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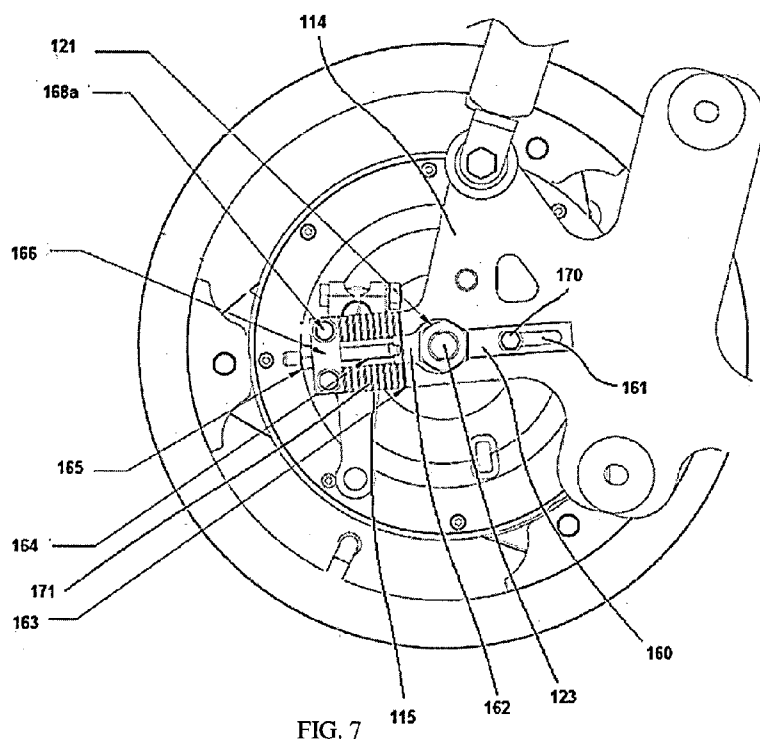
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[Continued on next page]

(54) Title: SWING ARM FOR A HYBRID VEHICLE



(57) Abstract: The present subject matter relates to a swing arm assembly for a scooter type motorcycle acting as a load carrying member and mounting an internal combustion engine (120). The swing arm assembly comprises a plurality of holding members (117) to route wiring harness (124) in the motorcycle with an electromechanical powertrain for improved vehicle safety and increase in durability of the wiring harness. The swing arm assembly is further operationally engaged with and supports a rear wheel adjuster unit (159) to adjust and align a rear wheel (102) with respect to the swing arm (110) and to adjust the chain or belt slack.



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SWING ARM FOR A HYBRID VEHICLE

FIELD OF THE INVENTION

[0001] The present invention relates generally to a two wheeled vehicle and more particularly, but not exclusively, to a body frame including a swing arm assembly for two wheeled vehicle.

BACKGROUND OF THE INVENTION

[0002] With dwindling non-renewable energy resources, the need to reduce fossil fuel consumption and emissions from vehicles powered by internal combustion engines is well known. One way to achieve the aforesaid goal is through an electrically driven vehicle. However, such a vehicle has greater body weight and shorter running distance per charge as compared to the conventional vehicles. Such drawbacks are overcome by hybrid vehicles, which utilize the advantages of an internal combustion engine and an electric traction motor into one vehicle. They provide great potential for reducing vehicle fuel consumption and emissions with no serious loss of vehicle performance or drivability.

[0003] A two wheeled scooter type vehicle generally has a swinging engine attached to a hub of a rear wheel as shown in FIG. 1. The swinging engine, in addition to driving the vehicle, also acts as a load carrying member as the rear suspension, muffler and center stand are directly supported on it. In such scooter type vehicle, the role of the engine as the load carrying member eliminates the need for a separate swing arm. However this construction may not be feasible in all scooter type vehicles, for example, in case of a scooter type hybrid vehicle. Generally, in such hybrid vehicles, the inclusion of engine, traction motor and battery demands a strong supporting body frame. Additionally, such vehicles demand optimal packaging of the engine and associated components as a bigger battery sufficient to power the the traction motor has to be accommodated.

[0004] Further, in such hybrid vehicles, the traction motor is connected to a controller, or to the battery, or to both through a wiring harness. The controller

controls the operation of the traction motor depending upon the drive conditions and user input. In an implementation where the traction motor is located proximately to the rear wheel, the wiring harness requires a specific route and support so that it is not damaged. Moreover, protection of wiring harness is also
5 important to prevent any electrical malfunctions or hazards.

SUMMARY OF THE INVENTION

[0005] The present subject matter is directed to overcome all or any of the problems as set forth above and thereby to obviate a lacunae in the prior art. It is, therefore, an object of the present subject matter to disclose a swing arm for a
10 scooter type motorcycle, preferably a scooter type motorcycle with electromechanical powertrain, to support the vehicle components including an internal combustion engine where the swing arm is the load carrying member. Yet another object of the present invention is to provide a swing arm assembly having a provision to route wiring harness connecting a traction motor to a controller, or
15 to battery, or to both for improved vehicle safety and increase in durability of the wiring harness.

[0006] To this end, the present invention discloses a swing arm assembly for a scooter type motorcycle comprising a swing arm having a first arm and a second arm, the first arm and the second arm further comprising a front portion, a
20 rear portion and a middle portion disposed between the front portion and the rear portion, wherein the front portion, the middle portion and the rear portion are integrally formed, and wherein the middle portion is nearer to the ground than the front portion and the rear portion. In an implementation of the present invention, a plurality of mounting brackets are disposed on cross members for mounting and
25 supporting an internal combustion engine over the swing arm, the swing arm being the load carrying member in the motorcycle. According to an aspect of the present invention, either the first arm, or the second arm, or the first arm and the second arm of the swing arm assembly, comprise a plurality of holding members on an outer surface for supporting wiring harness on the swing arm.

[0007] According to another aspect of the present invention, the first arm and the second arm are operatively engaged with and support a rear wheel adjuster unit for aligning a rear wheel substantially perpendicular to the first arm and the second arm. The rear wheel adjuster unit further comprises a movable adjuster plate having a central groove, a guide member comprising a second marking reference, a threaded adjusting screw connected to the adjuster plate through the guide member, an adjuster nut, a constrained adjuster block having a through opening for allowing the passage of the adjusting screw. The adjuster unit aligns a rear wheel with respect to the first arm and the second arm by operation of the adjuster nut in the first arm and the second arm when the second marking reference of the guide member matches the same marking reference in a first set of marking references provided on the rear portion above and below the one side open groove in both the first arm and the second arm.

