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FOLDING TRICYCLE

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] This application claims the benefit of priority under 35 USC §119(e) of U.S. Provisional Patent Application No. 62/814,900 filed March 7, 2019, entitled “COLLAPSIBLE MOTORIZED BICYCLE”, the contents of which are incorporated herein by reference in their entirety.

FIELD OF THE INVENTION

[0002] The invention relates to the field of vehicles, and more specifically to folding vehicles.

BACKGROUND

[0003] Bicycles have been in use as transportation vehicles since the late 19th century, and may be any human-powered, single-track vehicle, having two inline wheels attached to a frame. Tricycles have three wheels, where two wheels are concentric either in the front of the frame or the rear of the frame. Tricycles have the advantage of being more stable than bicycles and easier to balance while stopping. Push bicycles, considered the forerunners to modern bicycles, were introduced to the public in 1817, where a rider sat on a wooden frame supported by two wheels in line, and pushed the bicycle along with the feet while steering with the hands. Push bicycles are still used for children before they are ready for mechanically propelled bicycles.

[0004] Folding bicycles are designed to compactly fold into a smaller size for transport or storage. Folding mechanisms include mid folding, vertical folding, triangle hinge folding, breakaway folding, and/or the like. The folding mechanisms generally add weight and cost over ordinary bicycles but provides the convenience of a more compact size for storage, transport, and/or the like.

[0005] Electric bicycles are the driving electric motor-powered versions of motorized bicycles and include an electric motor and battery to assist in propelling the bicycle forward. The power of the electric motors varies from low power assisting motors to high powered driving motors that can propel the bicycle up to and over 60 kilometers

per hour. Electric bicycles have become popular as the battery and motor technology have advanced, resulting in lighter weight, lower cost, and farther travel range.

[0006] The foregoing examples of the related art and limitations related therewith are intended to be illustrative and not exclusive. Other limitations of the related art will become apparent to those of skill in the art upon a reading of the specification and a study of the figures.

SUMMARY

[0007] The following embodiments and aspects thereof are described and illustrated in conjunction with systems, tools and methods which are meant to be exemplary and illustrative, not limiting in scope.

[0008] There is provided, in accordance with an embodiment, a folding bicycle, comprising a frame comprising a pivot, a front frame part and a rear frame part. The bicycle comprises a seatpost integrated to the front frame part. The bicycle comprises a handlebar incorporating steering and braking controls, connected to the front frame part. The bicycle comprises at least one front wheel steerably connected to the handlebar controls. The bicycle comprises a rear wheel, comprising a drive, connected to the rear frame part. The axis of the pivot is substantially parallel to the axis of the front wheel or the axis of the rear wheel.

[0009] In some embodiments, two front wheels are steerable connected to each other and the handlebar controls.

[0010] In some embodiments, the drive is an electric drive and/or a mechanical pedal drive.

[0011] In some embodiments, the frame further comprises a shock absorbing unit.

[0012] In some embodiments, the shock absorbing unit is integrated in at least one of the pivot, the front frame part, the rear frame part, and a brace.

[0013] In some embodiments, the steerably connected is through at least one of a mechanical brace connection, an electrical connection, and a cable connection.

[0014] In some embodiments, the electrical connection is in a fly-by-wire configuration using sensors, motors, and processing units configured to translate sensor readings to steering and/or braking controls.

[0015] In some embodiments, the seatpost is telescopically extendable for riders of heights between 150 centimeters and 200 centimeters.

[0016] According to some embodiments of the invention there is provided a folding vehicle, including: a frame having a front portion including (i) at least one front wheel steerably connected to the frame and having an axis of rotation, and (ii) a handlebar including at least one steering control in communication with the steerable front wheel, and a rear portion including (i) at least one wheel having an axis of rotation and driven by (ii) at least one wheel drive, wherein, the front and rear portions are pivotably coupled via a pivot joint having an axis of pivot parallel to an axis of rotation of at least one of the front and rear wheels.

[0017] In some embodiments, the front wheel is steerable by a steering mechanism. In some embodiments, the steering mechanism is mechanically independent of the handlebar. In some embodiments, the steering mechanism includes at least one steering motor pivotably coupled to a forecarriage via at least one rotating arm. In some embodiments, the rotational or pivoting movement of the arm, adjusts the forecarriage bringing about turning of the at least one front wheel.

[0018] According to some embodiments, the foldable vehicle includes at least one frame orientation sensor unit. In some embodiments, the folding vehicle includes at least one processing unit in communication with the frame orientation sensor unit and the steering motor. In some embodiments, the processing unit controls the steering motor and thereby the rotating arm in accordance with a change in orientation of the frame. In some embodiments, the processing unit controls the steering motor and thereby the rotating arm following input received from the frame orientation sensor.

[0019] According to some embodiments, the handlebar is immovable. In some embodiments, the handlebar is at least partially movable towards and away from the rider along an axis parallel to a longitudinal axis of the vehicle. In some embodiments, the forward movement brings about forward acceleration of the vehicle. In some embodiments, wherein the backward movement brings about deceleration or breaking of the vehicle. In some embodiments, acceleration and/or deceleration/breaking commands from the handlebar are transmitted to the front wheels steering mechanism and/or back wheels mechanically, hydraulically or electronically.

[0020] According to some embodiments, the processing unit controls a direction of travel of the wheels by turning the wheels about a wheel-turning axis, which is perpendicular to a surface on which the wheels are rolling. In some embodiments, the wheel drive is at least one of an electric drive and a mechanical pedal drive. In some embodiments, the forecarriage includes two front wheels steerably connected to each

other and to the forecarriage. In some embodiments, the frame further includes a shock absorbing unit. In some embodiments, the frame includes a folding brace disposed between the front portion and the rear portion.

[0021] According to some embodiments, the frame includes a folding brace having a first portion and a second portion pivotably coupled disposed between the front portion and the rear portion. In some embodiments, the first portion of the brace includes the shock absorber. In some embodiments, the first portion and a second portion of the brace are coupled via a pivot joint and wherein the pivot joint is a dual-function joint providing a folding element as well as a bias limiter and/or guiding ring for the shock absorber. In some embodiments, the electrical connection is in a fly-by-wire configuration using sensors, motors, and processing units configured to translate sensor readings to at least one of (i) the steering controls and (ii) the breaking controls.

[0022] According to some embodiments, the vehicle includes a seat mounted on the frame via a seatpost, the seatpost being telescopically extendable for riders of heights between 150 centimeters and 200 centimeters. In some embodiments, the seatpost is adjustable. In some embodiments, the vehicle frame is adjustable from a folded state to an unfolded state, the seatpost is adjustable and includes a lock that automatically locks the seatpost when the frame is in the unfolded state.

[0023] In addition to the exemplary aspects and embodiments described above, further aspects and embodiments will become apparent by reference to the figures and by study of the following detailed description.

BRIEF DESCRIPTION OF THE FIGURES

[0024] Exemplary embodiments are illustrated in referenced figures. Dimensions of components and features shown in the figures are generally chosen for convenience and clarity of presentation and are not necessarily shown to scale. The figures are listed below.

[0025] Fig. 1 shows schematically, partially diagrammatically a folding electric vehicle;

[0026] Fig. 2A shows schematically a central brace for a folding electric vehicle;

[0027] Fig. 2B shows schematically a third central brace for a folding electric vehicle;

[0028] Fig. 3A shows schematically a steering pulley system for a folding electric vehicle;

[0029] Figs. 3B and 3C show schematically a second view of a steering pulley system for a folding electric vehicle;

[0030] Fig. 3D shows schematically a wheel steering system for a folding electric vehicle;

[0031] Figs. 4A and 4B show schematically a tilting angle and wheel geometry for a folding electric vehicle during turning;

[0032] Fig. 5 shows schematically a foot-peg accessory for a folding electric vehicle;

[0033] Fig. 6 shows schematically a motor drive, an optional transmission, and a battery for a folding electric vehicle;

[0034] Fig. 7A, 7B, 7C and 7D show schematically a first configuration of a folding electric vehicle;

[0035] Figs. 8A and 8B show schematically details of a central brace for a folding electric vehicle;

[0036] Fig. 9 shows schematically a handlebar folding mechanism and/or system for a folding electric vehicle;

[0037] Fig. 10 shows schematically a handlebar folding mechanism and/or steering lock for a folding electric vehicle;

[0038] Figs. 11A and 11B show schematically a basket accessory for a folding electric vehicle in an open configuration and a smart shopping basket (follow-me) configuration;

[0039] Fig. 12 shows schematically a child-seat accessory for a folding electric vehicle;

[0040] Fig. 13 shows schematically a baby-cradle accessory for a folding electric vehicle;

[0041] Fig. 14 shows schematically a suitcase accessory for a folding electric vehicle; and

[0042] Figs. 15A and 15B show schematically a rack accessory 1502 for a folding electric vehicle in an open configuration and a closed configuration;

[0043] Fig. 16 is a schematic, partial diagrammatic illustration of a steering mechanism, in accordance with some embodiments of the present invention;

[0044] Figs. 17A, 17B, 17C, and 17D are isometric and side view schematic illustrations of a vehicle, in accordance with some embodiments of the present invention;

[0045] Figs. 18A, 18B, and 18C are front and top view schematic illustrations of a steering mechanism, in accordance with some embodiments of the present invention;

[0046] Figs. 19A and 19B are exploded view schematic illustrations of a steering mechanism, in accordance with some embodiments of the present invention;

[0047] Figs. 20A, 20B, 20C, 20D, 20E, and 20F are side and top view schematic illustrations of a foldable brace, in accordance with some embodiments of the present invention;

[0048] Figs. 21A and 21B are isometric view exemplary folding positions of the vehicle, in accordance with some embodiments of the present invention; and

[0049] Figs. 22A and 22B are cross section view schematic illustrations of an exemplary locking mechanism, according to some embodiments of the present invention.

DETAILED DESCRIPTION

[0050] Disclosed is a folding electric vehicle, e.g. a bicycle, a tricycle (FEC) or a quadricycle. In some embodiments, the FEC includes one or more of a frame, a single rear wheel, and one or more front wheels. In some embodiments, the frame comprises two frame struts connected at the center of the frame with a pivot and locking mechanical elements. In some embodiments, the rear wheel incorporates an electric drive motor. In some embodiments, the one or more front wheels may include tilting and/or steering mechanical elements. In some embodiments, the tilting mechanical elements are configured to tilt the frame when the operator of a two-wheel embodiment (tricycle) makes a turn. In some embodiments, the steering mechanical elements are configured to allow steering controls incorporated in the handlebars to steer the direction of the cycle motion, such as by an intermediate mechanism that transfers the steering motion. In some embodiments, the handlebars are connected to one or more of the frame struts with a handlebar post, and in some embodiments are optionally collapsible. In some embodiments, a moveable seat post is incorporated into one of the frame struts, for example, such as the front frame strut supported by the front wheel(s).

[0051] As used herein, the term cycle and/or vehicle means a bicycle, tricycle, and/or the like. As used herein, the term mechanism means one or more mechanical elements, configured as a device and/or mechanical subsystem to provide mechanical support to other elements of the cycle.

[0052] In some embodiments, the configuration and geometry of the frame solves several important technical problems and provide significant benefits. In some embodiments, the moveable seat post allows the height of the seat to be adjusted to the height of the rider quickly and efficiently, while maintaining the rider center of gravity at a location that provides stability during the operation of the tricycle. In some embodiments, the use of two front wheels and one rear wheel, allows compact folding

of the tricycle at the central frame pivot. In some embodiments, the frame pivot locking mechanism incorporates suspension mechanical elements to provide shock absorption and damping. In some embodiments, the use of one rear and one front wheel with a screw motion type central pivot allows compact folding of the two-wheel embodiment, while maintain the other benefits (i.e., telescoping seat post, shock absorbing and/or spring loaded central pivot lock, and/or the like). In some embodiments, the battery is incorporated into the rear frame strut improving stability and lowering weight by putting the battery as close to the drive motor as possible. In some embodiments, the front tilting mechanism of the tricycle embodiment allows improved stability during turns over non-tilting tricycle or bicycle front wheel mechanisms. In some embodiments, the seating position and small wheel size allows kick-pushing the bike while seated when the battery charge is depleted.

[0053] The mechanical elements and benefits allow a large range of operator heights and/or weights to be supported, a low vehicle weight at reasonable tricycle costs, stability during high braking power, and/or the like. For example, rider height may be between 150 and 200 centimeters (cm), or an extended range of 140-210 cm. For example, vehicle weight may be between 8 kilograms and 15 kilograms but may be lower and higher than that.

[0054] Following are details of the different mechanism that provide these benefits.

[0055] Reference is now made to Fig. 1, which shows schematically and partial diagrammatically a folding electric vehicle **100**. In some embodiments, vehicle **100**, such as a bicycle or tricycle, comprises a frame **110**, a seat **107**, and two or more wheels **105A** and **106A**. In some embodiments, the frame **110** comprises a front strut **101**, a rear strut **102**, and a frame pivot joint **103** mechanically connecting the two struts. In some embodiments, a seatpost **104** extends telescopically from one of the struts, such as front strut **101**. In some embodiments, the seatpost **104** supports the seat **107**. In some embodiments, one or more hubs of a rear hub **105B** of the rear wheel **105A** and/or the front hubs **106B** of the front wheels **106A** comprise and/or are coupled to one or more driving electric motors 130 incorporated for propelling the vehicle **100** (i.e., bicycle or tricycle) and/or one or more braking mechanisms for stopping vehicle **100**. In some embodiments, the front wheel and/or the rear wheel assemblies comprise breaks e.g., drum breaks, disk breaks or similar. In some embodiments, vehicle 100 comprises a bicycle breaking system using breaking levers (e.g., Fig. 2A, lever 275). In some embodiments, the vehicle **100** comprises a handlebar strut **108** configured to support a

handlebar **109**. In some embodiments, the handlebar **109** comprises one or more controls, configured to control any one or more of the braking mechanism, the propelling mechanism, and the signal/sensor mechanism. In some embodiments, and as described in greater detail elsewhere herein, the handlebar **109** comprises one or more mechanical elements configured to operate the steering mechanism and transfer steering input from the handlebars **109** to one or more of the front wheel **106A** and the front hub **106B**.

[0056] In some embodiments, folding electric vehicle **100** comprises one or more processing units in communication with a steering mechanism e.g., the steering mechanism **1722/1622**, steering mechanism motor **1802/1612**, or more driving electric motors **130** propelling the vehicle **100**, one or more handlebar sensors **175**, one or more frame orientation sensors **1650** and one or more rear and front breaking systems, levers and controls.

[0057] In some embodiments, steering mechanism motor **1802/1612** is mounted on a yolk **1850**. In some embodiments, yolk **1850** is pivotably coupled to vehicle **100** frame **110/1602**. In some embodiments, steering mechanism motor **1802/1612**, yolk **1850** and vehicle **100** frame **110/1602** are coupled concentrically, sharing a single axis of rotation.

[0058] In some embodiments, handlebar **190** is moveable, or responsive to pressure applied by a rider, in a forward and/or backward direction, as indicated by an arrow designated reference number **150**, towards and away from the rider, along an axis parallel to a longitudinal axis of the vehicle. In some embodiments, forward movement or pressure brings about forward acceleration of the vehicle. In some embodiments, backward movement or pressure brings about deceleration or breaking of the vehicle. In some embodiments, handlebar **190** is biased or spring loaded such that handlebar **109** returns to a neutral position following forward movement or backward movement of the handlebar. In some embodiments, acceleration and deceleration/breaking commands from handlebar **109** are transmitted to the front wheels steering mechanism e.g. steering mechanism **1722/1622** and/or back wheels mechanically (e.g., via cables, rods or actuators such a rack and pinion systems), hydraulically or electronically. In some embodiments, handlebar **190** is immovable and comprises sensors **150** e.g., pressure sensors, that respond to pressure applied by a rider similar to a fly-by-wire configuration and are in communication with one or more folding vehicle **100** processing units. In some embodiments, footrests **250** comprise pressure sensors (not shown), that respond to pressure applied by a rider and are in communication with one or more folding vehicle **100** processing units.

[0059] In some embodiments, the seatpost **104** extends telescopically from front the front strut **101**, such that a raising or lowering seatpost **104** preserves the relative position of the center of gravity of an operator with respect to front wheel **106A** and front hub **106B**, thereby preserving the stability of the operator. In some embodiments, the seatpost **104** is lockable by operating a folding mechanism, such as, for example, a frame pivot folding release and/or a handlebar folding release.

[0060] For example, during hard breaking, the force of braking on the vehicle **100** creates a forward force of the operator's momentum, which is countered by the weight of the operator, a force downwards from the operator center of gravity. When the moment arm of the forward force is greater than the moment arm of the downward force, the braking will cause the vehicle **100** to pivot around the ground contact point and the operator may crash into the ground. When a taller rider moves seatpost **104** to extend telescopically, the riders weight is located higher and farther back from the front wheel **106A** than a low rider, thus the balance between the forward moment force and downward moment force is preserved. For comparison, on a conventional bicycle, raising a seatpost moves the rider mostly vertically upward, and the forward moment force is increased much more than the downward moment force, making the bicycle in risk of tipping forward under hard braking.

