(57) Abstract: A headlight mounting structure establishes mounting relationships between each of multiple portions of a metal stay and multiple portions of a battery box. In fact, the battery box is a plastic material that cannot be mounted with a heavy headlight unit. However, to provide the metal stay that is welded with the head pipe and supports the battery box, it is to improve the strength of the battery box, which makes it possible to mount with the heavy headlight unit. In more detail, the metal stay also supports the headlight unit, which makes the stable securement of the headlight mounting structure. Furthermore, the battery box is supported by metal materials such as a battery band, a laterally projecting portion, and an upwardly projecting portion. As a result, the metal materials can compensate for weakness of the plastic battery box and provide a strong and stable battery box structure, which can be the headlight mounting portion and make the relationship therebetween that are close together in some motorcycle models.
HEADLIGHT MOUNTING STRUCTURE FOR A MOTORCYCLE

TECHNICAL FIELD
The present disclosure relates to a headlight mounting structure for saddle or straddle type vehicles such as a motorcycle, wherein a metal stay structure secured to a steering headpipe carries a battery box. The headlight mounting structure includes a headlight mounting portion provided by the metal stay structure and the battery box. A headlight unit mounted to the motorcycle by way of the headlight mounting structure thus has a structural mounting relationship with the metal stay and the battery box.

BACKGROUND ART
Motorcycles include a headlight unit carried at a front portion thereof for illuminating the road ahead, and include a battery for providing electrical power to their electrical systems. In some motorcycles, a battery box is positioned at the front portion of the motorcycle.

JP 5222693 discloses a motorcycle (10) having a headlight unit (75) and a battery box (112). As indicated in this prior art, the motorcycle (10) includes a front cover (63) that covers frontal portions of a steering head pipe (12). The battery box (112) is made of a molded plastic material, and carries a battery (111). The battery box (112) is disposed beneath the front cover (63), and is mounted to the head pipe (12) by a plurality of mounting means (122). The headlight unit (75) is mounted above the battery box (112), and is thus completely separate from the battery box (112).

DISCLOSURE
Technical Problem
In the above prior art, the battery box is directly mounted to the motorcycle's steering headpipe by way of a mounting arrangement that can make access to the battery itself unnecessarily time consuming or difficult. Even though the headlight unit and the battery box are each disposed toward front portions of the motorcycle and have a generally close vertical spatial relationship relative to each other, the headlight unit and the battery box are separately mounted to the motorcycle by way of corresponding separate mounting points, with no direct structural mounting relationship between each other. As a result, the number of structurally distinct mounting points on the motorcycle is undesirably increased, which can increase motorcycle assembly time and/or complexity.
Moreover, in the prior art, the battery box is configured only for carrying the battery, and does not appear to have any other purpose. Unfortunately, in particular for carrying any additional structural element having significant mass, then the size, thickness, and/or shape of the battery box would need to be increased in order to accommodate additional mechanical stresses, thereby undesirably making the battery box more expensive and reducing the amount of available space beneath the front cover. Furthermore, depending upon the manner in which the size, thickness, and/or shape of the battery box were increased, access to the battery could be rendered more difficult and/or time consuming.

It would be desirable to provide a motorcycle headlight mounting structure in which a headlight unit and a battery box have a direct mounting relationship to one another in some motorcycle models without adversely affecting space efficiency and the positioning of other components beneath the front cover, while simultaneously enabling convenient headlight unit and battery maintenance.

**Technical Solution**
This invention according to claim 1 is a headlight mounting structure for a motorcycle, comprising a head pipe mounted to a frame of the motorcycle, and a battery box made from plastic for supporting a battery in an internal portion thereof (e.g., an internal compartment), where the battery box is mounted at a front portion of said head pipe by a metal stay, characterized in that: a headlight unit is mounted in front of said battery box, and said headlight unit is supported by each of a set of headlight mounting portions of said battery box (e.g., right and left headlight mounting portions of said battery box) as well as a headlight mounting portion of said metal stay.

