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(54) Title: A LOCKING SYSTEM FOR BATTERY PACK IN ELECTRIC VEHICLES

(57) Abstract: The embodiments herein discloses a design for an electric bicycle that has a battery pack and a lock mounting battery mechanism for securely holding the battery in the battery compartment. Further the battery assembly comprises a rigid door structure that has a railing which makes the battery easily slide and fit into the compartment. The embodiments herein also discloses a single locking technique for multiple locking mechanisms. Furthermore, the embodiments herein provides a shock proof, water resistant and a dust resistant battery assembly. The embodiments herein also discloses a pedal assisted bicycle which enables the user to have control over driving.

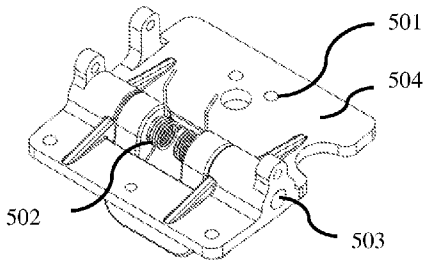


FIG. 5A

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A LOCKING SYSTEM FOR BATTERY PACK IN ELECTRIC VEHICLES

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] The embodiments herein are claims the priority of the Indian Provisional Patent Application filed on February 06, 2018 with the number 201841004475 and entitled, "A SYSTEM AND METHOD FOR LOCKING AND SAFEGUARDING BATTERY PACK IN TWO WHEELED ELECTRIC VEHICLES", and the contents of which are included in entirety as reference herein.

BACKGROUND

Technical Field

[0002] The embodiments herein are generally related to electric vehicles. The embodiments herein are particularly related to two wheeled electric vehicles. The embodiments herein are more particularly related to a system and method for securing, locking and safeguarding a battery pack in two wheeled electric vehicles. The embodiments herein are especially related to a two wheeled electric vehicles with an antiskid battery pack and locking mechanism for battery pack.

Description of the Related Art

[0003] With the advent of technology, diversified vehicles are designed for the convenience of the users. One such invention includes fuel powered electric motor vehicles. With an increased use of fuel powered vehicles, environment pollution is also increased along with an increase in greenhouse effect due to effluent gases released from the vehicles. Therefore, a preferred

mode of transport is shifted from the use of fuel powered motor cycles to the use of mechanical bicycles. However, the use of mechanical bicycles for the purposes of commuting as well as a hobby requires the riders to expend a lot of energy while riding the bicycle. Further, riding the bicycle in an uphill mode requires more energy for a rider than that required for riding on flat surfaces and downhill. Furthermore, the energy expended by the user in cycling is more, when the distance covered by rider with the bicycles is more.

[0004] Mechanical Bicycles are slowly replaced with Electric bicycles thereby reducing an energy consumption of the users. The electric bicycles otherwise termed as e-bikes are more effective and efficient and yet an eco-friendly alternative to manual bicycles. The electric bicycles require considerably lesser efforts on the part of the user while riding, and provide the user with an eco-friendly option for stress-free commuting.

[0005] Electric bicycles are typically driven by a motor which is in turn powered by a battery, and therefore battery packs are used as a primary source of energy for supplying power to the motor driving the electric bicycles. Further, electric bikes contain all the features that are also provided in the mechanical bicycles.

[0006] Further the battery pack provided in a two wheeled electric vehicles is susceptible for theft and short circuit due to unwanted and unnecessary movement battery or pack inside a battery compartment during a riding process. Still further a plurality of locks are needed to lock the battery door in a battery compartment/housing and to hold the battery in a position inside the battery

compartment/housing. Yet the battery has to be ejected during the replacement of the battery. The currently available solutions provides a plurality of locks and keys for achieving the abovementioned tasks thereby providing a complexity of solutions while designing the two wheeled electric vehicles.

[0007] Hence, there is a need to develop a two-wheeled electric vehicle that supports a manual mode, a power assisted mode and an exercise mode operation. Further, there is a need to develop a two-wheeled electric vehicle with an integrated secure battery box mounted on a frame of the electric vehicle. Yet there is a need to develop a two wheeled electric vehicle with an integrated locking assembly for safeguarding and arresting movement of battery pack in a battery pack assembly. Yet further there is a need to develop a two-wheeled electric vehicle with a single integrated locking assembly for locking door of battery compartment that enables ejection of battery easily. Yet further there is a need to develop a two-wheeled electric vehicle with an antiskid battery pack and single integrated battery pack lock mechanism.

[0008] The above-mentioned shortcomings, disadvantages and problems are addressed herein and which will be understood by reading and studying the following specification.

OBJECTS OF THE EMBODIMENTS

[0009] The primary object of the embodiments herein is to provide a two-wheeled electric vehicle that is operated in manual mode, a power assisted mode and an exercise mode.

[0010] Another object of the embodiments herein is to develop a two-wheeled electric vehicle with an integrated secure battery box with anti-shake and waterproof properties.

[0011] Yet another object of the embodiments herein is to develop a two wheeled electric vehicle with an integrated locking assembly for safeguarding and arresting movement of battery pack in a battery pack assembly.

[0012] Yet another object of the embodiments herein is to develop a two wheeled electric vehicle with a single integrated locking assembly for locking door of battery compartment, arresting movement of battery pack in a battery pack assembly and easy ejection of battery from a battery compartment.

[0013] Yet another object of the embodiments herein is to provide an electric two wheeled vehicle with a rigid door structure for safely accommodating the battery.

[0014] Yet another object of the embodiments herein is to provide an electric two wheeled vehicle that securely holds the battery and prevents the battery from shaking when the bicycle is mobile.

[0015] Yet another object of the embodiments herein is to provide an electric two wheeled vehicle with battery compartment with a simple battery ejection mechanism to allow a pop out of the battery easily for removal and replacement.

[0016] Yet another object of the embodiments herein is to provide an electric two wheeled vehicle with a single integrated locking system with multiple locking mechanisms.

[0017] Yet another object of the embodiments herein is to provide an electric two wheeled vehicle with a water resistant and shock proof battery assembly.

[0018] Yet another object of the embodiments herein is to provide an electric two wheeled vehicle with a battery assembly that is well protected against dust, water and external vibrations.

[0019] Yet another object of the embodiments herein is to provide an electric two wheeled vehicle with power-assisted mode having manual override facility.

[0020] Yet another object of the embodiments herein is to provide an electric two wheeled vehicle with power-assisted mode augmented with pedal mode and vice versa to enhance the speed of the vehicle.

