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(54) **PORTABLE FOLDING ELECTRIC
SKATEBOARD**

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

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(51) **Int. Cl.**

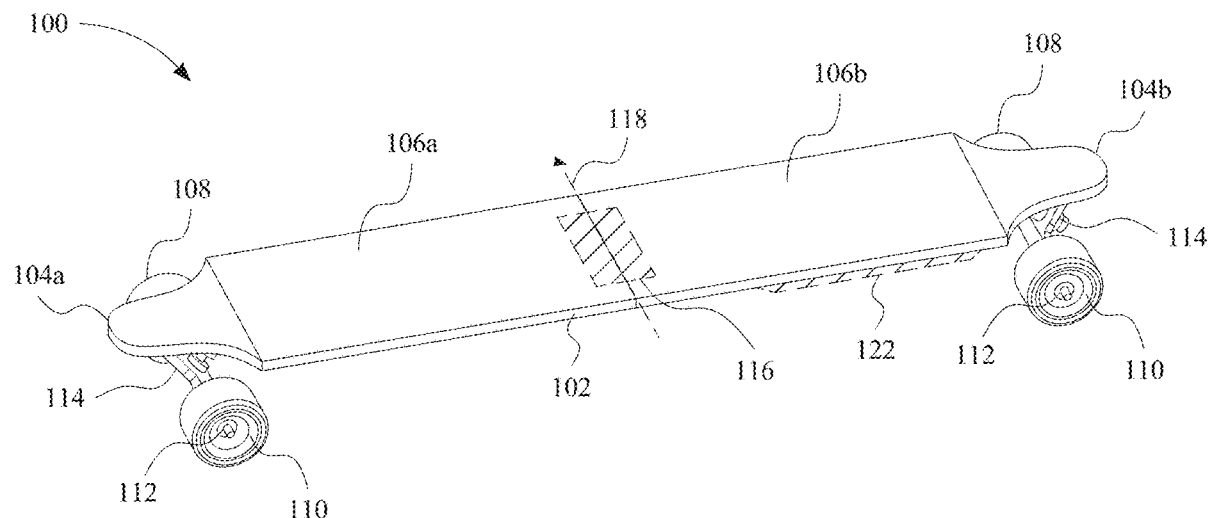
A63C 17/01 (2006.01)

A63C 17/12 (2006.01)

(57)

ABSTRACT

A portable skateboard, comprising a deck defined by a first board segment and a second board segment, each at least one wheel assembly attached to a bottom surface, a hinge mechanism disposed on the bottom surfaces of the board segments, configured to rotate the board segments along a lateral axis, and a locking mechanism having a latch configured to interfere with the rotation of the hinge mechanism, selectively securing the first board segment and the second board segment in an unfolded configuration, wherein top surfaces of the board segments form a continuous planar surface for standing thereon, and in a folded configuration, wherein the bottom surfaces of the first board segment and the second board segment are aligned, with the respective wheel assemblies adjacent to one another along a vertical axis.



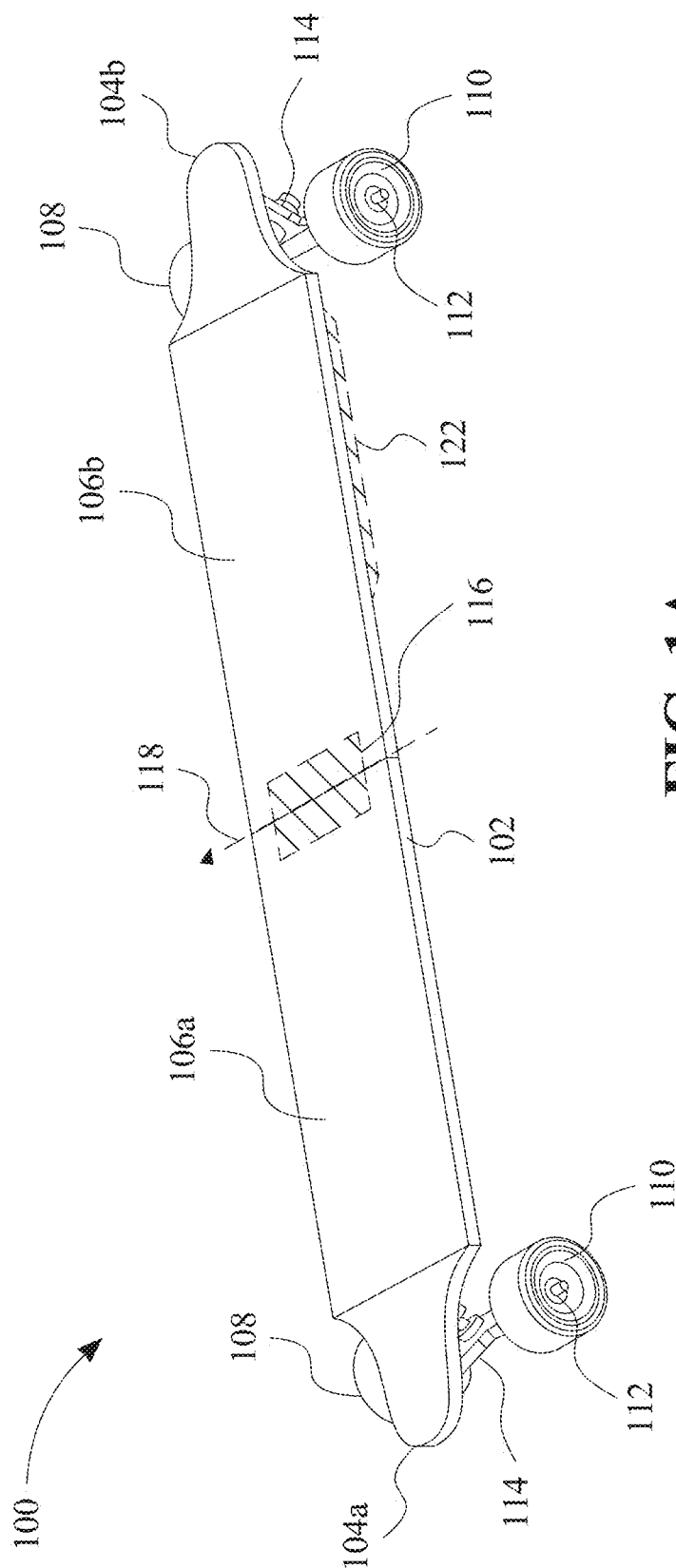


FIG. 1A

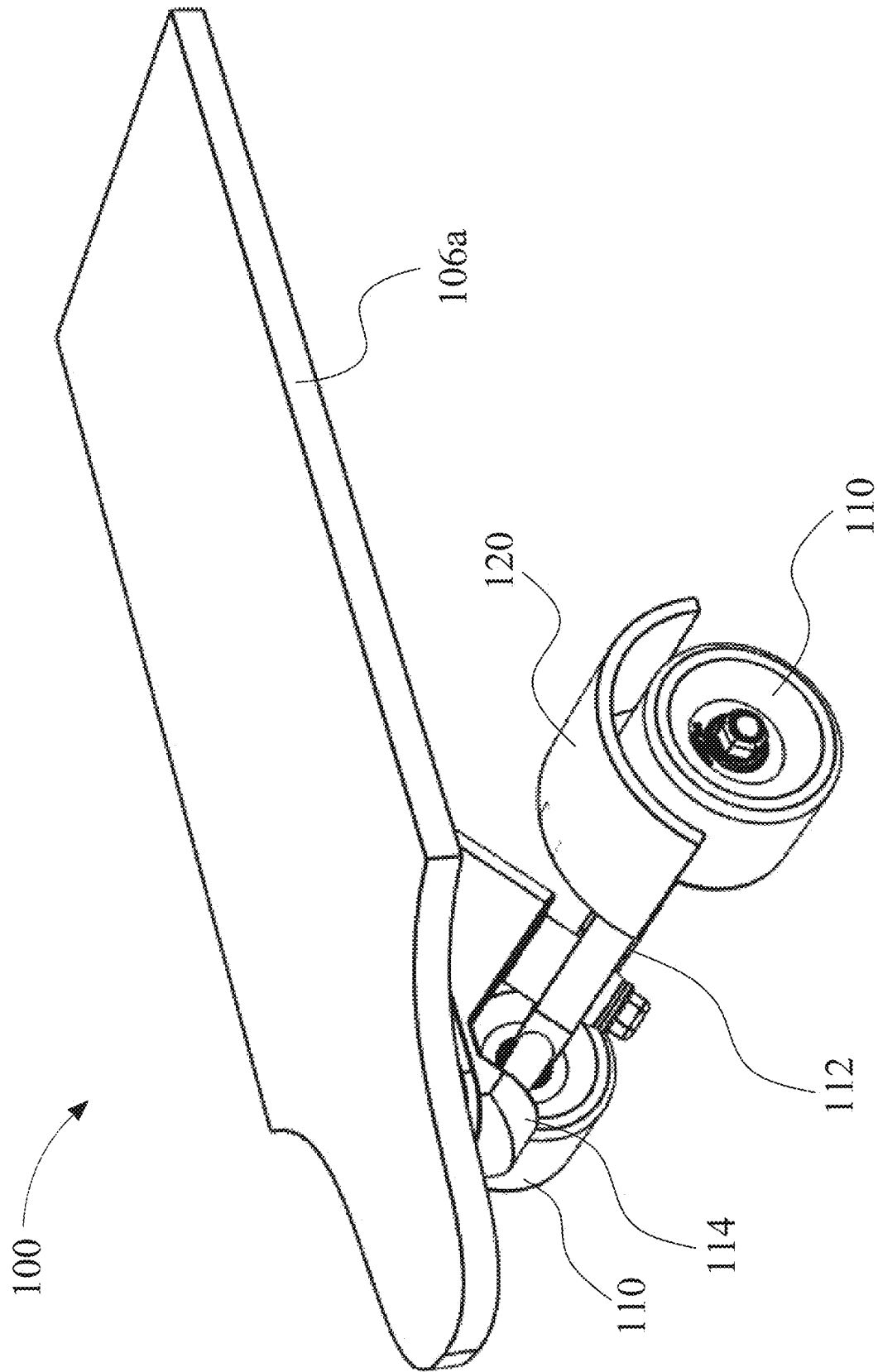


FIG. 1B

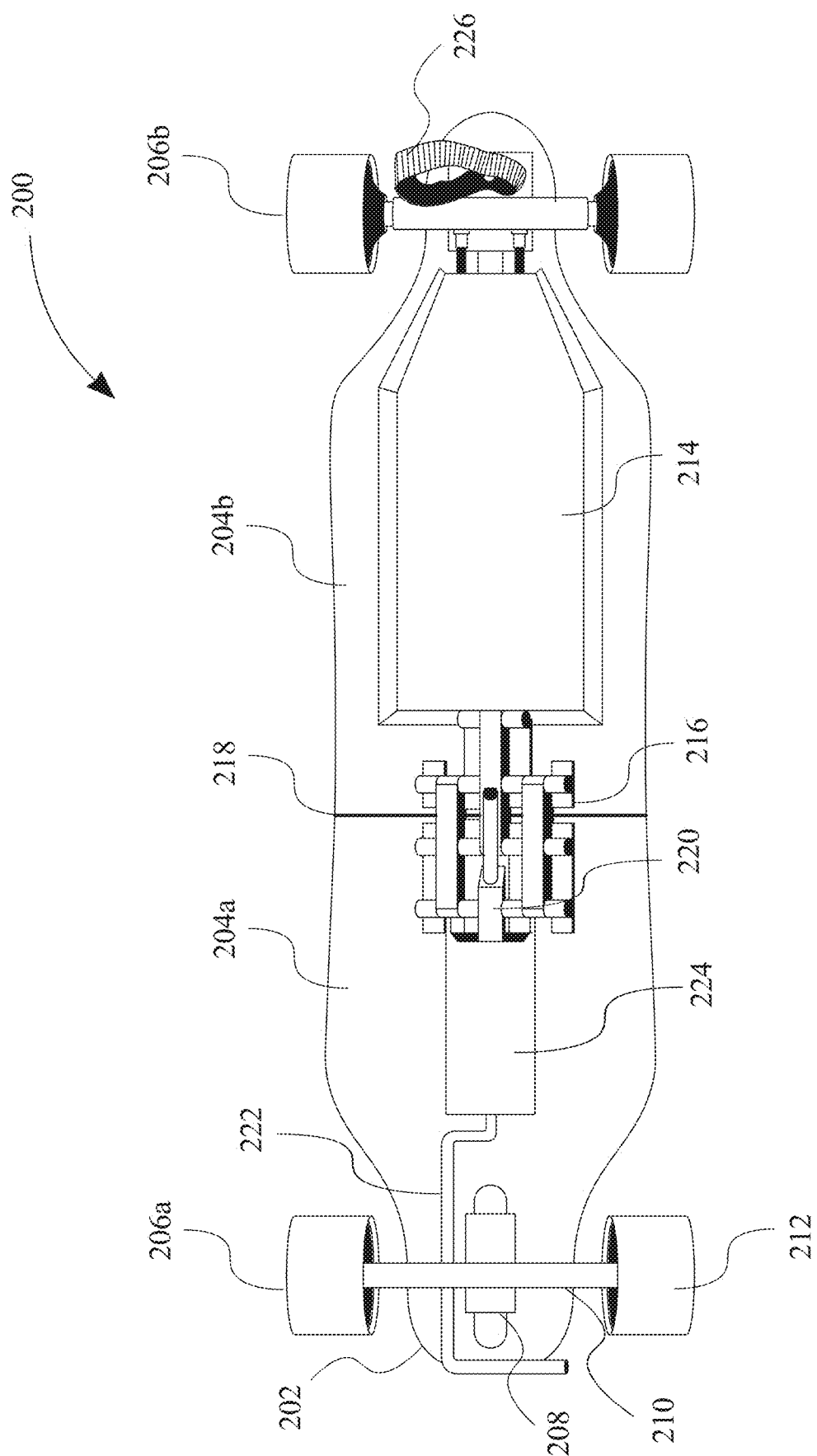
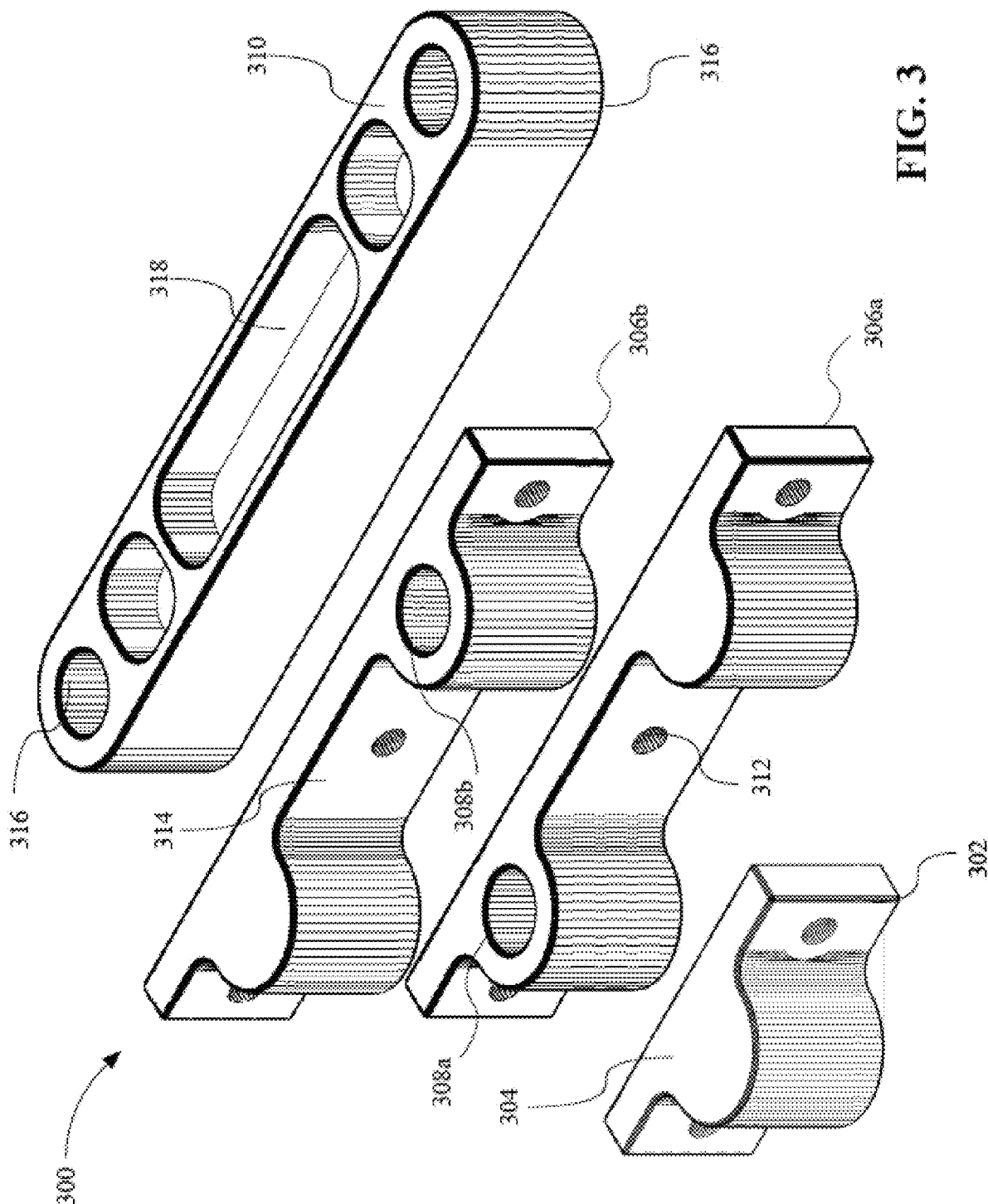


FIG. 2



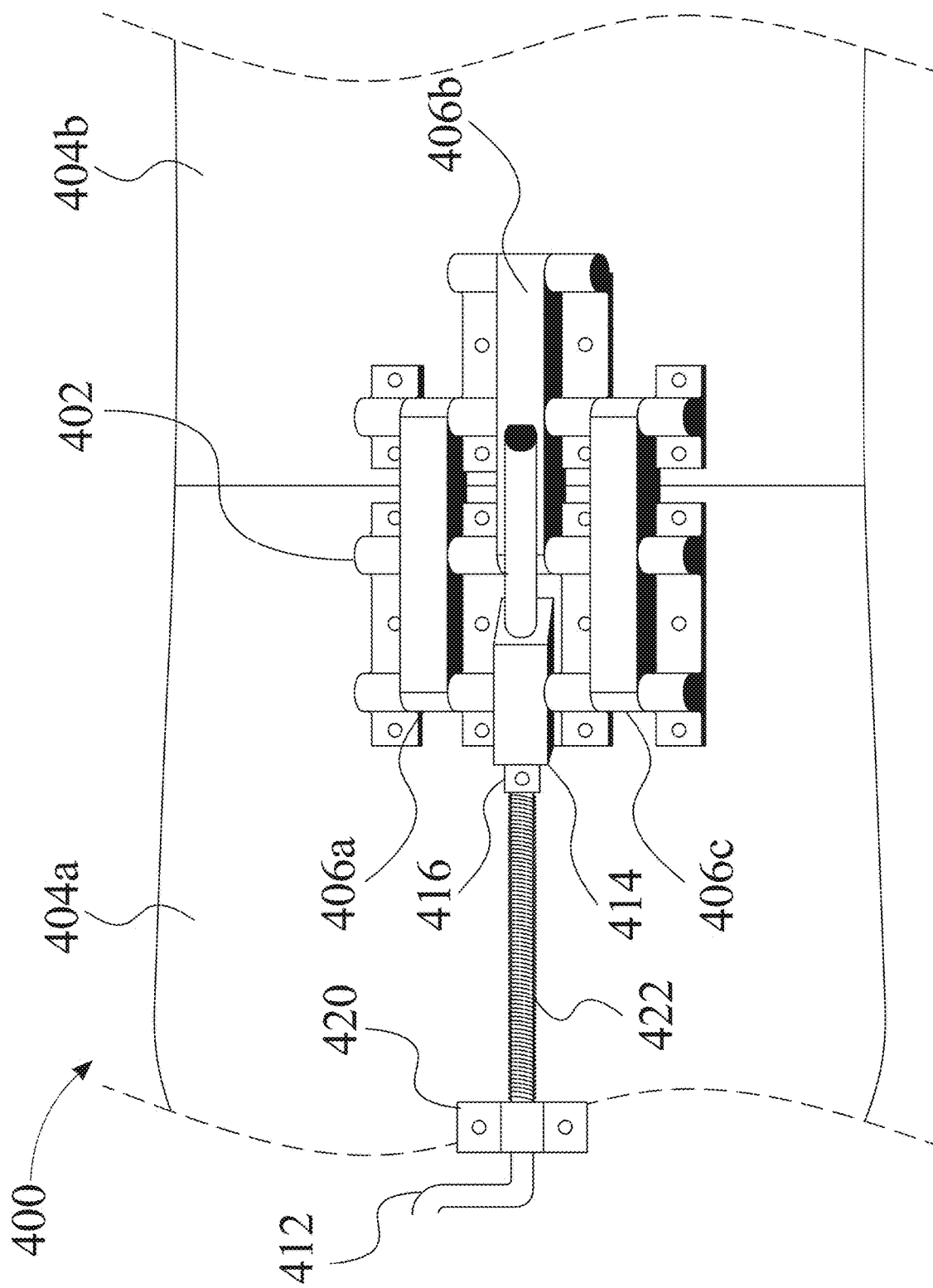
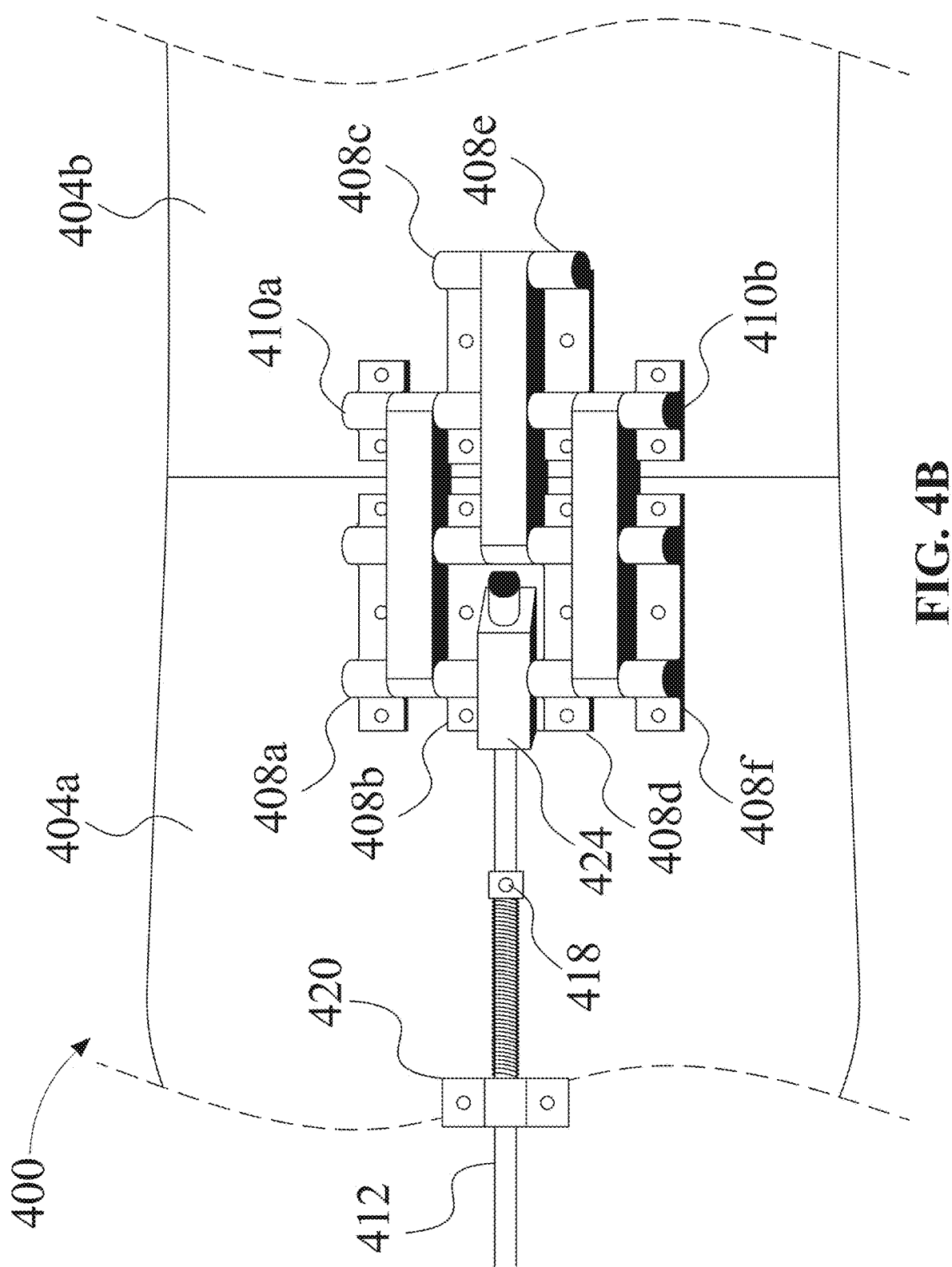
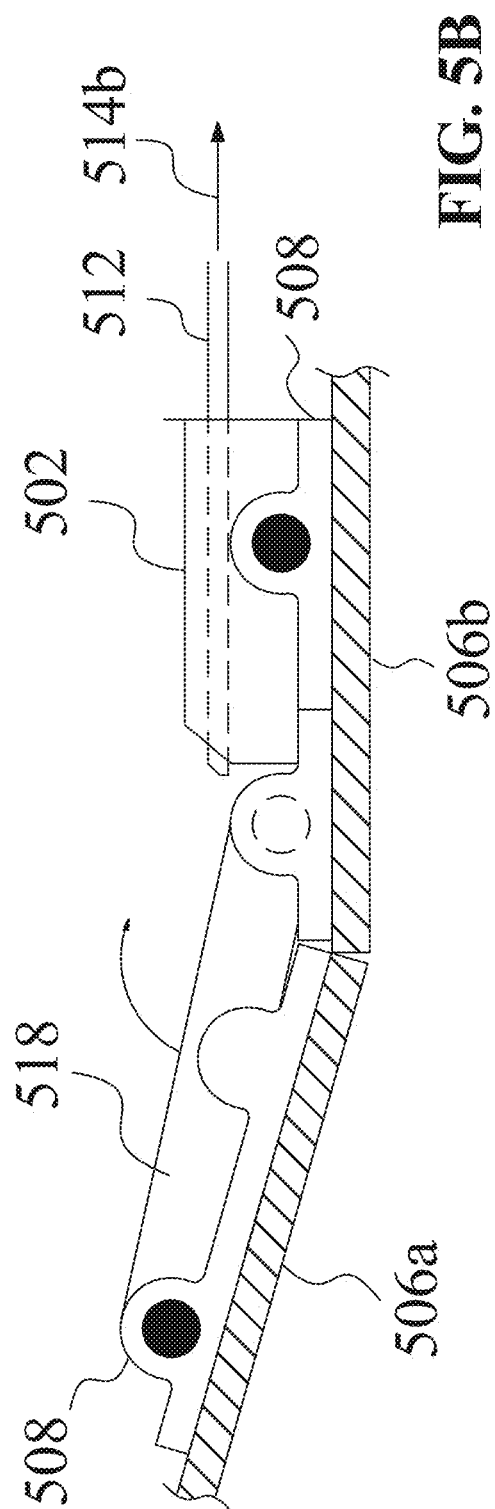
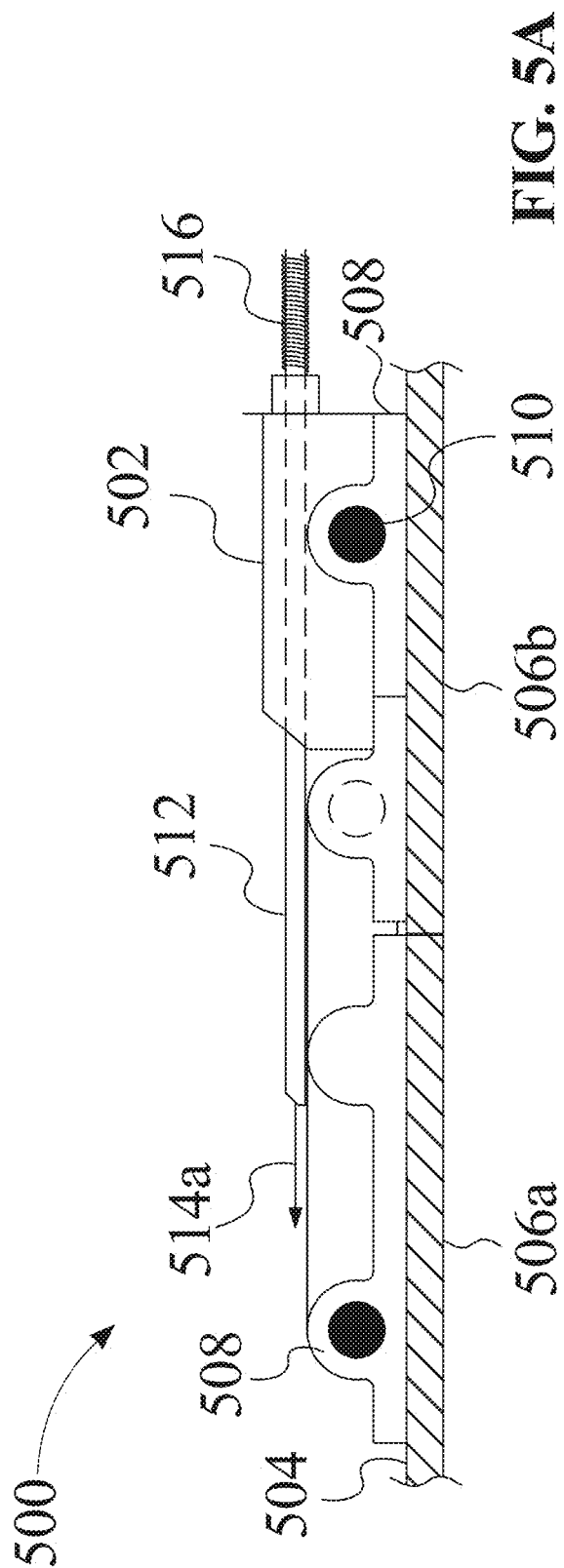


