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(54) **EXPANDABLE POWER STATION**

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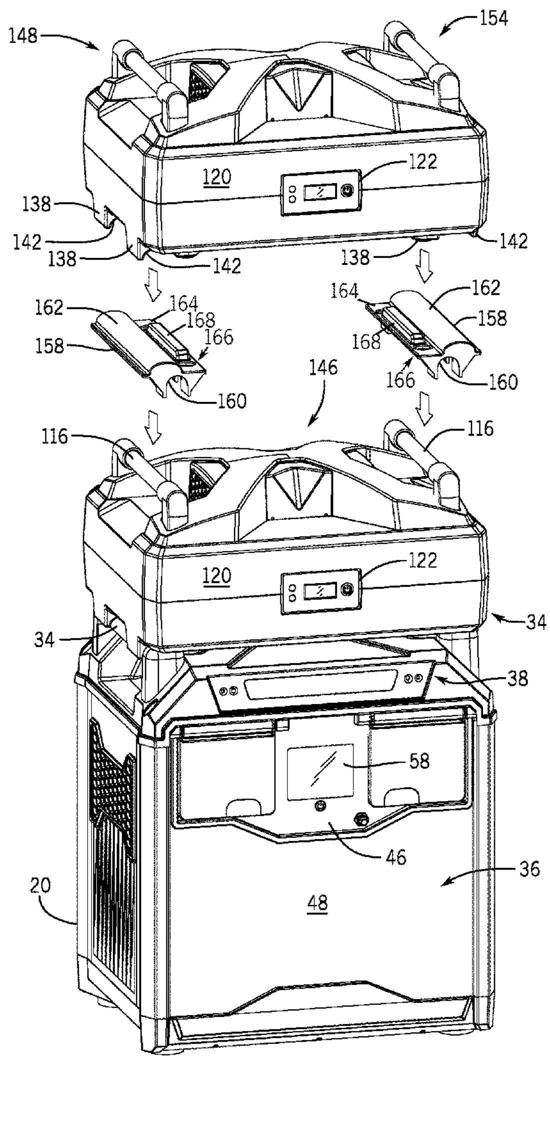
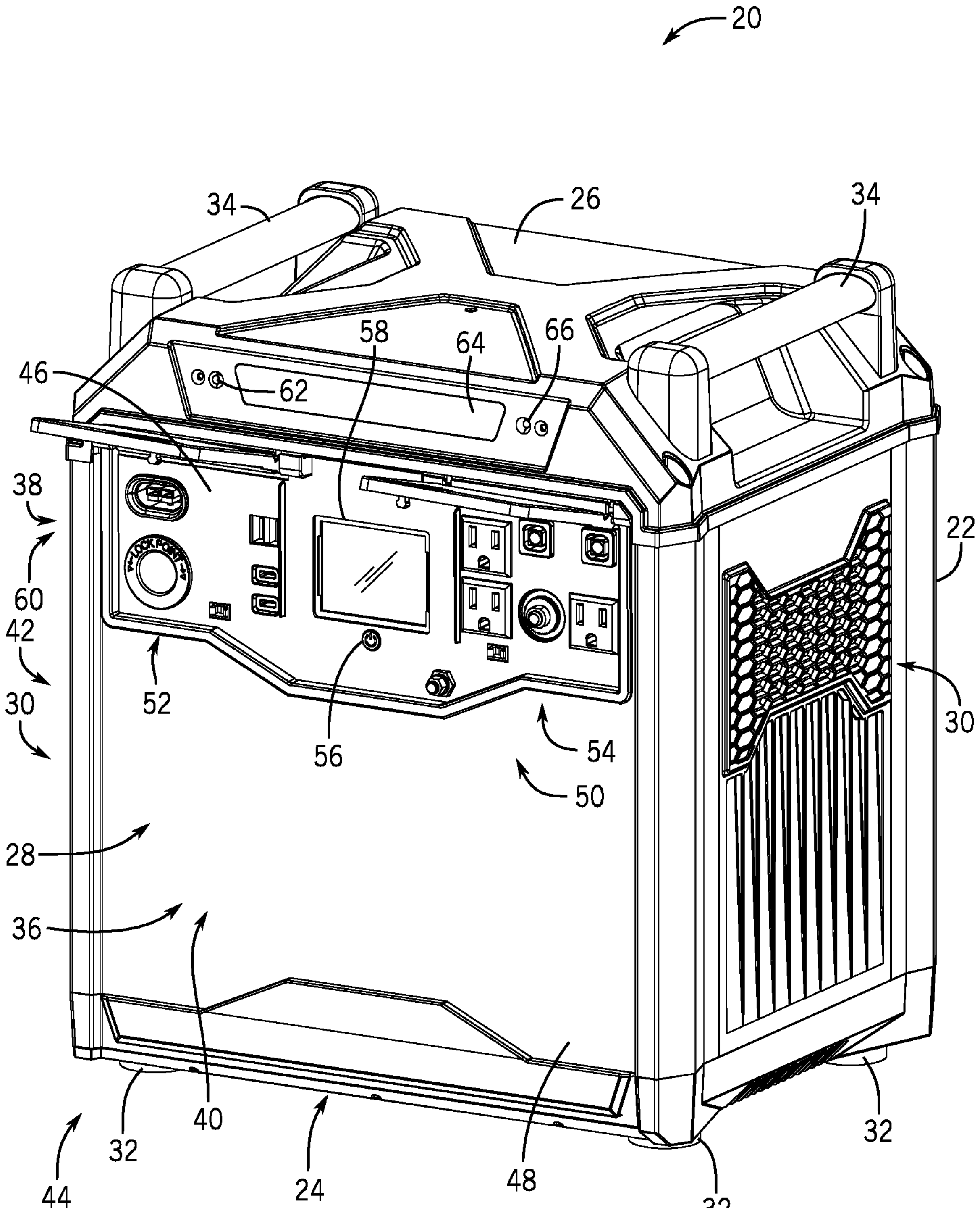
(57) **ABSTRACT**

An expandable power station includes a housing and an onboard battery system positioned within the housing. The expandable power station is electrically connectable to battery systems of one or more expansion batteries to increase a battery level available to the onboard battery system of the expandable power station and electrically connectable to a linking module configured to combine a power output of the expandable power station and a separate power output of a separate expandable power station into an increased power output. Further, the expandable power station includes a plurality of supports extending from the housing. The plurality of supports is configured to separately support one expansion battery of the one or more expansion batteries and the linking module directly thereon.

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LOCK POINT

FIG. 1

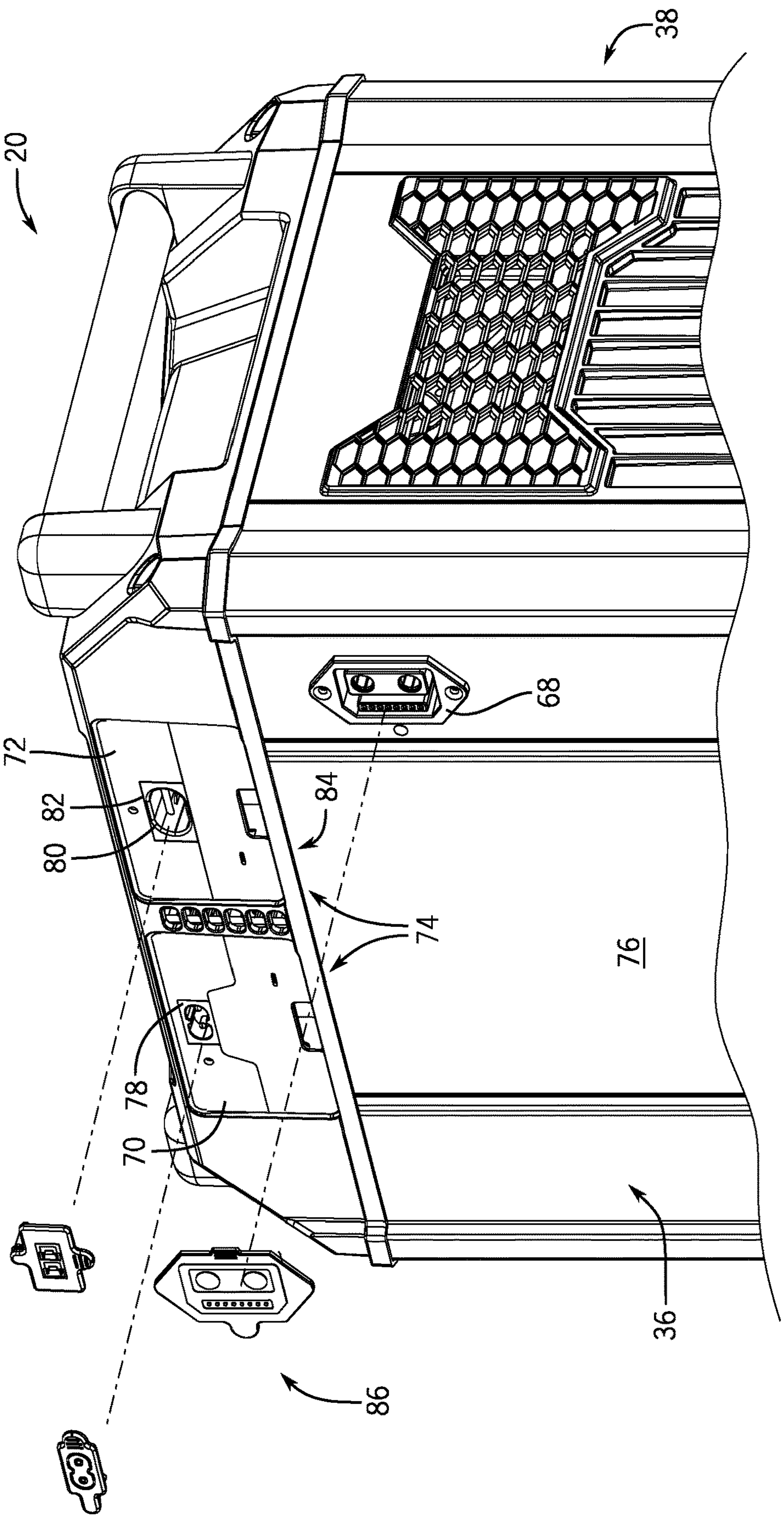

FIG. 2

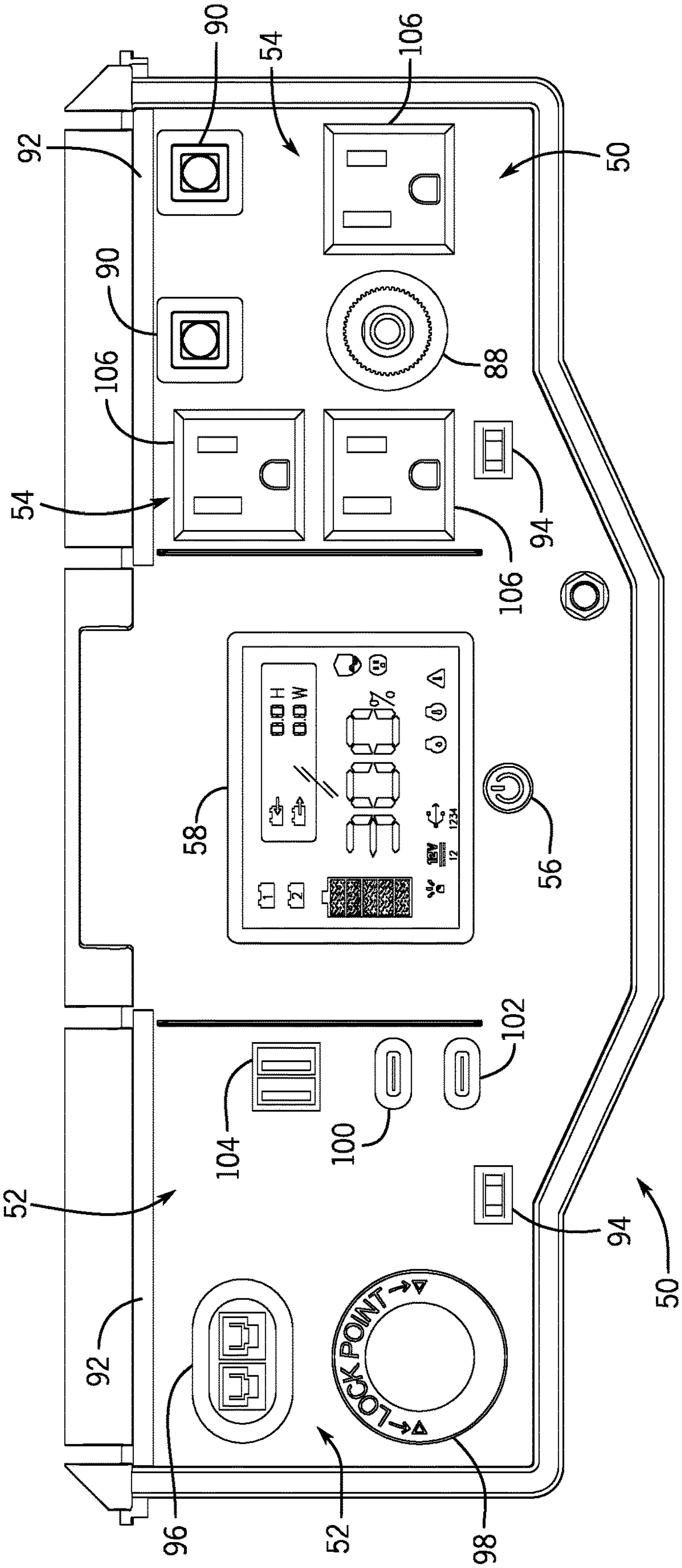
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FIG. 3