[0021] Yet another object of the embodiments herein is to provide an electric two wheeled vehicle with display for indicating the physiological parameters of induvial during riding and exercise, and to provide and change settings during exercise.

[0022] Yet another object of the embodiments herein is to provide an electric two wheeled vehicle with a novel and simple bell mechanism customized with respect to user preferred sound and a front basket to place necessary things.

[0023] These and other objects and advantages of the embodiments herein will become readily apparent from the following detailed description taken in conjunction with the accompanying drawings.

SUMMARY

[0024] The various embodiments herein provide an electric, two wheeled vehicle with a single integrated lock mechanism with a plurality of locks for locking a battery compartment door and to prevent a movement of battery within the battery compartment. The electric two wheeled vehicle comprises all aspects of a mechanical bicycle and new add-ons that brings a whole structure of an e-bike. The e-bike system is of two wheel structure, has a pedal mode, battery mode assistance and a combined mode. The vehicle is further enabled to comprise a front basket to place necessary things.

[0025] According to an embodiment herein, the electric vehicle includes a frame structure housing a seat tube comprising an upper portion and a lower portion. The electric vehicle includes a down tube embedded in the frame structure. The down tube includes a first end and a second end, the first end being connected to the lower portion of the seat tube and the second end being connected to a rear wheel. The electric vehicle includes a front tube embedded in the frame structure. The front tube is connected to a front wheel and also mounted with a handlebar. A front basked is attached to the frame structure. The electric cycle further comprises a pedal assist connected to the downtube, wherein the pedal assist is operated by the battery.

[0026] According to an embodiment herein, the electric cycle comprises an LED headlamp connected to front tube, rear view mirrors affixed to the handlebars, a Hydraulic front fork connecting the front tube and the front wheel, a rear light affixed on the rear wheel. The rear light comprises indicators. The

electric cycle further comprises a multifunctional digital display attached to the handlebar. The electric cycle includes a bell mechanism with metal rings that is customizable to generate a user preferred sound based on rotation of metal rings.

[0027] According to an embodiment herein, the electric bicycle also comprises Handlebar mounted with indicators, safety lamp. The electric cycle further comprises an exercising stand connected to the rear wheel of the cycle. The exercising stand is configured to maintain the cycle immobile to function as an exercise machine.

[0028] According to an embodiment herein, the electric vehicle includes a battery mounting box attached to the frame structure. The battery mounting structure includes a locking device and a door assembly. The locking device is configured to fasten and release a battery mounted on the battery mounting box. The locking device comprises a lock mounting plate, a spring plate, a lock bracket, a barrel lock and a lock axle. The door assembly is configured to receive the battery through an extrusion groove and thereby secure the battery in the battery mounting box without shaking. The spring plate is configured to move downward into an extrusion groove when door is in a locked position. The door assembly comprises a door and a tilt bracket connected to the frame structure using pivot pins to enable pivotal motion. The lock bracket of the locking device is positioned in between the lock mounting bracket using a lock axle, and wherein the lock bracket is configured to move radially using the lock spring. In the battery mounting box, the lock bracket is pushed towards the door by the lock spring. The locking device is mounted to the casted top part of the frame structure

using four Allen screws or any other fatteners. Thus, the locking device is configured to move downward when a key is turned to a lock position, thereby pushing the lock spring plate downward and securing the door in a locked state. Also, the lock mounting plate of the locking device comprises a hump shaped projection place to arrest the movement of the battery inside the battery box.

[0029] According to one embodiment herein, an electric bicycle is designed with a battery assembly, which has a compact design. The battery assembly is further placed in the down tube of the e-bike with wirings connected to the battery compartment. The down tube is formed in any regular shape, selected from a group consisting of rectangular, triangular, cubical, circular, trapezoidal etc. Further, the down tube comprises battery compartment in which a battery is securely placed. The battery placed inside the compartment is easily removable with a pop-up mechanism that allows a smooth removal and insertion of the battery from the compartment without any hassle. Further, the battery pop-up mechanism is provided by the door. The battery door comprises a flat plate provided with a protrusion at the top and a groove. The rigid door structure contains a railing that allows the battery to smoothly slide into the battery compartment. There is a casted aluminium head part and a down part between which the battery door is designed. There is also an extrusion door below the door structure of the battery.

[0030] According to one embodiment herein, the down tube is configured /designed to cover the wires safely that is connected to the battery compartment. The wires are sealed and covered inside the down tube to prevent damage to the wires.

[0031] According to one embodiment herein, the down tube is made up of a material selected from a group consisting of aluminum, iron, carbon, polymer, fibre, etc. The downtube is fabricated by a process selected from a group consisting of extrusion, casting, moulding, stamping or welding processes, etc.

[0032] According to one embodiment herein, an electric bicycle is designed with an anti-shake mechanism that prevents battery from vibrating when the bicycle is in motion. The electric bicycle is designed with a battery assembly that has an efficient locking mechanism of battery inside the compartment. The door locking mechanism comprises of a barrel lock, spring plate, tilt bracket and battery top lid with barrel to securely close and open the battery compartment. The spring plate in the battery locking mechanism is made up of a material selected from a group consisting of plastic, aluminium, steel etc.

[0033] According to one embodiment herein, the battery mechanism is formed as a part of the downtube and the downtube is formed as a part of the e-bike.

[0034] According to one embodiment herein, an electric bicycle is designed with single lock system with multiple locking elements. The battery door and the battery placed inside the compartment are locked simultaneously with a single locking mechanism. A lock mounting plate is used in the locking

mechanism. The locking mechanism comprises a single spring plate with a first locking element provided at one end and a second locking element provided at the centre of the locking plate. The first locking element is a projection which is protruded downwards from the back side of the spring plate. The projection is received in a groove provided at the door. The spring plate is pressed by a lever to insert the first locking element inside the groove at the door to lock the door of the battery compartment. The second locking element is a hump shaped projection formed at the centre of the locking plate. The hump shaped projection is protruded down wards to hold the battery pack in place to arrest the movement of the battery inside the battery compartment, when the spring plate is pressed down with a lever operated by the insertion of a key. Both the first locking element and the second locking element are formed integrally in the single locking plate. Thus, the single locking mechanism is operated to secure the battery door to prevent a theft of the battery and to arrest the movement of battery during a ride to prevent a short circuiting and draining of the battery unnecessarily.

