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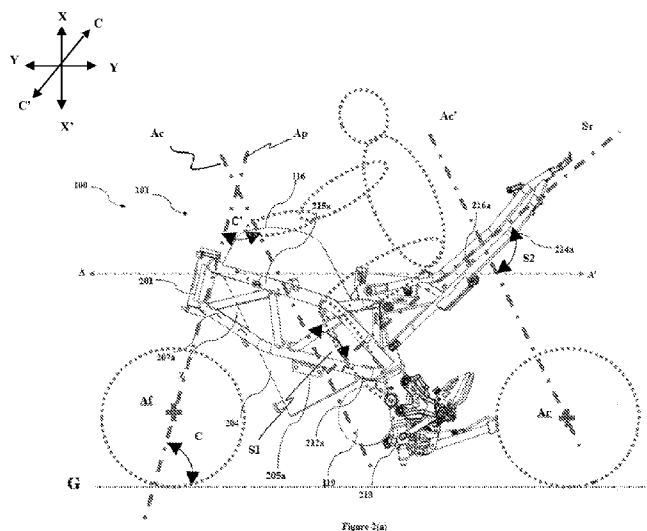
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(57) Abstract: A frame assembly (101) of a vehicle (100) comprising a pair of left and right upper frame members (215a, 215b) being extending rearwardly and downwardly from a head tube (201) and said pair of left and right upper frame members (215a, 215b) defines an interior space; said vehicle also comprises a battery casing (204); a charging and control unit assembly (500); and a prime mover (119), and said battery casing (204) being disposed of forwardly inclined in the interior space defined by the pair of left and right upper frame members (215a, 215b) and cover a portion of prime mover (119) when viewed from the top of said vehicle (100) to reduces weight, provide good performance and provide more storage space in the vehicle (100).

A VEHICLE

TECHNICAL FIELD

[0001] The present subject matter relates to a vehicle. More particularly, to a straddle-type vehicle.

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BACKGROUND

[0002] Over the last few years, with the induction of new powertrain technologies concomitantly very substantial attention has been paid to the reduction of pollutants emitted by vehicles. To this end, much attention has also been paid to the development of hybrid electric vehicles (HEV's)/ electric vehicles (EV's) for their optimal performance and durability. Importantly, performance and durability are essential vehicle attribute that attracts customers to purchase the vehicle.

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[0003] The above information disclosed in this Background section is only for enhancement of understanding of the background of the disclosure and therefore it may contain information that does not form the prior art that is already known in this country to a person of ordinary skill in the art.

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BRIEF DESCRIPTION OF THE DRAWINGS

[0004] The present invention is described with reference to an exemplary embodiment of a straddle type two-wheeled vehicle colloquially called a motorcycle wherein a rider has to straddle and sit. This invention is implementable in two-wheeled vehicles/three-wheeled vehicles. The same numbers are used throughout the drawings to reference like features and components. Further, the inventive features of the invention are outlined in the appended claims.

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[0005] Non-limiting and non-exhaustive embodiments of the invention are described with reference to the following figures, wherein like reference numerals refer to like parts throughout the various views unless otherwise

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specified. It should be appreciated that the following figures may not be drawn to scale.

5 [0006] Descriptions of certain details and implementations follow, including a description of the figures, which may depict some or all of the embodiments described below, as well as a discussion of other potential embodiments or implementations of the inventive concepts presented herein. An overview of
embodiments of the invention is provided below, followed by a more detailed description with reference to the drawings.

10 [0007] Figure 1 illustrates a right-side view of a vehicle (100) where few parts are omitted from figure, as per embodiment, in accordance with one example of the present subject matter.

[0008] Figure 2a illustrates a left side view of the vehicle (100), where few parts are omitted from figure 1 as per embodiment, in accordance with one example of the present subject matter.

15 [0009] Figure 2b illustrates front view of the vehicle (100) where few parts are omitted from figure 1 as per embodiment, in accordance with one example of the present subject matter.

20 [00010] Figure 2c illustrates left side view of the vehicle (100) with imaginary line Sr where few parts are omitted from figure 1 as per embodiment, in accordance with one example of the present subject matter.

[00011] Figure 3a illustrates a perspective view of a battery casing (204) as per embodiment, in accordance with one example of the present subject matter.

[00012] Figure 3b illustrates a perspective view of the battery casing (204) as per embodiment, in accordance with one example of the present subject matter.

25 [00013] Figure 3c illustrates a perspective view inside the battery casing (204) as per embodiment, in accordance with one example of the present subject matter.

[00014] Figure 4a illustrates a left side view of the vehicle (100), where few parts are omitted from figure 1 as per embodiment, in accordance with one example of the present subject matter.

5 [00015] Figure 4b illustrates a top view of the vehicle (100), where few parts are omitted from figure 1 as per embodiment, in accordance with one example of the present subject matter.

[00016] Figure 5a illustrates a localized top view of the vehicle (100), where few parts are omitted from the figure, as per embodiment, in accordance with one example of the present subject matter.

10 [00017] Figure 5b illustrates a localized side view of the vehicle (100), where few parts are omitted from the figure, as per embodiment, in accordance with one example of the present subject matter.

15 [00018] Figure 6 illustrates a side view of the vehicle (100), where few parts are omitted from the figure as per embodiment, in accordance with one example of the present subject matter.

[00019] Figure 7a illustrates a side view of the vehicle (100), where few parts have been omitted from the figure as per embodiment, in accordance with one example of the present subject matter.

20 [00020] Figure 7b illustrates an enlarged localized view of the vehicle (100), where few parts have been omitted from the figure as per embodiment, in accordance with one example of the present subject matter.

[00021] Figure 8 illustrates a rear side cut section view across A-A' of the vehicle (100) as shown in figure 2a as per embodiment, in accordance with one example of the present subject matter.

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DETAILED DESCRIPTION

[00022] In the following description, specific details are set forth to provide a thorough understanding of the embodiments. One skilled in the relevant art will recognize, however, that the techniques described herein can be practiced

without one or more of the specific details, or with other methods, components, materials, etc. In other instances, well-known structures, materials, or operations are not shown or described in detail to avoid obscuring certain aspects.

5 **[00023]** Various features and embodiments of the present invention here will be discernible from the following further description thereof, set out hereunder. Further "front" and "rear", and "left" and "right" referred to in the ensuing description of the illustrated embodiment refer to front and rear, and left and right directions as seen from a rear portion of the vehicle and looking forward.

10 Furthermore, a longitudinal axis Y – Y' unless otherwise mentioned, refers to a front to rear axis relative to the vehicle, while a lateral axis C – C' unless otherwise mentioned, refers generally to a side to side, or left to right axis relative to the vehicle.

15 **[00024]** However, it is contemplated that the disclosure in the present invention may be applied to any vehicle without defeating the spirit of the present subject matter. The detailed explanation of the constitution of parts other than the present invention which constitutes an essential part has been omitted at suitable places.

20 **[00025]** The looming problems of global warming and depletion of fossil fuels have resulted in a need for an alternate mode of transportation. The conventional vehicles which run on fossil fuels emit a lot of harmful fumes which pollute the air, thus a need for cleaner and economical mode of both public and private transportation is required. The alternate mode of transportation includes electric vehicles, electric vehicles with or without a supplemental IC engine (i.e., hybrid

25 electric vehicle), or fuel cell-powered vehicles. Such vehicles do not emit harmful fumes and operate silently thereby causes no pollution to the environment. Hence, customers are rapidly switching to such alternate mode of transportations for their regular usage.

30 **[00026]** Typically, a hybrid electric vehicle comprises an IC engine and a battery unit to run the vehicle. The hybrid vehicle is controlled electronically by an ECU (Electronic Control Unit) which in turn controls gears and vehicle speed

to run the vehicle as an output. It is known in the art, to provide various control strategies for a hybrid vehicle. More specifically, when the vehicle is not in motion and the gear position is Neutral, an electric motor is switched on to power the vehicle to move. If the gear position is other than Neutral, an
5 Indication is sent to the rider to change the gear position to Neutral. After reaching predefined speed, the sensor sends the signal to the controller to switch on the engine. There on the engine supplies the power to the wheel through a transmission system to run the vehicle. If the battery is not fully charged, the controller intelligently bypasses the motor and sends a signal to crank the engine
10 and the vehicle runs as a conventional internal combustion engine vehicle. Importantly, the motor provides additional power to the IC engine when the vehicle is in motion at higher gradients. However, as described above the hybrid vehicle requires complex control strategies. Further it is economically disadvantageous due to the plurality of control device to control the internal
15 combustion engine, and electric motor.

[00027] To this end, electric vehicles have the potential to substantially cut greenhouse gas emissions from the transport sector. Typically, a drive system of the electric vehicle includes a battery for powering an electric motor assembly and a transmission assembly. The electric motor assembly includes a
20 controller for controlling the speed of the electric motor. However, there are certain limitations associated with electric vehicles. Most significantly, the torque, speed, and range of electric vehicles. Thus, to assure an effective torque developed by the drive wheel and the force applied to the road surface special attention has been given to the electric drive and power source i.e., batteries.

[00028] Generally, electric vehicles, particularly high-performance vehicles require a plurality of batteries. The plurality of batteries are employed to achieve the equivalent performance in terms of the range of an gasoline powered vehicle since batteries generally have a lower energy density than gasoline. Further, it is counterintuitive in nature to meet the need to propel vehicles with
25 optimum torque and speed while enabling enough storage space inside the vehicles as a large proportion of the weight and volume of the electric vehicle must be devoted to the batteries. Therefore, it is challenging for the designer
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engineers for a two or three-wheeled straddle type vehicle when compared with a four-wheeled vehicle owing to the lack of space & compact layout as well as the economics.

5 **[00029]** As per known art, mounting the plurality of batteries in an electric vehicle below a seat assembly and above a swing arm unit is disclosed. Also mounting the batteries on the rear portion of the vehicle under the seat assembly and inside a rear fender of the vehicle is also disclosed. Further, in another art batteries are mounted on a tail cover of the vehicle. In another prior art, the batteries are disposed in the storage compartments wherein storage
10 compartments are overhanging members and mounted on the left and right side of the vehicle. Furthermore, it is obvious to a person skilled in the art to combine the teaching of above know prior arts to mount the plurality of batteries to at various location either alone or combined to meet the speed and torque requirement of the vehicle.

