1776 – 2026

United States of America

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The Director

of the United States Patent and Trademark Office has received an application for a patent for a new and useful invention. The title and description of the invention are enclosed. The requirements of law have been complied with, and it has been determined that a patent on the invention shall be granted under the law.

Therefore, this United States

Patent

grants to the person(s) having title to this patent the right to exclude others from making, using, offering for sale, or selling the invention throughout the United States of America or importing the invention into the United States of America, and if the invention is a process, of the right to exclude others from using, offering for sale or selling throughout the United States of America, products made by that process, for the term set forth in 35 U.S.C. 154(a)(2) or (c)(1), subject to the payment of maintenance fees as provided by 35 U.S.C. 41(b). See the Maintenance Fee Notice on the inside of the cover.

DIRECTOR OF THE UNITED STATES PATENT AND TRADEMARK OFFICE

250 1776-2026 ★★★

UNITED STATES PATENT AND TRADEMARK OFFICE

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Maintenance Fee Notice

If the application for this patent was filed on or after December 12, 1980, maintenance fees are due three years and six months, seven years and six months, and eleven years and six months after the date of this grant, or within a grace period of six months thereafter upon payment of a surcharge as provided by law. The amount, number and timing of the maintenance fees required may be changed by law or regulation. Unless payment of the applicable maintenance fee is received in the United States Patent and Trademark Office on or before the date the fee is due or within a grace period of six months thereafter, the patent will expire as of the end of such grace period.

Patent Term Notice

If the application for this patent was filed on or after June 8, 1995, the term of this patent begins on the date on which this patent issues and ends twenty years from the filing date of the application or, if the application contains a specific reference to an earlier filed application or applications under 35 U.S.C. 120, 121, 365(c), or 386(c), twenty years from the filing date of the earliest such application ("the twenty-year term"), subject to the payment of maintenance fees as provided by 35 U.S.C. 41(b), and any extension as provided by 35 U.S.C. 154(b) or 156 or any disclaimer under 35 U.S.C. 253.

If this application was filed prior to June 8, 1995, the term of this patent begins on the date on which this patent issues and ends on the later of seventeen years from the date of the grant of this patent or the twenty-year term set forth above for patents resulting from applications filed on or after June 8, 1995, subject to the payment of maintenance fees as provided by 35 U.S.C. 41(b) and any extension as provided by 35 U.S.C. 156 or any disclaimer under 35 U.S.C. 253.

Form PTO-377C (Rev 09/17)

US012583349B2

(12) United States Patent
Kulik

(10) Patent No.: US 12,583,349 B2
(45) Date of Patent: Mar. 24, 2026

(54) **SELF-CHARGING ELECTRIC VEHICLE (SCEV)**

(71) Applicant: **Gregory Kulik**, Winnetka, IL (US)

(72) Inventor: **Gregory Kulik**, Winnetka, IL (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 1473 days.

(21) Appl. No.: **17/260,180**

(22) PCT Filed: **Jul. 10, 2019**

(86) PCT No.: **PCT/US2019/041256**

§ 371 (c)(1),
(2) Date: **Jan. 13, 2021**

(87) PCT Pub. No.: **WO2020/014398**

PCT Pub. Date: **Jan. 16, 2020**

(65) **Prior Publication Data**

US 2021/0323430 A1 Oct. 21, 2021

Related U.S. Application Data

(60) Provisional application No. 62/697,723, filed on Jul. 13, 2018.

(51) **Int. Cl.**

B60L 53/51	(2019.01)
B60L 8/00	(2006.01)
B60L 50/60	(2019.01)
B60L 53/52	(2019.01)
B60N 2/01	(2006.01)
F03D 1/02	(2006.01)
F03D 1/06	(2006.01)
F03D 9/32	(2016.01)

(Continued)

(52) **U.S. Cl.**

CPC ***B60L 53/51*** (2019.02); ***B60L 8/003*** (2013.01); ***B60L 8/006*** (2013.01); ***B60L 50/66*** (2019.02); ***B60L 53/52*** (2019.02); ***B60N 2/012*** (2013.01); ***F03D 1/02*** (2013.01); ***F03D 1/0675*** (2013.01); ***F03D 9/32*** (2016.05); ***F03D 13/20*** (2016.05); ***H02S 10/12*** (2014.12); ***H02S 10/20*** (2014.12);

(Continued)

(58) **Field of Classification Search**

CPC B60L 53/51; B60L 53/52; B60L 50/66; B60L 8/003; B60L 8/006; H02S 10/12; H02S 10/20; H02S 10/40; H02S 20/32; H02S 30/20; F03D 9/32; F03D 13/20; F03D 1/02; F03D 1/0675; B60N 2/012

See application file for complete search history.

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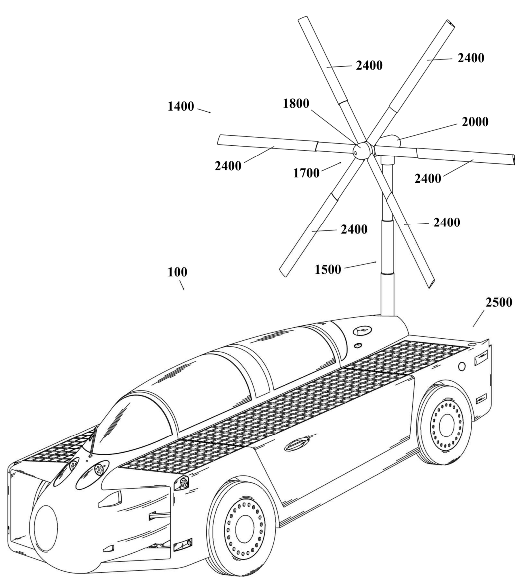
Primary Examiner — John D Walters
(74) *Attorney, Agent, or Firm* — DLA Piper LLP (US)

(57) **ABSTRACT**

A self-charging electric vehicle configured for converting solar energy and wind energy into electrical energy comprising a systems and methods. The vehicle includes a body and frame with a central body structure and centerline cabin and a chassis with a centerline battery compartment and a suspension system. Solar cells mounted to the vehicles top sides can be supplemented with extendable solar panel(s) that can be deployed by a control system to generate solar energy into electrical energy. An omnidirectional sun sensor provides for sun strength, angle and direction. A stowable horizontal-axis wind turbine with an extendable mast mounted to the vehicle that can be deployed by a control system to generate wind energy into electrical energy. A stowable anemometer provides for wind speed and wind direction.

22 Claims, 37 Drawing Sheets



(51) **Int. Cl.**

F03D 13/20	(2016.01)
H02S 10/12	(2014.01)
H02S 10/20	(2014.01)
H02S 10/40	(2014.01)
H02S 20/32	(2014.01)
H02S 30/20	(2014.01)

(52) **U.S. Cl.**

CPC ***H02S 10/40*** (2014.12); ***H02S 20/32*** (2014.12); ***H02S 30/20*** (2014.12); *F05B 2220/708* (2013.01); *F05B 2240/221* (2013.01); *F05B 2240/941* (2013.01); *F05B 2260/70* (2013.01); *F05B 2270/32* (2013.01); *F05B 2270/321* (2013.01)

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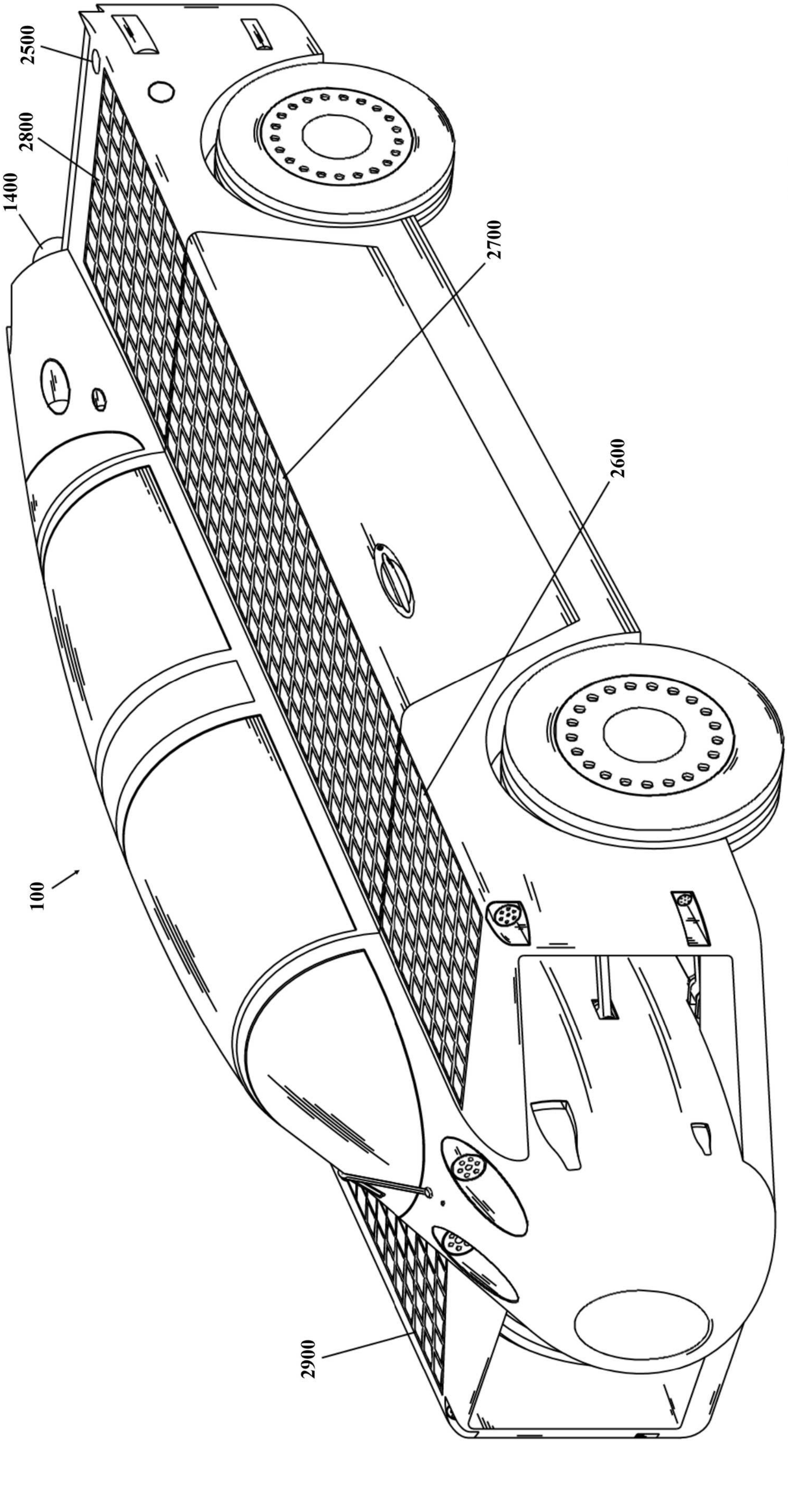
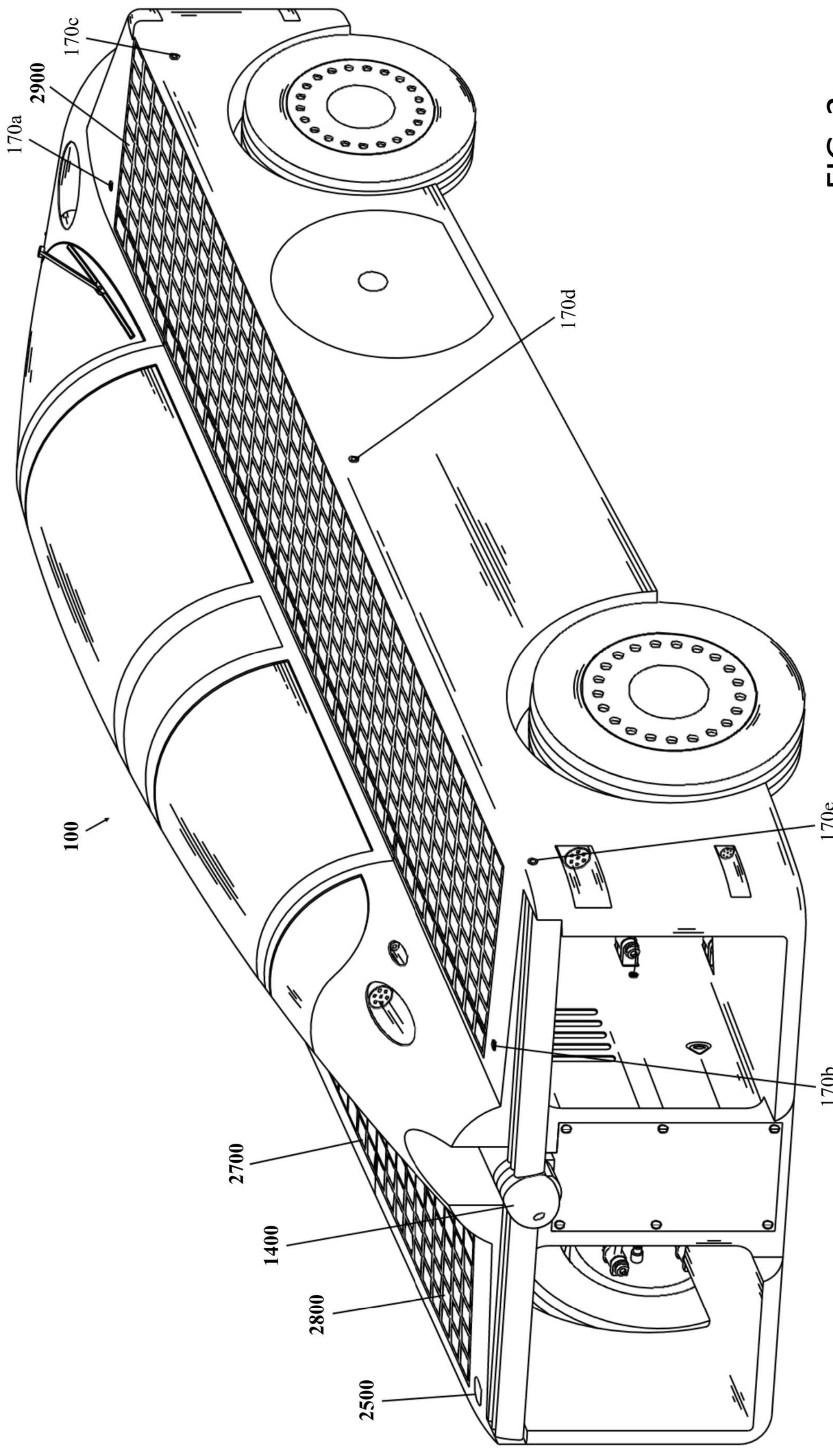


FIG. 1



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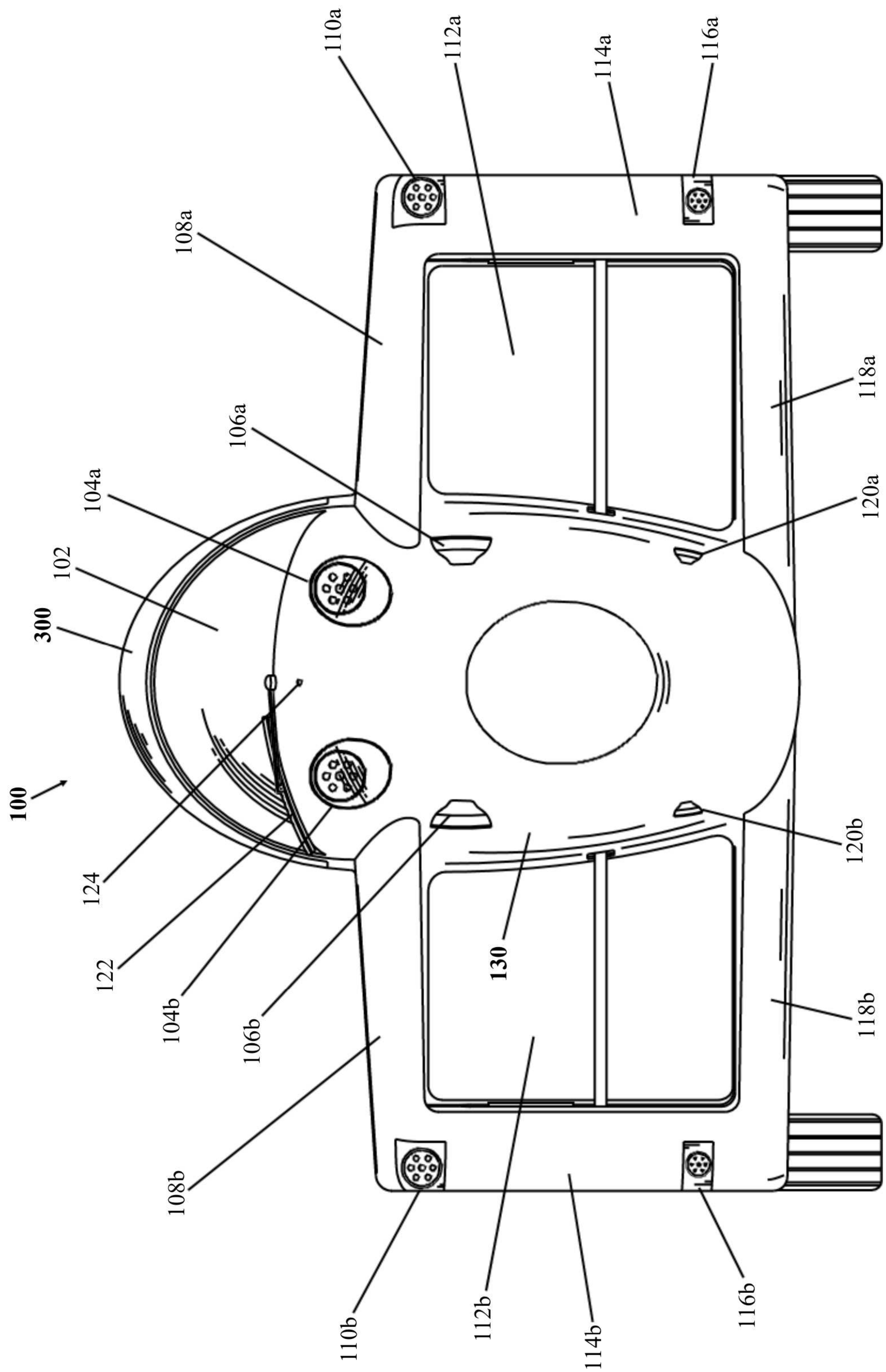
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110b
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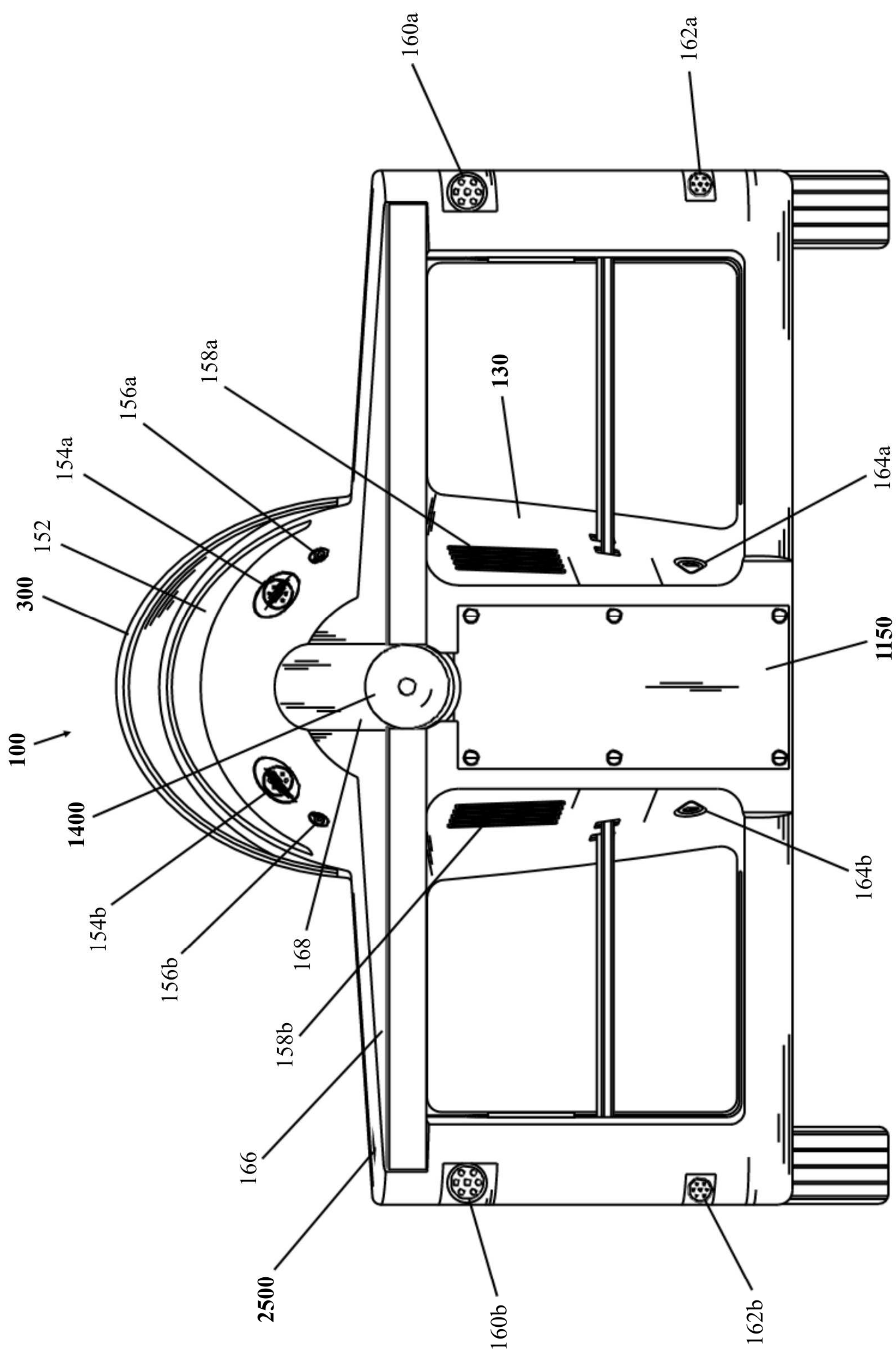
114b
116b

FIG. 3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160b
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FIG. 4