[0035] According to one embodiment herein, an electric bicycle is designed with lock assembly provided a plurality of locking elements. The lock assembly comprises a lock mounting plate, lock spring, lock bracket, barrel lock and lock axle. The lock bracket is placed in between the lock mounting bracket using a lock axle where the movement of the bracket is given by the lock spring. The lock assembly is mounted on the down tube using three screws. The lock bracket is moved radially to an open position and the lock bracket is pushed

towards the door side by the spring. A lock is mounted to the top part of lock mounting bracket with a plurality of Allen flat head screws. The barrel moves down when the keys turns to lock position, and the lock spring plate is pushed down and door is locked.

[0036] The embodiments herein allows the battery to be placed securely inside the battery compartment, to provide water resistant and shock proof properties.

[0037] According to one embodiment herein, an electric bicycle is designed with a pedal assisted mechanism. The e-bike enables the user to pedal and as well as convert the pedalling mode to battery mode and vice versa. Further, the pedalling mode is changed based on the threshold speed level and variation in speed.

[0038] According to one embodiment herein, the e-bike is automatically switched to pedalling mode, when the speed level drops to a particular threshold to enable the user to have a hassle free safe and smooth ride.

[0039] These and other aspects of the embodiments herein 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 the preferred embodiments and numerous specific details thereof, are given by way of illustration and not of limitation. Many changes and modifications may be made within the scope of the embodiments herein without departing from the spirit thereof, and the embodiments herein include all such modifications.

BRIEF DESCRIPTION OF THE DRAWINGS

[0040] The other objects, features and advantages will occur to those skilled in the art from the following description of the preferred embodiment and the accompanying drawings in which:

[0041] **FIG.1A** illustrates a side view of e-bike frame of the battery compartment in an electric bicycle, according to one embodiment herein.

[0042] **FIG.1B** illustrates a side view of e-bike frame component with door in an electric bicycle, according to one embodiment herein.

[0043] **FIG.1C** illustrates a perspective view of e-bike frame of the battery compartment in an electric bicycle, according to one embodiments herein.

[0044] **FIG.1D** illustrates the top view of locking parts of the battery compartment in an electric bicycle, according to one embodiment herein.

[0045] **FIG.2** illustrates the perspective view of door placement and mounting of the battery assembly and compartment in an electric bicycle, according to one embodiment herein.

[0046] **FIG.3A** illustrates a perspective view of the battery sliding through the railing in the door of battery compartment in an electric bicycle, according to one embodiment herein.

[0047] **FIG.3B** illustrates a perspective view of the assembly of the door of battery compartment in an electric bicycle, according to one embodiment herein.

[0048] **FIG.3C** illustrates a perspective view of the battery placed securely upon the tilt bracket inside the battery compartment in an electric bicycle, according to one embodiment herein.

[0049] **FIG.4A** illustrates the side view of the unlocked battery and door in an electric bicycle, according to one embodiment herein.

[0050] **FIG.4B** illustrates the side view of the locking mechanism of the door and battery placed in the compartment of an electric bicycle, according to one embodiment herein.

[0051] **FIG.5A** illustrates the perspective of lock assembly of a battery assembly in an electric bicycle, according to one embodiment herein.

[0052] **FIG.5B** illustrates a top view of a lock mounting mechanism of a battery assembly in an electric bicycle, according to one embodiment herein.

[0053] **FIG.5C** illustrates a side view of a lock mounting mechanism of a battery assembly in an electric bicycle, according to one embodiment herein.

[0054] **FIG.6A** illustrates a perspective view of a spring plate in a lock assembly of a battery assembly in an electric bicycle, according to one embodiment herein.

[0055] **FIG.6B** illustrates a top view of a spring plate in a lock assembly of a battery assembly in an electric bicycle, according to one embodiment herein.

[0056] **FIG.6C** illustrates a side view of a spring plate in a lock assembly of a battery assembly in an electric bicycle, according to one embodiment herein.

[0057] **FIG.7** illustrates a top side perspective view of an electric bicycle, according to one embodiment herein.

[0058] **FIG.8** illustrates the side perspective view of an electric bicycle, with exercising stand, according to one embodiment herein.

[0059] Although the specific features of the embodiments herein are shown in some drawings and not in others. This is done for convenience only as each feature may be combined with any or all of the other features in accordance with the embodiments herein.

DETAILED DESCRIPTION OF THE INVENTION

[0060] In the following detailed description, a reference is made to the accompanying drawings that form a part hereof, and in which the specific embodiments that may be practiced is shown by way of illustration. These embodiments are described in sufficient detail to enable those skilled in the art to practice the embodiments and it is to be understood that other changes may be made without departing from the scope of the embodiments. The following detailed description is therefore not to be taken in a limiting sense.

[0061] The embodiments herein discloses a design for providing an electric bicycle with a battery assembly and all the other components provided in a mechanical bicycle. The electric bicycle is provided with a door in the battery compartment to securely hold the battery.

[0062] The various embodiments herein provide an electric, two wheeled vehicle with a single integrated lock mechanism with a plurality of locks for locking a battery compartment door and to prevent a movement of battery within the battery compartment. The electric two wheeled vehicle comprises all aspects of a mechanical bicycle and new add-ons that brings a whole structure of an e-

bike. The e-bike system is of two wheel structure, has a pedal mode, battery mode assistance and a combined mode. The vehicle is further enabled to comprise a front basket to place necessary things.

[0063] According to an embodiment herein, the electric vehicle includes a frame structure housing a seat tube comprising an upper portion and a lower portion. The electric vehicle includes a down tube embedded in the frame structure. The down tube includes a first end and a second end, the first end being connected to the lower portion of the seat tube and the second end being connected to a rear wheel. The electric vehicle includes a front tube embedded in the frame structure. The front tube is connected to a front wheel and also mounted with a handlebar. A front basked is attached to the frame structure. The electric cycle further comprises a pedal assist connected to the downtube, wherein the pedal assist is operated by the battery.

[0064] According to an embodiment herein, the electric cycle comprises an LED headlamp connected to front tube, rear view mirrors affixed to the handlebars, a Hydraulic front fork connecting the front tube and the front wheel, a rear light affixed on the rear wheel. The rear light comprises indicators. The electric cycle further comprises a multifunctional digital display attached to the handlebar. The electric cycle includes a bell mechanism with metal rings that is customizable to generate a user preferred sound based on rotation of metal rings.

[0065] According to an embodiment herein, the electric bicycle also comprises Handlebar mounted indicators, safety lamp. The electric cycle further comprises an exercising stand connected to the rear wheel of the cycle. The

exercising stand is configured to maintain the cycle immobile to function as an exercise machine.