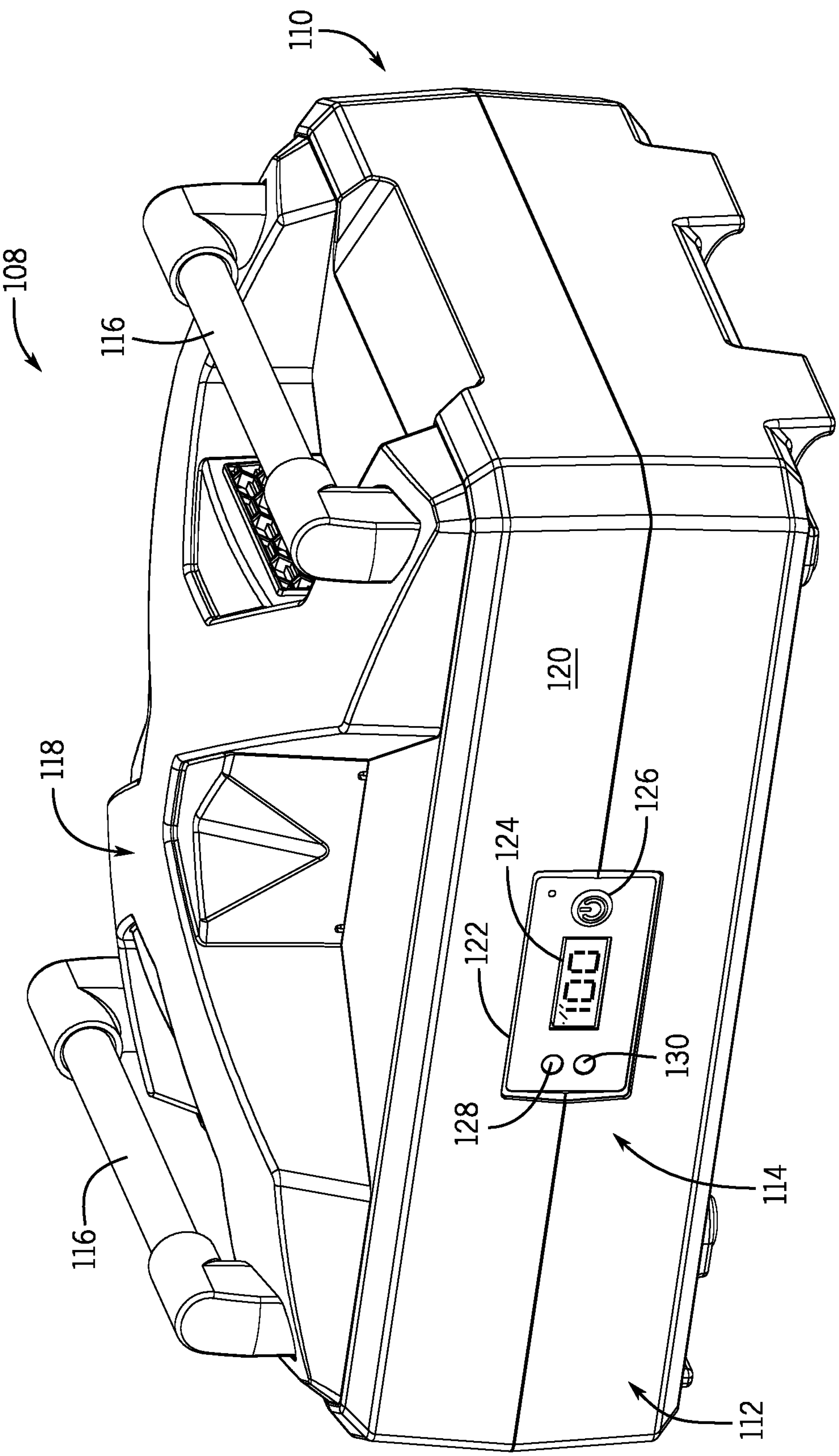

FIG. 4

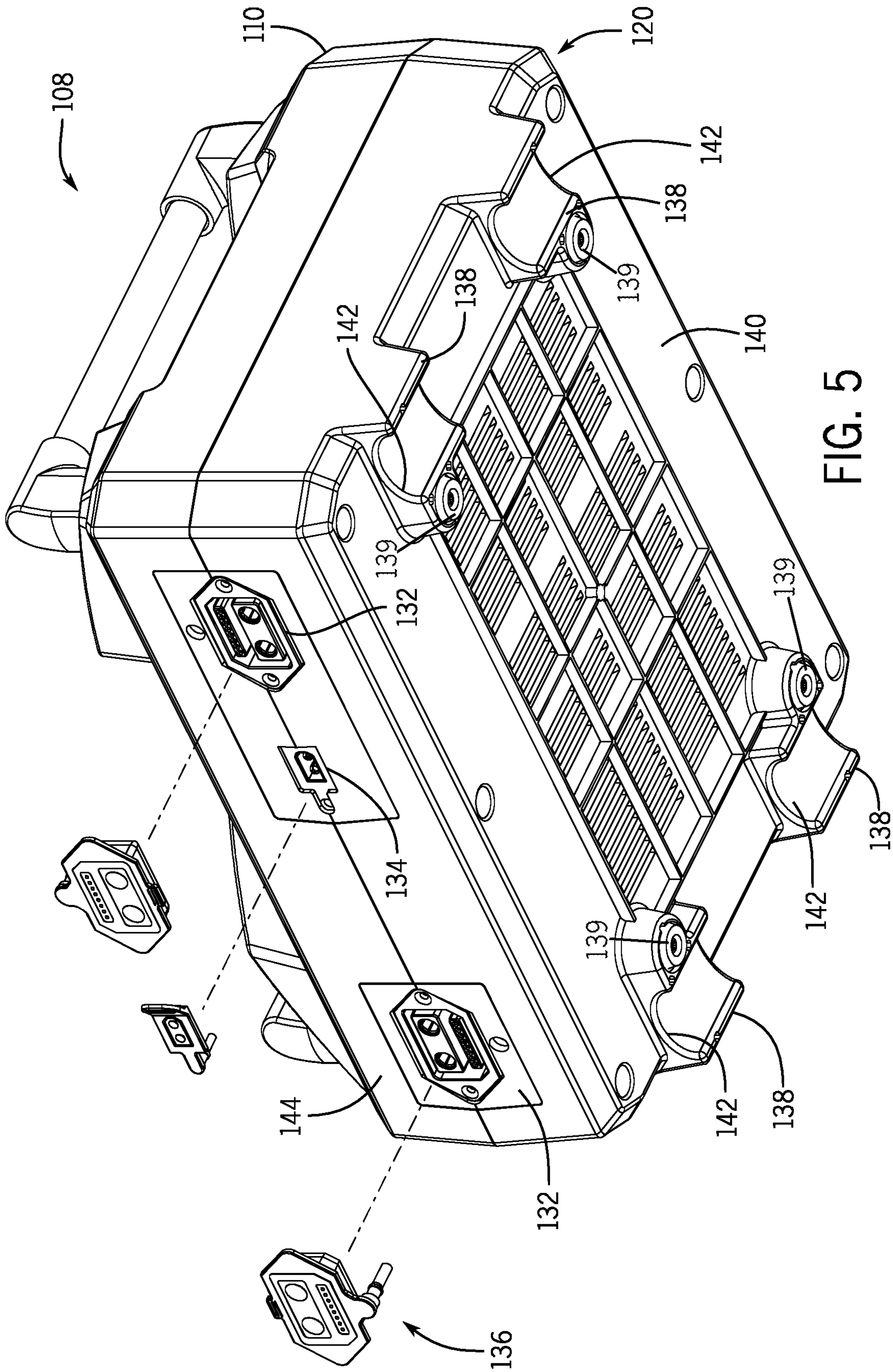
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FIG. 5

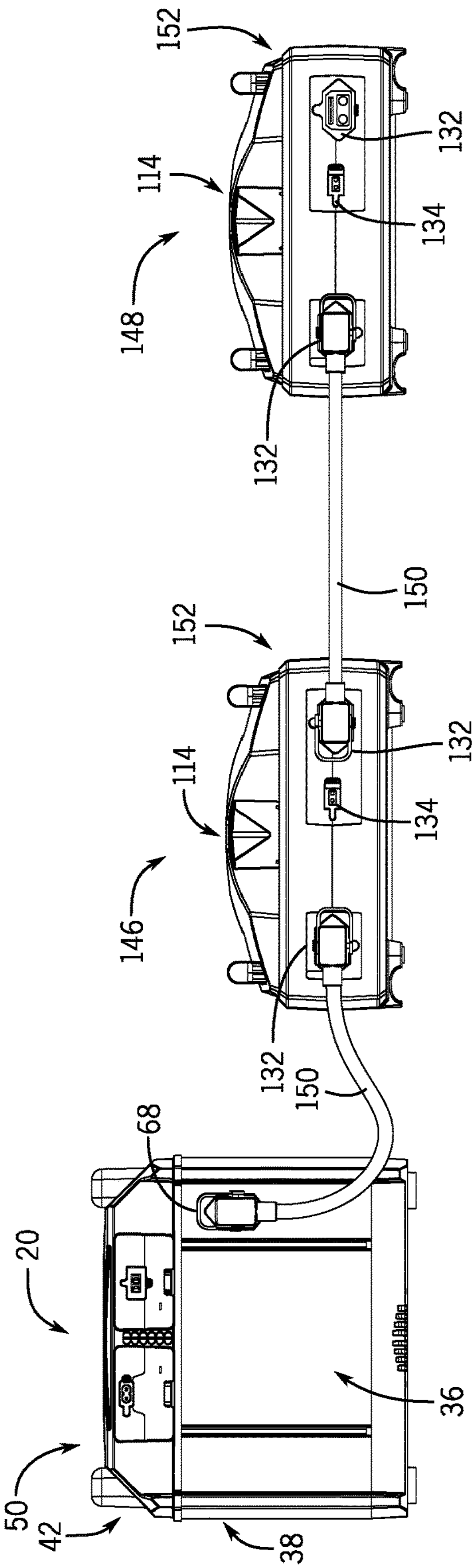
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FIG. 6

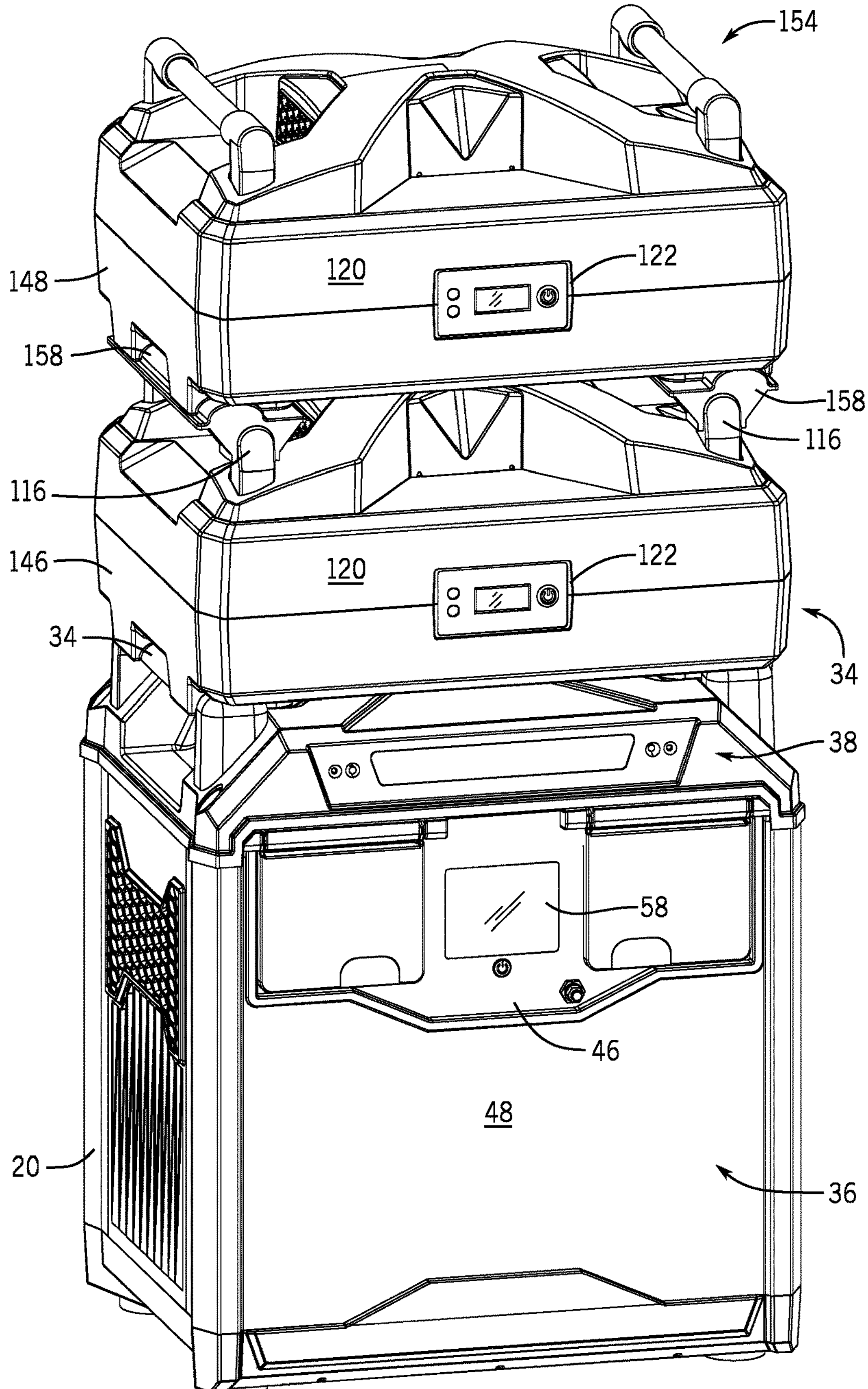

FIG. 7

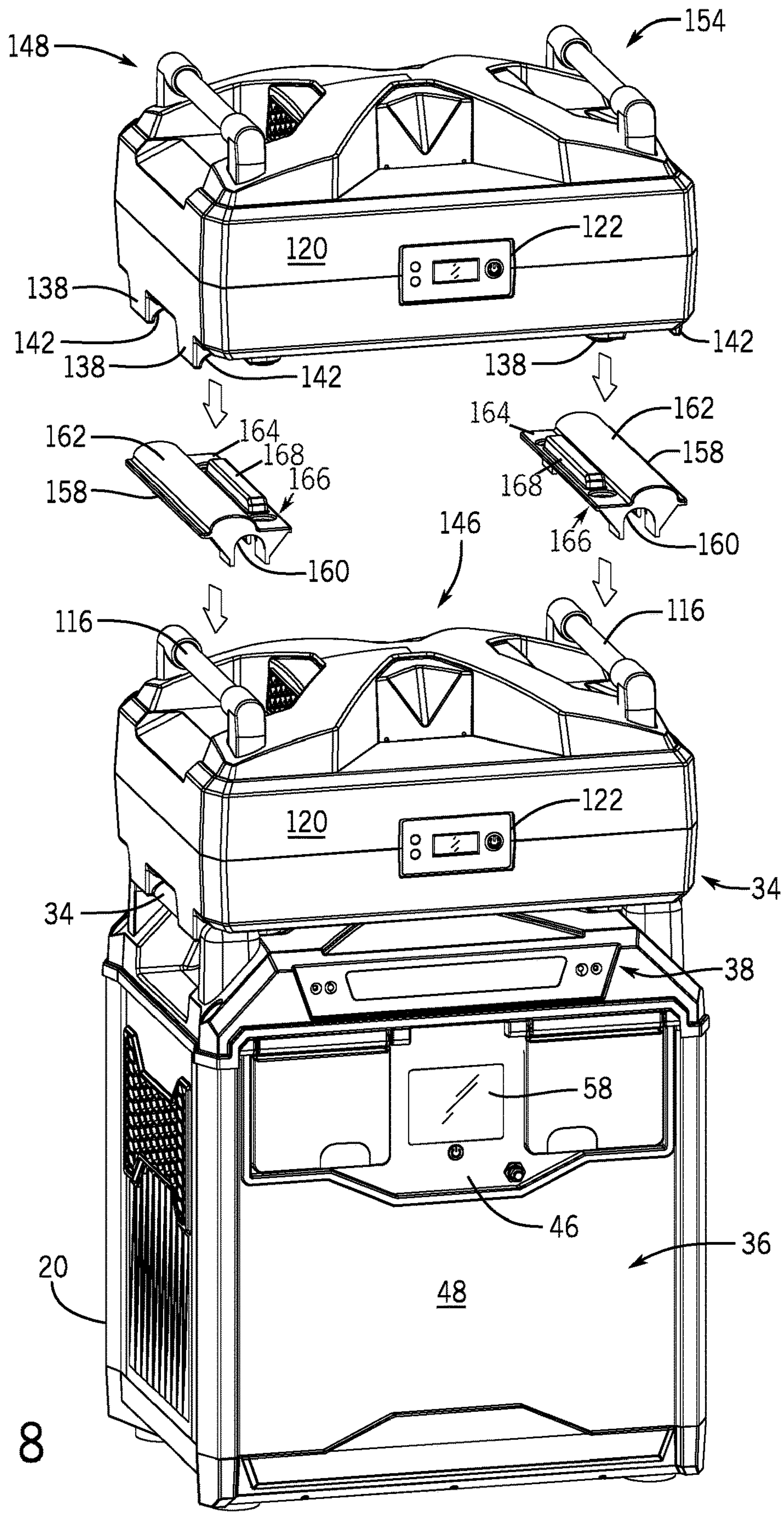
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FIG. 8

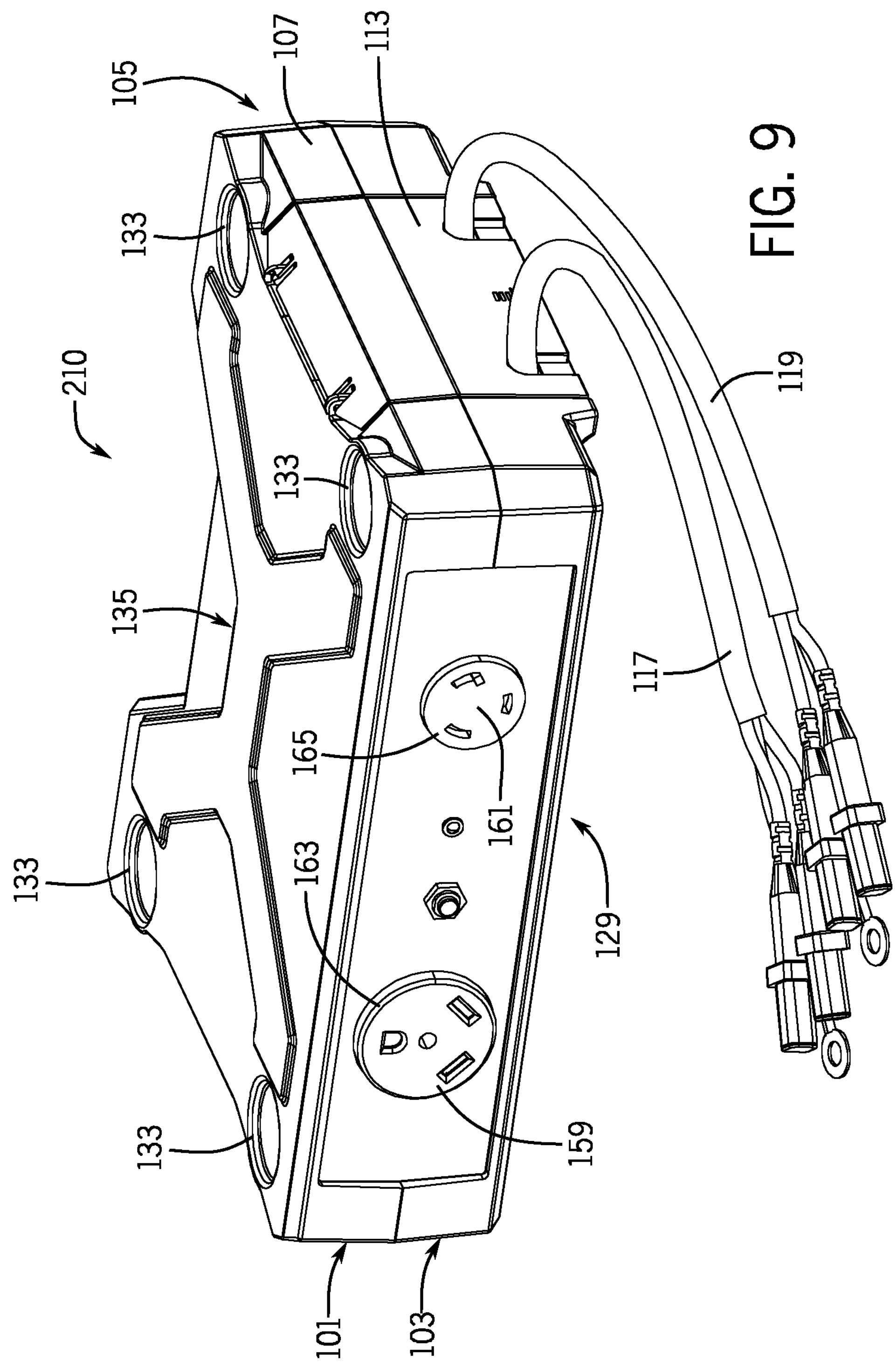
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FIG. 9