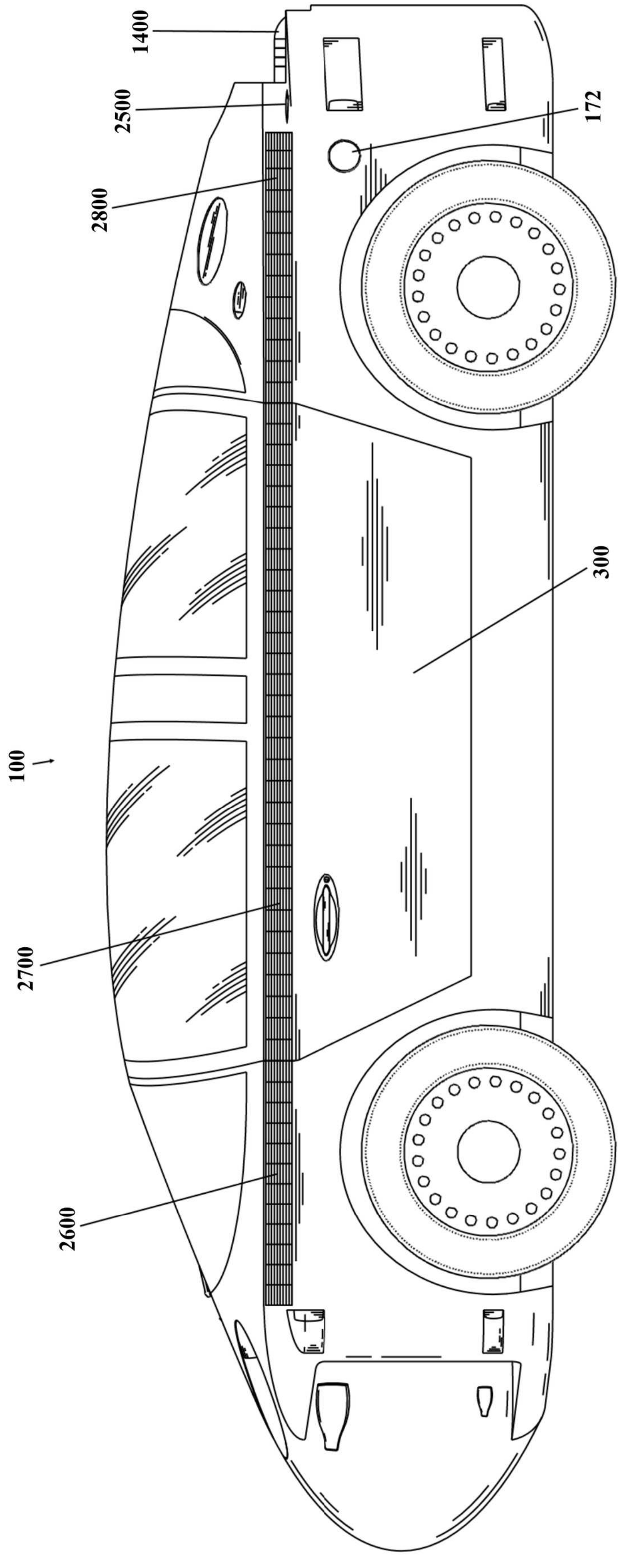

FIG. 5

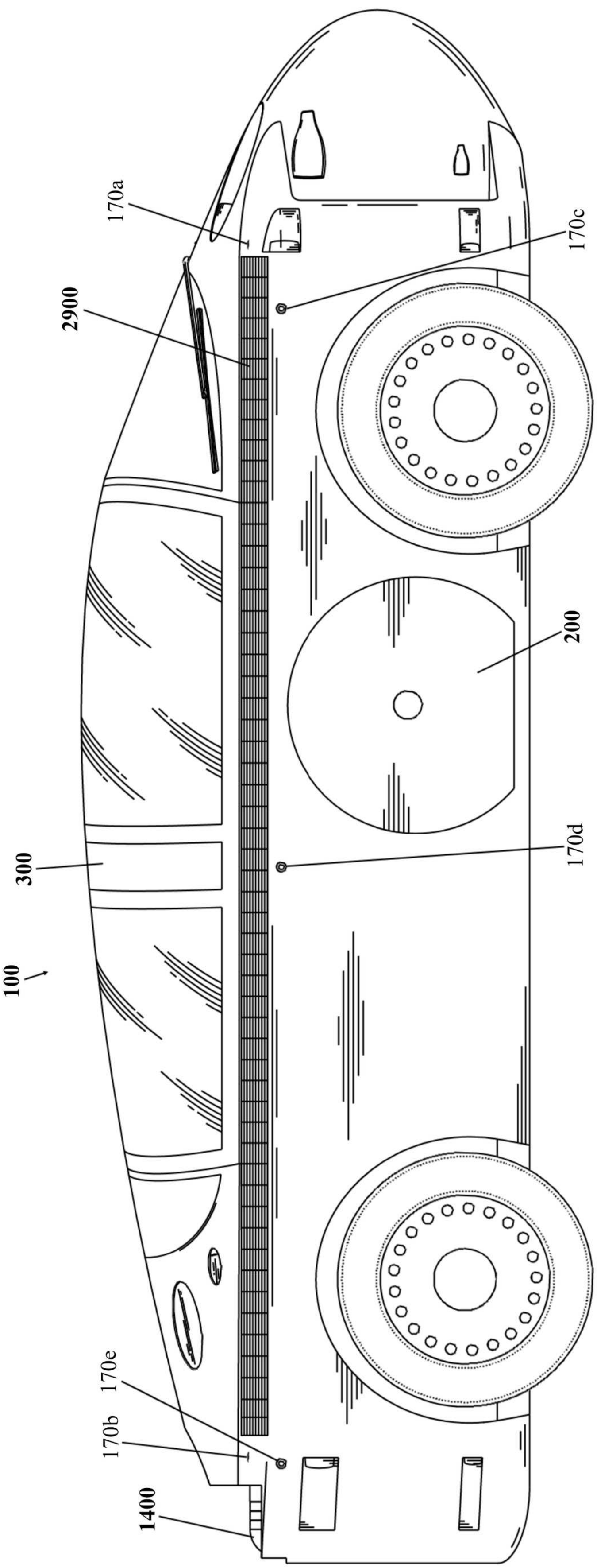

FIG. 6

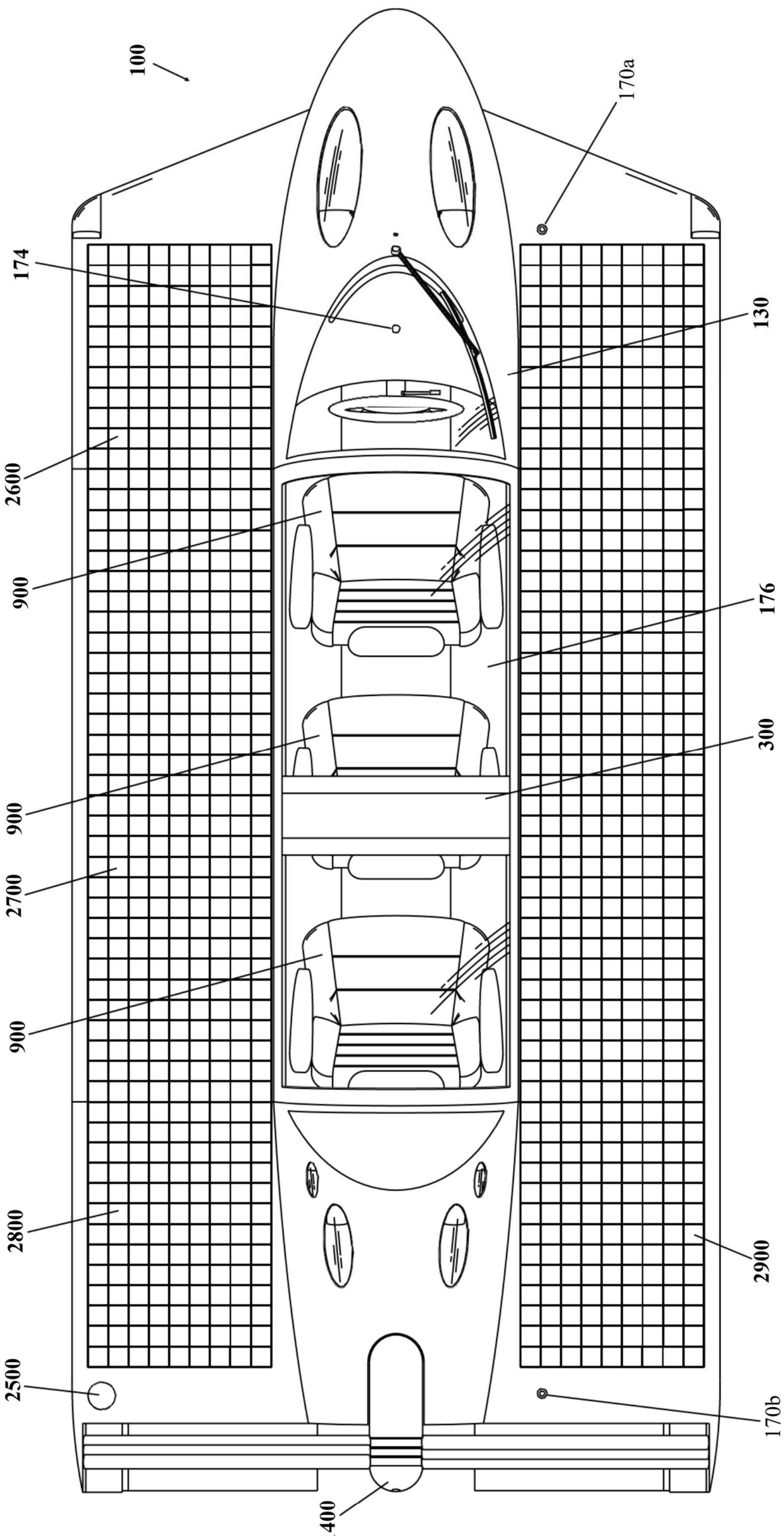
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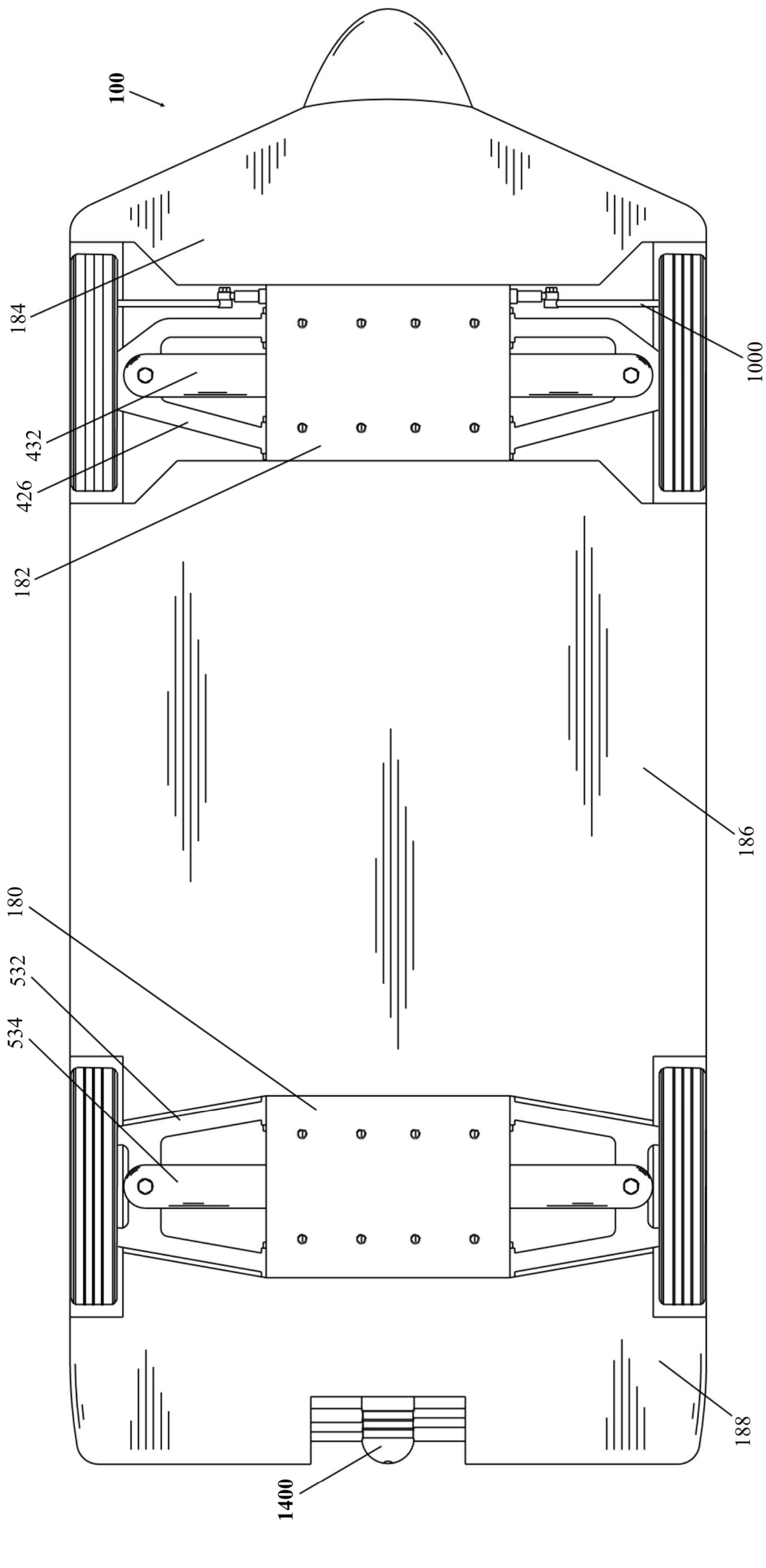
FIG. 7



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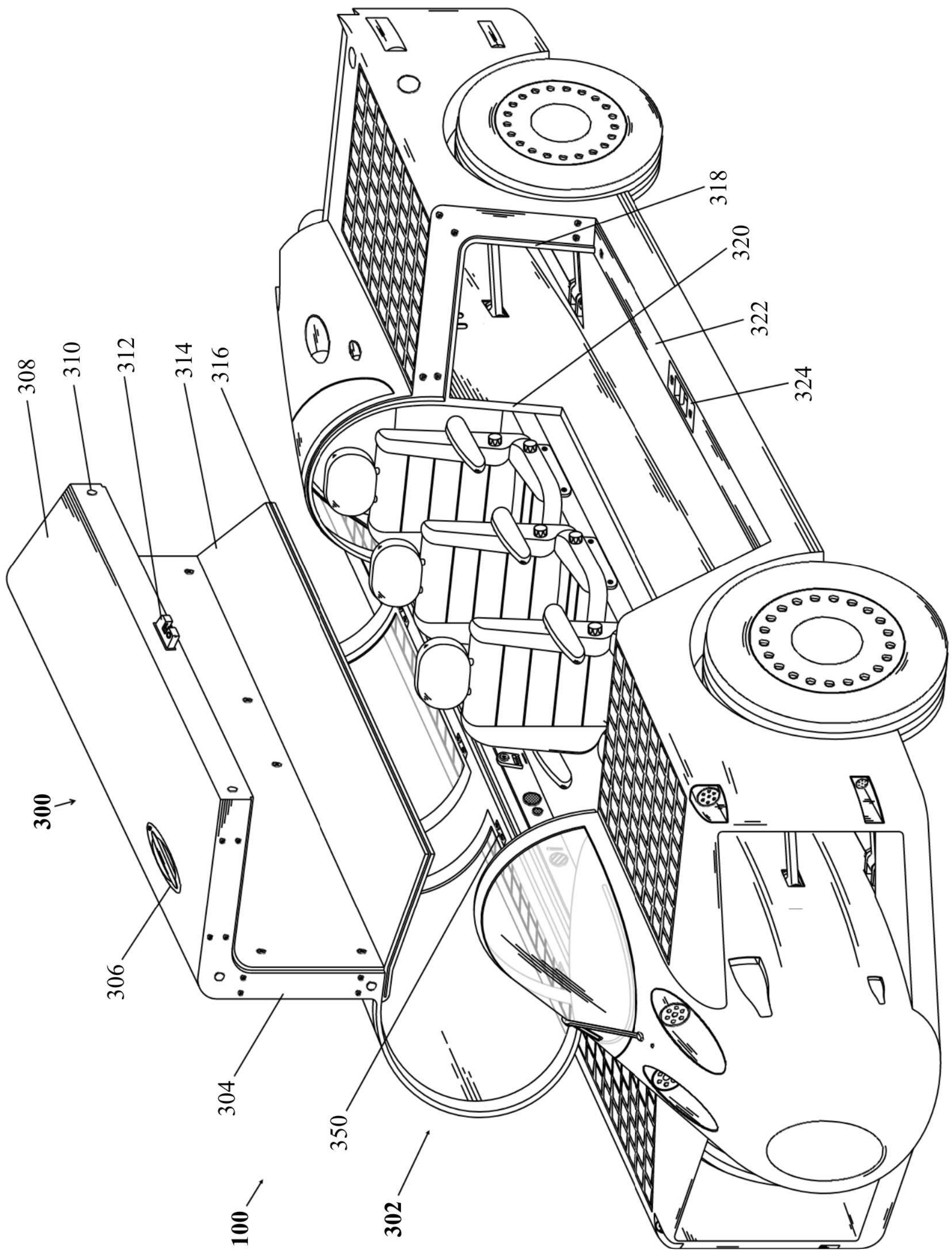
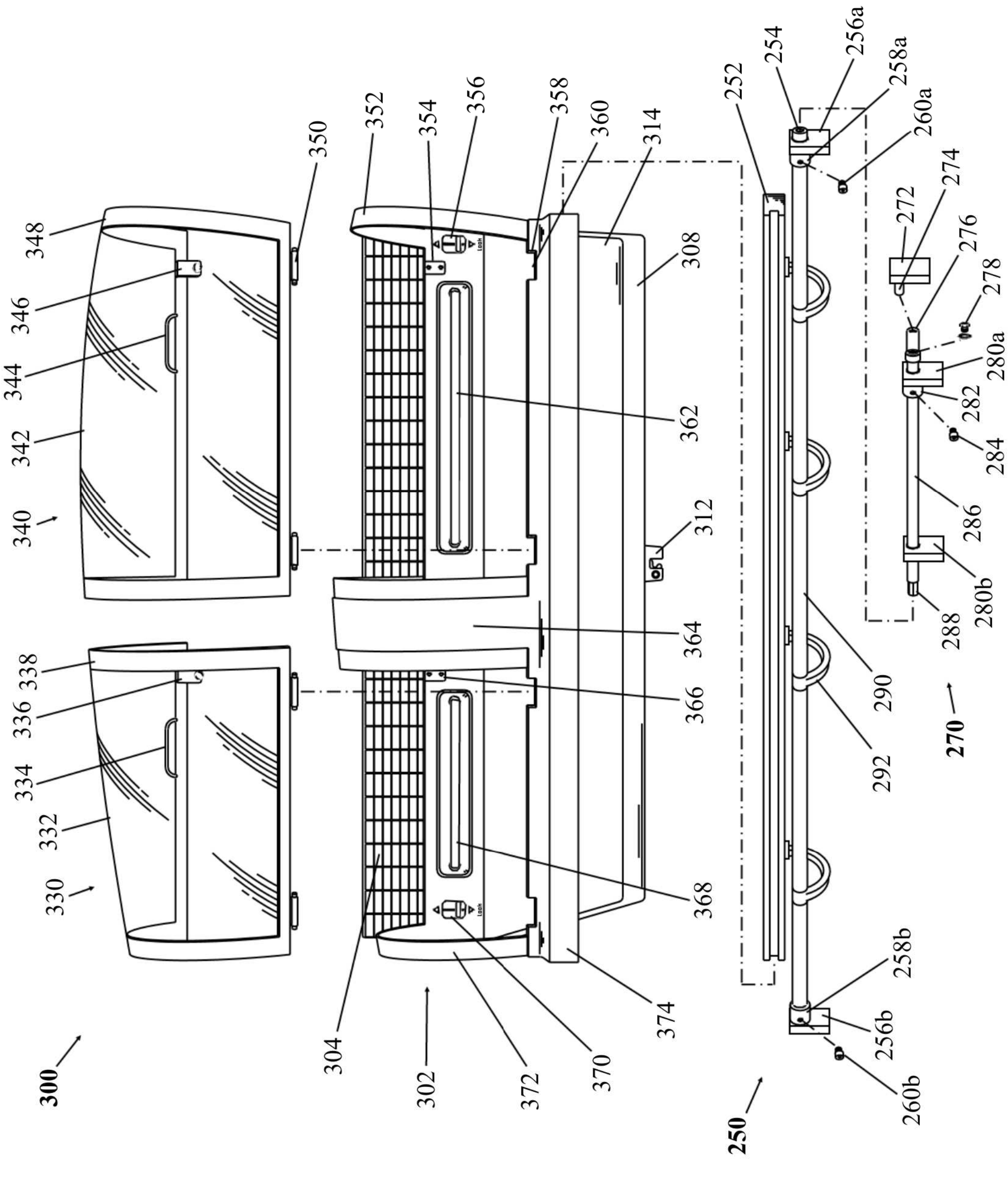


FIG. 9

FIG. 10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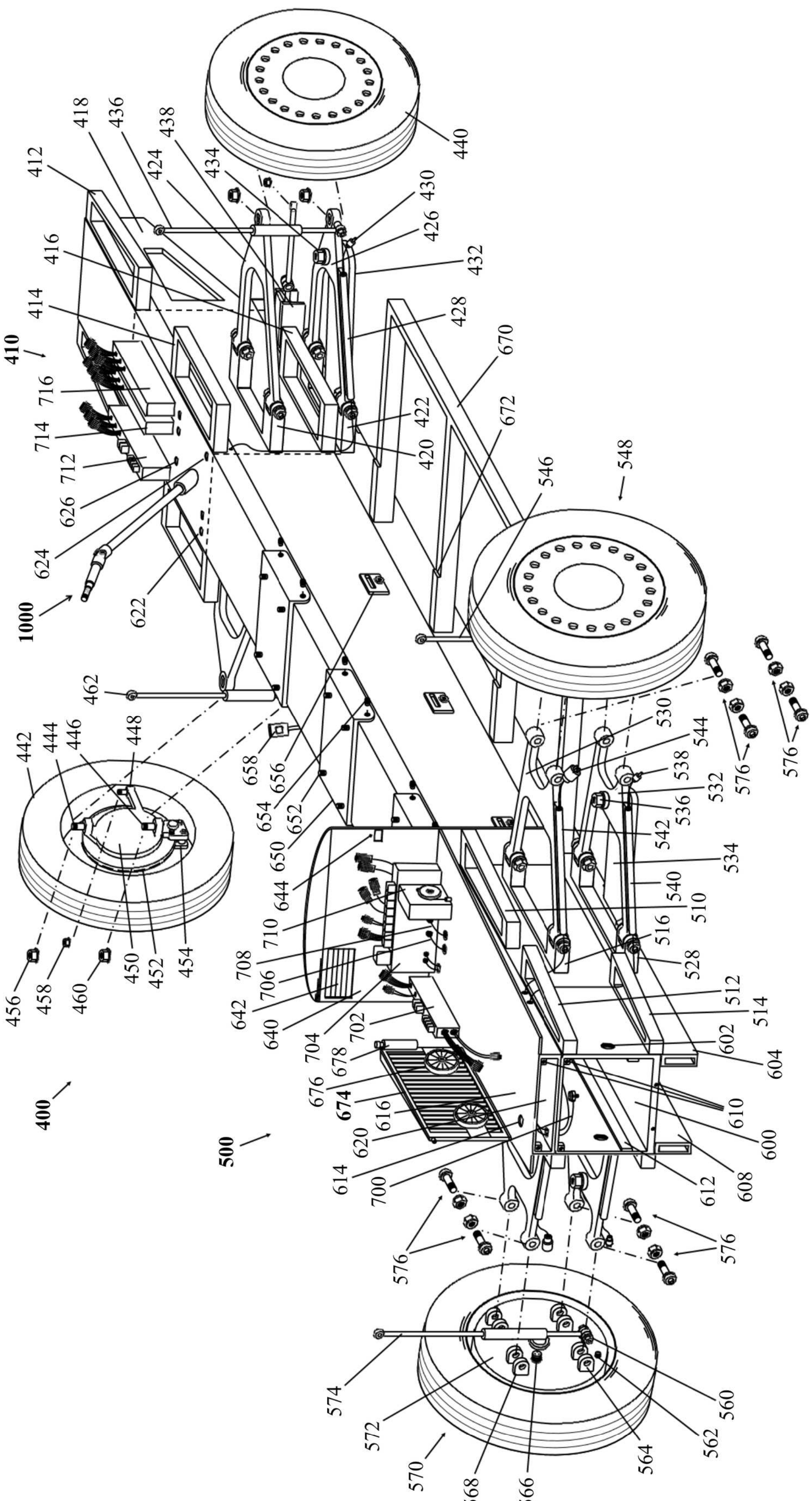

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FIG. 11

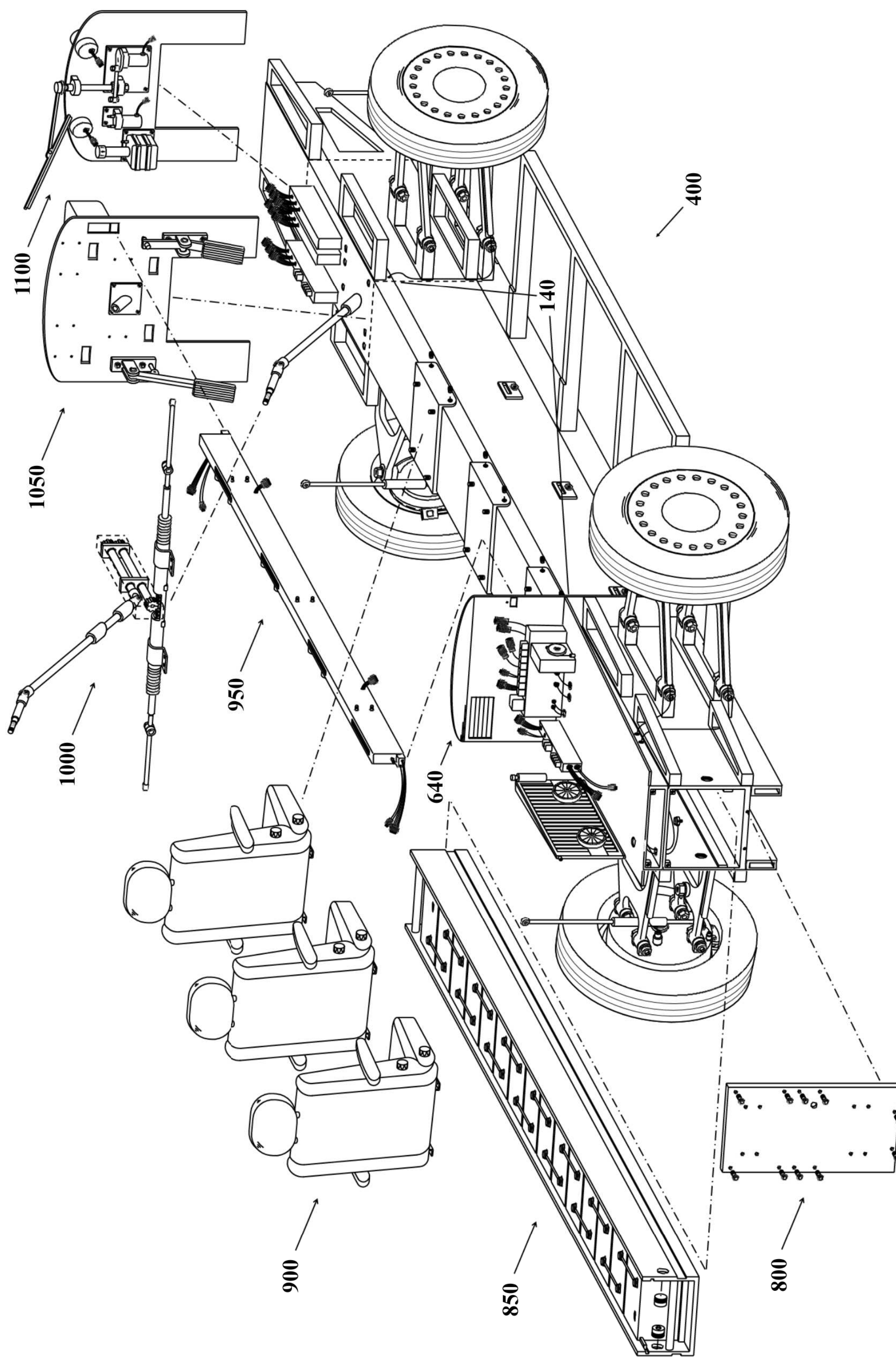

FIG. 12

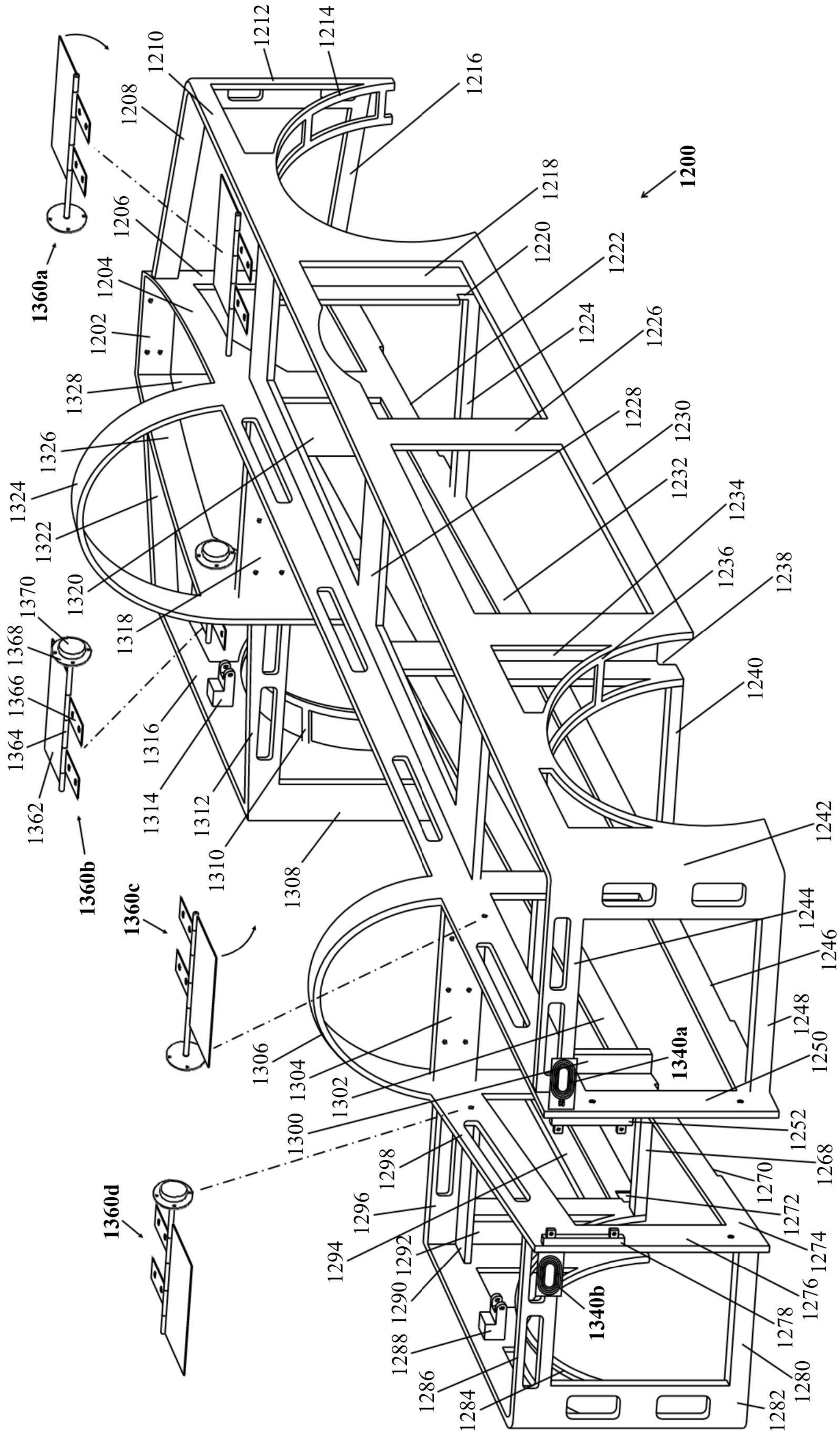
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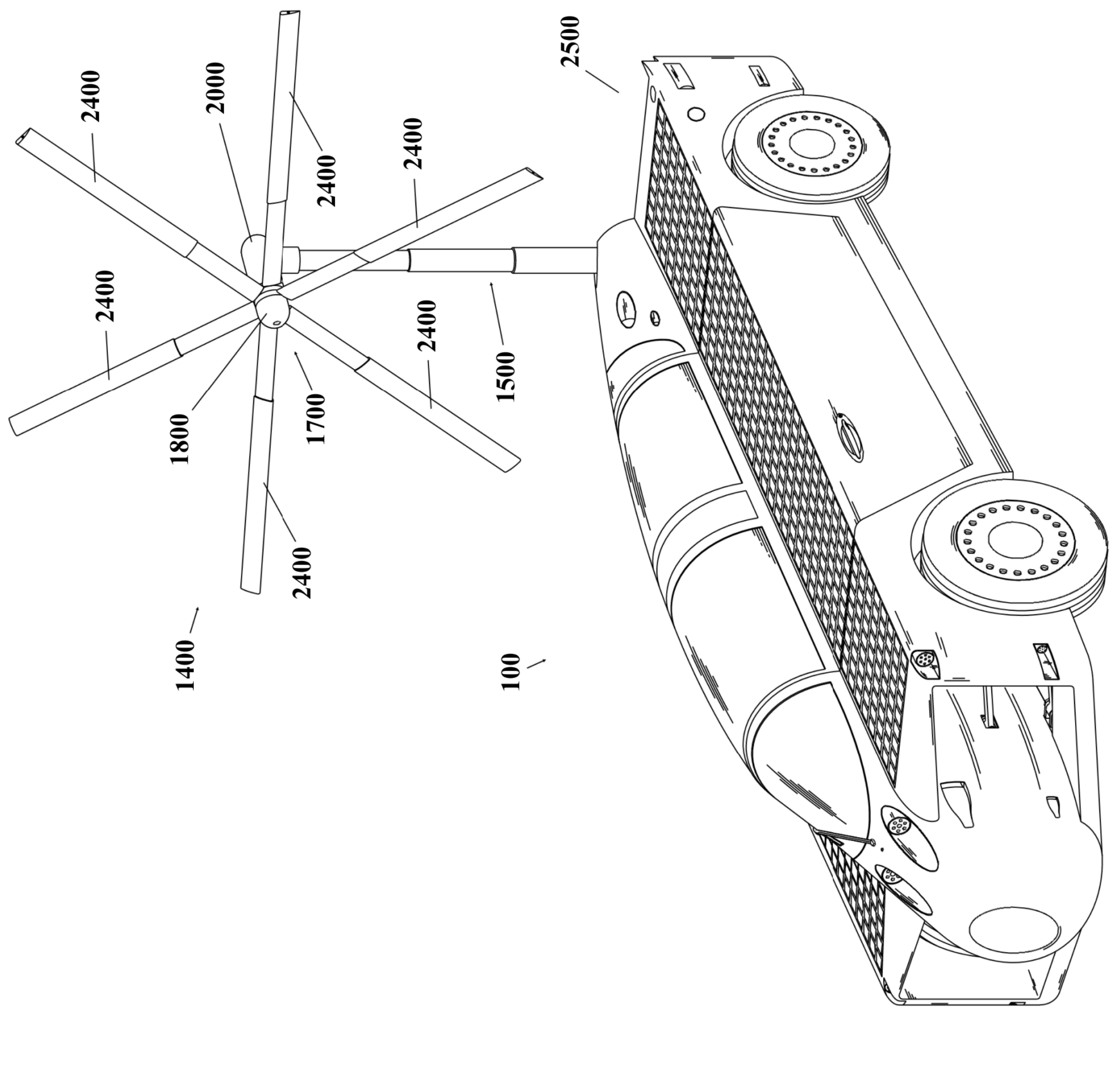
FIG. 13