[0066] According to an embodiment herein, the electric vehicle includes a battery mounting box attached to the frame structure. The battery mounting structure includes a locking device and a door assembly. The locking device is configured to fasten and release a battery mounted on the battery mounting box. The locking device comprises a lock mounting plate, a spring plate, a lock bracket, a barrel lock and a lock axle. The door assembly is configured to receive the battery through an extrusion groove and thereby secure the battery in the battery mounting box without shaking. The spring plate is configured to move downward into an extrusion groove when door is in a locked position. The door assembly comprises a door and a tilt bracket connected to the frame structure using pivot pins to enable pivotal motion. The lock bracket of the locking device is positioned in between the lock mounting bracket using a lock axle, wherein the lock bracket is configured to move radially using the lock spring. In the battery mounting box, the lock bracket is pushed towards the direction of door by the lock spring. The locking device is mounted to the casted top part of the frame structure using four Allen screws. Thus, the locking device is configured to move downward when a key is turned to a lock position, thereby pushing the lock spring plate downward and securing the door in a locked state. Also, the lock mounting plate of the locking device comprises a hump shaped projection place to arrest the movement of the battery inside the battery box.

[0067] According to one embodiment herein, an electric bicycle is designed with a battery assembly, which has a compact design. The battery assembly is further placed in the down tube of the e-bike with wirings connected to the battery compartment. The down tube is formed in any regular shape, selected from a group consisting of rectangular, triangular, cubical, circular, trapezoidal etc. Further, the down tube comprises battery compartment in which a battery is securely placed. The battery placed inside the compartment is easily removable with a pop-up mechanism that allows a smooth removal and insertion of the battery from the compartment without any hassle. Further, the battery pop-up mechanism is provided by the door. The battery door comprises a flat plate provided with a protrusion at the top and a groove. The rigid door structure contains a railing that allows the battery to smoothly slide into the battery compartment. There is a casted aluminium head part and a down part between which the battery door is designed. There is also an extrusion door below the door structure of the battery.

[0068] According to one embodiment herein, the down tube is configured /designed to cover the wires safely that is connected to the battery compartment. The wires are sealed and covered inside the down tube to prevent damage to the wires.

[0069] According to one embodiment herein, the downtube is made up of a material selected from a group consisting of aluminum, iron, carbon, polymer, fibre, etc. The downtube is fabricated by a process selected from a group consisting of extrusion, casting, moulding, stamping or welding processes, etc.

[0070] According to one embodiment herein, an electric bicycle is designed with an anti-shake mechanism that prevents battery from vibrating when the bicycle is in motion. The electric bicycle is designed with a battery assembly that has an efficient locking mechanism of battery inside the compartment. The door locking mechanism comprises of a barrel lock, spring plate, tilt bracket and battery top lid with barrel to securely close and open the battery compartment. The spring plate in the battery locking mechanism is made up of a material selected from a group consisting of plastic, aluminium, steel etc.

[0071] According to one embodiment herein, an electric bicycle is designed with single lock system with multi locking elements. The battery door and the battery placed inside the compartment are locked simultaneously with a single locking mechanism. A lock mounting plate is used in the locking mechanism. The locking mechanism comprises a single spring plate with a first locking element provided at one end and a second locking element provided at the centre of the locking plate. The first locking element is a projection which is protruded downwards from the back side of the spring plate. The projection is received in a groove provided at the door. The spring plate is pressed by a lever to insert the first locking element inside the groove at the door to lock the door of the battery compartment. The second locking element is a hump shaped projection formed at the centre of the locking plate. The hump shaped projection is protruded down wards to hold the battery pack in place to arrest the movement of the battery inside the battery compartment, when the spring plate is pressed down with a lever operated by the insertion of a key. Both the first locking

element and the second locking element are formed integrally in the single locking plate. Thus the single locking mechanism is operated to secure the battery door to prevent a theft of the battery and to arrest the movement of battery during a ride to prevent a short circuiting and draining of the battery unnecessarily.

[0072] The embodiments herein allows the battery to be placed securely inside the battery compartment, to provide water resistant and shock proof properties.

[0073] According to one embodiment herein, an electric bicycle is designed with a pedal assisted mechanism. The e-bike enables the user to pedal and as well as convert the pedalling mode to battery mode and vice versa. Further, the pedalling mode is changed based on the threshold speed level and variation in speed.

[0074] According to one embodiment herein, the e-bike is automatically switched to pedalling mode, when the speed level drops to a particular threshold to enable the user to have a hassle free safe and smooth ride.

[0075] **FIG.1** illustrates the side view of e-bike frame of the battery compartment in an electric bicycle. The frame comprises a casted aluminum head part (101); An aluminum door to protect the battery (102); a casted aluminum down part (103);

[0076] **FIG.1A** illustrates the side view of e-bike frame component with door in an electric bicycle, according to an embodiment herein. The frame comprises a casted aluminum head part (101); an aluminum door to protect the

battery (102); a casted aluminum down part (103); and an extrusion tube (104) at the bottom of the battery door.

[0077] **FIG.1B** illustrates the perspective view of e-bike frame of the battery compartment in an electric bicycle, according to an embodiment herein. The frame comprises a casted aluminum head part (101); An aluminum door to protect the battery (102); a casted aluminum down part (103); an extrusion tube (104) at the bottom of the battery door; a tilt bracket axle (105); and a tested barrel lock (106).

[0078] **FIG.1C** illustrates a bottom view of locking parts of the battery compartment in an electric bicycle, according to an embodiment herein. The battery compartment comprises an aluminum door (102), tested barrel lock (106), locking bracket (107), a battery (108), tilt bracket (109), tilt bracket pivot (110), and spring plate (111).

[0079] According to one embodiment herein, the battery assembly is set up in a frame of the electric bike. It comprises an aluminum door to safely hold the battery inside the compartment, an aluminum head part and down part on the two ends of the door and contains an extrusion tube. The battery frame contains a barrel lock to securely lock the battery. Further a tilt bracket axle is present in the extrusion tube. Furthermore there is a locking bracket and a spring plate near the barrel lock that helps in the battery compartment locking mechanism. The tilt bracket is present in the bottom which helps the battery fix inside the door.

[0080] **FIG.2** illustrates the perspective view of door placement and mounting of the battery assembly and compartment in an electric bicycle, according to one embodiment herein. With respect to FIG.2, the door for the battery assembly and compartment in an electric bicycle, comprises an extrusion groove (201). The aluminium door (102) is an extruded flat plate with groove that slides in the groove designed in the tilt bracket (109). Thus, the door is mounted in to the tilt bracket; using three screws.

