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(54) **Title:** A TWO WHEELED MOTOR VEHICLE

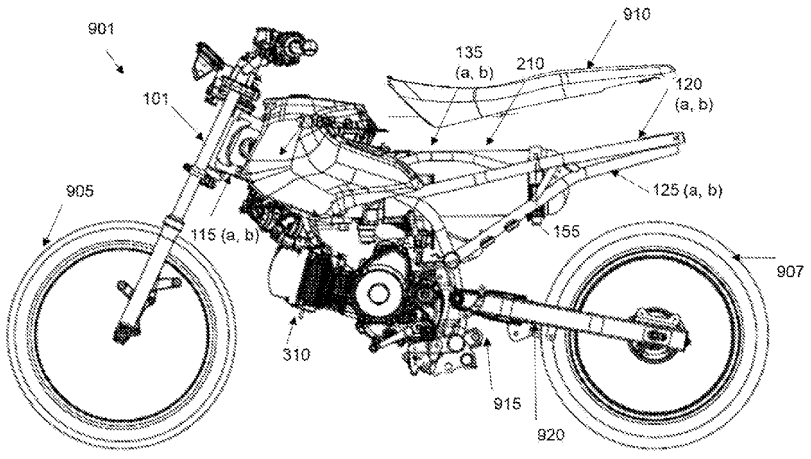

Figure 9

(57) **Abstract:** The present invention relates to a two-wheeled motor vehicle comprising a vehicle frame structure further comprising of, a head tube; a front frame structure extending rearwardly from the head tube; a rear frame structure connected to the front frame structure and extending rearwardly; a gas fuel cylinder for storing and supplying gaseous fuel to an engine, wherein the gas fuel cylinder extending substantially horizontally and is supported by the front frame structure and the rear frame structure using plurality of support brackets. The engine is mounted on the vehicle front frame structure such that the orientation of the engine is substantially horizontal.

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A TWO WHEELED MOTOR VEHICLE

FIELD OF THE INVENTION

[001] The present invention relates to a two-wheeled (2W) motor vehicle and more particularly relates to the vehicle powered by at least a gaseous fuel such as CNG (Compressed Natural gas), LNG (Liquefied Natural Gas), LPG (Liquefied Petroleum Gas), biogas or the like.

CROSS-REFERENCE TO RELATED APPLICATIONS

[002] This invention takes priority from an earlier filed provisional patent application no. 202121045739 filed on October 07, 2021; which is incorporated herein as reference

BACKGROUND TO THE INVENTION

[003] With rising concerns of global warming, aggravating emissions, and depleting fossil fuel resources, clean technologies are much needed to cater the transportation needs of the fast-paced world. However, transitioning from liquid-fuelled (petrol/ diesel) vehicles to clean energy-based driving systems involves multiple technological challenges. There are multiple pieces of research ongoing to replace petroleum-based fuels in two wheeled vehicles with environmentally acceptable gaseous fuels such as Compressed Natural Gas (CNG), Liquefied Petroleum Gas (LPG), Liquefied Natural Gas (LNG), biogas, and the like.

[004] Natural gas requires more storage space compared to gasoline operated vehicles and must be stored under highly pressurized containers. Therefore, packaging of a comparatively larger CNG cylinder/ tank is required on the vehicle as compared to a conventional gasoline fuel tank, to hold equivalent fuel. One of the key feature for any vehicle is a distance travelled by the vehicle in a given amount of fuel. There is higher demand for vehicles with longer travelling capabilities without refuelling. Hence, for vehicle with gaseous fuels, there is need to provide higher storage capacity for fuel in order to have longer distance travelled.

[005] In existing arts, there are two wheeled vehicles in which small gas fuel cylinders/ tanks are mounted, however, in such cases, the fuel capacity of gas fuel cylinders is highly compromised. With less capacity of gas fuel cylinder, the user may face

inconvenience, as frequent refilling of fuel is required or making vehicle not suitable for long distance travel. On the other hand, if the size of the gas fuel cylinder is increased for the two-wheeled vehicle, the design, aesthetics, and safety of the vehicle gets compromised as compared to conventional two-wheeled vehicle operated by liquid fuel. The two-wheeled vehicle being a compact vehicle does not have a trunk or additional space available as in three or four-wheeled vehicles and it becomes practically difficult to adapt the gas fuel cylinder of higher capacity.

[006] There have been attempts in past to mount gas fuel cylinders with higher capacities in a two wheeled vehicle, some of which needs a gas fuel cylinder to be tilted in order to accommodate itself within the frame structure of the two wheeled vehicle. The tilted arrangement still suffers from limitations in terms of size of cylinder, as the space available is restricted by frame structure, rear wheel and other components. The tilted arrangement of gas fuel cylinder also impacts on mounting arrangement and orientation of the engine. Further, tilted gas fuel cylinder occupies not only a conventional space for the fuel tank in the two wheeled vehicle but also substantially occupies conventional space for placement of other crucial components of the two wheeled vehicle, such as air filter, battery, limp home tank and fuel line. This type of mounting arrangement needs a frame support with complex construction for holding the gas fuel cylinder, which makes it bulky and heavy. Further, the vehicle aesthetics is also compromised for improving the capacity of the gas fuel cylinder. Therefore, it is necessary to have major modifications in the conventional frame structure used for gasoline vehicle to accommodate gas fuel cylinder. This increases cost as well as manufacturing time. Any major modifications made in the frame structure impacts conventional component placement of the vehicle and overall aesthetics of the vehicle.

[007] Further, in order to accommodate the gas fuel cylinder of larger capacity the frame tubes needs to be of sufficient strength and stiffness, while also being slender in terms of diameter, since tubes with larger diameter may not be suitable for compact mounting of larger gas fuel cylinder. Hence, achieving a balance in tube size and stiffness is one of the challenge to mount larger gas fuel cylinder.

[008] Another known gas fuel cylinder arrangement is horizontal mounting, which is also option to mount the gas fuel cylinder. However, the horizontal mounting of cylinder is restricted by the seat structure from rear side in two-wheeled vehicle. This limits the size and thereby storing capacity of the gas fuel cylinder. Further, the gas fuel cylinder needs to be rigidly supported by the frame structure and its position must be locked such that no movement is allowed. Horizontal mounting of gas fuel cylinder further adds to difficulty in mounting of other associated components like air filter, Limp home tank, shutoff valve etc. which frequently needs to be accessed for servicing/ maintenance purpose. Hence, it is necessary to mount these components at an easily accessible position. The horizontal mounting of larger gas fuel cylinder leads to increase in overall height of the vehicle, which increases overall Centre of Gravity (CG) of the vehicle leading to poor handling the vehicle. This may also result in increased wheelbase. Yet another challenge in horizontal mounting of gas fuel cylinder of larger diameter is to maintain ergonomics of the vehicle, specifically with larger gas fuel cylinder there is high possibility of having higher vehicle width, which may lead to uncomfortable posture of rider.

[009] The orientation, packaging and mounting of engine is dictated by the size and orientation of the gas fuel cylinder, position of other associated components like air filter and by the frame structure of the vehicle. Therefore, all these factors leads to compromise in orientation and space for mounting or packaging the engine and makes mounting of the engine cumbersome and complex. This also leads to suboptimal engine performance.

[010] Another requirement is a capability to replace or remove the gas fuel cylinder for servicing/ maintenance purpose. However, most of the existing vehicles have inconvenient provision to remove the gas fuel cylinder, as most of them requires disassembly of all other associated components and requires upward lifting of heavy and bulky gas fuel cylinder, which is very cumbersome.

[011] Due to the various challenges and problem stated herein above, gaseous fuel is not considered as a prominent alternative to the liquid fuel vehicles specifically in two-

wheeler segment and the wider adaptability of gaseous-fuelled two-wheeled vehicle is being hindered.

[012] Therefore, based on above, there is a clear need to address the aforementioned deficiencies and inadequacies by providing a two-wheeled vehicle with capability to accommodate larger gas fuel cylinder in its frame structure without major modifications in comparison to the frame structure of liquid fuel vehicle, while allowing easy accessibility to the various components and ensuring overall aesthetics and ergonomics of the vehicle is maintained while ensuring easy removal of larger gas fuel cylinder.

OBJECT OF INVENTION:

[013] An object of the present invention is to provide a large gas fuel cylinder so as to have higher fuel holding capacity while maintaining easy accessibility to the various associated components.

[014] Yet another object of the present invention is to provide a frame structure, which helps in secured and convenient mounting of the gas fuel cylinder of a larger capacity in a two-wheeled vehicle while allowing its easy removal for maintenance or serviceability purpose and providing comfortable ergonomics to the rider.

[015] Yet another object of the present invention is to better utilize the vehicle space while maintaining overall aesthetics and ease of maintenance of the two-wheeled vehicle.

[016] Still another object of the present invention is to provide safe, secured and improved mounting arrangement for the engine in a two-wheeled vehicle while ensuring compactness and space for mounting of other associated components.

[017] Another object of the present invention is to utilize the conventional frame structure for gas-fuelled vehicle.

[018] Yet another object of the present invention to provide a compact mounting arrangement of a gas fuel cylinder in a two-wheeled vehicle.

SUMMARY OF THE INVENTION

[019] With the above-mentioned objects, an embodiment of the present invention provides a two-wheeled motor vehicle comprising of

a vehicle frame structure comprising, a head tube; a front frame structure extending rearwardly from the head tube;

a rear frame structure connected to the front frame structure and extending rearwardly;

a gas fuel cylinder for storing and supplying gaseous fuel to an engine;

wherein; the gas fuel cylinder extending substantially horizontally and is supported by the front frame structure and the rear frame structure and; and

the engine mounted on the vehicle front frame structure wherein; the orientation of an engine is substantially horizontal.

[020] According to a preferred embodiment of present invention, an air filter mounted on the front frame structure and connected to the engine to supply purified air wherein the air-filter is preferably mounted vertically above the engine.

[021] According to an exemplary embodiment of present invention, The gas fuel cylinder is of diameter in the range of 130mm to 200mm preferably of 140mm to 170mm and of 550mm to 800mm in length, preferably 600-800 mm, wherein; the gas fuel cylinder is filled with at least one gaseous fuels such as CNG, LNG, biogas, LPG, and the like, more particularly the gas fuel cylinder is filled with CNG.

[022] A rider seat mounted on said the rear frame structure extending substantially horizontally in the rearward direction of the two-wheeled vehicle. According to an exemplary embodiment, the gas fuel cylinder extends from a front section of the front frame structure to at least up to middle section of the rear frame structure such that at least a portion of the gas fuel cylinder is positioned below rider seat. Preferably, a substantial top portion of the gas fuel cylinder is covered by the rider seat.

[023] According to another exemplary embodiment, the front frame structure comprises a set of front top tubes and a set of front lower frame tubes wherein; the front top tubes having at least a portion extending rearwardly and at least a portion extending

in downward direction from the head tube and the set of front lower frame tubes placed below front top tubes and extending substantially downwardly and horizontally in a rearward direction from the head tube and preferably connected to the set of front top tubes.

[024] The rear frame structure comprising a set of rear top tubes and a set of rear lower tubes wherein; the set of rear top tubes connected to the set of front top tubes and extending rearwardly and the set of rear lower tubes extending rearwardly and upwardly from the lower portion of the front top tubes connects the rear portion of the rear top tubes.

[025] According to an exemplary embodiment, a set of middle frame members are provided, extending horizontally and connected to the front top tubes and the rear top tubes.

[026] According to an exemplary embodiment, the set of front top tube and front lower frame tubes are connected to each other using plurality of connecting members. Further, the set of front top tubes, preferably at lower portion, are connected using plurality of cross members. The set of rear top tubes and the rear lower tubes are connected using plurality of rear connecting members. The front top tube connected with the front lower frame tubes using plurality of connecting members and helps to increase overall strength and stiffness of the frame structure, necessary to carry gas fuel cylinder of higher capacity. This helps in reducing overall size of the frame tube structure, thereby allowing compact mounting of the gas fuel cylinder while achieving required strength and stiffness. Optionally, it is possible to use frame tubes with cross section other than circular such as elliptical.

[027] According to a preferred embodiment of the present invention, the gas fuel cylinder is supported by plurality of support brackets mounted on said front frame structure and rear frame structure. Specifically, the front support brackets are mounted on front lower frame tubes of the front frame structure wherein; the front portion of the gas fuel cylinder is rested and locked by a front clamping bracket from top side. The clamping bracket is provided on the middle frame members. The rear portion of the gas fuel cylinder is rested upon rear support bracket mounted on rear top tubes and clamped

in the position using rear clamping bracket. The support brackets are of circular arc shape and connecting the respective sets of front lower frame tubes and the set of rear top tubes. The number of supporting brackets may be decided suitably based on the design requirements. The front lower frame tubes have enough strength for supporting the gas fuel cylinder through front support bracket. Further, the front frame tubes may also be used to support or clamp the gas fuel cylinder and may be provided with additional supporting/ clamping brackets to enhance strength and support to the gas fuel cylinder.

[028] According to a preferred embodiment of the present invention, the gas fuel cylinder is mounted on the frame structure such that it may be easily removable from the rear side of the vehicle without disturbing other associated components. The frame structure is provided with a suitable opening or a passage to facilitate removal of the gas fuel cylinder from rear side of vehicle. The frame structure may be provided with a guide rails for easy removal of gas fuel cylinder.

[029] According to an exemplary embodiment, the air filter is mounted on the front frame structure preferably above engine such that at least an air filter element is accessible from the top side of the vehicle for easy servicing, maintenance purpose and also helps in improved engine performance. Preferably, the air filter is mounted on one of the front top tube on left side of the vehicle proximate to the head tube, though it is possible to mount the air filter on right side front top tube.

[030] The air filter is fixed on one of the top tubes using mounting brackets. The air filter is preferably designed such that it at least partially accommodates the front top tube member of the front frame structure within its body. The air filter has at least a portion extending laterally over the portion of front top tubes and at least a portion extending downwardly over front top tube wherein; the downwardly extending portion of the air filter is further connected to the engine through a conduit to supply purified air. The depth of the downwardly extending portion is sufficient to accommodate different air duct conduit tuning length, for varying performance requirements of air for different variants of engine.

[031] According to another embodiment, the engine is mounted on the front frame structure in a substantially horizontal orientation. The horizontal orientation of engine also creates sufficient space for mounting other associated components and helps in creating better flow path for fuel intake charge and exhaust gas. The lower portion of the set of front top tube is provided with engine mounting brackets used for fixing the engine using mounting points provided on the engine. Optionally, a separate mounting tubes may be welded to the crossbar of front top tubes and engine mounting brackets may be welded on such mounting tubes. Preferably, the front portion of engine may be additionally supported by the front mounting brackets provided on the front lower frame tubes of the front frame structure. The engine may have mounting provisions on cylinder or head or crankcase etc.

[032] With the specific orientation of the engine and the air filter explained herein above, it is ensured that smooth flow of air to the engine is achieved. As a vertical conduit with minimum bends is used to supply purified air from the air filter towards the engine, high volumetric efficiency is achieved with improved tumbling flow of intake charge. Further, an intake port of the engine is designed to be substantially straight/ vertical to further enhance the tumbling motion of intake charge and helps in achieving better mixing.

[033] According to another exemplary embodiment, a limp home tank preferably used for storing liquid fuel as a secondary fuel source, to supply fuel to the engine, if the gas fuel is not available or not used for any reason. A suitable “change over system” may be employed for changing the type of fuel supply. The changeover may be automatic or manual. The limp home tank is mounted on the front frame structure above gas fuel cylinder, such that the liquid fuel filling provision is accessible from the top side of the vehicle for easy fuel refilling purpose. The limp home tank is preferably mounted on the right side of front top tube, on other side of the air filter mounting, though the position of air filter and limp home tank may be interchanged. A mounting support of the limp home tank is fixed on the front top tube. The limp home tank at least partially extends over front top tubes and front lower frame tubes. Preferably, at least a portion of the limp home tank designed in order to accommodate the front top tubes and front lower

frame tubes within its body at least partially. This helps in accommodating additional fuel and creates enough space for mounting fuel pump, strainer etc.

[034] According to another exemplary embodiment, the said air filer and said limp home tank may be mounted on same side of frame structure.

[035] According to another exemplary embodiment, a gas fuel filling point for gas fuel cylinder is provided such that it is accessible from top side of the vehicle and positioned near to liquid fuel filling provision of the limp home tank. This helps in convenient accessibility to refilling of both type of fuels (Liquid and gaseous) from top side of the vehicle.

[036] The air filter is mounted towards front side of the frame structure close to the gas fuel filing point, thereby providing easy accessibility for service and maintenance purpose.

[037] According to another exemplary embodiment, the components like limp home tank, air filter, gas fuel filling point etc. placed proximate to each other and accessible from front-top side of the vehicle. These components along with gas fuel cylinder and portion of the front frame structure are covered by a cover, preferably formed out of assembly of left side member, right side member and top covering member wherein; said components are accessible from top side of the vehicle through removably mounted top covering member. According to one of the embodiment, a flap cover is hinged to the top cover having a locking means in order to prevent any unauthorized access to said components. The flap cover also helps in improving aesthetics of the vehicle.

[038] The vehicle frame structure may be suitably changed while ensuring accomplishment of the objectives of the present invention listed herein above. Accordingly, a second exemplary embodiment of present invention is described herein below.

[039] According to the second embodiment of the present invention, the vehicle frame structure comprises

a head tube;

at least a front frame structure comprising a set of front top tubes extending substantially symmetrically in a rearward direction from the head tube;

a rear frame structure connected to the front frame structure and extending rearwardly;

a gas fuel cylinder for storing and supplying gaseous fuel to an engine;

wherein, the gas fuel cylinder is supported by the front frame structure using plurality of support brackets and extending substantially horizontally in the rearward direction; and the engine is mounted on the vehicle frame structure wherein; the orientation of the engine is substantially horizontal.

[040] The front frame structure comprises a set of front lower frame tubes extending substantially symmetrically in a downward direction and the rearward direction from the head tube; wherein; the set of front lower frame tubes comprises a left side front lower frame tubes and a right side front lower frame tubes. At least one of the side front lower frame tubes comprises a separable support portion. The separable support portion is dismantled to mount an engine of the two-wheeled vehicle. Preferably the right side downtube comprising a separable support portion.

[041] According to another exemplary embodiment, an air filter is mounted on the rear frame structure using a mounting bracket below the rider seat such that it is easily accessible from one side of the vehicle. The air filter at least partially extends below the gas fuel cylinder. Preferably, at least a portion of said extending portion has surface matching with lower surface of gas fuel tank.

[042] According to another exemplary embodiment, a limp home tank is mounted on the rear frame structure using a mounting support below the rider seat on opposite side of air filter. The limp home tank at least partially extends below the gas fuel cylinder. Preferably, at least a portion of said extending portion has surface matching with lower surface of gas fuel tank.

[043] According to an exemplary embodiment, the associated fuelling components including a pressure gauge, a low pressure regulator (LPR), a solenoid are mounted on the front frame structure.

[044] A gas filling point is mounted on the lower frame structure with an opening at a side of the vehicle and connected to a main valve of the gas fuel cylinder to fill fuel in the gas fuel cylinder.

[045] A rider seat mounted on said rear frame structure extending substantially horizontally in the rearward direction of the two-wheeled vehicle. According to an exemplary embodiment, the gas fuel cylinder extends from a front section of front frame structure to rider seat such that at least a portion of the gas fuel cylinder is positioned below rider seat. Preferably, a substantial top portion of the gas fuel cylinder is covered by the rider seat.

[046] According to another embodiment of present invention, the engine is provided with split type engine head with separate head cover wherein; the engine head is provided with fins aligned to the direction of incoming air to enhance heat transfer. To further improve the airflow into head air jacket, a scoop feature is present on head preferably near spark plug mounting area.

[047] According to another exemplary embodiment, the gas fuel is filled in the gas fuel cylinder through a gas fuel filling point connected to the main valve wherein; the main valve is mounted at the opening of the gas fuel cylinder. The fuel is supplied to the engine from gas fuel cylinder through a fuel circuitry comprising components like at least one pressure regulator and filter. A pressure gauge is connected to the pressure regulator for monitoring pressure level and is provided such that the reading on pressure gauge is visible from side of the vehicle. The fuel received from the pressure regulator at low pressure is supplied to a fuel rail or a throttle body for further injecting into the engine through an injector. Alternately, the fuel may be supplied to the carburettor configured to create an intake charge as a mix of purified air and fuel for supplying to the engine. Optionally, the pressure gauge reading is also made visible on speedometer of the vehicle for easy viewing. The pressure gauge may be suitably covered through covering members like tinted glass or any other vehicle covering part to improve overall aesthetics of the vehicle.

[048] According to another exemplary embodiment, the fuel rail comprises a solenoid to regulate the supply of fuel. The main valve is also acting as a shut-off valve configured to stop supply of fuel from the gas fuel cylinder, preferably mounted such that it is easily accessible.

[049] According to another exemplary embodiment, the orientation and position of the gas fuel cylinder along with associated fuelling components is locked using an alignment bracket wherein, the alignment bracket is provided with two-arm structure preventing any rotational movement of the gas fuel cylinder and more specifically that of main valve to ensure the necessary alignment of the main valve and alignment of all associated components including pressure regulator, pressure gauge and gas filling point.

[050] The alignment bracket is provided with a cavity to completely receive the main valve of the gas fuel cylinder within said cavity. This helps in ensuring the packaging of the gas fuel cylinder at a desired location, thereby ensuring proper alignment and packaging of all the associated components.

[051] The alignment bracket is mounted between front lower frame tubes and may be bolted or welded to the front lower frame tubes.

[052] According to another exemplary embodiment, the vehicle is provided with a mono-shock suspension system comprising a single shock absorber connecting rear frame structure and a swing arm through a linkage. According to another embodiment, the vehicle is provided with a twin suspension comprising two shock-absorbers mounted on either side of a rear wheel and connecting an axle of rear wheel with the rear frame structure.

[053] According to another exemplary embodiment, the vehicle is provided with a front and a rear wheel having diameter in a range of 14 to 18 inch. With the mounting configuration of the larger gas fuel cylinder, engine and other associated components as explained herein above effects in increasing overall height and wheel base (Distance

between two wheels) of the vehicle, hence, with the smaller diameter wheels, it is made possible to reduce the overall height of the vehicle without increasing wheel base, thereby keeping overall Centre of Gravity (CG) of the vehicle towards lower side, while using gas fuel cylinder of larger capacity. This helps in improving overall handling capabilities of the vehicle.

[054] According to another exemplary embodiment, a pillion seat is mounted on the rear frame structure at a rear of the rider seat. The pillion seat may be provided as an integral part of rider seat.

[055] According to another exemplary embodiment, a luggage box is mounted on the rear frame structure at the rear of the rider seat or on the front frame structure ahead of rider seat.

[056] The vehicle, as described above, is conveniently a two-wheeler vehicle such as a motorcycle, scooter, and the like.

[057] The rest of the features explained herein above w.r.t. first embodiment, may also be suitably adapted in the vehicle according to second embodiment.

BRIEF DESCRIPTION OF DRAWINGS

[058] The invention will now be described in more detail by way of example with reference to the embodiments shown in the figures mentioned below:

[059] Figure 1a-1b illustrates a view of the frame structure of a two-wheeled vehicle according to First embodiment of present invention;

[060] Figure 2a-2c illustrates a view of the frame structure of Fig. 1a-1b provided with a gas-fuelled cylinder according to First embodiment of present invention;

[061] Figure 3 illustrates a view of the frame structure of Fig. 1a-1b provided with an engine according to First embodiment of present invention;

[062] Figure 4a-4c illustrates a view of the frame structure of Fig. 1a-1b mounted with an air filter according to First embodiment of present invention;

[063] Figure 4d-4e illustrates a view of the engine intake manifold of Fig. 3-4c according to First embodiment of present invention;

[064] Figure 5a-5c illustrates a view of the frame structure of Fig. 1a-1b mounted with a limp home tank according to First embodiment of present invention;

[065] Figure 6a-6b illustrates a view of the frame structure of Fig. 1a-1b mounted with assembly of the limp home tank and air filter as illustrated in Fig 4a- 5c according to First embodiment of present invention;

[066] Figure 7a-7d illustrates a view of the frame structure mounted with assembly of the limp home tank and air filter as illustrated in Fig 4a- 5c and covered using covering members according to First embodiment of present invention;

[067] Figure 8a-8c illustrates a view of an alignment bracket and its associate mounting arrangement according to First embodiment of present invention;

[068] Figure 9 illustrates a view of two-wheeled vehicle with the components mounted according to the schematic of Fig. 1a-8c according to First embodiment of present invention;

[069] Figure 10 illustrates a vehicle frame (highlighted) of a two wheeled vehicle (faded) in accordance with second embodiment of the present invention;

[070] Figure 11 illustrates details of the vehicle frame in accordance with second embodiment of the present invention;

[071] Figure 12 illustrates a top view of the vehicle frame with mounting of a gas fuel cylinder, an engine, an air filter and a limp home tank, according to second embodiment of the present invention;

[072] Figure 13 illustrates a right side view of the vehicle frame with mounting of the gas fuel cylinder, the engine, and the limp home tank, a according to second embodiment of the present invention;

[073] Figure 14 illustrates a left side view of the vehicle frame with mounting of the gas fuel cylinder, the engine, and the air filter, according to second embodiment of the present invention;

[074] Figure 15 illustrates a left side perspective view of the vehicle frame mounting of the gas fuel cylinder, the engine, and the air filter, according to second embodiment of the present invention;

[075] Figure 16 illustrates a cross-sectional view of the vehicle frame with mounting of a gas fuel cylinder, an air filter and a limp home tank, according to second embodiment of the present invention; and

[076] Figure 17 illustrates details of a two wheeled vehicle in accordance with a second preferred embodiment of the present invention.

DETAILED DESCRIPTION OF DRAWINGS

[077] Embodiments of present invention are explained herein below with the help of figures 1a to 17 herein below. All the aspects described herein below, will be better appreciated and understood when considered in conjunction with the following description and the accompanying drawings. It should be understood, however, that the following descriptions, while indicating preferred embodiments and numerous specific details thereof, are given by way of illustration and not of limitation. Changes or modifications may be made within the scope defined herein without departing from the

spirit and scope thereof, and the present invention herein includes all such modifications.

First Embodiment:

[078] Fig. 1a-1b illustrates a frame structure (100) for a two-wheeled vehicle preferably operated by a gaseous fuel, stored in the gas fuel cylinder, according to an exemplary embodiment of present invention. The frame structure (100) comprises, a head tube (101); a front frame structure (102) (indicated by dotted portion) extending rearwardly from the head tube (101); a rear frame structure (103) (indicated by dotted portion) connected to the front frame structure (102) and extending rearwardly. The front frame structure (102) comprises a set of front top tubes (110 a, b) and a set of front lower frame tubes (115 a, b) wherein; the front top tubes (110 a, b) extending in a rearward and downward direction from the head tube (101) and the set of front lower frame tubes (115 a, b) placed below the front top tubes (110 a, b) and extending downwardly and substantially horizontally in a rearward direction from the head tube (101). Preferably, the set of front lower frame tubes (115 a, b) is connected to the set of front top tubes (110 a, b).

[079] The rear frame structure (103) comprising a set of rear top tubes (120 a, b) and a set of rear lower tubes (125 a, b) wherein; the set of rear top tubes (120 a, b) is connected to the set of front top tubes (110 a, b) and extending rearwardly. The set of rear lower tubes (125 a, b) extending rearwardly and upwardly from the lower portion of the front top tubes (110 a, b) and connected to the rear portion of the rear top tubes (120 a, b). Preferably, the set of rear lower tubes (125 a, b) extending rearwardly from a cross bar (150a) connecting lower portion of set of front top tubes (110 a, b).

[080] According to an exemplary embodiment, a set of middle frame members (135 a, b) are provided, extending horizontally and connecting the front frame structure (102) with the rear frame structure (103) preferably, connecting the front top tubes (110 a, b) and the rear top tubes (120 a, b).

[081] The set of front top tube (110 a, b) and front lower frame tubes (115 a,b) are connected using plurality of connecting members (175). Further, the set of front top tubes (110 a, b), preferably at lower portion, are connected using plurality of cross members (150 a, b). The set of rear top tubes (120 a, b) and the rear lower tubes (125 a, b) are connected using plurality of rear connecting members (185).

[082] The above defined frame structure (100) is advantageous for mounting the gas fuel cylinder as it provides a convenient space for mounting of larger gas fuel cylinder, while ensuring necessary strength and stiffness to the frame structure (100). The structural details of the frame including plurality of connecting members (175, 165), plurality of cross members (150 a, b), middle frame members (135 a, b) defined herein helps to increase strength necessary to carry gas fuel cylinder of higher capacity.

[083] The frame with bigger tubes is not suitable for mounting larger gas fuel cylinder as the bigger tubes occupies the space and makes gas fuel cylinder arrangement bulky. However, reducing size of the frame tubes, reduces overall strength and stiffness of the frame, thereby lowering the capability to carry larger gas fuel cylinder. Considering above constraints, the set of front lower frame tubes (115 a, b) connecting the head tube (101) and the front top tubes (110 a, b) provided with plurality of connecting members (175) provides adequate strength to the frame structure, while allowing significant reduction in the size of the frame tubes, thereby providing enough space for mounting larger gas fuel cylinder. This frame construction is also advantageous in terms of reducing cost and weight of the vehicle.

[084] Referring to the Fig. 2a- 2c illustrating mounting of the larger gas fuel cylinder (210) extending substantially horizontally according to one of the embodiment of present invention. The set of front top tubes (110 a, b), front lower frame tubes (115 a, b) and the set of rear top tubes (120 a, b) forms a space there between to securely mount the large gas fuel cylinder (210). According to an exemplary embodiment of present invention, the large gas fuel cylinder (210) is of diameter in the range of 130mm to 200mm preferably of 140mm to 170mm and of 550mm to 800mm in length, preferably 600 mm to 800 mm wherein; the gas fuel cylinder (210) is filled with at least one gaseous

fuels such as CNG, LNG, biogas, LPG, and the like, more particularly the gas fuel cylinder is filled with CNG.

[085] Preferably, the gas fuel cylinder (210) is supported by plurality of support brackets mounted on the front frame structure and rear frame structure. Specifically, the front support brackets (165 a, b) are mounted on the front lower frame tubes (115 a, b) of the front frame structure (102) wherein; the front portion of the gas fuel cylinder (210a) is rested and clamped by a front clamping bracket (165 c) from top side. The clamping bracket (165c) is provided on the middle frame members (135 a, b). The rear portion of the gas fuel cylinder (210b) is rested upon rear support bracket (155) mounted on rear top tubes (120 a, b) and clamped in the position using the rear clamping bracket (155 a). The support brackets (165 a-b, 155) are of circular arc shape and connecting the respective sets of front lower frame tubes (115 a, b) and the set of rear top tubes (120 a, b). The number of supporting brackets may be decided suitably based on the design requirements. The front lower frame tubes (115 a, b) has enough strength for supporting the gas fuel cylinder through the front support bracket (165 a-b). Further, the front frame tubes (110 a, b) may also be used to support or clamp the gas fuel cylinder (210) and may be provided with additional supporting/ clamping brackets to enhance strength and support to the gas fuel cylinder (210).

[086] The gas fuel cylinder (210) is mounted centrally along lateral direction of the vehicle, in order to distribute the weight equally and achieve balance as illustrated in Fig. 2c.

[087] Referring to the Fig. 3a- 3c illustrating mounting details of an engine (310) according to a preferred embodiment of present invention. The engine (310) is mounted on the vehicle front frame structure (102) wherein; the orientation of an engine cylinder (310) is substantially horizontal. The horizontal orientation of the engine (310) also creates sufficient space for mounting other associated components and helps in creating better flow path for fuel intake charge and exhaust gas. The lower portion (112) of the set of front top tube is provided with engine mounting brackets (145a) used for fixing the engine (310) using mounting points provided on the engine (310). Optionally,

separate mounting tubes (112) may be welded to the crossbar (150a) of the front top tubes (110 a, b) and the engine mounting brackets (145a) may be welded on such mounting tubes (112). Preferably, the front portion of the engine may be additionally supported by the front mounting brackets (145b) provided on the front lower frame tubes (115 a, b) of the front frame structure (102) engaging engine cylinder or head or crankcase.

[088] According to another embodiment of present invention, the engine (310) is provided with split type engine head (310a) wherein; the engine head (310a) is provided with fins aligned to the direction of incoming air. To further improve the airflow into engine head air jacket, a scoop feature is present on the engine head (310a) preferably near spark plug mounting area.

[089] Referring to the Fig. 4a-4c illustrating mounting details of the air filter (401) according to another exemplary embodiment. An air filter (401) is mounted on the front frame structure (102) and connected to the engine to supply purified air wherein; the air-filter (401) is preferably mounted vertically above the engine cylinder.

[090] The air filter (401) is mounted on the front frame structure (102) preferably above the engine (310) such that it is accessible from the top side of the vehicle for easy servicing, maintenance purpose and also helps in improving engine performance. Preferably, the air filter (401) is mounted on one of the front top tubes (110 a) on left side of the vehicle proximate to the head tube (101), though it is possible to mount the air filter (401) on right side front top tube (110 b).

[091] The air filter (401) is fixed on one of the front top tubes (110 a, b) using suitable mounting brackets (405 a, b) preferably provided on the front top tubes (110 a, b). The rear surface of the air filter (401 a) is preferably designed to at least partially accommodate the front top tube member (110 a, b) of the front frame structure (102) within its body. This helps in compact mounting of the air filter (401) and secured mounting with less number of mounting brackets. The air filter (401) has at least a portion (410 b) extending laterally over the portion of the front top tubes (110 a, b) and

at least a portion extending downwardly (401 c) over the front top tube (110 a, b) and the front lower frame tubes (115 a, b) wherein; the downwardly extending portion (401 c) of the air filter (401) is further connected to the engine (310) through a conduit (410) to supply purified air. The depth of the downwardly extending portion (401 c) is sufficient to accommodate different requirements of air for different variants of the engine.