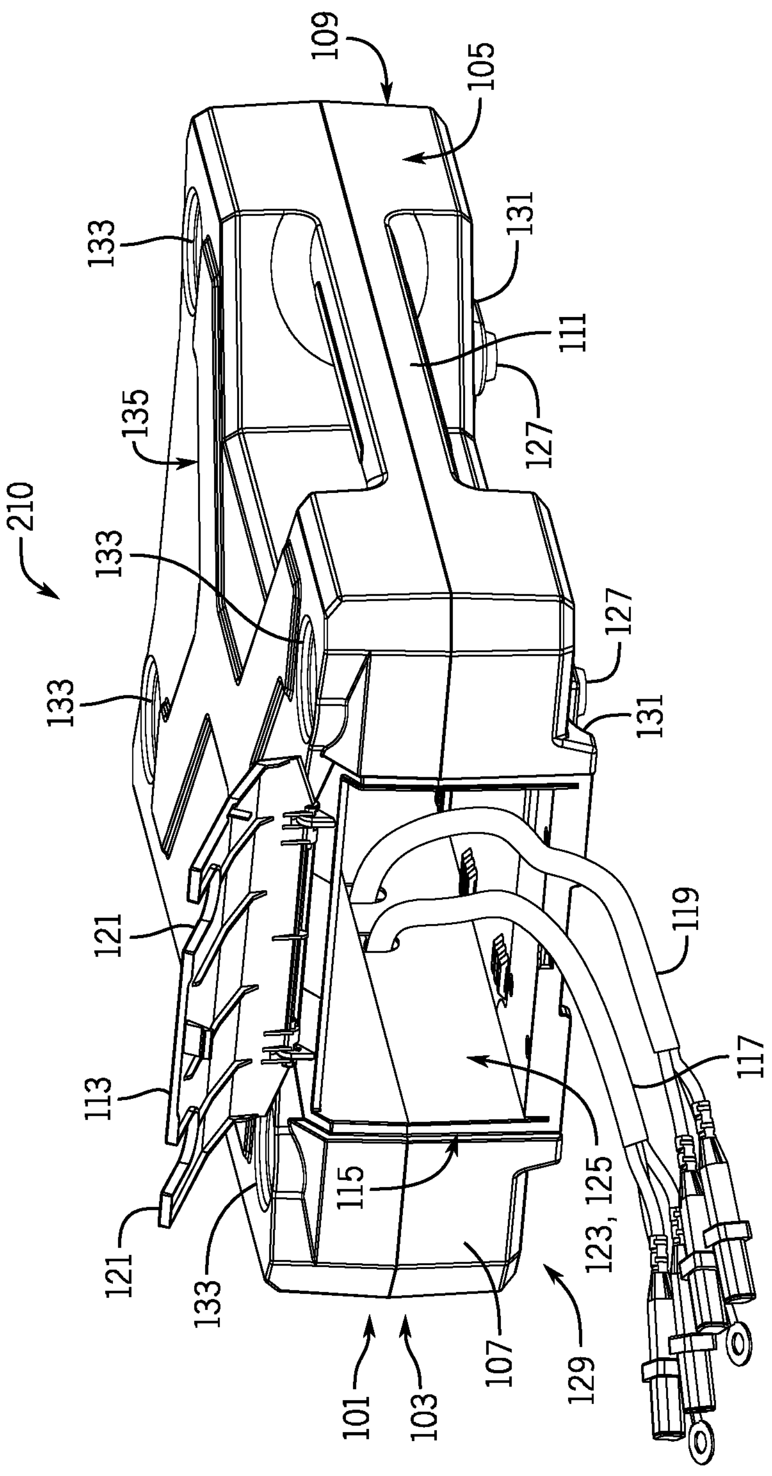
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FIG. 10

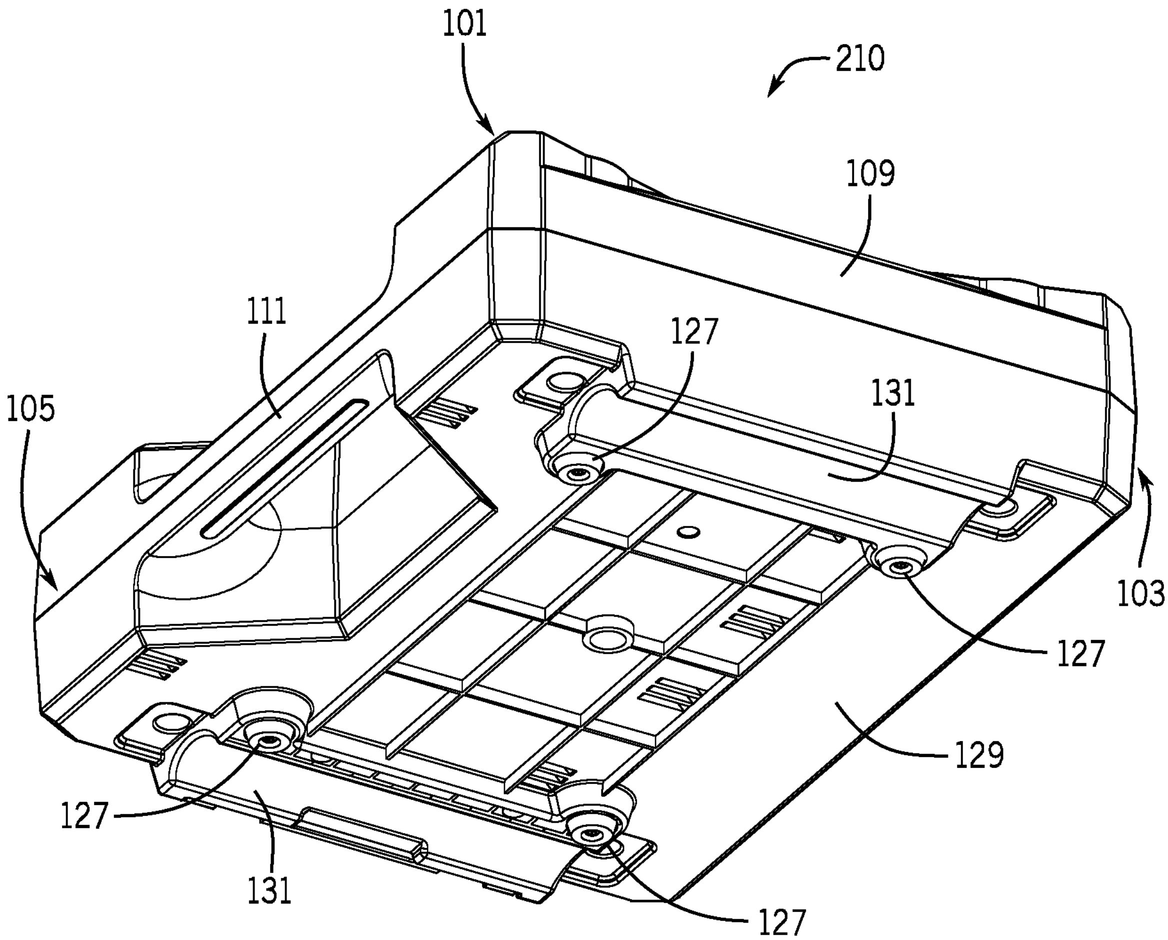
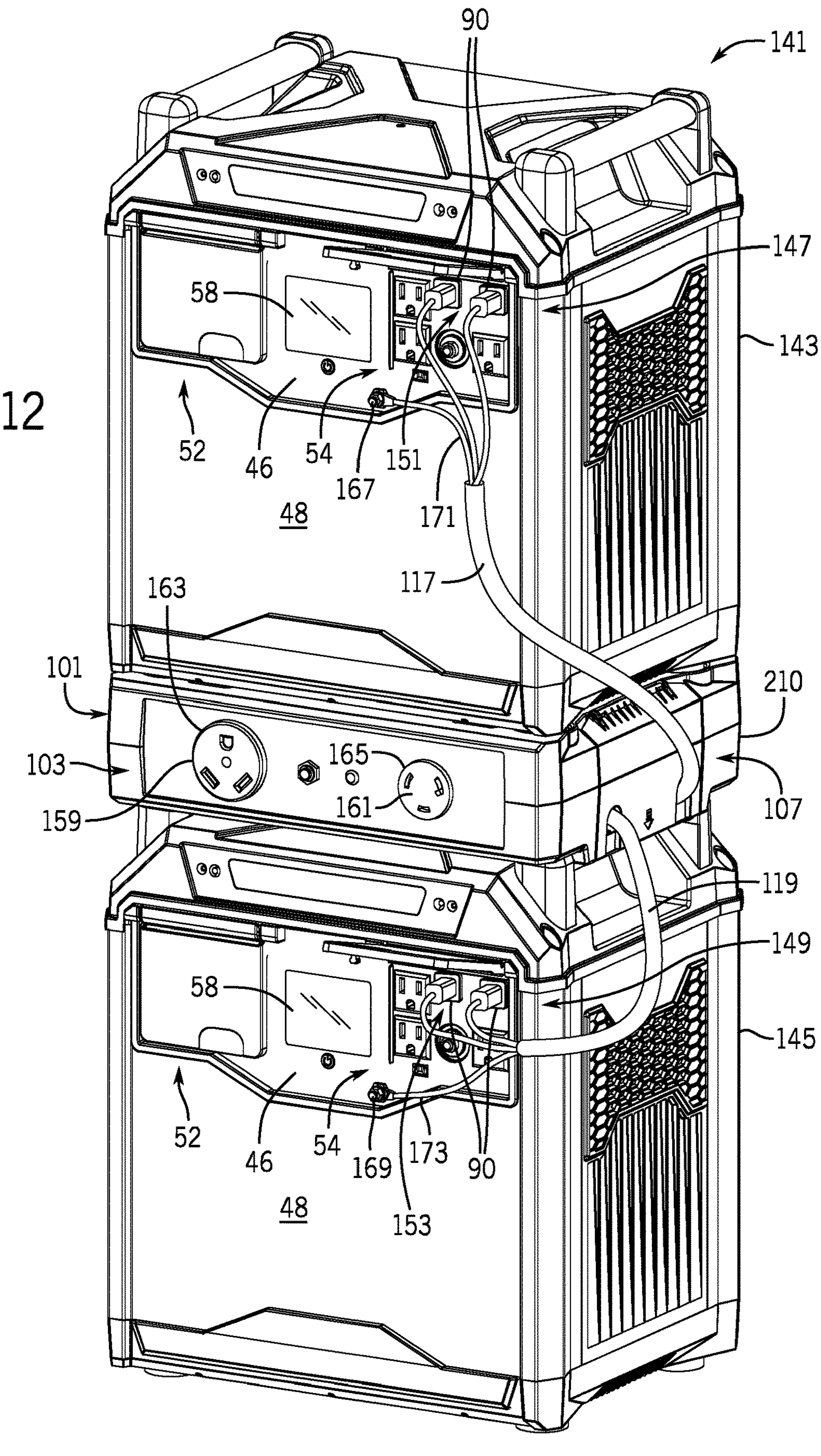


FIG. 11

FIG. 12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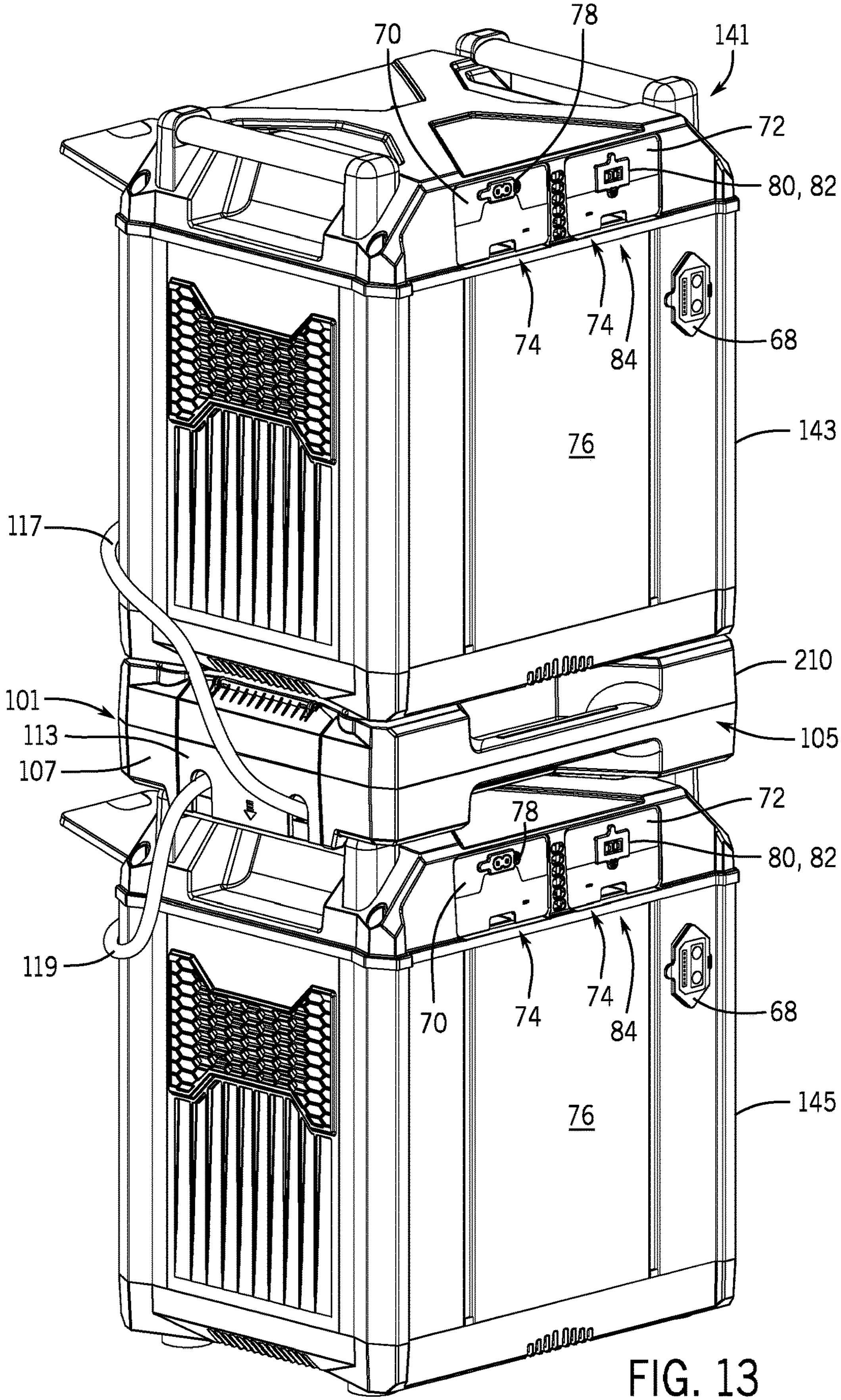
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FIG. 13

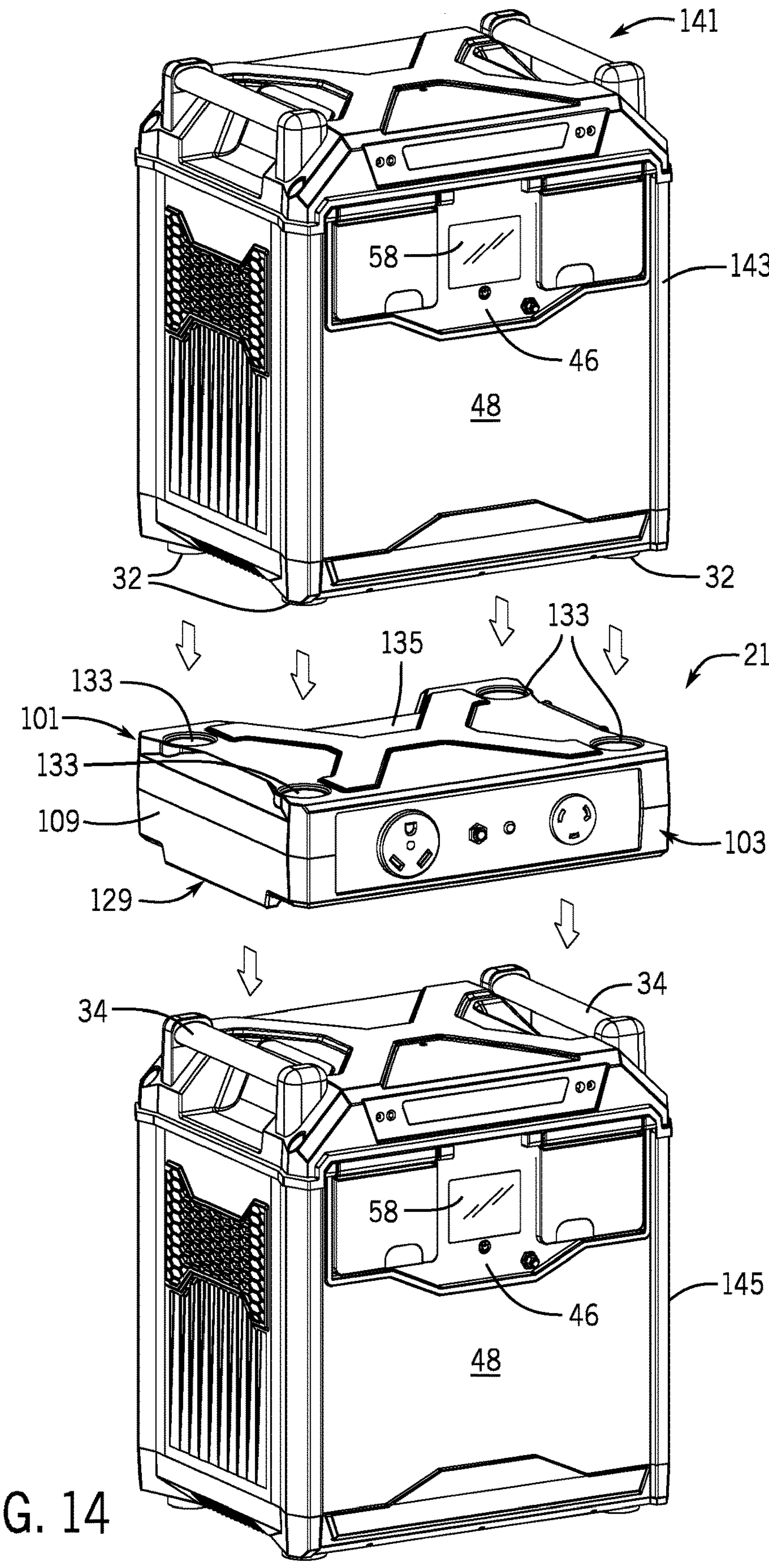
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FIG. 14