[0081] According to an embodiment herein, a battery mounting box is attached to the frame structure. The battery mounting structure includes a locking device and a door assembly. The locking device is configured to fasten and release a battery mounted on the battery mounting box. The locking device comprises a lock mounting plate, a spring plate, a lock bracket, a barrel lock and a lock axle. The door assembly is configured to receive the battery through an extrusion groove and thereby secure the battery in the battery mounting box without shaking. The spring plate is configured to move downward into an extrusion groove when door is in a locked position. The door assembly comprises a door and a tilt bracket connected to the frame structure using pivot pins to enable pivotal motion. The lock bracket of the locking device is positioned in between the lock mounting bracket using a lock axle, wherein the lock bracket is configured to move radially using the lock spring. In the battery mounting box, the lock bracket is pushed towards the direction of door by the lock spring. The locking device is mounted to the casted top part of the frame structure using four Allen screws. Thus, the locking device is configured to move downward when a

key is turned to a lock position, thereby pushing the lock spring plate downward and securing the door in a locked state. Also, the lock mounting plate of the locking device comprises a hump shaped projection place to arrest the movement of the battery inside the battery box.

[0082] **FIG.3A** illustrates a perspective view of the battery sliding through the railing in the door of battery compartment in an electric bicycle, according to one embodiment herein. With respect to FIG.3A, the battery is configured to slide smoothly through the railing in the door of battery compartment in an electric bicycle (301).

[0083] **FIG.3B** illustrates a perspective view of the assembly of the door of battery compartment in an electric bicycle, according to one embodiment herein. With respect to FIG.3B, the battery assembly housing comprises the door and tilt bracket, which is placed inside the frame and pivoted using a pivot pin (302)

[0084] **FIG.3C** illustrates a perspective view of the battery placed securely upon the tilt bracket inside the battery compartment in an electric bicycle, according to one embodiment herein. With respect to **FIG.3C,** the battery is placed securely upon the tilt bracket and get connected to the controller at the bottom of the battery (303).

[0085] **FIG.4A** illustrates the side view of the unlocked battery and door in an electric bicycle, according to one embodiment herein. With respect to **FIG.4A** the locking mechanism is shown in an unlocked position (401) of battery

and door in an electric bicycle. The spring plate (111) will be in normal position when the door (102) is opened.

[0086] **FIG.4B** illustrates the side view of the locking mechanism of the door and battery placed in the compartment of an electric bicycle, according to one embodiment herein. With respect to **FIG.4B**, the locking mechanism (402) of the door and battery placed in the compartment of an electric bicycle are shown. Once the door (102) is closed and with the turn of key the barrel (106) inside the lock moves downward.The barrel pushes the spring plate (111) down, also moves and locks in to the door groove, locking the batterydoor.

[0087] **FIG.5A** illustrates a perspective view of lock assembly of a battery assembly in an electric bicycle, according to one embodiment herein. With respect to **FIG.5A**, the lock comprises of a lock mounting hole (501), lock spring (502), a lock axle (503) and a lock spring plate (504). The lock bracket is placed in between the lock mounting bracket using a lock axle. However, the movement of the bracket is given by the lock spring. The lock is mounted to the top of lock mounting bracket with multiple flat head screws.

[0088] **FIG.5B** illustrates a top view of lock mounting mechanism of a battery assembly in an electric bicycle, according to one embodiment herein. With respect to **FIG.5B**, The lock comprises of a lock mounting hole (501); lock spring (502); a lock axle (503); and a lock spring plate (504).

[0089] **FIG.5C** illustrates the side view of lock mounting mechanism of a battery assembly in an electric bicycle, according to one embodiment herein. With respect to **FIG.5C**, the mechanism includes the following parts: a lock axle

(503); a lock mounting plate (504); a locking bracket (107). The lock bracket moves in a thoroughly open position and is pushed towards the door side by the spring. The barrel moves down when the keys turns to lock position, and the lock spring plate is pushed down and thus the door is locked.

[0090] **FIG.6A** illustrates a perspective view of spring plate (504) in a lock assembly of a battery assembly in an electric bicycle, according to one embodiment herein. The mechanism includes the following parts: a lock axle (503); lock mounting hole (501).

[0091] **FIG.6B** illustrates the top view of spring plate (504) in a lock mounting mechanism of a battery assembly in an electric bicycle, according to one embodiment herein.

[0092] **FIG.6C** illustrates a side view of spring plate (504) in a lock assembly of a battery assembly in an electric bicycle, according to one embodiment herein. The mechanism further comprises a lock axle (503).

[0093] **FIG.7** illustrates a top side perspective view of an electric bicycle 701. The electric vehicle includes a frame structure housing a seat tube comprising an upper portion and a lower portion. The electric vehicle includes a down tube embedded in the frame structure. The down tube includes a first end and a second end, the first end being connected to the lower portion of the seat tube and the second end being connected to a rear wheel. The electric vehicle includes a front tube embedded in the frame structure. The front tube is connected to a front wheel and also mounted with a handlebar. A front basked is attached to the frame structure. The electric vehicle includes a battery mounting box attached

to the frame structure. The battery mounting structure includes a locking device and a door assembly. The locking device is configured to fasten and release a battery mounted on the battery mounting box. The locking device comprises a lock mounting plate, a spring plate, a lock bracket, a barrel lock and a lock axle. The door assembly is configured to receive the battery through an extrusion groove and thereby secure the battery in the battery mounting box without shaking. The electric cycle further comprises a pedal assist connected to the downtube, wherein the pedal assist is operated by the battery.

[0094] According to an embodiment herein, the electric cycle comprises an LED headlamp connected to front tube, rear view mirrors affixed to the handlebars, a Hydraulic front fork connecting the front tube and the front wheel, a rear light affixed on the rear wheel. The rear light comprises indicators. The electric cycle further comprises a multifunctional digital display attached to the handlebar. The electric cycle includes a bell mechanism with metal rings that is customizable to generate a user preferred sound based on rotation of metal rings.

[0095] According to an embodiment herein, the electric bicycle also comprises Handlebar mounted indicators, safety lamp. The electric cycle further comprises an exercising stand connected to the rear wheel of the cycle. The exercising stand is configured to maintain the cycle immobile to function as an exercise machine.