FIG. 4A





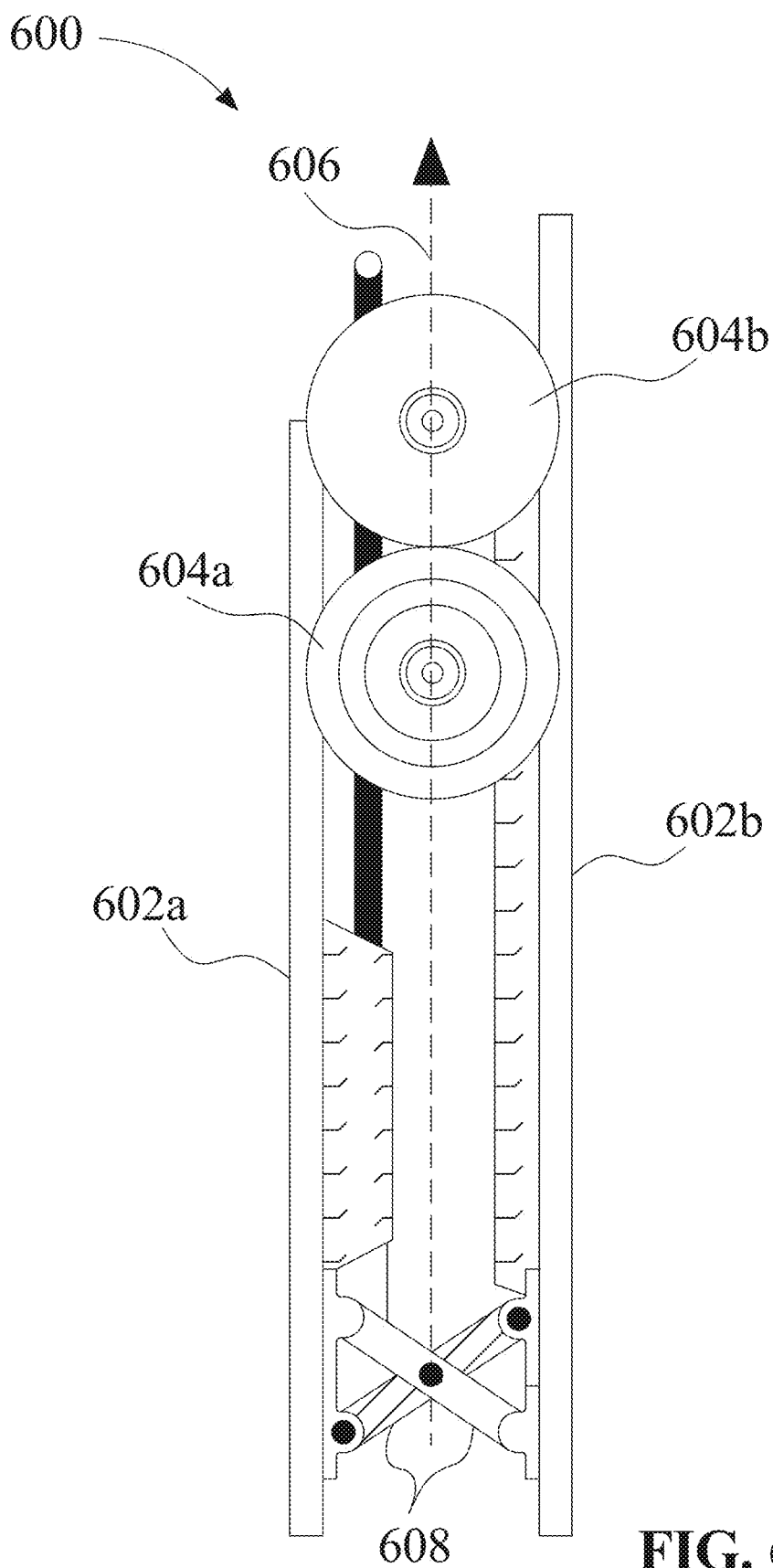


FIG. 6A

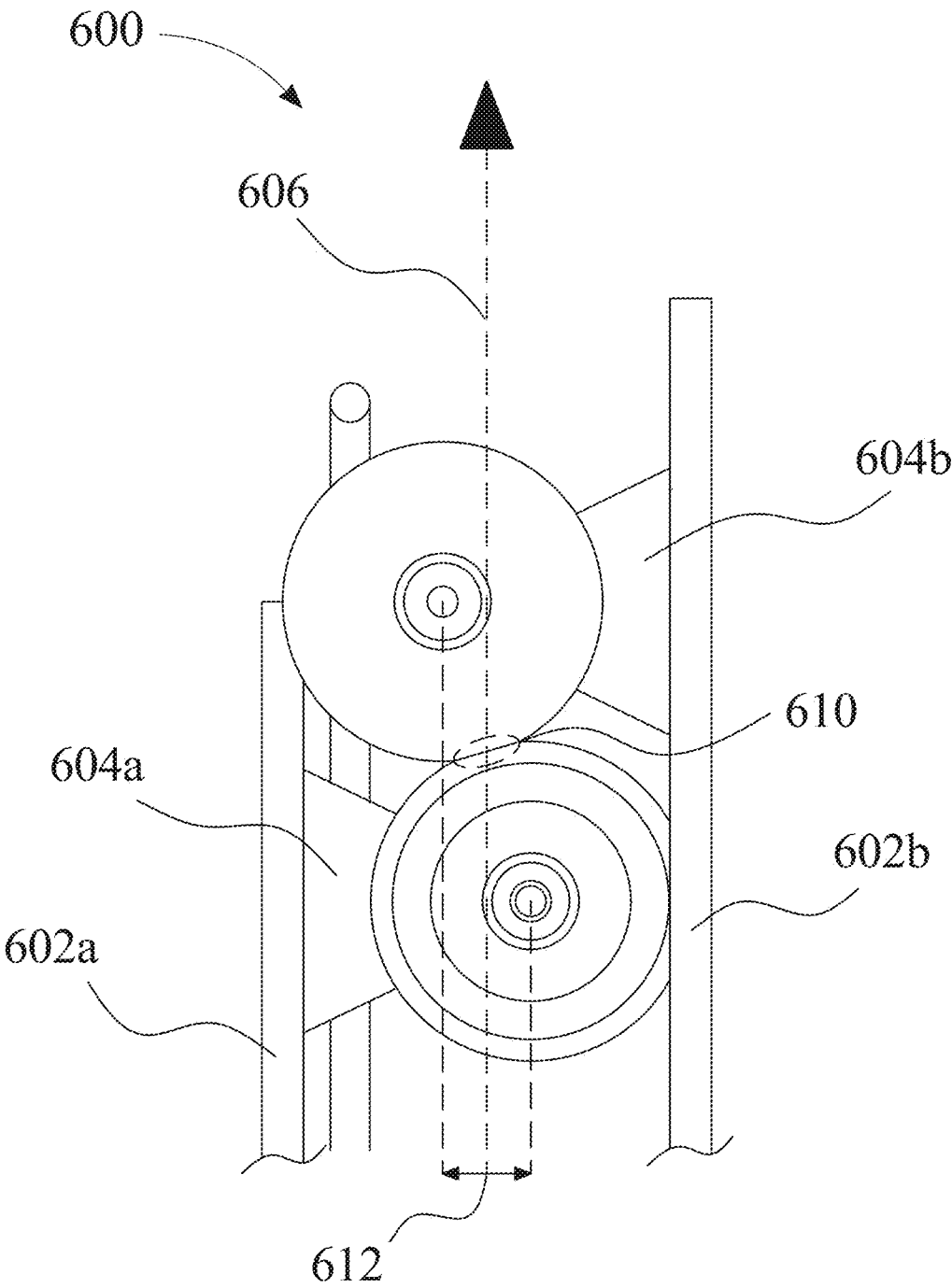


FIG. 6B

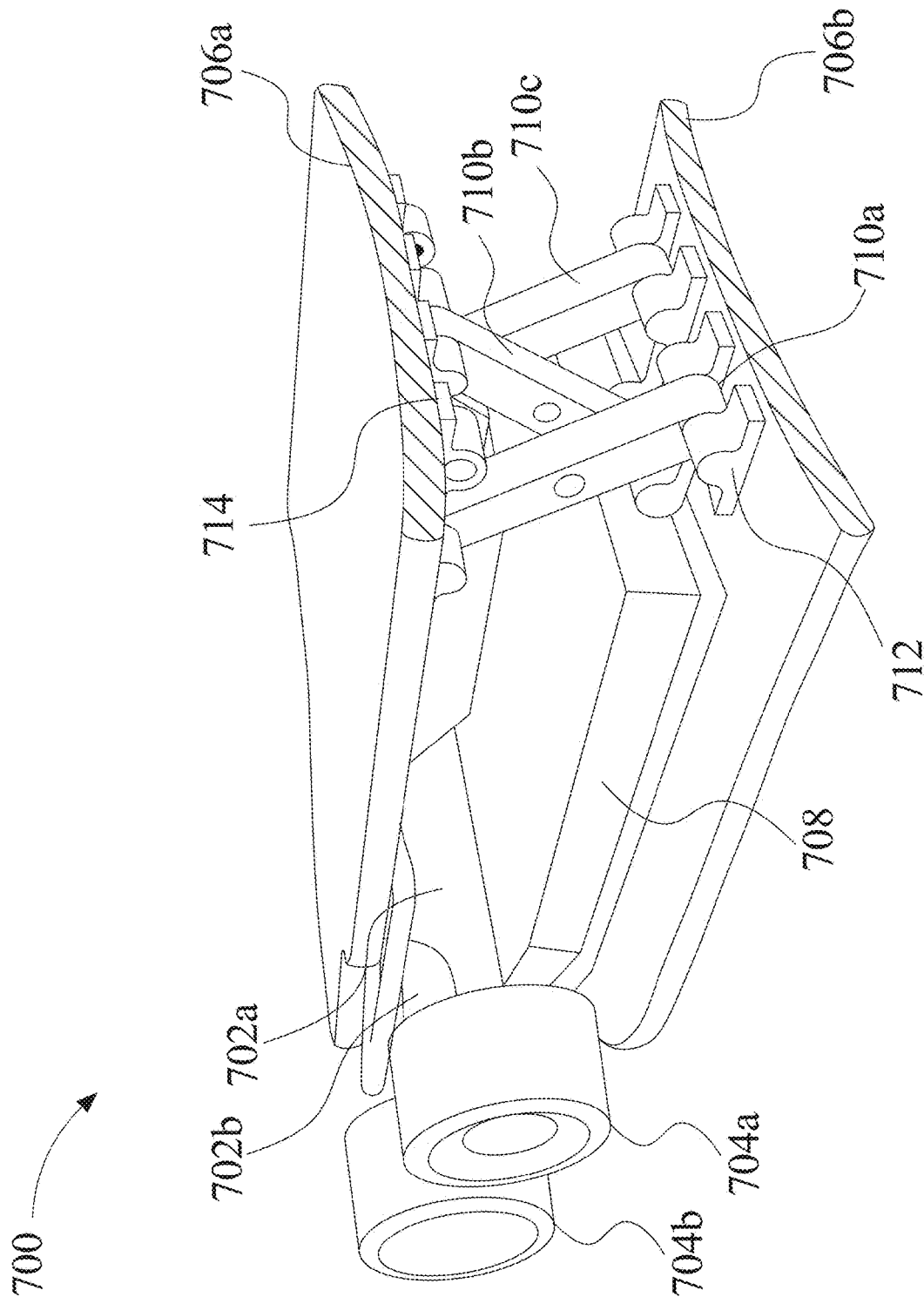


FIG. 7

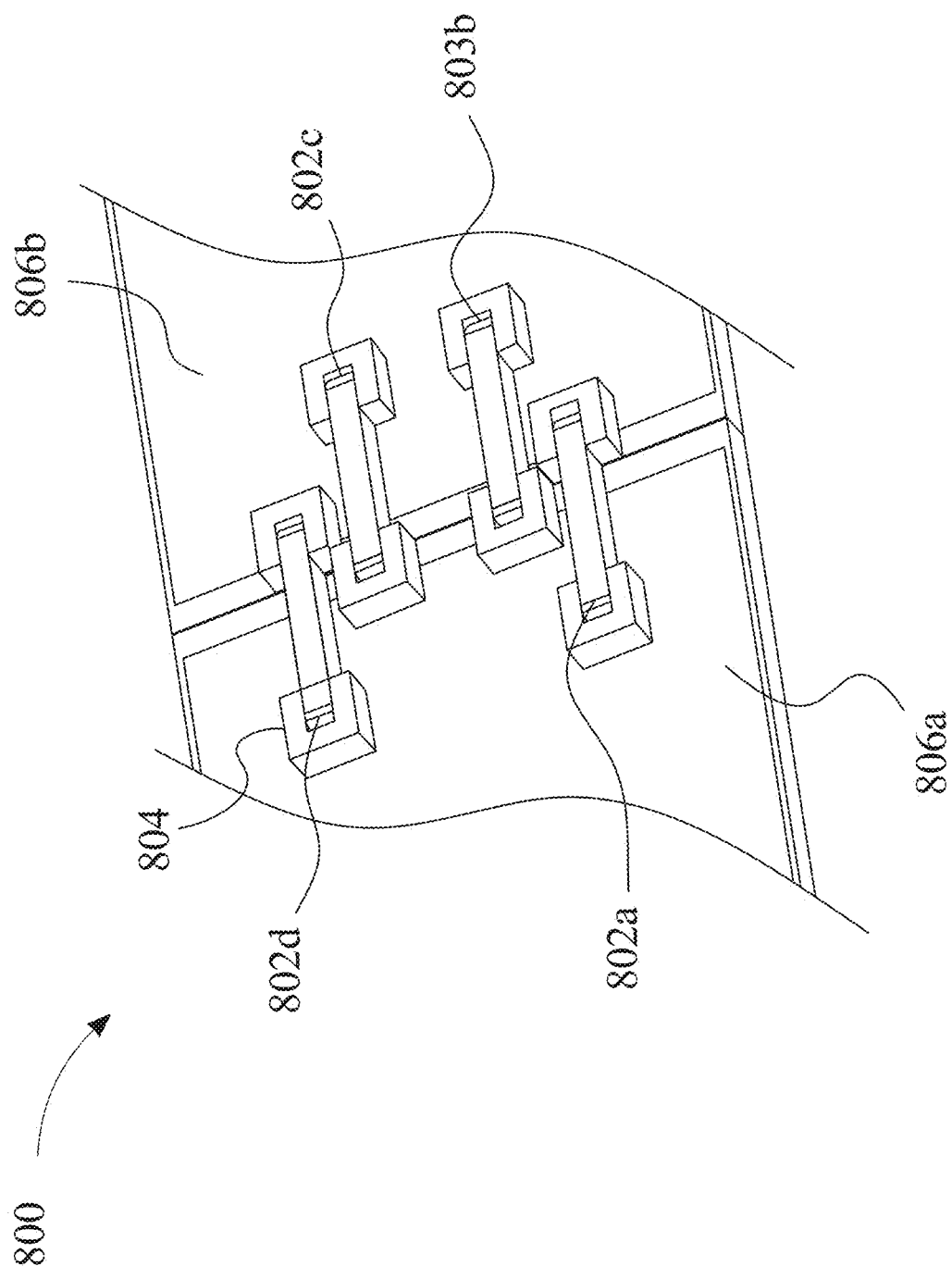


FIG. 8

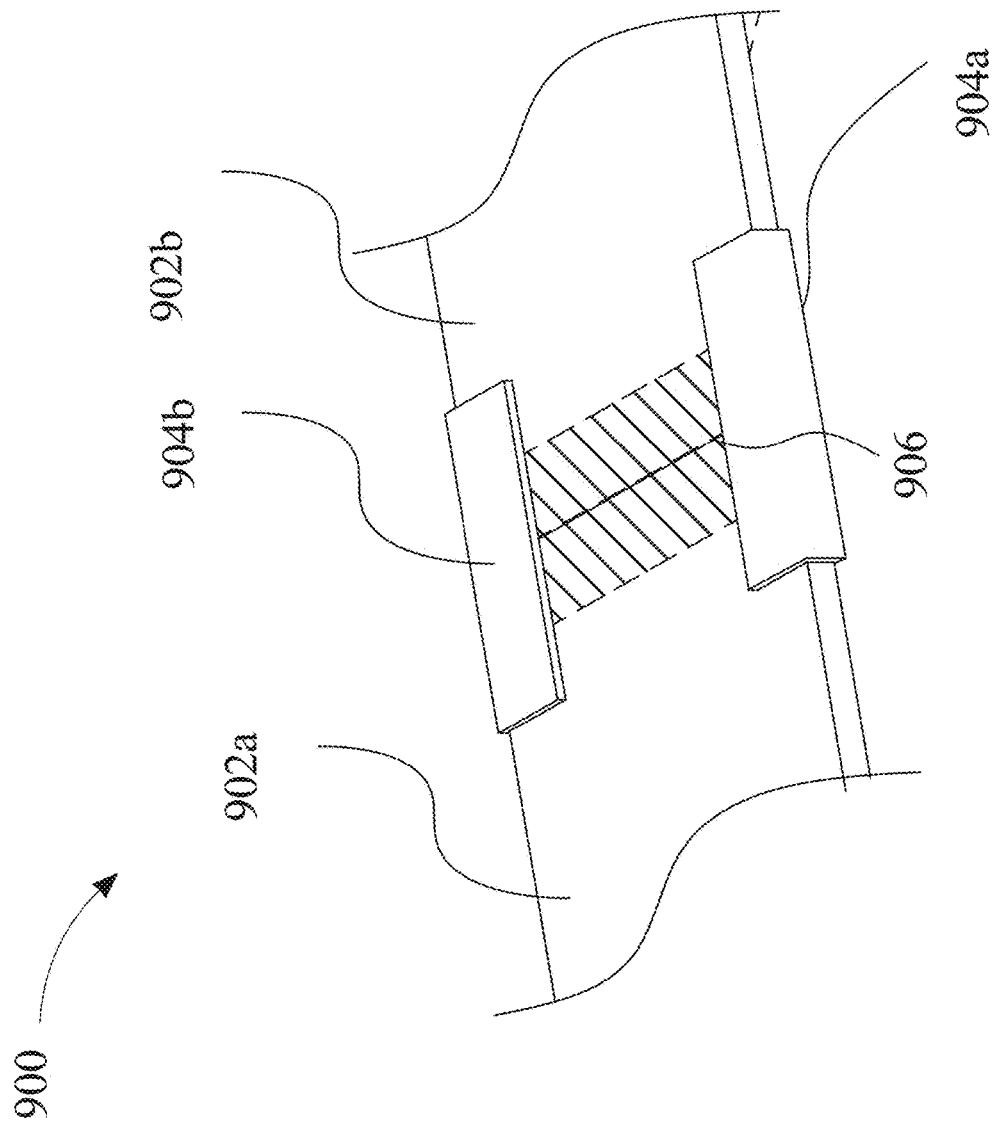


FIG. 9

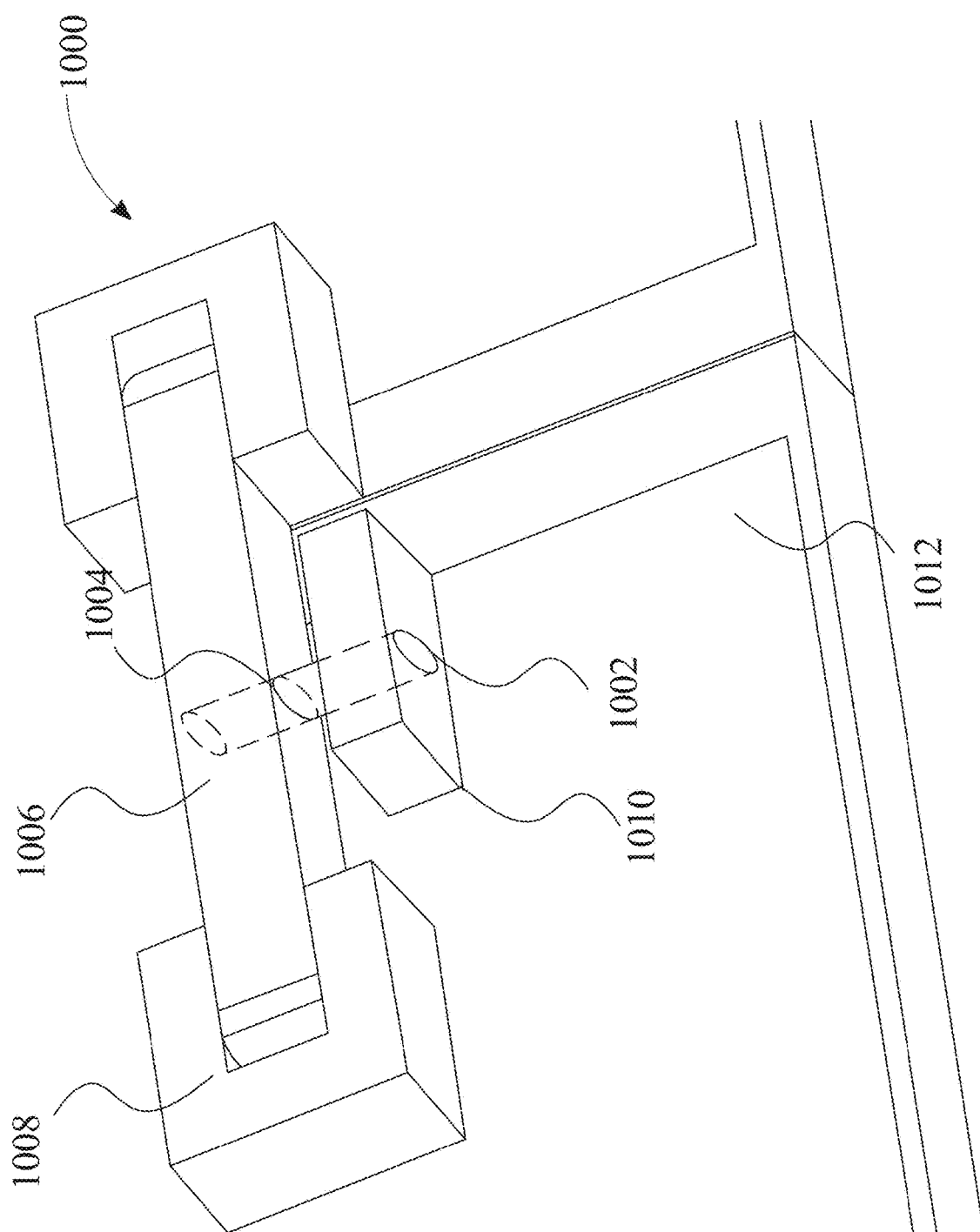


FIG. 10

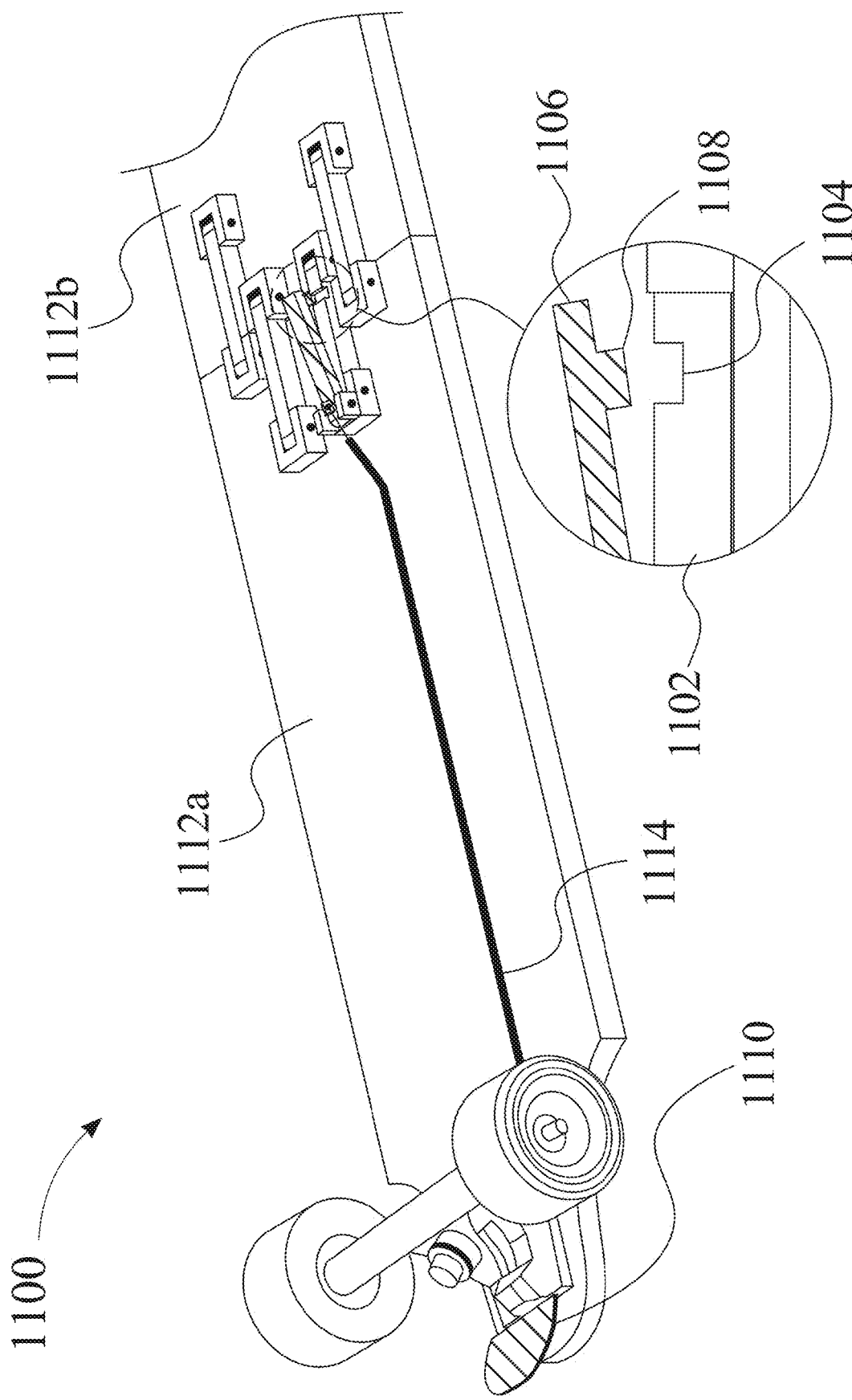


FIG. 11A

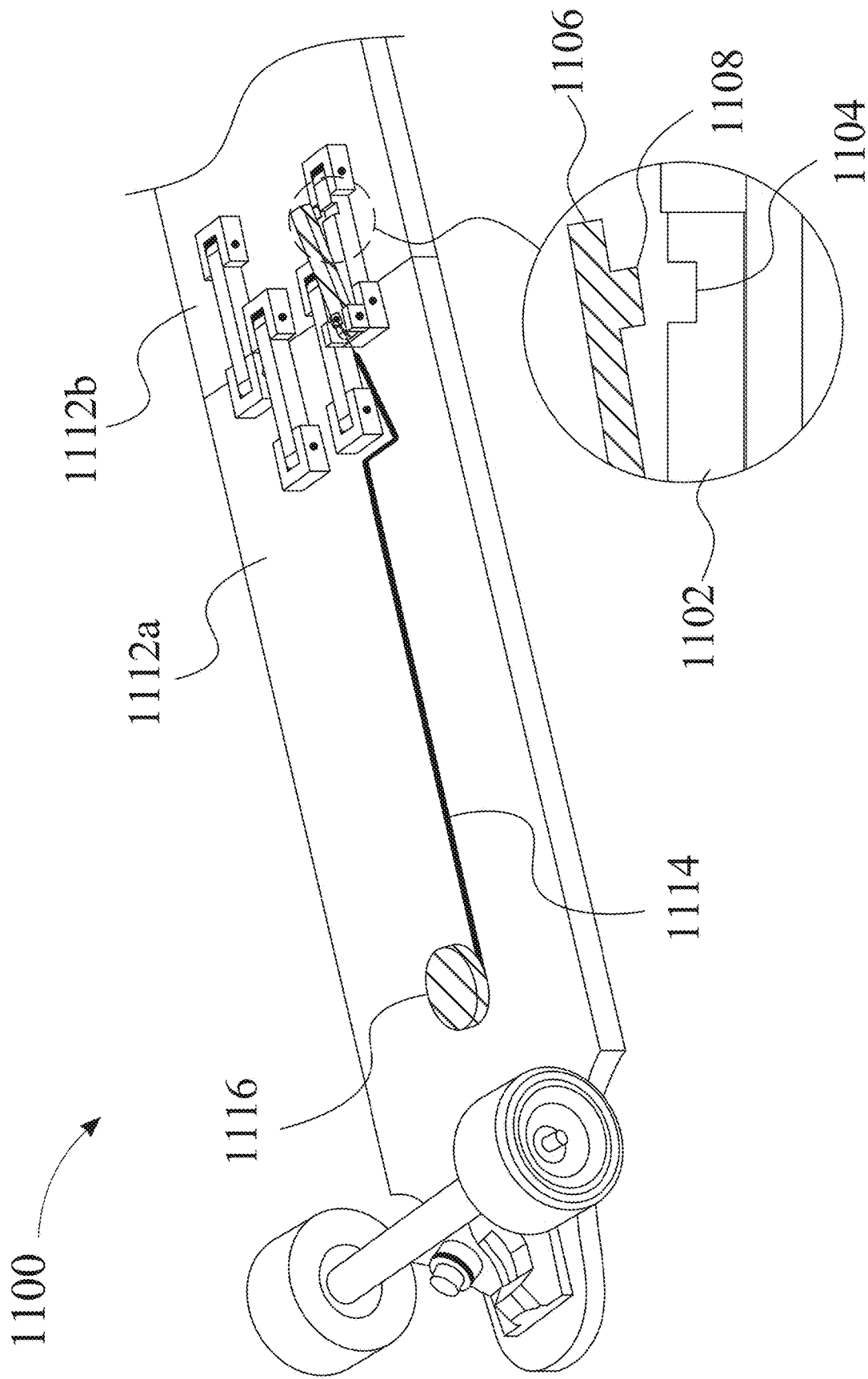