[092] With the specific orientation of the engine and the air filter (401) explained herein above, it is ensured that smooth flow of air to the engine is achieved. Referring to the Fig. 4d-4e illustrating the conduit (410) used to supply purified air from air filter (401) towards the engine (310) is designed to be substantially vertical with minimum bends, this helps in achieving high volumetric efficiency with improved tumbling flow of intake charge. Further, an intake port (448) and flow axis (410a) of the intake passage (468) within engine (310) is designed to be substantially straight/ vertical to further enhance the tumbling motion of intake charge and helps in achieving better mixing. The conduit (410) is provided with a throttle body (437) wherein; fuel is injected into the purified air received from air filter (401), which is further supplied to the engine (310) through the intake port (448).

[093] Referring to the Fig. 5a-5c illustrating mounting details of a limp home tank (501) according to another exemplary embodiment, the limp home tank (501) preferably used for storing liquid fuel as a second fuel source, to supply fuel to the engine, if the gas fuel is not available or not used for any reason. A suitable change over system may be employed for changing the type of fuel supply. The changeover may be automatic or manual. The limp home tank (501) is mounted on the front frame structure (102) above gas fuel cylinder (210), such that the liquid fuel filling provision (501c) is accessible from the top side of the vehicle for easy fuel refiling purpose. The limp home tank (501) is preferably mounted on the right side front top tube (110 b), opposite to the air filter (401) mounting. A mounting support of the limp home tank (501) is fixed on the front top tube using mounting brackets. The limp home tank (501) at least partially extends vertically downward over the front top tubes (110 a, b) and the front lower frame tubes (115 a, b). Preferably, at least a rear side portion of the limp home tank (501a) is

designed to accommodate the front top tubes (110 a, b) and the front lower frame tubes (115 a, b) within its body at least partially to have compact packaging. This also helps in accommodating additional fuel and mounting other components within the Limp home tank (501) such as fuel pump, strainer etc. According to another exemplary embodiment, the said air filer (401) and said limp home tank (501) may be mounted on same side of frame structure.

[094] Referring to the Fig. 6a-6b illustrating mounting arrangement of both the air filer (401) and the limp home tank (501) mounted opposite to each other as viewed from the front or top side of the vehicle. The position of the air filter (401) and the limp home tank (501) may be interchanged. The liquid fuel filling provision (501c) provided in the form an opening closed by a cap is accessible from top side of the vehicle. Similarly, access to air filter/ air filter element (401) is provided from top side of the vehicle for servicing or maintenance purpose. The air filter (401) is preferably a foam filter though other types of filter may also be used. This arrangement also helps in maintaining overall aesthetics of the vehicle.

[095] Referring to Fig 7a-7b illustrating a cover (710) configured to enclose components like gas fuel cylinder (210), limp home tank (501), air filter, fuel refiling points etc. The cover (710) may be formed out of assembly of left and right side member a (710a-b) and top covering member (not shown). As said components are mounted on front top side of the vehicle, these are accessible from through removably mounted top covering member. A gas fuel filling point (701) for gas fuel cylinder (201) provided such that it is accessible from top side of the vehicle and positioned near to liquid fuel filling provision (501c) of the limp home tank (501). This helps in convenient accessibility to refilling of both type of fuels (Liquid and gaseous) from top side of the vehicle. Further, Air filter (401) is also accessible upon opening the top covering member. According to one of the embodiment, the top covering member is provided with a flap cover preferably hinged to the top cover having a locking means in order to prevent any unauthorized access to said components. The flap cover also helps in improving aesthetics of the vehicle. The cover (710) may be formed using suitable

number of covering members, which may be provided as an integrated members or separate members assembled together.

[096] The fuel is supplied to the engine from gas fuel cylinder (210) through a gas fuel circuitry comprising components like main valve or a shut-off valve, at least one Pressure regulator, filter etc. The gas fuel is filled in the gas fuel cylinder (210) through a gas fuel filling point (701). A pressure gauge (815) is connected to the pressure regulator for monitoring pressure level and is provided such that the reading on pressure gauge (815) is visible from side of the vehicle. The fuel received from the pressure regulator at low pressure is supplied to a fuel rail (885) or a throttle body for further injecting into the engine through an injector. Alternately, the fuel may be supplied to a carburettor configured to create an intake charge as a mix of purified air and fuel for supplying to the engine. Optionally, the pressure gauge reading is also made visible on speedometer of the vehicle for easy viewing. The pressure gauge (815) may be suitably covered through covering members like tinted glass or any other vehicle covering part to improve overall aesthetics of the vehicle.

[097] According to another exemplary embodiment, the fuel rail comprises a solenoid to regulate the supply of fuel.

[098] The engine is also supplied with the liquid fuel through conventional fuelling circuitry separate from the gas fuel circuitry or may be commonly used suitably.

[099] It may be construed from the above that alignment of the gas fuel cylinder (210) is critical in order to achieve the compact packaging of all the associated components as explained herein above in order to achieve necessary benefits of the present invention. For example, the location and orientation of pressure gauge (815), main valve (825), gas filling point (701) alignment is important. Considering the necessity, the orientation and position of the gas fuel cylinder (210) along with associated fuelling components is locked using an alignment bracket (917) as illustrated in the Fig. 8a-8c. The alignment bracket (917) is provided with two-arm structure preventing any rotational movement of the gas fuel cylinder (210) and more specifically that of main valve (825) to ensure

the necessary alignment of the main valve (825) and thereby alignment of all associated components including pressure regulator (not shown) and pressure gauge (815). The gas fuel cylinder (210) has to be mounted close to the head tube (101) to achieve desired packaging, any variations there between may lead to misalignment of all the associated components. To ensure the desired packaging of the gas fuel cylinder (210), the alignment bracket (917) is provided with a cavity (917c) to completely receive the main valve (825) of the gas fuel cylinder (210) within said cavity (917c). This helps in ensuring the packaging of the gas fuel cylinder (210) at a desired location, thereby ensuring proper alignment and packaging of all the associated components. The alignment bracket (917) is mounted between front lower tubes (115 a, b) may be bolted or welded to the front lower tubes (115 a, b).

[0100] Referring to Fig. 9, illustrating a two-wheeled vehicle (901) with gas fuel cylinder (210) and other components mounted according to the schematic disclosed herein above. A rider seat (910) mounted on the rear frame structure (103) extending substantially horizontally in the rearward direction of the two-wheeled vehicle (901). According to an exemplary embodiment, the gas fuel cylinder (210) extends from a front section of the front frame structure (102) to at least up to middle section of the rear frame structure (103) such that at least a portion of the gas fuel cylinder (102) is positioned below the rider seat (910). Preferably, a substantial top portion of the gas fuel cylinder (210) is covered by the rider seat (910).

[0101] According to preferred embodiment of the present invention, the gas fuel cylinder (210) is mounted on the frame structure (100) such that it may be easily removable from the rear side of the vehicle without disturbing other associated components. The frame structure (100) is provided with a suitable opening or a passage to facilitate removal of the gas fuel cylinder from rear side of vehicle. The frame structure (100) may be provided with a guide rails for easy removal of gas fuel cylinder.

[0102] According to another exemplary embodiment, the vehicle is provided with a mono-shock suspension system comprising a single shock absorber (915) connecting the rear frame structure (103) and a swing arm (920) through a linkage. According to

another embodiment, the vehicle is provided with a twin suspension comprising two shock-absorbers mounted on either side of a rear wheel (907) and connecting an axle of rear wheel (907) with the rear frame structure (103).

[0103] According to another exemplary embodiment, the vehicle (901) is provided with a front (905) and a rear wheel (907) having diameter in a range of 14 to 18 inch. With the mounting configuration of the larger gas fuel cylinder, engine and other associated components as explained herein above, results in increase in overall height and wheel base of the vehicle, hence, with the smaller diameter wheels, it is made possible to reduce the overall height of the vehicle, thereby keeping overall Centre of Gravity (CG) of the vehicle towards lower side, while using gas fuel cylinder of a larger capacity. This helps in improving overall handling capabilities of the vehicle and wheelbase is retained.

[0104] According to another exemplary embodiment, a pillion seat is provided as a separate seat mounted on the rear frame structure (103) at the rear of the rider seat. The pillion seat may be provided as an integral part of the rider seat (901).

[0105] According to another exemplary embodiment, a first luggage box is mounted on the rear frame structure at the rear side of the rider seat.

[0106] The vehicle, as described above, is conveniently a two-wheeler vehicle such as a motorcycle, scooter, and the like.

Second Embodiment:

[0107] Figure 10 to 17 illustrates a two-wheeled vehicle (1000) in accordance with second embodiment of present invention, with some modifications in the frame structure while achieving the same objectives related to mounting of larger gas fuel cylinder. The two-wheeled vehicle (1100) comprises a vehicle frame (1200) including a front frame structure (1210) having a front lower frame structure (1215). The front frame structure 1(210 and the front lower frame structure (1215) extending from a head tube (1205) in a rearward direction. The front frame structure (1210) includes a set of front top tubes, namely a left side front top tube (1210L), and a right side front top tube (1210R) which

extend substantially symmetrically in a rearward and downward direction from the head tube (205). The rearward direction indicates direction of moving from front of the two-wheeled vehicle (1100) towards the rear of the two-wheeled vehicle (1100) [as indicated by arrowhead of A1 in figure 10].

[0108] The front frame structure (1205) comprises a set of front lower frame tubes, namely a left side front lower frame tubes (1215L) and a right side front lower frame tubes (1215R), extending substantially symmetrically in a downward direction and in the rearward direction from the head tube (1205. Further, the right side front lower frame tubes (1215R) comprises a separable support portion (1215B). In an exemplary embodiment of present invention, the separable support portion (1215B) is a portion of the right side front lower frame tubes (1215R) which is separable from the vehicle frame and bolted on the vehicle frame (1200) after mounting of an engine (1300) of the two-wheeled vehicle (1100). Alternatively, this support portion may be in form of swingable arrangement i.e. hinged at one end and bolted at other end. The bolts can be removed and hinged upwardly/downwardly while mounting or removing the engine. The set of front top tubes (1210 L, R) are connected to each other using at least a cross members; and a set of a front lower frame tubes (1215 L, R) connected to the set of front top tubes (1210 L, R) using at least a front connecting member.

[0109] The front frame structure (1215) is connected to the rear frame structure 1195) comprising a set of rear top tubes (2100L, 2100R) which extend substantially horizontally and parallelly in the rearward direction is connected to front top tubes (1210L, 1210R). A set of rear lower tubes (2100a, b) is provided connecting lower portion of front top tubes and the middle portion of rear top tubes (2100L, 2100R).

[0110] The engine (1300) is mounted on the front frame structure (1210) in a substantially horizontal orientation and locked within the vehicle frame (1200) using the support brackets (1235) provided on lower portion of front top tubes (2100L, 2100R). The separable support portion (1215B) is dismantled to mount the engine (1300) of the two-wheeled motor vehicle (1100) and further bolted to lock the engine (1300) on the

engine frame. Such a mounting provision of separable support portion (1215B) provides ease of assembly and maintenance for the two-wheeled vehicle (1100).

[0111] A plurality of support brackets (1220) of circular arc-shape are provided between the two horizontal tube portions (2100L, 2100R) enabling to effectively utilising space to mount the gas fuel cylinder (1110) on the front frame structure (1210). The space in an exemplary embodiment is cavity of circular arc profile on the plurality of support brackets (1220), complementing an outer lower profile of the gas fuel cylinder (1110).

[0112] According to an exemplary embodiment plurality of support brackets (1220) are welded on the vehicle frame (1200). The gas fuel cylinder (1110) is mounted on the front frame structure (1210) extending substantially horizontally in the rearward direction and at least partially extending below rider seat. The gas fuel cylinder (1110) is placed on the plurality of the support brackets (1220) within the space created. A plurality of corresponding securing brackets (1225 of reverse circular arc-shape are placed on top of the gas fuel cylinder (1110). The plurality of clamping brackets (1225) are of reverse circular arc-shape, complementing an outer upper profile of the gas fuel cylinder (1110). The plurality of clamping brackets (1225) are fixed on top of the plurality of support brackets (1220), sandwiching and locking the gas fuel cylinder (1110) there between.

[0113] The vehicle frame (1200) mounts a rider seat (1105) on the front and rear frame structure. The rider seat (1105) extends substantially horizontally in the rearward direction. In an exemplary embodiment, a pillion seat (165) is provided as an integral part of the rider seat (1105).

[0114] Figure 13 and 14 illustrates a gas filling point (1185) provided with an opening at a side of the two wheeled vehicle (1100). The gas filling point (1185) is connected to a main valve (1125) of the gas fuel cylinder (1110) to fill a fuel in the gas fuel cylinder (110). The pressure gauge (1130) and a pressure regulator (135) are connected to the main valve (1125). The pressure gauge (1130) is mounted on the front frame structure (1210) near the head tube structure (1205) preferably, rearward from the head tube

structure (1205), ahead of the front opening of the cylinder within the space between the front frame tubes (1210) and the front lower frame tubes (1215).

[0115] Further, in an exemplary embodiment of present invention, one or more elements of fuel line of the two-wheeled vehicle (1100) are compactly mounted on the vehicle frame (1200). As indicated in figure 15, an ECU is mounted on the two-wheeled vehicle at an ECU mounting location (1170) at rear side of the vehicle frame (1200), electronically connected with the one or more components of the fuel line to control and regulate the fuel supply for engine operations.

[0116] The gas fuel circuitry and its function is explained herein above for first embodiment is also applicable for second embodiment, hence further description is omitted herein for a sake of convenience.

[0117] As indicated in figure 12, 14, and 15, an air filter (1115) is mounted between the front frame structure (1210), and the rear frame structure (1195) on a mounting bracket (1115a). The air filter (1115) fixed on the horizontal tube portion 2100L) of one of the front top tubes (1210L, 1210R) below the rider seat (1105). The air filter (1115) at least partially extends below the gas fuel cylinder (1110). In an exemplary embodiment as indicated in the cross-sectional view of the vehicle frame in Figure 16, the air filter (1115) extends with an extending parallel matching surface of the air filter (1115) below the gas fuel cylinder (1110).

[0118] As indicated in figure 13, and 16, a limp home tank (1120) is mounted on between the front frame structure (1210) and the rear frame structure (1195), on a mounting support (1120a). The limp home tank (1120) is fixed on the horizontal tube portion (12100R) of one of the top tubes (1210R) below the rider seat (1105). The limp home tank at least partially extends below the gas fuel cylinder (1110). In an exemplary embodiment as indicated in the cross-sectional view of the vehicle frame in Figure 16, the limp home tank (1120) extends with an extending parallel matching surface of the air filter (115) below the gas fuel cylinder (1110). The limp home tank (1120) operates

as a secondary fuel source, to supply fuel to engine for engine (1300) operation via an injector, if the gas fuel cylinder (1110) is empty.

[0119] The second preferred exemplary embodiment in figure 17 illustrates a motorcycle vehicle or a moto-scooter type vehicle (1100) with telescopic suspension at front and spring suspension at rear, in accordance with the features explained herein above. For the exemplary embodiment, the height of the two wheeled vehicle, diameter of wheels, size of suspension system, and space between the front wheel and rear wheel are optimized as explained in the first embodiment of the present invention to accommodate the gas fuel cylinder within the vehicle frame of the two wheeled vehicle (1100).

[0120] Also, with the compact packaging of gas fuel cylinder (1110), horizontal engine (1300), and the fuel filler (1185) and the fuel line on the vehicle frame (1200), conventional fuel tank location remains free for mounting additional utilities. In an exemplary embodiment of present invention, a second storage box (1160) is mounted at front at the conventional fuel tank location, without compromising aesthetics of the two wheeled vehicle (1100. The modularity in space utilization of the two-wheeled vehicle (1100) is further enhanced with replacing the pillion seat (1165) with a first modular rack. A child seat or the second storage box (1160) is mounted on the first modular rack mounted.

[0121] Conclusively, the present invention provides a compact two-wheeled vehicle. The vehicle efficiently accommodates the gas fuel cylinder extending horizontally from the front of the two-wheeled vehicle towards the rider seat, without compromising aesthetics of the vehicle structure, while providing easy access to various components like air filter or limp home tank.

[0122] Although the features of the present invention are explained herein above in the form of various embodiments, the person skilled in the art would easily appreciate interchangeability of features between these embodiments and the description provided herein shall not limit the scope of the present invention to any specific embodiment.

Although the features of present invention are explained considering gaseous fuel, it is possible to provide vehicle only with single liquid fuel source wherein; the fuel cylinder stores liquid fuel instead of gas.

WE CLAIM;

1. A two-wheeled motor vehicle comprising:

a vehicle frame structure comprising of,

a head tube;

a front frame structure extending rearwardly from the head tube;

a rear frame structure connected to the front frame structure and extending rearwardly;

a gas fuel cylinder for storing and supplying gaseous fuel to an engine;

wherein the gas fuel cylinder extending substantially horizontally and is supported by the front frame structure and the rear frame structure using plurality of support brackets; and

the engine mounted on the vehicle front frame structure wherein; the orientation of an engine is substantially horizontal.

2. The two-wheeled vehicle as claimed in claim 1, wherein the engine is connected to an air filter to receive purified air, wherein the air-filter is mounted on the front frame structure vertically above the engine such that it is accessible from the top side of the vehicle.

3. The two-wheeled vehicle as claimed in claim 2, wherein at least a portion of the air filter is extending downwardly over the front frame structure and at least a portion extending laterally over the portion of the front frame structure and wherein; the downwardly extending portion of the air filter is further connected to the engine through a conduit to supply purified air.

4. The two-wheeled vehicle as claimed in claim 1, wherein the front frame structure comprises a set of front top tubes and a set of front lower frame tubes, wherein the front top tubes having at least a portion extending rearwardly and at least a portion extending in downward direction from the head tube and the set of front lower frame tubes placed below front top tubes and extending substantially

downwardly and horizontally in a rearward direction from the head tube and connected to the set of front top tubes.

5. The two-wheeled vehicle as claimed in claim 4, wherein the rear frame structure comprising a set of rear top tubes and a set of rear lower tubes, wherein the set of rear top tubes extending rearwardly and connected to the set of front top tubes; and the set of rear lower tubes connected to the lower portion of the front top tubes and extending rearwardly and upwardly to connect to the rear portion of the rear top tubes.

6. The two-wheeled vehicle as claimed in claim 5, wherein the set of front top tube and the front lower frame tubes are connected using plurality of connecting members and the set of rear top tubes and the rear lower tubes are connected using plurality of rear connecting members respectively.

7. The two-wheeled vehicle as claimed in claim 5, wherein the front top tubes and the rear top tubes are connected by a set of middle frame members extending horizontally.

8. The two-wheeled vehicle as claimed in claim 7, wherein the gas fuel cylinder is supported on the front frame structure using at least a front support bracket mounted on the front lower frame tubes and supported on the rear top tubes using at least a rear support bracket mounted on the rear top tubes.

9. The two-wheeled vehicle as claimed in claim 8, wherein the gas fuel cylinder is clamped by at least a front clamping bracket from top side, wherein the front clamping bracket is provided on the middle frame members and the gas fuel cylinder is clamped by at least a rear clamping bracket from rear side wherein; the rear clamping bracket is provided on the rear top tubes.

10. The two-wheeled vehicle as claimed in claim 9, wherein the vehicle frame structure is provided with a suitable opening or a passage to facilitate removal of the gas fuel cylinder from rear side of the vehicle.

11. The two-wheeled vehicle as claimed in claim 10, wherein the vehicle frame structure is provided with at least a guide rail for removal of the gas fuel cylinder.

12. The two-wheeled vehicle as claimed in claim 2, wherein the engine is supplied with a secondary liquid fuel stored in a limp home tank and wherein the limp home tank is mounted on the front frame structure, such that a secondary liquid fuel filling provision is accessible from the top side of the vehicle for liquid fuel refilling.

13. The two-wheeled vehicle as claimed in claim 12, wherein the limp home tank is designed to extend downwardly at least partially over the front frame structure wherein the limp home tank is mounted on opposite side of the air filter mounting.

14. The two-wheeled vehicle as claimed in claim 12, wherein fuel supply from the gaseous fuel is changed to the secondary liquid fuel and vice-versa by an automatic or a manual changeover system.

15. The two-wheeled vehicle as claimed in claim 12, wherein the gas fuel cylinder is provided with a gas fuel filling point accessible from top side of the vehicle and positioned beside the liquid fuel filling provision of the limp home tank.

16. The two-wheeled vehicle as claimed in claim 15, wherein the limp home tank, the air filter, the gas fuel filling point are accessible from front-top side of the vehicle.

17. The two-wheeled vehicle as claimed in claim 16, wherein the limp home tank, the air filter, the gas fuel filling point are covered by a cover, wherein the cover is formed out of assembly of left side member, right side member and an openable top covering member to provide access at least to the limp home tank, the air filter, the gas fuel filling point.

18. The two-wheeled vehicle as claimed in claim 17, wherein the top cover is provided with a flap cover having a locking means to prevent unauthorized access to the limp home tank, the air filter or the gas fuel filling point.

19. A two-wheeled motor vehicle comprising of the vehicle frame structure comprising;

a head tube;

at least a front frame structure extending in a rearward direction from the head tube;

a rear frame structure connected to the front frame structure and extending rearwardly;

a gas fuel cylinder for storing and supplying gaseous fuel to an engine;

wherein, the gas fuel cylinder is supported by the front frame structure and the rear frame structure using plurality of support brackets and extending substantially horizontally in the rearward direction; and

wherein the engine is mounted on the vehicle frame structure wherein; the orientation of the engine is substantially horizontal; and

the front frame structure comprises a set of front top tube extending substantially symmetrically in a rearward direction and a set of a front lower frame tubes extending substantially symmetrically in a downward and the rearward direction from the head tube; wherein at least one of the front lower frame tube comprises a separable support portion wherein; the separable support portion is dismantled to mount an engine of the two-wheeled vehicle.

20. The two-wheeled vehicle as claimed in claim 19, wherein the engine is connected to an air filter to receive purified air wherein, the air-filter is mounted on the rear frame structure below the rider seat.

21. The two-wheeled vehicle as claimed in claim 20, wherein the engine is supplied with a secondary liquid fuel stored in a limp home tank wherein; the limp home tank is mounted on the rear frame structure below the rider seat on opposite side of air filter.

22. The two-wheeled vehicle as claimed in claim 21, wherein at least a portion of the air filter and the limp home tank extends below the gas fuel cylinder wherein; the portion has a surface matching with lower surface of gas fuel tank.

23. The two-wheeled vehicle as claimed in claim 22, wherein the gas fuel cylinder is provided with a gas filling point provided on side of the vehicle.

24. The two-wheeled vehicle as claimed in any one of the claims above, wherein the gas fuel cylinder is of diameter in the range of 130mm to 200mm and length in the range of 550mm to 800mm.

25. The two-wheeled vehicle as claimed in any one of the claims above, wherein the gas fuel cylinder extends from a front section of the front frame structure to at least up to middle section of the rear frame structure such that at least a portion of the gas fuel cylinder is positioned below a rider seat wherein; the rider seat is mounted on the rear frame structure and extending substantially horizontally in the rearward direction.

26. The two-wheeled vehicle as claimed in any one of the claims above, wherein the front frame structure comprises a set of front top tubes connected to each other using at least a cross member; and a set of a front lower frame tubes connected to the set of front top tubes using at least a front connecting member.

27. The two-wheeled vehicle as claimed in any one of the claims above, wherein the engine is provided with a split type engine head having separate head cover, wherein the engine head is provided with fins aligned to the direction of incoming air to enhance heat transfer and provided with a scoop feature.

28. The two-wheeled vehicle as claimed in any one of the claims above, wherein the engine is horizontally supported at rear side on the lower portion of the front frame structure using mounting brackets and optionally supported at the front side using the front lower tubes.

29. The two-wheeled vehicle as claimed in any one of the claims above, wherein the engine is supplied with the gaseous fuel through to a main valve wherein; the main valve is mounted at the opening of the gas fuel cylinder; a pressure regulator and a filter unit wherein the gaseous fuel is supplied to a fuel rail or a throttle body for further injecting into the engine through an injector or the gaseous fuel is supplied to a carburettor configured to create an intake charge as a mix of purified air and fuel for supplying to the engine.

30. The two-wheeled vehicle as claimed in claim 29, wherein pressure level of gaseous fuel is monitored using a pressure gauge, wherein the reading on pressure gauge is visible from side of the vehicle and/or visible on a speedometer of the vehicle.

31. The two-wheeled vehicle as claimed in claim 30, wherein the pressure gauge is covered through a covering member including a tinted glass or any other vehicle covering part.

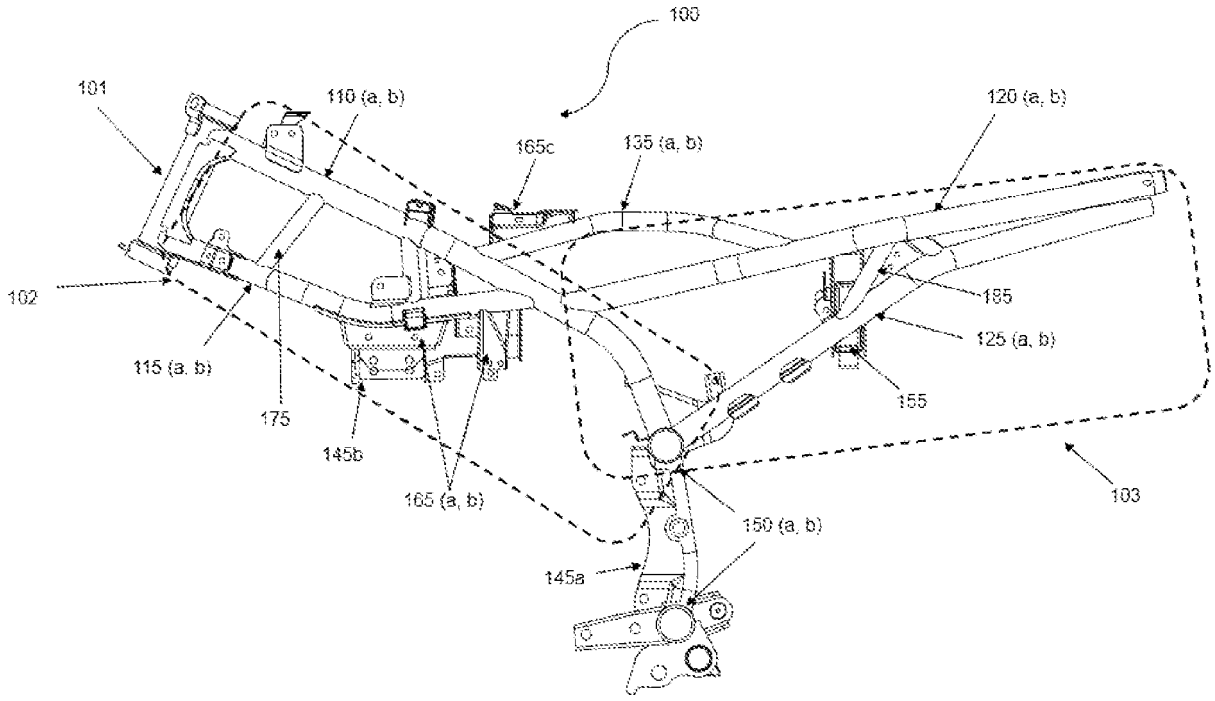
32. The two-wheeled vehicle as claimed in any one of the claims above, wherein the gas fuel cylinder orientation and position is locked using an alignment bracket wherein, the alignment bracket is mounted within the front frame structure and is provided with two-arm structure forming a cavity to completely receive the main valve of the gas fuel cylinder thereby restricting any movement of the main valve.

33. The two-wheeled vehicle as claimed in any one of the claims above, wherein the vehicle is provided with a mono-shock suspension system comprising a single shock absorber connecting the rear frame structure and a swing arm through a linkage or the vehicle is provided with a twin suspension comprising two shock-absorbers mounted on either side of a rear wheel and connecting an axle of rear wheel with the rear frame structure.

34. The two-wheeled vehicle as claimed in any one of the claims above, wherein, the vehicle is provided with a front and a rear wheel having diameter in a range of 14 to 18 inch.

35. The two-wheeled vehicle as claimed in any one of the claims above, wherein the vehicle is provided with a luggage box is mounted on the rear frame structure or on the front frame structure.

36. The two-wheeled vehicle as claimed in any one of the claims above, wherein the gas fuel cylinder is filled with at least one gaseous fuel including CNG, LNG, biogas, LPG.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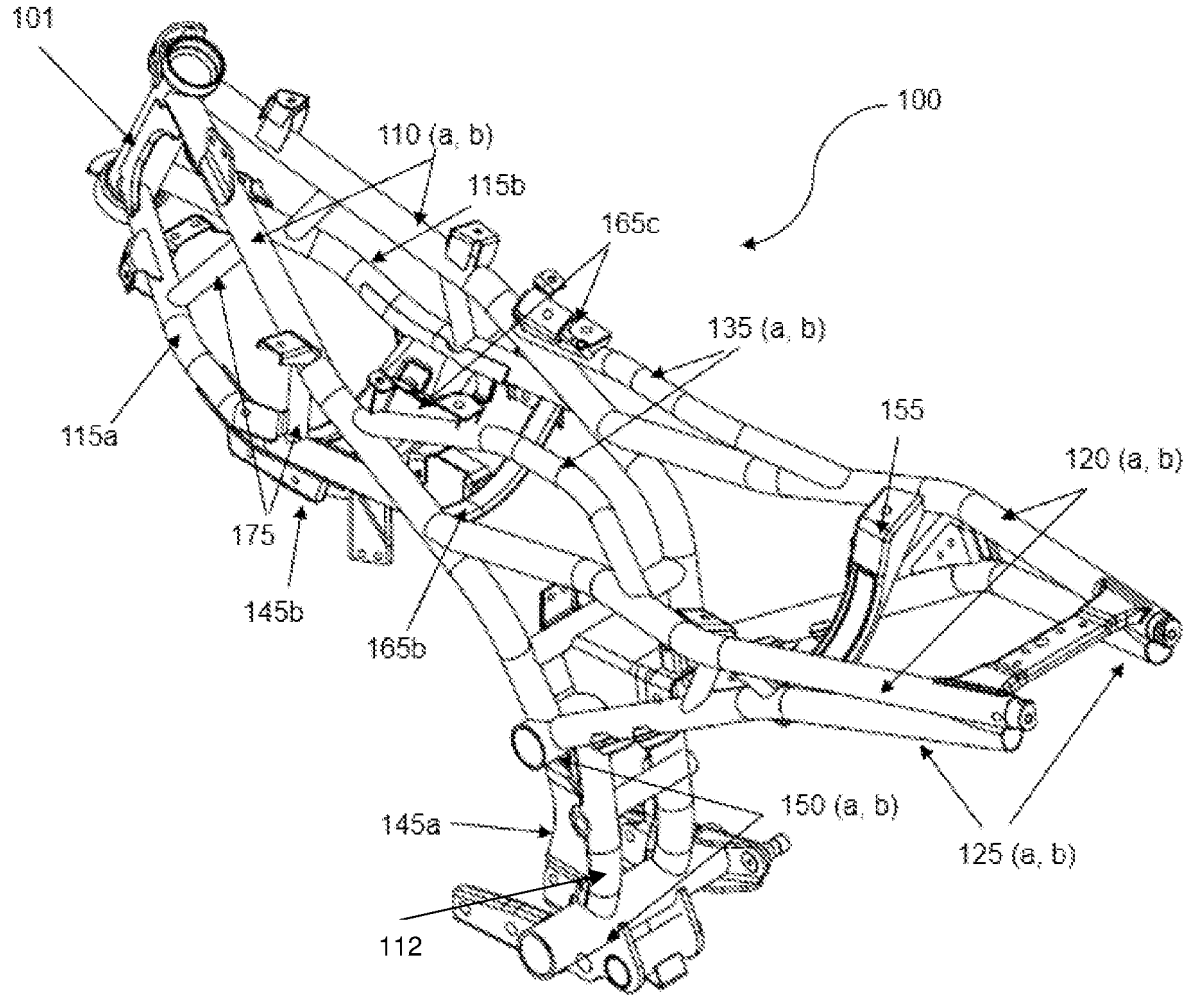
110 (a, b)
165c
135 (a, b)
120 (a, b)
102
185
125 (a, b)
115 (a, b)
155
175
145b
165 (a, b)
103
150 (a, b)
145a

Figure 1a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145b
165b
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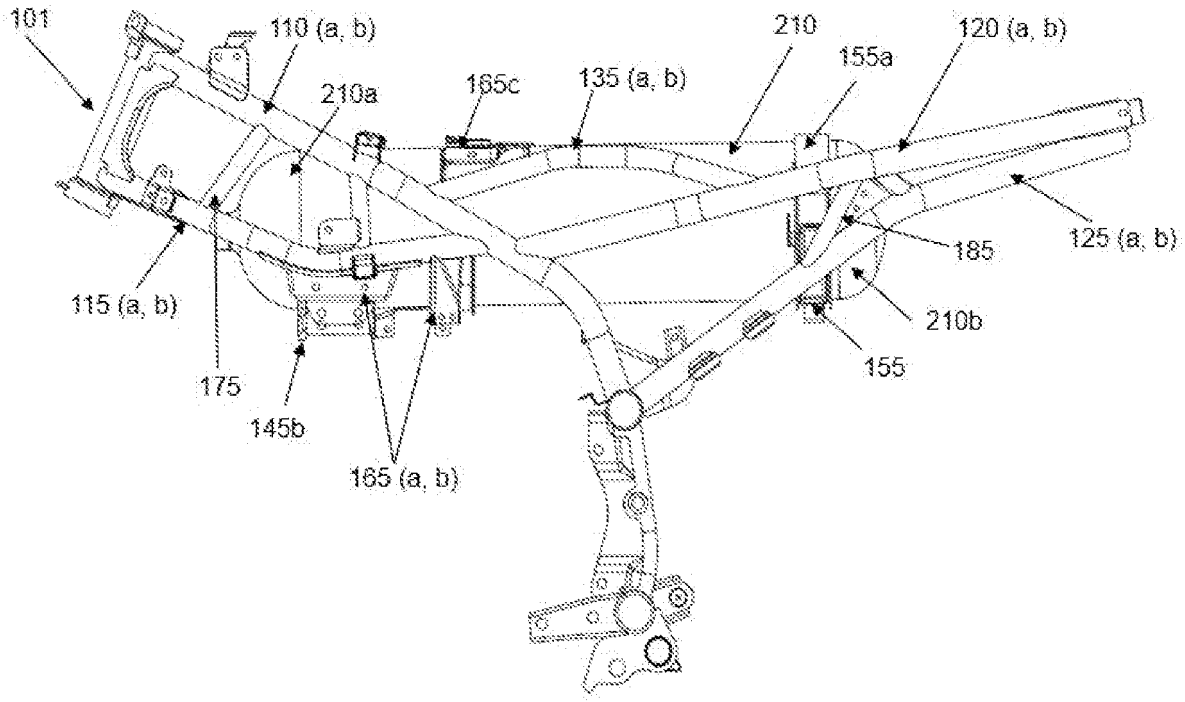
145a
125 (a, b)
112