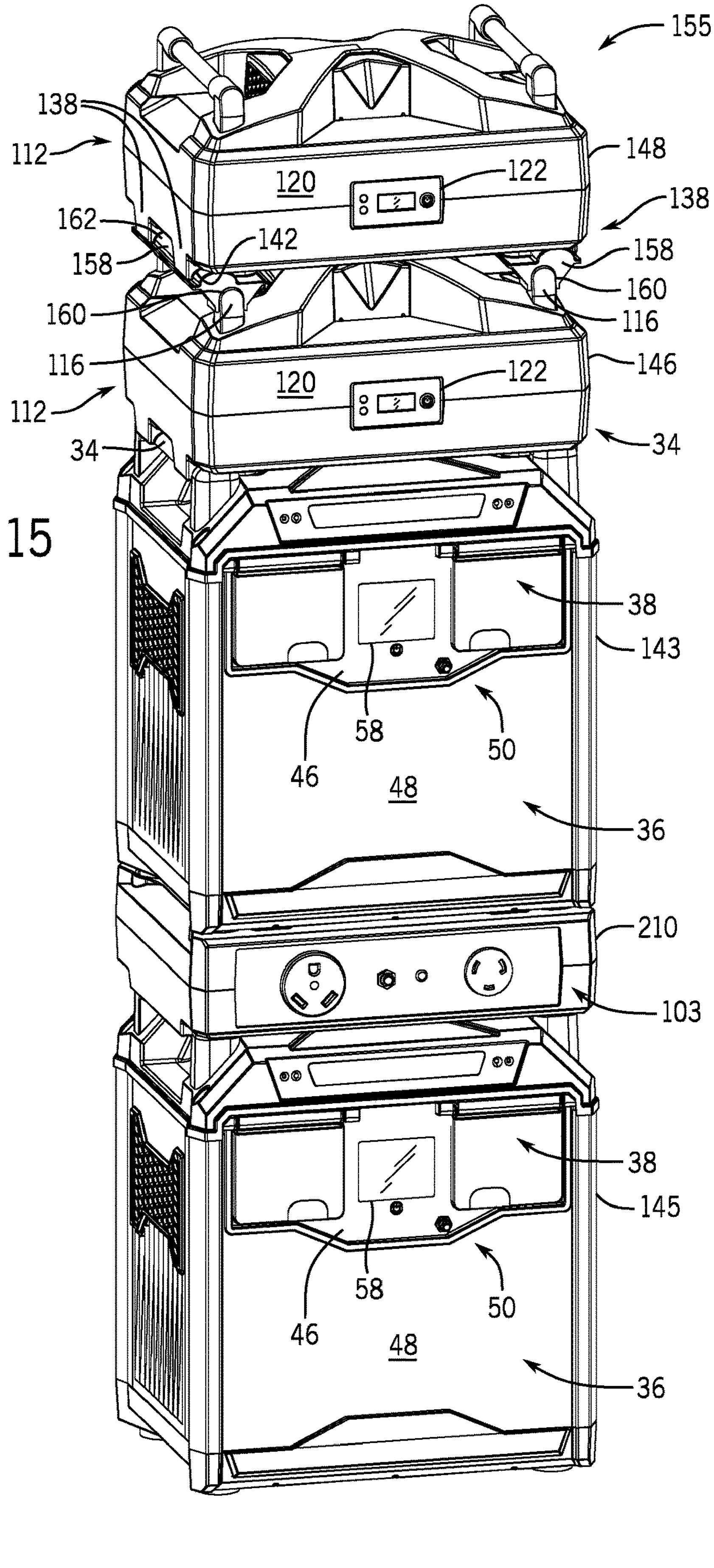
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FIG. 15

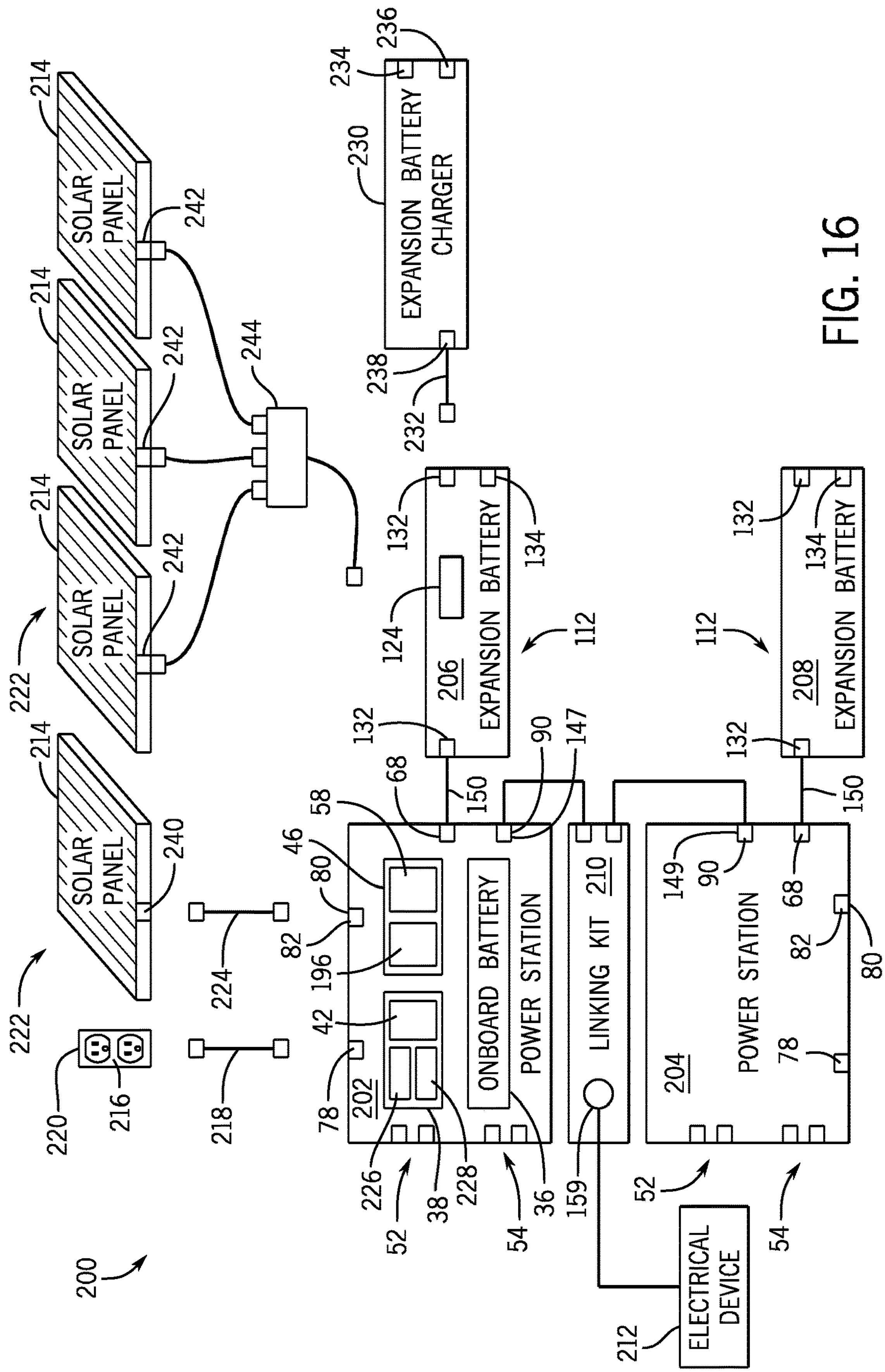
SOLAR PANEL
SOLAR PANEL
SOLAR PANEL
SOLAR PANEL
EXPANSION BATTERY CHARGER
206 EXPANSION BATTERY
208 EXPANSION BATTERY
202
ONBOARD BATTERY
POWER STATION
LINKING KIT 210
204
POWER STATION
ELECTRICAL DEVICE

FIG. 16

EXPANDABLE POWER STATION

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] The present application is a non-provisional of and claims priority to U.S. Provisional Patent Application Ser. No. 63/378,448, filed Oct. 5, 2022, the disclosure of which is incorporated herein by reference in its entirety.

BACKGROUND OF THE INVENTION

[0002] Embodiments of the present invention relate to gasless inverter generators or power stations and, more particularly, to a system for increasing power output or energy capacity available to an electrical load by connecting a power station to at least one additional power source.

[0003] Fuel generators powered by fossil fuels, such as, for example, gasoline, liquefied petroleum gas (LPG), or natural gas (NG), are commonly used as a mobile or backup power source. Fuel generators can provide power in locations without access to the utility grid or when natural disasters, extreme weather events, or other conditions result in a power outage. Fuel generators require a constant supply of fuel for combustion, and that fuel might not be readily available, particularly in remote locations and when natural disasters or severe weather interrupts the fuel supply. Further, these types of generators contribute to global warming, require frequent maintenance, and emit hazardous exhaust and noise, which makes them unsuitable for indoor environments.

[0004] Inverter power stations include battery systems that can store electrical energy for use in locations without access to the utility grid or when a power outage occurs in the grid. Inverter power station users can charge these battery systems with energy from various sources such as, for example, the utility grid using a converter or rectifier that changes alternating current ("AC") power into direct current ("DC") power. Alternatively, such users may elect to charge their battery systems with energy from carbon-free renewable energy sources, the use of which generally reduces dependence on fossil fuels and lowers energy bills. As an example, solar panels can charge battery systems to provide a renewable source of stored energy independent from the utility grid, which is convenient for many mobile and off-grid applications. Battery systems can include batteries connected in series or in parallel to expand capacity in terms of voltage and/or current and can power electrical devices that require AC power using an inverter that transforms DC power into AC power.

[0005] Portable inverter power stations often have a small size that allows them to be transportable. The size of these portable power stations can determine the space available for onboard battery systems and associated power electronics used to power electrical loads connected to the power stations. As a result, the energy capacity and available power output of a power station are often limited due to the portable nature of the power station. In addition, portable power stations often have power output receptacles couplable to an electrical load and that have a power rating based on the available power output of the power station. However, some loads may require connection to a power output receptacle with a higher power rating than what a smaller power station provides. Unfortunately, a larger power station that includes a larger energy capacity and a higher rated power output can be hard to transport, requires a larger footprint, and can be more costly.

[0006] Therefore, it would be desirable to provide a portable gasless inverter generator or power station powered by an expandable battery system and that can be combined with another power source to increase the power output and energy capacity available to a load.

BRIEF STATEMENT OF THE INVENTION

[0007] Embodiments of the invention relate to a power station connectable to one or more expansion batteries and to another power station to increase energy and power available to power a load.

[0008] In accordance with one aspect of the invention, an expandable power station includes a housing and an onboard battery system positioned within the housing. The expandable power station also includes an external battery port configured to electrically connect to a battery system of each expansion battery of at least one expansion battery to increase a battery level available to the onboard battery system of the expandable power station and a plurality of linking module connection ports configured to electrically connect to a linking module. The linking module is configured to combine a power output of the expandable power station and a separate power output of a separate expandable power station into an increased power output. Further, the expandable power station includes a plurality of supports extending from the housing. The plurality of supports is configured to separately support one expansion battery of the at least one expansion battery and the linking module directly thereon.

[0009] In accordance with another aspect of the invention, a power station assembly includes an expandable power station having a housing, a battery system positioned within the housing, an external battery port, a plurality of linking module connection ports, and a plurality of supports extending from the housing. The power station assembly additionally includes a linking module having a housing configured to stack securely on the plurality of supports of the power station, a first pair of connection cables configured to electrically couple to the plurality of linking module connection ports of the power station to receive a power output therefrom, a second pair of connection cables configured to electrically connect to linking module connection ports of a separate power station to receive a separate power output therefrom, and at least one power output receptacle configured to supply an increased power output resulting from a combination of the power output of the power station and the separate power output from the separate power station. Furthermore, the power station assembly includes at least one expansion battery. Each expansion battery of the at least one expansion battery includes a housing configured to stack securely on the plurality of supports of the power station and a battery system configured to electrically couple to the external battery port of the power station to increase a battery level available to the battery system of the power station.

[0010] In accordance with yet another aspect of the invention, a method of stacking a power station assembly includes positioning a first power station on a surface. The first power station includes a housing and an onboard battery system positioned within the housing. The first power station further includes an external battery port configured to electrically connect to a battery system of each expansion battery of at least one expansion battery to increase a battery level available to the onboard battery system of the first power station. The first power station also includes a plurality of linking module connection ports configured to electrically connect to a linking module configured to combine a power output of the first power station and a separate power output of a separate power station into an increased power output. In addition, the first power station includes a plurality of supports extending from the housing. The plurality of supports is configured to separately support one expansion battery of the at least one expansion battery and the linking module directly thereon.

[0011] These and various other features and advantages of the present invention will be more readily understood from the following detailed description and the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012] The drawings illustrate embodiments presently contemplated for carrying out the invention.

[0013] In the drawings:

[0014] FIG. **1** is an upper-right front perspective view of a power station, according to an embodiment of the invention.

[0015] FIG. **2** is a partial lower-left rear perspective view of the power station of FIG. **1** with power receptacle covers exploded from the power station, according to an embodiment of the invention.

[0016] FIG. **3** is a front view of a control panel of the power station of FIG. **1**, according to an embodiment of the invention.

[0017] FIG. **4** is an upper-right front perspective view of an expansion battery for the power station of FIG. **1**, according to an embodiment of the invention.

[0018] FIG. **5** is a lower-left rear perspective view of the expansion battery of FIG. **4** with power receptacle covers exploded from the expansion battery, according to an embodiment of the invention.

[0019] FIG. **6** is a rear view of the power station of FIG. **1** coupled to first and second expansion batteries of the type shown in FIG. **4**, according to an embodiment of the invention.

[0020] FIG. **7** is an upper-left front perspective view of the power station and expansion batteries of FIG. **6** in a stacked configuration with a pair of stack adaptors positioned on handles of the lower expansion battery to support the upper expansion battery thereon, according to an embodiment of the invention.

[0021] FIG. **8** is an exploded view of the stacked configuration of the power station and expansion batteries shown in FIG. **7**, according to an embodiment of the invention.

[0022] FIG. **9** is an upper-right front perspective view of a linking module to couple the power station of FIG. **1** to another power station, according to an embodiment of the invention.

[0023] FIG. **10** is an upper-right rear perspective view of the linking module of FIG. **9** with a hinged door of a housing of the linking module open, according to an embodiment of the invention.

[0024] FIG. **11** is a lower-left rear perspective view of the linking module of FIG. **9**, according to an embodiment of the invention.

[0025] FIG. **12** is an upper-right front perspective view of first and second power stations of the type shown in FIG. **1** coupled to the linking module of FIG. **9** in a stacked configuration, according to an embodiment of the invention.

[0026] FIG. **13** is an upper-right rear perspective view of the stacked configuration of the first and second power stations and linking module shown in FIG. **12**, according to an embodiment of the invention.

[0027] FIG. **14** is an upper-left front exploded perspective view of the stacked configuration of the first and second power stations and linking module shown in FIG. **12**, according to an embodiment of the invention.

[0028] FIG. **15** is an upper-left front perspective view of a power station assembly including the first and second power stations and the linking module of FIG. **12** and the expansion batteries of FIG. **6** in a stacked configuration, with a pair of stack adaptors positioned on handles of the first expansion battery and the second expansion battery positioned on the first expansion battery via the pair of stack adaptors, according to an embodiment of the invention.

[0029] FIG. **16** is a block diagram of a power station assembly, according to an embodiment of the invention.

DETAILED DESCRIPTION

[0030] The operating environment of the invention is described herein with respect to a portable gasless inverter generator or power station. However, those skilled in the art will appreciate that the invention is equally applicable for use with nonportable power stations. While the invention will be described with respect to a battery-operated power station having an inverter that converts DC power to AC power, embodiments of the invention are equally applicable for use with battery-operated power stations having a DC-to-DC power converter.

[0031] Referring to FIG. **1**, an upper-right front perspective view of a portable power station **20** for providing power to electrical devices (not shown in FIG. **1**) is shown, according to an embodiment of the invention. The power station **20** includes a housing **22** having a base **24**, a top wall or upper surface **26**, and a plurality of sidewalls **28** that surround and protect internal components of the power station **20**. Cooling vents **30** are positioned in one or more of the sidewalls **28** to provide cooling air to components within the housing **22**. The power station **20** may include a plurality of feet **32** extending downward from the base **24** to provide a stable foundation and to raise the housing **22** slightly off of the floor or ground. The power station **20** may include a pair of carrying handles **34** extending upward from the top wall **26** to lift and carry the power station **20**. While the carrying handles **34** are shown in FIG. **1** as being oval-shaped, in various embodiments, the carrying handles **34** may have another shape that is comfortable to a user. A single person may be able to lift the power station **20** with one or both of the carrying handles **34**, and thus, the power station **20** may act as a convenient mobile power source. Since the carrying handles **34** are also able to support and secure other devices on top of the power station **20**, the carrying handles **34** may also be considered supports **34**.

[0032] The power station **20** typically includes an onboard battery system **36** including one or more batteries (not shown in FIG. **1**) and a control system **38** positioned within the housing **22**. The onboard battery system **36** may include a rechargeable lithium-ion battery **40** with a chemistry of either nickel manganese cobalt (NMC) or lithium iron phosphate (LFP). The control system **38** may include a converter (not shown in FIG. **1**) for converting a voltage from the onboard battery system **36** into another voltage required to operate the electrical devices. The control system **38** may include an inverter **42** to change DC power from the onboard battery system **36** into AC power supplied to the electrical devices. For example, the inverter **42** may provide single or three phase AC power at 50 Hz or 60 Hz. Accordingly, the power station **20** may be referred to as a gasless inverter generator **20**.

[0033] The power station **20** is shown with a control panel **46** located on a front sidewall **48** of the power station **20**. The control panel **46** controls operation of the power station **20** and connects to one or more electrical devices powered by the power station **20**. The control panel **46** includes one or more power output receptacles **50** (for example, sockets) that receive electrical connections (for example, plugs) from the electrical devices. The power output receptacles **50** are generally powered by the onboard battery system **36** via the control system **38**. The one or more power output receptacles **50** are shown as a plurality of DC power output receptacles **52** and a plurality of AC power output receptacles **54**, with the inverter **42** providing AC power to the AC power output receptacles **54**.

[0034] The control panel **46** includes a power button **56** to turn on and off the power station **20**. The power station **20** is turned on/off by the power button **56** when pressed and held for a short period of time. When the power station **20** is on, the power button **56** can also turn the AC power output receptacles **54** on/off when pressed without being held. The control panel **46** may include a display **58**, also referred to as a user display panel, to show operating characteristics of the power station **20**. The display **58** is typically an automatic display **58** displaying one or more items of information that the control system **38** automatically stores and updates without user input and will be referenced as the automatic display **58** below. However, in some embodiments, the display **58** may also display one or more items of information that control system **38** does not automatically update or may be configured in a manner that requires a manual input from a user for all information updates. In some embodiments, the power button **56** illuminates the automatic display **58** each time it is pressed. The automatic display **58** can display a battery level of the power station **20** to a person using the power station **20**. Herein, the battery level of the power station **20** is also referred to as the energy level, charge level, or state of charge of the power station **20**. The automatic display **58** may display the battery level in terms of percentages. As such, the battery level is also referenced herein as a percent battery level. The battery level of the onboard battery system **36** may correspond to the battery voltage.

