wherein the one or more batteries comprise one or more of a Lithium Ion (Li+) battery, a lead acid (Pb) battery, or a Lithium Iron Phosphate (LiFePo) battery.

[0195] Embodiment 40. The apparatus of embodiment 31, wherein the one or more step-down transformers are configured to receive DC power, reduce the received DC power to a lower DC voltage, and provide the reduced DC power to a second output; and wherein the one or more DC to AC inverters are configured to receive DC power, convert the received DC power to AC power, and output the AC power to a third output.

[0196] Embodiment 41. An apparatus, comprising: one or more AC to DC converters configured to: receive AC power from an external power source, convert the AC power to DC power, and provide the converted DC power to a power distribution device via a first electrical connection; the power distribution device, configured to: receive the converted DC power from the one or more AC to DC converters via the first electrical connection, provide the converted DC power to one or more batteries, one or more step-down transformers, and one or more DC to AC inverters via a second electrical connection, invert the converted DC power to AC power, and provide the inverted AC power to a transfer switch via a third electrical connection; the one or more batteries, configured to: receive the converted DC power from the power distribution device via the second electrical connection, provide DC power to the one or more step-down transformers, and provide DC power to the one or more DC to AC inverters; and the transfer switch, configured to: receive the inverted AC power from the power distribution device via the third electrical connection, receive AC power from at least one of the external power source or the power distribution device, and provide the received AC power to an output.

[0197] Embodiment 42. The apparatus of embodiment 41, further comprising a variable frequency drive configured to: receive AC power from the power distribution device via a fourth electrical connection, convert the received AC power to three-phase AC power, and provide the three-phase AC power to the transfer switch via the third electrical connection.

[0198] Embodiment 43. The apparatus of embodiment 41, wherein the power distribution device is further configured to provide the AC power to the transfer switch via the third electrical connection when AC power is not present on the first electrical connection.

[0199] Embodiment 44. The apparatus of embodiment 41, wherein the power distribution device is further configured to: convert AC power to three-phase AC power, and provide the three-phase AC power to the transfer switch via the third electrical connection.

[0200] Embodiment 45. The apparatus of embodiment 41, wherein the inverter is further configured to: receive DC power from the one or more batteries via the second electrical connection, invert the received DC power to AC power, and provide the AC power to the transfer switch via the third electrical connection.

[0201] Embodiment 46. The apparatus of embodiment 41, wherein the power distribution device is further configured to provide AC power to the transfer switch via the third electrical connection while simultaneously providing the DC power to the one or more batteries, the one or more step-down transformers, and the one or more DC to AC inverters via the second electrical connection.

[0202] Embodiment 47. The apparatus of embodiment 41, wherein the external power source comprises at least one of a three-phase power supply or an AC power generator configured to be powered by at least one of gasoline, liquid propane gas, natural gas, or diesel fuel.

[0203] Embodiment 48. The apparatus of embodiment 47, further comprising: a first AC to DC converter of the one or more AC to DC converters configured to: receive AC power from the AC power generator, and provide DC power to the power distribution device via the first electrical connection; and a second AC to DC converter of the one or more AC to DC converters configured to: receive AC power from the three-phase power supply, and provide DC power to the power distribution device via a fifth electrical connection.

[0204] Embodiment 49. The apparatus of embodiment 41, further comprising a wheeled container configured to hold the one or more batteries, the transfer switch, the inverter, the one or more step-down transformers, and the one or more DC to AC inverters; and wherein the one or more batteries comprise one or more of a Lithium Ion (Li+) battery, a lead acid (Pb) battery, or a Lithium Iron Phosphate (LiFePo) battery.

[0205] Embodiment 50. The apparatus of embodiment 41, wherein the one or more step-down transformers are configured to receive DC power, reduce the received DC power to a lower DC voltage, and provide the reduced DC power to a second output; and wherein the one or more DC to AC inverters are configured to receive DC power, convert the received DC power to AC power, and output the AC power to a third output.

CLAIMS

1. An apparatus, comprising:

    one or more batteries;

    a transfer switch, configured to:

        receive AC power from an external power source via a first electrical connection,

        provide AC power to an inverter via a second electrical connection,

        receive AC power from the inverter via a third electrical connection,

        provide AC power to an external device via a fourth electrical connection, and

        provide AC power to a control module via a fifth electrical connection;

    the inverter, configured to:

        receive DC power from the one or more batteries via a sixth electrical connection,

        invert the received DC power to AC power, and

        provide the AC power to the transfer switch via the third electrical connection; and

    the control module, configured to:

        control operation of the inverter,

        provide a first power output via a first output, and

        provide a second power output via a second output.

2. The apparatus of claim 1, wherein the first electrical output comprises AC power or DC power, and wherein the second power output comprises AC power or DC power.

3. The apparatus of claim 1, wherein the inverter is further configured to provide the AC power to the transfer switch via the third electrical connection when AC power is not present on the first electrical connection.

4. The apparatus of claim 1, wherein the transfer switch comprises an adjustable voltage proving time delay module configured to variably set at least one of a voltage delay trigger or a time delay trigger when AC power presence is detected on the first electrical

connection, and wherein the transfer switch is further configured to override a power selection of the inverter.

5. The apparatus of claim 1, wherein when AC power is not available via the first electrical connection, the transfer switch is configured to provide the AC power to the control module via the fifth electrical connection.

6. The apparatus of claim 1, wherein the inverter is further configured to:
    receive an AC input from the second electrical connection,
    convert the received AC input to DC power,
    provide the DC power to the one or more batteries, wherein the one or more batteries are configured to be charged by the provided DC power.

7. The apparatus of claim 6, wherein the inverter is further configured to provide AC power to the transfer switch via the third electrical connection while simultaneously providing the DC power to the one or more batteries via the sixth electrical connection.

8. The apparatus of claim 1, wherein the external power source comprises an AC power generator configured to be powered by at least one of gasoline, liquid propane gas, natural gas, or diesel fuel.

9. The apparatus of claim 1, further comprising a wheeled container configured to hold the one or more batteries, the transfer switch, the inverter, and the control module.

10. The apparatus of claim 1, wherein at least one battery of the one or more batteries comprises an auxiliary port configured to provide external DC power or to receive external DC power, and wherein the one or more batteries comprise one or more of a Lithium Ion (Li+) battery, a lead acid (Pb) battery, or a Lithium Iron Phosphate (LiFePo) battery.

11. An apparatus, comprising:
    one or more batteries;
    an inverter, configured to:

receive DC power from the one or more batteries via a first electrical connection,

invert the received DC power to AC power,

provide the inverted AC power to a distribution hub via a second electrical connection,

receive AC power from an external power source via a third electrical connection, and

provide the received AC power to the distribution hub via the second electrical connection, wherein the inverter is configured to auctioneer AC power from the first electrical connection and the third electrical connection;

the distribution hub, configured to:

receive AC power via the second electrical connection,

provide a first power output via a first output, and

provide a second power output via a second output.

12. The apparatus of claim 11, wherein the distribution hub comprises a voltage indicator configured to indicate an AC voltage received via the second electrical connection, and an ampere indicator configured to indicate an AC current passing through the distribution hub.

13. The apparatus of claim 11, further comprising a power providing device coupled to the first output via a cable, the power providing device configured to:

receive power from the first output via the cable,

provide DC power to a first output of the power providing device, and

provide AC power to a second output of the power providing device.

14. The apparatus of claim 13, wherein a first power extension cable is coupled to the first output of the power providing device, and wherein a second power extension cable is coupled to the second output of the power providing device.

15. The apparatus of claim 13, wherein the first output of the power providing device comprises a first plurality of power outlets configured to couple to one or more electrical devices, and wherein the second output of the power providing device comprises a second plurality of power outlets configured to couple to the one or more electrical devices.

16. The apparatus of claim 11, wherein the external power source comprises an AC power generator configured to be powered by at least one of gasoline, liquid propane gas, natural gas, or diesel fuel.

17. The apparatus of claim 11, further comprising a wheeled container configured to hold the one or more batteries, the transfer switch, the inverter, and the distribution hub.

18. The apparatus of claim 11, wherein at least one battery of the one or more batteries comprises an auxiliary port configured to provide external DC power or to receive external DC power, and wherein the one or more batteries comprise one or more of a Lithium Ion (Li+) battery, a lead acid (Pb) battery, or a Lithium Iron Phosphate (LiFePo) battery.

19. The apparatus of claim 11, wherein the inverter is further configured to:

receive an AC input from the second electrical connection,

convert the received AC input to DC power,

provide the DC power to the one or more batteries, wherein the one or more batteries are configured to be charged by the provided DC power.

20. The apparatus of claim 11, further comprising a removeably connected jumper cable, configured to:

receive power from the external power source via a fourth electrical connection, and

provide the received power to the distribution hub via a fifth electrical connection by bypassing the inverter.

21. An apparatus, comprising:

one or more batteries;

an inverter, configured to:

receive DC power from the one or more batteries via a first electrical connection,

invert the received DC power to AC power, provide the inverted AC power to a step-down transformer and a variable frequency drive via a second electrical connection;

the step-down transformer, configured to:

receive AC power from the inverter via the second electrical connection,

reduce the received AC power to a lower AC voltage, and

provide the reduced AC power to a first output; and

a variable frequency drive, configured to:

receive AC power from the inverter via a third electrical connection,

convert the received AC power to three-phase AC power, and

provide the three-phase AC power to a second output.

22. An apparatus, comprising:

a transfer switch, configured to:

receive AC power from an external power source via a first electrical connection,

provide AC power to an inverter via a second electrical connection,

receive AC power from an inverter via a third electrical connection, and

provide AC power to an external device via a fourth electrical connection;

the inverter, configured to:

receive AC power from the transfer switch via the second electrical connection,

convert the received AC power to DC power, and

provide the converted DC power to one or more batteries, one or more step-down transformers, and one or more DC to AC inverters via a fifth electrical connection; and

the one or more batteries, configured to:

receive the converted DC power from the inverter via the fifth electrical connection,

provide DC power to the one or more step-down transformers, and

provide DC power to the one or more DC to AC inverters.

23. An apparatus, comprising:

one or more AC to DC converters configured to:

receive AC power from an external power source, convert the AC power to DC power, and

provide the converted DC power to a power distribution device via a first electrical connection;

the power distribution device, configured to:

receive the converted DC power from the one or more AC to DC converters via the first electrical connection,

provide the converted DC power to one or more batteries, one or more step-down transformers, and one or more DC to AC inverters via a second electrical connection,

invert the converted DC power to AC power, and

provide the inverted AC power to a transfer switch via a third electrical connection;

the one or more batteries, configured to:

receive the converted DC power from the power distribution device via the second electrical connection, and

provide DC power to the one or more step-down transformers, and

provide DC power to the one or more DC to AC inverters; and

the transfer switch, configured to:

receive the inverted AC power from the power distribution device via the third electrical connection,

receive AC power from at least one of the external power source or the power distribution device, and

provide the received AC power to an output.

24. A method, comprising:

receiving, by a transfer switch, power from at least one of a generator or a battery;

if AC power is received from the generator, providing the received AC power to a control module;

if AC power is received from the generator and the battery is not fully charged,

providing the AC power to an inverter,

converting the AC power to DC power by the inverter, and

providing the DC power to the battery; and

if DC power is received from the battery,

invert the received DC power to DC power by the inverter,

provide the inverted AC power to the transfer switch, and
provide the inverted AC power to the control module.