[0008] The foregoing objectives and summary is provided to introduce a selection of concepts in a simplified form, and is not limiting. To fully appreciate these and other objects of the present subject matter as well as the subject matter itself, all of which will become apparent to those skilled in the art, the ensuing detailed description of the subject matter and the claims should be read in conjunction with the accompanying drawings.

20 BRIEF DESCRIPTION OF DRAWINGS

[0009] The above and other features, aspects and advantages of the subject matter will be better understood with regard to the following description, appended claims and accompanying drawings where:

FIG. 1 shows a side view of a typical scooter type motorcycle according to prior art.

FIG. 2 shows a side view of a swing arm assembly installed on a scooter type hybrid vehicle according to the present invention.

FIG. 3 shows a side view of a rear portion of the motorcycle.

FIG. 4 shows a first arm of a swing arm of the swing arm assembly.

FIG. 5 shows a second arm of the swing arm of the swing arm assembly.

FIG. 6 shows a side view of the rear portion of the motorcycle with a transmission chain cover.

FIG. 7 shows a side view of a rear wheel adjuster unit installed in the second arm.

5 FIG. 8 shows an exploded view of the rear wheel adjuster unit.

DETAILED DESCRIPTION OF THE INVENTION

[00010] The present invention discloses a scooter type motorcycle, preferably having an electromechanical powertrain, in which a swing arm assembly mounts an internal combustion engine and acts as the load carrying member. The swing arm assembly of the present subject matter provides a mounting arrangement for the internal combustion engine ensuring that the engine is not acting as a stressed member and the stresses from the vehicle chassis and the suspension device are not transmitted on to the engine. Further, the proposed swing arm assembly also ensures that the engine vibrations are not transmitted directly to the vehicle chassis. More further, the swing arm assembly is capable of accommodating one or more type of engines ranging from a forced air cooled engine, horizontal engine, vertical engine etc. without having to undergo any constructional modification. Additionally, the present swing arm assembly helps in reducing material cost by enabling reduced usage of material for manufacturing the swing arm assembly.

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[00011] According to an aspect, the swing arm assembly provides provisions for supporting a wiring harness originating from a rear portion of the motorcycle on the swing arm. In an embodiment, the scooter type motorcycle includes a traction motor disposed in a hub of the rear wheel. The traction motor is connected to the controller or to the battery or to both through the wiring harness. The wiring harness is supported on the swing arm through a plurality of holding members on an outer surface and spaced apart from each other. Further, the holding members are disposed either on the first arm, or on the second arm, or on the first arm and the second arm.

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[00012] A rear wheel adjuster unit is secured to and operationally engaged with the swing arm through which a shaft of the rear wheel is substantially aligned to the first arm and the second arm of the swing arm assembly. The rear wheel is operationally connected to the engine at a fixed distance through a chain or belt drive. The adjuster unit adjusts and maintains the chain or belt in proper tension without any undesirable slackness.

[00013] The present subject matter would now be described in greater detail in conjunction with the figures in the following description. **FIG. 2** shows a side view of the concerned hybrid vehicle. The vehicle has body frame assembly made up of several tubes welded together which usually supports the body of the said vehicle. The vehicle has a steerable front wheel **101** and a driven rear wheel **102**. The body frame assembly of the vehicle is an elongated structure, which typically extends from a forward end to a rearward end of the vehicle. It is generally convex in shape, as viewed from a side elevational view. The said frame assembly includes a head tube (not shown), a main frame **108** and may also have a sub-frame. The sub-frame is attached to the main frame using appropriate joining mechanism. The frame assembly is covered by a plurality of vehicle body covers including a front panel **105**, a leg shield **141**, an under seat cover **143** and a side panel **106**.

[00014] A handlebar assembly **150** and a seat assembly **142** are supported at opposing ends of the frame assembly and a generally open area is defined there between known as floorboard **140** which functions as a step through space. The seat for a driver and a pillion is placed forward to a fuel tank and rearwardly of the floorboard **140**. A front fender **103** is provided above the front wheel **101** to avoid the said vehicle and its occupants from being splashed with mud. Likewise, a rear fender **104** is placed between fuel tank and rear wheel **102**, and to the outer side in the radial direction of rear wheel **102**. Rear fender **104** inhibits rain water or other impurities from being thrown up by rear wheel **102**.

[00015] Suspensions are provided for comfortable steering of the vehicle on the road. A front suspension assembly (not shown) is connected to a front fork

107 while the rear suspension assembly is a hydraulic damped arrangement and is connected to the body frame. The rear suspension assembly comprises of at least one rear suspension **131** preferably on the left side of the vehicle. However, a vehicle with two rear suspensions (**131**, **132**), namely on the left side and the right side is also possible. For the safety of the user and in conformance with the traffic rules, a headlight **136** in the front portion of the vehicle and a taillight **137** in the rear portion of the vehicle is also included.

[00016] **FIG. 3** shows a side view of a rear portion of the motorcycle. In a preferred embodiment, the scooter type motorcycle has an electromechanical powertrain including an internal combustion engine **120** and an electrical traction motor **122** as drive sources. In an embodiment, the engine is a four stroke single cylinder engine. The engine **120** is disposed substantially forwardly of the rear wheel **102**. The traction motor **122** is powered by a battery **126** whereas the engine **120** is cranked by a starter motor (not shown) powered by the battery. In an embodiment, the battery **126** includes a lithium ion battery and provides 48 V of electromotive force. A controller **125** controls the flow of power in the motorcycle. The rear wheel **102** is driven by driving force generated by either the engine **120** or the traction motor **122** or both. The power from the engine **120** is delivered to the rear wheel **102** through a transmission system. The engine **120** is arranged horizontally, that is, its crankshaft is placed at right angles to the longitudinal direction of the vehicle body. In a preferred embodiment, the traction motor **122** is coupled to a hub **127** of the rear wheel **102**. The direct coupling of traction motor **122** to the rear wheel hub **127** outside the engine crankcase saves space and prevents transmission losses due to absence of any gear reduction. The hub **127** moves around a wheel shaft **123** passing axially through the hub.

[00017] The controller **125** is further configured to operate the vehicle in a plurality of operating modes. A vehicle user can select any of the operating modes for operating the vehicle and/or switch between the operating modes. The selected mode is displayed on a display panel of the hybrid vehicle. The controller **125** starts the motor **122** or the engine **120** or both according to the mode selected by

the user. In case no mode is selected, the controller starts the vehicle in default (pre-selected) mode.

[00018] As shown in FIG. 2, the scooter type motorcycle comprises a swing arm assembly to provide strength and support to the body frame. The swing arm assembly comprises of a swing arm 110 having at least two arms, a first arm 111 and a second arm 112 as shown in FIG. 3 and FIG. 5. In an embodiment, the first arm 111 is disposed on a left side of the vehicle whereas the second arm 112 is disposed on a right side. In an implementation, the first arm 111 and the second arm 112 are not identical but disposed approximately parallel to longitudinal axis of the motorcycle.