15 **[00030]** However, the increased weight of the electric vehicle, more particularly high performance vehicle, is detrimental to the speed and range of the motorcycle. Therefore, to achieve good performance it is important to reduce the weight of the electric vehicle while retaining the optimum strength of the electric vehicle to support the multiple components including electric motor and
20 plurality of batteries. Typically vehicles with high acceleration and / or high engine power (KW) are referred to as high performance vehicles, wherein the minimum engine power consumed by a typical electric vehicle is 15KWH per 100 kms.

25 **[00031]** Further, in high-performance electric vehicles, known batteries are prone to failure due to reasons such as the continuous transmission of mechanical vibrations, exposure to high impact forces and, thermal runaway. This phenomenon can lead to an uncontrolled chain of exothermic reactions resulting in the release of toxic gas. This can further lead to the development of high pressure in the battery packs leading to premature failure, fire, and
30 explosions. To address the said issue, batteries are typically provided in the rear portion of the vehicle with an active cooling means. The placement in the rear portion of the vehicle protects and isolates the battery pack and at the same time,

active cooling means maintains optimum battery cell temperature. However, this significantly increases the size, weight, and cost of the electric vehicle. The increased weight and non-uniform weight distribution undesirably affects the handling and maneuverability of the electric vehicle. More specifically, the non-uniform weight distribution across the electric vehicle leads to imbalances of the center of gravity of the vehicle. Further, the batteries when mounted at the rear portion acts as an overhanging member which affects the durability of the frame assembly of the electric vehicle.

[00032] In addition to that, current batteries require a relatively long time to recharge, owing to the inherent limitations of chemical-based electric power sources as compared to gasoline fuel-based systems, and the gains in capacity vis-a-vis current batteries tend to be incremental. To address the said issue, the battery swap system is known. However, batteries are heavy, and exchanging these batteries is a huge task as the battery is to be removed from the vehicle and charged in a battery charger or at a remote station. More specifically, the plurality of panels mounted to a frame assembly is to be removed for accessing the battery that makes accessing cumbersome. Therefore, swapping the battery is time-consuming, as it is not easily accessible. Also, a dedicated locking provision is provided for securing the batteries in the vehicle,

[00033] In addition to that, it is important to provide charging units that are easily accessible as that of a fuel-filling unit in a conventional vehicle.

[00034] Further, recent times have witnessed a swift change from a conventional vehicle to an electric vehicle. Therefore, it is a challenge for automobile makers to cater to various market segments and provide a variety of products meeting various demands. Hence, it is always desirable for automobile makers to provide a variety of products with minimum changes and without additional costs to the existing design, assembly time, and manufacturing setup. Thus, the transition towards electric vehicles is a major challenge for the OEM's in terms of manufacturing, as it requires revamping of core processes to prepare for mass production of electric vehicles.

[00035] Hence, there is a need for an electric vehicle overcoming all the above problems & trade-offs as well as overcoming problems of the known art.

[00036] It is object of the invention to provide an improved electric vehicle layout with reduced weight, and good performance while providing more storage space.

[00037] To this end, the present invention discloses a vehicle comprising a frame assembly. The frame assembly includes a pair of left and right upper frame member and a head tube. The pair of left and right upper frame members extends rearwardly and downwardly from said head tube. The pair of left and right upper frame members define an interior space. Further, a vehicle includes a battery casing and a prime mover. The said battery casing being disposed of in a forwardly inclined orientation in an interior space defined by said pair of upper frame members, and said down frame members, wherein said battery casing covers at least partially overlaps a portion of said prime mover when viewed from the top of said vehicle.

[00038] In accordance with this configuration, one of the advantages of the present invention is that battery casing acts as a stressed member under different riding conditions thereby improving the stiffness of the frame assembly. Further, the battery casing is disposed between a pair of upper frame members which protects the battery casing from any side collision.

[00039] As per the second embodiment, a frame assembly of the vehicle comprises a head tube, a pair of left and right upper frame members, a pair of left and right down frame members, a pair of left and right cross frame members, a pair of left and right seat rail members, and a pair of left and right side frame members. The upper frame members being substantially parallel to said down frame members and being connected to said down frame members through a plurality of said cross frame members. The seat rail frame members extend upwardly and rearwardly from said pair of upper frame members. The said pair of down frame members being extended rearwardly and downwardly from said head tube. The vehicle further comprises a battery casing and a prime mover. The said battery casing being disposed of in a forwardly inclined

orientation in the interior space defined by said pair of left and right upper frame members and covers at least partially overlaps a portion of said prime mover when viewed from the top of said vehicle.

5 [00040] In accordance with this configuration, one of the advantages of the present invention is that the interior space available for the battery casing can be implemented in conventional frame structures. This provides flexibility to manufacture variants in form of size, the capacity of the vehicle, range of usage, cost, ease of manufacturing, etc. The design of the improved layout is flexible to cater to the variants and the demands and enable modified versions with
10 minimum changes in the vehicle layout, assembly time, manufacturing set-up, etc. and does not require a major revamping of core processes to prepare for mass production of electric vehicles during the transition from internal combustion engines.

15 [00041] As per the further embodiment, the said battery casing being attached to a portion of said pair of upper frame members through one or more primary mounting bracket. Further, said battery casing being attached to a portion of said pair of down frame members through one or more primary mounting bracket. Further, said prime mover being attached to a prime mover bracket, said prime mover bracket being attached to the lower part of the frame assembly
20 and at rear end region of the delta box upper frame member.

[00042] In accordance with this configuration, one of the advantages of the present invention is balanced weight distribution across the front portion and the rear portion of the vehicle. The battery casing and electric motor is disposed of in front portion of the vehicle such that battery casing is forwardly inclined
25 in front to rear direction of the vehicle. This provides equal distribution of weight as the weight of the battery casing and the prime mover is balanced by the weight of the riders including pillion rider in the rear portion of the vehicle.

[00043] As per further embodiment, the said battery casing being configured to have a predetermined profile in a side view of the vehicle, said profile
30 includes trapezoidal shape with the longer edge being disposed on the front side of the vehicle. Further, a portion of said battery casing being surrounded by a

pair of side panels, said side panels being configured to have a plurality of vents to egress the hot air.

5 [00044] In accordance with this configuration, one of the advantages of the present invention is that a front fender which is provided over the front wheel which efficiently directs the ram air towards the battery casing in the front to rear direction of the vehicle and provides efficient cooling through convection. Further, the plurality of vents in side panel, egress hot air, thereby preventing rise in temperaute of battery casing due to heat accumulation.

10 [00045] As per further embodiment, said battery casing being configured to have an inlet port and an outlet port and, said inlet port and the outlet port are positioned on the same surface of the said battery casing, wherein said inlet port is above the said outlet port when seen from the front.

15 [00046] In accordance with this configuration, one of the advantages of the present invention is that the inlet and outlet port provide an exchange of coolant and help in maintaining the ambient temperature of the batteries enclosed in the battery casing.

20 [00047] As per further embodiment, a portion of battery casing being covered by a U shaped hump structure, said U shaped hump structure being attached to said pair of down frame members using one or more secondary mounting bracket and, said U shaped hump structure being configured to have a storage space.

25 [00048] In accordance with this configuration, one of the advantages of the present invention the improved storage space due to compact layout. The storage space being configured to have a U-shaped hump structure which can accommodate tool kit and daily use objects including mobile phone, documents etc.

[00049] As per further embodiment, a storage space is provided with a protective lid and said protective lid is configured to have a push button which is pressed to access the storage space. Further said storage case is covered by a

lid, wherein said lid is configured to have a push-button which is pressed to access the said storage case as well as battery unit.

5 [00050] In accordance with this configuration, one of the advantages of the present invention is that the protective lid provides protection to the battery casing and objects placed in the storage space.

10 [00051] As per further embodiment, said charging and control unit assembly is attached to one of said pair of down frame members, wherein a portion of said charging and control unit assembly being covered and surrounded by side covers. Further, said charging and control unit assembly is positioned adjacent to storage case which is being covered by said side covers.

15 [00052] In accordance with this configuration, one of the advantages of the present invention is that the side covers prevents water ingress in the charging and control unit assembly thereby improving the durability of the charging and control unit. Further, the charging and control unit is positioned adjacent to storage case which protects the charging and control unit assembly during a collision.

[00053] As per further embodiment, said charging and control unit assembly has a charging and control unit, one or more brackets and attachment means.

20 [00054] In accordance with this configuration, one of the advantages of the present invention is the improved rigidity of the charging and control unit assembly as it is reliably and securely connected to frame assembly through bracket.

25 [00055] As per further embodiment, said charging and control unit is configured to have terminals, said terminals being provided on one or more of a lateral side surface of said charging and control unit assembly. Further, said charging and control unit being configured to have terminals, said terminals being provided on a top surface of said charging and control unit assembly. Further, said charging and control unit assembly being positioned above said storage case and rearward to said U shaped hump structure when viewed from
30 the top of said vehicle.

[00056] In accordance with this configuration, one of the advantages of the present invention is the flexibility to the user by providing multiple access points to charge the vehicle thereby improves the customer satisfaction.

5 [00057] As per further embodiment, a storage case being configured to have a lid, wherein said lid is configured to have a push-button which is pressed to access the said storage case.

[00058] In accordance with this configuration, one of the advantages of the present invention is that storage case is securely positioned and accessible by an authorized user.

10 [00059] The present subject matter is further described with reference to the accompanying figures. It should be noted that the description and figures merely illustrate the principles of the present subject matter. Various arrangements may be devised that, although not explicitly described or shown herein, encompass the principles of the present subject matter. Moreover, all
15 statements herein reciting principles, aspects, and examples of the present subject matter, as well as specific examples thereof, are intended to encompass equivalents thereof.