This invention according to claim 2 has, in the headlight mounting structure of claim 1, a characteristic in that said metal stay comprises (a) a main metal stay protruding forward from a lower front portion of said head pipe, and supporting a bottom portion or surface of said battery box; and (b) a sub metal stay protruding upwardly from an upper front portion of said head pipe and connected to a rear portion of said battery box, wherein said metal stay includes an upwardly projecting portion that (i) extends upward from the bottom portion of said battery box, and further (ii) includes a headlight mounting portion for said headlight unit and a battery box mounting portion for said battery box.
This invention according to claim 3 has, in the headlight mounting structure of claim 2, a characteristic in that said main metal stay further comprises a lateral extending portion that protrudes leftward and rightward from said main metal stay to form battery box mounting portions (e.g., left and right battery box mounting portions) on left and right sides of said metal stay, wherein said lateral extending portion includes an additional mounting portion for an electrical device (e.g., an additional electrical device other than the battery).

This invention according to claim 4 has, in the headlight mounting structure of claim 2, a characteristic in that said headlight unit comprises a pin structure at a rearward portion thereof, wherein said pin structure is connected to said headlight mounting portion of said upwardly projecting portion of said main metal stay, wherein said headlight mounting portion of said upwardly projecting portion comprises a hole and a grommet to receive said pin structure.

This invention according to claim 5 has, in the headlight mounting structure of claim 2, a characteristic in that said battery box is connected to said upwardly projecting portion of said main metal stay at a position between (a) said set of headlight mounting portions of said battery box, and (b) said headlight mounting portion of said upwardly protruding portion of said main metal stay.

This invention according to claim 6 has, in the headlight mounting structure of claim 5, a characteristic in that said battery box further includes an overhang portion on which said set of headlight mounting portions of said battery box is integrally formed with said overhang portion, wherein said overhang portion is connected to said upwardly projecting portion of said main metal stay by way of a fastening element from a front side of said battery box above said headlight mounting portion of said upwardly projecting portion of said main metal stay.

This invention according to claim 7 has, in the headlight mounting structure of claim 2, a characteristic in that said battery box includes a battery band made from metal, configured to downwardly press upon said battery from above, wherein a first end of said battery band is coupled to said sub metal stay, and a second end of said battery band is coupled to said
battery box at a center point between left and right boundaries of said set of headlight mounting portions of said battery box.

This invention according to claim 8 has, in the headlight mounting structure of claim 6, a characteristic in that said sub metal stay further comprises a hooking portion for connecting to said battery band, and said battery band includes a hanging portion for engaging said hooking portion.

This invention according to claim 9 has, in the headlight mounting structure of claim 1, a characteristic in that said battery box is supported by metal structures at front, rear, upper, and bottom sides of said battery box.

This invention according to claim 10 has, in the headlight mounting structure of claim 7, a characteristic in that said battery box is mounted to a plurality of metal means including each of said main stay, said sub metal stay, said upwardly projecting portion of said main stay, and said battery band.

This invention according to claim 11 has, in the headlight mounting structure of claim 1, a characteristic in that said battery box mounts with a fuse unit at one side of said battery box, and said battery box mounts closely with an electrical device at the other side of said battery box.

This invention according to claim 12 has, in the headlight mounting structure of claim 11, a characteristic in the said battery box includes an integrally formed fuse holder for mounting to said fuse unit.

**Advantageous Effects**

According to the invention disclosed in claim 1, the battery box is mounted to and structurally supported by the metal stay. The battery box is designed with sufficient strength to (a) support the weight of the motorcycle's battery, as well (b) aid support and stabilization of portions of the headlight unit by plastic and metal materials. Because the metal stay is securely attached to the motorcycle's head pipe, the headlight mounting structure reduces unnecessary mechanical stresses / forces on the headlight unit and the battery box. Consequently, the battery box need not be excessively large or thick, which allows for more
efficient space utilization beneath the motorcycle's front cover around portions of the battery box, such as for carrying other components such as one or more types of electrical devices. The addition of metal stay supports the battery box and headlight results in an integration of metal stays or fewer mounting points, and correspondingly fewer parts required for mounting the headlight unit and the battery box to the motorcycle compared to the prior art.