FIG. 11B

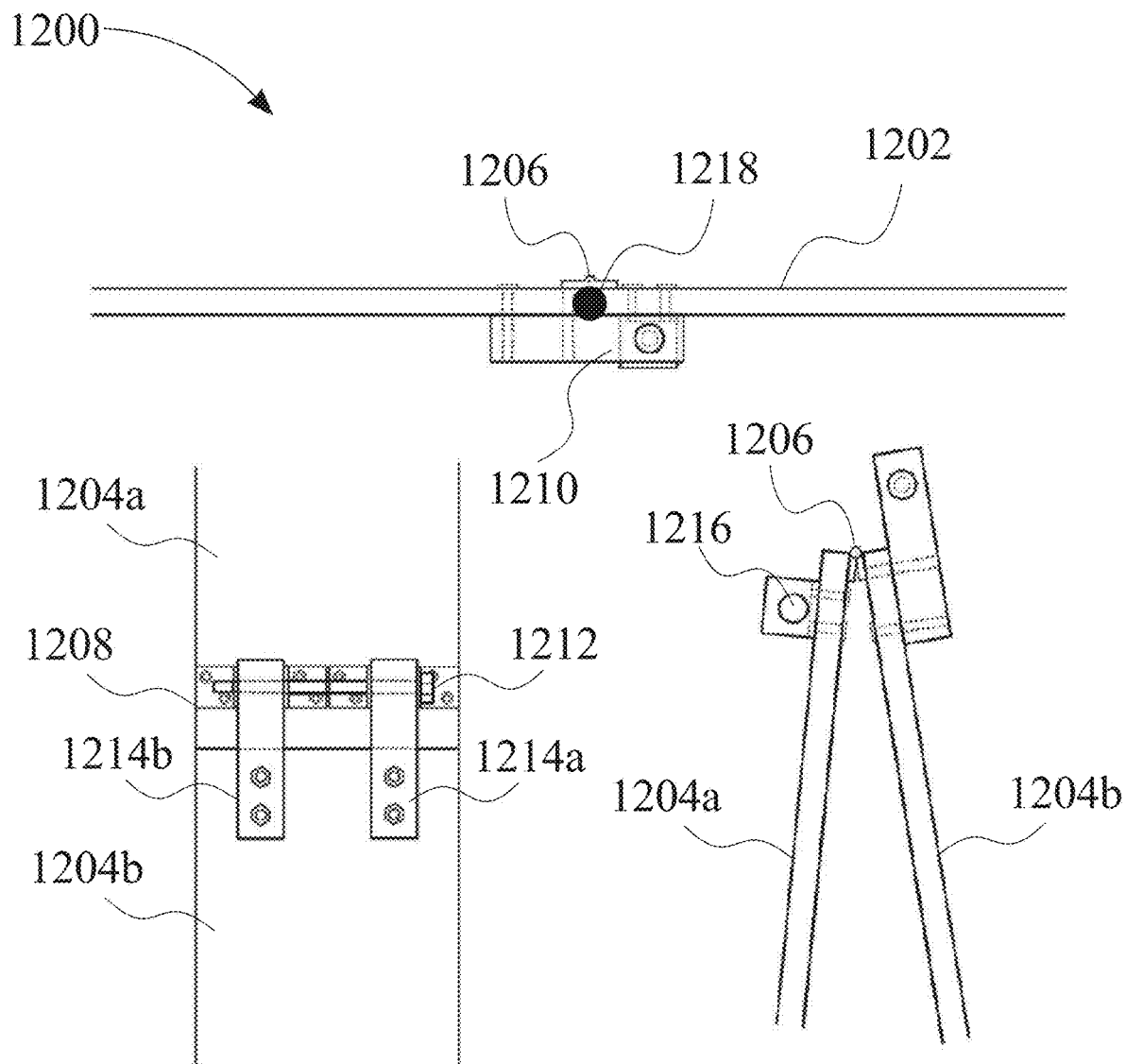


FIG. 12

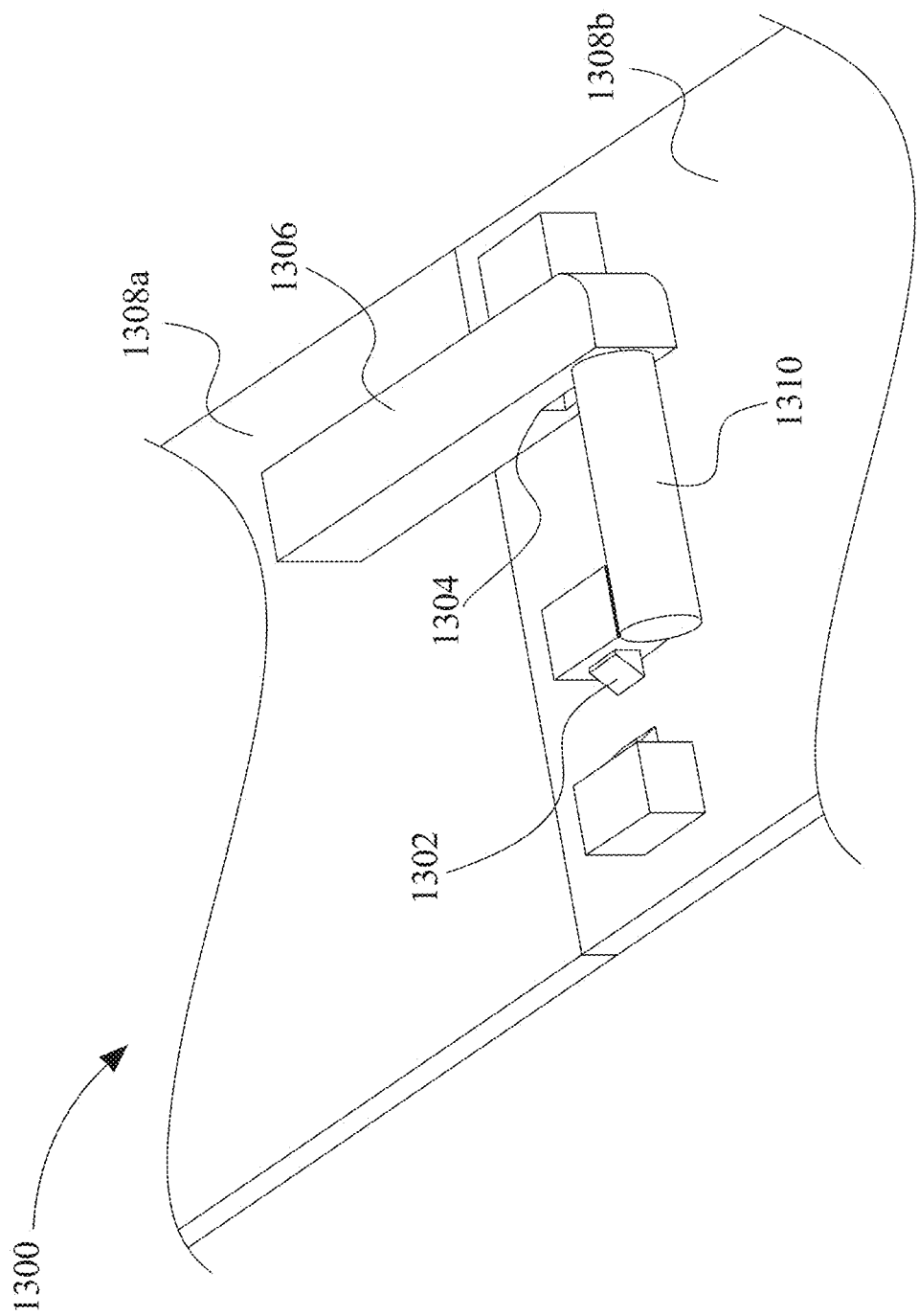


FIG. 13A

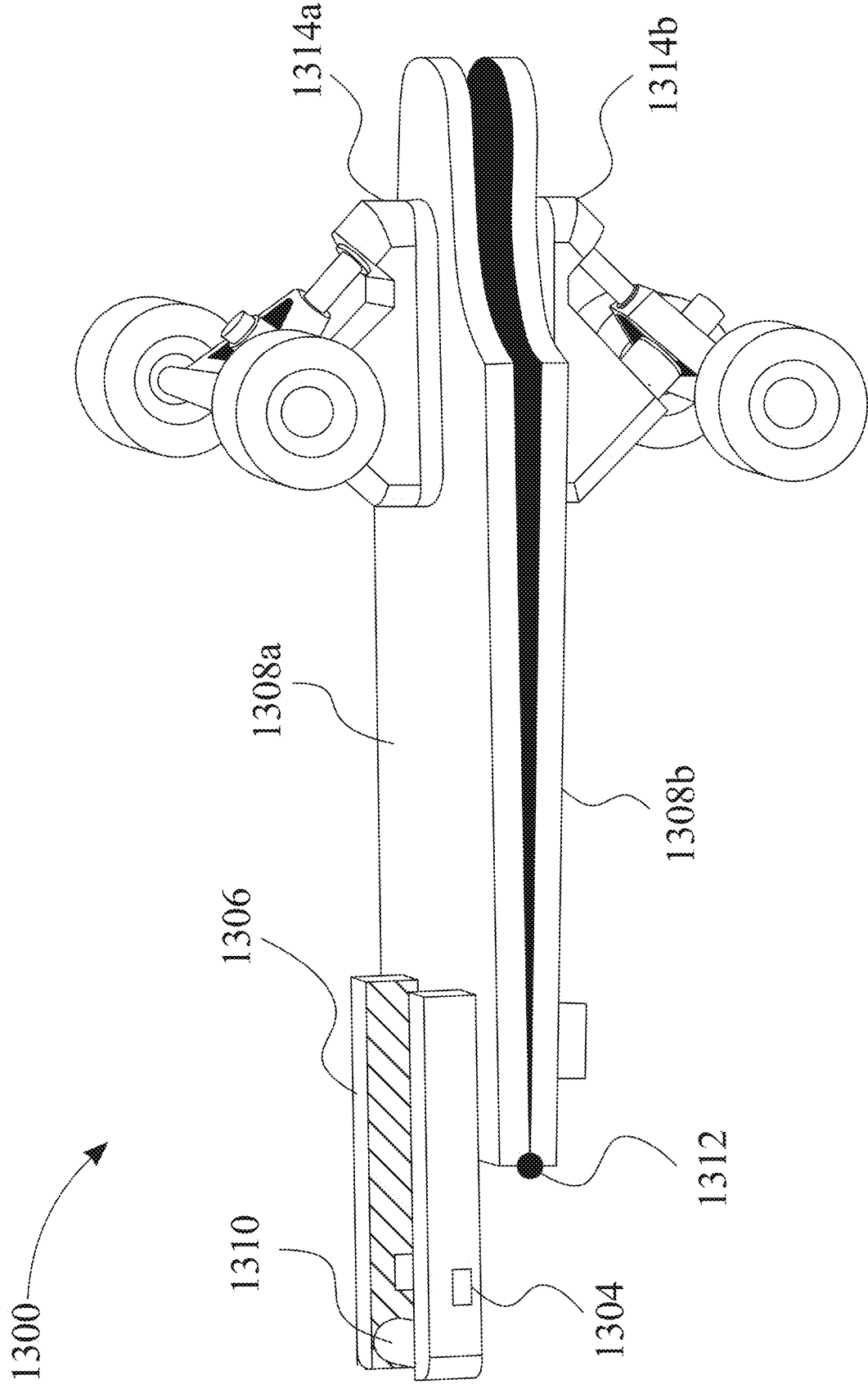


FIG. 13B

1500

FIG. 15A

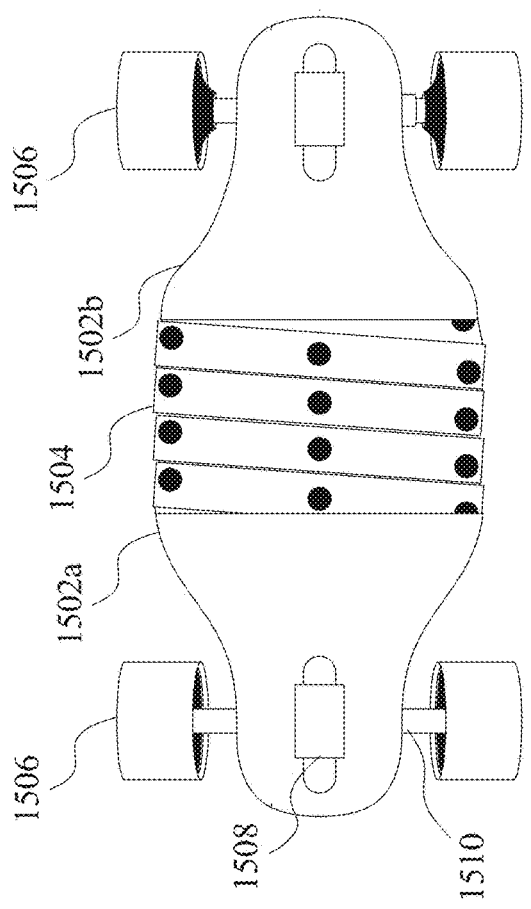
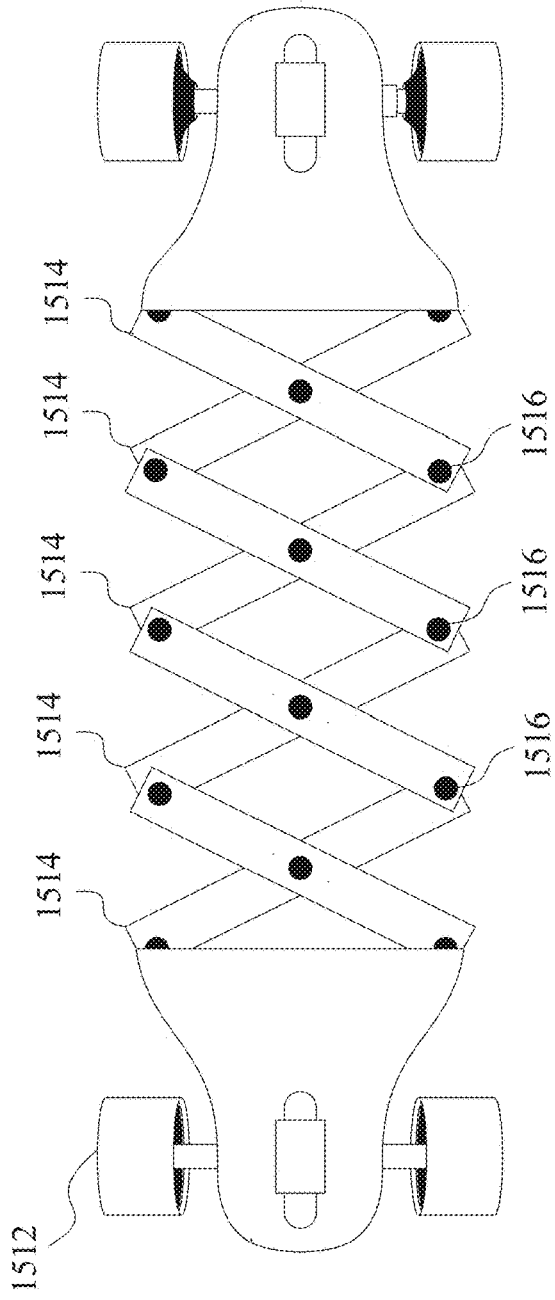


FIG. 15B



1600

FIG. 16A

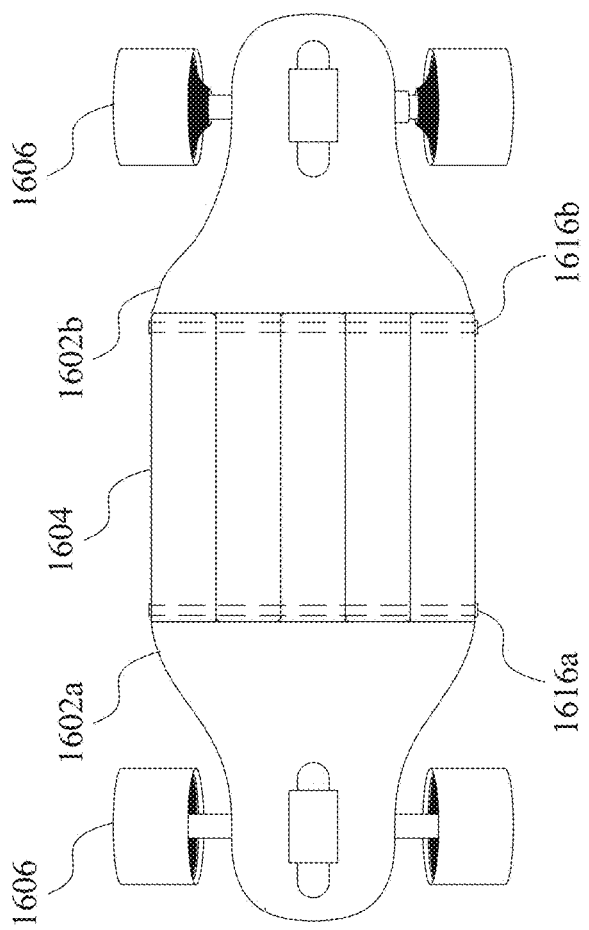
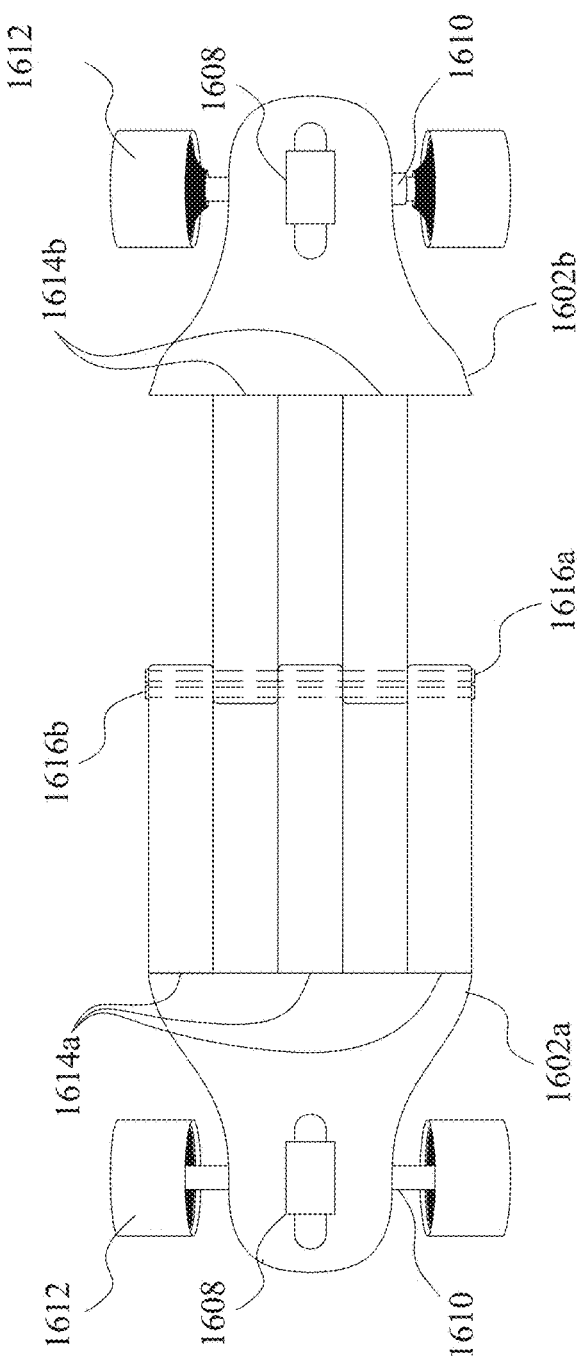