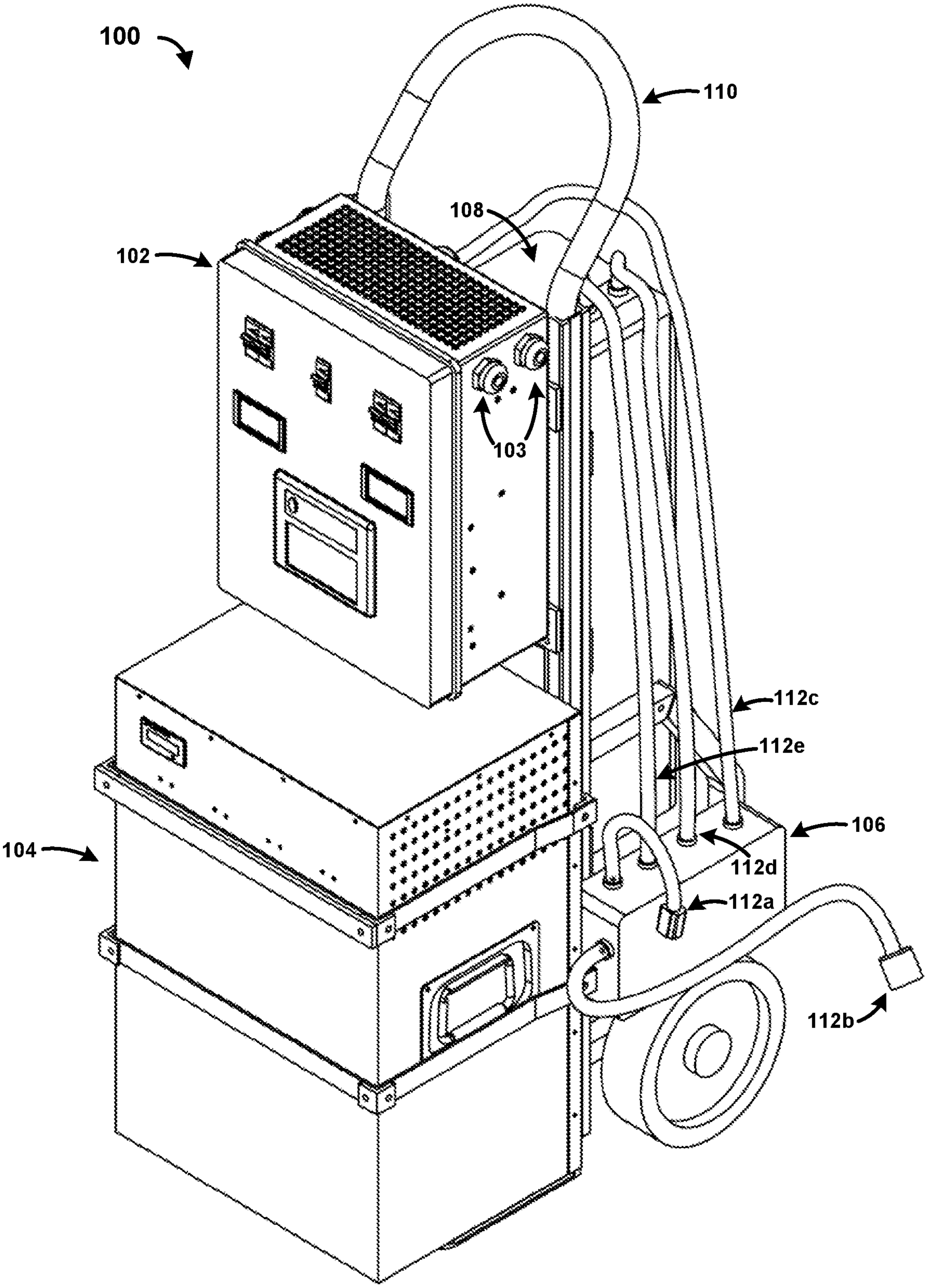


FIG. 1A

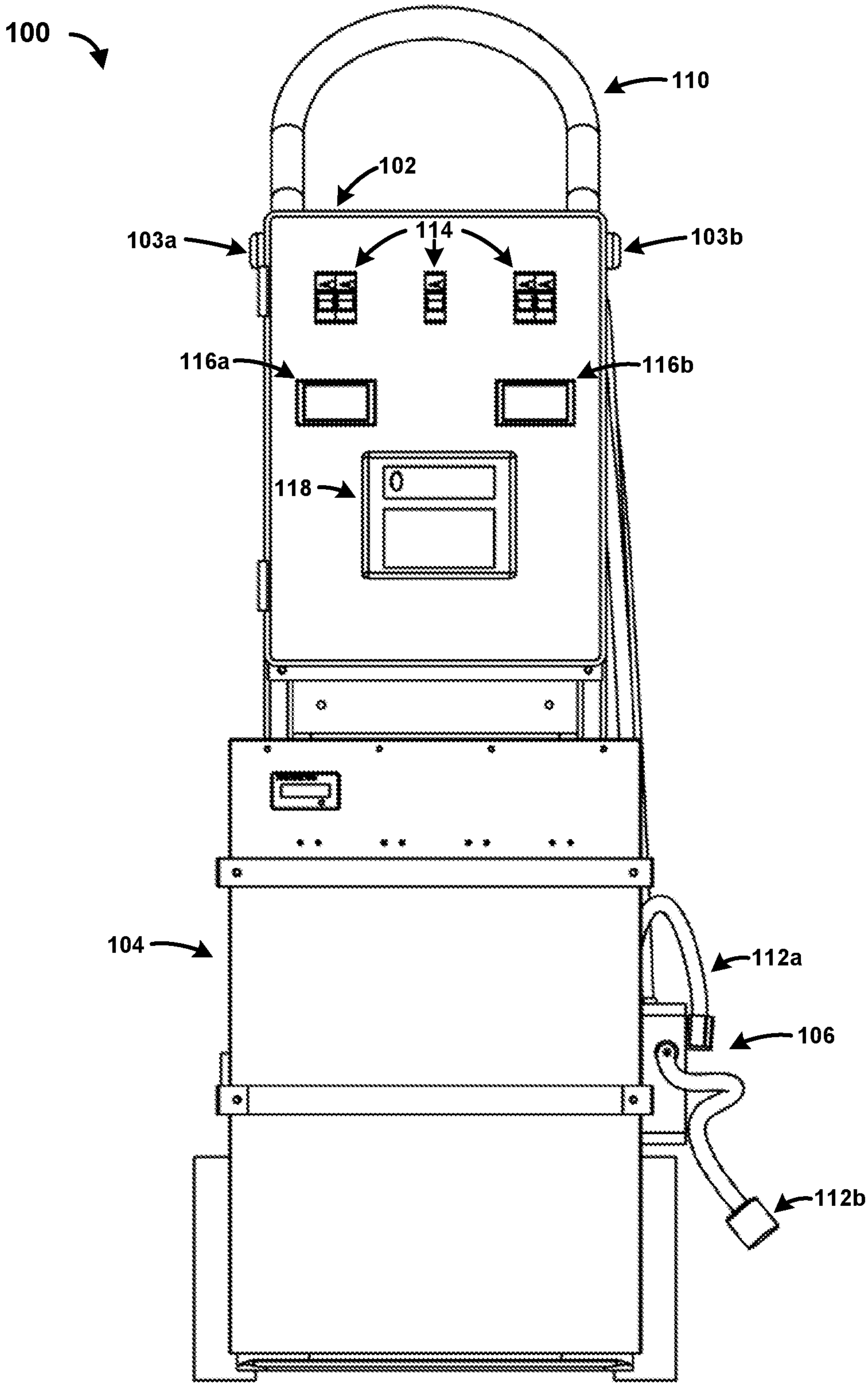


FIG. 1B

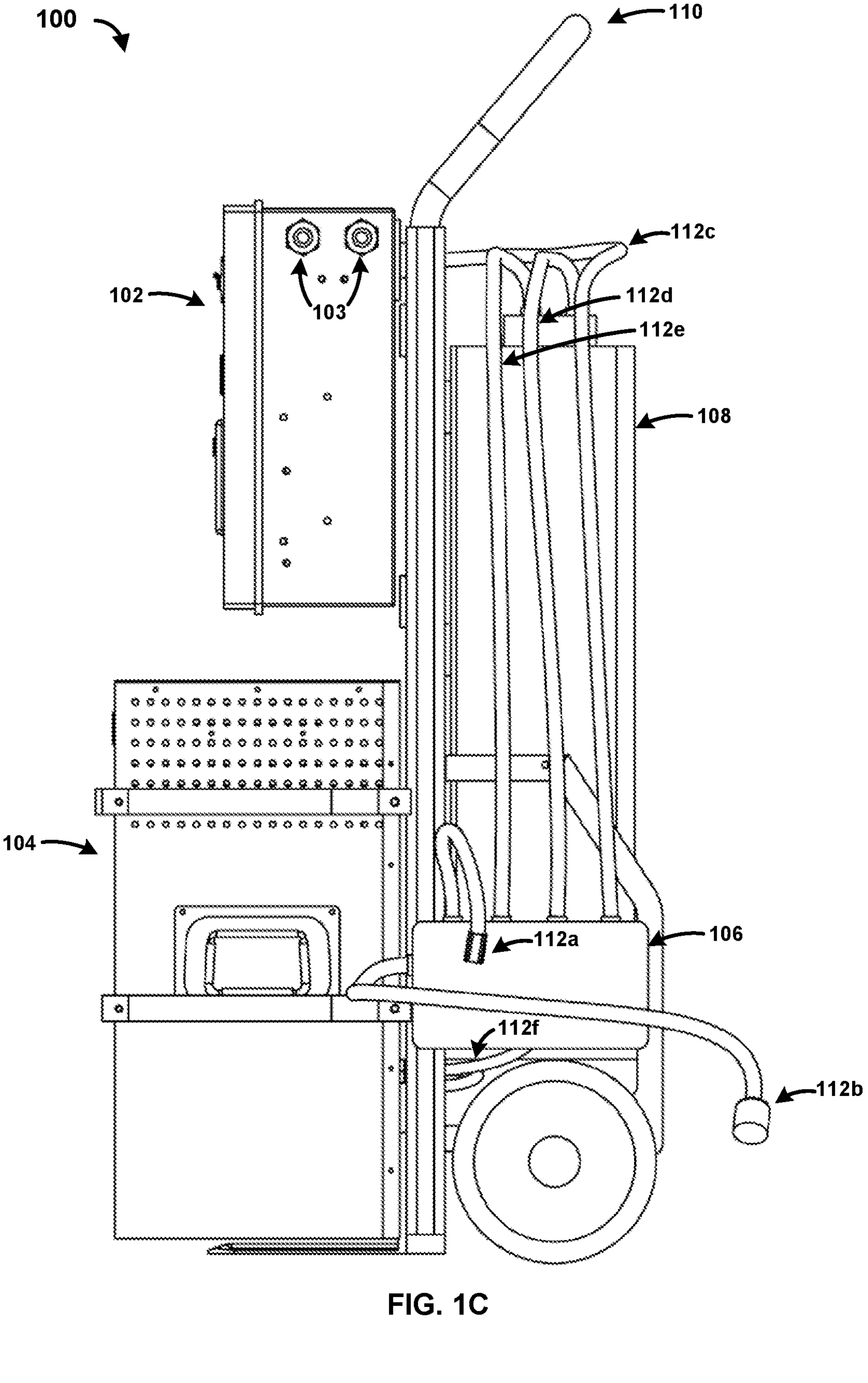


FIG. 1C

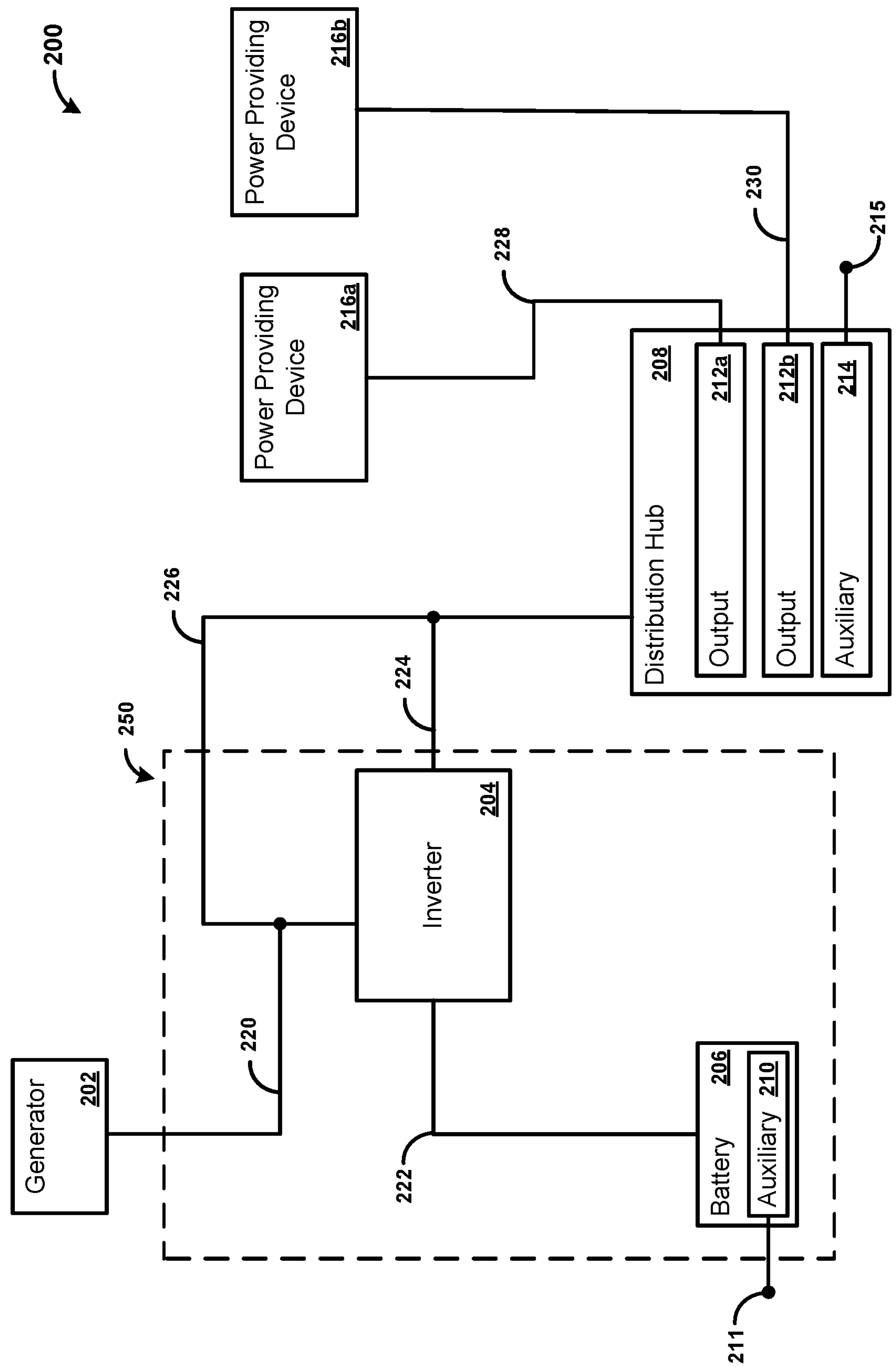
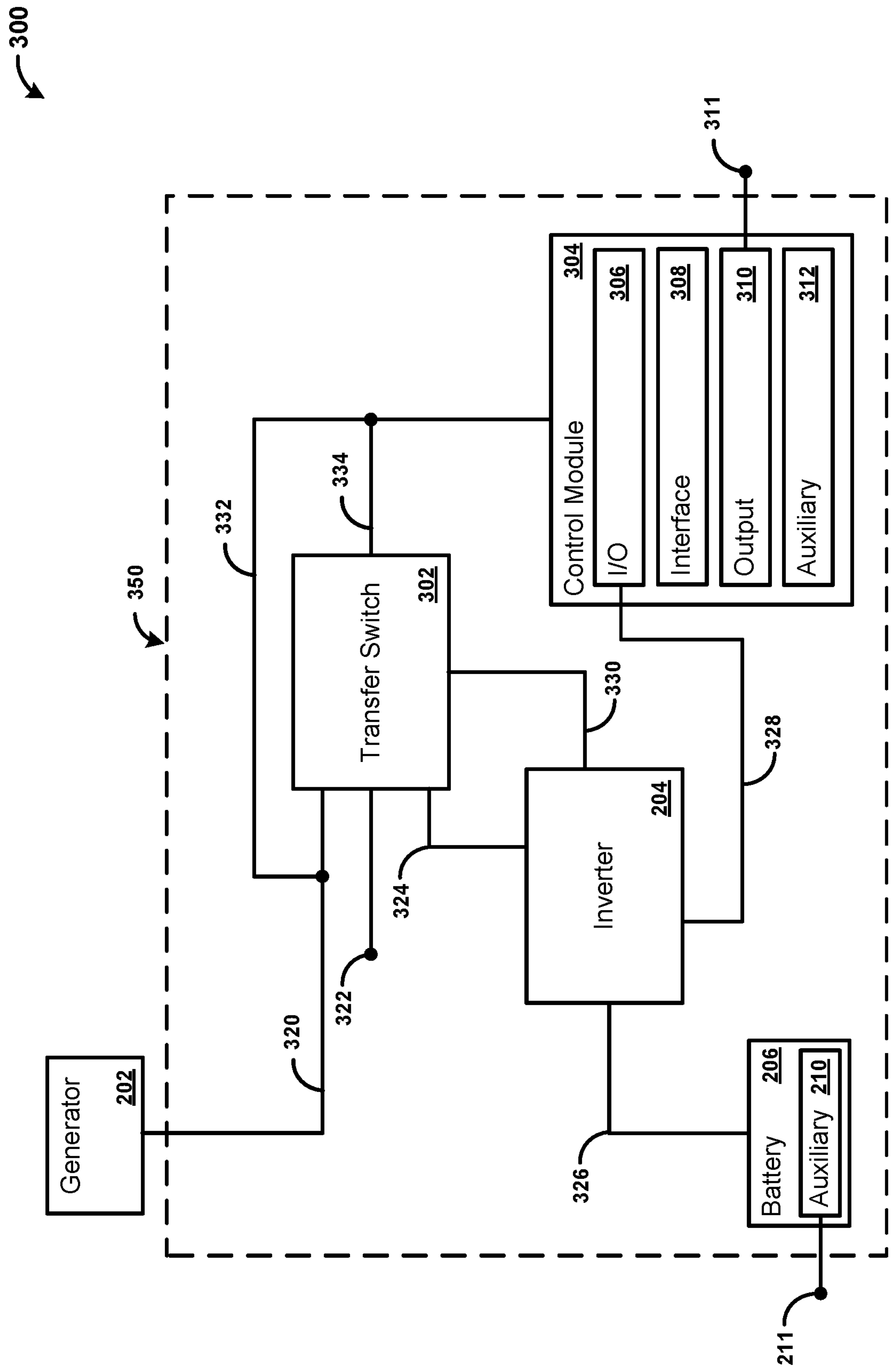

200
Power Providing Device
216b
Power Providing Device
216a
228
230
215
Distribution Hub
208
Output
212a
Output
212b
Auxiliary
214
226
224
250
Inverter
204
Generator
202
220
222
Battery
206
Auxiliary
210
211