[0035] The control system **38** is programmed to determine a THD associated with the AC power from the inverter **42** and to operate the automatic display **58** to indicate the THD to an operator. The automatic display **58** may indicate whether the THD is above a level that could damage sensitive electronic components powered by the inverter **42**. High THD is generally caused by a high load on the AC power output receptacles **54** and/or by a low battery level powering the inverter **42**. As the battery level drops, the AC power output can be too high for the inverter **42** to simulate a pure sine wave. In various embodiments, the battery level of the onboard battery system **36** corresponds to a voltage output from the battery. Thus, the THD may be determined based on power and voltage output from the power station **20**.

[0036] The control system **38** may determine the power and voltage output from the power station **20** via measured voltage, current, and/or power values from one or more voltage, current, and/or power sensors (not shown) on the power station **20**. Depending on the type of sensor used, the control system **38** may either utilize measured values from the sensors directly or calculate values based on the measured values. Thereafter, the control system **38** may determine the battery level based on the voltage of the onboard battery system **36** and calculate the percent battery level of the onboard battery system **36** at a point in time based on the determined battery level and the battery level capacity of the onboard battery system **36**. The THD can therefore be reduced by unplugging one or more AC devices from the power station **20** and/or by charging the onboard battery system **36**. If the power output is lower, the inverter **42** will be able to simulate a pure sine wave (for example, a waveform with a low THD) at a lower battery level and for a longer period of time prior to the onboard battery system **36** being recharged.

[0037] The control system **38** may be programmed with a THD shield **60** to automatically shut off AC power output from the AC power output receptacles **54** when the THD is above a predetermined level (for example, 5%). The THD shield **60** of the control system **38** may automatically shut off AC power output when the onboard battery system **36** has a battery level below a predetermined battery level, which can indicate that the THD is above a predetermined THD level. In various embodiments, at full AC load (for example, 1,600 Watts (1,600 W)), the THD will rise above 5% at less than 20-25% battery level remaining, and at low loads (for example, 100 W), the THD will not rise above 5% until the onboard battery system **36** is basically dead. Since a charged or partially charged battery might have low THD even at full load, the THD shield **60** could be configured to determine that the battery level of the onboard battery system **36** is lower than a predetermined battery level prior to determining if the THD requires shutting off AC power output. In various embodiments, the predetermined battery level is approximately 30% of a battery level of the onboard battery system **36** when the onboard battery system **36** is at 100% battery level or fully charged and the predetermined THD level is approximately 5%. The DC power output receptacles **52** can remain powered even if the AC power output receptacles **54** are shut off by the THD shield **60**.

[0038] An overload reset button **62**, also referred to as a THD shield button **62**, can be pressed to re-energize the DC and AC power output receptacles **52**, **54** if they have been shut off due to an electrical fault. The overload reset/THD shield button **62** may also provide a user input control to selectively enable the THD shield **60** while the automatic display **58** indicates whether the THD shield **60** is enabled or disabled. In various embodiments, a user may press the overload reset/THD shield button **62** once to re-energize both AC power output receptacles **54** and DC power output receptacles **52** after an overload fault and five times in three seconds to turn the THD shield **60** on or off. When the THD shield **60** is on and the THD rises above a predetermined level, also referred to as a THD fault level, the control system **38** shuts off AC power output to prevent damage to sensitive electronics. A user may press the overload reset/

THD shield button **62** to restore AC power to the AC power output receptacles **54** following a THD shutoff. An LED light **64** that can illuminate a work area in front of the power station **20** is positioned above the control panel **46** adjacent the overload reset button **62** and an LED light button **66** that turns on the LED light **64**.

[0039] In various embodiments, to restore AC output after the control system **38** shuts off power according to the THD shield **60**, a user should charge the power station **20** (if possible), lower the AC running watts by unplugging one or more electrical devices, and press the overload reset button **62** to re-energize the AC power output receptacles **54**. In various embodiments, to prevent control system **38** from shutting off power due to the THD shield **60**, a user should maintain a high battery level in the onboard battery system **36**, charge the power station **20** during use, unplug high current draw AC appliances to lower the AC running watts when the battery falls to near 30% charge capacity, and/or turn off the THD shield **60**. In various embodiments, to turn the THD shield **60** off, a user should lower the AC running watts by unplugging one or more devices to limit increasing THD levels as the battery level depletes and press the THD shield button **62** five times within three seconds. When the THD shield **60** is disabled, the control system **38** will not shut off AC power output when the THD rises above the predetermined level. A user should monitor sensitive devices for abnormal operation and disconnect as necessary.

[0040] Referring now to FIG. **2**, a partial lower-left rear perspective view of the power station **20** is shown with receptacle covers **86** exploded therefrom, according to an embodiment of the invention. The power station **20** includes an external battery port **68** to connect one or more expansion batteries (not shown in FIG. **2**), as explained in more detail below with respect to FIG. **6**. The power station **20** may couple to a single expansion battery or to a string of expansion batteries (for example, up to ten or more) to increase the battery or energy capacity and runtime of the power station **20**. The control system **38** couples the onboard battery system **36** and the external battery port **68** to each of the power output receptacles **50** (FIG. **1**).

[0041] FIG. **2** shows an AC charging module **70** and a DC charging module **72** that charge the onboard battery system **36** from an AC power source (not shown in FIG. **2**) and a DC power source (not shown in FIG. **2**), respectively. The AC charging module **70** and the DC charging module **72** are positioned within charging module slots **74** in the rear sidewall **76** of the power station **20**. Charging terminals (not shown in FIG. **2**) are located within the charging module slots **74** and electrically connect the AC and DC charging modules **70**, **72** to the power station **20** when the charging modules **70**, **72** are inserted into the charging module slots **74**. If a charging module with a different electrical configuration is desired, the AC charging module **70** and the DC charging module **72** can be removed from the charging module slots **74** for replacement.

[0042] The AC and DC charging modules **70**, **72** have respective AC and DC power inlet receptacles **78**, **80** each coupled to the onboard battery system **36** to recharge the power station **20**. The AC charging module **70** may include a rectifier (not shown in FIG. **2**) to convert AC power from an AC source into DC power supplied to the onboard battery system **36**. The AC power inlet receptacle **78** may charge the power station **20** from a traditional wall outlet (not shown in FIG. **2**) connected to the utility grid (not shown in FIG. **2**). The DC power inlet receptacle **80** may include an APP (Anderson Power Pole) input port **82** that can support DC charging from one or more solar panels (not shown in FIG. **2**). The DC charging module **72** may include a maximum power point tracking (MPPT) module **84** to optimize charging of the onboard battery system **36** from the solar panels. The receptacle covers **86** protect the external battery port **68**, the AC power inlet receptacle **78**, and the DC power inlet receptacle **80** from moisture, dirt, and other debris.

[0043] Referring now to FIG. **3**, a front view of the control panel **46** of the power station **20** of FIG. **1** is shown, according to an embodiment of the invention. The control panel **46** includes a power button **56** to turn on and off the power station **20** and to illuminate the automatic display **58**. The automatic display **58** can indicate the battery level available from the onboard battery system **36** and any connected expansion batteries (not shown in FIG. **3**) to a user. The control panel **46** also includes a circuit breaker **88**, linking module connection ports or linking kit connection ports **90**, and a plurality of selectively openable protective covers **92**. The circuit breaker **88** protects the power station **20** against electrical overloads and can be pressed by an operator to reset power to the power output receptacles **50**. The linking module connection ports **90** are used to electrically couple AC power outputs from the linking module connection ports **90** of two power stations **20** to a linking kit or module (not shown in FIG. **3**) that is able to provide an increased AC power output. The protective covers **92** are hinged to the control panel **46** to selectively cover the power output receptacles **50** and are latched in closed positions by depressible cover locks **94**.

[0044] The control panel **46** is shown with a plurality of DC power output receptacles **52** that are powered by the onboard battery system **36** and/or any connected expansion batteries (not shown in FIG. **3**) and that may output different levels of voltage and current. For example, an APP (Anderson Power Pole) port **96** may supply electrical power for operation of 12-volt (12V) DC, 20-amp (20 A) electrical loads. A regulated automotive port **98** may supply electrical power for operation of 12V DC, 10 A electrical loads. A plurality of Universal Serial Bus (USB) ports may provide power to devices such as, for example, cellphones, laptops, and tablets. A USB Type-C+Power Delivery (PD) port **100** may supply 5V/9V/12V/15V/20V DC, 3 A Fixed or 3.3V-21V DC according to the Programmable Power Supply (PPS) protocol to provide power up to a maximum of 60 watts (60 W) with PD compatible devices. A USB Type-C+ Quick Charge (QC) port **102** may supply 3.6V-12V DC, 3 A Fixed (for example, 5V/9V, 3 A Fixed or 12V, 2.5 A Fixed) or 3.6V-12V DC PPS to provide power up to a maximum of 30 W with QC 3.0 compatible devices. USB Type-A ports **104** may supply a maximum of 5V DC, 2.1 A.

[0045] The control panel **46** is also shown with a plurality of AC power output receptacles **54** that are powered by the onboard battery system **36** and/or any expansion batteries (not shown in FIG. **3**). For example, National Electrical Manufacturers Association (NEMA) 5-15R ports **106** may be used to supply electrical power for operation of 120V AC, 15 A, single phase, 60 Hz electrical loads. However, the AC power output receptacles **54** may provide power from the inverter at any suitable current (for example, any integer or half-integer value from 2.5 A to 30 A) and voltage (for example, any integer value from 110V to 120V AC or any integer value from 220V to 250V AC). In various embodiments, the power button **56** turns on the inverter **42** (FIG. **1**) to power the AC power output receptacles **54** while the DC power output receptacles **52** are configured to always receive power.

[0046] Referring now to FIG. **4**, an upper-right front perspective view of an expansion battery **108** for supplying additional power to the power station **20** of FIG. **1** is shown, according to an embodiment of the invention. The expansion battery **108** may include a housing **110** with a battery system **112** including one or more batteries and a control system **114** positioned within the housing. In some embodiments, the battery system **112** is a rechargeable lithium-ion battery with a chemistry of either nickel manganese cobalt (NMC) or lithium iron phosphate (LFP). The control system **114** operates the expansion battery **108** and may include a converter (not shown in FIG. **4**) for converting the voltage of battery system **112** into another voltage supplied to the power station **20**. A pair of carrying handles **116** extend upward from a top surface **118** of the housing **110** and can be used to lift the expansion battery **108** or to support another expansion battery **108** resting on the handles **116** when in a stacked configuration, as explained in more detail below with respect to FIGS. **7** and **8**. Since the carrying handles **116** are also able to support and secure another expansion battery **108** on top of the expansion battery **108**, the carrying handles **116** may also be considered supports **116**.

[0047] A front sidewall **120** of the housing **110** includes a display **122** that shows operating characteristics of the expansion battery **108**. The display **122** is generally an automatic display **122** displaying one or more items of information that the control system **114** automatically stores and updates without user input and will be referenced as the automatic display **122** below. However, in some embodiments, the display **122** may also display one or more items of information that the control system **114** does not automatically update or may be configured in a manner that requires a manual input from a user for all information updates. The automatic display **122** includes a fuel or battery gauge **124** that shows a remaining battery level for the expansion battery **108** in terms of percentages. As indicated above with respect to FIG. **1**, the remaining battery level may correspond to the battery voltage, and the battery level percentage value is also referenced as a percent battery level. The control system **114** may determine the percent battery level via a measured value from a voltage sensor (not shown) on the expansion battery **108**. Depending on the type of voltage sensor, the control system **114** may either utilize measured values from the voltage sensor as voltage values/battery levels or calculate battery levels based on the measured values. Thereafter, the control system **114** may determine the battery level based on the voltage of the battery system **112** and calculate the percent battery level of the battery system **112** at a point in time based on the determined battery level and the battery level capacity of the battery system **112**.

[0048] The automatic display **122** may also display fault codes when faults occur such as high or low temperature faults, battery or circuitry communication faults, or a battery management system (BMS) fault, as non-limiting examples. A display button **126** turns on/off the automatic display **122** and illuminates the fuel gauge **124**. A discharging indicator LED **128** will illuminate red when the automatic display **122** is turned on and the expansion battery **108** is discharging to the power station **20**. A charging indicator LED **130** will illuminate green when the automatic display **122** is turned on and the expansion battery **108** is charging.

[0049] Referring now to FIG. **5**, a lower-left rear perspective view of the expansion battery **108** is shown with receptacle covers **136** exploded therefrom, according to an embodiment of the invention. The expansion battery **108** includes a pair of battery connection ports **132**. Each of the battery connection ports **132** connect the expansion battery **108** to the power station **20** or to another expansion battery **108**. The expansion battery also includes a charging module input port **134** configured to connect to a power cord of a charging module (not shown in FIG. **5**) that is configured to charge the expansion battery **108**. The receptacle covers **136** protect the battery connection ports **132** and the charging module input port **134** from moisture, dirt, and other debris.

[0050] The expansion battery **108** generally includes four feet **138** extending downward from a bottom surface **140** of the housing **110** to secure the expansion battery in a stacked configuration or to raise the housing slightly off of the floor or ground. Each foot **138** includes a base **139** configured to support the expansion battery **108** when placed on a surface (not shown). Further, an arc-shaped cutout **142** is shown extending across each of the feet **138** in a direction from the front sidewall **120** to a rear sidewall **144** of the expansion battery **108**. In various embodiments, the expansion battery **108** stacks on the power station **20** with the arc-shaped cutouts **142** in the feet **138** sitting securely on the oval-shaped carrying handles **34** (FIG. **1**) of the power station **20**. While shown as arc-shaped in FIG. **5**, the cutout **142** may have a different shape in various embodiments. In many embodiments, the shape of the cutout **142** will correspond to the shape of the carrying handles **34** such that the carrying handles **34** are able to safely support the expansion battery **108**.

[0051] Although FIG. **5** shows the expansion battery **108** with a specific configuration of feet **138** and cutouts **142**, the expansion battery **108** may have a different number of feet **138** and/or cutouts **142** in different configurations. As a non-limiting example, expansion battery **108** may include two or six feet **138**. As another non-limiting example, the expansion battery **108** may include cutouts **142** as separate components from the feet **138**. As yet another non-limiting example, the cutouts **142** of the pairs of feet **138** aligned with each other in FIG. **5** and designed to sit securely on the same carrying handle **34** of the power station **20** may be connected across the bottom surface **140** of the housing **110** and considered a single cutout **142**. In that case, when those pairs feet **138** are connected by the cutouts **142**, the expansion battery **108** may be considered as either having four feet **138** and two cutouts **142** extending between the pairs of the feet **138** or as having two feet **138** each including one cutout **142**.

[0052] Regardless of the configuration of the feet **138** and cutouts **142** of the expansion battery **108**, the feet **138** and cutouts **142** are generally (though not necessarily) designed such that the expansion battery **108** stacks directly on the power station **20** with the front sidewall **48** (FIG. **1**) of the power station **20** and the front sidewall **120** of the expansion battery **108** facing the same direction. This enables users to conveniently view and access the control panel **46** (FIG. **1**) of the power station **20** and the display **122** (FIG. **4**) of the expansion battery **108** from one location. That is, users can view and access the control panel **46** of the power station **20** and the display **122** of the expansion battery **108** without having to move to a different side of the power station **20**

and/or expansion battery **108**. The same is true regarding the external battery port **68** and AC and DC charging modules **70**, **72** in the rear sidewall **76** (FIG. **2**) of the power station **20** and the battery connection and charging module input ports **132**, **134** in the rear sidewall **144** of the expansion battery **108**.

[0053] Further, the engagement between the cutouts **142** of the expansion battery **108** and the carrying handles **34** of the power station **20** secures the expansion battery **108** on the power station **20** without preventing the intentional removal of the expansion battery **108** from the power station **20** by a user. That is, when the cutouts **142** of the expansion battery **108** are positioned on the carrying handles **34** of the power station **20**, the expansion battery **108** cannot simply slide off of the carrying handles **34**. Instead, the carrying handles **34** block the feet **138** of the expansion battery **108** from sliding over the front or rear sidewalls **48**, **76** of the power station **20**, and the cutouts **142** block the expansion battery **108** from sliding sideways off of the power station **20** to the left or right. Further, the cutouts **142** of the expansion battery **108** and/or the carrying handles **34** may include a non-slip surface.

[0054] Therefore, once the cutouts **142** of the expansion battery **108** are on the carrying handles **34** of the power station **20**, the expansion battery **108** is protected from falling off of the power station **20** and sustaining damage. A user does not have to trigger any locks or other securing mechanisms or devices in order for this protection to take effect. Rather, a user merely has to place the cutouts **142** of the expansion battery **108** on the carrying handles **34** of the power station **20**. Since a user does not have to trigger any locks when placing the expansion battery **108** on the power station **20**, a user may similarly remove the expansion battery **108** from the power station **20** without the need to disengage any locks. That is, when a user no longer wants the expansion battery **108** on top of the power station **20** (for example, the expansion battery **108** has a low battery level), the user can simply lift the expansion battery **108** vertically off of the power station **20**.

[0055] Referring now to FIG. **6**, a rear view of the power station **20** connected to a pair of expansion batteries **146**, **148** is shown, according to an embodiment of the invention. The expansion batteries **146**, **148** are arranged similarly to the expansion battery **108** of FIG. **4**, and thus, like elements therein are numbered identically to corresponding elements in the expansion battery **108** of FIG. **4**. In FIG. **6**, the external battery port **68** of the power station **20** is connected to a first expansion battery **146** and a second expansion battery **148**. Each expansion battery **146**, **148** may include a pair of battery connection ports **132** that connect to the power station **20** or the other expansion battery **146**, **148** using a connection cable **150**. Up to ten or more expansion batteries **146**, **148** may be chained to the power station **20** to provide additional power. The battery system **112** of each expansion battery **146**, **148** increases the battery or energy capacity (watt-hours (Wh) or joules (J)) or runtime of the power station **20**. Alternatively, the expansion batteries **146**, **148** could be configured to increase the running power or starting power of the power station **20**. Each expansion battery **146**, **148** also includes a charging module input port **134** for charging the expansion battery **146**, **148**.