Figure 1b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210b
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115 (a, b)
175
145b
165 (a, b)

Figure 2a

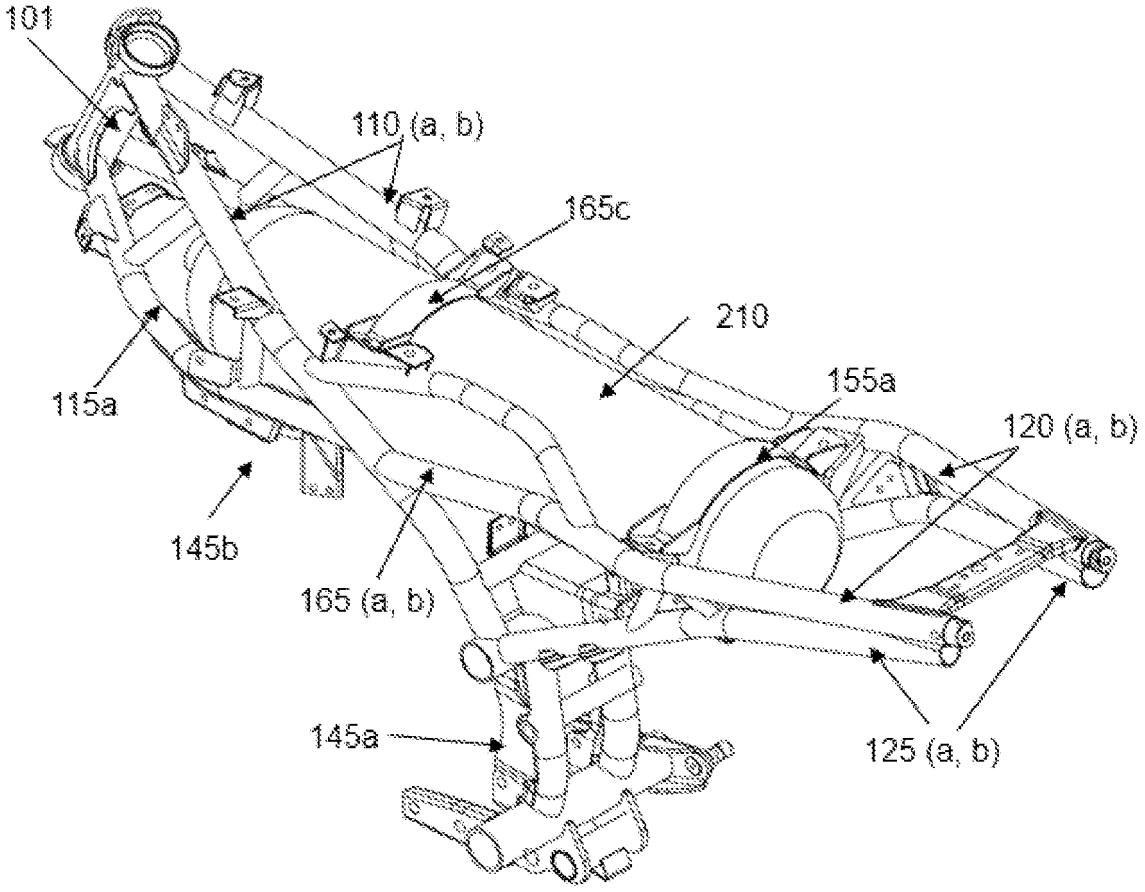


Figure 2b

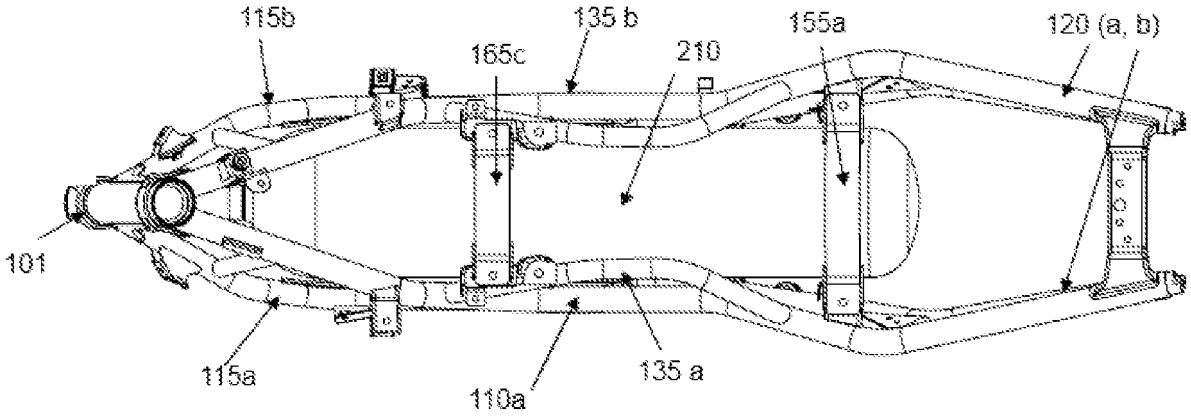
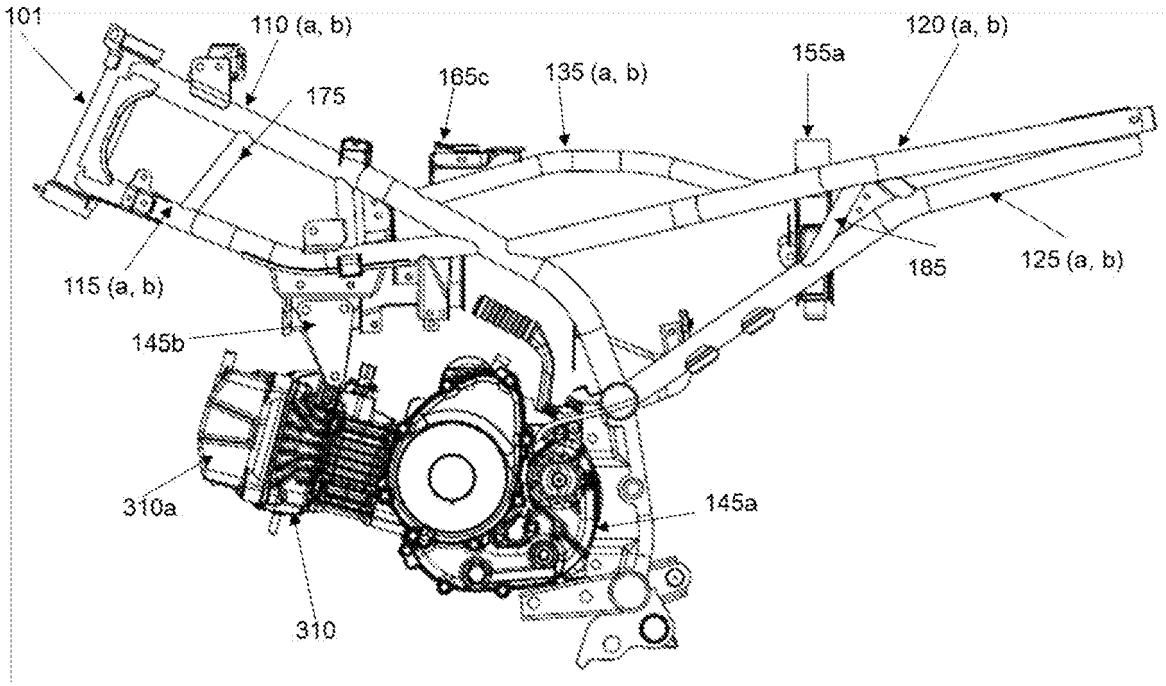


Figure 2c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185
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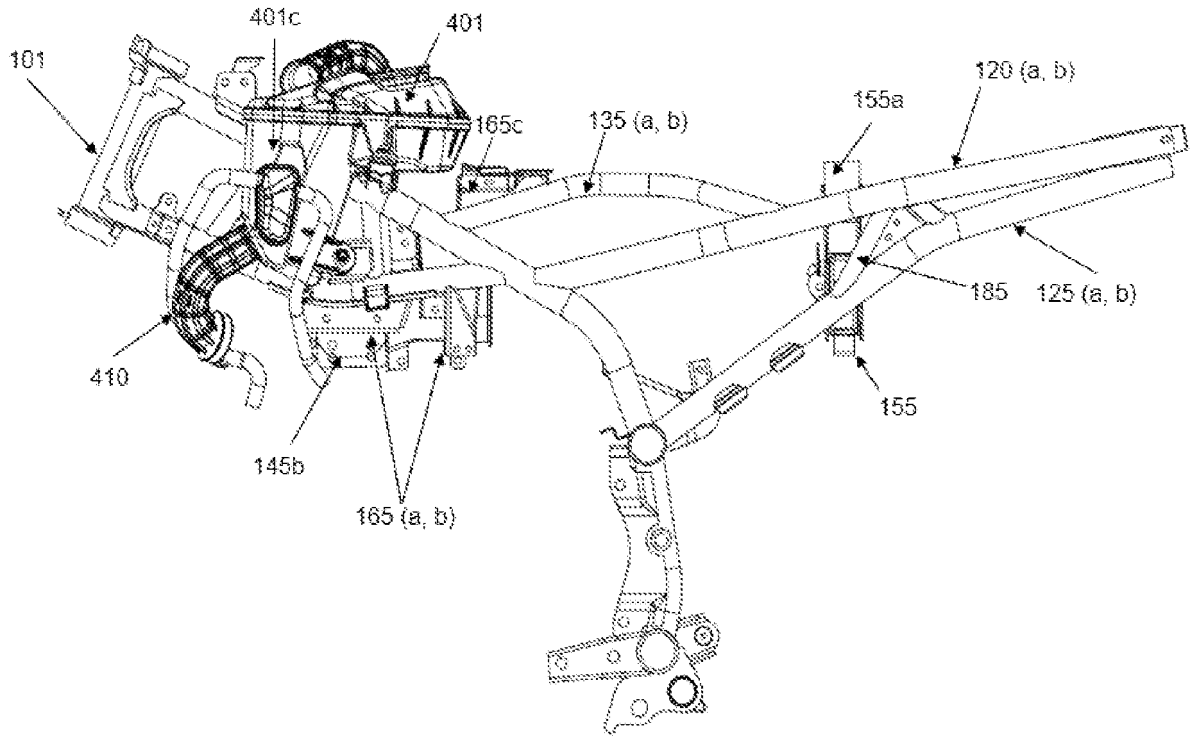
310a
145a
310

Figure 3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185
125 (a, b)
410
155
145b
165 (a, b)