FIG. 2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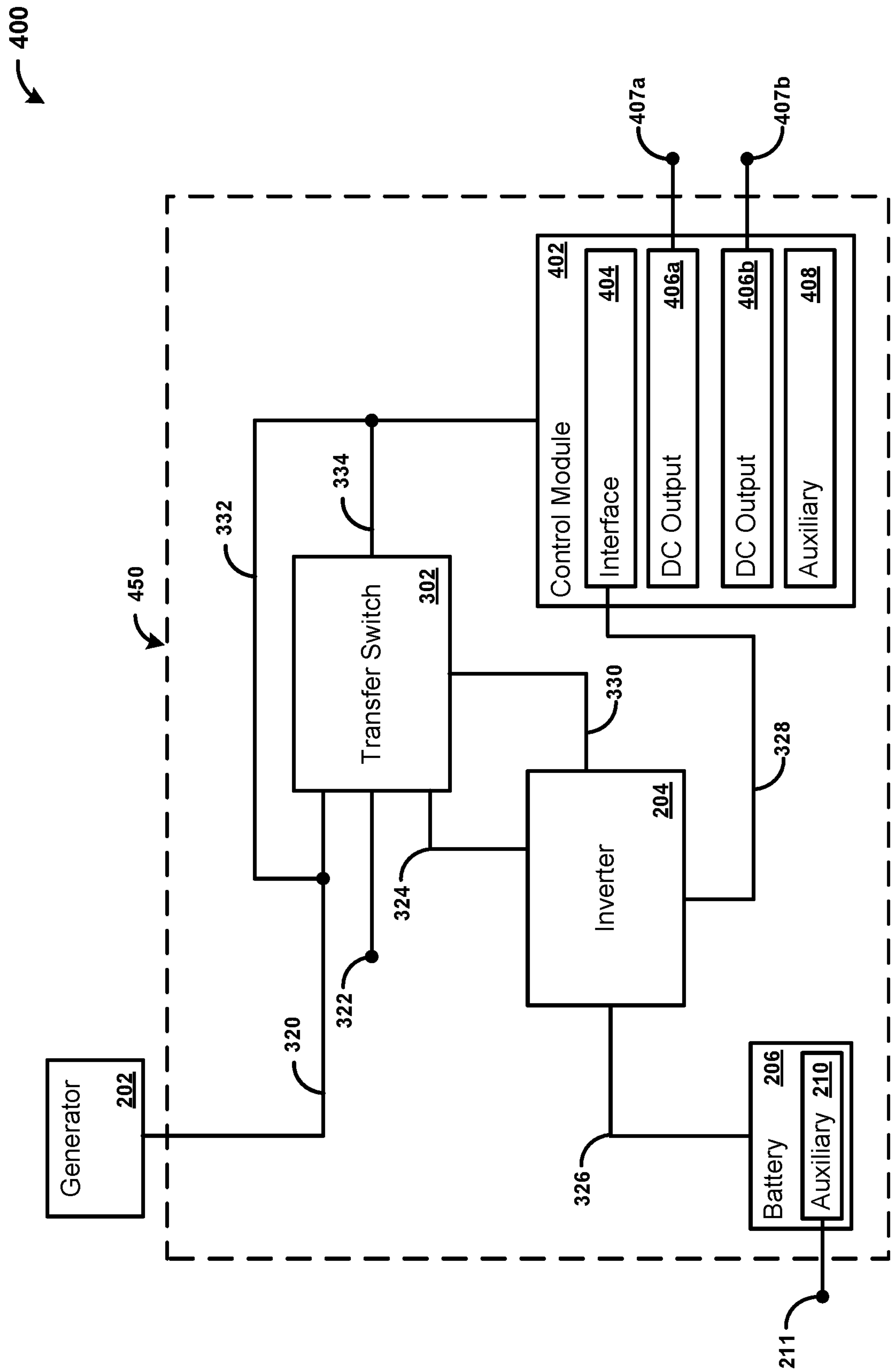
350
Generator
202
Transfer Switch
302
Control Module
304
I/O
306
Interface
308
Output
310
Auxiliary
312
311
Inverter
204
Battery
206
Auxiliary
210
211
320
322
324
326
328
330
332
334

FIG. 3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450
Generator
202
Transfer Switch
302
Inverter
204
Control Module
402
Interface
404
DC Output
406a
DC Output
406b
Auxiliary
408
Battery
206
Auxiliary
210
407a
407b
320
322
324
326
328
330
332
334
211