FIG. 14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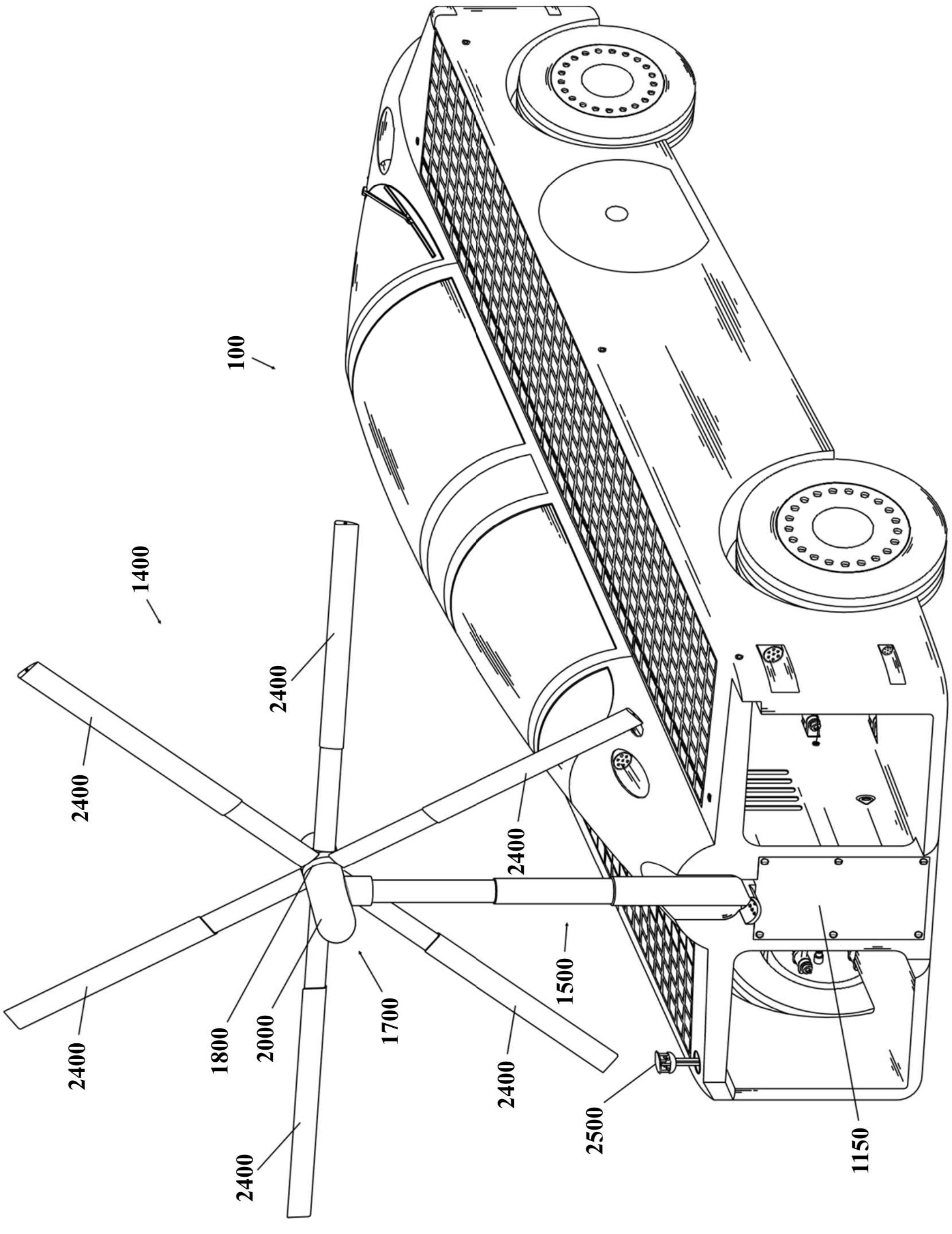
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FIG. 15

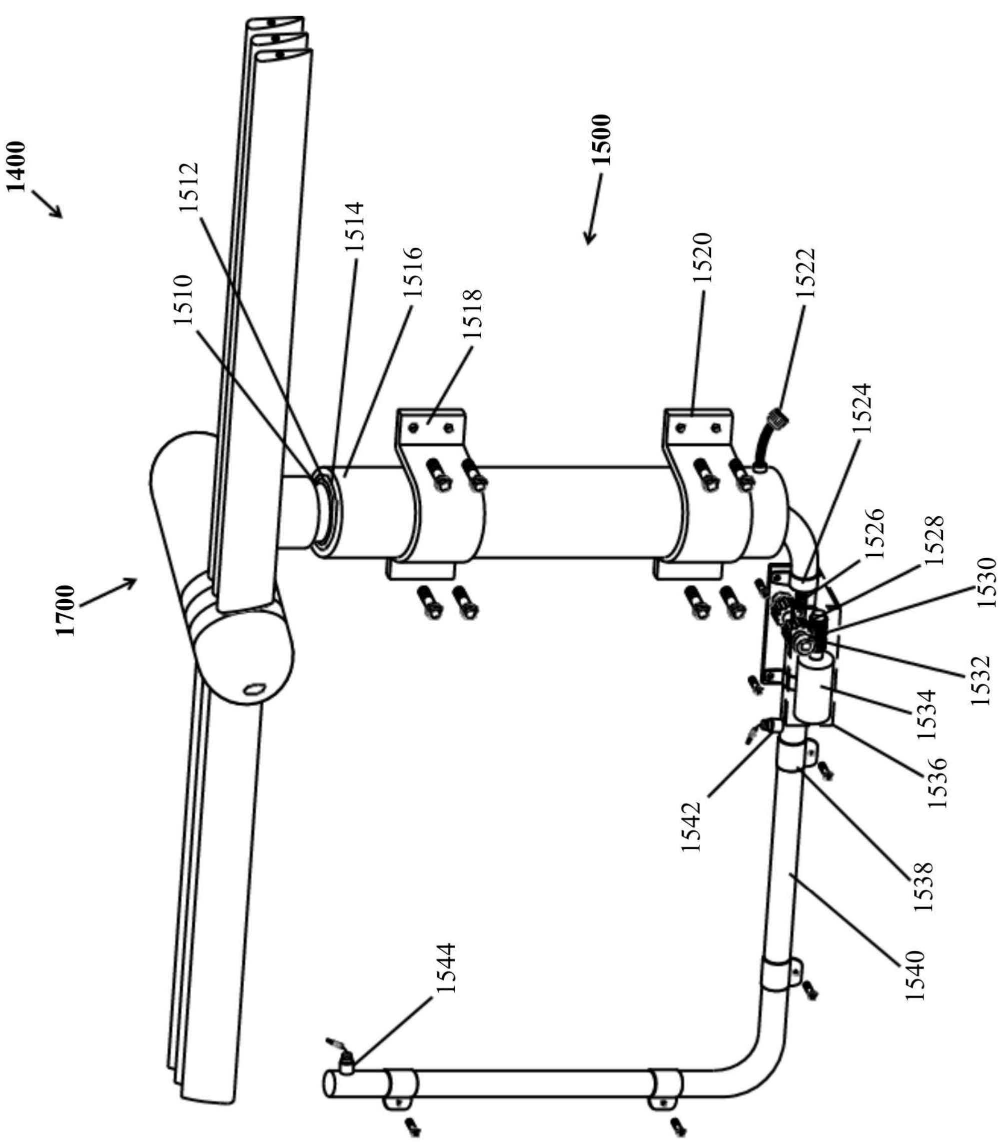
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FIG. 16

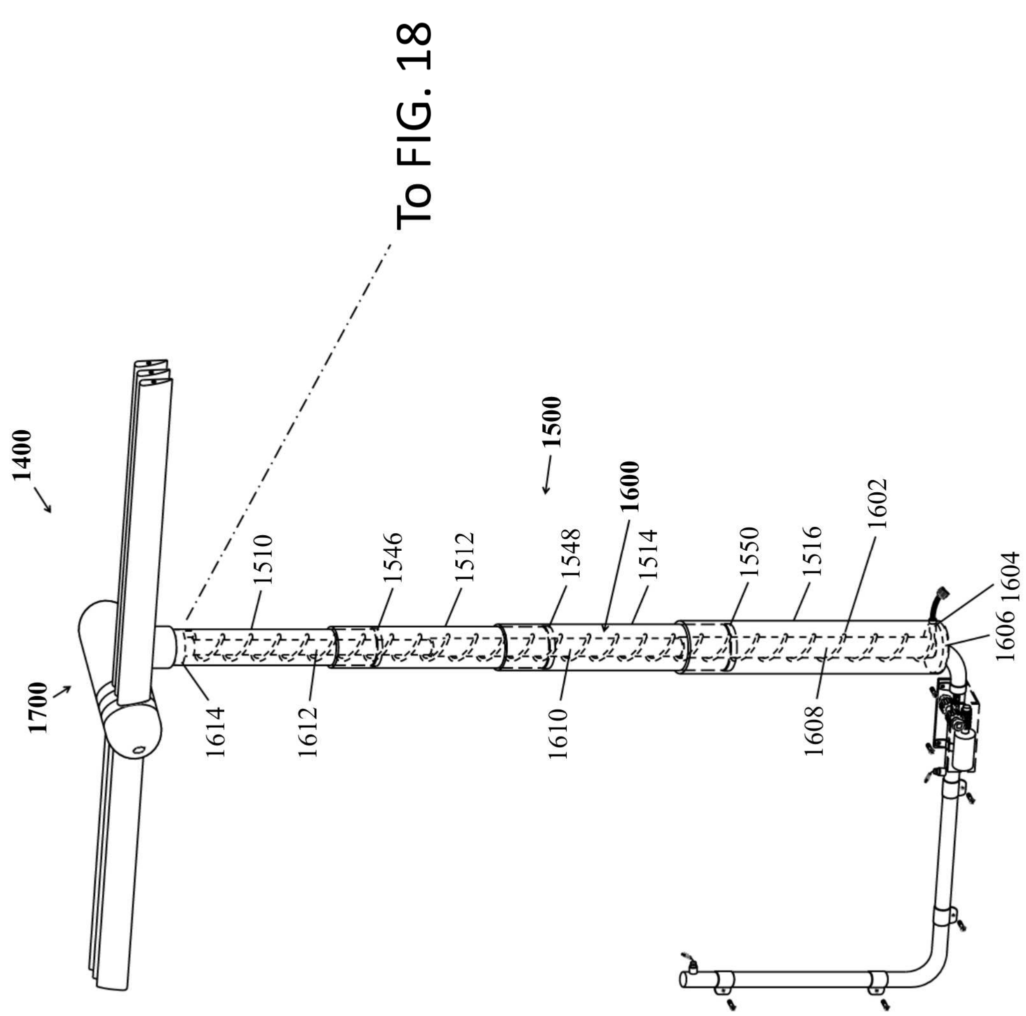
To FIG. 18
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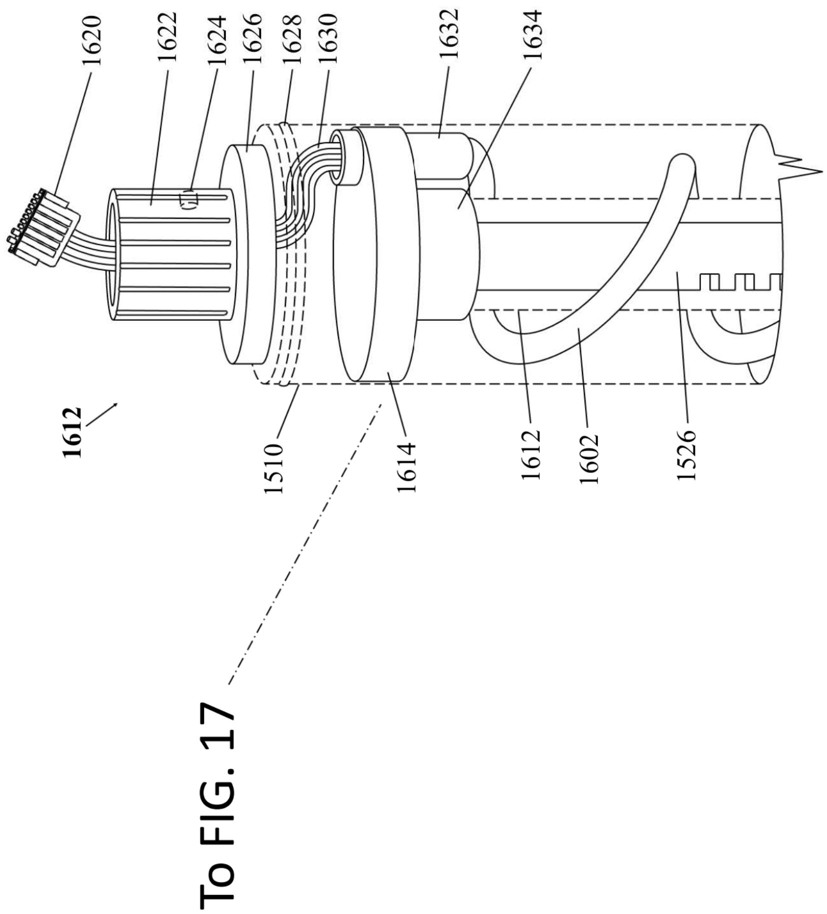
FIG. 17

FIG. 18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To FIG. 17

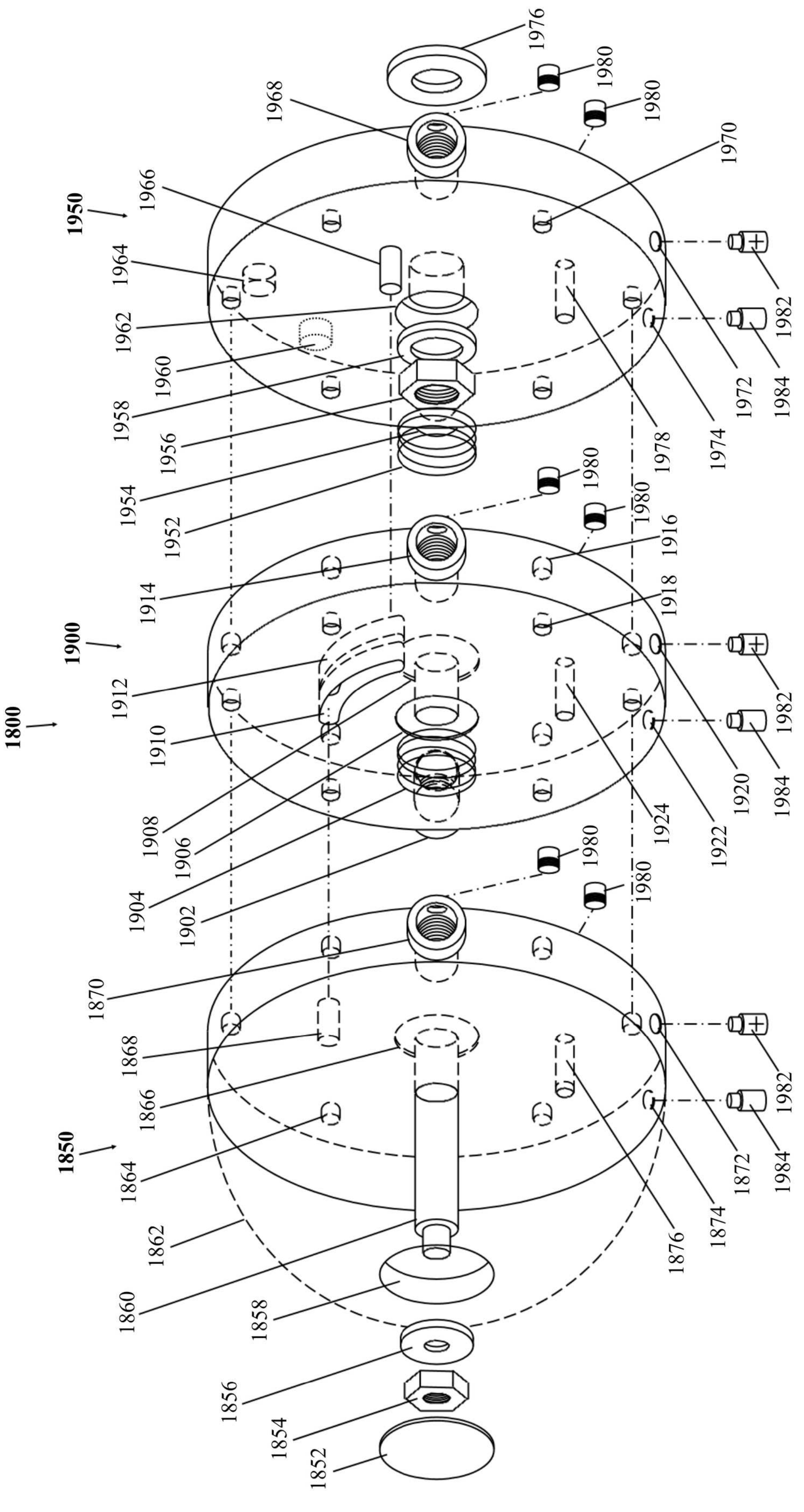
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FIG. 19

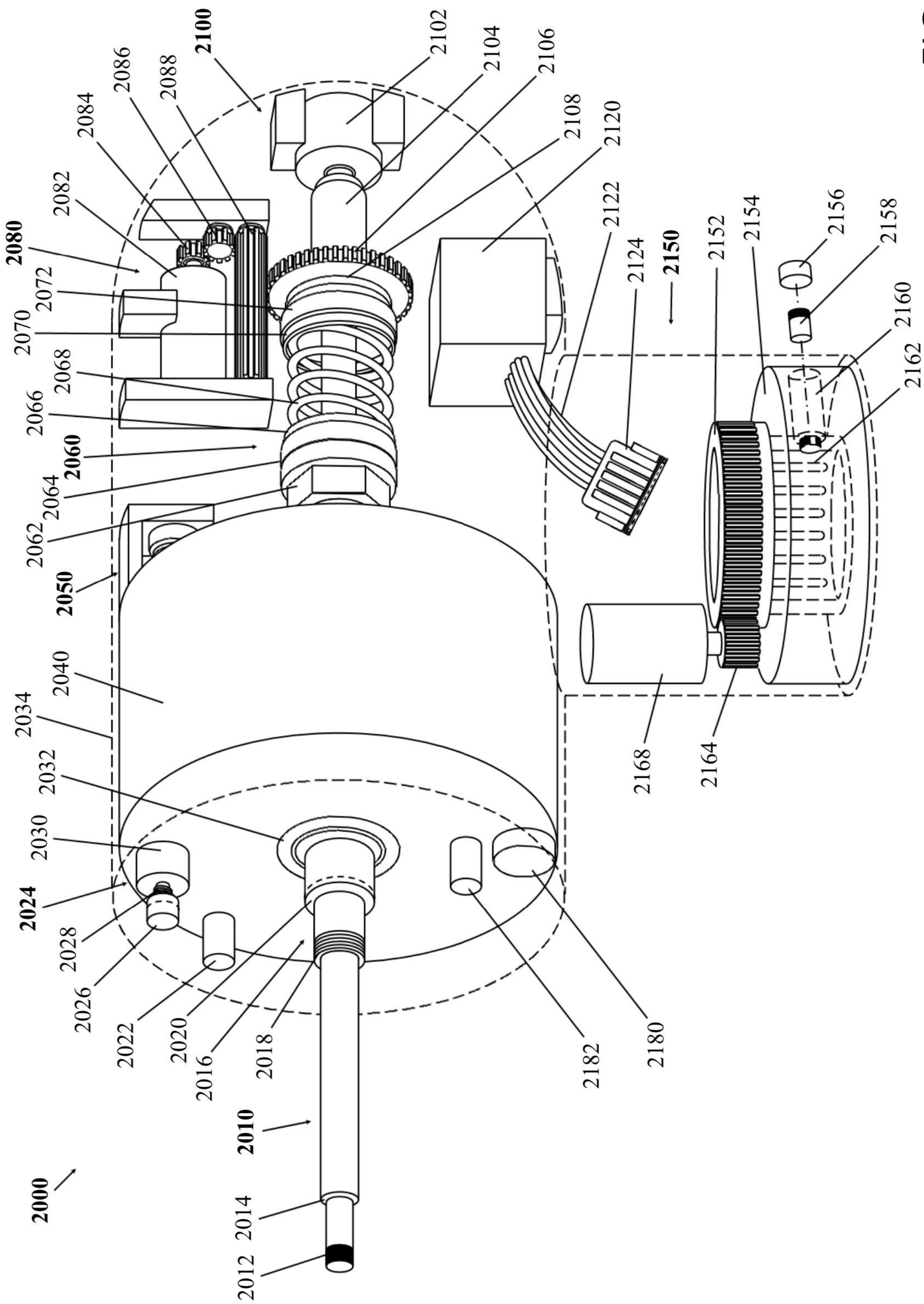
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FIG. 20

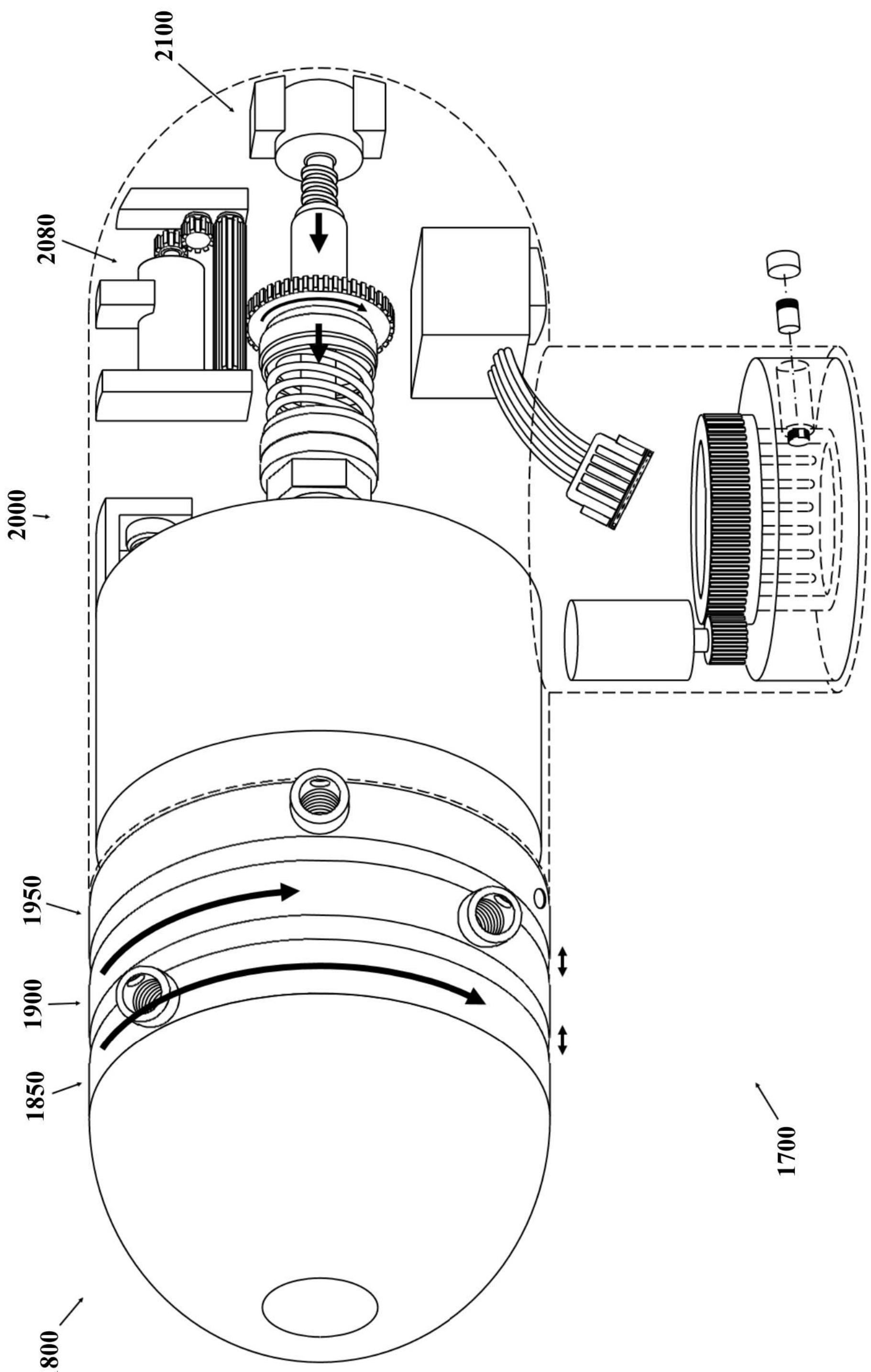

FIG. 21

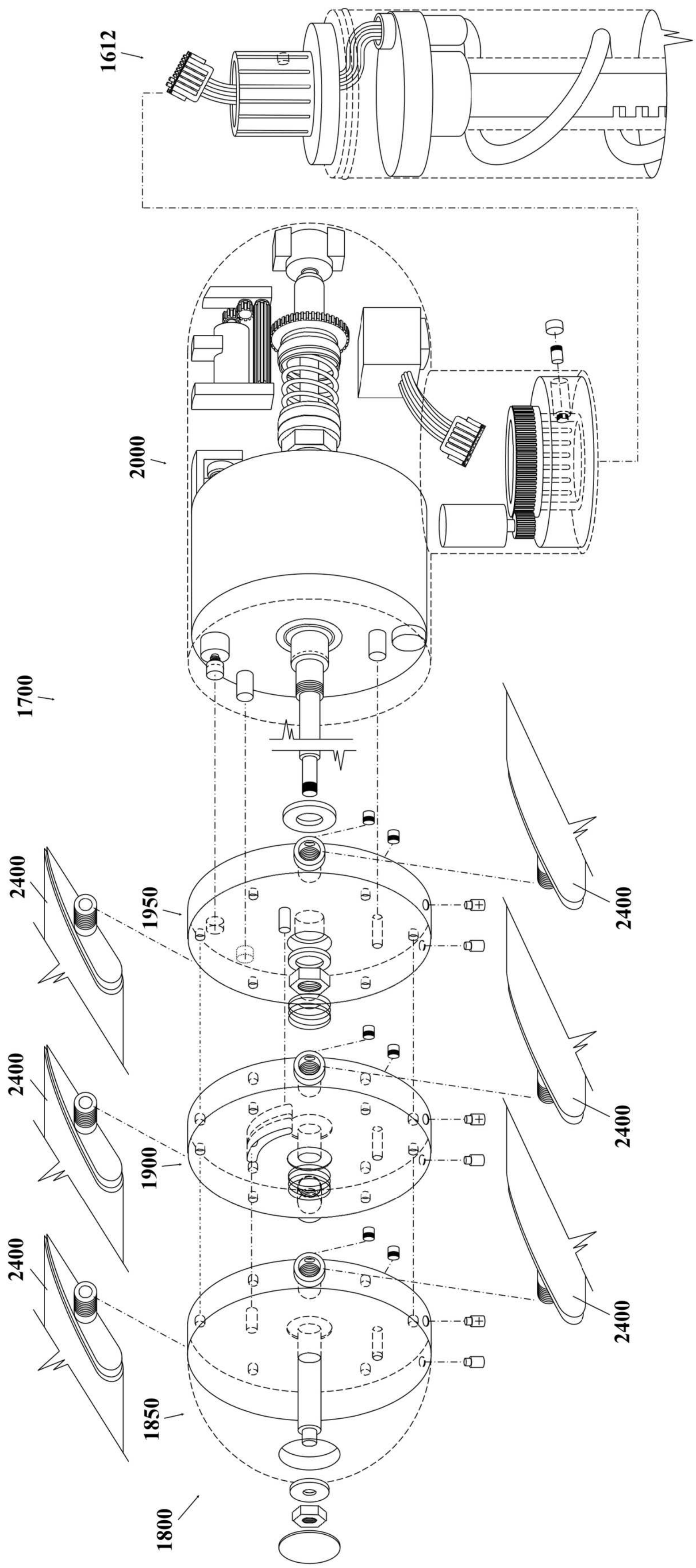
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FIG. 22

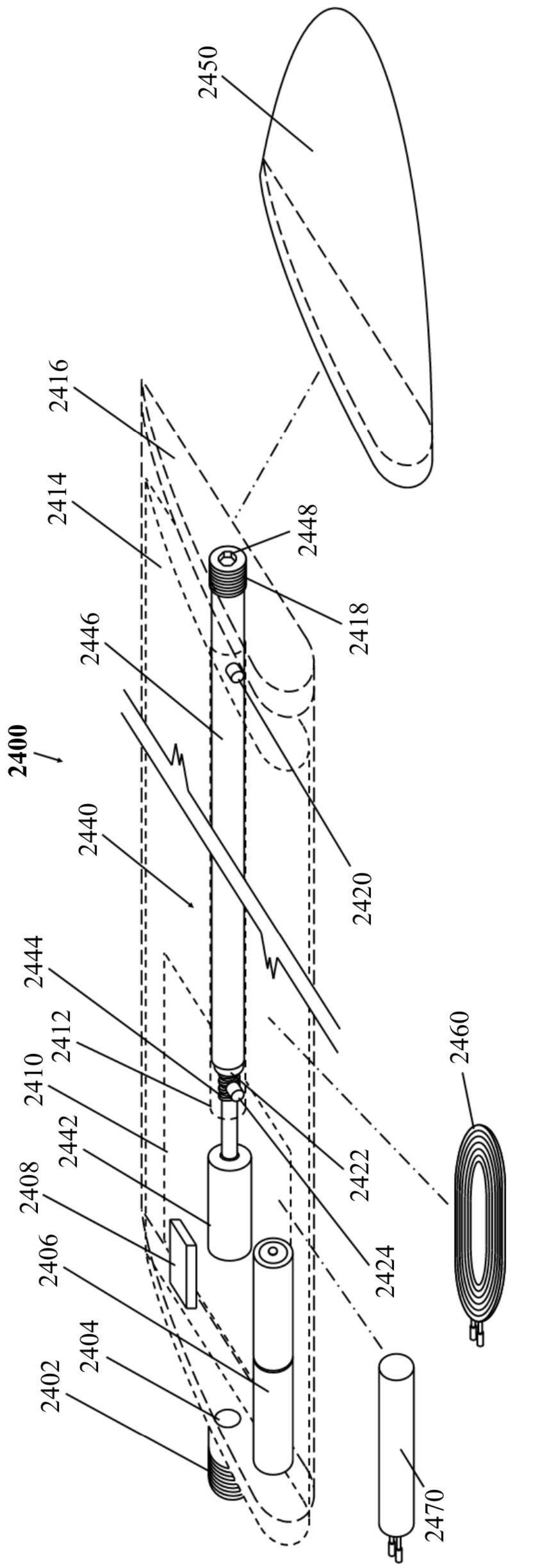
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FIG. 23