[00019] FIG. 4 shows the first arm 111 in detail. The first arm 111 further comprises of a front portion 113, a rear portion 114 and a middle portion 146 disposed between the front portion 113 and the rear portion 114. When viewed from the motorcycle front direction, the front portion 113 is followed by middle portion 146 and then the rear portion 114. In an embodiment, the front portion 113, the middle portion 146 and the rear portion 114 are integrally formed with the first arm 111. The front portion 113 is connected to a toggle link assembly 109 which connects the swing arm 110 to the main frame 108 of the motorcycle. The connection is by way of a bracket or bosses or similar mechanical means. The rear portion 114 is connected to one end of the rear suspension 131 and supports the wheel shaft 123.

[00020] According to a feature of the present invention, the middle portion 146 of the first arm 111 is nearer to the ground than the front portion 113 and the rear portion 114. Therefore, the middle portion 146 is not in a straight line with respect to the front portion and the rear portion. In an embodiment, the middle portion 146 of the left arm 112 is curved. In another embodiment, the middle portion 146 is arcuate in shape. In yet another embodiment, the middle portion 146 is bent in shape. The lower ground height of the middle portion 146 than the front portion 113 and the rear portion 114 gives the swing arm the ability to

optimally mount the internal combustion engine **120** while circumventing any space constraints.

[00021] The construction of the second arm **112** is broadly similar but not identical to the first arm **111**. Both the arms have same length in the longitudinal direction and the middle portions of both the arms are at same height from the ground. However, for the purpose of clarity, the second arm is explained again. The second arm **112** is shown in **FIG. 5**. Similar to the first arm, the second arm has a front portion **113** connected to the toggle link assembly **109**, a rear portion **114** connected to one end of the rear suspension **132** and supporting the wheel shaft **123**, and a middle portion **146** disposed between the front portion **113** and the rear portion **114**. The middle portion **146** of the second arm **112** is nearer to the ground than the front portion **113** or the rear portion **114**. It can be curved, bent or arcuate in shape. The first arm **111** and the second arm **112** are connected to the hub **127** of the rear wheel on opposite sides. Further, as shown in **FIG. 10**, the first arm **111** is connected to the second arm **112** through a plurality of cross members **148a**, **148b**, **148c** to develop into the swing arm **110**. The cross members **148a**, **148b**, **148c** laterally separate the first arm **111** and the second arm **112** from each other. In an implementation, the cross members are cross tubes. In another implementation, the cross members are cross plates.

[00022] The rear portion **114** of the first arm **111** comprises at least one suspension mounting bracket **118** coupled to the rear portion **114** for mounting one end of the rear suspension **131** (**FIG.4**). To connect the swing arm **110** to the rear wheel **102**, the rear portion **114** also comprises at least one side open groove **152** at an end portion **115** for supporting the wheel shaft **123**. The one side open groove is open from one side in longitudinal direction and hence the wheel shaft **123** can be slid into it. The groove however is closed from the other side. The rear portion **114** of the second arm **112** comprises similar suspension mounting bracket **118** for mounting one end of the rear suspension **132** and also comprises the one side open groove **152** at its end portion for supporting the wheel shaft **123**.

[00023] The rear portion **114** of the first arm **111** and the second arm **112** is substantially triangular in shape with a saving groove **153** in between the triangle. The triangular shape is provided so that the rear portion **114** is easily connected to the respective rear suspension (**131** or **132**) as well as the wheel shaft **123** without taking much space. It also ensures that the rear suspension **131** or **132** and the wheel shaft **123** maintain adequate distance from each other. The distance allows some space to access the rear suspension without disturbing an exhaust device and vice versa. The saving groove **153** ensures that the rear portion consumes less fabricating material.

10 [00024] According to another feature of the present invention, a plurality of mounting brackets **149-1**, **149-2**, **149-3** are provided in the swing arm assembly for mounting and supporting the internal combustion engine **120** over the swing arm **110** (shown in **FIG. 4** and **FIG. 10**). These mounting brackets are disposed on at least one cross member from the plurality of cross members. In one
15 embodiment, they are disposed on at least two cross members from the plurality of cross members. For example, the first cross member **148a** includes a first engine mounting bracket **149-1** for mounting the front portion of the engine **120** to the swing arm **110**. Similarly, the second cross member **148c** includes a second mounting bracket **149-2** and a third engine mounting bracket **149-3** spaced apart
20 from each other for mounting the rear portion of the engine **120** to the swing arm **110**. The mounting brackets optimally mount the engine on the cross members of the swing arm and thus, in the scooter type motorcycle, the swing arm functions as the load carrying member. The engine itself is not a load carrying member. The swing arm effectively absorbs the vibrations originating from the engine so that
25 they are not transferred to main frame **108**.

[00025] The motorcycle also comprises an exhaust device (not shown) connected to the engine **120** only on one side of the motorcycle. In an embodiment, the exhaust device is located on the right side of the vehicle. The second arm **112** therefore further comprises of a set of exhaust device mounting
30 brackets **130**, **130** for mounting and supporting the exhaust device on the vehicle.

As shown in **FIG. 5**, the exhaust device mounting brackets **130** are disposed in the rear portion **114** of the second arm **112** and are disposed forwardly of the suspension mounting bracket **118**. To accommodate the exhaust device mounting brackets, the rear portion of the second arm forwardly of the suspension mounting bracket is extended or protruded in vertical direction. In an embodiment, rear portion of the second arm is extended vertically up and vertically below. In case of the motorcycle where the exhaust device is located in the left direction, the rear portion **114** of the first arm **111** is modified and is made to include the exhaust device mounting brackets as aforementioned.

10 [00026] According to another aspect, the first arm **111** and the second arm **112** of the swing arm in the present invention have a non-hollow, metal plate like structure. Thus, they have a rectangular cross section when sectioned in a vertical direction. This structure provides strength to the swing arm while consuming less space than a tube like configuration. It also allows more attachment structures in
15 the swing arm like brackets, fasteners without loss of its strength and rigidity.