FIG. 4

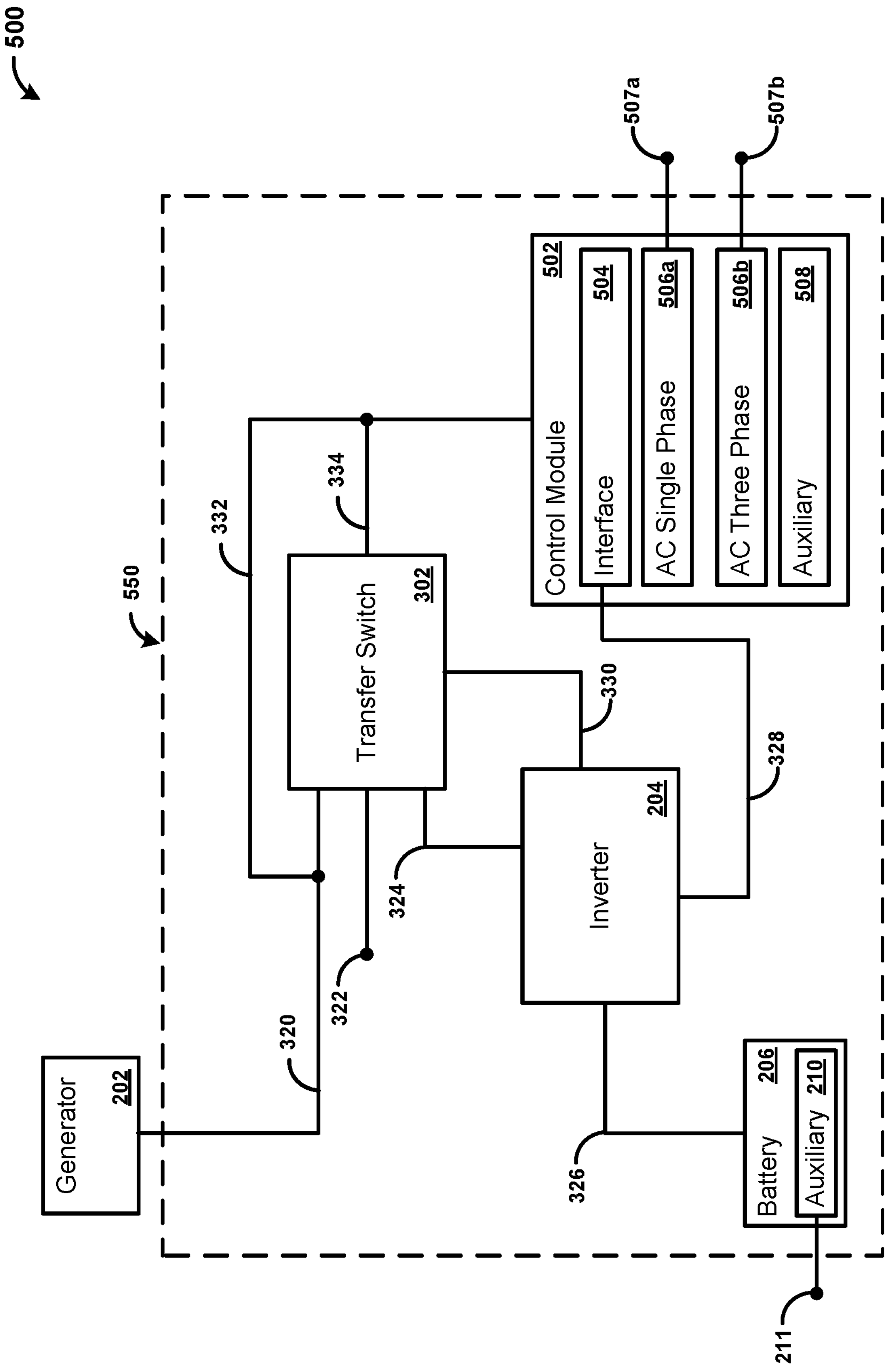
500
550
Generator
202
Transfer Switch
302
Inverter
204
Control Module
502
Interface
504
AC Single Phase
506a
AC Three Phase
506b
Auxiliary
508
Battery
206
Auxiliary
210
507a
507b
320
322
324
326
328
330
332
334
211

FIG. 5

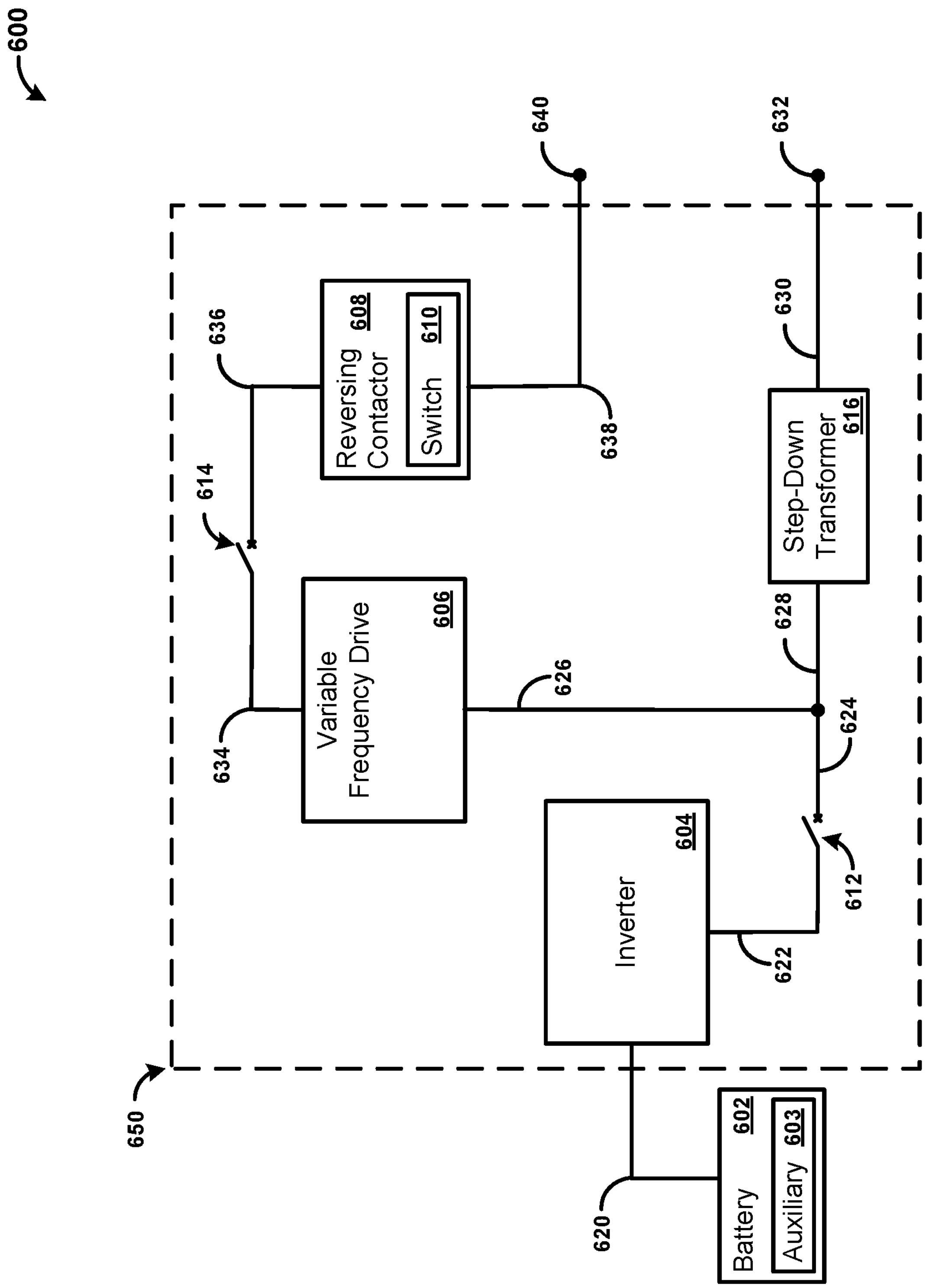
600
640
632
636
608
Reversing Contactor
Switch 610
638
630
614
Step-Down Transformer 616
Variable Frequency Drive 606
628
626
634
624
Inverter 604
612
622
650
Battery 602
Auxiliary 603
620

FIG. 6

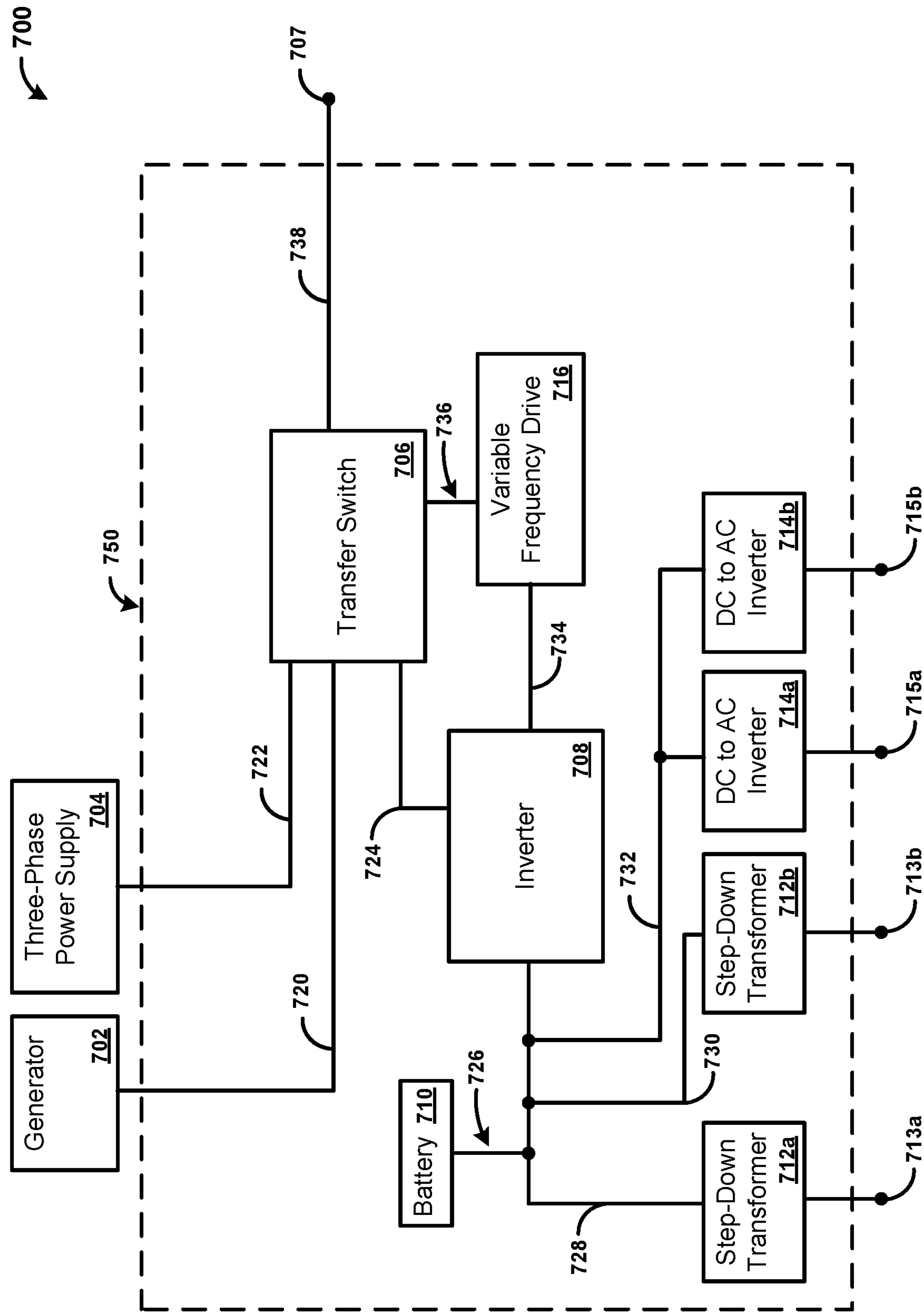
700
707
738
750
Transfer Switch
706
736
Variable
Frequency Drive
716
734
722
Three-Phase
Power Supply
704
724
Inverter
708
732
720
Generator
702
726
Battery 710
730
728
DC to AC
Inverter
714b
715b
DC to AC
Inverter
714a
715a
Step-Down
Transformer
712b
713b
Step-Down
Transformer
712a
713a

