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(54) **AUXILIARY POWER SYSTEM FOR A VEHICLE**

Publication Classification

(71) Applicant: **Oshkosh Corporation**, Oshkosh, WI (US)

(51) **Int. Cl.**
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B60L 58/20 (2006.01)
B60L 58/12 (2006.01)
B60L 50/50 (2006.01)
B60L 1/00 (2006.01)

(72) Inventors: **Matthew Dixon**, St. Petersburg, FL (US); **Martin Skurka**, Parrish, FL (US)

(52) **U.S. Cl.**
CPC **B60R 16/033** (2013.01); **B60L 58/20** (2019.02); **B60L 2200/40** (2013.01); **B60L 50/50** (2019.02); **B60L 1/00** (2013.01); **B60L 58/12** (2019.02)

(73) Assignee: **Oshkosh Corporation**, Oshkosh, WI (US)

(21) Appl. No.: **16/847,028**

(22) Filed: **Apr. 13, 2020**

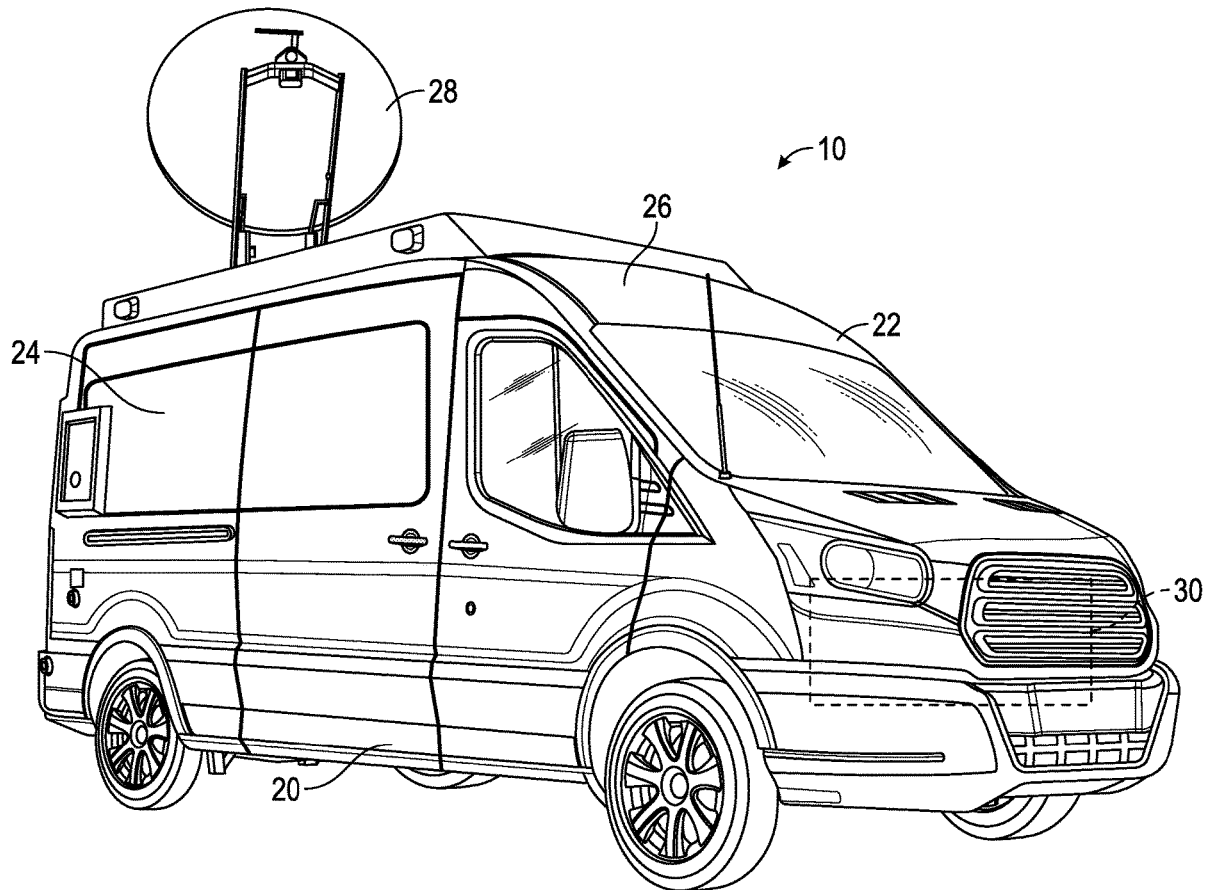
(57) **ABSTRACT**

Related U.S. Application Data

(63) Continuation of application No. 16/418,741, filed on May 21, 2019, now Pat. No. 10,618,481, which is a continuation of application No. 16/105,491, filed on Aug. 20, 2018, now Pat. No. 10,300,871, which is a continuation of application No. 14/678,706, filed on Apr. 3, 2015, now Pat. No. 10,053,035.

A vehicle includes a chassis, an engine coupled to the chassis, a primary electrical system including a primary alternator and a primary battery, and an auxiliary electrical system including an auxiliary alternator and an auxiliary battery. At least one of (a) the primary alternator is electrically decoupled from the auxiliary battery and (b) the auxiliary alternator is electrically decoupled from the primary battery, and the primary battery is electrically coupled to one or more electrical loads.

(60) Provisional application No. 61/975,663, filed on Apr. 4, 2014.



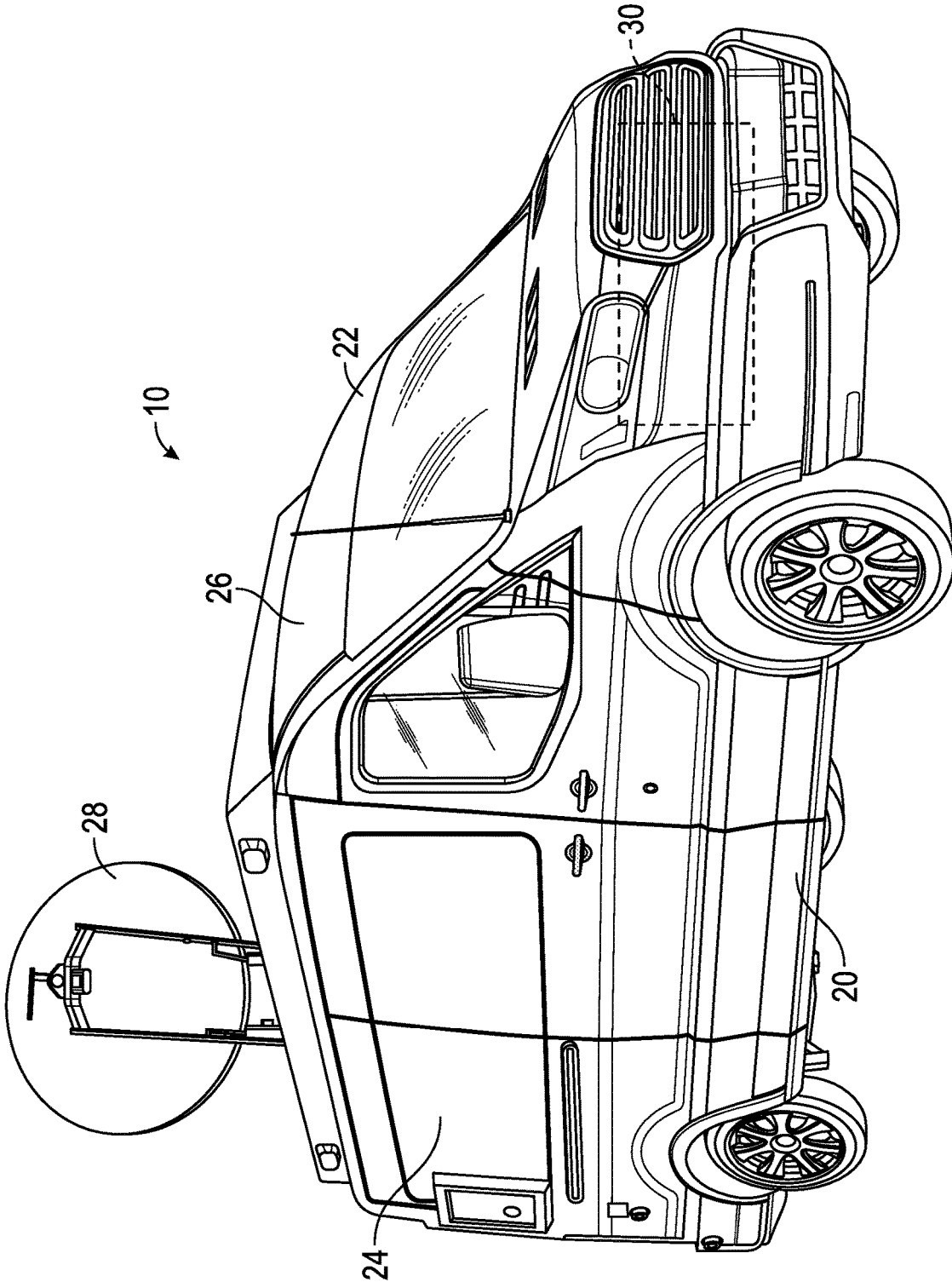


FIG. 1

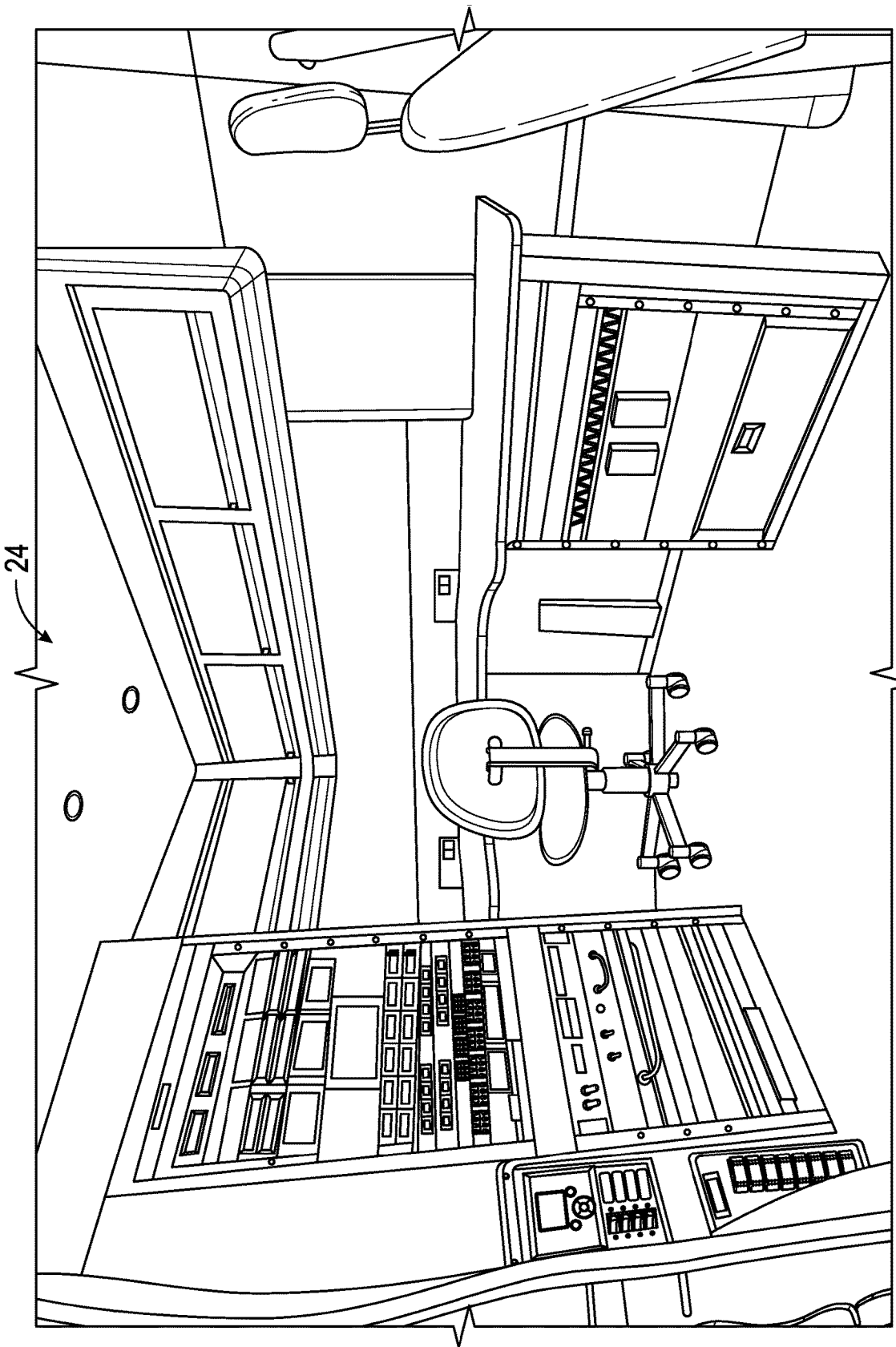


FIG. 2A

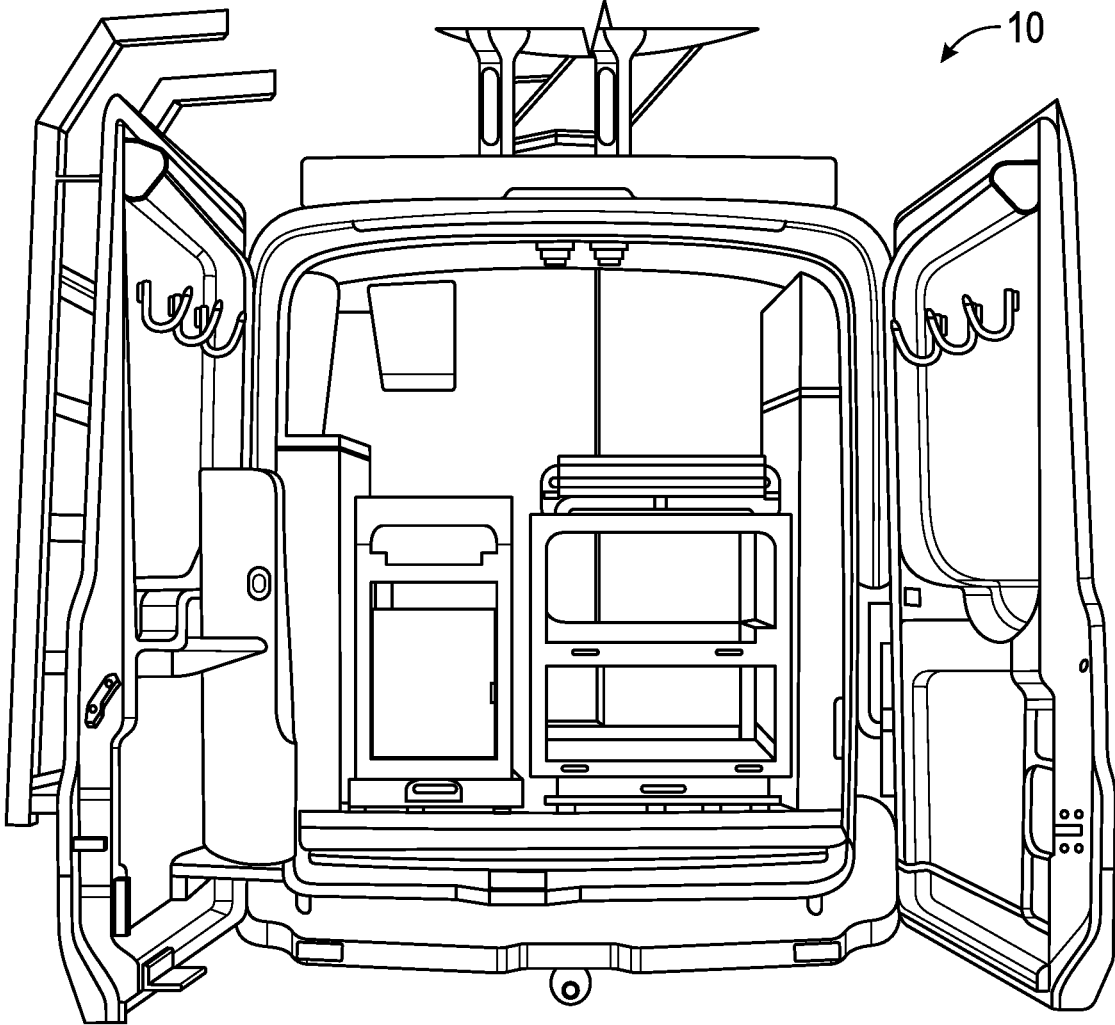
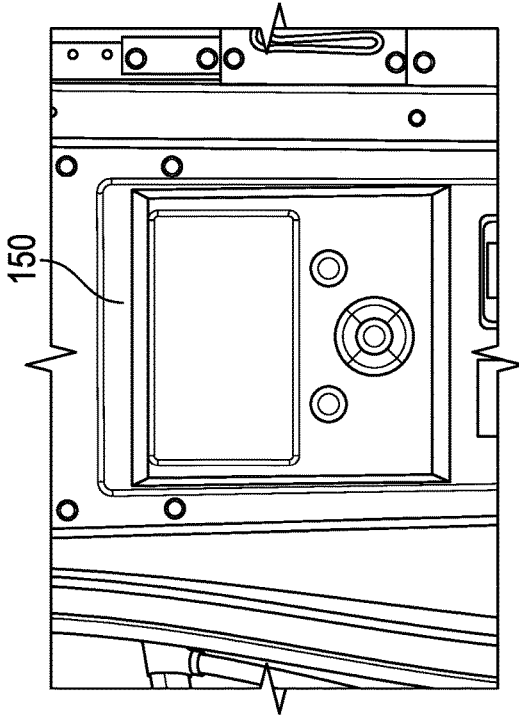


FIG. 2B

FIG. 2D



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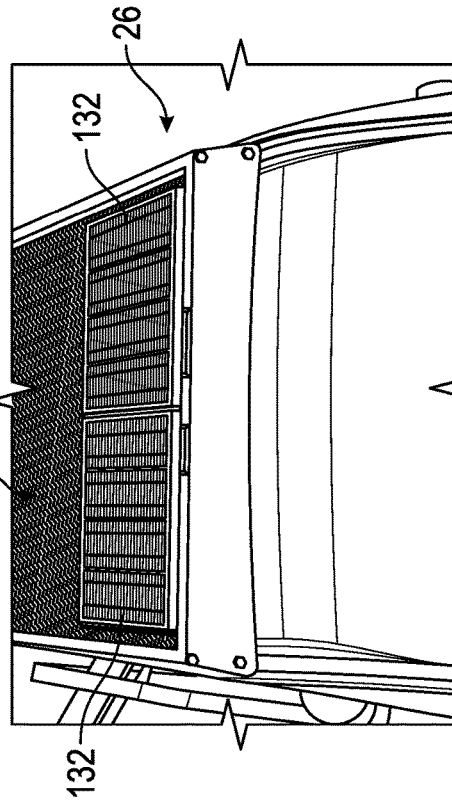


FIG. 2F

FIG. 2C

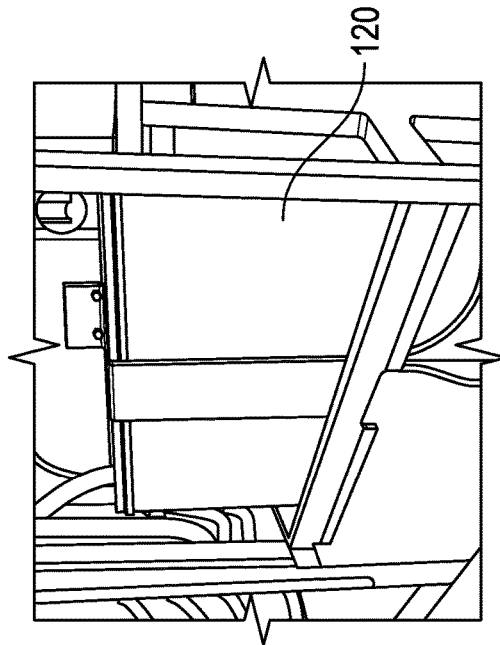
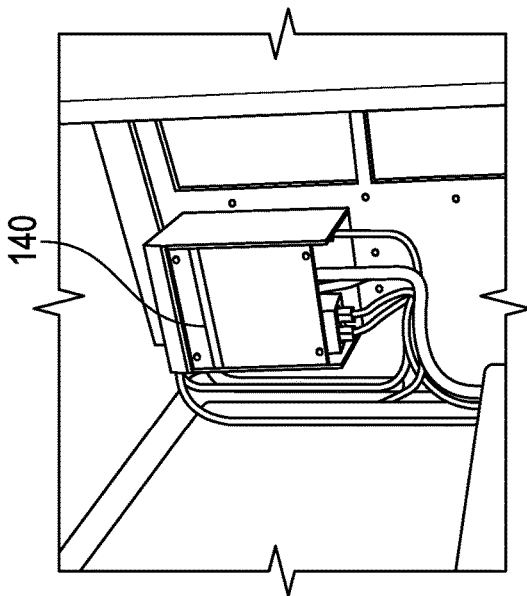