[00060] The foregoing disclosure is not intended to limit the present disclosure to the precise forms or particular fields of use disclosed. As such, it is
20 contemplated that various alternate embodiments and/or modifications to the present disclosure, whether explicitly described or implied herein, are possible in light of the disclosure. Having thus described embodiments of the present disclosure, a person of ordinary skill in the art will recognize that changes may be made in form and detail without departing from the scope of the present
25 disclosure. Thus, the present disclosure is limited only by the claims.

[00061] In the foregoing specification, the disclosure has been described with reference to specific embodiments. However, as one skilled in the art will appreciate, various embodiments disclosed herein can be modified or otherwise implemented in various other ways without departing from the spirit and scope
30 of the disclosure. Accordingly, this description is to be considered as illustrative and is for the purpose of teaching those skilled in the art the manner of making

and using various embodiments of the disclosure. It is to be understood that the forms of the disclosure herein shown and described are to be taken as representative embodiments. Equivalent elements, materials, processes or steps may be substituted for those representatively illustrated and described herein.

5 Moreover, certain features of the disclosure may be utilized independently of the use of other features, all as would be apparent to one skilled in the art after having the benefit of this description of the disclosure. Expressions such as “including”, “comprising”, “incorporating”, “consisting of”, “have”, “is” used to describe and claim the present disclosure are intended to be construed in a

10 non-exclusive manner, namely allowing for items, components or elements not explicitly described also to be present. Reference to the singular is also to be construed to relate to the plural.

[00062] Further, various embodiments disclosed herein are to be taken in the illustrative and explanatory sense, and should in no way be construed as limiting

15 of the present disclosure. All joinder references (e.g., attached, affixed, coupled, connected, etc.) are only used to aid the reader's understanding of the present disclosure, and may not create limitations, particularly as to the position, orientation, or use of the systems and/or methods disclosed herein. Therefore, joinder references, if any, are to be construed broadly. Moreover, such joinder

20 references do not necessarily infer that two elements are directly connected to each other.

[00063] Additionally, all numerical terms, such as, but not limited to, “first”, “second”, “third”, “primary”, “secondary”, “main” or any other ordinary and/or numerical terms, should also be taken only as identifiers, to assist the reader's

25 understanding of the various elements, embodiments, variations and/or modifications of the present disclosure, and may not create any limitations, particularly as to the order, or preference, of any element, embodiment, variation and/or modification relative to, or over, another element, embodiment, variation and/or modification.

[00064] It will also be appreciated that one or more of the elements depicted in the drawings/figures can also be implemented in a more separated or integrated

30 manner, or even removed or rendered as inoperable in certain cases, as is useful

in accordance with a particular application. Additionally, any signal hatches in the drawings/figures should be considered only as exemplary, and not limiting, unless otherwise specifically specified.

5 [00065] The embodiments of the present invention will now be described in detail with reference to the accompanying drawings.

[00066] Figure 1 illustrates a right-side view of a straddle vehicle (100), as per embodiment, in accordance with one example of the present subject matter. As per illustrated embodiment, a straddle vehicle (100) (hereinafter “vehicle”) includes a frame assembly (101) to support different parts of said vehicle (100).
10 The vehicle (100) according to an embodiment extends from the front portion (F) to the rear portion (R) and is supported by a frame assembly (101). The vehicle (100) includes a front wheel (103) steered by a handlebar (104) and a rear wheel (105) connected to a rear wheel hub (102) supported by a swing arm (106). Steering assembly parts including a visor assembly (107), a rider seat (108), and the front wheel (103) are supported for pivotal steering operation at
15 the front end of the vehicle frame assembly (101). A rider seat (108) for a rider and a seat for a pillion rider (109) is placed rearward to a U-shaped hump structure (116). A front fender (110) is provided above the front wheel (103) to avoid the vehicle occupants from being splashed with mud. Likewise, a rear
20 fender (111) is placed above the rear wheel (105), and to the outer side in the radial direction of the rear wheel (105). The rear fender (111) inhibits rainwater or the like from being thrown up by the rear wheel (105). The swingarm (106) along with a rear suspension assembly (112) is supported at a rear portion (R) thereof for pivotal motion by the frame assembly (101) including a front
25 suspension assembly (113). In general terms, both the front suspension (113) and rear suspension (112) act as shock absorbers and help cushion the vehicle on uneven roads. The vehicle (100) further comprises a headlamp (114), a tail lamp assembly (115), a footrest (118), a prime mover (119), connectors (117), a U-shaped hump structure (116) and a pair of side panels (120a, 120b) and at
30 least two turn signal lamps.

[00067] Figure 2a illustrates a left side view of the vehicle (100), where few parts are omitted from figure 1 as per embodiment, in accordance with one

example of the present subject matter. Figure 2b illustrates front view of the vehicle (100) where few parts are omitted from the figure 1 as per embodiment, in accordance with one example of the present subject matter. Figure 2c illustrates left side view of the vehicle (100) with imaginary line Sr where few parts are omitted from figure 1 as per embodiment, in accordance with one example of the present subject matter. For sake of brevity, Figure 2a, Figure 2b and Figure 2c will be discussed together. The frame assembly (101) comprises a head tube (201), a pair of left and right upper frame members (215a, 215b), a pair of left and right down frame members (212a, 212b), a pair of seat rail members (216a) and a pair of side frame members (214a) (only left side frame member is shown). The said pair of left and right seat rail members (216a, 216b) extends upwardly and rearwardly from the said pair of left and right upper frame members (215a, 215b). Further, the said pair of left and right side frame members (214a) (only left side frame member is shown) extends upwardly and rearwardly from a portion of the said pair of left and right upper frame members (215a, 215b). Further said pair of left and right upper frame members (215a, 215b) are substantially parallel to said pair of left and right down frame members (212a, 212b). The said pair of left and right upper frame members (215a, 215b) being connected to said pair of left and right down frame members (212a, 212b) through a pair of left and right cross frame members (207a, 207b). As per illustrated embodiment, the pair of left and right cross frame members (207a, 207b) are attached together to form small triangles made up of either steel or aluminum. These small triangles provides high stiffness and strdiness to the frame to resist external forces. As per preferred embodiment, the said pair of left and right upper frame members (215a, 215b), and said pair of left and right down frame members (212a, 212b) extend rearwardly from the headtube (201) and defines an interior space formed within the interior and referred as a delta box frame configuration. As per alternative embodiment, the said pair of left and right upper frame members (215a, 215b) extend rearwardly from the headtube (201) and define an interior space (Z). The frame assembly (101) supports a battery casing (204) disposed of in the front portion of the vehicle (100) in the said interior space (Z) and at least partially overlaps a portion of said prime mover (119) when viewed from the top of said vehicle (100). The said battery casing (204) is configured to be detachably attached on

the frame assembly (101) of the vehicle (100) using a pair of mounting brackets (205a, 205b). The pair of mounting brackets (205a, 205b) are fixedly attached to the frame assembly (101). The battery casing (204) acts as a stressed member of the frame assembly (101). The frame assembly (101) being configured to support a plurality of batteries enclosed in one or more battery casing. As per illusrrated embodiment, the present invention discloses one battery casing. The prime mover (119) includes a Brushless DC Motor (BLDC Motor) or a brushed DC motor, or an AC induction motor. The prime mover (119) being disposed on the frame assembly (101) downwards of the battery casing (204) and below the down frame members (212a, 212b) using prime mover bracket (213). The prime mover bracket (213) is provided on the lower part of the frame assembly (101) and at rear end region of the delta box upper frame member (215a, 215b). More specifically, prime mover (119) is detachably attached to the frame using attachment means. Furthermore, the said pair of left and right down frame members (212a, 212b) and said pair of left and right upper frame members (205a, 205b) surrounds and thereby protects the battery casing (204) from side collision. The said battery casing (204) includes an inlet port (204a) and an outlet port (204b) disposed on the frontal surface of the battery casing (204) for cooling purposes. As per an aspect of the present invention, the battery casing (204) is a substantially rectangular cross section profile with its casing axis A_c oriented to be inclined forwardly of the vehicle (100) forming a predetermined angle C' with the pivot steering axis A_p of the vehicle (100). As per an aspect of the present invention, to minimise the impact and vibration loads on the battery casing (204), the casing axis A_c is substantially equal or lower than the caster angle C formed on a ground plane G by the pivot steering axis A_p passing through the front wheel axle axis A_f i.e. $C' \leq C$. As per an additional embodiment, the seat rail members (216a, 216b) are configured along an imaginary line S_r which forms a predetermined angle S_1 with said casing axis A_c . The predeterminedn angle S_1 is equal or less than 90 degree. In other words, imaginary line S_r being configured to be substantially orthogonal to the casing axis A_c of the casing (204) i.e. predermtined angle $S_1 \leq 90$ degrees thereby enabling compact layout of the vehicle while maintinaing the sporty riding ergonomic posture for the performance bike. As per an additional embodiment, a pusedo axis A_c' drawn parallel to casing axis A_c and passing through rear

wheel axle axis A_r forms a predetermined angle S_2 with the imaginary line S_r wherein predetermined angle being substantially equal to predetermined angle S_1 . Further, predetermined angle S_2 being substantially equal or lower than 90 degree. The predetermined angle S_2 enables the back posture of the human anthropometry to be oriented in a forwardly leaning and substantially parallel to axis A_c' thereby achieving a desirable compact layout, mass balancing and high speed handling performance of the vehicle (100). As per an efficacy of the present layout the Centre of Gravity of the vehicle (100) is configured to be within the axis A_c and A_c' and substantially above the imaginary line S_r .