FIG. 16B



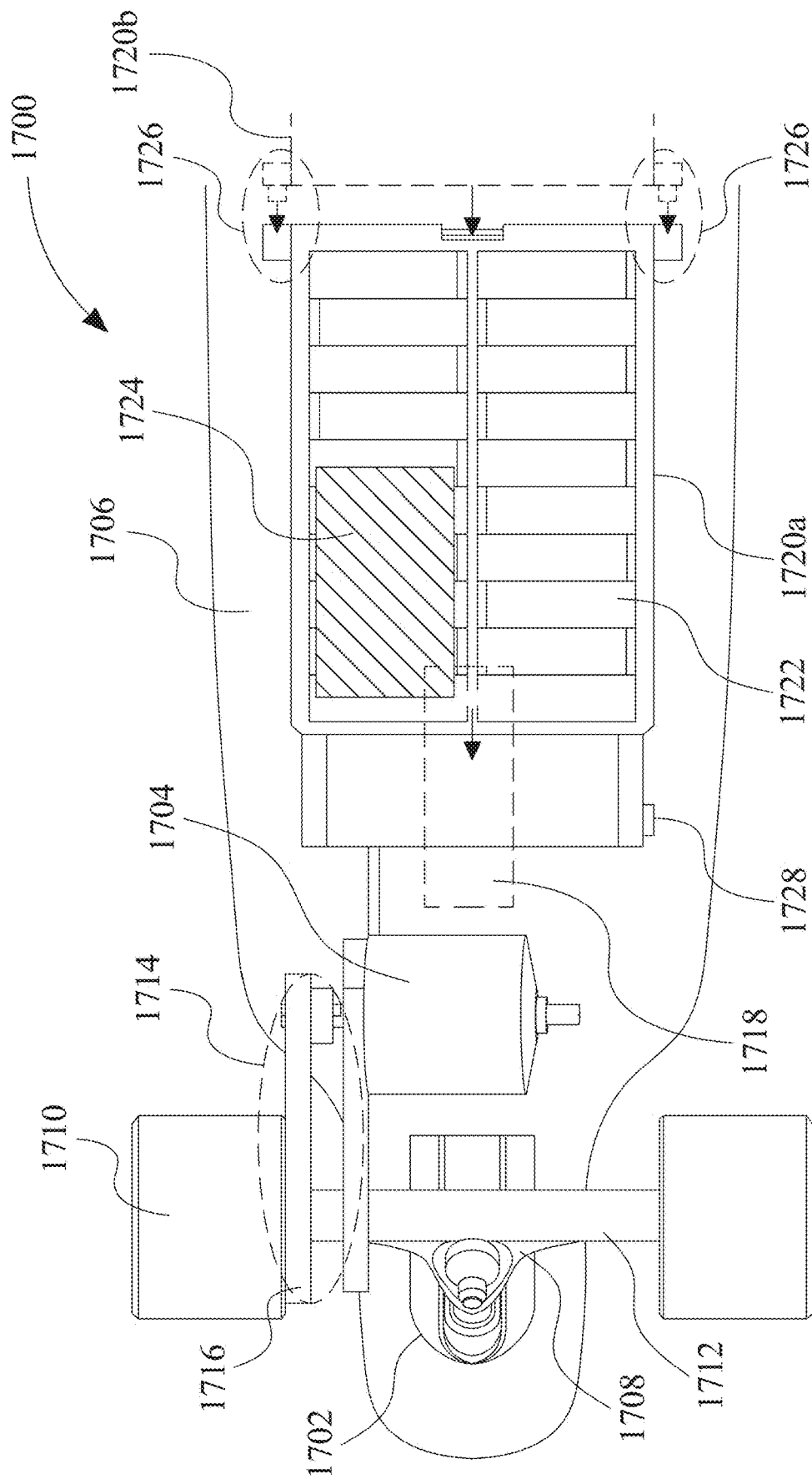


FIG. 17

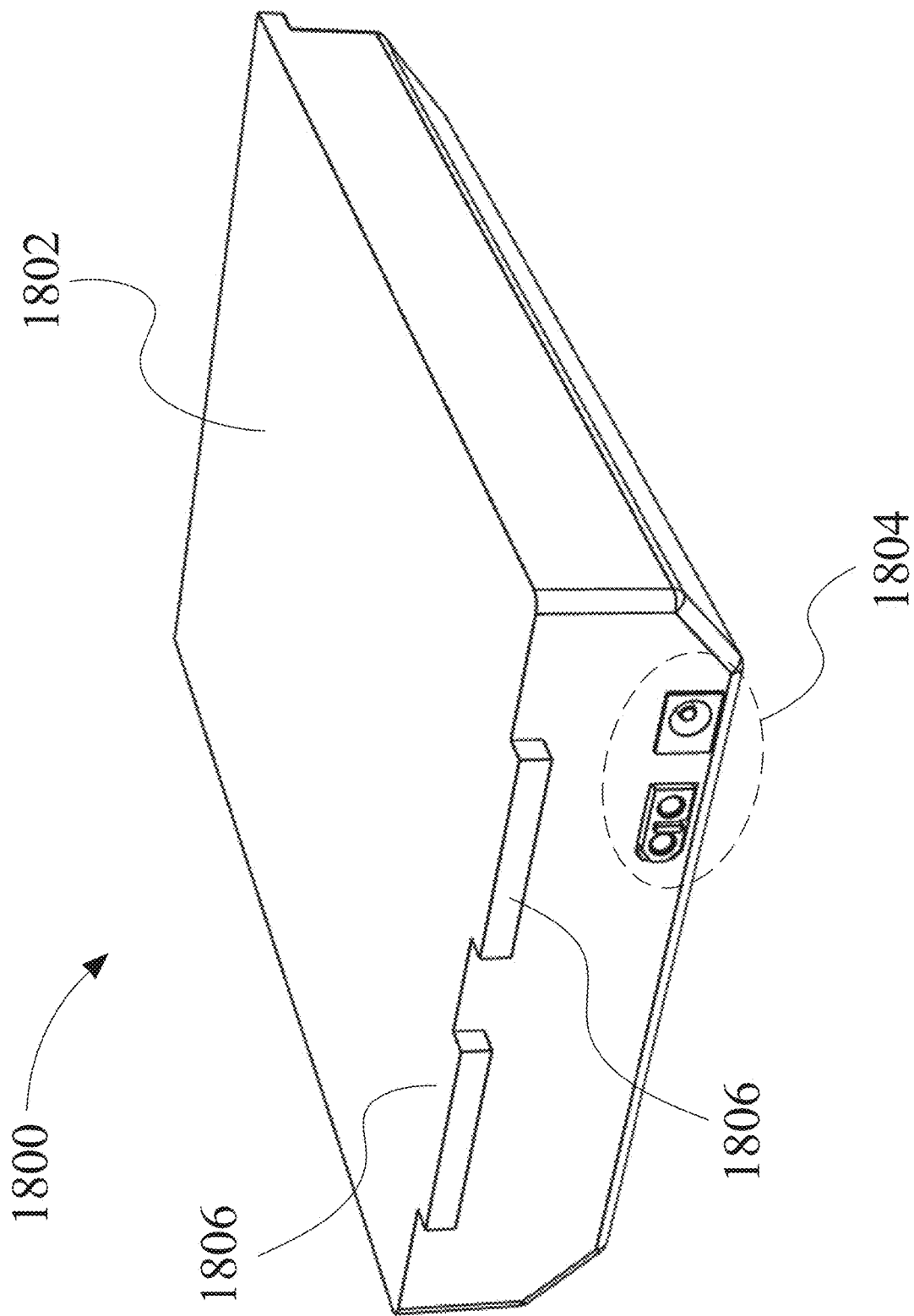


FIG. 18

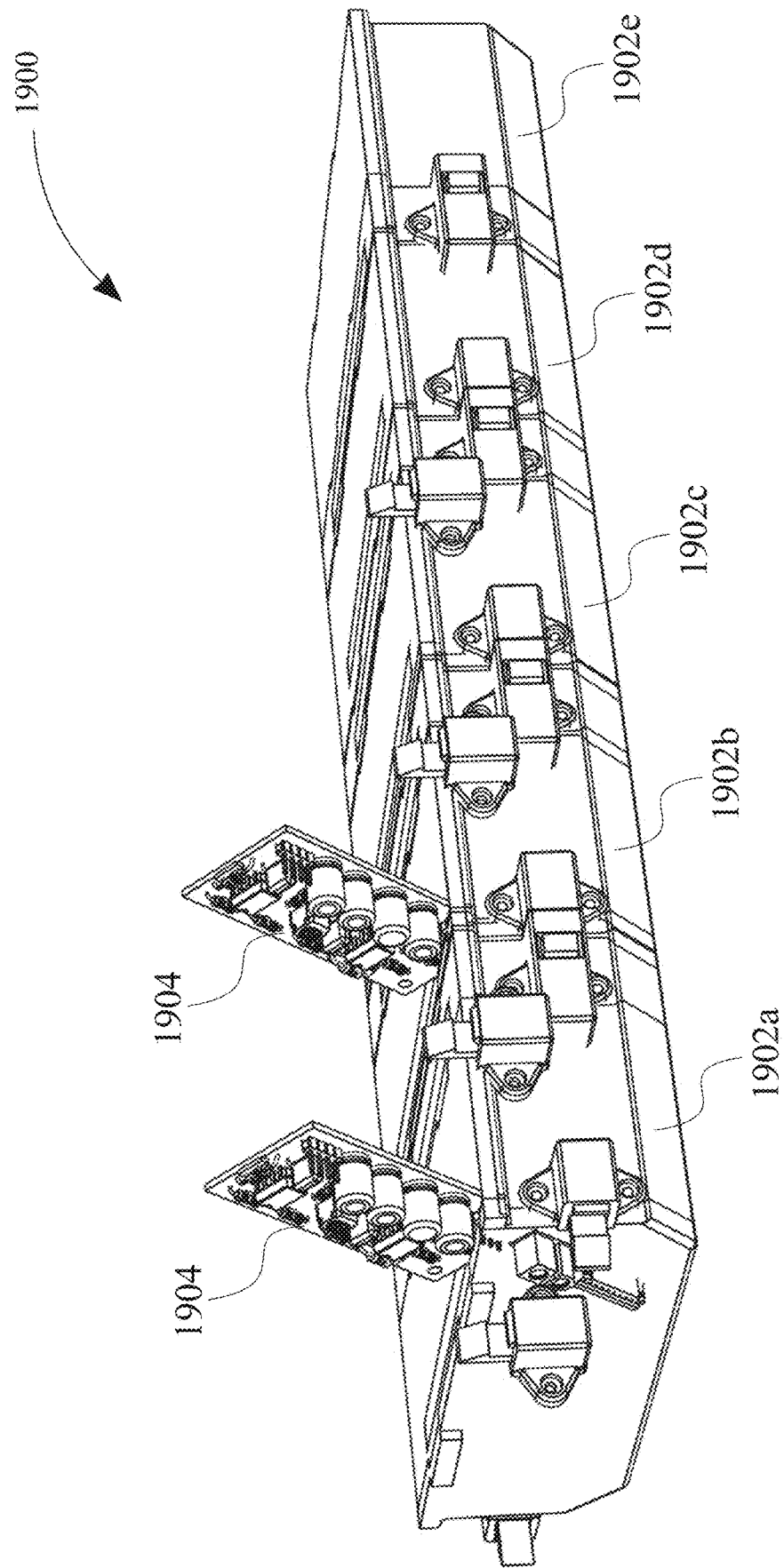


FIG. 19A

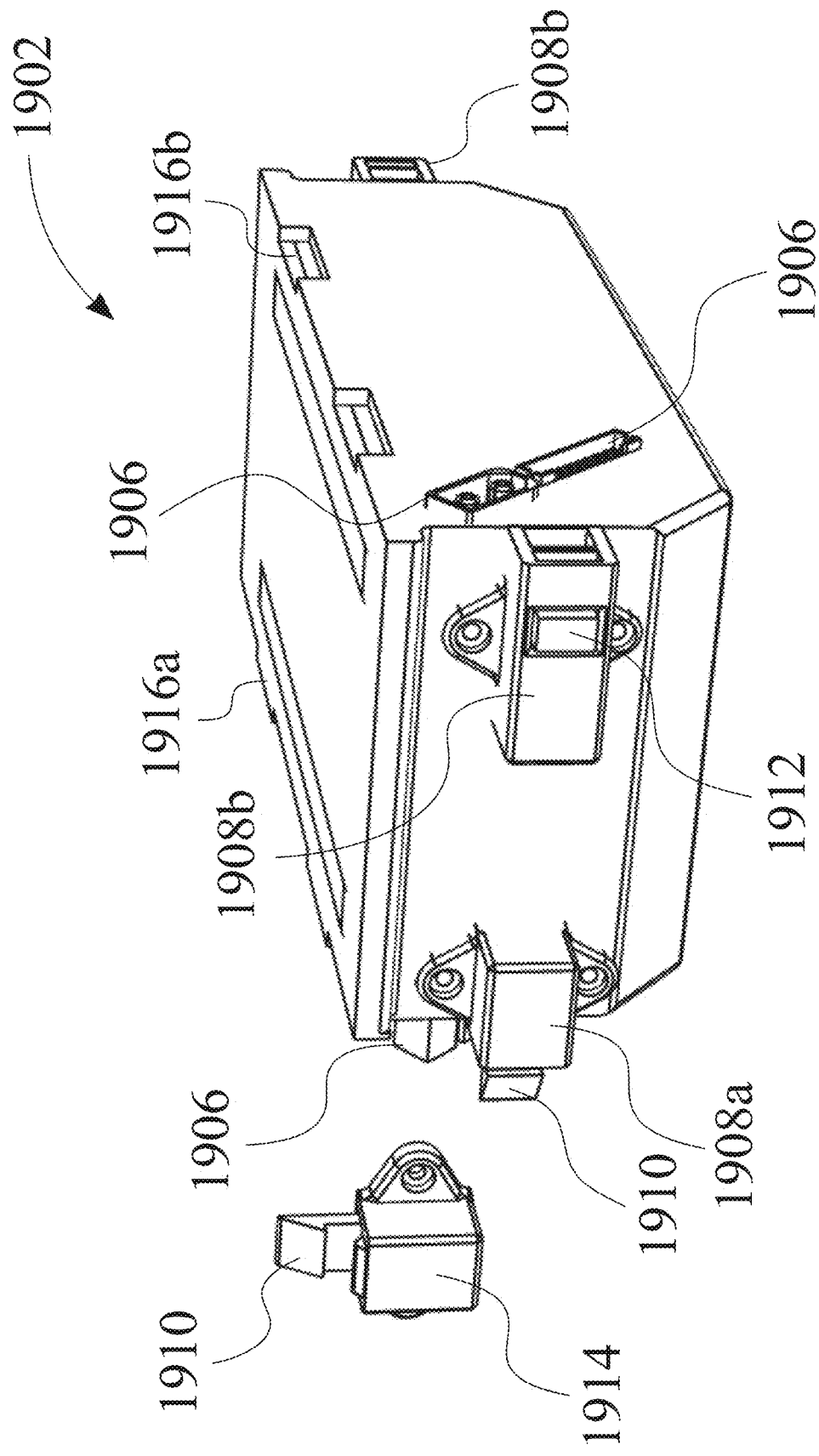


FIG. 19B

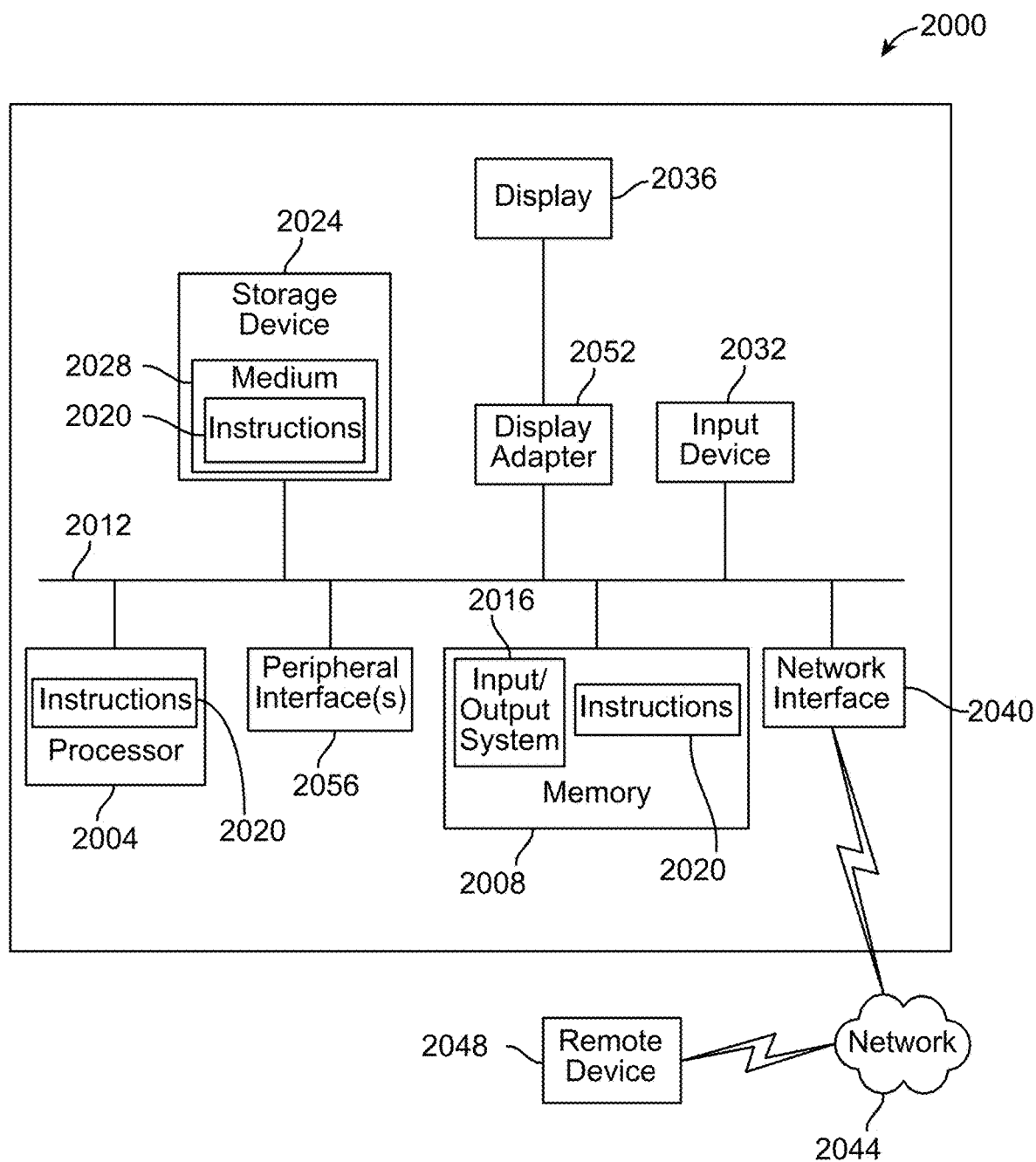


FIG. 20

PORTABLE FOLDING ELECTRIC SKATEBOARD

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims the benefit of priority of U.S. Provisional Patent Application Ser. No. 63/465,387, filed on May 10, 2023, and titled “COLLAPSIBLE TRANSPORTATION BOARD,” and U.S. Provisional Patent Application Ser. No. 63/531,752, filed on Aug. 9, 2023, and titled “LOCKING MECHANISM AND USER-INTERACTION FEATURES FOR A FOLDING ELECTRIC LONGBOARD,” which their entireties are all incorporated herein by reference.

FIELD OF THE INVENTION

[0002] The present invention generally relates to the field of transportation device. In particular, the present invention is directed to a portable folding electric skateboard.

BACKGROUND

[0003] Travel in urban environments presents many challenges and constraints. Automobiles can be mired in traffic and public transportation terminals can be distant from endpoints. Personal transportation devices must be stored and transported in their own right and secured from theft. Conventional skateboards are typically rigid in structure, which can make them cumbersome to carry in crowded environments or where space is limited, such as on public transport or in small living spaces. Their fixed size does not allow for easy adaptation to various storage conditions.

SUMMARY OF THE DISCLOSURE

[0004] In an aspect, a portable skateboard is described. The portable skateboard includes a deck defined by a first board segment and a second board segment, wherein each board segment includes a top surface, a bottom surface, and at least one wheel assembly attached to the bottom surface. The portable skateboard also includes at least a hinge mechanism disposed on the bottom surfaces of the board segments, mechanically connect the first board segment to the second board segment, wherein the at least a hinge mechanism is configured to rotate the board segments along a lateral axis passing through the at least a hinge mechanism. The portable skateboard further includes a locking mechanism having a latch configured to interfere with the rotation of the at least a hinge mechanism, selectively securing the first board segment and the second board segment in an unfolded configuration of the portable skateboard, wherein the top surfaces of the board segments form a continuous planar surface for standing thereon, and in a folded configuration of the portable skateboard, wherein the bottom surfaces of the first board segment and the second board segment are aligned, with the respective wheel assemblies adjacent to one another along a vertical axis.

[0005] In another aspect, a portable skateboard is described. The portable skateboard includes a deck defined by a first board segment and a second board segment, wherein each board segment comprises a top surface, a bottom surface, and at least one wheel assembly attached to the bottom surface. The portable skateboard also includes at least a hinge mechanism disposed on the top surfaces of the board segments, mechanically connect the first board seg-

ment to the second board segment, wherein the at least a hinge mechanism is configured to rotate the board segments along a lateral axis passing through the at least a hinge mechanism. The portable skateboard further includes a locking mechanism having a latch configured to interfere with the rotation of the at least a hinge mechanism, selectively securing the first board segment and the second board segment in an unfolded configuration of the portable skateboard, wherein the top surfaces of the board segments form a continuous planar surface for standing thereon, and in a folded configuration of the portable skateboard, wherein the top surfaces of the first board segment and the second board segment are adjacent with the respective wheel assemblies facing outward.

[0006] These and other aspects and features of non-limiting embodiments of the present invention will become apparent to those skilled in the art upon review of the following description of specific non-limiting embodiments of the invention in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] For the purpose of illustrating the invention, the drawings show aspects of one or more embodiments of the invention. However, it should be understood that the present invention is not limited to the precise arrangements and instrumentalities shown in the drawings, wherein:

[0008] FIGS. 1A-B are an exemplary embodiments of a portable skateboard;

[0009] FIG. 2 is a top-down view of a bottom surface of an exemplary embodiment of portable skateboard;

[0010] FIG. 3 is an exemplary embodiment a set of parts of at least a hinge mechanism;

[0011] FIGS. 4A-B are exemplary embodiments of an activation and deactivation of a locking mechanism;

[0012] FIGS. 5A-B are cross-sectional views of an exemplary flow for switching portable skateboard from an unfolded configuration to a folded configuration;

[0013] FIGS. 6A-B are side views of an exemplary embodiment of a wheel-to-wheel folding of a portable skateboard;

[0014] FIG. 7 is a perspective view of an exemplary embodiment of a nesting arrangement of plurality of hinge components;

[0015] FIG. 8 is an exemplary embodiment of at least a hinge mechanism having additional bar linkages;

[0016] FIGS. 9-10, 11A, and 11B are exemplary embodiments of an alternative locking mechanism of portable skateboard;

[0017] FIG. 12 is an exemplary embodiment of a board-to-board folding of a portable skateboard;

[0018] FIGS. 13A-B are exemplary embodiments of a locking mechanism of portable skateboard being a door latch mechanism;

[0019] FIG. 14 is an exemplary embodiment of a training handle;

[0020] FIGS. 15A-B and 16A-B are top down views of an exemplary embodiment of a telescopic portable skateboard;

[0021] FIG. 17 is an exemplary embodiment of an electric propulsion system of portable skateboard;

[0022] FIG. 18 is an exemplary embodiment of a swappable battery pack;

[0023] FIGS. 19A-B are exemplary embodiments of a modular battery pack; and

[0024] FIG. 20 is a block diagram of a computing system that can be used to implement any one or more of the methodologies disclosed herein and any one or more portions thereof.

[0025] The drawings are not necessarily to scale and may be illustrated by phantom lines, diagrammatic representations and fragmentary views. In certain instances, details that are not necessary for an understanding of the embodiments or that render other details difficult to perceive may have been omitted.

DETAILED DESCRIPTION

[0026] At a high level, aspects of the present disclosure are directed to a collapsible board. In one or more embodiments, collapsible board may be configured either as a skateboard or a longboard, with options for either electric or non-electric propulsion systems. As described herein, a “skateboard” and a “longboard” are wheeled vehicles that are navigated by a standing user through foot manipulation. In some cases, electric propulsion system may include a plurality of motorized wheels powered by one or more electric motors electrically connected to one or more batteries, wherein the electric motors (e.g., motor’s speed) may be remotely controlled via a handheld remote.

[0027] Aspect of the present disclosure can be used to collapse electric or non-electric skateboard or longboard to shorten a lateral length of the board. Such shortening of the board may be accomplished, in one or more embodiments, through various means including, without limitation, folding, telescoping, or complete separation, subsequently secured into its extended configuration through a robust locking mechanism. In some cases, electrical components of the board such as electric propulsion system and batteries are protected when collapsed.

[0028] Aspects of the present disclosure can be used to enhance portability (i.e., e.g., easier carrying, storage, and transportation) of the board. This is so, at least in part, because the board may stand independently and a carrying handle attached to one side of the board may become accessible when the board collapses. In an embodiment, carrying handle may be used to facilitate a vertical insertion of collapsed board into an independent charging dock, all while preserving the conventional functionality and characteristics of an extended skateboard or longboard. Exemplary embodiments illustrating aspects of the present disclosure are described below in the context of several specific examples.