[00027] Further, in the motorcycle, the traction motor **122** disposed on the hub **127** of the rear wheel **102** draws power from the battery **126** when instructed by the controller **125**. As shown in **FIG. 3**, a wiring harness **124** connects the controller **125** to the traction motor **122**. However, in another embodiment, the
20 traction motor **122** can also be connected to the battery or to the controller or to both by the same wiring harness having different wires for this purpose. Since the controller **125** is not present near the rear wheel **102**, the length of the wiring harness is long. The wiring harness is therefore supported on the swing arm **110** so that it does not fall off the motorcycle. To this end, either the first arm **111** or
25 the second arm **112**, or the first arm **111** and the second arm **112** comprise(s) a plurality of holding members **117** on an outer surface for supporting wiring harness **124** on the swing arm **110**. As shown in **FIG. 4**, the holding members **117** are spaced apart from each other. In a preferred embodiment, the holding members **117** are provided on the first arm **111**. In one embodiment, the outer
30 surface of the first arm (or the second arm) is the surface facing the rear wheel

102. In another embodiment, the outer surface of the first arm (or the second arm) is the surface not facing the rear wheel 102 and thus the wiring harness is visible to an onlooker. The wiring harness 124 is thus routed along the swing arm by the holding members 117. Some portion of the wiring harness 124 is not visible to an
5 onlooker as it is suspended behind the rear panel 106.

[00028] According to an aspect, the holding members 117 are welded to the outer surface of either arm of the swing arm so that the connection is strong. In one embodiment, the holding members are integrally formed with the swing arm. In a further embodiment, each holding member is a hook to support and clamp the
10 wiring harness so that it is held within the holding members and does not move out during the motorcycle operation.

[00029] FIG. 6 shows the rear portion of the scooter type motorcycle with a transmission chain cover 144 which prevents the rear wheel chain from gathering dust, water or other undesirable impurities. A provision for mounting
15 the transmission chain cover 144 is provided in at least one arm of the swing arm 110 as shown in FIG. 4. The provision is in the form of a protruding plate 154 with a threaded receiving opening. In an embodiment, a plurality of such protruding plates is provided in the swing arm depending upon the construction of the transmissison chain cover 144. Additionally to this, as is seen in FIG. 6, the
20 swing arm also supports a centre stand 145 and carries its load when the side stand is in unused position. A side stand can also be supported from such swing arm.

[00030] Since the swing arm 110 is the load carrying member, the rear wheel shaft 123 is supported on the rear portion of the both arms of the swing
25 arm. In an embodiment as shown in FIG. 7, the one side open groove 152 is provided in the end portion 115 of the rear portion 114 of the first arm 111 and the second arm 112. The end portion 115 is integrally formed with the swing arm or is welded to the rear portion as a separate part. The rear wheel shaft 123 is slid into the one side open groove 152 of respective arms 111, 112 and is thus jointly
30 supported on the swing arm. The rear wheel 102 is secured to the first arm and the

second arm through a wheel nut **121**. However, the alignment of the rear wheel **102** with respect to first arm **111** and second arm **112** of the swing arm is important else it would lead to variable load distribution on the swing arm. Further, after servicing of the rear wheel, when it is assembled and secured to the swing arm, the alignment should be precise. The rotating axis of rear wheel shaft should be substantially perpendicular to the first and second arm of the swing arm. Also since the transmission is a chain drive or a belt drive, the chain or belt may develop slackness or tension.

[00031] Therefore, according to another feature of the present invention, the first arm and the second arm of the swing arm are operatively engaged with a rear wheel adjuster unit to adjust the slack and substantially align the rear wheel with the swing arm. The rear wheel is operationally connected to the engine at a fixed distance through the chain or belt drive. The adjuster unit maintains the chain or belt in proper tension without any undesirable slackness. The rear wheel adjuster unit is supported on the rear portion **114** of the first arm **111** as well as the second arm **112** and is now explained with the help of **FIG. 7** and **FIG. 8**. Since the construction is similar, therefore the rear wheel adjuster unit is explained with the help of the first arm. A second rear wheel adjuster unit is secured to and operationally engaged with the second arm. The rear wheel adjuster unit **159** comprises of an adjuster plate **160**, a guide member **162**, a threaded adjusting screw **164** connected to the adjuster plate **160** through the guide member **162**, an adjuster nut **165** to operate the adjusting screw **164** and an adjuster block **166**.

[00032] The adjuster plate **160** has a central groove **161** through which the adjuster unit **159** is supported on the rear portion **114**. Precisely, the adjuster plate is supported on the rear portion **114** of the first arm **111** through a first fastener **169** passing through the rear portion **114** and the central groove **161**. An end nut **170** secures the adjuster plate against the swing arm. The fastener holds the adjuster plate **160** against the rear portion. The adjuster plate **160** also includes a wheel shaft opening **174** through which the rear wheel shaft **123** passes during the

assembly of the rear wheel **102**. The wheel shaft opening **174** is integrally formed with the adjuster plate **160**.

[00033] The adjuster block **166** is a T-shaped structure and has a through opening **167** for allowing the passage of the adjusting screw **164** through itself.

5 The adjuster block **166** is detachably secured to the end portion **115** of the rear portion **114**. One portion of the T-shaped structure goes in and rests within the one side open groove **152**. The other portions are immovably secured to the end portion of the swing arm through a second set of fasteners **168a**, **168b** passing through the adjuster block and the recesses provided in the end portion for this
10 purpose.

[00034] The adjusting screw **164** passes through the adjuster block **166** through the through opening **167** and protrudes towards the rear direction of the motorcycle. In an embodiment, the adjuster plate **160**, the guide member **162** and the threaded adjusting screw **164** are integrally formed extending in a longitudinal
15 direction. Further, the rear wheel adjuster unit **159** is operated by the adjuster nut **165**. Thus, any operation of the adjuster nut over the adjusting screw **164** moves the adjuster plate **160** and consequently the rear wheel shaft **123** which passes through the wheel shaft opening **174** of the adjuster plate **160**. The adjuster plate is movable in the longitudinal direction as its lateral movement is withheld by the
20 first fastener **169** and the end nut **170**. The adjuster plate **160** can move as much as the length of the central groove **161**.

[00035] The adjuster nut **165** can be tightened or loosened to move the adjuster plate **160** along the central groove **161** and consequently the rear wheel shaft **102**. The second arm **112** of the swing arm is provided with an identical rear
25 wheel adjuster unit. To align the rear wheel shaft substantially perpendicular to the first arm and the second arm, a marking reference system is provided. A first set of marking references **171** is provided on the rear portion of both the arms. Specifically, the first set of marking references **171** is provided on the end portion **115** of the rear portion **114** above and below the one side open groove **152**. The
30 first set of marking references **171** has a plurality of vertical lines equally spaced

apart from each other. The guide member **162** comprises a second marking reference **163**. The second marking reference **163** is preferably a single vertical line.