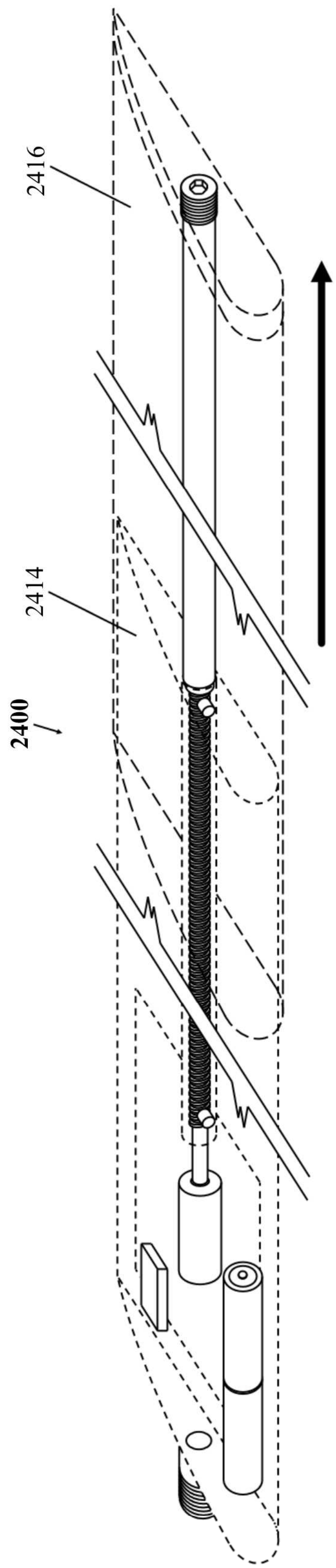

FIG. 24

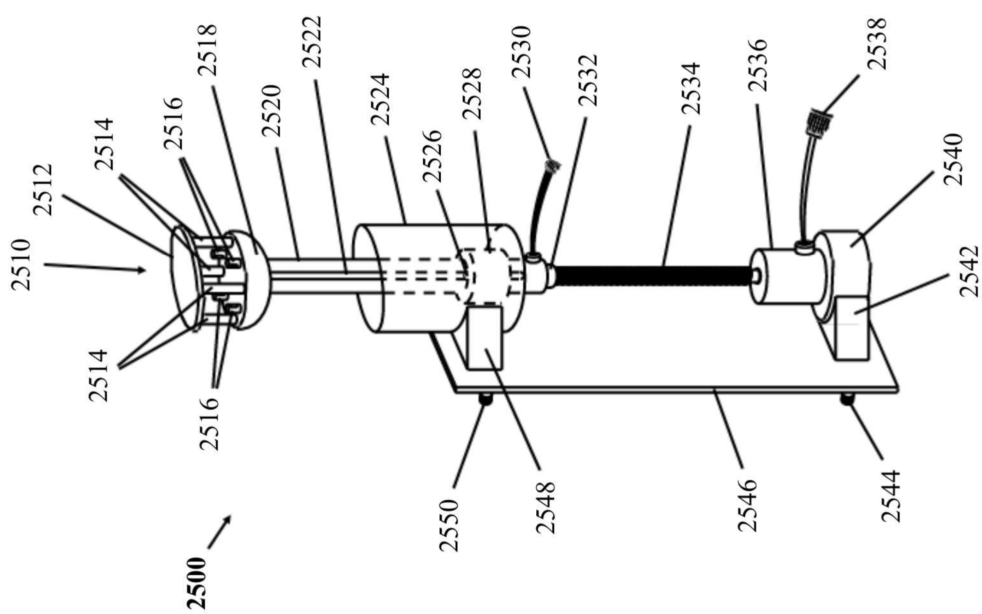
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FIG. 25

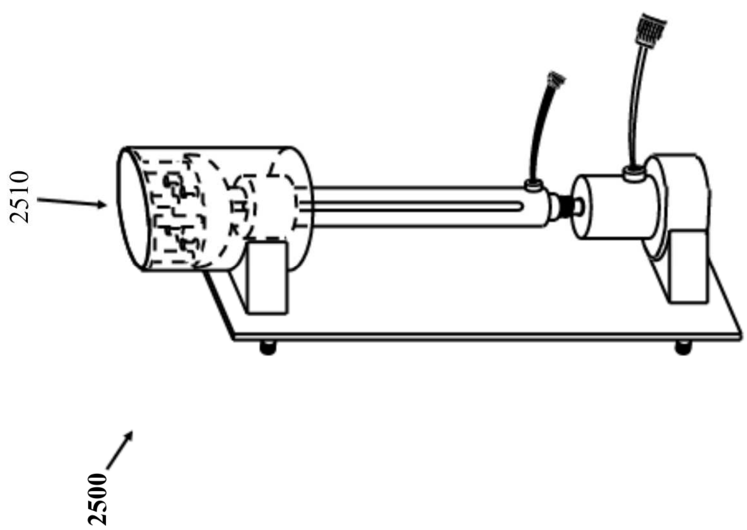
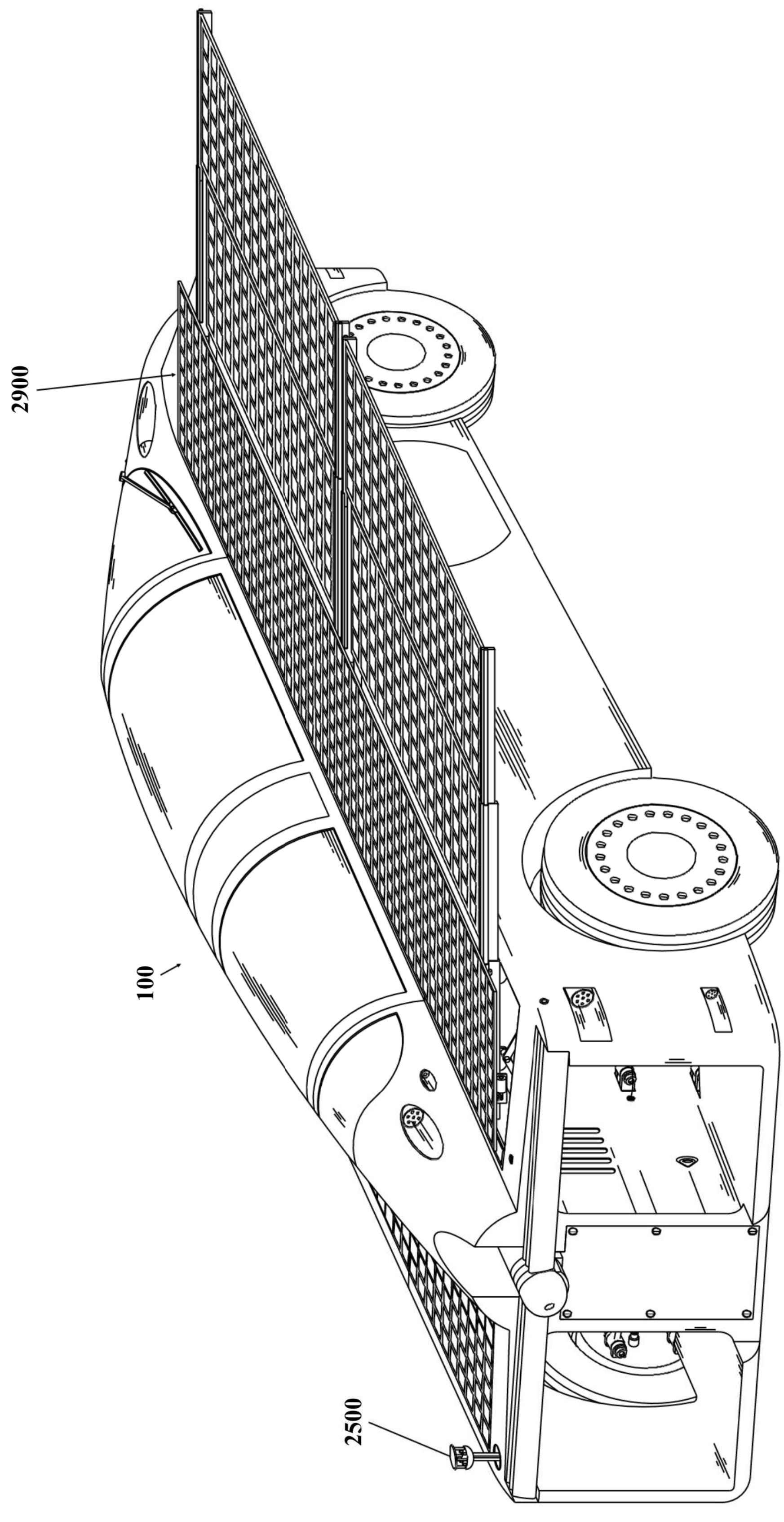


FIG. 26



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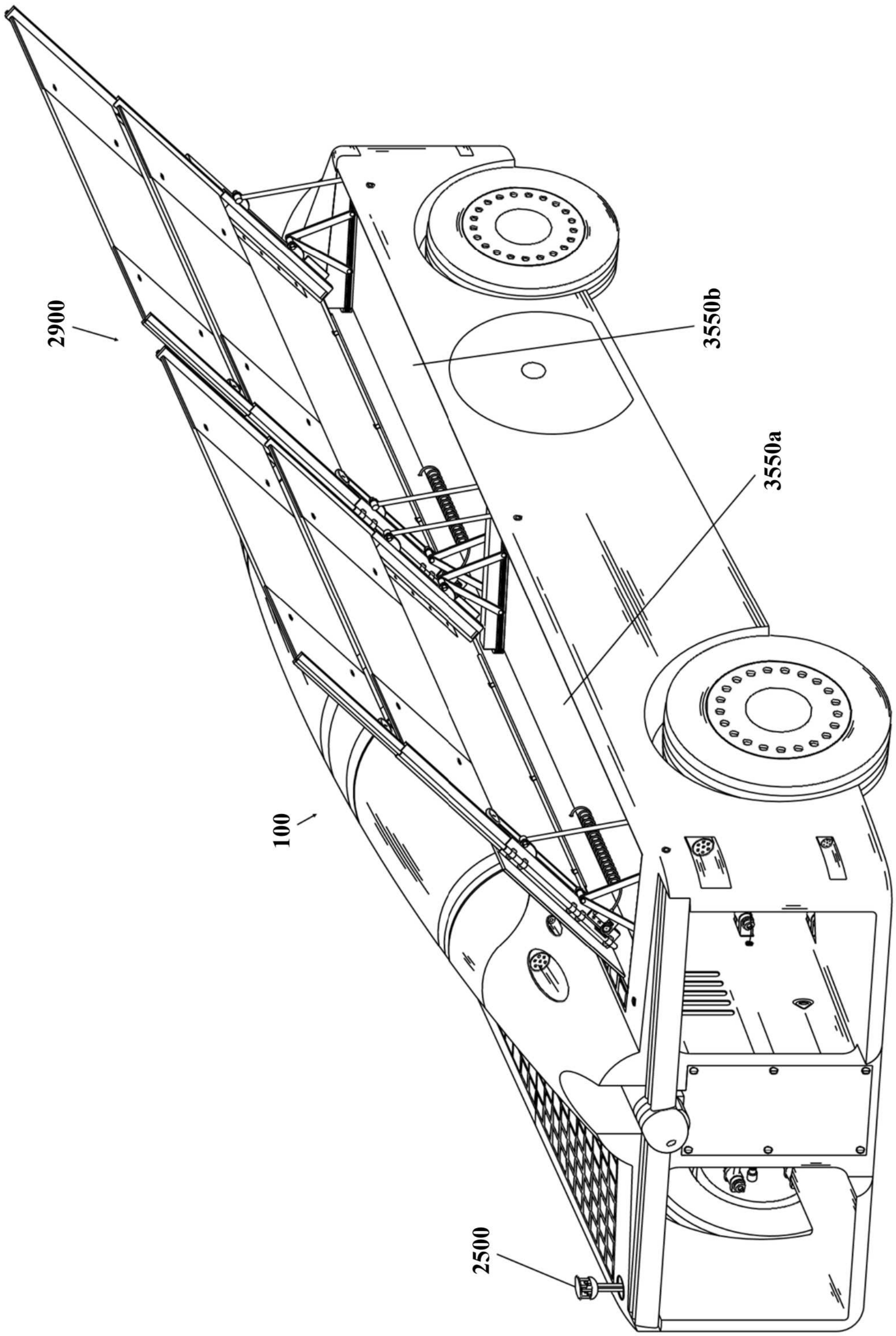


FIG. 28

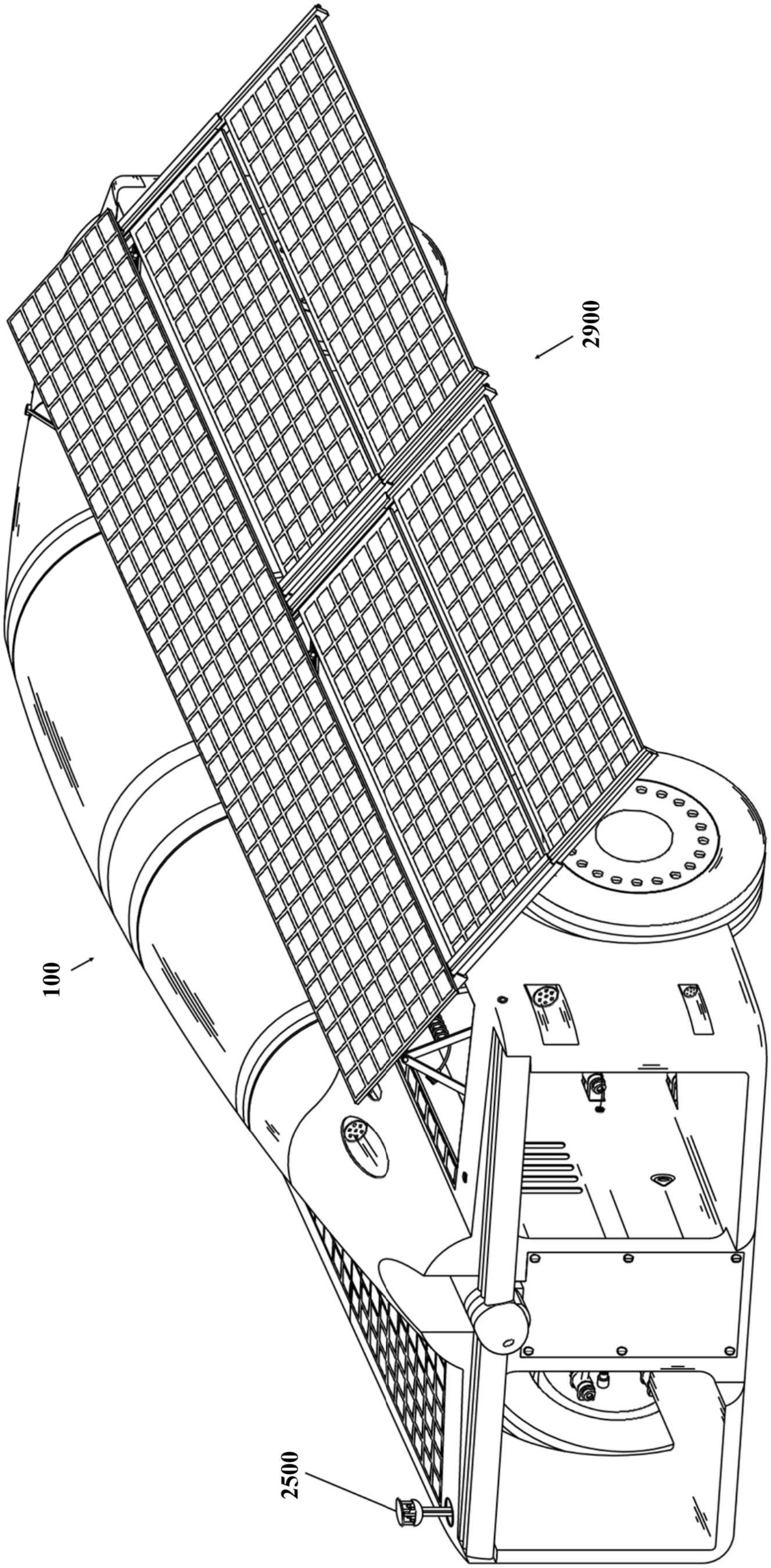
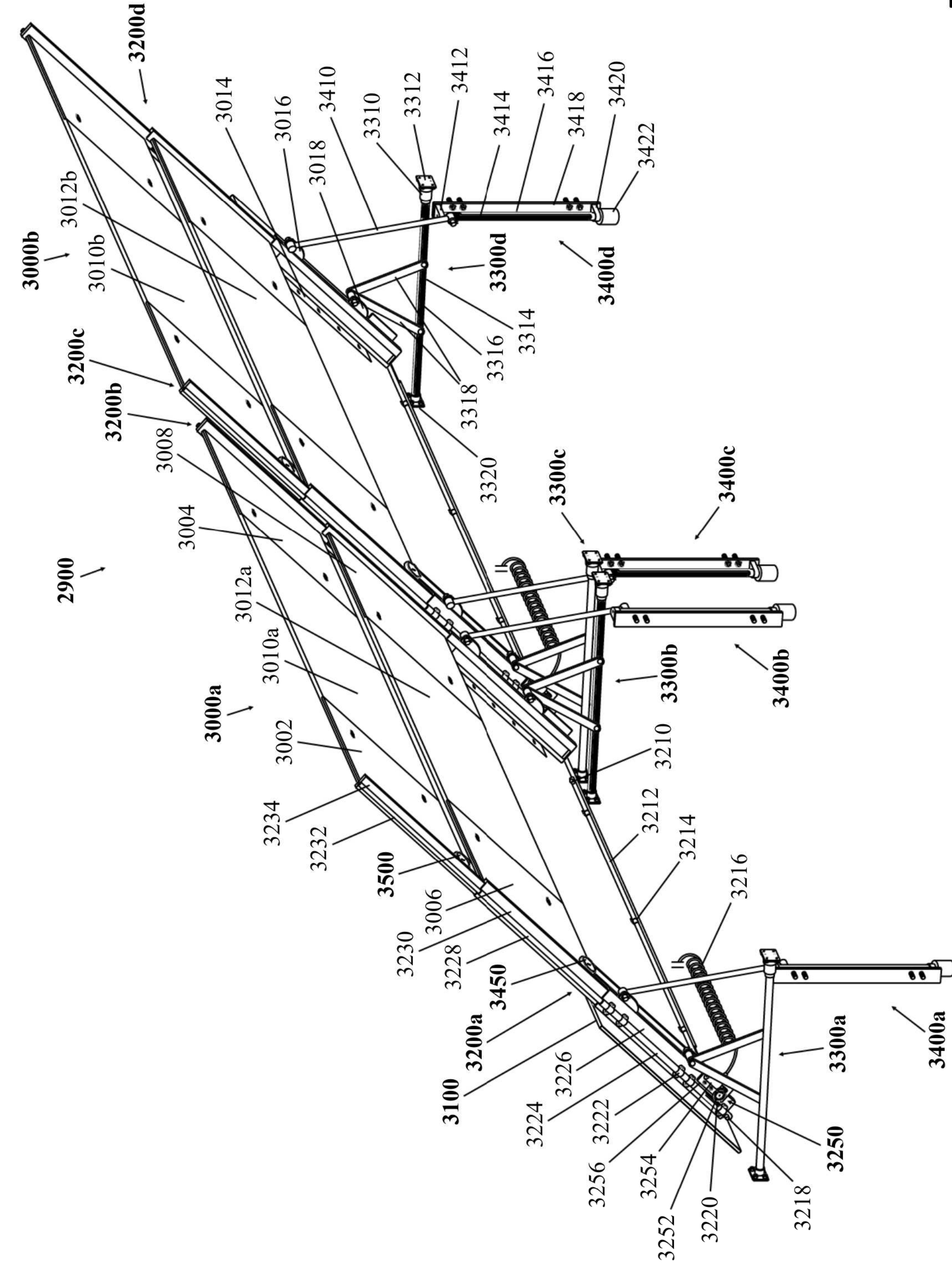


FIG. 29

FIG. 30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3400d
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3318
3200c
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3300c
3400c
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3010a
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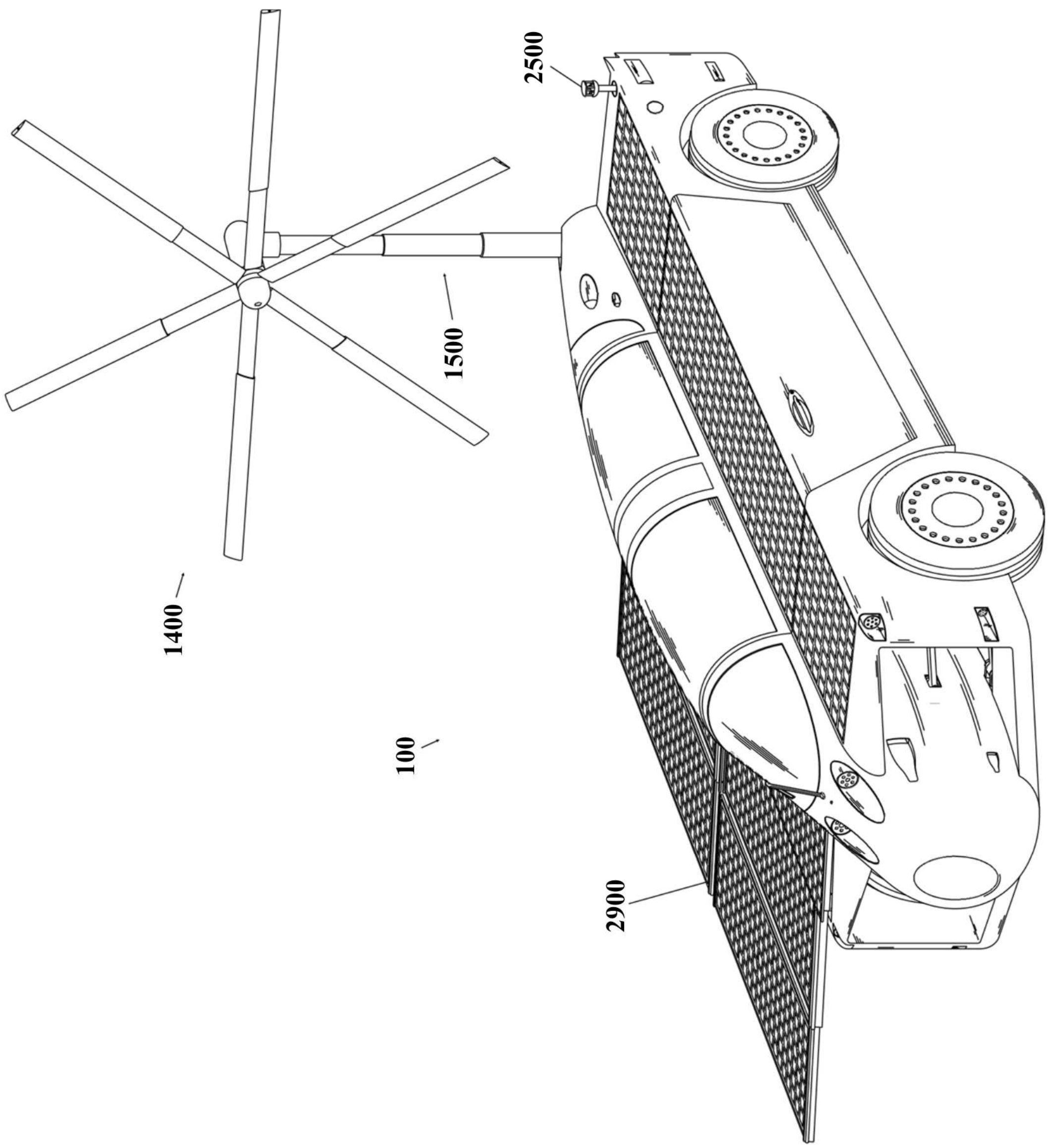

FIG. 31

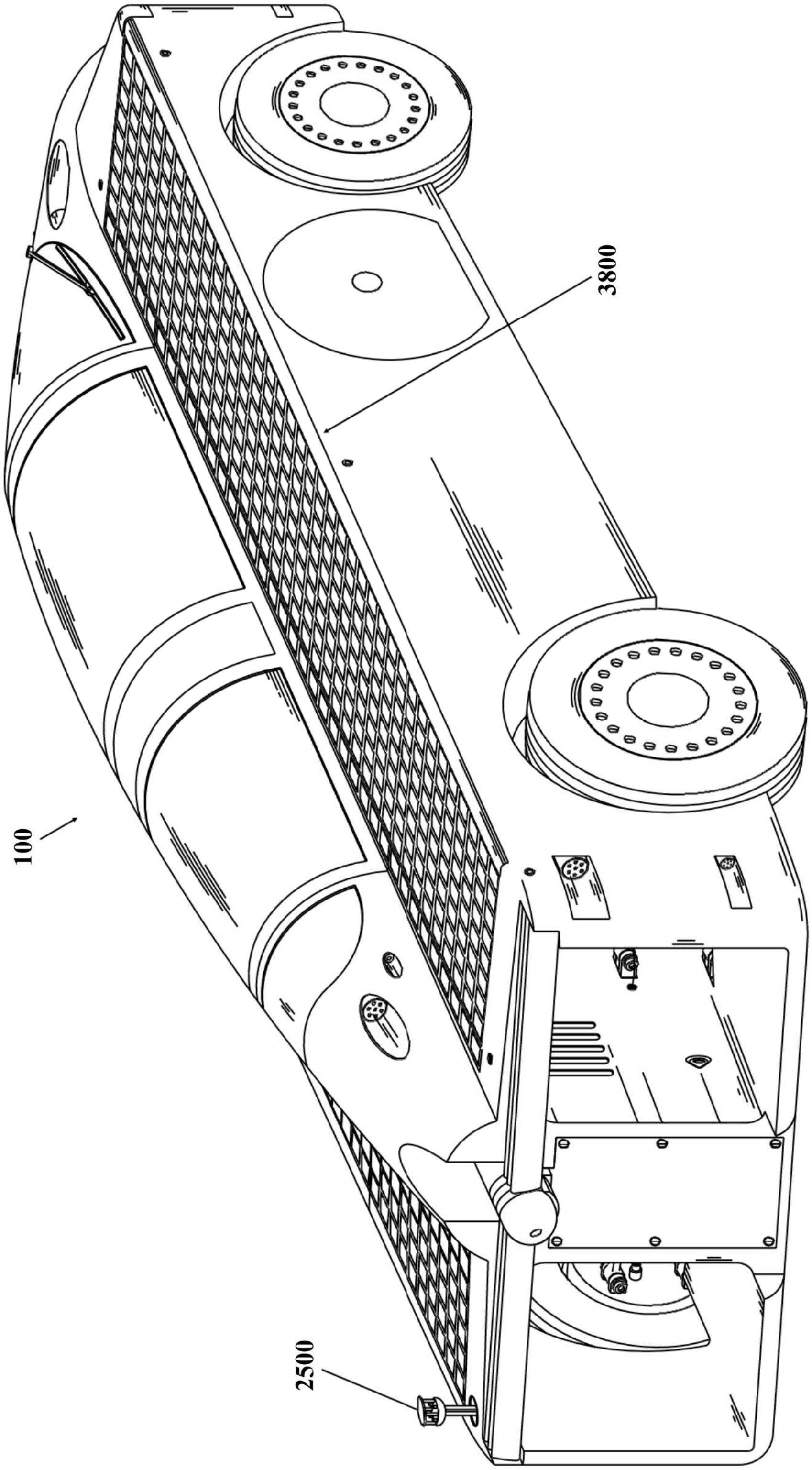

FIG. 32

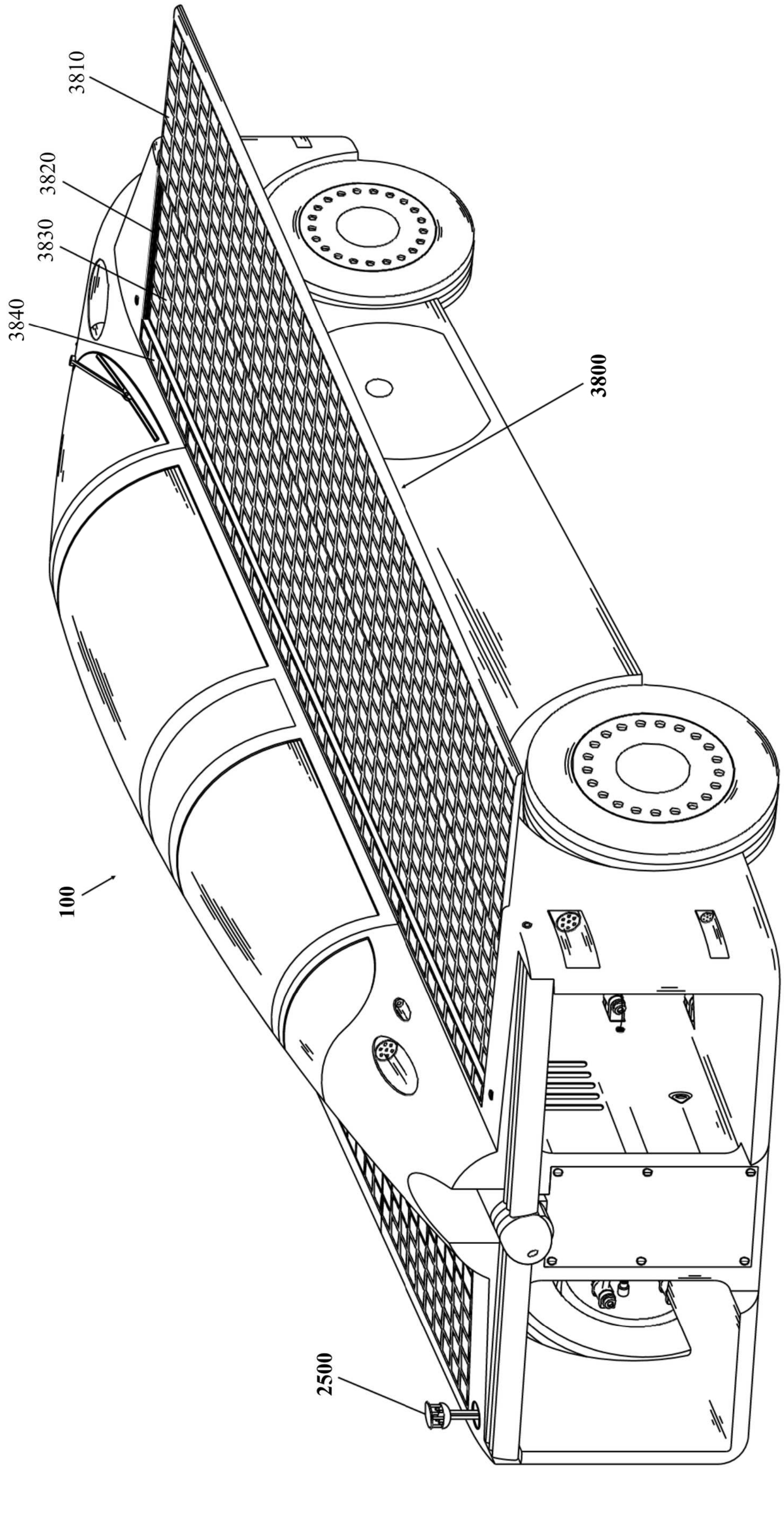

FIG. 33

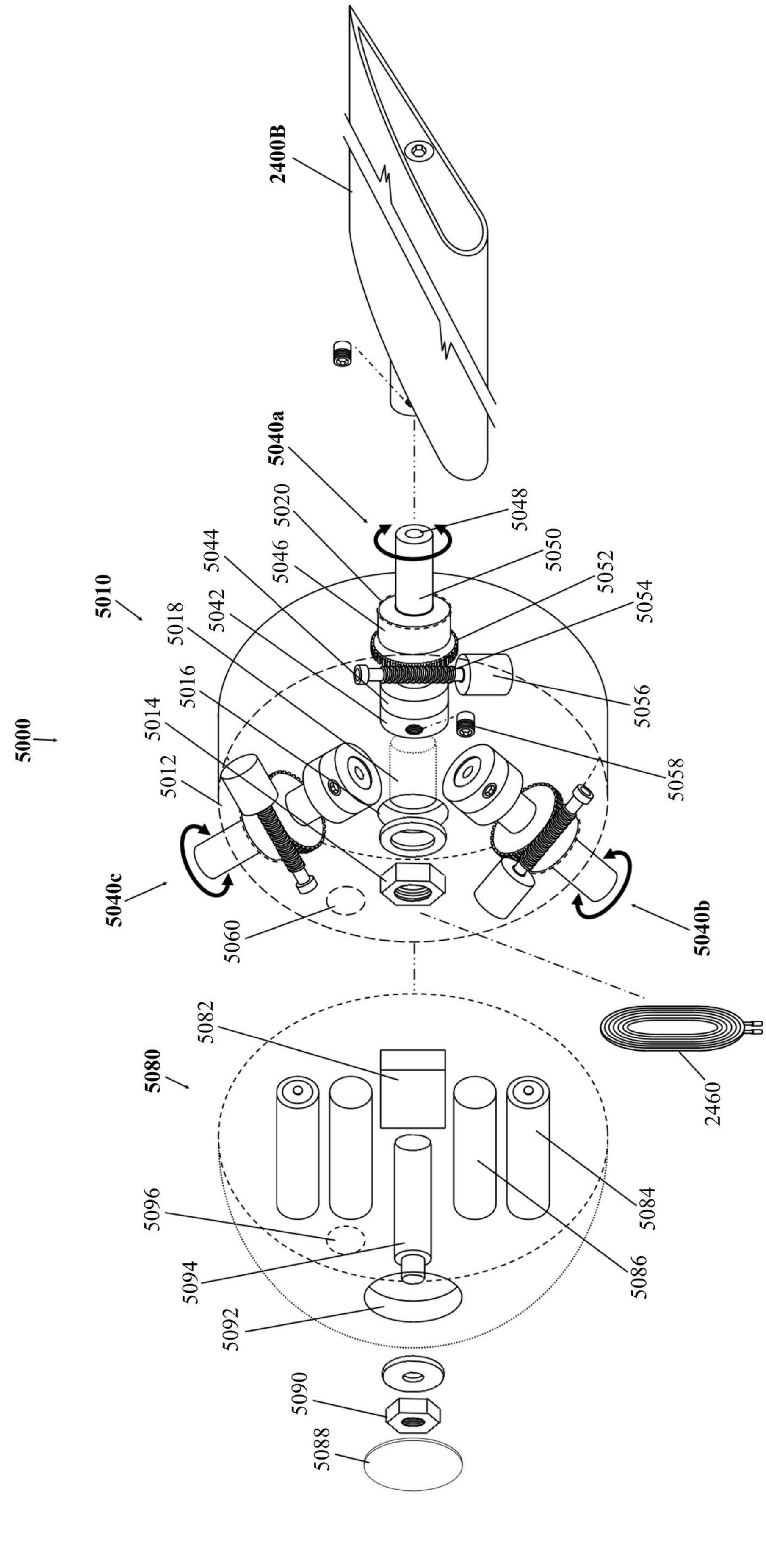
2400B
5040a
5048
5020
5046
5044
5050
5052
5054
5010
5018
5042
5056
5000
5016
5014
5012
5058
5040c
5060
5040b
5082
5080
2460
5096
5094
5084
5086
5092
5090
5088