[0029] Referring now to FIGS. 1, an exemplary portable skateboard 100 according to one embodiment is illustrated. Portable skateboard 100 includes a deck 102. As used in this disclosure, a “deck” is an elongated platform on which a rider stands. Deck 102 may include a primary body of portable skateboard 100, i.e., a base for other skateboard components such as, without limitation, wheel assemblies including trucks, with or without electrical propulsion system, and any other associated hardware as described in further detail below. In one or more embodiments, deck 102 may include a plurality of layers of material such as, without limitation, plastic, composites, wood, or metal. In some cases, material may be selected based on different performance characteristics such as, without limitation, flexibility, durability, weight, among others.

[0030] With continued reference to FIGS. 1A-B, in some cases, deck 102 may vary in shape depending on the style

and purpose of portable skateboard 100. Exemplary shapes may include, without limitation, popsicle, old school, cruiser, longboard, or the like, each tailored to different styles of riding. In some cases, the length and width of deck 102 may affect the stability, maneuverability, and suitability for different skateboarding disciplines. As a non-limiting example, longboard may be longer for greater stability at high speed, while shorter boards may be better for tricks and agility. In some cases, deck 102 may include a curvature between edges e.g., left edge and right edge that help rider gain better control over the board; for instance, and without limitation, deck 102 may include a dip running lengthwise from nose 104a to tail 104b, and side-to-side from edge to edge. As a non-limiting example, deck 102 may include a U-shaped or a V-shaped cross-section as shown in FIG. 7.

[0031] With continued reference to FIGS. 1A-B, as described herein, a “nose” is a front end of deck 102, while a “tail” is a back end of deck 102. In some cases, nose 104a may be broader or longer than tail 104b to aid in skateboard steering and maneuverability. In other cases, nose 104a and tail 104b may be identical and symmetrical. In some cases, nose 104a and tail 104b may include an upward curve (or kick). In asymmetrical skateboard designs, nose 104a may include a distinctive shape or graphic to help differentiate it from tail 104b. In some cases, tail may include a smaller, shorter, and narrower kick compared to nose 104a. Deck 102 includes a first board segment 106a and a second board segment 106b, wherein the first board segment 106a may include a front edge attached to nose 104a and the second board segment 106b may include a rear edge attached to tail 104b. In some cases, nose 104a and first board segment 106a/tail 104b and second board segment 106b may be integral.

[0032] With continued reference to FIGS. 1A-B, in some embodiments, deck 102 may include a plurality of board segments. As used in this disclosure, a “board segment” is a portion or section of deck 102. Deck 102 may include first board segment 106a and second board segment 106b mechanically coupled to first board segment 106a through at least a hinge mechanism as described below. In some cases, first board segment 106a may include a front half of portable skateboard 100 and second board segment 106b may include a rear half of portable skateboard 100. In one or more embodiments, both board segment 106a-b may be designed to evenly distribute rider’s weight across deck 102 to maintain balance. In some cases, edges of deck 102 may be smoothed or rounded. In some cases, both first board segment 106a and second board segment 106b may be made from the same piece of wood such that the grain/wood pattern lines up across the seam.

[0033] With continued reference to FIGS. 1A-B, each first board segment 106a and second board segment 106b may include a top surface, a bottom surface, and a wheel assembly 108 attached to the bottom surface. As used in this disclosure, a “wheel assembly” is a setup that attaches a plurality of wheels 110 to deck 102, enabling skateboard 100 to roll. In one or more embodiments, wheel assembly 108 may include 1, 2, 4, or 6 wheels configured to provide movement of portable skateboard 100 on various surfaces. In some cases, each wheel may be made from polyurethane for durability and resilience. One or more bearings (i.e., small round device that made up of a plurality of small metal balls enclosed within a metal ring) may fit inside each wheel, for example, and without limitation, two bearings may be

press-fit into each wheel hub, configured to rotate the wheel around the attached a wheel axle **112**, wherein the wheel axle **112** is a metal rod attached to a truck **114**. In some cases, a front wheel assembly may be attached to nose **104a** of deck **102** and a rear wheel assembly may be attached to tail **104b** of deck **102**. In some cases, wheel assembly **108** may additionally include a wheel fender **120** for plurality of wheels **110** to protect rider from the wheels kicking up flying debris and flying water.

[0034] With continued reference to FIGS. 1A-B, as described herein, a “truck” is a component mounted to bottom surface of deck **102** that attach wheels to deck **102**. In one or more embodiments, truck **114** may include a baseplate, e.g., a flat rectangular part that may be bolted directly to board segment configured to hold the rest of truck components. In some cases, truck **114** may include a hanger that holds wheel axle **112**, wherein wheels **110** may be attached to either end of wheel axle **112** that extends out on both sides of the hanger. In some cases, hanger may be T-shaped and pivots on baseplate, allowing skateboard **100** to turn when rider shifts weight on deck **102**. In some cases, truck **114** may include one or more bushings, wherein the “bushings” are soft urethane rings fitted around a kingpin (i.e., a large bolt that between baseplate and hanger), act as cushions that control the skateboard’s steering sensitivity. In some cases, tightness of bushings may be adjusted by adjusting the tightness of kingpin, thereby modifying how easily portable skateboard **100** turns. Additionally, or alternatively, trucks **114** may include one or more washers positioned on either side of bushings to help distribute pressure evenly to maintain bushings’ shape under load.

[0035] With continued reference to FIGS. 1A-B, portable skateboard **100** includes at least a hinge mechanism **116** mechanically connect first board segment **106a** to second board segment **106b**, wherein the at least a hinge mechanism **116** is configured to rotate board segments **106a-b** along a lateral axis **118** passing through at least a hinge mechanism **116**. As used in this disclosure, a “hinge mechanism” is a mechanical device or assembly that allows to solid object e.g., first board segment **106a** and second board segment **106b**, to rotate relative to each other around a fixed axis. In some embodiments, hinge mechanism **116** may be used to facilitate movements between an unfold/open position of skateboard **100** and a fold/close position of skateboard **100**. In some cases, hinge mechanism **116** may be attached to the bottom surface of deck **102**, enabling a wheel-to-wheel folding. In some cases, hinge mechanism **116** may be attached to the top surface of deck **102**, enabling a board-to-board folding. Portable skateboard **100** further includes a locking mechanism having a latch configured to interfere with the rotation of at least a hinge mechanism **116**, selectively securing first board segment **106a** and second board segment **106b** in folded or unfolded configuration of portable skateboard **100**. Hinge mechanism **116** and different folding configurations are described in detail below.

[0036] With continued reference to FIGS. 1A-B, as described herein, a “folded configuration” of portable skateboard **100** is a state in which portable skateboard **100** is collapsed or folded into a more compact form. In one embodiment, portable skateboard **100** under folded configuration may minimize the space portable skateboard **100** occupies, making it easier to carry, store, or otherwise transport. A “unfolded configuration” of portable skateboard **100** on the other hand, for the purpose of this disclosure, is

a state in which portable skateboard **100** is fully extended and ready for use. In one embodiment, portable skateboard **100** under unfolded configuration, first board segment **106a** and second board segment **106b** may be locked in place, end-to-end, to form the complete deck **102** of portable skateboard **100**. As a non-limiting example, when portable skateboard **100** is unfolded, top surfaces of board segments **106a-b** may form a continuous planar surface that provide a stable and safe platform for a rider to stand on. Locking mechanism as described in further detail below may ensure portable skateboard **100** remain rigid and secure during use, preventing any undesired folding. As used in this disclosure, a “continuous planar surface” is a flat or nearly flat surface that extends without interruption or significant change in angle across the length of skateboard deck **102** when skateboard **100** is in the unfolded configuration. A “flat” or “nearly-flat” surface, as defined in this disclosure, is a surface without any bumps, gaps, or angles that could disrupt the rider’s stability.

[0037] With continued reference to FIGS. 1A-B, portable skateboard **100** may include an electric propulsion system **122**. As used in this disclosure, an “electric propulsion system” is a mechanism that uses electrical energy to propel a vehicle such as skateboard **100**. In an embodiment, electric propulsion system **122** may include an electric motor. An “electric motor,” for the purpose of this disclosure is any machine that converts electrical energy into mechanical energy. Electric motor may be driven by direct current (DC) electric power and may include, without limitation, brushless DC electric motors, switched reluctance motors, induction motors, or any combination thereof. Electric motor may also include electronic speed controllers or other components for regulating motor speed, rotation direction, and/or dynamic braking. A “motor,” as described herein, is any machine that converts non-mechanical energy into mechanical energy. In some cases, electric propulsion system **122** may include a plurality of electric motors.

[0038] With continued reference to FIGS. 1A-B, in some cases, electric motor may include at least a stator and a rotor. As used in this disclosure, a “stator” is a stationary component of a motor and/or motor assembly. In an embodiment, stator may include at least first magnetic element. A “magnetic element,” for the purpose of this disclosure, is an element that generates a magnetic field. For example, first magnetic element may include one or more magnets which may be assembled in rows along a structural casing component e.g., interior of a motor housing. Further, first magnetic element may include one or more magnets having magnetic poles oriented in at least a first direction. In some embodiments, magnets may include at least a permanent magnet. In some cases, permanent magnets may be composed of, but are not limited to, ceramic, alnico, samarium cobalt, neodymium iron boron materials, any rare earth magnets, and the like. In other embodiments, the magnets may include an electromagnet (i.e., an electrical component that generates magnetic field via induction). In some cases, electromagnet may include a coil of electrically conducting material, through which an electric current flow to generate the magnetic field, also called a field coil of field winding. In some cases, a coil may be wound around a magnetic core, which may include without limitation an iron core or other magnetic material. In some cases, core may include a plurality of steel rings insulated from one another and then laminated together. In an embodiment, plurality of steel

rings may include slots in which the conducting wire will wrap around to form a coil. In some cases, first magnetic element may act to produce or generate a magnetic field to cause other magnetic elements to rotate, as described in further detail below. In some embodiments, stator may include a frame to house components including first magnetic element, as well as one or more other elements as described below. In other embodiments, magnetic field may be generated by first magnetic element and can include a variable magnetic field. For example, variable magnetic field may be achieved by use of an inverter, a controller, or the like.

[0039] With continued reference to FIGS. 1A-B, As used in this disclosure, a “rotor” is a portion of an electric motor that rotates with respect to a stator of the electric motor as described above. In some cases, rotor may be placed inside stator. In some cases, electric motor may include rotor shaft having one end attached to rotor and another end attached to one or more wheels. In an embodiment, wheel axle **112** may be mounted to rotor. In another embodiment, wheel axle **112** may be rotatably mounted to stator. As used in this disclosure, “rotatably mounted,” is functionally secured in a manner to allow rotation. In some cases, rotor shaft may include second magnetic element, which may include one or more further magnetic elements. In some embodiment, second magnetic element generates magnetic field designed to interact with first magnetic element. Further, second magnetic element may be designed with a material such that magnetic poles of at least a second magnetic element are oriented in an opposite direction from first magnetic element. In some cases, second magnetic element may include any magnetic element suitable for use as first magnetic element as described above. For instance, and without limitation, second magnetic element may include a permanent magnet and/or an electromagnet. In other cases, second magnetic element may include magnetic poles oriented in a second direction opposite, in whole or in part, of the orientation of poles of first magnetic element. In an embodiment, Electric motor may include motor assembly incorporating stator with first magnet element and second magnetic element. In some cases, first magnetic element may include a plurality of magnetic poles oriented in a first direction, second magnetic element includes a plurality of magnetic poles oriented in an opposite direction than the plurality of magnetic poles in first magnetic element.

[0040] With continued to FIGS. 1A-B, in some cases, electric motor may include one or more bearings. In an embodiment, rotor shaft may be inserted through a bore of bearing. In some cases, bearing may be attached to a structural component of skateboard **100**, for example, and without limitation, wheel axel **112**. As used in this disclosure, a “bearing” is a component that functions to support the rotor and to transfer the loads from the motor. In some cases, loads may include, without limitation, weight, power, fraction, out of balance situations, and the like. In some cases, bearing may include a plurality of smooth metal ball or roller that rolls against a smooth inner and outer metal surface. The rollers or balls take the load, allowing attached device to spin. Exemplary bearings may include, without limitation, ball bearing, straight roller bearing, tapered roller bearing or the like. In some embodiments, bearing may join electric motor to a structure feature e.g., one or more wheels to support the wheels and allow them to spin. In some cases, bearing may function to minimize the structural impact from

the transfer of bearing loads during ride. Additionally, or alternatively, bearing may support the two joined structures by reducing transmission of vibration from such bearings.

[0041] With continued reference to FIGS. 1A-B, electric propulsion system **122** may include a battery pack. As used in this disclosure, a “battery pack” is an assembly of individual battery cells configured in a way to meet electric propulsion system’s **120** energy and voltage requirements. Each battery cell provides a portion of electrical power to drive electric motor. In some cases, battery pack may include, without limitation, lithium-ion (Li-ion) batteries, Lithium-polymer (LiPo) batteries, Lithium-ion Phosphate (LiFePO4) batteries, or any combination thereof. In one or more embodiments, battery pack may be modular. As a non-limiting example, battery pack may include a modular battery pack removably attached to portable skateboard **100**. In some cases, battery pack may be interchangeable; for instance, and without limitation, rider may swap out depleted battery pack for charged one to extend the range of skateboard **100** without the need for lengthy recharging time. In some cases, individual modules may be replaced or upgraded without the need to service the entire battery subsystem within electric propulsion system **122**. In some cases, rider may choose between different battery capacities depending on specific situations in different trips. As a non-limiting example, when planning a trip that involves more hills, a larger capacity battery may be used to ensure sufficient power and range instead of a standard battery which provides a balance of weight and range suitable for flat conditions.

[0042] With continued reference to FIGS. 1A-B, in some cases, battery pack may include one or more standardized electrical connectors that allow for fast disconnection and connection to electric propulsion system **122**. In some cases, locking mechanism as described in further detail below may, additionally, or alternatively, hold battery pack in place during use of skateboard **100**. As a non-limiting example, locking mechanism may include a slide-and-lock design where edges of battery pack may slide into rails and lock in place, or a clip-in system with a release mechanism e.g., a button. In some cases, battery pack may include an integrated battery management system (BMS). In cases where electric propulsion system **122** includes more than one battery pack, for example, and without limitation, each battery pack may include its own BMS that manages the charging and discharging of corresponding battery cells to optimize performance and longevity of battery packs. In some cases, BMS may be communicatively connected to electrical propulsion system and skateboard’s **100** remote controller as described below, providing real-time data on, for example, battery health and charge levels.

[0043] With continued reference to FIGS. 1A-B, as used in this disclosure, “communicatively connected” means connected by way of a connection, attachment or linkage between two or more relata which allows for reception and/or transmittance of information therebetween. For example, and without limitation, this connection may be wired or wireless, direct or indirect, and between two or more components, circuits, devices, systems, and the like, which allows for reception and/or transmittance of data and/or signal(s) therebetween. Data and/or signals therebetween may include, without limitation, electrical, electro-magnetic, magnetic, video, audio, radio and microwave data and/or signals, combinations thereof, and the like, among

others. A communicative connection may be achieved, for example and without limitation, through wired or wireless electronic, digital or analog, communication, either directly or by way of one or more intervening devices or components. Further, communicative connection may include electrically coupling or connecting at least an output of one device, component, or circuit to at least an input of another device, component, or circuit. For example, and without limitation, via a bus or other facility for intercommunication between elements of a computing device. Communicative connecting may also include indirect connections via, for example and without limitation, wireless connection, radio communication, low power wide area network, optical communication, magnetic, capacitive, or optical coupling, and the like. In some instances, the terminology “communicatively coupled” may be used in place of communicatively connected in this disclosure.

[0044] With continued reference to FIGS. 1A-B, in some cases, electric motor may include an electric speed controller (ESC). As described herein, an “electric speed controller” is an electronic circuit that regulates the speed, direction, and braking of electric motor based on a received inputs. In some embodiments, ESC may be configured to regulate power delivered from battery pack to electric motor, controlling speed and torque of electric motor based on inputs from rider via a throttle. As used in this disclosure, a “throttle” is a hand-held remote controller or a foot-trigger on deck **102** of skateboard **100** itself that allows a user to control the speed of the skateboard **100**. Throttle and remote controller may be used interchangeably throughout the specification. In some cases, remote controller may be user-operated. In some cases, throttle may be communicatively connected to ESC. In some cases, ESC may include any computing device as described herein, e.g., a microcontroller configured to process input signals from throttle and executing one or more control commands to adjust electric motor behavior. ESC may include one or more metal oxide semiconductor field effect transistors (MOSFETs) configured as power switches that handle high current loads. In some cases, MOSFETs may control power delivered to electric motor. In some cases, ESC may also include a heat sink configured to dissipate heat generated by MOSFETs during operation.

[0045] With continued reference to FIGS. 1A-B, remote controller of portable skateboard **100** may include a processor communicatively connected to a memory. Remote controller may include any computing device as described in this disclosure, including without limitation a microcontroller, microprocessor, digital signal processor (DSP) and/or system on a chip (SoC) as described in this disclosure. Remote controller may include, be included in, and/or communicate with a mobile device such as a mobile telephone or smartphone. Remote controller may include a single computing device operating independently, or may include two or more computing device operating in concert, in parallel, sequentially or the like; two or more computing devices may be included together in a single computing device or in two or more computing devices. Remote controller may interface or communicate with one or more additional devices as described below in further detail via a network interface device. Network interface device may be utilized for connecting remote controller to one or more of a variety of networks, and one or more devices. Examples of a network interface device include, but are not limited to, a network interface card (e.g., a mobile network interface

card, a LAN card), a modem, and any combination thereof. Examples of a network include, but are not limited to, a wide area network (e.g., the Internet, an enterprise network), a local area network (e.g., a network associated with an office, a building, a campus or other relatively small geographic space), a telephone network, a data network associated with a telephone/voice provider (e.g., a mobile communications provider data and/or voice network), a direct connection between two computing devices, and any combinations thereof. A network may employ a wired and/or a wireless mode of communication. In general, any network topology may be used. Information (e.g., data, software etc.) may be communicated to and/or from a computer and/or a computing device. Remote controller may include but is not limited to, for example, a computing device or cluster of computing devices in a first location and a second computing device or cluster of computing devices in a second location. Remote controller may include one or more computing devices dedicated to data storage, security, distribution of traffic for load balancing, and the like. Remote controller may distribute one or more computing tasks as described below across a plurality of computing devices of computing device, which may operate in parallel, in series, redundantly, or in any other manner used for distribution of tasks or memory between computing devices. Remote controller may be implemented, as a non-limiting example, using a “shared nothing” architecture.

[0046] With continued reference to FIGS. 1A-B, remote controller may be designed and/or configured to perform any method, method step, or sequence of method steps in any embodiment described in this disclosure, in any order and with any degree of repetition. For instance, remote controller may be configured to perform a single step or sequence repeatedly until a desired or commanded outcome is achieved; repetition of a step or a sequence of steps may be performed iteratively and/or recursively using outputs of previous repetitions as inputs to subsequent repetitions, aggregating inputs and/or outputs of repetitions to produce an aggregate result, reduction or decrement of one or more variables such as global variables, and/or division of a larger processing task into a set of iteratively addressed smaller processing tasks. Remote controller may perform any step or sequence of steps as described in this disclosure in parallel, such as simultaneously and/or substantially simultaneously performing a step two or more times using two or more parallel threads, processor cores, or the like; division of tasks between parallel threads and/or processes may be performed according to any protocol suitable for division of tasks between iterations. Persons skilled in the art, upon reviewing the entirety of this disclosure, will be aware of various ways in which steps, sequences of steps, processing tasks, and/or data may be subdivided, shared, or otherwise dealt with using iteration, recursion, and/or parallel processing.

[0047] With continued reference to FIGS. 1A-B, in an embodiment, ESC may receive one or more input signals from remote controller. In one embodiment, input signals may include signals for power adjustments (voltage and current delivered to electric motor). This may be achieved through pulse width modulation (PWM), where the power supplied to electric motor may be turned on and off at high frequencies by varying the duration of the “on” pulses relative to the “off” pulses. In some cases, ESC may provide dynamic braking by rapidly switching electric motor’s con-

nections to create electromagnetic resistance to slow down electric motor. In another embodiment, input signals may include signals for direction control (for reversing). ESC may reverse the current flow through electric motor causing it to spin in an opposite direction. Additionally, or alternatively, ESC may be configured to protect electric motor from electrical overloads and ensuring it operates within safe parameter, for instance, and without limitations, ESC may be configured to monitor motor's voltage and current, reducing cur off power to prevent damage due to overheating or excessive strain. Further, ESC may be integrated with features that monitor the battery's voltage and prevent it from discharging below a safe threshold.

[0048] With continued reference to FIGS. 1A-B, in some embodiments, electric propulsion system 122 may be equipped with regenerative braking, i.e., a mechanism that captures the kinetic energy of a moving vehicle and converts it into electrical energy, which may then be used to recharge battery pack. As a non-limiting example, when skateboard 100 begins to slow down, electric motor, which normally drives the skateboard forward, may switch its role and act as a generator. Instead of using power to turn wheel assemblies 108, it may use the turning motion of one or more wheels 110 to generate electricity. Kinetic energy from skateboard's motion may be transferred to electric motor. As skateboard 100 slows down, rotational speed of one or more wheels 110 may drive electric motor's rotor, generating electricity through electromagnetic induction (i.e., a process where a moving conductor in a magnetic field induces an electrical current in the windings of electric motor). In some cases, ESC may adjust electrical load generated by electric motor to control the amount of braking force applied. In some cases, electrical load may be adjusted to control the amount of braking force applied (this is often matched to the amount of pressure rider applies to the brake controls). In some cases, the electricity produced during regenerative braking may be directed, managed by BMS, back to battery pack wherein it is stored for future use.

[0049] With continued reference to FIGS. 1A-B, electric propulsion system 122 may be mechanically coupled to deck 102. In some cases, electric propulsion system 122 may be mechanically coupled to either first board segment 106a, second board segment 106b, or both. In some cases, mechanically coupled may include a mechanical fastening, without limitation, such as nuts, bolts, or other fastening device. In some embodiments, mechanically coupled may include welding or casting or the like. In some cases, deck 102 may contain bores which allows insertion of bolts used for mechanically couple any structural element as described herein. In some cases, battery pack and electric motor may be heavy components and therefore, at least in part, may be placed at a position of deck 102 to maintain the skateboard's 100 balance for optimal control and performance. The placement may also consider ease of maintenance and the need to recharge battery pack. As a non-limiting example, electric motor may be directly mounted to wheel axle 112 of (rear) wheel assembly 108 of second board segment 106b. Battery pack may be mounted on the bottom surface of second board segment 106b. ESC and BMS may also be mounted on the bottom surface of deck 102, proximate to battery pack to minimize the length of high-current wiring.

[0050] Now referring to FIG. 2, a top-down view of a bottom surface of an exemplary embodiment of portable skateboard 200 (in an unfolded configuration) is illustrated.

Portable skateboard 200 includes deck 202 defined by first board segment 204a and second board segment 204b, wherein each board segment includes at least one wheel assembly 206 mechanically attached to the bottom surface. At least one wheel assembly 206 may include a truck having a baseplate 208 and a wheel axle 210 securely fastened to baseplate 208 to the baseplate 208. One or more wheels 212 may be rotatably attached to both side of wheel axle 210. In some cases, rear wheel assembly 206b may differ from the front wheel assembly 206a, due to the integration of electric propulsion system 214 as described above with reference to FIGS. 1A-B. As a non-limiting example, front wheel assembly 206a may include a relatively smaller baseplate 208 to optimize turning radius and reduce overall weight, whereas the electric motor of electric propulsion system 214 may be mounted on bigger baseplate 208 of rear wheel assembly 206b which provides more stability and support for added mechanical and electrical components. The wires from electric motor may be strategically routed along the inner surface of deck 202 to connect with battery pack and ESC and do not interfere with the riding. In other cases, wires may be organized using one or more cable tie mounts, cable management clips or clamps affixed to the bottom surface of deck 202 through screws or adhesive means.

[0051] With continued reference to FIG. 2, portable skateboard 200 includes at least a hinge mechanism 216 disposed on the bottom surfaces, mechanically connect first board segment 204a to second board segment 204b, configured to rotate board segments 204a-b along a lateral axis passing through at least a hinge mechanism 216. In some embodiments, hinge mechanism 216 may be positioned to maintain the balance and stability of portable skateboard 200 when unfolded, and do not interfere with rider's stance or structural load-bearing areas of deck 202. As a non-limiting example, at least a hinge mechanism 216 may be placed proximate to the center of deck 202 with a predetermined offset depending on the size of the wheels. In some cases, the location of a cut 218 (for the orthogonal separation of first board segment 204a and second board segment 204b) may be at least half of the average wheel diameter away from the true center of deck 202 (between the two truck axles/wheel center of rotation). To achieve wheel locking as described in further detail below with reference to FIGS. 6A-B, cut 218 may be offset from half of the average wheel diameter away from true center by a specified tolerance ($\frac{1}{4}$ ", $\frac{1}{8}$ ", $\frac{1}{16}$ ", and the like), which is dependent on the wheel properties such as truck spring constant and coefficient of restitution of the wheel material. For example, and without limitation, skateboard such as a Corsair Board F4U MK I may include an eighth inch offset from the Half wheel diameter away from the center of the board. This eighth inch offset may be achieved by adding one sixteenth of an inch to the shorter board segment and subtracting one sixteenth of an inch from the longer board segment. In some cases, first board segment 204a may be shorter board segment while second board segment 204b may be longer board segment.

[0052] With continued reference to FIG. 2, portable skateboard 200 includes a locking mechanism 220. As used in this disclosure, a "locking mechanism" is a device or system incorporated into a piece of a structure to secure it in a fixed or static position. Locking mechanism 220 may be mechanically connected to at least a hinge mechanism 216. In one embodiment, locking mechanism 220 may be affixed to the bottom surface of first board segment 204a via a dual blind

pivot block of at least a hinge mechanism as described below with reference to FIG. 3. Locking mechanism 220 includes a latch 222 configured to interfere with the rotation of at least a hinge mechanism 216. As used in this disclosure, a “latch” is a mechanical component that locks a connected part by fitting into a restraint on another part to prevent movement. In one embodiment, latch 222 may withstand repeated stress of locking and unlocking. In some cases, latch 222 may maintain its position under the load of the rider in unfolded configuration. In some cases, latch 222 may be constructed from high-strength material such as metal alloys that offer both durability and a lightweight profile. As a non-limiting example, locking mechanism 220 may include a locking bar that securely maintains at least a hinge mechanism 216 in a flat position by lying atop at least a hinge mechanism 216, over-constraining the mechanism and restricting rotational movement of the hinge and in turn “folding” movement of the board segments 204a-b, causing board segments 204a-b to be locked in unfolded configuration. Structurally, the integration of locking mechanism 220 with at least a hinge mechanism 216 may be designed to ensure that when at least a hinge mechanism 216 is locked, there is minimal to no play between board segments 204a-b. In some cases, latch 222 may be contoured to encircle and circumvent trucks of wheel assembly 206 and other obstacles. Additionally, or alternatively, contouring may allow latch 222 to serve as a practical carrying handle when needed. In some cases, latch 222 may be made with one continuous rod that is bent into shape. In other cases, latch 222 may be a combination of multiple rods connected together through means like welding or fastening.