[00036] To align the rear wheel **102** with respect to the first **111** and the
5 second arm **112**, the adjuster nut **165** is first operated over the adjusting screw **164**
protruded from the adjuster block **166**. The adjuster block **166** does not move
longitudinally as it is constrained by the second set of fasteners **168a**, **168b**. The
torque is therefore transferred to the guide member **162** which passes it to the
adjuster plate **160**. The adjuster plate **160** moves along the central groove **161**
10 which moves the wheel shaft opening **174** and consequently the rear wheel shaft
123. All movements happen in longitudinal direction as lateral movements are
either not possible or are arrested. When the second marking reference **163** of the
guide member **162** matches the same marking reference in the first set of marking
references **171** in both the first arm **111** and the second arm **112**, the rear wheel is
15 aligned perpendicularly to the swing arm. To carry out the alignment, the wheel
nut **121** has to be loosened first.

[00037] As explained earlier, the rear wheel adjuster unit **159** is supported
on the rear portion through the adjuster plate **160** and the adjuster block **166**
wherein the adjuster plate **160** is secured to the rear portion through the first
20 fastener **169** passing through the rear portion **114** and the central groove **161**, and
wherein the adjuster block **166** is secured to the rear portion of the swing arm
through the second set of fasteners **168a**, **168b**.

[00038] In an embodiment, the rear wheel adjuster unit can also be used
with a swing arm having a linear first arm and a linear second arm without a bend
25 or curve in their middle portion.

[00039] The present subject matter is thus described. The description is not
intended to be exhaustive nor is it intended to limit the invention to the precise
form disclosed. It will be apparent to those skilled in the art that the disclosed
embodiments may be modified in light of the above description.

We claim:

1. A swing arm assembly for a scooter type motorcycle comprising:

a swing arm (110) having a first arm (111) and a second arm (112),
the first arm and the second arm laterally separated from each other
through a plurality of cross members (148a, 148b, 148c) and disposed
substantially parallel to longitudinal axis of the motorcycle,

the first arm (111) and the second arm (112) further comprising:

a front portion (113) connected to a toggle link assembly
(109),

a rear portion (114) connected to a rear suspension (131)
and supporting a wheel shaft (123),

a middle portion (146) disposed between the front portion
(113) and the rear portion (114),

wherein the front portion (113), the middle portion (146) and the rear
portion (114) are integrally formed, and

wherein the middle portion (146) of the first arm (111) and the second arm
(112) is nearer to the ground than the front portion (113) and the rear
portion (114), and

wherein further a plurality of mounting brackets (149-1, 149-2, 149-3) are
disposed on cross members for mounting and supporting an internal
combustion engine (120) over the swing arm (110), the swing arm being
the load carrying member in the motorcycle.

2. The swing arm assembly as claimed in claim 1, wherein the rear portion
(114) is substantially triangular in shape and comprises at least one
suspension mounting bracket (118) coupled to the rear portion for
mounting one end of the rear suspension (131) and at least one side open
groove (152) at its end portion (115) for supporting the wheel shaft (123).

3. The swing arm assembly as claimed in claim 1, wherein either the first arm or the second arm, or the first arm and the second arm comprises a plurality of holding members (117) on an outer surface for supporting wiring harness (124) on the swing arm, wherein the holding members are spaced apart from each other.
4. The swing arm assembly as claimed in claim 3, wherein the holding members (117) are welded to the outer surface of either the first arm or the second arm, or the first arm and the second arm.
5. The swing arm assembly as claimed in claim 1, wherein the first arm (111) and the second arm (112) are operatively engaged with and supporting a rear wheel adjuster unit (159), the adjuster unit (159) further comprising:
- a movable adjuster plate (160) having a central groove (161),
 - a guide member (162) comprising a second marking reference (163),
 - a threaded adjusting screw (164) connected to the adjuster plate (160) through the guide member (162),
 - an adjuster nut (165),
 - a constrained adjuster block (166) having a through opening (167) for allowing the passage of the adjusting screw (164),
- wherein the operation of adjuster nut (165) over the adjusting screw (164) protruded from the adjuster block moves the adjuster plate (160) in a longitudinal direction along the central groove (161),
- and wherein further the adjuster unit (159) aligns a rear wheel (102) with respect to the first arm and the second arm by operation of the adjuster nut (165) in the first arm and the second arm when the second marking reference (163) of the guide member (162) matches the same marking reference in a first set of marking references (171) provided on the rear

portion above and below the one side open groove (152) in both the first arm and the second arm.

- 5 6. The swing arm assembly as claimed in claim 5, wherein the rear wheel adjuster unit (159) is supported on the rear portion through the adjuster plate (160) and the adjuster block (166) wherein the adjuster plate (160) is secured to the rear portion through a first fastener (169) passing through the rear portion and the central groove, and wherein the adjuster block (166) is secured to the rear portion of the swing arm through a second set of fasteners (168a, 168b).
- 10 7. The swing arm assembly as claimed in claim 5, wherein the adjuster plate (160), guide member (162) and adjusting screw (164) are integrally formed extending in a longitudinal direction.
8. The swing arm assembly as claimed in claim 1, wherein the middle portion (146) is curved, arcuate or bent in shape.
- 15 9. The swing arm assembly as claimed in claim 1, wherein the first arm (111) and the second arm (112) have a non-hollow, metal plate like structure.
10. The swing arm assembly as claimed in claim 2, wherein the second arm (112) further comprises a set of exhaust device mounting brackets (130) for mounting an exhaust device on the vehicle, the exhaust device mounting brackets disposed forwardly of the suspension mounting bracket (118).
- 20 11. A rear wheel adjuster unit (159) supported on a swing arm having a linear first arm and a linear second arm, the rear wheel adjuster unit further comprising:
 - 25 a movable adjuster plate (160) having a central groove (161),
 - a guide member (162) comprising a second marking reference (163),

a threaded adjusting screw (164) connected to the adjuster plate (160) through the guide member (162),

an adjuster nut (165),

a constrained adjuster block (166) having a through opening (167) for allowing the passage of the adjusting screw (164),

wherein the operation of adjuster nut (165) over the adjusting screw (164) protruded from the adjuster block moves the adjuster plate (160) in a longitudinal direction along the central groove (161),

and wherein further the adjuster unit (159) aligns a rear wheel (102) with respect to the first arm and the second arm by operation of the adjuster nut (165) in the first arm and the second arm when the second marking reference (163) of the guide member (162) matches the same marking reference in a first set of marking references (171) provided on a rear portion above and below a one side open groove (152) in both the first arm and the second arm.

12. The rear wheel adjuster unit (159) as claimed in claim 11, wherein the rear wheel adjuster unit (159) is supported on the rear portion through the adjuster plate (160) and the adjuster block (166) wherein the adjuster plate (160) is secured to the rear portion through a first fastener (169) passing through the rear portion and the central groove, and wherein the adjuster block (166) is secured to the rear portion of the swing arm through a second set of fasteners (168a, 168b).