FIG. 2E

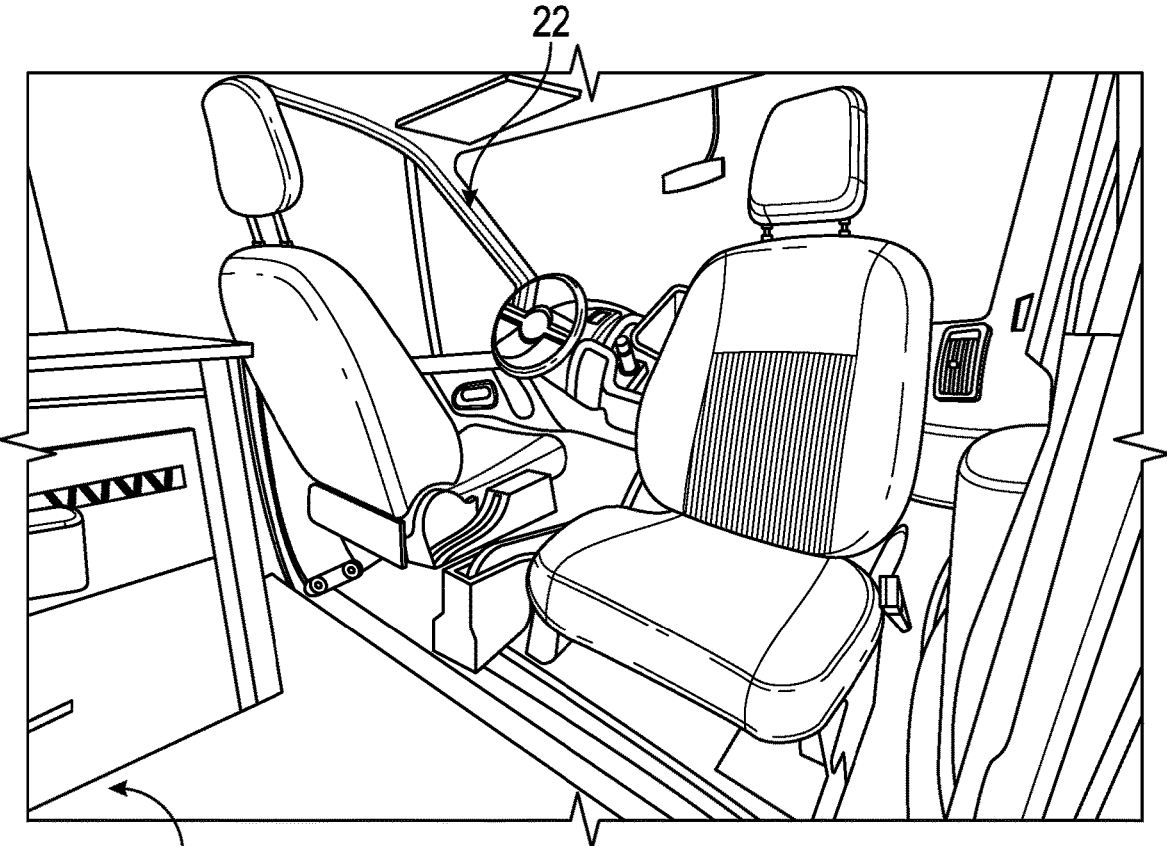


FIG. 2G

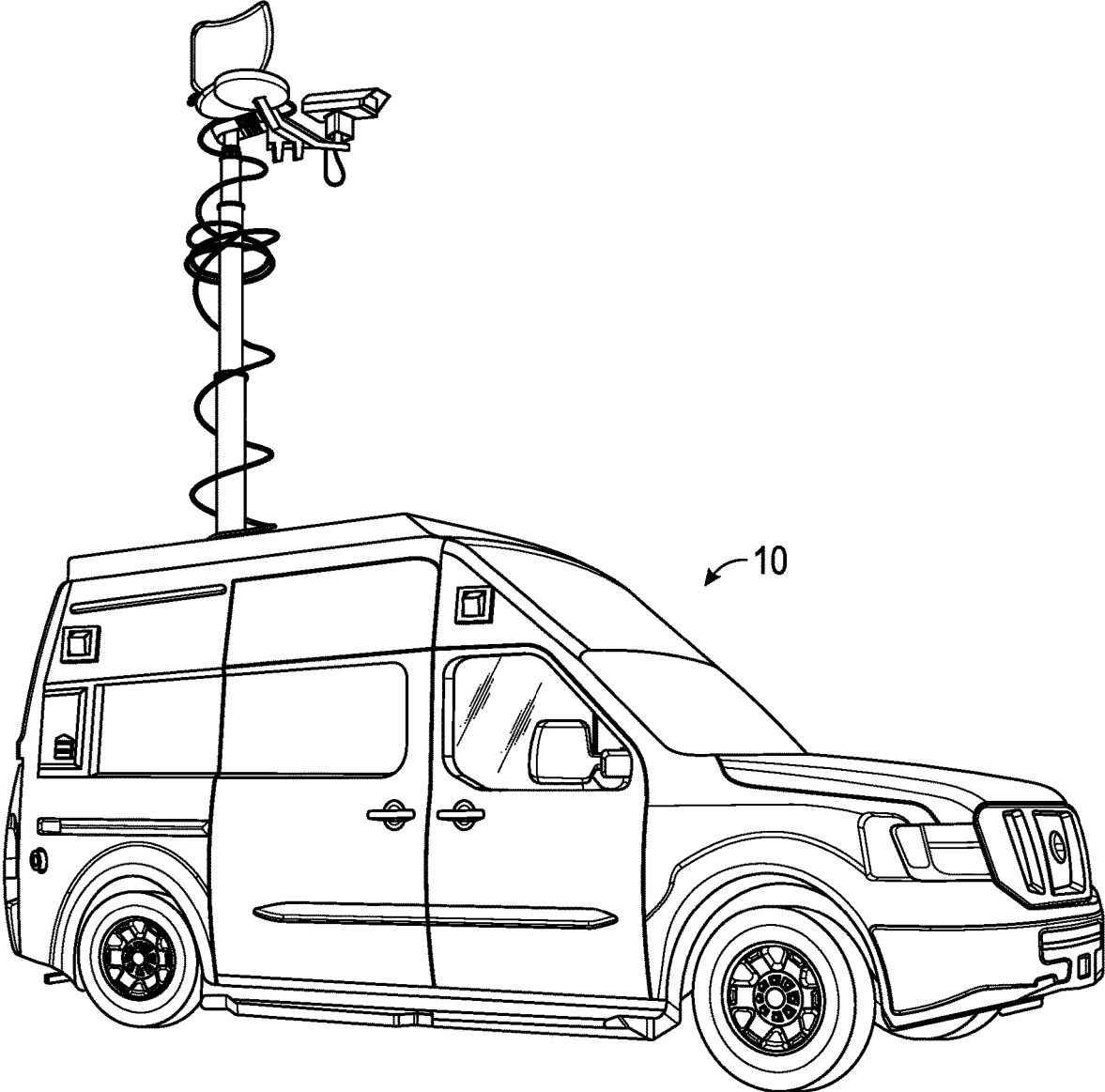


FIG. 3A

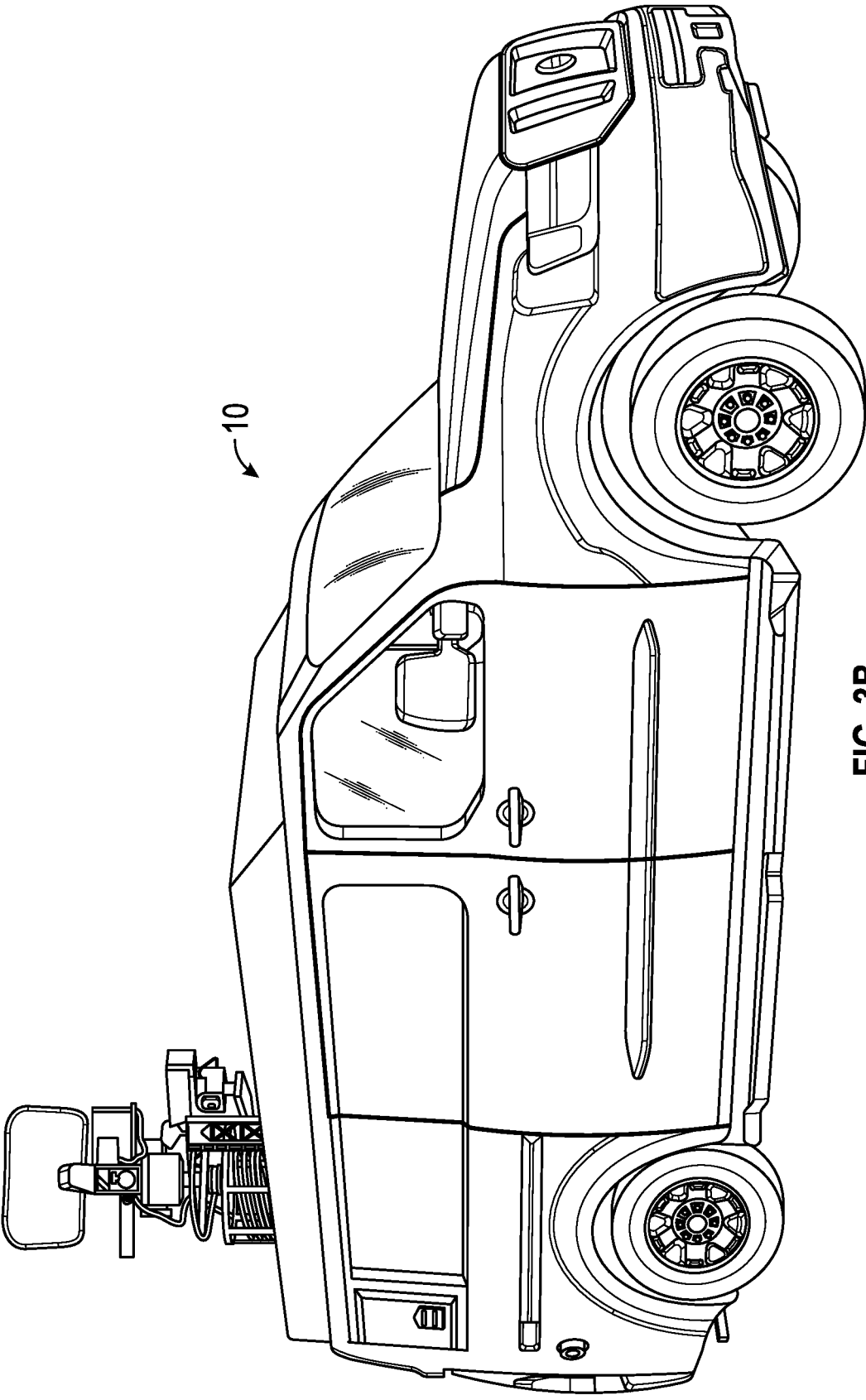


FIG. 3B

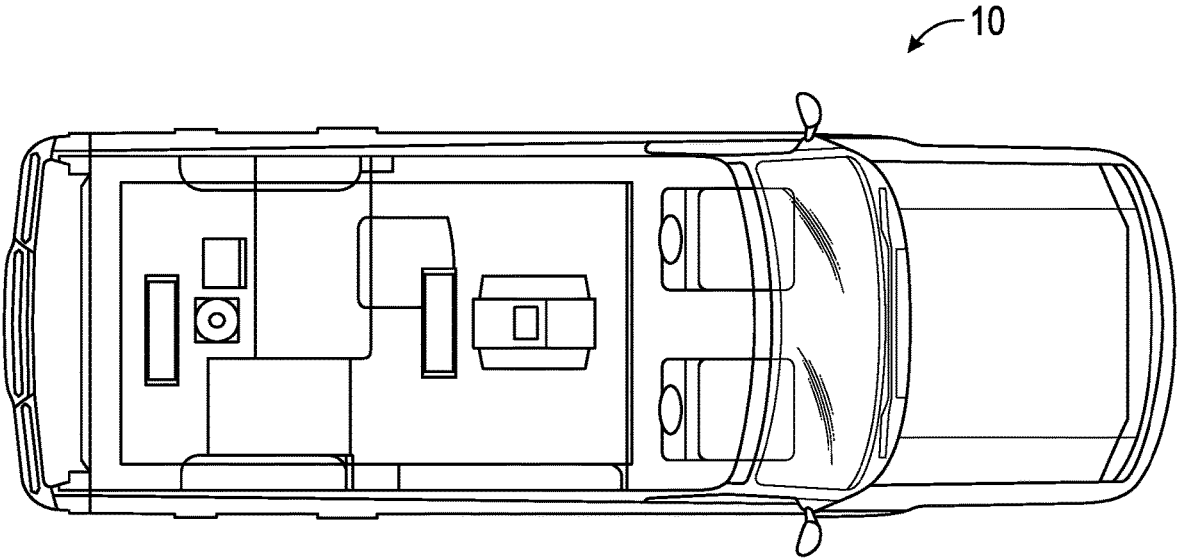


FIG. 4A

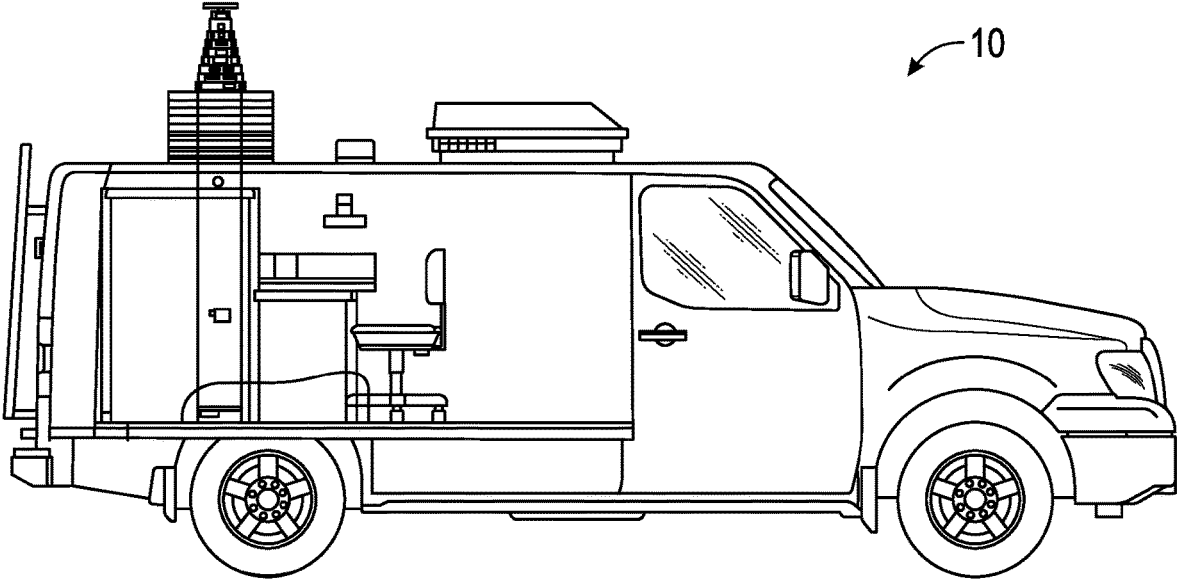


FIG. 4B

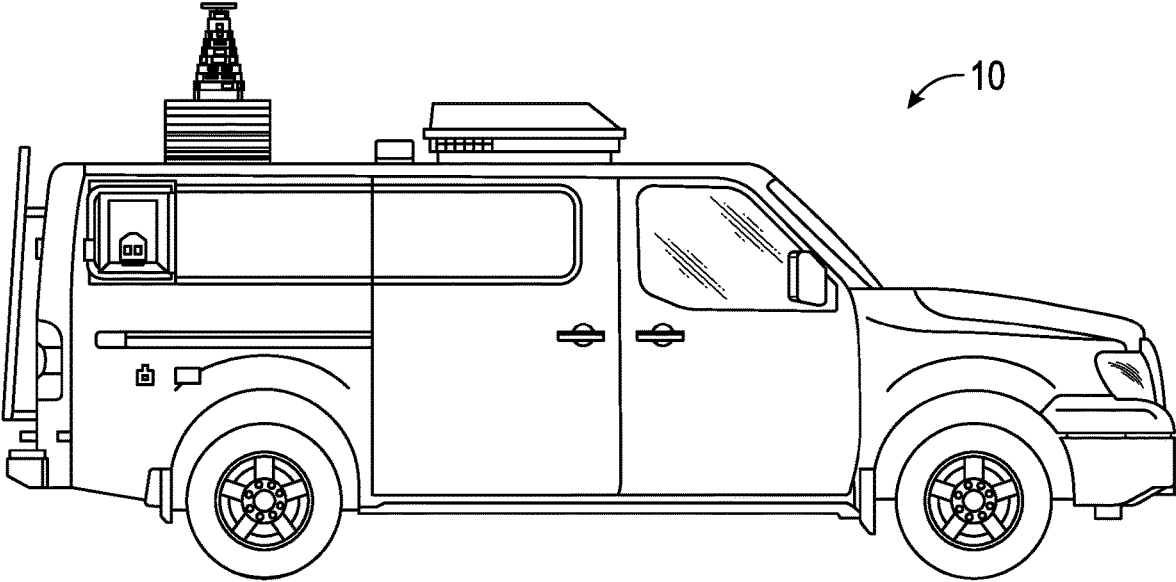


FIG. 4C

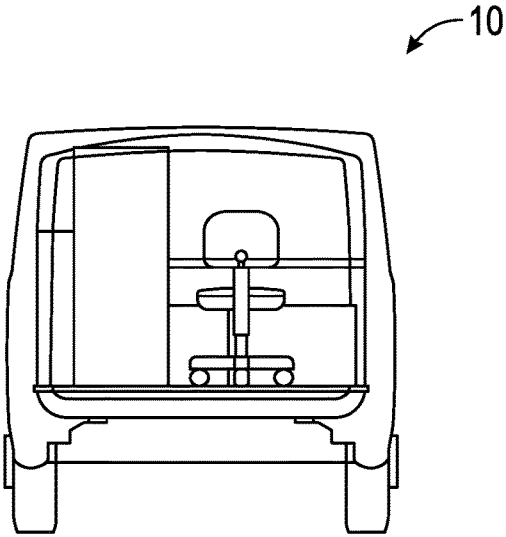


FIG. 4D

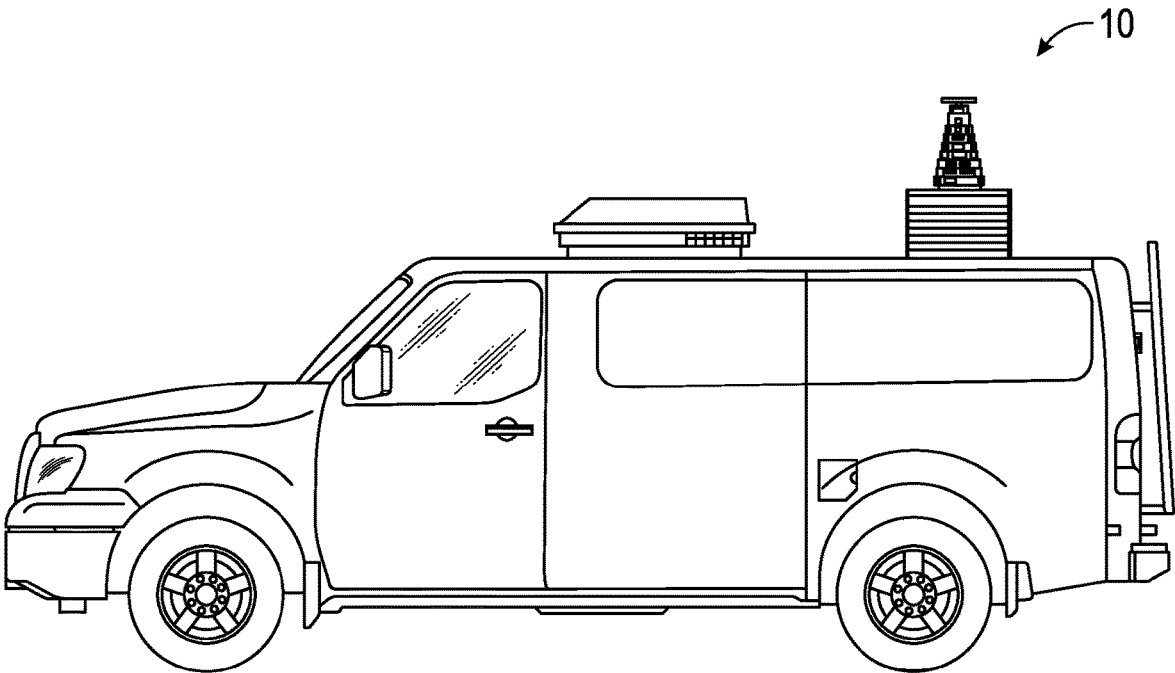


FIG. 4E

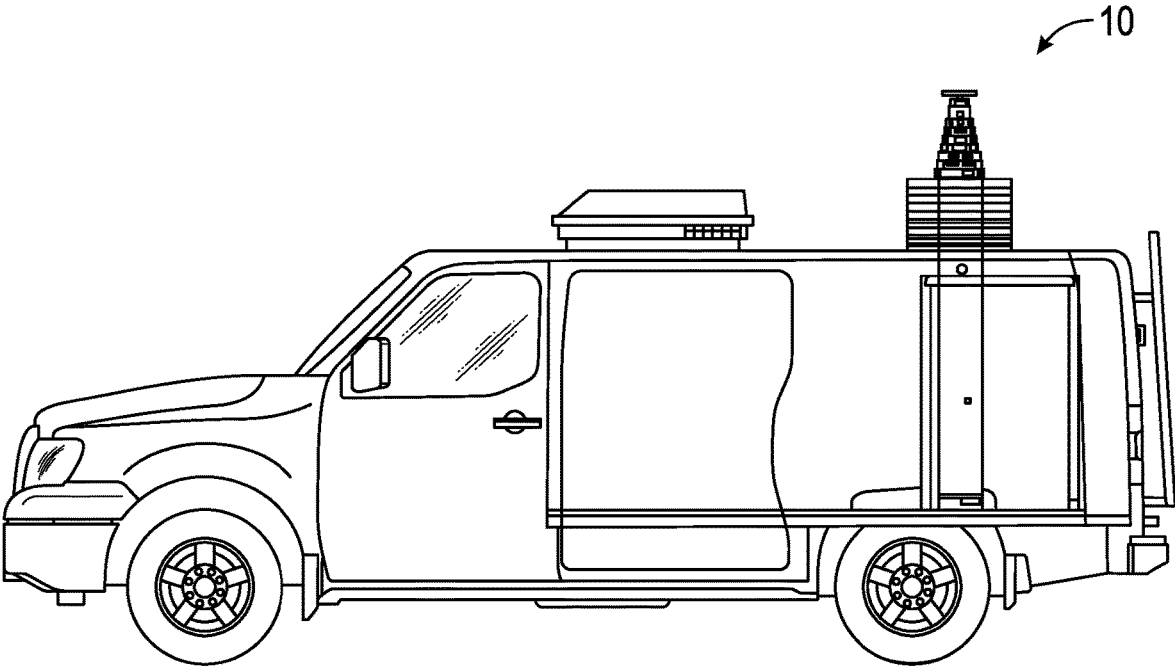


FIG. 4F

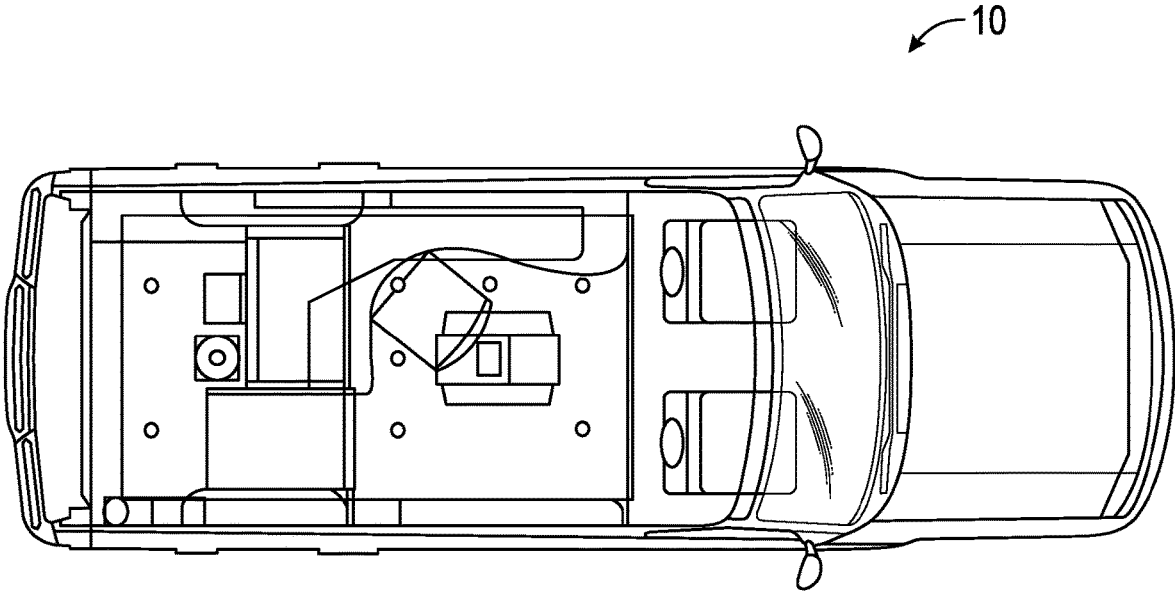


FIG. 5A

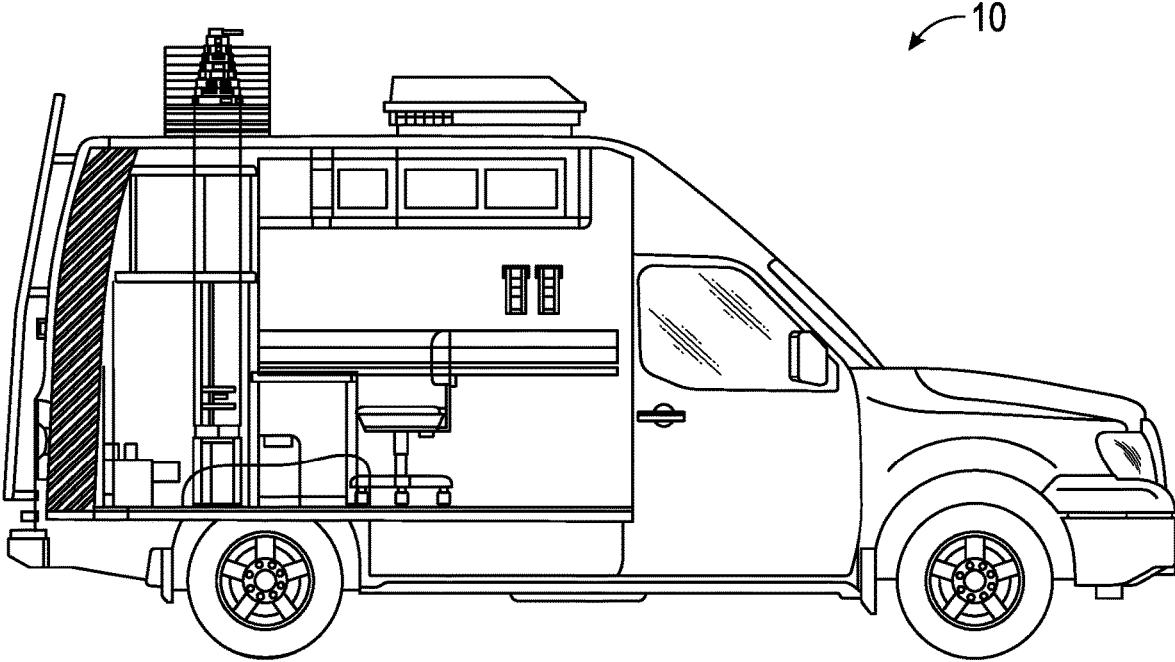


FIG. 5B

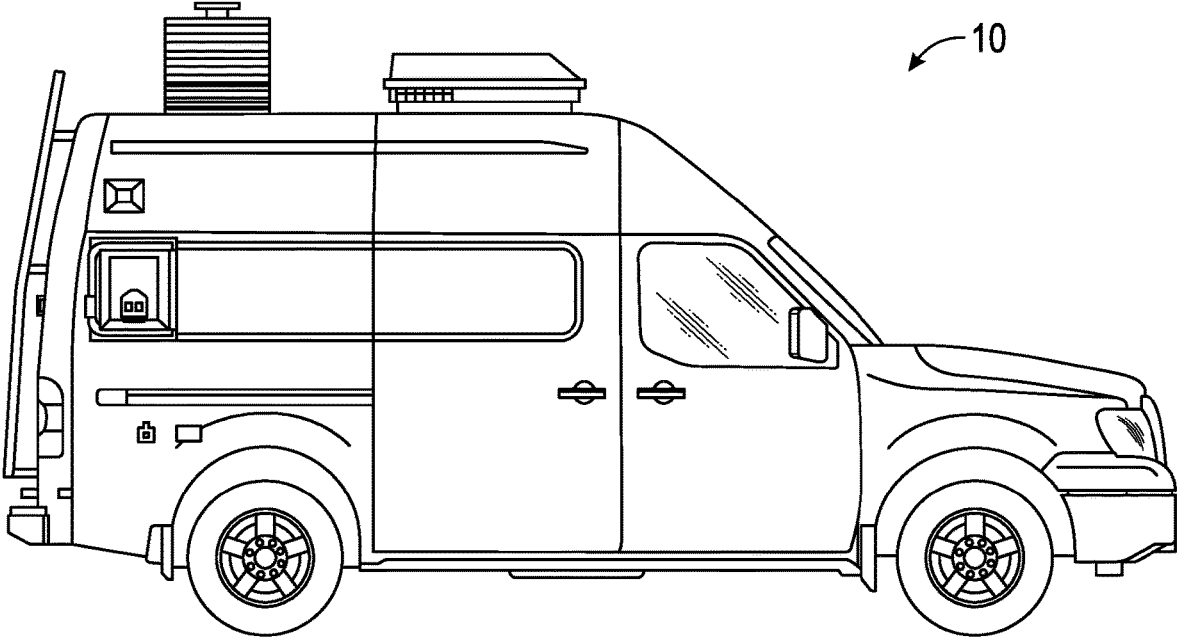


FIG. 5C

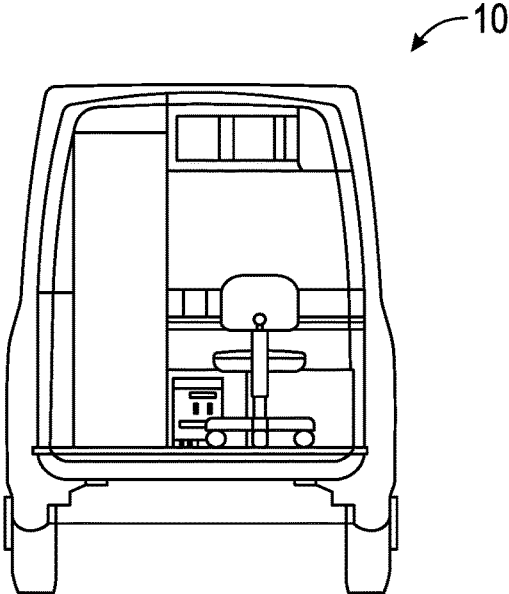


FIG. 5D

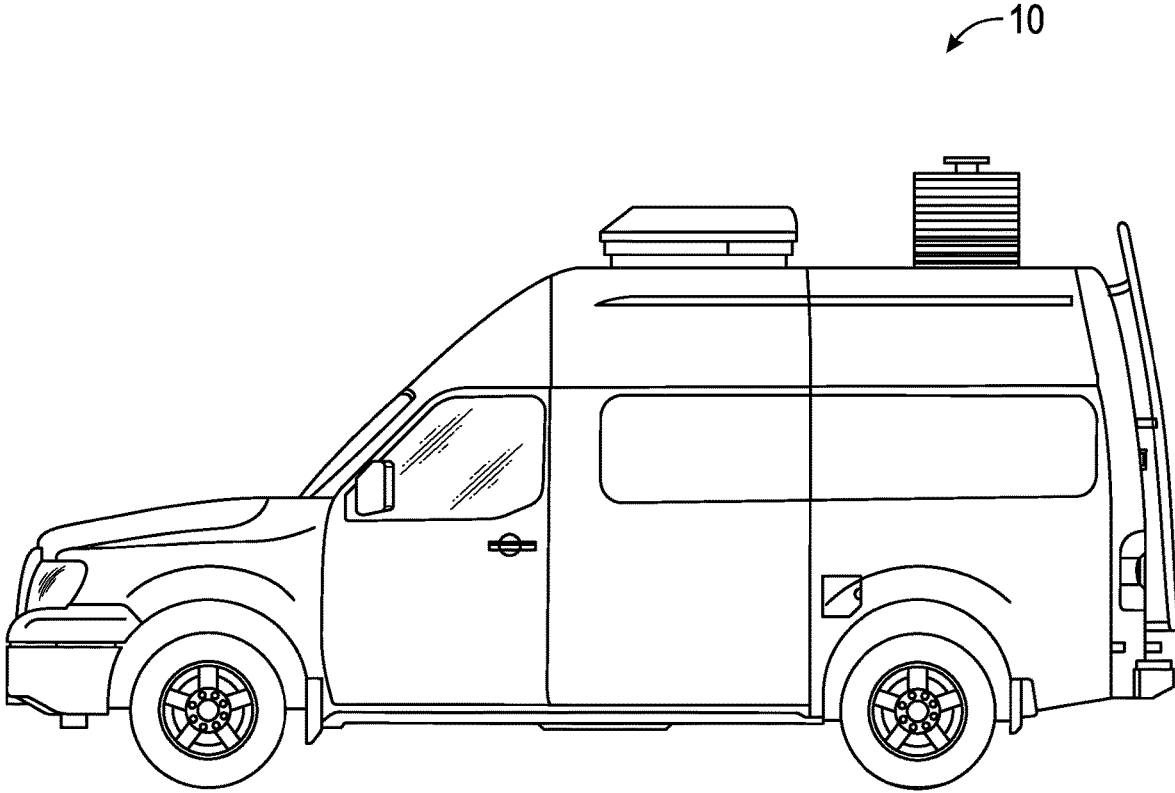


FIG. 5E

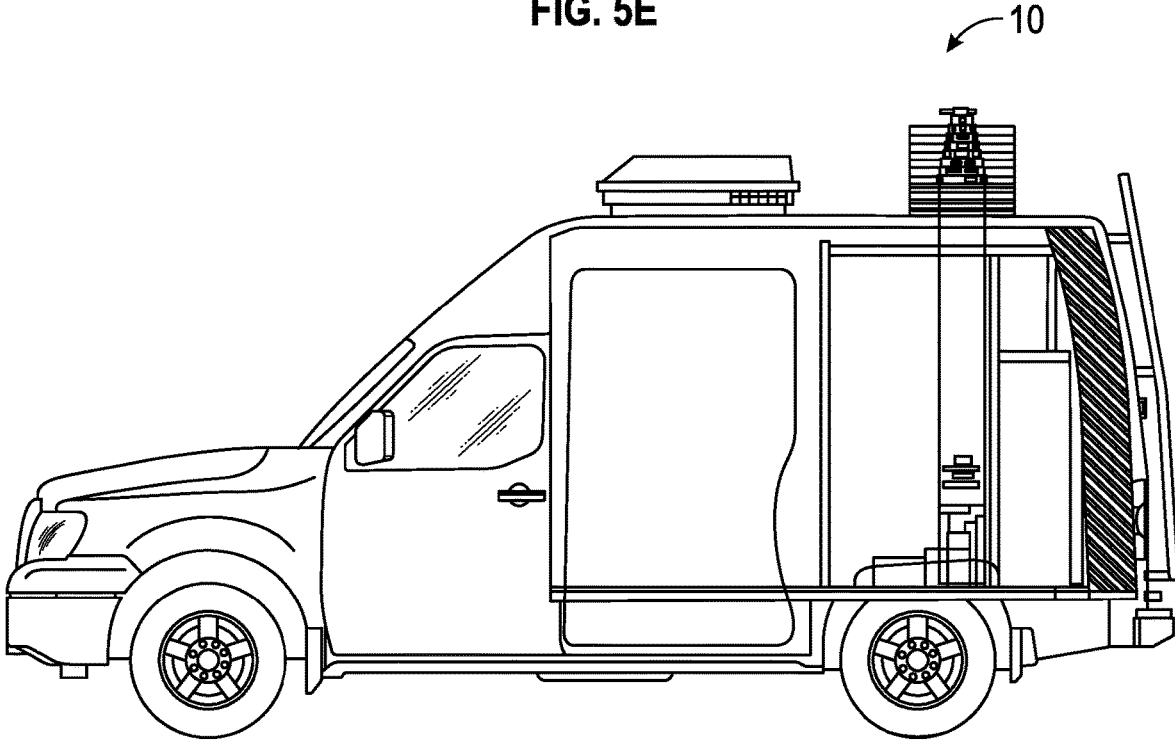


FIG. 5F

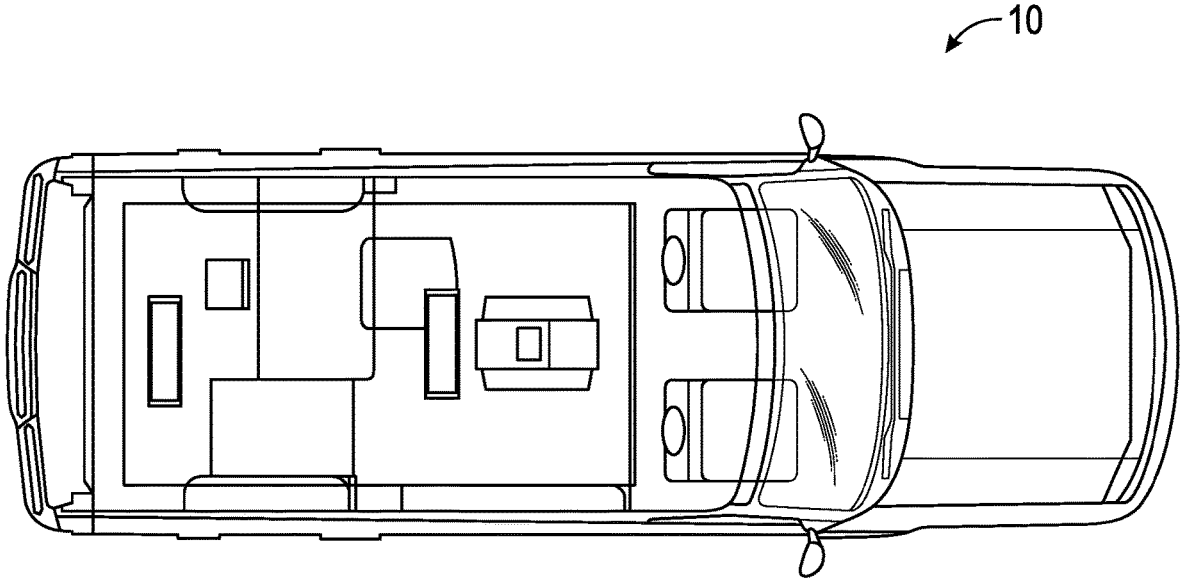


FIG. 6A

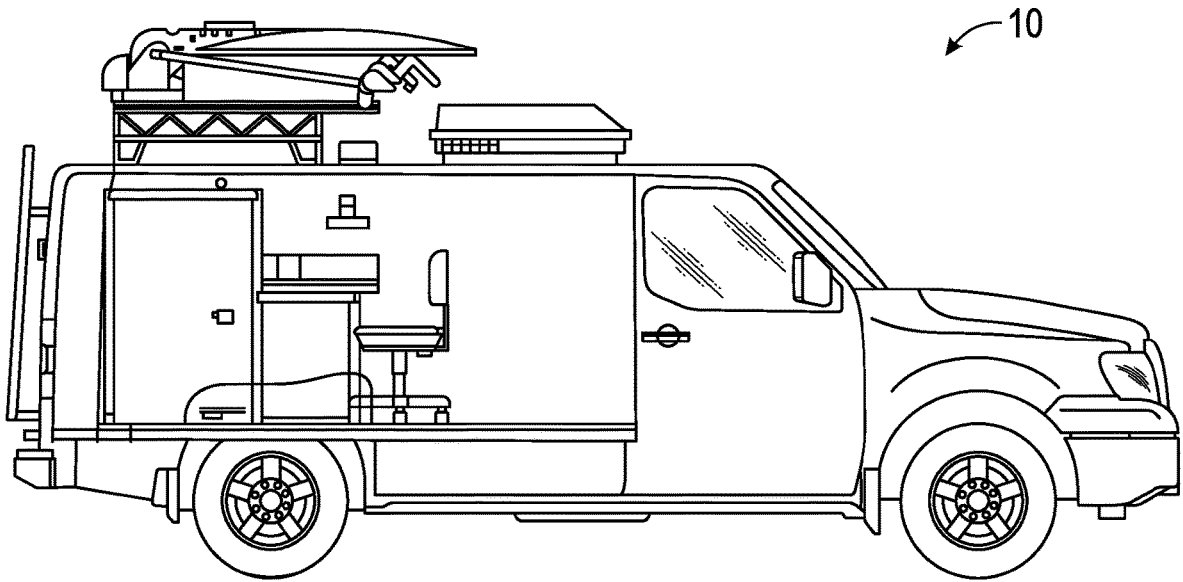


FIG. 6B

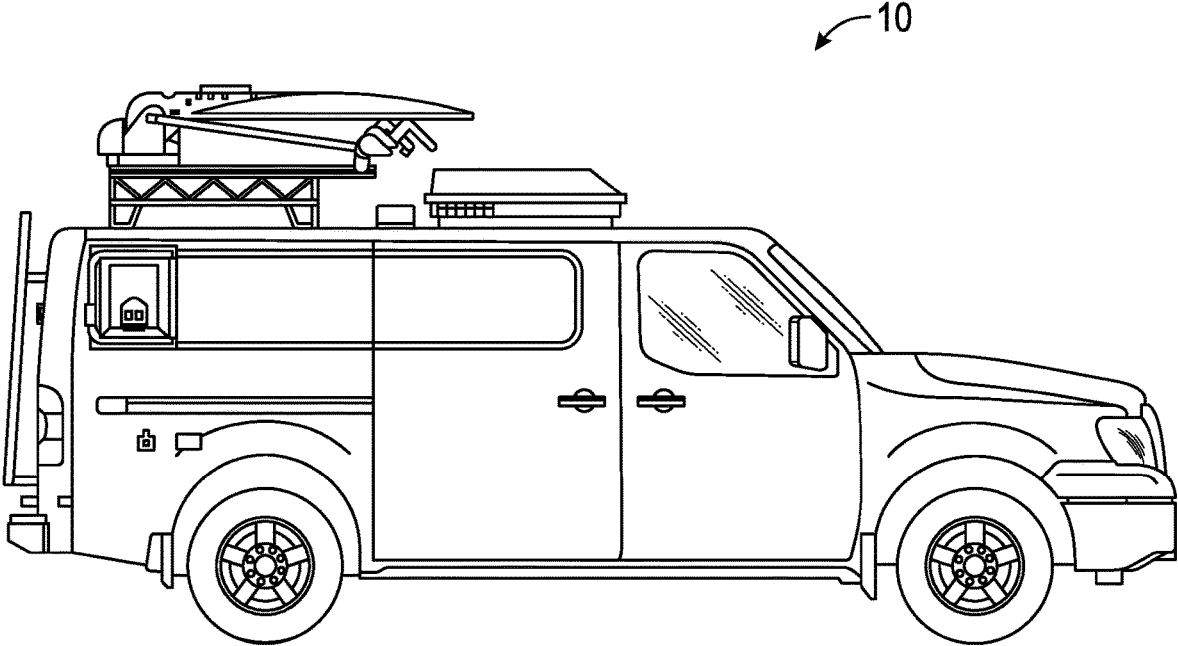


FIG. 6C

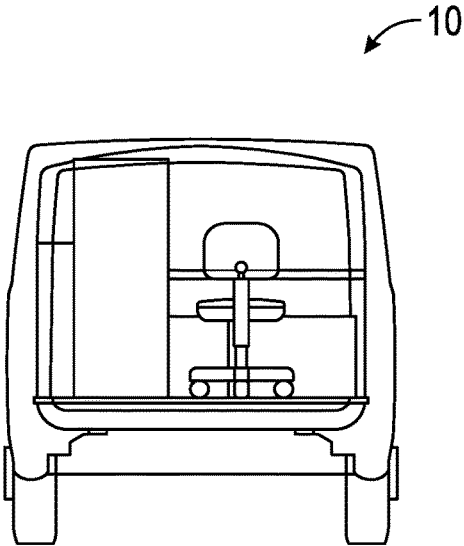


FIG. 6D

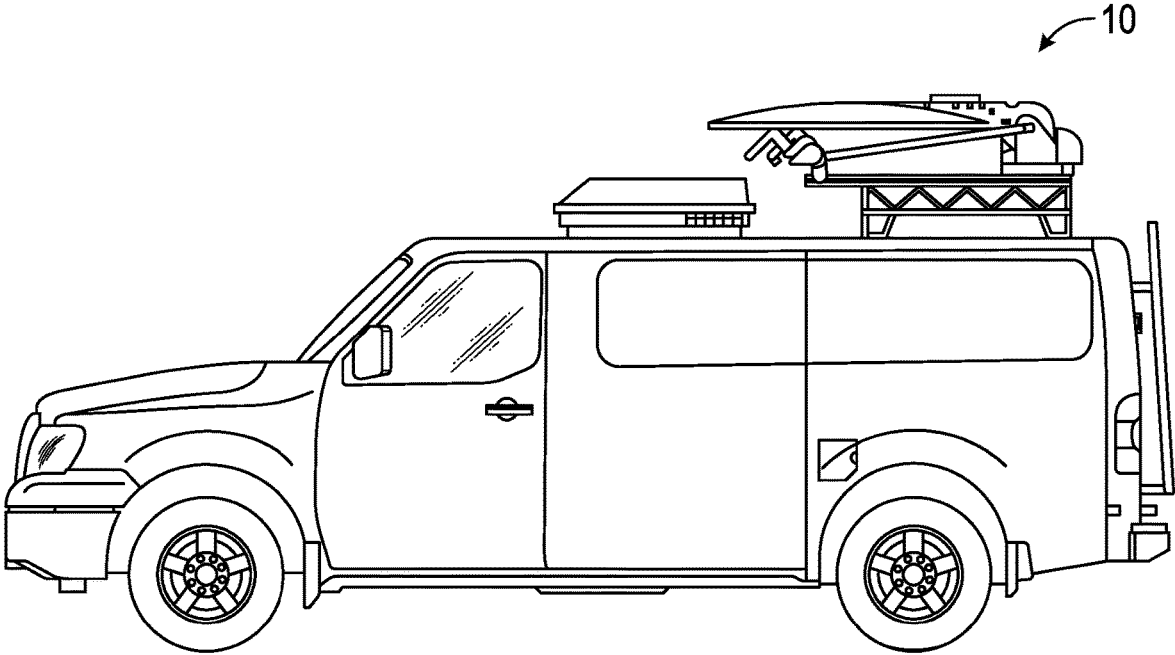


FIG. 6E

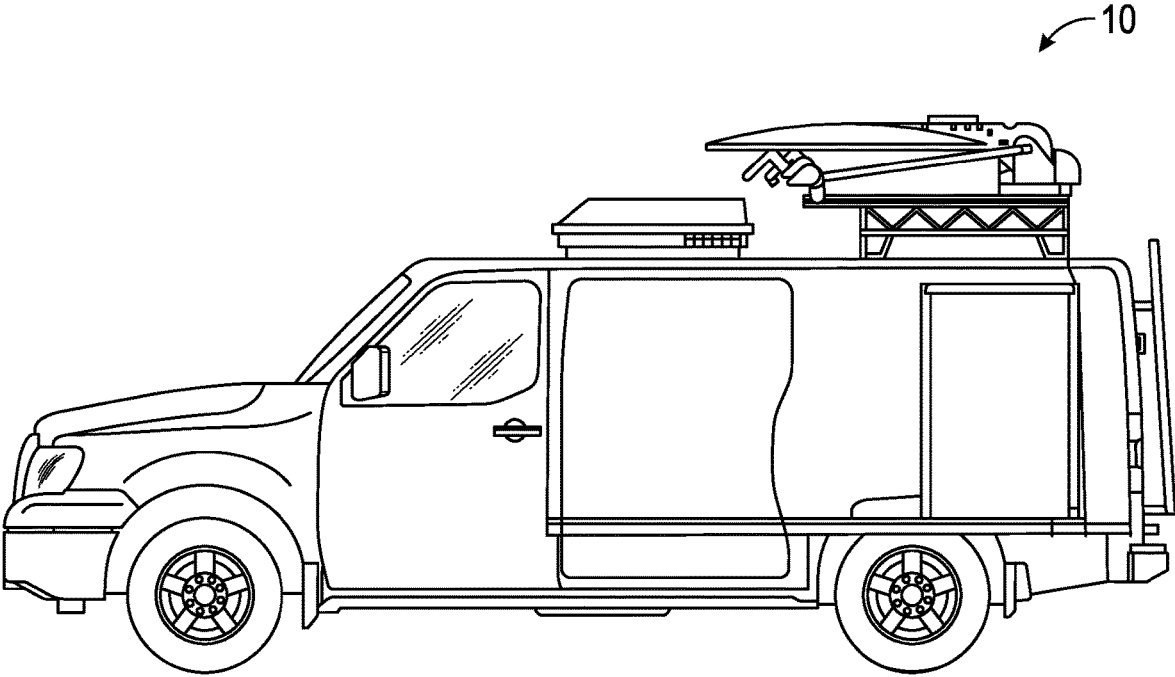


FIG. 6F

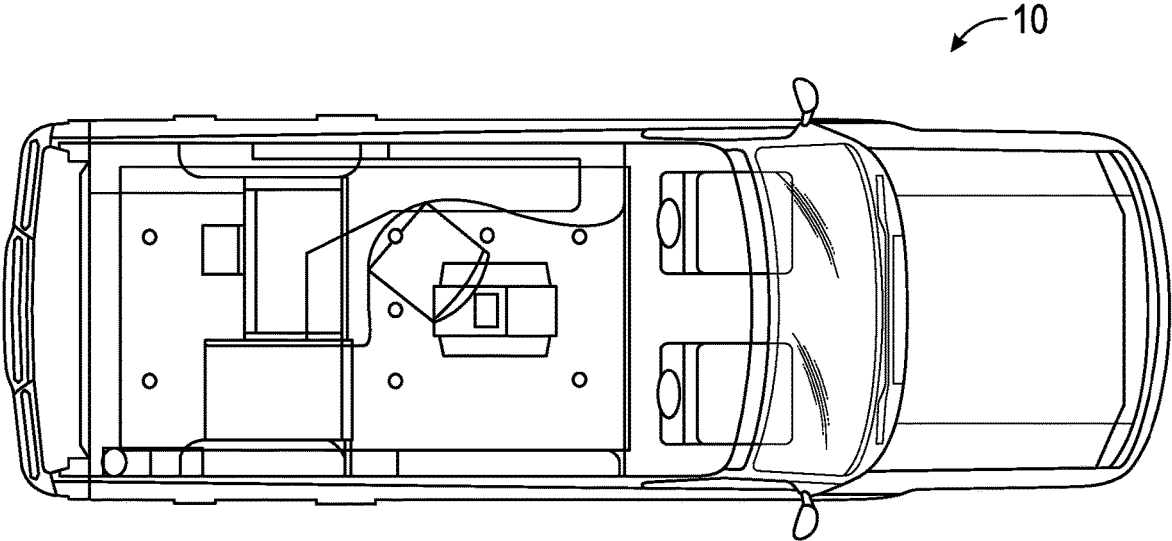


FIG. 7A

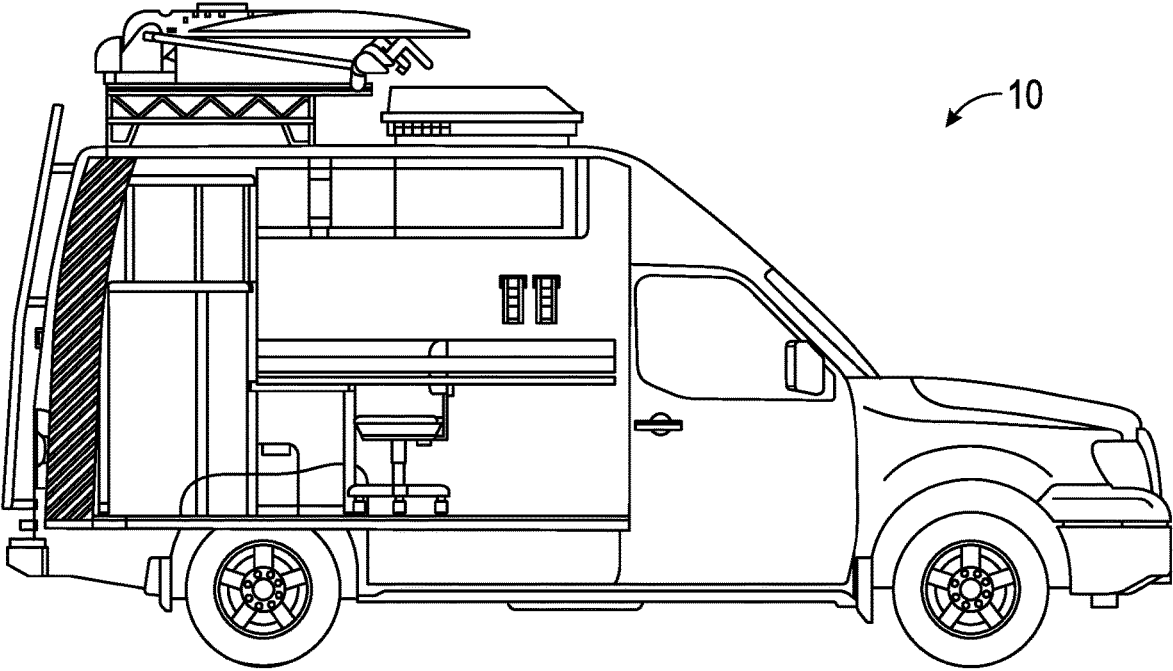


FIG. 7B

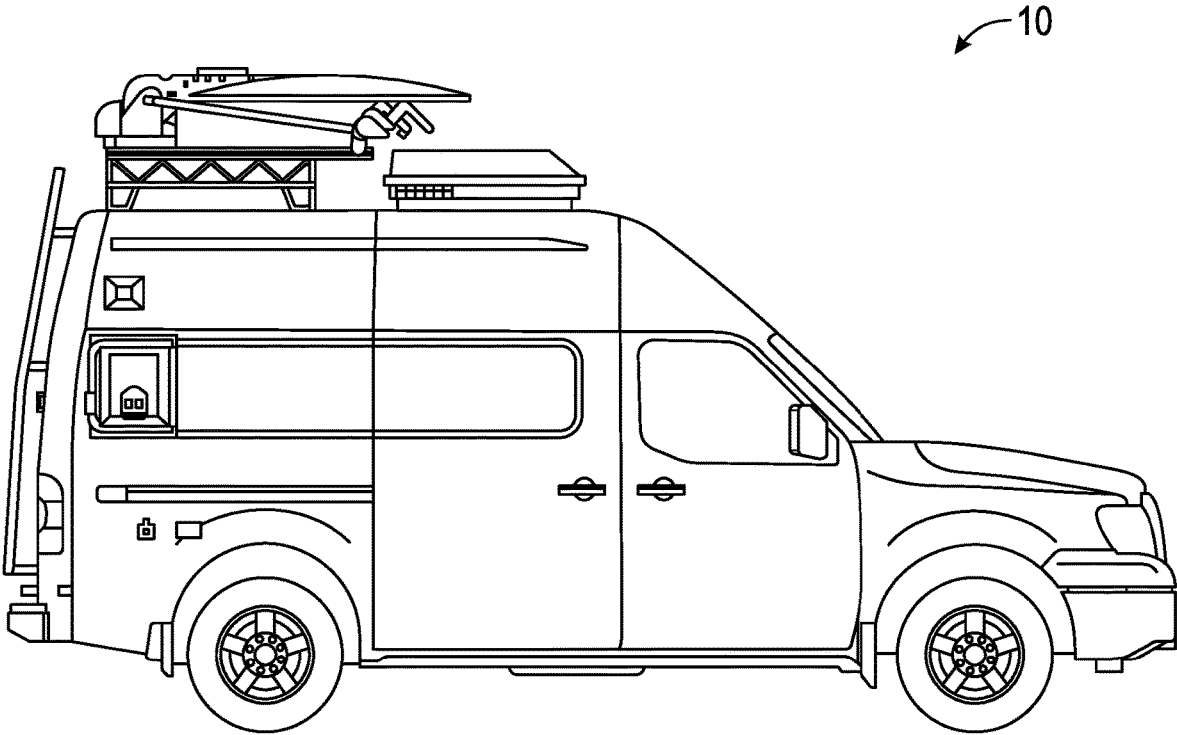


FIG. 7C