FIG. 7

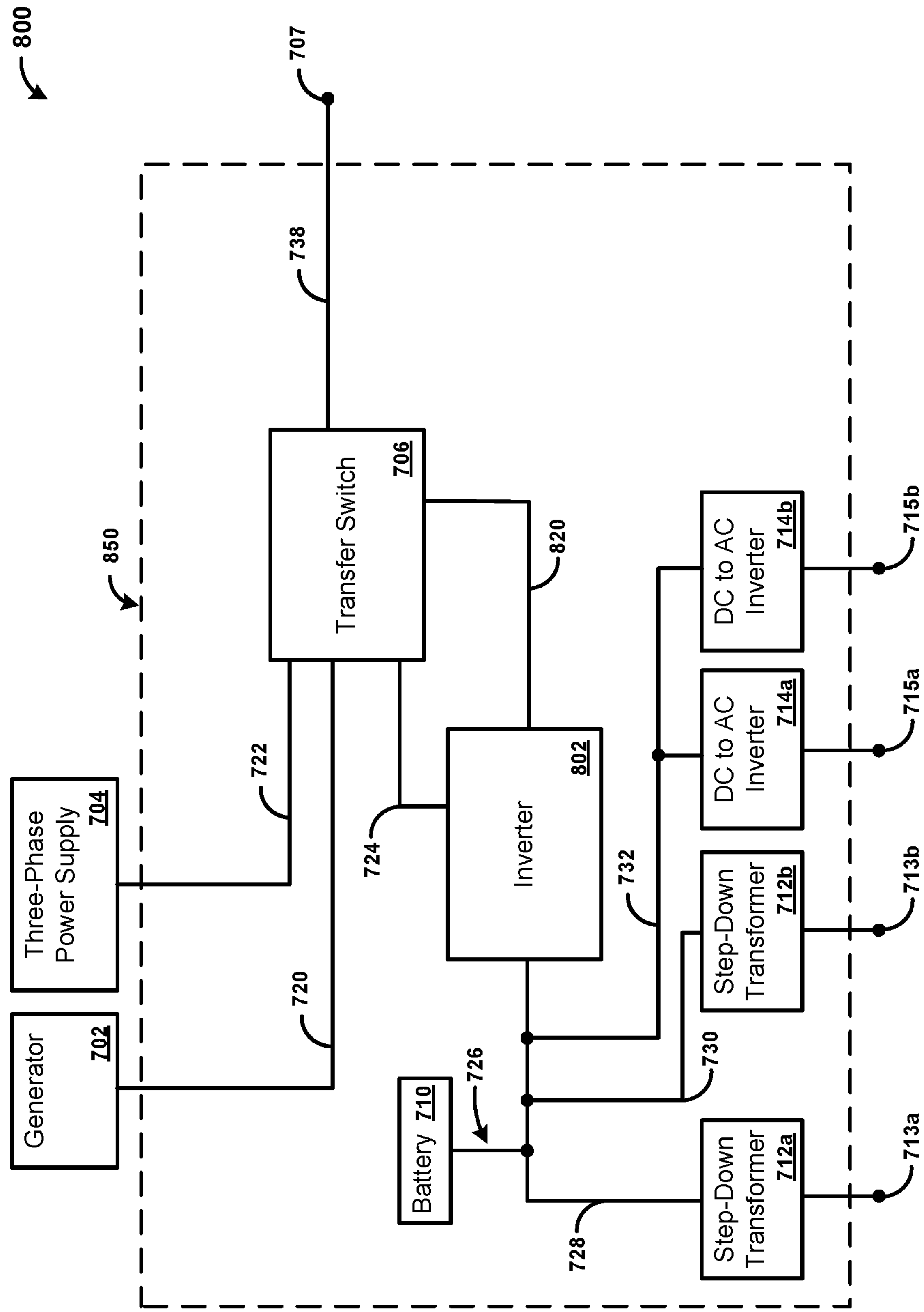
800
707
738
850
Transfer Switch
706
820
Three-Phase Power Supply
704
Generator
702
722
720
724
Inverter
802
732
DC to AC Inverter
714a
DC to AC Inverter
714b
715a
715b
Step-Down Transformer
712b
713b
730
726
Battery 710
728
Step-Down Transformer
712a
713a

FIG. 8

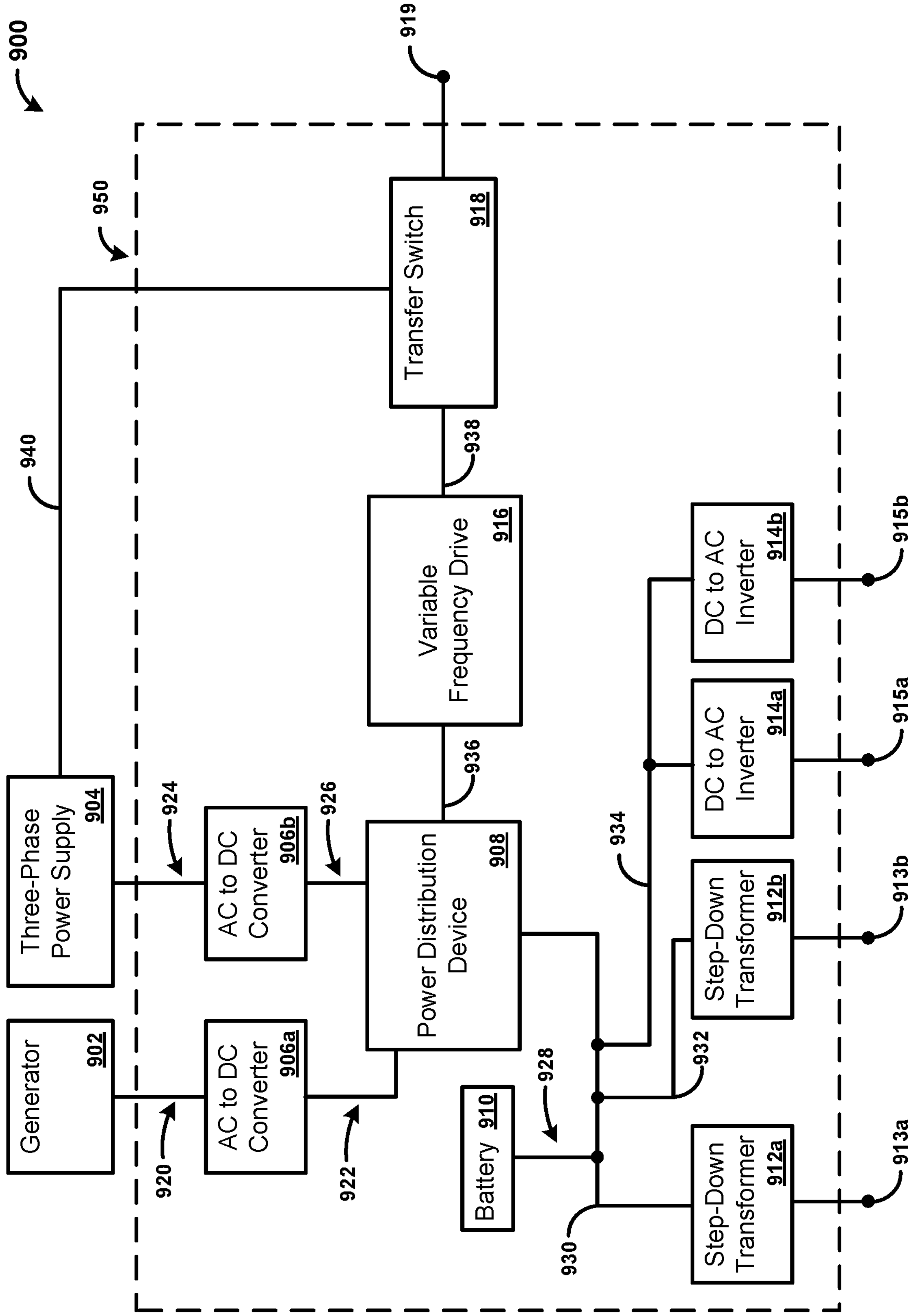
900
950
940
919
Transfer Switch
918
938
Variable
Frequency Drive
916
936
Three-Phase
Power Supply
904
924
AC to DC
Converter
906b
926
Power Distribution
Device
908
Generator
902
920
AC to DC
Converter
906a
922
Battery 910
928
930
932
934
DC to AC
Inverter
914b
915b
DC to AC
Inverter
914a
915a
Step-Down
Transformer
912b
913b
Step-Down
Transformer
912a
913a

FIG. 9

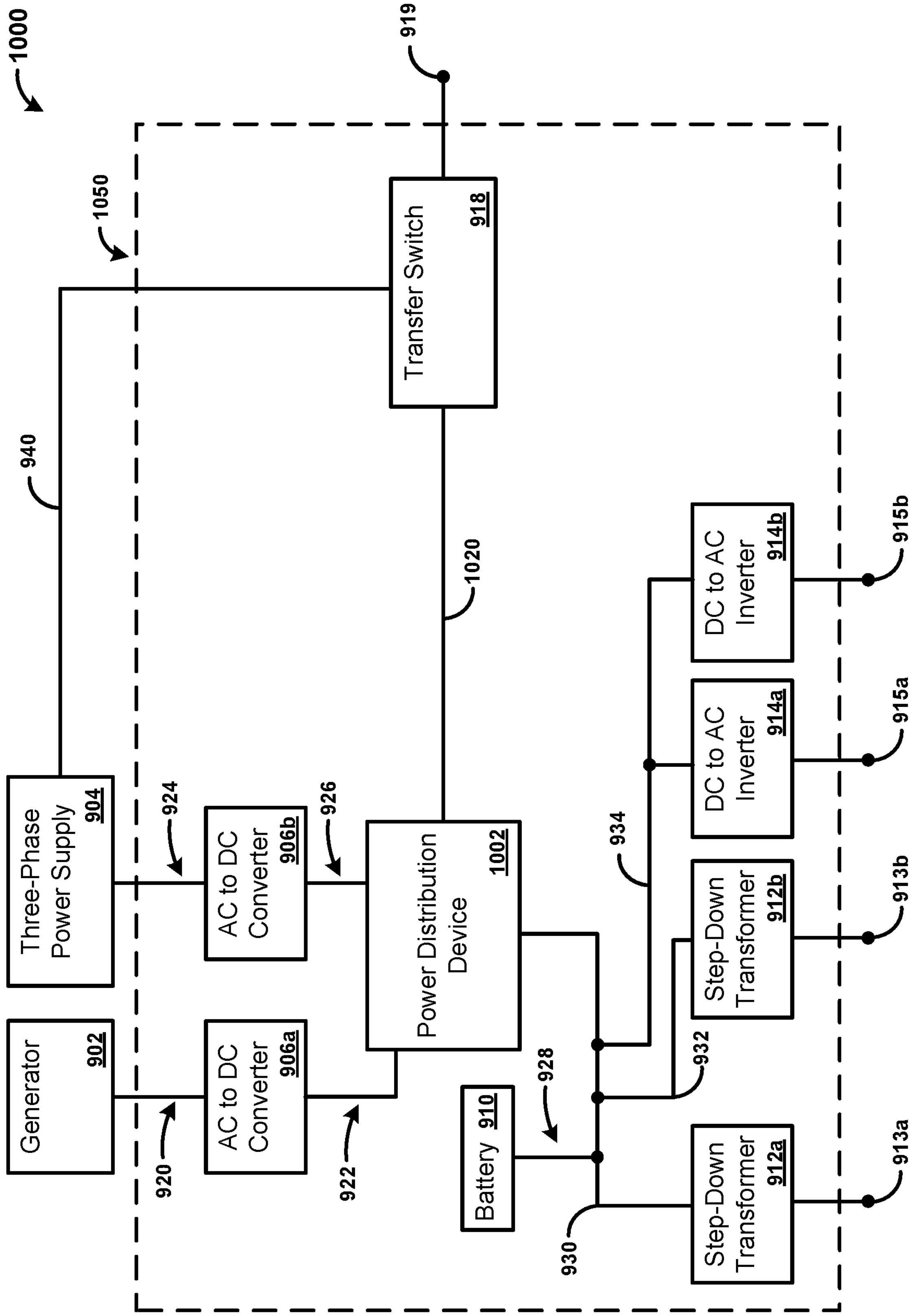
1000
1050
940
Generator
902
Three-Phase
Power Supply
904
920
924
AC to DC
Converter
906a
AC to DC
Converter
906b
922
926
Power Distribution
Device
1002
Transfer Switch
918
919
1020
Battery 910
928
930
932
934
Step-Down
Transformer
912a
Step-Down
Transformer
912b
DC to AC
Inverter
914a
DC to AC
Inverter
914b
913a
913b
915a
915b