[0053] With continued reference to FIG. 2, in some cases, a shroud 224 may be used to cover the area of locking mechanism 220. As described herein, a “shroud” is a protective cover designed to encase or shield various mechanical components, particularly those involving movement or sensitive functionalities, from external influences such as dirt, debris, moisture, and accidental contact. In some cases, shroud 224 may be constructed from durable, lightweight material that offer high impact resistance and environmental resilience. In some cases, shroud 224 may include a molded KYDEX. In other cases, shroud 224 may be made from metals, wood, or plastics. As a non-limiting example, shroud 224 may withstand the rigors of skateboarding including impacts from falls, strikes against curbs, and long-term exposure to various weather conditions. In one or more embodiments, shroud 224 may be fit around the contours of locking mechanism 220 without hindering the operation or accessibility of components of locking mechanism 220. In some cases, shroud 224 may be removably attached to the bottom surface of deck 202, for example, and without limitation, via snap-fit connections or clips that allow easy removal and reattachment when need. In other cases, screws may be used to attach shroud 224 to bottom surface of deck 202. Further, a second shroud may be used to cover the area of electric propulsion system 122, particularly covering the battery pack and electric motor. Such shroud may include ventilation or cooling slots to prevent overheating of the covered components during extensive use of skateboard 200.

[0054] With continued reference to FIG. 2, in some cases, portable skateboard 200 may include an additional handle 226 positioned at the very end of board after rear wheel assembly 206b, for instance, and without limitation, at the

tail of deck 202. In one embodiment, additional handle 226 may offer flexibility in terms of material composition, including options such as cloth, nylon, rope, or even metal. Notably, additional handle 226 may boast a slim profile and may be in close proximity to latch 222 or the locking bar handle as described above when skateboard 200 is in folded configuration, ensuing the user can grasp locking bar handle and additional handle 226 simultaneously so that board segments 204a-b do not begin unfolding while being carried. Such additional handle 226 may also enhance portable skateboard's 200 carrying ability. As a non-limiting example, additional handle 226 may be crafted from less rigid material or more pliable materials and wound around locking bar handle to achieve a comprehensive security against unintentional unfolding during storage of skateboard 200. Such wrapping action may effectively bolster the stability of the folded configuration and helps prevent unfolding of skateboard 200. For example, and without limitation, when transporting portable skateboard 200 in folded configuration, this dual-handle approach may mirror the convenience of carrying a briefcase. Such arrangement may afford a notably comfortable carrying posture while effectively countering any possibility of the board accidentally unfolding. The synchronized grip on both additional handle 226 and locking bar handle may assure a safe and secure transport experience.

[0055] Now referring to FIG. 3, exemplary embodiments of a set of parts 300 of at least a hinge mechanism is illustrated. At least a hinge mechanism may include one or more pivot blocks 302. As used in this disclosure, a “pivot block” is a mechanical component used as a mounting point and pivot center for one or more rotating parts within at least a hinge mechanism. In some cases, pivot block 302 may include a through hole or bearing surface through which a pivot element (e.g., pin, shaft, or axle) passes, allowing connected components to rotate or swivel around the pivot pint.

[0056] With continued reference to FIG. 3, in one or more embodiments, pivot block 302 may include a blind pivot block, wherein the “blind pivot block,” for the purpose of this disclosure, is a pivot block designed with a non-through hole or recess to accept a pivot element (not shown). Unlike standard pivot block that feature through holes allowing for the pivot element to pass entirely through, blind pivot block may include a closed end 304 where the pivot element only partially enters and does not exit on the other side. In this cases, pivot element such as a pivot pin or shaft may not need to be secure on both ends. In some cases, the dimensions of the blind hole may be precisely engineered to ensure a snug fit for pivot element e.g., a pivot pin or axle while allowing enough room for necessary lubrication and thermal expansion. As a non-limiting example, blind pivot block 302 may include a blind hole having approximately the same diameter as the pin and allows the pin to freely rotate but does not protrude all the way through the part. Considerations for lubrication may reduce wear and ensure smooth operation of parts 300. In some cases, special coatings or self-lubricating material may be employed to enhance the durability and function of pivot block 302.

[0057] With continued reference to FIG. 3, at least a hinge mechanism may include one or more dual pivot blocks 306a-b. As used in this disclosure, a “dual pivot block” is a mechanical component that includes two separate pivoting points integrated into a single unit. In some cases, dual pivot

blocks **306a-b** may function similarly to two individual pivot blocks **302** as described above but may be defined as a single piece to ensure alignment and stability between the two pivot points. In one or more embodiments, each dual pivot block **306a/b** may include two through holes. In some cases, at least one through hole may include a closed end (e.g., dual blind pivot block). As a non-limiting example, at least a hinge mechanism may include one or more first dual pivot blocks **306a**, wherein each first dual pivot block may include a first through hole **308a** and a second hole **308b** with a closed end, and wherein the first through hole **308a** is oriented either to the left or right to the second hole **308b**. Similarly, at least a hinge mechanism may also include one or more second dual pivot blocks **306b**, wherein each second dual pivot block may include a first through hole **308a** and a second hole **308b** with a closed end; however, in this case, the position of first through hole **308a** and second hole **308b** may be reversed.

[0058] With continued reference to FIG. 3, at least a hinge mechanism includes one or more bars **310**. As used in this disclosure, a “bar” is a rigid component that connects two or more pivot points within at least a hinge mechanism, configured to transmit forces and movement from one point to another. Pivot block **302** and/or dual pivot block **306** may use any means to fasten to first board segment or second board segment such as, without limitation, screws, bolts, or rivets, through one or more bores **312** disposed on either end of main surfaces (or top surfaces) **314** of the parts. In some cases, screws and screw holes may be countersunk/tapered so they are flush with the deck surface of skateboard. In one or more embodiments, bar **310** may act as a linkage or lever between pivot blocks **302** and/or dual pivot blocks **306** and helps coordinate the movement of attached board segments. As a non-limiting example, at least a hinge mechanism may include a blind pivot block on either side of the point of rotation **316** (i.e., through hole on either ends of bar **310**). This is so, that when the at least a hinge mechanism is fully assembled, and if both of the pivot blocks are blind, it is impossible for pivot element e.g., a pin to dislocate from the assembly (the closed end of pivot blocks hold the pin in place). In some cases, bars **310** may include various cross-sectional shapes such as, without limitation, rectangular, circular, or I-shaped depending on the required mechanical properties and the direction of the loads skateboard must handle.

[0059] With continued reference to FIG. 3, additionally, or alternatively, bar **310** may include a sufficient main surface area to distribute stress on the board and themselves. Further, bar **310** may include one or more recesses **318** configured for additional locking mechanisms. In some cases, one or more recesses **318** may be strategically placed along the length of bar **310** on the side to interact with corresponding locking element that can be activated to secure bar **310** in specific positions or alignments. When additional locking elements such as, without limitation, spring loaded pins or bolts engaged, movement or rotation of bar **310** may be restricted. In some cases, the shape of recesses **318** may be machined to match the dimension of the corresponding locking elements of additional locking mechanism to provide a tight and secure connection. Further, parts **300** may be made out of a strong material such as 6061 T6 Aluminum or other strong metals and materials. In one or more embodiments, bars **310** may rotate freely about pins, and the said pins may be made out of similarly strong or stronger metals

or material. In some cases, parts **300** including bars **310** and (dual) pivot locks **302-306** may use bushings or preferably self-lubricating bushings.

[0060] Referring now to FIGS. 4A-B, exemplary embodiments of activation and deactivation of locking mechanism of portable skateboard **400** is illustrated. Portable skateboard **400** includes at least a hinge mechanism **402** disposed between bottom surfaces of first board segment **404a** and second board segment **404b**, mechanically connect the two board segments. At least a hinge mechanism **402** may include a plurality of hinge components (not labeled for clarity), each hinge component may include a first hinge node proximate to a rear end of first board segment **404a**, a second hinge node proximate to a front end of second board segment, and a bar linkage connecting the first hinge node and the second hinge node, wherein the bar linkage may be configured to facilitate a rotational movement between first board segment **404a** and second board segment **404b** along lateral axis (or cut) **406**. Hinge nodes may include pivot blocks, blind pivot blocks, dual pivot blocks, dual blind pivot blocks, or any combinations thereof. In some cases, plurality of hinge components may include a first set of hinge components and a second set of hinge components, wherein the first set of hinge components is offset relative to the second set of hinge components along lateral axis, such that when portable skateboard **400** is in folded configuration, the offset forms a nesting arrangement of plurality of hinge components. Nesting arrangement is described in further detail below with reference to FIG. 7.

[0061] With continued reference to FIGS. 4A-B, in one embodiment, at least a hinge mechanism **402** may include a plurality of bars **406a-c** (i.e., bar linkages) configured to provide rotational freedom exceeding 180 degrees and to exhibit a predetermined motion path. Each bar of plurality of bars **406a-c** may be spaced apart by a predefined distance (e.g., a distance equal to a length of a pivot block as described above) from one another, as long as the pivot point (i.e., central axis of hinge node) of at least one bar (**406b**) is positioned in the plane of two projected axis of pivot points of adjacent bar (**406a** and/or **406c**) and lies between the projected axes' extents. This arrangement equally applies to all bars **406a-c**.

[0062] With continued reference to FIGS. 4A-B, as a non-limiting example, for at least a hinge mechanism **402** in a three-bars (or three hinge components) configuration, two dual pivot blocks **408a-b** (at least one dual pivot block being blind) attached to first board segment **406a** may connect to one pivotal end of a first bar (or bar linkage) **406a** and a blind pivot block **410a** in combination with at least one dual blind pivot block **408c** may connect to another pivotal end of the first bar **406a**. In some cases, any dual pivot blocks may be replaced with two pivot blocks, blind pivot blocks, or one of each. A second bar **406b** may offset, a predetermined distance *s*, from first bar **406a** (or third bar **406c**), and may include both pivotal end connected to dual pivot blocks **408d-e**. In some cases, dual pivotal blocks connected to pivotal ends of second bar **406b** may be shared with adjacent bars (first bar **406a** and third bar **406c**); for instance, and without limitation, dual pivotal block **408b** may include a first hole connected to one pivotal end of first bar **406a** on one side and a second hole connected to one pivotal end of second bar **406b** on another side. Similarly, dual pivotal block **408c** may include a first hole connected to another pivotal end of first bar **406b** on one side and a second hole

connected to another pivotal end of second bar **406b**. Further, a third bar **406c** (including connected blind pivot block **410b** and dual pivot blocks **408d-f**) may be symmetrically configured with first bar **406a** along a longitudinal axis of second bar **406b** or latch **412** of locking mechanism **414**. In some cases, dual pivot blocks **408d-e** may be shared with second bar **406b**. In some cases, all dual pivot blocks **408a-f** may be blind. Additionally, or alternatively one or more additional bar linkages may be incorporated to enhance structural rigidity, for instance, and without limitation, at least a hinge mechanism **402** may include a four-bars design as described in further detail below with reference to FIG. 8. These supplementary linkages may be dimensionally identical to and share the same pivotal plane as other bars **406a-c**.

[0063] With continued reference to FIGS. 4A-B, in some cases, an increase in the offset distance *s* between the bars **406a-c** may correlate with a greater separation distance between first board segment **404a** and second board segment **404b** when portable skateboard **400** is in a folded configuration. In some cases, when all pivot points are in the same plane as one another and/or if all bars of plurality of bars **406a-c** are parallel with one another, board segments **404a-b** that are rigidly attached to hinge points may overlap past pivot points (i.e., on top). Such overlap may over constrain the system and restricts any more rotational movement past the unfolded position. In some cases, at least a hinge mechanism **402** may then act as a rigid structure that cannot rotate and therefore does not necessarily need locking mechanism **414**. As a non-limiting example, if two rigidly attached board segments **404a-b** are arranged such that they contact one another when the hinge pivot points are planar (i.e., in unfolded configuration), first board segment **404a** and second board segment **404b** may be used in compression against one another (preferably in the center of the entire length of at least a hinge mechanism) to create an extremely efficient self-supporting structure; however, if board segments **404a-b** are not in compression, at least a hinge mechanism **402** may primarily support all of the force in the gap between segments which result in a bending moment in plurality of bars **406a-c**. In some cases, first board segment **404a** and second board segment **404b** may take away stress on at least a hinge mechanism **402**.

[0064] With continued reference to FIGS. 4A-B, to enhance the stability and safety of portable skateboard **400**, latch **412** of locking mechanism **414** may be spring-loaded. In one embodiment, latch **412** may be affixed to first board segment **404a** at a distinct point, wherein the distinct point may be an initial attachment point, situated close proximity to at least a hinge mechanism **402**. In some cases, locking mechanism **414** may include a precisely manufactured collar **416** which allows latch **412** or locking bar to slide through it. In some cases, collar **416** may be positioned at any point along the length of latch **412** prior to its insertion to locking mechanism **414** and interference with at least a hinge mechanism **402**. In some cases, collar may be machined out of aluminum or any other metal alloys. In some cases, collar may function as a main load bearing guide or a catch feature for a spring **422** and features a centrally cut hole **418**, allowing the collar **416** to be affixed to latch **412**. Tolerances of collar may be less than five thousandths of an inch, preferably less than one thousandth of an inch. Additionally, the cutout for latch **412** may match these tolerances, and the tolerance of latch's **412** proximity to second bar **406b** may

be minimal (i.e., one thousandth of an inch). In some embodiments, collar **416** and latch **412** may be made out of a material that has a high yield strength and resistance to elastic deformation to prevent bending under load.

[0065] With continued reference to FIGS. 4A-B, in some cases, a second attachment point **420**, located near trucks of wheel assembly (not shown), may be used as an additional mounting guide. In some cases, second attachment point **420** may be load bearing, especially when the user is flipping or holding portable skateboard **400**. In one embodiment, second attachment point **420** may be securely screwed into the bottom surface of first board segment **404a**. As a non-limiting example, second attachment point **420** may interact a shaft collar or similar device that may be securely mounted to the sliding locking bar to stop spring **422** from sliding freely on the locking bar and to allow for a compression. As a non-limiting example, spring **422** may be strategically introduced around at least a portion (i.e., between locking mechanism **402** and second attachment point **420**) of latch **412**. In some embodiments, in spring's **422** fully decompress position (i.e., extended state), collar **416** may be positioned adjacent to a body **424** (or a loading bearing guide) of locking mechanism **414**, holding latch **412** at a desired position (on top of at least a hinge mechanism **402**) such that the rotation of at least a hinge mechanism **402** is restricted. Conversely, compression of spring **422** may move collar **416** toward additional attachment point **420**. As a non-limiting example, when user pulls latch **412**, spring **422** compresses, causing the sliding locking bar to move away from at least a hinge mechanism and cease constraining the movement of plurality of bars **406a-c** (particularly second bar **406b**). Upon releasing latch **412** and unfolding portable skateboard **400**, spring **422** may naturally decompress, guiding the locking bar back into position above at least a hinge component. Such automatic action effectively locks board segments **404a-b** in unfolded configuration with no external force applied, providing a secure setup for usage. In some cases, locking mechanism **414** may still perform the same purpose in case where spring **422** is omitted; however, locking mechanism **414** may require external force to manually engage locking bar with at least a hinge mechanism **402**.

[0066] With continued reference to FIGS. 4A-B, in some embodiments, shroud (not shown) as described above with reference to FIG. 2, may cover the area of the locking bar which contains spring **422** and collar **416**, reaching all the way to additional attachment point **420**. In some cases, shroud may include two holes cut out at both ends to allow latch **412** to move freely during its use. In some cases, the hole next to additional attachment point **420** may have a diameter slightly greater than diameter of latch **412** by a few millimeters. The opposite hole may have a diameter slightly greater by a few millimeters than the diameter of the collar **416** that secures spring **422**, allowing for the collar **416** to impact the load bearing guide or body **424** of locking mechanism **414** when decompressed as it can handle more wear than a plastic shroud which may deform from repeated use. As a non-limiting example, shroud as described herein may be designed to protect spring **422** and guide from a buildup of dirt and other contaminants that would decrease latch's **412** ability to slide in and out of its locked position.

[0067] Now referring to FIGS. 5A-B, an exemplary flow for switching portable skateboard **500** from an unfolded configuration to a folded configuration in cross-sectional views are illustrated. In some cases, locking mechanism **502**

may be attached to the bottom surface **504** of first board segment **506a** through one or more dual pivot blocks **508**. As a non-limiting example, a longer pin **510** that span through a first set of dual pivot blocks disposed on both sides of a first bar including the first bar, a body of locking mechanism **502**, and a second set of dual pivot blocks disposed on both sides of a second bar including the second bar. Other fastening means such as, without limitation, screws, bolts, rivets, among others may be used in addition to pivot blocks.

[0068] With continued reference to FIG. 5A, when user pull latch **512** in a first direction **514a** (i.e., a direction towards the tail of second board segment **506b**), spring **516** may be extended and locking mechanism **502** may be activated. When locking mechanism **502** is activated, latch **512** may engage with or atop at least a bar **518** of at least a hinge mechanism; thus, at least in part, securely lock first board segment **506a** and second board segment **506b**.

[0069] With continued reference to FIG. 5B, when user pull latch **512** in a second direction **514b** (i.e., a direction towards the nose of first board segment **506a**), spring **516** may be compressed and locking mechanism **502** may be deactivated. When locking mechanism **502** is deactivated, latch **512** may disengage with or no longer atop at least a bar **518** of at least a hinge mechanism; thus, at least in part, unlock first board segment **506a** and second board segment **506b** to fold portable skateboard **500**.

[0070] Now referring to FIGS. 6A-B, an exemplary embodiment of a wheel-to-wheel folding of a portable skateboard **600** in a side view is illustrated. When portable skateboard **600** is folded, bottom surfaces of first board segment **602a** and second board segment **602b** may be aligned, with respective wheel assemblies **604a-b** adjacent to one another along a vertical axis **606** (i.e., an imaginary line that runs perpendicular to the ground when portable skateboard **600** is held upright). As a non-limiting example, under folded configuration, plurality of bars **608** of at least a hinge mechanism may allow two ends e.g., rear end of first board segment **602a** and front end of second board segment **602b** to separate from one another. Bottom surface of first board segment **602a** and second board segment **602b** may be parallel to one another, or preferably, the separation may be greater to create a stable standing base. As a non-limiting example, when portable skateboard **600** is folded, such wheel-to-wheel folding may allow skateboard **600** to stand upright on its base, which may be the exposed part of separated board segments **602a-b**. In some cases, first wheel assembly **604a** attached to first board segment **602a** may contact with the bottom surface of second board segment **602b** and second wheel assembly **604b** attached to second board segment **602b** may contact with the bottom surface of first board segment **602a**, thereby creating a highly space-efficient structure. Additionally, or alternatively, first board segment **602a** and second board segment **602b** may have longboard grip tape rolled over to respective standing edge, allowing for a more stable grip on the ground; it also protects the board segments **602a-b** from compression when unfolded (i.e., to cushion the folding edge), giving portable skateboard **600** a more seamless look. In other cases, such stable grip and compression protection may also be achieved from various different material attached to cut edges such as, without limitation, rubber gasket or other durable shock absorbing material. In some cases, this self-standing capa-

bility enhance convenience and accessibility, eliminating the need for additional support or surfaces when storing folded portable skateboard **600**.

[0071] With continued reference to FIGS. 6A-B, in an alternative embodiment, when portable skateboard **600** is folded, first wheel assembly **604a** attached to first board segment **602a** and second wheel assembly **604b** attached to second board segment **602b** may not be perfectly aligned along vertical axis **606**, but instead, they may slightly offset each other. In some cases, first wheel assembly **604a** and second wheel assembly **604b** may make direct contact **610** (i.e., a point or area where two wheel assemblies **604a-b** meet or touch each other), in folded configuration, when cut is made at least half of a wheel diameter (and less than a wheel diameter away) from a center of the deck. Such contact **610** may create a “wheel lock” mechanism whereby the wheel assemblies **604a-b** may interlock or engage with each other, preventing skateboard **600** from unfolding unintentionally. As a non-limiting example, when folding portable skateboard **600**, both first wheel assembly **604a** and second wheel assembly **604b** may roll past vertical axis **606**, creating an offset **612** between wheels. Each wheel may restrain the other by partially overlapping in a staggered arrangement, effectively using the geometry of the wheels to lock board segments **602a-b** in folded positions, ensuring skateboard **600** remains stable and stationary without additional supports or locking mechanism while folded. Additionally, or alternatively, first wheel assembly **604a**, second wheel assembly **604b**, or both may include a locking mechanism configured to lock each wheel, for example, and without limitation, through a lever-operated locking mechanism integrated into the hub of the wheels or attached to the trucks and act directly on each wheel. User may flip or push a lever, or press a pin against the interlocked wheel, either on the tread or against the side to prevent wheels from turning once portable skateboard **600** is folded.

[0072] Now referring to FIG. 7, a perspective view of an exemplary embodiment of a nesting arrangement of plurality of hinge components on a portable skateboard **700** is illustrated. Each hinge component may include a pair of at least one bar and at least two pivot blocks connected to the at least one bar on each end. When portable skateboard **700** is in a folded configuration, trucks **702a** of first wheel assembly **704a** attached to first board segment **706a** may contact with a shroud **708** covering electric propulsion system of the portable skateboard **700**, and trucks **702b** of second wheel assembly **704b** attached to second board segment **706b** may contact with bottom surface of first board segment **706a** (or baseplate of first wheel assembly **704a**). In one or more embodiments, top surfaces of both first board segment **706a** and second board segment **706b** may be curved inward, and (left and right) edges may be parallel to each other.

[0073] With continued reference to FIG. 7, as used in this disclosure, a “nesting arrangement” is a configuration in which components are aligned in an alternating pattern to maintain structure integrity and mechanical functions while maximizing spatial efficiency. As a non-limiting example, at least two lateral bars e.g., first bar **710a** and second bar **710** may together form an “X-shape” when viewed from the side. In some cases, in a three-bars setup, two side bars i.e., first bar **710a** and third bar **710c** may pivot inward towards the tail of second board segment **706b** or the nose of first board segment **706a**, while the middle bar i.e., second bar **710b** may extend outward the point of separation. This nesting

arrangement may be made possible by the relative positioning of one or more pivot blocks or dual pivot blocks where the offset between pivot blocks or dual pivot blocks for plurality of bars **710a-c** may allow them to move or rotate without interference. In one or more embodiments, each bar of plurality of bars **710a-c** may be attached to fixed pivot block **712** or dual pivot blocks **714** as described above. In some cases, one or more pivot block and/or dual pivot blocks **714** may be blind.

[0074] Now referring to FIG. 8, an exemplary embodiment of at least a hinge mechanism having additional bar linkages is illustrated. In some cases, portable skateboard **800** may include at least a hinge mechanism having a four-bars configuration. At least a hinge mechanism may include four interconnected bars **802a-d** (two side bars **802a** and **802d**, and two middle bars **802b-c**), each pivoting around their respective pivot points secured by one or more hinge nodes **804** e.g., pivot blocks positioned on bottom surface of board segments **806a-b**, distributing mechanical stress across multiple points, thereby reducing the wear of at least a hinge mechanism. Additional bar linkages may increase the stability and precise control over the folding and unfolding actions. As a non-limiting example, four-bar links may involve two pairs of parallel bars that are symmetrically aligned across the longitudinal axis of skateboard **800**. Such parallel arrangement of the bars may ensure that the motion is guided and restrained, preventing misalignment of the board segments **806a-b** during folding of skateboard **800**.

[0075] Now referring to FIG. 9, an exemplary embodiment of an alternative locking mechanism of portable skateboard **900** is illustrated. In some cases, another possible way to lock board segments **902a-b** in its unfolded configuration is to use a high strength material bent around the side edges of the board. As a non-limiting example, locking mechanism may include sliders **904a-b** (one on each side) that translates along the edges of board segments **902a-b**. In some cases, user may grab and slide sliders **904a-b** across a cut **906** and on both board segments **902a-b** when unfolded, sliders **904a-b** restrict folding. In some embodiments, user may then slide sliders **904a-b** onto solely one board segment which un-restricts folding and allows the user to fold skateboard **900**. In some cases, sliders **904a-b** may be designed to conform to the edges of skateboard's **900** deck with a low tolerance to ensure sufficient locking, but not too low to allow sliding. Additionally, or alternatively, sliders **904a-b** may include a guide channel respectively built into both board segments **902a-b** and a guide rail built into each slider **904a-b** to ensure only one degree of freedom. In some cases, each slider **904a-b** may be designed with a texture, a coating, or a feature to ensure the user has a good enough grip. In some cases, both sliders **904a-b** may be rigidly connected via a bar or by some other means, for example, a bar configured as a handle to translate both sliders simultaneously.

[0076] Now referring to FIG. 10, an exemplary embodiment of an alternative locking mechanism of portable skateboard **1000** is illustrated. In some embodiments, portable skateboard **1000** may include a locking mechanism having a pin **1002** being inserted into a hole **1004** in at least a bar linkage **1006** of a hinge component **1008**. As a non-limiting example, when pin **1002** is inserted, it may restrict movement of the bar linkage **1006**. Additionally, or alternatively, pin **1002** may intersect through a plurality of bar linkages. In some cases, locking mechanism may include a pin

housing **1010** mounted to the bottom surface of a board segment **1012**, adjacent to bar linkage **1006** that is independent of the movement of bar linkage **1006**. In some cases, when pin **1002** is engaged with a bar linkage **1006** or plurality of bar linkages, pin housing **1010** may not move relative to board segment **1012** so bar linkage **1006** may not move relative to the board segment **1012**, and therefore “locking” it. In some embodiments, locking mechanism may include a plurality of similar pin assemblies on at least a hinge component **1008** to achieve desired locking characteristics as described herein.