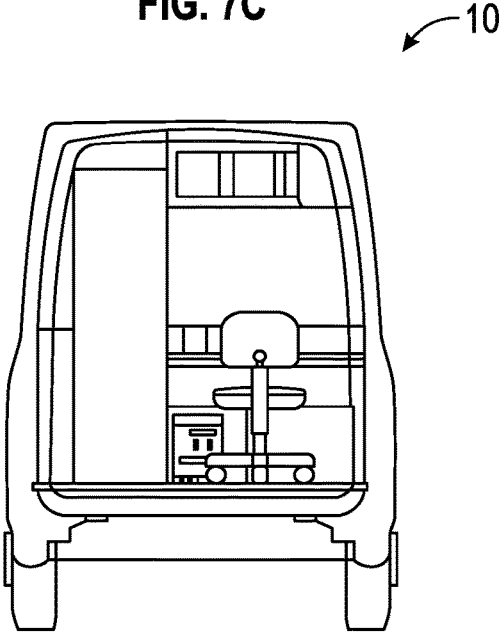


FIG. 7D

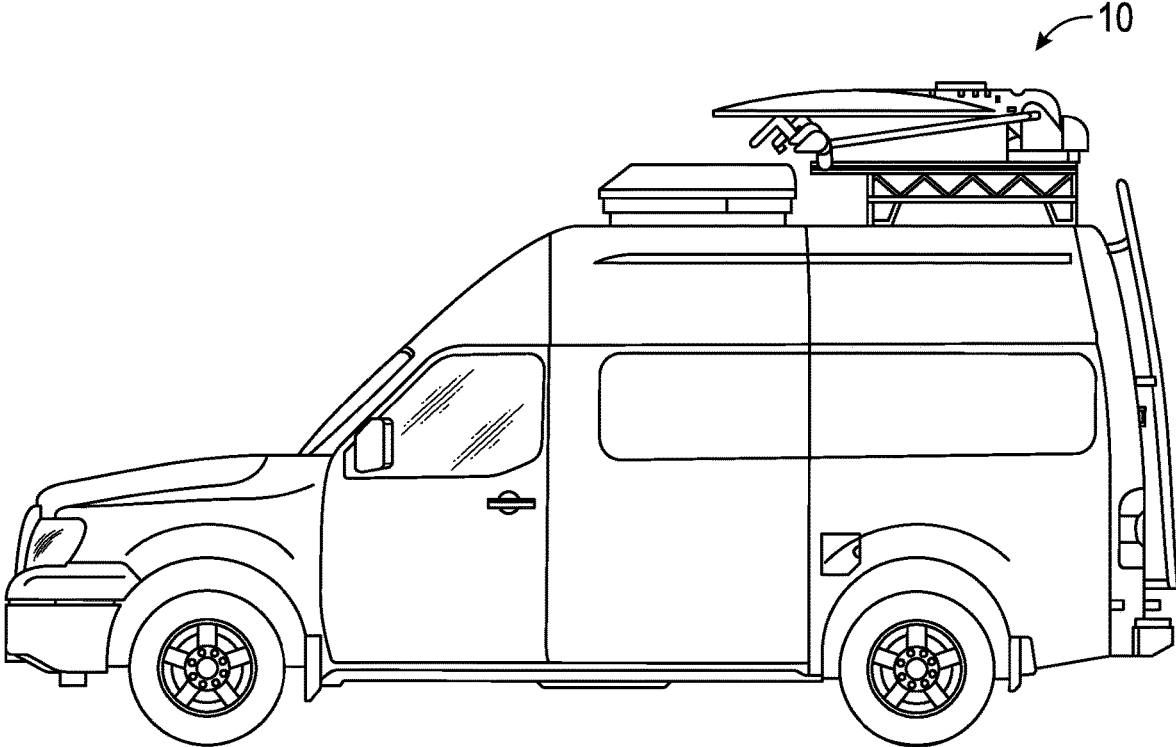


FIG. 7E

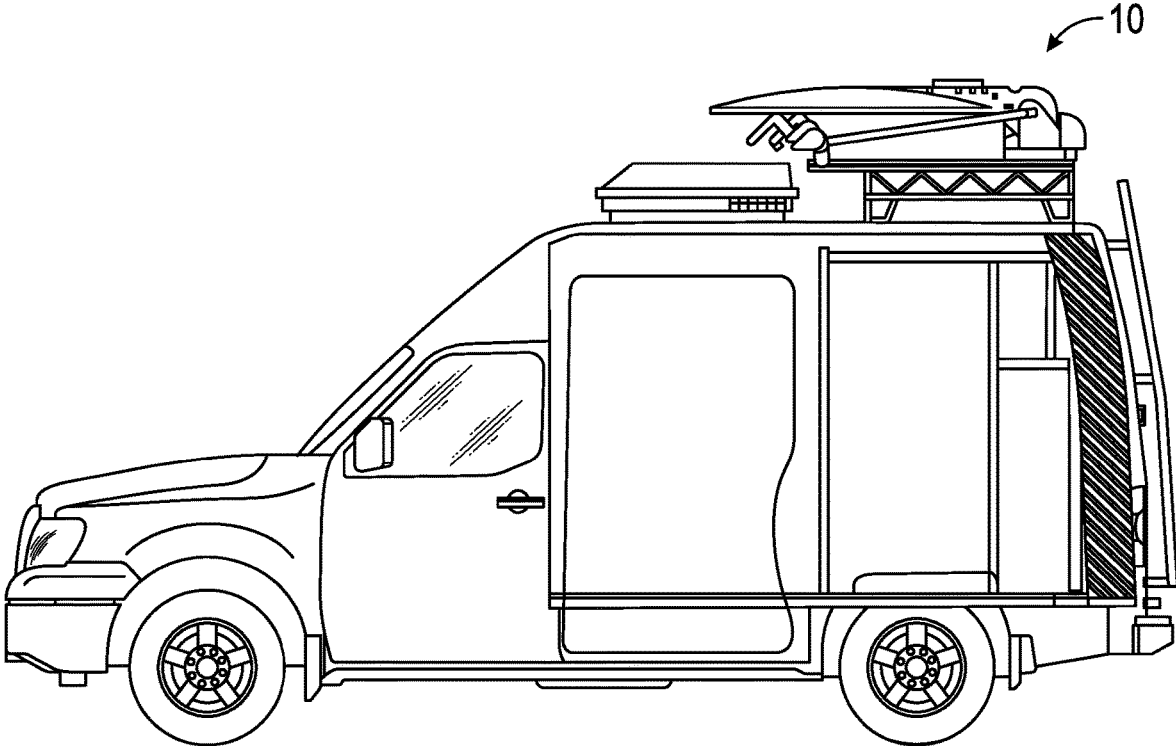


FIG. 7F

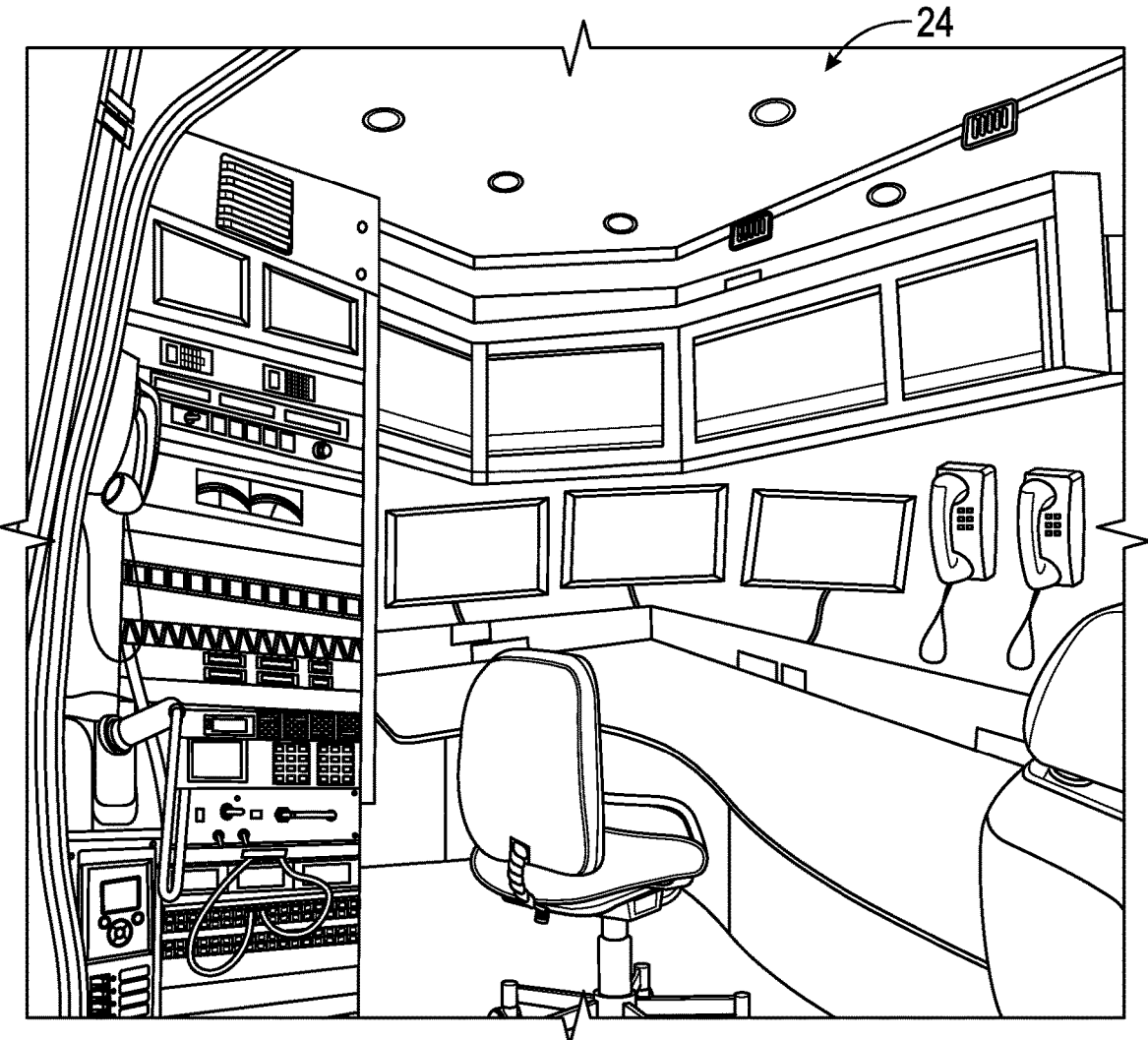


FIG. 8A

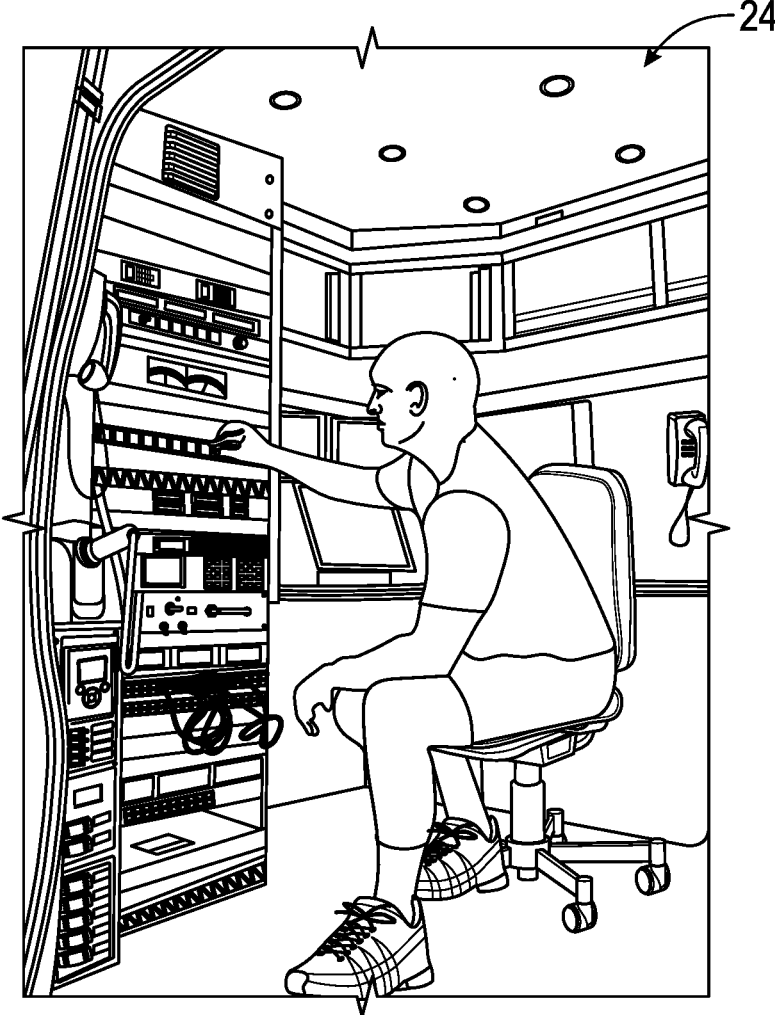


FIG. 8B

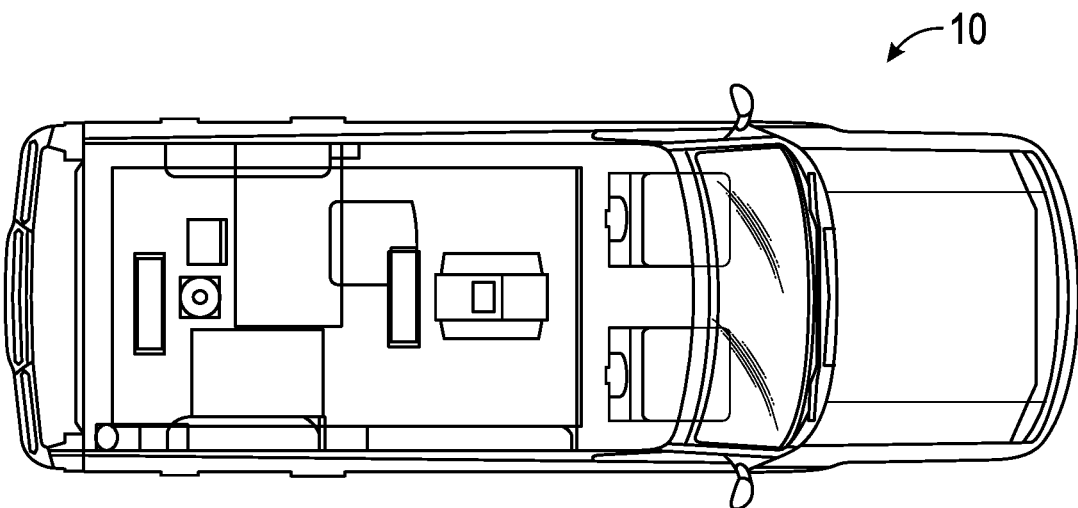


FIG. 8C

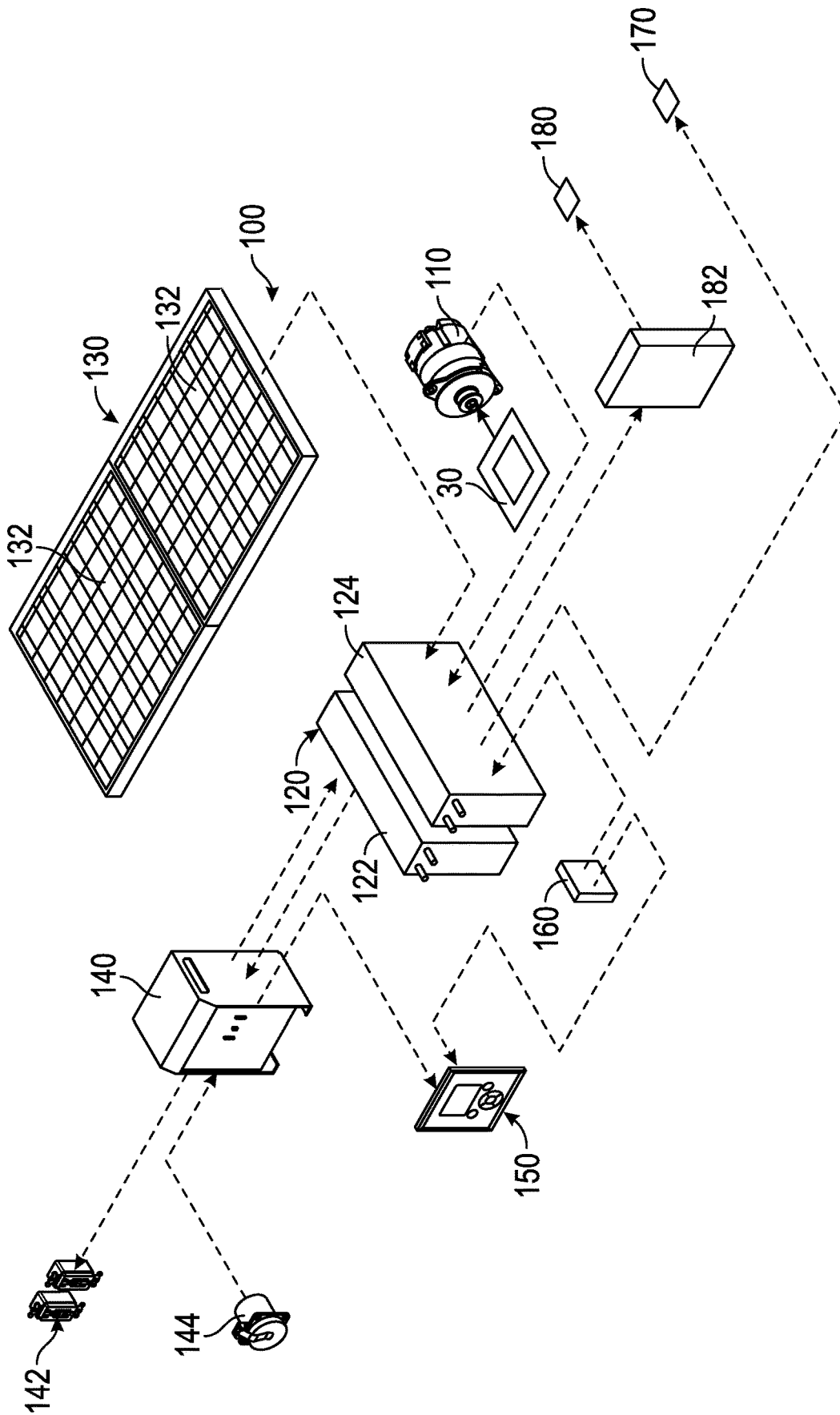


FIG. 9

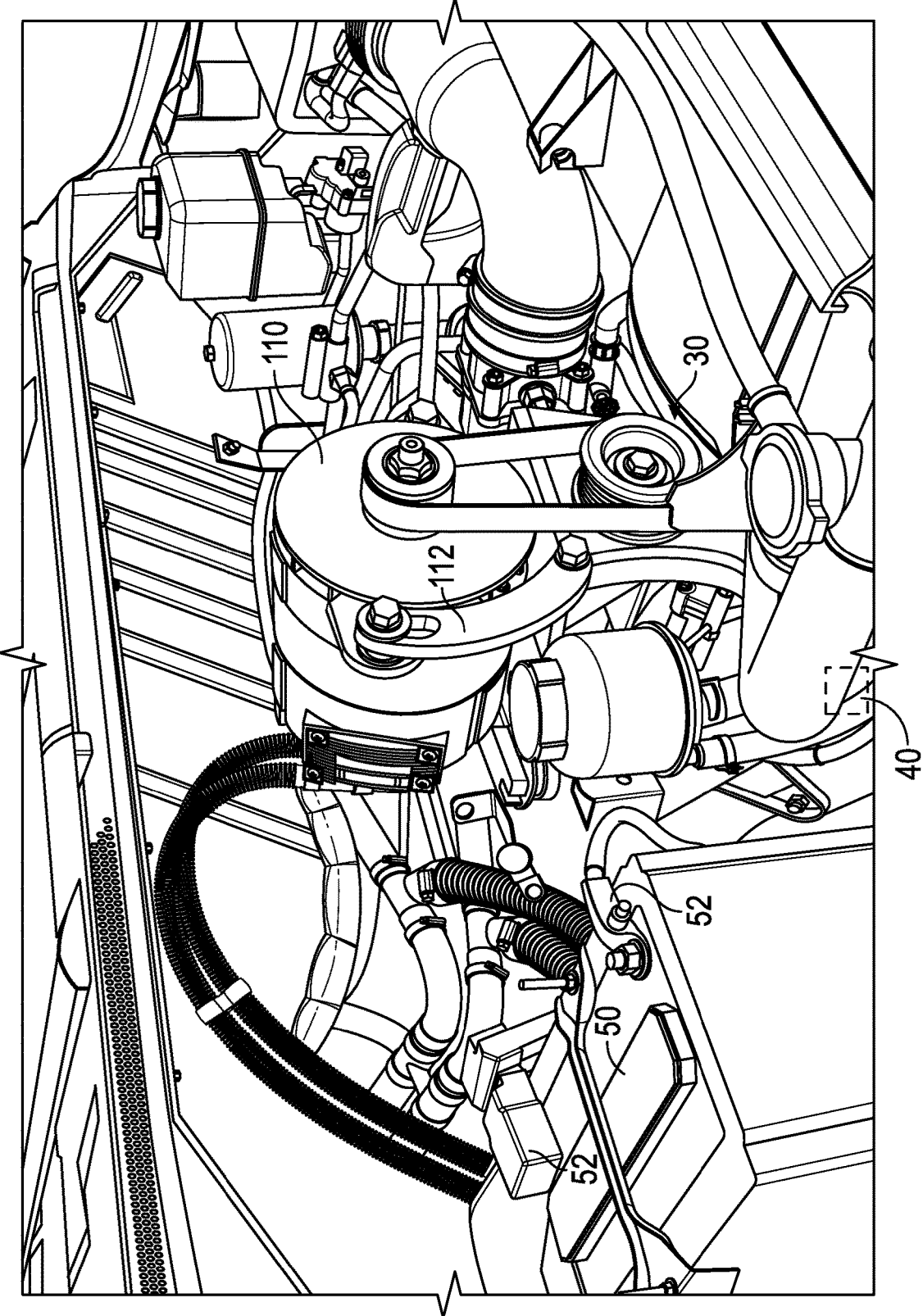


FIG. 10

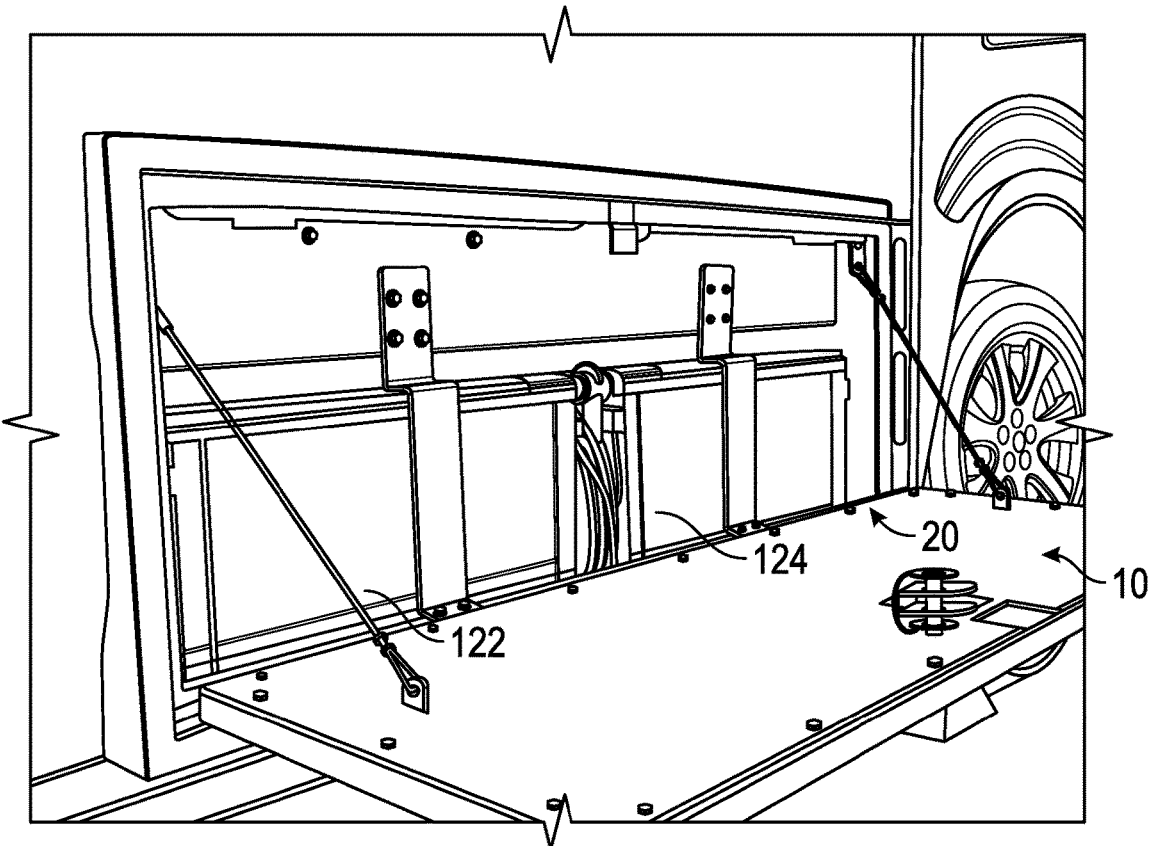


FIG. 11

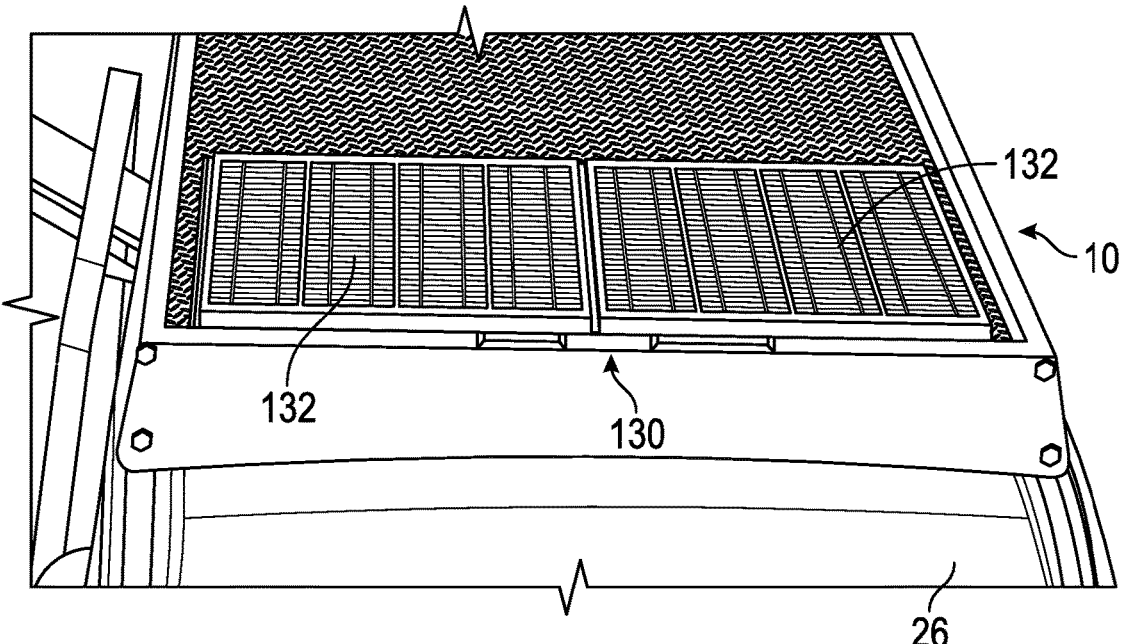


FIG. 12

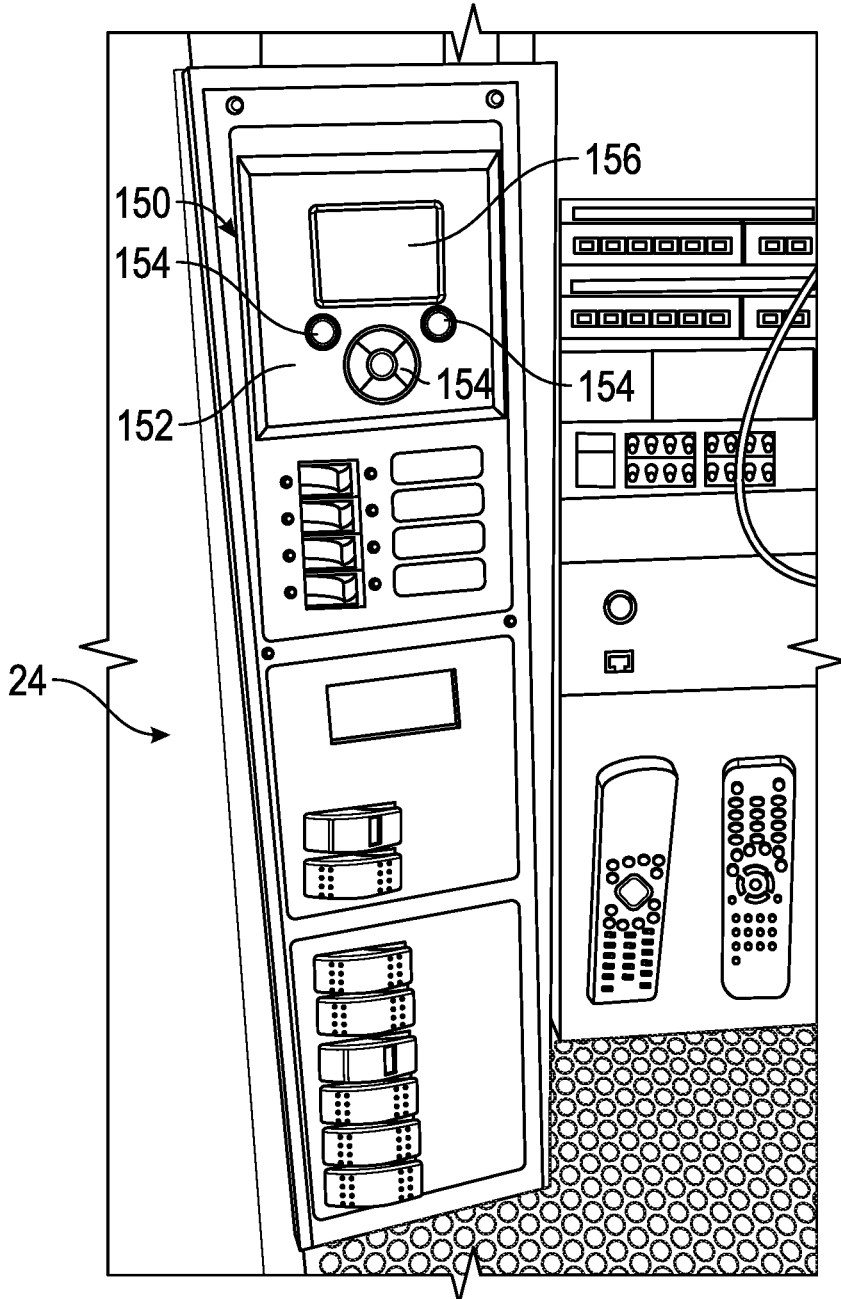


FIG. 13

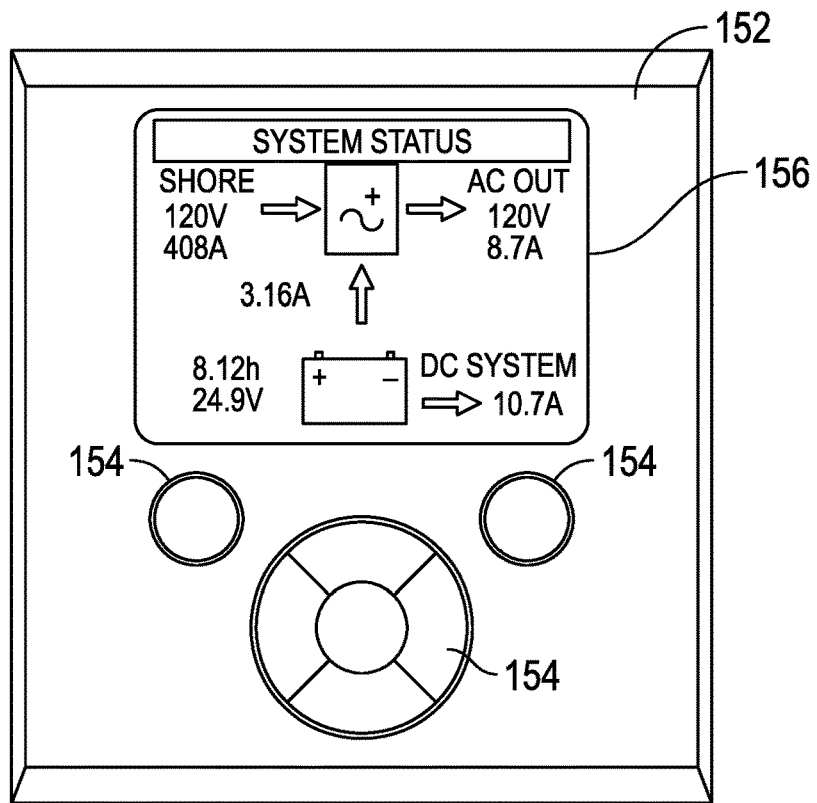


FIG. 14

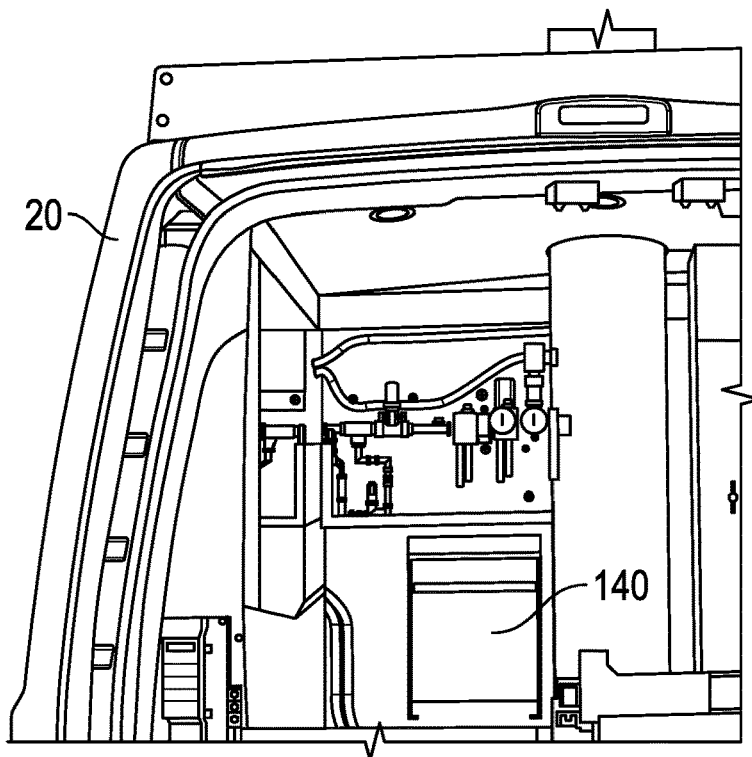


FIG. 15

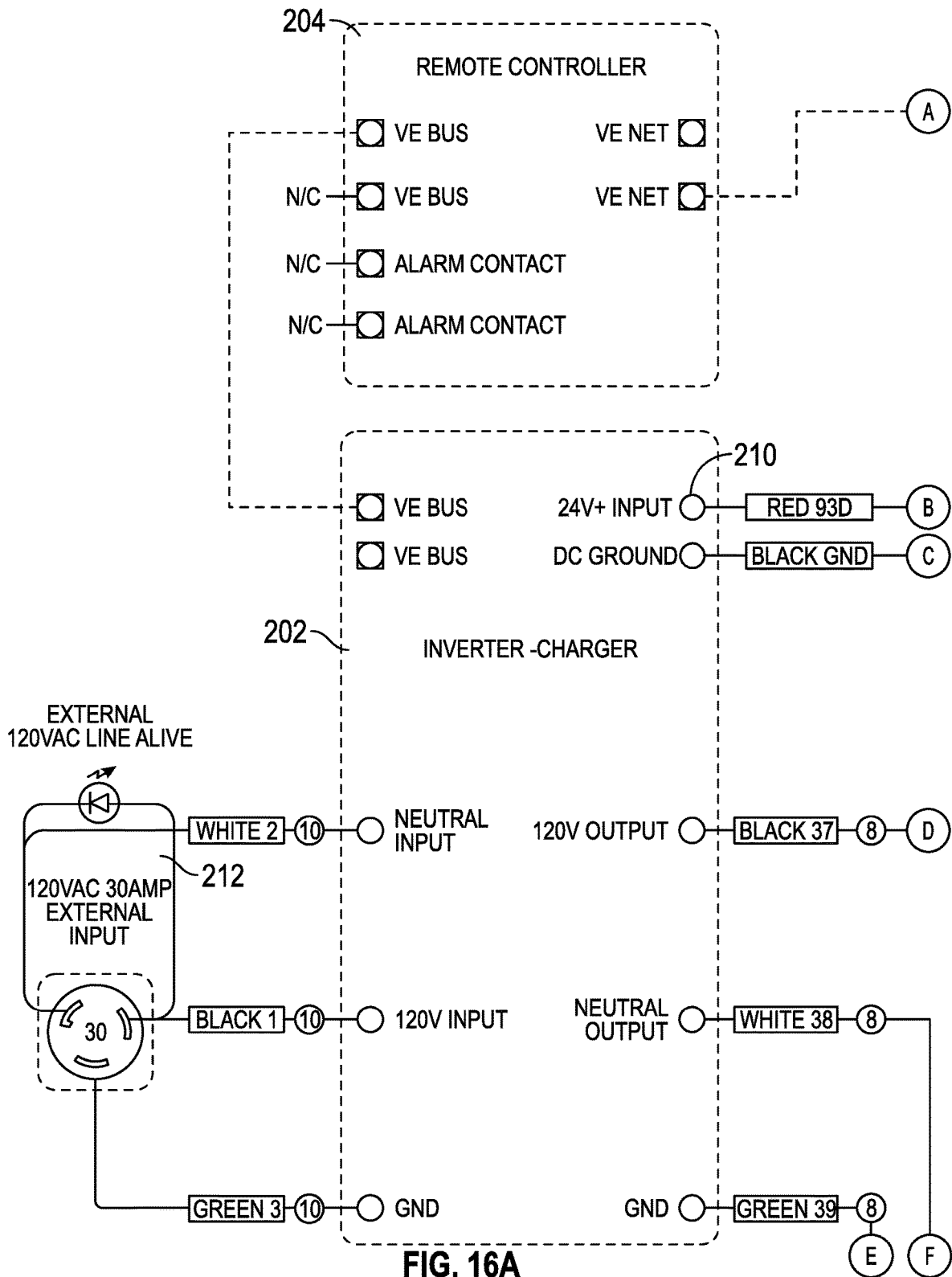


FIG. 16A

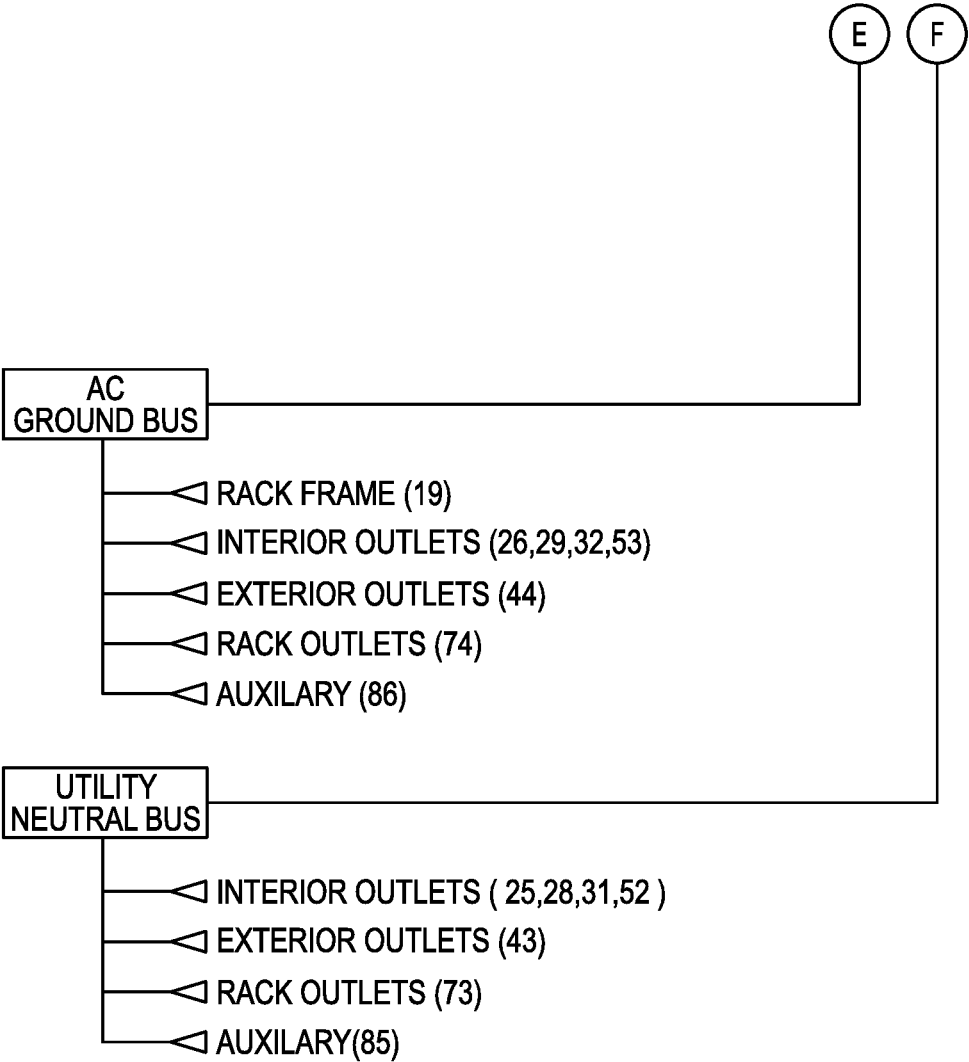


FIG. 16C

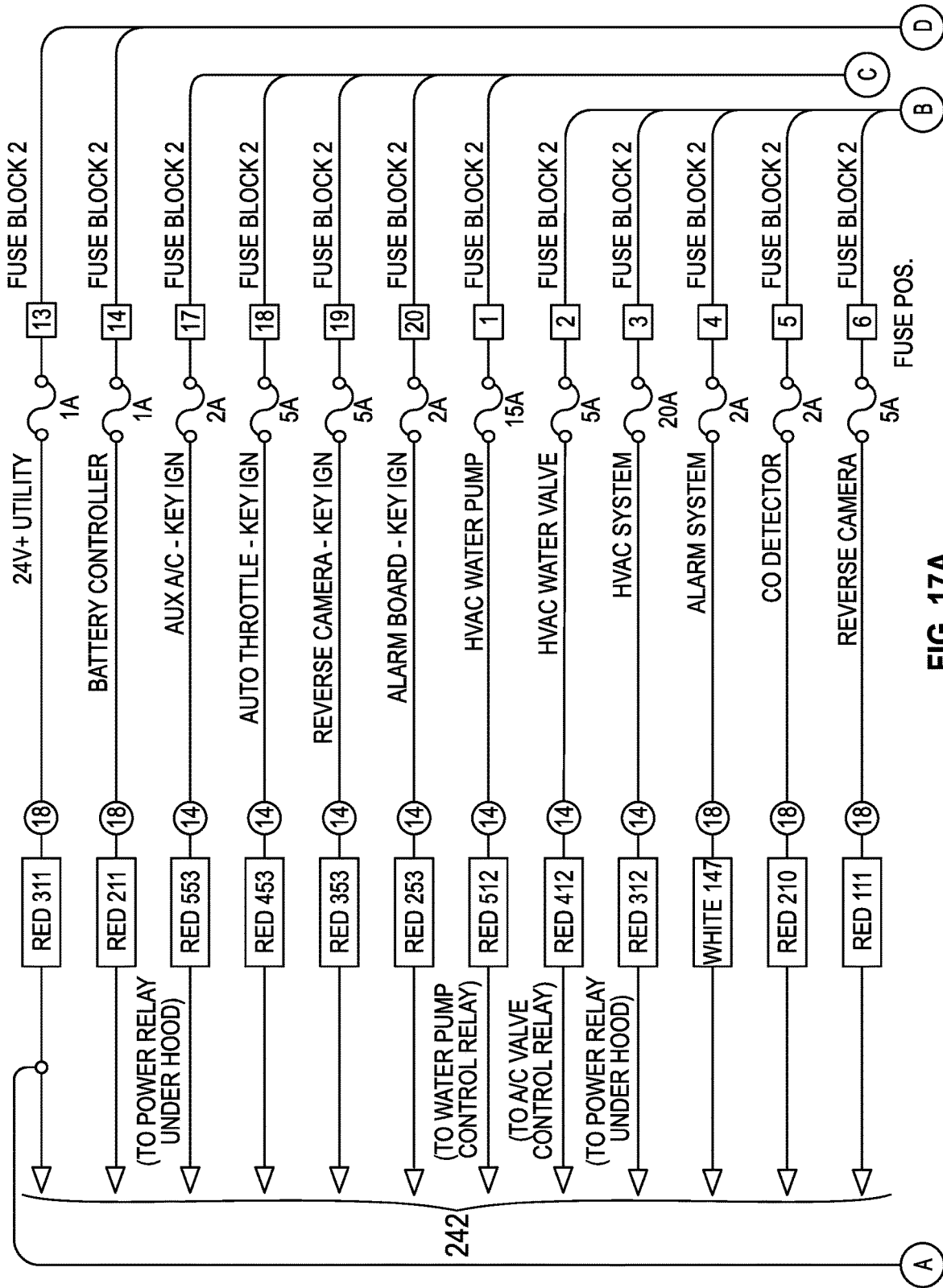


FIG. 17A

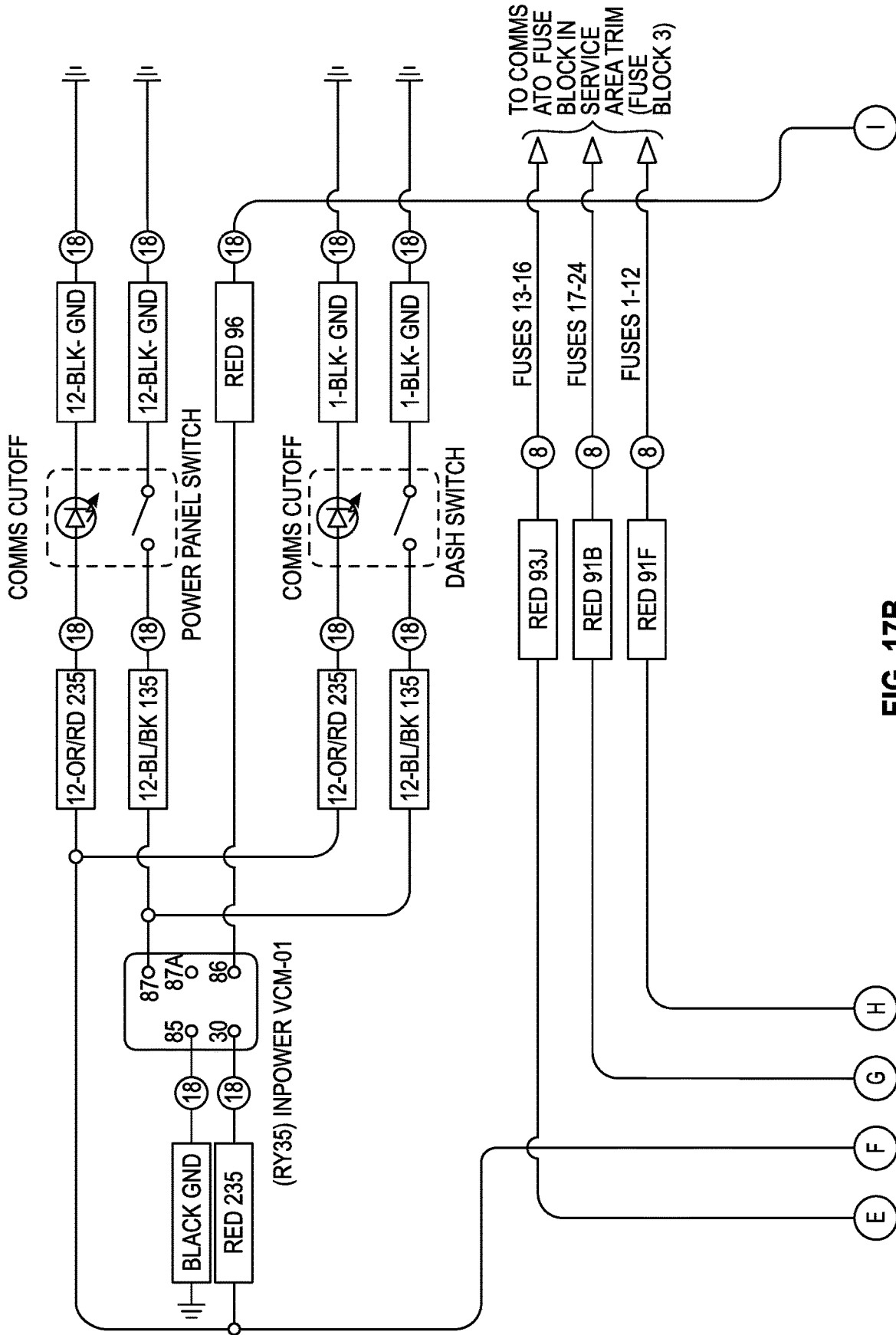


FIG. 17B

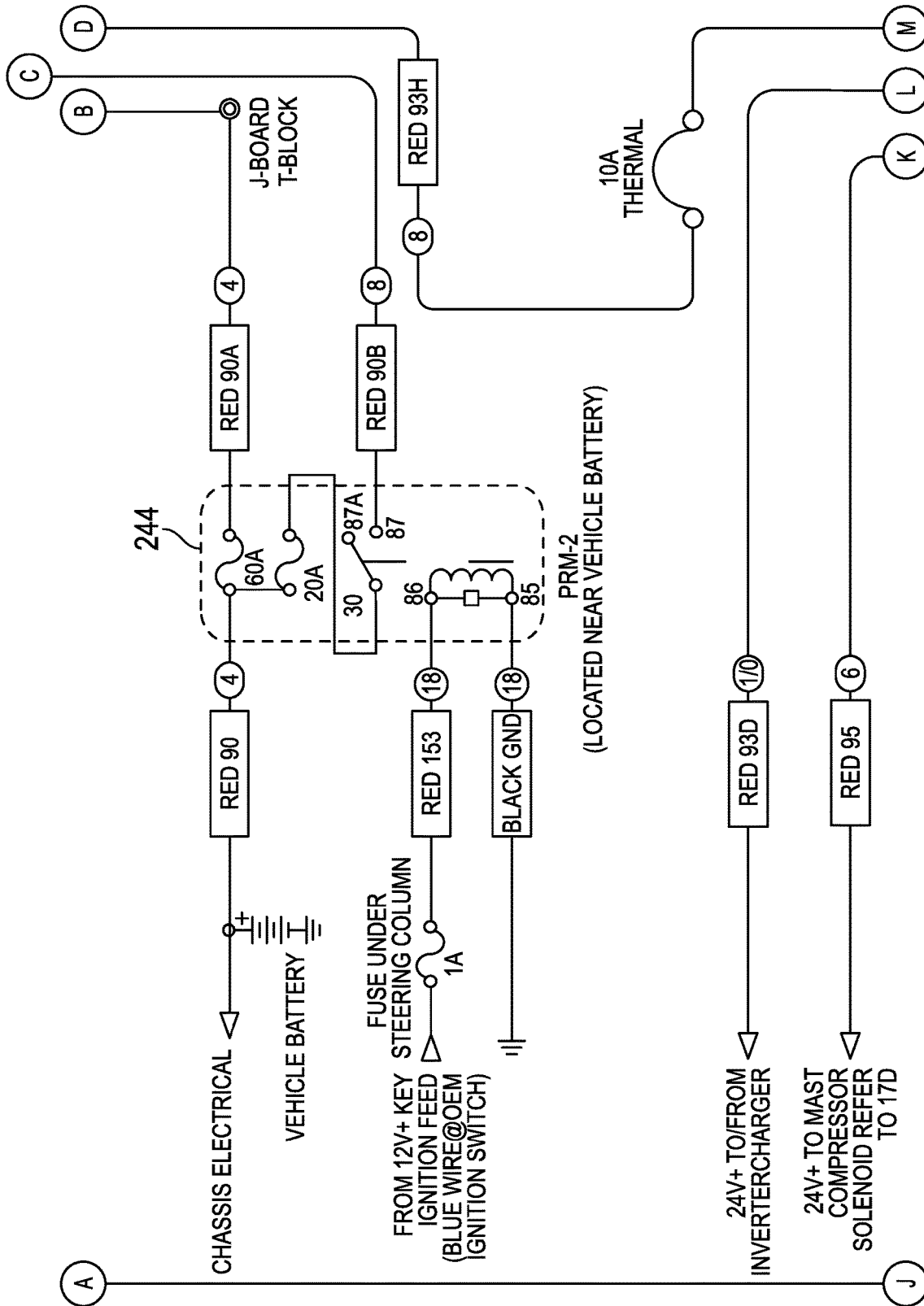


FIG. 17C

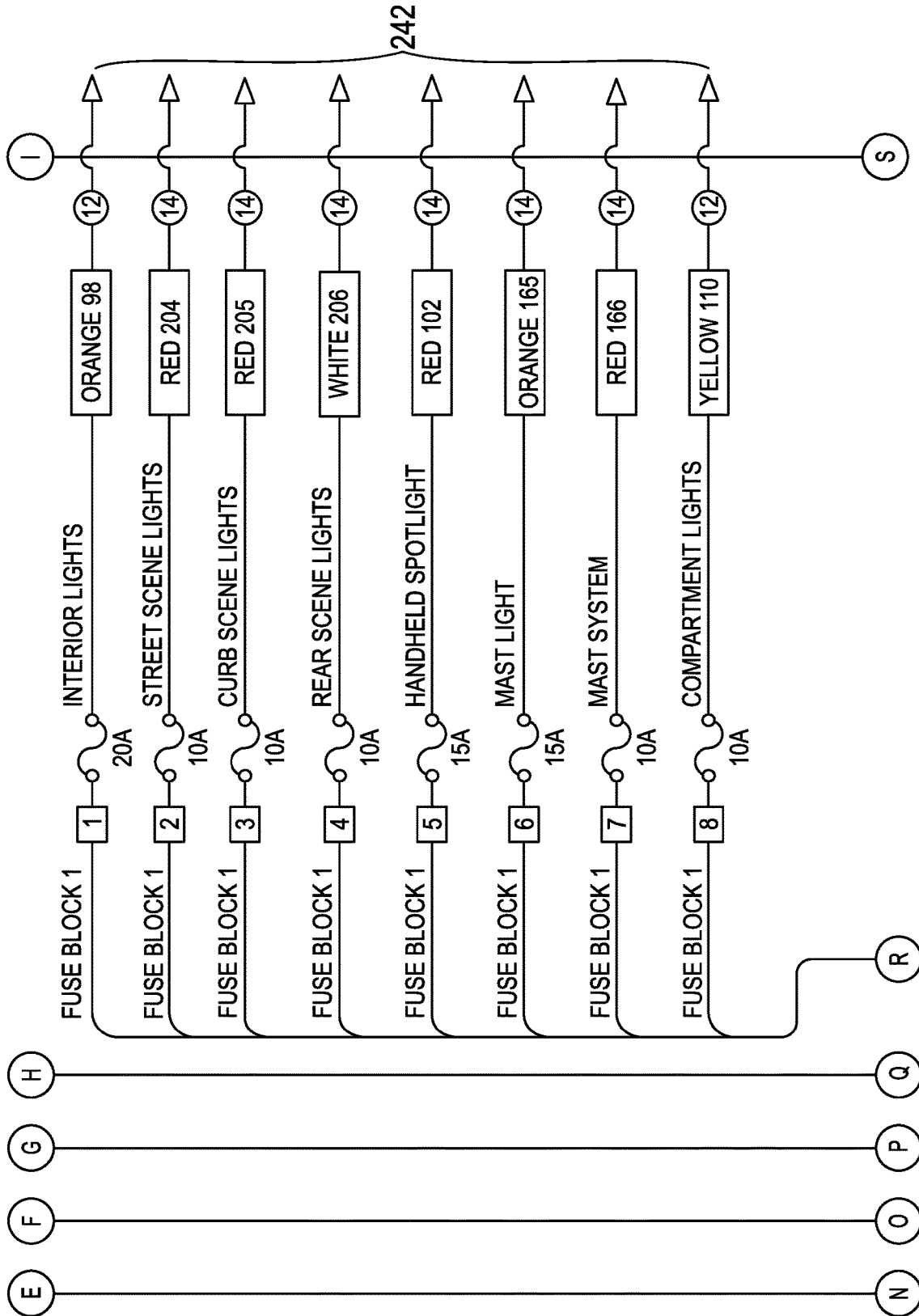


FIG. 17D

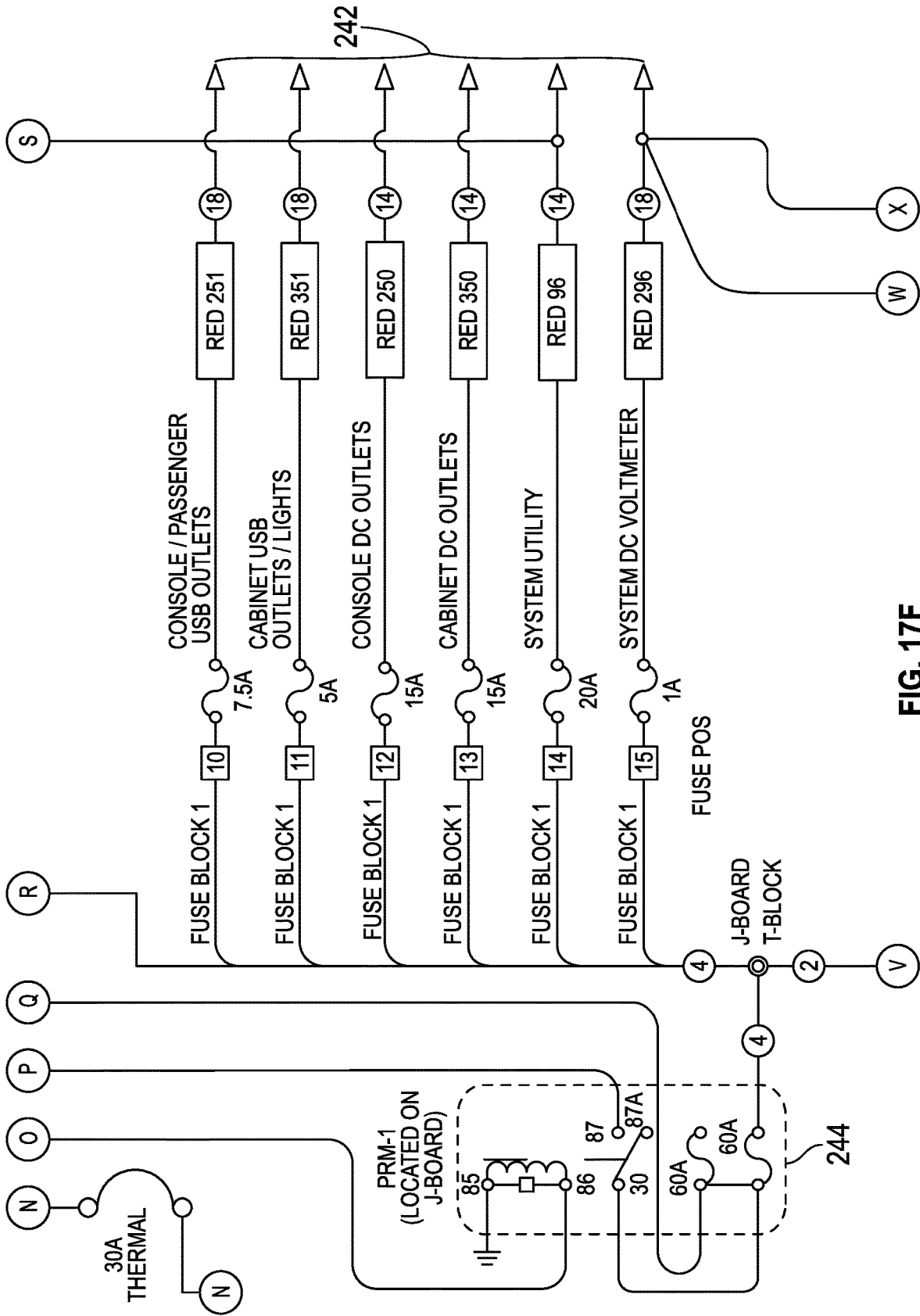


FIG. 17F

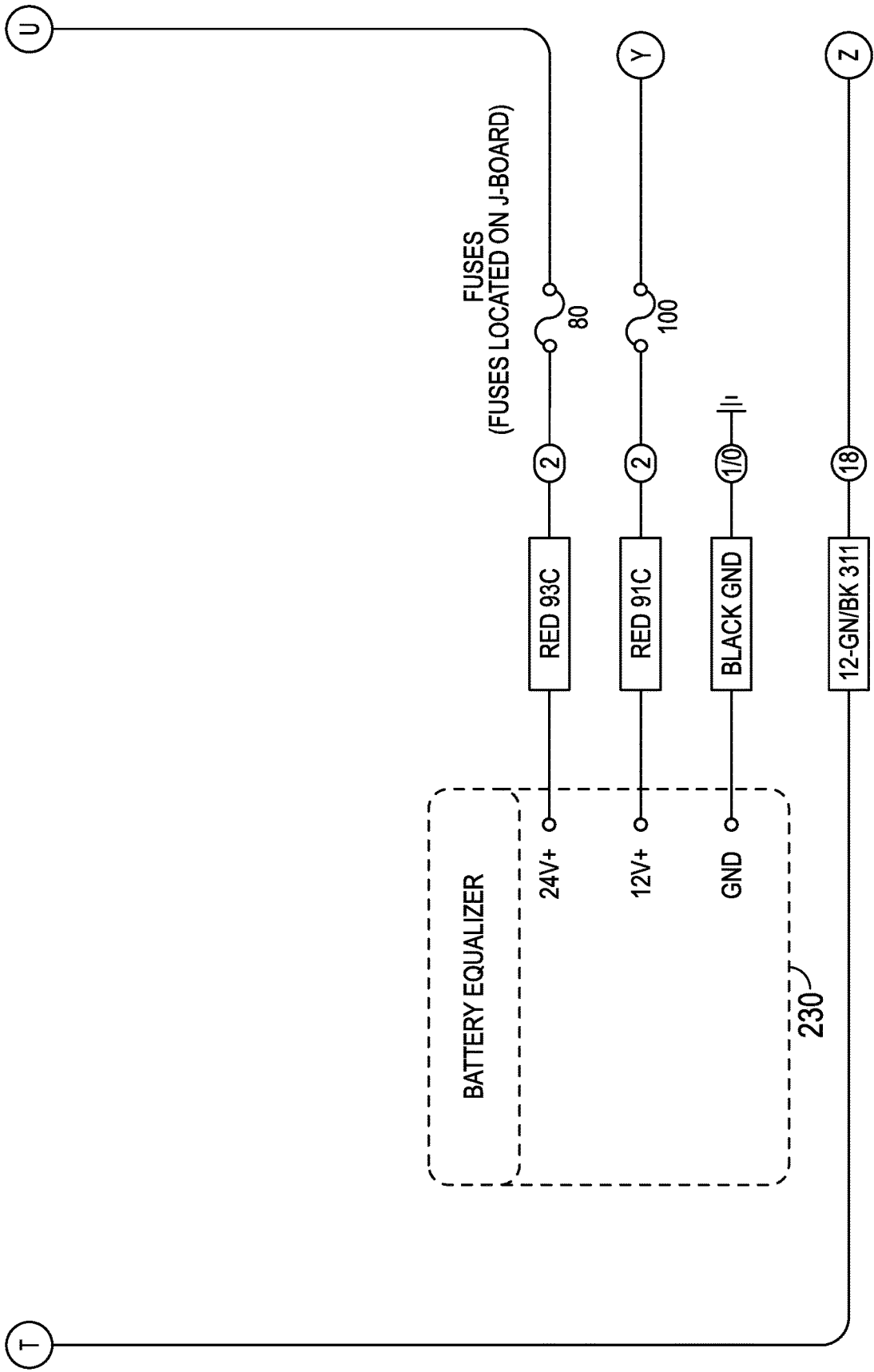


FIG. 17G

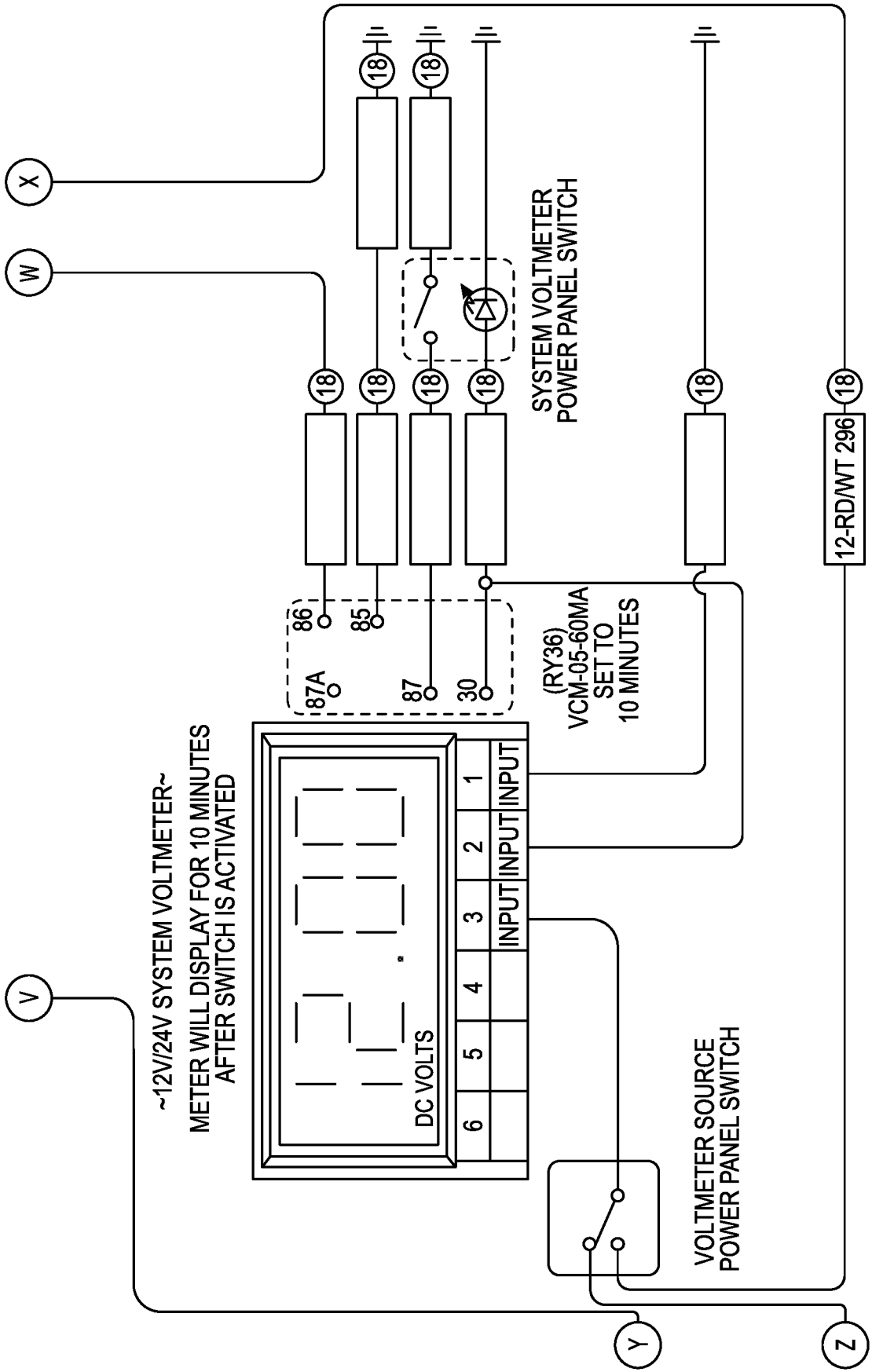


FIG. 17H

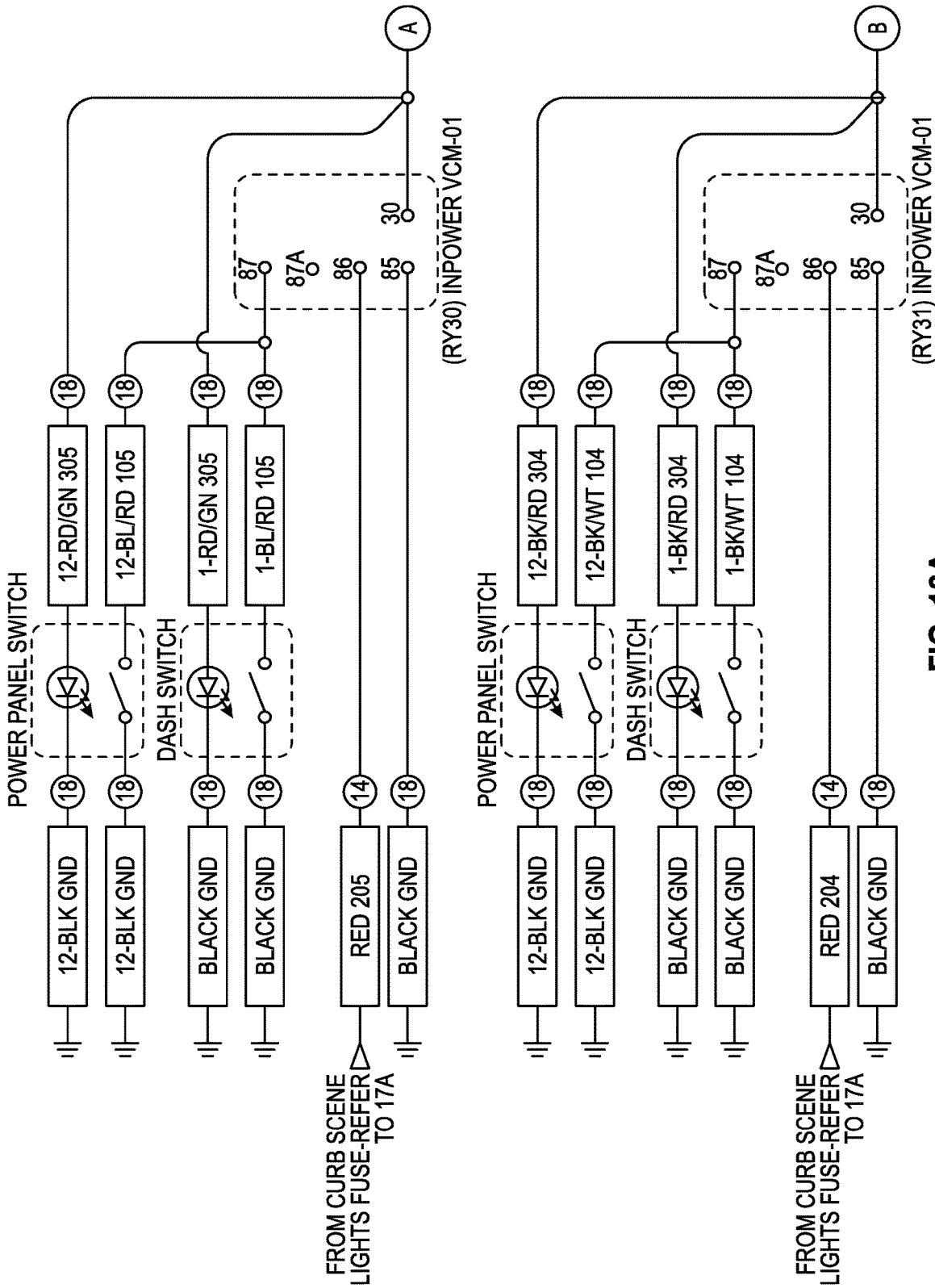


FIG. 18A

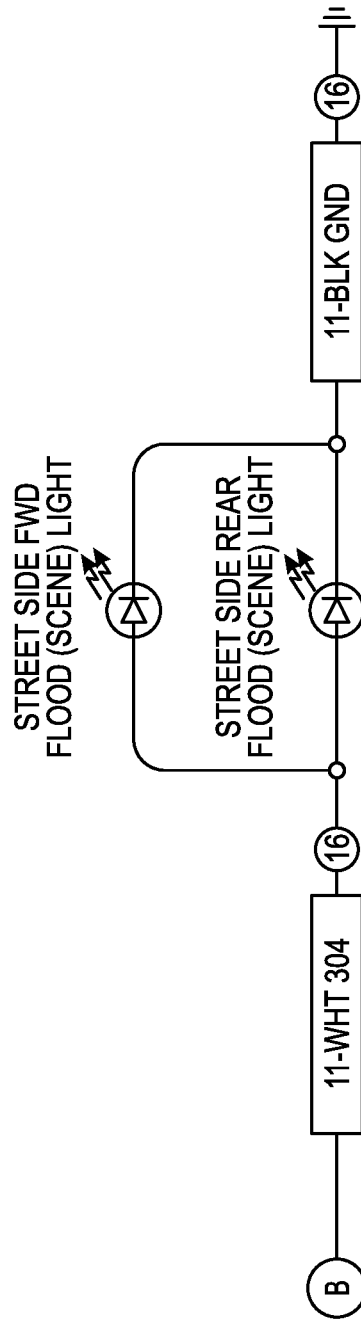
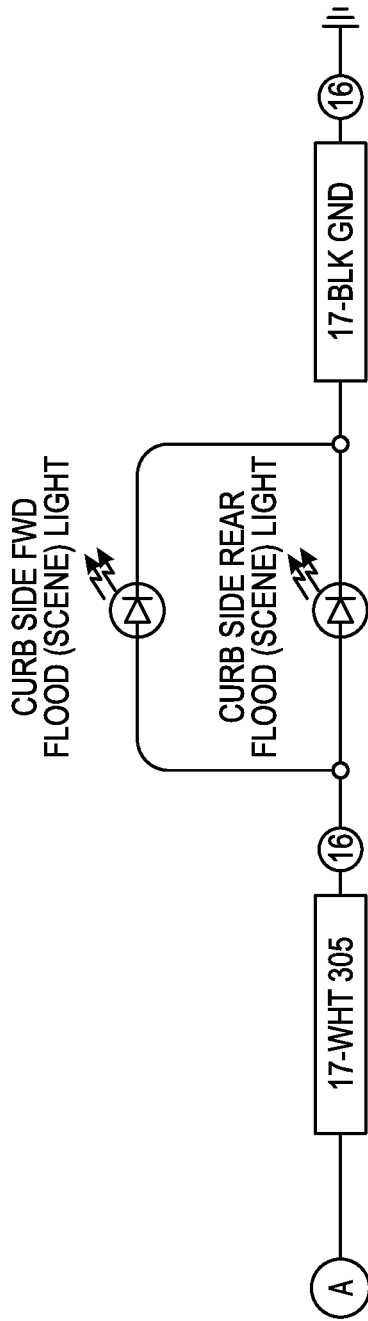