FIG. 34

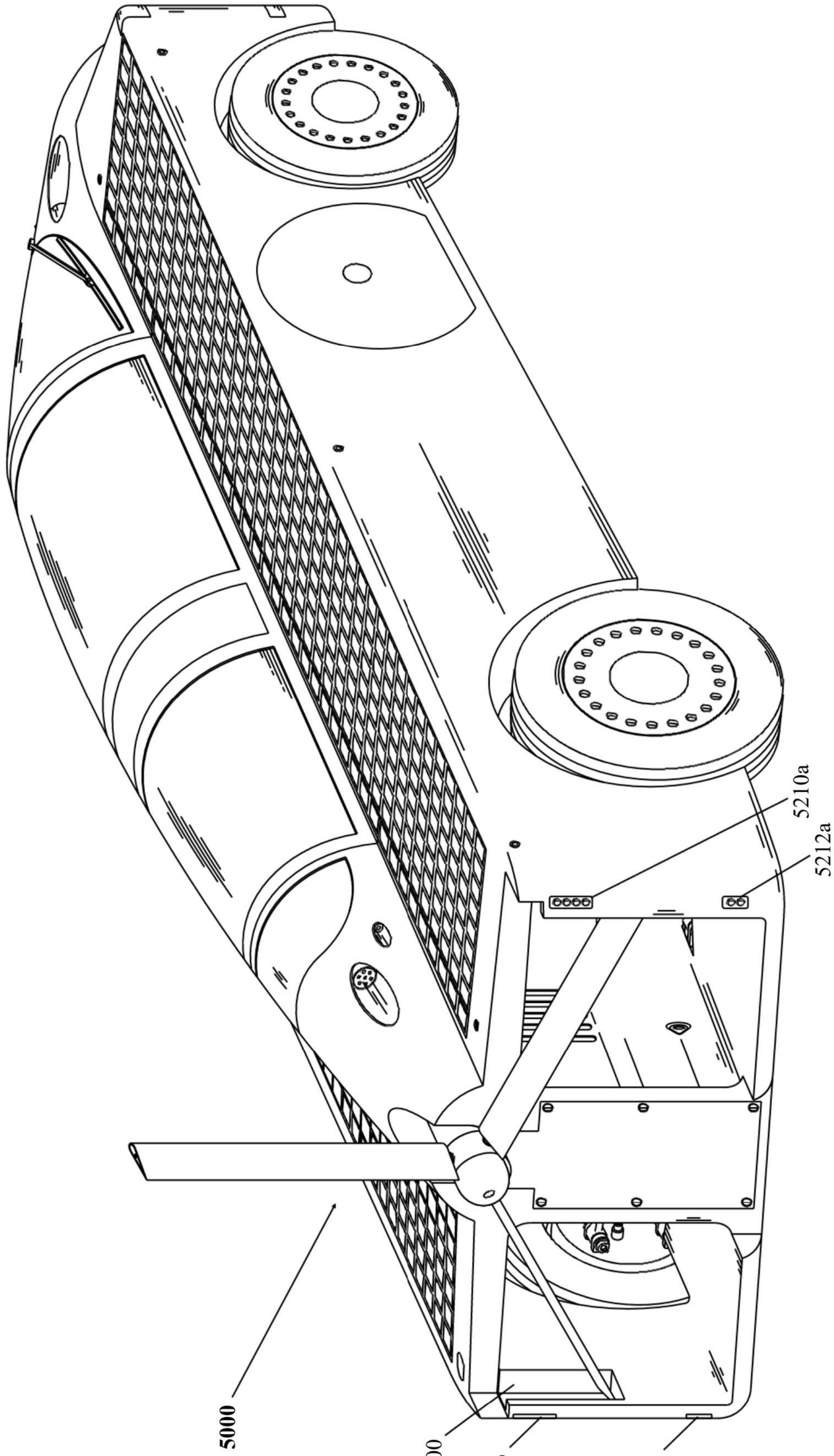

FIG. 35

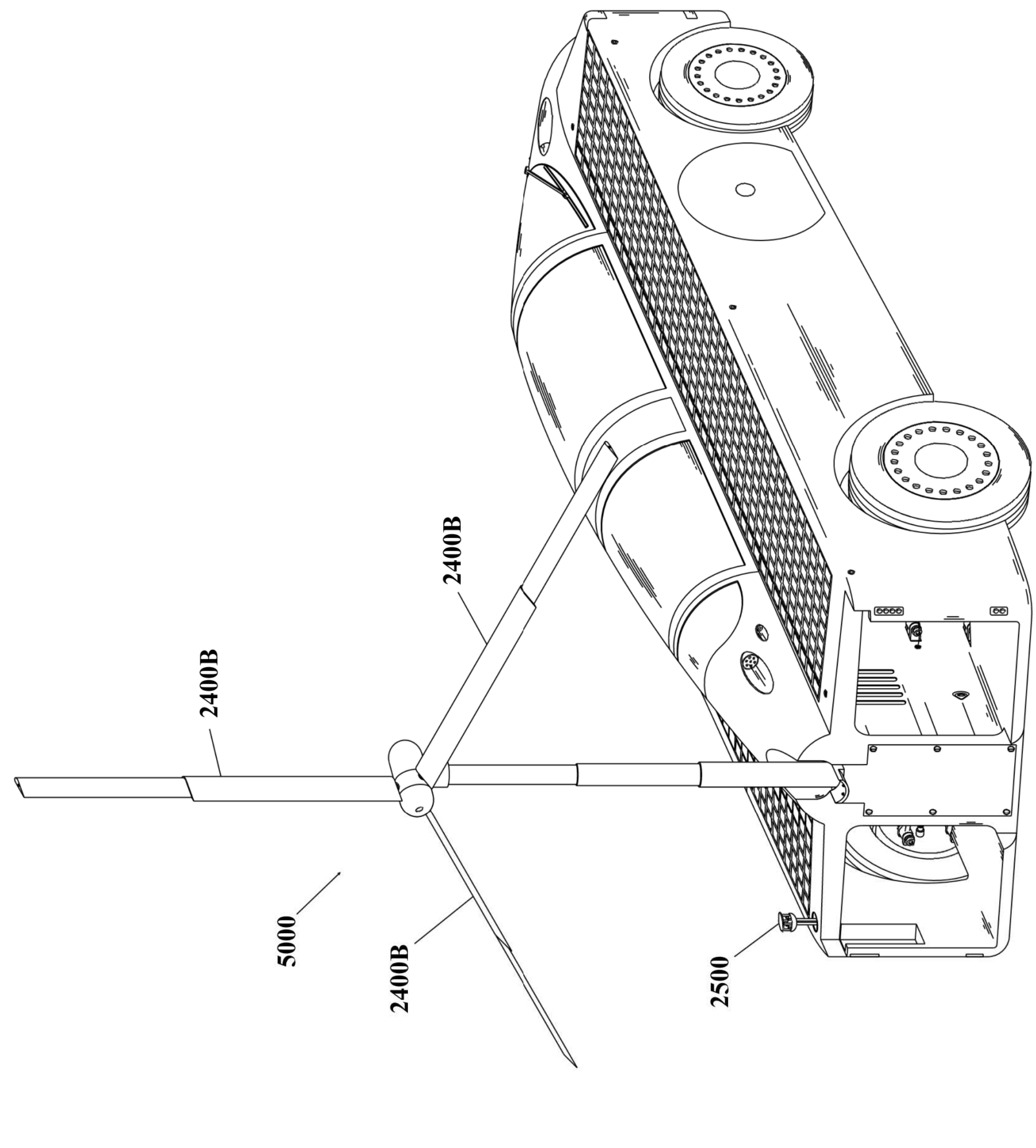

FIG. 36

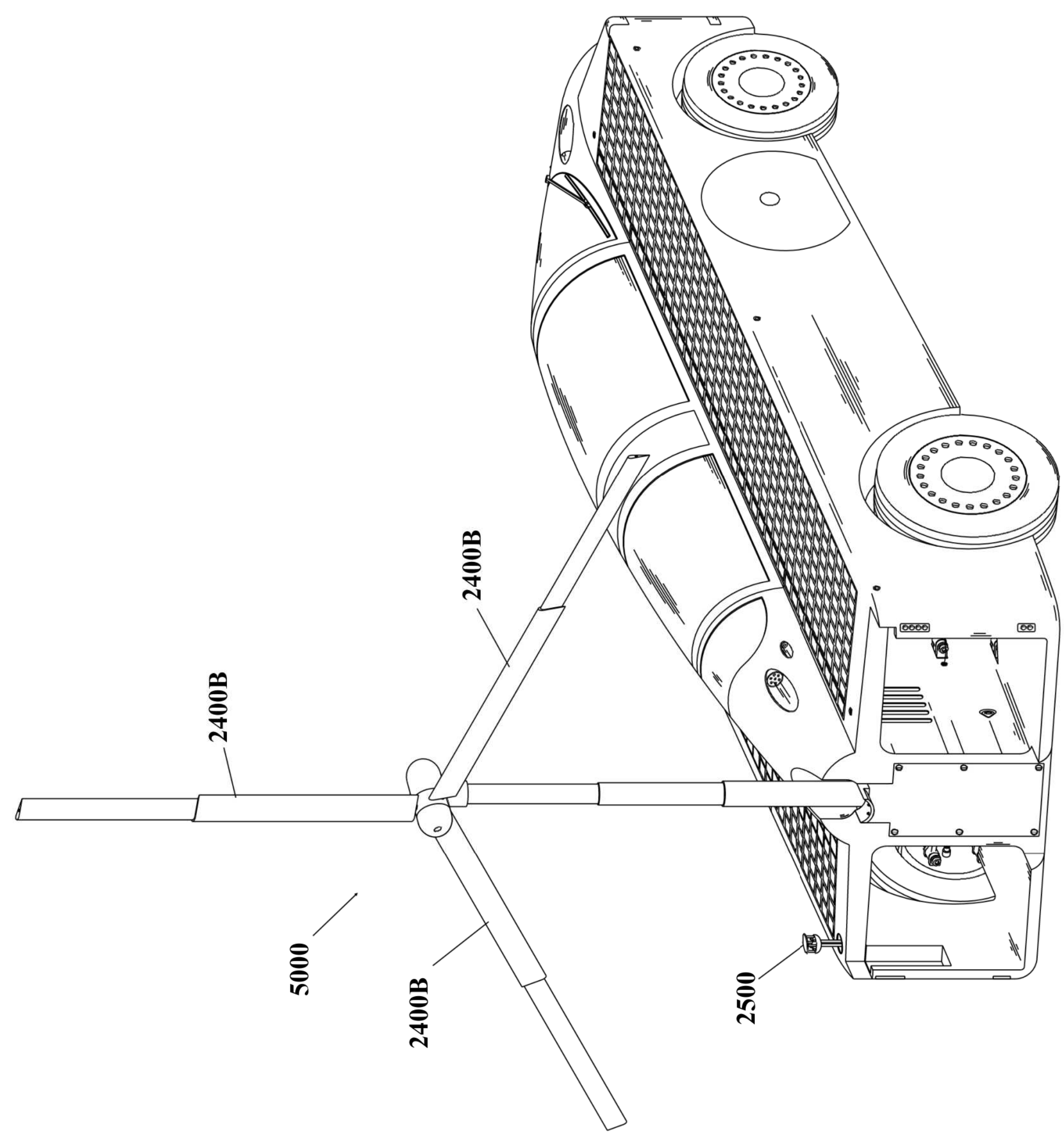

FIG. 37

SELF-CHARGING ELECTRIC VEHICLE (SCEV)

CROSS REFERENCE

This application is a national phase of International Application No. PCT/US2019/041256, filed on Jul. 10, 2019, which claims priority from U.S. provisional Application No. 62/697,723, filed on Jul. 13, 2018, each of which is hereby incorporated herein by reference in its entirety.

TECHNICAL FIELD

This application relates to the field of clean energy, automotive, and mechanical engineering.

BACKGROUND

Advances in technology and clean energy have allowed new vehicles to utilize different power sources than in the past.

The current landscape of clean energy vehicles deals mostly with battery operated electric automobiles. It however does not deal with harvesting renewable energy in any substantial or practical way, let alone combining harvesting energy with an electric vehicle.

Vehicles solely utilizing solar power and/or wind power are well known in the prior art. While these vehicles may fulfill their particular theoretical objectives, none are actually practical as either the vehicle itself is inefficient and/or the solar panels or the size of the wind turbine's rotor diameter is not of sufficient size, or in any combination of these.

With the exception of electric vehicles that recharge solely from renewable energy such as hydropower or wind power or solar power or in any combination of these, electric vehicles that recharge from fossil fuels and/or nuclear powered generating plants indirectly emit emissions and/or greenhouse gasses and are essentially emissions elsewhere vehicles. Depending on the fuel source including power distribution and transmission line losses an electric vehicle recharging from an electrical power plant can produce more emissions than an internal combustion engine operating on fossil fuels.

Hydrogen Fuel Cell Vehicles are also emissions-elsewhere vehicles as hydrogen is not a primary fuel and has to be produced using either electrolysis which requires energy or refined from fossil fuels producing emissions and greenhouse gases. In addition hydrogen by itself poses transportation and storage issues.

Electric vehicles that recharge solely from renewable energy such as solar power, wind power or hydropower are true zero-emission vehicles that would present a significant advantage over all the alternatives as utilization of true zero or even virtual zero-emission passenger vehicles would significantly reduce transportation's role in emissions and greenhouse gases and also reduce reliance on fossil fuels.

Solar-powered vehicles used in solar competition are very efficient and able to power solely from solar energy when solar energy is available, however they are impractical for daily commuter use as the vehicle and cabin is configured to maximize aerodynamic efficiency leaving little if any room for a driver, let alone any passengers.

Accordingly, any improvements to a vehicle's wind power generating capacity and/or solar power generating capacity in order to reduce reliance on fossil fuels would be desirable.

An aerodynamic, efficient and practical electric vehicle combined with sufficiently sized solar panels and a sufficiently sized wind generator that can directly generate abundant electrical energy from renewable sources that may allow for an electric vehicle to run solely from renewable energy and that could also provide electrical energy to the electrical grid, charge other electric vehicles, or be used to provide electrical energy to a home, or in any other application where electrical energy could be utilized would be ideal.

For the aforementioned reasons, there is a need for vehicles that can run solely from renewable energy and that may also be used to provide surplus electrical energy to wherever it may be needed. This disclosure is directed to the above problems as summarized below.

SUMMARY

Systems and methods here may be used to power a true clean-energy automobile and may also be used to supply electrical energy anywhere electrical energy could be utilized.

BRIEF DESCRIPTION OF THE DRAWINGS

For a better understanding of the embodiments described in this application, reference should be made to the Detailed Description below, in conjunction with the following drawings in which like reference numerals refer to corresponding parts throughout the figures.

FIG. **1** is an illustration of an example front side perspective view of a vehicle, according to some embodiments.

FIG. **2** is an illustration of an example rear side perspective view of a vehicle, according to some embodiments.

FIG. **3** is an illustration of an example front view of a vehicle, according to some embodiments.

FIG. **4** is an illustration of an example rear view of a vehicle, according to some embodiments.

FIG. **5** is an illustration of an example left side view of a vehicle, according to some embodiments.

FIG. **6** is an illustration of an example right side view of a vehicle, according to some embodiments.

FIG. **7** is an illustration of an example top side view of a vehicle, according to some embodiments.

FIG. **8** is an illustration of an example bottom side view of a vehicle, according to some embodiments.

FIG. **9** is an illustration of an example front side perspective view of a vehicle with a cabin door in an open position, according to some embodiments.

FIG. **10** is an illustration of an example exploded right perspective view of a cabin door, according to some embodiments.

FIG. **11** is an illustration of an example exploded rear perspective view of a chassis, according to some embodiments.

FIG. **12** is an illustration of an example exploded view showing an assemblage of various assemblies and components, according to some embodiments.

FIG. **13** is an illustration of an example rear perspective view of a frame assembly, according to some embodiments.

FIG. **14** is an illustration of an example front side perspective view of a vehicle shown with a stowable wind turbine assembly in a deployed position, and a stowable anemometer in a deployed position, according to some embodiments.

FIG. **15** is an illustration of an example rear side perspective view of a vehicle shown with a stowable wind turbine assembly in a deployed position, and a stowable anemometer in a deployed position, according to some embodiments.

FIG. **16** is an illustration of an example perspective view of a stowable wind turbine assembly shown in a stowed position, according to some embodiments.

FIG. **17** is an illustration of an example perspective view of a stowable wind turbine assembly shown in a deployed position, according to some embodiments.

FIG. **18** is an illustration of an example blown-up fractional view of the upper section of an inner mast top inner tube, according to some embodiments.

FIG. **19** is an illustration of an example exploded perspective view of a rotor hub assembly, according to some embodiments.

FIG. **20** is an illustration of an example perspective view of a generator assembly shown in a stowed position, according to some embodiments.

FIG. **21** is an illustration of an example perspective view of a horizontal-axis wind turbine assembly, according to some embodiments.

FIG. **22** is an illustration of an example exploded perspective view of an assemblage of a horizontal-axis wind turbine assembly, according to some embodiments.

FIG. **23** is an illustration of an example fragmentary perspective view of an outer mounted extendable blade, according to some embodiments.

FIG. **24** is an illustration of an example fragmentary perspective view of an outer mounted extendable blade shown in a deployed position, according to some embodiments.

FIG. **25** is an illustration of an example perspective view of a stowable anemometer shown in a deployed position, according to some embodiments.

FIG. **26** is an illustration of an example perspective view of a stowable anemometer shown in a stowed position, according to some embodiments.

FIG. **27** is an illustration of an example rear side perspective view of a vehicle and a stowable anemometer shown in a deployed position and a stowable solar panel assembly shown in a deployed position, according to some embodiments.

FIG. **28** is an illustration of an example rear side perspective view of a vehicle shown with a stowable anemometer in a deployed position and a stowable solar panel assembly in a deployed position, according to some embodiments.

FIG. **29** is an illustration of an example rear side perspective view of a vehicle shown with a stowable anemometer in a deployed position and a stowable solar panel assembly in a deployed position, according to some embodiments.

FIG. **30** is an illustration of an example perspective view of a stowable solar panel assembly shown dismounted from the vehicle in a deployed and tilted position, according to some embodiments.

FIG. **31** is an illustration of an example front side perspective view of a vehicle comprising a stowable wind turbine assembly shown in a deployed position, and a stowable solar panel assembly shown deployed in a level position, and a stowable anemometer shown in a deployed position, according to some embodiments.

FIG. **32** is an alternate example embodiment of a stowable solar panel assembly and is illustrated as a slidable solar panel assembly shown in a stowed position, according to some embodiments.

FIG. **33** is an alternate example embodiment of a stowable solar panel assembly and is illustrated as a slidable solar panel assembly shown in a deployed position, according to some embodiments.

FIG. **34** is an illustration of an example exploded perspective view of a three blade rotor hub assembly, according to some embodiments.

FIG. **35** is an illustration of an alternate example embodiment rear side perspective view of a vehicle shown with a three blade wind turbine assembly in a stowed position, according to some embodiments.

FIG. **36** is an illustration of an alternate example embodiment rear side perspective view of a vehicle shown with a three blade wind turbine assembly in a deployed position, according to some embodiments.

FIG. **37** is an illustration of an alternate example embodiment rear side perspective view of a vehicle shown with a three blade wind turbine assembly in a deployed position, according to some embodiments.

DETAILED DESCRIPTION

Reference will now be made in detail to embodiments, examples of which are illustrated in the accompanying drawings. In the following detailed description, numerous specific details are set forth in order to provide a sufficient understanding of the subject matter presented herein. But it will be apparent to one of ordinary skill in the art that the subject matter may be practiced without these specific details. Moreover, the particular embodiments described herein are provided by way of example and should not be used to limit the scope of the invention to these particular embodiments. In other instances, well-known data structures, timing protocols, software operations, procedures, and components have not been described in detail so as not to unnecessarily obscure aspects of the embodiments of the invention.

Overview

A self-charging electric vehicle configured for converting solar energy and wind energy into electrical energy comprising systems and/or methods are disclosed. The vehicle includes a body and frame with a central body structure and centerline cabin and a chassis with a centerline battery compartment and a suspension system. Solar cells mounted to the vehicles top sides can be supplemented with extendable solar panels that can be deployed by a control system to generate solar energy into electrical energy. A directional sun sensor provides measurements for the sun's strength, angle and direction. A stowable wind tracking horizontal-axis wind turbine with an extendable mast mounted to the vehicle that can be deployed by a control system to generate wind energy into electrical energy. A stowable anemometer provides measurements for wind speed and wind direction. The vehicle can also be utilized to supply electrical energy anywhere electrical energy would be desired including another electric vehicle, a home or to the electrical grid. In addition the stowable wind generator and/or the extending solar panels may not be limited to vehicles and may be used in any other application wherever wind and/or solar energy is desired.

Example Terms

In some examples here, terms are used to help define the systems and methods disclosed. The terms are not limited to specific definitions, but to help color the discussion, examples here describe how some terms may be used in the disclosure. For example, but not to limit the scope of any term, "anemometer" may refer to any instrument or device that can measure wind speed and wind direction; "fully deployed," "fully extended," "deployed," "deployed position," "extended," or "extended position" may refer to the described or illustrated position of the component(s) is but one of numerous positions that the component(s) or elements(s) or feature(s) can be positioned to; "control(s)" may refer to programs(s) or algorithm(s) or computer(s) or driver(s) or relay(s) that by any one alone or in any combination of can manipulate the described or illustrated device(s), component(s), element(s) or feature(s); "MPGe" and "Miles per gallon gasoline equivalent" and "mpg-equivalent" may be used interchangeably; "battery" as used herein may refer to any container consisting of one or more cells that can store electrical energy and can be used as a source of electrical power; "battery pack" as used herein may refer to a plurality of individual batteries contained within a single piece or multi-piece housing, the individual batteries electrically interconnected to achieve a desired voltage and capacity; "solar panel" and "photovoltaic panel" and "PV panel" may be used interchangeably and as used herein may refer to any device(s) that comprises at least one solar cell mounted on a panel configured to convert the energy of light into electricity; "solar cell" and "photovoltaic cell" and "photoelectric cell" and "PV" may be used interchangeably and as used herein may refer to any device(s) that converts the energy of light into electricity; "horizontal-axis wind turbine" and "horizontal-axis wind generator" and "HAWT" may be used interchangeably; "proximity sensor" may refer to any device(s) that provide close-range or long range detection of ferrous and/or non-ferrous material or provide close-range or long range detection of targets and/or objects and could be any number of contact and/or non-contact sensors that could be magnetic, electric or optical inductive including but not limited to any one of capacitive, capacitive displacement sensor, Doppler effect, eddy-current, inductive, magnetic, magnetic proximity fuse, photoelectric, photocell, laser rangefinder, passive, charge-coupled devices, passive thermal infrared, radar, reflection of ionizing radiation, lidar, cameras, active sonar, passive sonar, ultrasonic sensor, fiber optics sensor or hall effect sensor or in any combination of these; "electric vehicle" and "electric drive vehicle" and "EV" may be used interchangeably; "relay" and "computer controlled relay" may be used interchangeably; "computer controlled relay" and "computer controlled solid state relay" and "computer controlled mechanical relay" may be used interchangeably; "relay" and "switch" may be used interchangeably; "computer" as used herein may refer to any electronic device that could be used to store and manipulate information and is able to store a program and retrieve information from its memory, in some examples such computers may be programmed to manipulate a computer controlled relay driver(s); "fastener" or "fastening" or "screw" or "bolt" or "machine screw" or "machine screw and nut" or "bolt and nut" may be used interchangeably and may refer to a hardware device that mechanically joins or affixes two or more objects together; "stepper motor" as used herein is an electromechanical device which converts electrical pulses into discrete mechanical movements, the shaft or spindle of a stepper motor rotates in discrete step increments when electrical command pulses are applied to it in the proper sequence and may also rotate in either direction (clockwise or counter clockwise), the motor's position may be controlled without any feedback mechanism; "motor with rotational shaft control" as used herein is any type of motor that may include at least one rotary position sensor that can allow the rotation of the motor's shaft or spindle to rotate in steps and/or increments and that may also be connected to and manipulated by controls allowing the motor's shaft to rotate in either direction, clockwise or counter clockwise as may be manipulated by controls; "heat sink" as used herein is defined as any heat exchanger that transfers the heat generated by any electronic, mechanical or solar device including but not limited to a solar cell(s), solar panel(s), solar component(s) or any solar related component(s) or device(s) to a fluid medium such as air or liquid coolant where the heat it is dissipated away from any or all of these aforementioned items, and may include but not be limited to a passive or active design or to a combination of passive and active design; "actuator" as used herein is a device that controls or moves mechanisms and/or systems and may produce either linear motion or rotary/oscillatory motion and may be of but not limited to a hydraulic, pneumatic, electric and mechanical type design of in any combination of these; "wireless charging" or "wireless power transfer" may be used interchangeable and may refer to a device or devices that transfers wireless power utilizing various technologies such as but not limited to induction, inductive charging, inductive coupling, magnetic resonance coupling, RF radiation, resonant inductive coupling, capacitive coupling, magneto dynamic coupling, microwaves, light waves or laser; "data" or "measurements" may be used interchangeably; "sun position sensor" as used herein is defined as one or any combination of sensors and may be any sensor type and/or design such as but not limited to analog, digital, spinning, two-axis, light, solar radiation, photo sensors, photo detectors or any other sensor of light or other electromagnetic energy that may provide sun data including but not limited to the strength, position, direction and angle of the sun; "in the vehicle" means anywhere within the vehicles body, frame, chassis or component; "motion generator" may refer to any device that generates electrical energy by motion of any type and may include but not be limited to rotary motion, oscillating motion, linear motion or irregular motion. Furthermore, any numerical examples herein are intended to be non-limiting, and thus any additional numerical values, ranges, and percentages are within the scope of the disclosed embodiments.