[0056] As explained above, the control system **38** of the power station **20** is electrically coupled to the onboard battery system **36** and the external battery port **68** and may include a converter (not shown in FIG. **6**) configured to convert a DC voltage to another DC voltage. As a result, the control system **38** of the power station **20** may utilize the converter to convert the DC voltage from the battery systems **112** of the expansion batteries **146**, **148** into another DC voltage for distribution from the power station **20**. The control system **38** of the power station **20** may additionally include a power inverter **42** to change DC power from each expansion battery **146**, **148** to AC power for distribution from the power station **20**. In another embodiment, the control system **114** of each expansion battery **146**, **148** could provide a DC or AC power to the power station **20** that matches the requirements of any of the power output receptacles **50** of the power station **20**. Accordingly, the control system **114** of each expansion battery **146**, **148** may include a converter and/or inverter **152** to change DC power from the battery into an AC power supplied to the power station **20**. The expansion batteries **146**, **148** may also charge the onboard battery system **36** of the power station **20**.

[0057] Each expansion battery **146**, **148** may be paired to the power station **20** so that the control system **38** of the power station **20** can operate the expansion batteries **146**, **148**. Each expansion battery **146**, **148** can be paired by connecting the expansion battery **146**, **148** directly to the power station **20** and enabling a pairing feature on the power station **20**. According to various embodiments of the invention, a user of the power station **20** may pair the expansion batteries **146**, **148** to the power station **20** by performing a series of steps separately for each expansion battery **146**, **148**. Below is an example in which expansion battery **146** is paired to the power station **20**.

[0058] In a first step, the user pairing the expansion battery **146** turns on the power station **20** and unplugs all electrical devices therefrom including any additional expansion batteries already connected and/or paired to the power station **20**. In a second step, the user connects the expansion battery **146** being paired by connecting its connection cable **150** to the external battery port **68** of the power station **20**. In a third step, the user holds down the overload reset button **62** (FIG. **1**) of the power station **20** and presses the power button **56** (FIG. **3**) of the power station **20** twice. Finally, the LED light **64** (FIG. **1**) on the power station **20** will turn on and flash three times in a fourth step. If the LED light **64** does not turn on or flash three times, the user can repeat the second and third steps while ensuring that only the expansion battery **146** is connected to the power station **20**. Once the expansion battery **146** is paired with the power station **20**, the control system **38** of the power station **20** is able to communicate with and provide instructions to the control system **114** of the expansion battery **146**.

[0059] In order to pair additional expansion batteries (for example, the expansion battery **148**) to the power station **20**, the user must disconnect the paired expansion battery **146** and repeat steps one through four above. Once the expansion batteries **146**, **148** are paired to the power station **20**, the expansion batteries **146**, **148** will remain paired to the power station **20** until they are manually unpaired. In various embodiments, unpairing the expansion batteries **146**, **148** may be performed by powering down or shutting down the expansion batteries **146**, **148**, by repeating steps one through four above, or by either method.

[0060] Pairing the expansion batteries **146**, **148** allows the control system **38** of the power station **20** to discharge the battery system **36**, **112** with the highest battery level before discharging the remaining batteries. In various embodiments, the battery level corresponds to a battery voltage and only the battery system or systems **36**, **112** with the highest voltage will discharge until the voltage drops to approximately the same voltage level of the battery system or systems **36**, **112** with the next highest battery voltage. That is, additional non-discharging battery systems **36**, **112** will begin to discharge simultaneously with discharging battery systems **36**, **112** when the voltages of the discharging battery systems **36**, **112** approximate the voltages of the non-discharging battery systems **36**, **112**. In various embodiments, the voltages are approximate when the voltage levels or battery levels are within a specific percentage of each other such as 1%, 2%, 3%, 4%, or 5%, as non-limiting examples. However, in various embodiments, the voltages may be approximate when the voltage levels or battery levels are within a specific voltage level of the each other such as 1V or 2V, as non-limiting examples.

[0061] For example, the battery system **36**, **112** with the highest battery level among the expansion batteries **146**, **148** and the power station **20** could discharge first until the battery level is similar to the battery system **36**, **112** that had the second highest battery level. The two battery systems **36**, **112** will then discharge simultaneously to the level of the third highest battery level. Once all remaining battery levels are similar, each battery system **36**, **112** will discharge simultaneously or at the same rate. Thus, the battery systems **112** of the expansion batteries **146**, **148** may only begin discharging if their battery levels are equal to or greater than the battery level of the battery system **36** of the power station **20**.

[0062] Referring now to FIGS. **7** and **8**, a power station assembly **154** is shown, according to an embodiment of the invention. FIG. **7** shows an upper-left front perspective view of the power station assembly **154** including the power station **20** and the expansion batteries **146**, **148** of FIG. **6** in a stacked configuration. FIG. **8** shows an exploded view of the power station assembly **154** of FIG. **7**. While FIGS. **7** and **8** show the power station assembly **154** with two expansion batteries **146**, **148**, any suitable number of expansion batteries could be stacked on the power station **20** (for example, up to ten or more). The first expansion battery **146** is stacked directly on the carrying handles **34** of the power station **20**. The second expansion battery **148** is stacked on the carrying handles **116** of the first expansion battery **146** via a pair of stacking adaptors **158**. The stacking adaptors **158** sit or snap onto the carrying handles **116** of the first expansion battery **146** to secure the second expansion battery **148** to the first expansion battery **146**.

[0063] As shown, when the first and second expansion batteries **146**, **148** are stacked on the power station **20**, the front sidewall **48** of the power station **20** and the front sidewalls **120** of the expansion batteries **146**, **148** are facing the same direction. As such, a user of the power station assembly **154** is able to view and access the control panel **46** of the power station **20** and the displays **122** of the first and second expansion batteries **146**, **148** in one location. That is, a user can view and access the control panel **46** of the power station **20** and the displays **122** of the expansion batteries **146**, **148** without having to move to a different side of the power station **20** and/or expansion batteries **146**, **148**. The same is true regarding the external battery port **68** and AC and DC charging modules **70**, **72** in the rear sidewall **76** (FIG. **2**) of the power station **20** and the battery connection and charging module input ports **132**, **134** in the rear sidewalls **144** (FIG. **5**) of the expansion batteries **146**, **148**. This provides the users with a convenient presentation of information and access to functionality when using the power station assembly **154**.

[0064] Additionally, the engagement between the cutouts **142** of the first expansion battery **146** and the carrying handles **34** of the power station **20** secures the first expansion battery **146** on the power station **20** without preventing the intentional removal of the first expansion battery **146** from the power station **20** by a user. That is, when the cutouts **142** of the first expansion battery **146** are positioned on the carrying handles **34** of the power station **20**, the first expansion battery **146** cannot simply slide off of the carrying handles **34**. Instead, the carrying handles **34** block the feet **138** of the expansion battery **108** from sliding over the front or rear sidewalls **48**, **76** of the power station **20** and the cutouts **142** block the first expansion battery **146** from sliding sideways off of the power station **20** to the left or right.

[0065] Therefore, once the cutouts **142** of the first expansion battery **146** are on the carrying handles **34** are on the power station **20**, the first expansion battery **146** is protected from falling off of the power station **20** and sustaining damage. A user does not have to trigger any locks or other securing mechanisms or devices in order for this protection to take effect. Rather, a user merely has to place the cutouts **142** of the first expansion battery **146** on the carrying handles **34** of the power station **20**. Since a user does not have to trigger any locks when placing the first expansion battery **146** on the power station **20**, the user may similarly remove the first expansion battery **146** from the power station **20** without the need to disengage any locks. That is, when a user no longer wants the first expansion battery **146** on top of the power station **20** (for example, the first expansion battery **146** has a low battery level), the user can simply lift the first expansion battery **146** vertically off of the power station **20**. A user may remove the second expansion battery **148** with the first expansion battery **146** or may remove the second expansion battery **148** before removing the first expansion battery **146**, as desired.

[0066] The stacking adaptors **158** on the carrying handles **116** of the first expansion battery **146** provide support for the second expansion battery **148** in a similar manner as the carrying handles **34** on the power station **20** with respect to the first expansion battery **146**. Each stacking adaptor **158** has a lower surface with one or more semicircular cutouts **160** along a length of the stacking adaptor **158**. In the embodiment shown in FIGS. **7** and **8**, the stacking adaptors **158** each include four semicircular cutouts **160**. However, in various embodiments, the stacking adaptors **158** have a different number of cutouts **160**. As a non-limiting example, each stacking adaptor **158** may include one cutout **160** extending the entire length of the stacking adaptor **158**. As another non-limiting embodiment, each stacking adaptor **158** may include two cutouts **160**. Regardless of the number and configuration of the cutouts **160**, each cutout **160** of one stacking adaptor **158** sits or snaps on one rod-shaped carrying handle **116** of the first expansion battery **146**.

[0067] Each stacking adaptor **158** also has an oval-shaped upper surface **162** extending the length of the stacking adaptor **158**. The upper surfaces **162** are configured to receive the cutouts **142** in the feet **138** of the second expansion battery **148** much like the carrying handles **34** of the power stations **20**. Accordingly, the stacking adaptors **158** secure the feet **138** of the second expansion battery **148** to the carrying handles **116** of the first expansion battery **146**, even if the feet **138** have a geometry that fits securely on the oval-shaped carrying handles **34** of the power station **20**. Although the handles **116** and feet **138** of the expansion batteries **146**, **148** and the cutouts **160** of the stacking adaptor **158** are described with particular shapes or configurations, in various embodiments, other shapes or configurations may be used. However, the handles **116** are typically designed for the comfort of a user.

[0068] The stacking adaptors **158** also include a flat upper surface **164** with two openings **166** for receiving the base **139** of two feet **138** of the second expansion battery **148**. The flat upper surface also includes a raised section **168** between the two openings **166**. When the feet **138** of the second expansion battery **148** are positioned with the cutouts **142** on the oval-shaped upper surfaces **162**, the bases **141** of the feet **138** are positioned in the openings **166** in the flat upper surfaces **164**, and the raised sections **168** on the flat upper surfaces **164** are positioned between the feet **138**. This positioning of the feet **138** of the second expansion battery **148** on the upper surfaces **162**, **164** of the stacking adaptor **158** aids in securing the second expansion battery **148** on the first expansion battery **146**.

[0069] Regardless of the configuration of the cutouts **160** and upper surface **162** of the stacking adaptor, the cutouts **160** and upper surface **162** are generally (though not necessarily) designed such that the second expansion battery **148** (or another expansion battery **108**) stacks on the first expansion battery **146** (or another expansion battery **108**) with the front sidewalls **120** of the expansion batteries **146**, **148** facing the same direction. This enables users to conveniently view and access the displays **122** of the expansion batteries **146**, **148** from one location, as explained above. This also applies to the battery connection and charging module input ports **132**, **134** in the rear sidewalls **144** (FIG. **5**) of the expansion batteries **146**, **148**.

[0070] Further, the engagement between the cutouts **142** of the second expansion battery **148** and the upper surfaces **162** of the stacking adaptors **158** secures the second expansion battery **148** on the first expansion battery without preventing the intentional removal of the expansion battery **148** from the first expansion battery **146** by a user. That is, when the cutouts **160** of the stacking adaptors **158** are positioned on the carrying handles **116** of the first expansion battery **146**, the stacking adaptors **158** cannot simply slide off of the carrying handles **116** of the first expansion battery **146**. Instead, the carrying handles **116** block the cutouts **160** of the stacking adaptors **158** from sliding over the front or rear sidewalls **120**, **144** of the first expansion battery **146**, and the cutouts **160** prevent the stacking adaptors **158** from sliding sideways off of the carrying handles **116** of the first expansion battery **146** to the left or right.

[0071] Further, when the cutouts **142** of the second expansion battery **148** are positioned on the upper surfaces **162** of the stacking adaptors **158**, the cutouts **142** block the second expansion battery **148** from sliding sideways off of the of the upper surfaces **162** of the stacking adaptors **158**. Similarly, the engagement between the bases **139** of the feet **138** of the second expansion battery **148** and the openings **166** in the upper surfaces **164** and between the feet **138** of the second expansion battery **148** and the raised sections **168** of the upper surfaces **164** prevent the second expansion battery **148** from sliding off over the front or rear sidewalls **120**, **144** of the first expansion battery **146**. Further, the upper surfaces **162**, **164** may include a non-slip surface to prevent the second expansion battery **148** from sliding off over the front or rear sidewalls **120**, **144** of the first expansion battery **146**.

[0072] Therefore, once the cutouts **160** of the stacking adaptors **158** are on the carrying handles **116** of the first expansion battery **146** and feet **138** of the second expansion battery **148** are on the upper surfaces **162**, **164** of the stacking adaptors **158**, the expansion battery **148** is protected from falling off of the power station assembly **154** and sustaining damage. A user does not have to trigger any locks or other securing mechanisms or devices in order for this protection to take effect. Rather, a user merely has to place the cutouts **160** of the stacking adaptors **158** on the carrying handles **116** of the first expansion battery **116** and the cutouts **142** of the second expansion battery **148** on the upper surfaces **162** of the stacking adaptors **158**. Since a user does not have to trigger any locks when placing stacking adaptors **158** and the second expansion battery **148** the stacking configuration, a user may similarly remove the second expansion battery **148** and the stacking adaptors **158** without the need to disengage any locks. That is, when a user no longer wants the second expansion battery **148** on top of the first expansion battery **146** (for example, the second expansion battery **148** has a low battery level), the user can simply lift the second expansion battery **148** vertically off of the stacking adaptors **158**. Similarly, a user can remove the stacking adaptors **158** by pulling them off of the carrying handles **116** of the first expansion battery **146**.

[0073] In addition to the stacking capabilities enabled by the configuration of power assembly **154**, the control system **38** of the power station **20** may be configured to determine a number of expansion batteries **146**, **148** electrically coupled to the power station **20**, determine a battery level of each expansion battery **146**, **148**, and calculate a battery level available to the power station **20** by adding together the battery level of each expansion battery **146**, **148**. The control system **38** of the power station **20** may be programmed to sense each expansion battery **146**, **148** coupled to the power station **20** by determining which expansion batteries **146**, **148** are paired with the power station **20** and/or communicating with the control system **114** of each paired expansion battery **146**, **148**. The control system **38** may be programmed to determine the battery level of the battery system **112** of each expansion battery **146**, **148** by reading the battery gauge **124** on each expansion battery **146**, **148**. The control system **38** may be programmed to add together the battery level of each expansion battery **146**, **148** by adding together the percent battery level of each expansion battery **146**, **148**. In an alternative embodiment, the control system **38** may be configured to calculate a battery level available to the power station **20** by adding together the battery level of the onboard battery system **36** and the battery system **112** of each expansion battery **146**, **148** electrically coupled to the power station **20**. The automatic display **58** of the power station **20** operated by the control system **38** may display the available battery levels of the onboard battery system **36** and the battery systems **112** of the expansion batteries **146**, **148**.

[0074] The battery levels of the battery system **112** of each expansion battery **146**, **148** electrically coupled to the power station **20** may comprise percent battery levels, and the battery level available to the power station **20** from battery system **36** and/or battery systems **112** may comprise a percent battery level relative to a capacity of the battery system **112** of a single expansion battery **146**, **148** electrically coupled to the power station **20**. The automatic display **58** may display the available battery level to the power station **20** as a percentage of a single expansion battery **146**, **148** electrically coupled to the power station **20**. That is, the automatic display **58** of the power station **20** may display that the total percent battery level is higher than 100% when the battery levels of the battery systems **112** of each expansion battery **146**, **148** electrically coupled to the power station **20** have a total value greater than the capacity of the battery system **112** of a single expansion battery **146**, **148**. The automatic display **58** of the power station **20** may also display that the total percent battery level is higher than 100% when the battery levels of the battery system **36** of the power station **20** and each expansion battery **146**, **148** electrically coupled to the power station **20** have a total value greater than the capacity of the battery system **112** of a single expansion battery **146**, **148**.

[0075] The control system **38** may calculate the power output and hours to empty for a particular load and operate the automatic display **58** to display the power output and/or hours to empty. The battery level available to the power station **20** is typically independent of an electrical load on the power station **20**, but may be dependent on an electrical load on the power station **20** in some embodiments. Thus, the control system **38** may calculate the combined energy level of the expansion batteries **146**, **148** coupled to the power station **20** independent of or dependent on an electrical load on the power output receptacles **50** (FIG. **1**).

[0076] Referring now to FIGS. **9-11**, upper-right front perspective, upper-right rear perspective, and lower-left rear perspective views, respectively, of a linking module **210** configured to combine power received from two connectable inverter power stations **20** (FIG. **1**) are shown, according to an embodiment of the invention. The linking module **210** (also referred to as a linking kit **210**, link **210**, or paralink **210**) may electrically connect to at least one AC power output receptacle (for example, the linking module connection ports **90** (FIG. **3**)) of a first power station **20** (not shown in FIGS. **9-11**) and a second power station **20** (not shown in FIGS. **9-11**) to receive respective first and second AC power outputs therefrom and to combine the first and second AC power outputs into a third AC power output. The linking module **210** may provide the third AC power output to an electrical device (not shown in FIGS. **9-11**) coupled to one or more power output receptacles (not shown in FIGS. **9-11**) of the linking module **210**.

[0077] In various embodiments of the invention, the linking module **210** includes a housing **101** that has a generally rectangular shape with a front end **103**, a back end **105**, a right side **107**, and a left side **109**. A handle **111** is positioned at the back end **105** of the housing **101**, and a hinged door **113** is positioned at the right side **107** of the housing **101**. However, in various embodiments, the hinged door **113** is positioned at the left side **109** of the housing **101**.