[00068] Figure 3a illustrates a perspective view of a battery casing (204) as per embodiment, in accordance with one example of the present subject matter. Figure 3b illustrates a perspective view of the battery casing (204) as per embodiment, in accordance with one example of the present subject matter. Figure 3c illustrates a perspective view inside the battery casing (204) as per embodiment, in accordance with one example of the present subject matter. For sake of brevity, Figure 3a, Figure 3b, and Figure 3c will be discussed together. A battery assembly (300) comprises a battery unit (302) which is enclosed by the battery casing (204). The battery casing (204) is made of polypropylene resin including ABS plastic, plexiglass silicone rubber, and aluminum. The battery casing (204) secures the battery connections by keeping them sealed and further protects the user from getting electrocuted. The battery casing (204) is further provided with the inlet port (204a) for the coolant (305) to enter into the battery (302), and the outlet port (204b) and a mixture of exhaust gases, heat and water to be let out from the outlet port (204b). The battery casing (204) has a trapezoidal profile with the longer edge being disposed on the front side of the vehicle (100) in a side view that accommodates plurality of cells (303). As per illustrated embodiment, the battery casing (204) is provided with a casing lid (301) to protect the power terminals and prevent the leakage of coolant (305) outside the battery casing (204). This inlet port (204a) and outlet port (204b) is provided on the same side of the battery casing (204) and are attached to the battery casing (204). As per preferred embodiment, the battery casing (204) comprises a lithium-ion battery (302) stacked with cells (303) connected in a combination of series and or parallel layout to give an output power. These cells

(303) are arranged to form a flow channel (304) between them for providing a flow path for the coolant (305) for cooling purposes. The flow channel (304) is configured as a serpentine flow pattern wherein the coolant (305) flows between one end of the cell (303) to the other end of the cell (303) from a position of a high-pressure drop to a low-pressure drop and further flows from a position of low pressure to high-pressure drop in between the flow channels (304) without any supply of power from the prime mover (202). This flow pattern of the coolant (305) from a position of high-pressure drop to low-pressure drop leads to a serpentine flow pattern which cools the battery (302) efficiently. Further, a rubber cap (not shown in the figure) is provided on the cells (303) at the position of high-pressure drop, to seal the coolant (305) inside the flow channels (304) and prevents leakage of the coolant (305) onto a connecting surface consisting of electrical and circuit connections, thus averting short-circuiting of the circuit. A coolant (305) as per an embodiment includes a phase-changing material (PCM) which is generally made of paraffin which exists as a solid form in normal temperature, however, it changes its form into a fluid state during running condition or charging condition of the vehicle (100) and thus acts as a coolant fluid circulating across the serpentine flow channels and cools the battery (302).

[00069] Figure 4a illustrates a left side view of the vehicle (100), where few parts are omitted from figure 1 as per embodiment, in accordance with one example of the present subject matter. Figure 4b illustrates a top view of the vehicle (100), where few parts are omitted from figure 1 as per embodiment, in accordance with one example of the present subject matter. For sake of brevity, Figure 4a and Figure 4b will be discussed together. The battery casing (204) is configured to be supported at the front portion of the vehicle (100) which is covered by a U-shaped hump structure (116). The U-shaped hump structure (116) is divided by a partition wall (403). The said partition wall (403) is at an inclined profile to fit as per the trapezoidal shape of the battery casing (204). The said U-shaped hump structure (116) being configured to have a storage space (402) in a rear portion of the said U-shaped hump structure (116). The front portion of the U-shaped hump structure (116) comprises of a hollow space (405) configured to access the battery casing (204). More specifically the

battery casing (204) is forwardly inclined in the longitudinal axis (Y-Y') of the vehicle (100). The U-shaped hump structure (116) is covered with a protective lid (401). The protective lid (401) is configured to protect the battery casing (204) and also covers the storage space (402). The storage space (402) being
5 configured to store daily objects including charger, mobile phone, documents, and wallets etc. The U-shaped hump structure (116) is detachably attached to the frame assembly (101) of the vehicle (100) using fasteners (not shown). More specifically, the U-shaped hump structure (116) is further secured and attached to the pair of left and right upper frame member (215a, 215b) using a pair of
10 secondary mounting brackets (406a, 406b) on either side of the vehicle (100). As per preferred embodiment, the storage space (402) and battery casing (204) can be accessed by opening protective lid (401) by pressing a push-button (404). The said protective lid (401) opens away from the rider in a clockwise direction when viewed from the side of the vehicle (100) to provide ease of accessibility
15 to the user. The battery casing (204) can be accessed and replaced from the hollow portion (405) at the front of the U-shaped hump structure (116) by opening the protective lid (401). As per alternative embodiment, the storage space (402) and battery casing (204) can be accessed by opening protective lid (401) using a key mechanism or using a code combination to unlock the
20 protective lid (401). The protective lid (401) is attached from one end with flexible mechanical linkages including hinges. The actuating point of the protective lid (401) is provided within the ergonomical reach of the user.

[00070] Figure 5a illustrates a localized top view of the vehicle (100), where few parts are omitted from the figure, as per embodiment, in accordance with
25 one example of the present subject matter. Figure 5b illustrates a localized side view of the vehicle (100), where few parts are omitted from the figure, as per embodiment, in accordance with one example of the present subject matter. For sake of brevity, Figure 5a and Figure 5b will be discussed together. A charging and control unit assembly (500) includes a charging and control unit (501), one
30 or more bracket (505), and attachment means (503, 504). The said charging and control unit assembly (500) is mounted on the frame assembly (101) of the vehicle (100), using attachment means (503, 504), for plugging in an external AC supply to charge the battery (302) (as shown in figure 3b) and comprises of

terminals (502a, 502b) mounted on one or more of a lateral side surface of charging and control unit assembly (500). The said terminals (502a, 502b) is configured to be positioned inside a socket (502). As per illustrated embodiment, a charging and control unit (501) is mounted on a bracket (505).

5 As per alternative embodiment, a charging and control unit (501) is an on-board charger of the vehicle (100) placed adjacently to the battery casing (204) (as shown in figure 2a) on the top portion of the frame assembly (101) aligned at the centre as viewed from a longitudinal axis Y-Y' of the vehicle (100). The on-board charger comprises a combination of switches, semiconductors, and buses

10 connecting each other to form a charging and control unit (501) for the battery (302) (as shown in figure 3b). The supply from the on-board charger is given to the battery (302) (as shown in figure 3b) or a plurality of batteries during charging through bus bars which are connecting the battery or plurality of batteries and the on-board charger.

15 [00071] Figure 6 illustrates a localized side view of the vehicle (100), where few parts are omitted from the figure as per embodiment, in accordance with one example of the present subject matter. A storage case (602) is positioned adjacent to the charging and control unit assembly (500). More specifically, the storage case (602) is provided below the charging and control unit (501) of the

20 vehicle (100) to accommodate a toolkit, or daily use objects. The storage case (602) is configured below the charging and control unit (501) and between the pair of said left and right side frame members (214a) (only left side frame member is shown) through fastening means (not shown). The storage case (602) is protected by a pair of left and right side frame members (214a) (only left side

25 frame member is shown) from side collision to protect the objects placed inside the storage case (602). The storage case (602) being configured to have a lid (601). The objects placed in the storage case (602) can be accessed by opening the lid (601) from the side of the vehicle (100) using push button (603) or opening mechanism known in the art. More specifically, the storage case (602)

30 is covered by a side covers (not shown). The side covers (not shown) being configured to have an opening that enables the user to access the storage case (602) through the push button (603) or other opening mechanism known in the art.

[00072] Figure 7a illustrates a side view of the vehicle (100), where few parts have been omitted from the figure as per embodiment, in accordance with one example of the present subject matter. Figure 7b illustrates an enlarged localized view of the vehicle (100), where few parts have been omitted from the figure as per embodiment, in accordance with one example of the present subject matter. For sake of brevity, Figure 7a and Figure 7b will be discussed together. A pair of left and right side panels (120a, 120b (as shown in figure 1)) are configured to have plurality of vents (702a, 702b) on both the left and the right side. As per illustrated embodiment, left side panel is shown. As per an embodiment, the side panels (120a) provided on the vehicle (100) are being configured to allow the heat and water droplets to be let out from the vehicle (100) in an inward to outward flow direction from the outlet port (204b) of the battery casing (204) to outside through the vents (702a). Further, the vents (702a) also provide an inward flow of incoming natural air directed from the front fender (110) towards the battery casing (204) to keep the ambient temperature of the battery (302) (as shown in figure 3b) constant. The vents (702a) are extending from the bottom to top on the side panels (120a) and has a small cross-section opening area (705) to allow entry and exit of air and prevents entry of other particles. Said side panels (120a) are fixedly attached to the frame assembly (101) of the vehicle (100) using fasteners (703, 704).

[00073] Figure 8 illustrates a cut section of the vehicle (100) along with the frame assembly (101) across an A-A' axis as shown in figure 2a as per embodiment, in accordance with one example of the present subject matter. The battery casing (204) has a positive impact on the section modulus of the frame assembly (101) in the assembled condition. This improves the lateral stiffness of the frame assembly (101). More specifically, the sidewalls of the battery casing (204) are formed with load transferring features i.e. mounting brackets (205a, 205b). The battery casing (204) acts as a stressed member and improves the sectional modulus of the frame assembly (101) and prevent bending and/or buckling. The mounting brackets (205a, 205b) are preferable to a rectangular shape in cross-section. Further, the mounting brackets (205a, 205b) on the battery casing (204) provide the rigidity required for supporting and transferring the load from the battery casing (204) to the frame assembly (101).