FIG. 18B

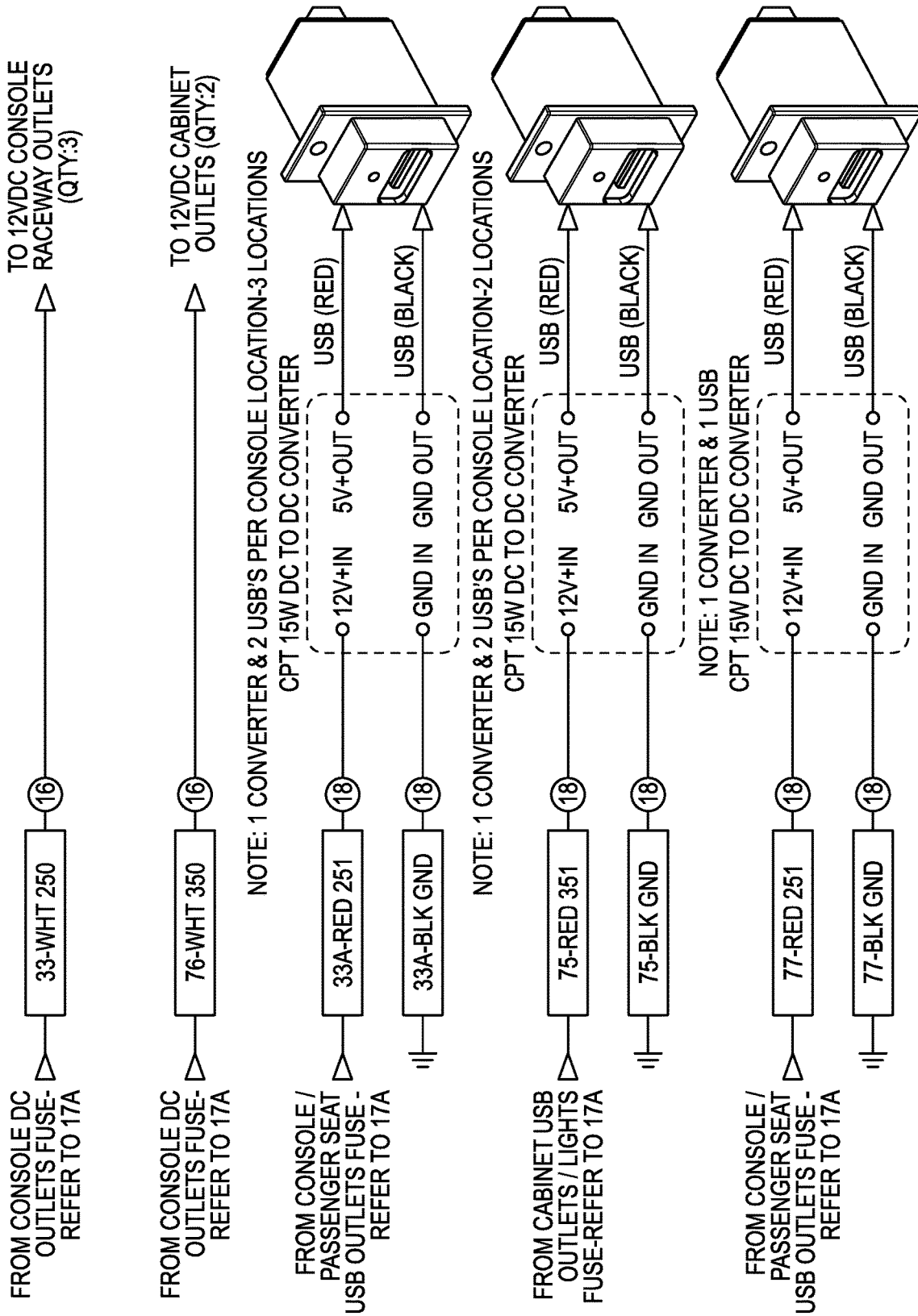


FIG. 18C

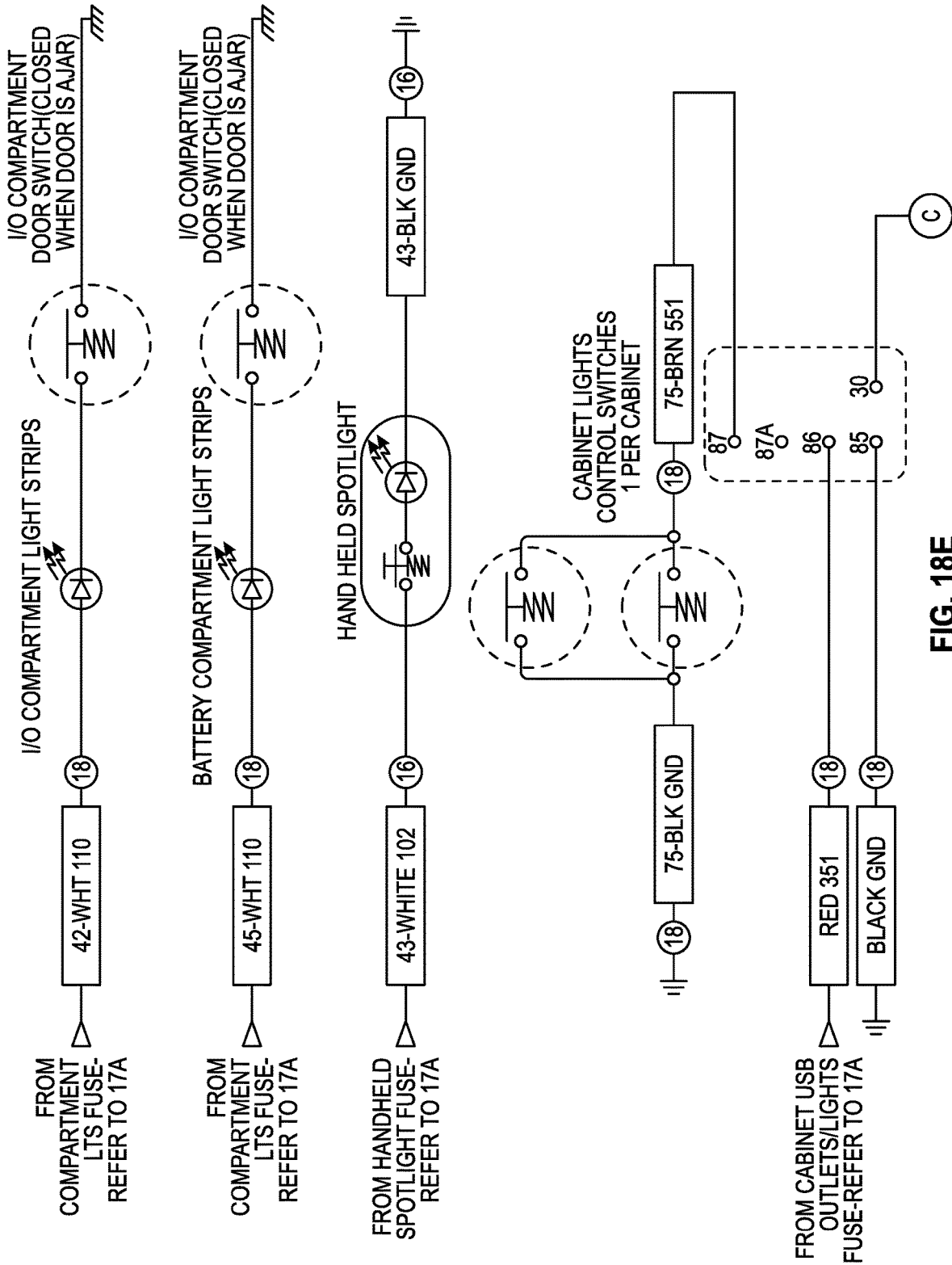


FIG. 18E

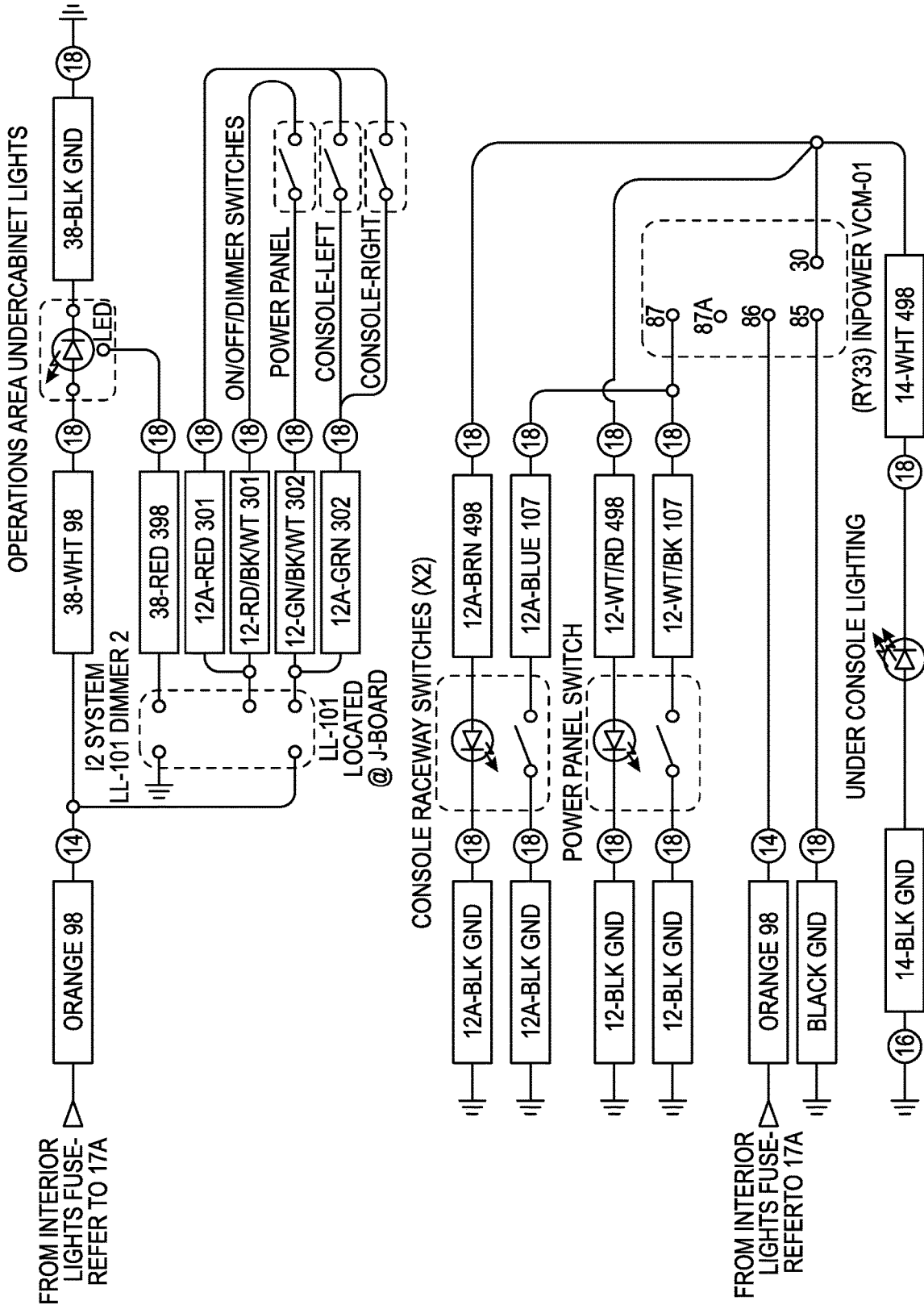


FIG. 18F

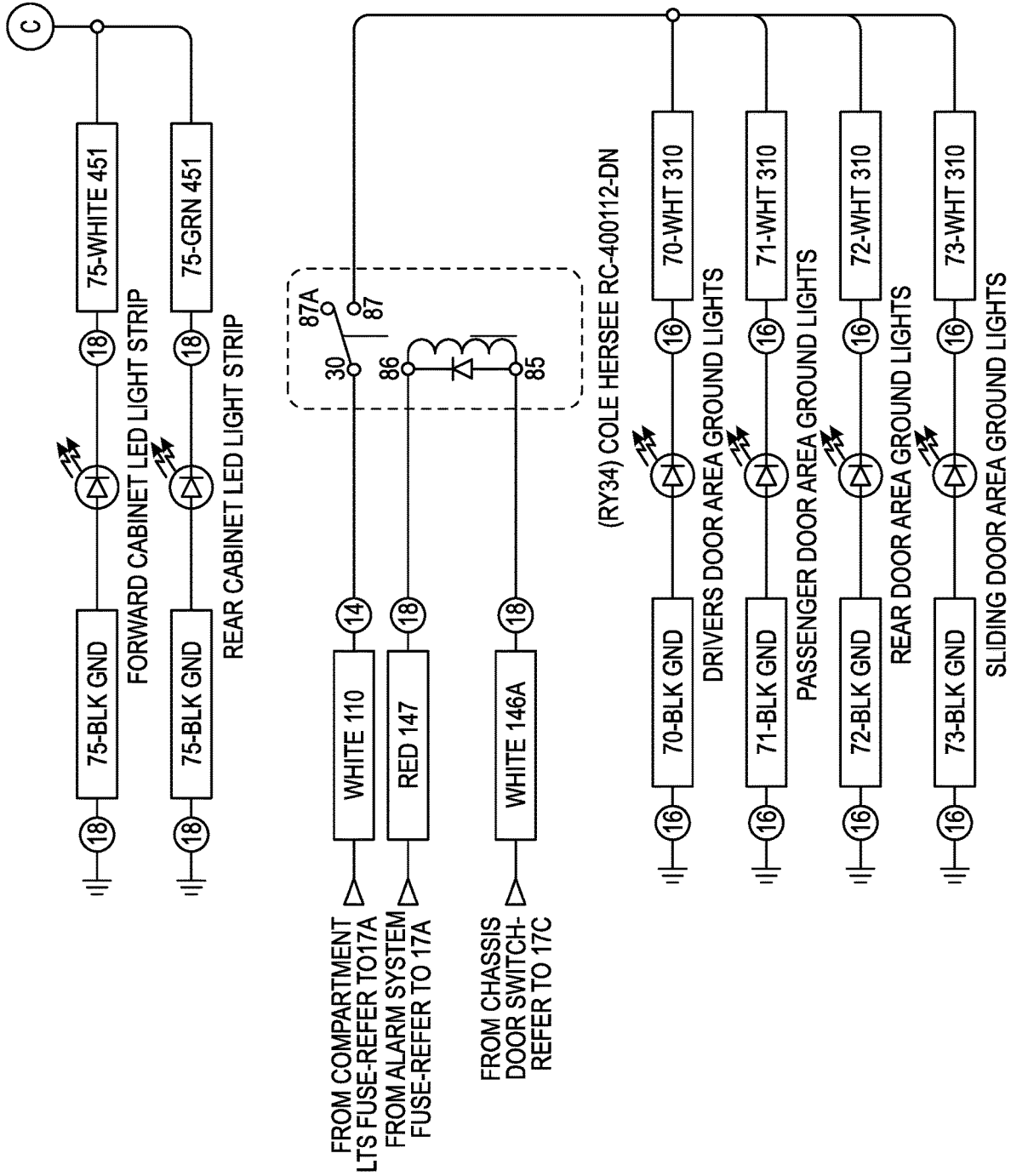


FIG. 18G

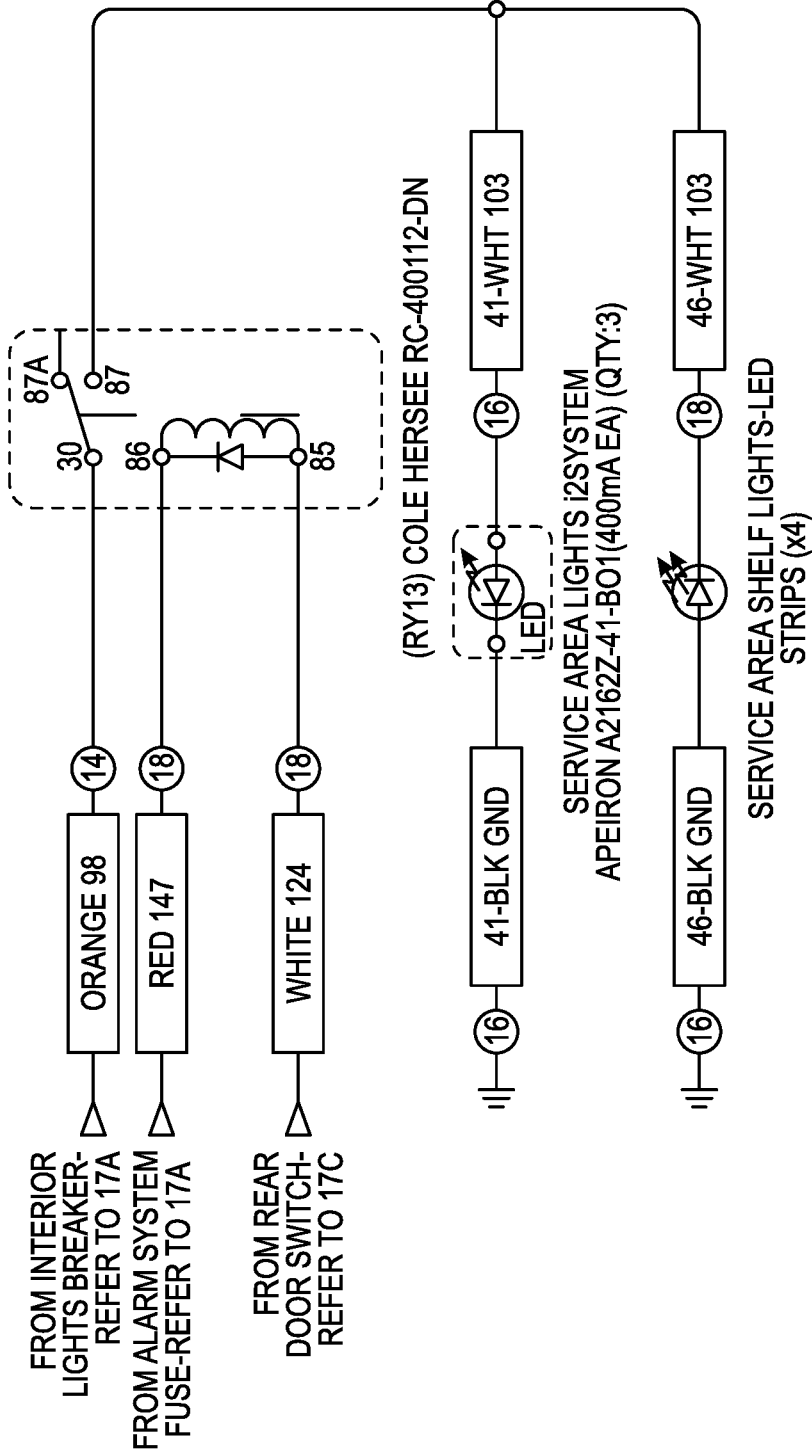


FIG. 18H

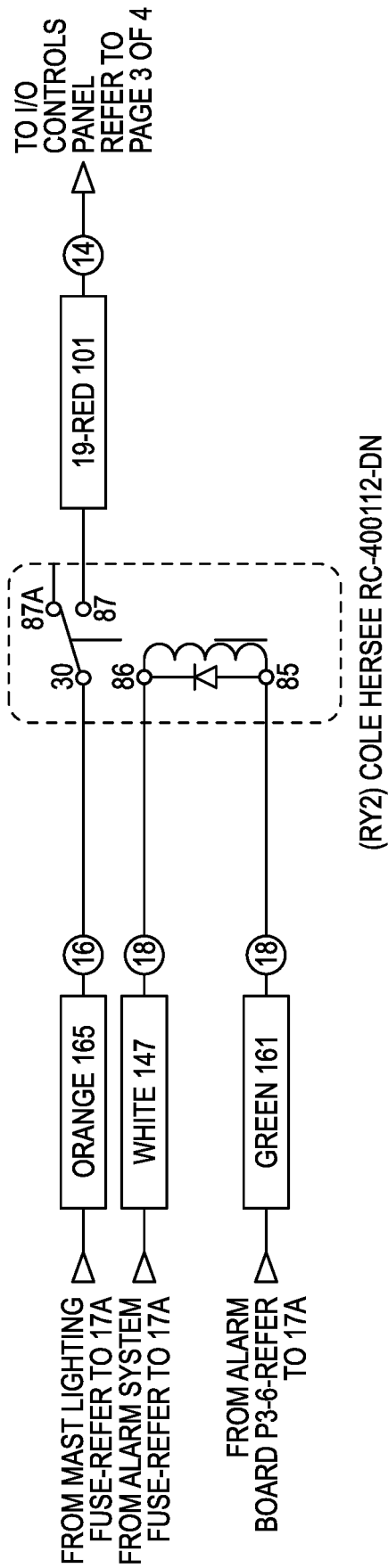


FIG. 18I

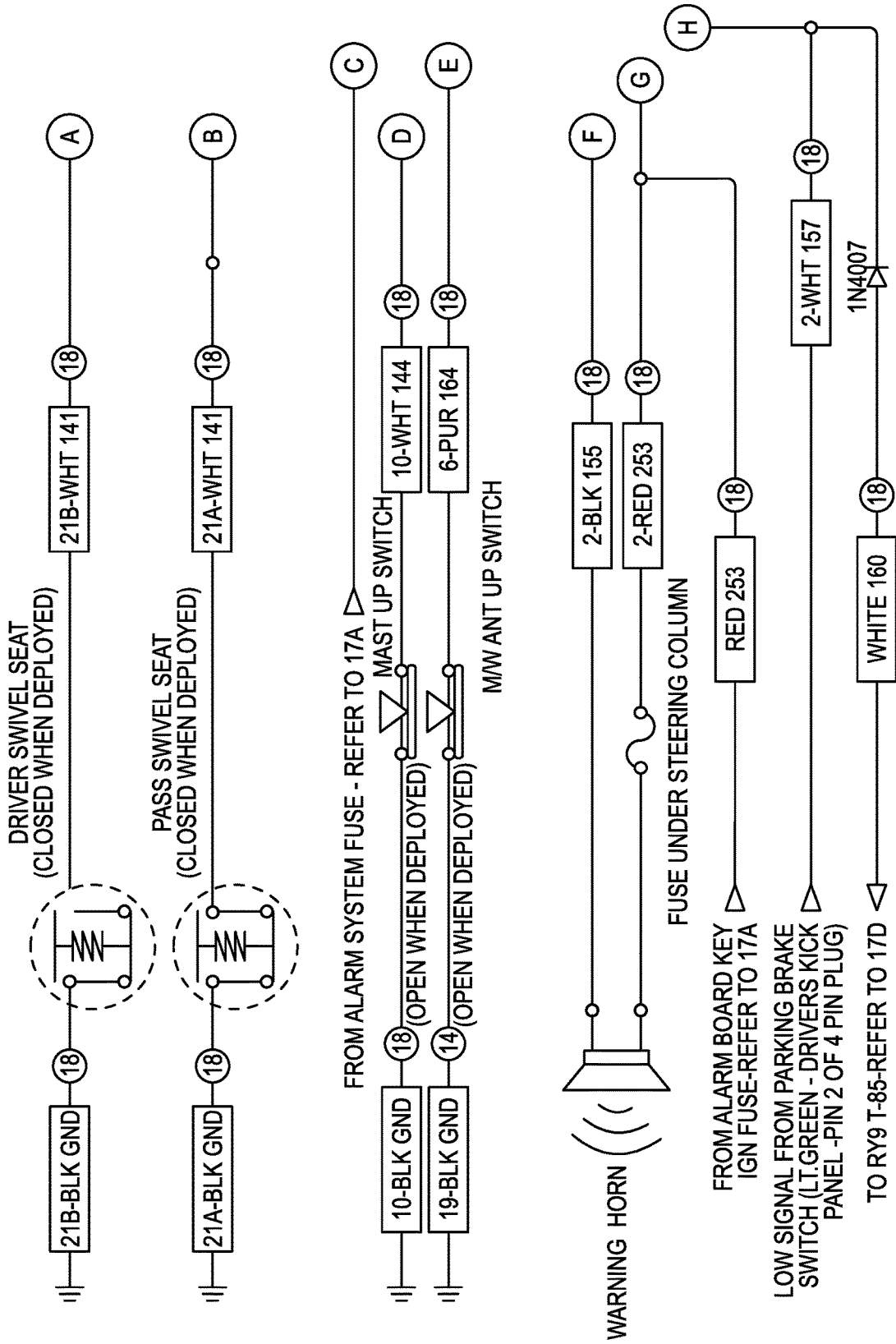


FIG. 19A

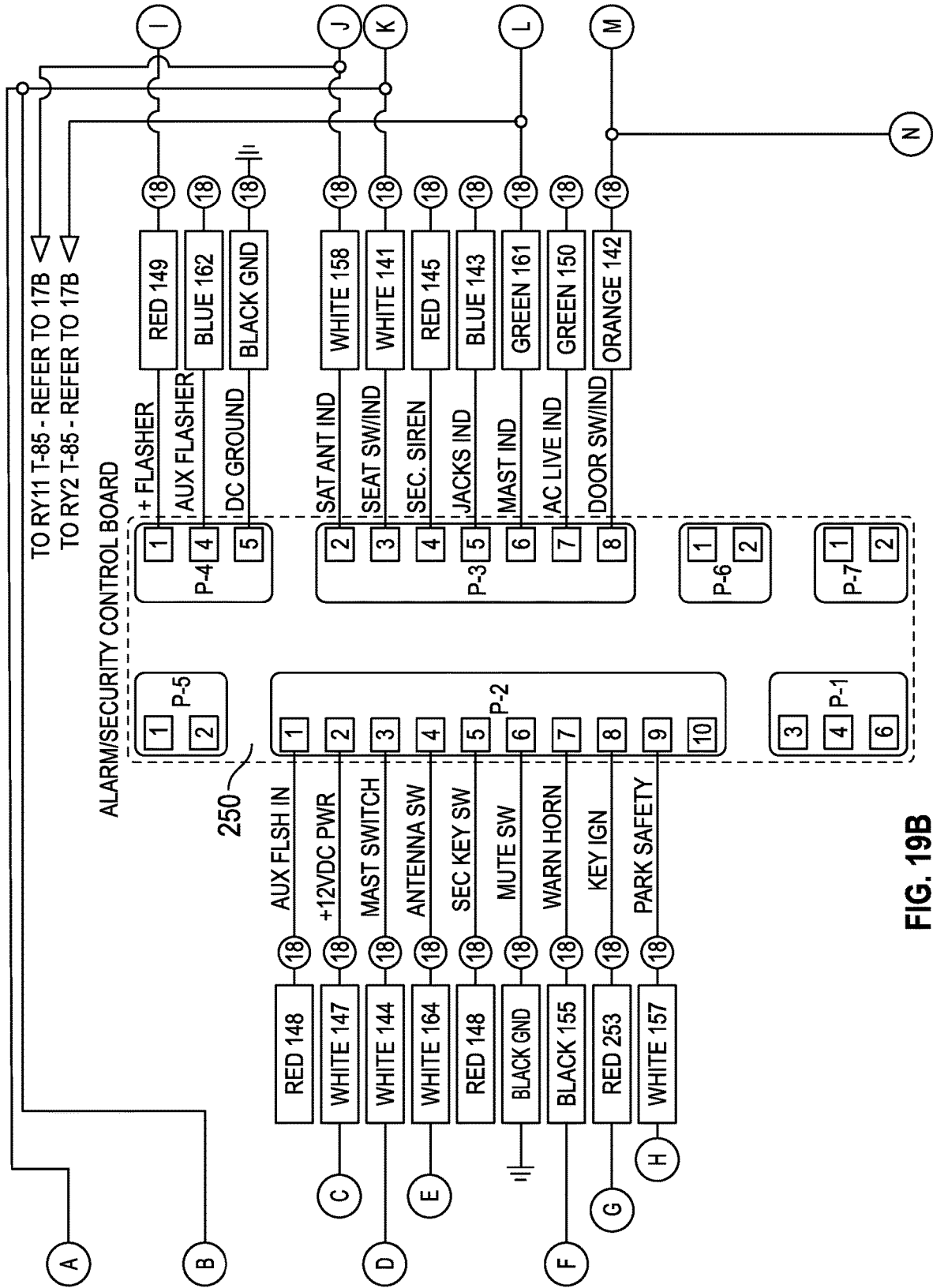


FIG. 19B

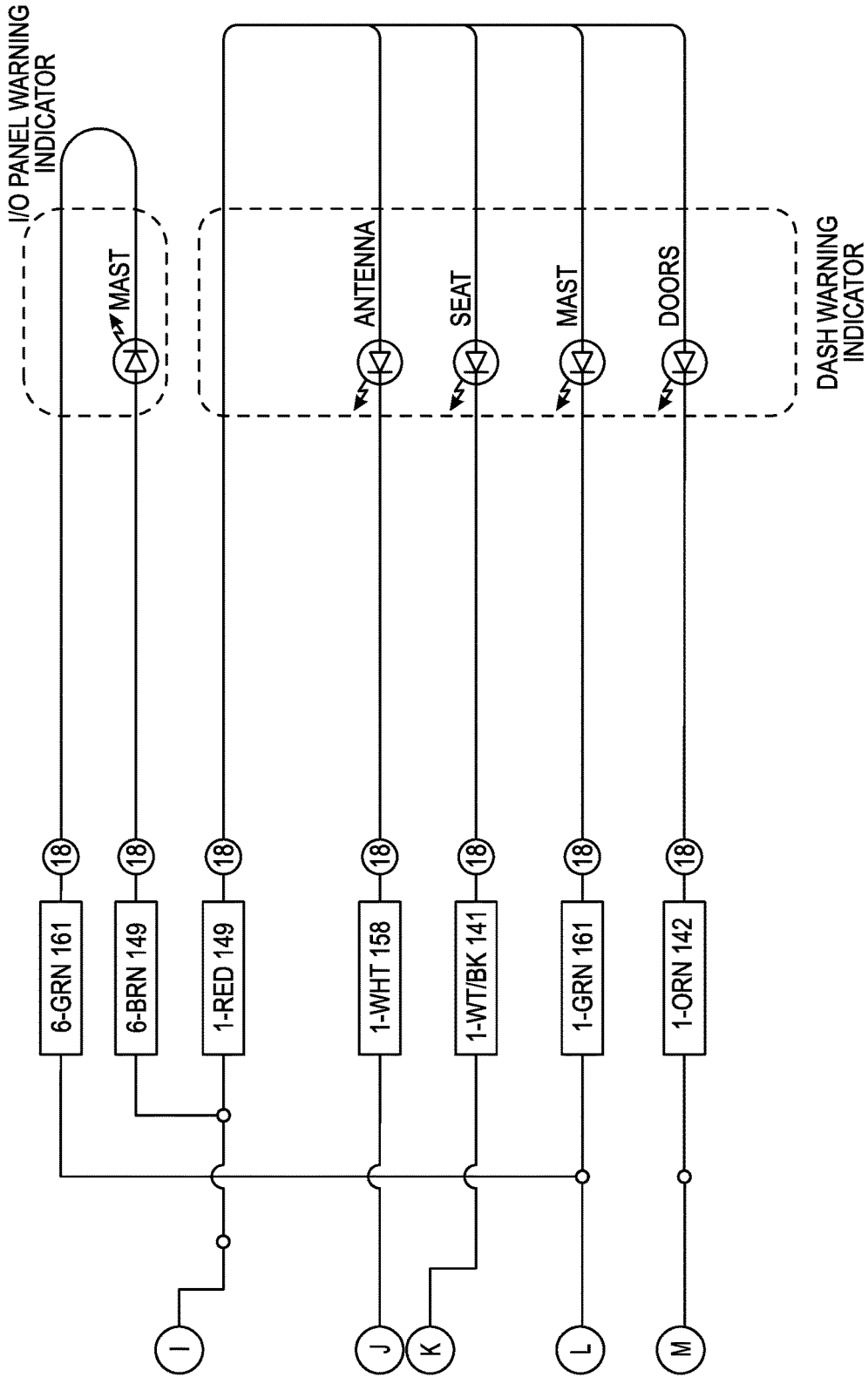


FIG. 19C

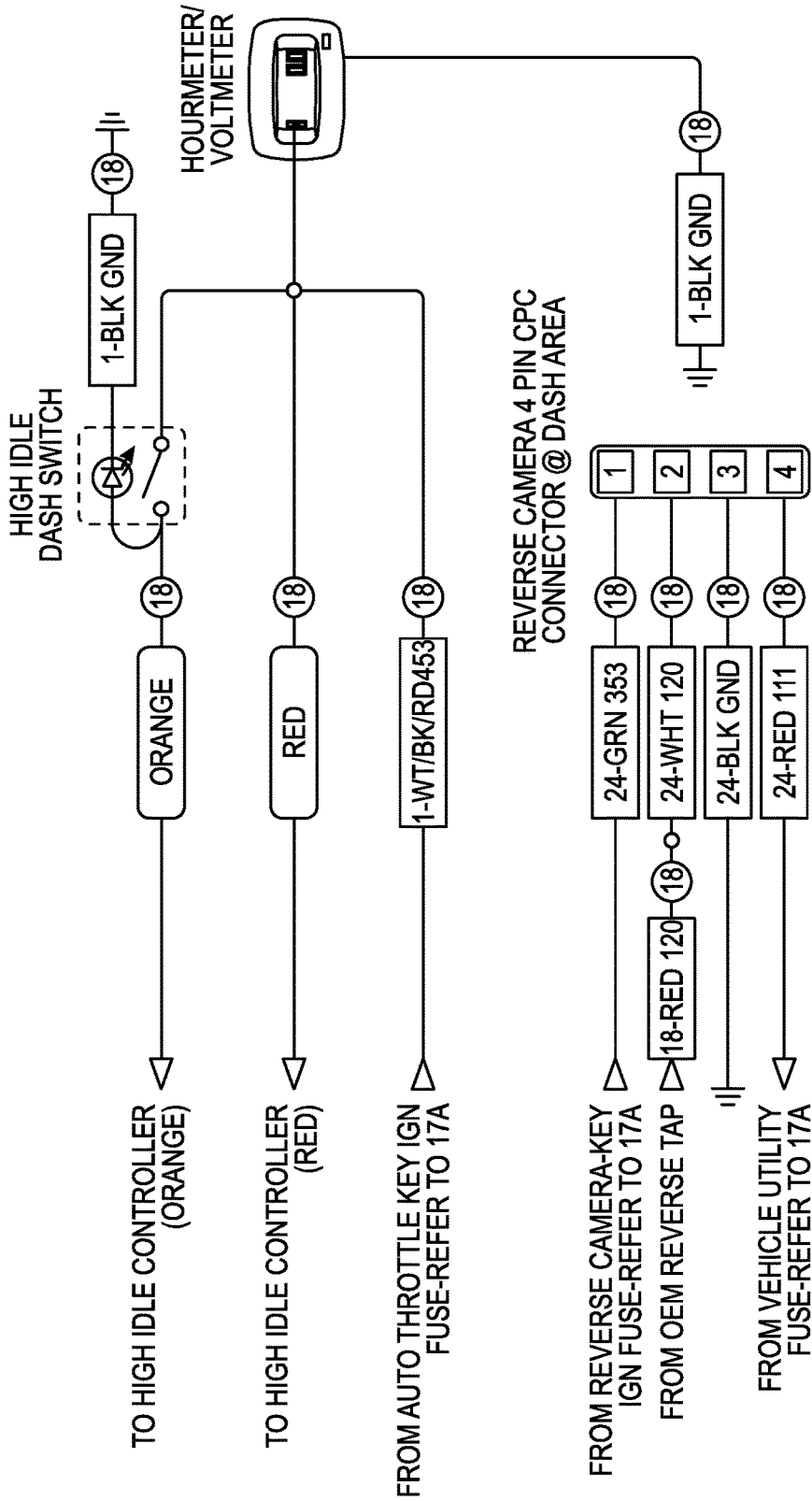


FIG. 19D

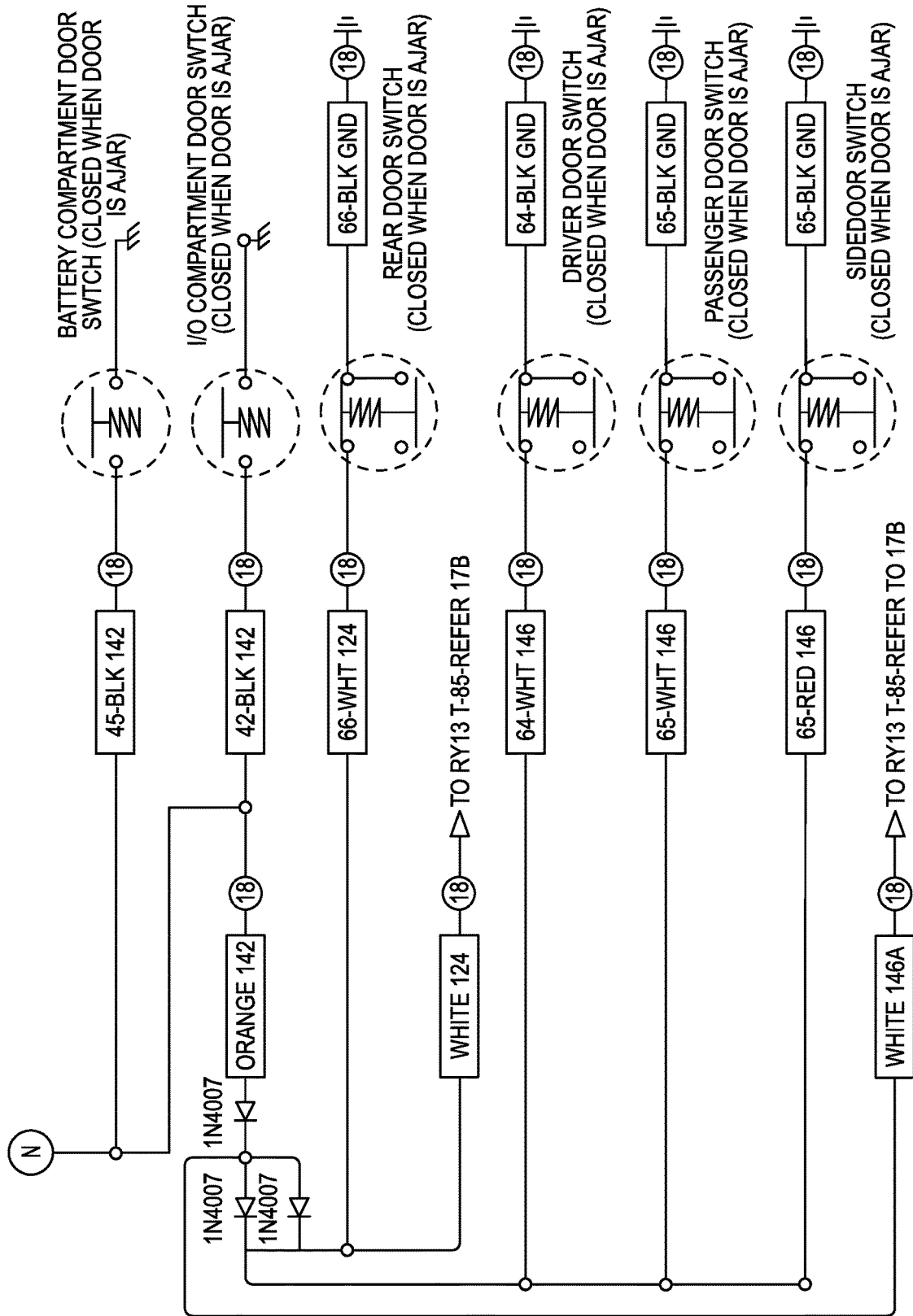


FIG. 19E

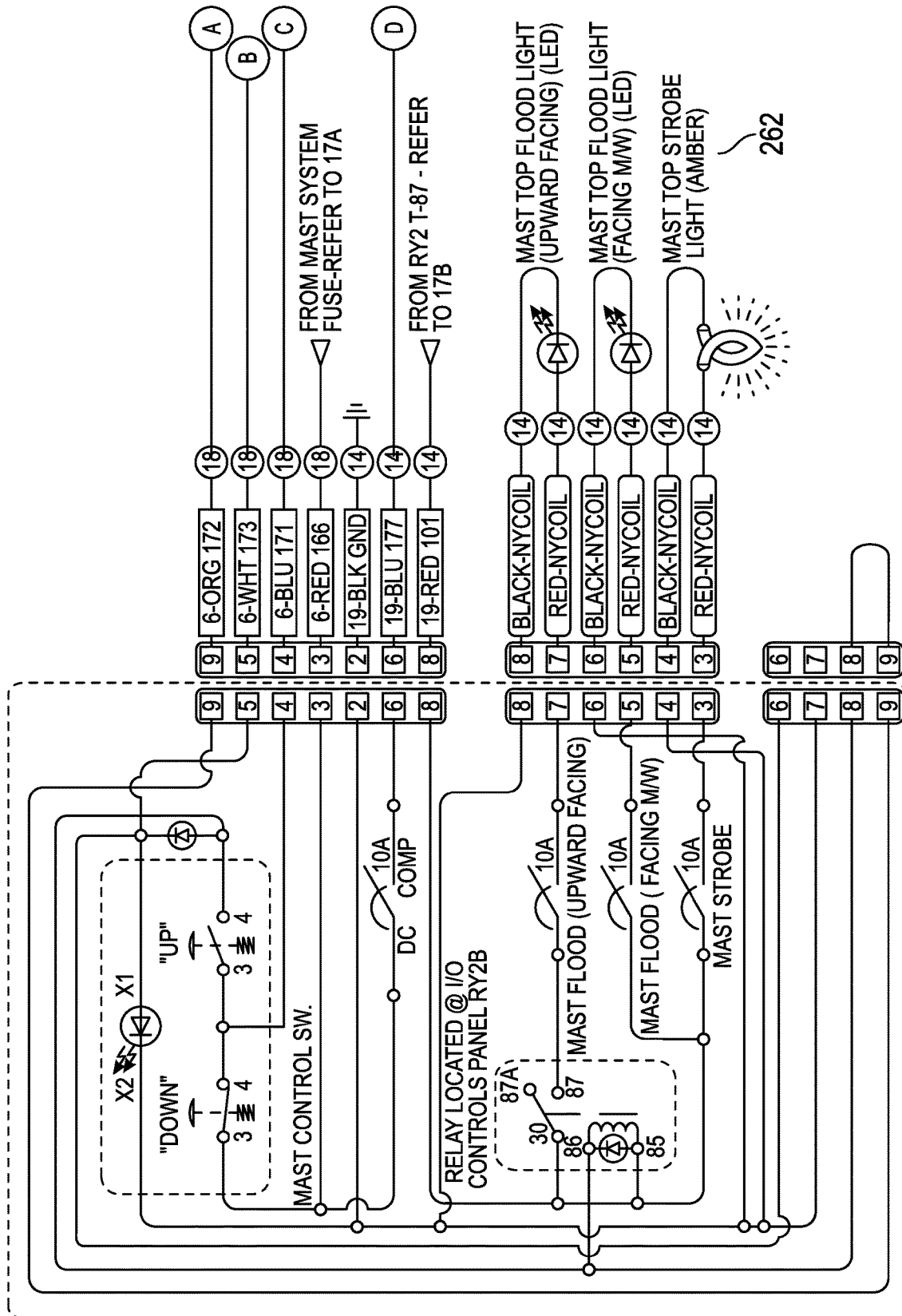


FIG. 20A

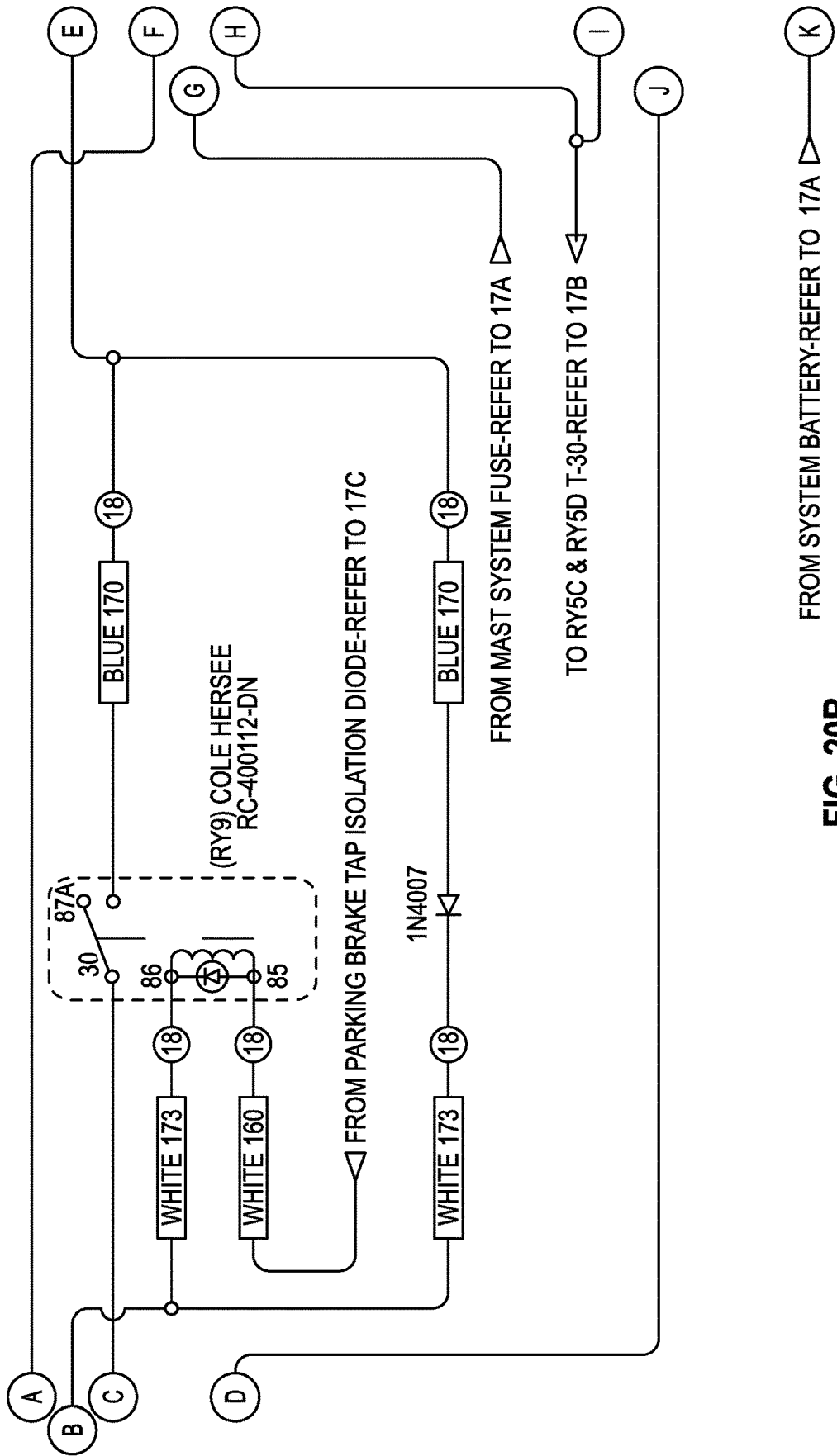


FIG. 20B