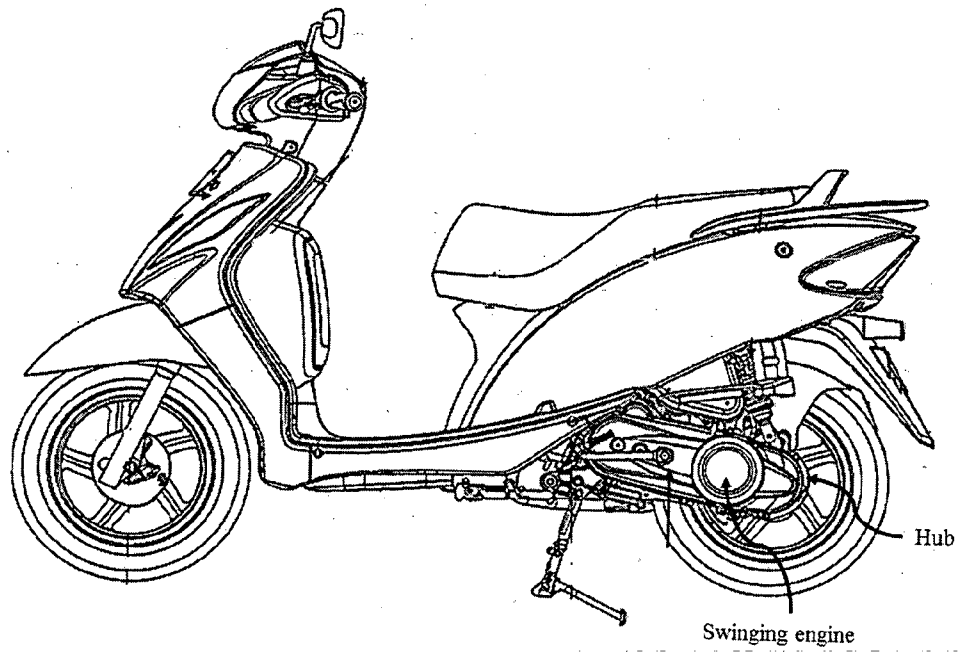


FIG. 1

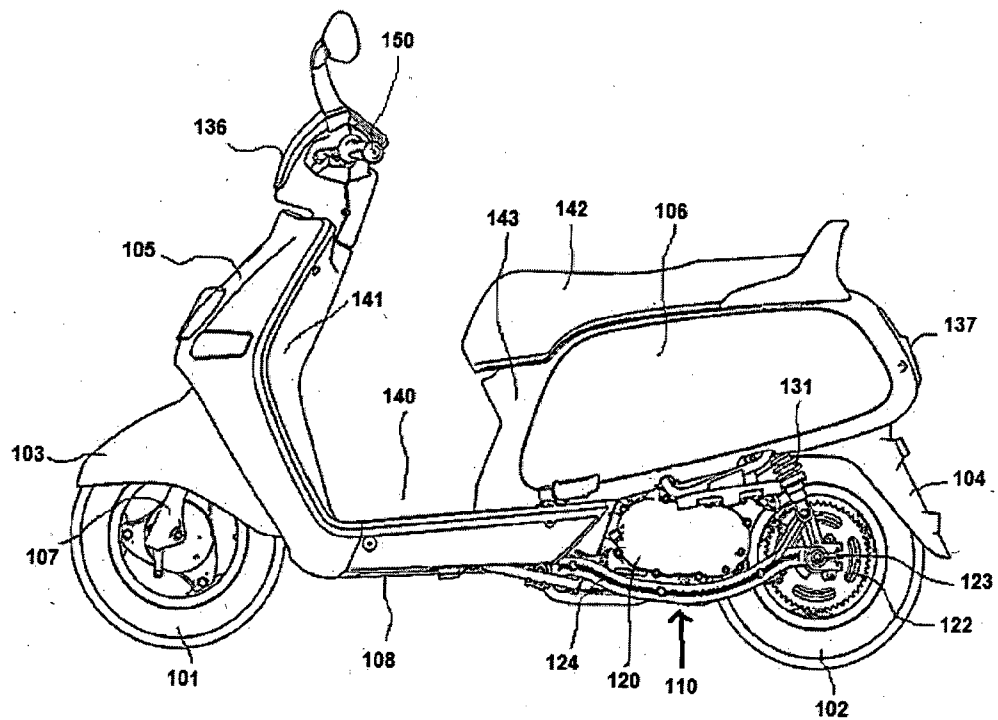


FIG. 2

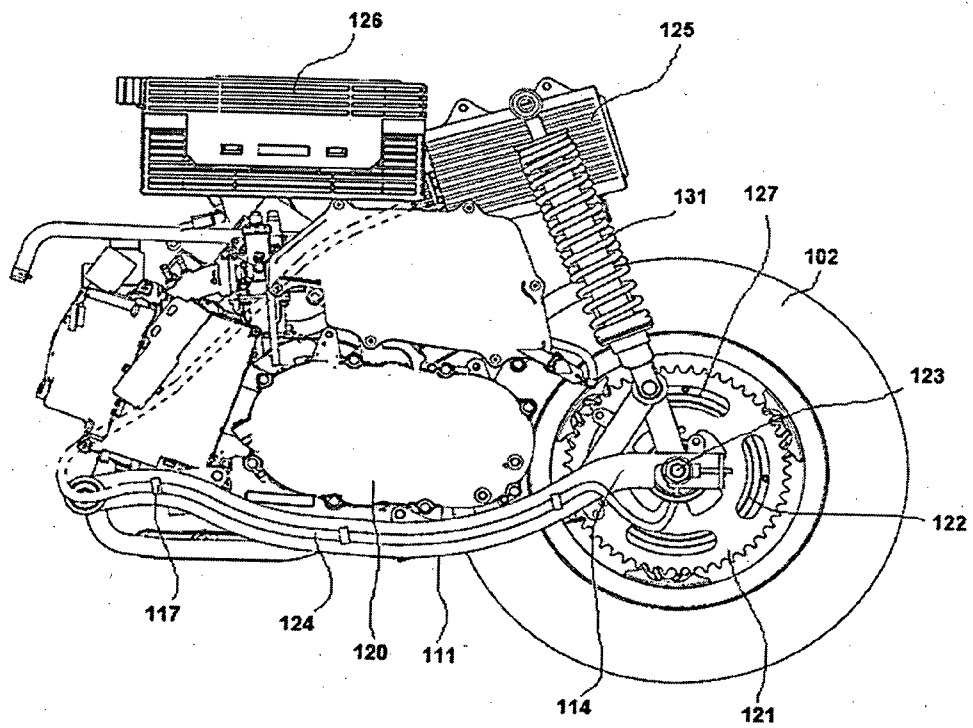