[00074] While the present invention has been shown and described with reference to the foregoing preferred embodiments, it will be apparent to those skilled in the art that changes in form, connection, and detail may be made therein without departing from the spirit and scope of the invention

List of references:

Y-Y' - Longitudinal axis

C-C' Lateral axis

X-X' up -down direction

5 Ac Casing axis

Ap Pivot steering axis

C caster angle

G Ground plane

Sr Imaginary line

10 Ac' Pseudo axis

100 Vehicle

101 Frame assembly

102 Wheel Hub

103 Front wheel

15 104 Handlebar

105 Rear wheel

106 Swing arm

107 Visor assembly

108 Rider Seat

- 109 Pillion Rider seat
- 110 Front fender
- 111 Rear fender
- 112 Rear suspension assembly
- 5 113 Front suspension
- 114 Headlamp
- 115 lamp assembly
- 116 U-shaped hump structure
- 117 Connectors
- 10 118 Footrest
- 119 Prime mover
- 120a, 120b pair of Side panels
- 201 Head tube
- 207a, 207b Pair of left and right cross frame members
- 15 205a, 205b Mounting Brackets
- A-A' Reference axis
- 215a, 215b Pair of left and right upper frame members
- 212a, 212b Pair of left and right down frame members
- 214a, left side frame member

	213	Prime Mover bracket
	204	Battery casing
	204a, 204b	Inlet and Outlet Port
	300	Battery assembly
5	301	Casing Lid
	302	Battery unit
	303	Cells
	304	Flow channel
	305	Coolant
10	401	Protective Lid
	402	Storage space
	403	Partition wall
	404	Push Button
	405	Hollow Portion
15	(406a, 406b)	Pair of secondary mounting brackets
	500	Charging and Control Unit Assembly
	501	Charging and Control Unit
	502	Socket
	502a, 502b	Terminals

503, 504	Attachment means
505	Bracket
601	Lid
602	Storage case
5 603	Push Button
702a, 702b	Pair of Left and Right side vents
Z	Interior space

We Claim:

1. A vehicle **(100)** comprising:

a frame assembly **(101)**, said frame assembly **(101)** includes

a pair of left and right upper frame members **(215a, 215b)**, and

5 a head tube **(201)**,

wherein said pair of left and right upper frame members **(215a, 215b)** being extending rearwardly and downwardly from said head tube **(201)**,

10 wherein said pair of left and right upper frame members **(215a, 215b)** defines an interior space **(Z)**;

a battery casing **(204)**; and

a prime mover **(119)**,

15 wherein said battery casing **(204)** being disposed in a forwardly inclined orientation in the interior space **(Z)** defined by said pair of left and right upper frame members **(215a, 215b)** and at least partially overlaps a portion of said prime mover **(119)** when viewed from the top of said vehicle **(100)**.

2. A vehicle **(100)** comprising:

a frame assembly **(101)**, said frame assembly **(101)** includes

20 a head tube **(201)**,

a pair of left and right upper frame members **(215a, 215b)**,

a pair of left and right down frame members **(212a, 212b)**,

a pair of left and right cross frame members **(207a, 207b)**,

a pair of left and right seat rail members **(216a, 216b)**, and

a pair of left and right side frame members **(214a)**;

5 wherein said upper frame members **(215a, 215b)**
being substantially parallel to said down frame members
(212a, 212b) and being connected to said down frame
members **(212a, 212b)** through a plurality of said cross
frame members **(207a, 207b)**,

10 wherein said seat rail frame members **(216a, 216b)**
extending upwardly and rearwardly from said pair of upper
frame members **(215a, 215b)**,

 wherein said pair of down frame members **(212a,**
212b) being extending rearwardly and downwardly from
15 said head tube **(201)**,

a battery casing **(204)**; and

a prime mover **(119)**,

 wherein said battery casing **(204)** being disposed in a forwardly
inclined orientation in an interior space **(Z)** defined by said pair of upper
20 frame members **(215a, 215b)**, and said down frame members **(212a, 212b)**,
wherein said battery casing **(204)** at least partially overlaps a portion of
said prime mover **(119)** when viewed from the top of said vehicle **(100)**.

3. The vehicle (100) as claimed in claim 1 or claim 2, wherein said battery casing (204) being attached to a portion of said pair of upper frame members (205a, 205b) using one or more primary mounting bracket (205a).

5 4. The vehicle (100) as claimed in claim 2, wherein said battery casing (204) being attached to a portion of said pair of down frame members (212a, 212b) using one or more primary mounting bracket (205a).

10 5. The vehicle (100) as claimed in claim 1 or claim 2, wherein said prime mover (119) being attached to a prime mover bracket (213), said prime mover bracket (213) being attached to the lower part of the frame assembly (101) and at rear end region of the delta box upper frame member (215a, 215b).

6. The vehicle (100) as claimed in claim 1 or claim 2, wherein said battery casing (204) being configured to have a predetermined profile in a side view of the vehicle, said profile includes trapezoidal shape with the longer edge being disposed on the front side of the vehicle.

15 7. The vehicle (100) as claimed in claim 1 or claim 2, wherein a portion of said battery casing (204) being surrounded by a pair of side panels (120a, 120b), said side panels (120a, 120b) being configured to have a plurality of vents (702a, 702b) to egress the hot air.

20 8. The vehicle (100) as claimed claim 1 or claim 2, wherein said battery casing (204) being configured to have an inlet port (204a) and an outlet port (204b), wherein said inlet port (204a) and outlet port (204b) are positioned on the same surface of the said battery casing (204), wherein said inlet port (204a) is above the said outlet port (204b) when seen from the front side of the vehicle (100).

25 9. The vehicle (100) as claimed in claim 1 or claim 2, wherein a portion of battery casing (204) being covered by a U shaped hump structure (116), said U shaped

hump structure **(116)** being attached to said pair of down frame members **(212a, 212b)** using one or more secondary mounting bracket **(406a, 406b)**.

10. The vehicle **(100)** as claimed in claim 9, wherein U shaped hump structure **(116)** being configured to have a storage space **(402)**.

5 11. The vehicle **(100)** as claimed in claim 9, wherein said U shaped hump structure **(116)** being configured to have a protective lid **(401)**.

12. The vehicle **(100)** as claimed in claim 9, wherein a portion of said storage space **(402)** is covered by a protective lid **(401)**, wherein said protective lid is configured to have a push-button **(404)** which is pressed to access the said storage space **(402)**
10 as well as battery unit **(302)**.

13. The vehicle **(100)** as claimed in claim 1 or claim 2, wherein a charging and control unit assembly **(500)** being attached to one of said pair of down frame members **(212a, 212b)**, wherein a portion of said charging and control unit assembly **(500)** being covered and surrounded by side covers.

15 14. The vehicle **(100)** as claimed in claim 13, wherein said charging and control unit assembly **(500)** includes a charging and control unit **(501)**, one or more bracket **(505)**, and attachment means **(503, 504)**.

15. The vehicle **(100)** as claimed in claim 13, wherein said charging and control unit **(501)** is positioned adjacent to a storage case **(602)**, said storage case **(602)**
20 being covered by said side covers.

16. The vehicle **(100)** as claimed in claim 15, wherein said charging and control unit **(501)** being configured to have terminals **(502a, 502b)**, said terminals **(502a, 502b)** being provided on one or more of a lateral side surface of said charging and control unit assembly **(500)**.

17. The vehicle (100) as claimed in claim 15, wherein said charging and control unit (501) being configured to have terminals (502a, 502b), said terminals (502a, 502b) being provided on a top surface of said charging and control unit assembly (500).

5 18. The vehicle (100) as claimed in claim 15, wherein said charging and control unit assembly (500) being positioned above a storage case (602) and rearward to said U shaped hump structure (116) when viewed from the top of said vehicle (100).

19. The vehicle (100) as claimed in claim 15, wherein said storage case (602) being configured to have a lid (601), wherein said lid (601) is configured to have a push-button (603) which is pressed to access the said storage case (602).

10 20. A saddle type vehicle (100) comprising

a frame assembly (101); and

a battery casing (204),

15 wherein said battery casing (204) being substantially rectangular cross section profile with a casing axis A_c oriented to be inclined forwardly of the vehicle (100) forming an predetermined angle C' with a pivot steering axis A_p of the vehicle (100).

21. The saddle type vehicle (100) as claimed in claim 20, wherein said casing axis A_c is substantially equal or lower than a caster angle C formed on a ground plane G by said pivot steering axis A_p of the vehicle (100) passing through a front wheel axle axis A_f .

22. The saddle type vehicle (100) as claimed in claim 20, wherein said frame assembly (101) includes a pair of left and right seat rail members (216a, 216b) being configured along an imaginary line S_r which forms a predetermined angle S_1 with said casing axis A_c .

23. The saddle type vehicle (100) as claimed in claim 20, wherein said casing axis Ac being substantially parallel to a pseudo axis Ac', said pseudo axis Ac' being passing through rear wheel axle axis Ar forms a predetermined angle S2 with said imaginary line Sr.

5 24. The saddle type vehicle (100) as claimed in claim 23, wherein said predetermined angle S2 is substantially equal or lower than 90 degree.

25. The saddle type vehicle (100) as claimed in claim 23, wherein said predetermined angle S2 being substantially equal to said predetermined angle S1.

10 26. The saddle type vehicle (100) as claimed in claim 20, wherein said casing axis Ac being substantially parallel to said pseudo axis Ac'.

27. The saddle type vehicle (100) as claimed in claim 20, wherein a centre of gravity of the vehicle (100) is configured to be within said casing axis Ac and said pseudo axis Ac' and substantially above imaginary line Sr.