Figure 4a

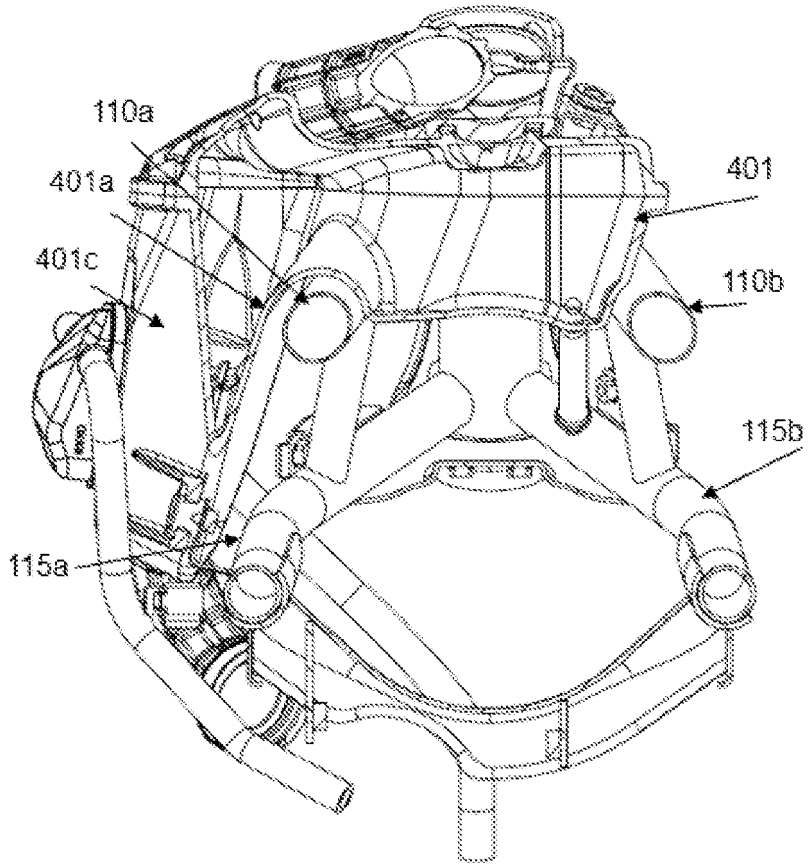


Figure 4b

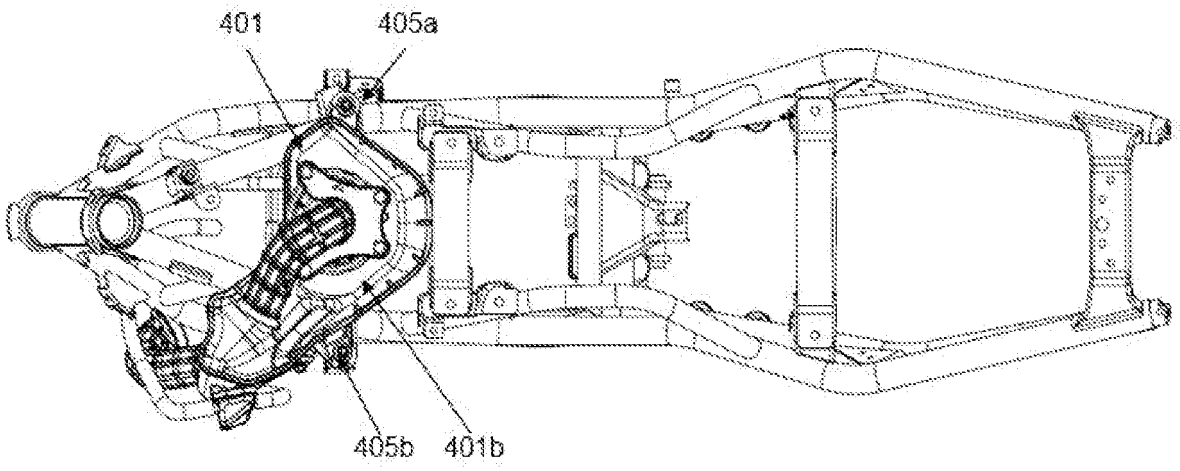


Figure 4c

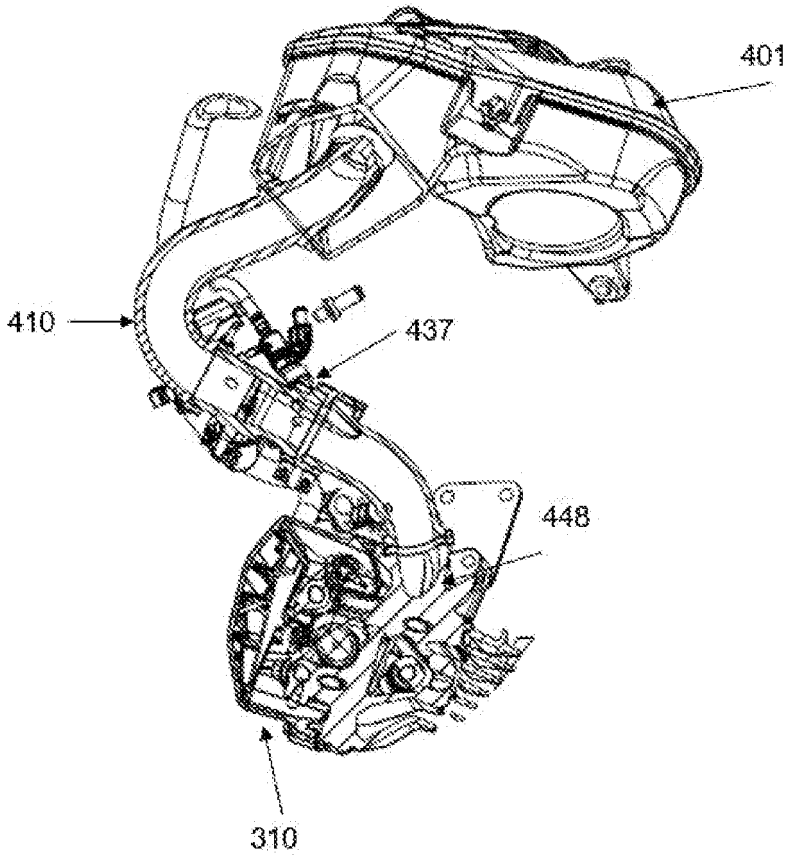


Figure 4d

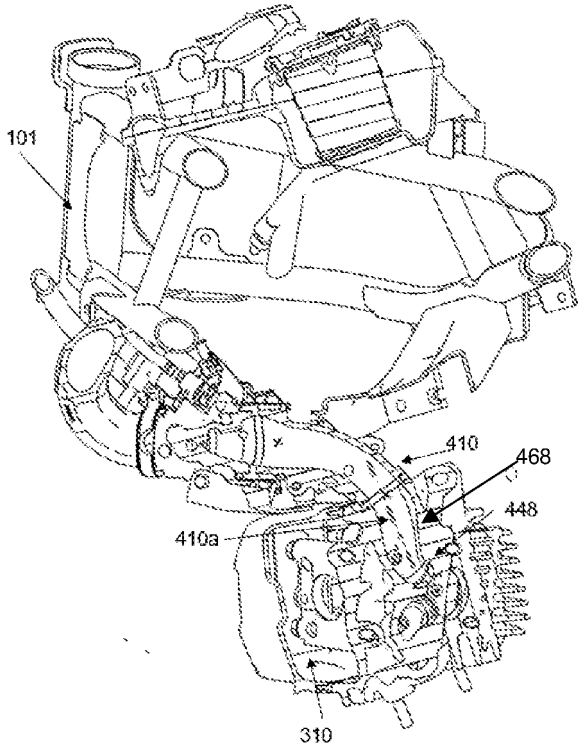


Figure 4e

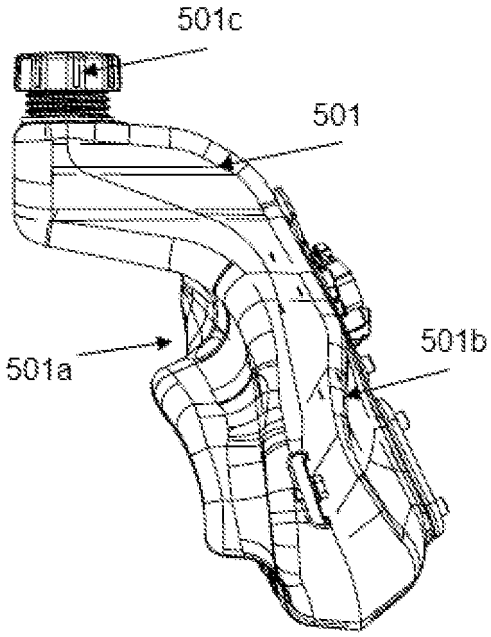


Figure 5a

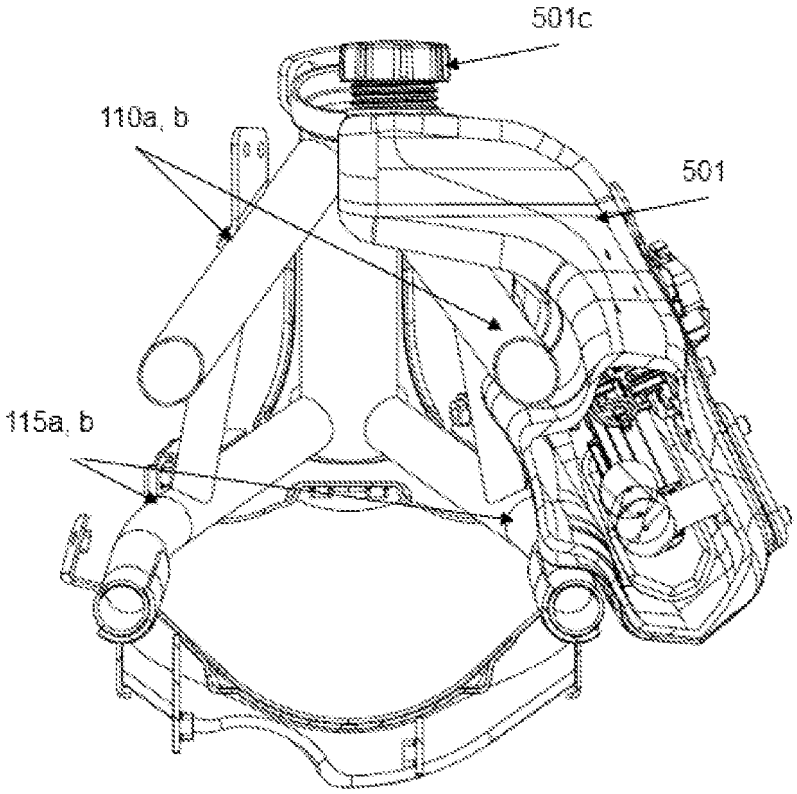


Figure 5b

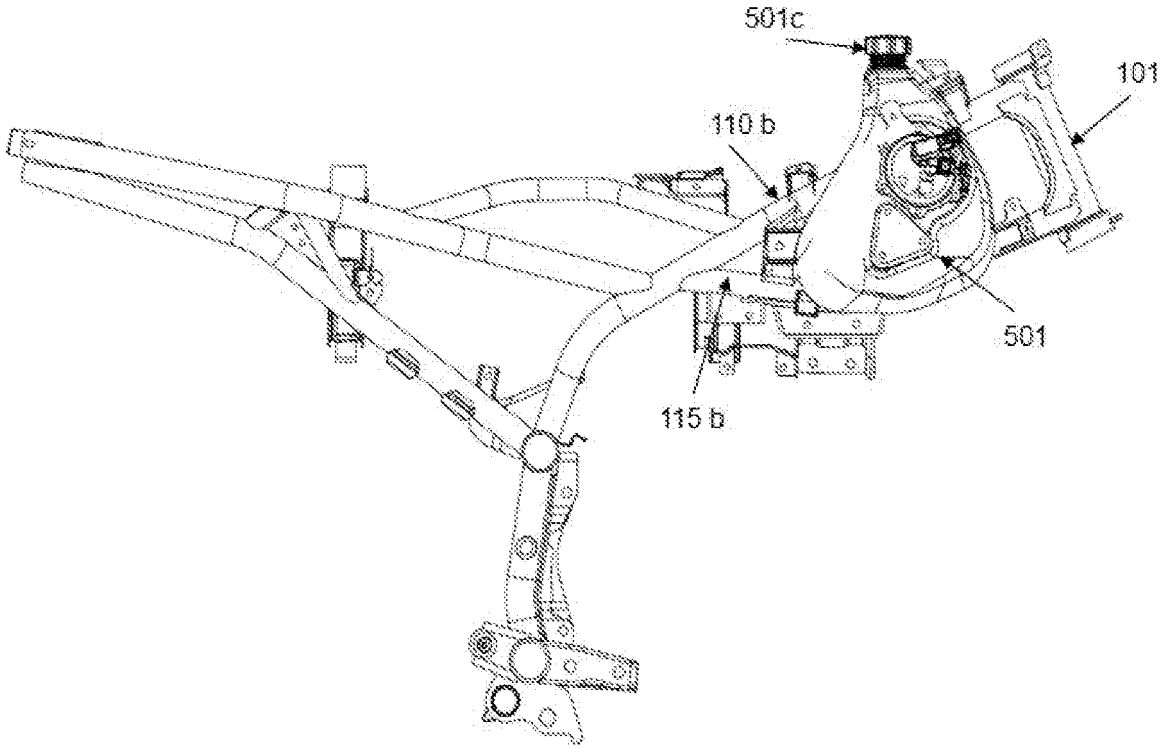


Figure 5c

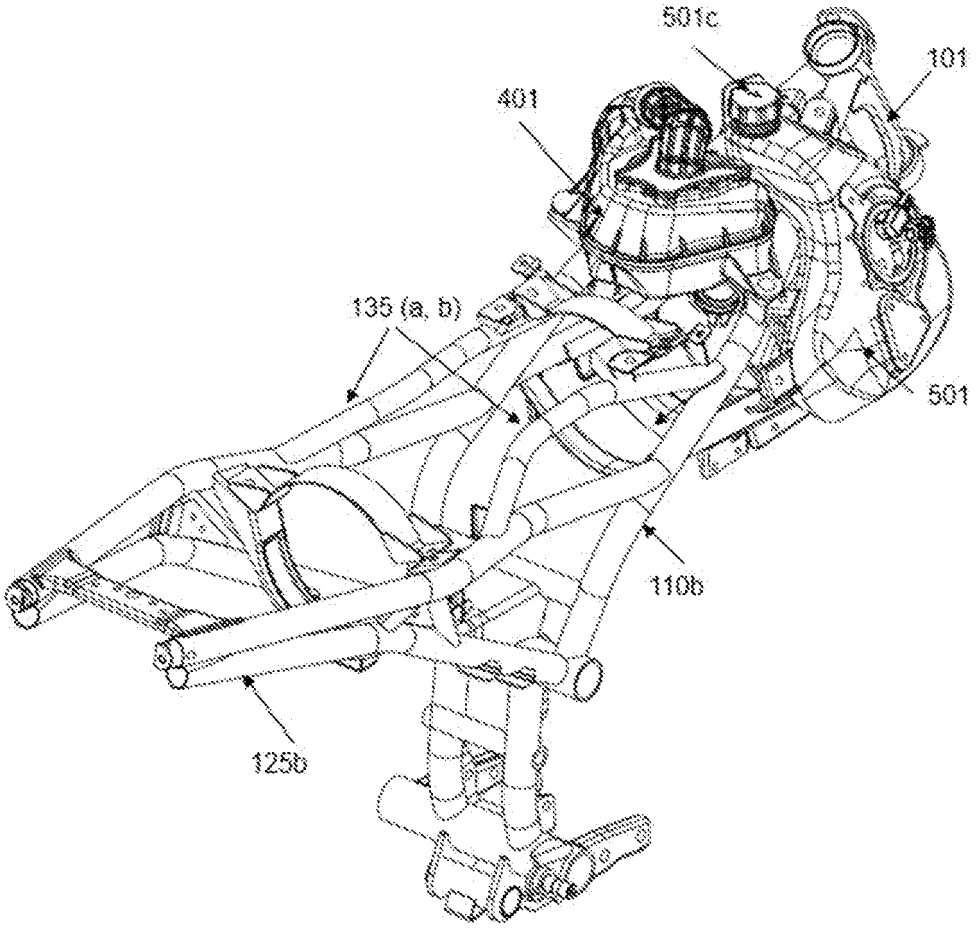


Figure 6a

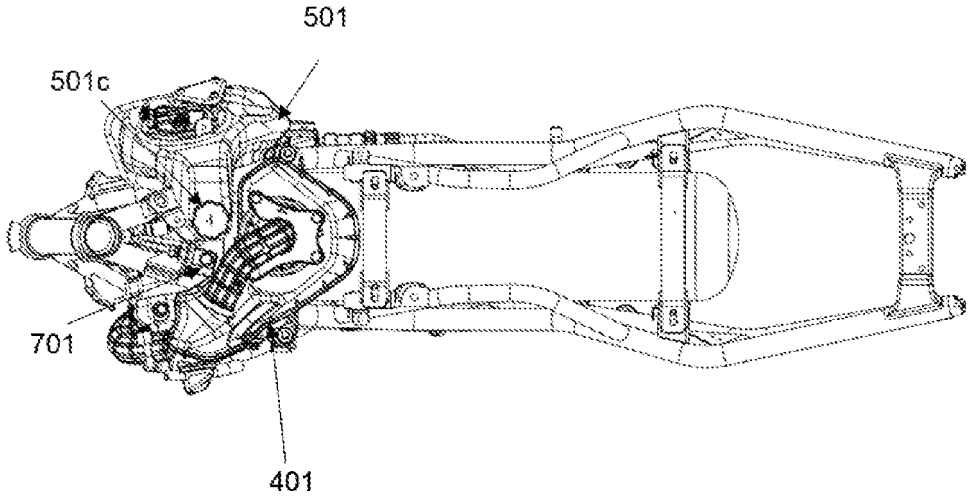


Figure 6b

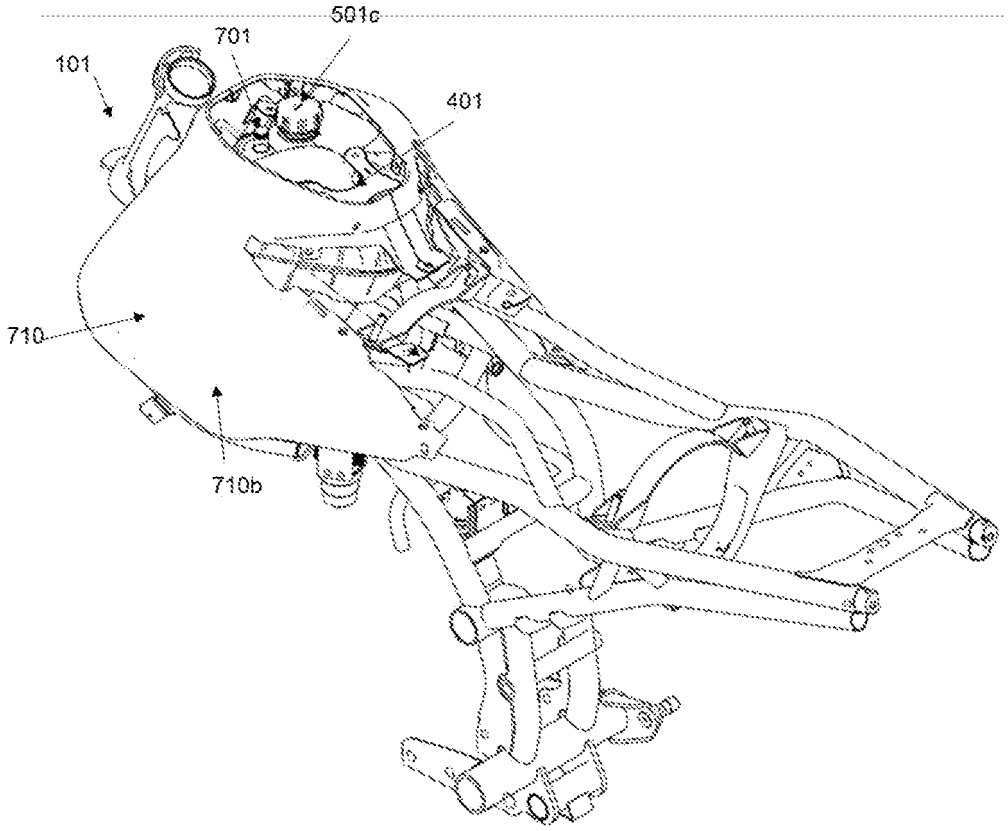


Figure 7a

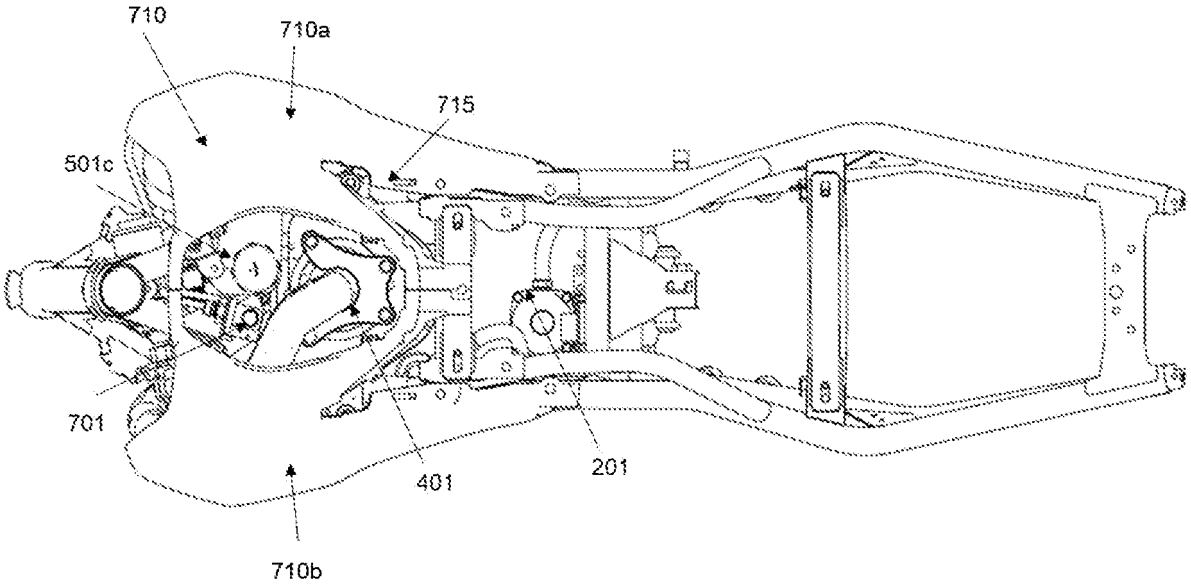


Figure 7b

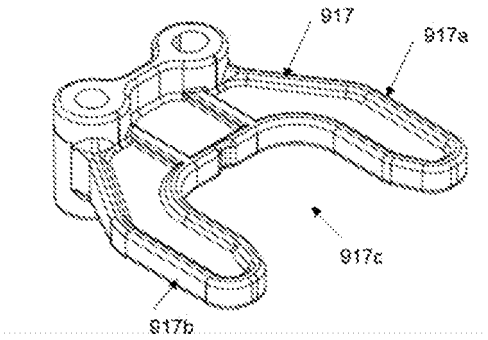


Figure 8a

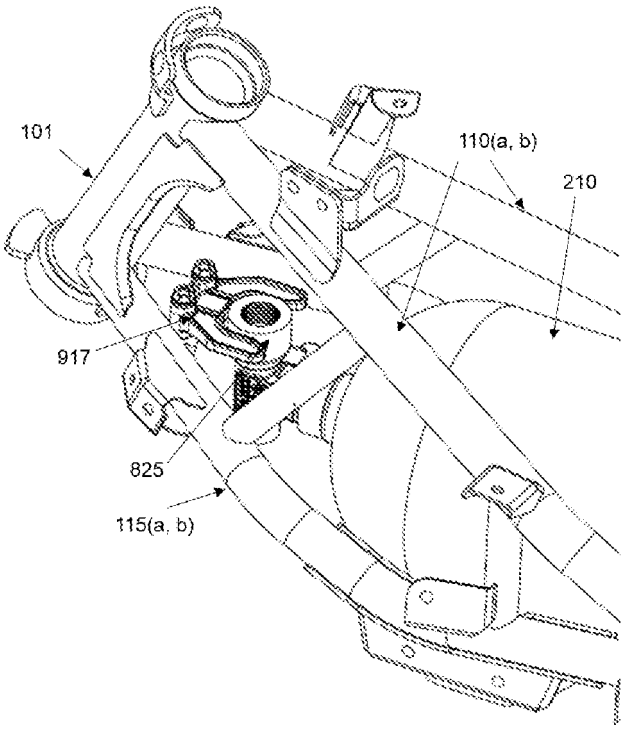


Figure 8b

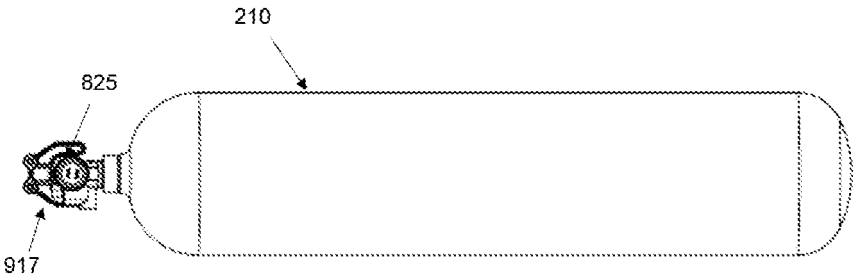
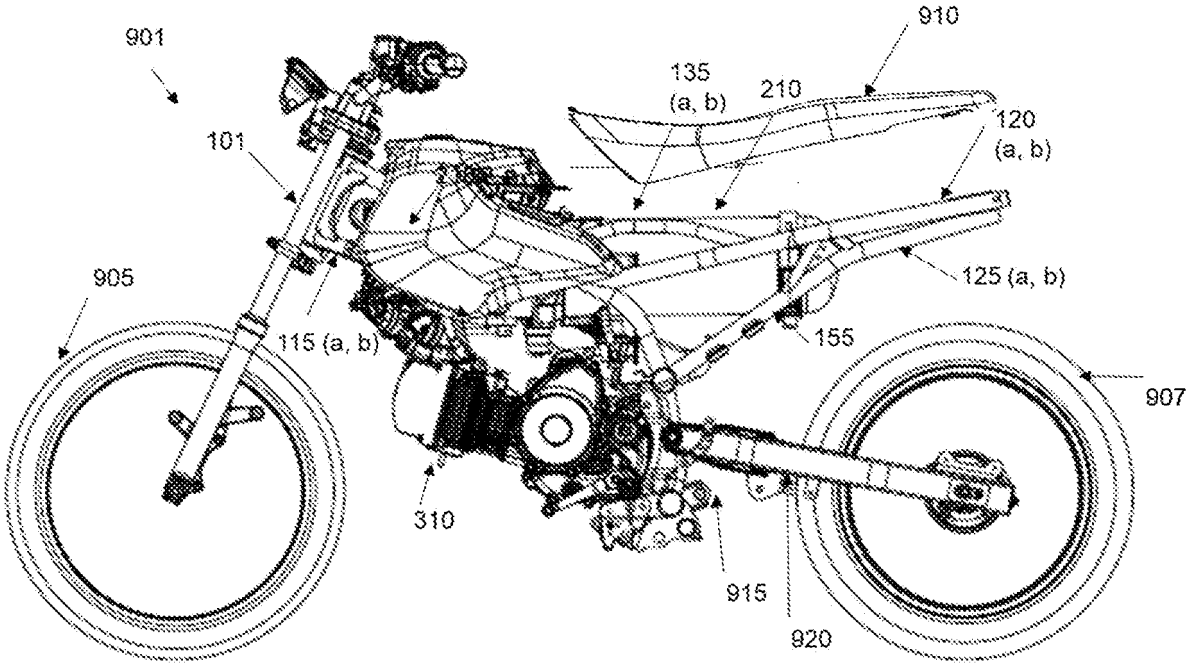


Figure 8c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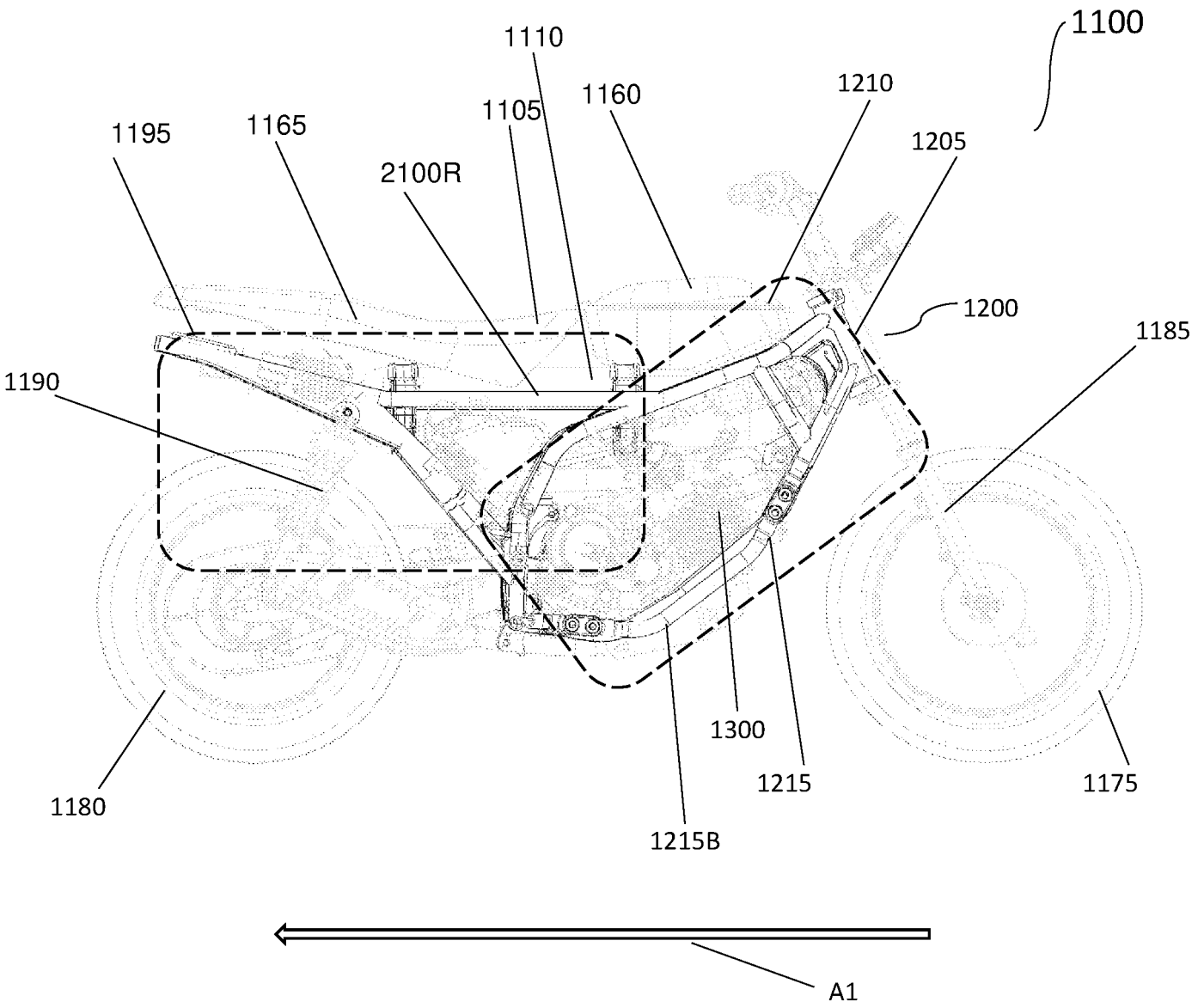
920

Figure 9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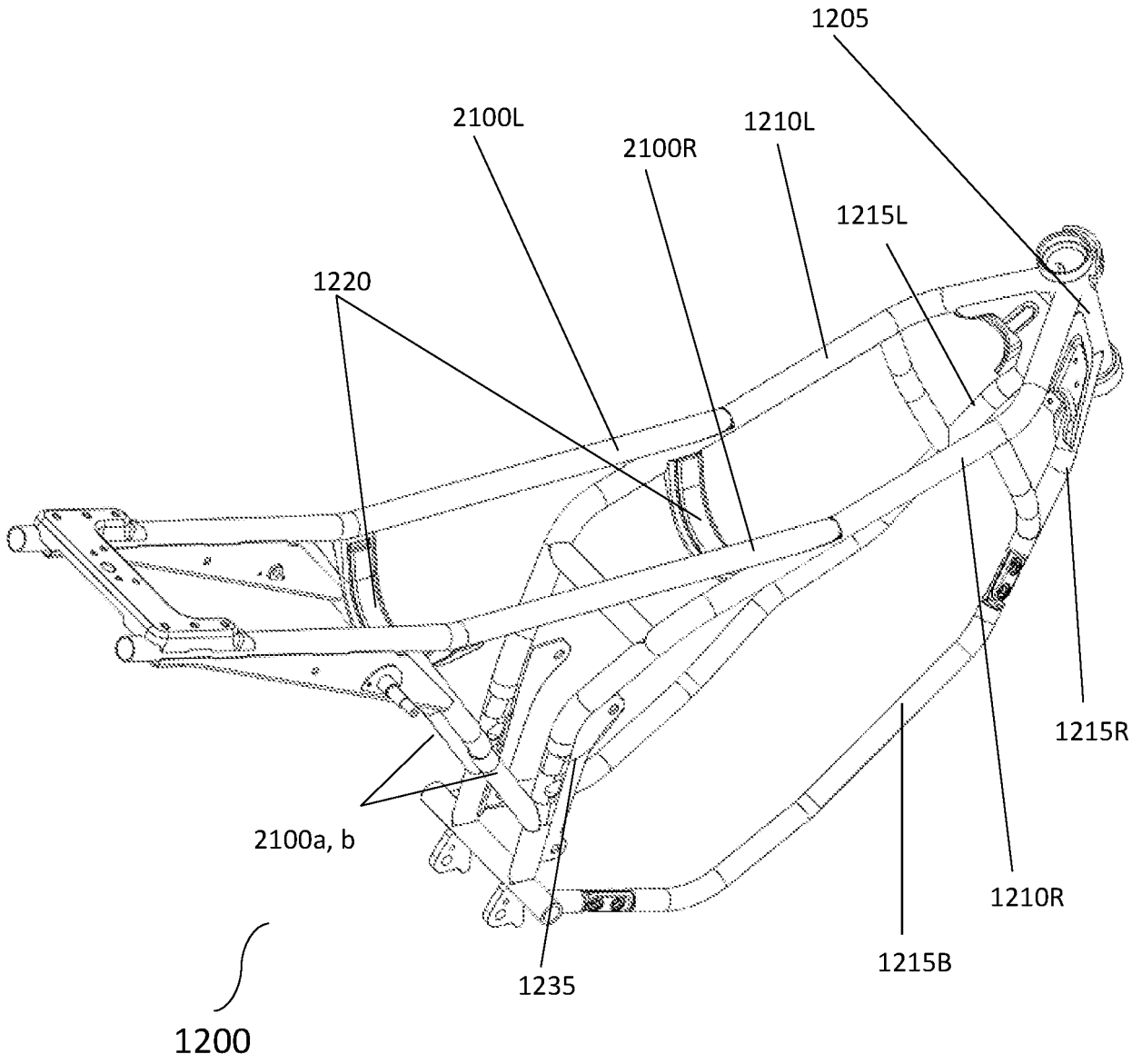
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Figure 11

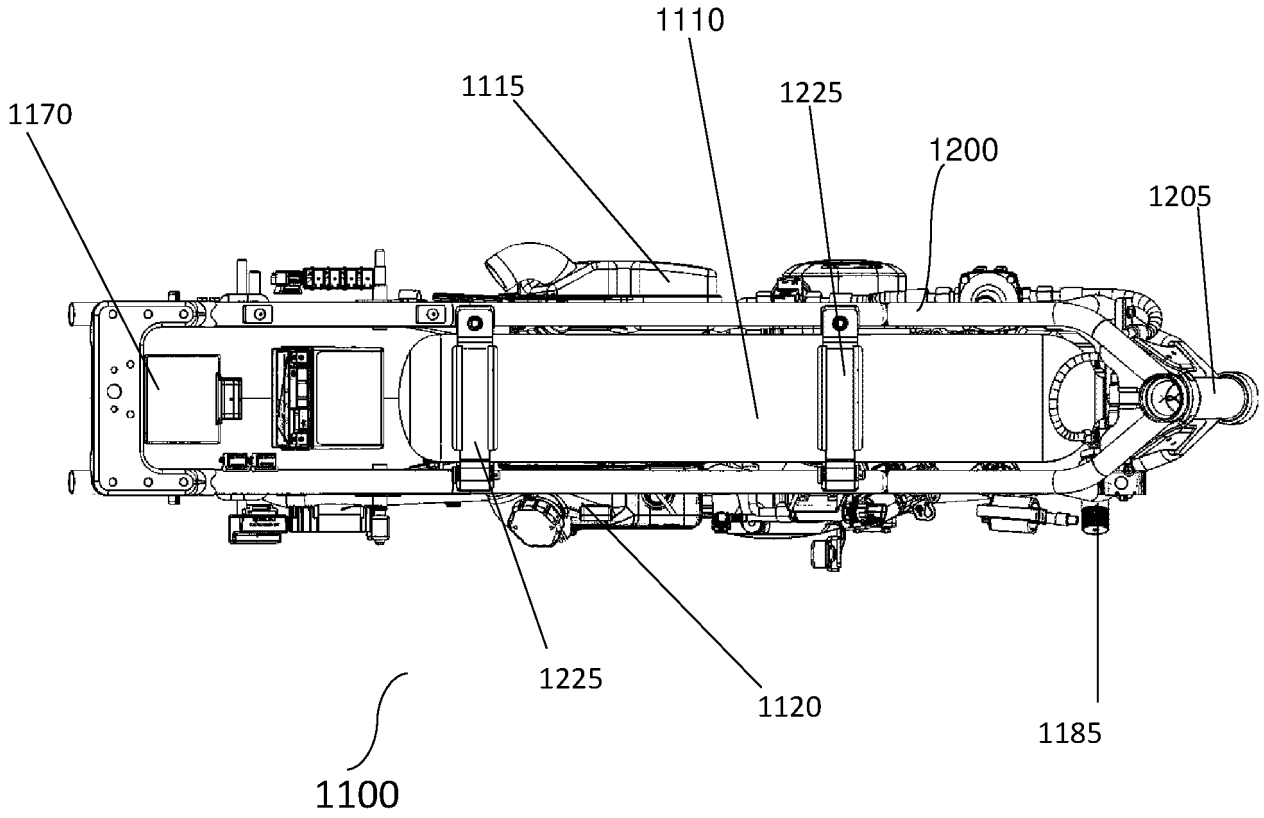

Figure 12

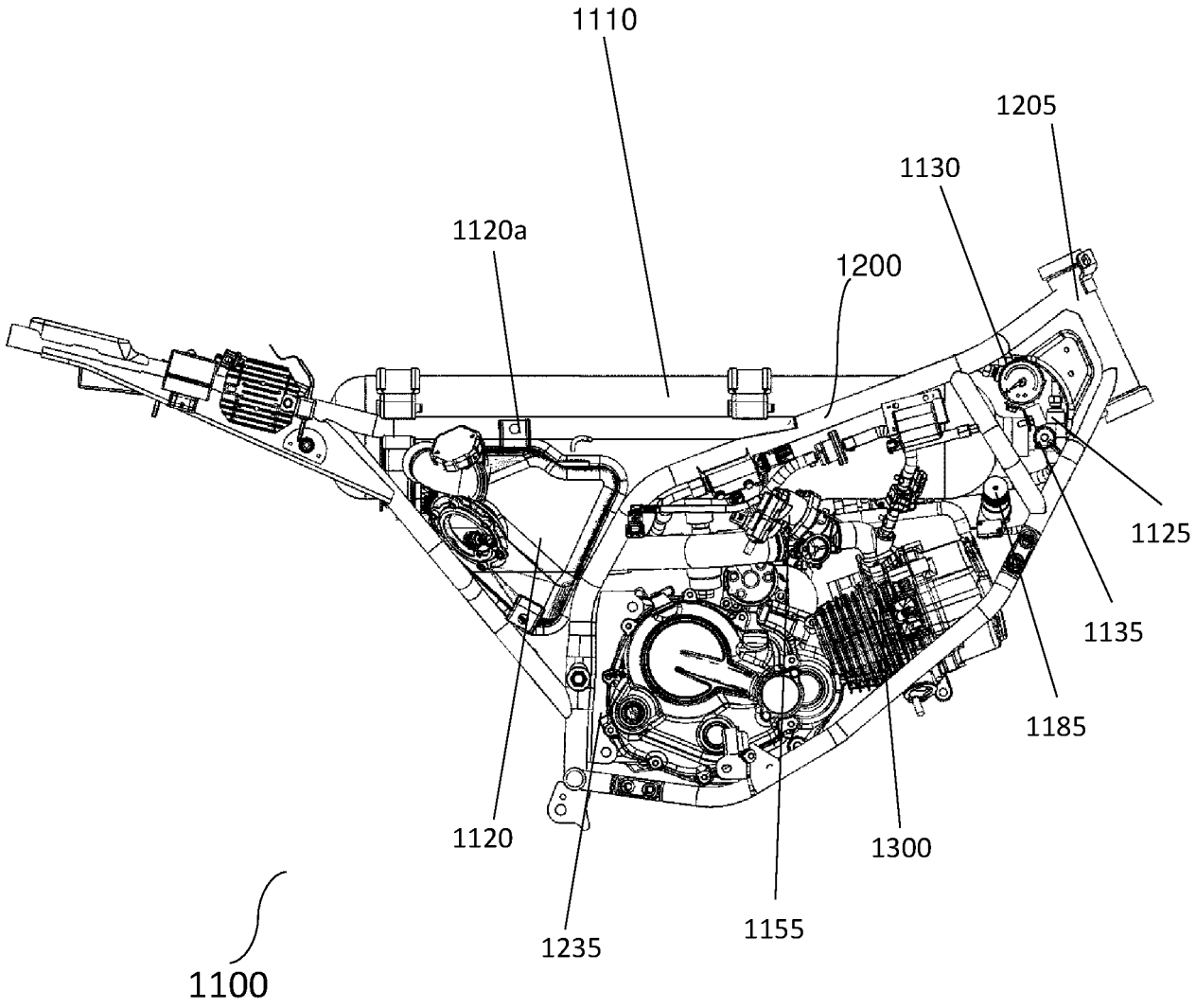
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Figure 13

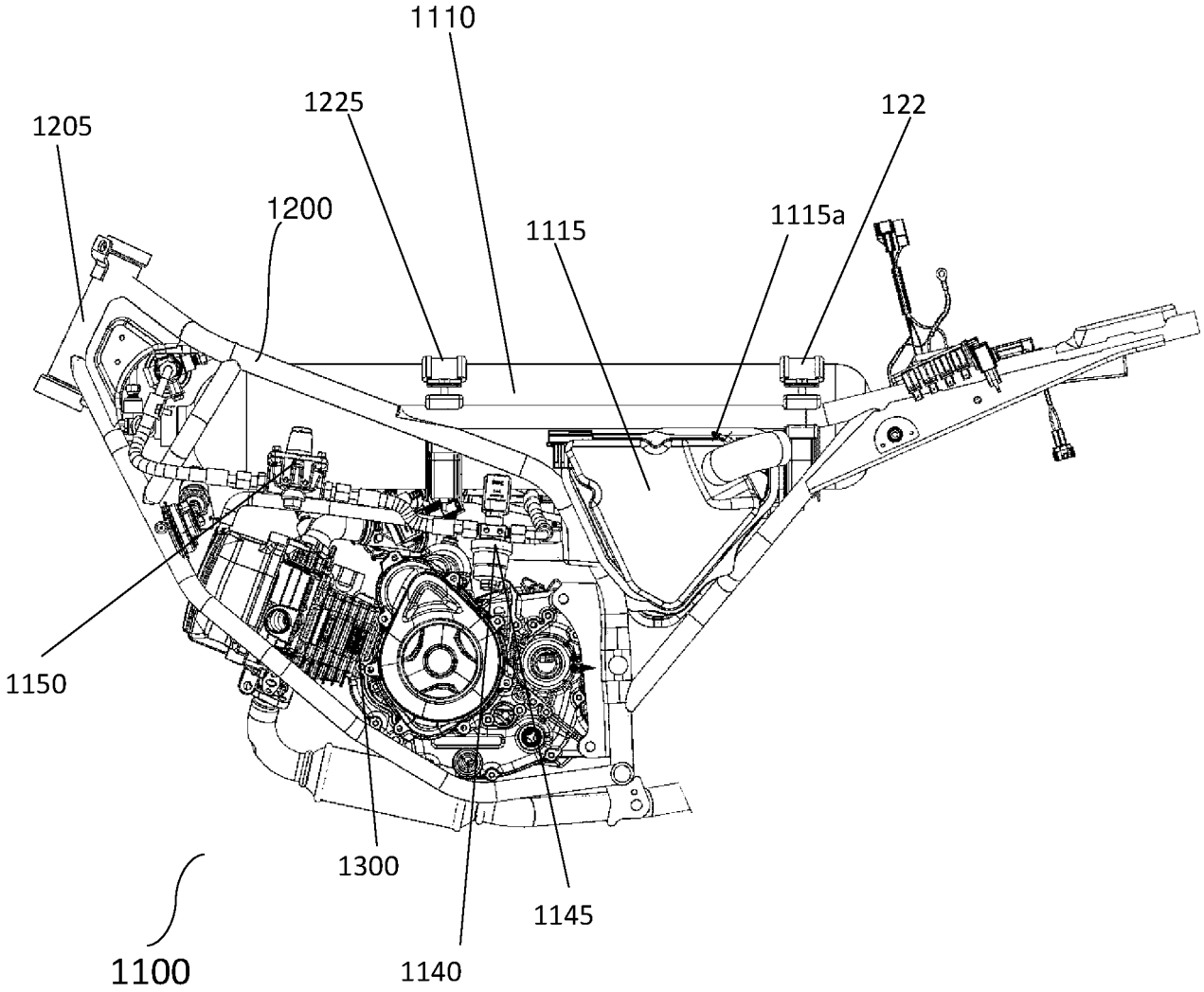


Figure 14

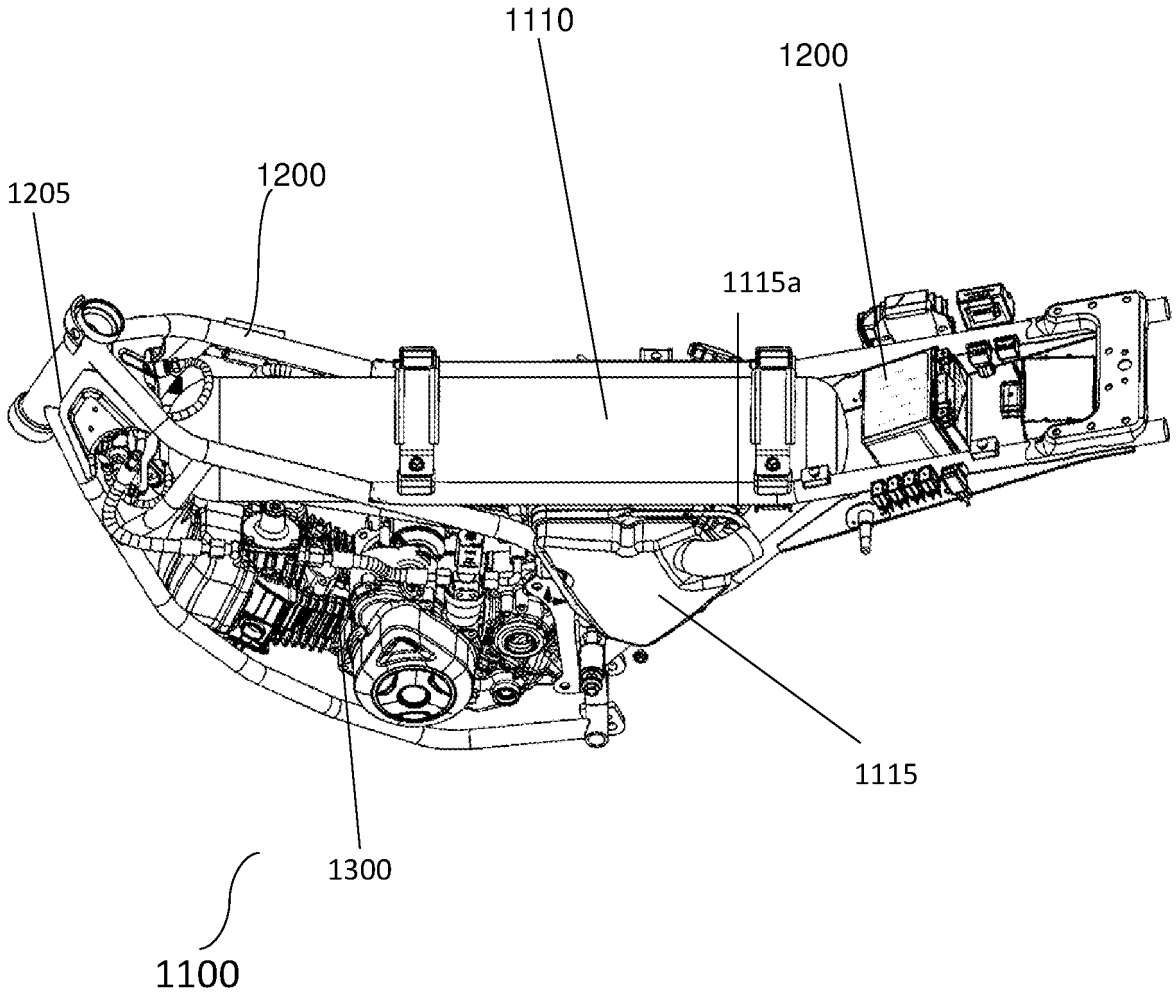


Figure 15

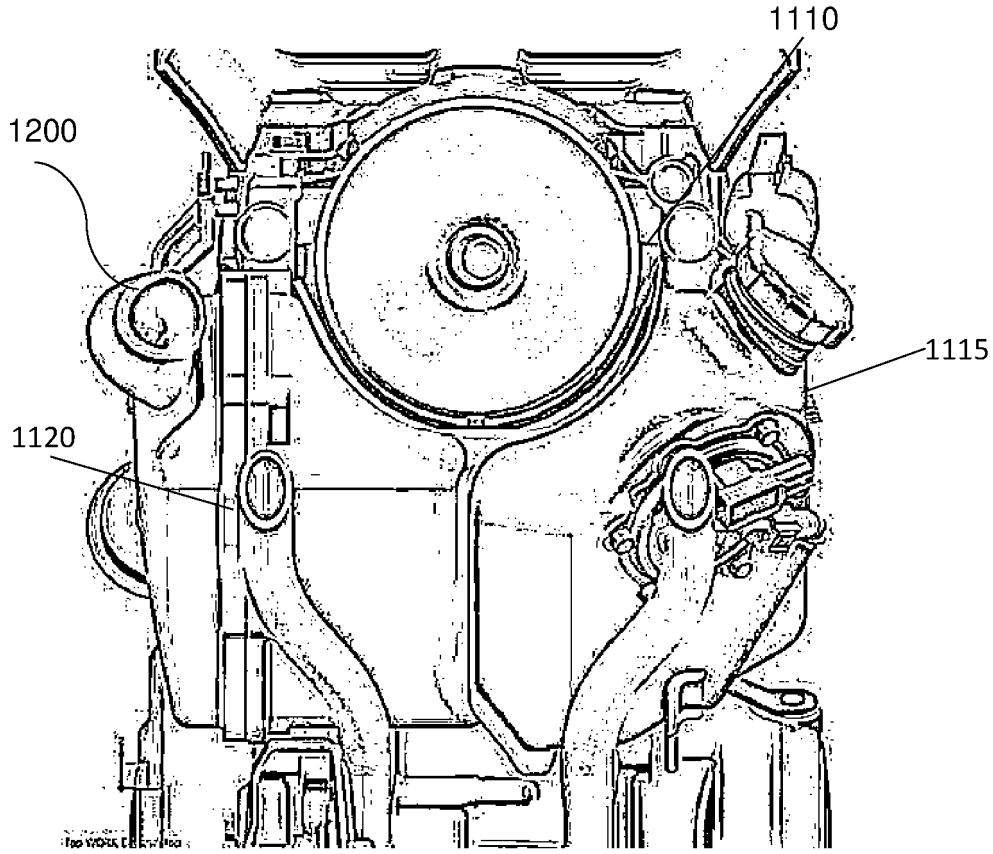


Figure 16

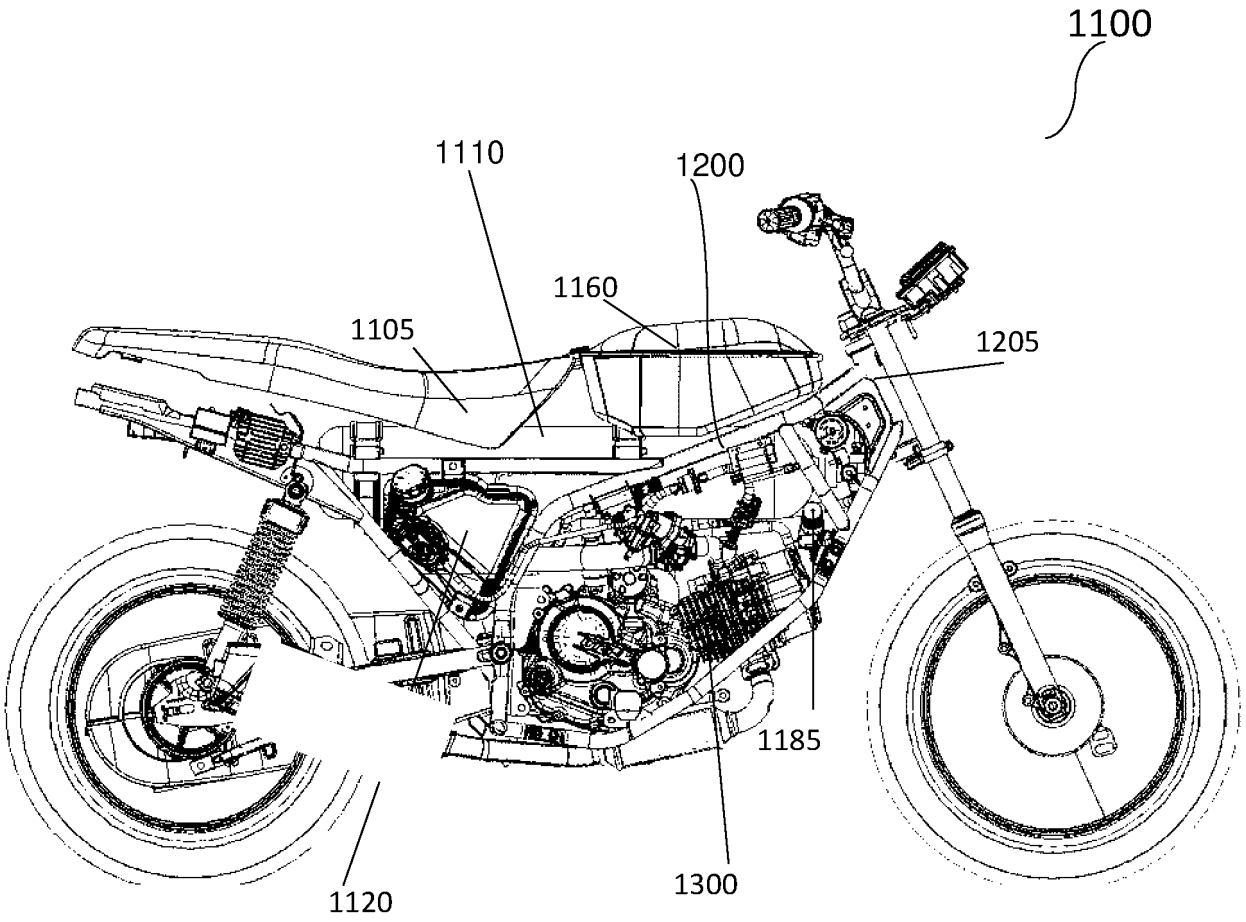


Figure 17

INTERNATIONAL SEARCH REPORT

International application No.
PCT/IN2022/050900

A. CLASSIFICATION OF SUBJECT MATTER
B60K15/07,B62J35/00 Version=2023.01

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)

B60K15/07,B62J35/00

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic database consulted during the international search (name of database 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.
A	CN200995746Y (BIGE SCIENCE & TECHNOLOGY DEV (CN)) 26 DEC 2007; abstract; para [0020]; fig 1;	1-36
A	CN201165282Y (CHENG, Haiquan(CN)) 17 DEC 2008; fig 1;	1-36

☐ 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	Date of mailing of the international search report
31-01-2023	31-01-2023
Name and mailing address of the ISA/ Indian Patent Office Plot No.32, Sector 14,Dwarka,New Delhi-110075 Facsimile No.	Authorized officer Abinash Kumar Puhan Telephone No. +91-1125300200

A TWO-WHEELED MOTOR VEHICLE

FIELD OF THE INVENTION:

[001] The present invention relates to a two-wheeled (2W) vehicle and more particularly relates to the vehicle powered by at least a gaseous fuel such as CNG (Compressed Natural gas), LNG (Liquefied Natural Gas), LPG (Liquefied Petroleum Gas), biogas or the like.