[0077] With continued reference to FIG. 10, in some cases, pin **1002** or a plurality of pins may either be manually operated, operated using mechanical leverage, operated with a cable, hydraulic, spring loaded, electronic, or any combination thereof. In some embodiments, pin **1002** may be made from a strong material such as, without limitation, steel, or aluminum. As a non-limiting example, locking mechanism may include a dual function cable and manual function that uses a central spring loaded main load bearing pin (MLBP) connected to a smaller diameter shaft with a flange on the end. In some cases, either bar linkage **1006** or the mount for described lock mechanism may have a blind larger diameter hole with a smaller through hole. In some cases, a spring may be inside larger diameter hole and may compress against MLBP base and the closed end of the hole. In some cases, MLBP may include a thinner diameter shaft (e.g., a screw) attached or fastened to MLBP, wherein the shaft may include a flange with a larger diameter than smaller diameter hole at the closed end to prevent spring from forcing the whole assembly through the smaller diameter hole.

[0078] With continued reference to FIG. 10, additionally, or alternatively, locking mechanism may also include a handle, wherein the shaft may slip through a through hole with a smaller diameter than the head/flange of the shaft. For example, and without limitation, if handle is pulled, the shaft and in turn, the MLBP may be pulled as well, resulting in a compression of the spring. When handle is released, the spring may return the whole assembly back to its original position (i.e., pin **1002** may be inserted into either pin housing **1010** or hole **1004** in bar linkage **1006** to restrict movement. Further, handle may include a slot for a cable to travel through, wherein the cable may attach directly or indirectly to shaft flange/head. In some cases, due to the shaft not being connected to handle, when the cable is pulled, the shaft and in turn pin **1002** may be pulled as well, resulting in a compression of the spring. In some embodiments, cable may be operated via many means such as, without limitation, a hand or foot operated lever, a handle, a pedal, electronic, a button, and the like.

[0079] With continued reference to FIG. 10, MLBP may include a rounded or triangular-shaped head so that when hinge component **1008** is being unfolded, the geometry of the head of the MLBP may push in the MLBP with lateral motion of bar linkage **1006** and then snap back into the receiving hole **1004** for MLBP via compression of the spring. In other embodiments, pin **1002** may be built into a flexible holding handle, wherein the pin **1002** may move in and out via rotation of the flexible holding handle. In some cases, ends of the flexible holding handle may include two flares in opposing directions on the same axis configured to act as MLBPs. In some cases, there may be rounded or triangular protrusions tangential to the rotation of such

handle and upon grabbing and rotating such handle, the geometry of the protrusions may result in the flared ends of the handle traveling inwards or outwards depending on the design. This may result in MLBP no longer restricting the movement of hinge component **1008** and allowing hinge component **1008** to fold. In some embodiments, flexible holding handle may be made of a spring like material so that when flexible holding handle is rotated back into original configuration, the spring characteristics of the handle may push MLBP back into the locked position. In further embodiments, locking mechanism may include a spring loaded lever operated by a rigid bar or a cable, wherein the spring loaded lever may include one or more pivot points which allow for the pulling of the cable to cause MLBP to exit receiving hole **1004**. Such lever may be spring loaded to automatically lock when portable skateboard **1000** is in unfolded configuration, and the head of MLBP may include similar geometry as mentioned previously.

[0080] Now referring to FIGS. **11A-B**, an exemplary embodiment of an alternative locking mechanism of a portable skateboard **1100** is illustrated. In some cases, latch may be integrated with at least a bar linkage **1102**. In some cases, any of the folding and/or unfolding of skateboard **1100** as described herein may be locked with integrated latch. As a non-limiting example, at least a bar linkage **1102** may include a notch **1104** and with a restraint bar **1106** (i.e., integrated latch) that has a nub **1108** that fits perfectly in the notch holding it in place. Such restraint bar **1106** may be disengaged with a foot pedal **1110** located at the nose of first board segment **1112a**. In some cases, if a pressure is applied via user's foot, restraint bar **1106** may unlatch from at least a bar linkage **1102** and allows skateboard **1100** to fold. In some embodiments, foot pedal may be directly linked to integrated latch via a steel cable or rod **1114**. As a non-limiting example, pressing foot pedal **1110** will cause skateboard **1100** to fold when foot pedal **1110** is attached to the longer of the two board segments **1112a-b**. In some cases, first board segment **1112a** may be longer than second board segment **1112b**. Additionally, or alternatively, to unlatch latch or restraint bar **1106**, locking mechanism may include a knob **1116**, wherein the knob **1116** may be rotated. Other exemplary embodiments such as, without limitation, a lever, a pin, or a button may be used to provide enough leverage or release stored potential energy to compress spring/latch and pull restraint bar **1106** out of notch **1104**, allowing at least a bar linkage **1102** to move freely again.

[0081] With continued reference to FIGS. **11A-B**, locking mechanism may further include an actuator that is responsible for moving and/or controlling any latch as described herein. An actuator may, in some cases, require a control signal and/or a source of energy or power. In some cases, a control signal may be relatively low energy. Exemplary control signal forms include electric potential or current, pneumatic pressure or flow, or hydraulic fluid pressure or flow, mechanical force/torque or velocity, or even human power. As a non-limiting example, control signal may be received from remote controller or electronic propulsion system as described above. In some cases, actuator may have an energy or power source other than control signal. This may include a main energy source, which may include for example electric power, hydraulic power, pneumatic power, mechanical power, and the like. In some cases, upon receiving a control signal, an actuator may respond by converting source power, for example, electric power from

battery pack into mechanical motion. In some cases, actuator as described herein may be understood as a form of automation or automatic control.

[0082] With continued reference to FIGS. **11A-B**, in one embodiment, actuator may include an electric actuator. Electric actuator may include any electromechanical actuators, linear motors, and the like. In some cases, actuator may include an electromechanical actuator. An electromechanical actuator may convert a rotational force of an electric rotary motor into a linear movement to generate a linear movement through a mechanism. Exemplary mechanisms, include rotational to translational motion transformers, such as without limitation a belt, a screw, a crank, a cam, a linkage, a scotch yoke, and the like. In some cases, control of an electromechanical actuator may include control of a second electric motor, for instance a control signal may control one or more second electric motor parameters to control electromechanical actuator. Exemplary non-limitation second electric motor parameters include rotational position, input torque, velocity, current, and potential. Electric actuator may include a linear motor. In some cases, Linear motors such as, without limitation, flat linear motor, U-channel linear motor, tubular linear motor, and the like may differ from electromechanical actuators, as power from linear motors is output directly as translational motion, rather than output as rotational motion and converted to translational motion. Linear motors may be directly controlled by a control signal for controlling one or more linear motor parameters e.g., position, force, velocity, potential, and current. In another embodiment, actuator may include a mechanical actuator which may function to execute movement by converting one kind of motion, such as rotary motion, into another kind, such as linear motion. An exemplary mechanical actuator includes a rack and pinion. Mechanical actuators may employ any number of mechanism, including for example without limitation gears, rails, pulleys, cables, linkages, and the like.

[0083] Now referring to FIG. **12**, an exemplary embodiment of a board-to-board folding of a portable skateboard **1200** is illustrated. In one embodiment, portable skateboard **1200** includes a deck **1202** defined by a first board segment **1204a** and a second board segment **1204b**, wherein each board segment **1204a-b** may include a top surface, a bottom surface, and at least one wheel assembly attached to the bottom surface. Portable skateboard **1200** also includes at least a hinge mechanism **1206** disposed on the top surfaces of board segments **1204a-b**, mechanically connect the first board segment **1204a** to the second board segment **1204b**, wherein the at least a hinge mechanism **1206** may be configured to rotate board segments **1204a-b** along a lateral axis **1208** passing through at least a hinge mechanism **1206**. Portable skateboard **1200** further includes a locking mechanism **1210** having a latch **1212** configured to interfere with the rotation of at least a hinge mechanism **1206**, selectively securing first board segment **1204a** and second board segment **1204b** in an unfolded configuration of portable skateboard **1200**, wherein top surfaces of board segments **1204a-b** form a continuous planar surface for standing thereon, and in a folded configuration of portable skateboard **1200**, wherein top surfaces of first board segment **1204a** and second board segment **1204b** are adjacent with the respective wheel assemblies facing outward.

[0084] With continued reference to FIG. **12**, as a non-limiting example, at least a hinge mechanism **1206** may

include one or more central hinges attached to top surfaces of board segments **1204a-b** and located near the center of skateboard **1200**. Locking mechanism may include at least two bars **1214a-b**, each having one end mechanically attached to either first board segment **1204a** or second board segment **1204b**, and another end including a through hole **1216** which allows a single pin i.e., latch **1212** to pass through both bars, locking board segments **1204a-b** thereby making a folding point **1218** rigid in unfolded configuration. Conversely, when skateboard **1200** is in folded configuration, latch **1212** may be used as a carrying handle. In some cases, folded skateboard **1200** may stand vertically on the butt of the board and the outward facing wheel assemblies.

[0085] Now referring to FIGS. 13A-B, an exemplary embodiment of a locking mechanism of portable skateboard **1300** being a door latch mechanism is illustrated. In some cases, locking mechanism may include one or more retractable latch **1302** that engages with one or more corresponding catch or recesses **1304** located on at least one bar linkage **1306** to securely lock skateboard **1300** in an unfolded configuration. In some cases, retractable latch **1302** may be operated either manually through a lever or automatically via a loaded spring, ensuring that once engaged, first board segment **1308a** and second board segment **1308b** may remain rigidly connected as one continuous deck. Additionally, or alternatively, locking mechanism may include a carrying handle **1310** attached to at least one bar linkage **1306** or a rod. In some cases, carrying handle **1310** may include a cross-sectional profile that matches with bar linkage **1306**; for instance, and without limitation, carrying handle **1310** may be configured as an additional supporting element for the opposing board segment when skateboard **1300** is in unfolded configuration; however, in folded configuration, as shown in FIG. 13B, at least a hinge mechanism **1312** positioned at the joining edge of each board segment **1308a-b** may allow the board segments **1308a-b** to rotate towards each other along a shared axis. In some cases, at least a hinge mechanism may include one or more leaf hinge attached to the top surface of the deck. In some cases, at least a hinge mechanism **1312** may be configured to stop at certain angle (e.g., less than 180 degrees).

[0086] With continued reference to FIG. 13B, as a non-limiting example, in folded configuration, top surfaces of board segments **1308a-b** may face one another when board segments **1308a-b** fold towards each other. Respective wheel assemblies **1314a-b** attached to first and second board segment **1308a-b** may end up positioned outward. In some cases, wheel assemblies **1314a-b** may be configured as a base for skateboard **1300** to stand vertically, aiding in efficient storage. In some cases, locking mechanism for skateboard **1300** in such folded configuration may be omitted; for instance, and without limitation, user may hold carrying handle **1310** and the weight of board segments **1308a-b** (and corresponding wheel assemblies **1314a-b**) may press them together, and therefore, at least in part, maintaining skateboard **1300** in board-to-board folded configuration (as long as the user holds carrying handle **1310** vertically). This arrangement may facilitate quick transitions between use and transitions between use and transport, enabling user to unfold skateboard **1300** easily and swiftly for riding or fold it for carrying without the need for engaging or disengaging additional locking mechanism.

[0087] With continued reference to FIGS. 13A-B, additionally, or alternatively, at least a hinge mechanism **1312**

may include one or more pins. In some cases, board segments **1308a-b** rotate on either of the pins individually but when all pins are in, it locks the board in place, acting as both at least a hinge mechanism and locking mechanism. As a non-limiting example, skateboard **1300** may include at least two pins; a first pin may be located in the center of the board and a second pin may be located at least one half of a wheel's width away or greater from the first pin. In some cases, when both pins are slid into their housings, both board segments **1308a-b** may be rigidly locked; however, when either pin is removed, board segments **1308a-b** may hinge upon the remaining pin. In a non-limiting embodiment, the first board segment **1308a** may hinge in either direction on first pin and result in multiple different configurations for storage and carrying such as wheels inward or wheels outward. In addition to this, both pins may be removed, and the board will completely separate into two detached segments.

[0088] With continued reference to FIGS. 13A-B, in some embodiments, pins may be individual removable components that can be slid in and out of brackets/housings. In some cases, brackets may be mounted in such a way that when pins are in, board segments **1308a-b** may either rotate about the pin or can be completely locked in place. In some cases, brackets and housings may be mounted on the deck of skateboard **1300**, or alternatively, board segments **1308a-b** themselves may be the housing. In some cases, when skateboard **1300** is in folded configuration, pins may be used as handles for the user to be able to pick up the board. Additionally, or alternatively, board segment geometry, housing/bracket configuration, and pin placement may allow for the pin to be put back into the housing in folded configuration in such a way that the user may grab at least one pin and the at least one pin may support the weight of skateboard **1300** in its entirety. Once pins are in, they may be locked into place by any means as described herein, such as, without limitation, external locking mechanism including a latch or similar device built into pin itself e.g., a pin lock or a quick release pin. Such locking mechanism may prevent pins from unwanted fall out while user is riding. In some cases, pins may also include spring loaded plungers to keep them in place. Further, each pin may be embedded half of a pin's diameter into corresponding board segment. This is because when folding skateboard **1300** in board-to-board configuration, the top surfaces of both board segments **1308a-b** may fold and be completely flush with one another.

[0089] Now referring to FIG. 14, an exemplary embodiment of a training handle is illustrated. In one or more embodiments, deck **1402** may be designed in a way that allow for additional attachment to be easily installed to skateboard **1400**. As a non-limiting example, skateboard **1400** may include a training handle **1404** that user may attach to deck **1402** and hold on to for stabilization. In some cases, training handle **1404** may be collapsible for easy portability. The purpose of installing training handle **1404** is to aid the user in learning how to use skateboard **1400** as described herein. In some cases, training handling **1404** may also help with the overall stability of the user when riding. In some embodiments, training handle **1404** may be a telescoping, a folding handle, or any other means of collapsibility. In some cases, training handle may be locked in either the functional configuration or the folded configuration with any of the aforementioned locking mechanisms or the like. Additionally, or alternatively, training handle **1404**

may have the ability to mount the remote controller of skateboard **1400** as described above, for example, and without limitation, training handle **1404** may optionally include a holder configured to securely hold a remote controller through snap fit such that user no longer need to hold the remote while also holding training handle **1404**. In some cases, remote controller may be integrated into the design of training handle **1404**; for example, and without limitation, user may use the throttle almost like it was built into training handle **1404** in the first place. Alternatively, user may easily dismount remote controller and detach training handle **1404** and use remote controller freely without training handle **1404**. In some cases, training handle **1404** may be mounted using a built in standard screw and a standard thread built into either board segment. As a non-limiting example, training handle may be screw into first board segment **1406** and then be locked into the right orientation for use. Additionally, training handle **1404** may include a bell made of a tough durable material like metal or hard plastic. In some cases, training handle **1404** may be made with a grippy material like rubber. Other exemplary attachment may be a cap that can be removably attached to the end of skateboard **1200** e.g., nose or tail, to protect them from scratches and impact damage.

[0090] Now referring to FIGS. **15A-B**, top down views of an exemplary embodiment of a telescopic portable skateboard **1500** is illustrated. Telescopic portable skateboard **1500** may include a deck defined by a first board segment **1502a**, a second board segment **1502b**, and a telescopic mechanism **1504** interconnecting the first board segment **1502a** and the second board segment **1502b**. In some cases, first board segment **1502a** may include only a nose portion of skateboard **1500** while second board segment **1502b** may include only a tail portion of skateboard **1500**. Each board segment **1502a-b** may include a wheel assembly **1506**, wherein the wheel assembly **1506** may include a truck having a baseplate **1508** attached to the first board segment **1502** on one side and a wheel axle **1510** on the other side. One or more wheels **1512** may rotatably attached to each end of wheel axle **1510**.

[0091] With continued reference to FIG. **15A-B**, as used in this disclosure, a “telescopic mechanism” is a mechanical assembly designed to allow portable skateboard **1500** to expand and contract along a linear path or longitudinal axis of portable skateboard **1500**. In one embodiment, telescopic mechanism **1504**, as shown in FIG. **15A**, may include a plurality of interlocking sections **1514** connected in parallel between first board segment **1502a** and second board segment **1502b**, wherein each interlocking section of the plurality of interlocking sections **1514** may include at least a hinge point (or pivot point) **1514** at each connection between plurality of interlocking sections **1514**, and wherein plurality of interlocking sections is configured to rotate along at each hinge point **1516** thereby extend or retract board segments **1502a-b** along a linear path.

[0092] With continued reference to FIGS. **15A-B**, as a non-limiting example, telescopic mechanism **1504** may include a scissoring structure having a plurality of pairs of intersecting bars that are pivotally connected at their intersections and may extend or retract in a scissor-like manner (i.e., a mechanical movement where two or more interlocking sections **1514** are pivotally interconnected and move in a way that allow them to extend or retract by sliding over each other in a crossing pattern, similar to scissors). In some

cases, each pair of intersecting bars may pivot at its ends to the adjacent pairs or board segment to facilitate a smooth extension and retraction of the deck. In some cases, telescopic mechanism **1504** may be configured such that, in an extended configuration as shown in FIG. **15B**, deck forms a staggered surface which may include one or more gaps (between bars) but remain sufficiently supportive for a user to stand and maneuver portable skateboard **1500** safely.

[0093] With continued reference to FIGS. **15A-B**, in one or more embodiments, telescopic portable skateboard **1500** may include a locking mechanism associated with telescopic mechanism **1504** for securing, for example, and without limitation, plurality of pairs of intersecting bars in both retracted configuration (as shown in FIG. **15A**) and extended configuration (as shown in FIG. **15B**). As a non-limiting example, locking mechanism may include one or more locking pins. Locking pins may be manually inserted into one or more receiving holes that align when scissoring structure reaches a desired extension of contraction. Locking pins may prevent plurality of interlocking sections **1514** from moving once inserted, thereby securing skateboard **1500** in either the fully extended for riding or fully retracted for storage positions. As another non-limiting example, locking mechanism may include a ratchet mechanism integrated into one or more pivot points **1516** with a pawl that engage the ratchet teeth to lock the interlocking sections **1514** at various degrees of extension, allowing for adjustable locking positions along extension path. In such embodiment, telescopic portable skateboard **1500** may include a flexibility in the length of the deck. This may be preferable for user who prefer different board lengths or need to adjust the deck size frequently. In other embodiments, plurality of interlocking sections **1514** may be locked through one or more spring-loaded buttons mounted on one or more bars, which engage with corresponding recess or holes in adjacent bars when fully extended or retracted. In some cases, lock of telescopic mechanism **1504** may be released by pushing the buttons.

[0094] With continued reference to FIGS. **15A-B**, further, locking mechanism of telescopic mechanism **1504** may further include a telescoping rod designed to extend along the length of skateboard, connecting nose and tail or first board segment **1502a** and second board segment **1502b**. In some cases, two ends of telescoping rod may be affixed to the bottom surface of board segments **1502a-b** via one or more screw-tightened collar. When skateboard **1500** is extended, telescoping rod may engage with one or more locking features at both ends to secure the entire structure and restricting any lateral movements of the ends or towards or away from each other. In some cases, telescoping rod itself may include a plurality of segments that may slide within one another. In some cases, each segment of plurality of segments may be attached to each pair of intersecting bars through hinge point **1516**. A locking mechanism within the rod, such as, without limitation, a twist- and lock system, a pin-and-hole arrangement, or otherwise a clamping mechanism, allows it to be fixed at various length depending the extension of telescopic mechanism **1504**. In some embodiments, when a desired length is reached, telescoping rod may be locked in place, stabilizing skateboard **1500** in either its fully extended or fully retracted configuration. It should be noted that the function of telescoping rod as described herein may not be limited to locking skateboard **1500** in a rigid linear arrangement. Telescoping rod may also be

configured to enhance the structural integrity of telescopic portable skateboard **1500** when in use by preventing unwanted flex or bending at the hinge points **1516** of telescopic mechanism **1504**. In some cases, locking mechanism may include a plurality of telescoping rods, as a non-limiting example, three telescoping rod evenly positioned in parallel across the lateral axis of skateboard **1500**. In some cases, plurality of telescoping rods may be adjusted and locked independently or simultaneously.

[0095] With continued reference to FIGS. **16A-B**, top down views of an exemplary embodiment of a telescopic portable skateboard **1600** is illustrated. Telescopic portable skateboard **1600** may include a deck defined by a first board segment **1602a**, a second board segment **1602b**, and a telescopic mechanism **1604** interconnecting the first board segment **1602a** and the second board segment **1602b**. In some cases, first board segment **1602a** may include only a nose portion of skateboard **1600** while second board segment **1602b** may include only a tail portion of skateboard **1600**. Each board segment **1602a-b** may include a wheel assembly **1606**, wherein the wheel assembly **1606** may include a truck having a baseplate **1608** attached to the first board segment **1602** on one side and a wheel axle **1610** on the other side. One or more wheels **1614** may rotatably attached to each end of wheel axle **1610**.

[0096] With continued reference to FIGS. **16A-B**, in one embodiment, telescopic mechanism **1604** may include a plurality of slidable bars **1614a-b** connected in parallel between first board segment **1602a** and second board segment **1602b**. Plurality of slidable bars may include a first set of slidable bars **1602a** having one end attached to first board segment **1602a** and another end rotatably connected a second set of slidable bars attached to second board segment **1602b**. Each slidable bar of plurality of slidable bars **1614a-b** may be equipped with one or more guide rails or tracks along the sides which align with corresponding grooves or channels in adjacent bars. In some cases, guide rails may ensure plurality of slidable bars **1614a-b** to move in a controlled linear manner, maintaining the alignment of deck during both extension and retraction of telescopic mechanism **1604**. User may adjust the length of skateboard **1600** by pulling plurality of slidable bars **1614a-b** or board segments **1602a-b** horizontally along guide rails. Portable skateboard **1600** may include a locking mechanism to lock plurality of slidable bars **1614a-b** at various extended positions along the length of slidable bar. As a non-limiting example, each slidable bar of plurality slidable bars **1614a-b** may include a series of through holes for receiving one or more lock pins **1616a-b**. In some cases, each lock pin **1616a-b** may span through plurality of slidable bars, having a length equal to or slightly greater than a width of the deck. In some cases, plurality of slidable bars **1614a-b**, once extended, may pivot around central axis of an inserted lock pin **1616a** in both direction, for example, allowing portable skateboard **1600** to be folded in either board-to-board configuration or wheel-to-wheel configuration as described above. Telescopic mechanism **1604** and the attached board segments **1602a-b** may be locked in place when an additional lock pin **1616b** is inserted in any of the adjacent holes.

[0097] Now referring to FIG. **17**, an exemplary embodiment of an electric propulsion system **1700** is illustrated. In some cases, electric propulsion system may be disposed on either first board segment or second board segment, in close proximity to wheel assembly **1702**. Electric propulsion

system may include an electric motor **1704**. Electric motor **1704** may include any electric motor as described above with reference to FIGS. **1-2**. In one embodiment, skateboard as described herein may be equipped with a belt-driven motor setup. In some cases, electric motor **1704** may be mounted to bottom surface of the deck **1706**, near a truck **1708** of wheel assembly **1702**. In some cases, electric motor **1704** may be secured to the bottom surface of deck **1706** using one or more brackets made from metal or durable composites. In some cases, electric motor **1704** may be mounted so that it aligns with one or the drive wheel **1710** rotatably attached to hub motor near wheel axle **1712**. As a non-limiting example, electric propulsion system **1700** may include a pulley system **1714**, wherein electric motor **1704** may be equipped with a small pulley, while wheel **1710** may have a larger pulley. The pulleys may be linked by a timing belt **1716**. Such setup may convert high-speed rotation of the motor's rotor into a more powerful, lower-speed turn that drives wheel **1710**, maximizing torque. In one or more embodiments, a reinforced rubber or composite belt may be used to connect motor pulley to wheel pulley. In some cases, belt **1716** may include a plurality of teeth mesh with corresponding teeth on the pulleys to prevent slippage and improve the efficiency of power transfer.

[0098] With continued reference to FIG. **17**, electric propulsion system **1700** may include an electronic speed controller (ESC) **1718** configured to control the speed of communicatively connected electric motor **1704** based on signals, for example, inputs from rider via a handheld remote controller as described above with reference to FIG. **1**. In one or more embodiments, ESC may be configured to handle braking by reversing electric motor's **1704** direction. In some cases, ESC may also be configured to provide regenerative braking capabilities that help recharge battery pack **1720** during use. In some cases, ESC **1718** may include a single motor control ESC designed to control a single motor by regulating the speed based on inputs from communicatively connected remote controller and manage braking functions. In cases where electric propulsion system **1700** having more than one electric motors, for example, when electric propulsion system includes two electric motors, a dual motor ESC may be used to independently control the two motors. This may be useful in a skateboard having an all-wheel-drive configuration, allowing for a more precise power distribution and handling. In some cases, dual motor ESC may improve traction and stability of skateboard on uneven surface or when turning. In some cases, ESC **1718** may include a programmable circuit, for example, and without limitation, ESC **1718** may be connected to one or more computing device, allowing user to program or customize one or more pre-defined settings such as, without limitation, acceleration curves, braking intensity, power management, and/or the like according to user's personal riding preferences or specific conditions. Additionally, or alternatively, ESC **1718** may be waterproof. In some cases, ESC **1718** may be enclosed in a temper proof housing. In other cases, ESC **1718** may be housed by the skateboard's deck itself.

[0099] With continued reference to FIG. **17**, electric propulsion system **1700** may include at least one battery pack **1720**. In some cases, electric propulsion system **1700** may include a plurality of battery packs **1720** connect through each other to one common battery management system (BMS) and ESC as described above. Electric propulsion

system 1700 may be configured to both control the electric motor 1704 and control the balance charging of plurality of battery cells 1722 in each of the packs. In some cases, battery pack 1720 may include series and/or parallel configurations a plurality of battery cells 1722. As a non-limiting example, at least one battery pack 1720 may include 6, 8, 10, 12, 14, 16, 18, and 20 battery cells 1722 connected in series and electric propulsion system 1700 may include a second battery pack 1720b electrically connected to at least one battery pack 1720a in parallel. In some cases, battery cells 1722 in series connection may boost the voltage output of the battery pack (with each cell's voltage summing up to give the total voltage of the pack), for example, and without limitation, if each cell has a normal voltage of 3.6V, a battery pack having 10s configuration may have a total pack voltage of 36V; however, battery cells in parallel may increase the capacity (Ah) while maintaining the same voltage. As a non-limiting example, when two battery packs 1720a-b are connected in parallel, battery pack's overall capacity may be doubled, enabling longer usage periods without altering the voltage. Parallel connection may effectively pool amp-hour (Ah) capacities of two battery packs 1720a-b, offering increased current delivery capability and energy reserve.