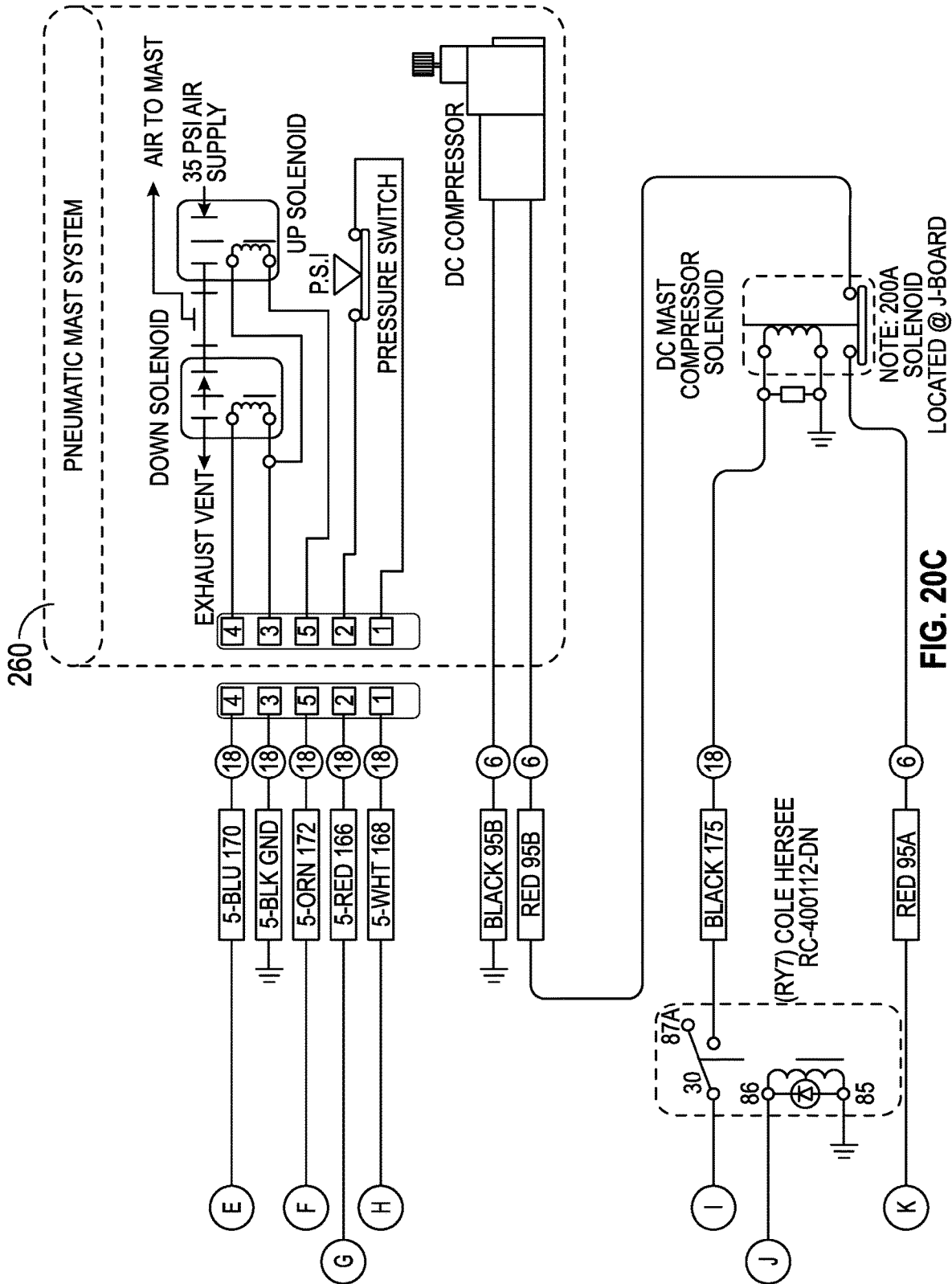


FIG. 20C

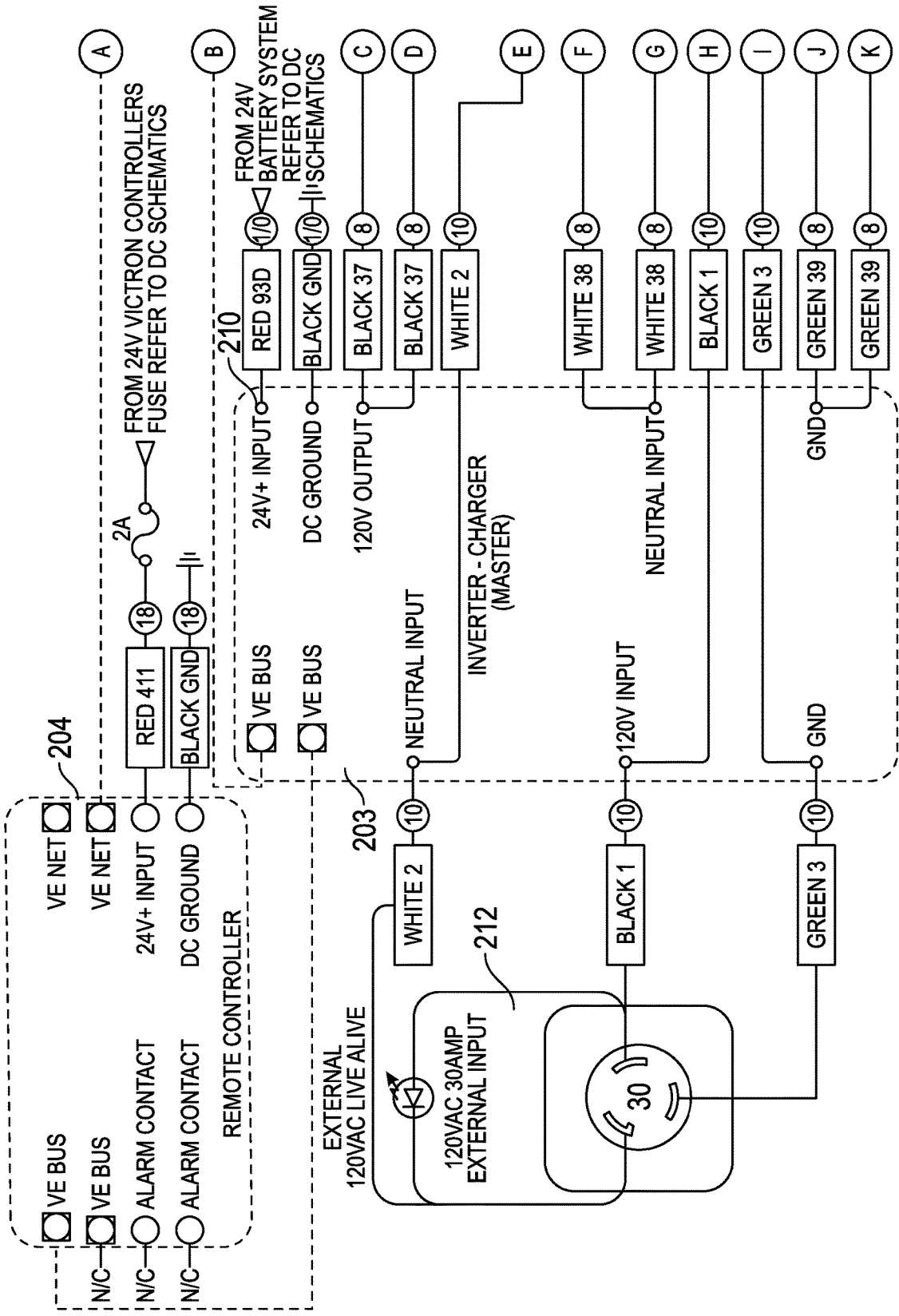


FIG. 21A

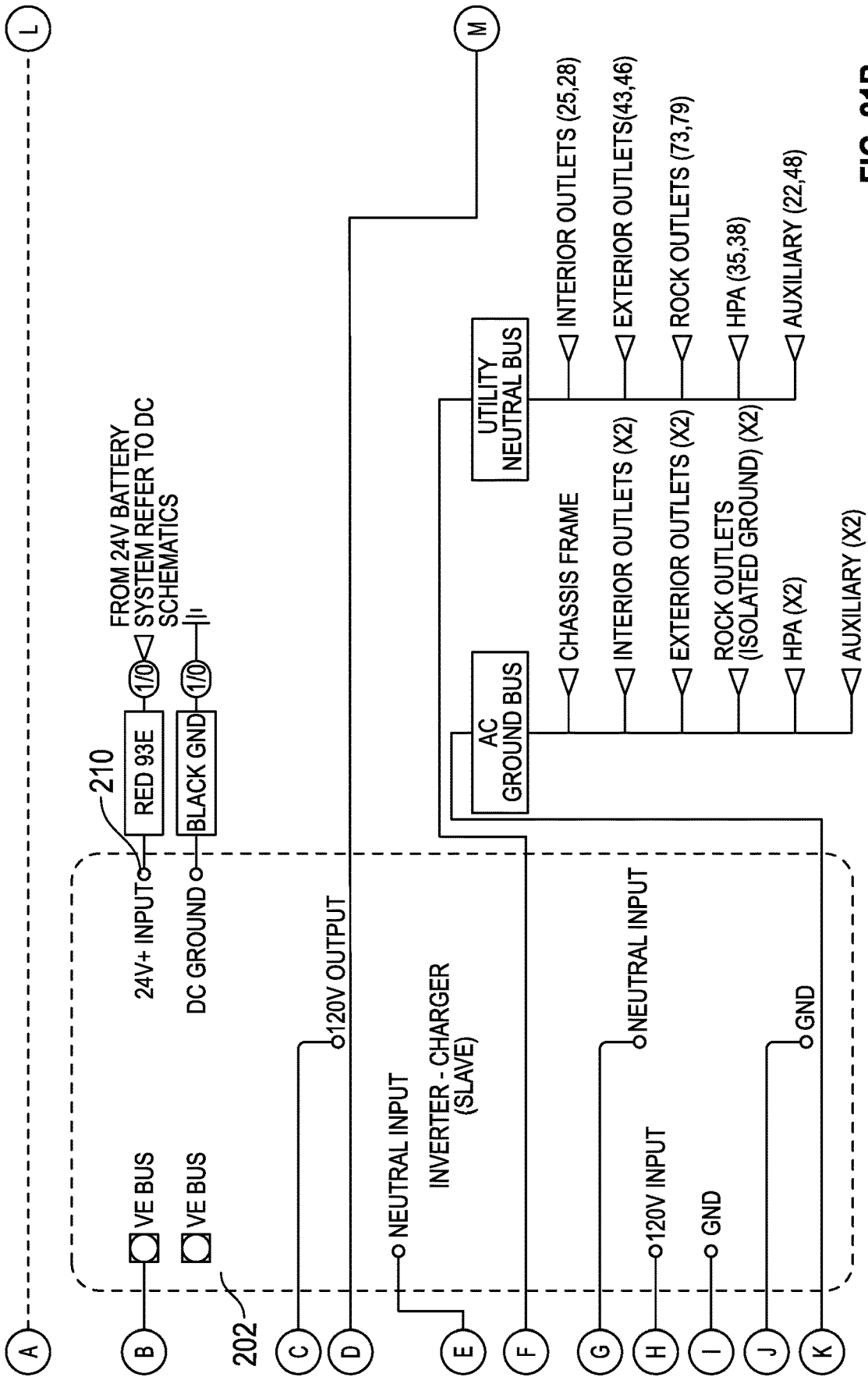


FIG. 21B

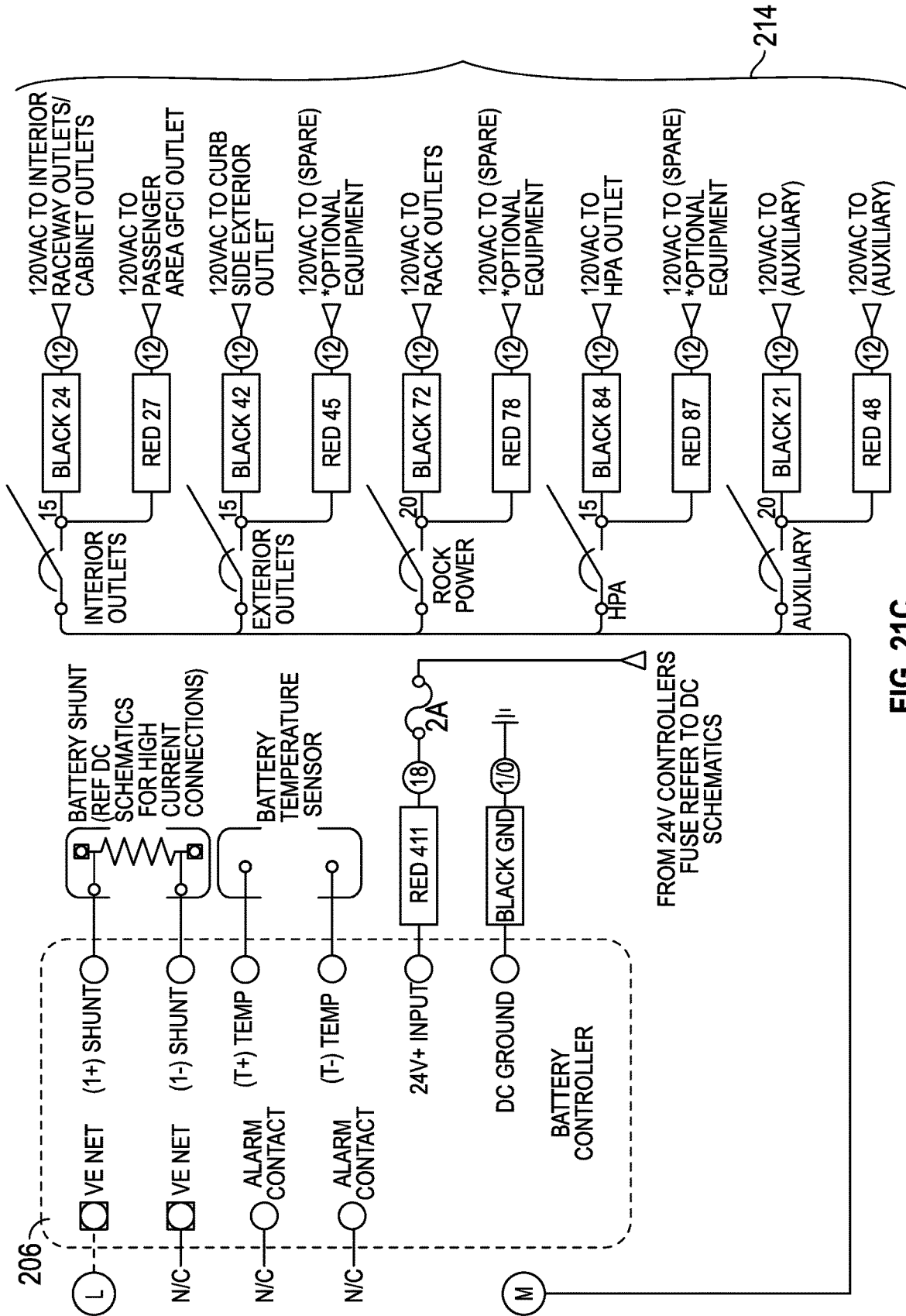


FIG. 21C

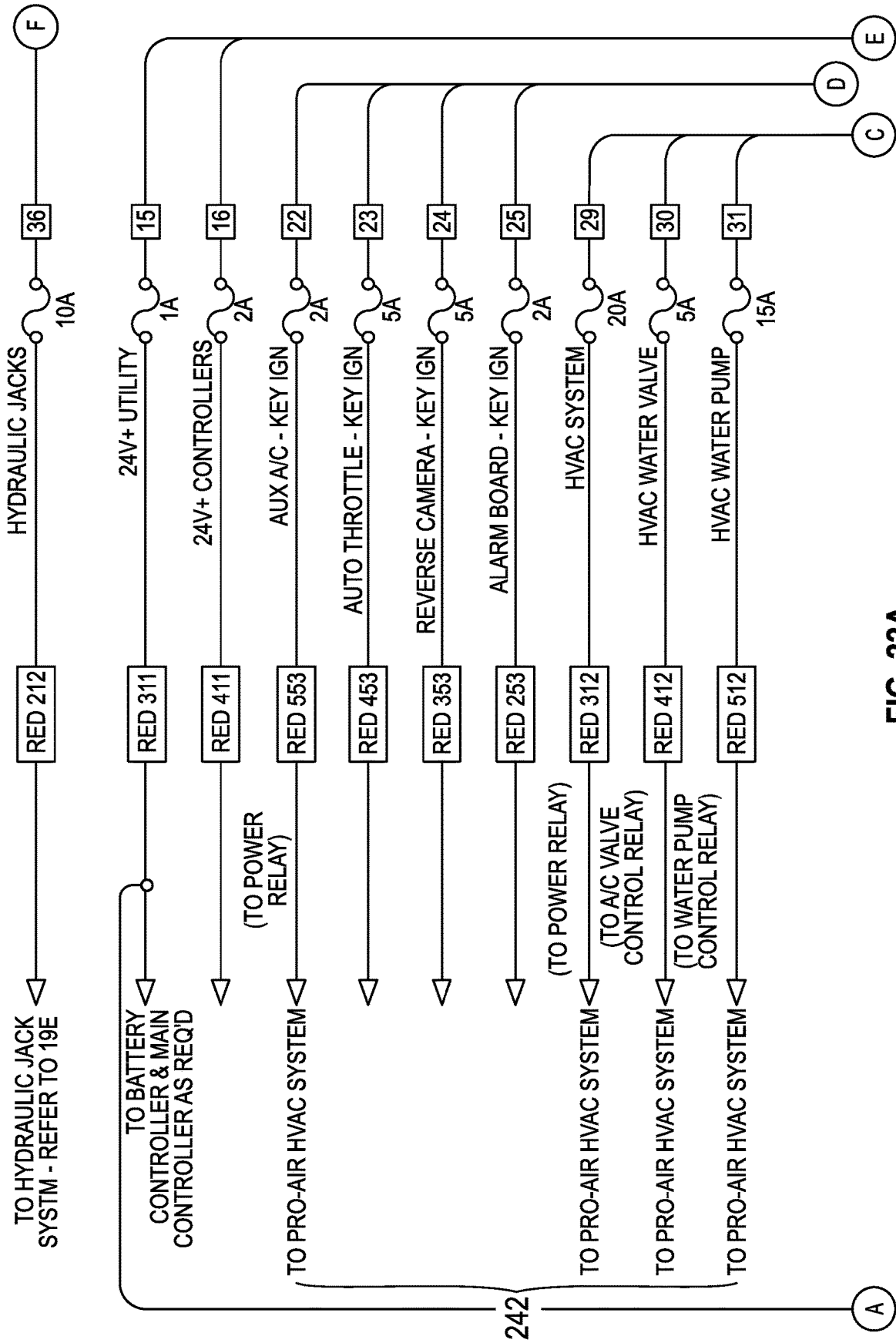


FIG. 22A

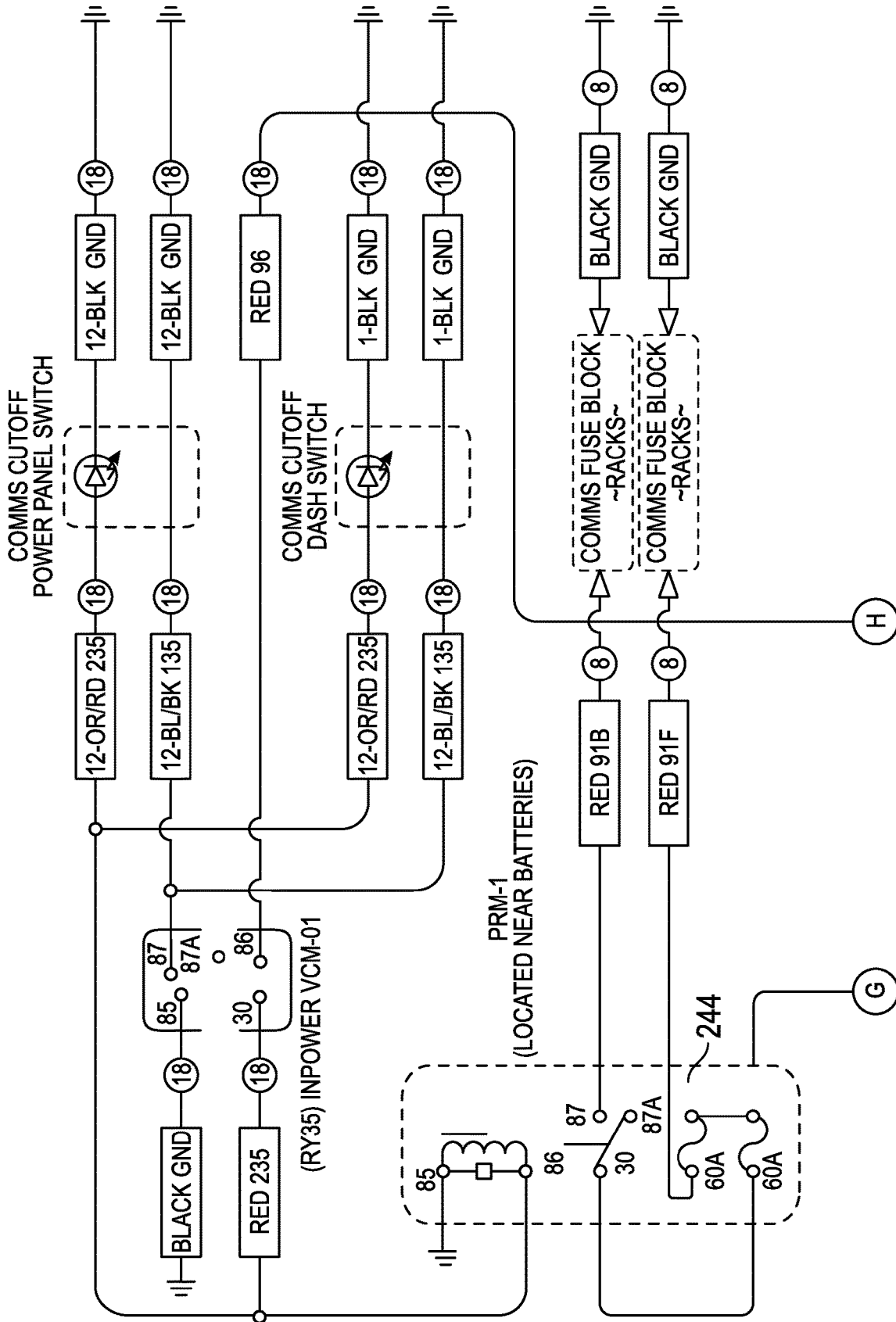


FIG. 22B

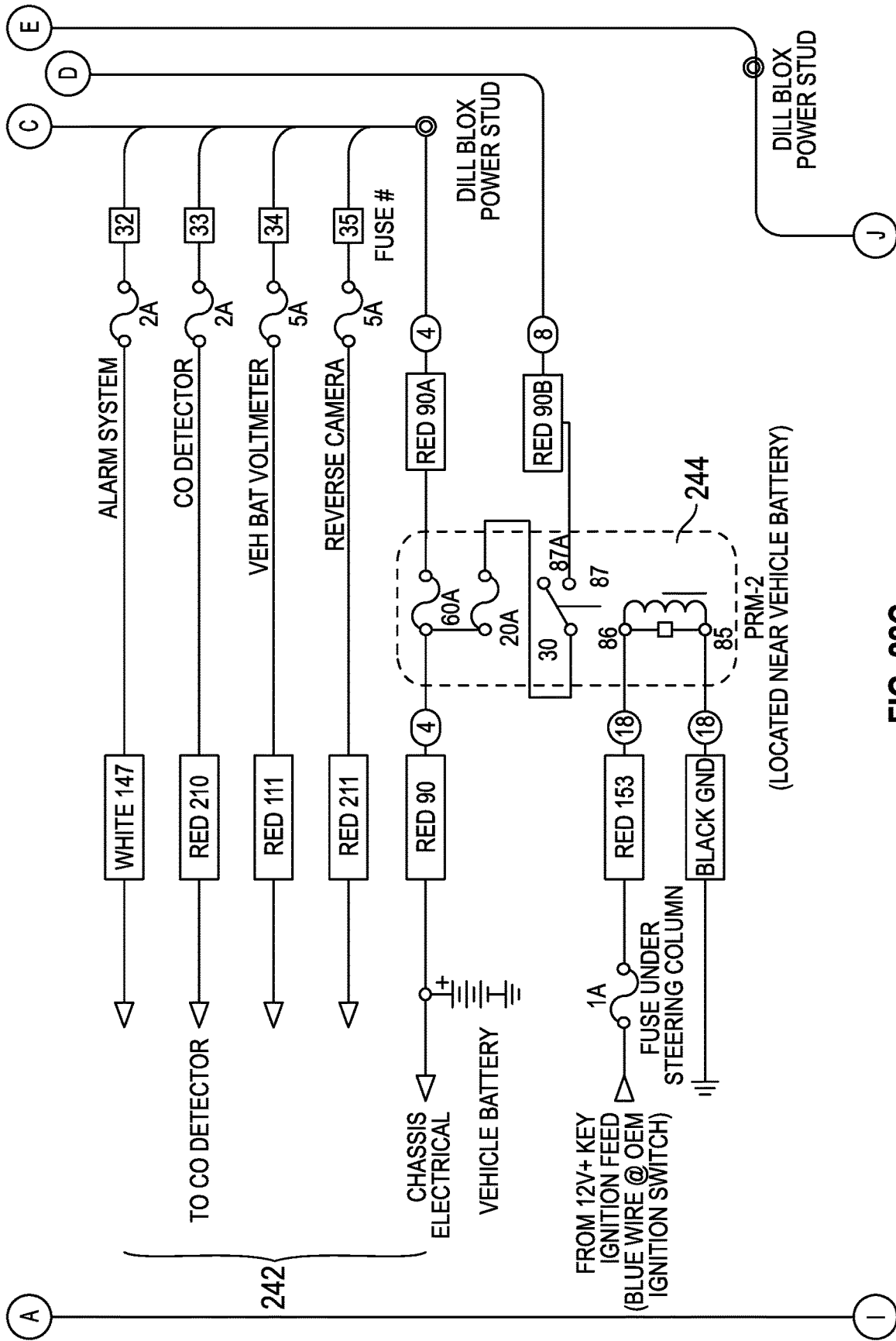


FIG. 22C

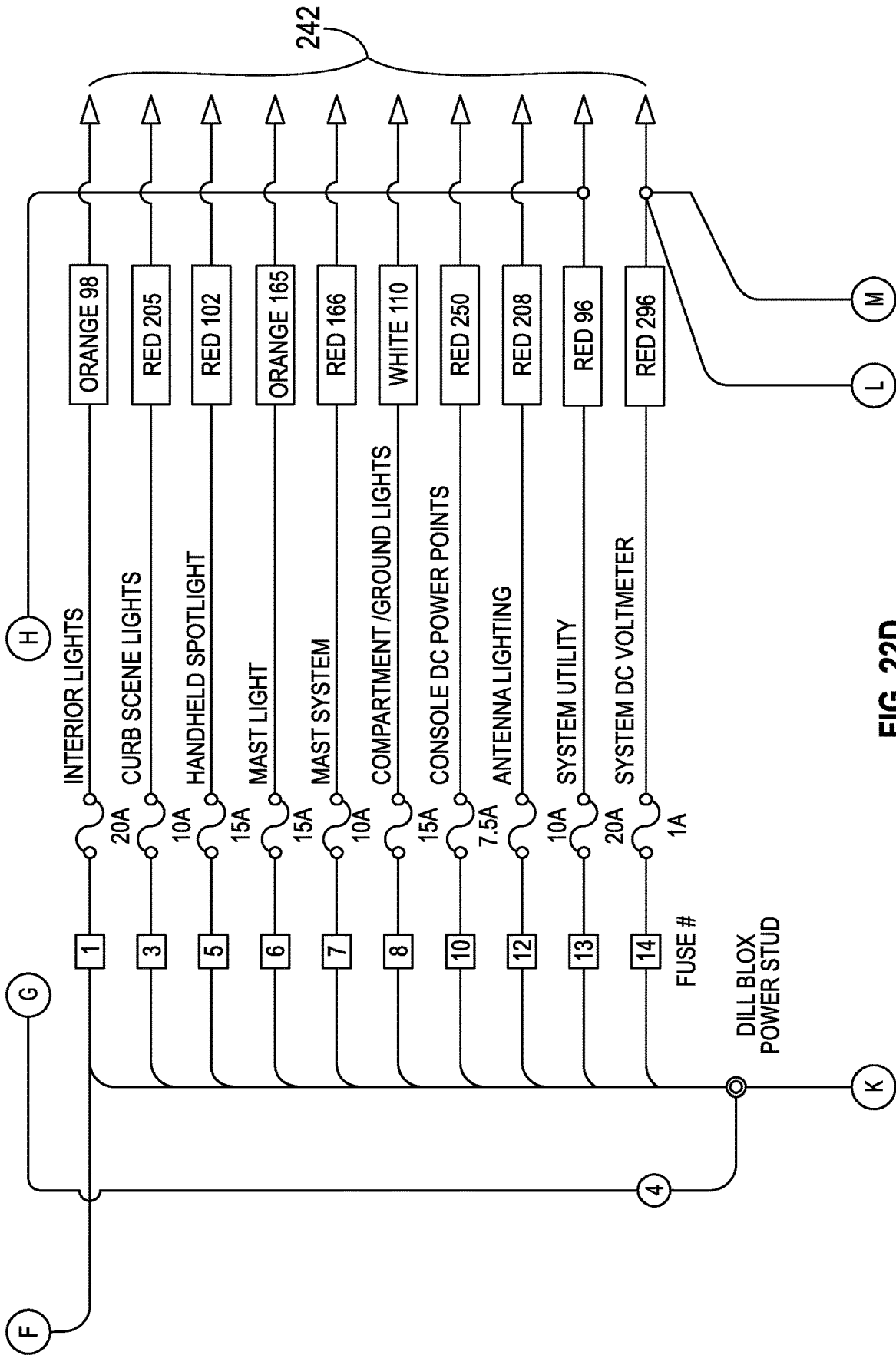


FIG. 22D

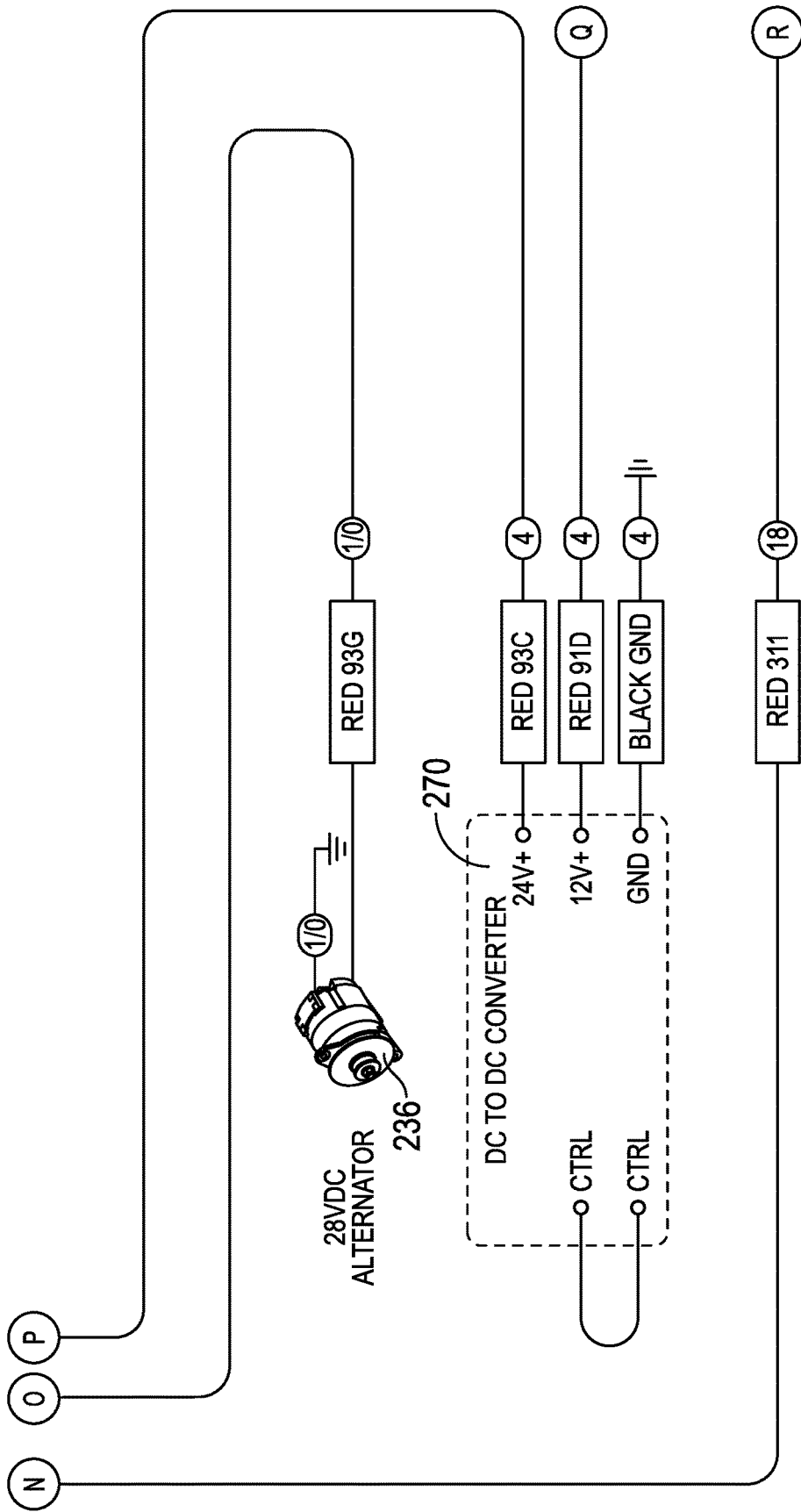


FIG. 22F

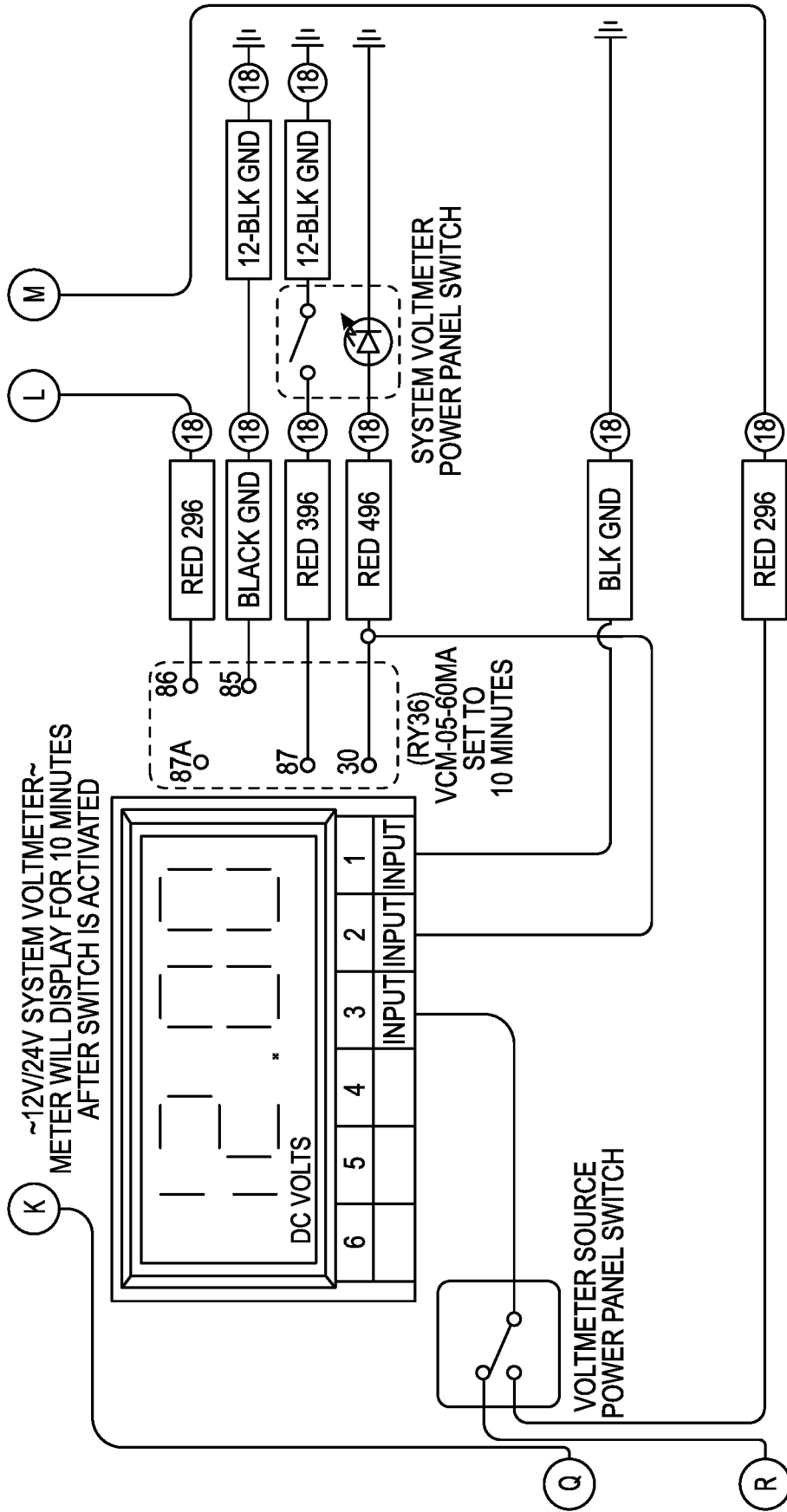


FIG. 22G

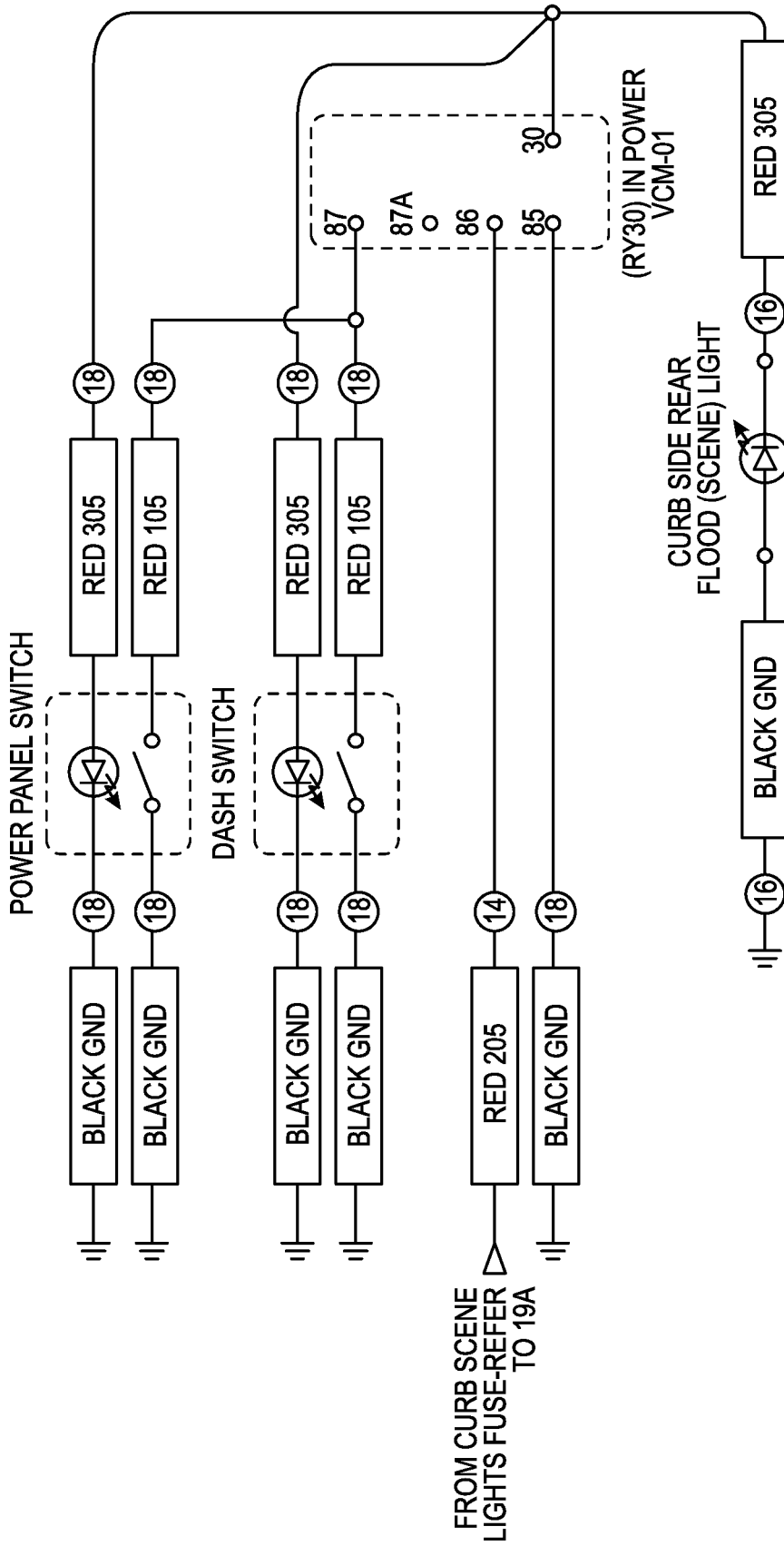


FIG. 23A

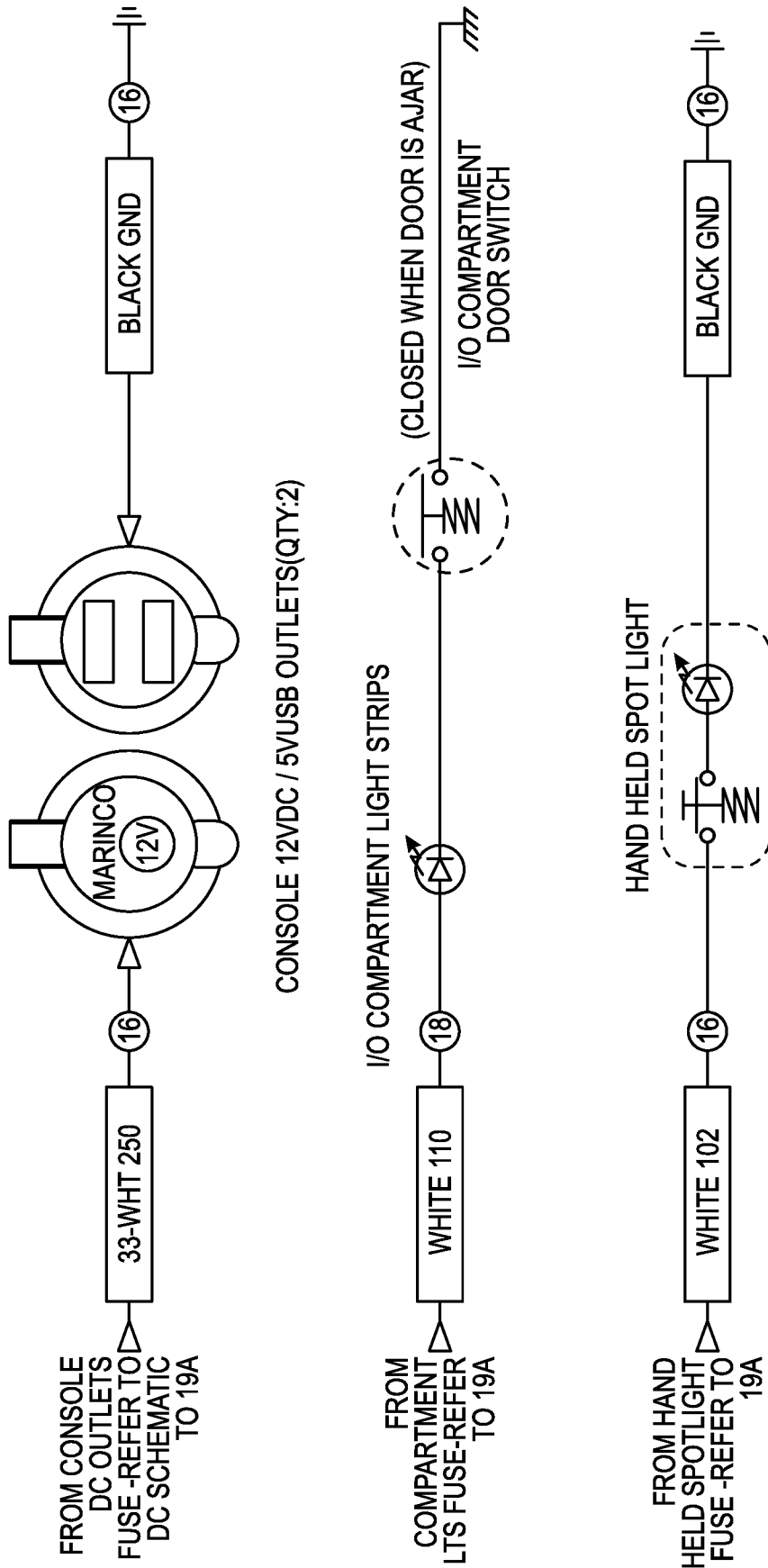


FIG. 23B

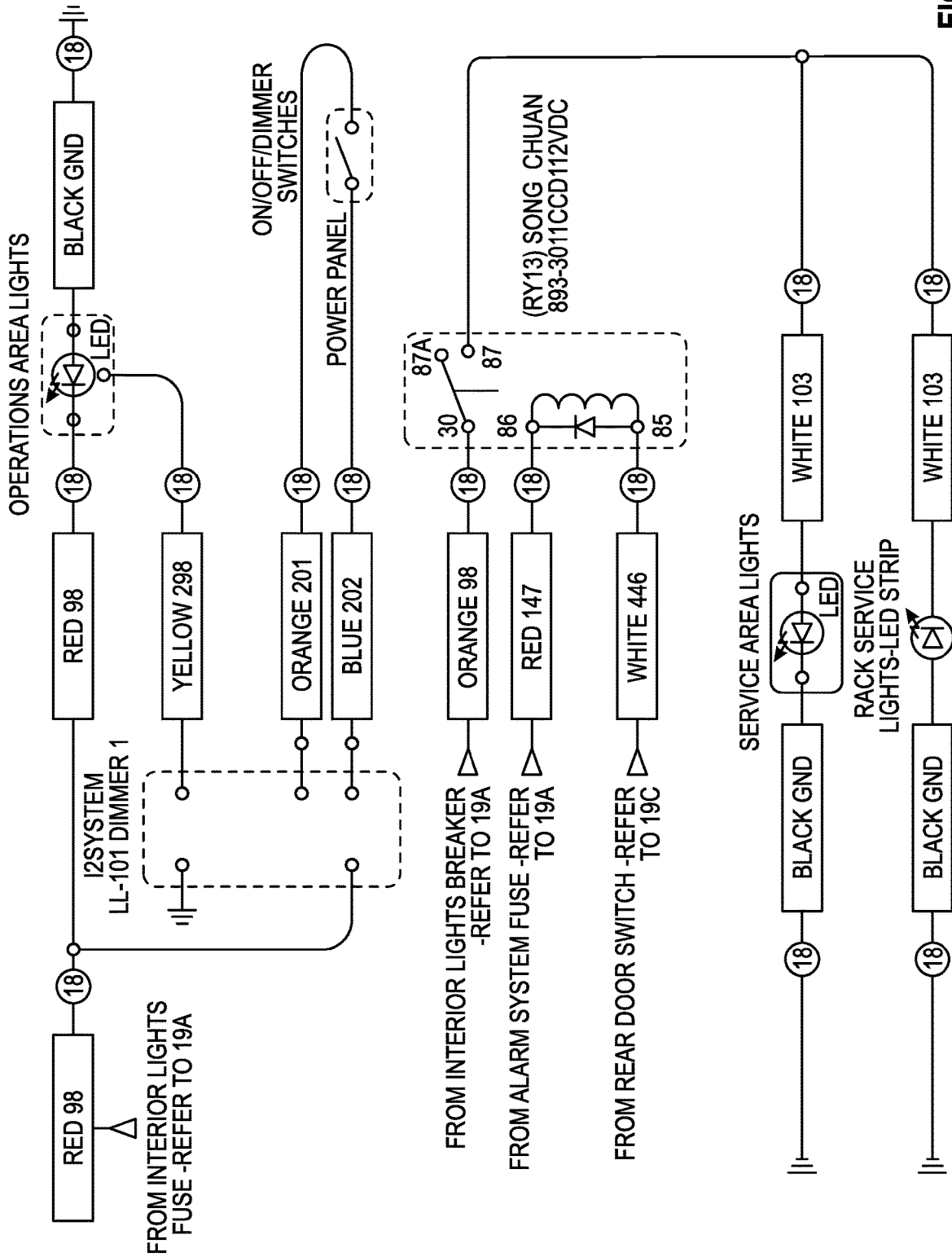
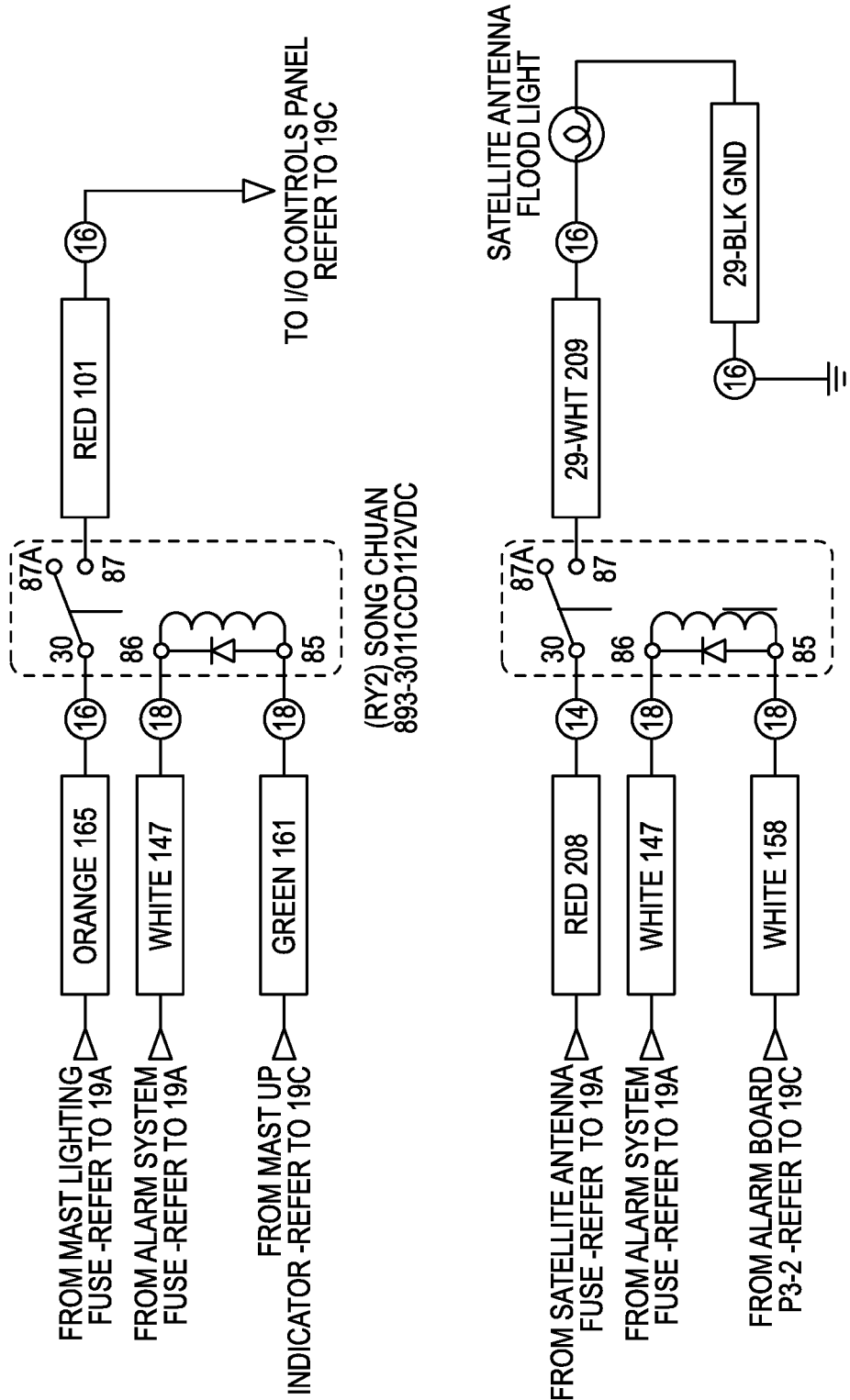