[0096] **FIG.8** illustrates the front perspective view of an electric bicycle, according to one embodiment herein. The bicycle is provided with an exercising stand 801 to enable the user to use the electric bicycle as an exercise machine.

The electric bicycle is further provided with a multifunctional digital display device to provide the workout information for the user.

[0097] Although the embodiments herein are described with various specific embodiments, it will be obvious for a person skilled in the art to practice the embodiments herein with modifications.

[0098] The embodiments herein provides an electric bicycle which has similar features with respect to the mechanical bicycles but with a battery compartment that has a compact design. The embodiments herein also provides an electric bicycle with rigid door structure for safely accommodating the battery. Further, the electric bicycle is provided with a with a battery compartment that has a lock to securely hold the battery within the compartment and prevents the battery from vibrating when the bicycle is in motion. Furthermore, the battery placed inside the compartment is easily removable with a pop-up mechanism that allows smoothly removing and reinserting the battery from the compartment without any hassle. The embodiments herein also provides an electric bicycle with single locking system with multiple locking mechanisms. Further, the e-bike is designed to provide water resistant, shock proof and dust resistant battery assembly. Furthermore, the embodiments herein provides a pedal-assisted mode technique in the electric bicycle, in order to help the user to have control over driving.

[0099] The foregoing description of the specific embodiments will so fully reveal the general nature of the embodiments herein that others can, by applying current knowledge, readily modify and/or adapt for various applications

such as specific embodiments without departing from the generic concept, and, therefore, such adaptations and modifications should and are intended to be comprehended within the meaning and range of equivalents of the disclosed embodiments.

[00100] It is to be understood that the phraseology or terminology employed herein is for the purpose of description and not of limitation. Therefore, while the embodiments herein have been described in terms of preferred embodiments, those skilled in the art will recognize that the embodiments herein can be practiced with modifications. However, all such modifications are deemed to be within the scope of the claims.

CLAIMS

What is claimed is:

1. An electric vehicle comprising:

a frame structure housing a seat tube comprising an upper portion and a lower portion,

a down tube embedded in the frame structure, and wherein the down tube comprises a first end and a second end, and wherein the first end is connected to the lower portion of the seat tube and wherein the second end is connected to a rear wheel;

a front tube embedded in the frame structure, and wherein the front tube is connected to a front wheel, and wherein the front tube is mounted with a handlebar;

a front basked optionally attached to the frame structure;

a battery mounting box attached to the frame structure, and wherein the battery mounting structure comprises:

a locking device, and wherein the locking device is a single locking mechanism configured to fasten and release a battery mounted on the battery mounting box, and wherein the locking device comprises a lock mounting plate, a spring plate, a lock bracket, a barrel lock and a lock axle; and

a door assembly that is configured to receive the battery through a groove and thereby secure the battery in the battery mounting box without shaking; and

a pedal assist connected to the downtube, and wherein the pedal assist is operated by the battery.

2. The electric cycle as claimed in claim 1, further comprises

an LED headlamp connected to front tube;

rear view mirrors affixed to the handlebars;

a Hydraulic front fork connecting the front tube and the front wheel;

a rear light affixed on the rear wheel, wherein the rear light comprises indicators;

a multifunctional digital display attached to the handlebar; and

a bell mechanism with metal rings that is customizable to generate a user preferred sound based on rotation of metal rings.

3. The electric cycle as claimed in claim 1, further comprises an exercising stand connected to the rear wheel of the cycle, wherein the exercising stand is configured to maintain the cycle immobile to function as an exercise machine.

4. The electric cycle as claimed in claim 1, further comprises a spring plate configured to move downward into an extrusion groove when door is in a locked position.

5. The electric cycle as claimed in claim 1, wherein the door assembly comprises a door and a tilt bracket.

6. The electric cycle as claimed in claim 6, wherein the door and the tilt bracket are connected to the frame structure using pivot pins to enable pivot motion.

7. The electric cycle as claimed in claim 1, wherein the lock mounting plate comprises a hump shaped projection place to arrest the movement of the battery inside the battery box.

8. The electric cycle as claimed in claim 1, wherein the lock bracket of the locking device is positioned in between the lock mounting bracket using a lock axle, and wherein the lock bracket is configured to move radially using the lock spring.

9. The electric cycle as claimed in claim 1, wherein the lock bracket is hump pushed towards the direction of door by the lock spring.

10. The electric cycle as claimed in claim 1, wherein the locking device is mounted to the casted top part of the frame structure using four Allen screws.

11. The electric cycle as claimed in claim 1, wherein the locking device is configured to move downward, when a key is turned to a lock position, thereby pushing the lock spring plate downward and securing the door in a locked state.

12. A battery mounting box attached to a frame structure of an electric cycle, wherein the battery mounting structure comprises:

a locking device, wherein the locking device is configured to fasten and release a battery mounted on the battery mounting box, wherein the locking device comprises a lock mounting plate, a lock spring, a lock bracket, a barrel lock and a lock axle; and

a door assembly that is configured to receive the battery through a groove and thereby secure the battery in the battery mounting box without shaking.

13. The battery mounting box as claimed in claim 12, further comprises a spring plate configured to move downward into an extrusion groove when door is in locked position.

14. The battery mounting box as claimed in claim 12, wherein the door assembly comprises a door and a tilt bracket.

15. The battery mounting box as claimed in claim 12, wherein the door and the tilt bracket is connected to the frame structure using pivot pins to enable pivot motion.

16. The battery mounting box as claimed in claim 12, wherein the lock bracket of the locking device is positioned in between the lock mounting bracket using a lock axle, wherein the lock bracket is configured to move radially using the lock spring.

17. The battery mounting box as claimed in claim 12, wherein the lock bracket is pushed towards the direction of door by the lock spring.

18. The battery mounting box as claimed in claim 12, wherein the locking device is mounted to the casted top part using four Allen screws.

19. The battery mounting box as claimed in claim 12, wherein the locking device is configured to move downward when a key is turned to a lock position, thereby pushing the lock spring plate downward and securing the door in a locked state.