According to the invention disclosed in claim 2, bottom and rear portions of the battery box and are respectively supported by the main metal stay and the sub metal stay. The battery box is provided with strong, stable structural support with respect to the head pipe and hence portions of the motorcycle's structural frame. The upwardly projecting portion that extends upwardly from the main metal stay at the front of the battery box, the main metal stay at least partially overlays or surrounds and supports both frontal and bottom portions of the battery box, thereby providing effective mounting for the battery box and battery as well as structurally protecting the battery box and battery. Finally, because the upwardly projecting portion of the main metal stay includes a mounting portion for the battery box and headlight unit, this upwardly projecting portion is stabilized by the battery box itself, to simultaneously provide a strong, stable mounting point for the headlight unit by way of the headlight mounting portion thereof.

According to the invention disclosed in claim 3, the battery box is mounted on both sides of the laterally extending portion, and thus bottom portions of the battery box are stably held in position. Also, the lateral extending portion can hold another electrical device, without the need for an additional separate stay element for mounting the other electrical device to the motorcycle, thereby reducing cost and parts count.

According to the invention disclosed in claim 4, the headlight mounting portion of the main metal stay's upwardly projecting portion can be a simple structure such as an opening or hole, such that a simple, inexpensive fitting ring or grommet can provide a suitable holding force for securely retaining the headlight unit's pin structure in position without the need for an additional fastening element. The headlight unit's pin structure can simply be inserted into the hole through the fitting ring. Thus, the headlight unit mounting structure reduces a number of fastening elements required for mounting the headlight unit to the motorcycle, while decreasing manufacturing / assembly time.
According to the invention disclosed in claim 5, as the battery box, including the set of headlight mounting portions thereof, is typically made from molded rigid plastic, the battery box by itself does not provide sufficient strength for securely and stably supporting the headlight unit. However, the upwardly projecting portion of the main metal stay is made from a metal such as steel, and is connected to the battery box to compensate for any lack of strength that may exist at the set of battery box headlight mounting portions, which are plastic.

According to the invention disclosed in claim 6, the overhang structure augments the strength of the set of headlight mounting portions of the battery box by being supported from the upwardly projecting portion, thus compensating for any lack of strength in the battery box headlight mounting portions that can arise because of battery box manufacture from plastic material(s). Also, the overhang portion is mounted by a fastening element of the upwardly projecting portion, so the strength of the overhang portion is enhanced, which enhances the overall strength and stability of the headlight mounting structure.

According to the invention disclosed in claim 7, the metal battery band augments the strength of the battery box, and further decreases the magnitude of torsional or twisting force(s) exerted upon the battery box when the motorcycle is ridden. Consequently, the twisting action of the headlight, which occurs as a result of the twisting force of the battery box, is decreased as well. The metal battery band enhances headlight mounting structure strength and stability.

According to the invention disclosed in claim 8, the connection between the battery band and the sub metal stay provides a structurally simple mechanism by which the battery band can be conveniently and rapidly installed onto and removal from the sub metal stay.

According to the invention of claim 9, metal structures support the battery box at each of its front, rear, upper, and bottom sides. Such supporting metal structures correspond to or form metal “cage members” that enhance the structural integrity and stability of each of the battery box’s sides, which compensate for battery box structural weakness that may exist because the battery box itself is made of plastic.

According to the invention of claim 10, distinct portions of the plastic battery box are mounted to a plurality of metal means, in particular, bottom portions of the battery box are
mounted to the main metal stay; a rear portion of the battery box is mounted to the sub metal stay; a front portion of the battery box is mounted to the upwardly projecting portion of the main metal stay; and the upper portion of the battery box is mounted to the metal battery band. Such mounting of distinct portions of the battery box to the plurality of metal means provides the headlight mounting structure with a high degree of structural integrity and stability, without requiring the battery box to be unnecessarily thick or large. Also, this results in a strong structure and makes it possible to carry other parts surrounding battery box.