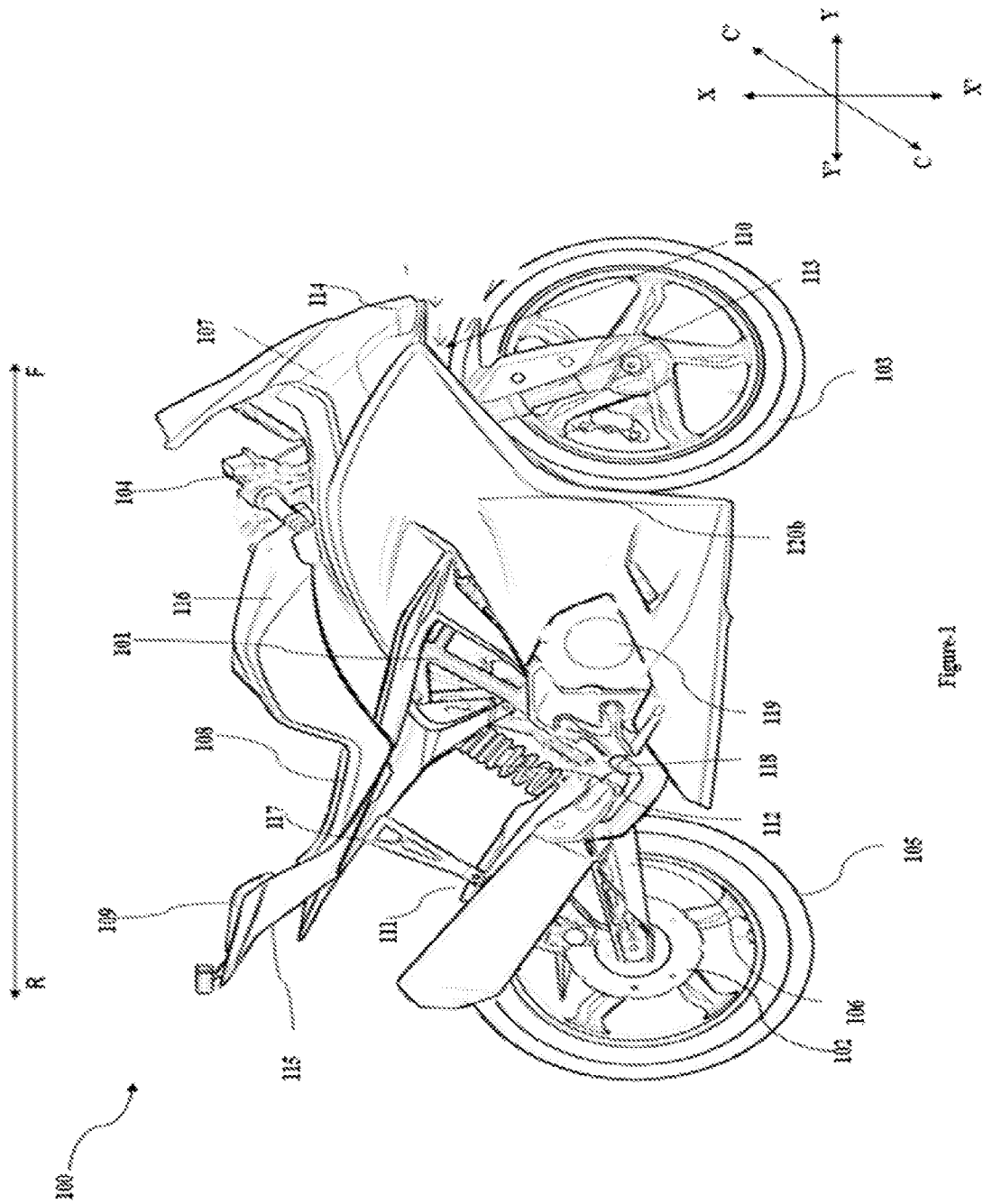
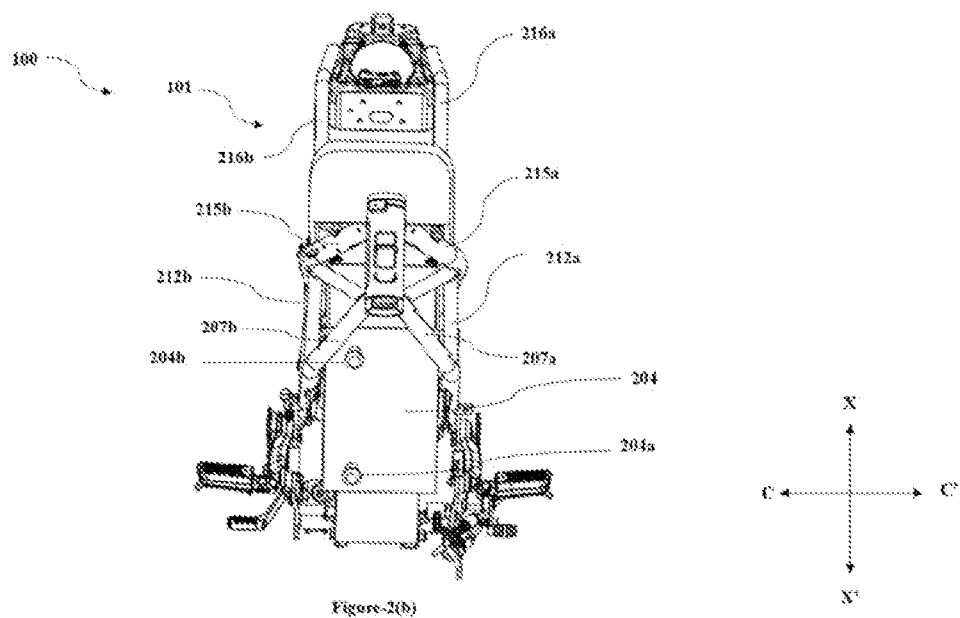
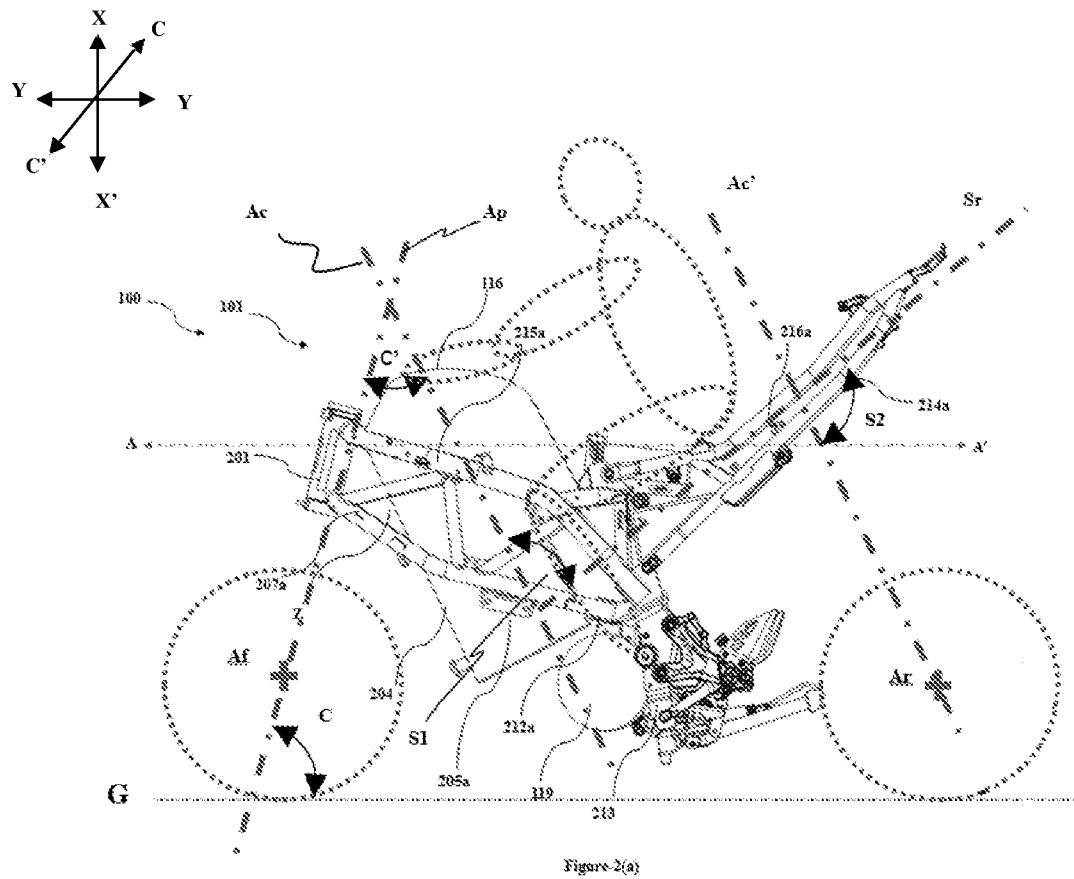


Figure-1



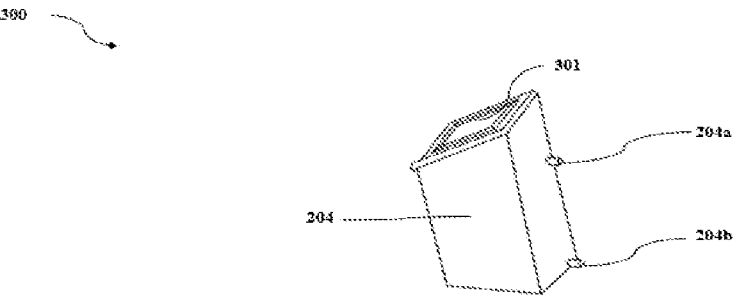


Figure-3(a)

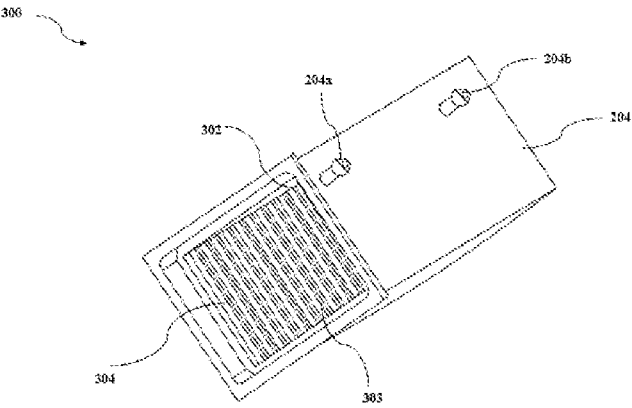


Figure-3(b)

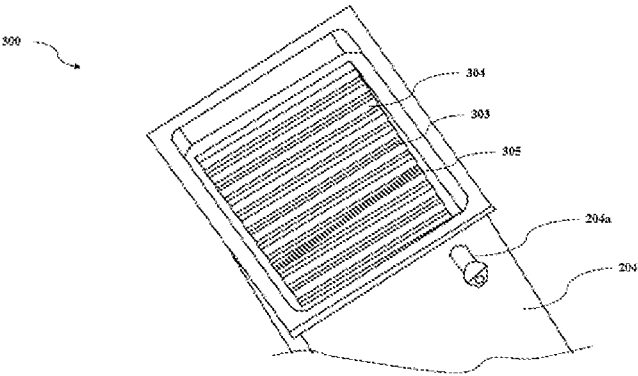


Figure-3(c)