CROSS-REFERENCE TO RELATED APPLICATIONS

[002] This invention takes priority from an earlier filed provisional patent application no. 202121045739 filed on October 07, 2021; which is incorporated herein as reference.

BACKGROUND TO THE INVENTION:

[003] With rising concerns of global warming, aggravating emissions, and depleting fossil fuel resources, clean technologies are much needed to cater the transportation needs of the fast-paced world. However, transitioning from liquid-fuelled (petrol/ diesel) vehicles to clean energy-based driving systems involves multiple technological challenges. There are multiple pieces of research ongoing to replace petroleum-based fuels in two wheeled vehicles with environmentally acceptable gaseous fuels such as Compressed Natural Gas (CNG), Liquefied Petroleum Gas (LPG), Liquefied Natural Gas (LNG), biogas, and the like.

[004] Natural gas requires more storage space compared to gasoline operated vehicles and must be stored under highly pressurized containers. Therefore, packaging of a comparatively larger CNG cylinder/ tank is required on the vehicle as compared to a conventional gasoline fuel tank, to hold equivalent fuel. One of the key feature for any vehicle is a distance travelled by the vehicle in a given amount of fuel. There is higher demand for vehicles with longer travelling capabilities without refuelling. Hence, for vehicle with gaseous fuels, there is need to provide higher storage capacity for fuel in order to have longer distance travelled.

[005] In existing arts, there are two wheeled vehicles in which small gas fuel cylinders/ tanks are mounted, however, in such cases, the fuel capacity of gas fuel cylinders is highly compromised. With less capacity of gas fuel cylinder, the user may face inconvenience, as frequent refilling of fuel is required or making vehicle not suitable for long distance travel. On the other hand, if the size of the gas fuel cylinder is increased for the two-wheeled vehicle, the design, aesthetics, and safety of the vehicle gets compromised as compared to conventional two-wheeled vehicle operated by liquid fuel. The two-wheeled vehicle being a compact vehicle does not have a trunk or additional space available as in three or four-wheeled vehicles and it becomes practically difficult to adapt the gas fuel cylinder of higher capacity.

[006] There have been attempts in past to mount gas fuel cylinders with higher capacities in a two wheeled vehicle, some of which needs a gas fuel cylinder to be tilted in order to accommodate itself within the frame structure of the two wheeled vehicle. The tilted arrangement still suffers from limitations in terms of size of cylinder, as the space available is restricted by frame structure, rear wheel and other components. The tilted arrangement of gas fuel cylinder also impacts on mounting arrangement and orientation of the engine. Further, tilted gas fuel cylinder occupies not only a conventional space for the fuel tank in the two wheeled vehicle but also substantially occupies conventional space for placement of other crucial components of the two wheeled vehicle, such as air filter, battery, limp home tank and fuel line. This type of mounting arrangement needs a frame support with complex construction for holding the gas fuel cylinder, which makes it bulky and heavy. Further, the vehicle aesthetics is also compromised for improving the capacity of the gas fuel cylinder. Therefore, it is necessary to have major modifications in the conventional frame structure used for gasoline vehicle to accommodate gas fuel cylinder. This increases cost as well as manufacturing time. Any major modifications made in the frame structure impacts conventional component placement of the vehicle and overall aesthetics of the vehicle.

[007] Further, in order to accommodate the gas fuel cylinder of larger capacity the frame tubes needs to be of sufficient strength and stiffness, while also being slender in terms of diameter, since tubes with larger diameter may not be suitable for compact

mounting of larger gas fuel cylinder. Hence, achieving a balance in tube size and stiffness is one of the challenge to mount larger gas fuel cylinder.

[008] Another known gas fuel cylinder arrangement is horizontal mounting, which is also option to mount the gas fuel cylinder. However, the horizontal mounting of cylinder is restricted by the seat structure from rear side in two-wheeled vehicle. This limits the size and thereby storing capacity of the gas fuel cylinder. Further, the gas fuel cylinder needs to be rigidly supported by the frame structure and its position must be locked such that no movement is allowed. Horizontal mounting of gas fuel cylinder further adds to difficulty in mounting of other associated components like air filter, Limp home tank, shutoff valve etc. which frequently needs to be accessed for servicing/ maintenance purpose. Hence, it is necessary to mount these components at an easily accessible position. The horizontal mounting of larger gas fuel cylinder leads to increase in overall height of the vehicle, which increases overall Centre of Gravity (CG) of the vehicle leading to poor handling the vehicle. This may also result in increased wheelbase. Yet another challenge in horizontal mounting of gas fuel cylinder of larger diameter is to maintain ergonomics of the vehicle, specifically with larger gas fuel cylinder there is high possibility of having higher vehicle width, which may lead to uncomfortable posture of rider.

[009] The orientation, packaging and mounting of engine is dictated by the size and orientation of the gas fuel cylinder, position of other associated components like air filter and by the frame structure of the vehicle. Therefore, all these factors leads to compromise in orientation and space for mounting or packaging the engine and makes mounting of the engine cumbersome and complex. This also leads to suboptimal engine performance.

[010] Another requirement is a capability to replace or remove the gas fuel cylinder for servicing/ maintenance purpose. However, most of the existing vehicles have inconvenient provision to remove the gas fuel cylinder, as most of them requires disassembly of all other associated components and requires upward lifting of heavy and bulky gas fuel cylinder, which is very cumbersome.

[011] Due to the various challenges and problem stated herein above, gaseous fuel is not considered as a prominent alternative to the liquid fuel vehicles specifically in two-wheeler segment and the wider adaptability of gaseous-fuelled two-wheeled vehicle is being hindered.

[012] Therefore, based on above, there is a clear need to address the aforementioned deficiencies and inadequacies by providing a two-wheeled vehicle with capability to accommodate larger gas fuel cylinder in its frame structure without major modifications in comparison to the frame structure of liquid fuel vehicle, while allowing easy accessibility to the various components and ensuring overall aesthetics and ergonomics of the vehicle is maintained while ensuring easy removal of larger gas fuel cylinder.

OBJECT OF INVENTION:

[013] An object of the present invention is to provide a large gas fuel cylinder so as to have higher fuel holding capacity while maintaining easy accessibility to the various associated components.

[014] Yet another object of the present invention is to provide a frame structure, which helps in secured and convenient mounting of the gas fuel cylinder of a larger capacity in a two-wheeled vehicle while allowing its easy removal for maintenance or serviceability purpose and providing comfortable ergonomics to the rider.

[015] Yet another object of the present invention is to better utilize the vehicle space while maintaining overall aesthetics and ease of maintenance of the two-wheeled vehicle.

[016] Still another object of the present invention is to provide safe, secured and improved mounting arrangement for the engine in a two-wheeled vehicle while ensuring compactness and space for mounting of other associated components.

[017] Another object of the present invention is to utilize the conventional frame structure for gas-fuelled vehicle.

[018] Yet another object of the present invention to provide a compact mounting arrangement of a gas fuel cylinder in a two-wheeled vehicle.

SUMMARY OF THE INVENTION:

[019] With the above-mentioned objects, an embodiment of the present invention provides a two-wheeled vehicle comprising of

a vehicle frame structure comprising, a head tube; a front frame structure extending rearwardly from the head tube;

a rear frame structure connected to the front frame structure and extending rearwardly;

a gas fuel cylinder for storing and supplying gaseous fuel to an engine;

wherein; the gas fuel cylinder extending substantially horizontally and is supported by the front frame structure and the rear frame structure and; and

the engine mounted on the vehicle front frame structure wherein; the orientation of an engine is substantially horizontal.

[020] According to a preferred embodiment of present invention, an air filter mounted on the front frame structure and connected to the engine to supply purified air wherein the air-filter is preferably mounted vertically above the engine.

[021] According to an exemplary embodiment of present invention, The gas fuel cylinder is of diameter in the range of 130mm to 200mm preferably of 140mm to 170mm and of 550mm to 800mm in length, preferably 600-800 mm, wherein; the gas fuel cylinder is filled with at least one gaseous fuels such as CNG, LNG, biogas, LPG, and the like, more particularly the gas fuel cylinder is filled with CNG.

[022] A rider seat mounted on said the rear frame structure extending substantially horizontally in the rearward direction of the two-wheeled vehicle. According to an exemplary embodiment, the gas fuel cylinder extends from a front section of the front frame structure to at least up to middle section of the rear frame structure such that at least a portion of the gas fuel cylinder is positioned below rider seat. Preferably, a substantial top portion of the gas fuel cylinder is covered by the rider seat.

[023] According to another exemplary embodiment, the front frame structure comprises a set of front top tubes and a set of front lower frame tubes wherein; the front top tubes having at least a portion extending rearwardly and at least a portion extending in downward direction from the head tube and the set of front lower frame tubes placed below front top tubes and extending substantially downwardly and horizontally in a rearward direction from the head tube and preferably connected to the set of front top tubes.

[024] The rear frame structure comprising a set of rear top tubes and a set of rear lower tubes wherein; the set of rear top tubes connected to the set of front top tubes and extending rearwardly and the set of rear lower tubes extending rearwardly and upwardly from the lower portion of the front top tubes connects the rear portion of the rear top tubes.

[025] According to an exemplary embodiment, a set of middle frame members are provided, extending horizontally and connected to the front top tubes and the rear top tubes.

[026] According to an exemplary embodiment, the set of front top tube and front lower frame tubes are connected to each other using plurality of connecting members. Further, the set of front top tubes, preferably at lower portion, are connected using plurality of cross members. The set of rear top tubes and the rear lower tubes are connected using plurality of rear connecting members. The front top tube connected with the front lower frame tubes using plurality of connecting members and helps to increase overall strength and stiffness of the frame structure, necessary to carry gas fuel cylinder of higher capacity. This helps in reducing overall size of the frame tube structure, thereby allowing compact mounting of the gas fuel cylinder while achieving required strength and stiffness. Optionally, it is possible to use frame tubes with cross section other than circular such as elliptical.

[027] According to a preferred embodiment of the present invention, the gas fuel cylinder is supported by plurality of support brackets mounted on said front frame structure and rear frame structure. Specifically, the front support brackets are mounted on front lower frame tubes of the front frame structure wherein; the front portion of the

gas fuel cylinder is rested and locked by a front clamping bracket from top side. The clamping bracket is provided on the middle frame members. The rear portion of the gas fuel cylinder is rested upon rear support bracket mounted on rear top tubes and clamped in the position using rear clamping bracket. The support brackets are of circular arc shape and connecting the respective sets of front lower frame tubes and the set of rear top tubes. The number of supporting brackets may be decided suitably based on the design requirements. The front lower frame tubes have enough strength for supporting the gas fuel cylinder through front support bracket. Further, the front frame tubes may also be used to support or clamp the gas fuel cylinder and may be provided with additional supporting/ clamping brackets to enhance strength and support to the gas fuel cylinder.

[028] According to a preferred embodiment of the present invention, the gas fuel cylinder is mounted on the frame structure such that it may be easily removable from the rear side of the vehicle without disturbing other associated components. The frame structure is provided with a suitable opening or a passage to facilitate removal of the gas fuel cylinder from rear side of vehicle. The frame structure may be provided with a guide rails for easy removal of gas fuel cylinder.

[029] According to an exemplary embodiment, the air filter is mounted on the front frame structure preferably above engine such that at least an air filter element is accessible from the top side of the vehicle for easy servicing, maintenance purpose and also helps in improved engine performance. Preferably, the air filter is mounted on one of the front top tube on left side of the vehicle proximate to the head tube, though it is possible to mount the air filter on right side front top tube.

[030] The air filter is fixed on one of the top tubes using mounting brackets. The air filter is preferably designed such that it at least partially accommodates the front top tube member of the front frame structure within its body. The air filter has at least a portion extending laterally over the portion of front top tubes and at least a portion extending downwardly over front top tube wherein; the downwardly extending portion of the air filter is further connected to the engine through a conduit to supply purified air. The depth of the downwardly extending portion is sufficient to accommodate

different air duct conduit tuning length, for varying performance requirements of air for different variants of engine.

[031] According to another embodiment, the engine is mounted on the front frame structure in a substantially horizontal orientation. The horizontal orientation of engine also creates sufficient space for mounting other associated components and helps in creating better flow path for fuel intake charge and exhaust gas. The lower portion of the set of front top tube is provided with engine mounting brackets used for fixing the engine using mounting points provided on the engine. Optionally, a separate mounting tubes may be welded to the crossbar of front top tubes and engine mounting brackets may be welded on such mounting tubes. Preferably, the front portion of engine may be additionally supported by the front mounting brackets provided on the front lower frame tubes of the front frame structure. The engine may have mounting provisions on cylinder or head or crankcase etc.

[032] With the specific orientation of the engine and the air filter explained herein above, it is ensured that smooth flow of air to the engine is achieved. As a vertical conduit with minimum bends is used to supply purified air from the air filter towards the engine, high volumetric efficiency is achieved with improved tumbling flow of intake charge. Further, an intake port of the engine is designed to be substantially straight/ vertical to further enhance the tumbling motion of intake charge and helps in achieving better mixing.

[033] According to another exemplary embodiment, a limp home tank preferably used for storing liquid fuel as a secondary fuel source, to supply fuel to the engine, if the gas fuel is not available or not used for any reason. A suitable “change over system” may be employed for changing the type of fuel supply. The changeover may be automatic or manual. The limp home tank is mounted on the front frame structure above gas fuel cylinder, such that the liquid fuel filling provision is accessible from the top side of the vehicle for easy fuel refilling purpose. The limp home tank is preferably mounted on the right side of front top tube, on other side of the air filter mounting, though the position of air filter and limp home tank may be interchanged. A mounting support of the limp home tank is fixed on the front top tube. The limp home tank at least partially extends over front top tubes and front lower frame tubes. Preferably, at

least a portion of the limp home tank designed in order to accommodate the front top tubes and front lower frame tubes within its body at least partially. This helps in accommodating additional fuel and creates enough space for mounting fuel pump, strainer etc.

[034] According to another exemplary embodiment, the said air filer and said limp home tank may be mounted on same side of frame structure.

[035] According to another exemplary embodiment, a gas fuel filling point for gas fuel cylinder is provided such that it is accessible from top side of the vehicle and positioned near to liquid fuel filling provision of the limp home tank. This helps in convenient accessibility to refilling of both type of fuels (Liquid and gaseous) from top side of the vehicle.

[036] The air filter is mounted towards front side of the frame structure close to the gas fuel filing point, thereby providing easy accessibility for service and maintenance purpose.

[037] According to another exemplary embodiment, the components like limp home tank, air filter, gas fuel filling point etc. placed proximate to each other and accessible from front-top side of the vehicle. These components along with gas fuel cylinder and portion of the front frame structure are covered by a cover, preferably formed out of assembly of left side member, right side member and top covering member wherein; said components are accessible from top side of the vehicle through removably mounted top covering member. According to one of the embodiment, a flap cover is hinged to the top cover having a locking means in order to prevent any unauthorized access to said components. The flap cover also helps in improving aesthetics of the vehicle.

[038] The vehicle frame structure may be suitably changed while ensuring accomplishment of the objectives of the present invention listed herein above. Accordingly, a second exemplary embodiment of present invention is described herein below.

[039] According to the second embodiment of the present invention, the vehicle frame structure comprises

a head tube;

at least a front frame structure comprising a set of front top tubes extending substantially symmetrically in a rearward direction from the head tube;

a rear frame structure connected to the front frame structure and extending rearwardly;

a gas fuel cylinder for storing and supplying gaseous fuel to an engine;

wherein, the gas fuel cylinder is supported by the front frame structure using plurality of support brackets and extending substantially horizontally in the rearward direction; and the engine is mounted on the vehicle frame structure wherein; the orientation of the engine is substantially horizontal.

[040] The front frame structure comprises a set of front lower frame tubes extending substantially symmetrically in a downward direction and the rearward direction from the head tube; wherein; the set of front lower frame tubes comprises a left side front lower frame tubes and a right side front lower frame tubes. At least one of the side front lower frame tubes comprises a separable support portion. The separable support portion is dismantled to mount an engine of the two-wheeled vehicle. Preferably the right side downtube comprising a separable support portion.

[041] According to another exemplary embodiment, an air filter is mounted on the rear frame structure using a mounting bracket below the rider seat such that it is easily accessible from one side of the vehicle. The air filter at least partially extends below the gas fuel cylinder. Preferably, at least a portion of said extending portion has surface matching with lower surface of gas fuel tank.

[042] According to another exemplary embodiment, a limp home tank is mounted on the rear frame structure using a mounting support below the rider seat on opposite side of air filter. The limp home tank at least partially extends below the gas fuel cylinder. Preferably, at least a portion of said extending portion has surface matching with lower surface of gas fuel tank.

[043] According to an exemplary embodiment, the associated fuelling components including a pressure gauge, a low pressure regulator (LPR), a solenoid are mounted on the front frame structure.

[044] A gas filling point is mounted on the lower frame structure with an opening at a side of the vehicle and connected to a main valve of the gas fuel cylinder to fill fuel in the gas fuel cylinder.

[045] A rider seat mounted on said rear frame structure extending substantially horizontally in the rearward direction of the two-wheeled vehicle. According to an exemplary embodiment, the gas fuel cylinder extends from a front section of front frame structure to rider seat such that at least a portion of the gas fuel cylinder is positioned below rider seat. Preferably, a substantial top portion of the gas fuel cylinder is covered by the rider seat.

[046] According to another embodiment of present invention, the engine is provided with split type engine head with separate head cover wherein; the engine head is provided with fins aligned to the direction of incoming air to enhance heat transfer. To further improve the airflow into head air jacket, a scoop feature is present on head preferably near spark plug mounting area.

[047] According to another exemplary embodiment, the gas fuel is filled in the gas fuel cylinder through a gas fuel filling point connected to the main valve wherein; the main valve is mounted at the opening of the gas fuel cylinder. The fuel is supplied to the engine from gas fuel cylinder through a fuel circuitry comprising components like at least one pressure regulator and filter. A pressure gauge is connected to the pressure regulator for monitoring pressure level and is provided such that the reading on pressure gauge is visible from side of the vehicle. The fuel received from the pressure regulator at low pressure is supplied to a fuel rail or a throttle body for further injecting into the engine through an injector. Alternately, the fuel may be supplied to the carburettor configured to create an intake charge as a mix of purified air and fuel for supplying to the engine. Optionally, the pressure gauge reading is also made visible on speedometer of the vehicle for easy viewing. The pressure gauge may be suitably

covered through covering members like tinted glass or any other vehicle covering part to improve overall aesthetics of the vehicle.

[048] According to another exemplary embodiment, the fuel rail comprises a solenoid to regulate the supply of fuel. The main valve is also acting as a shut-off valve configured to stop supply of fuel from the gas fuel cylinder, preferably mounted such that it is easily accessible.

[049] According to another exemplary embodiment, the orientation and position of the gas fuel cylinder along with associated fuelling components is locked using an alignment bracket wherein, the alignment bracket is provided with two-arm structure preventing any rotational movement of the gas fuel cylinder and more specifically that of main valve to ensure the necessary alignment of the main valve and alignment of all associated components including pressure regulator, pressure gauge and gas filling point.

[050] The alignment bracket is provided with a cavity to completely receive the main valve of the gas fuel cylinder within said cavity. This helps in ensuring the packaging of the gas fuel cylinder at a desired location, thereby ensuring proper alignment and packaging of all the associated components.

[051] The alignment bracket is mounted between front lower frame tubes and may be bolted or welded to the front lower frame tubes.

[052] According to another exemplary embodiment, the vehicle is provided with a mono-shock suspension system comprising a single shock absorber connecting rear frame structure and a swing arm through a linkage. According to another embodiment, the vehicle is provided with a twin suspension comprising two shock-absorbers mounted on either side of a rear wheel and connecting an axle of rear wheel with the rear frame structure.

[053] According to another exemplary embodiment, the vehicle is provided with a front and a rear wheel having diameter in a range of 14 to 18 inch. With the mounting configuration of the larger gas fuel cylinder, engine and other associated components

as explained herein above effects in increasing overall height and wheel base (Distance between two wheels) of the vehicle, hence, with the smaller diameter wheels, it is made possible to reduce the overall height of the vehicle without increasing wheel base, thereby keeping overall Centre of Gravity (CG) of the vehicle towards lower side, while using gas fuel cylinder of larger capacity. This helps in improving overall handling capabilities of the vehicle.

[054] According to another exemplary embodiment, a pillion seat is mounted on the rear frame structure at a rear of the rider seat. The pillion seat may be provided as an integral part of rider seat.

[055] According to another exemplary embodiment, a luggage box is mounted on the rear frame structure at the rear of the rider seat or on the front frame structure ahead of rider seat.

[056] The vehicle, as described above, is conveniently a two-wheeler vehicle such as a motorcycle, scooter, and the like.

[057] The rest of the features explained herein above w.r.t. first embodiment, may also be suitably adapted in the vehicle according to second embodiment.

BRIEF DESCRIPTION OF DRAWINGS:

[058] The invention will now be described in more detail by way of example with reference to the embodiments shown in the figures mentioned below:

[059] Figure 1a-1b illustrates a view of the frame structure of a two-wheeled vehicle according to First embodiment of present invention;

[060] Figure 2a-2c illustrates a view of the frame structure of Fig. 1a-1b provided with a gas-fuelled cylinder according to First embodiment of present invention;

[061] Figure 3 illustrates a view of the frame structure of Fig. 1a-1b provided with an engine according to First embodiment of present invention;

[062] Figure 4a-4c illustrates a view of the frame structure of Fig. 1a-1b mounted with an air filter according to First embodiment of present invention;

[063] Figure 4d-4e illustrates a view of the engine intake manifold of Fig. 3-4c according to First embodiment of present invention;

[064] Figure 5a-5c illustrates a view of the frame structure of Fig. 1a-1b mounted with a limp home tank according to First embodiment of present invention;

[065] Figure 6a-6b illustrates a view of the frame structure of Fig. 1a-1b mounted with assembly of the limp home tank and air filter as illustrated in Fig 4a- 5c according to First embodiment of present invention;

[066] Figure 7a-7d illustrates a view of the frame structure mounted with assembly of the limp home tank and air filter as illustrated in Fig 4a- 5c and covered using covering members according to First embodiment of present invention;

[067] Figure 8a-8c illustrates a view of an alignment bracket and its associate mounting arrangement according to First embodiment of present invention;

[068] Figure 9 illustrates a view of two-wheeled vehicle with the components mounted according to the schematic of Fig. 1a-8c according to First embodiment of present invention;

[069] Figure 10 illustrates a vehicle frame (highlighted) of a two wheeled vehicle (faded) in accordance with second embodiment of the present invention;

[070] Figure 11 illustrates details of the vehicle frame in accordance with second embodiment of the present invention;

[071] Figure 12 illustrates a top view of the vehicle frame with mounting of a gas fuel cylinder, an engine, an air filter and a limp home tank, according to second embodiment of the present invention;

[072] Figure 13 illustrates a right side view of the vehicle frame with mounting of the gas fuel cylinder, the engine, and the limp home tank, a according to second embodiment of the present invention;

[073] Figure 14 illustrates a left side view of the vehicle frame with mounting of the gas fuel cylinder, the engine, and the air filter, according to second embodiment of the present invention;

[074] Figure 15 illustrates a left side perspective view of the vehicle frame mounting of the gas fuel cylinder, the engine, and the air filter, according to second embodiment of the present invention;

[075] Figure 16 illustrates a cross-sectional view of the vehicle frame with mounting of a gas fuel cylinder, an air filter and a limp home tank, according to second embodiment of the present invention;

[076] Figure 17 illustrates details of a two wheeled vehicle in accordance with a second preferred embodiment of the present invention.

DETAILED DESCRIPTION OF DRAWINGS

[077] Embodiments of present invention are explained herein below with the help of figures 1a to 17 herein below. All the aspects described herein below, will be better appreciated and understood when considered in conjunction with the following description and the accompanying drawings. It should be understood, however, that the following descriptions, while indicating preferred embodiments and numerous specific details thereof, are given by way of illustration and not of limitation. Changes or modifications may be made within the scope defined herein without departing from the spirit and scope thereof, and the present invention herein includes all such modifications.

First Embodiment:

[078] Fig. 1a-1b illustrates a frame structure (100) for a two-wheeled vehicle preferably operated by a gaseous fuel, stored in the gas fuel cylinder, according to an

exemplary embodiment of present invention. The frame structure (100) comprises, a head tube (101); a front frame structure (102) (indicated by dotted portion) extending rearwardly from the head tube (101); a rear frame structure (103) (indicated by dotted portion) connected to the front frame structure (102) and extending rearwardly. The front frame structure (102) comprises a set of front top tubes (110 a, b) and a set of front lower frame tubes (115 a, b) wherein; the front top tubes (110 a, b) extending in a rearward and downward direction from the head tube (101) and the set of front lower frame tubes (115 a, b) placed below the front top tubes (110 a, b) and extending downwardly and substantially horizontally in a rearward direction from the head tube (101). Preferably, the set of front lower frame tubes (115 a, b) is connected to the set of front top tubes (110 a, b).

[079] The rear frame structure (103) comprising a set of rear top tubes (120 a, b) and a set of rear lower tubes (125 a, b) wherein; the set of rear top tubes (120 a, b) is connected to the set of front top tubes (110 a, b) and extending rearwardly. The set of rear lower tubes (125 a, b) extending rearwardly and upwardly from the lower portion of the front top tubes (110 a, b) and connected to the rear portion of the rear top tubes (120 a, b). Preferably, the set of rear lower tubes (125 a, b) extending rearwardly from a cross bar (150a) connecting lower portion of set of front top tubes (110 a, b).

[080] According to an exemplary embodiment, a set of middle frame members (135 a, b) are provided, extending horizontally and connecting the front frame structure (102) with the rear frame structure (103) preferably, connecting the front top tubes (110 a, b) and the rear top tubes (120 a, b).

[081] The set of front top tube (110 a, b) and front lower frame tubes (115 a,b) are connected using plurality of connecting members (175). Further, the set of front top tubes (110 a, b), preferably at lower portion, are connected using plurality of cross members (150 a, b). The set of rear top tubes (120 a, b) and the rear lower tubes (125 a, b) are connected using plurality of rear connecting members (185).

[082] The above defined frame structure (100) is advantageous for mounting the gas fuel cylinder as it provides a convenient space for mounting of larger gas fuel cylinder, while ensuring necessary strength and stiffness to the frame structure (100). The

structural details of the frame including plurality of connecting members (175, 165), plurality of cross members (150 a, b), middle frame members (135 a, b) defined herein helps to increase strength necessary to carry gas fuel cylinder of higher capacity.

[083] The frame with bigger tubes is not suitable for mounting larger gas fuel cylinder as the bigger tubes occupies the space and makes gas fuel cylinder arrangement bulky. However, reducing size of the frame tubes, reduces overall strength and stiffness of the frame, thereby lowering the capability to carry larger gas fuel cylinder. Considering above constraints, the set of front lower frame tubes (115 a, b) connecting the head tube (101) and the front top tubes (110 a, b) provided with plurality of connecting members (175) provides adequate strength to the frame structure, while allowing significant reduction in the size of the frame tubes, thereby providing enough space for mounting larger gas fuel cylinder. This frame construction is also advantageous in terms of reducing cost and weight of the vehicle.

[084] Referring to the Fig. 2a- 2c illustrating mounting of the larger gas fuel cylinder (210) extending substantially horizontally according to one of the embodiment of present invention. The set of front top tubes (110 a, b), front lower frame tubes (115 a, b) and the set of rear top tubes (120 a, b) forms a space there between to securely mount the large gas fuel cylinder (210). According to an exemplary embodiment of present invention, the large gas fuel cylinder (210) is of diameter in the range of 130mm to 200mm preferably of 140mm to 170mm and of 550mm to 800mm in length, preferably 600 mm to 800 mm wherein; the gas fuel cylinder (210) is filled with at least one gaseous fuels such as CNG, LNG, biogas, LPG, and the like, more particularly the gas fuel cylinder is filled with CNG.

[085] Preferably, the gas fuel cylinder (210) is supported by plurality of support brackets mounted on the front frame structure and rear frame structure. Specifically, the front support brackets (165 a, b) are mounted on the front lower frame tubes (115 a, b) of the front frame structure (102) wherein; the front portion of the gas fuel cylinder (210a) is rested and clamped by a front clamping bracket (165 c) from top side. The clamping bracket (165c) is provided on the middle frame members (135 a, b). The rear portion of the gas fuel cylinder (210b) is rested upon rear support bracket (155) mounted on rear top tubes (120 a, b) and clamped in the position using the rear

clamping bracket (155 a). The support brackets (165 a-b, 155) are of circular arc shape and connecting the respective sets of front lower frame tubes (115 a, b) and the set of rear top tubes (120 a, b). The number of supporting brackets may be decided suitably based on the design requirements. The front lower frame tubes (115 a, b) has enough strength for supporting the gas fuel cylinder through the front support bracket (165 a-b). Further, the front frame tubes (110 a, b) may also be used to support or clamp the gas fuel cylinder (210) and may be provided with additional supporting/ clamping brackets to enhance strength and support to the gas fuel cylinder (210).

[086] The gas fuel cylinder (210) is mounted centrally along lateral direction of the vehicle, in order to distribute the weight equally and achieve balance as illustrated in Fig. 2c.

[087] Referring to the Fig. 3a- 3c illustrating mounting details of an engine (310) according to a preferred embodiment of present invention. The engine (310) is mounted on the vehicle front frame structure (102) wherein; the orientation of an engine cylinder (310) is substantially horizontal. The horizontal orientation of the engine (310) also creates sufficient space for mounting other associated components and helps in creating better flow path for fuel intake charge and exhaust gas. The lower portion (112) of the set of front top tube is provided with engine mounting brackets (145a) used for fixing the engine (310) using mounting points provided on the engine (310). Optionally, separate mounting tubes (112) may be welded to the crossbar (150a) of the front top tubes (110 a, b) and the engine mounting brackets (145a) may be welded on such mounting tubes (112). Preferably, the front portion of the engine may be additionally supported by the front mounting brackets (145b) provided on the front lower frame tubes (115 a, b) of the front frame structure (102) engaging engine cylinder or head or crankcase.

[088] According to another embodiment of present invention, the engine (310) is provided with split type engine head (310a) wherein; the engine head (310a) is provided with fins aligned to the direction of incoming air. To further improve the airflow into engine head air jacket, a scoop feature is present on the engine head (310a) preferably near spark plug mounting area.

[089] Referring to the Fig. 4a-4c illustrating mounting details of the air filter (401) according to another exemplary embodiment. An air filter (401) is mounted on the front frame structure (102) and connected to the engine to supply purified air wherein; the air-filter (401) is preferably mounted vertically above the engine cylinder.

[090] The air filter (401) is mounted on the front frame structure (102) preferably above the engine (310) such that it is accessible from the top side of the vehicle for easy servicing, maintenance purpose and also helps in improving engine performance. Preferably, the air filter (401) is mounted on one of the front top tubes (110 a) on left side of the vehicle proximate to the head tube (101), though it is possible to mount the air filter (401) on right side front top tube (110 b).

[091] The air filter (401) is fixed on one of the front top tubes (110 a, b) using suitable mounting brackets (405 a, b) preferably provided on the front top tubes (110 a, b). The rear surface of the air filter (401 a) is preferably designed to at least partially accommodate the front top tube member (110 a, b) of the front frame structure (102) within its body. This helps in compact mounting of the air filter (401) and secured mounting with less number of mounting brackets. The air filter (401) has at least a portion (410 b) extending laterally over the portion of the front top tubes (110 a, b) and at least a portion extending downwardly (401 c) over the front top tube (110 a, b) and the front lower frame tubes (115 a, b) wherein; the downwardly extending portion (401 c) of the air filter (401) is further connected to the engine (310) through a conduit (410) to supply purified air. The depth of the downwardly extending portion (401 c) is sufficient to accommodate different requirements of air for different variants of the engine.

[092] With the specific orientation of the engine and the air filter (401) explained herein above, it is ensured that smooth flow of air to the engine is achieved. Referring to the Fig. 4d-4e illustrating the conduit (410) used to supply purified air from air filter (401) towards the engine (310) is designed to be substantially vertical with minimum bends, this helps in achieving high volumetric efficiency with improved tumbling flow of intake charge. Further, an intake port (448) and flow axis (410a) of the intake passage (468) within engine (310) is designed to be substantially straight/ vertical to further enhance the tumbling motion of intake charge and helps in achieving better

mixing. The conduit (410) is provided with a throttle body (437) wherein; fuel is injected into the purified air received from air filter (401), which is further supplied to the engine (310) through the intake port (448).