FIG. 3

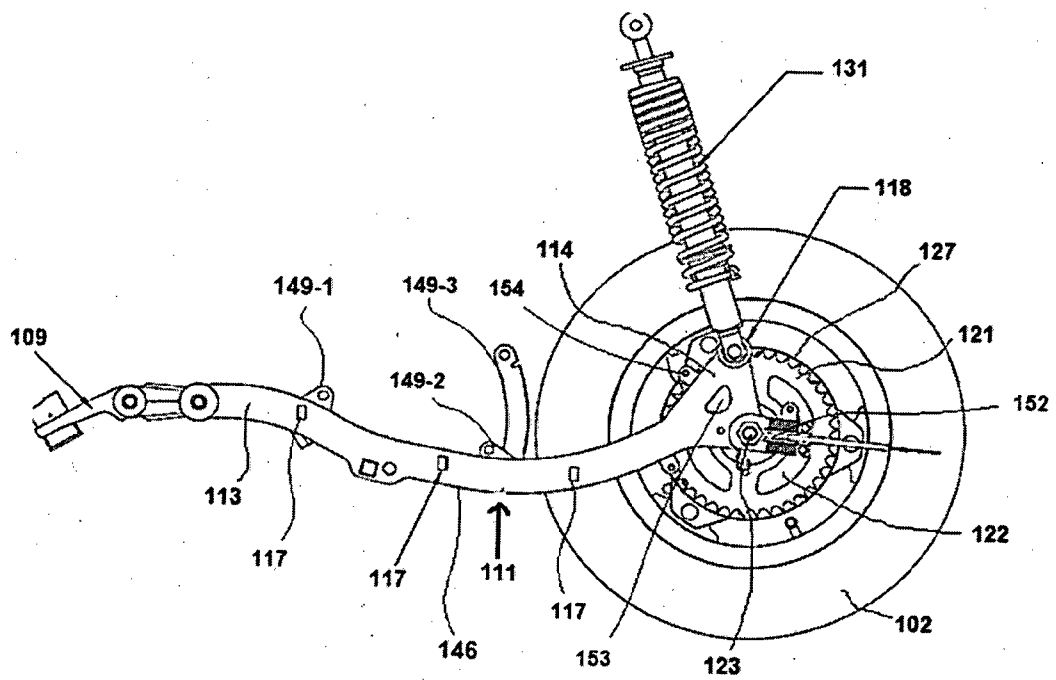


FIG. 4

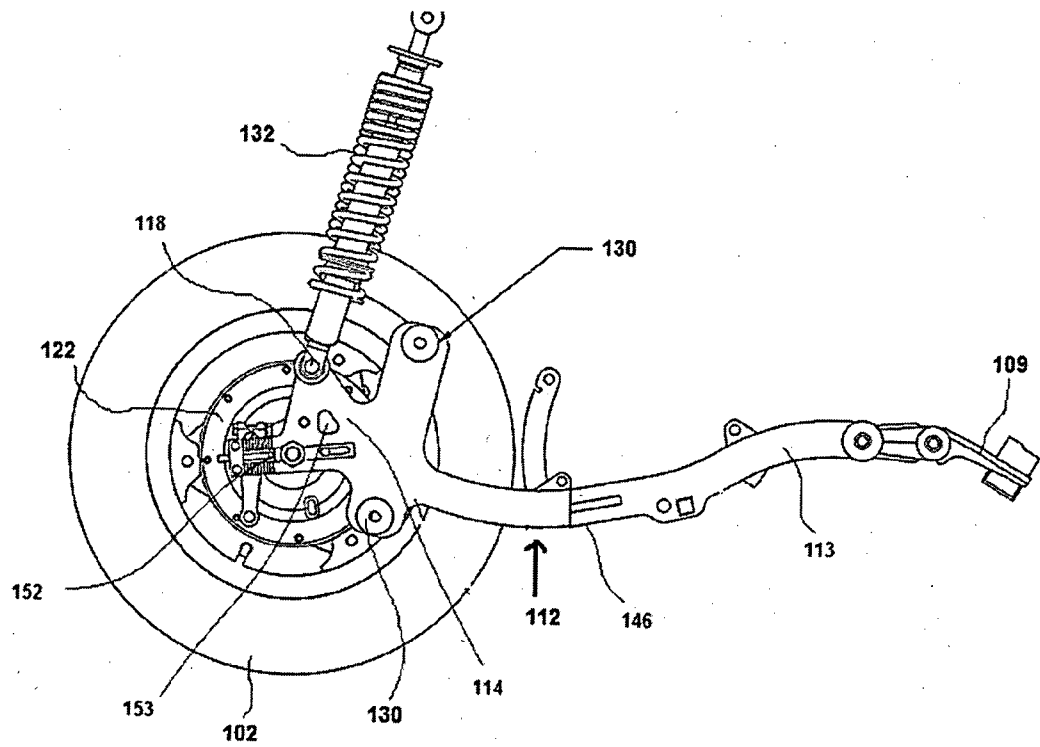


FIG. 5