Vehicle Body Examples

Referring to FIG. **1**-**7**, an example embodiment of a vehicle **100** is shown having wind energy and solar energy generating components. A stowable HAWT assembly **1400** is shown in a stowed position. A solar panel assembly **2900** is shown in a stowed position. The solar panel assembly **2900** may be comprised of one or more panels and may include one or more extendable panels. The vehicle **100** may include solar panels attached to or made out of the actual body of the vehicle **100**. In some examples, the vehicle **100** may include a left front upper deck fixed solar panel **2600**, a door fixed solar panel **2700**, and a left rear upper deck fixed solar panel **2800**.

In some example embodiments, in order for an operator or user to determine which direction the wind is coming from, in order to best deploy an optimal turbine configuration, a stowable anemometer **2500** may be mounted in or on the vehicle **100** capable of being in a deployed or stowed position.

In some example embodiments, a variety of proximity sensors may be arranged on the vehicle **100** body. Such sensors could be any number of sensors including but not limited to radar, lidar, sonar, cameras, or a combination of these or other sensors. The positioning of such sensors may be in any of various places as shown in, but not limited to FIGS. **2**, **6** and **7**. For example, the vehicle **100** may include a front top proximity sensor **170***a*, a rear top proximity sensor **170***b*, a front side proximity sensor **170***c*, a middle side proximity sensor **170***d*, and/or a rear side proximity sensor **170***e*.

In examples where sensors may be stowed, these stowed configurations may help to reduce the aerodynamic drag of the vehicle **100** when driven. In examples with wind energy generating and solar energy generating capable components, they may be able to be manually or automatically deployed when the vehicle **100** is stationary.

The wind energy generating and solar energy generating components are described in more detail in FIGS. **14**-**37**.

Still referring to the overall general vehicle, FIG. **3** and FIG. **4** show examples where the vehicle **100** includes a front windshield **102**, a left front headlight **104***a*, and a right front headlight **104***b*. These headlights may be any number of LED lights or any other light technology arranged in any of various places on the vehicle **100**. Some examples of the vehicle **100** may include any of other various light arrangement such as but not limited to a left front upper light **110***a*, a right front upper light **110***b*, a left front lower light **116***a*, a right front lower light **116***b* in any arrangement. Some examples include a right rear center light **154***a*, and a left rear center light **154***b*, a right rear upper light **160***a*, a left rear upper light **160***b*, a right rear lower light **162***a*, and a left rear lower light **162***b*.

In some examples, the vehicle **100** chassis itself is configured to allow for a maximum upper surface area to include solar panels for solar energy collection including a central body structure **130**. Additionally, in order to cut down as much as possible on aerodynamic drag while in operation, the vehicles **100** body may be tapered towards the rear on some or all of the vehicles **100** body. In another example the vehicle **100** may include a left front cabin air scoop **106***a*, and a right front cabin air scoop **106***b*. In another example, the vehicle **100** may include a left upper deck **108***a*, and a right upper deck **108***b*. In some examples, these upper decks **108***a*, **108***b*, may be integrated with or be mounted with a solar collection system. In some examples the upper decks **108***a*, **108***b*, may be tilted allowing water to runoff thereby allowing the solar panels to be self-cleaned by rain water. Some examples include a right rear vent **158***a* and a left rear vent **158***b*. The vehicles **100** width may be extended thereby providing more upper surface area for larger solar panels and also providing for a wind turbine with a larger rotor diameter.

In some examples, the vehicle **100** chassis includes a left front battery compartment air scoop **120***a*, a right front battery compartment air scoop **120***b*, a left bypass air duct **112***a*, a right bypass air duct **112***b*, a left side outer body **114***a*, a right side outer body **114***b*, a left lower deck **118***a*, a right lower deck **118***b*, in any of various configurations. The left bypass air duct **112***a* and right bypass air duct **112***b* may provide for an air passage longitudinally from the front to back of the vehicle **100** when the vehicle **100** is being driven thereby provides for minimizing the aerodynamic drag. In another example the bypass air ducts **112***a*, **112***b* may each or both be any shape including but not limited to an oval, rectangular, triangular shape or in any combination of these shapes.

Some example embodiments include a windshield wiper **122**, a windshield fluid nozzle **124**, and a rear windshield **152**.

In some examples, various sensors may be arranged on the vehicle **100**. For example, right rear view camera **156***a*, a left rear view camera **156***b*, and a front top proximity sensor **170***a*, a rear top proximity sensor **170***b*, a front side proximity sensor **170***c*, a middle side proximity sensor **170***b*, and a rear side proximity sensor **170***e*. As discussed, the sensors could be any of various sensors in any combination, used by the system to detect obstacles, other vehicles, road features, wind, solar energy, or other various things. Data collected from these sensors may be sent to any of various computer components which may use that data to make determinations, provide signal information for a driver, send collected data by antennae to a back end server system, etc.

In some examples, the vehicle **100** may include features used to keep the battery components cool. Such example features may include but are not limited to a right rear battery compartment vent **164***a*, and a left rear battery compartment vent **164***b*. Any of various fans, or other features may contribute to cooling the battery components, motors, or other features which may increase in temperature during operation. Air scoops **106***a*, **106***b* may be used to provide for air circulation to the cabin **140**.

In examples where a horizontal-axis wind turbine is utilized, the vehicle **100** may include various features such as a blade docking platform **166**. In some examples, a wind generator docking well **168** may be integrated into the vehicle **100**.

In some examples shown in FIG. **5**, the vehicle **100** may include features used to keep the battery charged and/or may be used to connect the vehicles **100** wind and/or solar generating components to the electrical grid or to recharge other electric vehicles or to supply electrical power to a house or in any combination. Such example features may include but are not limited to at least one electrical plug or connector stowed in an electrical plug compartment **172**.

In some examples shown in FIG. **6**, the vehicle **100** may include a spare wheel compartment **200** for storing a spare tire and tools which may include a car jack and tire iron.

Referring to FIG. **7**, an example of an omni-directional sun sensor **174** is shown that that may provide sun strength and position data including the sun's azimuth and angle in relation to the direction of the vehicle **100**. In another example sun data may be provided by any number and any variety of sensors, designs and/or sensing technologies and in any combination that may detect the strength, position, azimuth and angle of the sun. The positioning of such sensors may be in a location as shown in, but not limited to FIG. **7**. Data collected from the sensor(s) may be sent to any of various computer components which may use that data to make determinations, provide signal information for a driver, send collected data by antennae to a back end server system, etc. This configuration allows a stowable solar panel assembly **2900** to be manipulated into various deployed positions that may be favorable to generating solar energy.

In some examples shown in FIG. **8**, a vehicle **100** body/chassis may include a rear suspension access panel **180**, a front suspension access panel **182**, a front bottom panel **184**, a center bottom panel **186**, and a rear bottom panel **188**. Examples of suspension components may be shown partially and may include a right rear lower control arm **532**, and a front leaf spring **432**, and a rear leaf spring **534**, and a right front lower control arm **426**. An example of a steering assembly **1000** is shown partially. This configuration may allow a reduction in aerodynamic drag while the vehicle **100** is in operation

In some examples spaces within the vehicle **100** including but not limited to the cabin, the front or rear compartment or outer body or upper decks or under any of the solar panels may be used as storage compartments that may be accessed by various ways including but not limited to a removable panel or hinged panel.

Cabin Door Examples

Referring to FIG. **9**, an example of a vehicle **100** is shown having a cabin door **300** providing the vehicles **100** occupants with an entrance to or from the vehicle **100**. In some examples the cabin door **300** may be configured to open from the left or right of the vehicle **100**. The cabin door **300** may include a canopy structure **302**, an upper deck **304**, a door handle **306**, an outer door panel **308**, a door bumper **310**, a door lock **312**, an inner door panel **314**, a cabin door seal **316**, a door stop **318**, an inner door panel stop **320**, a door sill **322**, a strike plate and bolt **324** and double bolt hinge assemblies **350**. The cabin door's **300** components are described in more detail in FIG. **10**.

Referring to FIG. **10**, an example of a cabin door **300** in an exploded view is shown providing the vehicles **100** occupants ingress to and egress from the vehicle **100**. The cabin door is comprised of an upper deck **304**, a rear canopy **330**, a rear canopy windshield **332**, a rear canopy handle **334**, a rear canopy lock **336**, a rear canopy frame **338**, a front canopy **340**, a front canopy windshield **342**, a front canopy handle **344**, a front canopy lock **346**, a front canopy frame **348**, a double pin hinge assembly **350**, a front canopy strike plate **354**, a front door lock **356**, a hinge sleeve **358**, a hinge cutout **360**, a front cabin door handle **362**, a rear canopy strike plate **366**, a rear cabin door handle **368**, a rear door lock **370**, a hidden door hinge assembly **250**, and a torsion bar assembly **270**. The cabin door **300** may include a canopy structure **302** comprised of a front canopy support **352**, a middle canopy support **364**, and a rear canopy support **372**, which may be used for attaching a rear canopy **330** and a front canopy **340**.

In some examples double bolt hinge assemblies **350** may be attached to a rear canopy **330** and a front canopy **340** that allows the canopies to be attached pivotally to pairs of hinge sleeves **358** located on the cabin door **300** in FIG. **10**.

The canopies **330**, **340** may include a rear canopy lock **336** having a bolt that can insert into a rear canopy strike plate **366** and a front canopy lock **346** having a bolt that can insert into a front canopy strike plate **354**. This configuration allows for the canopies to be locked in a closed position or partially tilted up that may provide for cabin ventilation.

In another example the canopies **330**, **340** may be fully removed from the door **300** by compressing a pair of spring loaded double bolt hinge assemblies **350** attached to each canopy which may retract the two bolts from the hinge sleeves **358** thereby freeing the canopies from the door **300**. The double bolt hinge assemblies **350** may be comprised of a spring positioned between two bolts in the barrel of a hinge wherein the spring presses against the bolts causing the bolts to remain in the hinge sleeves **358**. Moving the two bolts together compresses the spring and allows for the bolts to retract from the hinge sleeves **358**. The double bolt hinge assemblies **350** may include a knob attached to each bolt for manually compressing the spring from inside the canopies as shown in FIG. **9**.

Referring to FIG. **10**, an example of a hidden door hinge assembly **250** is shown configured for attaching the cabin door **300** in a pivoting arraignment to the vehicle **100** by mounting the cabin door mounting bar **252** inside a cabin door mounting channel **374**.

The hidden door hinge assembly **250** may include a torsion bar connector sleeve **254**, a front mounting plate **256***a,* a rear mounting plate **256***b,* a front bar limit collar **258***a,* a rear bar limit collar **258***b,* a collar lock setscrew **260***a,* a collar lock setscrew **260***b,* a door hinge bar **290** and a hinge arm **292**.

In another example the hidden door hinge assembly **250** may include at least one torsion bar assembly **270** comprising an arm stop mounting plate **272**, an arm stop pin **274**, a torsion anchor arm **276**, a lock screw **278**, a front mounting plate **280***a,* a rear mounting plate **280***b,* a torsion bar limit collar **282**, a collar lock setscrew **284**, a torsion bar **286** and a mounting stud **288** which allows for the torsion bar assembly **270** to be attached to the hidden door hinge assembly **250**. The torsion bar assembly **270** allows for the cabin door **300** to be partially or fully counter balanced.

Chassis Examples

Referring to FIG. **11**, an example embodiment of a chassis **400** is shown having suspension, steering, frame/body attachment and support components including a front end section, a cabin section and a rear end section. In examples where suspension components may be partially or fully hidden, these hidden configurations may help to reduce the aerodynamic drag of the vehicle **100**.

In some examples, the chassis **400** includes a front end section **410** having a right front end spacer **412**, a right front upper spacer **414**, and a right front lower spacer **416** for providing intermediate support for attaching the frame/body. The front end section **410** may include a front end structure **418** having a tapered shape towards the front that may provide a crumple zone for absorbing the force of an impact from a collision.

In some examples the front end section **410** may include suspension components. Some examples may include a front upper control arm bracket **420** and a front lower control arm bracket **422** for attaching the right front upper control arm **424** and a right front lower control arm **426**. The control arm brackets **420**, **422** may be used for attaching a right front wheel assembly **440** and a left front wheel assembly **442**. The left front wheel assembly **442** may include a upper ball joint **444** and a upper ball joint nut **456** and a lower ball joint **446** and a lower ball joint nut **460** for attaching to the upper and lower control arms and a steering arm **448** and a tie rod nut **458** for attaching the steering link allowing the wheel to be manipulated by the steering components.

In some examples the wheel assembly **442** components may include a front left steering knuckle **450** that may mount to the wheel and brake components that may include a front left disk brake rotor **452** and a front left brake caliper **454** that may attach to a **430** brake line connector. The brake components may be used for stopping the vehicle **100**. The brake lines may be housed in a brake line tube **428** attached to the lower control arms that help to shield the brake lines and helps reduce aerodynamic drag.

In some examples the suspension components may include a left front shock absorber **462** and a right front shock absorber **436** in which the rod end at the bottom of the shock absorber is attached to the lower control arms. The shock absorbers may contribute to limiting excessive suspension movement and to damp spring oscillations.

In some examples the suspension components may include a front leaf spring **432** which may attach to the left front lower control arm and a right front lower control arm **426** by a leaf spring bolt and nut assembly **434** and a rear leaf spring **534** which may be attached to a left rear lower control arm and a right rear lower control arm **532** by a leaf spring bolt and nut assembly **536**. The front and rear leaf springs **432**, **534** may be attached to the bottom portion of a right lower chassis rail **604** and a left lower chassis rail **608**. The front and rear leaf springs **432**, **534** allows the vehicle **100** to maintain its height including absorbing impacts while traveling over rough terrain roads.

In some examples the suspension components may include a right rear shock absorber **546** and a left rear shock absorber **574**, in which the rod end at the bottom may attach to a wheel shock absorber mounting bracket **560**. The shock absorbers contribute to limiting excessive suspension movement and to damp spring oscillations.

Additional examples may show a rack and pinion steering housing **438** for shielding and attaching the steering assembly.

In some examples, the chassis **400** includes a rear end section **500** having a right rear upper spacer **510**, a right rear end upper spacer **512**, and a right rear end lower spacer **514** for providing intermediate support for attaching the frame/body. The rear end section **500** may have a tapered shape towards the rear that provides a crumple zone for absorbing the force of an impact from a collision.

In some examples the rear end section **500** may include suspension components. Such examples may include a rear upper control arm bracket **516** and a rear lower control arm bracket **528** for attaching the right rear upper control arm **530** and a right rear lower control arm **532** for attaching a right rear wheel assembly **548**, and a left rear wheel assembly **570**.

In some examples the left rear wheel assembly **570** may include a wheel shock absorber mounting bracket **560** which may attach to the rod end at the bottom of a left rear shock absorber **574**.

In some examples the left rear wheel assembly **570** may include a wheel brake line connector **562** that may connect to a brake line connector **538**, wherein the brake line itself is housed in a brake line tube **540**, wherein the brake line may connect to a brake assembly for stopping the vehicle **100**.

In some examples the left rear wheel assembly **570** may include lower wheel control arm brackets **564** and upper wheel control arm brackets **568** for attaching the wheel assembly **570** to a right rear upper control arm **530** and a right rear lower control arm **532** with a control arm mounting bolt and nut set **576**.

In some examples the wheel assembly **570** may include a wheel motor **572** having a wheel power plug socket **566** that may connect to a power plug **544** that may supply power from a power source to the wheel motor **572**. The power plug **544** cable may be housed in a power cable tube **542** that is attached to the rear lower control arms.

In some examples the rear end section **500** shows the vehicle **100** configured with two wheel motors however in another example any number of wheel motors may be used.

In another example the vehicle **100** may be powered with at least one electric motor mounted to the chassis **400** that may linked by at least one drive shaft to at least one wheel and that may use one or more gears to reduce or increase the rotation of the drive shaft.

In another example the rear end section **500** may be comprised of a cooling system that may include at least one radiator **674** having an upper coolant hose connector, a lower coolant hose connector, an expansion tank and cap **678**, and a pair of cooling fans **676**.

In another example a cooling system may include at least one coolant pump, at least one temperature sensor and controls for managing the coolant temperature and/or coolant flow thereby providing a means for cooling a battery pack.

Battery Compartment Examples

Referring to FIG. **11**, an example of a chassis **400** is shown having a battery compartment **600** that may include a right lower chassis rail **604** and a left lower chassis rail **608** attached to the bottom of the battery compartment **600** that may add strength to the chassis **400** in addition to providing attachment areas for other components.

In other examples the battery compartment **600** may include a pair of battery pack lock threads **602** for locking a battery pack assembly **850** shown in FIG. **12** and a pair of hold down rails **612** for securing a battery pack assembly **850**.

In other examples the battery compartment **600** may include mounting threads **610** for attaching a battery compartment cover **800** shown in FIG. **12**.

In other examples the battery compartment **600** may include at least one rear wire harness cutout **614** that may be used for routing for example any combination of electrical wires, cables or conduit, and a rear compartment deck **616** that may be used for mounting various components.

Utility Channel Examples

Referring to FIG. **11**, an example of a chassis **400** is shown having a utility channel **620** that may be attached to the battery compartment **600** having brake line cutouts **622** that may be used for routing brake lines, an accelerator cable cutout **624** that may be used for routing the accelerator cable, and wire harness cutouts **626** that may be used for routing various electrical wires. The utility channel **620** may provide reinforcement for the chassis and may be used for routing and/or housing various battery compartment **600** components.

Rear Firewall Examples

Referring to FIG. **11**, an example of a chassis **400** is shown having a rear firewall **640** that may include a cabin exhaust vent **642** having one way flaps, and a vent and wire harness assembly mount **644** for attaching a vent and wire harness assembly **950** shown in FIG. **12**.

Cabin Examples

Referring to FIG. **11**, an example of a chassis **400** having a cabin **140** is shown bordered in the fore-aft direction of the vehicle **100** by a rear firewall **640** and by a front inner firewall assembly **1050** and bordered on the left and the right side by a frame step **672** that is part of the lower deck support frame **670** located on the left and the right side of the chassis **400**. The frame steps **672** may also provide a border for the cabin floor **176** shown in FIG. **7**. The cabin's **140** fore-aft borders are also shown in FIG. **12** situated between the rear firewall **640** and the front inner firewall assembly **1050**. The cabin **140** may include at least one seat bracket **650** shown in FIG. **11** having a plurality of seat mounting studs **652** for attaching a seat **900** shown in FIG. **12** and a plurality of bracket set screws **654** that may be used to secure the bracket/seat to the utility channel **620**. The seat bracket **650** may be used to adjust the seat in a fore or aft direction in addition the bracket set screws **654** may be removed to allow for a seat(s) **900** to be removed from the cabin. The cabin may include at least one seat belt anchor **656** and at least one seat belt buckle **658** for each seat that may provide for the installation of seat belts.

Power, Computer, Relay Examples

Referring to FIG. **11**, an example of a chassis **400** is shown having power and control components including battery cables **700** for connecting to a battery pack and a charge controller **702** that may be used for regulating the voltage and/or current generated from the solar panels and/or wind turbine going to the battery pack.

In another example the charge controller **702** may include fuses and relays. Also shown is an example of a rear power distribution, fuse, relay and controller box **704** having a power cable **706** for a left wheel motor and a power cable **708** for a right wheel motor, the controller **704** may be connected to a potentiometer **710** that may read the setting of the gas pedal as set by the driver. With input from a potentiometer **710** the controller part of the rear power distribution, fuse, relay and a controller box **704** may control the transfer of power to a wheel motor from the battery to regulate the speed of the vehicle **100**. The potentiometer **710** shown may be directly connected through a cable to the gas pedal. The gas pedal may be measured by any number of other devices that can provide input to the controller part of the rear power distribution, fuse, relay and controller box **704** including but not limited to a "hall effect sensor(s)" or an Electronic Throttle Control system.

In another example the power distribution, fuse, relay and controller box **704** may be used for controlling and/or providing power to various components.

Referring to FIG. **11**, an example of a chassis **400** is shown having a front power distribution, fuse and relay box **712** that may be used for controlling and/or providing power to various components. Other control components may include a computer **714**, and a relay box **716**, that may be used for providing control and/or power to devices that may be used for deploying or stowing wind generating and/or solar generating systems and/or their components.

Computing Device Examples

Referring to FIG. **11**, an example of a computing device is shown, computer **714** that may be used in practicing certain example embodiments described herein. Such computing device, computer **714** may be integrated into the systems to monitor power intake, usage, storage, output, etc. Such computer, computer **714** may be hard wired into the vehicle **100**, it could be a mobile device used to send and receive and display data, as well as receive and cause display of GUIs representing data. The computing device, computer **714** could be integrated into the vehicle **100**, it could be a smartphone, a laptop, tablet computer, server computer, or any other kind of computing device.

Assembly Examples

Referring to FIG. **12**, an exploded view of an assemblage of various assemblies and components is shown comprising examples of a chassis **400** having a battery compartment cover **800**, a battery pack assembly **850**, a plurality of seats **900**, a vent and wire harness assembly **950**, a steering assembly **1000**, a front inner firewall assembly **1050** and a front outer firewall assembly **1100**, also included is an example of the fore-aft borders of the cabin **140**.

In some examples a battery pack assembly **850** may include at least one battery held in a slidable tray allowing for the battery pack assembly **850** to be secured within the battery compartment part of the chassis. The slidable tray can also provide for the removal of the battery pack.

In some examples a battery compartment cover **800** may provide for enclosing the battery compartment and utility channel and may be attached to the rear end of the chassis **400** using bolts. The four upper bolts of the battery compartment cover **800** may be attached to a right mounting bracket **1252** and a left mounting bracket **1278** that is part of the rear end of a frame assembly **1200** shown in FIG. **13**.

In some examples seats **900** may be configured centerline of the chassis **400** that may provide for a tandem seating arrangement and may be configured to include only one seat or a plurality of seats.

In some examples a vent and wire harness assembly **950** may be used for routing electrical wires, cabin ventilation including distributing heat and/or cooling and also for defogging the canopies. The assembly **950** is also shown with mounting bolts on the side which can be used to attach to the interior of the cabin.

In some examples a steering assembly **1000** is shown that may include rack and pinion components and a steering shaft wherein the upper part of the steering shaft passes through a collar attached to the front inner firewall assembly **1050** allowing for attachment of a steering wheel inside the cabin **140**. The lower part of the steering shaft may pass through a collar attached to the utility channel **620** and the bottom end of the rack may be attached in a rack and pinion steering housing **438** shown in FIG. **11** that is attached to the bottom end of the battery compartment **600** thereby attaching the steering assembly **1000** to the chassis **400**. The steering shaft may attach to a gearbox having a pinion coupled to a rack. The rack may include a tie rod at both ends that may connect to the steering arms of the front wheels. This configuration provides for a steering system for the vehicle **100**.

In some examples a front inner firewall assembly **1050** may include a brake pedal and an accelerator pedal including providing a structure for attaching a dash board and instrument cluster. The front inner firewall **1050** may include a fan assembly and vents for providing air circulation to the cabin, including providing structural support to the vehicles **100** body.

In some examples a front outer firewall assembly **1100** may include windshield washing components and headlights, including providing structural support to the vehicles **100** body.

The example arrangement of a chassis **400**, including a battery pack assembly **850**, and seats **900** contributes to a low center of gravity which may provide for better vehicle handling and stability.

Frame Examples

Referring to FIG. **13**, an example of a frame assembly **1200** is shown that may provide intermediate support for attaching the chassis to the body in addition to providing structural support to the wind and solar generating components and may add structural strength that may provide for protecting the vehicles **100** occupants in the event of a collision. The frame assembly **1200** may include a front end cross member **1202**, a right inner upper rail **1204**, a right front end vertical cross member **1206**, a right front upper cross member **1208**, a right upper outer rail **1210**, a right front corner vertical member **1212**, a right front wheel well structure **1214**, a right front lower cross member **1216**, a vertical inner cross member **1218**, a right front control arm notch **1222**, a vertical cross member **1226**, a upper right cross members **1228**, a vertical inner cross member **1234**, a right rear wheel well structure **1236**, a right rear corner vertical member **1242**, a right rear upper cross member **1244**, a right rear control arm notch **1246**, a right rear lower cross member **1248**, a right rear inner vertical cross member **1250**, a right mounting bracket **1252**, a left rear control arm notch **1270**, a left lower cabin rail **1274**, a left rear vertical cross member **1276**, a left mounting bracket **1278**, a left rear lower cross member **1280**, a left rear corner vertical member **1282**, a left rear wheel well structure **1284**, a left rear upper cross member **1286**, a shock absorber mounting bracket **1288**, a left rear cross member **1290**, a rear vertical door frame member **1292**, a left lower rear outer rail **1294**, a rear upper door frame member **1296**, a left rear upper inner rail **1298**, a rear firewall cross member **1304**, a rear overhead structure **1306**, a front vertical door frame member **1308**, a front left wheel well structure **1310**, a front upper door frame member **1312**, a shock absorber mounting bracket **1314**, a left front upper rail **1316**, a front inner firewall cross member and mounting bracket **1318**, a left front upper cross member **1322**, a front overhead structure **1324**, a left front upper inner rail **1326**, and a left front end vertical cross member **1328**.

The frame assembly **1200** may be attached to the chassis **400** by attaching a left rear frame mounting notch **1272**, a lower left rear mounting cross member **1268**, a left lower rear outer rail **1294**, and a left lower cabin rail **1302**, attached to the left side of a lower deck support frame **670** shown in FIG. **11** and may include attaching a right rear frame mounting notch **1238**, a lower right rear mounting cross member **1240**, a right lower cabin rail **1232**, a right lower outer rail **1230**, a right front frame mounting notch **1220**, and a front right lower mounting cross member **1224** may attach to the right side of a lower deck support frame **670** shown in FIG. **11**.

The frame assembly **1200** may be centrally attached to the chassis **400** on top of the utility channel **620** and battery compartment **600** and may include a U-shaped rear center chassis mount **1300** that may be attached adjacent to the rear firewall **640** shown in FIG. **11**, and a U-shaped front center chassis mount **1320** that may be attached adjacent to the front inner firewall assembly **1050** shown in FIG. **12**.

In another example the frame assembly **1200** may include one or more vertical and horizontal frame cutouts and one or more dampers **1360***a,* **1360***b,* **1360***c,* **1360***d* that may be attached to any location on or in the vehicle **100** for allowing airflow that may provide for cooling the solar panels and components while the vehicle **100** is static or in motion.

In another example one or more vertical or horizontal frame cutouts may be configured with dampers for manipulating the airflow within the vehicle **100**.

The airflow may be the result of convection, wind or a combination of convection and wind and may include airflow resulting from one or more fans or blowers that may be attached to any location within the vehicle **100**.

In another example the frame assembly **1200** may include dampers **1360***a,* **1360***b,* **1360***c,* **1360***d* that may be located at the bottom of the left upper deck **108***a* and right upper deck **108***b* of the vehicle **100** that may be used to regulate airflow. The dampers **1360***a,* **1360***b,* **1360***c,* **1360***d* may be attached to the vehicle's **100** frame **1200** and/or body by a motor mounting plate **1368** which is attached to a stepper motor **1370**. The stepper motor's **1370** shaft is attached to the part of a knuckle hinge **1364** that is also attached to a flap **1362**. This configuration allows a stepper motor **1370** attached to controls to manipulate a flap **1362** while the mounting plates **1366** attached to the other part of the knuckle hinge **1364** may hold the damper in place.

A stepper motor **1370** and controls is only one of various ways to manipulate the flap and may include but not be limited to a bi-metallic coil in place of the stepper motor **1360** attached to a flap **1352** through the knuckle hinge **1354**. In another example the motor may be any type of motor including but not limited to a stepper motor that may be manipulated by controls. In another example the motor may be a motor with rotational shaft control. The dampers shown are of only one design however, as any design or any device which may provide airflow into the vehicle **100** at any one or more locations may be used such as but not limited to air scoops and/or air vents.

In another example the dampers may be manipulated into an open or closed position by various means that may include but not be limited to a thermostat, mechanical, non-programmable, programmable, manually set, analog, digital, wireless design, computer or controls in one or in any combination and may be comprised of one or more temperature sensors.

In another example, one or more dampers **1360***a,* **1360***b,* **1360***c,* and **1360***d* may be configured to be closed, or partially open, or fully open in any combination that may allow for optimizing the air circulation under the solar panels.

In another example dampers may be attached to the cutouts adjacent to the cabin and rear compartment and may be used to manipulate airflow which may allow heated air from the solar panels to circulate into the cabin, or rear compartment.

In another example at least one of the solar panels may be comprised of cooling fins and/or heat sinks that may provide for cooling the solar panels.

Wind Examples, Overview

Referring to FIG. **14** and FIG. **15**, a vehicle **100** having an example embodiment of a stowable HAWT assembly **1400** is shown in a deployed position comprising a mast assembly **1500** in a deployed position, a horizontal-axis wind turbine assembly **1700** in a deployed position, a rotor hub assembly **1800** in a deployed position, a generator assembly **2000** having outer mounted extendable blades **2400** in a deployed position, a stowable anemometer **2500** is shown in a deployed position and a rear cover and docking cradle **1150** is shown attached.

In other examples the stowable HAWT assembly **1400** may be configured with one or more hubs with each hub having one or more fixed or extendable blades of any type or design.

In another example the stowable HAWT assembly **1400** may be deployed in favorable wind conditions when the vehicle **100** is parked, thereby providing electrical energy for charging the vehicles **100** battery pack. Wind generated electricity may be used to charge another electric vehicle or to supply electrical energy to a house or to the electrical grid or anywhere electrical energy would be desired.

In another example the stowable HAWT assembly **1400** may include wind tracking components comprised of a stepper motor having at least one gear which may manipulate the yaw position of a generator assembly **2000** and may include at least one rotational sensor capable of detecting the yaw position that may provide for positional feedback for rotating the generator assembly **2000** into various yaw positions including a deployed or stowed position. In another example the motor may be any type of motor including but not limited to a stepper motor that may be manipulated by controls. In another example the motor may be a motor with rotational shaft control. The wind generating components of the stowable HAWT assembly **1400** are described in more detail in FIGS. **16**-**24**.