[0078] The linking module **210** is shown with the hinged door **113** in an open position in FIG. **10** to expose an interior compartment **115** in the housing **101** and with first and second pairs of connection cables **117**, **119** extending out of the interior compartment **115**. The pairs of connection cables **117**, **119** are couplable to the linking module connection ports **90** of the power stations **20** to receive power therefrom. The hinged door **113** may close over the pairs of connection cables **117**, **119** with the cables extending through slots **121** in the hinged door **113** when the hinged door **113** is closed, as shown in FIG. **9**. The hinged door **113** can be opened to easily place the pairs of connection cables **117**, **119** inside the housing **101** for storage and to access internal components within the housing **101**. The linking module **210** may also include a control system **123** positioned therein to operate the linking module **210** and a converter **125** for converting power received from the power stations **20** into a desired form with voltages and currents that are optimally suited for user loads.

[0079] In various embodiments, the linking module **210** includes one or more power output receptacles **159**, **161** configured to provide the third AC power output, and the third AC current rating may be an AC current rating of the power output receptacles **159**, **161**. For example, the linking module **210** may include at least one AC power output receptacle **159**, **161** configured to provide a third AC power output at the AC voltage and a third AC current that is a combination of the first and second AC currents of a first inverter power station **20** (not shown in FIGS. **9-11**) and a second inverter power station **20** (not shown in FIGS. **9-11**) and that does not exceed a third AC current rating of the linking module **210**, the third AC current rating being higher than each of the first and second AC current ratings. The at least one AC power output receptacle **159**, **161** of the linking module **210** may have a voltage rating equal to a voltage rating of the power output receptacles (not shown in FIGS. **9-11**) of the first and second inverter power stations **20**, **20**. In various embodiments, the one or more power output receptacles **159**, **161** of the linking module **210** includes a 120V AC, 30 A RV receptacle (or a NEMA TT-30R receptacle) **163** and a 120V AC, 30 A locking receptacle (or a NEMA L5-30R receptacle) **165**.

[0080] As shown mostly clearly in FIG. **11**, the linking module **210** may include a plurality of feet **127** extending downward from a bottom surface **129** of the housing **101** to secure the linking module **210** in a stacked configuration directly on top of the carrying handles **34** of one power station **20** of FIG. **1**, much like the expansion battery **108** of FIG. **4**, or to raise the housing **101** slightly off of the floor or ground. Two arc-shaped cutouts **131** are shown extending across the bottom surface **129** of the housing **101** in a direction from the front end **103** to the back end **105** of the linking module **210** and extending through the feet **127**. In the configuration shown, the linking module **210** may be considered as either having four feet **127** and two cutouts **131** extending between and through pairs of the feet **127** aligned with each other or as having two feet **127** each including one cutout **131**.

[0081] Although FIG. **11** shows the linking module **210** with a specific configuration of feet **127** and cutouts **131**, the linking module **210** may have a different number of feet **127** and/or cutouts **131** in different configurations. As a non-limiting example, the linking module **210** may include four separate feet **127** each having its own cutout **131** in a similar manner to the feet **138** with cutouts **142** on the expansion battery **108** of FIG. **4**. As another non-limiting example, the linking module **210** may include a different number of feet **127** such as, for example, six or eight feet **127**. In addition, the cutouts **131** may have a different shape to match a different shape on the carrying handles **34** of the power station **20**.

[0082] While four feet **127** are shown, the linking module **210** may have a different number of feet **127** such as two or six feet **127**, as non-limiting examples. In various embodiments, the linking module **210** stacks on a power station **20** with the arc-shaped cutouts **131** sitting securely on the oval-shaped carrying handles **34** (FIG. **1**) of the power station **20**. While shown as arc-shaped in FIG. **4**, the cutouts **131** may have a different shape in various embodiments. In many embodiments, the shape of the cutouts **131** will correspond to the shape of the carrying handles **34** such that the carrying handles **34** are able to safely support the linking module **210**.

[0083] Regardless of the configuration of the feet **127** and cutouts **131** of the linking module **210**, the feet **127** and cutouts **131** are generally (though not necessarily) designed such that the linking module **210** stacks directly on the power station **20** with the front sidewall **48** (FIG. **1**) of the power station **20** and the front end **103** of the linking module **210** facing the same direction. This enables users to conveniently view and access the control panels **46** (FIG. **1**), receptacles **50** (FIG. **1**), and ports **90** (FIG. **1**) of the first and second power stations **20** and the receptacles **159**, **163** of the linking module **210**. That is, users can view and access the control panels **46**, receptacles **50**, and ports **90** on the first and second power stations **20** and the receptacles **159**, **163** on the linking module **210** without having to move to a different side of the power stations **20** and/or linking module **210**.

[0084] Further, the engagement between the cutouts **131** of the linking module **210** and the carrying handles **34** of the power station **20** secures the linking module **210** on the power station **20** without preventing the intentional removal of the linking module **210** from the power station **20** by a user. That is, when the cutouts **131** of the linking module **210** are positioned on the carrying handles **34** of the power station **20**, the linking module **210** cannot simply slide off of the carrying handles **34**. Instead, the carrying handles **34** block the feet **127** of the linking module **210** from sliding over the front or rear sidewalls **48**, **76** of the power station **20**, and the cutouts **131** block the linking module **210** from sliding sideways off of the power station **20** to the left or right. Further, the cutouts **131** of the linking module **210** and/or the carrying handles **34** may include a non-slip surface.

[0085] Therefore, once the cutouts **131** of the linking module **210** are on the carrying handles **34** of the power station **20**, the linking module **210** is protected from falling off of the power station **20** and sustaining damage. A user does not have to trigger any locks or other securing mechanisms or devices in order for this protection to take effect. Rather, a user merely has to place the cutouts **131** of the linking module **210** on the carrying handles **34** of the power station **20**. Since a user does not have to trigger any locks when placing the linking module **210** on the power station **20**, a user may similarly remove the linking module **210** from the power station **20** without the need to disengage any locks. That is, when a user no longer wants the linking module **210** on top of the power station **20** (for example, the user no longer requires the increased power output), the user can simply lift the linking module **210** vertically off of the power station **20**.

[0086] The linking module **210** may also include power station mounts **133** on an upper surface **135** thereof to receive and secure the plurality of feet **32** (FIG. **1**) from a power station **20** stacked thereon. The power station mounts **133** are shown as circular mounting indentations that match a corresponding geometry of the feet **32**. Although the power station mounts **133** of the linking module **210** and the feet **32** of the power station **20** are described with particular shapes or configurations, in various embodiments, other shapes or configurations may be used. As a non-limiting example, the power station mounts **133** of the linking module **210** may be square-shaped to match square-shaped feet **32** of the power station **20**. As another non-limiting example, the linking module **210** may include a different number of power station mounts **133** to accommodate a lower or higher number of feet **32** of the power station **20** such as, for example, two or six power station mounts **133**. Accordingly, the linking module **210** may stack between first and second power stations **20**, with the linking module **210** secured on the oval-shaped carrying handles **34** of the first power station **20** and the second power station **20** secured on the power station mounts **133** of the linking module **210**.

[0087] Referring now to FIGS. **12-14**, upper-right front perspective, upper-right rear perspective, and upper-left front exploded perspective views, respectively, of a power station assembly **141** are shown, according to an embodiment of the invention. The power station assembly **141** may include a first inverter power station **143**, a second inverter power station **145**, and the linking module **210** of FIG. **9** in a stacked configuration. The first and second inverter power stations **141**, **143** are arranged similarly to the power station **20** of FIG. **1**, and hence, like elements therein are numbered identically to corresponding elements in the power station **20** of FIG. **1**. The first inverter power station **143** may be configured to provide a first AC power output at an AC voltage and a first AC current at or below a first AC current rating of the first inverter power station **143**, and the second inverter power station **145** may be configured to provide a second AC power output at the AC voltage and a second AC current at or below a second AC current rating of the second inverter power station **145**. The first inverter power station **143** may include a power output receptacle **147** configured to provide the first AC power output, and the second inverter power station **145** may include a power output receptacle **149** configured to provide the second AC power output.

[0088] The cutouts **131** on the bottom surface **129** of the housing **101** of the linking module **210** are positioned on the carrying handles **34** of the second inverter power station **145** to secure the linking module **210** in a stacked configuration with the second inverter power station **145**. That is, the arc-shaped cutouts **131** sit securely on the oval-shaped carrying handles **34** of the second inverter power station **145**. The feet **32** of the first inverter power station **143** are positioned in the power station mounts **133** on the upper surface **135** of the linking module to secure the first inverter power station **143** to the linking module **210**. That is, the power station mounts **133** of the linking module **210** receive and secure the plurality of feet **32** of the first inverter power station **143** stacked on the upper surface **135** of the linking module **210**. Accordingly, the linking module **210** is stacked between first and second inverter power stations **143**, **145**, with the linking module **210** secured on the oval-shaped carrying handles **34** and the second inverter power station **145** secured on power station mounts **133** of the linking module **210**. Again, although the power station mounts **133** and cutouts **131** of the linking module **210** and feet **32** of the first and second inverter power stations **143**, **145** are shown and described with particular shapes or configurations, in various embodiments, other shapes or configurations may be used.

[0089] In various embodiments of the invention, the linking module **210** may be a parallel link capable of providing an AC power output that combines the AC power outputs from the two inverter power stations **143**, **145** in parallel. In other embodiments of the invention, the linking module **210** may be a series link capable of providing an AC power output that combines the AC power outputs from the two inverter power stations **143**, **145** in series. The power output receptacles **147**, **149** of the first and second inverter power stations **143**, **145** may include respective pairs of linking module connection ports **90** each coupled to one of the first and second pairs of connection cables **117**, **119** of the linking module **210** extending through the slots **121** in the hinged door **113** in the right side **107** of the linking module **210**, as shown in FIGS. **12** and **13**. In other embodiments of the invention, the power output receptacles **147**, **149** of the first and second inverter power stations **143**, **145** may include AC power output receptacles **54** which may be configured to power the linking module **210** or an external electrical device (not shown in FIGS. **12-14**). In various embodiments, the linking module **210** couples to the DC power output receptacles **52** of the first and second inverter power stations **143**, **145** to receive power therefrom.

[0090] In various embodiments, the linking module **210** connects the first and second inverter power stations **143**, **145** in parallel and therefore the linking module connection ports **90** may be respective pairs of parallel AC power output receptacles **151**, **153**. That is, the first inverter power station **143** may include a first pair of parallel AC power output receptacles **151**, and the second inverter power station **145** may include a second pair of parallel AC power output receptacles **153**. Each pair of parallel cables **117**, **119** are electrically connectable to the first and second pairs of parallel AC power output receptacles **151**, **153** and configured to electrically connect to one of the first and second pairs of parallel AC power output receptacles **151**, **153** at a time to receive the first AC power output or the second AC power output. In FIGS. **12-13**, the first pair of parallel AC power output receptacles **151** of the first power inverter station **143** is coupled to the first pair of connection cables **117** of the linking module **210**, and the second pair of parallel AC power output receptacles **153** of the second inverter power station **145** is coupled to the second pair of connection cables **119**.

[0091] The linking module **210** may be configured to electrically connect to the first inverter power station **143** to receive the first AC power output therefrom, electrically connect to the second inverter power station **145** to receive the second AC power output therefrom, and combine the first and second AC power outputs into a third AC power output at the AC voltage and a third AC current that is a combination of the first and second AC current. The linking module **210** may also be configured to provide the third AC power output to an electrical load (not shown in FIGS. **12-14**) at the AC voltage and the third AC current at or below a third AC current rating that is a combination of the first and second AC current ratings. In various embodiments, the third AC current rating may be equal to a sum of the first and second AC current ratings.

[0092] In various embodiments, the one or more power output receptacles **159**, **161** of the linking module **210** are configured to provide the third AC power output, and the third AC current rating may be an AC current rating of the power output receptacles **159**, **161**. For example, the linking module **210** may include at least one AC power output receptacle **159**, **161** configured to provide a third AC power output at the AC voltage and a third AC current that is a combination of the first and second AC currents of the first and second inverter power stations **143**, **145** and that does not exceed a third AC current rating of the linking module **210**, the third AC current rating being higher than each of the first and second AC current ratings. The at least one AC power output receptacle **159**, **161** of the linking module **210** may have a voltage rating equal to a voltage rating of the power output receptacles **147**, **149** of the first and second inverter power stations **143**, **145**. In various embodiments, the one or more power output receptacles **159**, **161** of the linking module **210** includes a 120V AC, 30 A RV receptacle (or a NEMA TT-30R receptacle) **163** and a 120V AC, 30 A locking receptacle (or a NEMA L5-30R receptacle) **165**.

[0093] In various embodiments, the first inverter power station **143** includes a ground terminal **167**, and the second inverter power station **145** includes a ground terminal **169**. The linking module **210** may also include a first ground wire **171** electrically connectable to the ground terminals **167**, **169** and configured to electrically connect to one of the ground terminals **167**, **169** at a time. The linking module **210** may further include a second ground wire **173** electrically connectable to the first and second ground terminals **167**, **169** and configured to electrically connect to one of the first and second ground terminals **167**, **169** at a time. In FIG. **5**, the first ground wire **171** of the linking module **210** is coupled to the ground terminal **167** of the first inverter power station **143**, and second ground wire **173** of the linking module **210** is coupled to the ground terminal **169** of the second inverter power station **145**.

[0094] Referring now to FIG. **15**, an upper-left front perspective view of a power station assembly **155** is shown with the first and second inverter power stations **143**, **145** and linking module **210** of the power station assembly **154** of FIG. **12** and the expansion batteries **146**, **148** of FIG. **6** in a stacked configuration, according to an embodiment of the invention. FIG. **15** shows the power station assembly **155** with two expansion batteries **146**, **148** stacked on the first inverter power station **143**, the first inverter power station **143** stacked on the linking module **210**, and the linking module **210** stacked on the second inverter power station **145**. In essence, the power station assembly **155** illustrates a combination of the power station assembly **154** of FIG. **7** and the power station assembly **141** of FIG. **12**. In other words, power station assembly **155** shows how the power station **20** of FIG. **1** (as first power station **143**) is connectable to more than one of the expansion battery **108** of FIG. **4** (as expansion batteries **146**, **148**) and to another power station **20** (as second power station **145**) via the linking module **210** to expand the energy capacity and power output available to a load. Thus, the power station **20** may be called an expandable power station.

[0095] While the power station assembly **155** of FIG. **15** shows a particular configuration of the expansion batteries **146**, **148**, the first and second inverter power stations **143**, **145**, and linking module **210**, the configuration shown should not be considered limiting. That is, the power station assembly **155** could include additional expansion batteries (not shown in FIG. **15**) coupled to either the first or second inverter power stations **143**, **145**. In addition, although the stacked configuration shown consolidates the area used by the power station assembly **155**, the components of the power station assembly **155** do not need to be in the stacked configuration to operate as designed. Rather, as long as the proper electrical connections and procedures are made and followed, each component of the power station assembly **155** will operate with its full functionality, as described above.

[0096] The stacked configuration is enabled by the engagement between the cutouts **131** in the feet **127** of the linking module **210** and the carrying handles **34** of the second inverter power station **145**, the engagement between the power stations mounts **133** of the linking module **210** and the feet **32** of the first inverter power station **143**, the engagement between cutouts **142** of the feet **138** of the first expansion battery **146** and the carrying handles **34** of the second inverter power station **145**, the engagement between the cutouts **160** of the stacking adaptors **158** and the carrying handles **116** of the first expansion battery **146**, and the engagement between the cutouts **142** of the feet **138** of the second expansion battery **148** and the upper surfaces **162** of the stacking adaptors **158**. Additional expansion batteries **108** may be added to the stacked configuration via additional stacking adaptors **158**. Further, a user may stack the power station assembly **155** in a variety of different manners. As a non-limiting example, a user may stack the first power station **143** with expansion batteries **146**, **148**, stack the second power station **145** with additional expansion batteries **108** (not shown in FIG. **15**), and place the linking module **210** positioned between the two stacks or under the second power station **145**. As another non-limiting example, the linking module **210** may include carrying handles (not shown) for receiving additional expansion batteries **108** such that the linking module **210** could be stacked between the first power station **143** and the additional expansion batteries **108** in the prior example. As yet another example, stack adaptors **158** and/or power station mounts **133** could be configured to engage with each other so as to enable the linking module **210** to receive additional expansion batteries **108** securely thereon. In other words, a user's ability to stack the components of the power station assembly **155** is not limited to what is shown and, instead, is variable based on the user's preference or space available.

[0097] Referring now to FIG. **16**, a block diagram of a power station assembly **200** is shown, according to an embodiment of the invention. The power station assembly **200** is shown with a first power station **202** coupled to a second power station **204** by the linking module **210** of FIG. **9**, with the linking module **210** increasing the power output available to an electrical device **212** powered by the power station assembly **200**. The first and second power stations **202**, **204** are arranged similarly to the power station **20** of FIG. **1** and the first and second power stations **143**, **145** of FIG. **12**, and hence, like elements therein are numbered identically to corresponding elements in the power station **20** of FIG. **1** and the first and second power stations **143**, **145** of FIG. **12**. A first expansion battery **206** is coupled to the first power station **202**, and a second expansion battery **208** is coupled to the second power station **204**. The first expansion battery **206** and the second expansion battery **208** increase the energy capacity or runtime of the power station assembly **200**. The expansion batteries **206**, **208** are arranged similarly to the expansion battery **108** of FIG. **4** and the expansion batteries **146**, **148** of FIG. **6**, and thus, like elements therein are numbered identically to corresponding elements in the expansion battery **108** of FIG. **4** and the expansion batteries **146**, **148** of FIG. **6**.

[0098] The power stations **202**, **204** may each include one or more linking module connection ports **90** configured to receive connections to the linking module **210**. The linking module **210** may be used as a parallel link to couple together the AC power outputs from the linking module connection ports **90** of the two power stations **202**, **204** to increase output current or a series link to couple together the AC power outputs from the linking module connection ports **90** of the two power stations **202**, **204** to increase output voltage. The power stations **202**, **204** are also shown with an external battery port **68** configured to connect expansion batteries **206**, **208**, a DC power inlet receptacle **80** configured to connect to a DC power source **222** and an AC power inlet receptacle **78** configured to connect to an AC power source **216**. The power stations **202**, **204** may also include DC power output receptacles **52** and AC power output receptacles **54** configured to power electrical devices coupled to the power station **202**, **204**.