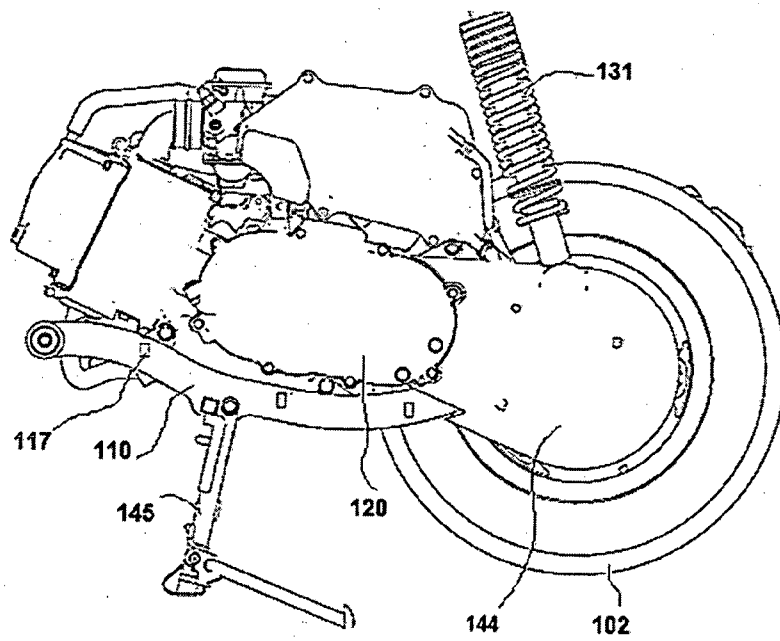


FIG. 6

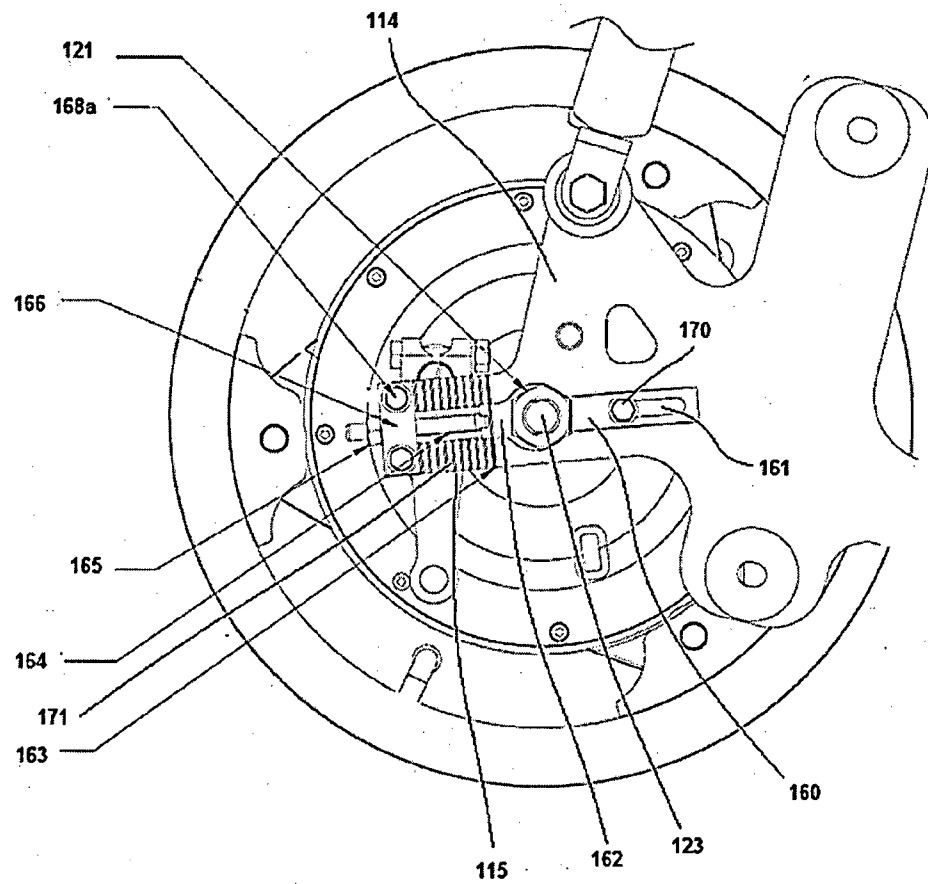


FIG. 7

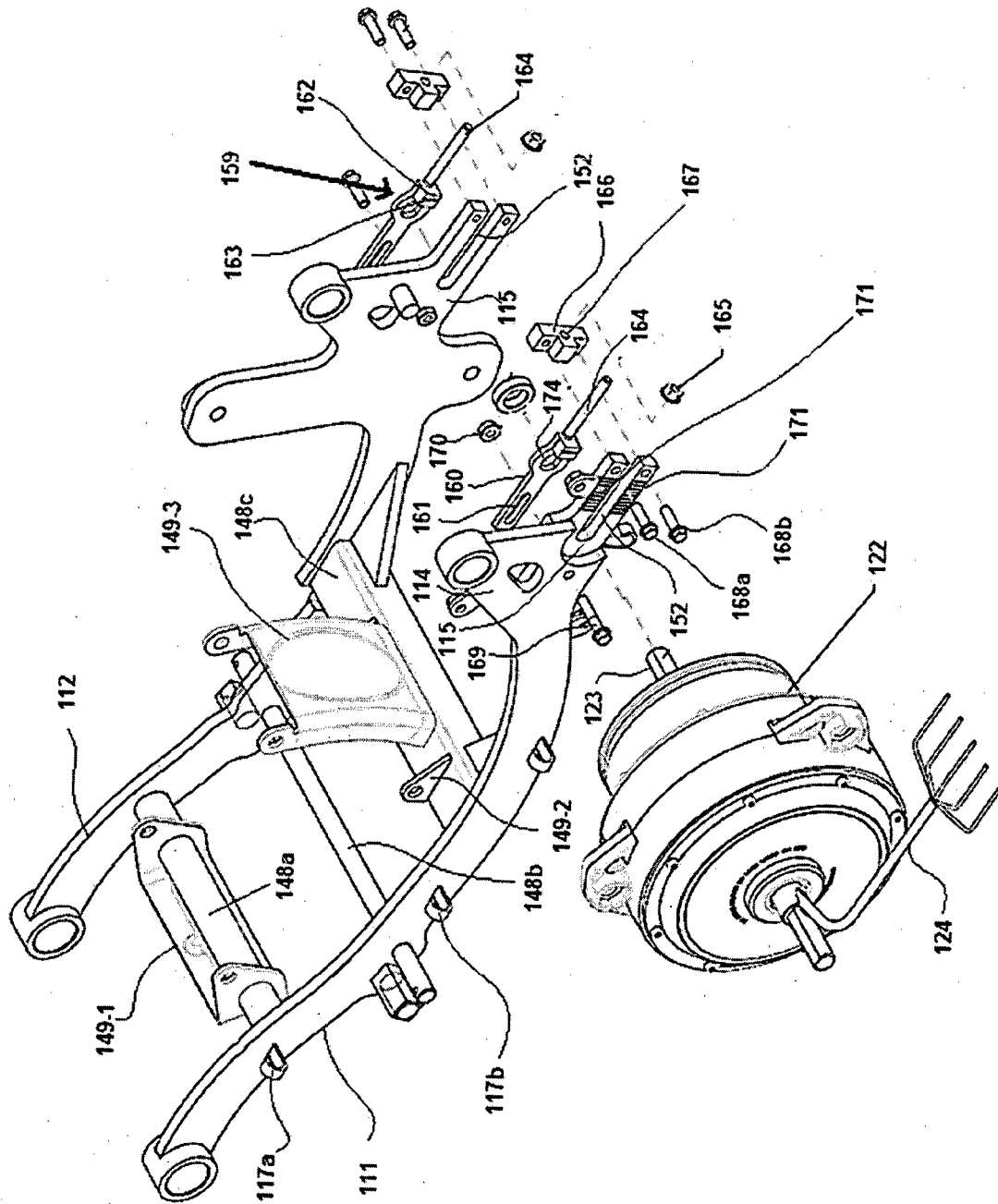


FIG. 8