[093] Referring to the Fig. 5a-5c illustrating mounting details of a limp home tank (501) according to another exemplary embodiment, the limp home tank (501) preferably used for storing liquid fuel as a second fuel source, to supply fuel to the engine, if the gas fuel is not available or not used for any reason. A suitable change over system may be employed for changing the type of fuel supply. The changeover may be automatic or manual. The limp home tank (501) is mounted on the front frame structure (102) above gas fuel cylinder (210), such that the liquid fuel filling provision (501c) is accessible from the top side of the vehicle for easy fuel refiling purpose. The limp home tank (501) is preferably mounted on the right side front top tube (110 b), opposite to the air filter (401) mounting. A mounting support of the limp home tank (501) is fixed on the front top tube using mounting brackets. The limp home tank (501) at least partially extends vertically downward over the front top tubes (110 a, b) and the front lower frame tubes (115 a, b). Preferably, at least a rear side portion of the limp home tank (501a) is designed to accommodate the front top tubes (110 a, b) and the front lower frame tubes (115 a, b) within its body at least partially to have compact packaging. This also helps in accommodating additional fuel and mounting other components within the Limp home tank (501) such as fuel pump, strainer etc. According to another exemplary embodiment, the said air filer (401) and said limp home tank (501) may be mounted on same side of frame structure.

[094] Referring to the Fig. 6a-6b illustrating mounting arrangement of both the air filer (401) and the limp home tank (501) mounted opposite to each other as viewed from the front or top side of the vehicle. The position of the air filter (401) and the limp home tank (501) may be interchanged. The liquid fuel filling provision (501c) provided in the form an opening closed by a cap is accessible from top side of the vehicle. Similarly, access to air filter/ air filter element (401) is provided from top side of the vehicle for servicing or maintenance purpose. The air filter (401) is preferably a foam filter though other types of filter may also be used. This arrangement also helps in maintaining overall aesthetics of the vehicle.

[095] Referring to Fig 7a-7b illustrating a cover (710) configured to enclose components like gas fuel cylinder (210), limp home tank (501), air filter, fuel refiling points etc. The cover (710) may be formed out of assembly of left and right side member a (710a-b) and top covering member (not shown). As said components are mounted on front top side of the vehicle, these are accessible from through removably mounted top covering member. A gas fuel filling point (701) for gas fuel cylinder (201) provided such that it is accessible from top side of the vehicle and positioned near to liquid fuel filling provision (501c) of the limp home tank (501). This helps in convenient accessibility to refilling of both type of fuels (Liquid and gaseous) from top side of the vehicle. Further, Air filter (401) is also accessible upon opening the top covering member. According to one of the embodiment, the top covering member is provided with a flap cover preferably hinged to the top cover having a locking means in order to prevent any unauthorized access to said components. The flap cover also helps in improving aesthetics of the vehicle. The cover (710) may be formed using suitable number of covering members, which may be provided as an integrated members or separate members assembled together.

[096] The fuel is supplied to the engine from gas fuel cylinder (210) through a gas fuel circuitry comprising components like main valve or a shut-off valve, at least one Pressure regulator, filter etc. The gas fuel is filled in the gas fuel cylinder (210) through a gas fuel filling point (701). A pressure gauge (815) is connected to the pressure regulator for monitoring pressure level and is provided such that the reading on pressure gauge (815) is visible from side of the vehicle. The fuel received from the pressure regulator at low pressure is supplied to a fuel rail (885) or a throttle body for further injecting into the engine through an injector. Alternately, the fuel may be supplied to a carburettor configured to create an intake charge as a mix of purified air and fuel for supplying to the engine. Optionally, the pressure gauge reading is also made visible on speedometer of the vehicle for easy viewing. The pressure gauge (815) may be suitably covered through covering members like tinted glass or any other vehicle covering part to improve overall aesthetics of the vehicle.

[097] According to another exemplary embodiment, the fuel rail comprises a solenoid to regulate the supply of fuel.

[098] The engine is also supplied with the liquid fuel through conventional fuelling circuitry separate from the gas fuel circuitry or may be commonly used suitably.

[099] It may be construed from the above that alignment of the gas fuel cylinder (210) is critical in order to achieve the compact packaging of all the associated components as explained herein above in order to achieve necessary benefits of the present invention. For example, the location and orientation of pressure gauge (815), main valve (825), gas filling point (701) alignment is important. Considering the necessity, the orientation and position of the gas fuel cylinder (210) along with associated fuelling components is locked using an alignment bracket (917) as illustrated in the Fig. 8a-8c. The alignment bracket (917) is provided with two-arm structure preventing any rotational movement of the gas fuel cylinder (210) and more specifically that of main valve (825) to ensure the necessary alignment of the main valve (825) and thereby alignment of all associated components including pressure regulator (not shown) and pressure gauge (815). The gas fuel cylinder (210) has to be mounted close to the head tube (101) to achieve desired packaging, any variations there between may lead to misalignment of all the associated components. To ensure the desired packaging of the gas fuel cylinder (210), the alignment bracket (917) is provided with a cavity (917c) to completely receive the main valve (825) of the gas fuel cylinder (210) within said cavity (917c). This helps in ensuring the packaging of the gas fuel cylinder (210) at a desired location, thereby ensuring proper alignment and packaging of all the associated components. The alignment bracket (917) is mounted between front lower tubes (115 a, b) may be bolted or welded to the front lower tubes (115 a, b).

[0100] Referring to Fig. 9, illustrating a two-wheeled vehicle (901) with gas fuel cylinder (210) and other components mounted according to the schematic disclosed herein above. A rider seat (910) mounted on the rear frame structure (103) extending substantially horizontally in the rearward direction of the two-wheeled vehicle (901). According to an exemplary embodiment, the gas fuel cylinder (210) extends from a front section of the front frame structure (102) to at least up to middle section of the rear frame structure (103) such that at least a portion of the gas fuel cylinder (102) is positioned below the rider seat (910). Preferably, a substantial top portion of the gas fuel cylinder (210) is covered by the rider seat (910).

[0101] According to preferred embodiment of the present invention, the gas fuel cylinder (210) is mounted on the frame structure (100) such that it may be easily removable from the rear side of the vehicle without disturbing other associated components. The frame structure (100) is provided with a suitable opening or a passage to facilitate removal of the gas fuel cylinder from rear side of vehicle. The frame structure (100) may be provided with a guide rails for easy removal of gas fuel cylinder.

[0102] According to another exemplary embodiment, the vehicle is provided with a mono-shock suspension system comprising a single shock absorber (915) connecting the rear frame structure (103) and a swing arm (920) through a linkage. According to another embodiment, the vehicle is provided with a twin suspension comprising two shock-absorbers mounted on either side of a rear wheel (907) and connecting an axle of rear wheel (907) with the rear frame structure (103).

[0103] According to another exemplary embodiment, the vehicle (901) is provided with a front (905) and a rear wheel (907) having diameter in a range of 14 to 18 inch. With the mounting configuration of the larger gas fuel cylinder, engine and other associated components as explained herein above, results in increase in overall height and wheel base of the vehicle, hence, with the smaller diameter wheels, it is made possible to reduce the overall height of the vehicle, thereby keeping overall Centre of Gravity (CG) of the vehicle towards lower side, while using gas fuel cylinder of a larger capacity. This helps in improving overall handling capabilities of the vehicle and wheelbase is retained.

[0104] According to another exemplary embodiment, a pillion seat is provided as a separate seat mounted on the rear frame structure (103) at the rear of the rider seat. The pillion seat may be provided as an integral part of the rider seat (901).

[0105] According to another exemplary embodiment, a first luggage box is mounted on the rear frame structure at the rear side of the rider seat.

[0106] The vehicle, as described above, is conveniently a two-wheeler vehicle such as a motorcycle, scooter, and the like.

Second Embodiment:

[0107] Figure 10 to 17 illustrates a two-wheeled vehicle (1000) in accordance with second embodiment of present invention, with some modifications in the frame structure while achieving the same objectives related to mounting of larger gas fuel cylinder. The two-wheeled vehicle (1100) comprises a vehicle frame (1200) including a front frame structure (1210) having a front lower frame structure (1215). The front frame structure (1210) and the front lower frame structure (1215) extending from a head tube (1205) in a rearward direction. The front frame structure (1210) includes a set of front top tubes, namely a left side front top tube (1210L), and a right side front top tube (1210R) which extend substantially symmetrically in a rearward and downward direction from the head tube (1205). The rearward direction indicates direction of moving from front of the two-wheeled vehicle (1100) towards the rear of the two-wheeled vehicle (1100) [as indicated by arrowhead of A1 in figure 10].

[0108] The front frame structure (1205) comprises a set of front lower frame tubes, namely a left side front lower frame tubes (1215L) and a right side front lower frame tubes (1215R), extending substantially symmetrically in a downward direction and in the rearward direction from the head tube (1205). Further, the right side front lower frame tubes (1215R) comprises a separable support portion (1215B). In an exemplary embodiment of present invention, the separable support portion (1215B) is a portion of the right side front lower frame tubes (1215R) which is separable from the vehicle frame and bolted on the vehicle frame (1200) after mounting of an engine (1300) of the two-wheeled vehicle (1100). Alternatively, this support portion may be in form of swingable arrangement i.e. hinged at one end and bolted at other end. The bolts can be removed and hinged upwardly/downwardly while mounting or removing the engine. The set of front top tubes (1210 L, R) are connected to each other using at least a cross members; and a set of a front lower frame tubes (1215 L, R) connected to the set of front top tubes (1210 L, R) using at least a front connecting member.

[0109] The front frame structure (1215) is connected to the rear frame structure (1195) comprising a set of rear top tubes (2100L, 2100R) which extend substantially horizontally and parallelly in the rearward direction is connected to front top tubes

(1210L, 1210R). A set of rear lower tubes (2100a, b) is provided connecting lower portion of front top tubes and the middle portion of rear top tubes (2100L, 2100R).

[0110] The engine (1300) is mounted on the front frame structure (1210) in a substantially horizontal orientation and locked within the vehicle frame (1200) using the support brackets (1235) provided on lower portion of front top tubes (2100L, 2100R). The separable support portion (1215B) is dismantled to mount the engine (1300) of the two-wheeled motor vehicle (1100) and further bolted to lock the engine (1300) on the engine frame. Such a mounting provision of separable support portion (1215B) provides ease of assembly and maintenance for the two-wheeled vehicle (1100).

[0111] A plurality of support brackets (1220) of circular arc-shape are provided between the two horizontal tube portions (2100L, 2100R) enabling to effectively utilising space to mount the gas fuel cylinder (1110) on the front frame structure (1210). The space in an exemplary embodiment is cavity of circular arc profile on the plurality of support brackets (1220), complementing an outer lower profile of the gas fuel cylinder (1110).

[0112] According to an exemplary embodiment plurality of support brackets (1220) are welded on the vehicle frame (1200). The gas fuel cylinder (1110) is mounted on the front frame structure (1210) extending substantially horizontally in the rearward direction and at least partially extending below the rider seat. The gas fuel cylinder (1110) is placed on the plurality of support brackets (1220) within the space created. A plurality of corresponding securing brackets (1225) of reverse circular arc-shape are placed on top of the gas fuel cylinder (1110). The plurality of clamping brackets (1225) are of reverse circular arc-shape, complementing an outer upper profile of the gas fuel cylinder (1110). The plurality of clamping brackets (1225) are fixed on top of the plurality of support brackets (1220), sandwiching and locking the gas fuel cylinder (1110) there between.

[0113] The vehicle frame (1200) mounts a rider seat (1105) on the front and rear frame structure. The rider seat (1105) extends substantially horizontally in the rearward

direction. In an exemplary embodiment, a pillion seat (1165) is provided as an integral part of the rider seat (1105).

[0114] Figure 13 and 14 illustrates a gas filling point (1185) provided with an opening at a side of the two wheeled vehicle (1100). The gas filling point (1185) is connected to a main valve (1125) of the gas fuel cylinder (1110) to fill a fuel in the gas fuel cylinder (1110). The pressure gauge (1130) and a pressure regulator (135) are connected to the main valve (1125). The pressure gauge (1130) is mounted on the front frame structure (1210) near the head tube structure (1205) preferably, rearward from the head tube structure (1205), ahead of the front opening of the cylinder within the space between the front frame tubes (1210) and the front lower frame tubes (1215).

[0115] Further, in an exemplary embodiment of present invention one or more elements of fuel line of the two-wheeled vehicle (1100) are compactly mounted on the vehicle frame (1200). As indicated in figure 15, an ECU is mounted on the two-wheeled vehicle at an ECU mounting location (1170) at rear side of the vehicle frame (1200), electronically connected with the one or more components of the fuel line to control and regulate the fuel supply for engine operations.

[0116] The gas fuel circuitry and its function is explained herein above for first embodiment is also applicable for second embodiment, hence further description is omitted herein for a sake of convenience.

[0117] As indicated in figure 12, 14, and 15, an air filter (1115) is mounted between the front frame structure (1210), and the rear frame structure (1195) on a mounting bracket (1115a). The air filter (1115) fixed on the horizontal tube portion (2100L) of one of the front top tubes (1210L, 1210R) below the rider seat (1105). The air filter (1115) at least partially extends below the gas fuel cylinder (1110). In an exemplary embodiment as indicated in the cross-sectional view of the vehicle frame in Figure 16, the air filter (1115) extends with an extending parallel matching surface of the air filter (1115) below the gas fuel cylinder (1110).

[0118] As indicated in figure 13, and 16, a limp home tank (1120) is mounted on between the front frame structure (1210) and the rear frame structure (1195), on a

mounting support (1120a). The limp home tank (1120) is fixed on the horizontal tube portion (2100R) of one of the top tubes (1210R) below the rider seat (1105). The limp home tank at least partially extends below the gas fuel cylinder (1110). In an exemplary embodiment as indicated in the cross-sectional view of the vehicle frame in Figure 16, the limp home tank (1120) extends with an extending parallel matching surface of the air filter (1115) below the gas fuel cylinder (1110). The limp home tank (1120) operates as a secondary fuel source, to supply fuel to engine for engine (1300) operation via an injector, if the gas fuel cylinder (1110) is empty.

[0119] The second preferred exemplary embodiment in figure 17 illustrates a motorcycle vehicle or a moto-scooter type vehicle (1100) with telescopic suspension at front and spring suspension at rear, in accordance with the features explained herein above. For the exemplary embodiment, the height of the two wheeled vehicle, diameter of wheels, size of suspension system, and space between the front wheel and rear wheel are optimized as explained in the first embodiment of the present invention to accommodate the gas fuel cylinder within the vehicle frame of the two wheeled vehicle (1100).

[0120] Also, with the compact packaging of gas fuel cylinder (1110), horizontal engine (1300), and the fuel filler (1185) and the fuel line on the vehicle frame (1200), conventional fuel tank location remains free for mounting additional utilities. In an exemplary embodiment of present invention, a second storage box (1160) is mounted at front at the conventional fuel tank location, without compromising aesthetics of the two wheeled vehicle (1100). The modularity in space utilization of the two-wheeled vehicle (1100) is further enhanced with replacing the pillion seat (1165) with a first modular rack. A child seat or the second storage box (1160) is mounted on the first modular rack mounted.

[0121] Conclusively, the present invention provides a compact two-wheeled vehicle. The vehicle efficiently accommodates the gas fuel cylinder extending horizontally from the front of the two-wheeled vehicle towards the rider seat, without compromising aesthetics of the vehicle structure, while providing easy access to various components like air filter or limp home tank.

[0122] Although the features of the present invention are explained herein above in the form of various embodiments, the person skilled in the art would easily appreciate interchangeability of features between these embodiments and the description provided herein shall not limit the scope of the present invention to any specific embodiment. Although the features of present invention are explained considering gaseous fuel, it is possible to provide vehicle only with single liquid fuel source wherein; the fuel cylinder stores liquid fuel instead of gas.

WE CLAIM

1. A two-wheeled motor vehicle comprising:

a vehicle frame structure comprising of,

a head tube;

a front frame structure extending rearwardly from the head tube;

a rear frame structure connected to the front frame structure and extending rearwardly;

a gas fuel cylinder for storing and supplying gaseous fuel to an engine;

wherein the gas fuel cylinder extending substantially horizontally and is supported by the front frame structure and the rear frame structure using plurality of support brackets; and

the engine mounted on the vehicle front frame structure wherein; the orientation of an engine is substantially horizontal.

2. The two-wheeled vehicle as claimed in claim 1, wherein the engine is connected to an air filter to receive purified air, wherein the air-filter is mounted on the front frame structure vertically above the engine such that it is accessible from the top side of the vehicle.

3. The two-wheeled vehicle as claimed in claim 2, wherein at least a portion of the air filter is extending downwardly over the front frame structure and at least a portion extending laterally over the portion of the front frame structure and wherein; the downwardly extending portion of the air filter is further connected to the engine through a conduit to supply purified air.

4. The two-wheeled vehicle as claimed in claim 1, wherein the front frame structure comprises a set of front top tubes and a set of front lower frame tubes, wherein the front top tubes having at least a portion extending rearwardly and at least a portion extending in downward direction from the head tube and the set of front lower frame tubes placed below front top tubes and extending substantially downwardly and horizontally in a rearward direction from the head tube and connected to the set of front top tubes.

5. The two-wheeled vehicle as claimed in claim 4, wherein the rear frame structure comprising a set of rear top tubes and a set of rear lower tubes, wherein the set of rear top tubes extending rearwardly and connected to the set of front top tubes; and the set of rear lower tubes connected to the lower portion of the front top tubes and extending rearwardly and upwardly to connect to the rear portion of the rear top tubes.

6. The two-wheeled vehicle as claimed in claim 5, wherein the set of front top tube and the front lower frame tubes are connected using plurality of connecting members and the set of rear top tubes and the rear lower tubes are connected using plurality of rear connecting members respectively.

7. The two-wheeled vehicle as claimed in claim 5, wherein the front top tubes and the rear top tubes are connected by a set of middle frame members extending horizontally.

8. The two-wheeled vehicle as claimed in claim 7, wherein the gas fuel cylinder is supported on the front frame structure using at least a front support bracket mounted on the front lower frame tubes and supported on the rear top tubes using at least a rear support bracket mounted on the rear top tubes.

9. The two-wheeled vehicle as claimed in claim 8, wherein the gas fuel cylinder is clamped by at least a front clamping bracket from top side, wherein the front clamping bracket is provided on the middle frame members and the gas fuel cylinder is clamped by at least a rear clamping bracket from rear side wherein; the rear clamping bracket is provided on the rear top tubes.

10. The two-wheeled vehicle as claimed in claim 9, wherein the vehicle frame structure is provided with a suitable opening or a passage to facilitate removal of the gas fuel cylinder from rear side of the vehicle.

11. The two-wheeled vehicle as claimed in claim 10, wherein the vehicle frame structure is provided with at least a guide rail for removal of the gas fuel cylinder.

12. The two-wheeled vehicle as claimed in claim 2, wherein the engine is supplied with a secondary liquid fuel stored in a limp home tank and wherein the limp home tank is mounted on the front frame structure, such that a secondary liquid fuel filling provision is accessible from the top side of the vehicle for liquid fuel refilling.

13. The two-wheeled vehicle as claimed in claim 12, wherein the limp home tank is designed to extend downwardly at least partially over the front frame structure wherein the limp home tank is mounted on opposite side of the air filter mounting.

14. The two-wheeled vehicle as claimed in claim 12, wherein fuel supply from the gaseous fuel is changed to the secondary liquid fuel and vice-versa by an automatic or a manual changeover system.

15. The two-wheeled vehicle as claimed in claim 12, wherein the gas fuel cylinder is provided with a gas fuel filling point accessible from top side of the vehicle and positioned beside the liquid fuel filling provision of the limp home tank.

16. The two-wheeled vehicle as claimed in claim 15, wherein the limp home tank, the air filter, the gas fuel filling point are accessible from front-top side of the vehicle.

17. The two-wheeled vehicle as claimed in claim 16, wherein the limp home tank, the air filter, the gas fuel filling point are covered by a cover, wherein the cover is formed out of assembly of left side member, right side member and an openable top covering member to provide access at least to the limp home tank, the air filter, the gas fuel filling point.

18. The two-wheeled vehicle as claimed in claim 17, wherein the top cover is provided with a flap cover having a locking means to prevent unauthorized access to the limp home tank, the air filter or the gas fuel filling point.

19. A two-wheeled motor vehicle comprising of the vehicle frame structure comprising;

a head tube;

at least a front frame structure extending in a rearward direction from the head tube;

a rear frame structure connected to the front frame structure and extending rearwardly;

a gas fuel cylinder for storing and supplying gaseous fuel to an engine;

wherein, the gas fuel cylinder is supported by the front frame structure and the rear frame structure using plurality of support brackets and extending substantially horizontally in the rearward direction; and

wherein the engine is mounted on the vehicle frame structure wherein; the orientation of the engine is substantially horizontal; and

the front frame structure comprises a set of front top tube extending substantially symmetrically in a rearward direction and a set of a front lower frame tubes extending substantially symmetrically in a downward and the rearward direction from the head tube; wherein at least one of the front lower frame tube comprises a separable support portion wherein; the separable support portion is dismantled to mount an engine of the two-wheeled vehicle.

20. The two-wheeled vehicle as claimed in claim 19, wherein the engine is connected to an air filter to receive purified air wherein, the air-filter is mounted on the rear frame structure below the rider seat.

21. The two-wheeled vehicle as claimed in claim 20, wherein the engine is supplied with a secondary liquid fuel stored in a limp home tank wherein; the limp home tank is mounted on the rear frame structure below the rider seat on opposite side of air filter.

22. The two-wheeled vehicle as claimed in claim 21, wherein at least a portion of the air filter and the limp home tank extends below the gas fuel cylinder wherein; the portion has a surface matching with lower surface of gas fuel tank.

23. The two-wheeled vehicle as claimed in claim 22, wherein the gas fuel cylinder is provided with a gas filling point provided on side of the vehicle.

24. The two-wheeled vehicle as claimed in any one of the claims above, wherein the gas fuel cylinder is of diameter in the range of 130mm to 200mm and length in the range of 550mm to 800mm.

25. The two-wheeled vehicle as claimed in any one of the claims above, wherein the gas fuel cylinder extends from a front section of the front frame structure to at least up to middle section of the rear frame structure such that at least a portion of the gas fuel cylinder is positioned below a rider seat wherein; the rider seat is mounted on the rear frame structure and extending substantially horizontally in the rearward direction.

26. The two-wheeled vehicle as claimed in any one of the claims above, wherein the front frame structure comprises a set of front top tubes connected to each other using at least a cross member; and a set of a front lower frame tubes connected to the set of front top tubes using at least a front connecting member.

27. The two-wheeled vehicle as claimed in any one of the claims above, wherein the engine is provided with a split type engine head having separate head cover, wherein the engine head is provided with fins aligned to the direction of incoming air to enhance heat transfer and provided with a scoop feature.

28. The two-wheeled vehicle as claimed in any one of the claims above, wherein the engine is horizontally supported at rear side on the lower portion of the front frame structure using mounting brackets and optionally supported at the front side using the front lower tubes.

29. The two-wheeled vehicle as claimed in any one of the claims above, wherein the engine is supplied with the gaseous fuel through to a main valve wherein; the main valve is mounted at the opening of the gas fuel cylinder; a pressure

regulator and a filter unit wherein the gaseous fuel is supplied to a fuel rail or a throttle body for further injecting into the engine through an injector or the gaseous fuel is supplied to a carburettor configured to create an intake charge as a mix of purified air and fuel for supplying to the engine.

30. The two-wheeled vehicle as claimed in claim 29, wherein pressure level of gaseous fuel is monitored using a pressure gauge, wherein the reading on pressure gauge is visible from side of the vehicle and/or visible on a speedometer of the vehicle.

31. The two-wheeled vehicle as claimed in claim 30, wherein the pressure gauge is covered through a covering member including a tinted glass or any other vehicle covering part.

32. The two-wheeled vehicle as claimed in any one of the claims above, wherein the gas fuel cylinder orientation and position is locked using an alignment bracket wherein, the alignment bracket is mounted within the front frame structure and is provided with two-arm structure forming a cavity to completely receive the main valve of the gas fuel cylinder thereby restricting any movement of the main valve.

33. The two-wheeled vehicle as claimed in any one of the claims above, wherein the vehicle is provided with a mono-shock suspension system comprising a single shock absorber connecting the rear frame structure and a swing arm through a linkage or the vehicle is provided with a twin suspension comprising two shock-absorbers mounted on either side of a rear wheel and connecting an axle of rear wheel with the rear frame structure.

34. The two-wheeled vehicle as claimed in any one of the claims above, wherein, the vehicle is provided with a front and a rear wheel having diameter in a range of 14 to 18 inch.

35. The two-wheeled vehicle as claimed in any one of the claims above, wherein the vehicle is provided with a luggage box is mounted on the rear frame structure or on the front frame structure.

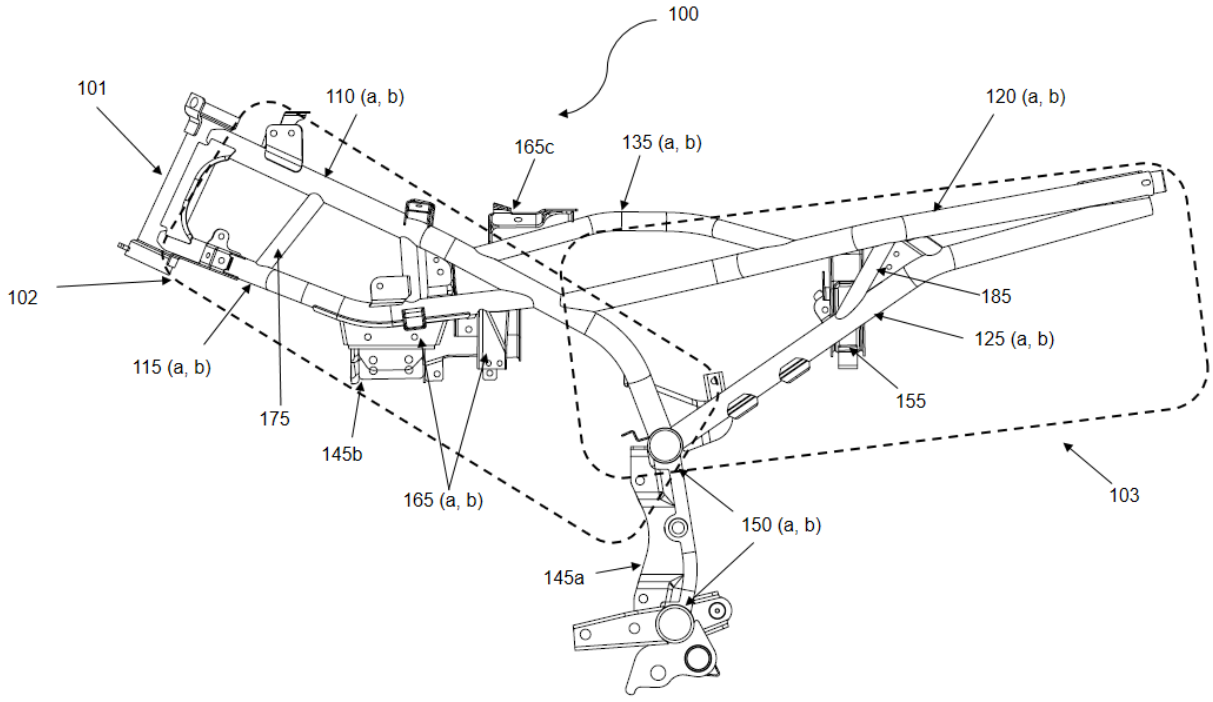
36. The two-wheeled vehicle as claimed in any one of the claims above, wherein the gas fuel cylinder is filled with at least one gaseous fuel including CNG, LNG, biogas, LPG.

ABSTRACT

A TWO WHEELED MOTOR VEHICLE

The present invention relates to a two-wheeled motor vehicle comprising a vehicle frame structure further comprising of, a head tube; a front frame structure extending rearwardly from the head tube; a rear frame structure connected to the front frame structure and extending rearwardly; a gas fuel cylinder for storing and supplying gaseous fuel to an engine, wherein the gas fuel cylinder extending substantially horizontally and is supported by the front frame structure and the rear frame structure using plurality of support brackets. The engine is mounted on the vehicle front frame structure such that the orientation of the engine is substantially horizontal.

Figure 9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103
150 (a, b)
145a

Figure 1a

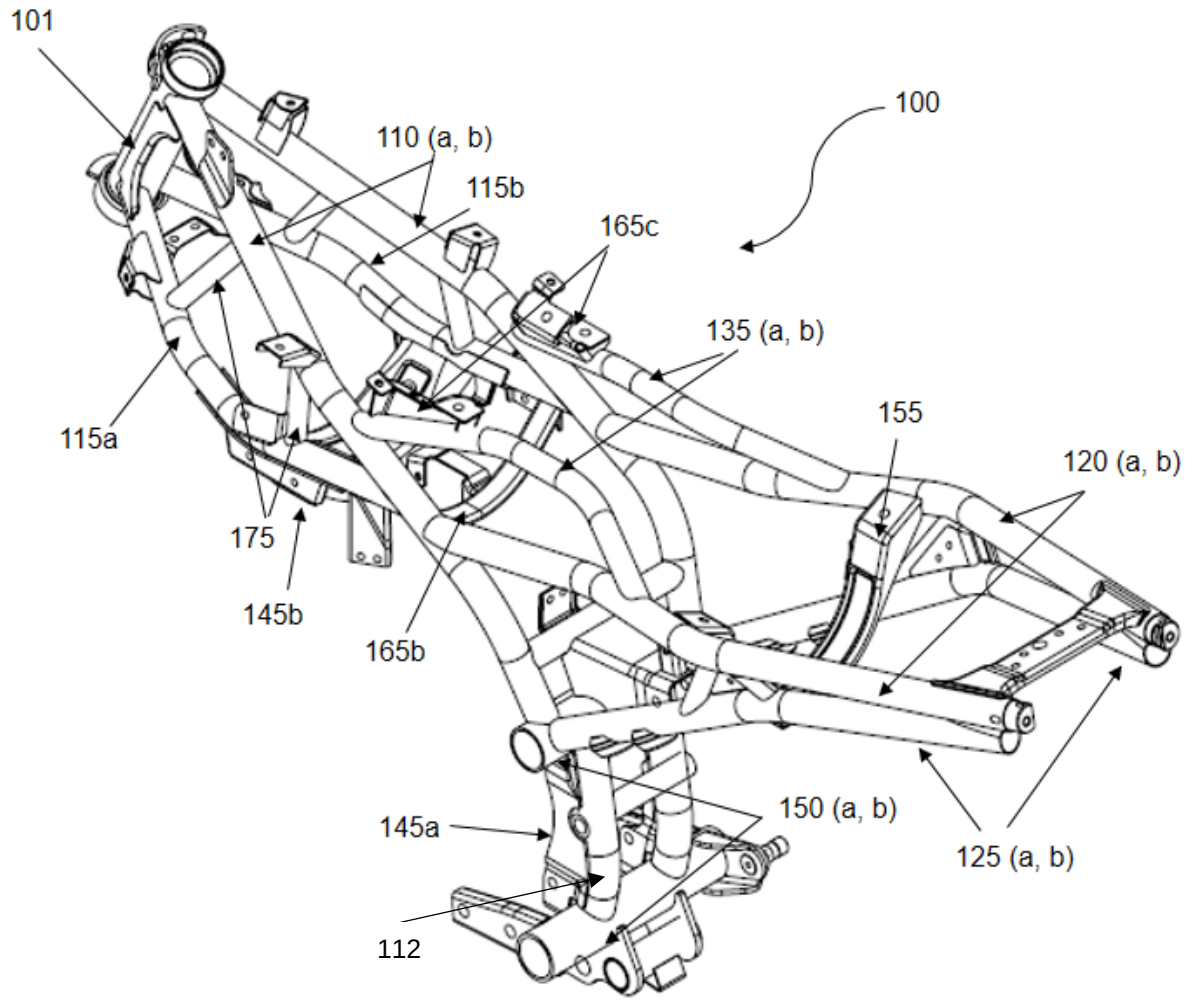
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Figure 1b

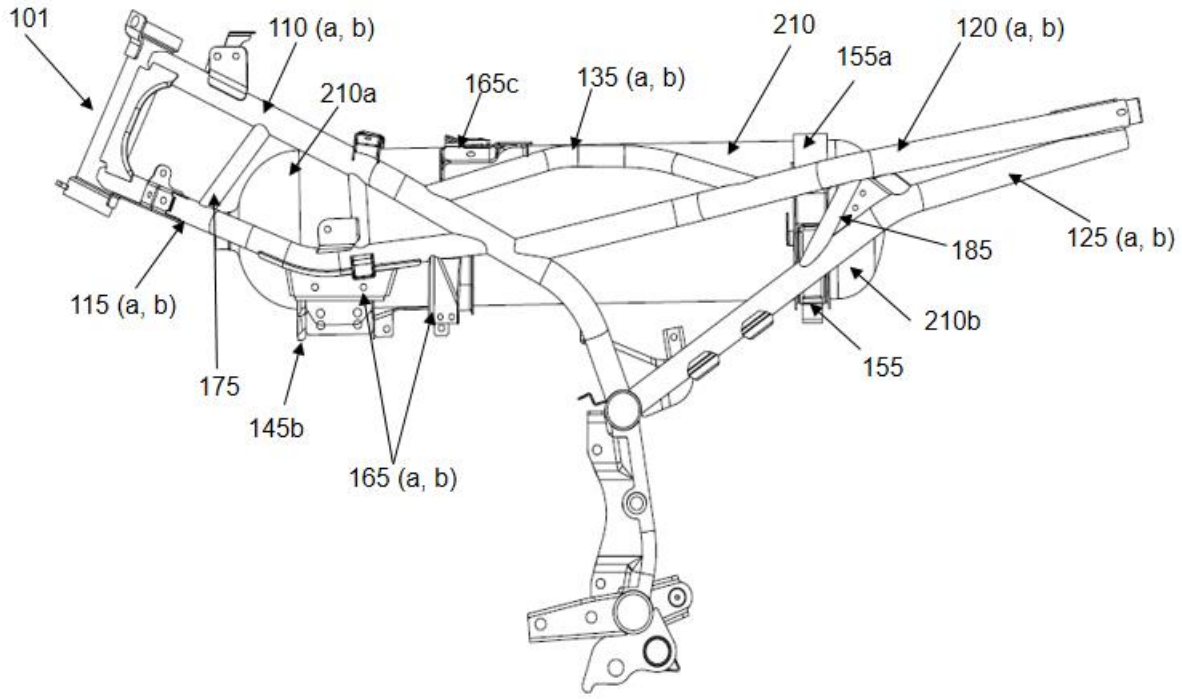
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Figure 2a