[0099] The AC power inlet receptacle **78** couples to the AC power source **216** using an AC cord **218**. The AC power source **216** may be a traditional wall outlet **220** coupled to the utility grid. The AC power inlet receptacle **78** may support AC fast charging (for example, at 120V AC, 50 Hz/60 Hz, 4.5 A MAX). The DC power inlet receptacle **80** may include an APP input port **82** configured to couple to the DC power source **222** using an APP cord **224**. The DC power source **222** may include one or more solar panels **214**. The APP input port **82** may support DC fast charging (for example, at 10V-28V DC, 25 A MAX).

[0100] The power stations **202**, **204** may also include a control system **38** including an inverter **42**, a processor **226** and memory **228**. While the inverter **42** is illustrated as part of the control system **38**, the inverter **42** may be controlled by the control system **38** as a separate element therefrom. The processor **226** may be one or more computer processors or microprocessors capable of executing a computer program having instructions including executable code. The executable code may be stored on the memory **228** which may include any suitable non-transitory media that can store executable code for use by the processor **226** to perform the presently disclosed techniques. The memory **228** may be any suitable type of computer-readable media that can store the executable code, data, analysis of the data, or the like. The power stations **202**, **204** may also include a control panel **46** having an automatic display **58** and a battery gauge **196**.

[0101] The linking module **210** may be configured to electrically connect to the first power station **202** to receive a first AC power output at an AC voltage and a first AC current less than or equal to a first AC current rating and electrically connect to the second power station **204** to receive a second AC power output at the AC voltage and a second AC current less than or equal to a second AC current rating. The linking module **210** may also be configured to electrically connect the first and second AC power outputs in parallel to combine the first and second AC power outputs into a third AC power output at the AC voltage and a third AC current that is a combination of the first and second AC currents, and provide the third AC power output to an electrical device or load **212**.

[0102] In various embodiments of the invention, each of the two connectable inverter power stations **202**, **204** include at least one respective power output receptacle **147**, **149** configured to provide a respective first and second rated AC power output. More specifically, the linking module **210** may be configured to electrically connect to the first power station **202** via a first AC power output receptacle **147** of the first power station **202**, with the first AC current rating being an AC current rating of the first AC power output receptacle **147**. The linking module **210** may be configured to electrically connect to the second power station **204** via a second AC power output receptable **149** of the second power station **204**, with the second AC current rating being an AC current rating of the second AC power output receptacle **149**. In various embodiments, first and second AC power output receptacles **147**, **149** have an AC voltage of approximately 120V (within plus or minus 10V, or from 110V to 130V), and the first and second AC current ratings are approximately 15 A (within plus or minus 3 A, or from 12 A to 18 A).

[0103] In various embodiments of the invention, the power station assembly **200** may include two connectable inverter power stations **202**, **204** each configured to provide a first rated AC power output at a first voltage rating and a first current rating. When the linking module **210** electrically connects the two connectable power stations **202**, **204**, the power station assembly **200** may include a second rated AC power output at the first voltage rating and a second current rating higher than the first current rating. According to various embodiments, when the linking module **210** electrically connects the two connectable power stations **202**, **204**, the linking module **210** is capable of providing the second rated AC power output. The linking module **210** may include at least one power output receptacle **159** configured to provide the second rated AC power output. Accordingly, the linking module **210** may include a second rated AC power output at the first voltage rating and a second current rating higher than the first current rating. The linking module **210** may be a parallel link configured to couple the two connectable inverter power stations **202**, **204** in parallel and capable of providing a rated AC power output that combines the rated AC power outputs from the two connectable inverter power stations **202**, **204**.

[0104] An expansion battery charger or charging module **230** is configured to charge the expansion batteries **206**, **208**. The expansion battery charging module **230** may receive power from the AC power source **216** and/or the DC power source **222** and supply the power to one expansion battery **206**, **208** using a power cord **232**. The expansion battery charging module **230** includes an AC input port **234**, an APP input port **236**, and a power DC output port **238**. The AC input port **234** is configured to couple to an AC power source such as, for example, the AC power source **216** using the AC cord **218**. The APP input port **236** is configured to couple to a DC power source such as, for example, the DC power source **222** using the APP cord **224**.

[0105] The expansion batteries **206**, **208** may include a charging module input port **134** that connects to the power output port **238** of the expansion battery charging module **230** using the power cord **232**. The expansion batteries **206**, **208** may also include a pair of battery connection ports **132** that couple to a battery connection port **132** of another expansion battery **206**, **208** or to the external battery port **68** of a power station **202**, **204**. A connection cable **150** may electrically couple the expansion batteries **206**, **208** to the power stations **202**, **204** when coupled to one battery connection port **132** and one external battery port **68**. The expansion batteries **206**, **208** may each be connected to one or more additional expansion batteries (not shown in FIG. **16**) to increase the battery capacity available to the power stations **202**, **204**.

[0106] In various embodiments, the solar panels **214** of the DC power source **222** may be rated between 10V-28V with MC4 or APP connectors and may power one or more of the power stations **202**, **204** or the expansion batteries **206**, **208** via the expansion battery charging module **230**. The solar panels **214** may include APP connectors **240** that can be coupled directly to the APP input ports **82** of the power stations **202**, **204** or the APP input port **236** of the expansion battery charging module **230**. The solar panels **214** may alternatively include MC4 connectors **242** that can be connected to the APP input ports **82**, **236** using an MC4 to APP solar charge harness **244**. The solar charge harness **244** may have an APP plug connectable to the power stations **202**, **204** and the expansion battery charging module **230** with MC4 connections such as, for example, three MC4 connections to couple up to three or more solar panels **214** having MC4 connectors **242**.

[0107] In some embodiments of the invention, the capacity of the onboard battery system **36** and/or each expansion battery **206**, **208** could have an approximate (within plus or minus 5%) capacity of 1600 Wh or 3200 Wh. The onboard battery system **36** and/or each battery system **112** of the expansion batteries **206**, **208** may have a rated output voltage of approximately 46.8V and a max output voltage of approximately 54.6V-55V, although the battery systems **36**, **112** could have any suitable voltage rating such as 12V, 24V, or 48V, as non-limiting examples. The percent battery level of the battery systems **36**, **112** may correspond to the battery voltage. As a non-limiting example, 100% battery level could correspond to 55V, and 0% battery level could correspond to 38V. In some embodiments, when power stations **202**, **204** operate at full load, they will not reach 5% THD until the voltage drops to 42.57V with 17% battery capacity, and when power stations **202**, **204** operate at full load with double the battery capacity, they will not reach 5% THD until the voltage drops to 42.70V with 11% battery capacity. In various embodiments, the power stations **202**, **204** may each provide single phase AC power at 60 Hz with a current rating of approximately 13.3 A at 120V.

[0108] One skilled in the art will appreciate that embodiments of the invention may be interfaced to and controlled by a computer readable storage medium having stored thereon a computer program. The computer readable storage medium includes a plurality of components such as one or more of electronic components, hardware components, and/or computer software components. These components may include one or more computer readable storage media that generally stores instructions such as software, firmware and/or assembly language for performing one or more portions of one or more implementations or embodiments of a sequence. These computer readable storage media are generally non-transitory and/or tangible. Examples of such a computer readable storage medium include a recordable data storage medium of a computer and/or storage device. The computer readable storage media may employ, for example, one or more of a magnetic, electrical, optical, biological, and/or atomic data storage medium. Further, such media may take the form of, for example, floppy disks, magnetic tapes, CD-ROMs, DVD-ROMs, hard disk drives, and/or electronic memory. Other forms of non-transitory and/or tangible computer readable storage media not listed may be employed with embodiments of the invention.

[0109] A number of such components can be combined or divided in an implementation of a system. Further, such components may include a set and/or series of computer instructions written in or implemented with any of a number of programming languages, as will be appreciated by those skilled in the art. In addition, other forms of computer readable media such as a carrier wave may be employed to embody a computer data signal representing a sequence of instructions that when executed by one or more computers causes the one or more computers to perform one or more portions of one or more implementations or embodiments of a sequence.

[0110] Beneficially, embodiments of the invention provide an expandable inverter power station powered by an expandable battery system. The power station is connectable to one or more expansion batteries to obtain an increased energy capacity of the power station. The power station is also connectable to another power station to increase the power output available to an electrical load. The control system may further calculate the combined energy level of each expansion battery. A digital display indicates the energy level of an onboard battery and the combined energy level of each expansion battery so that an operator knows the available battery level for a particular load prior to connecting the load.

[0111] Therefore, according to one embodiment of the invention, an expandable power station includes a housing and an onboard battery system positioned within the housing. The expandable power station also includes an external battery port configured to electrically connect to a battery system of each expansion battery of at least one expansion battery to increase a battery level available to the onboard battery system of the expandable power station and a plurality of linking module connection ports configured to electrically connect to a linking module. The linking module is configured to combine a power output of the expandable power station and a separate power output of a separate expandable power station into an increased power output. Further, the expandable power station includes a plurality of supports extending from the housing. The plurality of supports is configured to separately support one expansion battery of the at least one expansion battery and the linking module directly thereon.

[0112] According to another embodiment of the invention, a power station assembly includes an expandable power station having a housing, a battery system positioned within the housing, an external battery port, a plurality of linking module connection ports, and a plurality of supports extending from the housing. The power station assembly additionally includes a linking module having a housing configured to stack securely on the plurality of supports of the power station, a first pair of connection cables configured to electrically couple to the plurality of linking module connection ports of the power station to receive a power output therefrom, a second pair of connection cables configured to electrically connect to linking module connection ports of a separate power station to receive a separate power output therefrom, and at least one power output receptacle configured to supply an increased power output resulting from a combination of the power output of the power station and the separate power output from the separate power station. Furthermore, the power station assembly includes at least one expansion battery. Each expansion battery of the at least one expansion battery includes a housing configured to stack securely on the plurality of supports of the power station and a battery system configured to electrically couple to the external battery port of the power station to increase a battery level available to the battery system of the power station.

[0113] According to yet another embodiment of the invention, a method of stacking a power station assembly includes positioning a first power station on a surface. The first power station includes a housing and an onboard battery system positioned within the housing. The first power station further includes an external battery port configured to electrically connect to a battery system of each expansion battery of at least one expansion battery to increase a battery level available to the onboard battery system of the first power station. The first power station also includes a plurality of linking module connection ports configured to electrically connect to a linking module configured to combine a power output of the first power station and a separate power output of a separate power station into an increased power output. In addition, the first power station includes a plurality of supports extending from the housing. The plurality of supports is configured to separately support one expansion battery of the at least one expansion battery and the linking module directly thereon.

[0114] While the invention has been described in detail in connection with only a limited number of embodiments, it should be readily understood that the invention is not limited to such disclosed embodiments. Rather, the invention can be modified to incorporate any number of variations, alterations, substitutions or equivalent arrangements not heretofore described, but which are commensurate with the spirit and scope of the invention. The singular forms 'a', 'an', and 'the' in the claims include plural reference unless the context clearly dictates otherwise. Additionally, while various embodiments of the invention have been described, it is to be understood that aspects of the invention may include only some of the described embodiments. Accordingly, the invention is not to be seen as limited by the foregoing description but is only limited by the scope of the appended claims.

What is claimed is:

1. An expandable power station comprising:

a housing;

an onboard battery system positioned within the housing;

an external battery port configured to electrically connect to a battery system of each expansion battery of at least one expansion battery to increase a battery level available to the onboard battery system of the expandable power station;

a plurality of linking module connection ports configured to electrically connect to a linking module, the linking module configured to combine a power output of the expandable power station and a separate power output of a separate expandable power station into an increased power output; and

a plurality of supports extending from the housing, the plurality of supports configured to separately support one expansion battery of the at least one expansion battery and the linking module directly thereon.

2. The expandable power station of claim **1** wherein the plurality of support comprises a pair of carrying handles.

3. The expandable power station of claim **2** wherein each of the pair of carrying handles is configured to separately receive at least one cutout on the linking module and at least one cutout on the one expansion battery of the at least one expansion battery.

4. The expandable power station of claim **3** wherein each of the pair of carrying handles is oval-shaped and configured to separately receive at least one arc-shaped cutout on the linking module and at least one arc-shaped cutout on the one expansion battery of the at least one expansion battery.

5. The expandable power station of claim **1** wherein:

the plurality of supports is configured to support at least nine additional expansion batteries of the at least one expansion battery on top of the one expansion battery of the at least one expansion battery; and

the expandable power station is configured to electrically connect to the at least nine additional expansion batteries via the external battery port.

6. The expandable power station of claim **1** wherein the plurality of supports is configured to indirectly support the separate expandable power station on top of the linking module.

7. The expandable power station of claim **6** wherein the plurality of supports is configured to support the one expansion battery of the at least one expansion battery indirectly on top of the separate expandable power station on top of the linking module.

8. A power station assembly comprising:

an expandable power station comprising:

a housing;

a battery system positioned within the housing;

an external battery port;

a plurality of linking module connection ports; and

a plurality of supports extending from the housing;

a linking module comprising:

a housing configured to stack securely on the plurality of supports of the power station;

a first pair of connection cables configured to electrically couple to the plurality of linking module connection ports of the power station to receive a power output therefrom;

a second pair of connection cables configured to electrically connect to linking module connection ports of a separate power station to receive a separate power output therefrom; and

at least one power output receptacle configured to supply an increased power output resulting from a combination of the power output of the power station and the separate power output from the separate power station; and

at least one expansion battery, each expansion battery of the at least one expansion battery comprising:

a housing configured to stack securely on the plurality of supports of the power station; and

a battery system configured to electrically couple to the external battery port of the power station to increase a battery level available to the battery system of the power station.

9. The power station assembly of claim **8** further comprising a plurality of stacking adaptors configured to attach to a plurality of supports of each expansion battery of the at least one expansion battery to allow for stacking one expansion battery of the at least one expansion battery on top of another expansion battery of the at least one expansion battery.

10. The power station assembly of claim **8** wherein the housing of the linking module comprises a top surface with a plurality of power station mounts configured to secure and support the power station.

11. The power station assembly of claim **8** wherein each support of the plurality of supports of the power station is a carrying handle.

12. The power station assembly of claim **11** wherein each carrying handle is oval-shaped.

13. The power station assembly of claim **8** wherein:

the housing of the linking module comprises a bottom surface with a plurality of feet and at least two cutouts extending through the plurality of feet, each cutout extending through at least one foot of the plurality of feet; and

each of the plurality of supports of the power station is configured to receive one or more of the at least two cutouts thereon such that engagement between the plurality of supports and the cutouts secures the linking module on the power station.

14. The power station assembly of claim **13** wherein the housing of the linking module comprises first and second cutouts extending between a first pair of the plurality of feet and between a second pair of the plurality of feet, respectively.

15. The power station assembly of claim **13** wherein each of the at least two cutouts of the housing of the linking module is arc-shaped.

16. The power station assembly of claim **8** wherein:

the housing of each expansion battery of the at least one expansion battery comprises a bottom surface with a plurality of feet and at least two cutouts, each cutout extending through at least one foot of the plurality of feet; and

each support of the plurality of supports of the power station is configured to receive one or more of the at least two cutouts thereon such that engagement between the plurality of supports and the cutouts secures one expansion battery of the at least one expansion battery on the power station.

17. The power station assembly of claim **16** wherein each cutout of the housing of each expansion battery of the at least one expansion battery comprises an arc-shaped cutout.

18. A method of stacking a power station assembly, the method comprising:

positioning a first power station on a surface, the first power station comprising:

a housing;

an onboard battery system positioned within the housing;

an external battery port configured to electrically connect to a battery system of each expansion battery of at least one expansion battery to increase a battery level available to the onboard battery system of the first power station;

a plurality of linking module connection ports configured to electrically connect to a linking module configured to combine a power output of the first power station and a separate power output of a separate power station into an increased power output; and a plurality of supports extending from the housing, the plurality of supports configured to separately support one expansion battery of the at least one expansion battery and the linking module directly thereon.

19. The method of claim **18** further comprising stacking a first expansion battery of the at least one expansion battery on the plurality of supports of the first power station; and

electrically coupling the battery system of the first expansion battery of the at least one expansion battery to the first power station via the external battery port to increase a battery level available to the onboard battery system of the first power station.

20. The method of claim **18** further comprising positioning the linking module on the plurality of supports of the first power station; and

electrically coupling the linking module to the first power station by coupling a first pair of connection cables to the plurality of linking module connection ports of the first power station.

21. The method of claim **20** wherein positioning the linking module on the plurality of supports of the first power station comprises positioning cutouts on a bottom surface of a housing of the linking module on the plurality of supports of the first power station.

22. The method of claim **20** further comprising:

positioning a second power station in power station mounts of the linking module, the second power station comprising:

a housing;

an onboard battery system positioned within the housing;

an external battery port configured to electrically connect to the battery system of each expansion battery of the at least one expansion battery to increase a battery level available to the onboard battery system of the second power station;

a plurality of linking module connection ports configured to electrically connect to the linking module; and

a plurality of supports extending from the housing, the plurality of supports configured to separately support the one expansion battery of the at least one expansion battery and the linking module directly thereon; and

electrically coupling the second power station to the linking module by coupling a second pair of connection cables to the plurality of linking module connections ports of the second power station.

23. The method of claim **22** positioning a first expansion battery of the at least one expansion battery on the plurality of supports of the second power station; and

electrically coupling the battery system of the first expansion battery of the at least one expansion battery to the onboard battery system of the second power station to increase a battery level available to the second power station.

24. The method of claim **23** wherein positioning the first expansion battery of the at least one expansion battery on the plurality of supports of the second power station comprises positioning cutouts on a bottom surface of a housing of the expansion battery on the plurality of supports of the second power station.

25. The method of claim **23** further comprising positioning a plurality of stacking adaptors on a plurality of supports on a housing the first expansion battery of the at least one expansion battery;

positioning a second expansion battery of the at least one expansion battery on the plurality of stacking adaptors; and

electrically coupling the battery system of the second expansion battery of the at least one expansion battery to the onboard battery system of the second power station to increase a battery level available to the second power station.

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