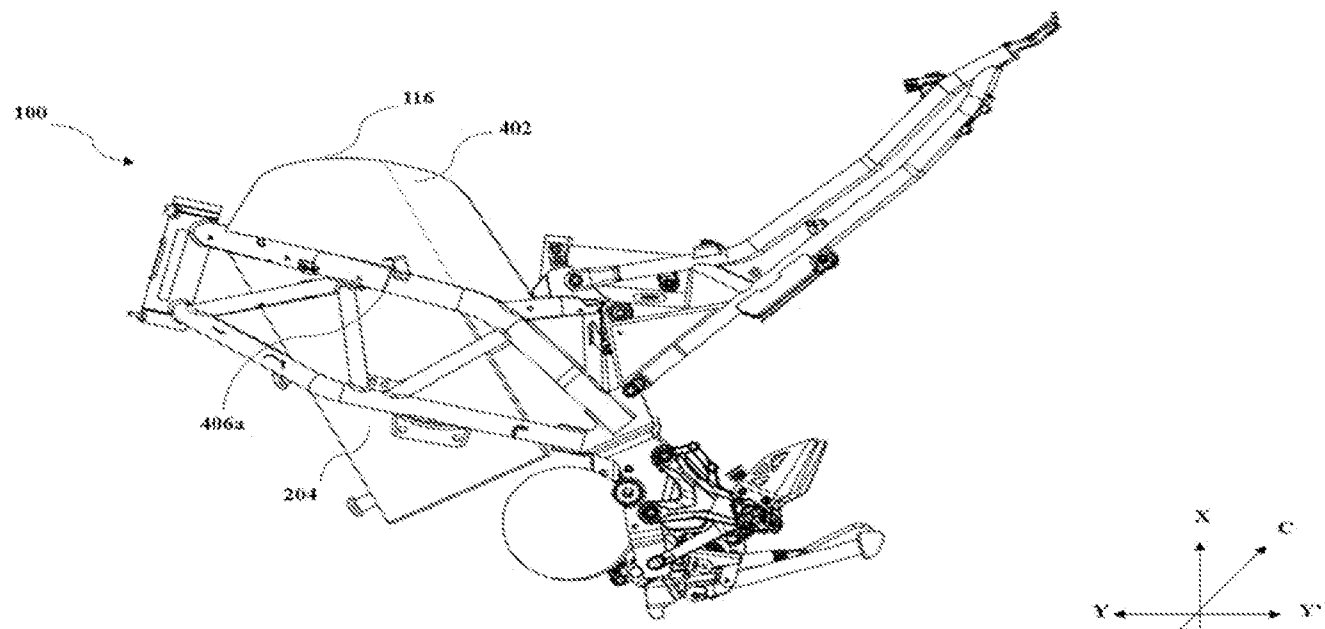


Figure-4(a)

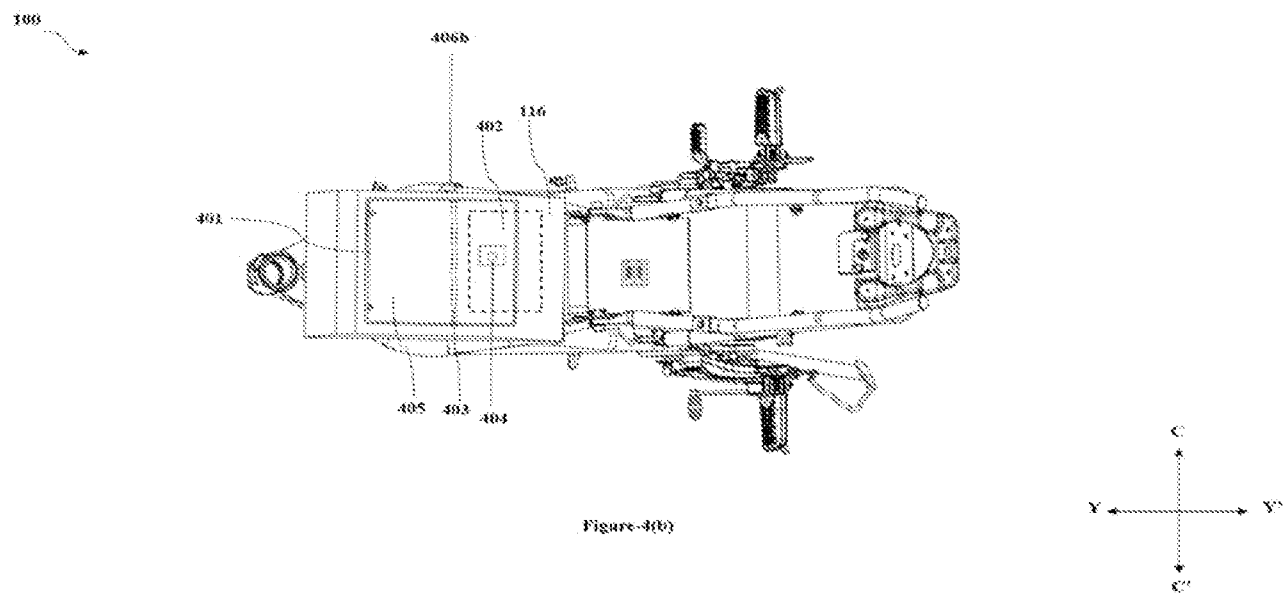


Figure-4(b)

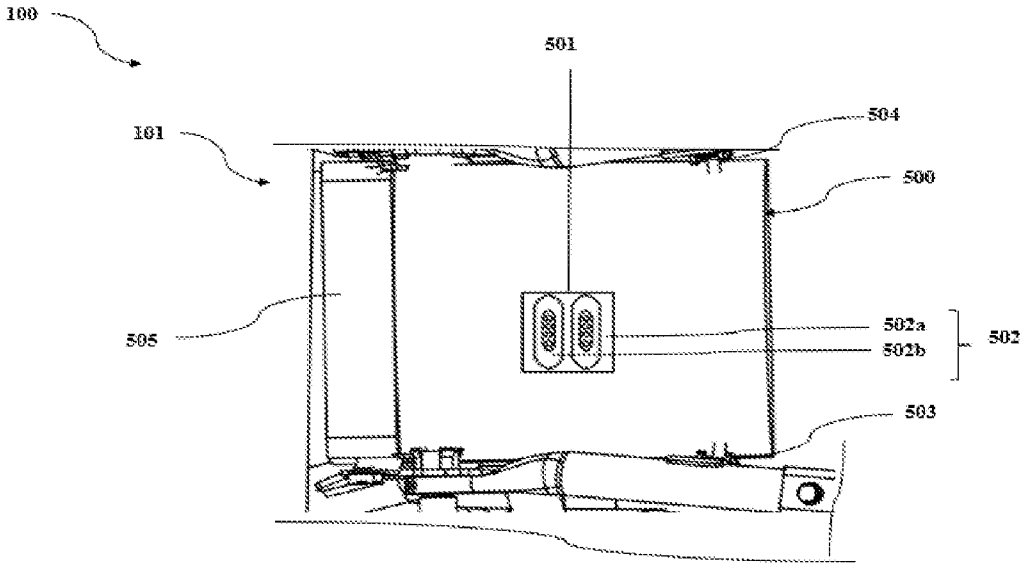


Figure-5(a)

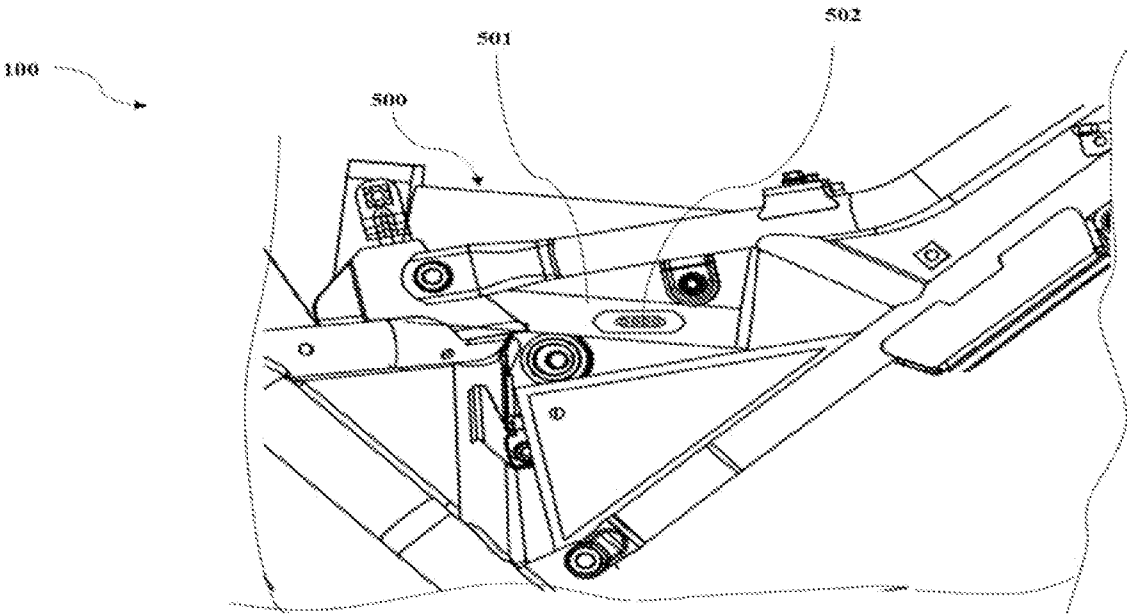


Figure-5(b)