[0061] The disclosed configuration of vehicle **100** comprises the struts 101/102, the wheels 105A/106A, and the seatpost **104**, which make the maximum breaking force relative constant regardless of rider height and weight.

[0062] In some embodiments, a dual front wheel embodiment (i.e. tricycle) comprises a hinge-type central frame pivot with a front wheels tilting/steering mechanism.

[0063] In some embodiments, a single front wheel embodiment (i.e. bicycle) comprises a screw-type central frame pivot with a front wheel steering mechanism.

[0064] In some embodiments, the frame pivot and/or locking mechanism incorporates a shock absorbing mechanism, such as using an elastomer, a piston, a hydraulic piston, a magnetic shock absorber, a spring, and a dampener.

[0065] Reference is now made to Fig. 2A, which shows schematically a first central brace for a folding electric vehicle. In some embodiments, the Folding Electric Vehicle (FEV) **200** frame **212** comprises a central pivot **201** configured for folding the frame. In some embodiments, the FEV 200 comprises braces **202/203** may be used support frame in one configuration, such as an open configuration. In some embodiments, the frame **212**, the pivot **201** and/or one or more of the braces **202/203** combine a shock absorbing

and/or dampening unit **204** to provide wheel tracking and operator comfort during operation. In some embodiments, the seat **206** may be incorporated into a front diagonal part **200A** of frame **212**. In some embodiments, extending the seat **206** keeps the operator near an optimal operational seating position to maintain stability and balance. In some embodiments, a rear diagonal part **200B** of the frame **212** comprises a drive, power, energy storage, braking mechanism(s), and/or the like.

[0066] Reference is now made to Fig. 2B, which shows schematically a second central brace for a folding electric vehicle and Fig. 2C, which shows schematically a third central brace for a folding electric vehicle in accordance with some embodiments of the invention. In some embodiments, the seat **206** is in open configuration. In some embodiments, an elastomer **210** is used for shock absorption, that is pressed by a first frame part to a second frame part. In some embodiments, the elastomer **210** is configured to compress by a first frame part and a second frame part. In some embodiments, latches are used to release from locked position.

[0067] In some embodiments, the front handlebar comprises one or more of a steering, acceleration, and braking controls for operation of the vehicle.

[0068] In some embodiments, the steering mechanism has a handlebar steering axis, a mechanical intermediate linking mechanism, and a front steering pivot mechanism. In some embodiments, intermediate elements, such as one or more cables, levers, hydraulics, sensors, actuators, electronics, and/or the like, are used to transfer the handlebar motion to the steering mechanism. In some embodiments, a mechanical system uses a pulley, push-rod, actuator, lever, pivot, and/or the like to translate the steering motion at the handlebar mechanically to the front wheel.

[0069] Reference is now made to FIG. 3A, which shows schematically a steering pulley system for a folding electric vehicle. In some embodiments, a handlebar steering axis **301** is coupled to front wheel(s) steering axis **302** such that rotational motion is translated from the handlebar steering axis **301** to the front wheel(s) steering axis **302**.

[0070] Reference is now made to FIG. 3B, which shows schematically a second view of a steering pulley system for a folding electric vehicle. A closeup view of handlebar steering axis **301** translated to front wheel(s) steering axis **302**.

[0071] Reference is now made to FIG. 3C, which shows schematically a wheel steering system for a folding electric vehicle. A closeup view of front wheel(s) steering axis **302**, with pull-pull actuator cables **303**. In some embodiments, the wheel steering axis **302** is rotatable. In some embodiments, the wheel steering axis **302** is coupled to a steering

lever **304**. In some embodiments, the steering lever **304** is coupled to a central point of one wheel. In some embodiments, rotation of the wheel steering axis **302** rotates the steering lever **304** and/or the central point of the wheel. In some embodiments, a cross brace **305** may transfer the steering forces to the second wheel when a second front wheel is used. These aspects allow converting the handlebar steering forces to front when directional changes. In some embodiments, the feedback ratios and force responses may be applied using different shaped wheels, braces, and geometries.

[0072] In some embodiments, wheel steering axis is operated by an electro-mechanical actuator, such as a step motor, a linear actuator, and/or the like.

[0073] In some embodiments, the handlebar steering input is using sensors, such as pressure sensors, cameras, piezoelectric sensors, capacitive sensors, and/or the like.

[0074] Following are drawings showing the tilting angles and steering geometry during turning.

[0075] As shown in FIGS. 4A and 4B and is explained in greater detail elsewhere herein, a tilting angle of the frame of the folding electric vehicle effects a change in a direction of travel of the vehicle by turning the wheels.

[0076] Reference is now made to FIG. 5, which shows schematically a foot-peg accessory for a folding electric vehicle. In some embodiments, the foot-peg is adjustable and can be positioned according to the height and riding style of a user.

[0077] In some embodiments, the tilting mechanism increases the stability of the vehicle by keeping all three wheels on the road surface while allowing steering and geometry of the vehicle to change. In some embodiments, the front wheels stay on the road at the angles for turning and wheel camber while the frame is tilting. In some embodiments, the angle between the front to rear wheel ground contact axis and hinge axis is between 6 and 20 degrees. In some embodiments, the ground contact axis is between the front frame tilt hinge and the rear wheel ground contact, and the hinge axis is the axis of rotation of the tilt hinge. In some embodiments, the tilting stabilizer causes the two front wheels to turn into the leaning direction, and act as a stabilizer like in a traditional bicycle. In some embodiments, a torque spring keeps the frame upright without a rider and gives an adjustable spring force for a better tilting experience when riding.

[0078] In some embodiments, the center of gravity of the rider is such that a high braking force can be applied to the vehicle without losing stability or control of the vehicle. In some embodiments, the seatpost is at a 45-degree angle and thus the rider weight remains stable when raising or lowering the seat height. In some embodiments, the maximum

deceleration is proportional to the height of the center of gravity divided by the distance from the center of gravity to the front wheel. In some embodiments, when this ratio remains constant the rider's height and set height have little effect on the stability during braking. For example, the deceleration can reach 0.842 multiplied by the gravitational constant (g).

[0079] In some embodiments, a battery is located within the rear frame strut.

[0080] In some embodiments, a driving electric motor is located in at least one of a front wheel and a rear wheel.

[0081] Reference is now made to FIG. 6, which shows schematically a motor drive system, an optional transmission, and a battery for a folding electric vehicle;

[0082] Following are descriptions of the steps between an open and a closed configuration of the folding electric vehicle.

[0083] Referring back to FIG. 2A, which shows schematically a first configuration of a folding electric vehicle, such as an open configuration and FIGS. 7A, 7B, 7C and 7D, which show schematically a first configuration of a folding electric vehicle. On the left is a slightly open configuration and on the right a slightly closed configuration.

[0084] Reference is now made to FIG. 7B, which shows schematically a first configuration of a folding electric vehicle. On the left is an almost closed configuration and on the right a closed configuration.

[0085] In some embodiments, the central brace comprises one or more arms and/or a locking/releasing mechanism. In some embodiments, the locking and/or releasing mechanism comprises one or more lockable configurations for different operation types, such as, for example, storage, follow-me configuration, and/or the like.

[0086] Reference is now made to FIGS. 8A and 8B, which show schematically details of a central brace for a folding electric vehicle. In some embodiments, one or more brace arms (Fig. 8A) is lockable in different configurations using a mechanism (Fig. 8B). In some embodiments, the motion of the brace arms also may allow compression or extension of a shock absorbing and/or dampening mechanical mechanism, such as an elastomer, a piston, and/or the like.

[0087] Reference is now made to FIG. 9, which shows schematically a handlebar folding mechanism and/or system for a folding electric vehicle. In some embodiments, one or more steering cables and/or wires are routed through the frame, with optional locking mechanisms. An exemplary locking tab for handlebar is shown in Fig. 9. In some embodiments, a cam **901** is used to release a latch of the telescoping seatpost,

thereby allowing the seatpost to be raised or lowered. In some embodiments, the cam has only releases the latch when the handlebar is intermediately folded, so the seatpost remains closed when folded. In some embodiments, the seatpost has a separate locking mechanism that allows fixing the height for a specific rider.

[0088] Reference is now made to FIG. 10, which shows schematically a handlebar folding mechanism and/or steering lock for a folding electric vehicle. In some embodiments, the steering cables and/or wires are routed through the frame, with steering locking mechanisms, for example, as shown in Fig. 10. In some embodiments, the steering lock may use a mechanical protrusion to physically lock the handlebars when in the folded configuration. In some embodiments, the steering locking is done electronically with sensors, contacts, and/or the like.

[0089] Following are descriptions of some common accessories.

[0090] Reference is now made to FIG. 11, which shows schematically a basket accessory for a folding electric vehicle in an open configuration and a smart shopping basket (follow-me) configuration. In some embodiments, a basket may be added modularly to any frame, using integrated or add on attachment accessories. Bottom schematic photo shows follow me configuration.

[0091] Reference is now made to FIG. 12, which shows schematically a child-seat 1202 accessory for a folding electric vehicle, in open configuration.

[0092] Reference is now made to FIG. 13, which shows schematically a baby-cradle 1302 accessory for a folding electric vehicle, in open configuration.

[0093] Reference is now made to FIG. 14, which shows schematically a suitcase accessory 1402 for a folding electric vehicle, in open configuration. Suitcase and/or handbag adapter can be added or integrated into frame on front or rear parts.

[0094] Reference is now made to FIG. 15, which shows schematically a rack accessory 1502 for a folding electric vehicle in an open configuration (left) and a closed configuration (right). In some embodiments, regenerative braking is added to front and/or rear wheels.

[0095] In some embodiments, pedals may be added to allow propelling the vehicle forward. In some embodiments, a smart “follow-me” controller is added to add a configuration for partial opening and operation of the drive train to follow an operator and/or device.

Steering Control Unit

[0096] Reference is made to Fig. 16, which is a schematic illustration of a steering mechanism, in accordance with some embodiments of the present invention.

[0097] In some embodiments, a folding electric vehicle 1600 comprises a forecarriage 1610 coupled to at least two front wheels 1606-1/1606-2. In some embodiments, the forecarriage 1610 comprises a steering mechanism 1622. In some embodiments, the steering mechanism 1622 is mechanically independent. In some embodiments, the steering mechanism 1622 is mechanically dissociated from the handlebar 109. In some embodiments, the steering mechanism 1622 is responsive to the tilting angle of a frame 1602 relative to forecarriage 1610 and/or the surface on which the vehicle is travelling. In some embodiments, the steering mechanism 1622 is coupled to frame 1602 and/or to the wheels 1606-1/1606-2. In some embodiments, the steering mechanism 1622 is configured to control a direction of travel of the vehicle 1600 based on the tilting angle of the frame 1602 relative to forecarriage 1610 and/or the surface on which the vehicle is travelling. In some embodiments, the steering mechanism 1622 is configured to control at least one of a tilting angle and direction of travel of the front wheels 1606-1/1606-2. In some embodiments, and as explained in detail elsewhere herein, control of the direction of travel of the wheels 1606-1/1606-2 is executed by turning the wheels, as indicated by arrows 1620-1/1620-2,, about a wheel-turning axis 1608-1/1608-2, which is perpendicular to a surface on which the wheels are rolling.

[0098] In some embodiments, the vehicle 1600 comprises a frame orientation sensor unit 1650 configured to measure an acceleration of a center of gravity of the vehicle 1600. In some embodiments, the sensor unit comprises at least one of an accelerometer, a pressure sensor, a load sensor. In some embodiments, the sensor unit comprises at least one sensor positioned at at least one of the frame 1602, the front portion of the vehicle 1600, the rear portion of the vehicle 1600, the steering mechanism 1622, one of the front wheels 1606-1/1606-2, and the rear wheel.

[0099] In some embodiments, the vehicle 1600 comprises a steering control unit configured to operate the steering mechanism 1622. In some embodiments, the steering control unit is in communication with the sensor unit. In some embodiments, the steering control unit is in communication with the sensor unit. In some embodiments, the steering control unit is in communication with the sensor unit via at least one of a cable, WiFi

and Bluetooth. In some embodiments, the sensor unit is configured to communicate data to the steering control unit.

[0100] In some embodiments, the steering control unit is configured to determine at least one of the acceleration of the front wheels 1606-1/1606-2 and/or rear wheel, the acceleration of the center of mass of the vehicle 1600, the acceleration of the center of mass of the vehicle 1600 together with a rider that is riding the vehicle, and the acceleration of the center of mass in relation to the acceleration of the front wheels 1606-1/1606-2 and/or rear wheel.

[0101] In some embodiments, the vehicle forecarriage 1610 comprises a steering mechanism 1622. In some embodiments, steering mechanism 1622 comprises one or more steering mechanism motor 1612 configured to drive the steering mechanism 1622. In some embodiments, the steering mechanism motor 1612 is coupled to the forecarriage 1610 by a rotating arm 1614. In some embodiments, the rotating arm 1614 comprises one or more pivot joints 1616/1808 and is rotatable about one or more axes of rotation (for example, as depicted by the arrow 1618). In some embodiments, the one or more pivot joints 1616/1808 are positioned at the ends of the rotating arm 1614. In some embodiments, the rotating arm 1614 is coupled to the steering mechanism motor 1612 via a first pivot joint 1616 on one end thereof and to the forecarriage 1610 via a second pivot joint 1808 at a second end thereof. In some embodiments, the first pivot joint 1616 comprises a rotating arm 1614 - steering mechanism motor 1612 pivot joint, and second pivot joint 1808 comprises a rotating arm 1614 - forecarriage 1610 pivot joint.

[0102] In some embodiments, the steering control unit is in communication with and controls the steering mechanism motor 1612. In some embodiments, the steering control unit controls the front wheels 1606-1/1606-2 through the steering mechanism motor 1612 and rotating arm 1614.

[0103] In some embodiments, at a neutral position, the longitudinal axis of the vehicle 1604 is perpendicular to a surface on which the vehicle is travelling and parallel to a plane defined by a circumference of the wheels along the wheel turning axes of the front wheels 1620-1/1620-2. In some embodiments, at a tilted position of the vehicle frame 1602, the longitudinal axis of the vehicle 1604' forms a tilt angle (α) in relation to the longitudinal axis of the vehicle 1604 in the neutral position and the wheel turning axes of the front wheels 1608-1/1608-2. In some embodiments, the tilt angle is between 0 and 90 degrees. In some embodiments, the tilt angle is between 0 and 45 degrees. In some embodiments, the tilt angle is between 0 and 30 degrees. In some embodiments, the

steering control unit is configured to receive information from the sensor unit regarding the orientation e.g., tilt angle of the frame in relation to the forecarriage. In some embodiments, the steering control unit is configured to control an orientation of the front wheels 1606-1/1606-2 in relation to the of the vehicle 1604 frame 1602. In some embodiments, the steering control unit is configured to control the orientation or degree of turn of the front wheels 1606-1/1606-2 in response to one or more of the tilt angle, a position of the center of gravity of the vehicle (with and/or without a rider), and acceleration and direction of acceleration of the center of gravity in relation to the acceleration of the front wheels 1606-1/1606-2.

[0104] In some embodiments, the steering control unit is configured to maintain the vehicle balanced in response to a change in one of the position of the center of gravity and/or the tilt angle (e.g., tilt angle (α)). In some embodiments, the steering control unit is configured to translate the position of the center of gravity and/or the tilt angle to a specific orientation of the front wheels 1606-1/1606-2.

[0105] In some embodiments, the orientation or degree of turn of the front wheels 1606-1/1606-2 compensates for a change in forces (e.g., force of gravity, centripetal force) resulting from a change in the orientation (e.g., tilt) of the frame 1602 in relation to the surface on which the vehicle is moving to maintain the vehicle and the rider balanced. For example, in a regular bicycle the rider turns the wheels by turning the handlebar in the desired direction of travel. As a result, the bike rides along a circumference of an imaginary circle resulting in development of centripetal force threatening to topple the rider. To balance the centripetal force, the rider tilts the bicycle frame towards the center of the imaginary circle.

[0106] In folding electric vehicle 100/1600, the handlebar is not steerable and there is no mechanical connection between the handlebar 109 and the forecarriage and front wheels. The rider may change the direction of travel, e.g., turn by tilting the frame towards a desired direction of turn, e.g., tilt the frame to the left, if a left turn is desired or tilt the frame to the right if a right turn is desired. As a result the sensor unit, sensing the change in the tilt angle of the frame 1602 in relation to the surface or to the forecarriage turns the wheels about the wheel turning axes of the front wheels 1620-1/1620-2 to bring about the vehicle to turn in the direction of the tilt of the frame and develop centripetal force to prevent the rider from falling into the imaginary circle formed by the turn.