FIG. 23C



(RY2) SONG CHUAN
893-3011CCD112VDC

(RY11) SONG CHUAN
893-3011CCD112VDC

FIG. 23D

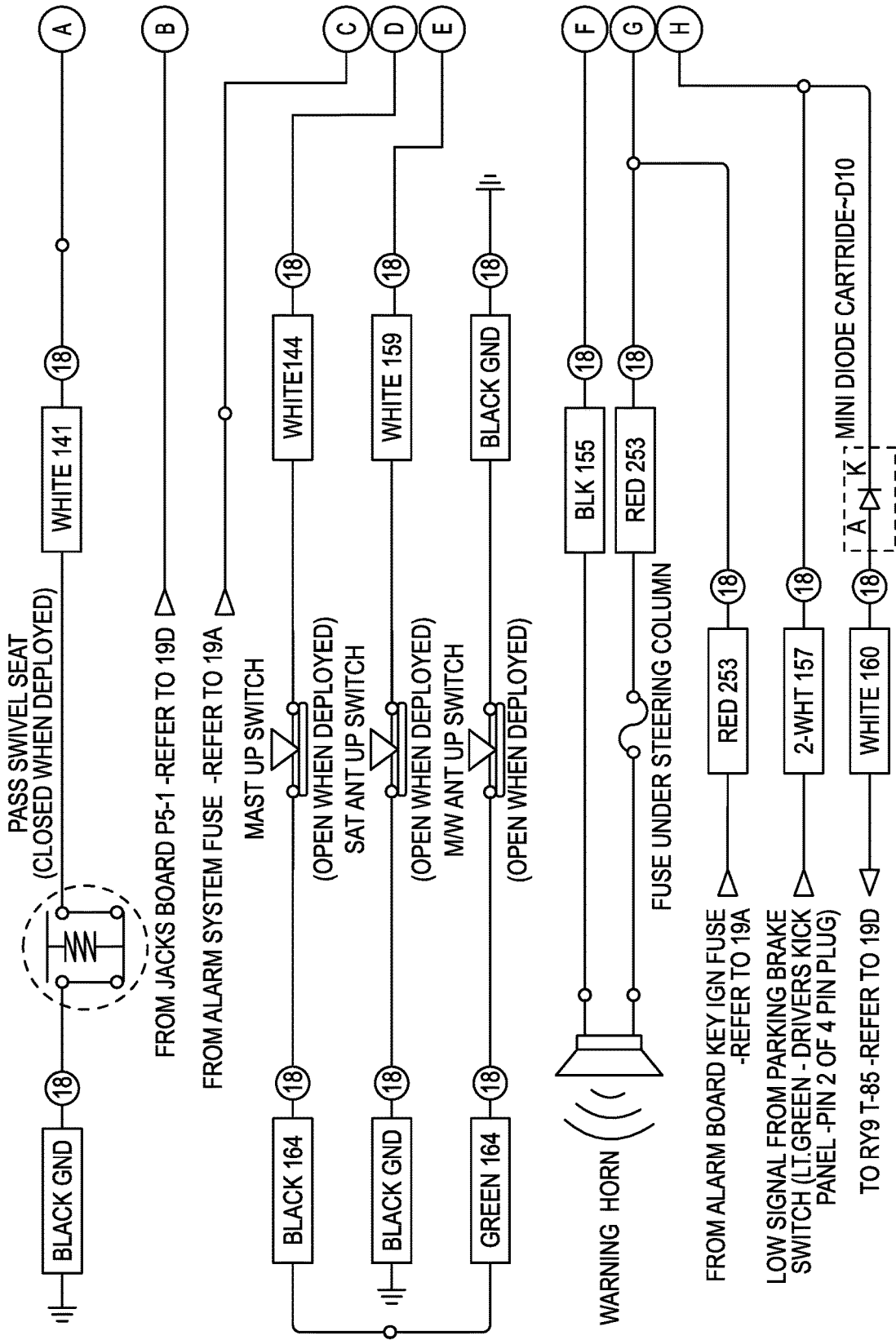


FIG. 24A

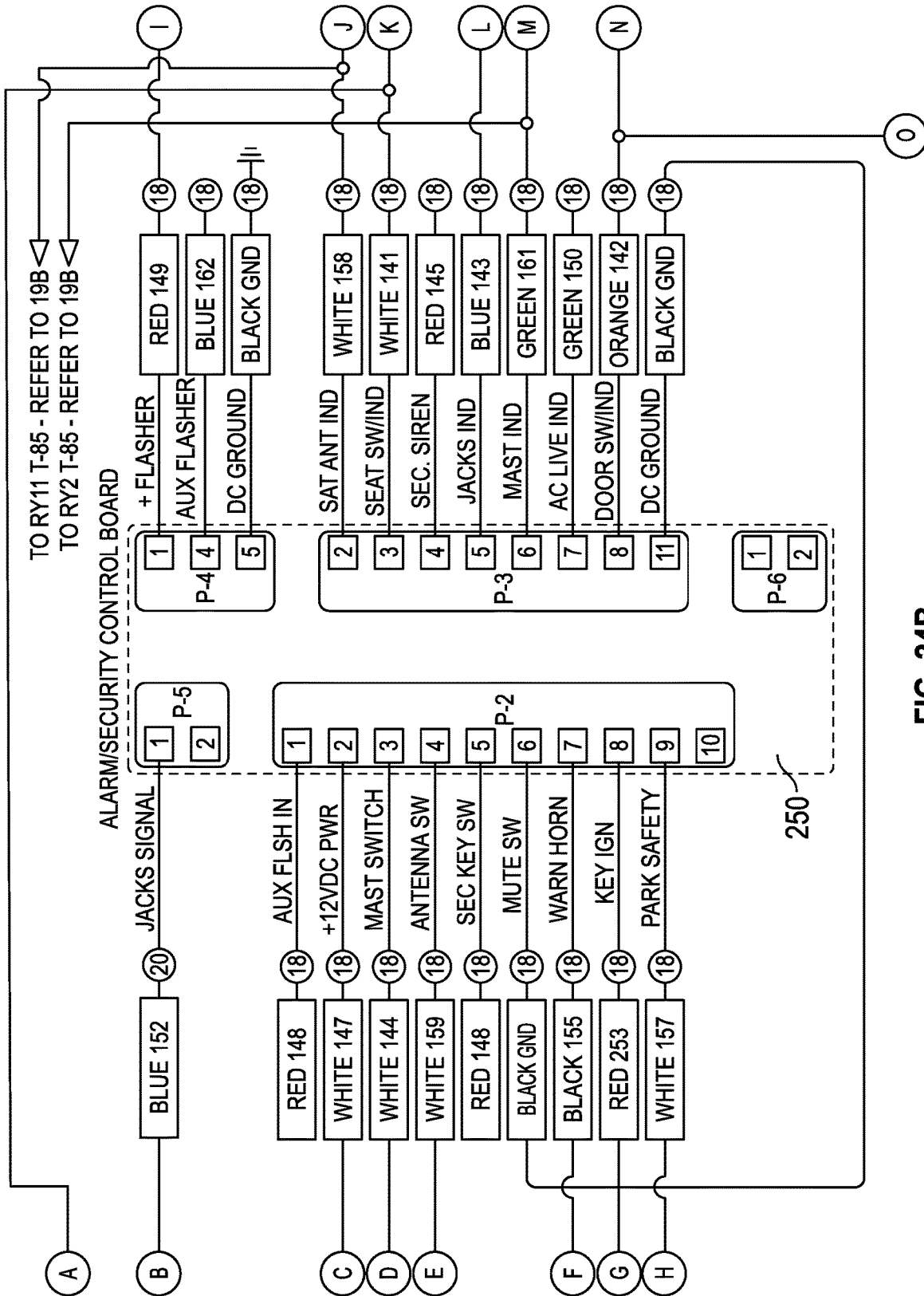


FIG. 24B

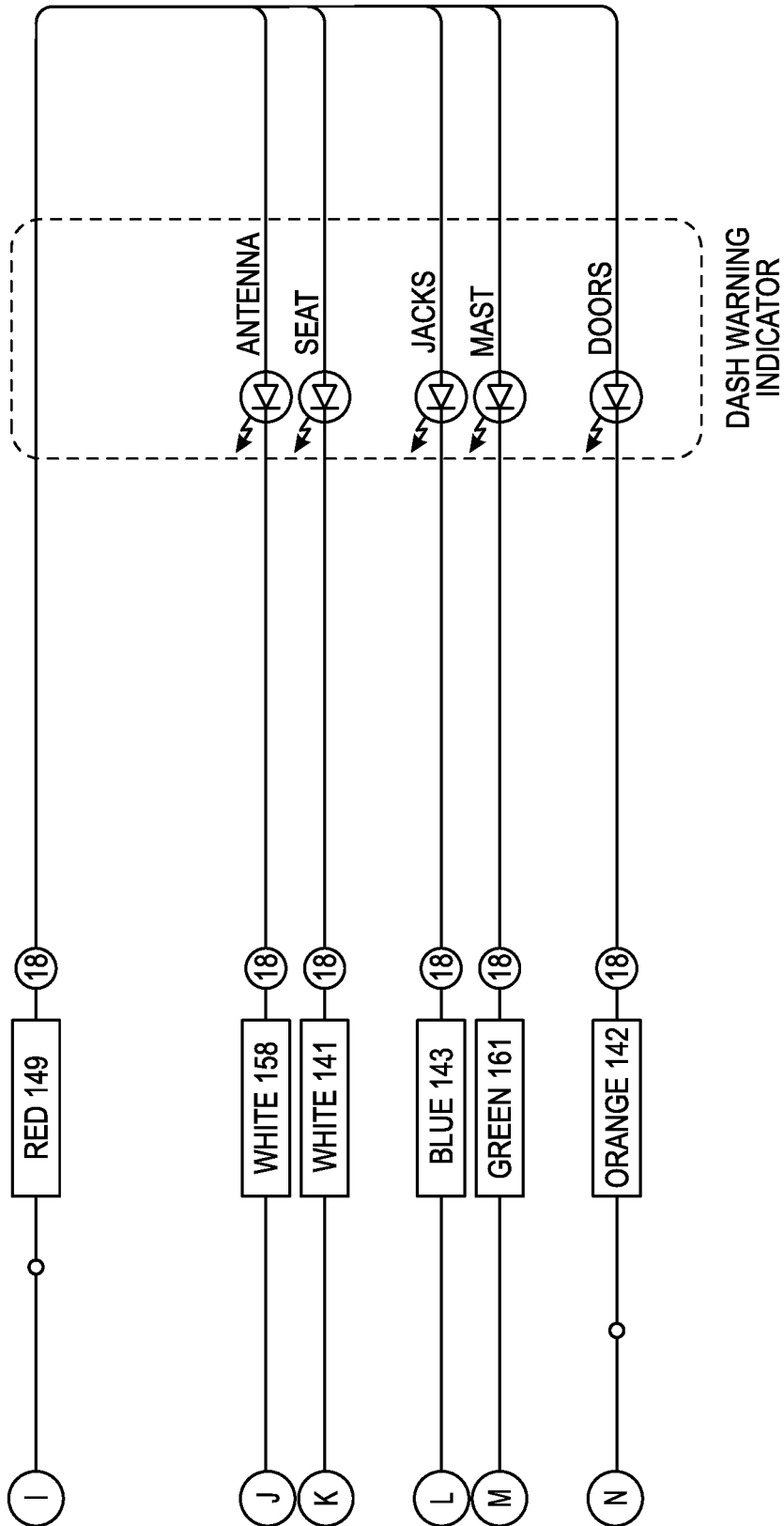


FIG. 24C

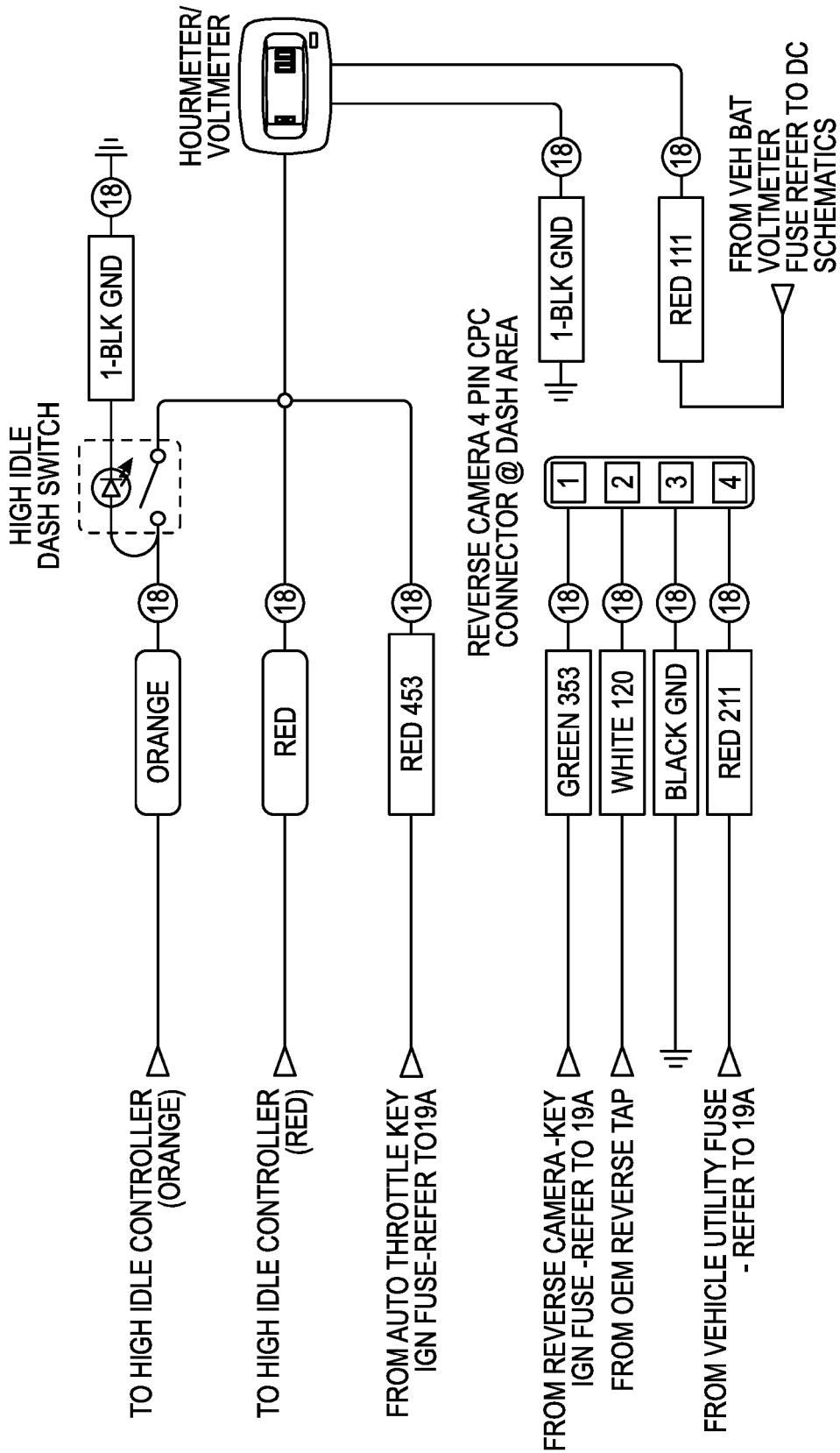


FIG. 24D

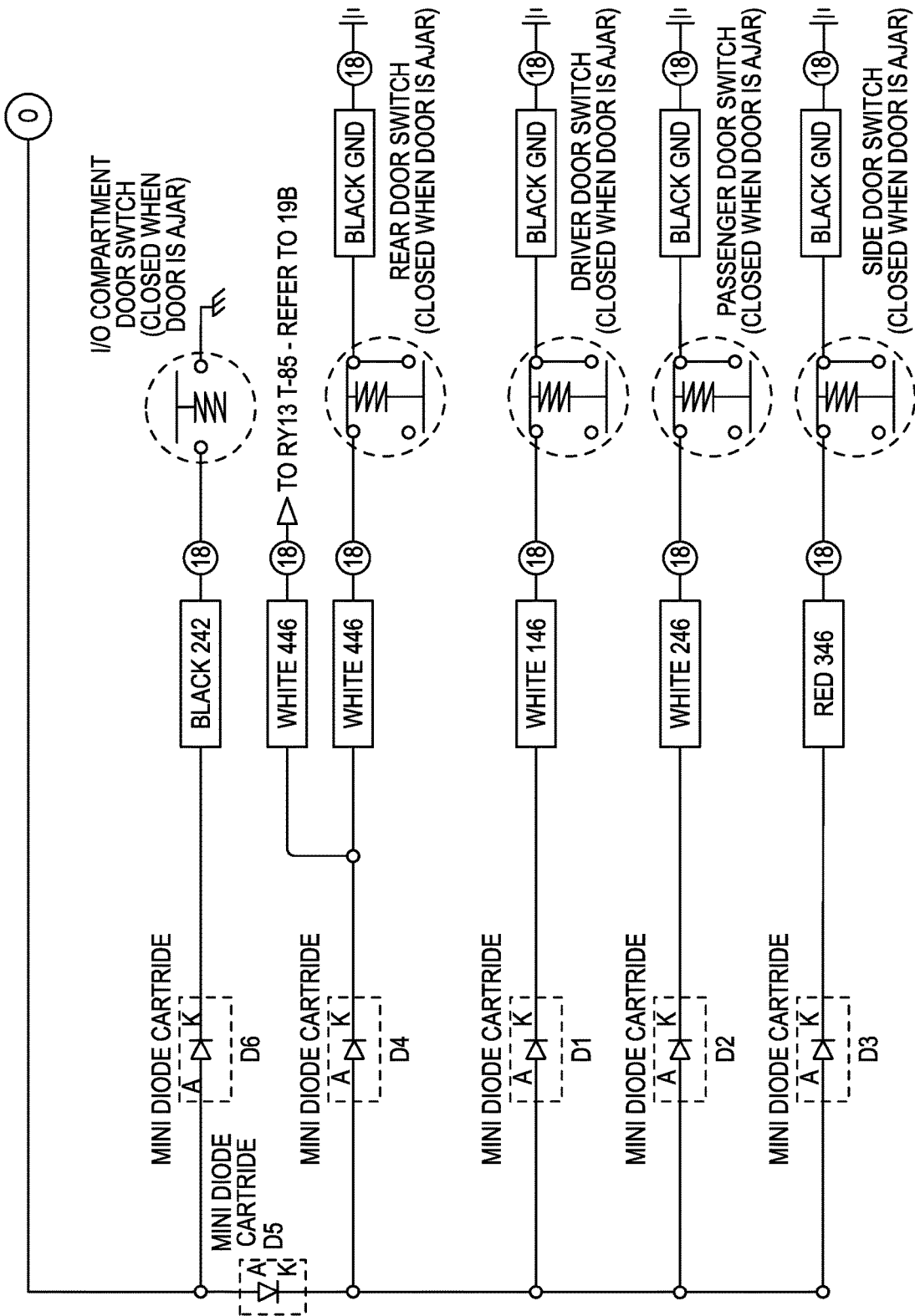


FIG. 24E

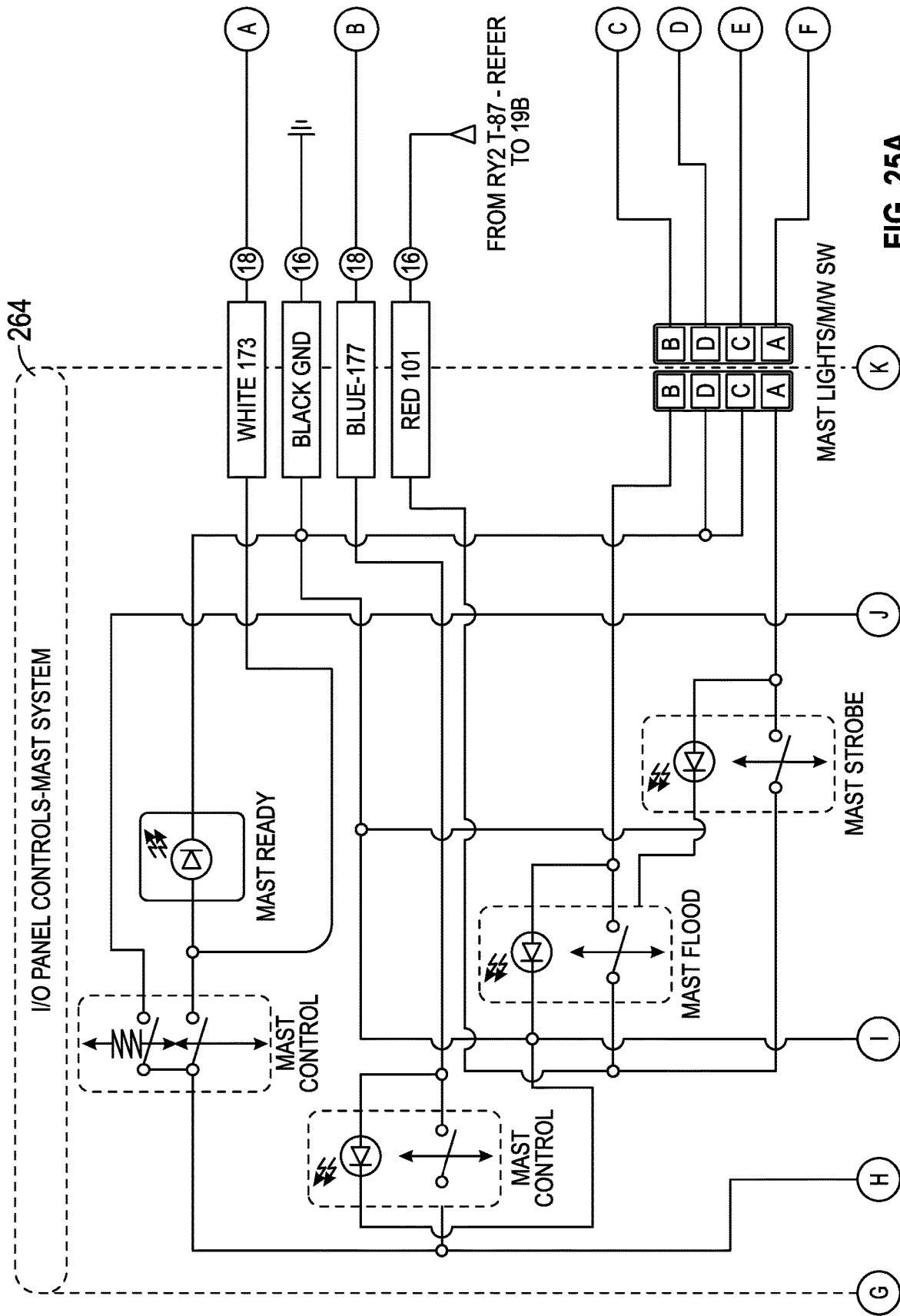


FIG. 25A

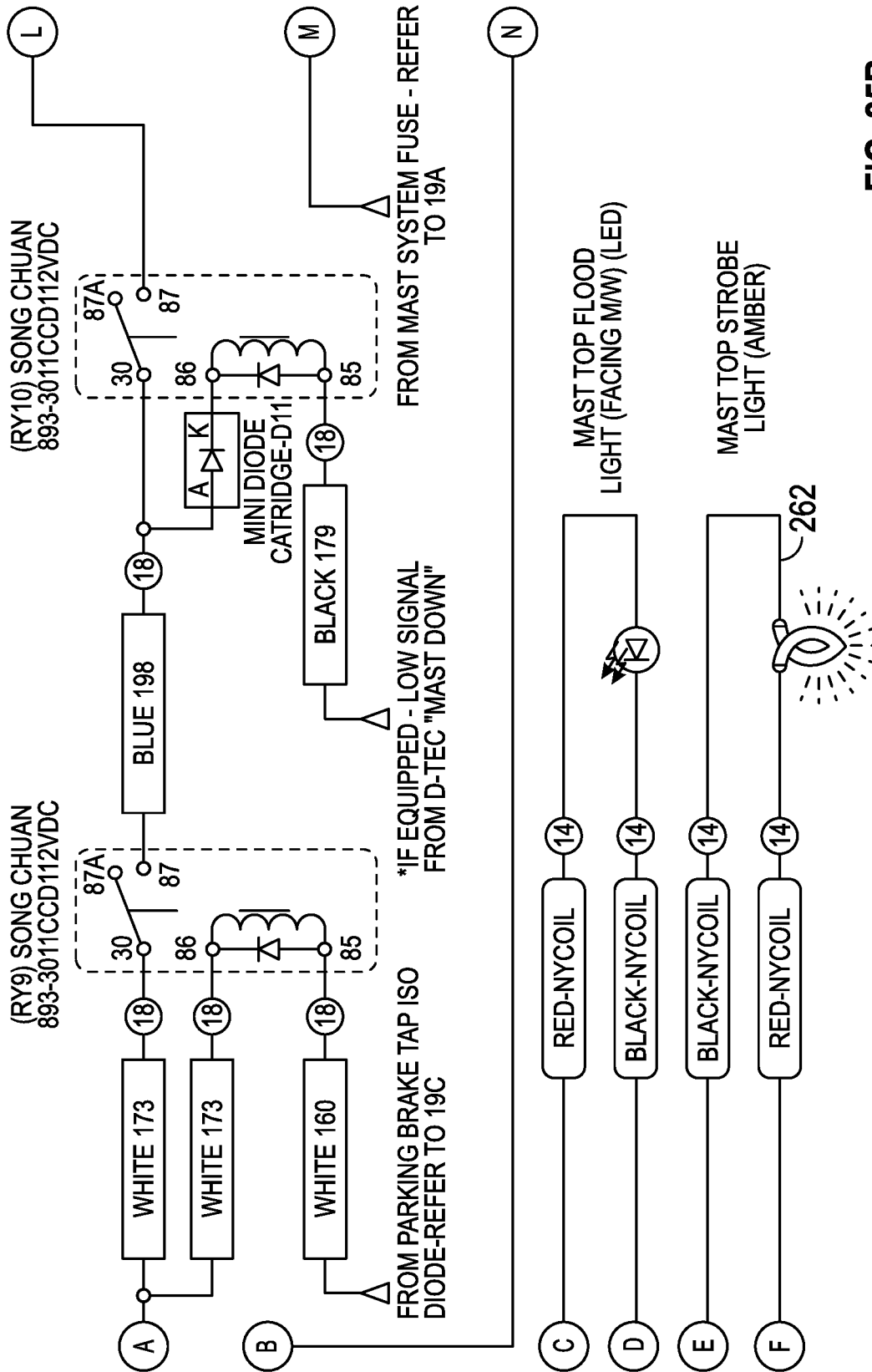


FIG. 25B

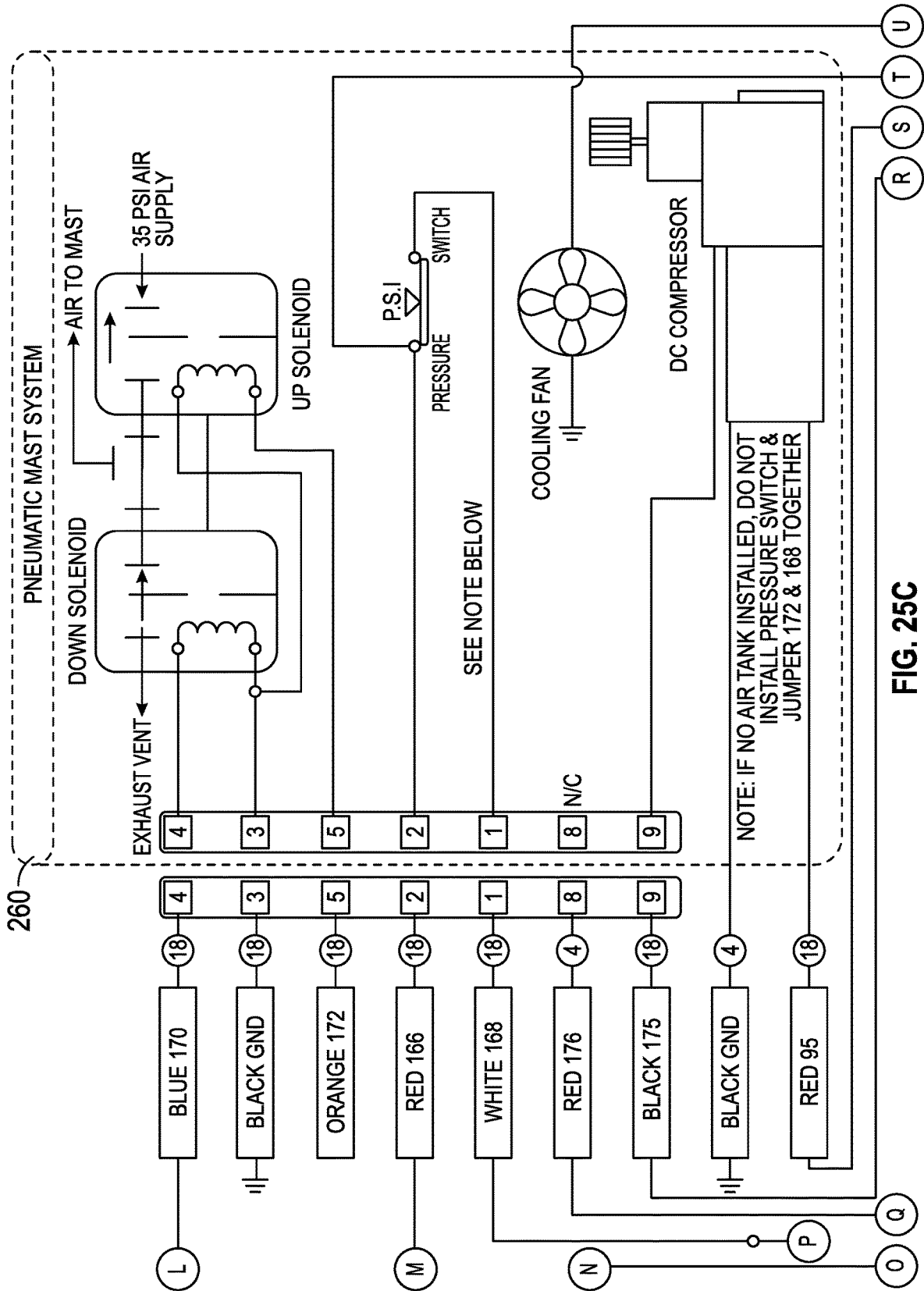


FIG. 25C

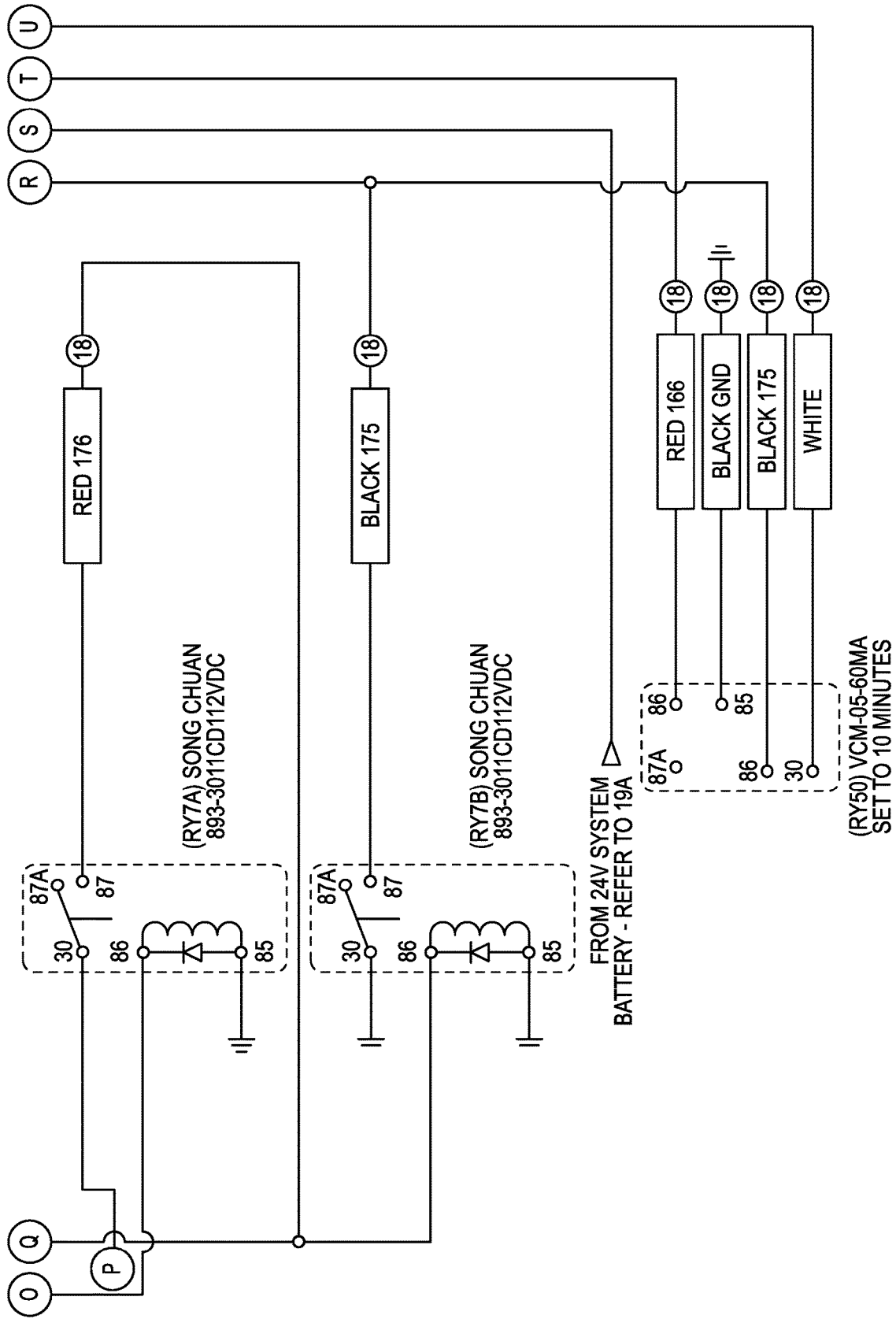


FIG. 25E

NOTE: RELAY LOCATED AT COMPRESSOR AREA

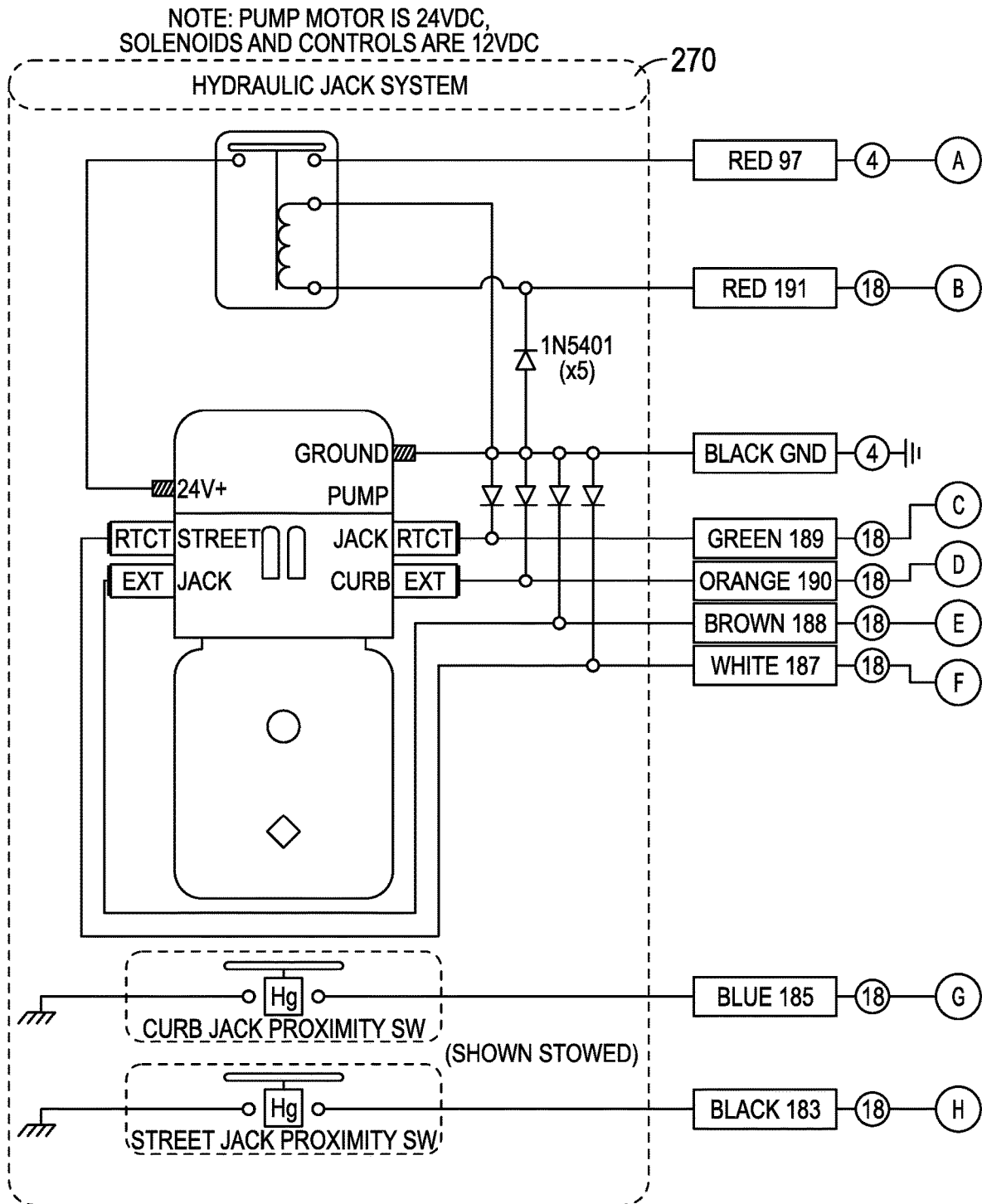


FIG. 26A

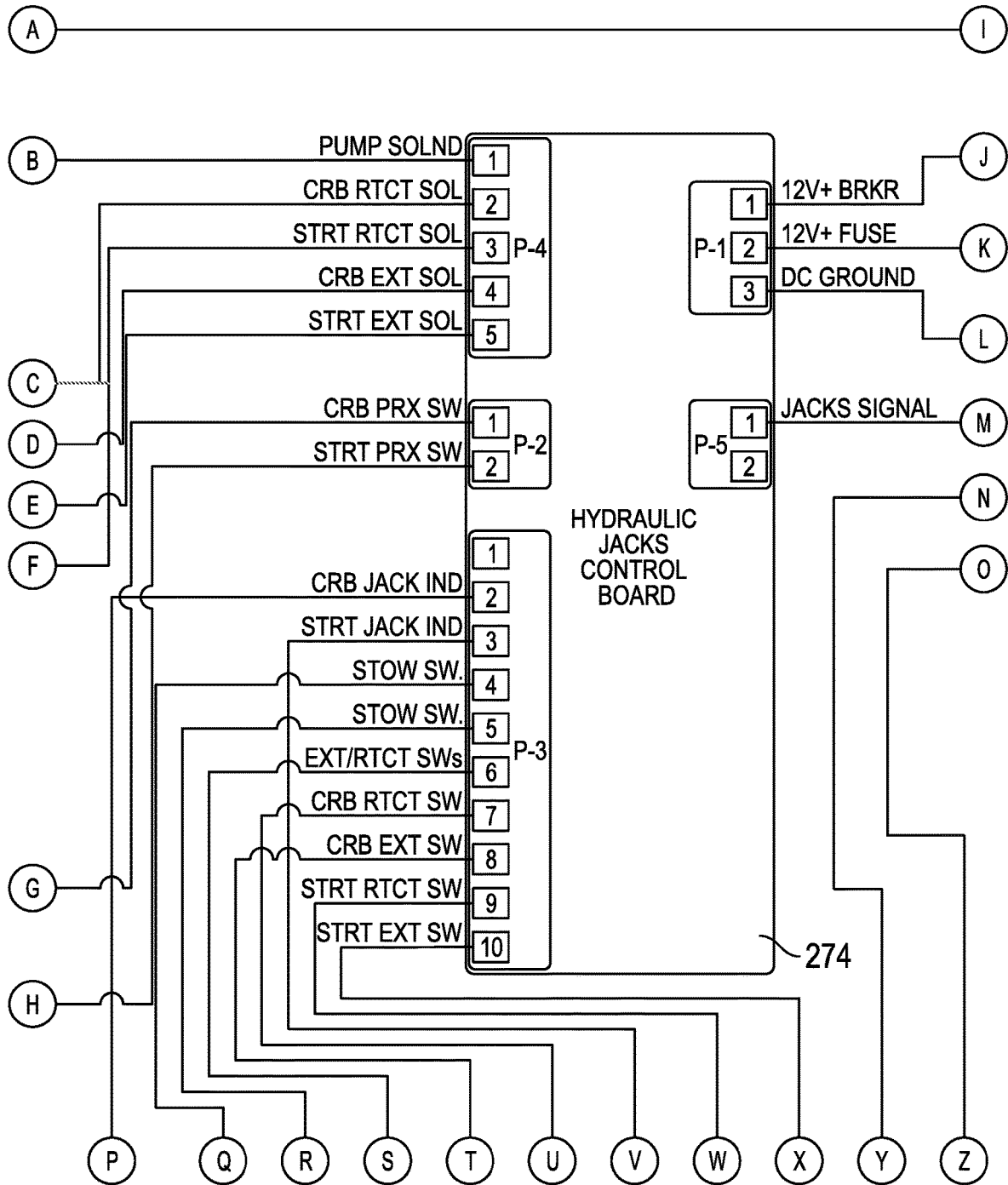


FIG. 26B

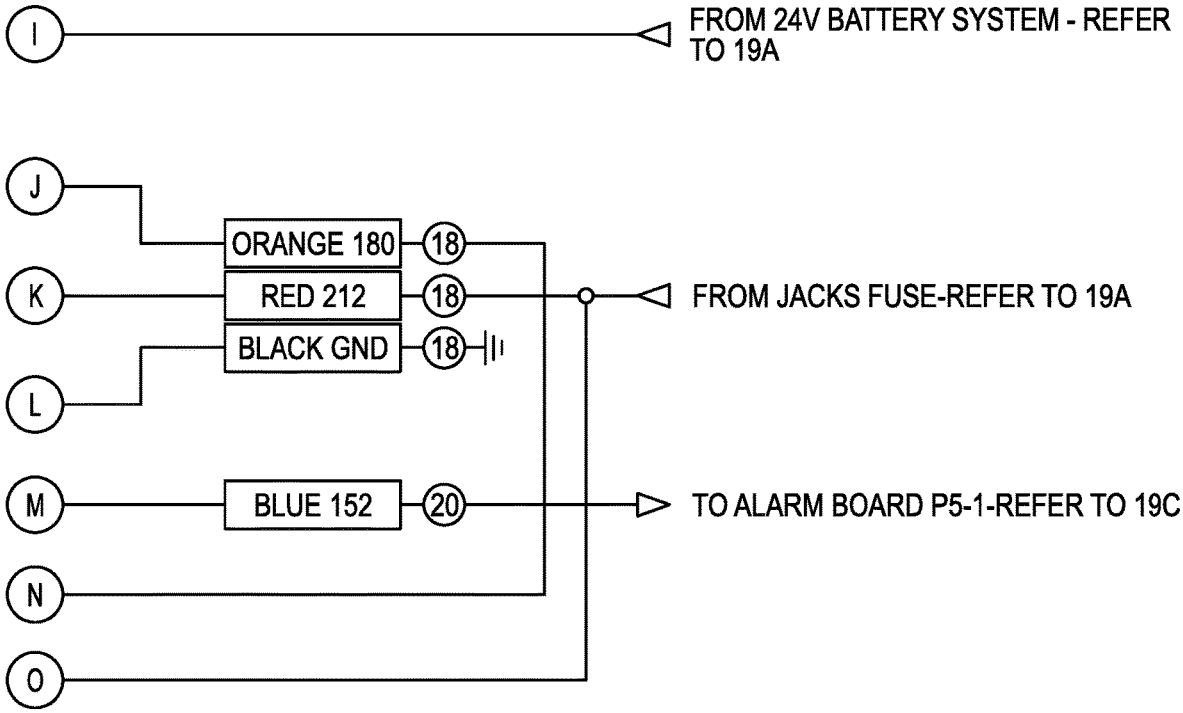


FIG. 26C

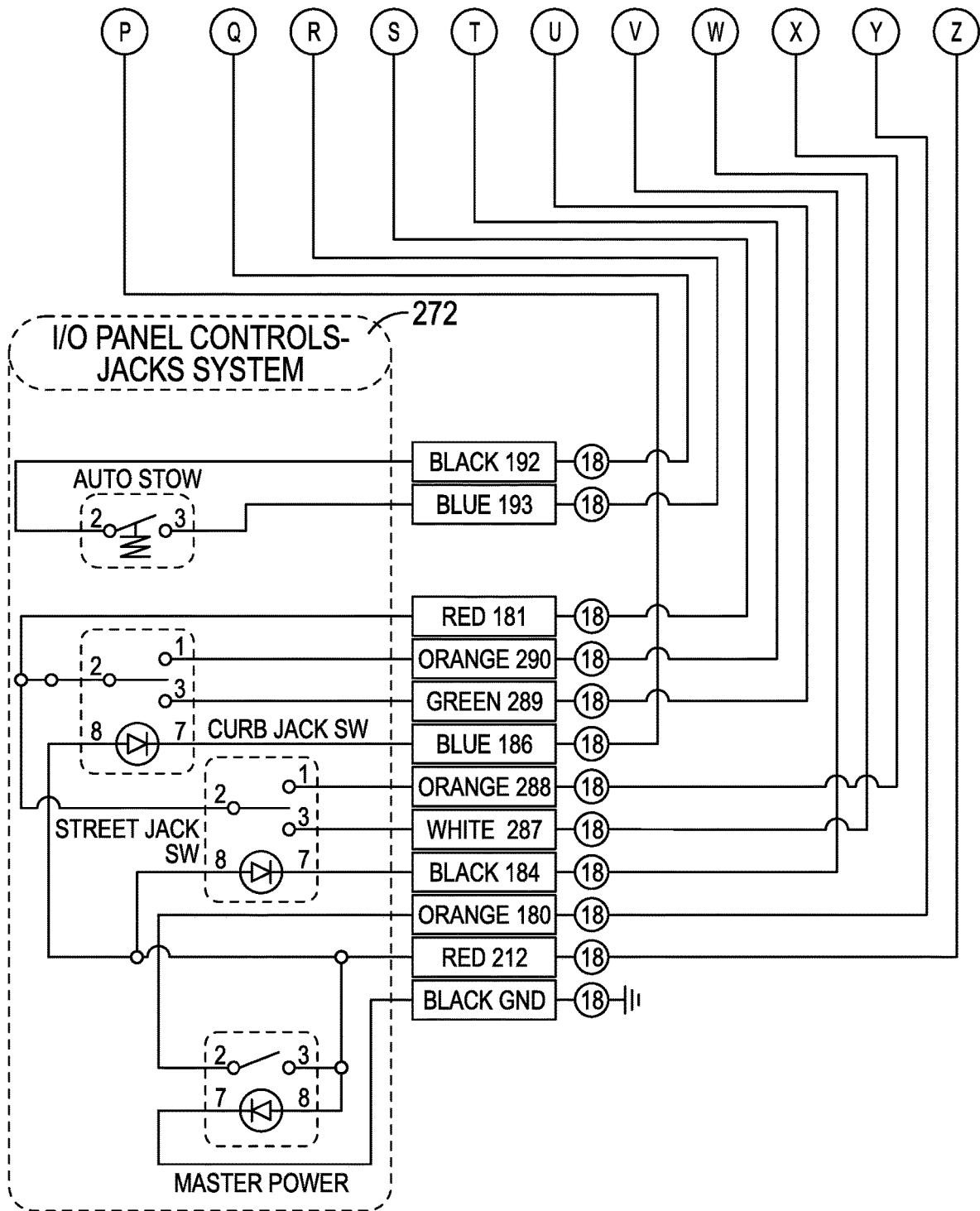
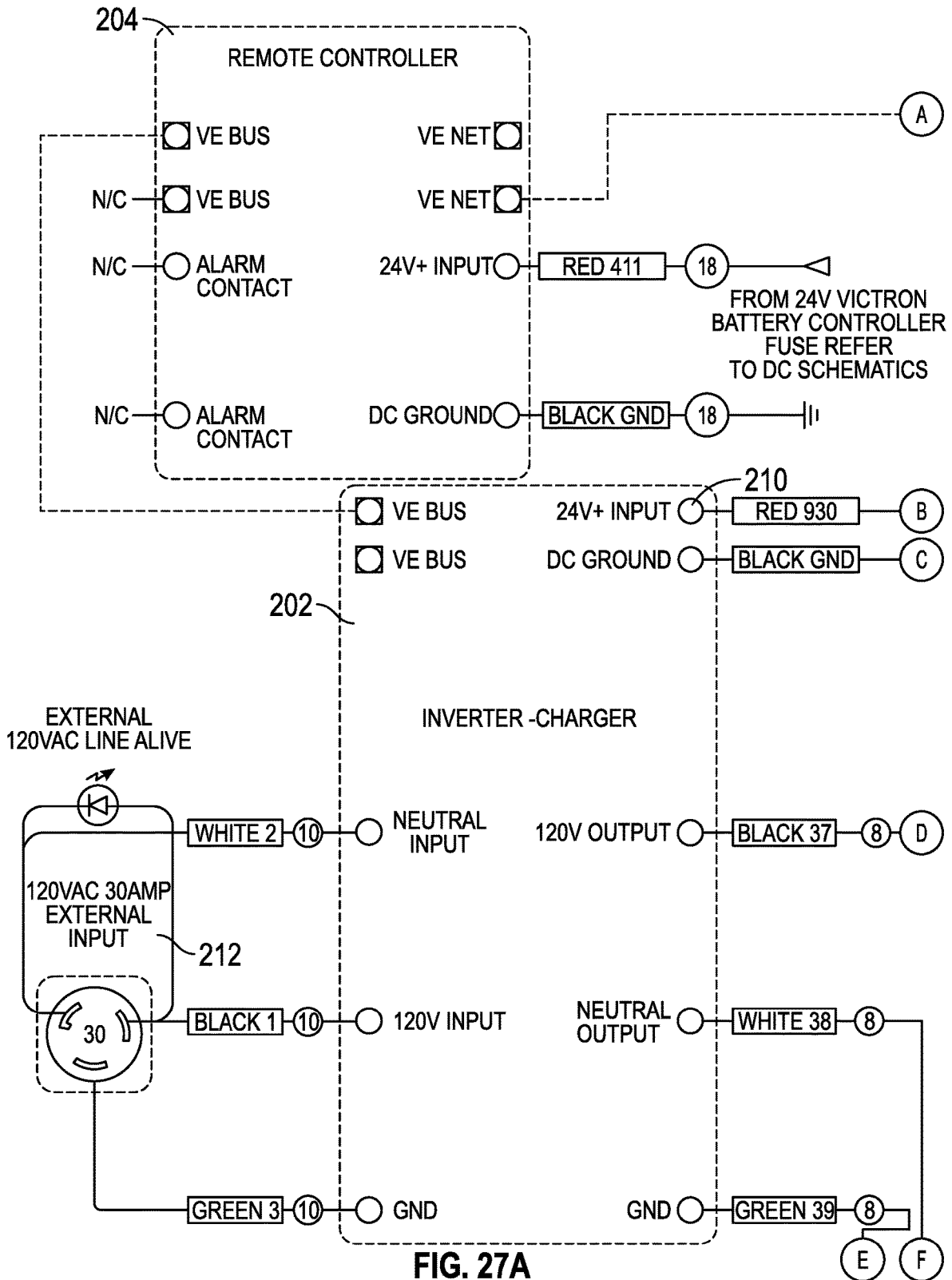


FIG. 26D



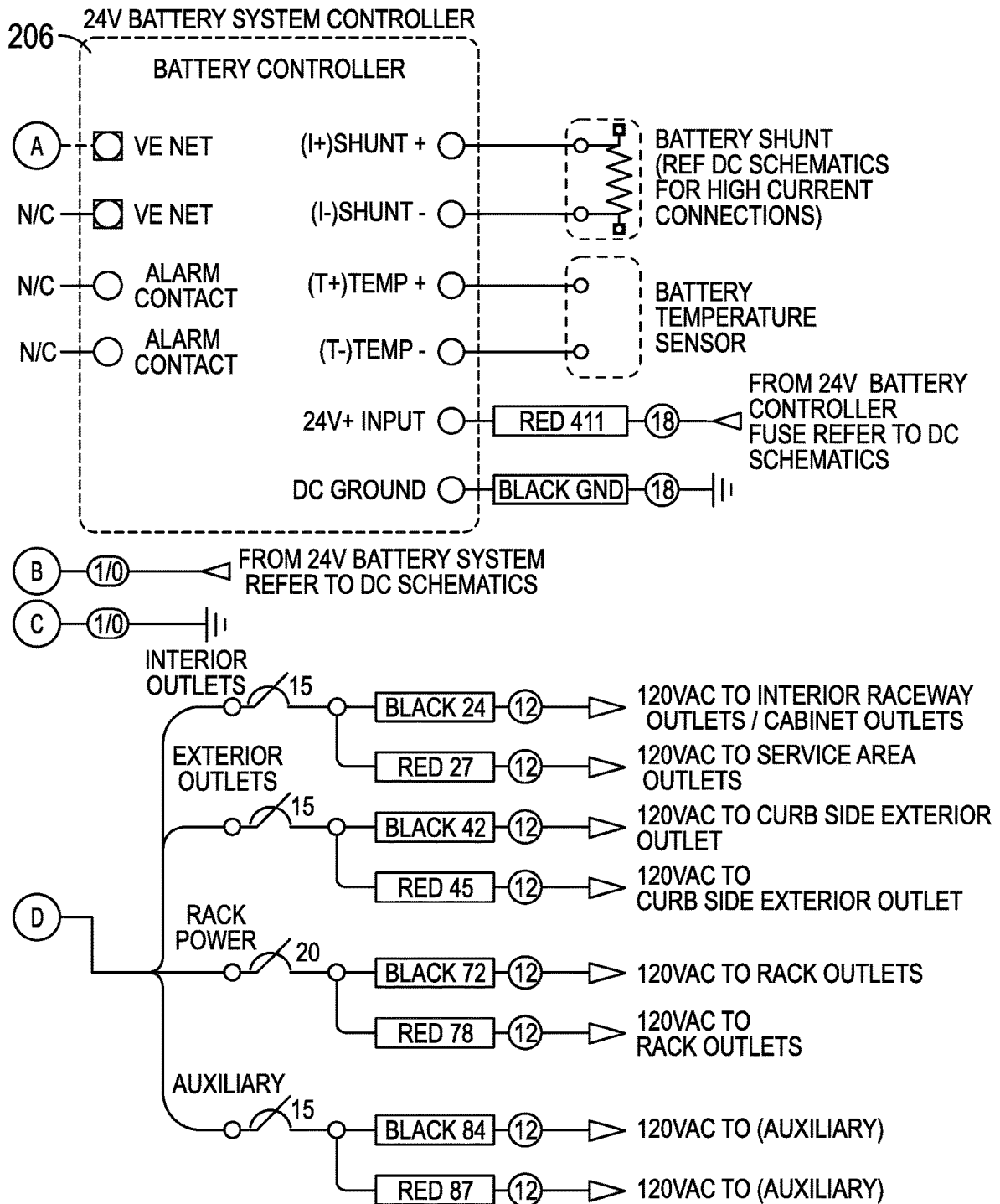


FIG. 27B

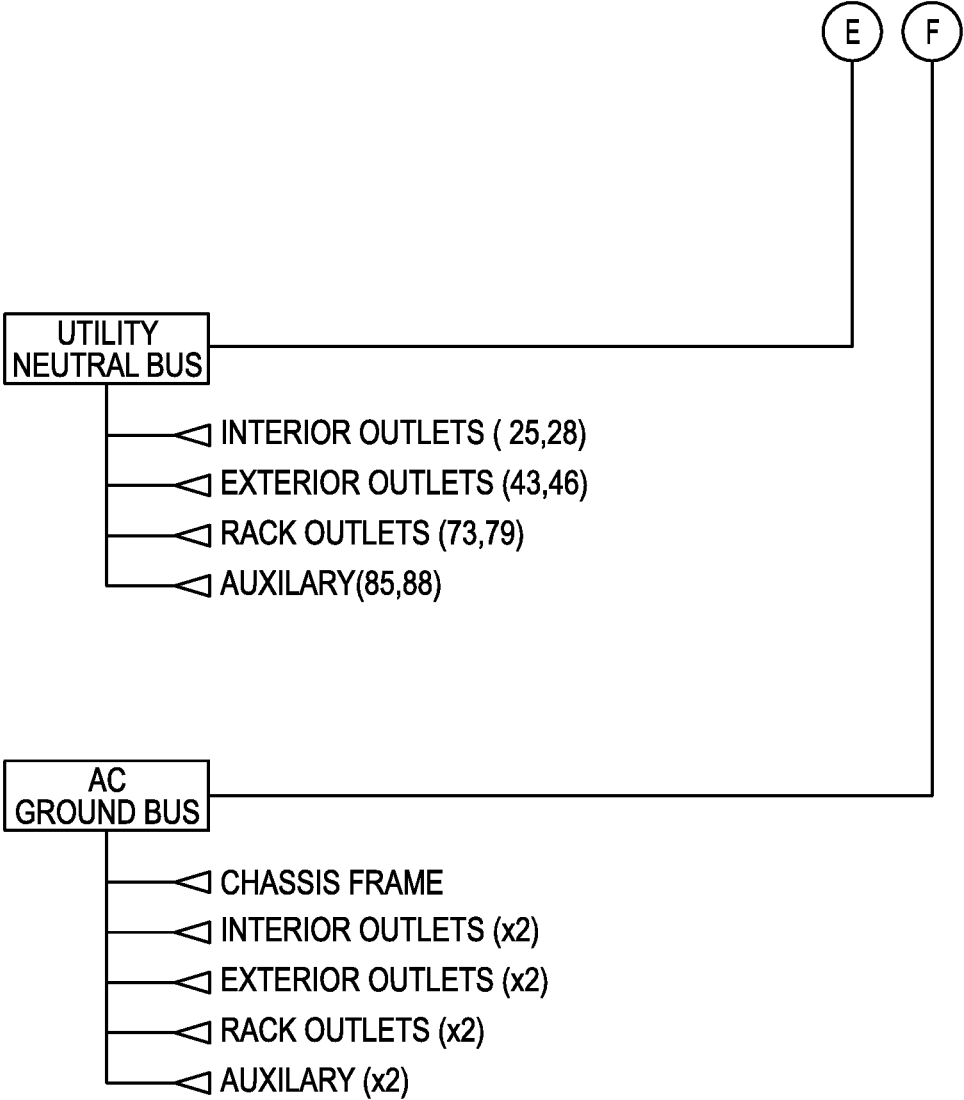


FIG. 27C

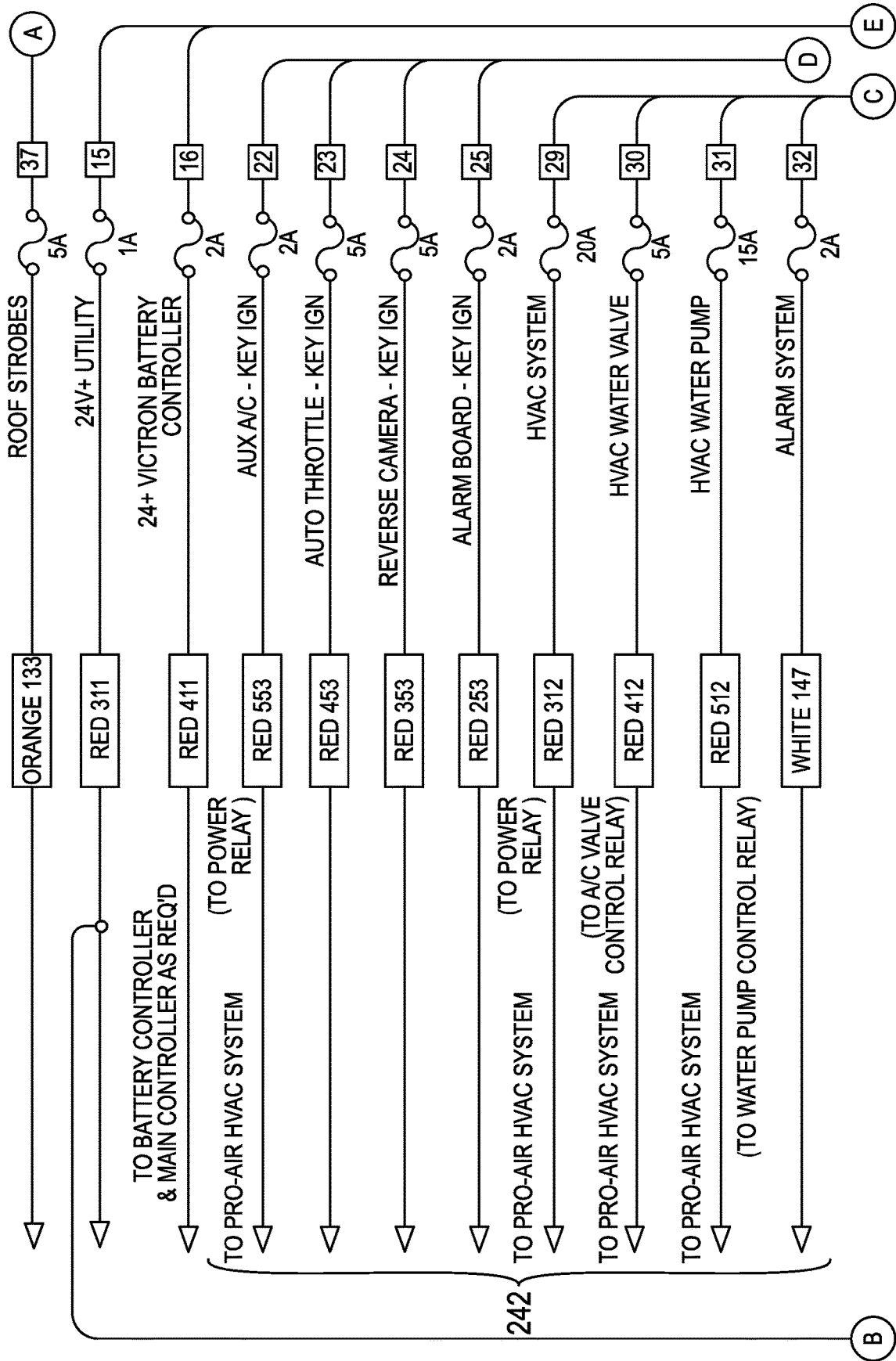


FIG. 28A

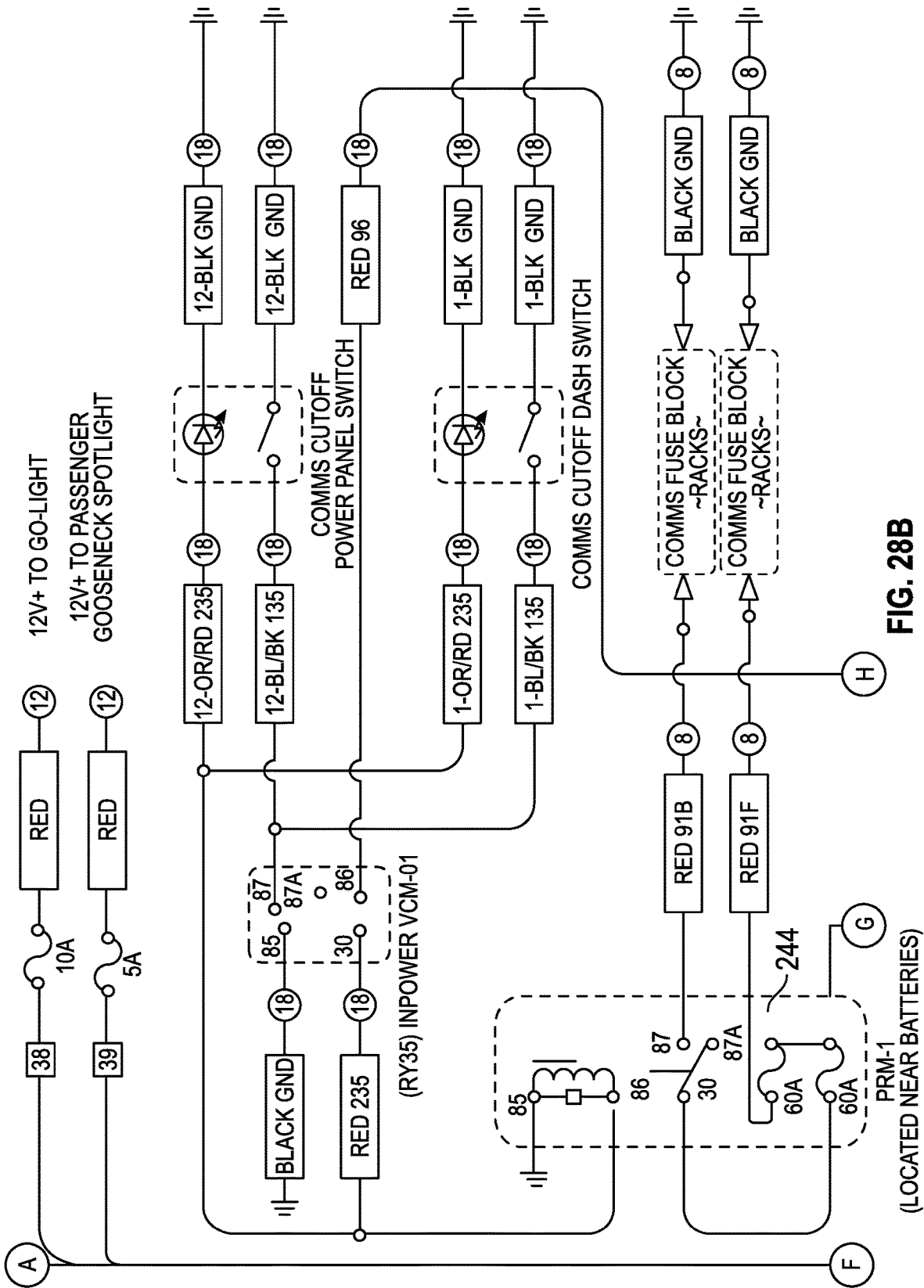
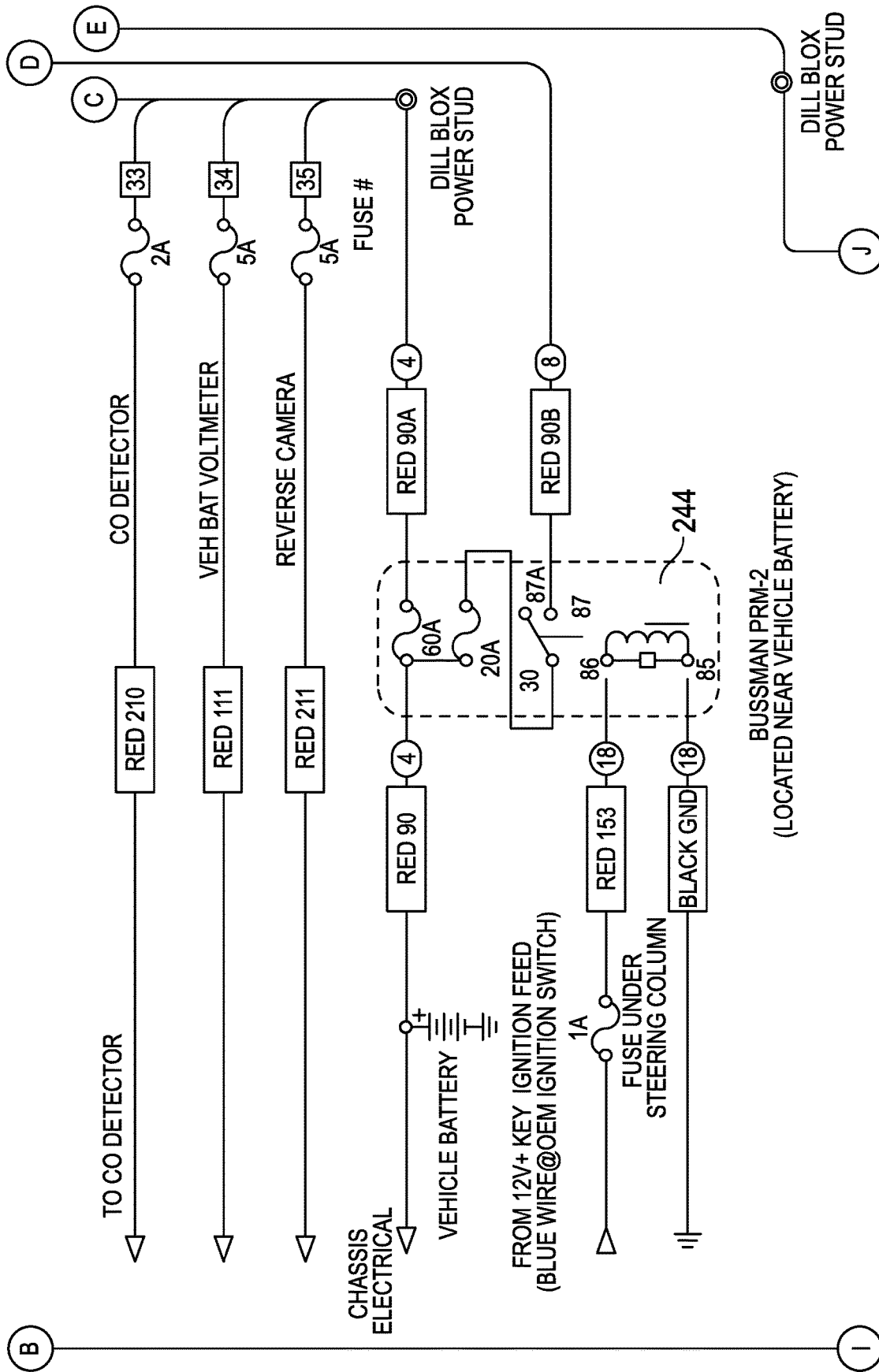


FIG. 28B



BUSSMAN PRIM-2
(LOCATED NEAR VEHICLE BATTERY)