According to the invention of claim 11, because the battery is typically closely connected to the fuse unit and the fuse unit is a very lightweight component, in an improved battery box design one side of the battery box mounts with the fuse unit. This also results in more effective utilization of available space at the other side of battery box beneath the motorcycle's front cover. Additionally, to avoid what would otherwise be unused dead space, it's possible to adapt or mount an additional or auxiliary electrical device to another side of the battery box.

According to the invention of claim 12, the fuse unit is a very lightweight component that can readily mount with the battery box's fuse holder, thus the battery box integrally forms the fuse holder without any need for an additional mounting structure separate from the battery box. The battery box's fuse holder thus reduces parts count and cost.

**Brief Description of the Drawings**

FIG. 1 is a left side view of a representative motorcycle having a headlight mounting structure in accordance with embodiments of the present disclosure.

FIG. 2 is a partial left side view of the motorcycle of FIG. 1, illustrating portions of the headlight mounting structure in accordance with embodiments of the present disclosure.

FIG. 3 is a partial front view of the motorcycle of FIG. 1, illustrating portions of the headlight mounting structure in accordance with an embodiment of the present disclosure, corresponding to section Y-Y of FIG. 4.

FIG. 4 is a partial top sectional view of the motorcycle of FIG. 1, illustrating portions of the headlight mounting structure in accordance with an embodiment of the present disclosure.
FIG. 5 is a left sectional view showing portions of a headlight mounting structure in accordance with an embodiment of the present disclosure, corresponding to section A-A of FIG. 4.

FIG. 6 is a rear sectional view showing portions of the headlight mounting structure in accordance with an embodiment of the present disclosure, corresponding to section X-X of FIG. 2.

FIG. 7A is a top view showing portions of the headlight mounting structure in accordance with an embodiment of the present disclosure.

FIG. 7B is a first sectional view taken from FIG. 7A, illustrating portions of the headlight mounting structure in accordance with an embodiment of the present disclosure, corresponding to section B-B of FIG. 7A.

FIG. 7C is second sectional view taken from FIG. 7A, illustrating portions of the headlight mounting structure in accordance with an embodiment of the present disclosure, corresponding to section C-C of FIG. 7A.

FIG. 7D is third sectional view taken from FIG. 7A, illustrating portions of a headlight mounting structure in accordance with an embodiment of the present disclosure, corresponding to section D-D of FIG. 7A.

FIG. 7E is a partial perspective view showing a battery band engagement structure of the headlight mounting structure by which a battery band is mechanically coupled to an auxiliary / sub metal stay element in accordance with an embodiment of the present disclosure.

**Detailed Description of Example Embodiments**

For purposes of brevity and clarity, descriptions of representative embodiments of a headlight mounting structure for a motorcycle in accordance with particular embodiments of the present disclosure are provided hereafter. With respect to FIGs. 1 - 7E, FIG. 1 is a left side view of a motorcycle 20 having a headlight mounting structure 200 disposed at a front portion thereof in accordance with an embodiment of the present disclosure. FIG. 2 is a
partial left side sectional view, FIG. 3 is a partial front sectional view, and FIG. 4 is a partial top sectional view of upper frontal portions of the motorcycle 20, where each such partial view shows portions of a headlight mounting structure 200 relative to other frontal elements of the motorcycle 20 in accordance with an embodiment of the present disclosure. FIG. 5 is a left sectional view corresponding to section A-A of FIG. 4, and FIG. 6 is a rear sectional view corresponding to section X-X of FIG. 2. FIG. 7A is a top view showing portions of the headlight mounting structure in accordance with an embodiment of the present disclosure. FIG. 7B is a first sectional view corresponding to section B-B of FIG. 7A; and FIG. 7C and 7D are second and third sectional corresponding to section C-C and section D-D in respect of FIG. 7A. Finally, FIG. 7E is a partial perspective view showing a hooking portion and a hanging portion of an engagement structure by which a battery band is connected to an auxiliary / sub metal stay element in accordance with an embodiment of the present disclosure.