FIG. 10

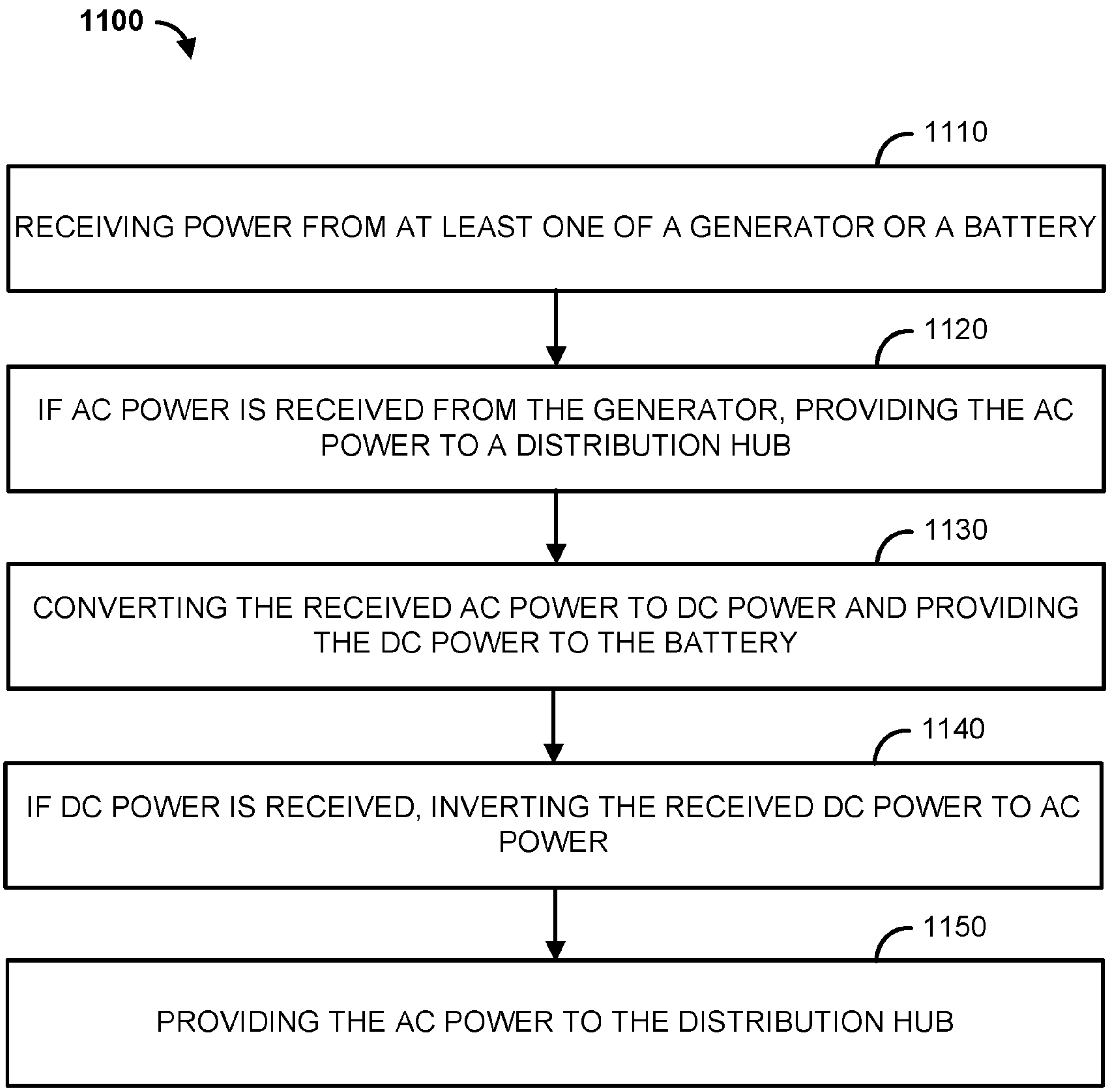
1100
1110
RECEIVING POWER FROM AT LEAST ONE OF A GENERATOR OR A BATTERY
1120
IF AC POWER IS RECEIVED FROM THE GENERATOR, PROVIDING THE AC POWER TO A DISTRIBUTION HUB
1130
CONVERTING THE RECEIVED AC POWER TO DC POWER AND PROVIDING THE DC POWER TO THE BATTERY
1140
IF DC POWER IS RECEIVED, INVERTING THE RECEIVED DC POWER TO AC POWER
1150
PROVIDING THE AC POWER TO THE DISTRIBUTION HUB

FIG. 11

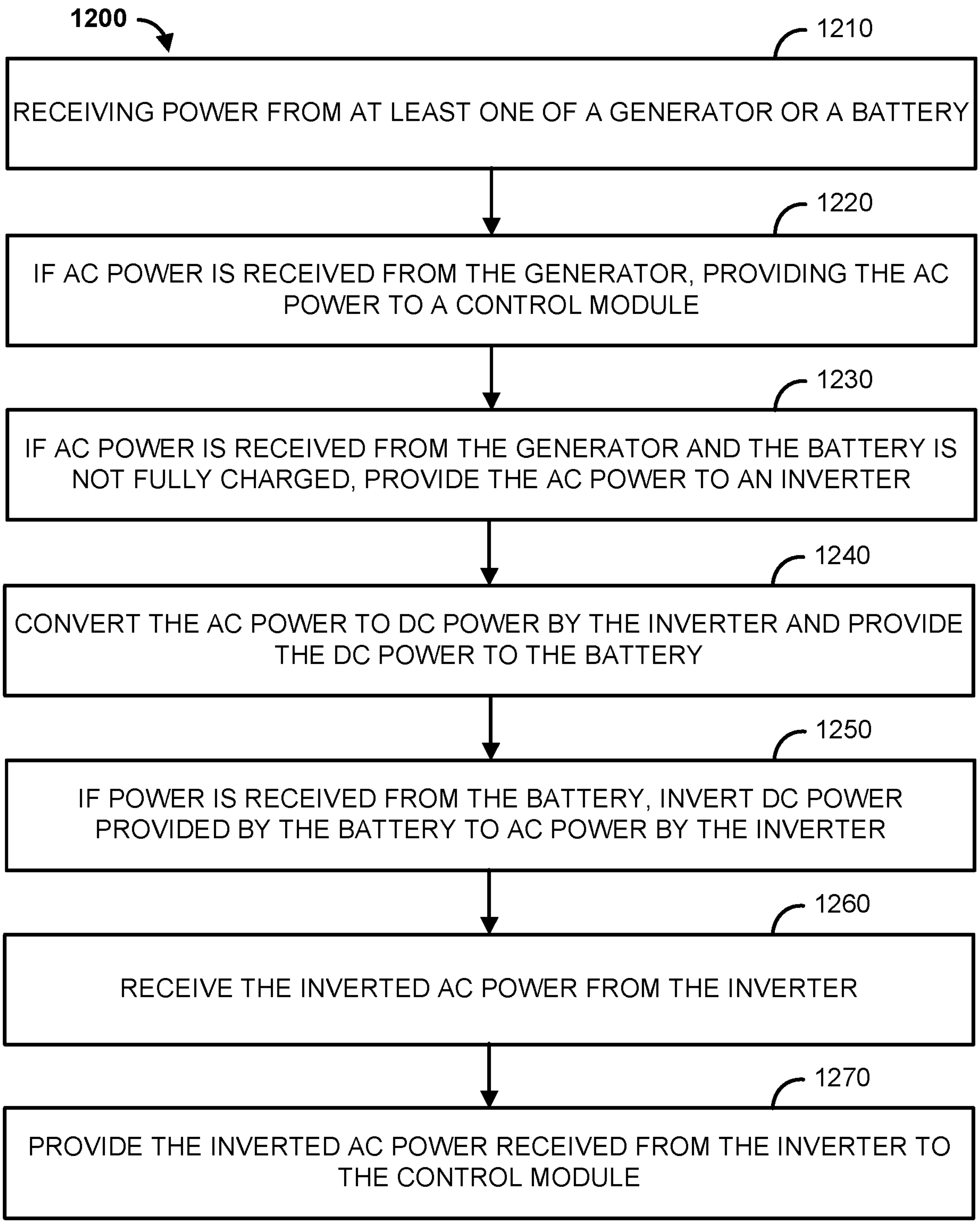
1200
1210
RECEIVING POWER FROM AT LEAST ONE OF A GENERATOR OR A BATTERY
1220
IF AC POWER IS RECEIVED FROM THE GENERATOR, PROVIDING THE AC POWER TO A CONTROL MODULE
1230
IF AC POWER IS RECEIVED FROM THE GENERATOR AND THE BATTERY IS NOT FULLY CHARGED, PROVIDE THE AC POWER TO AN INVERTER
1240
CONVERT THE AC POWER TO DC POWER BY THE INVERTER AND PROVIDE THE DC POWER TO THE BATTERY
1250
IF POWER IS RECEIVED FROM THE BATTERY, INVERT DC POWER PROVIDED BY THE BATTERY TO AC POWER BY THE INVERTER
1260
RECEIVE THE INVERTED AC POWER FROM THE INVERTER
1270
PROVIDE THE INVERTED AC POWER RECEIVED FROM THE INVERTER TO THE CONTROL MODULE

FIG. 12

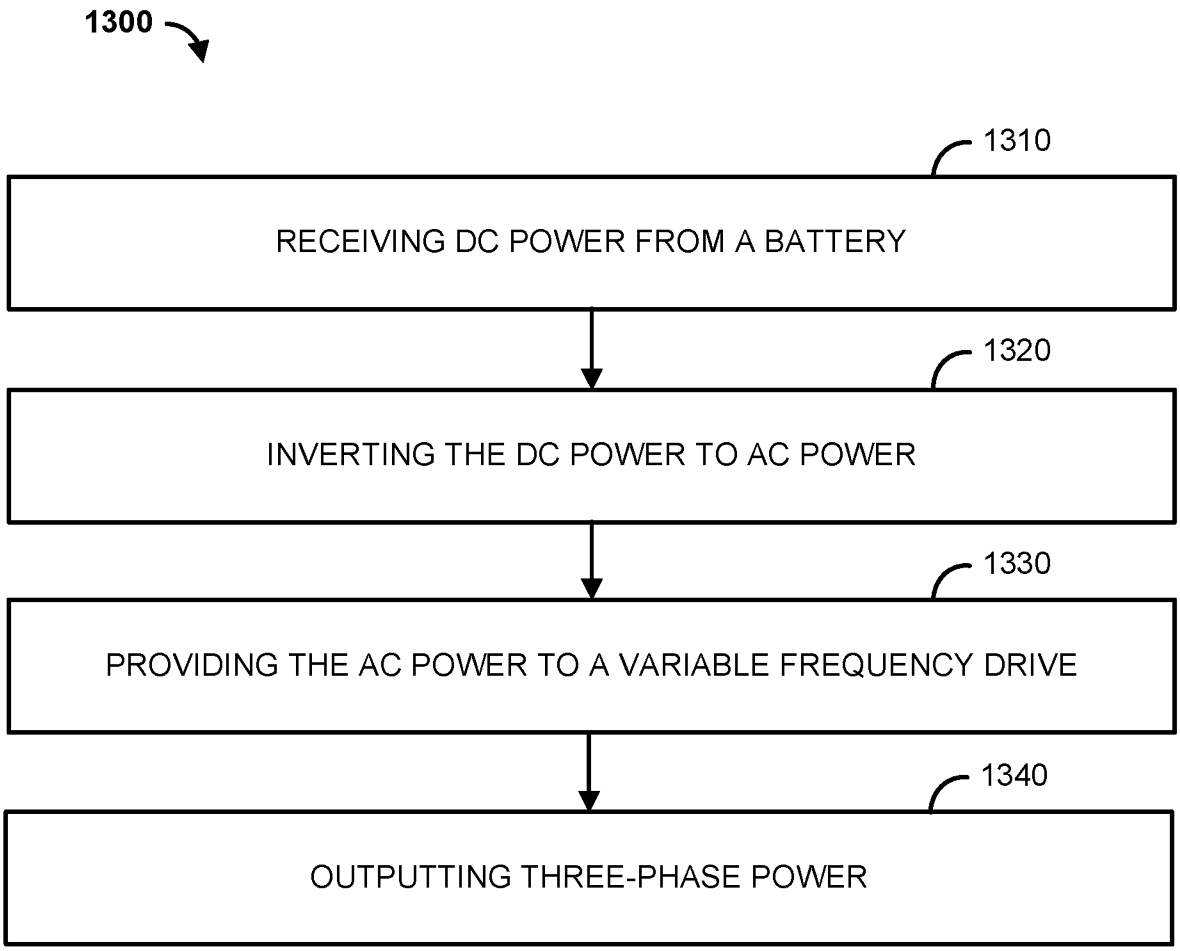
1300
1310
RECEIVING DC POWER FROM A BATTERY
1320
INVERTING THE DC POWER TO AC POWER
1330
PROVIDING THE AC POWER TO A VARIABLE FREQUENCY DRIVE
1340
OUTPUTTING THREE-PHASE POWER