[0107] In some embodiments, the folding vehicle or tricycle frame comprises a frame orientation sensor and one or more processing units in communication with the frame orientation sensor unit and the steering motor. In some embodiments, the processing unit controls the steering motor and thereby the rotating arm in accordance with a change in orientation of the frame in a form of input received from the frame orientation sensor. The folding vehicle according to claim 7, wherein said processing unit controls said steering motor and thereby said rotating arm in accordance with a change in orientation of said frame. The processing unit controls the steering motor and thereby the rotating arm following input received from the frame orientation sensor.

[0108] Unlike a regular bicycle in which the tilt of the frame follows or responds to the turn of the handlebar/wheels, in folding electric vehicle 100/1600, steering mechanism 1722/1622 of forecarriage 1610 responds to and follows the tilt of the frame 1602 to maintain vehicle 100/1600 balanced throughout the turn.

[0109] In some embodiments, the orientation of the front wheels 1606-1/1606-2 comprises a degree of turn around a wheel turning axis of the front wheels 1620-1/1620-2. In some embodiments, a specific orientation of the front wheels 1606-1/1606-2 is directly correlated with, and results from the magnitude of the tilt of the frame 1702.

[0110] In some embodiments, the change in orientation/degree of turn of the front wheels 1606-1/1606-2 comprises a change in the angle between the wheel-turning axes of the front wheels 1608-1/1608-2 and the longitudinal axis 1604 of the frame 1602 while maintaining the frame 1602 balanced. In some embodiments, the change in orientation of the front wheels 1606-1/1606-2 comprises change in the height of one of the front wheels 1606-1/1606-2 in relation to the other.

[0111] Reference is made to Figs. 17A, 17B, 17C, and 17D, which are isometric and side views of a vehicle, in accordance with some embodiments of the present invention. In some embodiments, the vehicle 1700 is structurally and/or functionally similar to vehicle 1600 as described elsewhere herein.

[0112] In some embodiments, the frame 1702 of the vehicle 1700 comprises a front strut 1718 and a rear strut 1708. In some embodiments, the front strut 1718 is coupled to the steering mechanism 1722/1622. In some embodiments, the rear strut 1708 is coupled to one or more rear wheels 1704. In some embodiments, and as described in greater detail elsewhere herein, the front strut 1718 and the rear strut 1708 are coupled by a brace 2000. In some embodiments, the front strut 1718 comprises one or more foot rests 250.

[0113] In some embodiments, the vehicle 1700 comprises an adjustable seatpost 1712. In some embodiments, the vehicle 1700 comprises a seat 1710 coupled to the adjustable seatpost 1712. In some embodiments, the adjustable seatpost 1712 is extendable from the frame 1702. In some embodiments, the adjustable seatpost 1712 is telescopically extendable. In some embodiments, the adjustable seatpost 1712 is slidable within a portion of the frame 1702, such as, for example, the front portion of the strut 1718. For example, in some embodiments, the adjustable seatpost 1712 is slidable in along the direction depicted by arrow 1750.

[0114] In some embodiments, the position of the adjustable seatpost 1712 is fixable and/or lockable. In some embodiments, and as described in greater detail elsewhere herein, the adjustable seatpost 1712 and/or the frame 1702 comprise a locking mechanism 2200 configured to fix the adjustable seatpost in relation to the frame 1702.

[0115] In some embodiments, the sensor unit is located along the vehicle at a position from which the distance between the seat 1710 and at least one of the wheels 1706-1/1706-2/1704 is measurable. In some embodiments, the sensor unit is configured to determine the distance between the seat 1710 and the at least one of the wheels 1706-1/1706-2/1704.

[0116] For example, in Fig. 17B, the distance between the seat 1710 and the wheels 1706-1/1706-2/1704 is smaller than the distance between the seat 1710 and the wheels 1706-1/1706-2/1704 as depicted by Fig. 17C.

Forecarriage

[0117] Reference is made to Figs. 18A, 18C, and 18D, which are front and top views of a steering mechanism, in accordance with some embodiments of the present invention, and to Figs. 19A and 19B, which are exploded views of a steering mechanism, in accordance with some embodiments of the present invention.

[0118] In some embodiments, the vehicle **1700** and/or the steering mechanism **1722/1622** comprise a 1722 coupled to two steering arms **1810**. In some embodiments, a first steering arm **1810** is coupled to one end of the steering rod 1806 and a second steering arm **1810** is coupled to a second end of the rack bar **1806**. In some embodiments, each of the steering arms **1810** is configured to couple to one or more wheels. For example, in some embodiments, each of the steering arms **1810** is coupled to one or more front wheels. In some embodiments, one or more of the steering arms are couple to the one or more wheels via one or more swing arms **1818**.

[0119] In some embodiments, the vehicle **1700** and/or the steering mechanism **1722/1622** comprise a steering actuator 1820 slidingly and rotatably coupled to the steering rod 1806. In some embodiments, the steering actuator 1820 comprises a tube. In some embodiments, the steering actuator 1820 is positioned between the two or more front wheels. In some embodiments, the steering rod 1806 and the steering actuator 1820 are coaxial.

[0120] In some embodiments, the steering actuator 1820 is coupled to the steering mechanism motor **1802/1612**. In some embodiments, the steering actuator 1820 is coupled to the steering mechanism motor **1802/1612** via one or more pivots **1808/1816**. In some embodiments, the steering actuator 1820 is coupled to the steering mechanism motor **1802/1612** via a rotation arm **1614**. In some embodiments and as explained elsewhere herein, the rotating arm 1614 comprises one or more pivot joints 1616/1808 and is rotatable about one or more axes of rotation (for example, as depicted by the arrow 1618). **1614** In some embodiments, the rotation arm **1614** comprises one or more pivots **1808/1816**. In some embodiments, the rotation axis of one or more pivots **1808/1816** crosses at least one of the longitudinal axis of the steering rod 1806, the longitudinal axis of the steering actuator 1820, and the longitudinal axis of the steering mechanism motor **1802**. In some embodiments, the rotation axis of the one of more pivots **1808/1806** is between the longitudinal axis of the steering rod 1806 and the longitudinal axis of the steering mechanism motor **1802**.

[0121] In some embodiments, rotation of rotation arm **1614** via one or more pivots **1808/1816**, driven by steering mechanism motor 1802 slides and/or rotates steering actuator 1820 over steering rod 1806 and urging against one or more bias elements 1804. A force generated by the urging of steering actuator 1820 against one or more bias elements 1804 brings about turning of the wheels, as indicated by arrows 1620-1/1620-2 (Fig. 16), about a wheel-turning axis 1608-1/1608-2, which is perpendicular to a surface on which the wheels are rolling.

[0122] In some embodiments, alternatively and/ or additionally, bias elements 1804 function as shock absorbers configured to dampen forces effected on the forecarriage 1610, steering mechanism **1722/1622** and especially steering rod 1806, e.g., in a situation in which a wheel hits an obstacle. In such a circumstance, a sudden force applied to a wheel is dampened by one or more bias elements 1804 protecting rotation arm **1614** and steering mechanism motor 1802 from damage and breakage.

[0123] In some embodiments, the steering mechanism **1722/1622** is configured to control an orientation of the steering actuator1820. In some embodiments, the steering mechanism **1722/1622** is configured to control an orientation of the steering rod 1806 by controlling the orientation of the steering actuator1820. In some embodiments, the steering mechanism motor **1802** is configured to drive the rotational arm **1614** thereby driving the steering actuator1820 and/or the steering rod 1806.

[0124] In some embodiments, the vehicle **1700** comprises one or more bias elements 1804 positioned between one of the steering arms **1810** and the steering actuator1820 . In some embodiments, the one or more bias elements 1804 are configured to dampen backlash from the one or more steering arms **1810** and the steering actuator1820 . In some embodiments, the one or more bias elements 1804 are coaxial with the longitudinal axis of the steering actuator1820 and/or the longitudinal axis of the steering rod 1806. In some embodiments, the longitudinal axis of the one or more bias elements 1804 in relation to the longitudinal axis of the steering rod 1806 varies in accordance with the steering of the steering rod 1806.

[0125] In some embodiments, the one or more bias elements 1804 are resilient. In some embodiments, the one or more shock absorbers **1804** comprise an elastic material. In some embodiments, the one or more shock absorbers **1804** comprise a spring. In some embodiments, the spring is wrapped around one or more of the steering actuator1820 and the steering rod 1806.

[0126] A potential advantage of the one or more bias elements 1804 positioned between one of the steering arms **1810** and the steering actuator1820 is in that movements of the steering arms **1810** are dampened by the bias elements 1804 and prevent damage of the steering mechanism motor **1802**. For example, an obstruction to the wheels while driving, such as a rock or a pothole, is dampened by the shock absorbers **1804**.

Brace

[0127] Reference is made to Figs. 20A, 20B, 20C, 20D, 20E, and 20F, which are side and top views of a foldable brace, in accordance with some embodiments of the present invention. In some embodiments, the vehicle **1700** comprises a brace **2000** configured to fold from an open state to a closed state. In some embodiments, the brace **2000** is combined with a shock absorber mechanism 2050 configured to dampen backlash forces applied to the frame **1702**.

[0128] In some embodiments, the brace **2000** comprises a first brace portion **2002** and a second brace portion **2004**. In some embodiments, one or more of the first brace portion **2002** and the second brace portion **2004** comprise are pivotally coupled at a pivot joint 2006. In some embodiments, pivot joint 2006 comprises a dual-function joint providing a folding element about which brace **2000** first brace portion **2002** and second brace portion **2004** pivot to fold as well as providing a bias limiter and/or guiding ring for suspension member **2012**.

[0129] In some embodiments, the pivot joint 2006 comprises a locking mechanism. In some embodiments, at an open state of the brace **2000**, such as depicted by Figs. 20A and 20B, the position of the first brace portion **2002** is fixed in relation to the second brace portion **2004**.

[0130] In some embodiments, each of the first brace portion **2002** and the second brace portion **2004** are configured to couple to one or more struts of the frame **1702/1602**. In some embodiments, each of the first brace portion **2002** and the second brace portion **2004** are configured to couple to one or more struts of the frame **1702/1602** by one or more hinges **2008-1/2008-2**. In some embodiments, the first brace portion **2002** is configured to couple to one of the front strut **1718** and the rear strut **1708**. In some embodiments, the second brace portion **2004** is configured to couple to one of the front strut **1718** and the rear strut **1708**. In some embodiments, the first brace portion **2002** and the second brace portion **2004** are configured to couple to different struts of the frame **1702**.

[0131] In some embodiments, the pivot joint 2006 comprises a rod. In some embodiments, the pivot joint 2006 is coupled to the first brace portion **2002**. In some embodiments, the second portion comprises a slot **2010** configured to define a range of movement of the pivot joint 2006. In some embodiments, the pivot joint 2006 is slidable within the slot **2010**. In some embodiments, the slot **2010** extends along at least a portion of the length of the second brace portion **2004**. In some embodiments, the total length of the brace **2000** correlates with the position of the pivot joint 2006 in relation to the slot **2010**.

[0132] In some embodiments, such as depicted in Figs. 20A and 20B, at an open state of the brace **2000**, the first brace portion **2002** is parallel to the second brace portion **2004**. For example, in some embodiments, such as depicted in Fig. 20B, the longitudinal axes of the first base portion **2002** and the second base portion **2004** align at axis (A).

[0133] In some embodiments, the second brace portion **2004** comprises a suspension member **2012** configured to extend a length of the second brace portion **2004** in response to two or more opposing forces exerted onto the second brace portion **2004**. In some embodiments, the suspension member **2012** comprises a resilient portion, such as, for example, a spring. In some embodiments, the suspension member **2012** is positioned such that extension of the total length of the brace **2000** loads pressure onto the suspension member **2012**.

[0134] In some embodiments, an increase in the total length of the brace **2000** includes increasing the distance between the pivot joint **2006** and the suspension member **2012**. In some embodiments, a decrease in the total length of the brace **2000** includes decreasing the distance between the pivot joint **2006** and the suspension member **2012**. In some embodiments, an increase and/or decrease in the total length of the brace **2000** includes increasing the load of the suspension member **2012**. In some embodiments, the resilience of the suspension member **2012** is in an axis perpendicular to the rotational axis of the pivot joint **2006**.

[0135] In some embodiments, at a closed state of the brace, at least a portion of one of the brace portions **2002/2004** is positioned within at least a portion of the other brace portion **2002/2004**.

Folding Mechanism

[0136] Reference is made to Figs. 21A and 21B, which are isometric view exemplary folding positions of the folding vehicle, in accordance with some embodiments of the present invention. As shown in Figs. 21A and 21B, the vehicle **2100** is foldable from a closed state (Fig. 21B) to a fully open state (e.g., Figs. 17A–17D). As explained elsewhere herein, in a fully open state, seat **2110** is locked in position such as to provide safe riding and disable a change in seat height adjustment during movement of the vehicle. When the vehicle is partially unfolded, e.g., to a position as shown in Fig. 21A, seat **2110** is unlocked to allow adjustment of the seat height.

[0137] As depicted in Figs. 22A and 22B, which is an enlargement of a circled area in Fig. 22A, which are cross section schematic illustrations of an exemplary locking mechanism, according to some embodiments of the present invention, when the vehicle **2100** is in a fully open position, a locking mechanism **2102** locks a moveable seat post **2104** in place disabling any adjustment in seat height while riding the vehicle. In some

embodiments, locking mechanism 2102 comprises a rotatable arm 2106 pivotably coupled at one end to rear strut 1708, in a region between frame pivot joint 2103 and handlebar 2109 and at a second end to front strut 1718.

In some embodiments, rotatable arm 2106 comprises an eccentric locking tip 2108 at the coupling of rotatable arm 2106 and front strut 1718. In some embodiments, locking tip 2108 comprises a resilient or semi-rigid material. In some embodiments, seat post 2104 comprises a locking pad 2112 positioned in propinquity to eccentric locking tip 2108 such that in an open position, eccentric locking tip 2108 is rotated in a direction indicated by an arrow designated reference number 2150, an urged against locking pad 2112 thus locking seat post 2104 in place. Once vehicle 2100 frame is folded, rotatable arm 2106 is rotated in an opposite direction, rotating in turn eccentric locking tip 2108 and disengaging eccentric locking tip 2108 from locking pad 2112 thus releasing seat post 2104 and allowing adjusting the level of seat 2110.

[0138] Throughout this application, various embodiments of this invention may be presented in a range format. It should be understood that the description in range format is merely for convenience and brevity and should not be construed as an inflexible limitation on the scope of the invention. Accordingly, the description of a range should be considered to have specifically disclosed all the possible subranges as well as individual numerical values within that range. For example, description of a range such as from 1 to 6 should be considered to have specifically disclosed subranges such as from 1 to 3, from 1 to 4, from 1 to 5, from 2 to 4, from 2 to 6, from 3 to 6 etc., as well as individual numbers within that range, for example, 1, 2, 3, 4, 5, and 6. This applies regardless of the breadth of the range.

[0139] Whenever a numerical range is indicated herein, it is meant to include any cited numeral (fractional or integral) within the indicated range. The phrases “ranging/ranges between” a first indicate number and a second indicate number and “ranging/ranges from” a first indicate number “to” a second indicate number are used herein interchangeably and are meant to include the first and second indicated numbers and all the fractional and integral numerals therebetween.

[0140] In the description and claims of the application, each of the words “comprise” “include” and “have”, and forms thereof, are not necessarily limited to members in a list with which the words may be associated. In addition, where there are inconsistencies between this application and any document incorporated by reference, it is hereby intended that the present application controls.

CLAIMS

What is claimed is:

1. A folding vehicle, comprising:
 - a frame having
 - a front portion including
 - (i) at least one front wheel steerably connected to said frame and having an axis of rotation; and
 - (ii) a handlebar including at least one steering control in communication with said steerable front wheel; and
 - a rear portion including
 - (i) at least one wheel having an axis of rotation and driven by
 - (ii) at least one wheel drive;wherein, said front and rear portions are pivotably coupled via a pivot joint having an axis of pivot parallel to an axis of rotation of at least one of said front and rear wheels.
2. The folding vehicle according to claim 1, wherein said front wheel is steerable by a steering mechanism.
3. The folding vehicle according to claim 2, wherein said steering mechanism is mechanically independent of said handlebar.
4. The folding vehicle according to any one of claims 2 and 3, wherein said steering mechanism comprises at least one steering motor pivotably coupled to a forecarriage via at least one rotating arm.
5. The folding vehicle according to claim 4, wherein said rotational or pivoting movement of said arm, adjusts said forecarriage bringing about turning of said at least one front wheel.
6. The folding vehicle according to any one of claims 1-5, wherein said foldable vehicle comprises at least one frame orientation sensor unit.