With reference to FIG. 1, in various embodiments, the motorcycle 20 is or exhibits structural elements / features corresponding to an underbone or similar type of motorcycle (e.g., a scooter), in a manner understood by an individual having ordinary skill in the relevant art. However, an individual having ordinary skill in the relevant art will further recognize that a headlight mounting structure 200 in accordance with an embodiment of the present disclosure is not limited to such types of motorcycles 20. Particular left side elements of the motorcycle 20 shown in FIG. 1 are identified with an "L" suffix append to their corresponding element numbers, such that an individual having ordinary skill in the relevant art will readily understand that these left side elements have counterpart right side elements, some but not all of which are shown in other FIGs. When such counterpart right side elements are shown, they are identified with an "R" suffix appended to their element numbers.

In the embodiment shown in FIG. 1, the motorcycle 20 includes an underlying structural frame that is coupled to a seat 22 on which a rider can sit; a left front step floor panel 24L that provides a left step floor 25L for supporting the rider's left foot; a left rear step cover 26L from which a left rear step 27 is accessible (e.g., foldably extendable) for supporting a passenger's left foot; and a main stand 28 and a side stand 29 for supporting the motorcycle 20 when it is parked.
The motorcycle's underlying structural frame supports an engine unit 30, which is positioned below the seat 22. The engine unit 30 is coupled to an air cleaner 40 that filters air to prevent particulate matter from entering the engine unit 30. Filtered air and atomized fuel are introduced into a cylinder head 31 of the engine unit 30 and combusted within a combustion chamber thereof. As a result of such combustion, the engine unit 30 generates a propulsion or driving force that is delivered to a rear wheel 32 that carries a rear tire 33. The rear wheel 32 is supported by a rear axle 34 about which the rear wheel 32 rotates in response to the propulsion force. More particularly, the engine's propulsion force is communicated to the rear wheel 32 by way of a crank shaft that rotates about a crank shaft axis 36, and a belt converter or continuously variable transmission (CVT) having a belt drive axis 38. Exhaust from the engine unit 30 is directed into an exhaust pipe 42, which is disposed below the engine unit 30; and the exhaust pipe 42 is coupled to a muffler 44 for attenuating the engine unit's noise output.

A rear fender 46 is disposed below the seat 22 above and rearward of the rear wheel 32, for intercepting road spray or debris traveling away from the rear wheel 32, thereby preventing such road spray or debris from traveling beyond the rear fender 46. A rear suspension or cushion 48 is coupled between the motorcycle's structural frame and a swingarm that supports the rear wheel 32, in order to dampen road vibrations when the motorcycle 20 is in motion. The motorcycle 20 additionally includes a rear grip 50 that the passenger can grasp; a rear combination light 52 such as a combined tail light, rear winker and license light; and other conventional components or elements, in a manner readily understood by individuals having ordinary skill in the relevant art.

At the front portion of the motorcycle 20, a front wheel 54 that carries a front tire 55 is rotatably mounted to a front axle 56, about which the front wheel 54 spins as the motorcycle 20 is ridden. The front axle 56 is coupled to and supported by a front fork 58, which includes a left fork member 59L. A front fender 60 is disposed above the front wheel 54 for preventing road spray or debris from traveling beyond the front fender 60 as a result of the front wheel's rotation when the motorcycle 20 is in motion. The motorcycle 20 further includes a front braking mechanism, such as a disc brake 62 coupled to the front wheel 54 and a brake caliper 64 that can selectively engage with the disk brake 62 for applying a braking force to the front wheel 54 to thereby slow down the motorcycle 20 in a manner readily understood by those having ordinary skill in the relevant art.
The motorcycle 20 also includes a number of structural panels or covers that overlay particular internal portions of the motorcycle 20, including the motorcycle's underlying structural frame. In various embodiments, the motorcycle 20 includes a left rear side cover 66L disposed below the seat 22, and a center cover 68 disposed below the seat 22 contiguous with and forward of the rear side cover 66L and its right side counterpart. The center cover 68 includes an aperture formed therein forward of the seat 22, to which a pivotally openable / closeable fuel lid 78 is mounted. The motorcycle 20 additionally includes a left front side cover 70L disposed below the center cover 68 and forward portions of the left rear side cover 66L; a left lower under cover 72L disposed contiguous with and below the left front side cover 70L; and a belt converter cover 35 that overlays the belt converter. The motorcycle 20 further includes a left leg shield 74L disposed contiguous with and forward of the left front side cover 70L, above frontal portions of the step floor panel 24L, for protecting the rider's left leg when the motorcycle 20 is ridden.