FIG. 13

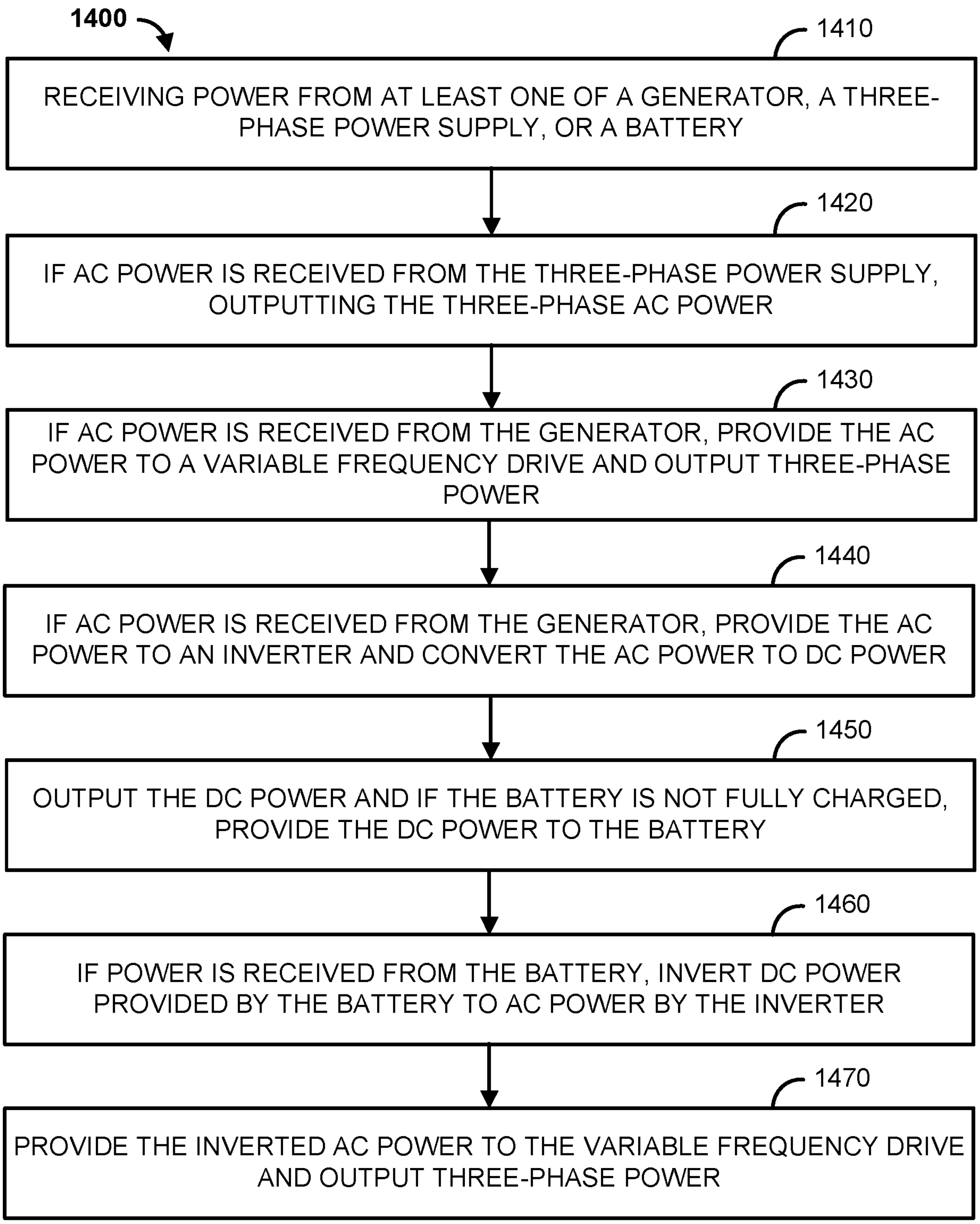
1400
1410
RECEIVING POWER FROM AT LEAST ONE OF A GENERATOR, A THREE-PHASE POWER SUPPLY, OR A BATTERY
1420
IF AC POWER IS RECEIVED FROM THE THREE-PHASE POWER SUPPLY, OUTPUTTING THE THREE-PHASE AC POWER
1430
IF AC POWER IS RECEIVED FROM THE GENERATOR, PROVIDE THE AC POWER TO A VARIABLE FREQUENCY DRIVE AND OUTPUT THREE-PHASE POWER
1440
IF AC POWER IS RECEIVED FROM THE GENERATOR, PROVIDE THE AC POWER TO AN INVERTER AND CONVERT THE AC POWER TO DC POWER
1450
OUTPUT THE DC POWER AND IF THE BATTERY IS NOT FULLY CHARGED, PROVIDE THE DC POWER TO THE BATTERY
1460
IF POWER IS RECEIVED FROM THE BATTERY, INVERT DC POWER PROVIDED BY THE BATTERY TO AC POWER BY THE INVERTER
1470
PROVIDE THE INVERTED AC POWER TO THE VARIABLE FREQUENCY DRIVE AND OUTPUT THREE-PHASE POWER

FIG. 14

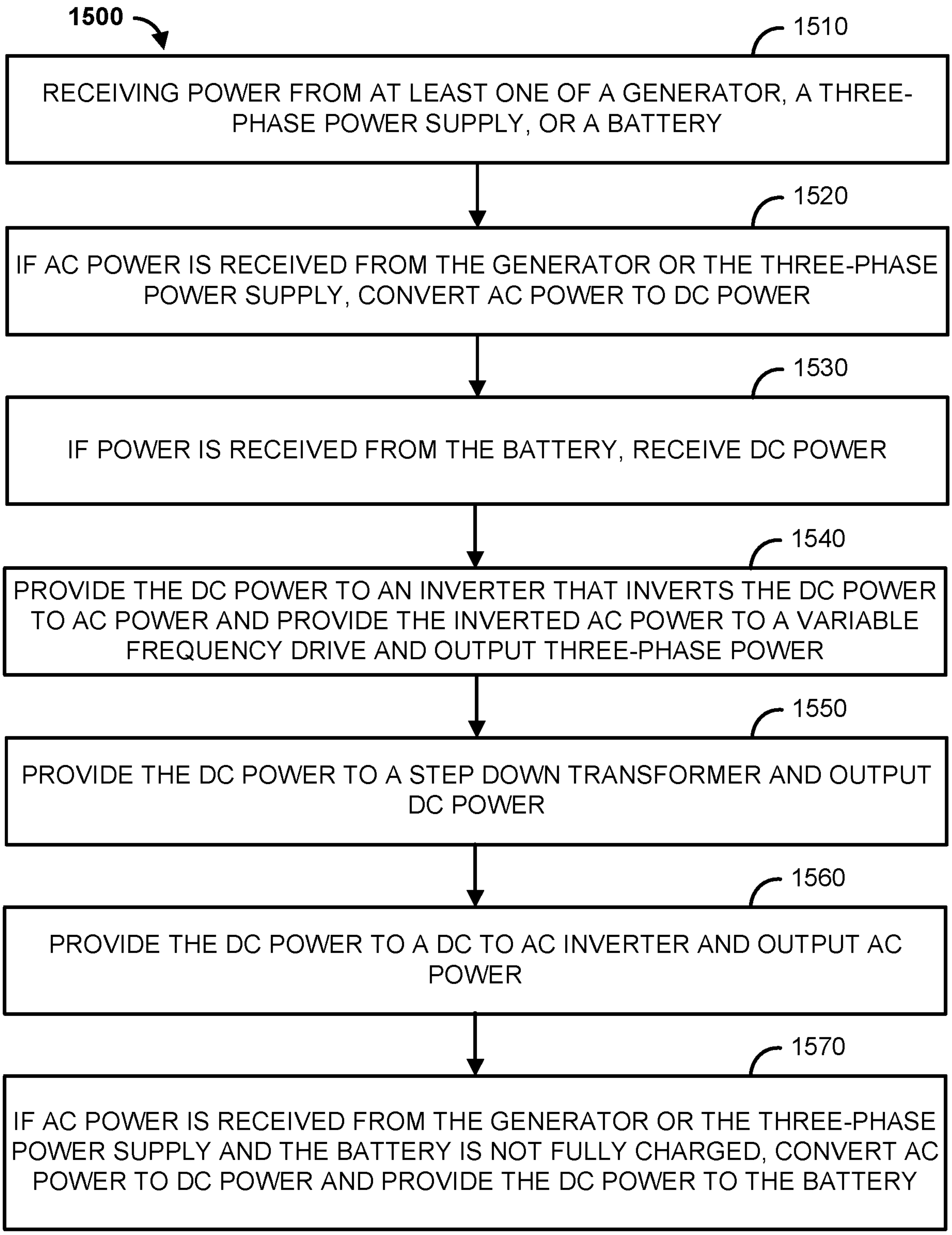
1500
1510
RECEIVING POWER FROM AT LEAST ONE OF A GENERATOR, A THREE-PHASE POWER SUPPLY, OR A BATTERY
1520
IF AC POWER IS RECEIVED FROM THE GENERATOR OR THE THREE-PHASE POWER SUPPLY, CONVERT AC POWER TO DC POWER
1530
IF POWER IS RECEIVED FROM THE BATTERY, RECEIVE DC POWER
1540
PROVIDE THE DC POWER TO AN INVERTER THAT INVERTS THE DC POWER TO AC POWER AND PROVIDE THE INVERTED AC POWER TO A VARIABLE FREQUENCY DRIVE AND OUTPUT THREE-PHASE POWER
1550
PROVIDE THE DC POWER TO A STEP DOWN TRANSFORMER AND OUTPUT DC POWER
1560
PROVIDE THE DC POWER TO A DC TO AC INVERTER AND OUTPUT AC POWER
1570
IF AC POWER IS RECEIVED FROM THE GENERATOR OR THE THREE-PHASE POWER SUPPLY AND THE BATTERY IS NOT FULLY CHARGED, CONVERT AC POWER TO DC POWER AND PROVIDE THE DC POWER TO THE BATTERY