7. The folding vehicle according to claim 6, wherein said folding vehicle comprises at least one processing unit in communication with said frame orientation sensor unit and said steering motor.
8. The folding vehicle according to claim 7, wherein said processing unit controls said steering motor and thereby said rotating arm in accordance with a change in orientation of said frame.
9. The folding vehicle according to claim 7, wherein said processing unit controls said steering motor and thereby said rotating arm following input received from said frame orientation sensor.
10. The folding vehicle according to any one of claims 1-9, wherein said handlebar is immovable.
11. The folding vehicle according to any one of claims 1-9, wherein said handlebar is at least partially movable towards and away from the rider along an axis parallel to a longitudinal axis of the vehicle.
12. The folding vehicle according to claim 11, wherein said forward movement brings about forward acceleration of the vehicle.
13. The folding vehicle according to any one of claims 11 and 12, wherein said backward movement brings about deceleration or breaking of the vehicle.
14. The folding vehicle according to claim 13, wherein acceleration and/or deceleration/breaking commands from said handlebar are transmitted to the front wheels steering mechanism and/or back wheels mechanically, hydraulically or electronically.
15. The folding vehicle according to any one of claims 7 to 14, wherein said processing unit controls a direction of travel of said wheels by turning said wheels about a wheel-turning axis, which is perpendicular to a surface on which the wheels are rolling.

16. The folding vehicle according to any one of claims 1-15, wherein said wheel drive is at least one of an electric drive and a mechanical pedal drive.
17. The folding vehicle according to any one of claims 4 and 5, wherein said forecarriage comprises two front wheels steerably connected to each other and to the forecarriage.
18. The folding vehicle according to any one of claims 1-17, wherein the frame further comprises a shock absorbing unit.
19. The folding vehicle according to any one of claims 1-18, wherein said frame comprises a folding brace disposed between said front portion and said rear portion.
20. The folding vehicle according to claim 18, wherein said frame comprises a folding brace having a first portion and a second portion pivotably coupled disposed between said front portion and said rear portion.
21. The folding vehicle according to claim 20, wherein said first portion of said brace comprises said shock absorber.
22. The folding vehicle according to claim 21, wherein said first portion and a second portion of said brace are coupled via a pivot joint and wherein said pivot joint is a dual-function joint providing a folding element as well as a bias limiter and/or guiding ring for said shock absorber.
23. The folding vehicle according to claim 6, wherein the electrical connection is in a fly-by-wire configuration using sensors, motors, and processing units configured to translate sensor readings to at least one of (i) the steering controls and (ii) the braking controls.
24. The folding vehicle according to any one of claims 1-23, wherein said vehicle comprises a seat mounted on said frame via a seatpost, said seatpost being telescopically extendable for riders of heights between 150 centimeters and 200 centimeters.

25. The folding vehicle according to claim 24, wherein said seatpost is adjustable.

26. The folding vehicle according to claim 24, wherein said vehicle frame is adjustable from a folded state to an unfolded state, said seatpost is adjustable and comprises a lock that automatically locks said seatpost when said frame is in said unfolded state.

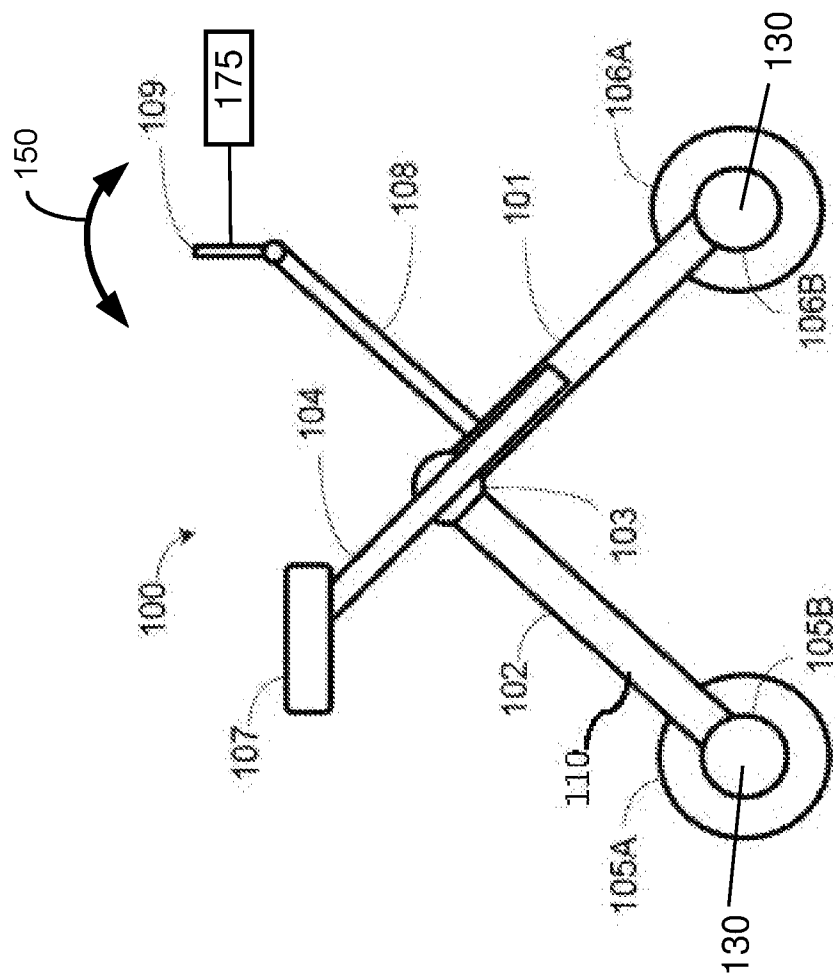
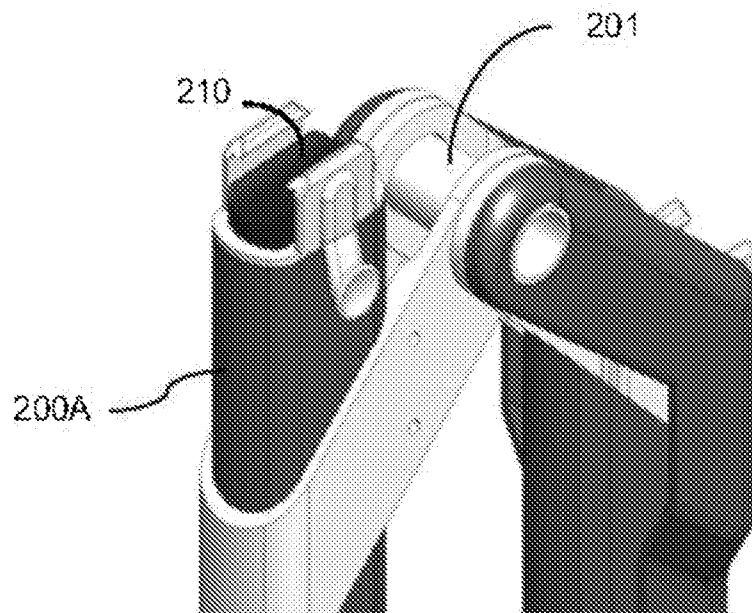
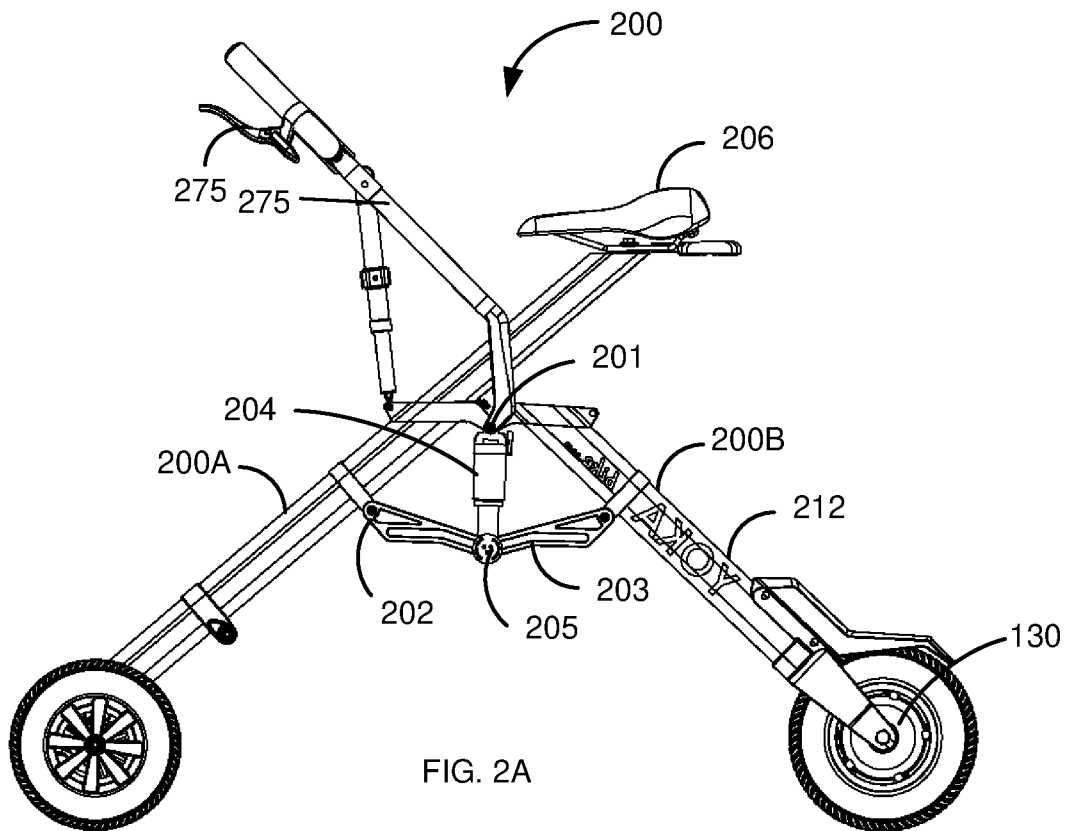
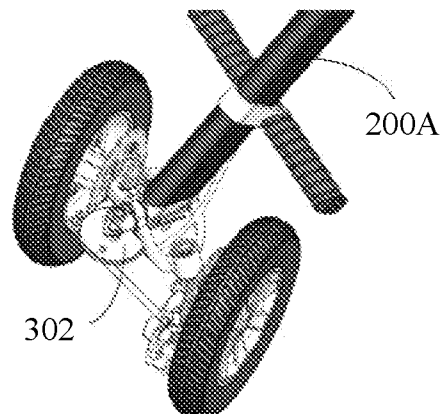
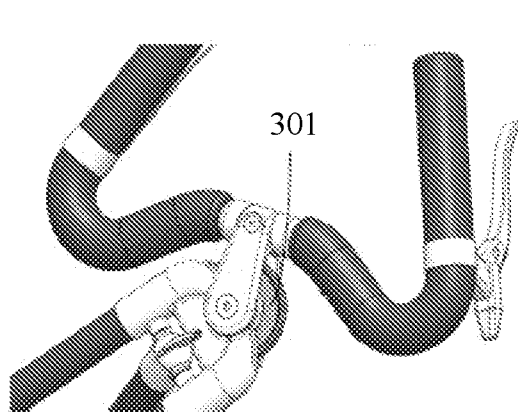
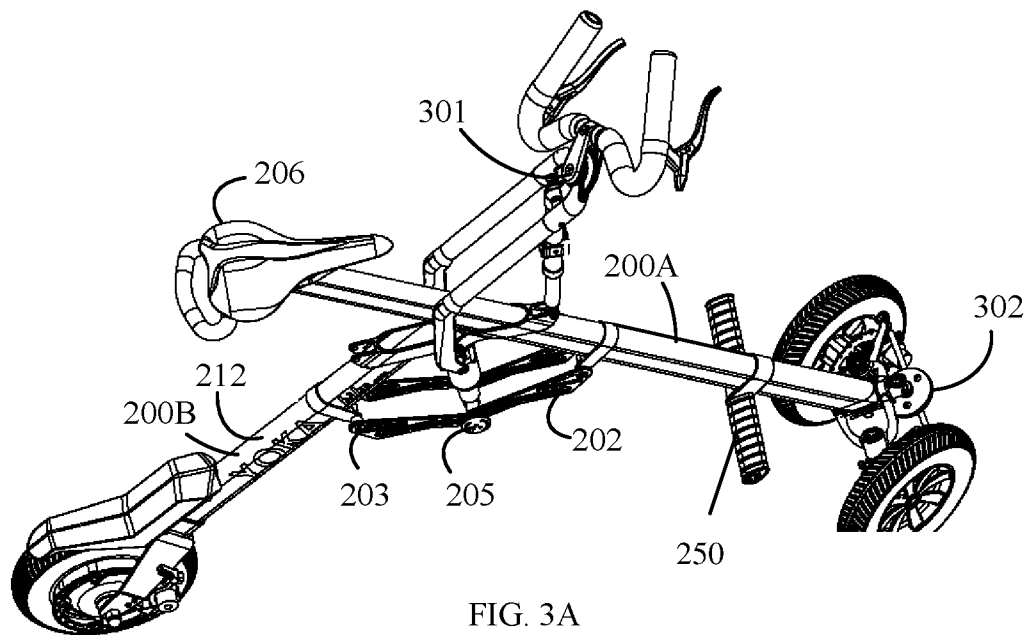