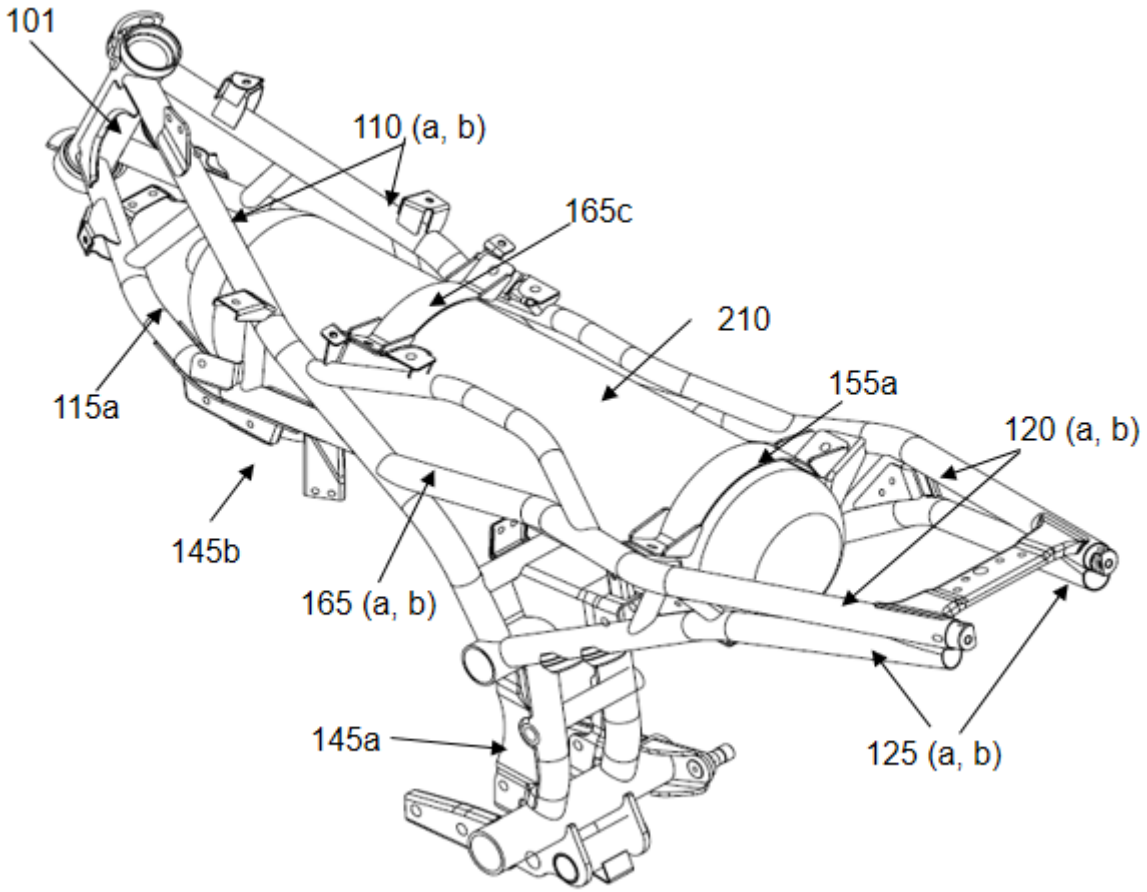


Figure 2b

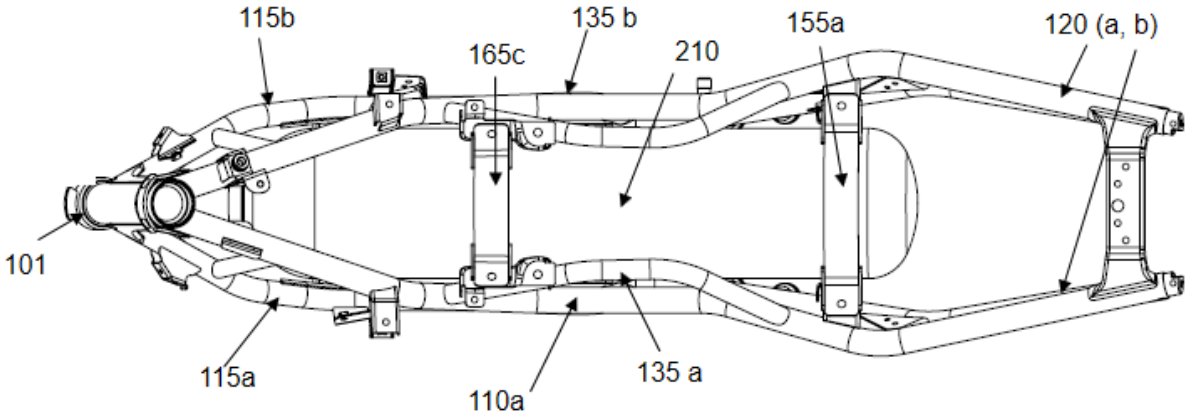
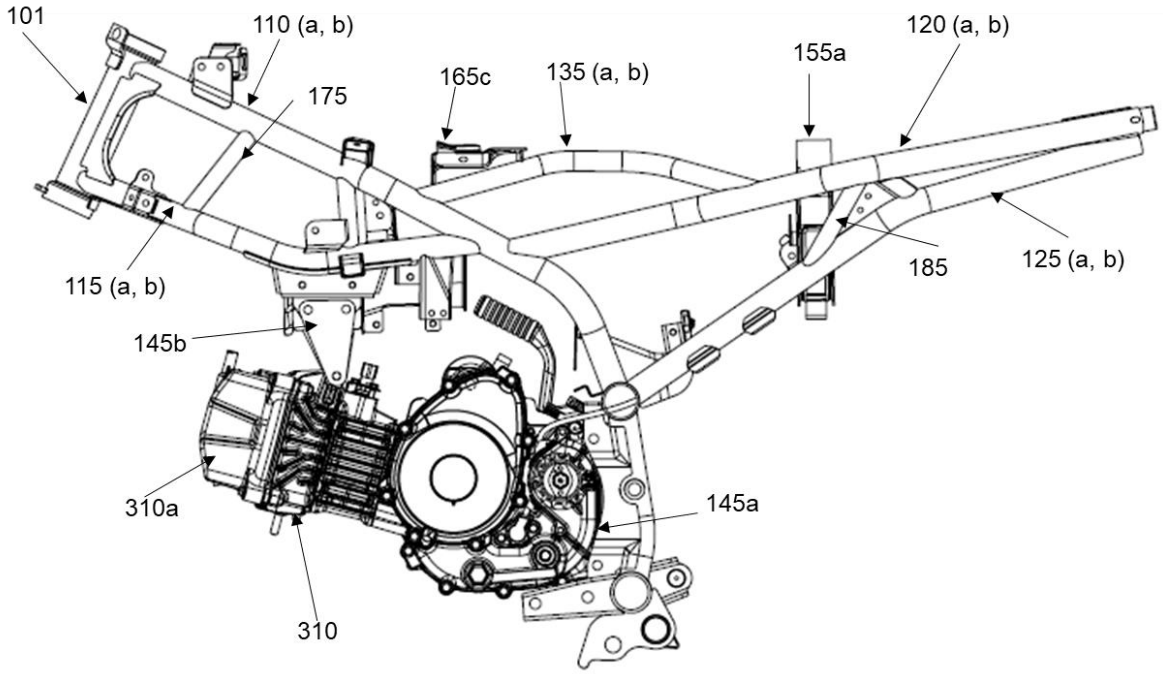


Figure 2c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145a
310

Figure 3

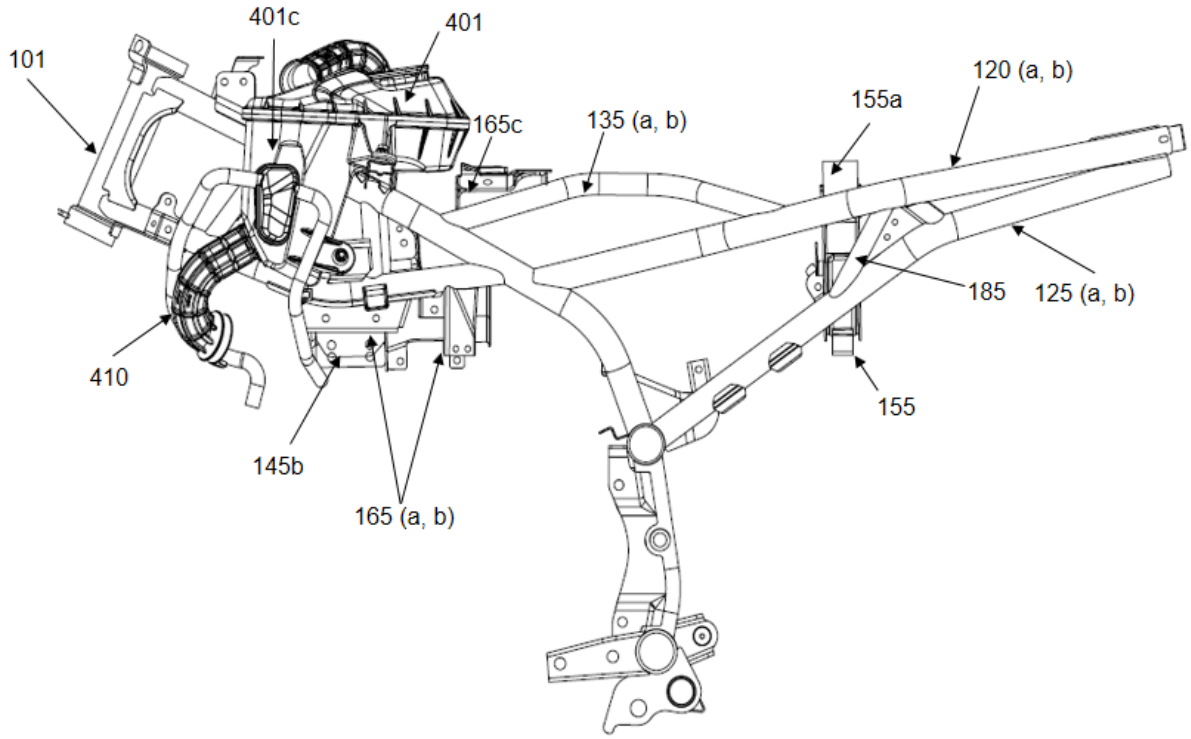
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Figure 4a