Wind Examples, Mast

Referring to FIG. **16**, an example of a stowable HAWT assembly **1400** is shown in a stowed position having a horizontal-axis wind turbine assembly **1700** shown in a stowed position, and a mast assembly **1500** shown in a stowed position. In another example the mast assembly **1500** may include a top mast tube **1510**, an upper middle mast tube **1512**, a lower middle mast tube **1514** and a bottom mast tube **1516**. The tubes may be configured in a slidable arrangement which may allow the mast to extend or retract.

In another example the mast assembly **1500** may include an upper bracket **1518** and a lower bracket **1520** that may be used for mounting the mast assembly **1500** to the battery compartment cover **800** shown in FIG. **12**. In another example a housing cradle bracket **1524** may attach a motor and gear cradle **1536** to the vehicle **100**.

In another example the motor and gear cradle **1536** may house a mast motor **1534** and a worm and shaft **1532** that may be mated to transfer gears **1528** that may be mounted to a bearing **1530**. This configuration allows the vehicles **100** controls to manipulate an inner mast lifter belt **1526** which may extend or retract the mast assembly **1500**. The mast motor **1534** may be any type of motor including but not limited to a stepper motor that may be manipulated by controls. In another example the motor may be a motor with rotational shaft control.

In another example the inner mast lifter belt **1526** may include sensing data from a lower proximity sensor **1542** and an upper proximity sensor **1544** which may allow for limiting the extension or retraction of the inner mast lifter belt **1526**.

In other examples the mast assembly **1500** may include housing brackets **1538** for attaching the belt housing **1540** to the vehicle **100**, and a belt housing **1540** for housing the inner mast lifter belt **1526**, and may include at least two proximity sensors, a lower proximity sensor **1542**, and an upper proximity sensor **1544** that may be used for detecting the stowed or a deployed position of the mast assembly **1500**. The proximity sensors may be used in combination with a motor having at least one gear.

Referring to FIG. **17**, an example of a stowable HAWT assembly **1400** is shown having a horizontal-axis wind turbine assembly **1700** shown in a stowed position, and a mast assembly **1500** shown in a deployed position having a top mast tube **1510**, a upper middle mast tube **1512**, a lower middle mast tube **1514** and a bottom mast tube **1516**, wherein the tubes are slidably arranged.

In another example a top mast tube stop **1546**, an upper middle mast tube stop **1548** and a lower middle mast tube stop **1550** is shown attached to the bottom of the tubes wherein the tube stops allow the tubes to slide within the larger diameter part of the tubes they are nestled in and are stopped from extending when the tube stop slides into the smaller diameter part of the tube it is nestled in. This configuration allows the mast tubes to extend or retract in a slidable arrangement and also may limit the extension of the mast.

In another example the mast tubes may be comprised of a groove and tab arrangement wherein a tab attached to an inner mast tube resides within a groove of an outer mast tube wherein the travel of the tab is limited to the length of the groove thereby allowing the mast tubes to be manipulated to extend or retract in a slidable arrangement and also limits the extension of the tubes. The groove and tab arrangement may include more than one set of grooves and tabs.

In another example an inner mast assembly **1600** is shown in an extended position and attached at the bottom to a bottom stop plate mount **1606** and attached at the top to an upper stop plate mount **1614**, and includes an inner mast bottom outer tube **1608**, an inner mast middle tube **1610**, and an inner mast top inner tube **1612**. The tubes may be configured in a slidable arrangement.

In another example a retractable coil cord **1602** is shown that may wrap around the inner mast assembly **1600**, and may be attached at the bottom to a lower coil collar **1604**. The retractable coil cord **1602** may provide for housing and routing wires when the mast assembly **1500** is extended or retracted and may include a lower wire harness **1522** shown in FIG. **16** for attaching a horizontal-axis wind turbine assembly **1700** to the vehicles **100** power and control systems.

In other examples the mast assembly **1500** may be comprised of at least two outer tubes and at least two inner tubes.

Wind Examples, Inner Mast

Referring to FIG. **18**, an example embodiment is shown of a fractional view of an upper section of an inner mast top inner tube **1612** having an upper wire harness connector **1620** that may attach to a wiring harness connector **2124** and a wiring harness **2122** located in the generator assembly **2000** shown in FIG. **20**. The connection may provide for the horizontal-axis wind turbine assembly **1700** to connect to and be manipulated by the vehicles **100** power and control systems and also allows for the horizontal-axis wind turbine assembly **1700** to route electrical energy to a charge controller **702** shown in FIG. **11** which may be connected to a battery pack assembly **850** thereby allowing the electrical energy generated by the wind turbine to charge the battery pack.

In another example a fluted mounting post **1622** having a set screw hole **1624** is shown that may be used for attaching the mast to a fluted inner mount **2162** located in the generator assembly **2000** shown in FIGS. **20**-**22**.

In another example a post base **1626** is shown that may provide a base and support to the top tube and an O-ring **1628** that may provide a seal between the generator and the mast.

In another example a wiring harness **1630** is shown routed through an upper coil collar **1632** which allows the retractable coil cord **1602** to be attached to the upper part of the mast assembly **1500**.

In another example an upper inner mast mount **1634** is shown attached to an upper stop plate mount **1614** which itself is attached to the upper part of a top mast tube **1510**.

In another example the upper inner mast mount **1634** is attached to an inner mast top inner tube **1612** which also houses an inner mast lifter belt **1526**.

This configuration allows for an inner mast assembly **1600** to manipulate the mast assembly **1500** into a deployed position or into a stowed position.

Wind Examples, Mast Deployment

In an example of a mast deployment, referring to FIGS. **16**-**17**, controls may manipulate a mast motor **1534** attached to a worm and shaft **1532** that is mated to an inner mast lifter belt **1526** by transfer gears **1528** thereby allowing an inner mast assembly **1600** slidably arranged and attached to a **1614** upper stop plate mount and a **1606** bottom stop plate mount to extend in a telescopic manner within a top mast tube **1510**, upper middle mast tube **1512**, lower middle mast tube **1514** and a bottom mast tube **1516** which are also slidably arranged to also extend in a telescopic manner. The mast assembly is held in place by the worm and shaft **1532** mated to the transfer gears **1528** thereby securing the inner mast lifter belt **1526**. This configuration allows the mast assembly **1500** to raise an attached horizontal-axis wind turbine assembly **1700**.

Wind Examples, Mast Stowing

In an example of a mast stowing, referring to FIGS. **16**-**17**, controls may manipulate a mast motor **1534** attached to a worm and shaft **1532** that is mated to an inner mast lifter belt **1526** by transfer gears **1528** thereby allowing an inner mast assembly **1600** slidably arranged and attached to a **1614** upper stop plate mount and a **1606** bottom stop plate mount to retract in a telescopic manner within a top mast tube **1510**, upper middle mast tube **1512**, lower middle mast tube **1514** and a bottom mast tube **1516** which are also slidably arranged to also retract in a telescopic manner. The mast assembly is held in place by the worm and shaft **1532** mated to the transfer gears **1528** thereby securing the inner mast lifter belt **1526**. This configuration allows the mast assembly **1500** to lower an attached horizontal-axis wind turbine assembly **1700**.

Wind Examples, Rotor Hubs and Generator, Overview

Referring to FIG. **19**, an example embodiment of a rotor hub assembly **1800** in an exploded view is shown having a front hub **1850**, a middle hub **1900** and a rear hub **1950**. Each hub may include a pair of blade mounts that may include a blade mount **1870**, a blade mount **1902**, a blade mount **1914**, a blade mount **1954**, and a blade mount **1968**. The blade mounts may be used for attaching outer mounted extendable blades **2400** shown in FIGS. **23**-**24**, however any blade design or any modified version of the blade designs shown may be used.

In some examples an inner shaft lock nut **1854** and washer **1856** may be used for attaching a front hub **1850** that may include a cone mount **1860** shown in FIG. **19** to an inner shaft **2010** that may include outer hub mounting threads **2012** and a shaft stop **2014** shown in FIG. **20**. The front hub **1850** may include a cap cover **1852** that can be attached into a cone nut recess **1858** thereby providing a seal. A cone **1862** shown in FIG. **19** may provide an aerodynamic cover to the front hub.

In other examples the hubs may include hub lock pins **1864** on the back of a front hub **1850**, a plurality of hub pin receptacles **1918** on the front of a middle hub **1900**, a plurality of hub lock pins **1916** on the back of a middle hub **1900** and a plurality of hub locking pin receptacles **1970** on the front of a rear hub **1950**. The hub lock pins and hub locking pin receptacles provide for locking the hubs, thereby preventing them from rotating when in a stowed or in a deployed position.

In another example the rear hub **1950** shown in FIG. **19** may be attached to an outer shaft **2016** that may include inner hub mounting threads **2018** and a shaft stop **2020** shown in FIG. **20** by using a rear hub lock nut **1956** and a washer **1958**. A spacer washer **1976** may provide a base and spacer for attaching the rotor hub assembly **1800** to the generator assembly **2000**.

Referring to FIG. **19**, the outer mounted extendable blades **2400** may be charged through hub charging receptacles **1872**, **1874**, **1920**, **1922**, **1972**, and **1974** located on the hubs. The charge may be provided when in contact with three sets of positive charging prongs **1982** and negative charging prongs **1984** located in the rear cover and docking cradle **1150** shown in FIG. **15**. The charging prongs may be connected to a power source from within the vehicle **100**.

The blade mounts each include a blade mount set screw **1980** that may be used to lock the blade to the hub and may be used to manually change the pitch of the blade. The rotor hub assembly **1800** shown in FIG. **19** may include three hubs and six blades.

In another example the rotor hub assembly **1800** may be configured with two hubs and four blades and may include a rear hub **1950**, and a middle hub **1900** with each hub having a pair of outer mounted extendable blades **2400**, wherein a rear travel limit cutout **1912** would be increased to a sufficient size in order to provide for more travel which would allow equal spacing between the blades **2400**.

In another example the rotor hub assembly **1800** may be configured with only a rear hub **1950** and a pair of outer mounted extendable blades **2400**.

In other examples the rotor hub assembly **1800** may be configured with more than three hubs with each hub having two blades.

In other examples the wind turbine blades may be of any type, shape or design, including but not limited to extendable blades, or fixed blades.

Wind Examples, Rotor Hubs and Generator, Stowed

Referring to FIG. **19**, an example of a rotor hub assembly **1800** in an exploded view is shown which may be attached to a generator assembly **2000** shown in FIG. **20** by a rear hub **1950** that may be attached to an outer shaft **2016** and a front hub **1850** that may be attached to an inner shaft **2010**.

The generator assembly **2000** may include a pair of generator bearings shown in the example as a generator bearing **2032**, a generator **2040** and a nacelle **2034** which may provide for covering and housing various generator components. The generator **2040** may be a direct drive generator or may be any other type or design including but not limited to a generator configured with at least one gear and/or gear box.

The rotor hub assembly **1800** in FIG. **19** is configured to allow the hubs **1850**, **1900** and **1950** to remain locked and adjacent to each when in a stowed position, and to separate and rotate when being deployed, and to remain locked and adjacent to each other when in a deployed position.

Wind Examples, Rotor Hubs and Generator, Deployment Phases

In an example of a hub separation phase, a power distribution and controller box **2120** located in the generator assembly **2000** may manipulate an inner shaft actuator assembly **2100** shown in FIG. **20** to extend allowing an attached friction disc **2108** and a friction disc attached to a friction disc and spring shoe base **2072** to engage and compress the spring **2068** housed in the inner shaft spring assembly **2060** thereby pushing out an inner shaft **2010** that is slidably nestled within an outer shaft **2016** shown in FIG. **20**. The front hub **1850** in FIG. **19** attached to the inner shaft **2010** in FIG. **20** may then be moved away from the rear hub **1950**, allowing a hub separation spring **1904** between a front hub **1850** and a middle hub **1900**, and a hub separation spring **1952** between the middle hub **1900** and a rear hub **1950** to separate the hubs thereby freeing the hubs for rotation.

The inner shaft actuator assembly **2100** in FIG. **20** may include a motor **2102**, a load cap **2104**, and an inner shaft drive gear **2106** that is mounted rotatably to the load cap **2104**. A rotor hub assembly **1800** shown in FIG. **19** may include a spring recess **1866**, and a spring recess **1906** that provides shoes for a hub separation spring **1904** and a spring recess **1908**, and a hub lock nut recess **1962** that provides shoes for a hub separation spring **1952**.

In an example of a hub rotation phase, an inner shaft rotator assembly **2080** comprised of a motor **2082**, a motor gear **2084**, a transfer gear **2086**, and a drive gear **2088**, then rotates the inner shaft **2010** with an attached front hub **1850**, thereby rotating the front hub **1850** counterclockwise until an outer hub drive pin **1868** on the back of the front hub **1850** that is seated in the front travel limit cutout **1910** located in the middle hub **1900** engages the middle hub **1900** to also rotate counterclockwise until a stop pin **1966** on the front of the rear hub **1950** seated in the rear travel limit cutout **1912** in the middle hub **1900** stops the rotation. A rear hub lock actuator **2024** remains inserted in a rear hub lock pin recess **1964** which prevents the rear hub **1950** from rotating. The inner shaft actuator assembly **2100** then retracts allowing the spring **2068** to compress the front hub **1850**, a middle hub **1900** and a rear hub **1950** together into a deployed position. The rear hub lock actuator **2024** is then retracted which unlocks the rear hub **1950** allowing the rotor hub assembly **1800** to rotate freely. This configuration allows for each hub with their attached blades to be separated and rotated into equally spaced positions.

In an example of a hub contraction phase, a power distribution and controller box **2120** located in the generator assembly **2000** may manipulate an inner shaft actuator assembly **2100** shown in FIG. **20** to retract allowing an attached friction disc **2108** and a friction disc attached to a friction disc and spring shoe base **2072** to disengage and decompress the spring **2068** housed in the inner shaft spring assembly **2060** thereby withdrawing the inner shaft **2010** that is slidably nestled within an outer shaft **2016** shown in

FIG. **20**. The front hub **1850** in FIG. **19** is attached to the inner shaft **2010** in FIG. **20** and is then moved back towards the rear hub **1950**, compressing a hub separation spring **1904** between a front hub **1850** and a middle hub **1900**, and compressing a hub separation spring **1952** between the middle hub **1900** and a rear hub **1950**, thereby joining all the hubs together. The hubs remain compressed together by a spring **2068** and locked together by each hub having a plurality of hub lock pins shown as **1864** and **1916** wherein the pins are set into a plurality of hub pin receptacles shown as a **1918** hub pin receptacle.

In an example of a hub deployed phase, a rear hub lock actuator **2024** shown in FIG. **20** may then be manipulated by controls to withdraw its load cap **2026** from a rear hub lock pin recess **1964** located in the rear hub **1950** shown in FIG. **19**, thereby allowing the rotor hub assembly **1800** attached to an outer shaft **2016** and an inner shaft **2010** to rotate freely.

Referring to FIG. **21**, an example embodiment of a horizontal-axis wind turbine assembly **1700** is shown with the hubs separated and rotated.

Wind Examples, Rotor Hubs and Generator, Stowing Phases

In an example of a hub braking and aligning phase, controls may manipulate a brake assembly **2050** shown in FIG. **20** to stop the rotation of a rotor hub assembly **1800** and generator **2000**. The brake assembly **2050** may be comprised of a brake caliper that may be attached to a generator **2040**, and a brake disc that may be attached to the outer shaft **2016**. An inner shaft rotator assembly **2080** shown in FIG. **20** may then be used to rotate a rotor hub assembly **1800** shown in FIG. **19**, and may stop the rotation when controls detect when a rear hub position magnet **1960** located in the rear hub **1950** in FIG. **19** is aligned with a rear hub position sensor **2022** shown in FIG. **20**. A rear hub lock actuator **2024** shown in FIG. **20** may then be manipulated by controls to insert its load cap **2026** into a rear hub lock pin recess **1964** located in the rear hub **1950** shown in FIG. **19**, thereby allowing the rotor hub assembly **1800** attached to an outer shaft **2016** and an inner shaft **2010** to lock, thereby preventing rotation.

The rear hub lock actuator **2024** may include a motor **2030** having a lifting screw **2028** and a load cap **2026** that may be manipulated by controls that allows the load cap **2026** to extend or retract. The motor **2030** may be any type of motor including but not limited to a stepper motor that may be manipulated by controls. In another example the motor may be a motor with rotational shaft control.

The hubs may then be separated in the same manner as described in the hub separation phase of deployment.

The hubs may then be rotated in the same manner as described in the hub rotation phase of deployment, with the exception that the hubs are rotated clockwise.

The hubs may then be contracted in the same manner as described in the hub contraction phase of deployment.

In another example the deployment phases and stowing phases may be performed in any order that allows for the wind generator and/or hub(s) to be in a deployed position or to be in a stowed position.

Wind Examples, Rotor Hubs and Generator, Other Examples

The inner shaft spring assembly **2060** shown in FIG. **20** may include an outer shaft spring shoe nut **2062** for attaching to the outer shaft **2016**, a slip bearing **2064** for allowing the inner shaft **2010** to rotate, a spring shoe **2066** and a spring shoe **2070** for holding the spring **2068** in place, and a friction disc attached to a friction disc and spring shoe base **2072** which engages a friction disc **2108** and allows the inner shaft **2010** to be rotated. The friction discs may be comprised of any type of surface, material or design that allows the two surfaces to engage with each other thereby allowing the inner shaft **2010** to be manipulated by an inner shaft actuator assembly **2100** and an inner shaft rotator assembly **2080**.

In other examples a hub alignment proximity sensor **2182** may be used to detect when the hubs are aligned with the generator.

In another example the motor **2082**, and the motor **2102** shown in FIG. **20** may be any type of motor including but not limited to a stepper motor that may be manipulated by controls. In another example the motor may be a motor with rotational shaft control. In another example the power distribution and controller box **2120** located in the generator assembly shown in FIG. **20** may be used to manipulate other various components inside the generator assembly **2000**.

In another example hub position sensing data may be provided by at least one hub proximity sensor **2182** shown in FIG. **20** that may be capable of sensing the target disc in the hub alignment hole and target disc **1876**, by sensing through a hub alignment hole **1924**, and through a hub alignment hole **1978** shown in FIG. **19**.

In another example an additional hub alignment hole and target plate such as the hub alignment hole and target disc **1876** shown in FIG. **19** may be added to the front hub **1850** and an additional hub alignment hole such as the hub alignment hole **1924** shown may be added to the middle hub **1900** which may allow the hub alignment proximity sensor **2182** shown in FIG. **20** to sense the rotational position of the hubs which may then stop the rotation of the hubs when the hubs are in a deployed position. The proximity sensor **2182** may include any type of sensor capable of sensing the target disc **1876** including but not limited to a light or laser device that may be reflected from the target disc back to the sensor.

Wind Examples, Assemblage

Referring to FIG. **22**, an exploded view of an assemblage of various assemblies and components is shown comprising examples of a horizontal-axis wind turbine assembly **1700** having a rotor hub assembly **1800**, a front hub **1850**, a middle hub **1900**, a rear hub **1950**, a generator assembly **2000**, and an outer mounted extendable blade **2400**, including an inner mast top inner tube **1612**.

Wind Examples, Tracking

Referring to FIGS. **20**-**22**, a yaw drive housing **2150** is shown comprising yaw control and components and may include a yaw drive bearing inner race **2152** which is seated rotatably inside a yaw drive bearing outer race **2154**, which having a fluted inner mount **2162**, may be mounted to an inner mast top inner tube **1612** shown in FIG. **22**. A post set screw **2158** may be used to lock the yaw drive bearing inner race **2152** to the inner mast top inner tube **1612** and may be accessed by a set screw hollow **2160** that may be sealed by a seal plug **2156**. This configuration allows attaching a generator assembly **2000** of the horizontal-axis wind turbine assembly **1700** to an inner mast top inner tube **1612** of a mast assembly **1500** while also allowing the generator assembly **2000** to be manipulated by the yaw motor **2168**.

The yaw drive bearing inner race **2152** may be manipulated by a yaw motor **2168** having a yaw motor gear **2164** whereby the yaw motor gear **2164** is mated to the gear of the yaw drive bearing inner race **2152**. The yaw motor **2168** may be a motor with at least one rotary position sensor. In another example the yaw motor **2168** may be any type of motor including but not limited to a stepper motor that may be manipulated by controls. In another example the motor may be a motor with rotational shaft control.

In another example the yaw motor **2168** may be connected to and manipulated by controls which may include wind tracking data from a stowable anemometer **2500** thereby allowing the horizontal-axis wind turbine assembly **1700** to track the wind. The yaw drive housing **2150** may include at least one position sensor that may measure rotational angles thereby providing the generator assembly **2000** with wind tracking capability and that also may be capable of detecting the stowed position. This configuration allows controls to manipulate the yaw rotation of a horizontal-axis wind turbine assembly **1700** into various yaw positions.

Wind Examples, Extending Blades, Overview

Referring to FIGS. **23**-**24**, an example embodiment of an outer mounted extendable blade **2400** is shown that may include an outer blade **2416** mounted slidably over an inner blade **2414** wherein the inner blade **2414** is attached to a hub and the outer blade **2416** may be attached to an outer tube **2446** configured to extend or retract. This configuration allows an outer mounted extendable blade **2400** to extend or retract in a telescopic manner.

An outer mounted extendable blade **2400** may include a blade mounting stud **2402** that may be used for attaching to blade mounts **1870**, **1902**, **1914**, **1954**, and **1968** shown in FIG. **19** and may be attached to hubs **1850**, **1900** and **1950** as shown in FIG. **22**. A stud hole **2404** shown in FIG. **23** may be used to keep a battery pack **2406** charged by routing electrical wires from the battery pack **2406** to hub charging receptacles **1872**, **1874**, **1920**, **1922**, **1972**, and **1974** shown in FIG. **19**.

In another example a battery pack **2406** may be charged by wireless charging which may include but not be limited to inductive charging whereby two induction coils in proximity combine to transfer electrical energy. A pair of induction transmitter coils **1340***a,* **1340***b* shown in FIG. **13** may be mounted within or on the vehicle **100** anywhere in proximity to the induction receiver coil(s) **2460** shown in FIG. **23** and may include a power source, a controller, a communication module, an AC to DC or DC to DC converter, and a power stage driver.

An example of an induction receiver coil **2460** shown in FIG. **23** may include a battery pack, a controller, communication module, a rectifier, voltage conditioner, device load, and may be mounted within or on each extendable blade **2400**. In other examples the wireless transmitting and/or receiving devices may include other components including but not limited to a rectifier, oscillator and a resonant circuit.

In another example the battery pack **2406** may be charged by a motion generator **2470** shown in FIG. **23** that may be mounted within each extendable blade **2400** thereby charging the battery pack as the wind generator's hub(s) rotate. The motion generator may be a linear induction type and may be comprised of a magnet held between two springs that can move up and down and may include controls. In another example the motion generator **2470** may be comprised of a slider and a stator and may include controls. In another example the motion generator **2470** may be situated in a hub(s) and may include one or more motion generators that may provide for charging the battery pack **2406**.

In other examples the battery pack **2406** may be charged by any combination of motion generator(s), wireless or charging receptacle(s) means.

The blade extending actuator **2440** may be further comprised of a motor **2442**. The motor may be a motor with at least one gear or may be a stepper motor with at least one gear that may be attached to and manipulated by controls which may allow for the full or partial extension or full or partial retraction of an outer mounted extendable blade **2400**. The motor **2442** may be attached to a threaded rod

2444 mounted in a traveling nut **2422** which when the motor rotates causes the outer tube **2446** to extend or retract. The blade extending actuator **2440** may include at least one proximity sensor **2420** which may be used to detect the full extension of the actuator, and at least one proximity sensor **2424** which may be used to detect the full retraction of the actuator thereby stopping the actuator from over extending or over retracting. In another example the motor **2442** may be any type of motor including but not limited to a stepper motor that may be manipulated by controls. In another example the motor may be a motor with rotational shaft control.

The extendable blade **2400** may include a maintenance access panel **2410** for accessing various components inside the extendable blade **2400**. The movable outer blade **2416** may be attached to a blade tip **2450** which may be any shape or size and may contribute to the aerodynamics of the blade. In other examples the blade **2400** may be partially or wholly twisted in any section of the blade **2400**. In another example the blade **2400** may have a tapered shape.

In other examples one or more blade stiffeners may be used separately or in combination that may aid in stiffening the blade **2400** when in an extended position. The blade stiffeners may be of any shape or size including but not limited to a blade sleeve arraigned slidably between the outer and inner blades having tabs that would limit its travel. In another example, the stiffeners may be slidably arranged tubes and may be positioned adjacent to the blade extending actuator **2440**.

In other examples the blade **2400** shown in FIG. **23**-**24** may also be attached to the hubs **1850**, **1900**, and **1950** shown in FIG. **19** using more than one blade stud, or any other attachment of any design or any type that allows for the blades to be mounted securely to the hubs.

In other examples the blades and hubs may also be configured to include fixed pitch blades, or may include a configuration where the pitch of the blades may be manually altered or may be manipulated with controls. In another example the blades may also be configured as part of the hub wherein the hub and blade are one piece.

Wind Examples, Extending Blades, Deployment

In a blade deployment phase example, controls may manipulate a power distribution and controller box **2120** to send a wireless signal from a transmitter **2180** in FIG. **20** to a wireless control box **2408** in FIG. **23**, which may manipulate a blade extending actuator **2440** to partially or fully extend an outer tube **2446** attached to an outer blade **2416**. The outer tube **2446** may be nestled slidably in the actuator borehole **2412** of the inner blade section **2414**, having a threaded tube stud **2448** that is attached to the internal mounting threads **2418** in the upper part of a movable outer blade **2416**. This configuration allows the outer mounted extendable blades **2400** to deploy into a partially or fully extended position when a mast assembly **1500** is in a deployed position.

Wind Examples, Extending Blades, Stowing

In a stowing phase example, controls may manipulate a power distribution and controller box **2120** to send a wireless signal from a transmitter **2180** in FIG. **20** to a wireless control box **2408** in FIG. **23**, which may manipulate a blade extending actuator **2440** to retract an outer tube **2446** attached to an outer blade **2416**. This configuration allows the outer mounted extendable blades **2400** to retract into a stowable position.

Wind Examples, Stowable HAWT Assembly, Deployment

In a deployment example of a stowable HAWT assembly **1400**, a stowable anemometer **2500** shown in FIGS. **25**-**26**, may provide feedback to controls which in favorable wind conditions may manipulate a mast assembly **1500** shown in FIGS. **16**-**17** to extend into a deployed position, controls may then initiate the deployment of a horizontal-axis wind turbine assembly **1700** shown in FIG. **21** by having components from the generator assembly **2000** and the rotor hub assembly **1800** interact in separating the hubs and rotating the hubs into a deployed position, controls may then activate the extension of outer mounted extendable blades **2400** shown in FIGS. **23**-**24** into a deployed position, a stowable anemometer **2500** shown in FIGS. **25**-**26** may provide feedback to controls which may then activate wind tracking components in the generator assembly **2000** to track the wind. This configuration provides a system that allows the stowable HAWT assembly **1400** to be in a deployed position when wind conditions are favorable.

Wind Examples, Stowable HAWT Assembly, Stowing

In a stowing example of a stowable HAWT assembly **1400**, a stowable anemometer **2500** shown in FIGS. **25**-**26** may provide feedback to controls which in unfavorable wind conditions may then activate wind tracking components in the generator assembly **2000** to align the generator assembly **2000** into a stowable position, controls may then activate the retraction of outer mounted extendable blades **2400** shown in FIGS. **23**-**24** into a stowed position, controls may then initiate the deployment of a horizontal-axis wind turbine assembly **1700** shown in FIG. **21** by having components from the generator assembly **2000** and the rotor hub assembly **1800** interact in separating the hubs and rotating the hubs into a stowed position, controls may then manipulate a mast assembly **1500** shown in FIGS. **16**-**17** to retract into a deployed position. This configuration provides a system that allows the stowable HAWT assembly **1400** to be in a stowed position when wind conditions are no longer favorable.

Wind Examples, Adjustable Blade Pitch Hub

Referring to FIG. **34**, an example embodiment of an adjustable blade pitch rotor hub assembly **5000** in an exploded view is shown having a rotor hub assembly **5010**, a hub nose cone **5080**, and an example of an inner mounted extendable blade **2400**B partially shown having an outer blade which may be attached to a hub, and an inner blade mounted slidably inside the outer blade. The adjustable blade pitch rotor hub assembly **5000** may be configured to attach to a generator assembly **2000** shown in FIG. **20** and a mast assembly **1500** shown in FIGS. **16**-**17**. The adjustable blade pitch rotor hub assembly **5000** may be configured with a taller mast assembly **1500**.

In another example the adjustable blade pitch rotor hub assembly **5000** may be comprised of two rotor hub assemblies **5010** with at least 6 blades, or, three rotor hub assemblies **5010** with at least nine blades and may include hub components as shown in FIG. **19** which may allow the rotor hub assembly(s) to rotate into a deployed position or allow the rotor hub assembly(s) to rotate into a stowable position.

The rotor hub assembly **5010** may include a hub casing **5012**, a hub lock nut **5014**, a hub lock recess **5016**, a hub collar **5018**, a pitch assembly hub cutout **5020**, a top position pitch assembly **5040***a,* and two lower pitch assemblies **5040***b,* **5040***c*.

In another example the hub casing **5012** shown in FIG. **34** may include a rear hub position magnet **1960** shown in FIG. **20** for providing hub position data for allowing the hub to be aligned for stowing and a **1964** rear hub lock pin recess for allowing the hub(s) to lock, thereby preventing rotation.

The pitch assemblies **5040***a,* **5040***b,* and **5040***c* may each be further comprised of a stop collar **5042**, an inner bearing **5044**, an outer bearing **5046**, a wire hole **5048**, a shaft **5050**, a main gear **5052**, a worm drive gear **5054**, a motor **5056**, a set screw **5058**, and a wire access cutout **5060**.