FIG 1





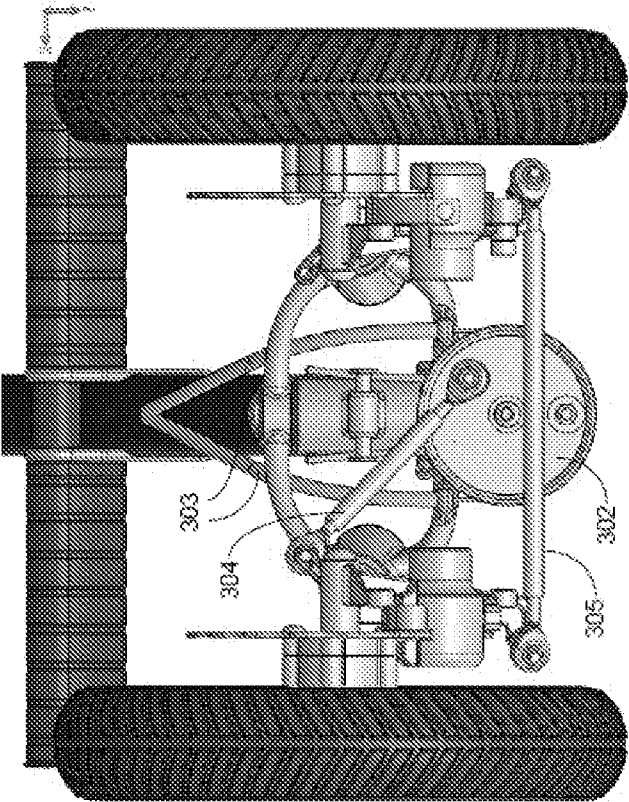


FIG. 3D

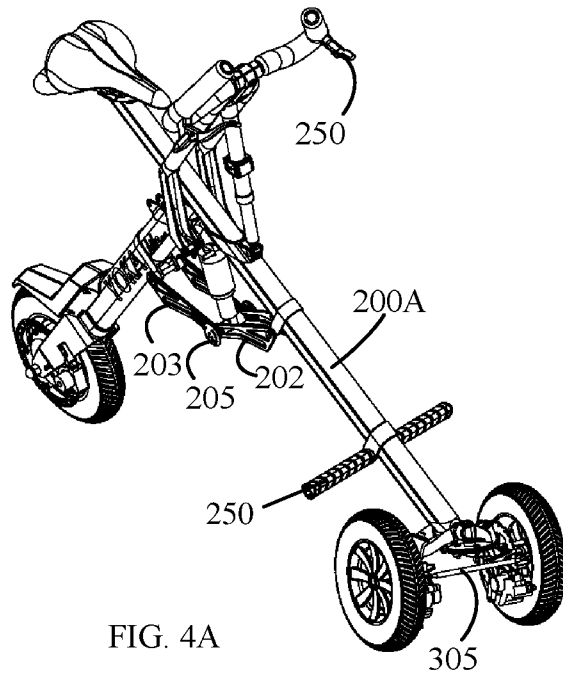


FIG. 4A

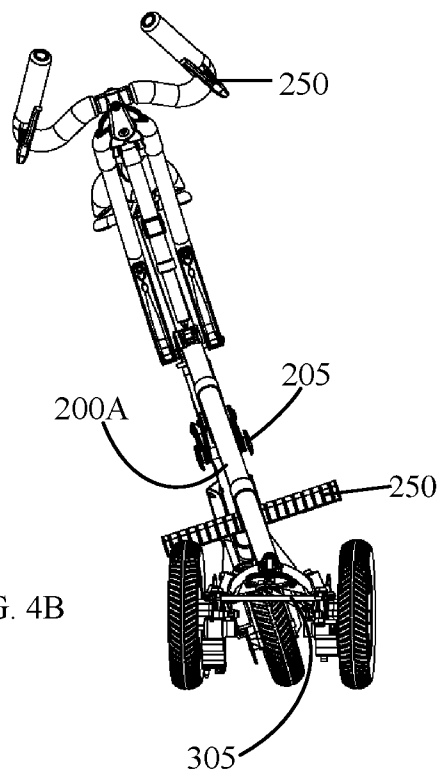
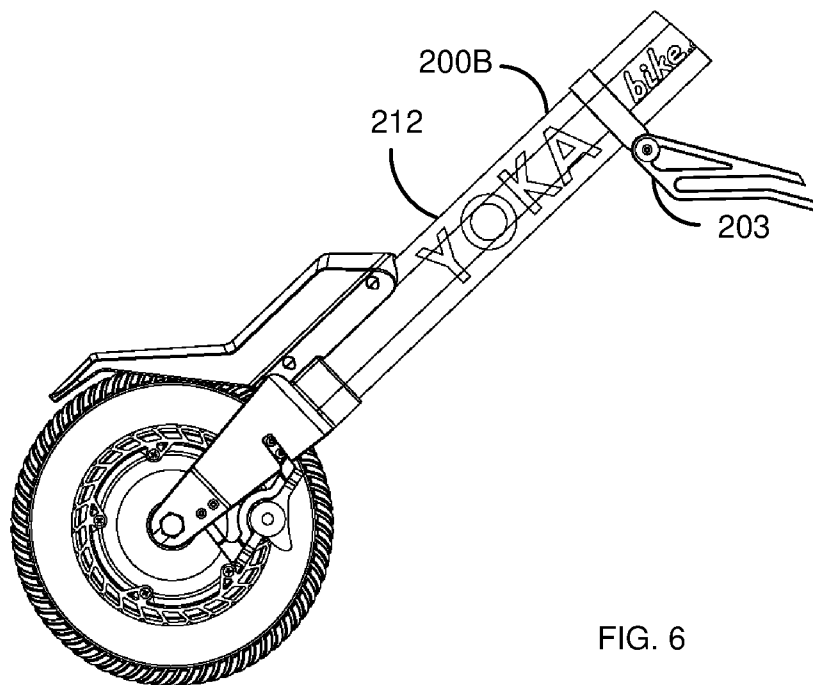
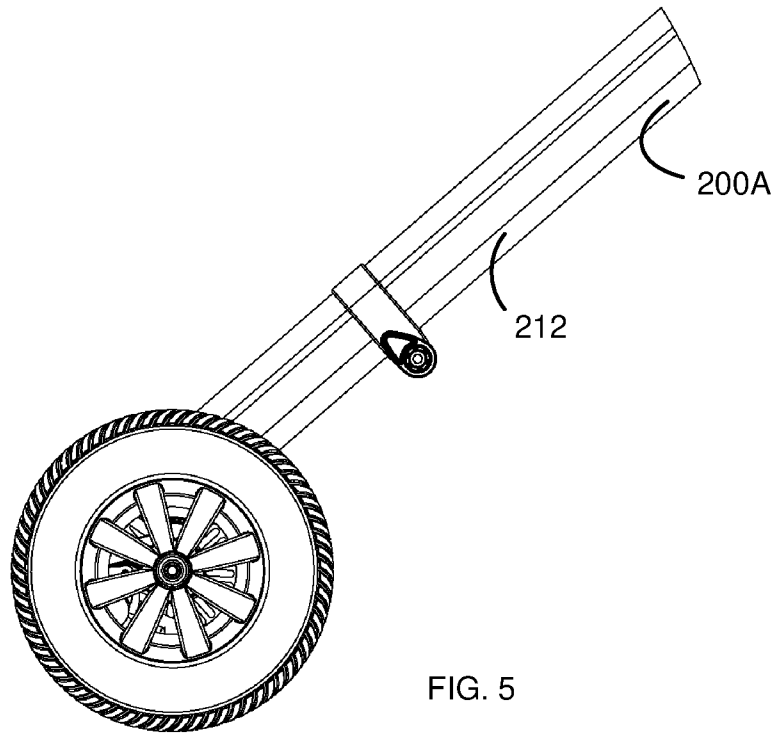