The motorcycle 20 also includes an inner cover 76 disposed contiguous with and forward of the center cover 68 and contiguous with and above the left front side cover 70L, such that the inner cover 76 overlays particular portions of the motorcycle's structural frame that face the rider. As described in greater detailed below, a rear handle cover 94 extends above the inner cover 76, and a front handle cover 96 is disposed forward of the rear handle cover 94, such that a left handle grip 88L is accessible to the rider.

A front cover 100 is mounted contiguous with and forward of the inner cover 76, below and extending forward of the front handle cover 96 and above the left leg shield 74L, substantially across the motorcycle's width when seen from a front view. The front cover 100 exhibits a downward slope when seen from a side view. The front cover 100 includes an opening or aperture that carries a removable front hood 108, beneath which a headlight mounting structure having a headlight unit 201 mounted thereto in accordance with an embodiment of the present disclosure resides, as also described in detail below.

With further reference to FIGs. 2 - 4, for controlling the motorcycle's direction of travel, the motorcycle 20 includes a handle pipe 84 that includes right and left handle pipe members 85R,L on which the right and left hand grips 88R,L are respectively carried. The handle pipe 84 is coupled to a steering stem 82 that extends through a steering head pipe 86, which forms
part of the motorcycle's structural frame. The steering stem 82 is further coupled to the front fork 58. The steering stem 82 is pivotally displaceable about a steering axis definable therethrough. Left or right steering motion that the rider imparts to the handle grips 88R,L is correspondingly imparted to the handle pipe 84R,L and the steering stem 82 in response to a rider's relative pivotal displacement of the handle grips 88R,L about the steering axis, which causes the front wheel 54 to turn in a right or left direction. In various embodiments, the rear handle cover 94 and the front handle cover 96 cover the motorcycle's handle pipe 84. Rearview mirror(s) (not shown) can be coupled to the handle grips 88R,L to allow the rider to view objects to the rear of the motorcycle 20, as readily understood by those having ordinary skill in the art.

For controlling the forward speed of the motorcycle 20, the right handle grip 88R functions as or includes an accelerator or acceleration grip. Rotating the right handle grip 88R rearward causes the motorcycle 20 to accelerate. A rear brake lever 90 is disposed forward of the right handle grip 88R for controlling a rear wheel braking mechanism. Thus, the rider controls the acceleration of the motorcycle 20 using his right palm on the right handle grip 88R, and controls the braking of the motorcycle 20 by using his right fingers on the rear brake lever 90. On the opposite side of the motorcycle, a front brake lever 92 is disposed forward of the left handle grip 88L for controlling the braking mechanism of the front wheel 54, as set forth above. Depending upon the type of motorcycle 20 under consideration, the motorcycle 20 can include other or additional types of braking mechanisms (e.g., a rear brake pedal that is accessible to the rider's foot), in a manner readily understood by those having ordinary skill in the relevant art. The motorcycle 20 further includes various indicators, meters, and/or gauges disposed rearwards of the handle grips 88R,L and facing the rider, such as a speedometer 98.