[0100] With continued reference to FIG. 17, in some cases, each battery pack 1720a/b may include a printed circuit board (PCB) 1724 that monitors an overall voltage of the pack and/or voltage of each individual battery cell 1722. In one embodiment, PCB 1724 may be configured to preventing overcharge and deep discharge conditions by continuously monitoring and balancing plurality of battery cells 1722. As a non-limiting example, when two battery packs 1720a-b are connected in parallel, PCB 1724 may compare the voltages of battery packs 1720a-b. In some cases, connecting two battery packs with large voltage differential may lead to rapid, uncontrolled current flow from the higher voltage pack to the lower, potentially causing overheating, damage, or even thermal runaway of the connected battery packs. PCB 1724, in these cases, may be configured to ensure that the voltage of two battery packs must be within a specified allowable range before allowing parallel connection. PCB 1724 may be configured as a safeguard that helps in maintaining balanced charging/discharging cycles and prolong the overall battery system's life. In other embodiments, if voltage difference between two packs is too great, PCB 1724 may prevent such connection, thereby avoiding possible electrical mismatches that can lead to operational hazards. In some cases, at least one battery pack 1720a and/or second battery pack 1720b may be swapped for maintenance or replaced by new battery packs over time. Swappable battery pack is further described below with reference to FIG. 18.

[0101] With continued reference to FIG. 17, as a non-limiting example, when a plurality of battery packs are connected, PCB 1724 may identify a battery pack with the highest voltage and discharge it first. By discharging the highest voltage pack first, electric propulsion system 1700 may ensure that no single battery pack remains at a significantly higher charge state than other battery packs. As another non-limiting example, PCB 1724 may be configured to discharge the highest voltage pack until it reaches a voltage level that is within an allowable range of the other packs. Conversely, and in yet another non-limiting example, when charging, PCB 1724 may prioritize battery pack with the lowest voltage. In some cases, such battery pack may be

charged first to elevate its voltage to match the average levels of the other packs before to charge them in parallel. Only once the voltage are sufficiently aligned (i.e., the previously lowest voltage pack reaches a level comparable to the other battery packs), PCB 1724 may then allow plurality of battery packs to be connected in parallel for further charging. Even if a battery pack with a higher voltage is connected behind another pack with a lower voltage, PCB 1724 of battery pack in front of the higher voltage pack may bypass its own battery pack, allowing current from the higher voltage pack to flow through it (and to electric motor 1704) without interacting with its own battery pack. Once the higher voltage pack achieves a similar voltage to the PCB's pack, it may then activate and connect the two packs in parallel with one another and discharge both safely at the same rate.

[0102] With continued reference to FIG. 17, in some embodiments, electric propulsion system 1700 may include at least one battery pack 1720a having PCB 1724 being a "front pack" that can recognize when connected "behind pack" i.e., second battery pack 1720b has a higher voltage. In such instance, front pack's PCB 1724 may be configured to "bypass" its own battery cells 1722, allowing current from behind pack to flow directly to electric motor 1704. In some cases, such bypass functionality may prevent lower voltage pack from being subjected to the stress of a higher voltage, which could lead to excessive current draw and potential damage. Electric propulsion system 1700 may use electrical energy of a higher voltage pack first by allowing the current from the higher voltage pack directly power electric motor 1704, thus, at least in part, helping to level out the voltage difference over time. Similarly, when two battery packs 1720a-b are being charged while connected, PCB 1724 may direct the charging voltage/current through each other to the lowest voltage pack, and once that pack achieves a similar voltage, PCB 1724 may then connect packs in parallel and at least one BMS may charge both battery packs 1724a-b in parallel simultaneously.

[0103] With continued reference to FIG. 17, in some cases, plurality of battery packs 1720a-b may be modular. In one or more embodiments, battery packs 1720a-b may include one or more alignment features 1726. As used in this disclosure, an "alignment feature" is any mechanical design that aid in the correct positioning and secure fitting of two structural elements. As a non-limiting example, modular battery packs 1720a-b may be designed with snap, click, or latch mechanism that allow them to securely connect to each other. Similarly, these mechanism may be employed to attach plurality of modular battery packs 1720a-b directly to deck 1706, for example, and without limitation, via one or more snapping components that fit into corresponding receptacles on deck 1706, clicking into place with a simple push, or latching through a lever or similar device that locks battery packs 1720a-b in position. Additionally, or alternatively, alignment features 1726 may include a rail system that allow one or more battery packs to slide in and out easily. As a non-limiting example, battery packs 1720a-b may be mounted to and removed from skateboard by traveling along a secure line. In some cases, rail system may include one or more locking mechanism at certain points along the rail to secure the battery pack in its operational position, preventing the pack from sliding or detaching

during maneuvers or when skateboard is in motion. Modular battery pack is described in further detail below with reference to FIGS. 19A-B.

[0104] With continued reference to FIG. 17, additionally, or alternatively, user may carry extra charged packs and swap them as needed, extending the range and usage time of skateboard without needing a prolonged recharge period. User may customize the energy capacity of skateboard by choosing different numbers or sizes of battery packs according to specific needs. In some cases, electric propulsion system 1700 may be housed within an impact-resistant and waterproof or water-resistant casing e.g., a shroud as described above. In some embodiment, user may be able to bring described skateboard including electric propulsion system 1700 on airplanes. As a non-limiting example, if an individual battery pack is under 100 WH or the allowable limit for an airline, user may disconnect one or more battery packs from other battery packs and bring remaining battery packs on skateboard individually. It should be noted that modular battery packs as described herein do not have to solely apply to electric longboards.

[0105] With continued reference to FIG. 17, for the scenario where battery packs 1720a-b or ESC 1718 is on the opposite board segment to the motorized wheel 1710, electric propulsion system 1700 may transmit power to the wheels through one or more contact points located in the cut ends of both board segments. In some cases, contact points may act in a way such that when skateboard is in unfolded configuration and ready for riding, contact point on one board segment may contact the respective positive and negative or other contact on the other board segment, allowing for a secure power transmission and for folding. Preferably, the contact points may be recessed into corresponding board segments when skateboard is in folded configuration to prevent shorting the battery or system when set on the ground which could potentially be a conductive surface. Such recession may either be built into the board segments, or it can be achieved via a mechanism. As a non-limiting example, contact point may be a magnet on a tension spring. When skateboard is in the unfolded configuration, the magnets of opposing contact points may be attracted to one another with a force greater than the spring via magnetism, ultimately making the contact. When the board folds, the magnets may detach from one another non-destructively and thus, at least in part, the springs may no longer have an opposing tension force, causing the magnets to recess into the corresponding board segment. As another non-limiting example, contact points may protrude from one side and the opposing contact points be recessed and when folded, the protruded contacts would protrude into the recession and make contact. In some cases, recessed contact points may be on the board segment having battery pack attached to prevent shorting when set on a conductive surface. Additionally, or alternatively, electric propulsion system 1700 may further include a power switch 1728 to cut power off when in the folded configuration. In some cases, switch 1728 may be activated by the user or it may be activated via a mechanism related to the folding action of the board such as a contact switch.

[0106] Now referring to FIG. 18, an exemplary embodiment of a swappable battery pack 1800 is illustrated. As a non-limiting example, electric propulsion system may include a swappable battery pack 1800. Swappable battery pack 1800 may include a rectangular casing 1802. In some

cases, casing 1802 may be made from durable, lightweight material such as hard plastic or metal to protect internal battery cells from mechanical damage and environmental elements. Swappable battery pack 1800 may include a plurality of connector or ports 1804 located on one end. As a non-limiting example, swappable battery pack 1800 may include a port for connecting the battery pack to other electronic devices within electric propulsion system, such as electric motor and any other devices it powers. In some cases, ports 1804 may include a charging port configured to charging battery pack 1800 when plugged in. In one or more embodiments, swappable battery pack 1800 may include a physical locking mechanism 1806, for example, and without limitation, one or more protrusions or tabs disposed on one or more sides of the battery pack 1800 designed to slot into one or more corresponding fittings on bottom surface of skateboard, securing swappable battery pack 1800 in place during use and allow easy release when it is depleted and need to be swapped out for charging. In some cases, swappable battery pack 1800 may be charged without detach it from the skateboard. Additionally, and alternatively, swappable battery pack 1800 may include any integrated electronics as described above with reference to FIG. 17, such as, without limitation, PCB, BMS, ESC, and/or the like. It should be noted that skateboard as described in this disclosure may require extended use beyond single charge capacity of one battery pack. User may easily carry one or more spare batteries in a bag or even in a pocket for a smaller battery pack design.

[0107] Now referring to FIGS. 19A-B, exemplary embodiments of modular battery pack are illustrated. Modular battery packs 1900 may be structured into a plurality of independent battery modules 1902a-e, each battery module of the plurality of battery modules 1902a-e may house a set of battery cells (not shown). Individual battery module may be replaced or maintained without needing to service the entire modular battery pack 1900. In one or more embodiments, each battery module of plurality of battery modules 1902a-e may be encased in a separate shell configured to protect the set of battery cells from physical impacts, environmental factors, and electrical interference, wherein the shell may be constructed from durable, lightweight material such as hard plastic or metal. In some cases, PCB 1904 may be integrated in each battery module of plurality of battery modules 1902a-e (e.g., each battery module may include its own BMS), or in other cases, plurality of battery modules 1902 may share a single PCB 1904 housing a common BMS. As a non-limiting example, modular battery pack 1900 may include a single PCB disposed in a “head battery module” e.g., battery module 1902a. In some cases, head battery module 1902a may be mounted in close proximity to electric motor or at least a wheel assembly as described above with reference to FIG. 17. In some cases, each battery module of plurality of battery modules 1902a-e may include one or more connectors or ports 1906 on both ends supporting electrical connections between adjacent battery modules.

[0108] As a non-limiting example, and as shown in FIG. 19B, ports 1906 may include one or more high-current connectors designed to handle output power of modular battery pack 1900 or a subsequent battery module. For example, each battery module of plurality of battery modules 1902a-e may include an Anderson or XT90 plugs. In some cases, ports 1906 may include a dedicated charging port necessary for recharging modular battery pack 1900. In

some cases, charging port may support one or more communication protocols such as CAN bus or power line communication (PLC), for example, and without limitation, modular battery pack's **1900** charging parameters may be adjusted based on battery modules' condition when a charger is plugged. Additionally, or alternatively, one or more ports **1906** may be used for (battery) data transmission, for example, and without limitation, data regarding battery status, diagnostics, control commands, among others may be transmitted between BMS of each battery module or other system components e.g., remote controller and/or a central controller of electric propulsion system. In some embodiments, ports **1906** may be inter-module connectors; for instance, individual battery module may be connected using one or more busbars or high-grade electrical cables capable of handling required current and voltage. In some cases, inter-module connections may include one or more safe features, such as, without limitation, quick disconnects or fuses to isolate modules if needed. As a non-limiting example, safety ports e.g., emergency disconnect switches or breakers may be integral to large battery packs and may be used to physically disconnect electrical continuity in emergency situations or for maintenance purposes, preventing accidental discharge or exposure of live circuits. Plurality of battery modules **1902a-e** may be connected in series to achieve a desired voltage level necessary for riding as described above with reference to FIG. 17. In some cases, parallel connections may be employed to increase modular battery pack's **1900** capacity and provide redundancy. When plurality of battery modules **1902a-e** may be used together, connected either in series or parallel.

[0109] With continued reference to FIG. 19B, in one or more embodiments, each individual battery module **1902** may include one or more locking mechanisms **1908a-b** designed to securely attach battery module **1902** with adjacent battery modules and/or skateboard or electric propulsion system it powers. As a non-limiting example, each individual battery module **1902** may include at least one inter-module locks. In some cases, each individual battery module **1902** may include two locks disposed on each side of the battery module **1902**. In some cases, inter-module locks may include a latch that can engage with a corresponding fixture **1908b** on an adjacent module, allowing multiple battery modules to be securely connected side-by-side as shown in FIG. 19A. In some cases, latch of inter-module lock may be designed like any latch as described herein, for example, and without limitation, latch may include a lever or a pull mechanism that, when activated, either extends or retract a bolt or hook **1910** that interlocks with a receiving part **1908b** on the neighboring module (similar to door latch mechanism as described above with reference to FIGS. 13A-B), wherein the receiving part **1908b** may include a release button **1912** that, when pressed by user, disengages hook **1910**, allowing for a separation of the interconnected battery modules. Locking mechanisms may ensure that plurality of battery modules **1902a-3e** remain tightly coupled during operation, preventing any relative movement that may lead to disconnections or electrical interruptions under normal conditions and vibrations during ride.

[0110] With continued reference to FIG. 19B, additionally, or alternatively, each individual battery module **1902** may include an additional locking mechanism **1914** configured to attach module securely to the deck. As a non-limiting

example, additional locking mechanism **1914** may include a sliding lock positioned vertically on at least one side of battery module **1902** which engage with a fixed mount on the bottom surface of the deck (or the fix mount may be integrated within the deck). In some cases, additional locking mechanism or any aforementioned locking mechanism may be operated either manually or automatically once the module is correctly positioned. Once locked, plurality of battery module **1902a-e** or the entire modular battery pack **1900** may not be dislodged from its mounts without deliberate retraction of the latch. In some cases, both inter-module lock and additional locking mechanism **1914** may be identical. Further, each individual battery module **1902** may include one or more protrusions or tabs **1916a** disposed on one or more sides of the battery module **1902** slot into one or more corresponding fittings **1916b** on opposite sides of neighboring battery module, similar to the swappable battery pack as described above with reference to FIG. 17.

[0111] It is to be noted that any one or more of the aspects and embodiments described herein may be conveniently implemented using one or more machines (e.g., one or more computing devices that are utilized as a user computing device for an electronic document, one or more server devices, such as a document server, etc.) programmed according to the teachings of the present specification, as will be apparent to those of ordinary skill in the computer art. Appropriate software coding can readily be prepared by skilled programmers based on the teachings of the present disclosure, as will be apparent to those of ordinary skill in the software art. Aspects and implementations discussed above employing software and/or software modules may also include appropriate hardware for assisting in the implementation of the machine executable instructions of the software and/or software module.

[0112] Such software may be a computer program product that employs a machine-readable storage medium. A machine-readable storage medium may be any medium that is capable of storing and/or encoding a sequence of instructions for execution by a machine (e.g., a computing device) and that causes the machine to perform any one of the methodologies and/or embodiments described herein. Examples of a machine-readable storage medium include, but are not limited to, a magnetic disk, an optical disc (e.g., CD, CD-R, DVD, DVD-R, etc.), a magneto-optical disk, a read-only memory "ROM" device, a random access memory "RAM" device, a magnetic card, an optical card, a solid-state memory device, an EPROM, an EEPROM, and any combinations thereof. A machine-readable medium, as used herein, is intended to include a single medium as well as a collection of physically separate media, such as, for example, a collection of compact discs or one or more hard disk drives in combination with a computer memory. As used herein, a machine-readable storage medium does not include transitory forms of signal transmission.

[0113] Such software may also include information (e.g., data) carried as a data signal on a data carrier, such as a carrier wave. For example, machine-executable information may be included as a data-carrying signal embodied in a data carrier in which the signal encodes a sequence of instruction, or portion thereof, for execution by a machine (e.g., a computing device) and any related information (e.g., data structures and data) that causes the machine to perform any one of the methodologies and/or embodiments described herein.

[0114] Examples of a computing device include, but are not limited to, an electronic book reading device, a computer workstation, a terminal computer, a server computer, a handheld device (e.g., a tablet computer, a smartphone, etc.), a web appliance, a network router, a network switch, a network bridge, any machine capable of executing a sequence of instructions that specify an action to be taken by that machine, and any combinations thereof. In one example, a computing device may include and/or be included in a kiosk.

[0115] FIG. 20 shows a diagrammatic representation of one embodiment of a computing device in the exemplary form of a computer system 2000 within which a set of instructions for causing a control system to perform any one or more of the aspects and/or methodologies of the present disclosure may be executed. It is also contemplated that multiple computing devices may be utilized to implement a specially configured set of instructions for causing one or more of the devices to perform any one or more of the aspects and/or methodologies of the present disclosure. Computer system 2000 includes a processor 2004 and a memory 2008 that communicate with each other, and with other components, via a bus 2012. Bus 2012 may include any of several types of bus structures including, but not limited to, a memory bus, a memory controller, a peripheral bus, a local bus, and any combinations thereof, using any of a variety of bus architectures.

[0116] Processor 2004 may include any suitable processor, such as without limitation a processor incorporating logical circuitry for performing arithmetic and logical operations, such as an arithmetic and logic unit (ALU), which may be regulated with a state machine and directed by operational inputs from memory and/or sensors; processor 2004 may be organized according to Von Neumann and/or Harvard architecture as a non-limiting example. Processor 2004 may include, incorporate, and/or be incorporated in, without limitation, a microcontroller, microprocessor, digital signal processor (DSP), Field Programmable Gate Array (FPGA), Complex Programmable Logic Device (CPLD), Graphical Processing Unit (GPU), general purpose GPU, Tensor Processing Unit (TPU), analog or mixed signal processor, Trusted Platform Module (TPM), a floating point unit (FPU), system on module (SOM), and/or system on a chip (SoC).

[0117] Memory 2008 may include various components (e.g., machine-readable media) including, but not limited to, a random-access memory component, a read only component, and any combinations thereof. In one example, a basic input/output system 2016 (BIOS), including basic routines that help to transfer information between elements within computer system 2000, such as during start-up, may be stored in memory 2008. Memory 2008 may also include (e.g., stored on one or more machine-readable media) instructions (e.g., software) 2020 embodying any one or more of the aspects and/or methodologies of the present disclosure. In another example, memory 2008 may further include any number of program modules including, but not limited to, an operating system, one or more application programs, other program modules, program data, and any combinations thereof.

[0118] Computer system 2000 may also include a storage device 2024. Examples of a storage device (e.g., storage device 2024) include, but are not limited to, a hard disk drive, a magnetic disk drive, an optical disc drive in com-

bination with an optical medium, a solid-state memory device, and any combinations thereof. Storage device 2024 may be connected to bus 2012 by an appropriate interface (not shown). Example interfaces include, but are not limited to, SCSI, advanced technology attachment (ATA), serial ATA, universal serial bus (USB), IEEE 1394 (FIREWIRE), and any combinations thereof. In one example, storage device 2024 (or one or more components thereof) may be removably interfaced with computer system 2000 (e.g., via an external port connector (not shown)). Particularly, storage device 2024 and an associated machine-readable medium 2028 may provide nonvolatile and/or volatile storage of machine-readable instructions, data structures, program modules, and/or other data for computer system 2000. In one example, software 2020 may reside, completely or partially, within machine-readable medium 2028. In another example, software 2020 may reside, completely or partially, within processor 2004.

[0119] Computer system 2000 may also include an input device 2032. In one example, a user of computer system 2000 may enter commands and/or other information into computer system 2000 via input device 2032. Examples of an input device 2032 include, but are not limited to, an alpha-numeric input device (e.g., a keyboard), a pointing device, a joystick, a gamepad, an audio input device (e.g., a microphone, a voice response system, etc.), a cursor control device (e.g., a mouse), a touchpad, an optical scanner, a video capture device (e.g., a still camera, a video camera), a touchscreen, and any combinations thereof. Input device 2032 may be interfaced to bus 2012 via any of a variety of interfaces (not shown) including, but not limited to, a serial interface, a parallel interface, a game port, a USB interface, a FIREWIRE interface, a direct interface to bus 2012, and any combinations thereof. Input device 2032 may include a touch screen interface that may be a part of or separate from display 2036, discussed further below. Input device 2032 may be utilized as a user selection device for selecting one or more graphical representations in a graphical interface as described above.

[0120] A user may also input commands and/or other information to computer system 2000 via storage device 2024 (e.g., a removable disk drive, a flash drive, etc.) and/or network interface device 2040. A network interface device, such as network interface device 2040, may be utilized for connecting computer system 2000 to one or more of a variety of networks, such as network 2044, and one or more remote devices 2048 connected thereto. Examples of a network interface device include, but are not limited to, a network interface card (e.g., a mobile network interface card, a LAN card), a modem, and any combination thereof. Examples of a network include, but are not limited to, a wide area network (e.g., the Internet, an enterprise network), a local area network (e.g., a network associated with an office, a building, a campus or other relatively small geographic space), a telephone network, a data network associated with a telephone/voice provider (e.g., a mobile communications provider data and/or voice network), a direct connection between two computing devices, and any combinations thereof. A network, such as network 2044, may employ a wired and/or a wireless mode of communication. In general, any network topology may be used. Information (e.g., data, software 2020, etc.) may be communicated to and/or from computer system 2000 via network interface device 2040.

[0121] Computer system **2000** may further include a video display adapter **2052** for communicating a displayable image to a display device, such as display device **2036**. Examples of a display device include, but are not limited to, a liquid crystal display (LCD), a cathode ray tube (CRT), a plasma display, a light emitting diode (LED) display, and any combinations thereof. Display adapter **2052** and display device **2036** may be utilized in combination with processor **2004** to provide graphical representations of aspects of the present disclosure. In addition to a display device, computer system **2000** may include one or more other peripheral output devices including, but not limited to, an audio speaker, a printer, and any combinations thereof. Such peripheral output devices may be connected to bus **2012** via a peripheral interface **2056**. Examples of a peripheral interface include, but are not limited to, a serial port, a USB connection, a FIREWIRE connection, a parallel connection, and any combinations thereof.

[0122] The foregoing has been a detailed description of illustrative embodiments of the invention. Various modifications and additions can be made without departing from the spirit and scope of this invention. Features of each of the various embodiments described above may be combined with features of other described embodiments as appropriate in order to provide a multiplicity of feature combinations in associated new embodiments. Furthermore, while the foregoing describes a number of separate embodiments, what has been described herein is merely illustrative of the application of the principles of the present invention. Additionally, although particular methods herein may be illustrated and/or described as being performed in a specific order, the ordering is highly variable within ordinary skill to achieve methods, systems, and software according to the present disclosure. Accordingly, this description is meant to be taken only by way of example, and not to otherwise limit the scope of this invention.

[0123] Exemplary embodiments have been disclosed above and illustrated in the accompanying drawings. It will be understood by those skilled in the art that various changes, omissions and additions may be made to that which is specifically disclosed herein without departing from the spirit and scope of the present invention.

What is claimed is:

1. A portable skateboard comprising:

a deck defined by a first board segment and a second board segment, wherein each board segment comprises a top surface, a bottom surface, and at least one wheel assembly attached to the bottom surface;

at least a hinge mechanism disposed on the bottom surfaces of the board segments, mechanically connect the first board segment to the second board segment, wherein the at least a hinge mechanism is configured to rotate the board segments along a lateral axis passing through the at least a hinge mechanism; and

a locking mechanism having a latch configured to interfere with the rotation of the at least a hinge mechanism, selectively securing the first board segment and the second board segment:

in an unfolded configuration of the portable skateboard, wherein the top surfaces of the board segments form a continuous planar surface for standing thereon; and

in a folded configuration of the portable skateboard, wherein the bottom surfaces of the first board segment and the second board segment are aligned, with

the respective wheel assemblies adjacent to one another along a vertical axis.

2. The portable skateboard of claim **1**, wherein the first board segment comprises a nose portion.

3. The portable skateboard of claim **1**, wherein the second board segment comprises a tail portion.

4. The portable skateboard of claim **1**, wherein the deck comprises a cut orthogonally separating the first board segment and the second board segment, and wherein the cut is positioned at least half of a wheel diameter away from a center of the deck.

5. The portable skateboard of claim **1**, wherein the at least a hinge mechanism comprises:

a plurality of hinge components, wherein each hinge component of the plurality of hinge components comprises:

a first hinge node proximate to a rear end of the first board segment;

a second hinge node proximate to a front end of the second board segment; and

a bar linkage connecting the first hinge node and the second hinge node, wherein the bar linkage is configured to facilitate a rotational movement between the first board segment and the second board segment along the lateral axis.

6. The portable skateboard of claim **5** wherein the second hinge node comprises a blind pivot block and the first hinge node comprises a dual blind pivot block.

7. The portable skateboard of claim **5**, wherein the plurality of hinge components comprises:

a first set of hinge components; and

a second set of hinge components, wherein the first set of hinge components is offset relative to the second set of hinge components along the lateral axis, such that when the portable skateboard is in the folded configuration, the offset forms a nesting arrangement of the plurality of hinge components.

8. The portable skateboard of claim **5**, wherein the bar linkage comprises one or more recesses configured for receiving an additional locking element to secure the bar linkage to the bottom surfaces of the deck in the unfolded configuration.

9. The portable skateboard of claim **8**, wherein the recesses comprises a receiving hole and the additional locking element comprises a locking pin.

10. The portable skateboard of claim **8**, wherein the recesses comprises at least one notch and the additional locking element comprises a restraint bar having a nub.

11. The portable skateboard of claim **1**, wherein the locking mechanism comprises a spring, positioned between a collar and an attachment point affixed to the bottom surface of the first board segment approximate to the at least a wheel assembly, configured to hold the latch at a decompress position thereby restricting the rotation of the at least a hinge mechanism.

12. The portable skateboard of claim **11**, wherein the locking mechanism comprises a shroud covering the spring.

13. The portable skateboard of claim **1**, further comprising an electronic propulsion system including at least one electric motor mechanically coupled to at least one wheel assembly.

14. The portable skateboard of claim **13**, wherein the electronic propulsion system further comprises at least one modular battery removably attached to the bottom surfaces of the deck.

15. A portable skateboard comprising:

a deck defined by a first board segment and a second board segment, wherein each board segment comprises a top surface, a bottom surface, and at least one wheel assembly attached to the bottom surface;

at least a hinge mechanism disposed on the top surfaces of the board segments, mechanically connect the first board segment to the second board segment, wherein the at least a hinge mechanism is configured to rotate the board segments along a lateral axis passing through the at least a hinge mechanism; and

a locking mechanism having a latch configured to interfere with the rotation of the at least a hinge mechanism, selectively securing the first board segment and the second board segment:

in an unfolded configuration of the portable skateboard, wherein the top surfaces of the board segments form a continuous planar surface for standing thereon; and in a folded configuration of the portable skateboard, wherein the top surfaces of the first board segment and the second board segment are adjacent with the respective wheel assemblies facing outward.

16. The portable skateboard of claim **1**, wherein the first board segment comprises a nose portion.

17. The portable skateboard of claim **1**, wherein the second board segment comprises a tail portion.

18. The portable skateboard of claim **15**, wherein the deck comprises a cut orthogonally separating the first board segment and the second board segment, positioned at a center of the deck.

19. The portable skateboard of claim **15**, wherein the at least a hinge mechanism comprises at least a leaf hinge.

20. The portable skateboard of claim **13**, wherein the locking mechanism comprises a door latch mechanism and wherein the latch comprises a retractable latch.

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