FIG. 28C

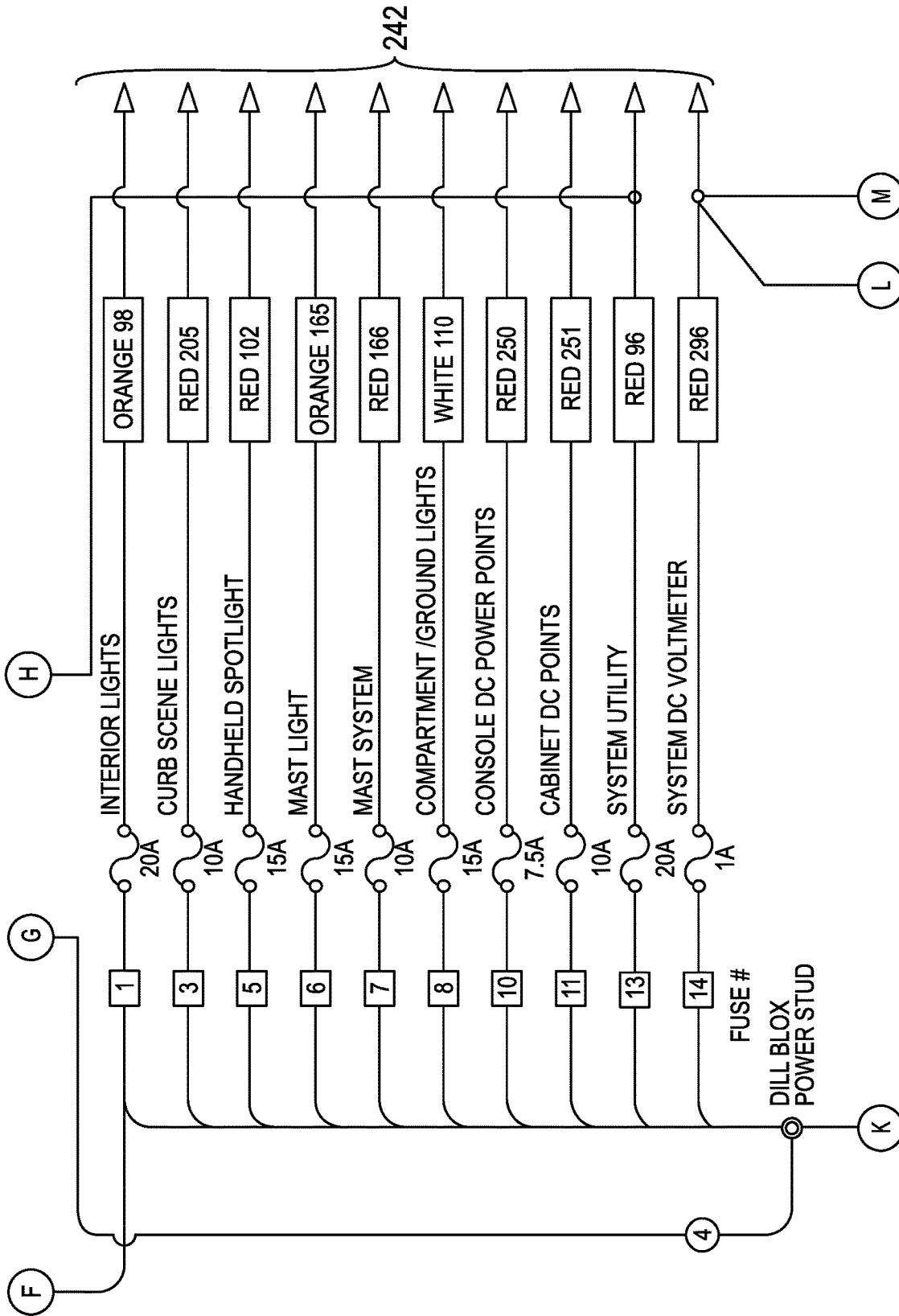


FIG. 28D

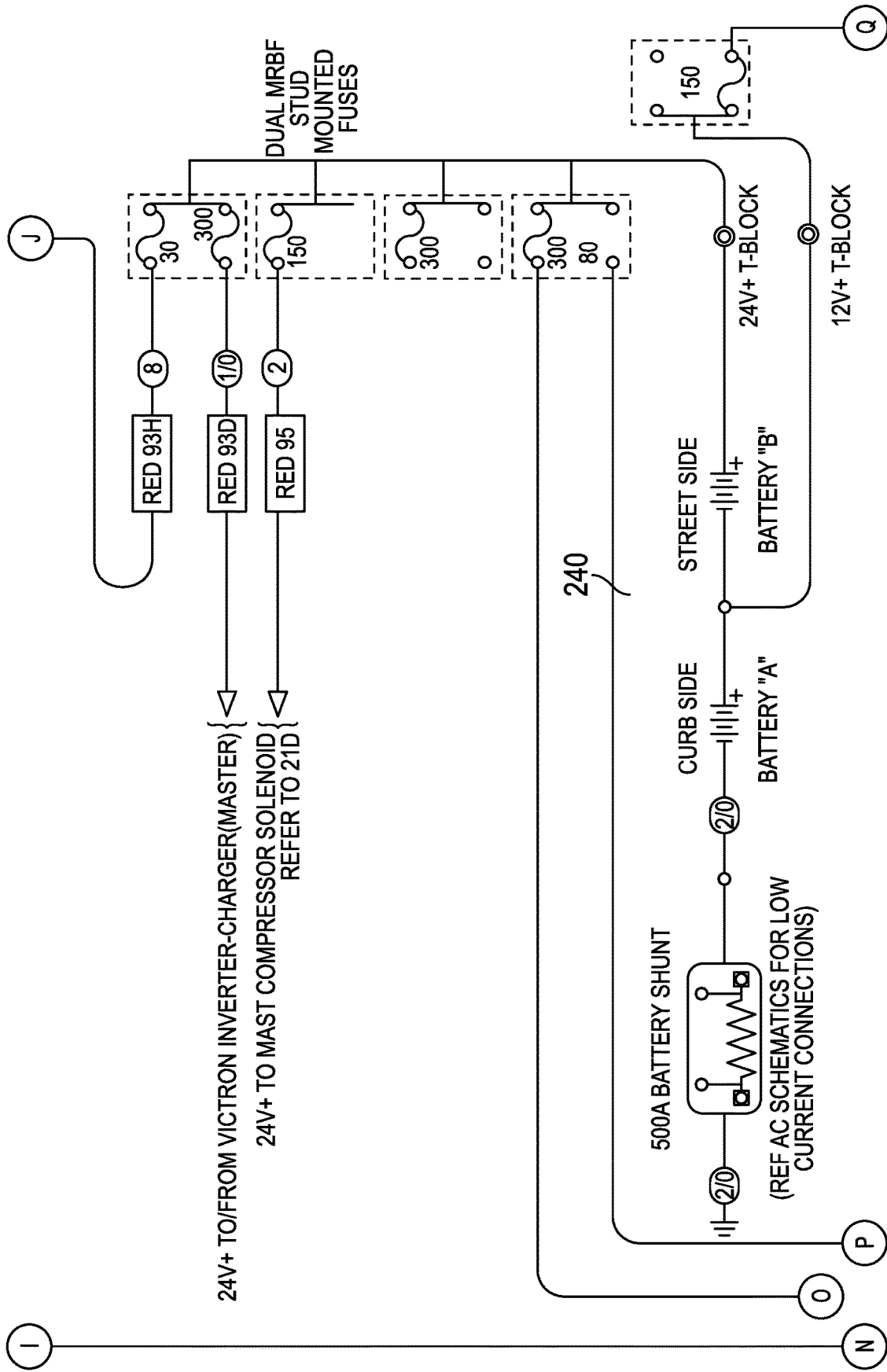


FIG. 28E

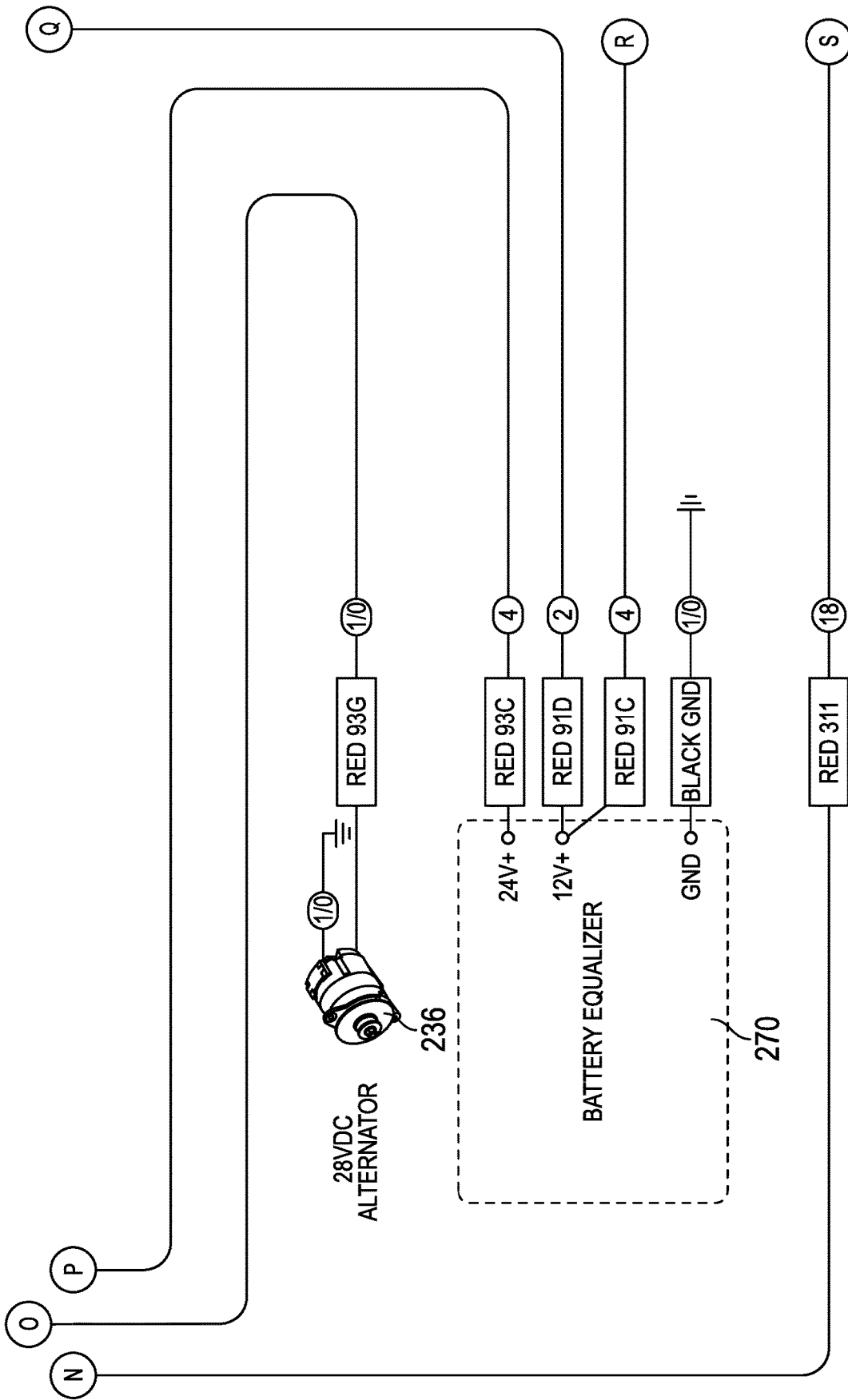


FIG. 28F

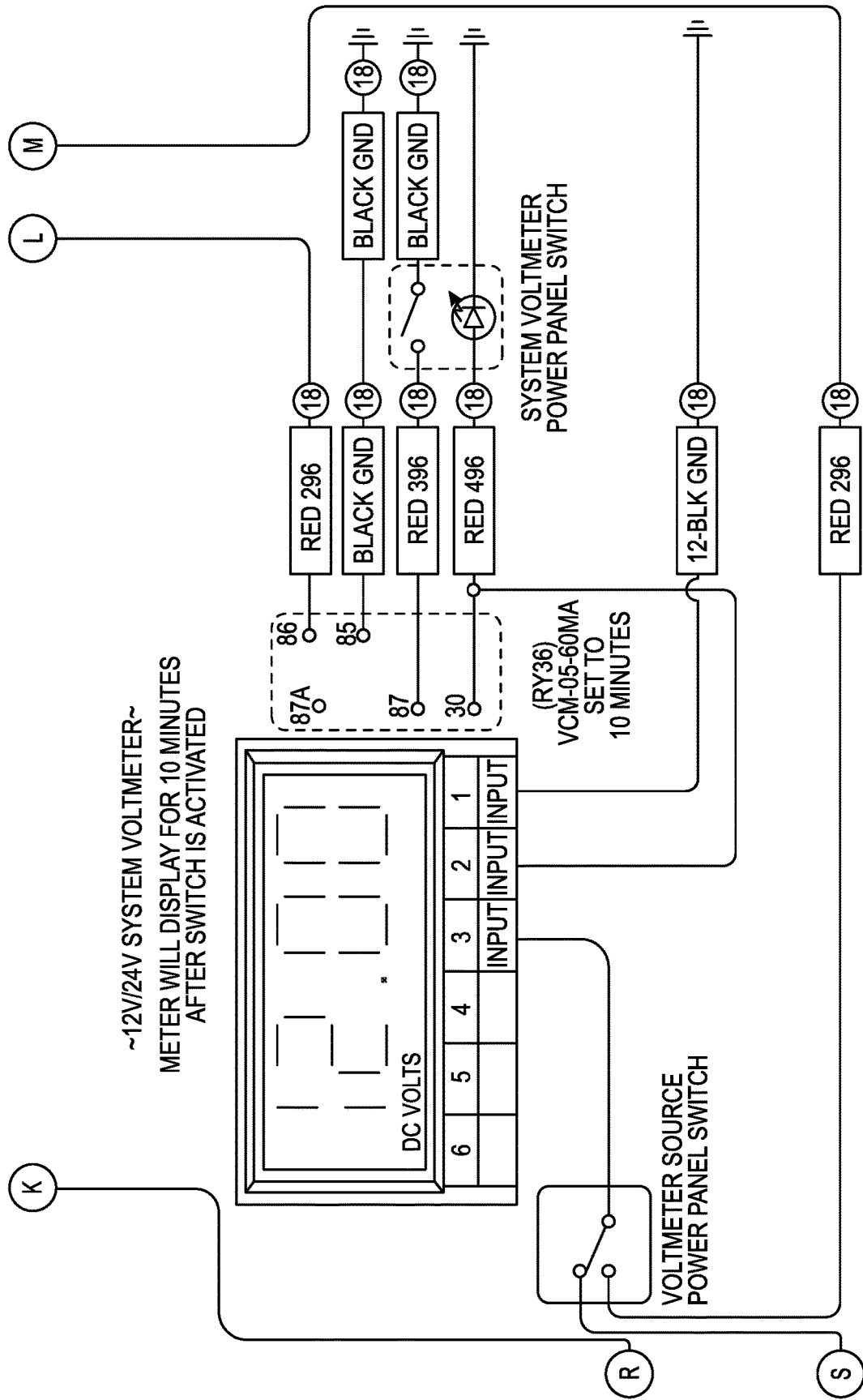


FIG. 28G

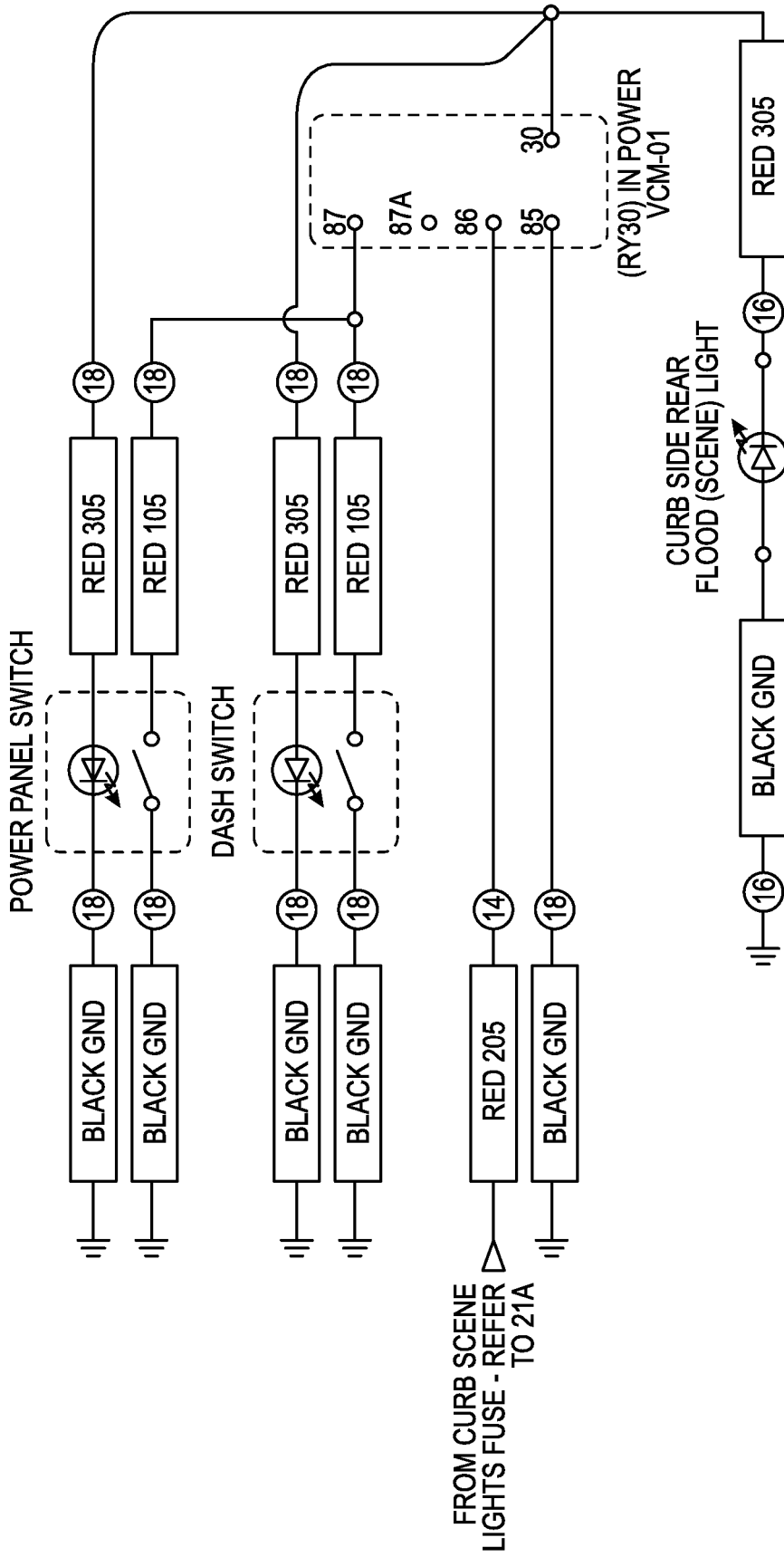


FIG. 29A

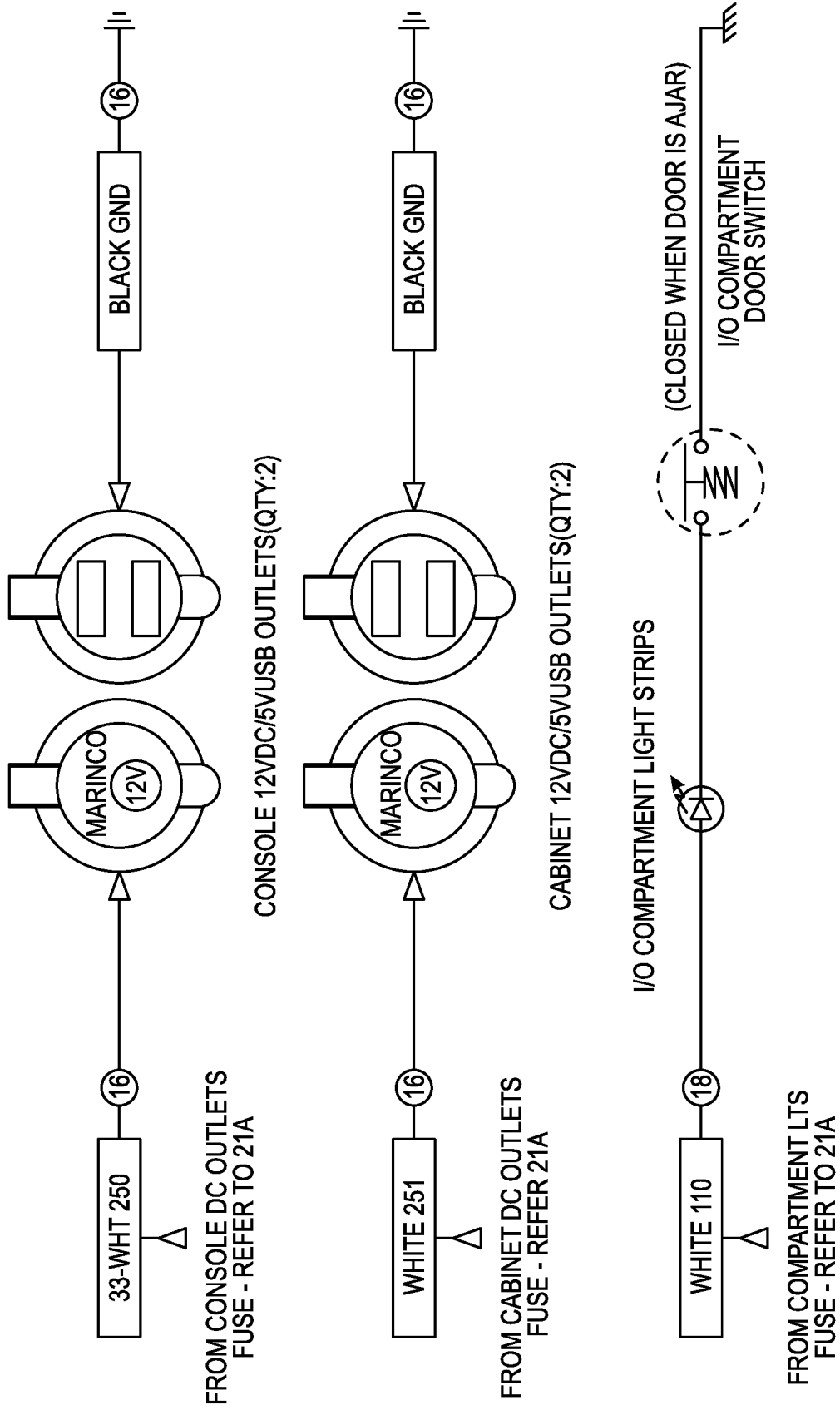


FIG. 29B

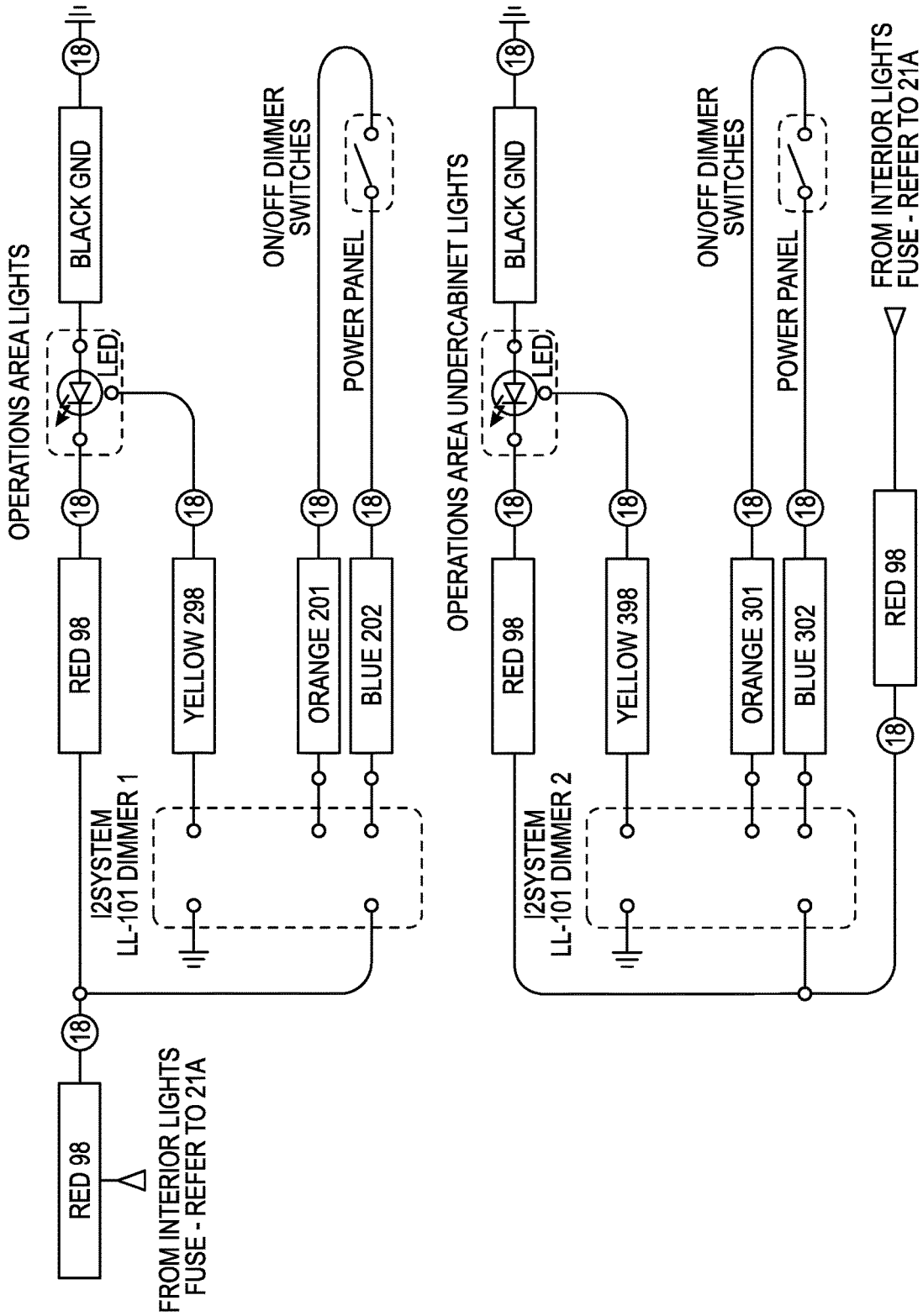


FIG. 29C

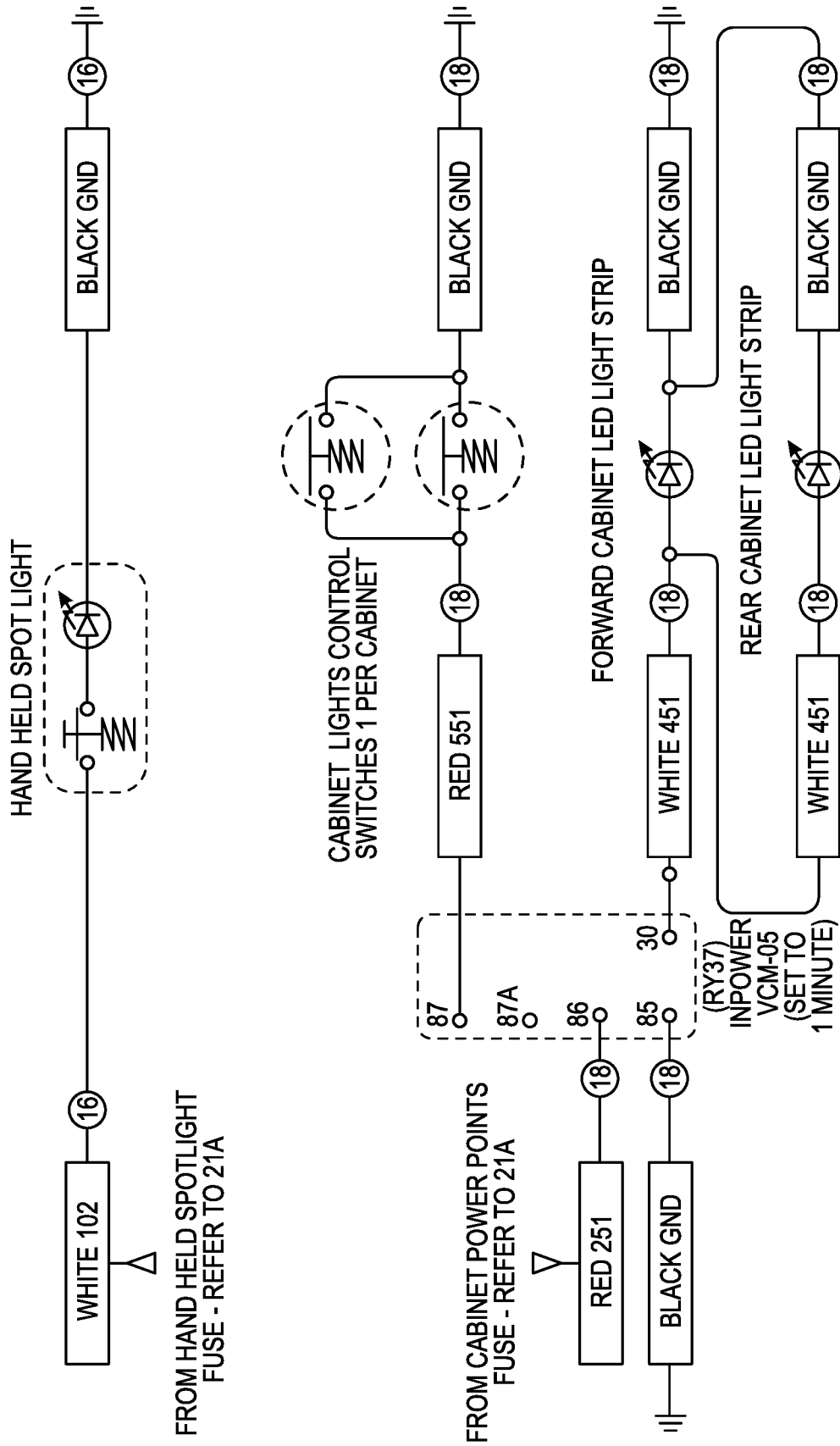


FIG. 29D

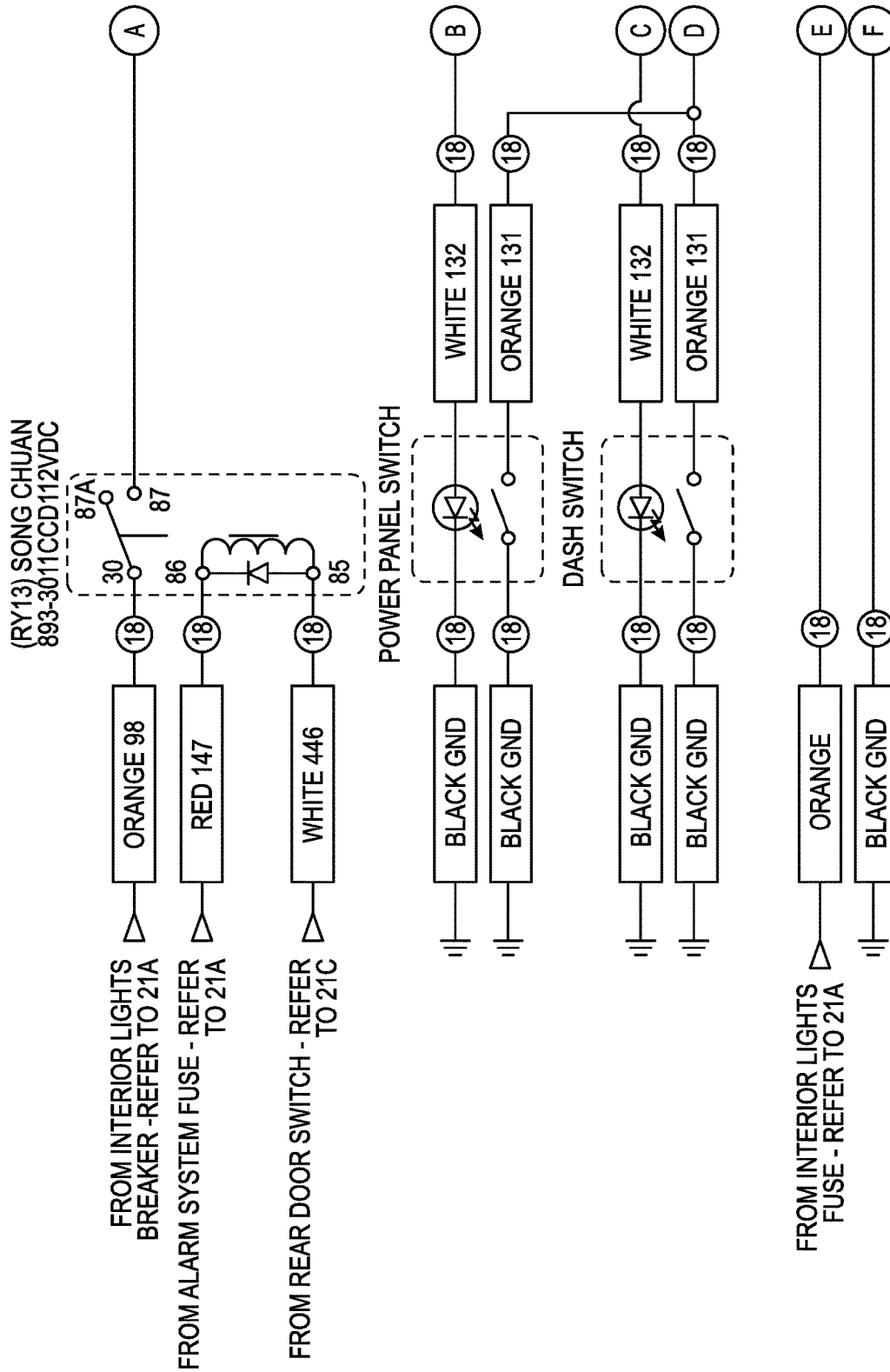


FIG. 29E

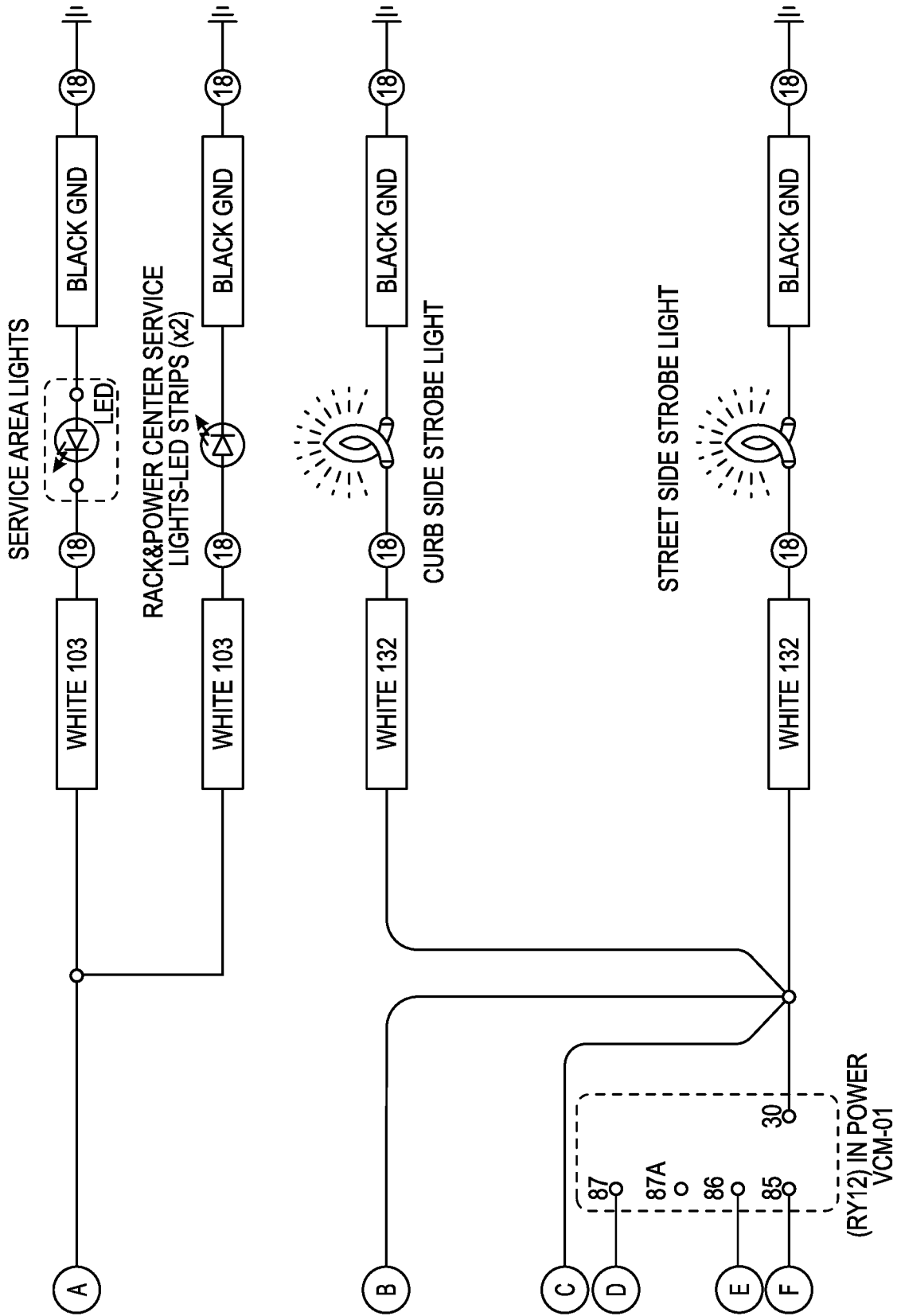


FIG. 29F

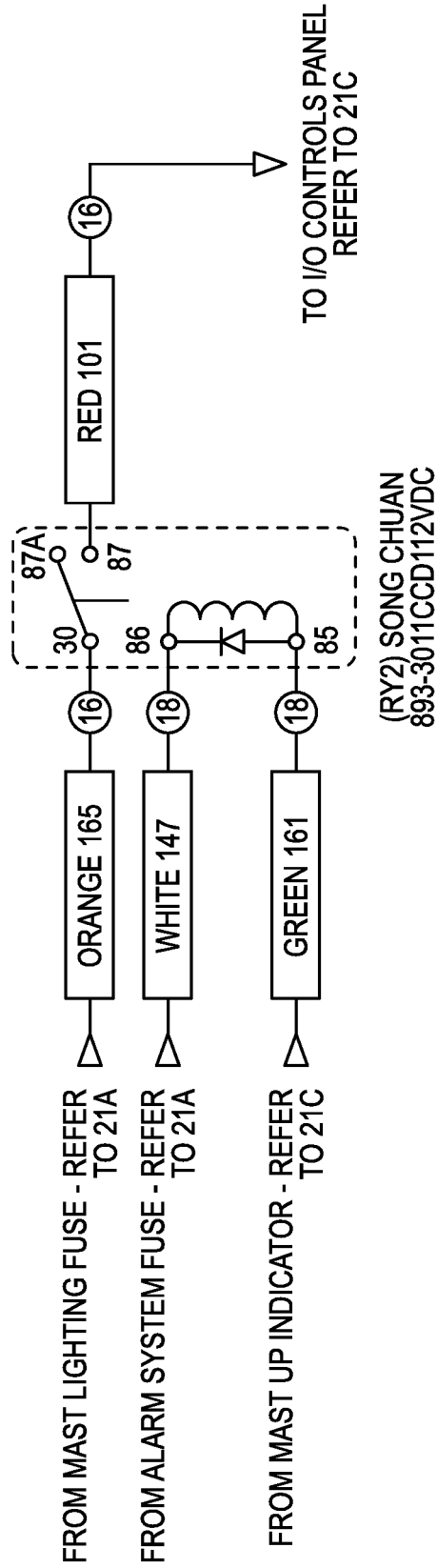


FIG. 29G

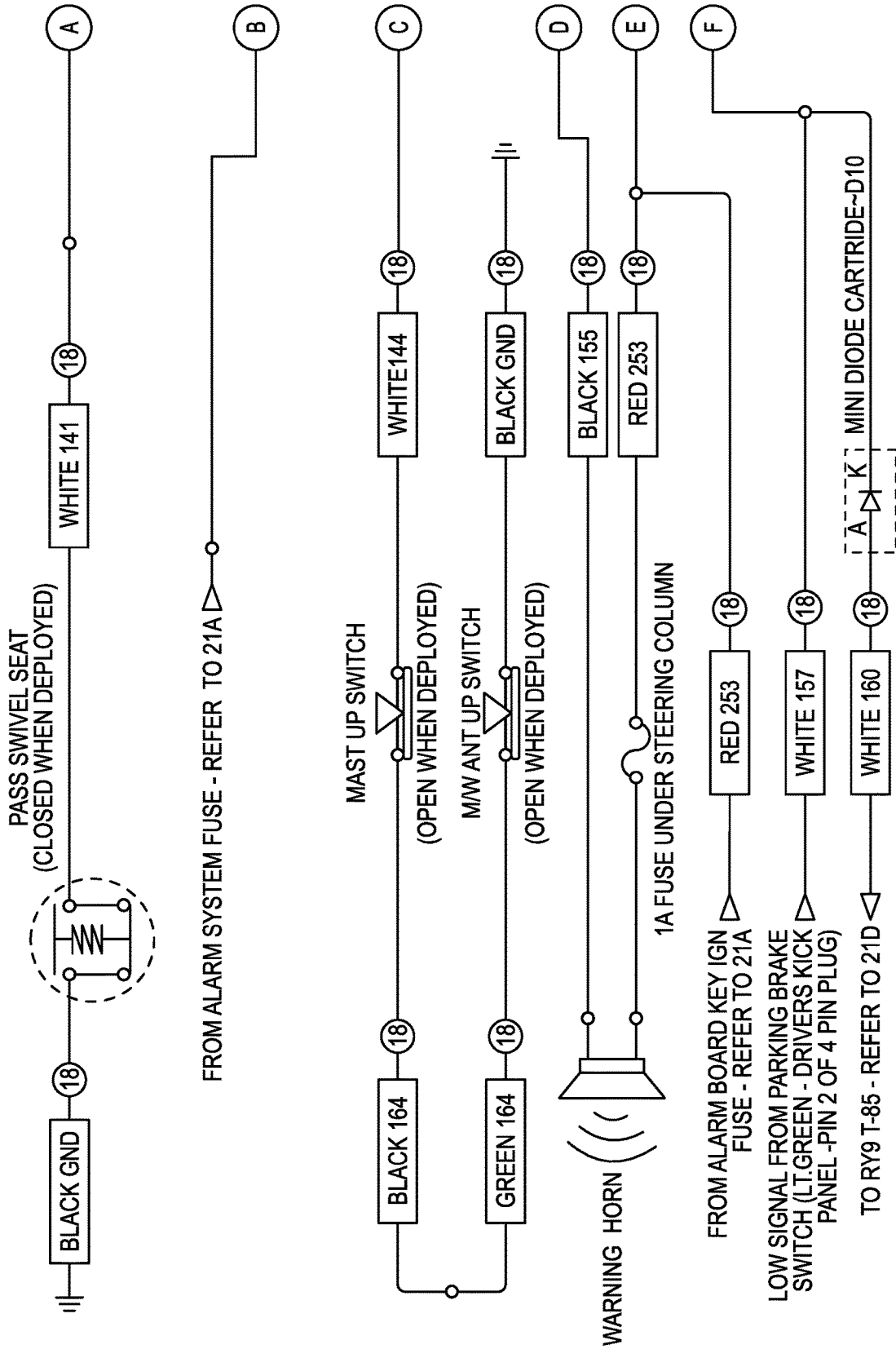


FIG. 30A

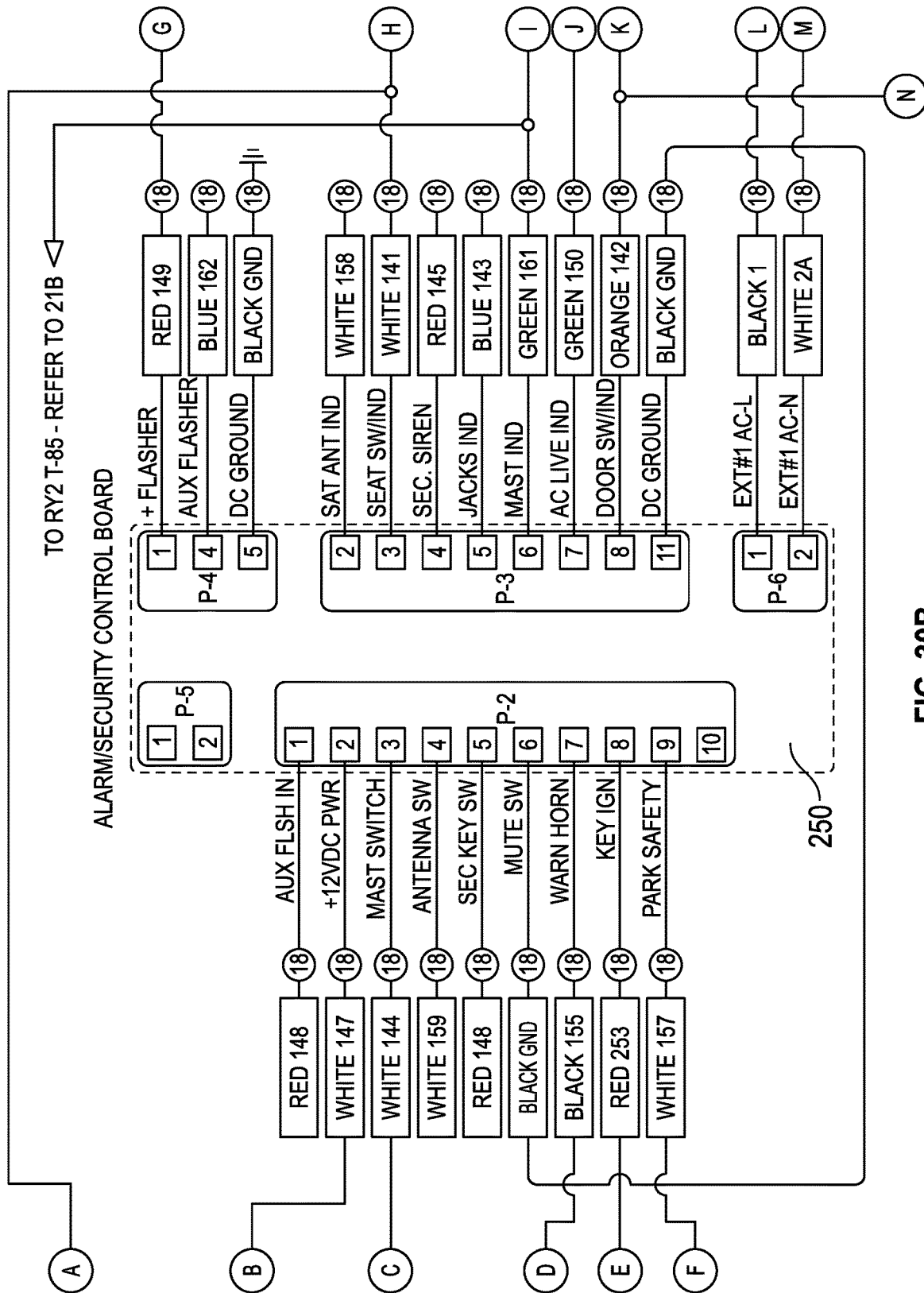


FIG. 30B

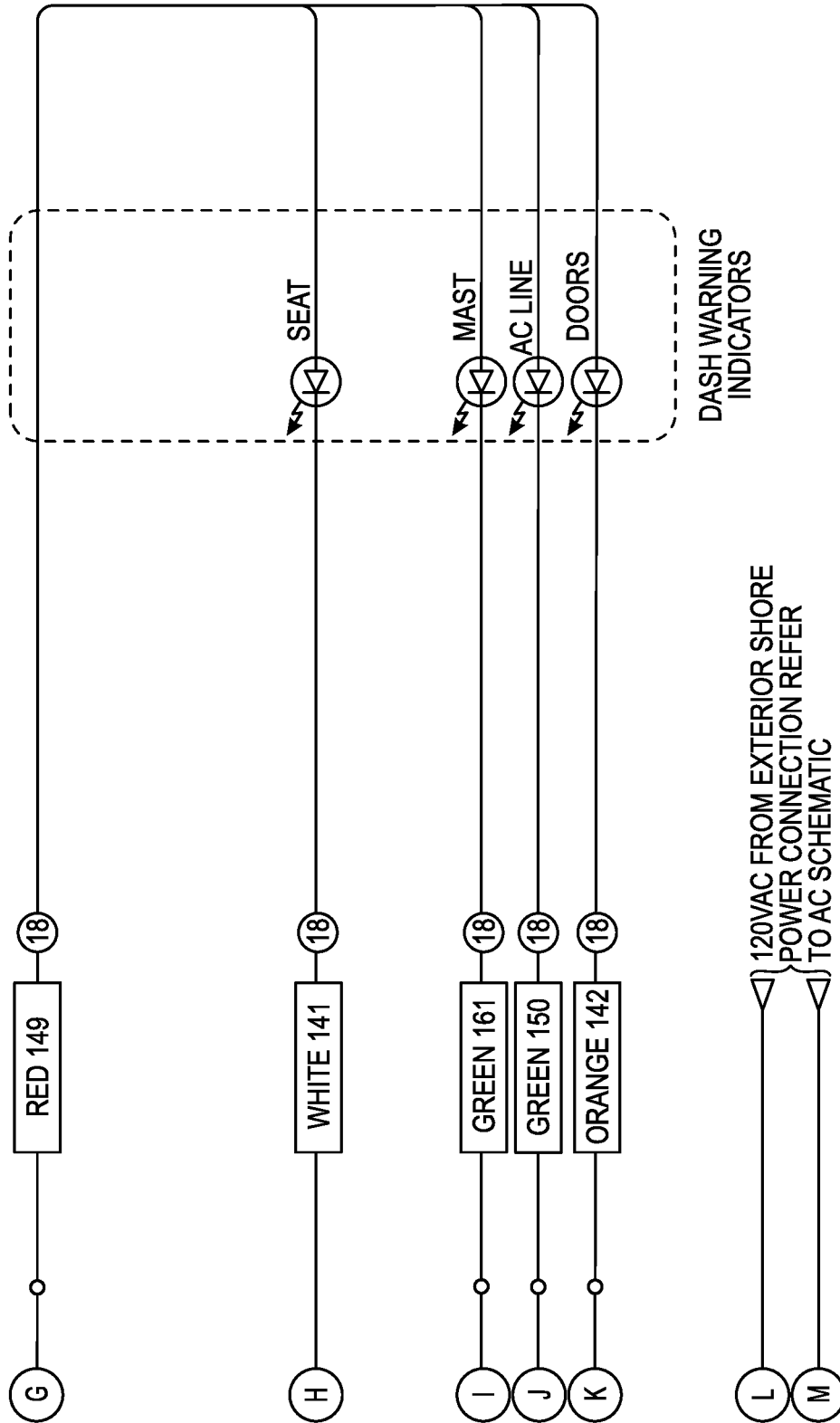


FIG. 30C

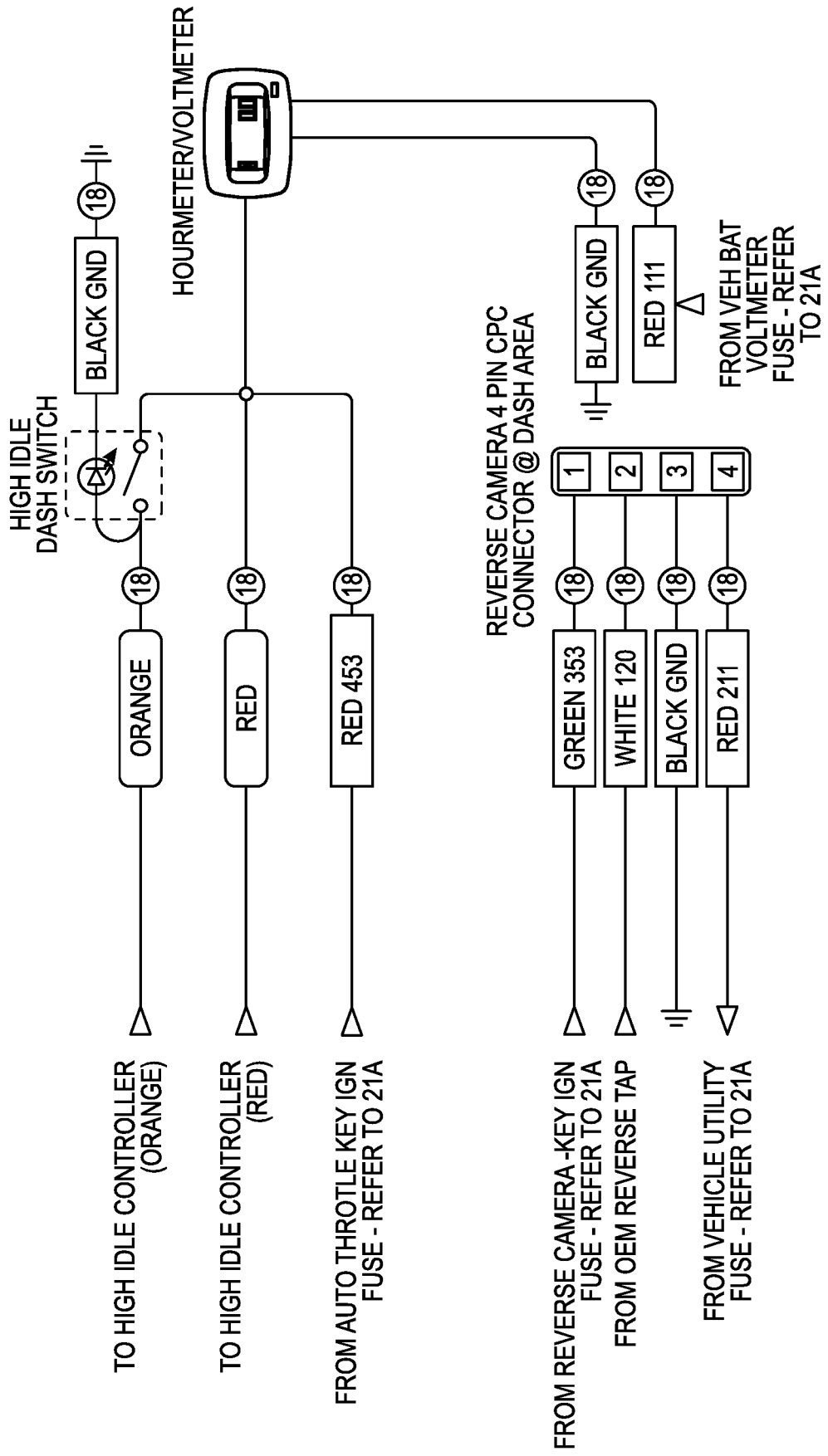


FIG. 30D

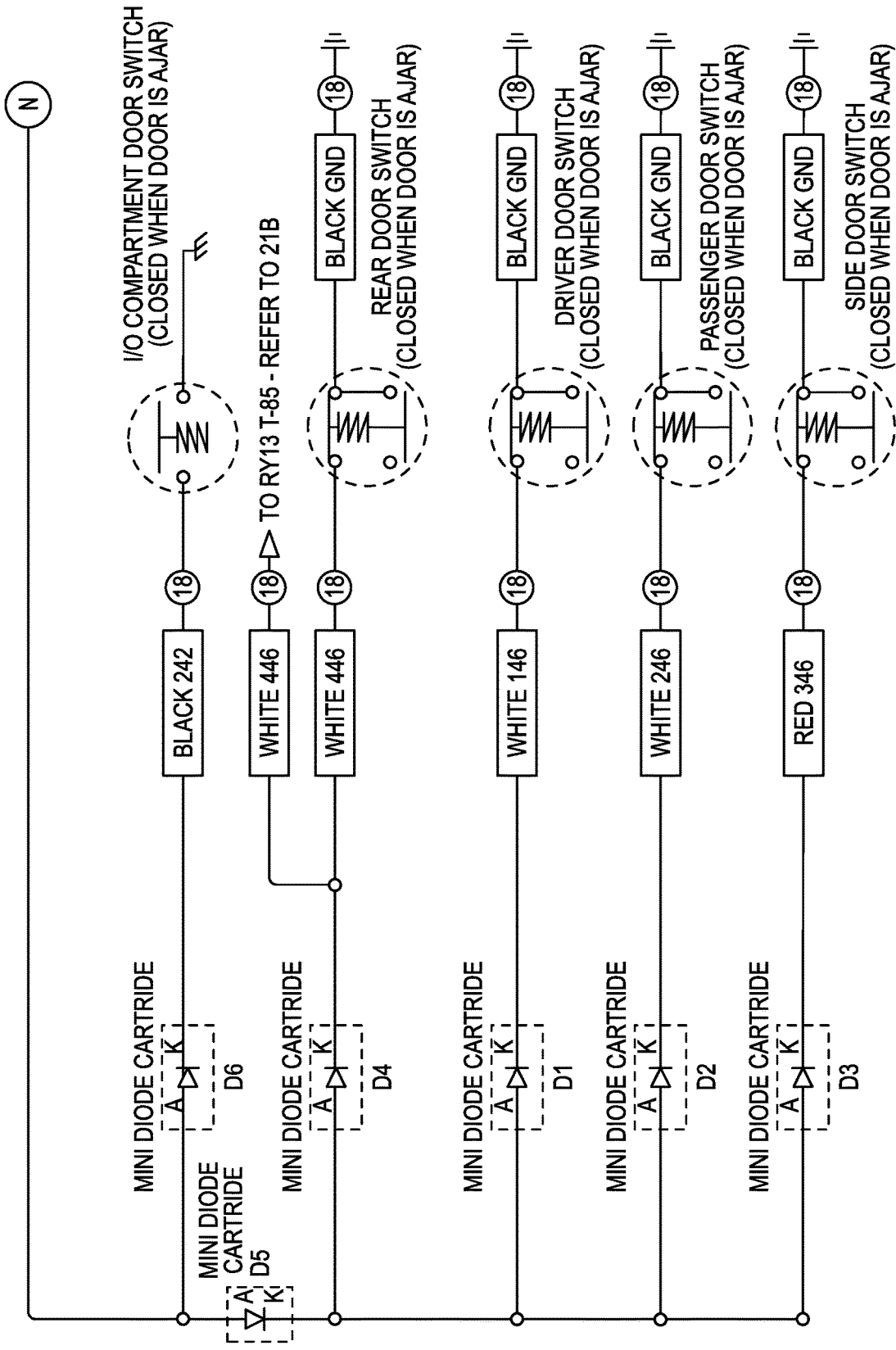


FIG. 30E

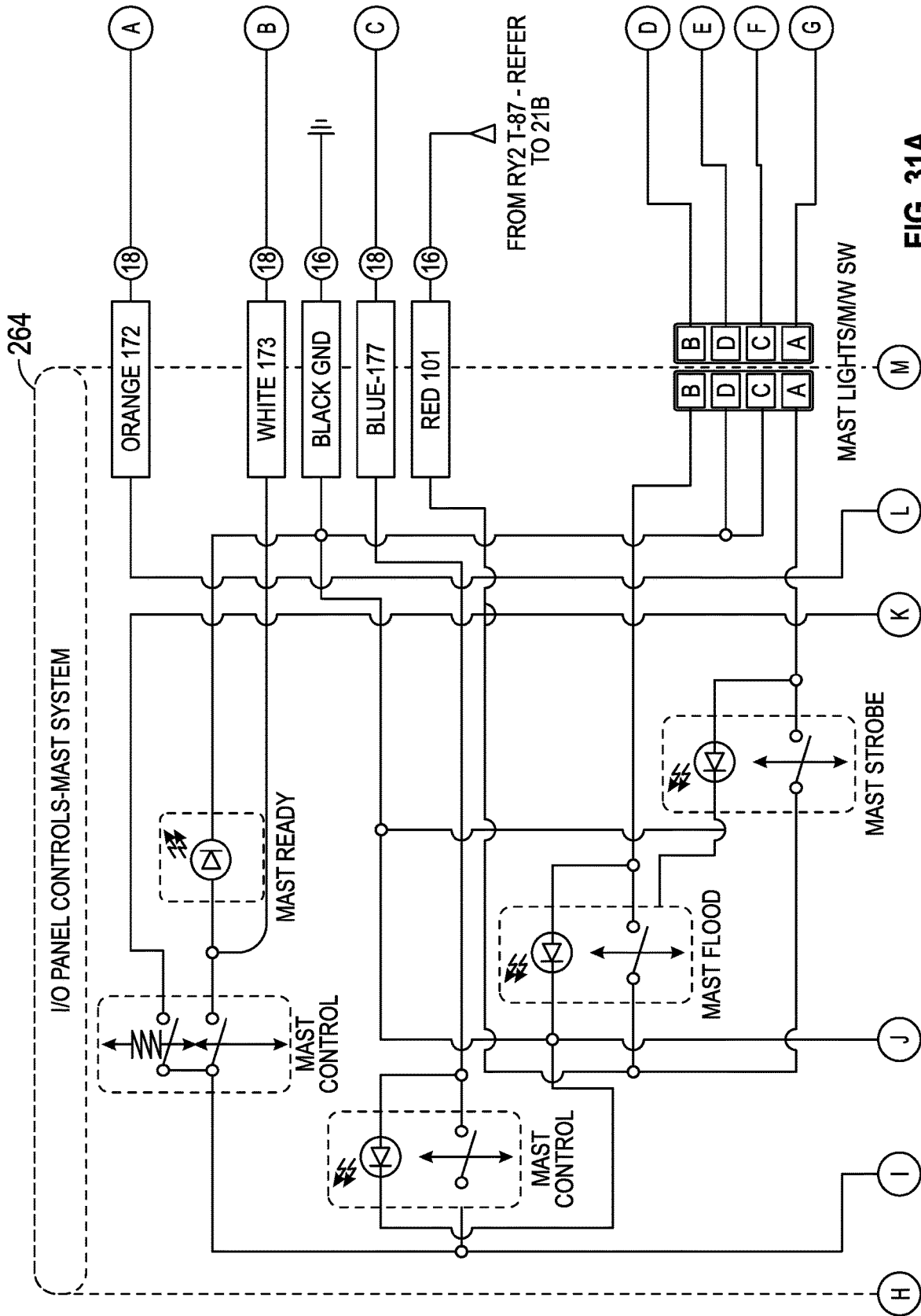


FIG. 31A

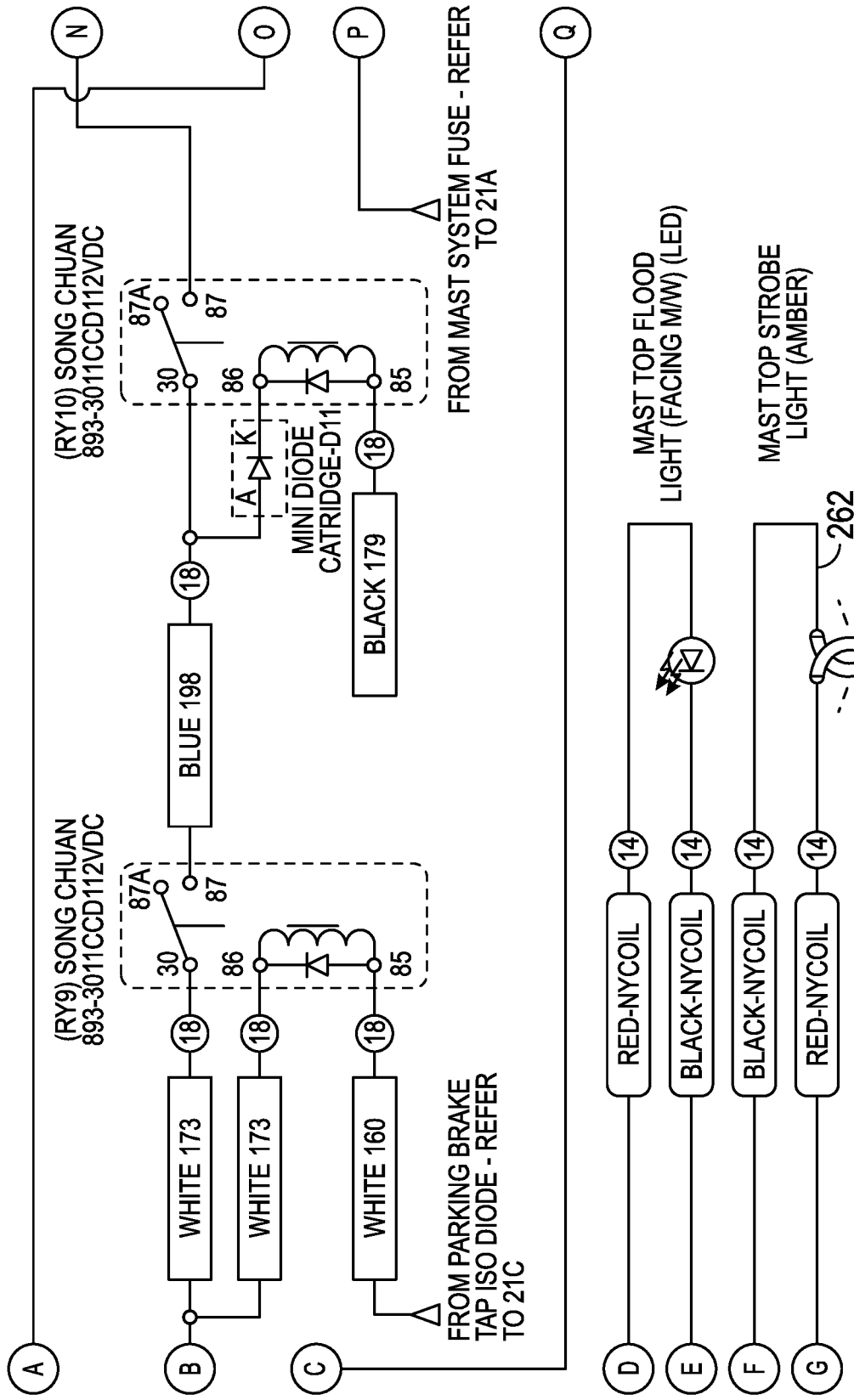


FIG. 31B

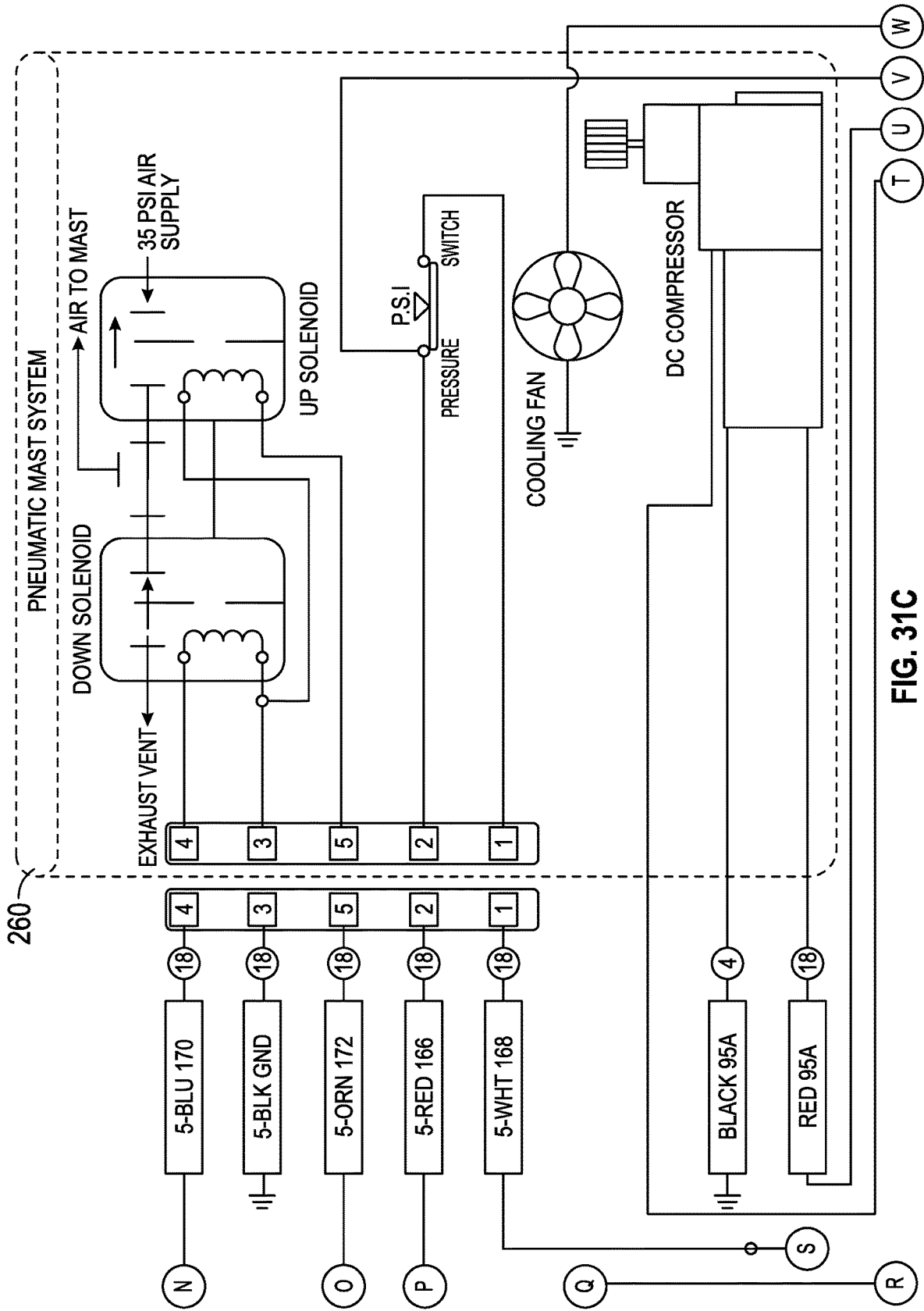


FIG. 31C

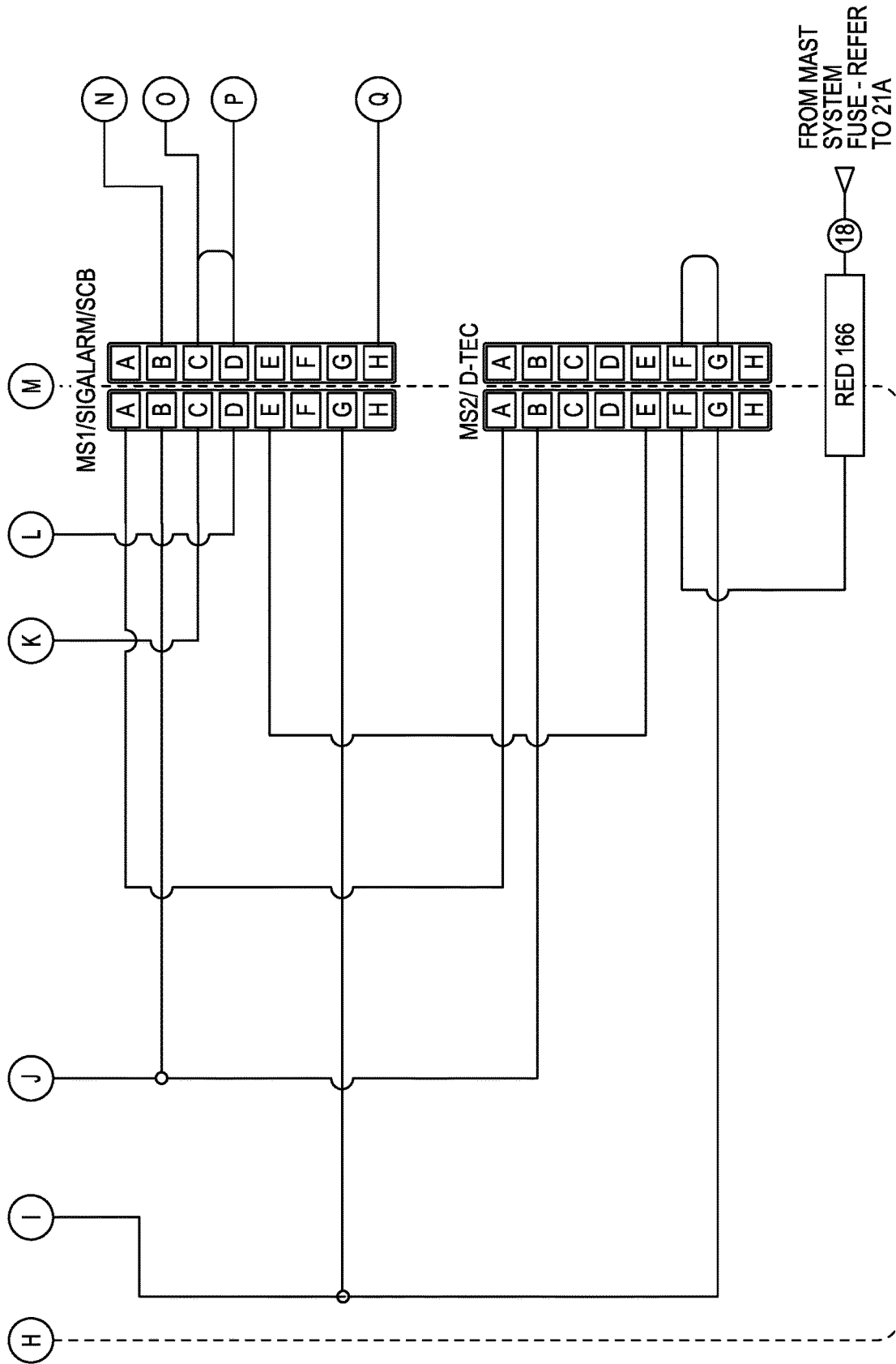


FIG. 31D

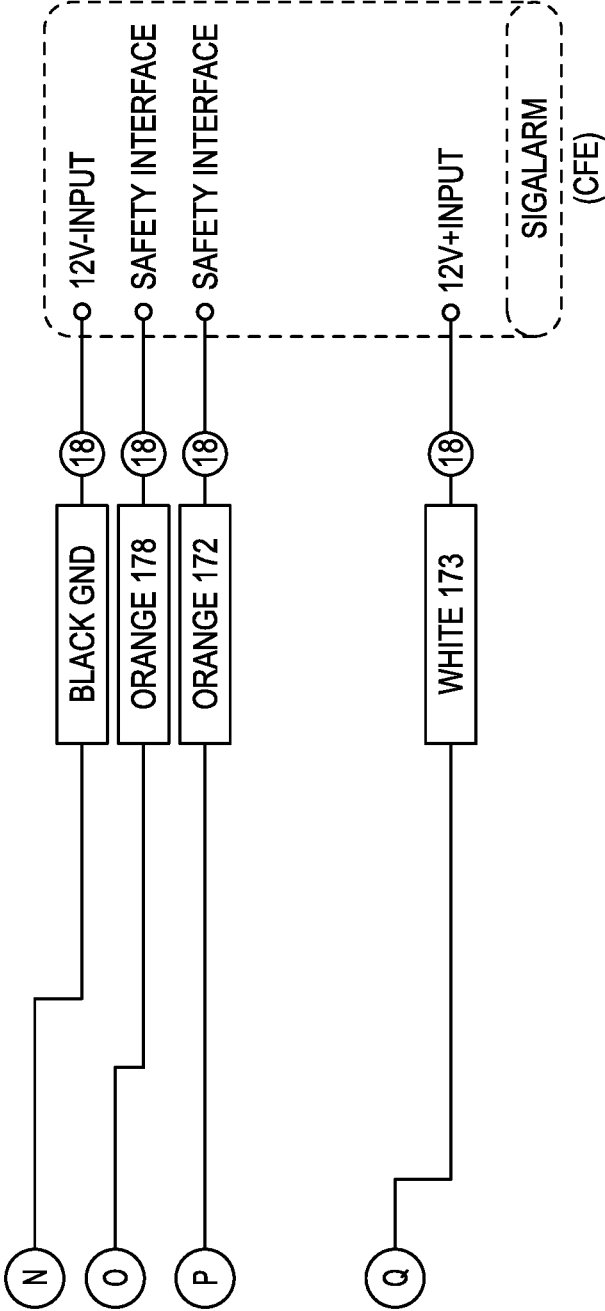


FIG. 31E

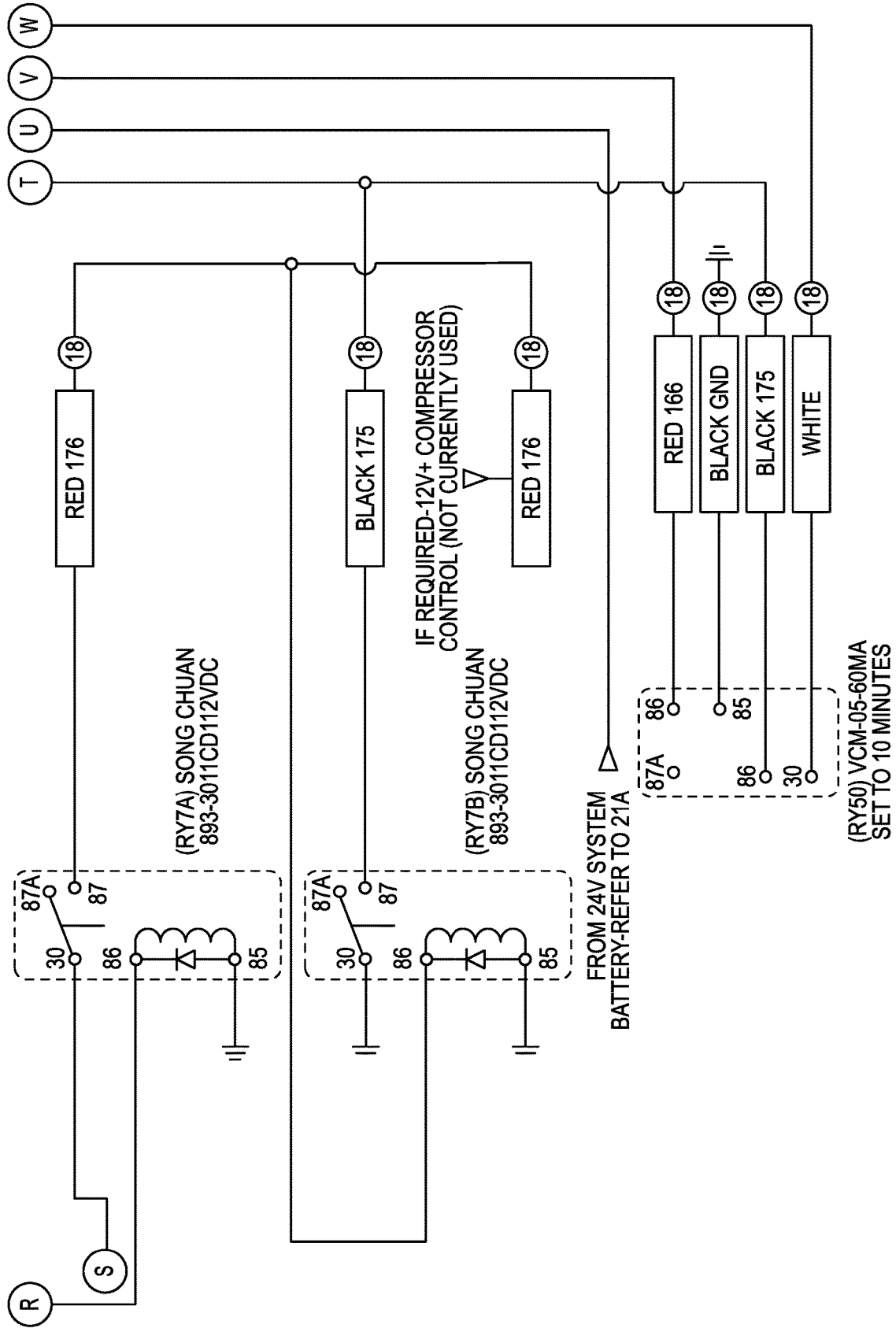


FIG. 31F

NOTE: RELAY LOCATED AT COMPRESSOR AREA

AUXILIARY POWER SYSTEM FOR A VEHICLE

CROSS-REFERENCE TO RELATED PATENT APPLICATIONS

[0001] This application is a continuation of U.S. patent application Ser. No. 16/418,741, filed May 21, 2019, which is a continuation of U.S. patent application Ser. No. 16/105,491, filed Aug. 20, 2018, now U.S. Pat. No. 10,300,871, which is a continuation of U.S. patent application Ser. No. 14/678,706, filed Apr. 3, 2015, now U.S. Pat. No. 10,053,035, which claims the benefit of U.S. Provisional Patent Application No. 61/975,663, filed Apr. 4, 2014, all of which are incorporated herein by reference in their entireties.

BACKGROUND

[0002] Broadcast vehicles traditionally include alternating current (AC) generator systems. Such generator systems produce AC electrical power and require either the engine of the vehicle or a generator power source (e.g., an engine, a motor, etc.) to be running during use of the various electrical systems of the broadcast vehicle. Generator-powered systems are often loud and expensive to maintain. Such characteristics may degrade the quality of the filming for which the vehicle may be used (i.e., due to the noisy generator sound in the live film footage or recording, etc.).

SUMMARY

[0003] One embodiment relates to a vehicle. The vehicle includes a chassis, an engine coupled to the chassis, a primary electrical system including a primary alternator and a primary battery, and an auxiliary electrical system including an auxiliary alternator and an auxiliary battery. At least one of (a) the primary alternator is electrically decoupled from the auxiliary battery and (b) the auxiliary alternator is electrically decoupled from the primary battery, and the primary battery is electrically coupled to one or more electrical loads.

[0004] Another embodiment relates to a power system for a vehicle. The power system includes a primary electrical system including a primary alternator and a primary battery and an auxiliary electrical system including an auxiliary alternator and an auxiliary battery. At least one of (a) the primary alternator is electrically decoupled from the auxiliary battery and (b) the auxiliary alternator is electrically decoupled from the primary battery, and the primary battery is electrically coupled to one or more electrical loads.

[0005] Still another embodiment relates to a method for powering a vehicle. The method includes converting mechanical energy from an engine of the vehicle into primary electrical energy with a primary alternator of a primary electrical system, supplying at least a portion of the primary electrical energy to a primary battery of the primary electrical system, generating auxiliary electrical energy with an auxiliary alternator of an auxiliary electrical system, and storing the generated auxiliary electrical energy in an auxiliary battery of the auxiliary electrical system. At least one of (a) the primary alternator is electrically decoupled from the auxiliary battery and (b) the auxiliary alternator is electrically decoupled from the primary battery, and the primary battery is electrically coupled to one or more electrical loads.

[0006] The invention is capable of other embodiments and of being carried out in various ways. Alternative exemplary embodiments relate to other features and combinations of features as may be recited herein.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] The disclosure will become more fully understood from the following detailed description, taken in conjunction with the accompanying figures, in which:

[0008] FIG. 1 is a perspective view of a mobile communications vehicle, according to an exemplary embodiment;

[0009] FIGS. 2A-2G are various perspective views of components of a mobile communications vehicle, according to an exemplary embodiment;

[0010] FIG. 3A is a perspective view of a high-roof model of a mobile communications vehicle, according to an exemplary embodiment;

[0011] FIG. 3B is a perspective view of a standard roof model of a mobile communications vehicle, according to an exemplary embodiment;

[0012] FIGS. 4A-4F are various plan views of a mobile communications vehicle, according to an exemplary embodiment;

[0013] FIGS. 5A-5F are various plan views of a mobile communications vehicle, according to another exemplary embodiment;

[0014] FIGS. 6A-6F are various plan views of a mobile communications vehicle, according to still another exemplary embodiment;

[0015] FIGS. 7A-7F are various plan views of a mobile communications vehicle, according to yet another exemplary embodiment;

[0016] FIGS. 8A-8C are various interior views of a mobile communications vehicle, according to an exemplary embodiment;

[0017] FIG. 9 is a schematic view of an auxiliary electrical system, according to an exemplary embodiment;

[0018] FIG. 10 is a perspective view of a primary alternator and an auxiliary alternator of an auxiliary electrical system, according to an exemplary embodiment;

[0019] FIG. 11 is a perspective view of a battery system of an auxiliary electrical system, according to an exemplary embodiment;

[0020] FIG. 12 is a perspective view of a solar panel system of an auxiliary electrical system, according to an exemplary embodiment;

[0021] FIG. 13 is a perspective view of a power panel of an auxiliary electrical system, according to an exemplary embodiment;

[0022] FIG. 14 is a schematic view of a user interface for an auxiliary electrical system, according to an exemplary embodiment;

[0023] FIG. 15 is a perspective view of an inverter for an auxiliary electrical system, according to an exemplary embodiment;

[0024] FIGS. 16A-16C are a schematic diagram of an AC portion of an auxiliary power system, according to an exemplary embodiment;

[0025] FIGS. 17A-17H are a schematic diagram of a DC portion of an auxiliary power system, according to an exemplary embodiment;

[0026] FIGS. 18A-18I are schematic diagrams of other portions of a DC portion of an auxiliary power system, according to an exemplary embodiment;

[0027] FIGS. 19A-19E are a schematic diagram of another portion of a DC portion of an auxiliary power system, according to an exemplary embodiment;

[0028] FIGS. 20A-20C are a schematic diagram of another portion of a DC portion of an auxiliary power system, according to an exemplary embodiment;

[0029] FIGS. 21A-21C are a schematic diagram of an AC portion of an auxiliary power system, according to another exemplary embodiment;

[0030] FIGS. 22A-22G are a schematic diagram of a portion of a DC portion of an auxiliary power system, according to another exemplary embodiment;

[0031] FIGS. 23A-23D are schematic diagrams of other portions of a DC portion of an auxiliary power system, according to another exemplary embodiment;

[0032] FIGS. 24A-24E are schematic diagrams of other portions of a DC portion of an auxiliary power system, according to another exemplary embodiment;

[0033] FIGS. 25A-25E are a schematic diagram of another portion of a DC portion of an auxiliary power system, according to another exemplary embodiment;

[0034] FIGS. 26A-26D are a schematic diagram of another portion of a DC portion of an auxiliary power system, according to another exemplary embodiment;

[0035] FIGS. 27A-27C are a schematic diagram of an AC portion of an auxiliary power system, according to yet another exemplary embodiment;

[0036] FIGS. 28A-28G are a schematic diagram of a portion of a DC portion of an auxiliary power system, according to yet another exemplary embodiment;

[0037] FIGS. 29A-29G are schematic diagrams of other portions of a DC portion of an auxiliary power system, according to yet another exemplary embodiment;

[0038] FIGS. 30A-30E are schematic diagrams of other portions of a DC portion of an auxiliary power system, according to yet another exemplary embodiment; and

[0039] FIGS. 31A-31F are a schematic diagram of another portion of a DC portion of an auxiliary power system, according to yet another exemplary embodiment.

DETAILED DESCRIPTION

[0040] Before turning to the figures, which illustrate the exemplary embodiments in detail, it should be understood that the present application is not limited to the details or methodology set forth in the description or illustrated in the figures. It should also be understood that the terminology is for the purpose of description only and should not be regarded as limiting.

[0041] According to an exemplary embodiment, a vehicle includes a primary electrical system and an auxiliary electrical system. In one embodiment, the vehicle is a mobile news vehicle (e.g., used to broadcast from a particular location, etc.). In other embodiments, the vehicle is a public safety vehicle (e.g., a homeland security vehicle, an emergency response mobile command vehicle, etc.) or still another type of vehicle. The primary electrical system may include a first DC alternator and a first battery. It should be understood that the primary electrical system is used to power the ordinary operational functions of the vehicle. By way of example, the primary electrical system may power headlights of the vehicle, instrument panel lighting and displays within a cab of the vehicle, and the various electrical devices used during vehicle operation (e.g., sensors, spark plugs, engine management systems, etc.). In one

embodiment, the auxiliary electrical system replaces the AC generator systems traditionally implemented on broadcast vehicles (e.g., 7 kW Onan generators, engine-mounted generators, etc.). Such generators produce AC electrical power and require either the engine of the vehicle or the generator power source (e.g., engine, motor, etc.) to be running during use. The auxiliary electrical system may operate various systems of the vehicle for an extended period of time (e.g., several hours) without operating the engine of the vehicle. The auxiliary electrical system may be quieter and less expensive to maintain than generator-powered systems. Such characteristics may improve the quality of the filming for which the vehicle may be used (i.e., by removing the noisy generator sound from the live film footage or recording, etc.). The auxiliary electrical system may include various components that are arranged to facilitate use of the vehicle by a broadcaster.

[0042] According to an exemplary embodiment, the auxiliary electrical system includes a second DC alternator and a second battery. By way of example, the second DC alternator may be coupled to an engine of the vehicle and used to generate electrical power that may be stored within the second battery. An onboard inverter may be used to convert electrical power stored within the second battery from DC to AC current. In one embodiment, the auxiliary electrical system is used to power various AC and DC loads. By way of example, such AC and DC loads may include lighting, displays, and communications equipment disposed within a cargo area of the vehicle.

[0043] Referring to the exemplary embodiment shown in FIG. 1, a vehicle, shown as mobile communications vehicle 10, includes a body, shown as body 20, and an engine 30. In one embodiment, mobile communications vehicle 10 has as 9,000; 9,500; 9,900; or 10,360 pound GVWR and is manufactured using a full-frame V-8 chassis to provide over 1,000 pounds of payload. Mobile communications vehicle 10 may have a wheel base of 148 inches. Engine 30 may be configured to combust gasoline, diesel, or still another fuel. In other embodiments, an electric motor is used in place of or in addition to engine 30. Mobile communications vehicle 10 may be an ENG vehicle, a DSNG vehicle, or a combination thereof, among other alternatives. As shown in FIG. 1, body 20 includes a cab portion 22 and a rear body portion, shown as cargo portion 24. In one embodiment, an operator may sit within cab portion 22 and drive mobile communication vehicle 10 (e.g., to a location from which a broadcast will occur, etc.). Cargo portion 24 may include equipment utilized for the recordation or transmission of a broadcast (e.g., a television broadcast, etc.). In one embodiment, cargo portion 24 has a 72 inch interior height and may house three full-height equipment racks. In other embodiments, cargo portion 24 has a 54 inch interior height. As shown in FIG. 1, body 20 includes a roof portion, shown as roof panel 26. Roof panel 26 may be configured to provide a low roof model, a standard roof model, or a high roof model, among other alternatives. A communications device, shown as dish 28, is coupled to roof panel 26, according to an exemplary embodiment. Dish 28 may be directly coupled to roof panel 26 or coupled to roof panel 26 with an intermediate superstructure (e.g., a pole, etc.). In one embodiment, the intermediate superstructure includes a driver configured to reposition dish 28 between a storage orientation and an operational orientation. By way of example, the intermediate superstructure may include a pole (e.g., a telescoping pole,

etc.) that may be actuated between a lowered storage orientation and a raised operational orientation.

[0044] Referring to FIGS. 2A-2G, various views of mobile communications vehicle 10 are shown, according to an exemplary embodiment. As shown in FIG. 2A, cargo portion 24 of mobile communications vehicle 10 may include an interior layout configured to facilitate a non-linear editing environment. As shown in FIG. 2B, various equipment or racks may be positioned in a rear portion of body 20. In one embodiment, mobile communications vehicle 10 includes a modular equipment storage system. The modular equipment storage system may include a light weight adjustable storage system. The various equipment and racks may be slidably coupled to the rear portion of body 20 to facilitate easy access to the area behind the racks. The racks may further include a tilting feature when extended from the rear portion of the body 20. As shown in FIGS. 2C-2F, mobile communications vehicle 10 includes an auxiliary electrical system that includes an inverter 140, a control system with a user interface 150, and a battery system 120 that may include one or more batteries. A solar panel system 130 may be electrically coupled to the batteries and positioned on roof panel 26 of mobile communications vehicle 10. In other embodiments, the solar panel system 130 may be removable (e.g., an operator may position the solar panel along a ground surface nearby mobile communications vehicle 10, etc.). The solar panel system 130 may include one or more solar panels 132 (e.g., one, two, three, etc.) and provide power to the battery system 120. In one embodiment, mobile communications vehicle 10 includes two 55 watt solar panels 132 that may provide four amps of electrical power. As shown in FIG. 2G, a passenger seat positioned within cab portion 22 may swivel and may have an alarm that sounds if a drive gear of mobile communications vehicle 10 is selected with the passenger seat facing cargo portion 24.

[0045] According to an exemplary embodiment, mobile communications vehicle 10 is manufactured based upon a Ford Transit chassis. According to the various embodiments shown in FIGS. 3A-8C, mobile communications vehicle 10 may be manufactured using various other chassis, including the Nissan NV HD chassis. As shown in FIG. 3A, in one embodiment, mobile communications vehicle 10 is a high roof model (e.g., ENG-NV HR model, etc.). The high roof model of mobile communications vehicle 10 may provide an interior height of around 72 inches. As shown in FIG. 3B, in other embodiments, mobile communications vehicle 10 is a standard roof model (e.g., ENG-NV HR model, etc.). The standard roof model of mobile communications vehicle 10 may provide an interior height of around 54 inches.

[0046] FIGS. 4A-7F show various features and dimensions of mobile communications vehicle 10, according to various alternative embodiments. Referring to FIGS. 4A-4F, in one embodiment, mobile communications vehicle 10 has a wheel base of approximately 148 inches, an exterior height of approximately 84 inches, and a longitudinal length of approximately 240 inches. Mobile communications vehicle 10 may include various features including, but not limited to, an interior battery/component compartment, a mast coupled to the roof, a mast actuator, a scene light, a roof mounted air conditioning unit, and a roof access ladder. Referring to FIGS. 5A-5F, in an alternative embodiment, mobile communications vehicle 10 has an exterior height of approximately 108 inches. Referring now to FIGS. 6A-7F, in some embodiments, mobile communications vehicle 10

includes an antenna platform configured to couple an antenna (e.g., dish 28, etc.) to the roof panel (e.g., roof panel 26, etc.) of mobile communications vehicle 10. Referring now to FIGS. 8A-8C, mobile communications vehicle 10 may include an interior layout configured to facilitate a non-linear editing environment. As shown in FIGS. 8A-8C, cargo portion 24 of mobile communications vehicle 10 may include storage compartments (e.g., cabinets, etc.), display monitors, telephones (or other communication equipment), and various controls and electronics to operate various systems of mobile communications vehicle 10 that facilitate non-linear editing.

[0047] According to an exemplary embodiment, mobile communications vehicle 10 includes a primary electrical system and an auxiliary electrical system. In one embodiment, the auxiliary electrical system may have a power rating of 3 kW, 8 kW, or still another level (e.g., a power level for AC power, etc.) and may power one or more systems of mobile communications vehicle 10 for four hours without running engine 30. The auxiliary electrical system may be an inverter based un-interruptible power supply system that operates at a standard idle of mobile communications vehicle 10. Engine 30 provides a motive power to move mobile communications vehicle 10, powers the primary electrical system, and powers the auxiliary electrical system, according to an exemplary embodiment. According to an exemplary embodiment, the auxiliary power system includes a high voltage warning and detection system.

[0048] Referring next to FIGS. 9-15, an auxiliary electrical system, shown as auxiliary electrical system 100, is configured to operate independent of the primary electrical system of mobile communications vehicle 10. As shown in FIG. 9, auxiliary electrical system 100 includes an auxiliary alternator, shown as auxiliary alternator 110. Auxiliary alternator 110 generates DC electrical power (e.g., a direct current flow of electrical energy, etc.). In one embodiment, auxiliary alternator 110 provides up to 300 amps of 28 volt DC current. Auxiliary alternator 110 may be an 8400 watt alternator that is provided in addition to the OEM alternator that defines at least a portion of a primary electrical system of mobile communications vehicle 10. By way of example, auxiliary alternator 110 may be a Mil-Spec alternator. In one embodiment, mobile communications vehicle 10 does not include a generator (e.g., a device coupled to engine 30 that produces AC electrical power, etc.) or an onboard generator set (e.g., a portable or fixed unit having a motor or engine and used to produce AC electrical power, etc.).

[0049] As shown in FIG. 9, auxiliary electrical system 100 includes a battery system, shown as battery system 120. In one embodiment, battery system 120 is electrically coupled to auxiliary alternator 110. Auxiliary alternator 110 may power 95-100 percent of loads of mobile communications vehicle 10 either directly or by way of battery system 120. Auxiliary electrical system 100 may operate automatically (e.g., without operator input). In one embodiment, auxiliary electrical system 100 may turn on and turn off engine 30 based on a charge level of battery system 120 (e.g., auxiliary electrical system 100 may include a controller configured to turn on engine 30 based on a determination that the charge level of battery system 120 has fallen below a threshold level, etc.).

[0050] As shown in FIG. 10, auxiliary alternator 110 is coupled to engine 30 of mobile communications vehicle 10 with a bracket 112. Auxiliary alternator 110 may operate in

parallel to a primary alternator **40** of mobile communications vehicle **10**. In one embodiment, both primary alternator **40** and auxiliary alternator **110** are coupled to (e.g., rotationally coupled to with a belt, etc.) engine **30**. Primary alternator **40** and auxiliary alternator **110** may convert rotational energy produced by engine **30** into DC electrical power for use in the primary electrical system and auxiliary electrical system **100** of mobile communications vehicle **10**. In one embodiment, primary alternator **40** is electrically coupled to a battery **50** (e.g., a primary battery, etc.) of the primary electrical system of mobile communications vehicle **10** with leads **52**. In one embodiment, primary alternator **40** is not coupled to battery system **120** of auxiliary electrical system **100**.

[0051] In one embodiment, battery system **120** is configured to store electrical power (e.g., DC electrical power, etc.) generated by auxiliary alternator **110**. A controller may be configured to provide an alarm based on a determination that a charge level of battery system **120** has fallen below a threshold level (e.g., a percentage of a maximum charge level, an amp-hour reading, etc.). As shown in FIG. **9**, battery system **120** includes a first battery pack (e.g., a first battery cell, a first set of battery cells, etc.), shown as battery pack **122**, and a second battery pack (e.g., a second battery cell, a second set of battery cells, etc.), shown as battery pack **124**. In one embodiment, battery system **120** is configured to store electrical power that corresponds with the characteristics of the electrical power produced by auxiliary alternator **110**. By way of example, battery system **120** may be configured to store DC current at a voltage of 28 volts DC. In other embodiments, battery system **120** may be configured to store DC current at another voltage (e.g., 12 volts, 24 volts, etc.). According to an exemplary embodiment, battery pack **122** and battery pack **124** each include 12 volt batteries arranged in parallel to form a 24 volt battery system **120**. Battery pack **122** and battery pack **124** may include 12 volt Odyssey Extreme Series model PC **1800-FT** batteries, or batteries manufactured by another supplier. In one embodiment, battery pack **122** and battery pack **124** are gel cell batteries. According to an alternative embodiment, at least one of battery pack **122** and battery pack **124** may include lithium ion batteries or still another type of energy storage device. According to an exemplary embodiment, battery pack **122** and battery pack **124** are coupled to a frame rail (e.g., of a chassis, etc.) of mobile communications vehicle **10**. As shown FIG. **11**, battery pack **122** and battery pack **124** are disposed within body **20** of mobile communications vehicle **10**.

[0052] Referring next to FIGS. **9** and **12**, auxiliary electrical system **100** includes an electrical power producer that is electrically coupled with battery system **120**. According to the exemplary embodiment shown in FIGS. **9** and **12**, auxiliary electrical system **100** includes a solar panel system, shown as solar panel system **130**. In one embodiment, solar panel system **130** is coupled to battery system **120** and is configured to produce electrical power from incident solar energy. Solar panel system **130** may keep battery system **120** topped off and hot, according to an exemplary embodiment. As shown in FIGS. **9** and **12**, solar panel system **130** includes a pair of solar panels **132**. In other embodiments, solar panel system **130** includes more or fewer solar panels **132**. According to an exemplary embodiment, solar panel system **130** is configured to provide electrical power having characteristics that correspond to features of battery system

120. By way of example, battery system **120** may be configured to store DC electrical power at 24 volts, and solar panel system **130** may be configured to provide 24 volt DC electrical power to battery system **120**. In one embodiment, solar panels **132** are connected in parallel and are each configured to provide electrical power at 12 volts DC. According to an alternative embodiment, solar panels **132** are connected in series and are each configured to provide electrical power at 24 volts DC. The amperage of the electrical power produced by solar panel system **130** may vary based on the ambient sun exposure, among other conditions, but may reach or exceed four amps. As shown in FIG. **12**, solar panel system **130** is coupled to roof panel **26** of mobile communications vehicle **10**.