The motor **5056** may be manipulated by controls to turn clockwise or counter clockwise thereby rotating the worm drive gear **5054** which is mated to a main gear **5052** which is attached to a shaft **5050**. The shaft **5050** may be held in place by an outer bearing **5046** and an inner bearing **5044** and may include a stop collar **5042** with a set screw **5058**. The pitch assemblies **5040***a,* **5040***b,* and **5040***c* are configured to allow attachment of inner mounted extendable blades **2400**B, however any blade design or any modified version of the blade designs shown may be used including outer mounted extendable blades **2400** shown in FIGS. **23**-**24**. Controls attached to the pitch assemblies **5040***a,* **5040***b,* and **5040***c* may provide for manipulating the angle of attack of each individual blade into a pitch angle favorable for generating wind energy or to a pitch angle favorable for stowage. The motor **5056** may be any type of motor including but not limited to a stepper motor that may be manipulated by controls. In another example the motor may be a motor with rotational shaft control which allows for manipulating the blade pitch angle.

The hub nose cone **5080** shown in FIG. **34** may include a control box **5082**, a battery pack **5084**, a motion generator **5086**, a cap **5088**, a nose nut **5090**, a nut recess **5092**, a shaft collar **5094**, and a wire access cutout **5096**. In another example a battery pack **5084** may be charged by any combination of motion generator(s) **5086**, wireless induction receiver coil(s) **2460** or by contact means which may use hub charging receptacles and charging prongs shown in FIG. **19**.

The inner mounted extendable blades **2400**B may include the same components as the outer mounted extendable blades **2400** shown in FIGS. **23**-**24**, and may be configured in a slidable arrangement wherein the inner blade may extend and retract and the outer blade may be attached to the hub.

Referring to FIGS. **35**, **36** and **37**, an alternative embodiment example of a vehicle **100** is shown having an adjustable blade pitch rotor hub assembly **5000** mounted to the rear end section of a vehicle **100**. Referring to FIG. **35** an adjustable blade pitch rotor hub assembly **5000** is shown in a stowed position.

Referring to FIG. **36**, an adjustable blade pitch rotor hub assembly **5000** is shown in a deployed position attached to an extendable mast shown in an extended position and inner mounted extendable blades **2400**B shown in an extended position including a stowable anemometer **2500** shown in a deployed position. Referring to FIG. **37**, an adjustable blade pitch rotor hub assembly **5000** is shown with the inner mounted extendable blades **2400**B shown having alternative pitch angles.

In another example the rear end section of a vehicle **100** may include a left blade slot **5200** and a right blade slot for housing the lower left and lower right blades of the adjustable blade pitch rotor hub assembly **5000**. The vehicle **100** may include a right rear upper tail lights **5210***a,* a left rear upper tail lights **5210***b,* a right rear lower tail lights **5212***a,* and a left rear lower tail lights) **5212***b.*

In other examples the three blade hub configuration may be configured with two or more hubs with each hub having three blades that may be stowed behind the vehicle **100**. In another example the extendable blades may be configured with more than two blades slidably arranged.

Anemometer Examples, Overview

Referring to FIGS. **25**-**26**, an example embodiment of a stowable anemometer **2500** is shown that may provide wind speed and wind direction data in relation to the direction of the vehicle **100**. Referring to FIG. **25**, a stowable anemometer **2500** is shown in a deployed position and shown in a stowed position in FIG. **26**. The stowable anemometer **2500** may include an anemometer **2510** that may be stored in a housing cup **2524** which is attached to an upper bracket **2548**. The anemometer **2510** is attached to a post **2520**, and may include ultrasonic wind sensors **2516** for measuring wind speed and wind direction, including a top cover **2512** and base **2518** which are attached by support columns **2514**. This configuration provides for housing the sensors and their components, and for running wires within the post **2520** to the post wire harness connector **2530** which may provide a connection(s) to the vehicles **100** controls. The stowable anemometer **2500** may provide wind data to the vehicles **100** controls which may be used to manipulate a stowable HAWT assembly **1400** including wind tracking controls and devices, and may also be used to safeguard the vehicle **100** wind and solar generating components from extreme wind conditions.

The stowable anemometer **2500** may include a post groove **2522**, which together with a sleeve stud **2526** attached inside a post sleeve **2528**, may provide for keeping the anemometer **2510** aligned when being deployed or stowed, and may include a traveling nut **2532**, attached to the bottom end of a post **2520** which is mated to a threaded rod **2534** which is connected to a motor **2536** which may allow the anemometer **2510** to be extended or retracted. A motor **2536** may be attached to a motor mount **2540** having a lower bracket **2542**. A motor wire connector **2538** may provide a connection to the vehicles **100** controls that may manipulate the stowable anemometer **2500**.

The stowable anemometer **2500** may be attached to the vehicle **100** using a plate **2546** which has at least one lower mounting stud **2544**, and at least one upper mounting stud **2550**. This configuration allows a stowable anemometer **2500** shown in FIGS. **25**-**26** to remain nestled within the vehicle **100** when stowed and to extend when being deployed. In examples where the stowable anemometer **2500** may be stowed, these stowed configurations may help to reduce the aerodynamic drag of the vehicle **100** when driven.

In another example the stowable anemometer **2500** shown may include ultrasonic wind sensors **2516** for providing wind speed and direction data, however any variety of sensors, designs and/or sensing technologies may be used including but not limited to cup, wind vane, propeller, ultrasonic, sonic, lidar, acoustic resonance, ultrasonic, laser Doppler, hot-wire, pitot-static tube, cup, vane or any combination of these. The positioning of such sensors may be in any of various places as shown in, but not limited to FIG. **25**.

In another example the motor **2536** may include at least one gear or may be a stepper motor. In another example the motor **2536** may be any type of motor including but not limited to a stepper motor that may be manipulated by controls. In another example the motor may be a motor with rotational shaft control. In another example the anemometer **2500** may be configured with longer components that may allow for a longer extension than what is shown in the examples. In another example the stowable anemometer **2500** may be deployed manually or may be deployed automatically by controls. In another example initial wind measurements may also be provided by wind sensors mounted to the top cover **2512**.

In another example, a stowable anemometer **2500** may be used for detecting unfavorable wind conditions thereby allowing the vehicles **100** controls to prevent a stowable solar panel assembly **2900** from deploying, and may also be used to retract a deployed stowable solar panel assembly **2900** partially or into a stowed position.

Anemometer Examples, Deployment

In a deployment phase example, a stowable anemometer **2500** may be partially deployed by controls when the vehicle **100** is parked, thereby allowing the wind sensors to initially measure wind conditions, when favorable wind conditions are detected, the stowable anemometer **2500** may then be fully extended. A motor **2536** having a threaded rod **2534** may be manipulated by controls to rotate allowing the threaded rod **2534** to move the mated traveling nut **2532** which is attached to the post **2520**, thereby allowing the anemometer **2510** to extend.

Anemometer Examples, Stowing

In a stowing phase example, a stowable anemometer **2500** may be stowed when the vehicle **100** is no longer parked. Controls may detect the vehicle **100** being shifting from park to drive and then controls may manipulate a motor **2536** having a threaded rod **2534** to rotate allowing the threaded rod **2534** to move the mated traveling nut **2532** which is attached to the post **2520**, thereby allowing the anemometer **2510** to retract.

In another deployment and/or stowing example, a stowable anemometer **2500** may be manipulated by wireless devices including but not limited to a smartphone.

Solar Examples, Overview

Referring to FIGS. **27**-**31**, an example embodiment of a stowable solar panel assembly **2900** is shown in various extended positions that may be deployed by controls in favorable sun conditions, and may track the sun or may be stowed when sun conditions are no longer favorable. The stowable solar panel assembly **2900** may be housed within a rear solar panel assembly compartment **3550***a* and a front solar panel assembly compartment **3550***b* shown in FIG. **28**.

An omni-directional sun sensor **174** shown in FIG. **7** may provide sun strength and/or sun tracking data to the vehicles **100** controls which may manipulate the stowable solar panel assembly **2900** into a deployed position that may be favorable for generating solar energy or into a stowed position.

Referring to FIG. **30**, an example of a stowable solar panel assembly **2900** is shown comprised of a top side solar panel **3100** that may be attached to a rear panel assembly **3000***a* and a front panel assembly **3000***b,* both panel assemblies **3000***a,* **3000***b* may include a pair of rail assemblies shown as a right rail assembly **3200***a,* and a left rail assembly **3200***b,* and a right rail assembly **3200***c,* and a left rail assembly **3200***d.* The rear panel assembly **3000***a* may include a right upper mounting plate **3002**, and a left upper mounting plate **3004** for mounting an upper solar panel **3010***a,* and a right middle mounting plate **3006**, and a left middle mounting plate **3008** for mounting a lower solar panel **3012***a.* The upper and lower solar panels **3010***a,* **3012***a* may be connected to the vehicles **100** controls by electrical wires that may be routed through a middle panel spool assembly **3450**, and a upper panel spool assembly **3500** where they are then routed to an electrical junction box where they are then routed to a wire harness coil **3216** that may then be connected to a charge controller **702** shown in FIG. **11**. A rear panel assembly **3000***a* and a front panel assembly **3000***b* may have similar components.

The rail assemblies **3200***a,* **3200***b,* **3200***c,* and **3200***d* shown in FIG. **30** may each include mounting plates **3014** that may be used to attach to the top side solar panel **3100**, and may each be configured as shown in an example of a right rail assembly **3200***a* which includes an outer rail **3226**, a middle rail **3230**, and an inner rail **3234** that are slidably arranged wherein the inner rail **3234** is slidably received in the middle rail **3230** and the middle rail is slidably received in the outer rail **3226**. The outer, middle and inner rails are sized that allows the inner rail to be retracted into a middle rail and a middle rail to be retracted into an outer rail thereby allowing the inner and middle rails to extend or retract in a telescopic manner. The middle and inner rails may each include a solar panel mounting plate as shown in an example of a middle rail **3230** attached to a right middle mounting plate **3006** and an inner rail **3234** attached to a right upper panel mounting plate **3002**. The mounting plates **3002**, and **3004** allows for the upper solar panel **3010***a* to be attached to the inner rails as shown in **3234** and the mounting plates **3006**, and **3008** allows for attaching the lower solar panel **3012***a* to the inner rails as shown in **3234**. This configuration allows attaching the upper solar panels to the inner rails and for attaching the lower solar panels to the middle rails in a slidable arrangement thereby allowing the upper and lower solar panels to extend or retract.

Referring to FIG. **30**, an example of a telescopic tube structure may include an outer cable tube **3224**, middle cable tube **3228**, and an inner cable tube **3232** that may attach to the outer rails **3226** with at least one outer tube hanger **3222** and may include a rail cable housing **3212** that may be attached to the top side solar panel **3100** by at least one rail cable housing hanger **3214**. The outer, middle and inner cable tubes are slidably arranged so that the inner tube can be retracted into the middle tube and the middle tube can be retracted into the outer tube thereby allowing the cable tubes to extend or retract in a telescopic manner.

An example of a motor assembly **3250** shown in FIG. **30** may include a mounting plate **3256** which may be attached to the outer rail **3226**. A threaded cable **3220** housed in the rail cable housing **3212** may be attached within an inner cable tube **3232** which is attached to the end of an inner rail **3234**. A threaded cable **3220** is mated to a transfer gear **3252** which is mated to a motor and worm gear shaft assembly **3254**. This configuration allows the vehicles **100** controls to manipulate the motor and worm gear shaft assembly **3254** allowing the telescopic tube structures to extend or retract thereby also allowing the rail assemblies **3200***a,* **3200***b,* **3200***c* and **3200***d* and their attachment components to extend or retract as the threaded cable **3220** moves out into the extending telescopic tube structure when being deployed or retracts back into the rail cable housing **3212** when being stowed. A right rail assembly lower proximity sensor **3210**, and a right rail assembly upper proximity sensor **3218** may be used by the vehicles **100** controls to prevent an over extension or over retraction of the threaded cable **3220**.

In other examples the motor of the motor and worm gear shaft assembly **3254** may be a stepper motor that may include one or more various gears. In another example the motor may be any type of motor including but not limited to a stepper motor that may be manipulated by controls. In another example the motor may be a motor with rotational shaft control.

The rail assemblies **3200***a,* **3200***b,* **3200***c,* and **3200***d* shown in FIG. **30** may each include an outer rail link mount attached to a lifter assembly **3300***a,* **3300***b,* **3300***c,* **3300***d* and may each include an inner rail link mount attached to a tilting assembly **3400***a* **3400***b* **3400***c* **3400***d.* The example shown includes an inner rail link mount **3018** attached pivotally to a pair of links **3318** which are attached to a pair of traveling nuts mounted on a threaded rod **3316** housed within a barrel **3314** of a left lifter assembly **3300***d.*

A threaded rod **3316** attached to the motor **3310** allows a pair of traveling nuts to spread apart when rotated in one direction which may lower the rails **3200***a,* **3200***b,* **3200***c,* **3200***d,* and to allow the traveling nuts to move towards each other when the rotation is reversed which may lift the rails.

The lifter assemblies **3300***a,* **3300***b,* **3300***c,* **3300***d* may include the same components as a left lifter assembly **3300***d* shown in FIG. **30** and may include a motor frame mount **3312** that may be used to attach to the vehicle **100** and may also provide for attaching the right end of a threaded rod **3316**, a barrel **3314**, and a motor **3310**, and may include a bearing frame mount **3320** that allows for attaching the other end to the vehicle**100** and may also provide for attaching the left end of a threaded rod **3316**, and a barrel **3314**. The lifter assembly motor **3310** may be any type of motor including but not limited to a stepper motor that may be manipulated by controls. In another example the motor may be a motor with rotational shaft control.

The examples shown includes an outer rail link mount **3016** attached pivotally to a lifter link arm **3410** which is attached to a traveling nut mounted on threaded rod **3414** housed in barrel **3416** of a tilting assembly **3400***d.* The tilting assembly **3400***d* may further include an upper bearing barrel mount **3412** for attaching the upper end of the threaded rod **3414** and barrel **3416**, a mounting plate **3418** for mounting to the vehicle **100**, a motor mount **3420** for mounting the lower end of a threaded rod **3414** and barrel **3416** and for mounting the motor **3422**. The tilting assembly motors **3422** may be any type of motor including but not limited to a stepper motor that may be manipulated by controls. In another example the motor may be a motor with rotational shaft control.

The rail assemblies **3200***a,* **3200***b,* **3200***c,* and **3200***d* shown in FIG. **30** may each be attached to an outer rail link mount as shown in one example **3016** that may be used to attach to tilting assemblies shown in the example as a right tilting assembly **3400***a,* a left tilting assembly **3400***b,* a right tilting assembly **3400***c,* and a left tilting assembly **3400***d.* Each tilting assembly may include a lifter link arm as shown in one example **3410** which may provide a connection to the rail assemblies' outer link mounts.

The tilting assemblies **3400***a,* **3400***b,* **3400***c,* and **3400***d* may each having traveling nuts that may be mounted to a threaded rod attached to a motor that may be manipulated by controls that allows the threaded rod to rotate allowing the traveling nuts to extend or retract the lifter link arm **3410** which are attached to the rail assemblies' **3200***a,* **3200***b,* **3200***c,* **3200***d* outer link mounts as shown in one example outer link mount **3016**. This configuration allows the vehicles **100** controls, including data from an omni-directional sun sensor **174** shown in FIG. **7** to manipulate a stowable solar panel assembly **2900** into various extended and/or tilted positions. In another example the lifter assemblies **3300***a,* **3300***b,* **3300***c,* **3300***d* and the tilting assemblies **3400***a,* **3400***b,* **3400***c,* **3400***d* may be manipulated by the vehicles **100** controls to alternate functions between lifting and tilting in any combination thereby allowing a stowable solar panel assembly **2900** to be capable of omnidirectional tilting.

Solar Examples, Other Examples

In another example the stowable solar panel assembly **2900** shown in FIG. **30** may be configured with less slidable solar panels or more slidable solar panels than shown.

In another example the stowable solar panel assembly **2900** shown in FIG. **30** may be comprised of two separate top side solar panels wherein a front portion top side solar panel is attached to a rear panel assembly **3000***a* and a rear portion top side solar panel is attached to a front panel assembly **3000***b*. This configuration allows two separate stowable solar panel assemblies to be independently manipulated by controls.

Solar Examples, Deployment

In a deployment phase example, when favorable sun conditions are detected by an omni-directional sun sensor **174** shown in FIG. **7**, including sensing data provided by proximity sensors **170***a*, **170***b*, **170***c*, **170***d* shown in FIG. **2** that sense no obstructions in the path of a deploying stowable solar panel assembly **2900**, the vehicles **100** controls may then manipulate the stowable solar panel assembly **2900** shown in FIG. **30** by activating the lifter assemblies **3300***a*, **3300***b*, **3300***c*, **3300***d* and tilting assemblies **3400***a*, **3400***b*, **3400***c*, **3400***d* to lift the stowable solar panel assembly **2900**, and then by activating a motor assembly **3250** to partially or fully extend the upper and lower solar panels **3010***a*, **3012***a*, **3010***b*, **3012***b*. An omni-directional sun sensor **174** may provide sun strength and/or sun tracking data to the vehicles **100** controls which may tilt the stowable solar panel assembly **2900** by manipulating the tilting assemblies **3400***a*, **3400***b*, **3400***c*, and **3400***d* to track the sun as shown in FIGS. **28**-**29**. The lifter assemblies and tilting assemblies may also allow a horizontal deployment as shown in FIG. **27**.

Solar Examples, Stowing

In a stowing phase example, when an omni-directional sun sensor **174** shown in FIG. **7** detects unfavorable sun conditions, the vehicles **100** controls may then manipulate the stowable solar panel assembly **2900** by activating the motor assembly **3250** shown in FIG. **30** to retract the upper and lower solar panels **3010***a*, **3012***a*, **3010***b*, **3012***b* and then activate the lifter assemblies **3300***a*, **3300***b*, **3300***c*, **3300***d* to lower the stowable solar panel assembly **2900** and then activate the tilting assemblies **3400***a*, **3400***b*, **3400***c*, **3400***d* to lower the stowable solar panel assembly **2900** into a rear solar panel assembly compartment **3550***a* and a front solar panel assembly compartment **3550***b* shown in FIG. **28** thereby completing the stowing phase.

Solar and Wind Examples, Combined Deployment

Referring to FIG. **31**, an example embodiment of a vehicle **100** is shown having a stowable horizontal axis wind turbine assembly **1400** and a stowable solar panel assembly **2900** deployed simultaneously, wherein each assembly may be separately manipulated by controls into various deployed positions.

Solar Examples, Overview Slide-Out (Alternative Embodiment)

Referring to FIGS. **32**-**33**, an example embodiment of a vehicle **100** is shown having wind energy and solar energy generating components. Referring to FIG. **32**, a stowable HAWT assembly **1400** is shown in a stowed position and a slidable solar panel assembly **3800** is shown in a stowed position. Referring to FIG. **33**, a slidable solar panel assembly **3800** is shown in a deployed position.

Referring to FIG. **33**, an example embodiment of a slidable solar panel assembly **3800** and a bottom solar panel **3830** is shown which may be comprised of one or more solar panels, and a topside inner solar panel strip **3840** is shown which may be comprised of one or more solar panel strips. Extending the top slidable solar panel **3810** allows the bottom solar panel **3830** to be exposed to the sun, thereby providing additional solar generating capacity.

Solar Examples, Slide-Out Deployment

In a deployment phase example, when favorable sun conditions are detected by an omni-directional sun sensor **174** shown in FIG. **7**, including sensing data provided by proximity sensors **170***a*, **170***b*, **170***c*, **170***d* shown in FIG. **2** that sense no obstructions in the path of a deploying slidable solar panel assembly **3800**, the vehicles **100** controls may then manipulate a pair of actuator assemblies **3820** shown in one example in FIG. **33** to extend the slidable solar panel assembly **3800** into a deployed position.

The actuator assemblies **3820** may be located at opposite ends and may each include a motor attached to a threaded rod having a traveling nut housed in a barrel. The top slidable solar panel **3810** may be attached to at least one traveling nut of each actuator assembly **3820** thereby allowing the actuator assemblies **3820** to extend or retract the top slidable solar panel **3810**.

Solar Examples, Slide-Out Stowing

In a stowing phase example, when an omni-directional sun sensor **174** shown in FIG. **7** detects unfavorable sun conditions, the vehicles **100** controls may then manipulate the slidable solar panel assembly **3800** shown in FIG. **33** into a stowed position by manipulating the actuator assemblies **3820** to retract the top slidable solar panel **3810** thereby completing the stowing phase.

Solar Examples, Slide-Out Other Examples

In other examples the slidable solar panel assembly **3800** may be configured with two or more solar panels that may be slidably arranged.

CONCLUSION

As disclosed herein, features consistent with the present inventions may be implemented by computer-hardware, software and/or firmware. For example, the systems and methods disclosed herein may be embodied in various forms including, for example, a data processor, such as a computer that also includes a database, digital electronic circuitry, firmware, software, computer networks, servers, or in combinations of them. Further, while some of the disclosed implementations describe specific hardware components, systems and methods consistent with the innovations herein may be implemented with any combination of hardware, software and/or firmware. Moreover, the above-noted features and other aspects and principles of the innovations herein may be implemented in various environments. Such environments and related applications may be specially constructed for performing the various routines, processes and/or operations according to the invention or they may include a general-purpose computer or computing platform selectively activated or reconfigured by code to provide the necessary functionality. The processes disclosed herein are not inherently related to any particular computer, network, architecture, environment, or other apparatus, and may be implemented by a suitable combination of hardware, software, and/or firmware. For example, various general-purpose machines may be used with programs written in accordance with teachings of the invention, or it may be more convenient to construct a specialized apparatus or system to perform the required methods and techniques.

Aspects of the method and system described herein, such as the logic, may be implemented as functionality programmed into any of a variety of circuitry, including programmable logic devices ("PLDs"), such as field programmable gate arrays ("FPGAs"), programmable array logic ("PAL") devices, electrically programmable logic and memory devices and standard cell-based devices, as well as application specific integrated circuits. Some other possibilities for implementing aspects include: memory devices, microcontrollers with memory (such as 1PROM), embedded microprocessors, firmware, software, etc. Furthermore, aspects may be embodied in microprocessors having software-based circuit emulation, discrete logic (sequential and combinatorial), custom devices, fuzzy (neural) logic, quantum devices, and hybrids of any of the above device types. The underlying device technologies may be provided in a variety of component types, e.g., metal-oxide semiconductor field-effect transistor ("MOSFET") technologies like complementary metal-oxide semiconductor ("CMOS"), bipolar technologies like emitter-coupled logic ("ECL"), polymer technologies (e.g., silicon-conjugated polymer and metal-conjugated polymer-metal structures), mixed analog and digital, and so on.

It should also be noted that the various logic and/or functions disclosed herein may be enabled and/or monitored using any number of combinations of hardware, firmware, and/or as data and/or instructions embodied in various machine-readable or computer-readable media, in terms of their behavioral, register transfer, logic component, and/or other characteristics including but not limited to a cell phone or network card or any type of wireless device. Computer-readable media in which such formatted data and/or instructions may be embodied include, but are not limited to, non-volatile storage media in various forms (e.g., optical, magnetic or semiconductor storage media) and carrier waves that may be used to transfer such formatted data and/or instructions through wireless, optical, or wired signaling media or any combination thereof. Examples of transfers of such formatted data and/or instructions by carrier waves include, but are not limited to, transfers (uploads, downloads, e-mail, etc.) over the Internet and/or other computer networks by one or more data transfer protocols (e.g., HTTP, FTP, SMTP, and so on).

Unless the context clearly requires otherwise, throughout the description and the claims, the words "comprise," "comprising," and the like are to be construed in an inclusive sense as opposed to an exclusive or exhaustive sense; that is to say, in a sense of "including, but not limited to." Words using the singular or plural number also include the plural or singular number respectively. Additionally, the words "herein," "hereunder," "above," "below," and words of similar import refer to this application as a whole and not to any particular portions of this application. When the word "or" is used in reference to a list of two or more items, that word covers all of the following interpretations of the word: any of the items in the list, all of the items in the list and any combination of the items in the list.

Although certain presently preferred implementations of the invention have been specifically described herein, it will be apparent to those skilled in the art to which the invention pertains that variations and modifications of the various implementations shown and described herein may be made without departing from the spirit and scope of the invention. Accordingly, it is intended that the invention be limited only to the extent required by the applicable rules of law.

The foregoing description, for purpose of explanation, has been described with reference to specific embodiments. However, the illustrative discussions above are not intended to be exhaustive or to limit the invention to the precise forms disclosed. Many modifications and variations are possible in view of the above teachings. The embodiments were chosen and described in order to best explain the principles of the invention and its practical applications, to thereby enable others skilled in the art to best utilize the invention and various embodiments with various modifications as are suited to the particular use contemplated.

The foregoing description, for purpose of explanation, has been described with reference to specific embodiments. However, the illustrative discussions above are not intended to be exhaustive or to limit the invention to the precise forms disclosed. Many modifications and variations are possible in view of the above teachings. The embodiments were chosen and described in order to best explain the principles of the invention and its practical applications, to thereby enable others skilled in the art to best utilize the invention and various embodiments with various modifications as are suited to the particular use contemplated, etc.

The invention claimed is:

1. A vehicle, comprising,

a main body chassis with a cabin, a rear portion, at least one electric motor, and four wheels;

a solar subsystem, attached to the main body chassis,

wherein the solar subsystem includes a plurality of solar panels disposed on a top side of the main body chassis and disposed adjacent to the cabin,

wherein the plurality of solar panels are configured to extend and retract, relative to the main body chassis; and

a wind generation subsystem, attached to the main body chassis,

wherein the wind generation subsystem includes a telescoping mast and a horizontal-axis wind turbine assembly disposed at the rear portion of the main body chassis, the horizontal-axis wind turbine assembly including at least one rotor hub configured with at least two turbine blades attached to the rotor hub, wherein the telescoping mast is configured to extend vertically from the rear portion to deploy the at least two turbine blades attached to the rotor hub of the horizontal-axis wind turbine assembly.

2. The vehicle of claim **1** further comprising controls in the main body chassis.

3. The vehicle of claim **2** wherein the controls are configured to manipulate the extension or retraction of the plurality of solar panels from the solar subsystem.

4. The vehicle of claim **2** wherein the controls are configured to control the tilt of the plurality of solar panels.

5. The vehicle of claim **2** wherein the controls are configured to control the extension or retraction of the extendable mast using wires housed in a retractable coil cord coiled around an inner mast.

6. The vehicle of claim **1** wherein the horizontal-axis wind turbine assembly includes the two turbine blades that are positioned opposite one another with its blades spaced equally apart at 180 degrees from each other.

7. The vehicle of claim **1** wherein the at least two blades are configured to extend or retract from the rotor hub to increase or decrease a rotor diameter of the horizontal-axis wind turbine.

8. The vehicle of claim **1** further comprising a battery pack including a plurality of battery modules arranged in a tandem configuration and housed in the cabin.

9. The vehicle of claim **8** wherein the main body chassis includes at least two seats in tandem mounted on an upper surface of the battery pack disposed in the main body chassis.

10. The vehicle of claim **1** wherein the main body chassis has an air tunnel on each side of the main body chassis.

11. The vehicle of claim **10** wherein the vehicle includes an upper control arm and a lower control arm attached to each wheel.

12. The vehicle of claim **1** wherein the telescoping mast is configured to be raised or lowered vertically on a rear section of the main body chassis using an inner mast lifter belt.

13. The vehicle of claim 12 wherein the telescoping mast is stowable vertically inside the main body chassis.

14. The vehicle of claim 1 wherein the main body chassis includes a stowable ultrasonic anemometer to measure wind direction and speed and configured to be manually or automatically raised or lowered vertically on the rear section of the main body chassis.

15. A system comprising:

a main body chassis with a cabin, a rear portion, at least one electric motor, and four wheels;

a plurality of solar panels on a top side of the main body chassis and disposed adjacent to the cabin,

wherein of the plurality of solar panels are configured to extend and/or tilt, relative to the main body chassis; and

a stowable horizontal-axis wind turbine assembly disposed within the rear portion of the main body chassis, the stowable horizontal-axis wind turbine assembly including a telescoping mast and the horizontal-axis wind turbine assembly, the horizontal-axis wind turbine assembly including a rotor hub and at least two turbine blades attached to the rotor hub,

wherein the telescoping mast is configured to extend vertically from the rear portion to deploy the at least two turbine blades attached to the rotor hub of the horizontal-axis wind turbine assembly.

16. The system of claim 15 including an ultrasonic anemometer in communication with a computing system for controlling the stowable horizontal-axis wind turbine assembly and the plurality of solar panels, and configured to send and receive data regarding sensed wind direction and speed;

wherein the telescoping mast is attached to the horizontal-axis wind turbine assembly yaw drive configured to twist;

wherein the computing system is in communication with at least one motor having a worm gear disposed adjacent to the telescoping mast, and the computing system is configured to control twisting of the horizontal-axis wind turbine assembly through a yaw drive, based on data received from the ultrasonic anemometer.

17. The system of claim 16 wherein the computing system is further configured to control an angle of attack of the at least two turbine blades attached to the rotor hub, based on the data received from the ultrasonic anemometer, wherein each of the at least two turbine blades are attached to a pitch assembly motor disposed within the rotor hub.

18. The system of claim 16 including an omnidirectional sun sensor in communication with the computing system, configured to send and receive data regarding sensed sun position and sun strength relative to the main body chassis.

19. The system of claim 18 wherein the computing system is further configured to control an angle of tilt and amount of extension of the solar panels, based on the data received from the omnidirectional sun sensor.

20. The system of claim 15 wherein the main body chassis includes a central body structure with an air tunnel on each side of the central body structure, wherein the air tunnel on each side of the central body structure includes a generally horizontal top portion and side portions, the generally horizontal top portion including the plurality of the solar panels.

21. The system of claim 20 wherein the main body chassis includes a horizontally arranged and pivotally attached cabin door, the cabin door including a canopy structure and an upper deck, the upper deck including a portion of one of the air tunnels generally horizontal top portions and side portions,

wherein the cabin door includes a pair of canopies that are each attached by a pair of pin hinge assemblies configured to allow each canopy to swing up and away from the door or allow to be detached from the door.

22. The system of claim 15 further comprising dampers for cooling the plurality of solar panels, wherein the dampers are attached to the main body chassis by at least one hinge, wherein each damper has an attached motor that in communication with a set of controls to control a flap position of each damper.

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