FIG. 15

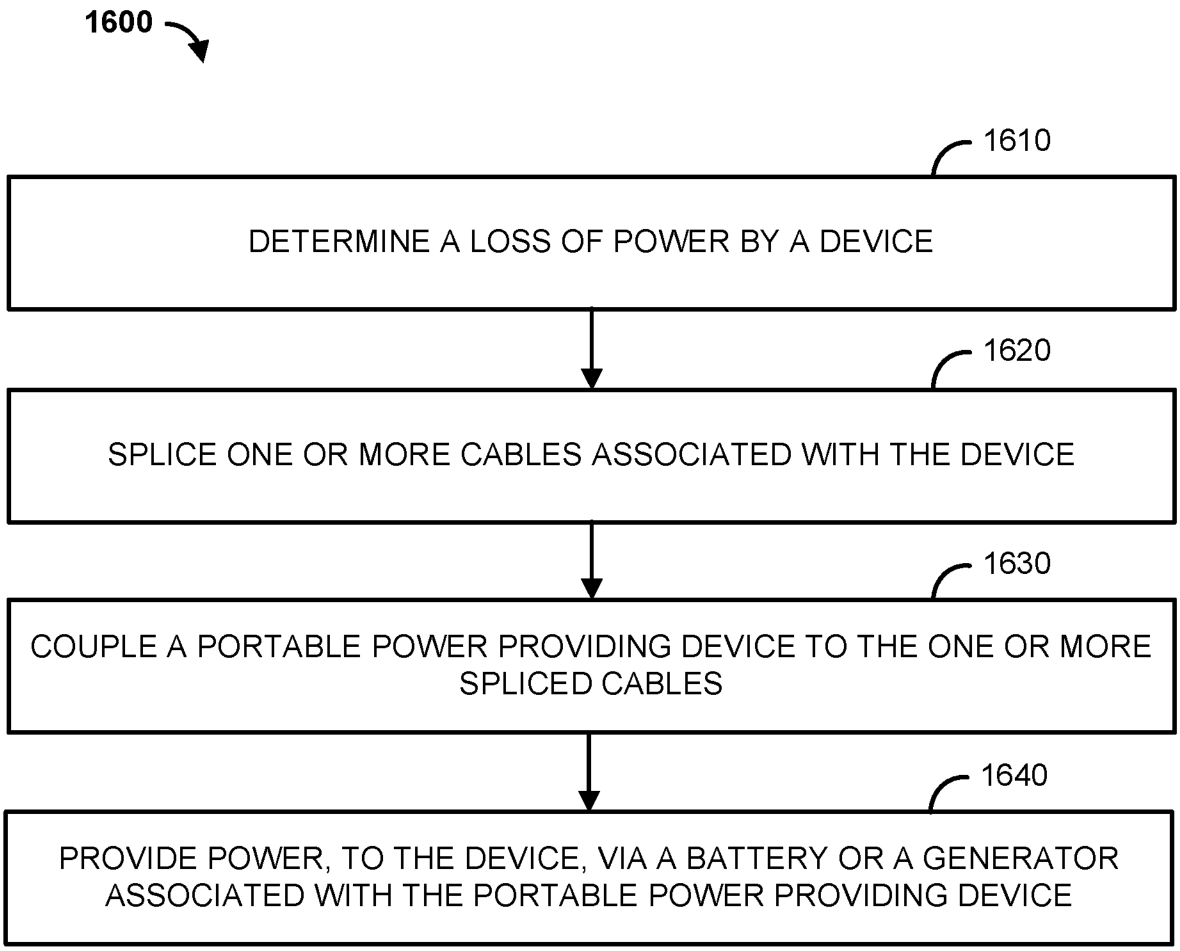
1600
1610
DETERMINE A LOSS OF POWER BY A DEVICE
1620
SPLICE ONE OR MORE CABLES ASSOCIATED WITH THE DEVICE
1630
COUPLE A PORTABLE POWER PROVIDING DEVICE TO THE ONE OR MORE SPLICED CABLES
1640
PROVIDE POWER, TO THE DEVICE, VIA A BATTERY OR A GENERATOR ASSOCIATED WITH THE PORTABLE POWER PROVIDING DEVICE

FIG. 16

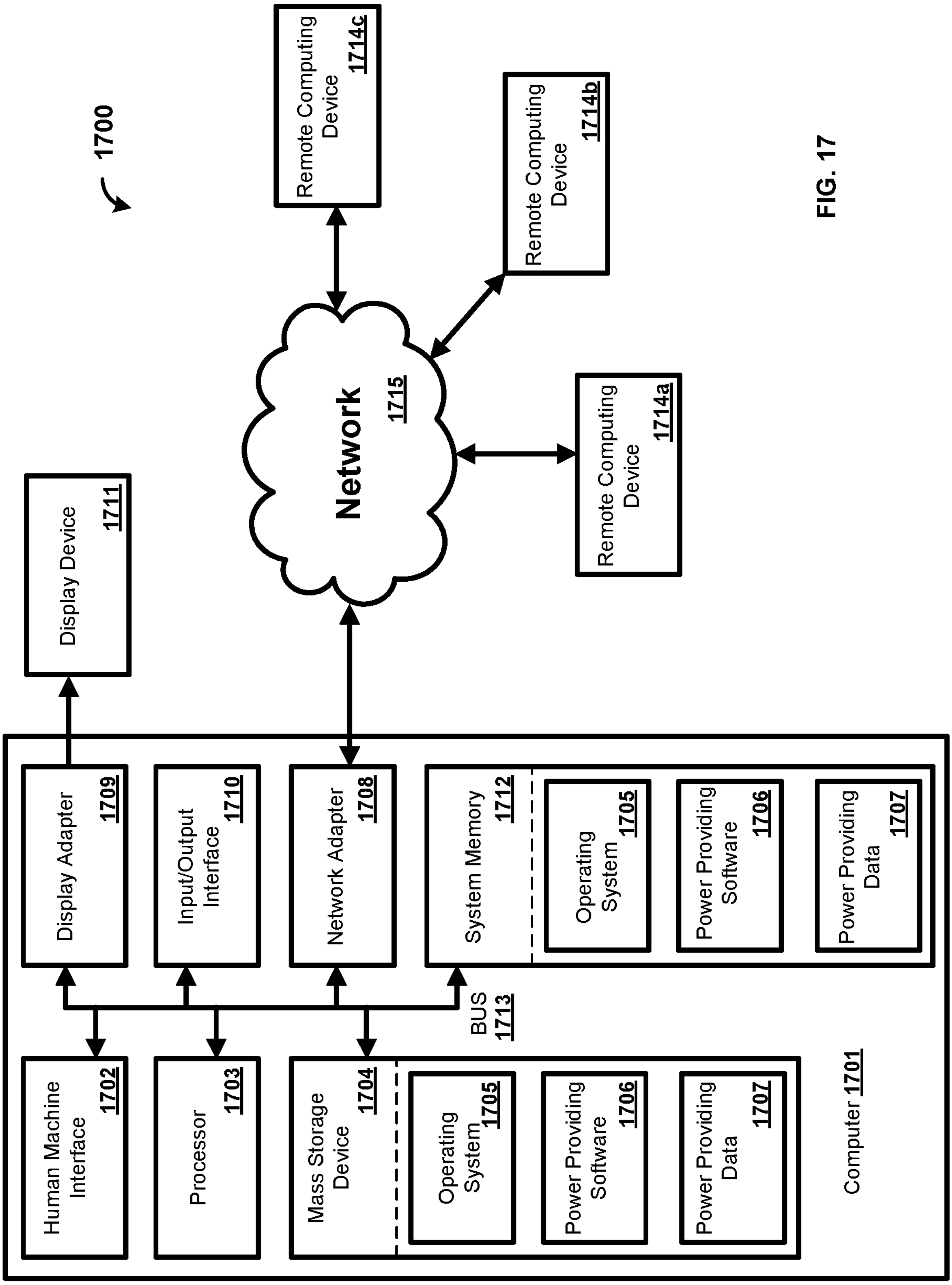
1700
Remote Computing Device 1714c
Remote Computing Device 1714b
Remote Computing Device 1714a
Network 1715
Display Device 1711
Display Adapter 1709
Input/Output Interface 1710
Network Adapter 1708
System Memory 1712
Operating System 1705
Power Providing Software 1706
Power Providing Data 1707
BUS 1713
Human Machine Interface 1702
Processor 1703
Mass Storage Device 1704
Operating System 1705
Power Providing Software 1706
Power Providing Data 1707
Computer 1701

FIG. 17

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 20/43422

A. CLASSIFICATION OF SUBJECT MATTER

IPC - H02J 3/32; H02J 3/38; H03K 17/62 (2020.01)

CPC - H02J 3/32; H02J 3/322; H02J 3/38; H02J 3/381; H03K 17/62

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 9,583,942 B2 (CZARNECKI) 28 February 2017 (28.02.2017) Fig 1, abstract, col 4, ln 3-59, col 5, ln 13-31	1-10
A	US 5,939,799 A (WEINSTEIN) 17 August 1999 (17.08.1999) Fig 1, abstract, col 2, ln 47-col 4, ln 7	1-10
A	US 9,774,190 B2 (INERTECH IP LLC) 26 September 2017 (26.09.2017) Fig 3, abstract, col 6, ln 35-col 7, ln 27	1-10
A	US 9,929,592 B2 (CYBERPOWER SYSTEMS, INC.) 27 March 2018 (27.03.2018) Fig 1, abstract, col 5, ln 18-44	1-10

☐ Further documents are listed in the continuation of Box C. ☐ 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
"D" document cited by the applicant in the international application
"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
23 November 2020	18 DEC 2020

Name and mailing address of the ISA/US	Authorized officer
Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-8300	Lee Young Telephone No. PCT Helpdesk: 571-272-4300

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 20/43422

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 extra 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 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.:
1-10

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.

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 1-10 drawn to an apparatus including specific connection details between one or more batteries, a transfer switch, an inverter, and control module.

Group II: Claim 11-20 drawn to an apparatus including specific connection details between one or more batteries, an inverter, and a distribution hub.

Group III: Claim 21 drawn to an apparatus including specific connection details between one or more batteries, an inverter, a step-down transformer, and a variable frequency drive.

Group IV: Claim 22 drawn to an apparatus including specific connection details between one or more batteries, an inverter, a transfer switch, a step-down transformer, and one or more DC to AC inverters.

Group V: Claim 23 drawn to an apparatus including specific connection details between one or more AC to DC converters, a power distribution device, one or more batteries, a transfer switch, a step-down transformer, and one or more DC to AC inverters.

Group VI: Claim 24 drawn to a method including conditional power deliver to an inverter based on battery charging level.

The inventions listed as Groups I through VI 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 features of a transfer switch, configured to: receive AC power from an external power source via a first electrical connection, provide AC power to an inverter via a second electrical connection, receive AC power from the inverter via a third electrical connection, provide AC power to an external device via a fourth electrical connection, and provide AC power to a control module via a fifth electrical connection; and the control module, configured to: control operation of the inverter, not included in the other groups.

Group II includes the special technical features of the inverter configured to: provide the received AC power to the distribution hub via the second electrical connection, wherein the inverter is configured to auctioneer AC power from the first electrical connection and the third electrical connection, not included in the other groups.

Group III includes the special technical features of the inverter configured to: provide the inverted AC power to a step-down transformer and a variable frequency drive via a second electrical connection; the step-down transformer, configured to: receive AC power from the inverter via the second electrical connection, reduce the received AC power to a lower AC voltage, and provide the reduced AC power to a first output; and a variable frequency drive, configured to: receive AC power from the inverter via a third electrical connection, convert the received AC power to three-phase AC power, and provide the three-phase AC power to a second output, not included in the other groups.

Group IV includes the special technical features of the inverter, configured to: receive AC power from the transfer switch via the second electrical connection, convert the received AC power to DC power, and provide the converted DC power to one or more batteries, one or more stepdown transformers, and one or more DC to AC inverters via a fifth electrical connection; and the one or more batteries, configured to: receive the converted DC power from the inverter via the fifth electrical connection, provide DC power to the one or more step-down transformers, and provide DC power to the one or more DC to AC inverters, not included in the other groups.

Group V includes the special technical features of one or more AC to DC converters configured to:receive AC power from an external power source, convert the AC power to DC power, and provide the converted DC power to a power distribution device via a first electrical connection; the power distribution device, configured to:
receive the converted DC power from the one or more AC to DC converters via the first electrical connection,
provide the converted DC power to one or more batteries, one or more stepdown transformers, and one or more DC to AC inverters via a second electrical connection, invert the converted DC power to AC power, and provide the inverted AC power to a transfer switch via a third electrical connection; the one or more batteries, configured to: receive the converted DC power from the power distribution device via the second electrical connection, and
provide DC power to the one or more step-down transformers, and provide DC power to the one or more DC to AC inverters; and the transfer switch, configured to: receive the inverted AC power from the power distribution device via the third electrical connection, receive AC power from at least one of the external power source or the power distribution device, and provide the received AC power to an output, not included in the other groups.

Group VI includes the special technical features of if AC power is received from the generator, providing the received AC power to a control module; if AC power is received from the generator and the battery is not fully charged, providing the AC power to an inverter, converting the AC power to DC power by the inverter, and
providing the DC power to the battery, not included in the other groups.

Common Technical Features:
The only technical features shared by Groups I-VI that would otherwise unify the groups, are that various Groups include recitation of one or more batteries, a transfer switch, an inverter for converting DC to AC, a step-down transformer, an AC-to-DC converter, and a power distribution unit. However, these shared technical features do not represent a contribution over prior art, because the shared technical features are disclosed by US 9,774,190 B2 to Inertech IP LLC (hereinafter 'Inertech').

see next page

previous page

Inertech discloses an apparatus including one or more batteries (264), a transfer switch (130), an inverter (268) for converting DC to AC, a step-down transformer (135), an AC-to-DC converter (45a), and a power distribution unit (120) (Fig 3, col 6, ln 35-col 7, ln 27).

As the shared technical features were known in the art at the time of the invention, they cannot be considered special technical features that would otherwise unify the groups.

Therefore, Groups I-VI lack unity under PCT Rule 13.