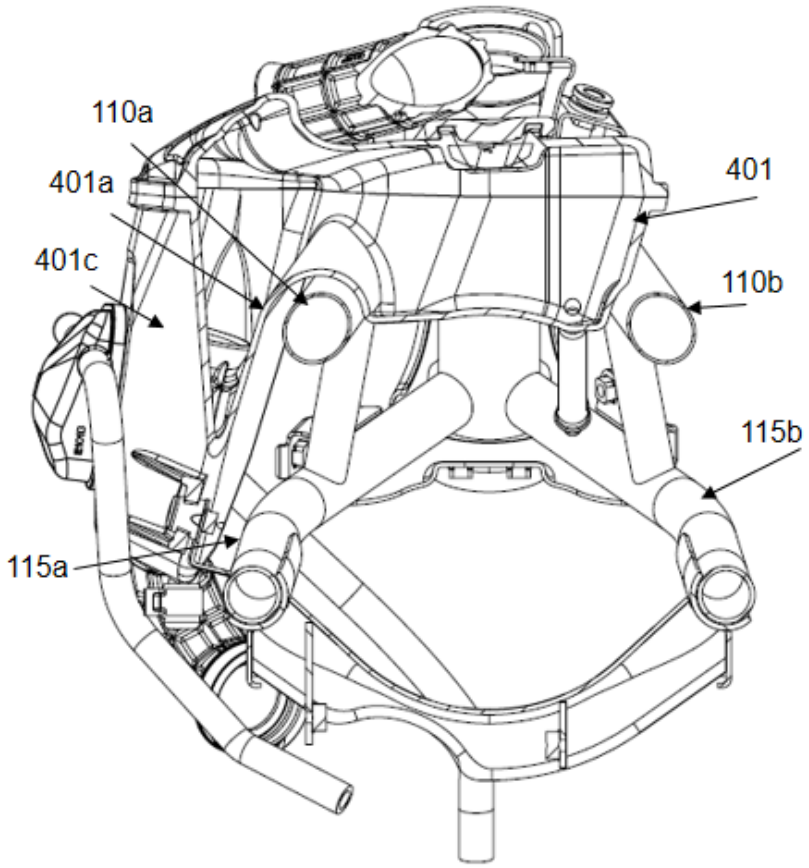

Figure 4b

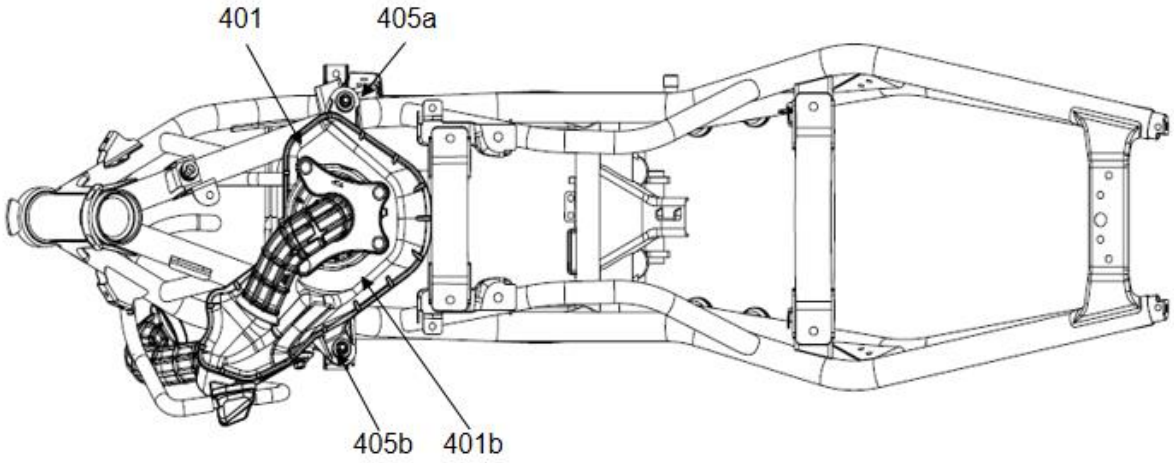

Figure 4c

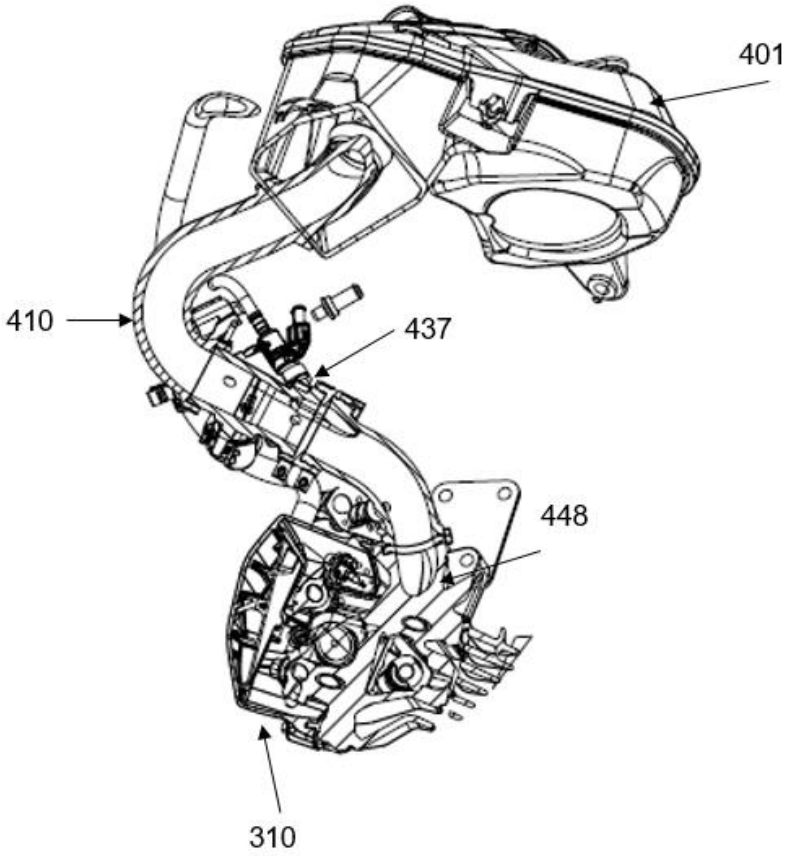

Figure 4d

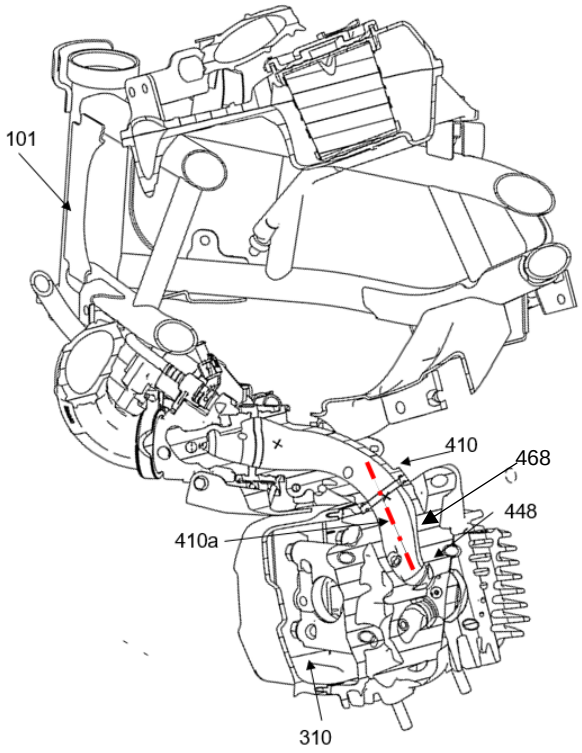

Figure 4e

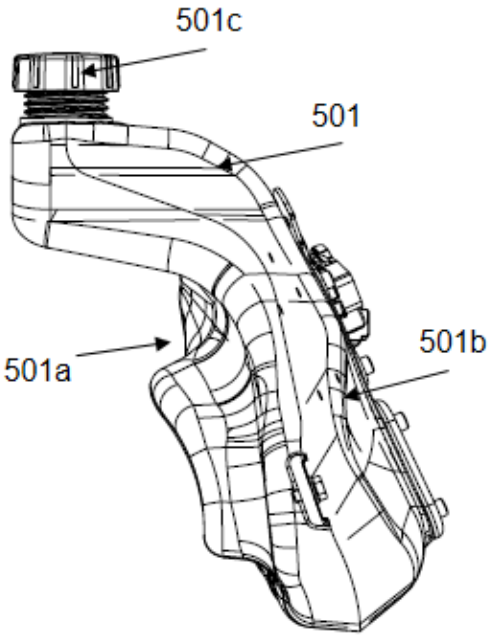

Figure 5a

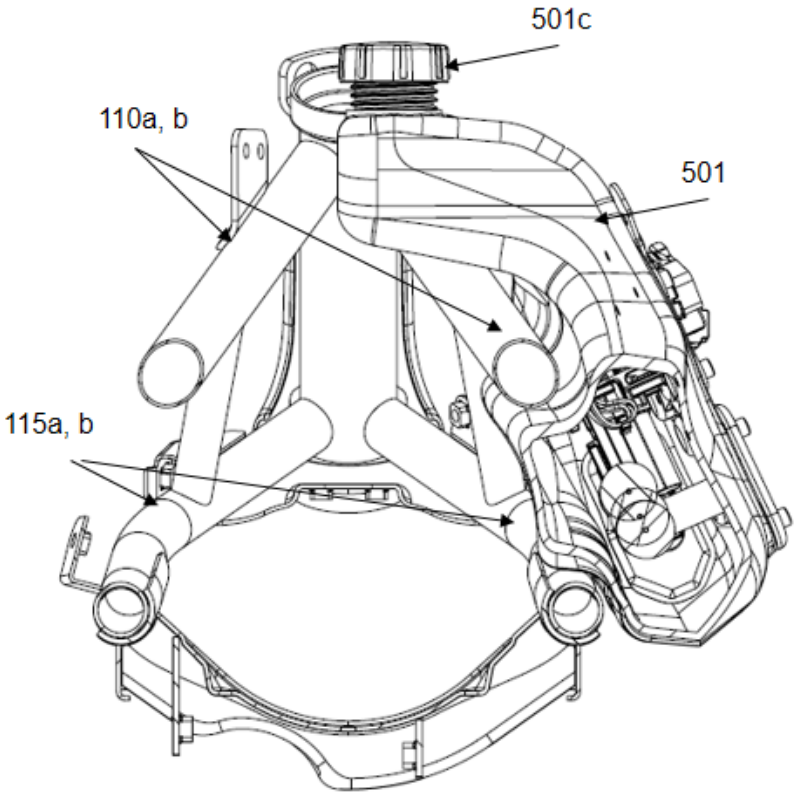

Figure 5b

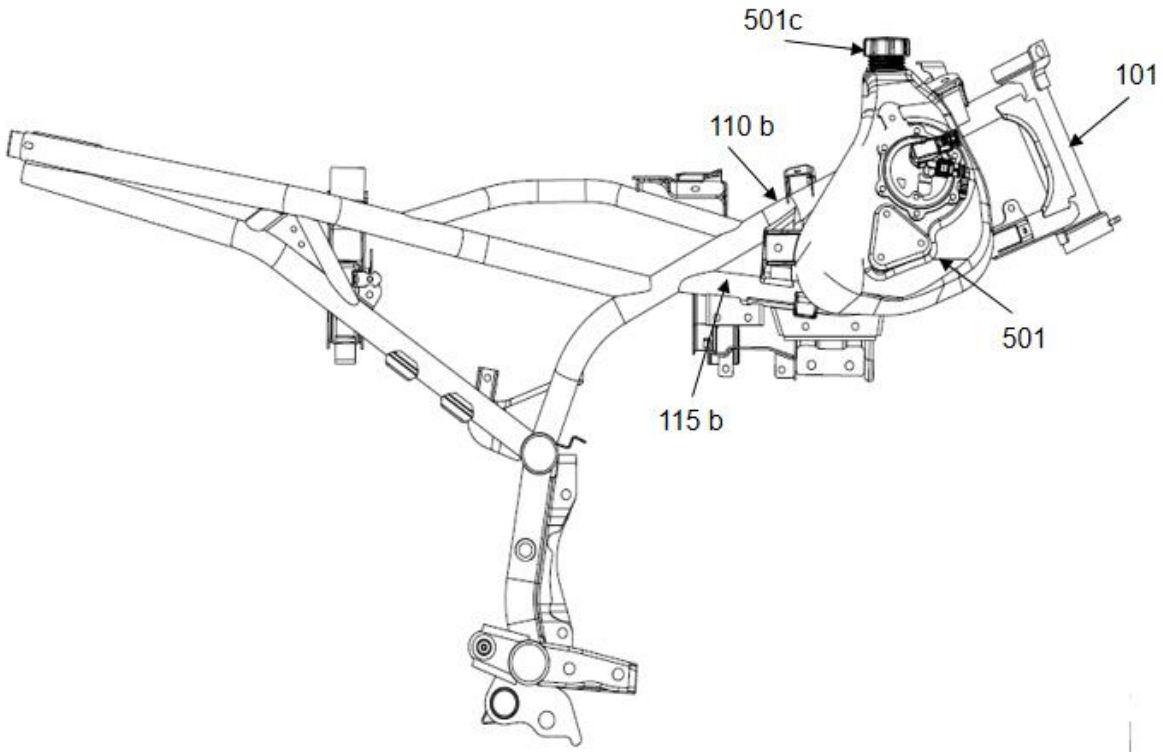

Figure 5c

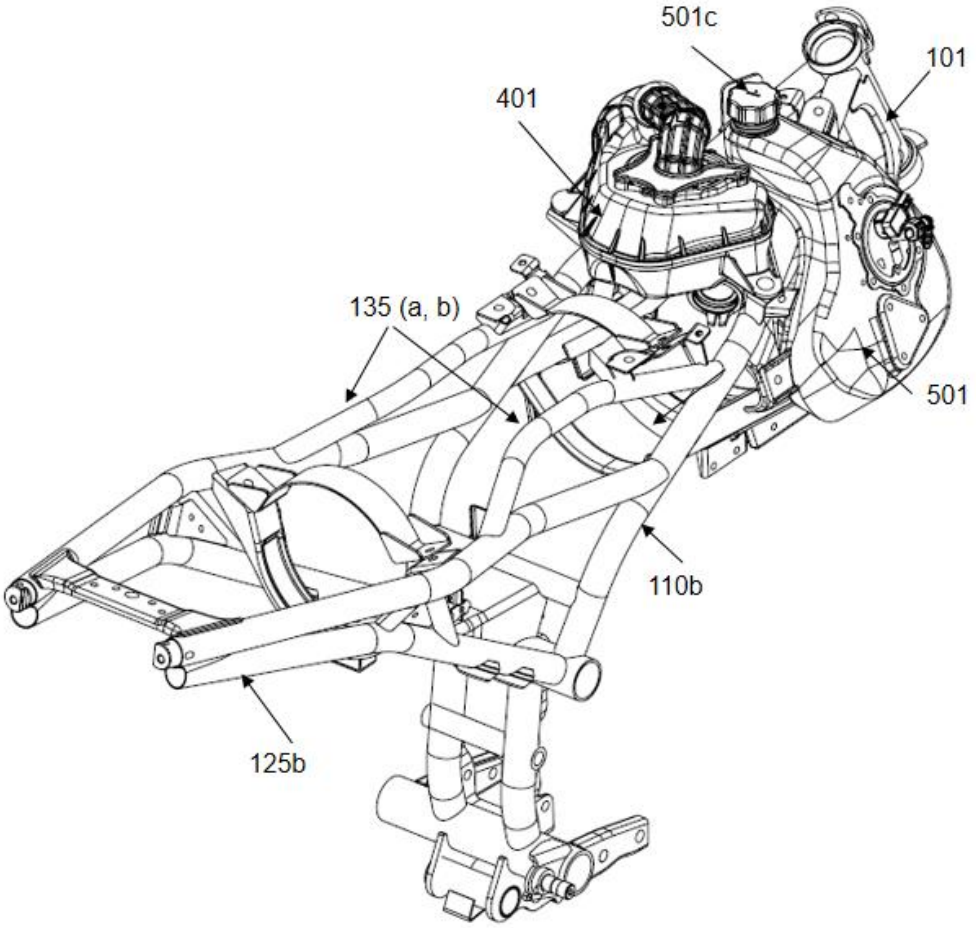

Figure 6a

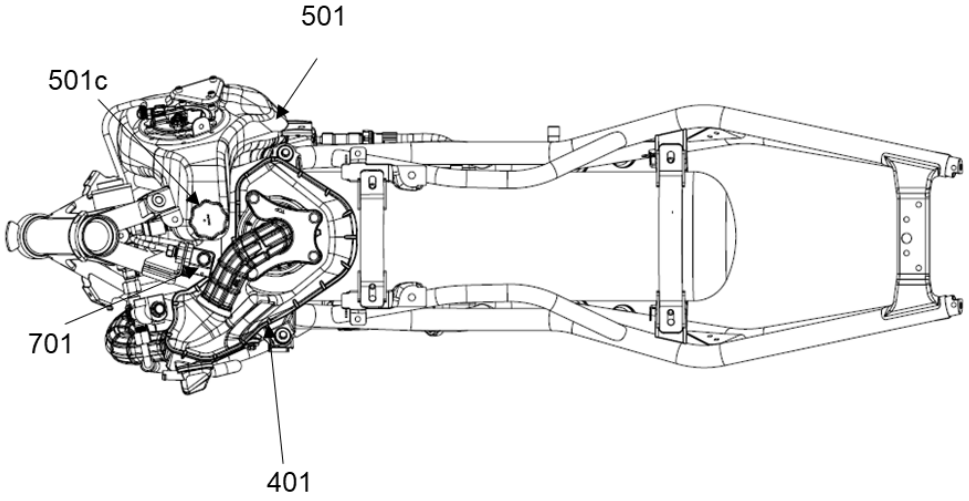

Figure 6b

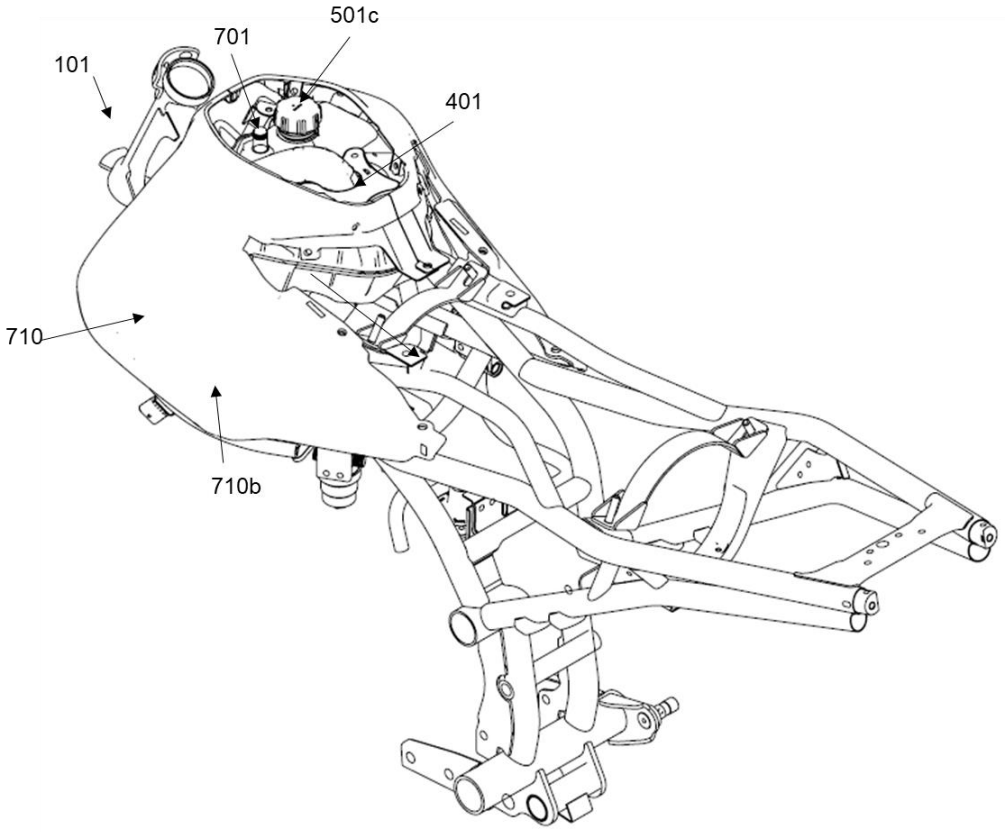

Figure 7a

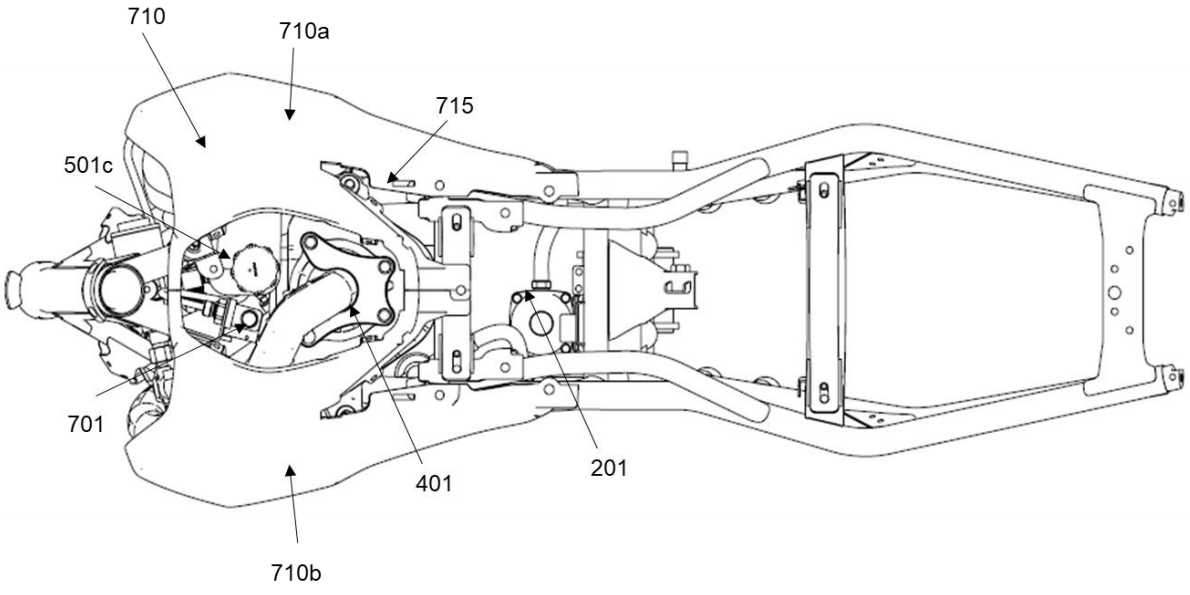

Figure 7b

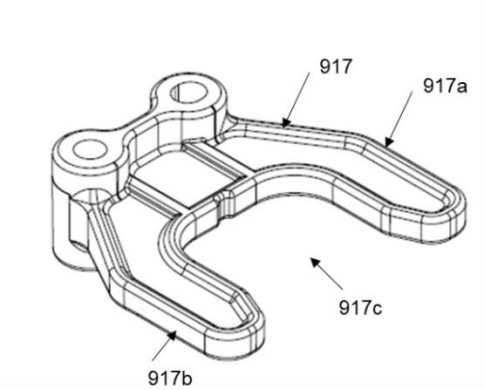

Figure 8a

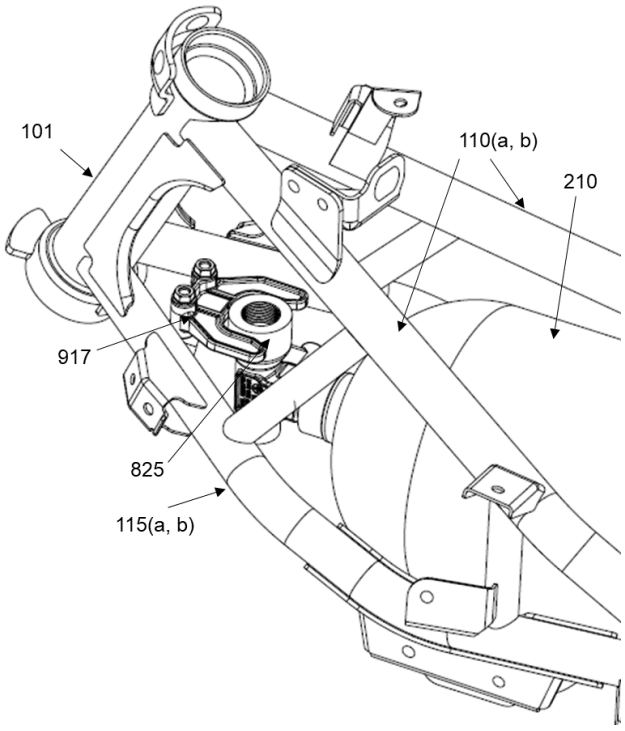

Figure 8b

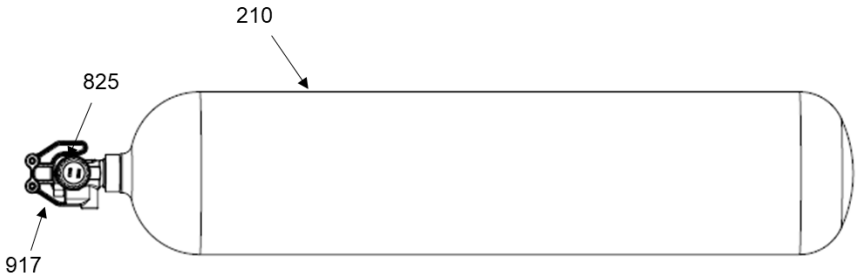

Figure 8c

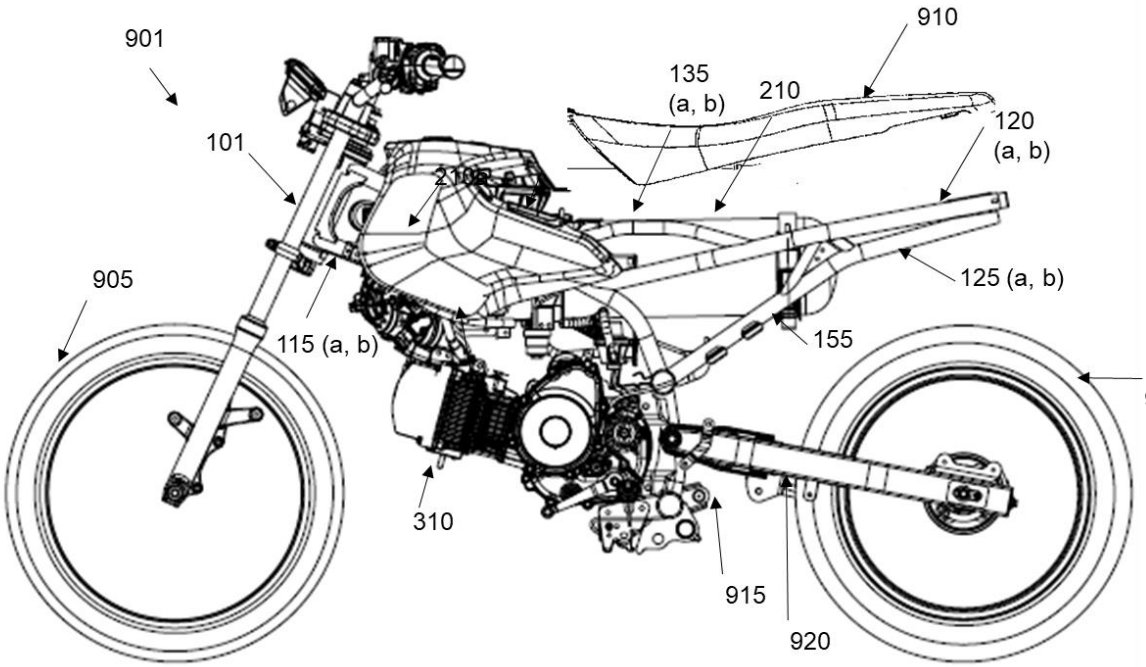
901
910
135
(a, b)
210
120
(a, b)
101
210a, b
905
125 (a, b)
115 (a, b)
155
907
310
915
920

Figure 9

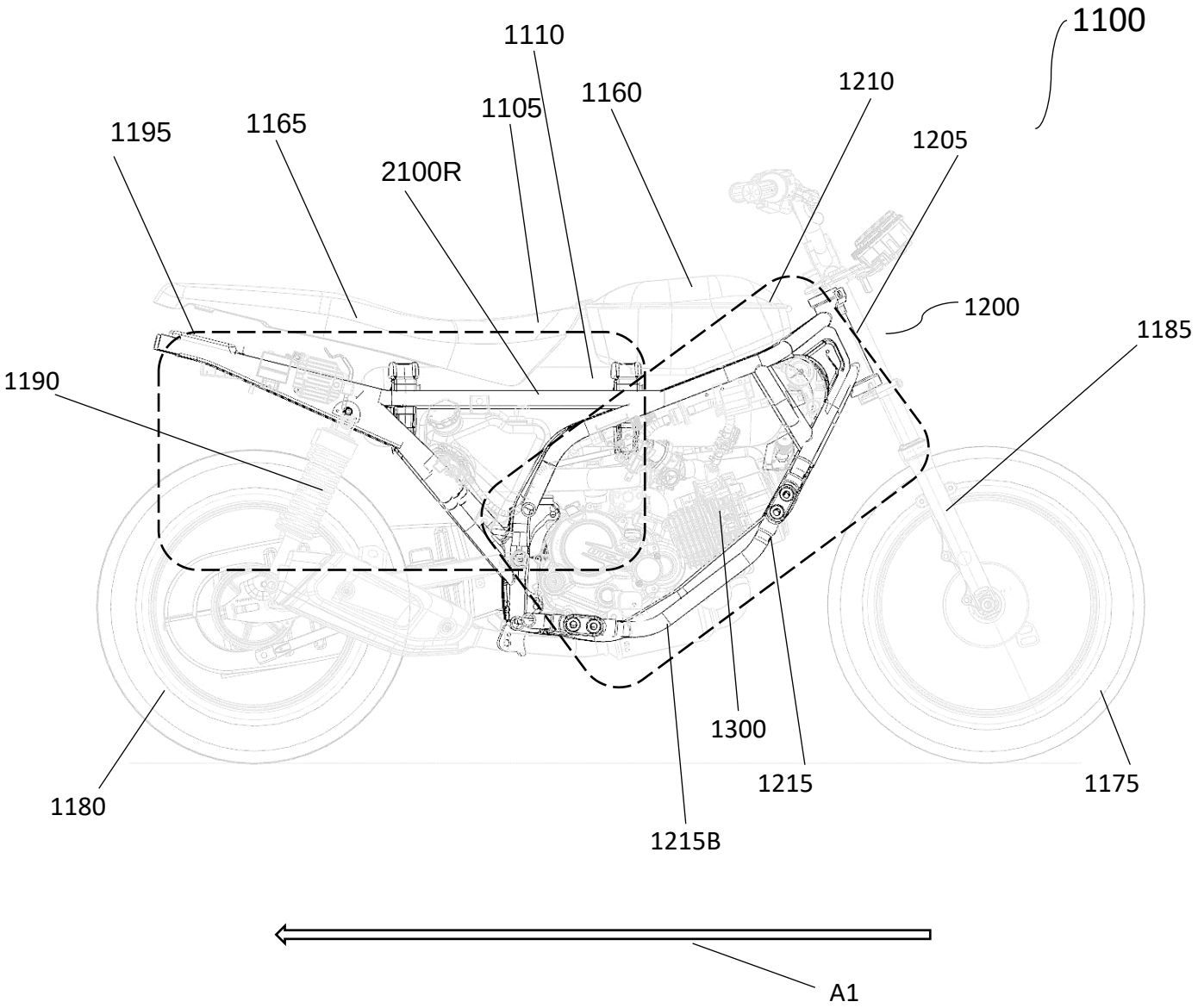
1100
1110
1105
1160
1210
1195
1165
2100R
1205
1200
1185
1190
1180
1300
1215
1175
1215B
A1

Figure 10

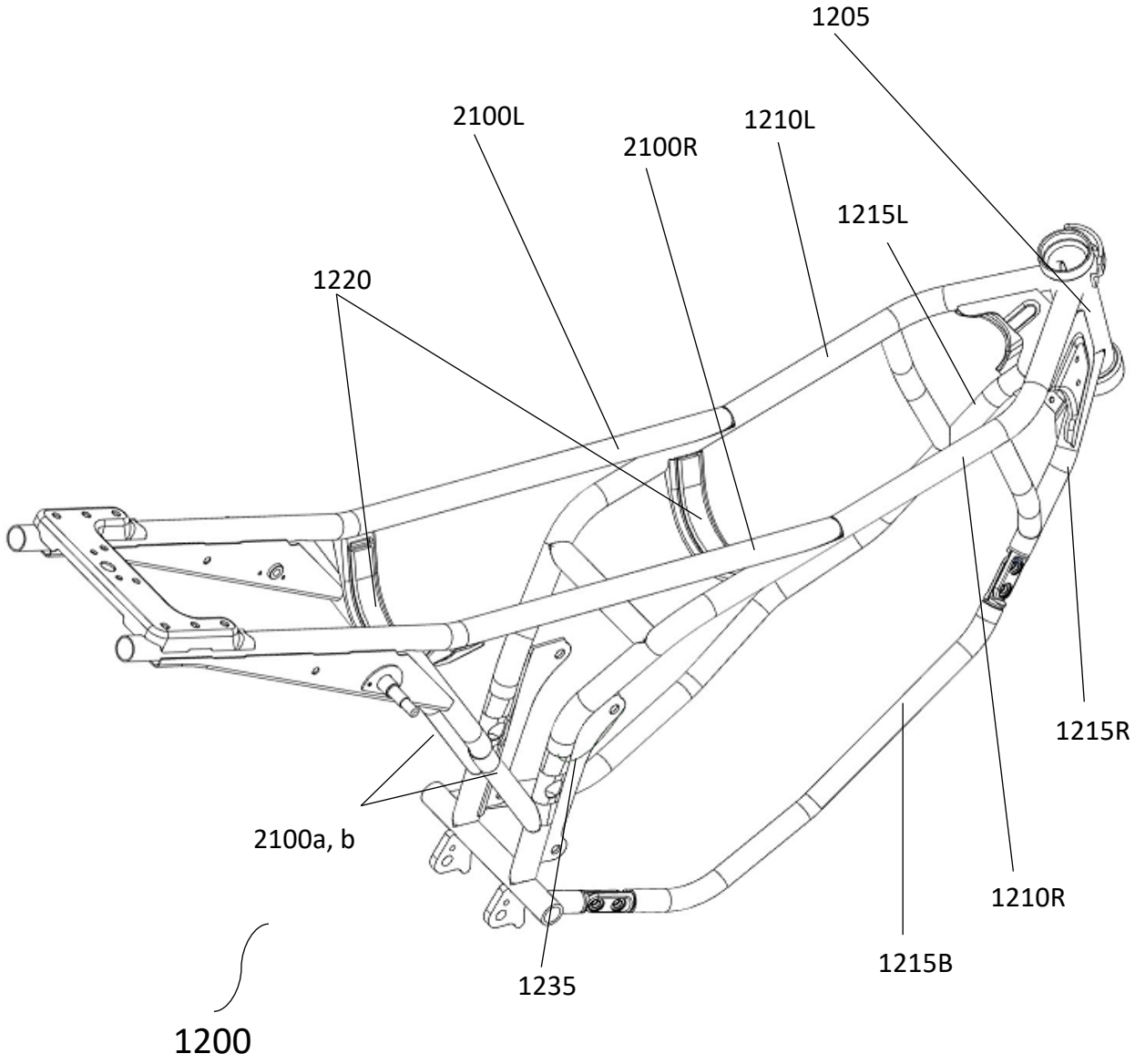
1205
2100L
1210L
2100R
1215L
1220
1215R
2100a, b
1210R
1215B
1235
1200

Figure 11

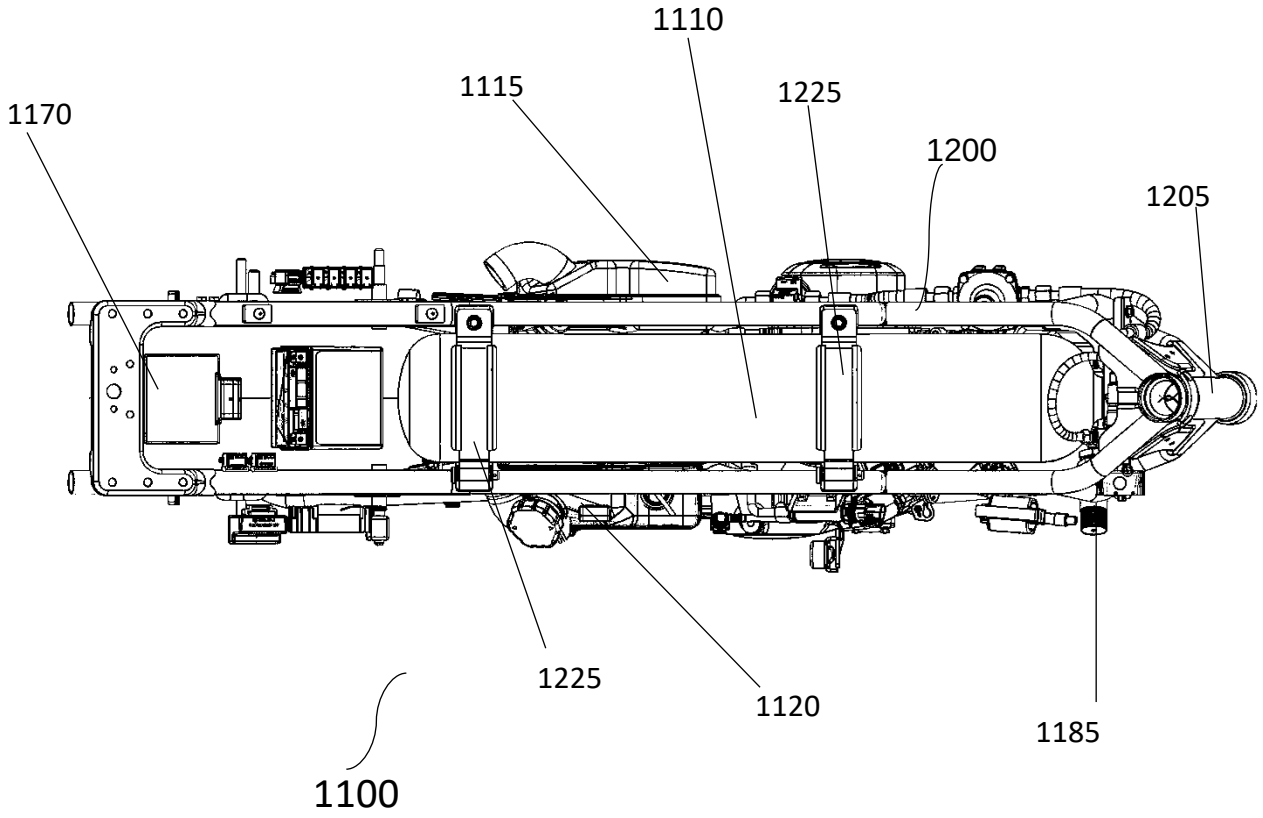

Figure 12

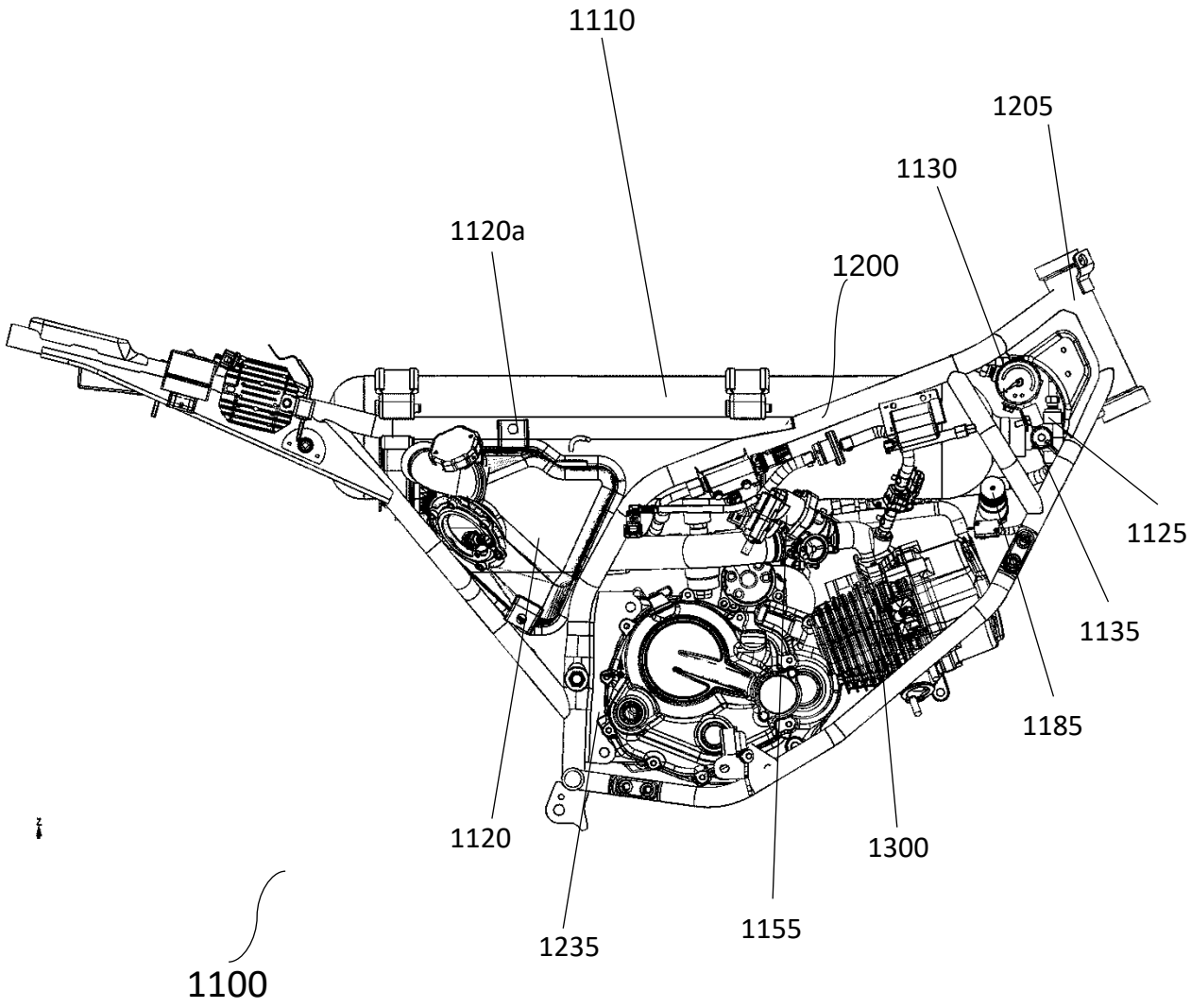
1110
1205
1130
1120a
1200
1125
1135
1185
1120
1300
1235
1155
1100

Figure 13

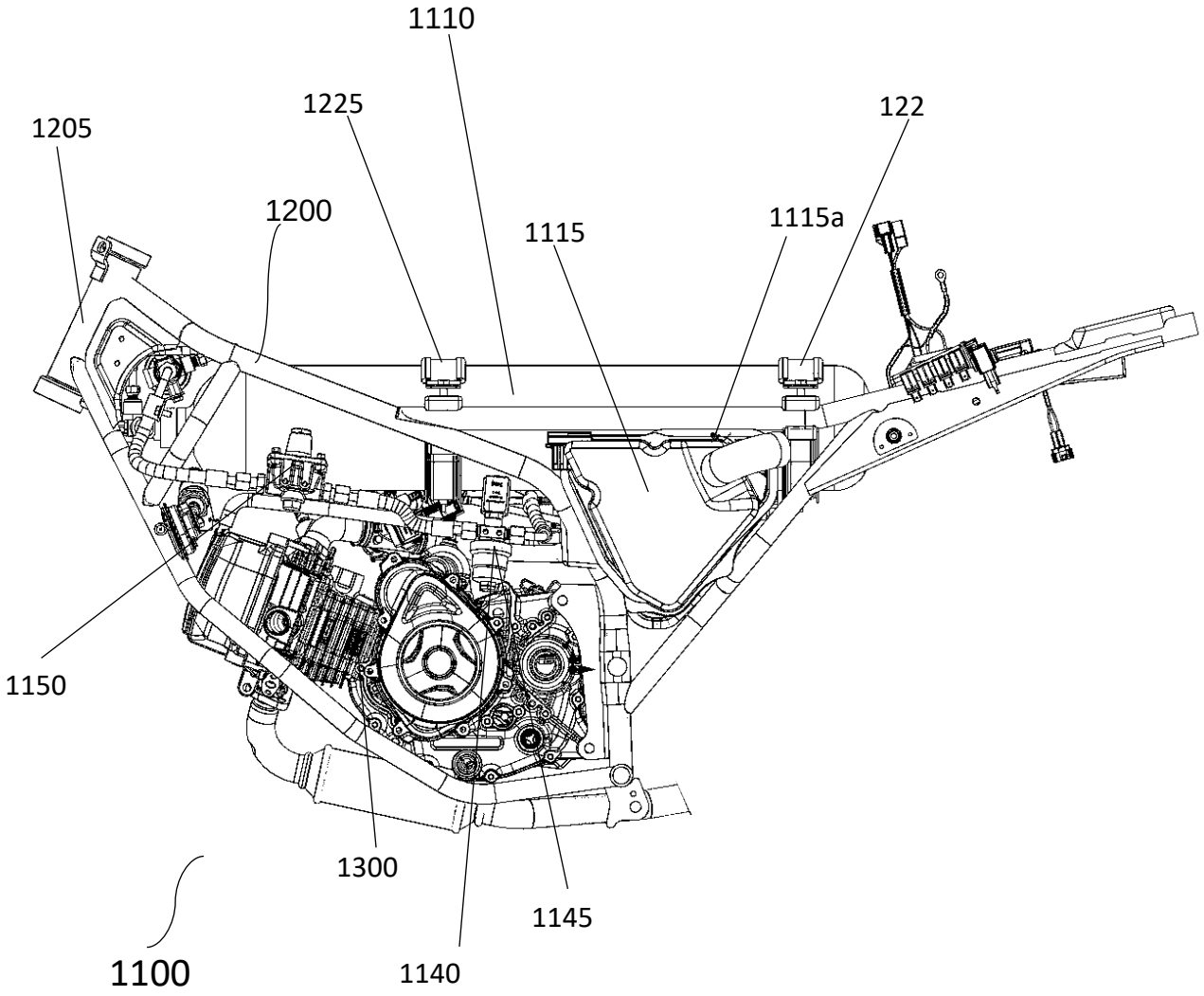

Figure 14

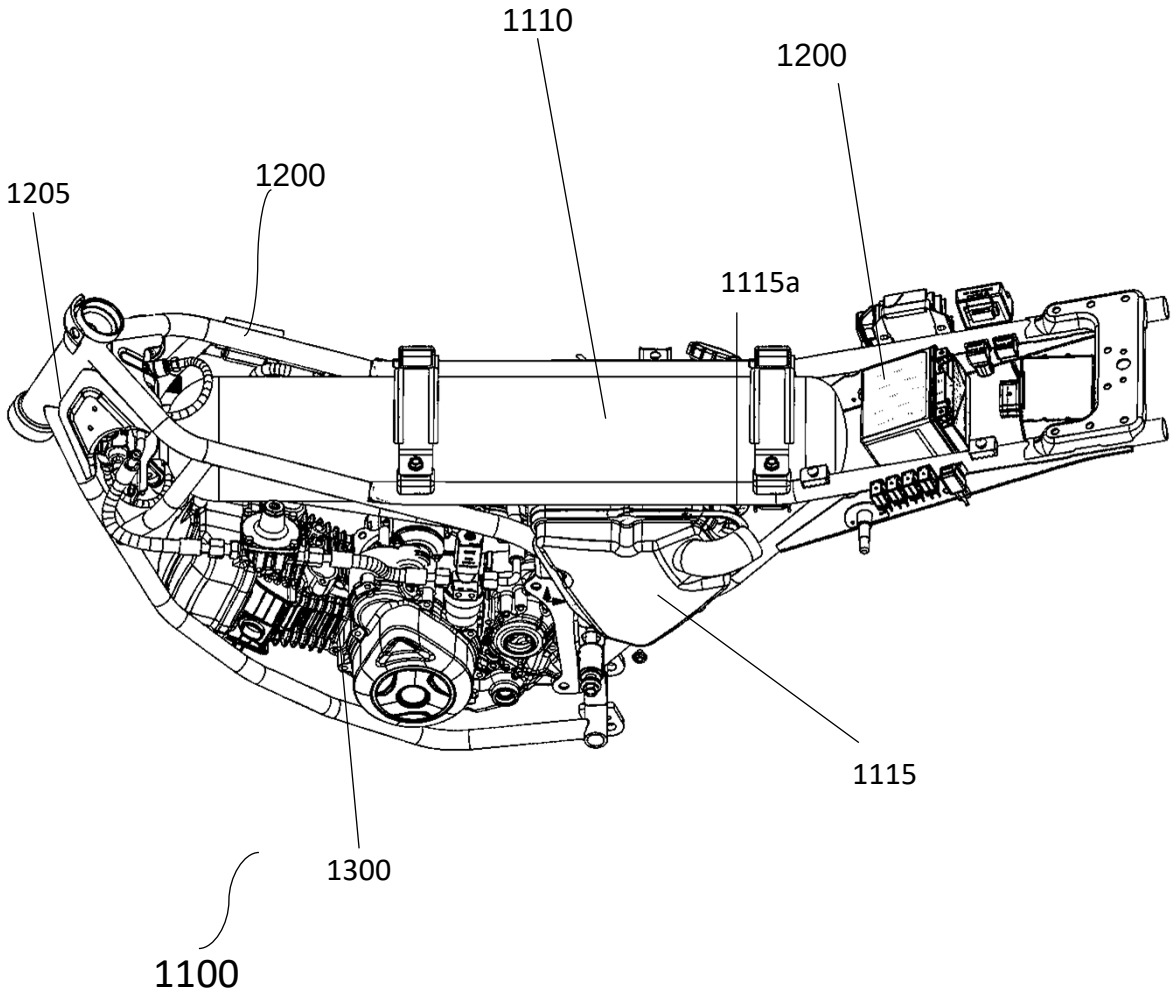

Figure 15

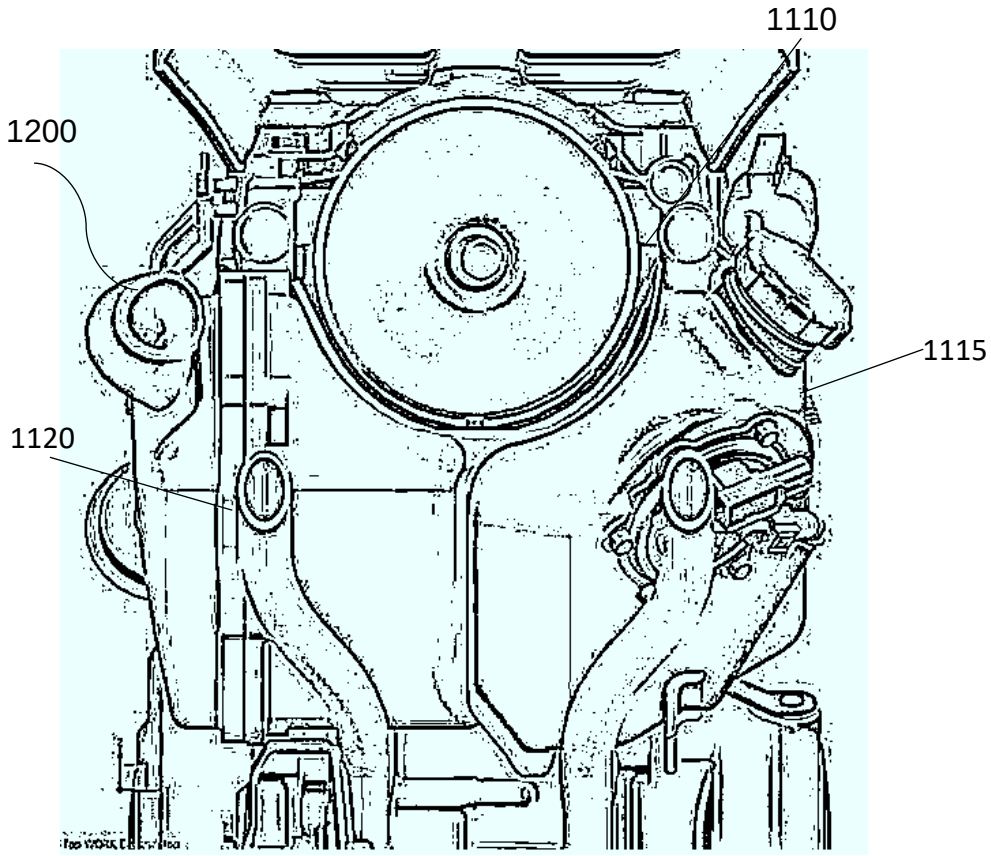

Figure 16

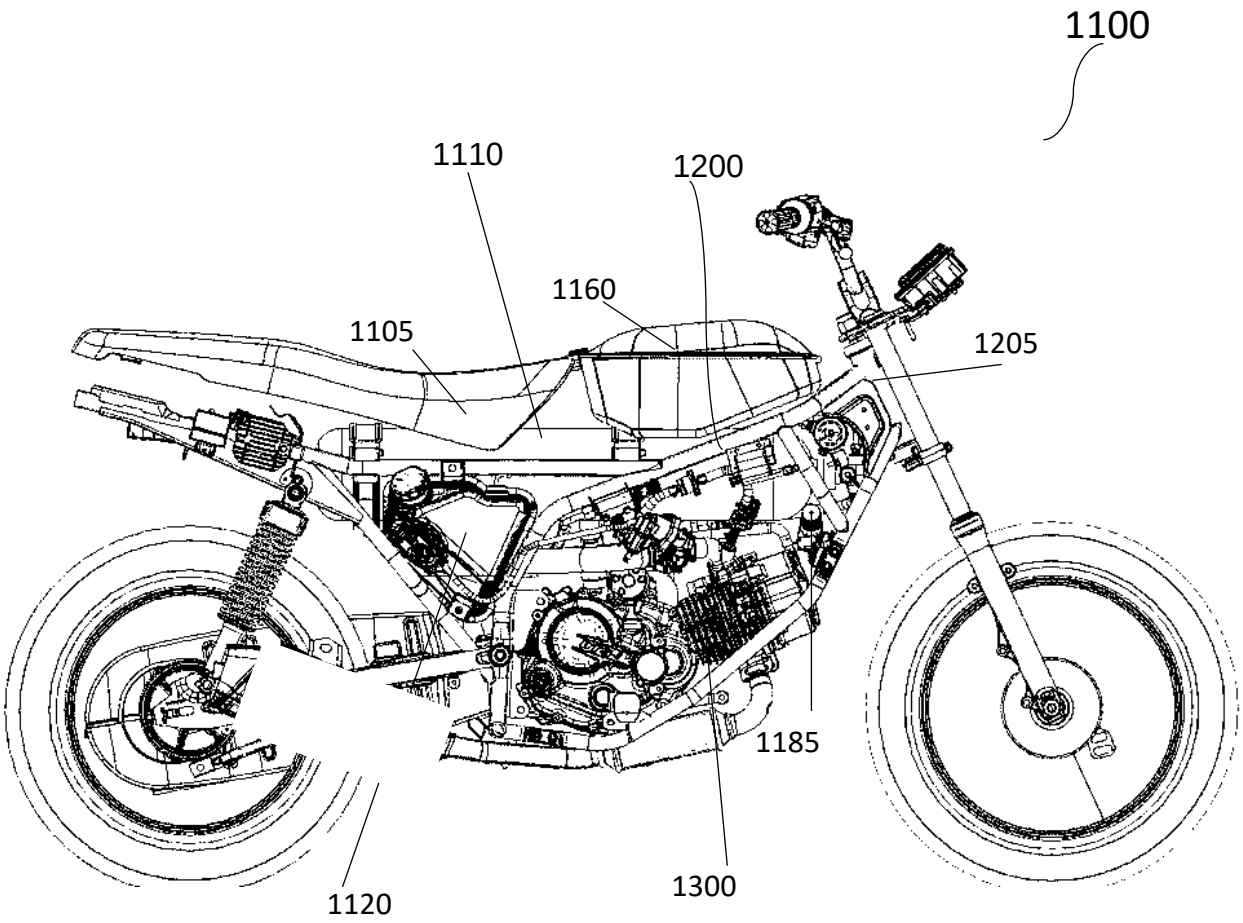

Figure 17