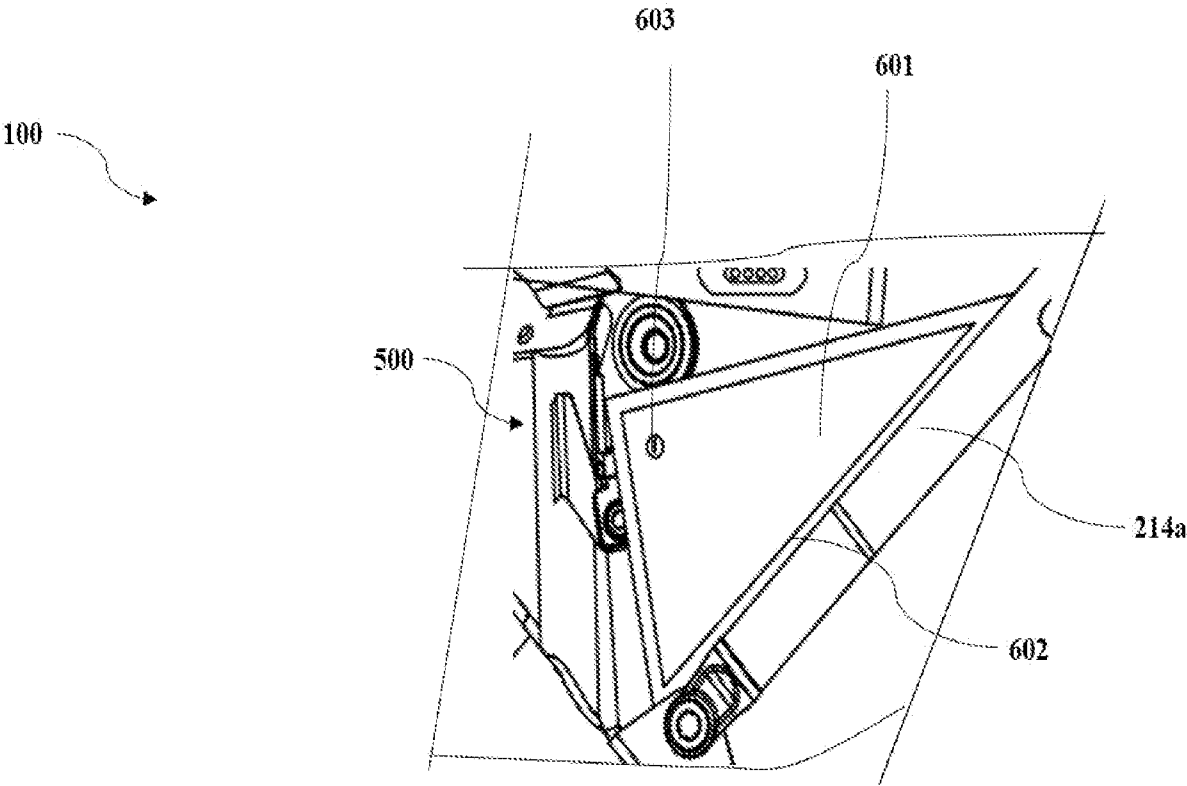


Figure-6

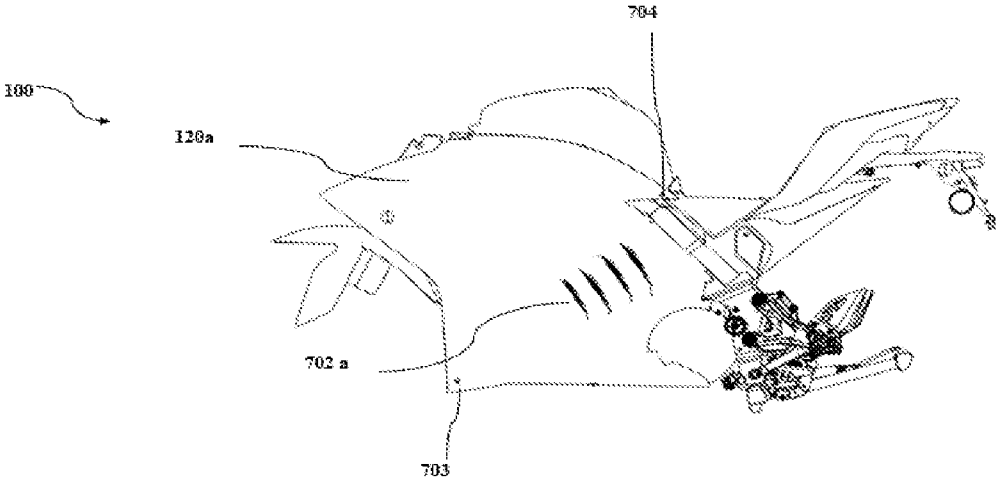


Figure-7(a)

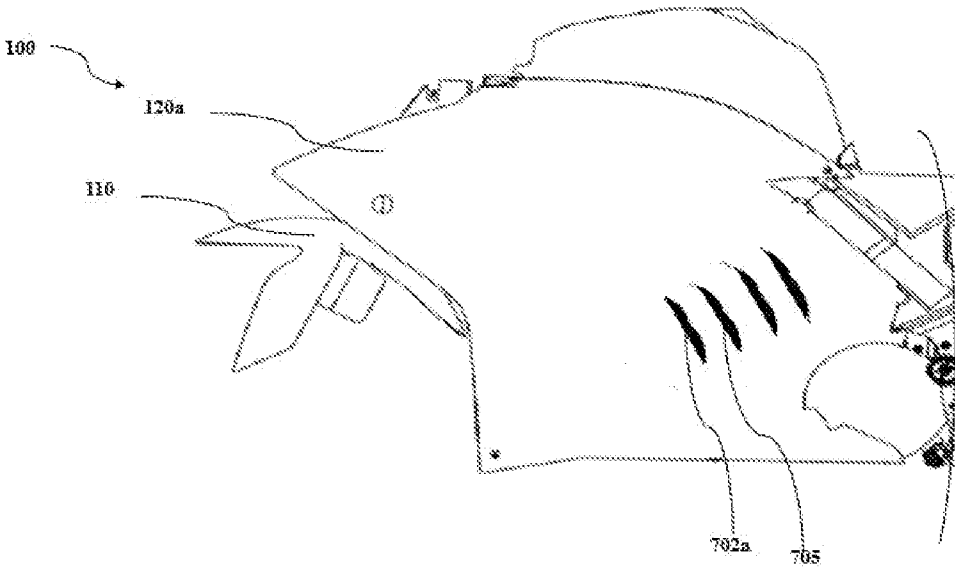


Figure-7(b)

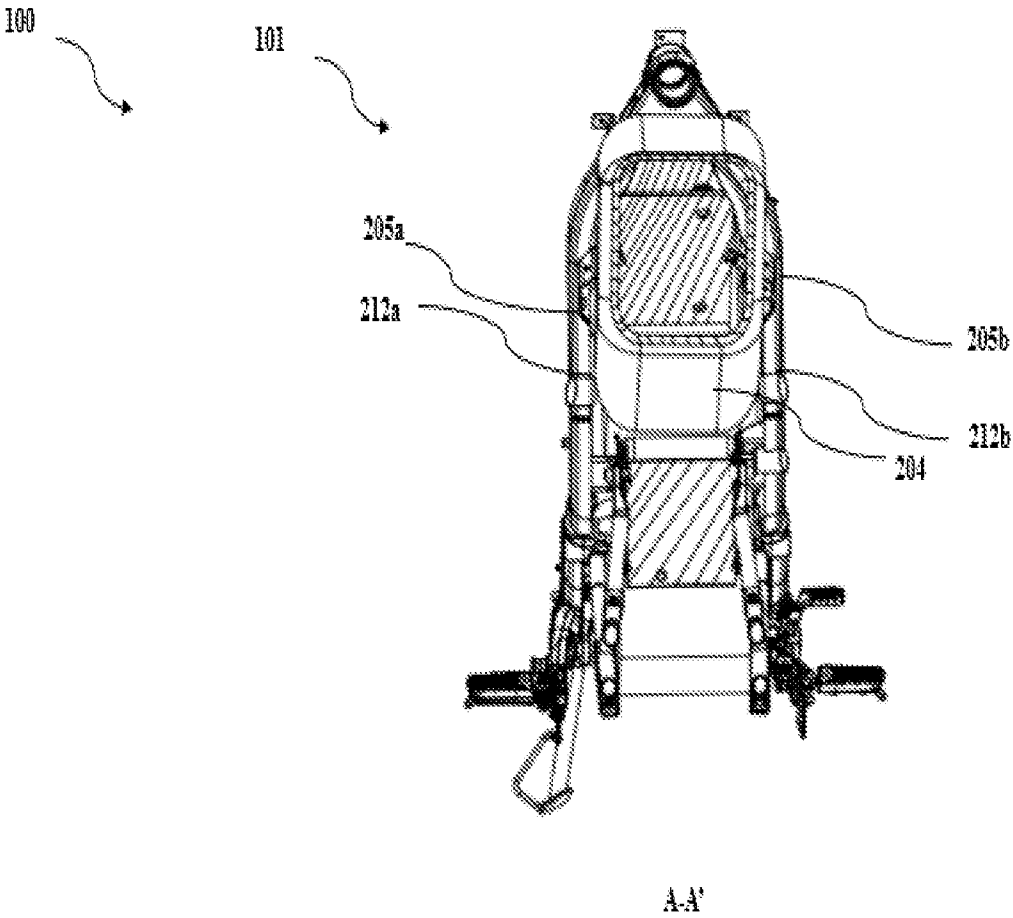


Figure-8

INTERNATIONAL SEARCH REPORT

International application No.
PCT/IN2022/050210

A. CLASSIFICATION OF SUBJECT MATTER
B60L50/60 Version=2022.01

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)

B60L

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)

PatSeer, IPO Internal Database

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US20140299393A1 (KAWASAKI JUKOGYO KABUSHIKI KAISHA; 09 OCT 2014; 2014-10-09) Description, Paragraph-[0040] to [0045], [0048] Figures. 1-13	1-27
Y	EP2636583A1 (KAWASAKI HEAVY IND LTD; 11 SEP 2013; 2013-09-11) Description, Paragraph-[0026] to [0032], [0059] to [0062], Figure. 6	1-27

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

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Date of the actual completion of the international search

24-06-2022

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/IN2022/050210

Citation	Pub.Date	Family	Pub.Date
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		CN 103153770 A	12-06-2013
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