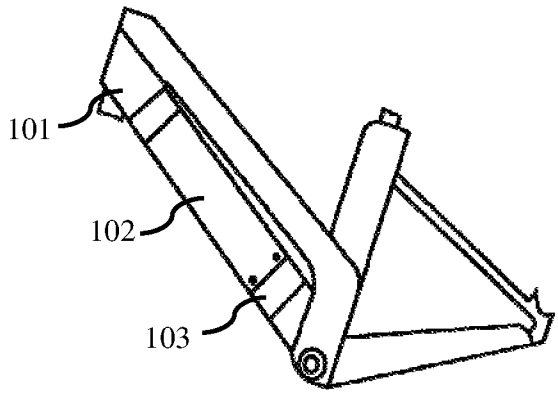


FIG. 1A

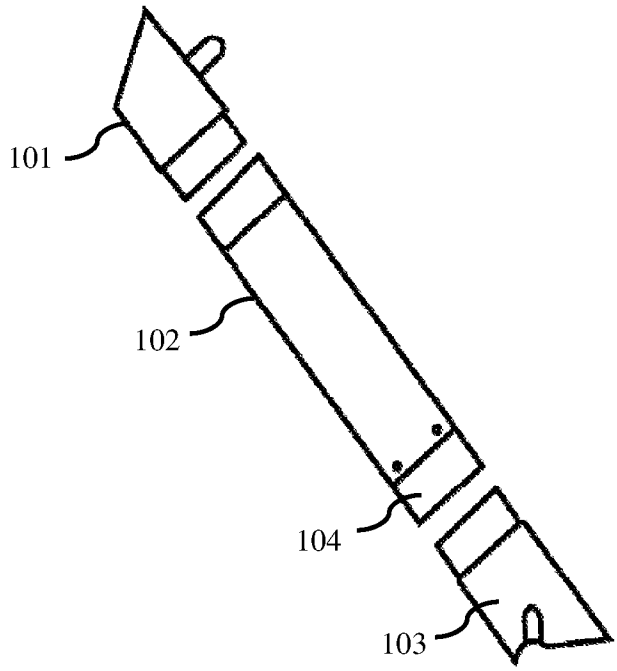


FIG. 1B

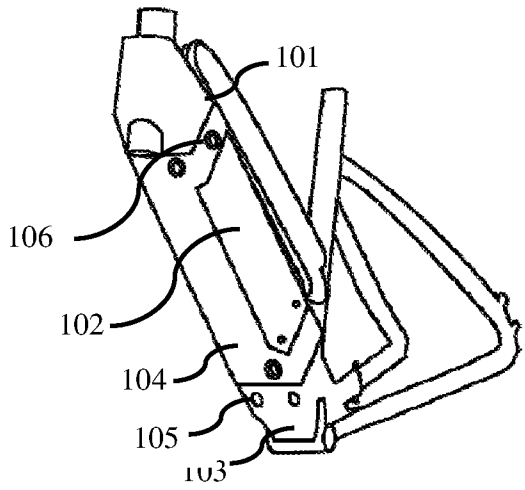


FIG. 1C

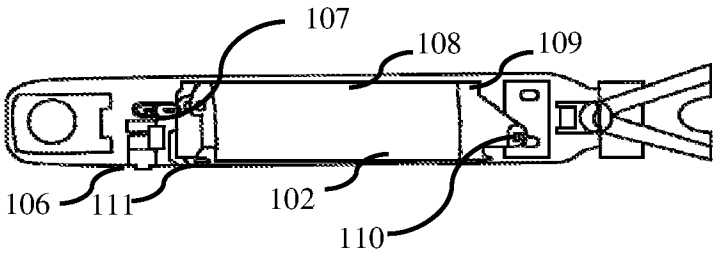


FIG. 1D

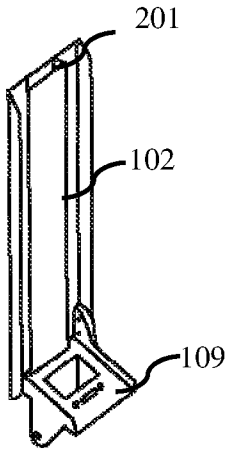


FIG. 2

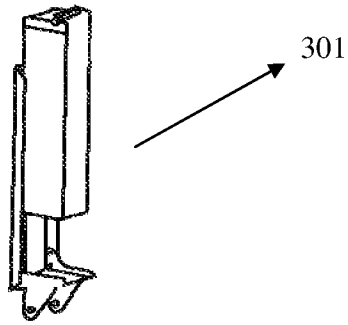


FIG. 3A

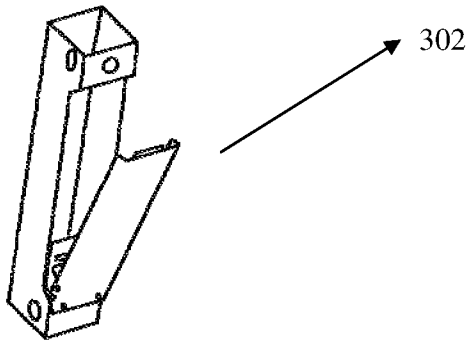


FIG. 3B

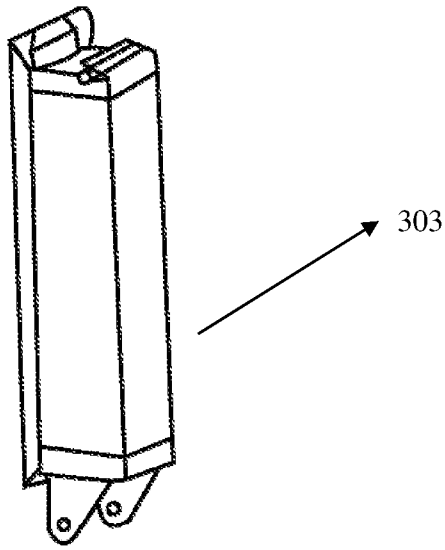


FIG. 3C

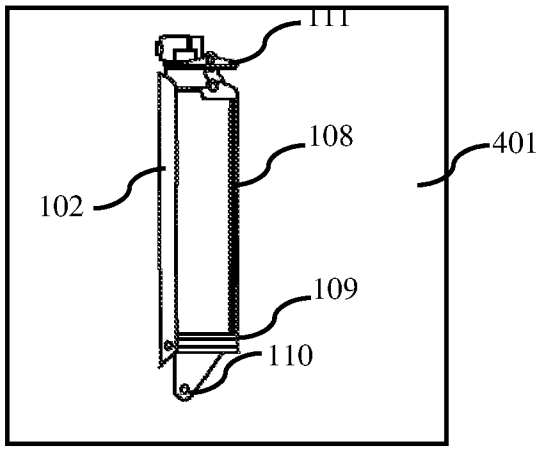


FIG. 4A

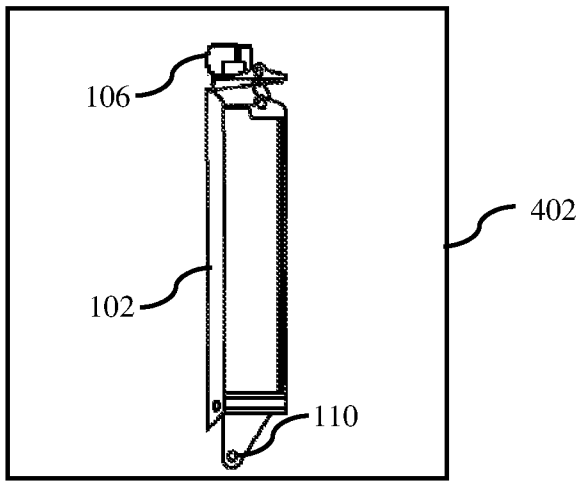


FIG. 4B

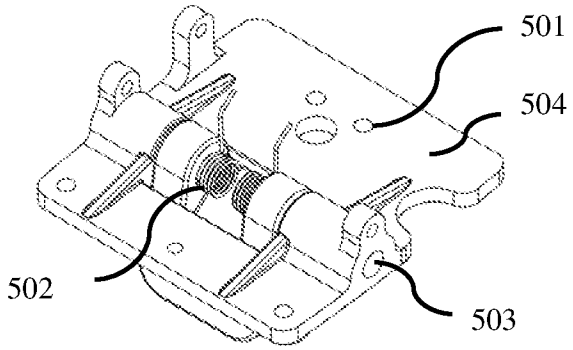


FIG. 5A

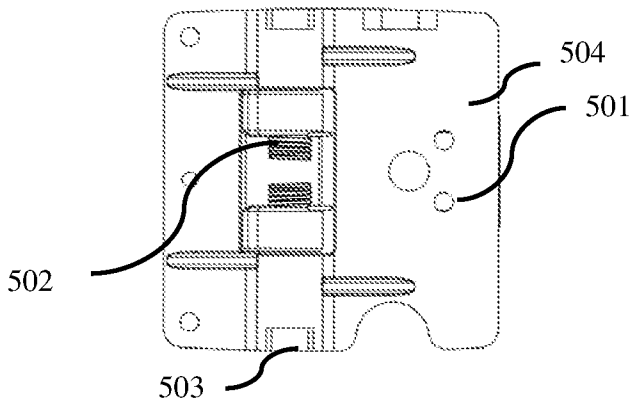


FIG. 5B

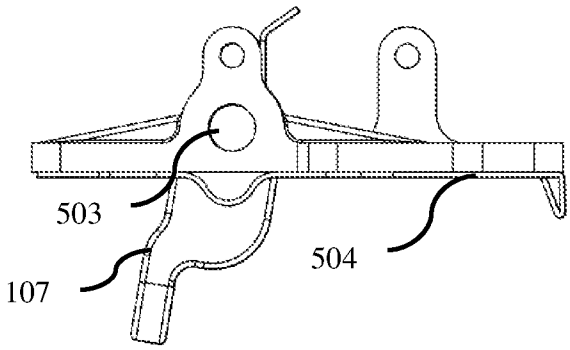


FIG. 5C

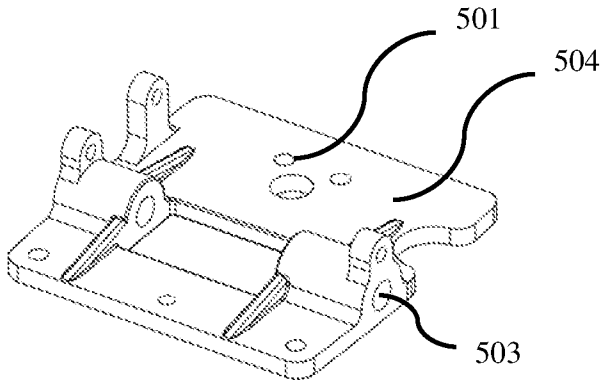


FIG. 6A

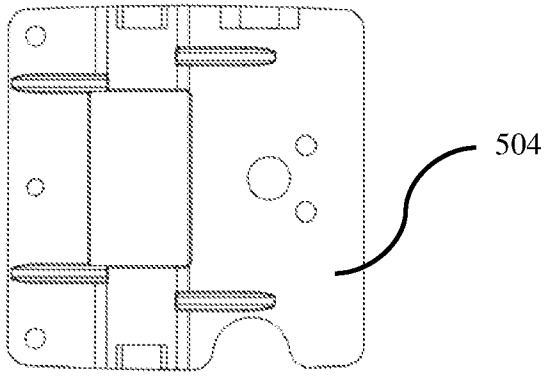


FIG. 6B

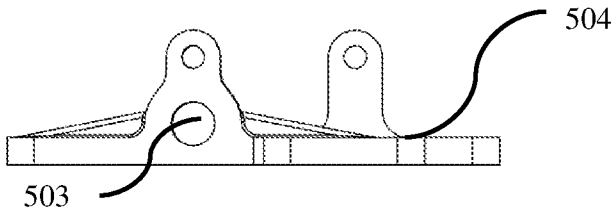


FIG. 6C



FIG. 7



FIG. 8

INTERNATIONAL SEARCH REPORT

International application No.
PCT/IN2018/050391

A. CLASSIFICATION OF SUBJECT MATTER
B62M6/90,B62K19/40 Version=2018.01

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)

B62M, B62K

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

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

TotalPatent One, 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	EP0818843 B1 (HONDA MOTOR CO LTD) 19 May 2004 (19.05.2004) Para [0012] - [0013], [0018], [0022], [0029], Figure 1, 6, 7	1-19
A	JPH10255744 A (MATSUSHITA ELECTRIC IND CO LTD) 25 September 1998 (25.09.1998) Para [0018], Figure 1-3	1-19
A	US20170174095 A1 (DARFON ELECTRONICS (SUZHOU) CO LTD et. al.) 22 June 2017 (22.06.2017) Para [0046], Figure 2A-2	1-19

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

* Special categories of cited documents:

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"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
23-10-2018	23-10-2018

Name and mailing address of the ISA/	Authorized officer
Indian Patent Office Plot No.32, Sector 14,Dwarka,New Delhi-110075	Seetha Raman A
Facsimile No.	Telephone No. +91-1125300200

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/IN2018/050391

Citation	Pub.Date	Family	Pub.Date
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US 2017174095 A1	22-06-2017	DE 102016124710 A1	22-06-2017