FIG. 4B



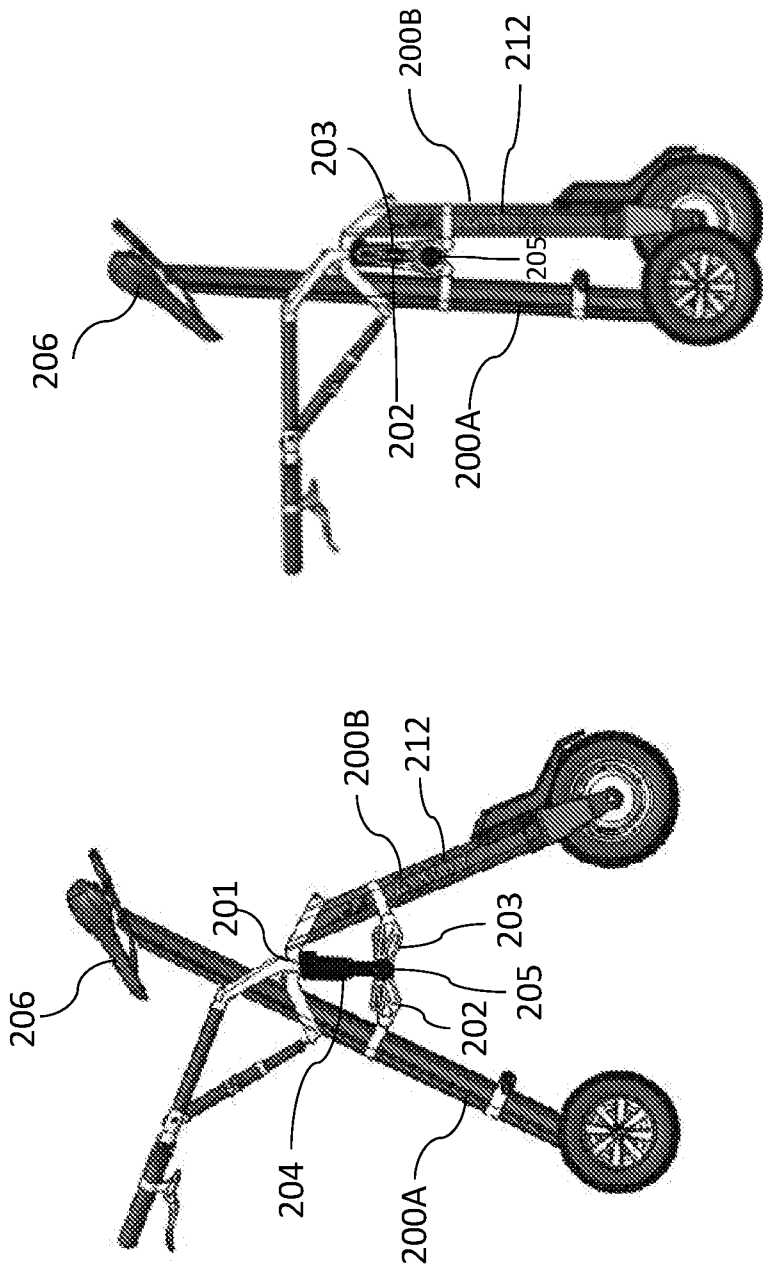


FIG. 7B

FIG. 7A

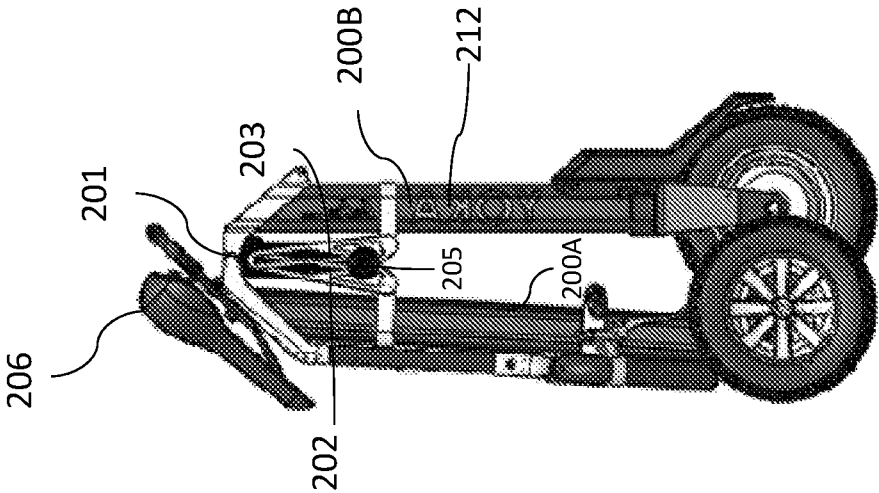


FIG. 7D

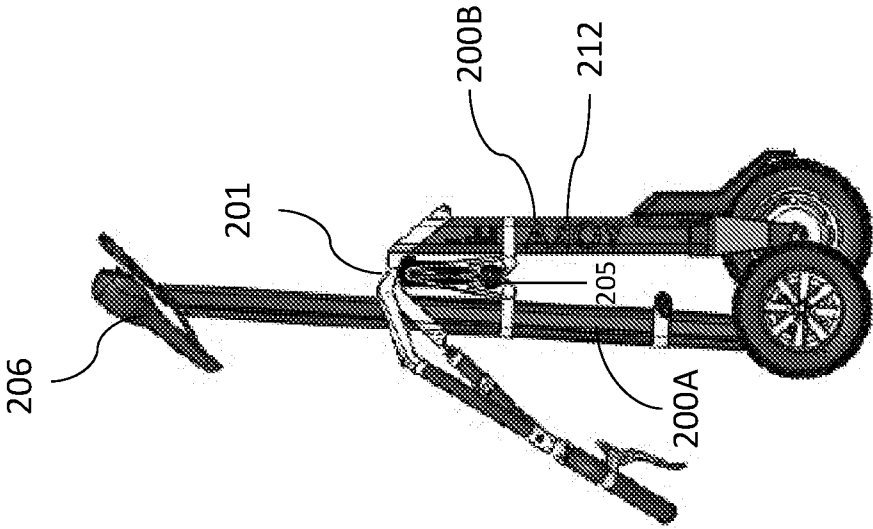


FIG. 7C

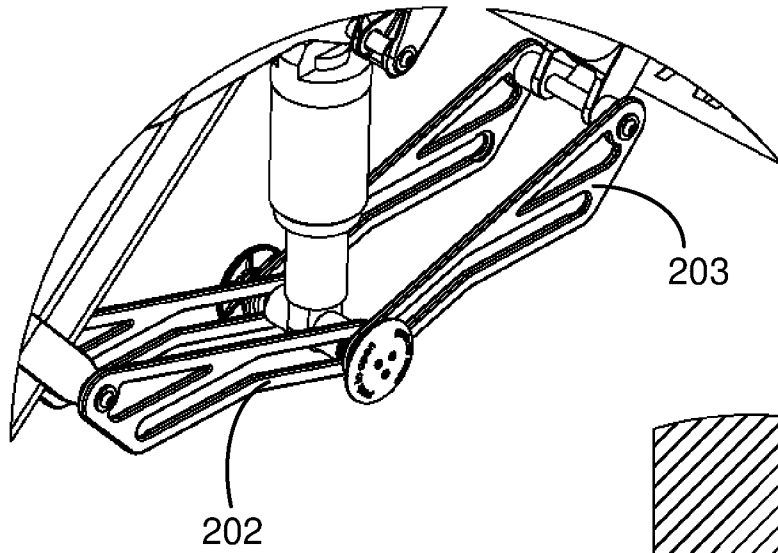


FIG. 8A

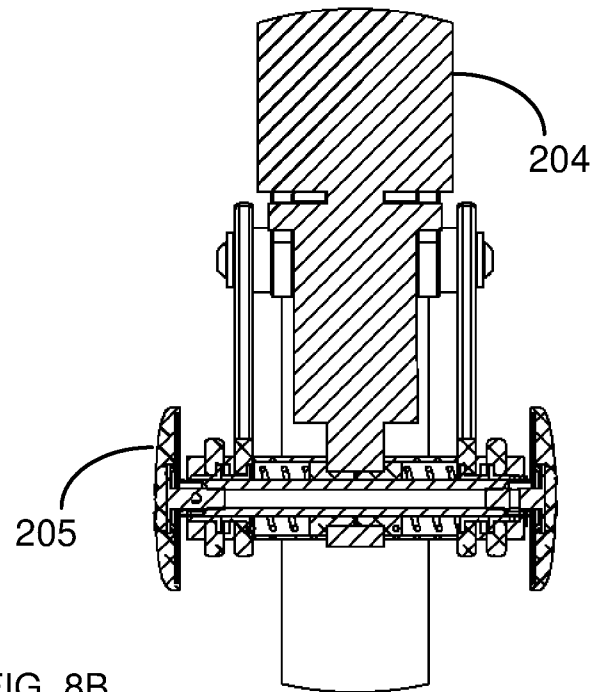


FIG. 8B

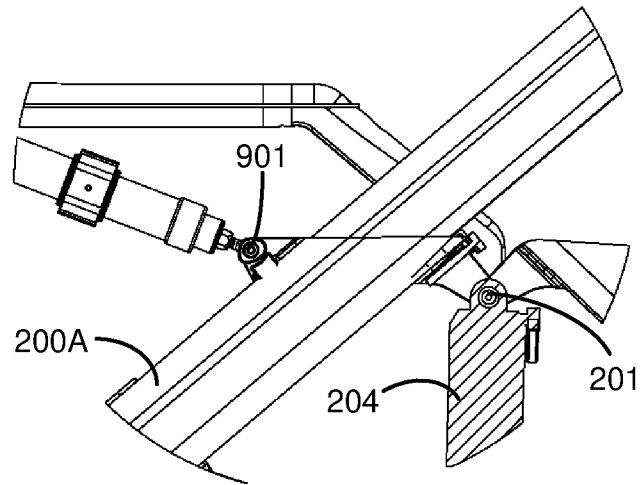


FIG. 9

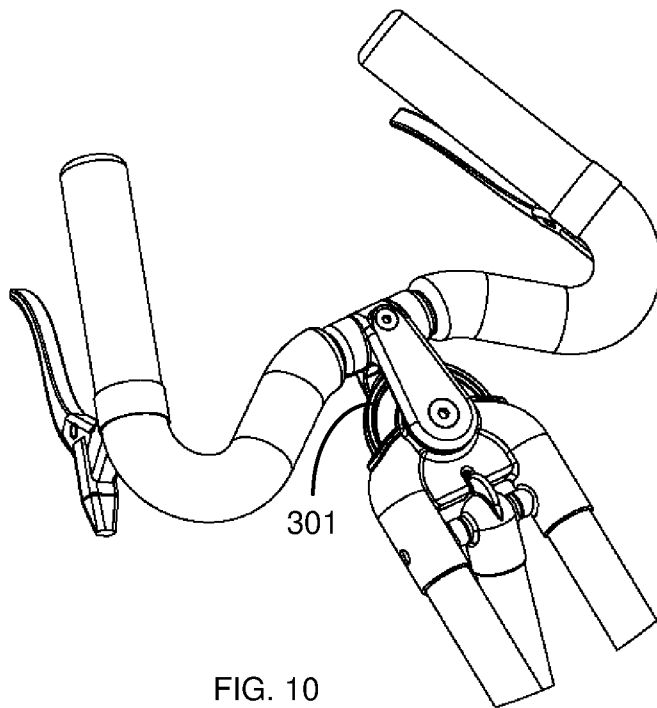
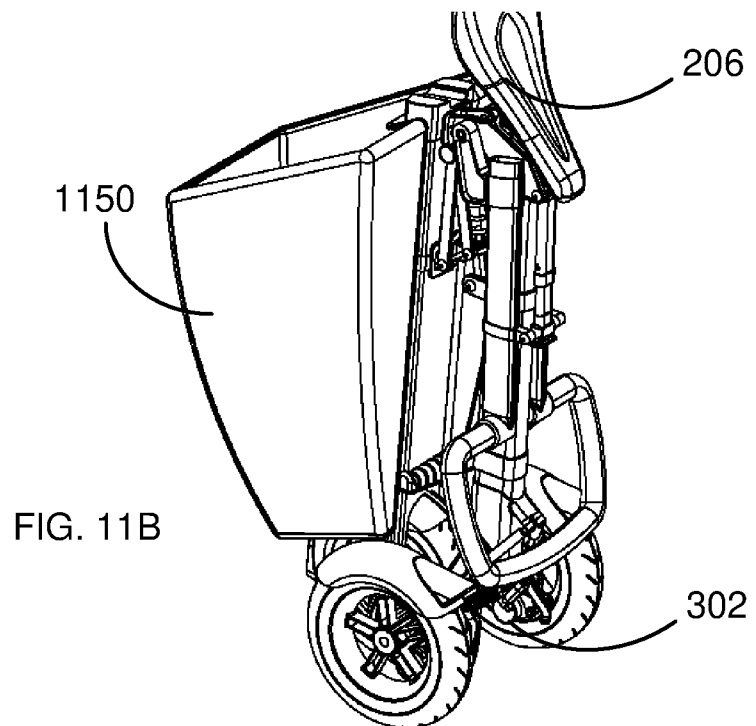
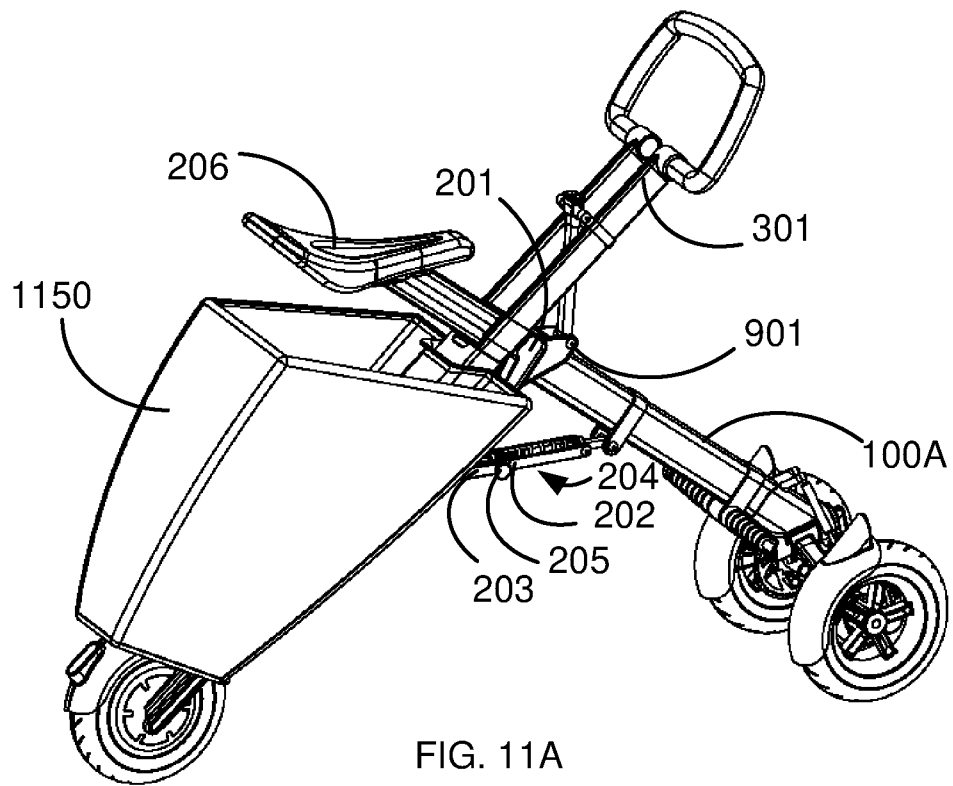
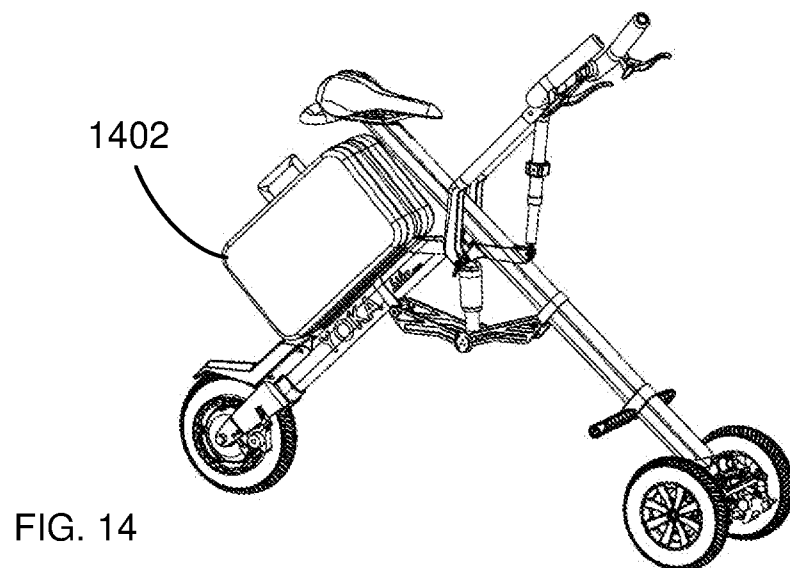
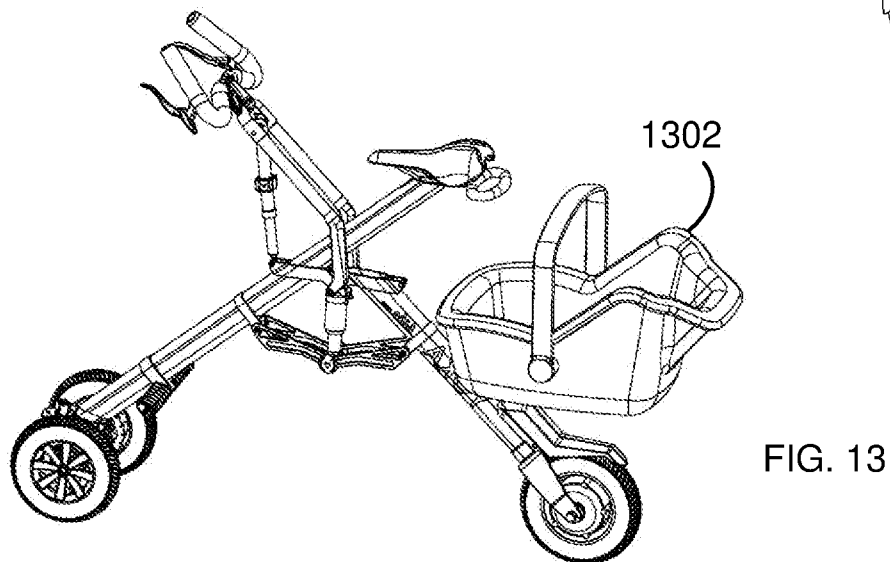
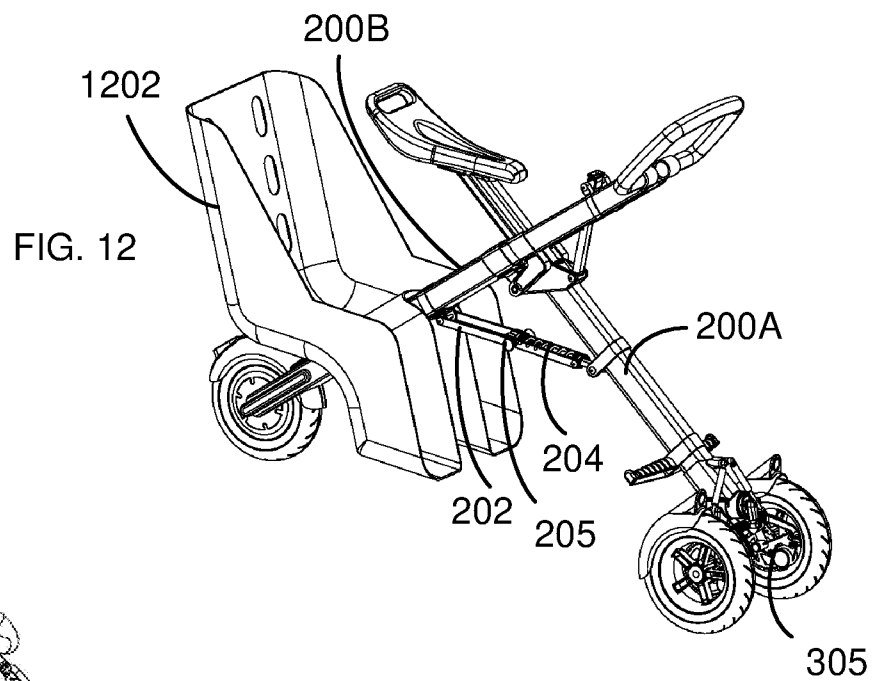
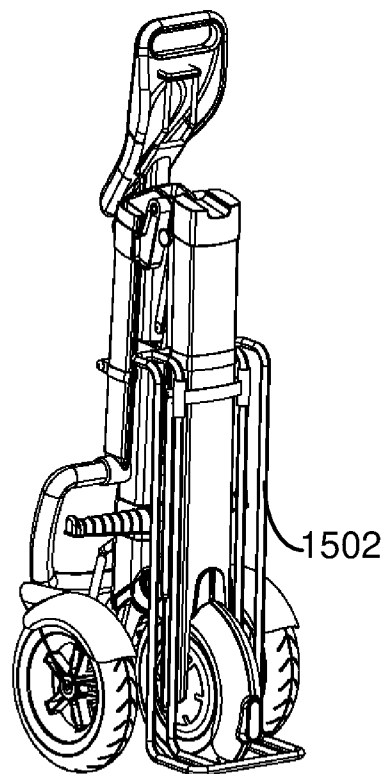
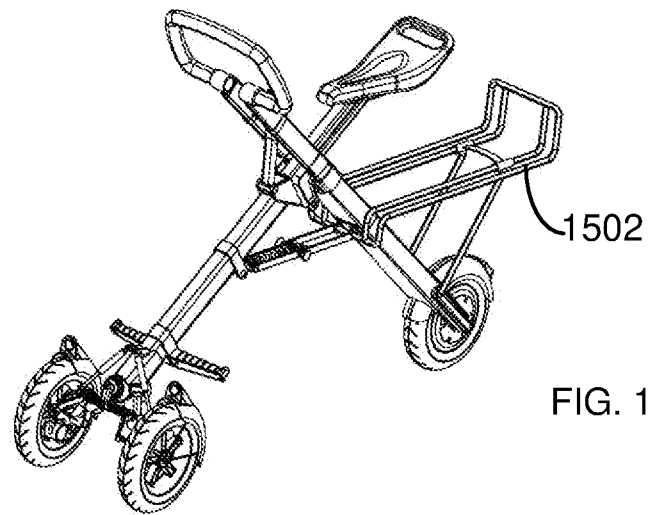


FIG. 10







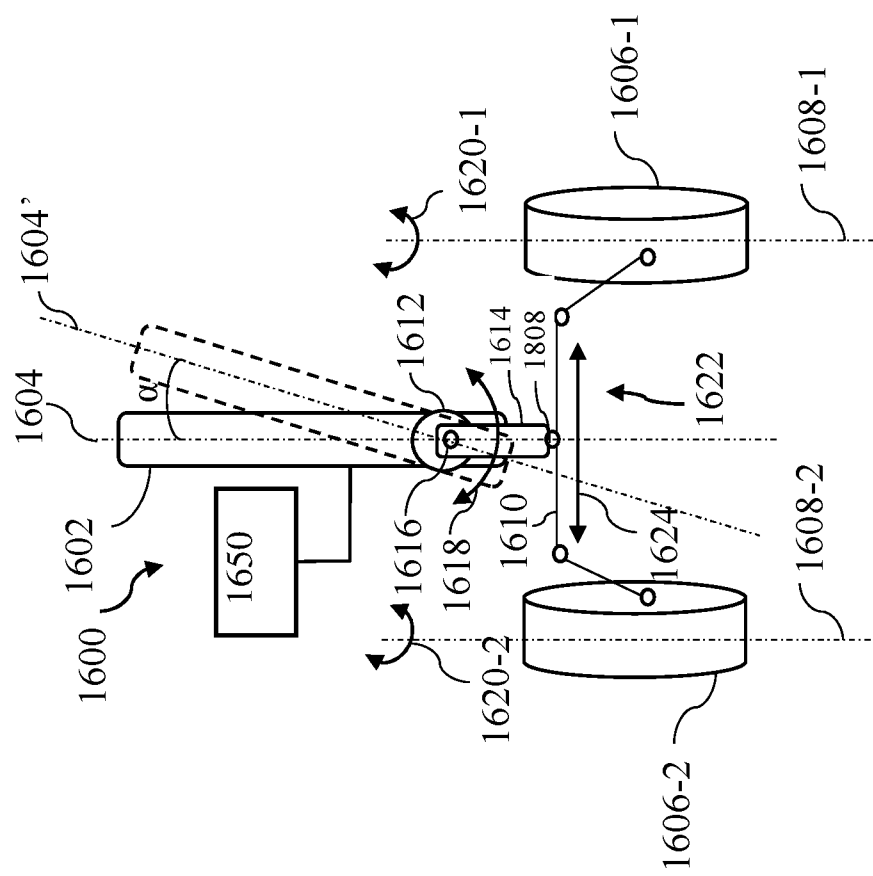


FIG. 16

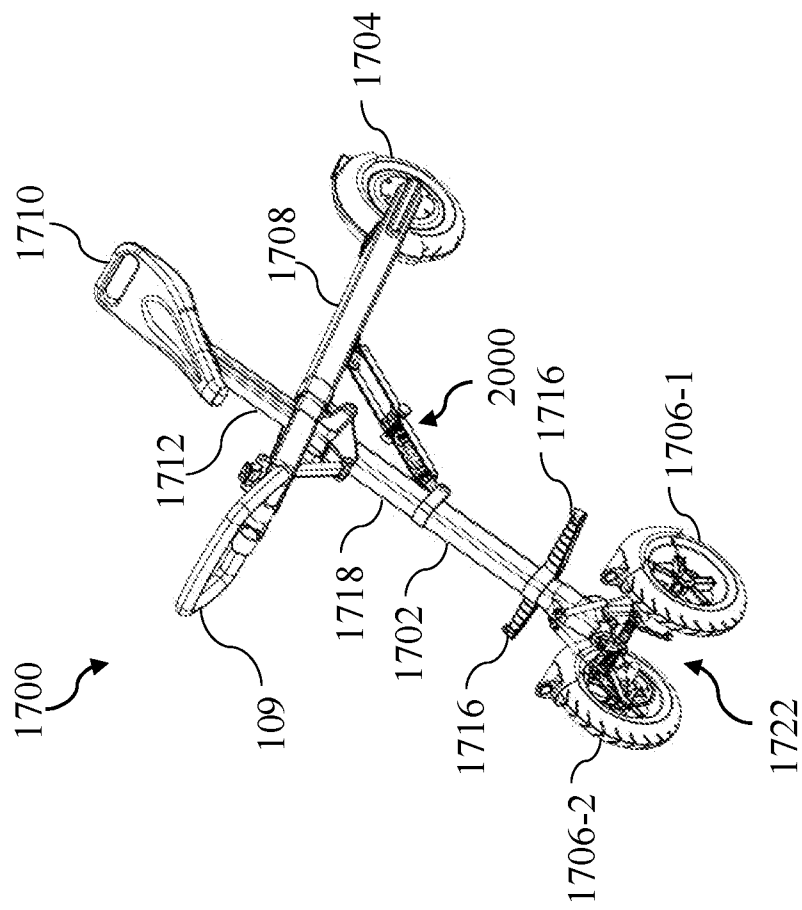
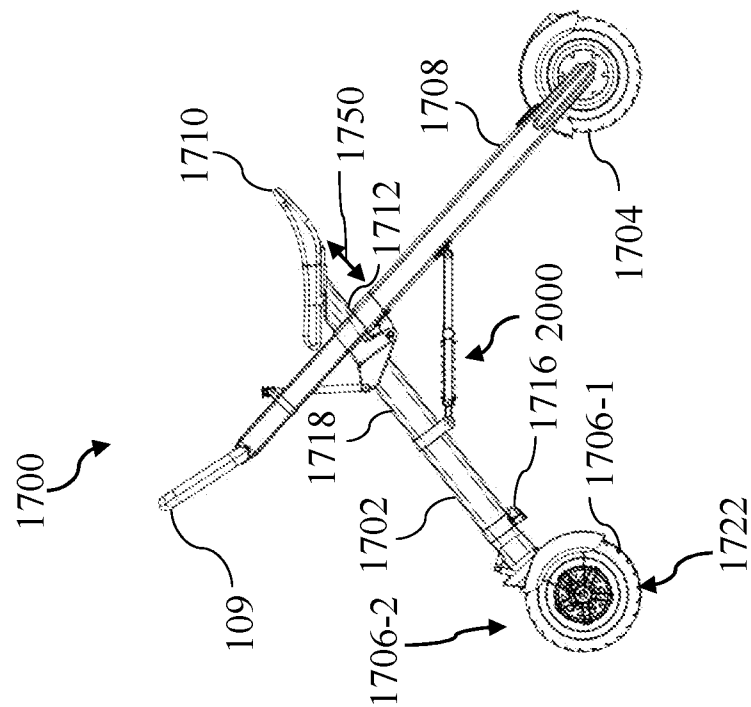
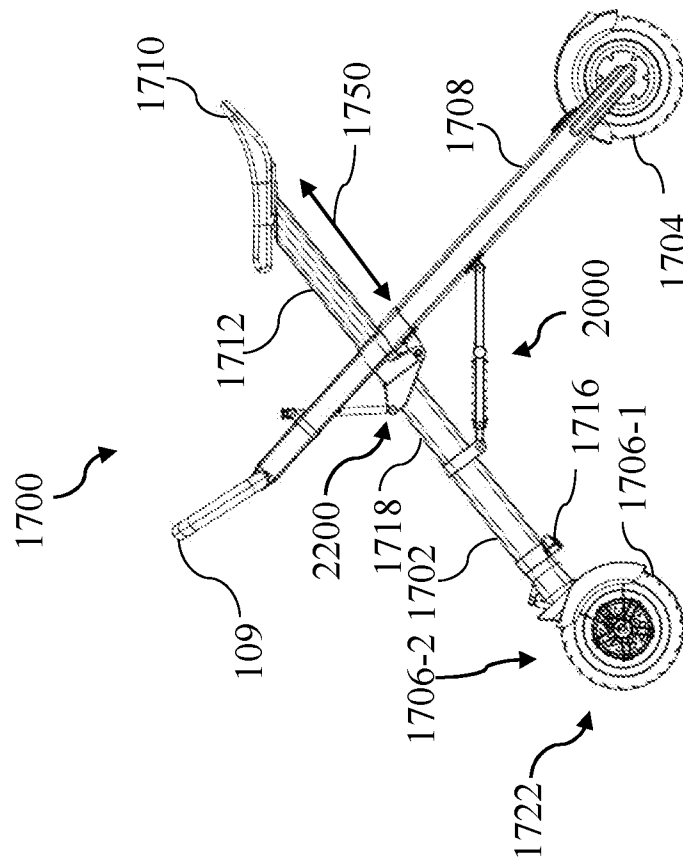