[0053] Referring to FIGS. **9** and **13-15**, auxiliary electrical system **100** includes an inverter **140** and a user interface, shown as power panel **150**. Inverter **140** may monitor the various loads on battery system **120** and provide an estimated charge time remaining for battery system **120** based on a current or projected use profile. As shown in FIG. **13**, power panel **150** is positioned within an operating environment disposed within cargo portion **24** of body **20**. In other embodiments, power panel **150** is otherwise positioned (e.g., within cab portion **22**, etc.) within body **20** of mobile communications vehicle **10**. In still other embodiments, auxiliary electrical system **100** is remotely controlled (e.g., via a satellite, Wi-Fi, or other wireless connection, etc.). A mobile communications vehicle **10** having a remotely controlled auxiliary electrical system **100** may or may not include power panel **150**, according to various alternative embodiments. As shown in FIG. **15**, inverter **140** may be positioned within a rear portion (e.g., behind an operating environment within cargo portion **24**, etc.) of body **20**.

[0054] According to an exemplary embodiment, inverter **140** is configured to convert electrical power between direct current and alternating current. Inverter **140** may be manufactured by Victron Energy or another manufacturer, according to various alternative embodiments. As shown in FIG. **9**, inverter **140** is coupled to battery system **120**. During a first mode of operation, DC electrical energy (e.g., 24 volt DC electrical energy, etc.) flows from battery system **120** to inverter **140**, where it is converted into AC electrical energy (e.g., 110 volt or 120 volt AC electrical energy). The AC electrical energy may be thereafter utilized to power one or more AC loads **142**. By way of example, such AC loads may include various displays, camera equipment, rack equipment, editing equipment, satellite amplifiers, or communications equipment associated with mobile communications vehicle **10** (e.g., microwave or radio transmitters, etc.). During a second mode of operation, AC electrical energy may be provided to inverter **140** by way of an electrical power connector, shown as AC electrical power inlet **144**. In one embodiment, an operator may couple AC electrical power inlet **144** with an electrical power source (e.g., a generator set, the power grid, etc.) using a cable (e.g., a power cord, etc.). AC electrical power may flow through AC electrical power inlet **144** and into inverter **140**, where it is converted into DC electrical power (e.g., 24 volt DC electrical power, etc.) and stored within battery system **120** (i.e., battery system **120** may be charged using an external source of AC electrical power). During a third mode of operation, a first portion of the AC electrical power provided to inverter **140** (e.g., by way of AC electrical power input **144**, etc.) is used to charge battery system **120** and a second portion of

the AC electrical power provided to inverter **140** is used to directly power AC loads **142**.

[0055] According to the exemplary embodiment shown in FIGS. **13-14**, power panel **150** includes a user interface **152** having a plurality of user inputs, shown as buttons **154**, and a display, shown as screen **156**. Power panel **150** may be manufactured by Victron Energy or another manufacturer, according to various alternative embodiments. Power panel **150** is coupled to inverter **140** and battery system **120**, according to an exemplary embodiment. As shown in FIG. **9**, power panel **150** is coupled to battery system **120** by way of a battery monitor **160**. Battery monitor **160** may be manufactured by Victron Energy or another manufacturer, according to various alternative embodiments. According to an exemplary embodiment, power panel **150** is configured to provide an operator with information relating to auxiliary electrical system **100**. By way of example, power panel **150** may be configured to provide an operator with performance information relating to auxiliary electrical system **100**. In one embodiment, power panel **150** is configured to provide information relating to a charge level of battery system **120**. In another embodiment, power panel **150** is configured to provide information relating to a charge status of battery system **120** (e.g., the electrical power being provided to battery system **120** by auxiliary alternator **110** or inverter **140**, etc.). In still another embodiment, power panel **150** is configured to provide information relating to a draw on battery system **120** (e.g., the electrical power being used by mobile communications vehicle **10**, etc.). In yet another embodiment, power panel **150** is configured to provide at least one of these types of information and/or still other information.

[0056] Referring to the exemplary embodiment shown in FIG. **14**, user interface **152** displays a system status of auxiliary electrical system **100**. As shown in FIG. **14**, screen **156** may provide a voltage and current of electrical energy provided by AC electrical power input **144** as a “Shore” power and a voltage and current of electrical energy provided to various AC loads **142** as an “AC Out.” Screen **156** may also show a current provided to first DC electrical load **170** and second DC electrical load **180** as a “DC System” reading (shown as 10.7 amps) and readings associated with a charge level of battery system **120** (shown as 24.9 volts) along with an estimated time until the charge level of battery system **120** is depleted (shown as 8.12 hours) at a current electrical power usage level. Screen **156** may also provide a characteristic of the energy provided to inverter **140** from battery system **120** (shown as 3.16 amps). Buttons **154** may be used to turn on or off screen **156**, toggle between various system and device list options (e.g., for inverter **140**, for battery system **120**, etc.), and to turn on or off inverter **140** after selecting inverter **140** with a button **154**.

[0057] According to an exemplary embodiment, battery system **120** provides DC electrical energy to power various DC electrical loads. As shown in FIG. **9**, battery system **120** is configured to power a first DC electrical load **170** and a second DC electrical load **180**. According to an exemplary embodiment, first DC electrical load **170** has characteristics that correspond to the electrical power stored by battery system **120**. By way of example, first DC electrical load **170** may be a 24 volt DC electrical load. First DC electrical load **170** may include news transmission systems or lighting loads, among others.

[0058] In one embodiment, second DC electrical load **180** has characteristics that are different than the electrical power stored by battery system **120**. By way of example, second DC electrical load **180** may be a 12 volt DC electrical load. In one embodiment, second DC electrical load **180** includes various lighting loads. By way of example, mobile communications vehicle **10** may include exterior lighting (e.g., Whelen micro pioneer super LEDs, etc.) that defines at least a portion of second DC electrical load **180**. In one embodiment, the exterior lighting is scene lighting configured to be used on-site (e.g., at a particular location, etc.). LED lighting may be used to reduce power draw on auxiliary electrical system **100**, and the LED lighting may be dimmable to further reduce power draw. Auxiliary power system **100** includes an electrical device **182** that is disposed along a flow path between battery system **120** and second DC electrical load **180** to convert the electrical power from battery system **120** into electrical power appropriate for second DC electrical load **180**. By way of example, electrical device **182** may be a Vanner model 66-100 Voltmaster 100 amp unit, a Beltron Unit, or an Orion 24/12-70 amp unit, among other alternatives. In one embodiment, electrical device **182** is a DC to DC voltage converter configured to reduce the voltage from battery system **120** (e.g., 24 volts DC) into a voltage appropriate for second DC electrical load **180** (e.g., 12 volts DC). In other embodiments, electrical device **182** is a battery equalizer.

[0059] According to an exemplary embodiment, energy may flow from engine **30**, through auxiliary alternator **110** and into battery system **120**. By way of example, auxiliary alternator **110** may convert rotational energy provided by engine **30** into electrical energy for storage in battery system **120**. In some embodiments, battery system **120** further receives electrical energy from solar panel system **130**. Energy may thereafter flow from battery system **120** to one or more of the AC or DC outputs/loads of mobile communications vehicle **10** either directly (e.g., to DC electrical loads, etc.) or through inverter **140** (e.g., to AC electrical loads, etc.).

[0060] Referring generally to FIGS. **16A-20C**, a first embodiment of an auxiliary power system for a vehicle is shown. FIGS. **16A-16C** illustrate a schematic diagram of an AC portion of the auxiliary power system. The AC portion generally includes a charger/inverter **202**, a remote controller **204**, and a battery controller **206**.

[0061] Charger/inverter **202** may be, for example, a Victron Multiplus PMP243021102, 3000 Watt 24 VDC/120 VAC inverter. Charger/inverter **202** is configured to convert DC power from the 24V battery system (battery system **240** shown in FIG. **17E**) to AC power via input **210**. Charger/inverter **202** may further receive AC power from an external input **212**. Charger/inverter **202** may supply the AC power to a plurality of outputs **214**, to provide power to a plurality of vehicle systems.

[0062] Charger/inverter **202** may further provide a power supply to remote controller **204**. Remote controller **204** may be, for example, a Victron Blue Power Panel GX. Remote controller **204** may receive an input from charger/inverter **202** and use the input to provide a display for a user relating to operation of the auxiliary power system. Remote controller **204** further receives a user input via the interface of the controller and uses the user input to control operation of the auxiliary power system. In other words, remote controller **204** may act as a monitoring tool for a user associated with

the auxiliary power system, providing the user with the ability to configure various settings of any device of the auxiliary power system.

[0063] Battery controller 206 is shown coupled to remote controller 204 and may receive information relating to the operation of one or more batteries of the auxiliary power system. Battery controller 206 may generally be a device that monitors the status of one or more batteries of the auxiliary power system. For example, battery controller 206 may monitor battery voltage, battery current, battery temperature, a state of charge of the battery, etc. Battery controller 206 may include an interface that a user may interact with. Battery controller 206 may be, for example, a Victron Vnet battery controller.

[0064] FIGS. 17A-20C are schematic diagrams of the DC portion of the auxiliary power system. The DC portion generally includes a battery equalizer 230, solar panels 232 (shown as rooftop photovoltaic cells in FIG. 17E), solar controller 234, alternator 236, and battery system 240.

[0065] Referring now to FIGS. 17A-17H, a schematic diagram of a portion of the DC portion is shown in greater detail. The DC portion includes a battery equalizer 230. Battery equalizer 230 may be, for example, a Vanner 66-100 battery equalizer. Battery equalizer 230 may be configured to ensure a battery voltage produced by battery system 240 is relatively stable, so that the power supply may be provided to various vehicle systems.

[0066] The DC portion further includes solar panels 232 and a solar controller 234 configured to control solar panels 232 and the power source provided to battery system 240 by solar panels 232. Solar panels 232 may be, for example, a pair of rooftop photovoltaic cells. Solar controller 234 may be, for example, a SunSaver SS-10-24V controller.

[0067] The DC portion further includes alternator 236. Alternator 236 may generally be configured to produce DC power.

[0068] The DC portion further includes a battery system 240. Battery system 240 is shown in FIG. 17E to include a pair of 24V system batteries, in one embodiment. Battery system 240 provides a power source to various vehicle systems, either directly or indirectly via a battery equalizer or through charger/inverter 202. Referring further to FIGS. 17A-17H, battery system 240 is shown to provide a power source to various vehicle systems 242 such as the auxiliary A/C, reverse camera, alarm system, HVAC system, etc. Power relay modules (PRM) 244 (e.g., a Bussman PRM-1) may be configured to relay power from battery system 240 to other vehicle systems 242 (e.g., various vehicle lights and outlets). In some embodiments, battery system 240 includes a battery monitor configured to monitor performance characteristics of battery system 240 (e.g., voltage/current draw, charge level, etc.).

[0069] Referring now to FIGS. 18A-18I, a schematic diagram of another portion of the DC portion of the auxiliary power system is shown. More particularly, the schematic diagram of FIGS. 18A-18I illustrates in greater detail the various vehicle systems 242 that receive power from battery system 240.

[0070] Referring now to FIGS. 19A-19E, a schematic diagram of another portion of the DC portion of the auxiliary power system is shown. More particularly, the schematic diagram of FIGS. 19A-19E illustrates in greater detail an alarm/security control board 250 of the auxiliary power system. Alarm/security control board 250 may be configured

to control various vehicle subsystems related to providing alarms or warnings to occupants of the vehicle. For example, alarm/security control board 250 may control one or more warning indicators on a panel or dash of the vehicle, one or more door switches, and one or more vehicle subsystems related to generating visual or audio alarms for occupants of the vehicle.

[0071] Referring now to FIGS. 20A-20C, a schematic diagram of another portion of the DC portion of the auxiliary power system is shown. More particularly, the schematic diagram of FIGS. 20A-20C illustrates in greater detail pneumatic mast system 260. Pneumatic mast system 260 may be a vehicle system configured to deploy communications equipment (e.g., dishes, microwave transmitters, etc.), lighting, and other vehicle systems at a location above the vehicle. Pneumatic mast system 260 may be powered by DC power provided by battery system 240 as described above. Pneumatic mast system 260 may include a plurality of lights 262 powered by battery system 240.

[0072] Referring generally to FIGS. 21A-26D, a second embodiment of an auxiliary power system for a vehicle is shown. FIGS. 21A-21C illustrate a schematic diagram of an AC portion of the auxiliary power system. As compared to the first embodiment, the auxiliary power system includes a second charger/inverter 203 in addition to the first charge/inverter 202. The first charger/inverter 202 is shown as a slave device and the second charge/inverter 203 as a master device. First charger/inverter 202 receives input from battery system 240 and generates AC power from the DC power input. The AC power is provided as an input to the second charger/inverter 203, which is then configured to provide the power supply to the various vehicle systems as described above. Second charger/inverter 203 may further receive a DC power supply from battery system 240.

[0073] Referring now to FIGS. 22A-22G, in the second embodiment, the DC portion of the auxiliary power system includes a DC to DC converter 270 and excludes a battery equalizer. DC to DC converter 270 may convert the DC power supply generated by battery system 240 from one voltage level to another. DC to DC converter 270 may be used to control the power supply generated by battery system 240 in place of battery equalizer 230. Unlike the first embodiment, the embodiment of FIGS. 22A-22G does not include a solar power source or other external power source beyond the power source provided by battery system 240. The DC portion of the auxiliary power system may further include the other various components as described with reference to FIGS. 17A-17H. However, it should be understood that the individual vehicle components powered by the auxiliary power system may vary based on vehicle configuration.

[0074] Referring to FIGS. 23A-25E, schematic diagrams of other portions of the DC portion of the auxiliary power system are shown in greater detail. The DC portion of the auxiliary power system as shown in detail in FIGS. 23A-25E may have the same general functionality as described with reference to FIGS. 18A-20C. Referring more particularly to FIGS. 25A-25E, I/O panel controls 264 for mast system 260 is illustrated that may be used to control pneumatic mast system 260 and lights 262.

[0075] Referring now to FIGS. 26A-26D, a schematic diagram of another portion of the DC portion of the auxiliary power system is shown in greater detail. The schematic diagram of FIGS. 26A-26D illustrates a hydraulic jack

system 270, I/O panel controls 272 for controlling hydraulic jack system 270 via user input, and a hydraulic jacks control board 274 for controlling hydraulic jack system 270. Hydraulic jack system 270 may be powered by battery system 240 as shown in FIGS. 26A-26D and described above.

[0076] Referring generally to FIGS. 27A-31F, a third embodiment of an auxiliary power system for a vehicle is shown. FIGS. 27A-27C illustrate a schematic diagram of an AC portion of the auxiliary power system. The AC portion of the auxiliary power system may be similar to the AC portion of the first embodiment of the auxiliary power system as shown in FIGS. 16A-16C. However, it should be understood that the various embodiments may vary in terms of the power output to the various vehicle systems of the vehicle (e.g., compared to the embodiment shown in FIGS. 16A-16C, the embodiment of FIGS. 27A-27C is shown to provide a power output to different outlets of the vehicle, based on the vehicle configurations).

[0077] Referring now to FIGS. 28A-28G, in the third embodiment, the DC portion of the auxiliary power system is shown to include a battery equalizer 230 as described with reference to FIGS. 17A-17H. Battery equalizer 230 may be configured to ensure a battery voltage produced by battery system 240 is relatively stable, so that the power supply may be provided to various vehicle systems. However, the embodiment of FIGS. 28A-28G is shown not to include a solar power source. Unlike the first embodiment and like the second embodiment, there is no outside power source in addition to the power generated via local sources (e.g., battery system 240). In other embodiments, such features may be added to the system shown in FIGS. 28A-28G.

[0078] Referring to FIGS. 29A-31F, schematic diagrams of other portions of the DC portion of the auxiliary power system are shown in greater detail. The DC portion of the auxiliary power system as shown in detail in FIGS. 29A-31F may have the same general functionality as described with reference to the first and second embodiments. Referring in greater detail to FIGS. 31A-31F, I/O panel controls 264 for pneumatic mast system 260 are shown included, similar to the second embodiment shown in FIGS. 25A-25E.

[0079] The construction and arrangements of the power system, as shown in the various exemplary embodiments, are illustrative only. Although only a few embodiments have been described in detail in this disclosure, many modifications are possible (e.g., variations in sizes, dimensions, structures, shapes and proportions of the various elements, values of parameters, mounting arrangements, use of materials, colors, orientations, etc.) without materially departing from the novel teachings and advantages of the subject matter described herein. Some elements shown as integrally formed may be constructed of multiple parts or elements, the position of elements may be reversed or otherwise varied, and the nature or number of discrete elements or positions may be altered or varied. The order or sequence of any process, logical algorithm, or method steps may be varied or re-sequenced according to alternative embodiments. Other substitutions, modifications, changes and omissions may also be made in the design, operating conditions and arrangement of the various exemplary embodiments without departing from the scope of the present invention.

What is claimed is:

1. A vehicle, comprising:
 - a chassis;
 - an engine coupled to the chassis;
 - a primary electrical system including a primary alternator and a primary battery; and
 - an auxiliary electrical system including an auxiliary alternator and an auxiliary battery,
 wherein at least one of:
 - the primary alternator is electrically decoupled from the auxiliary battery; and
 - the auxiliary alternator is electrically decoupled from the primary battery, and the primary battery is electrically coupled to one or more electrical loads.
2. The vehicle of claim 1, wherein the auxiliary electrical system further includes an inverter coupled to the auxiliary battery.
3. The vehicle of claim 2, wherein the inverter is electrically decoupled from the primary battery.
4. The vehicle of claim 2, wherein the auxiliary battery is configured to provide stored electrical power to at least one of the inverter and a direct current load powered by the inverter.
5. The vehicle of claim 1, further comprising a controller configured to interrupt depletion of stored electrical energy associated with the auxiliary battery in response to receiving an inlet electrical energy.
6. The vehicle of claim 1, wherein the primary alternator is electrically decoupled from the auxiliary battery.
7. The vehicle of claim 1, wherein the auxiliary alternator is electrically decoupled from the primary battery, and the primary battery is electrically coupled to the one or more electrical loads.
8. The vehicle of claim 1, wherein both:
 - the primary alternator is electrically decoupled from the auxiliary battery; and
 - the auxiliary alternator is electrically decoupled from the primary battery, and the primary battery is electrically coupled to the one or more electrical loads.
9. A power system for a vehicle, comprising:
 - a primary electrical system including a primary alternator and a primary battery; and
 - an auxiliary electrical system including an auxiliary alternator and an auxiliary battery;
 wherein at least one of:
 - the primary alternator is electrically decoupled from the auxiliary battery; and
 - the auxiliary alternator is electrically decoupled from the primary battery, and the primary battery is electrically coupled to one or more electrical loads.
10. The power system of claim 9, wherein the auxiliary electrical system further includes an inverter coupled to the auxiliary battery.
11. The power system of claim 10, wherein the inverter is electrically decoupled from the primary battery.
12. The power system of claim 10, further comprising a solar panel system electrically coupled to at least one of the auxiliary battery and a direct current load powered by the inverter, the solar panel system configured to generate electrical power from incident solar energy, wherein the solar panel system provides the generated electrical power to at least one of the auxiliary battery and the direct current load.
13. The power system of claim 9, further comprising a controller configured to interrupt depletion of stored elec-

trical energy associated with the auxiliary battery in response to the auxiliary electrical system receiving an inlet electrical energy.

14. The power system of claim **9**, wherein the auxiliary electrical system has a power rating of at least 3 kW.

15. The power system of claim **9**, wherein the auxiliary electrical system has a power rating of 3 kW.

16. The power system of claim **9**, wherein the auxiliary electrical system further includes an inverter coupled to the auxiliary battery, and wherein the auxiliary battery is configured to provide direct current electrical energy to at least one of the inverter and a direct current load powered by the inverter at a target voltage.

17. A method for powering a vehicle, comprising:
converting mechanical energy from an engine of the vehicle into primary electrical energy with a primary alternator of a primary electrical system;
supplying at least a portion of the primary electrical energy to a primary battery of the primary electrical system;
generating auxiliary electrical energy with an auxiliary alternator of an auxiliary electrical system; and

storing the generated auxiliary electrical energy in an auxiliary battery of the auxiliary electrical system, wherein at least one of:

the primary alternator is electrically decoupled from the auxiliary battery; and

the auxiliary alternator is electrically decoupled from the primary battery, and the primary battery is electrically coupled to one or more electrical loads.

18. The method of claim **17**, further comprising:
converting the stored auxiliary electrical energy to converted alternating current electrical energy with an inverter of the auxiliary electrical system; and
powering one or more systems of the vehicle with the auxiliary electrical system while the engine of the vehicle is turned off.

19. The method of claim **18**, wherein the inverter of the auxiliary electrical system is electrically decoupled from the primary battery.

20. The method of claim **17**, wherein the auxiliary electrical system has a power rating of at least 3 kW.

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