FIG. 17A



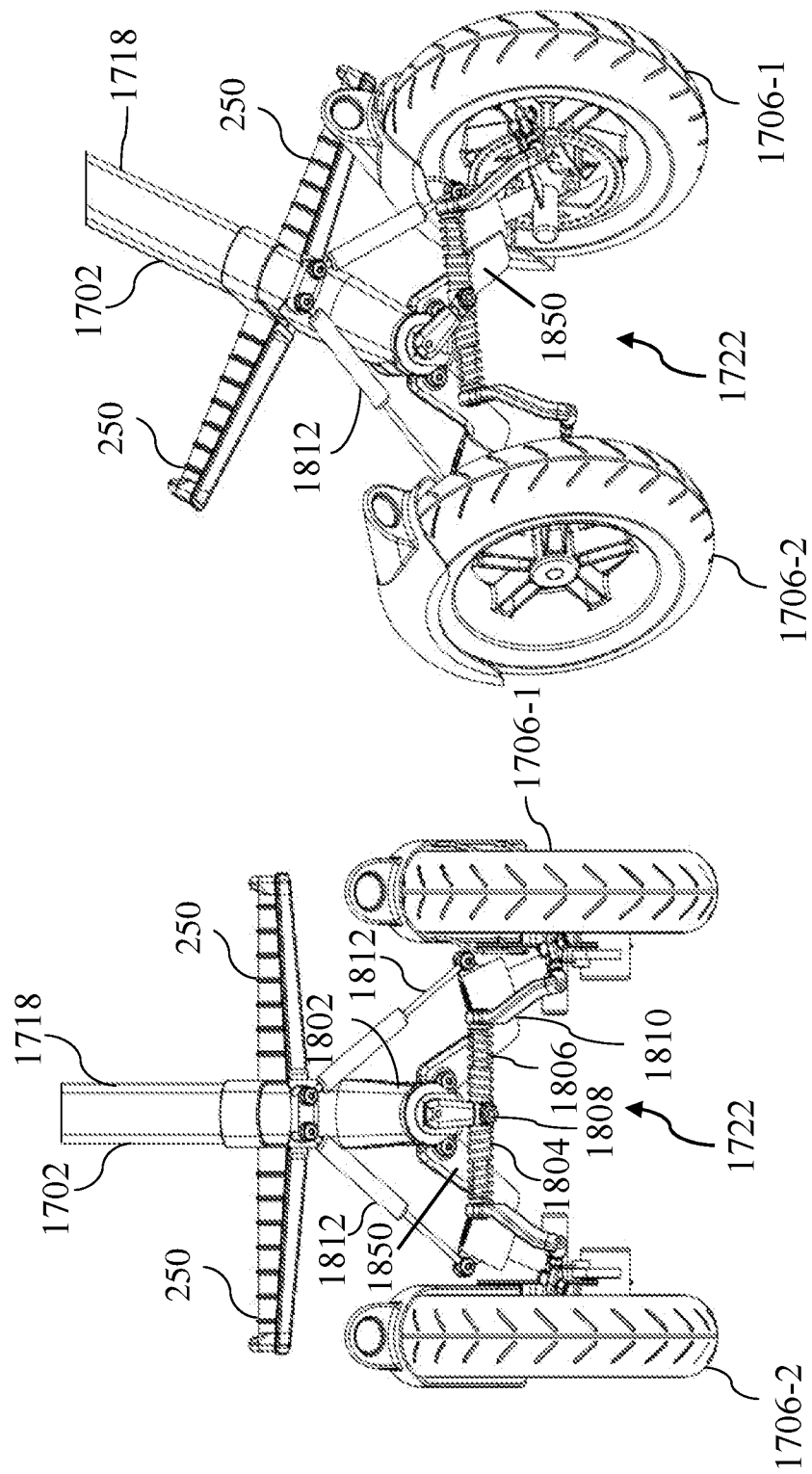


FIG. 18B

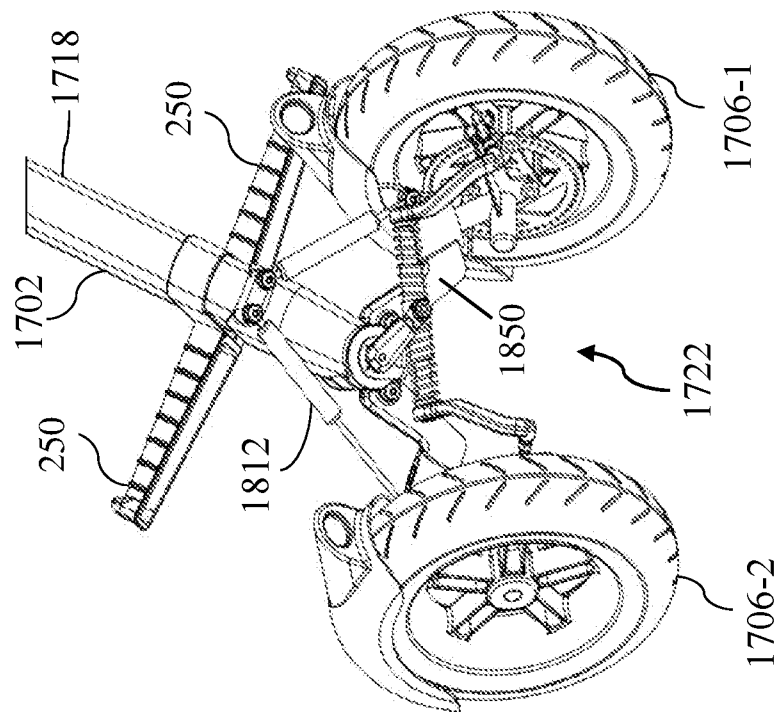


FIG. 18A

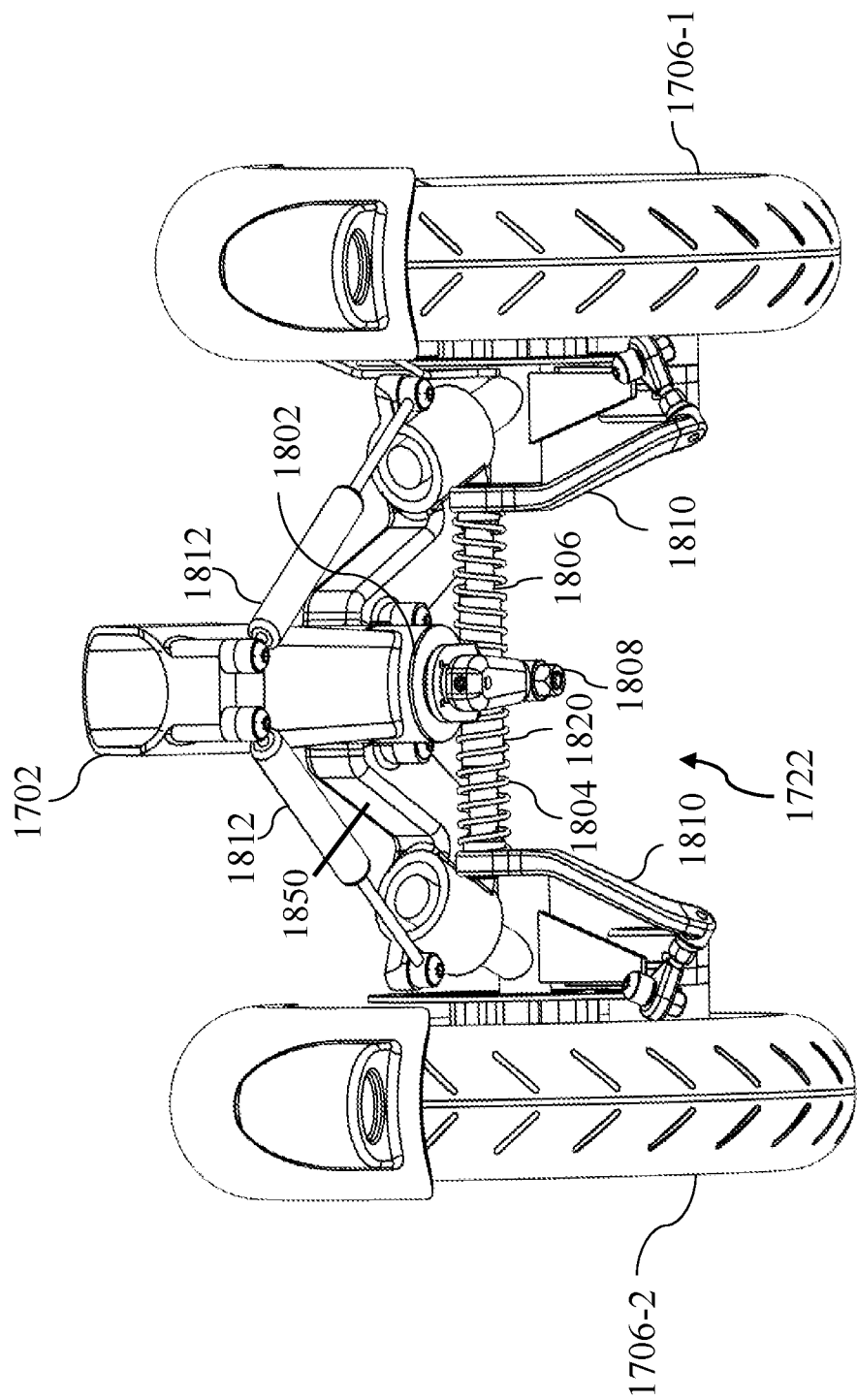


FIG. 18C

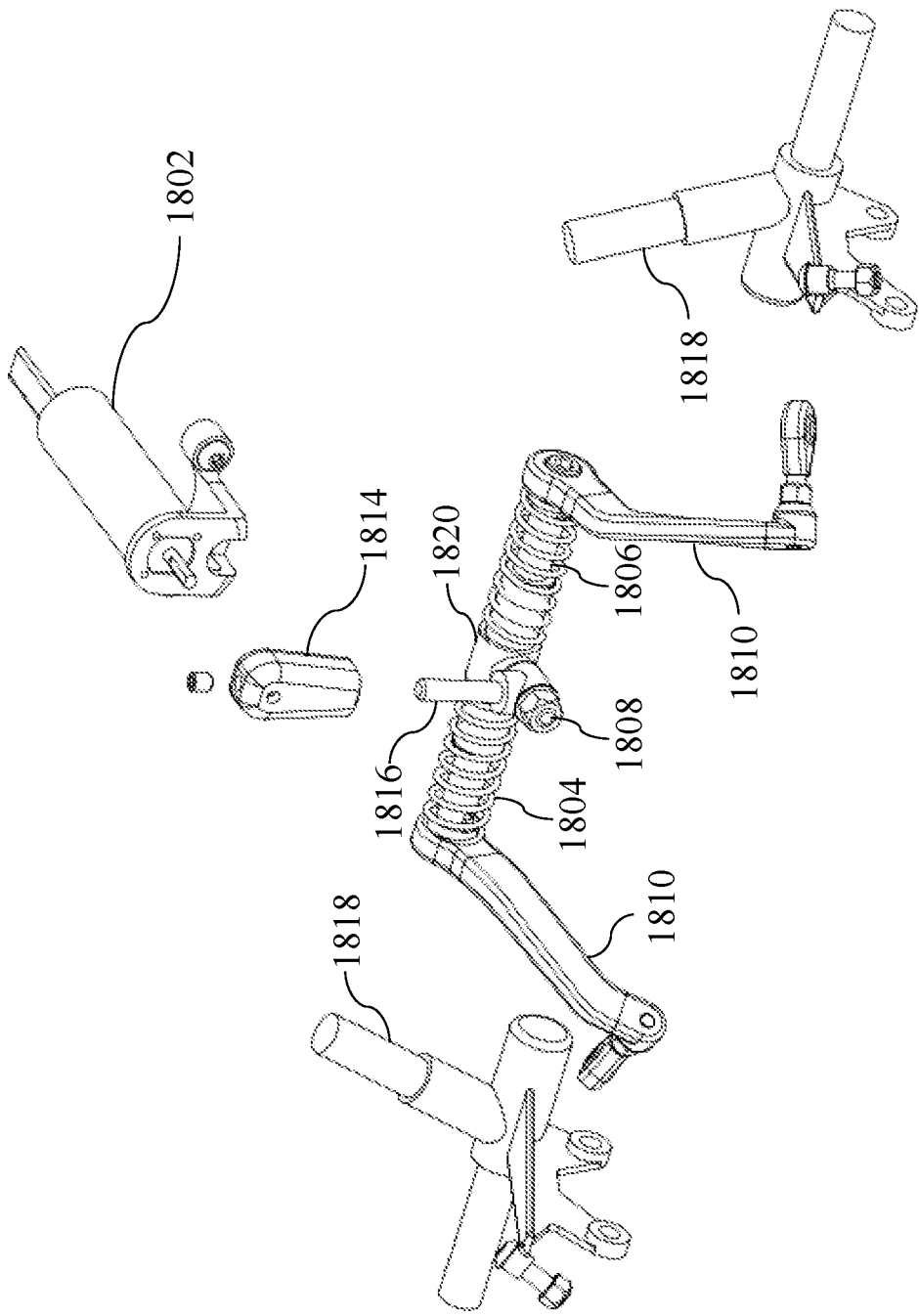


FIG. 19A

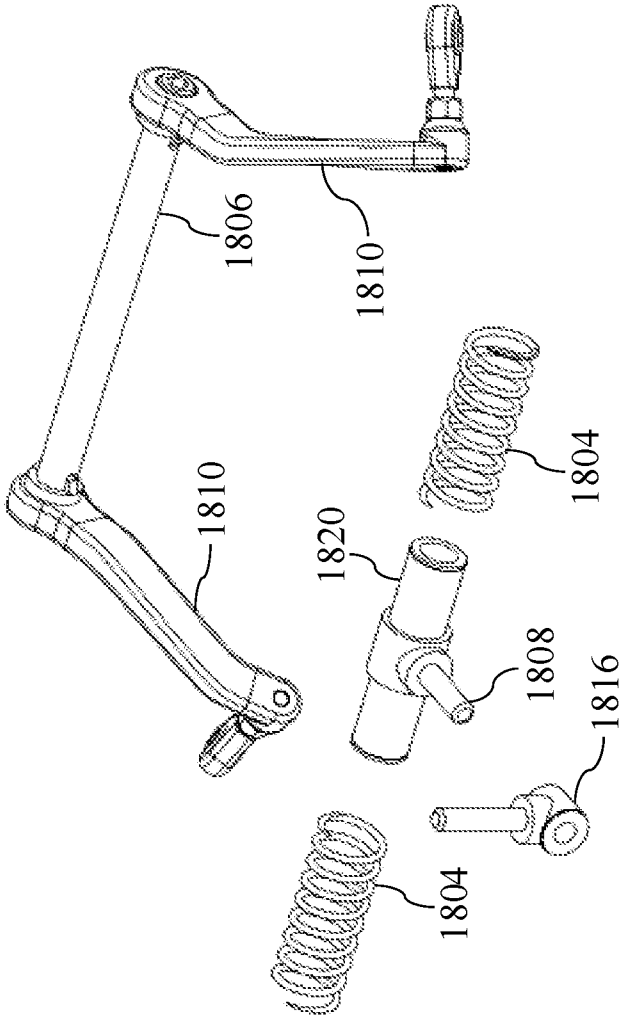


FIG. 19B

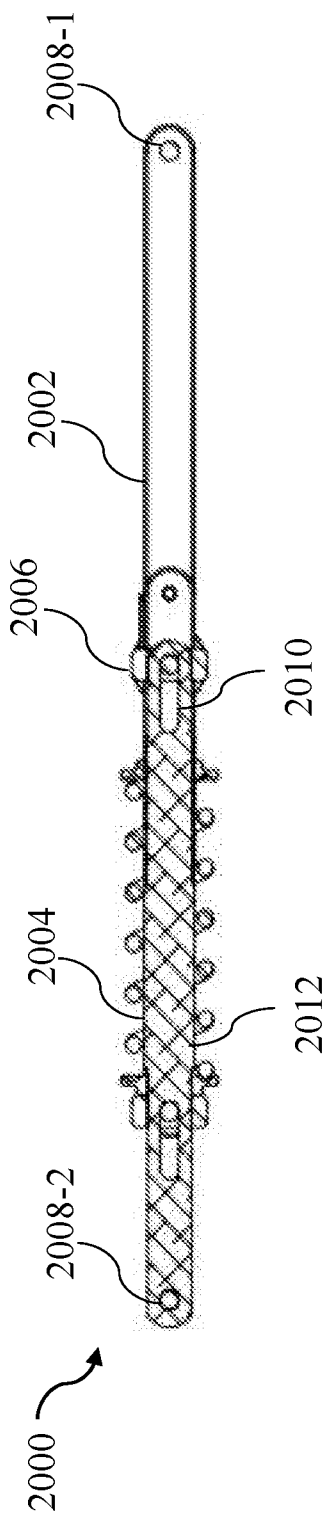


FIG. 20A

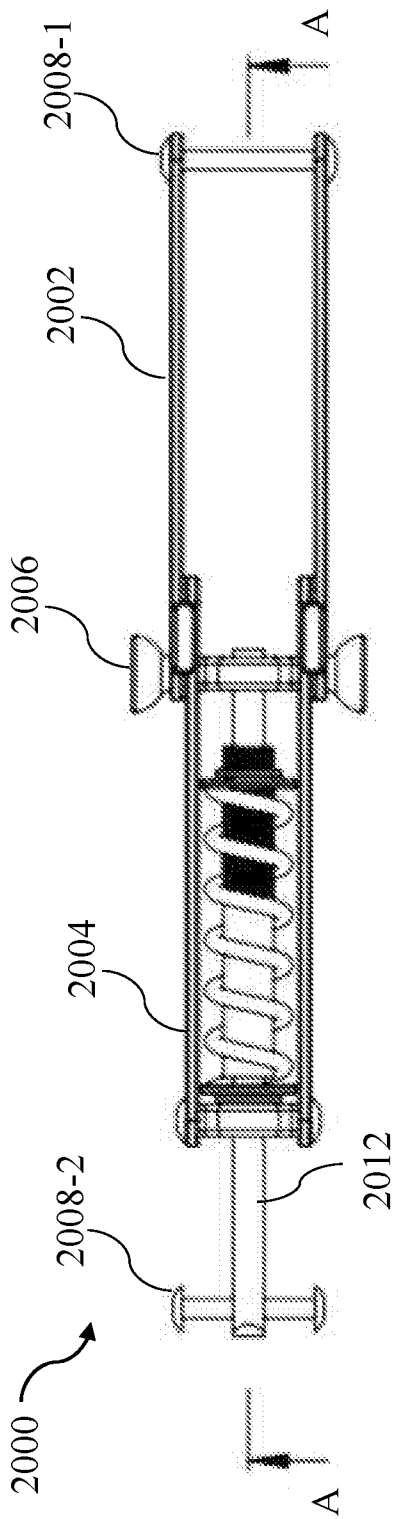


FIG. 20B

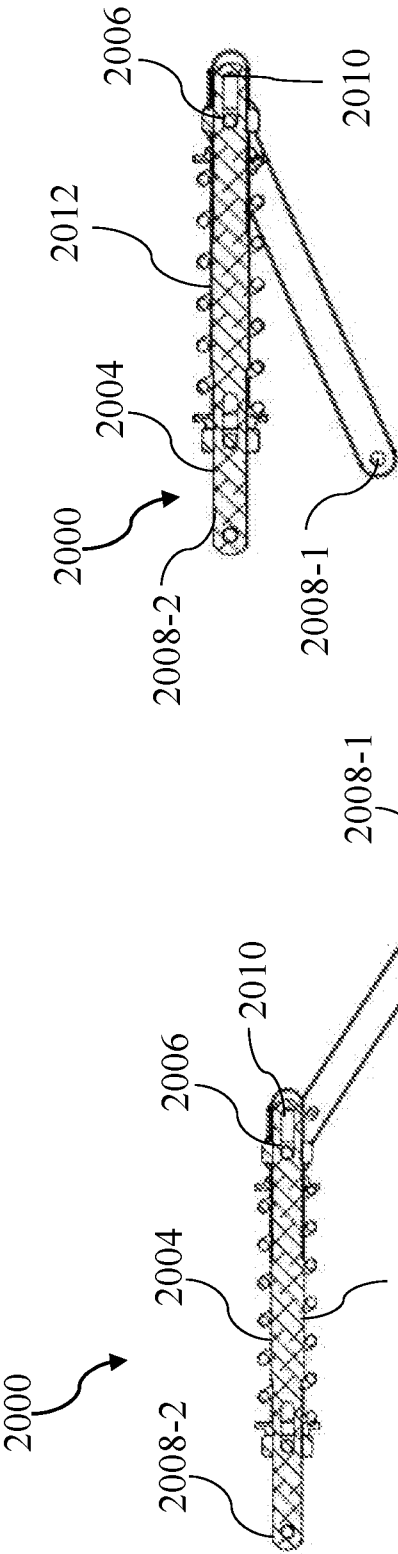


FIG. 20E

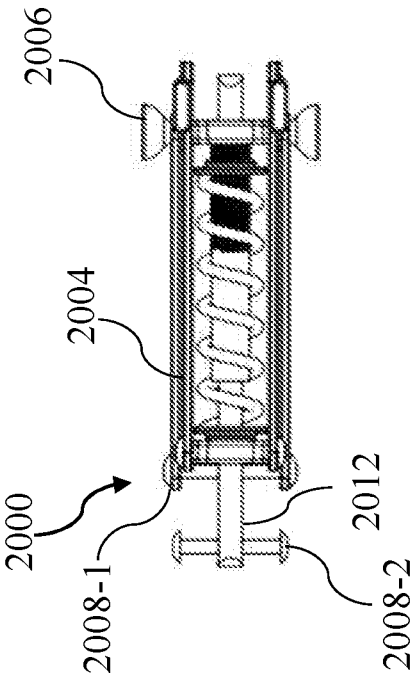


FIG. 20F

FIG. 20C

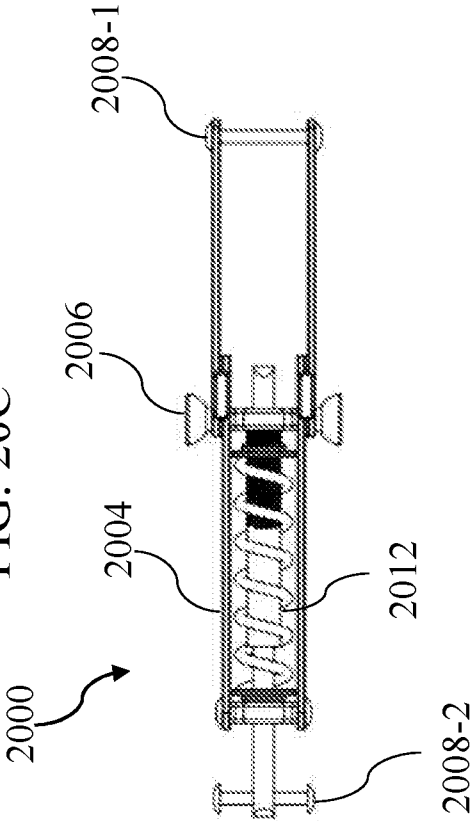


FIG. 20D

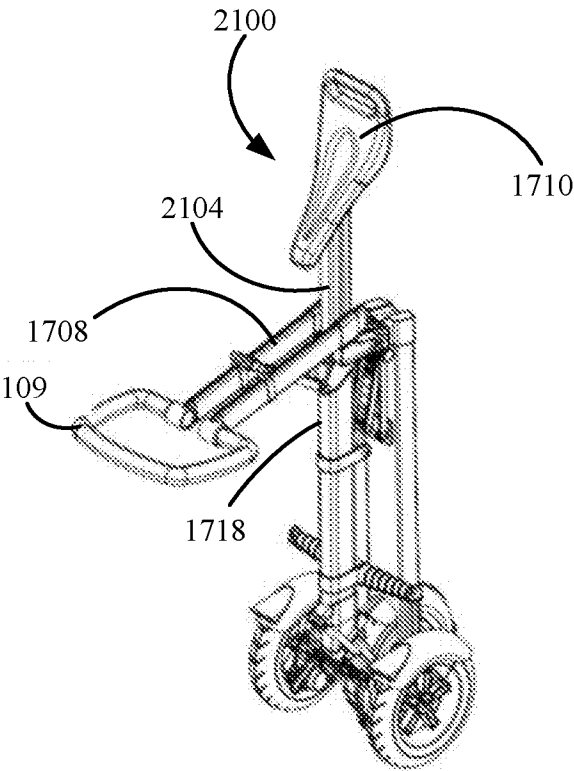


FIG. 21A

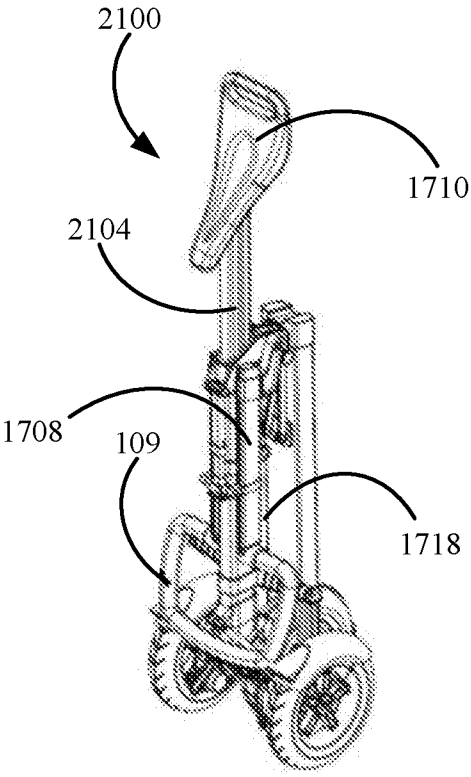
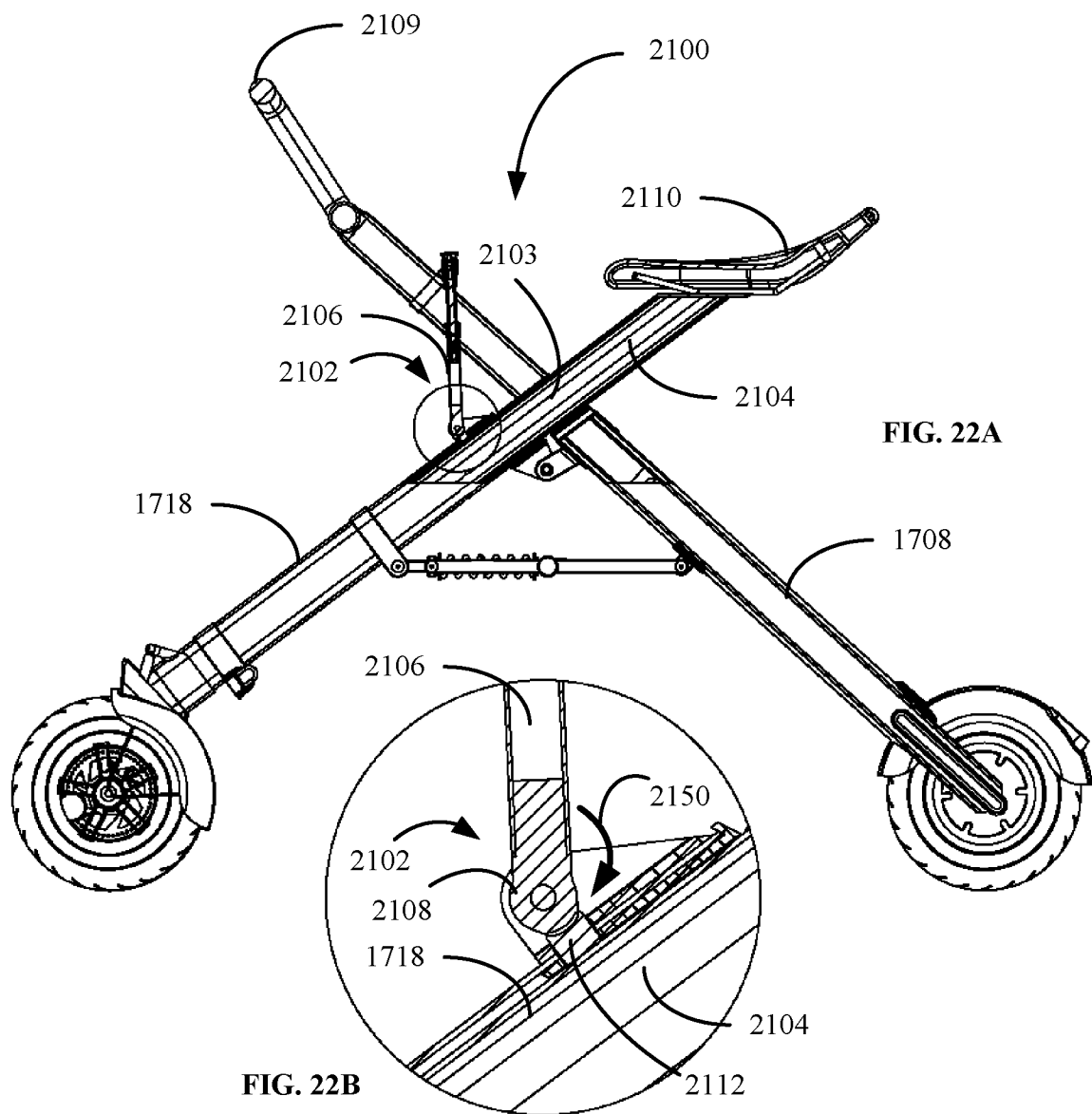


FIG. 21B



INTERNATIONAL SEARCH REPORT

International application No.

PCT/IL2020/050268

A. CLASSIFICATION OF SUBJECT MATTER IPC (20200101) B62D 6/00, B62D 5/04, B62K 5/08, B62D 9/02, B62D 9/04, B62K 15/00, B62K 5/027 CPC (20160501) B62D 6/00, B62D 5/04, B62K 5/08, B62D 9/02, B62D 9/04, B62K 15/006, B62K 5/027 According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED Minimum documentation searched (classification system followed by classification symbols) IPC (20200101) B62D 6/00, B62D 5/04, B62K 5/08, B62D 9/02, B62D 9/04, B62K 15/00, B62K 5/027 CPC (20160501) B62D 6/00, B62D 5/04, B62K 5/08, B62D 9/02, B62D 9/04, B62K 15/006, B62K 5/027 Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) Databases consulted: Esp@cenet, Google Patents, PatBase		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP 2010018173 A Kajikawa Atsushi 28 Jan 2010 (2010/01/28)	1-3,10-14,16
Y		4-9,15,17-23
X	WO 9202402 A1 SINCLAIR RES LTD 20 Feb 1992 (1992/02/20)	1,24-26
Y	US 2018208259 A1 KERV AUTOMOTIVE NV 26 Jul 2018 (2018/07/26)	4-9,15,17,23
Y	CN 201818694 U JIANMIN ZHANG 04 May 2011 (2011/05/04)	18-22
☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.		
* Special categories of cited documents: "A" document defining the general state of the art which is not considered to be of particular relevance "D" document cited by the applicant in the international application "E" earlier application or patent but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family		
Date of the actual completion of the international search 06 Jul 2020		Date of mailing of the international search report 06 Jul 2020
Name and mailing address of the ISA: Israel Patent Office Technology Park, Bldg.5, Malcha, Jerusalem, 9695101, Israel Email address: pctoffice@justice.gov.il		Authorized officer GUTKIN Solomon Telephone No. 972-73-3927213

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/IL2020/050268

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