As clearly shown in FIGS. 1 - 3, the motorcycle's headlight unit 201 is disposed such that an outer lens 202 thereof is disposed within an aperture formed in the lower portion of the front cover 100, such that the outer lens 202 resides vertically above and forward of the leg shield 74R,L. The headlight unit 201 includes a case that carries reflector structures configured directing low beam and high beam illumination produced by a set of headlight bulbs in forward directions, and projecting such illumination through the outer lens 202 toward the road ahead. Additionally, in the embodiment shown the headlight unit 201 includes a pair of
winker units carried within its case, which are configured for intermittently or periodically
flashing illumination corresponding to right and left turn signals.

With additional reference to FIG. 3, beneath the front cover 100, the headlight unit 201 includes a set of upper rear lateral headlight unit mounting portions 208R,L by which upper rear right and left portions of the headlight unit 201 can be secured to the motorcycle 20. The upper rear lateral headlight mounting portions 208R,L can include apertures 209R,L formed therein for receiving fastening elements such as screws. As indicated in FIG. 3, the motorcycle 20 additionally a control unit 105 for an answer-back system beneath the front cover 100. The motorcycle 20 also includes an ignition key unit 77 that is mounted in the inner cover 76.

With particular reference to FIGS. 2 - 5, the motorcycle's headlight mounting structure 200 is disposed beneath the motorcycle's front cover 100, and includes structural elements configured for enabling convenient mounting of the headlight unit 201 to the motorcycle 20 such that the headlight unit 201 and its outer lens 202 are securely maintained in an intended position as the motorcycle 20 is ridden, effectively regardless of variations in terrain. In general, in various embodiments the headlight mounting structure 200 includes: (a) a main metal stay 400 having a set of laterally extending portions or members 410R,L typically carried or disposed at a frontal or generally frontal segment thereof, as well as an upwardly or vertically projecting portion 420 frontally carried or disposed thereon; (b) an auxiliary or sub metal stay 460 positioned above the main metal stay 400; (c) particular rearward portions of the headlight unit 201; (d) particular forward portions of a battery box 300 in which a motorcycle battery 302 resides; (e) particular rearward portions of the battery box 300; (f) a battery band 380 that extends across upper portions of the battery box 300; and (g) the motorcycle's steering head pipe 86, to which the main metal stay 400 and the sub metal stay 460 are welded, thereby mechanically coupling the headlight mounting structure 200 to the motorcycle's underlying structural frame.

The headlight mounting structure 200 provides mounting points by which: lower or bottom portions of the battery box 300 are mounted to the lateral extending portions 410R,L of the main metal stay 400, such that the laterally extending portions 410R,L and the main metal stay 400 support portions of the underside of the battery box 300; a central front portion of the battery box 300 is mounted to the upwardly projecting portion 420 of the main metal stay
an upper rear portion 360 of the battery box 300 is mounted to the sub metal stay 460; at least one upper rear portion of the headlight unit 201 is mounted to an upper section of a front overhang portion 320 of the battery box 300; a lower rear portion of the headlight unit 201 is mounted to the upwardly projecting portion 420 of the main metal stay 400; and the battery band 380 is mounted to each of the sub metal stay 460 and the upper front portion of the battery box 300.

More particularly, as illustrated in FIGs. 2 and 5, the main metal stay 400 is welded to a lower front portion of the steering head pipe 86, and the sub metal stay 460 is welded to an upper front portion of the steering head pipe 86. The main metal stay 400 projects, protrudes, or extends a predetermined distance in a forward direction away from the lower front portion of the steering head pipe 86, and includes a platform 402 (e.g., a planar or generally planar support platform 402) as well as the laterally extending portions 410R,L for supporting lower portions or a bottom surface 306 of the battery box 300, as further described below.

With reference also to FIG. 7A, the laterally extending portions 410R,L of the main metal stay 400 extend rightward and leftward away from the main metal stay 400, respectively, from a position along the main metal stay 400 that is slightly rearward of the main metal stay's upwardly projecting portion 420. The laterally extending portions 410R,L are typically welded onto the main metal stay 400, although other arrangements are possible (e.g., a main metal stay 400 can have the laterally extending portions 410R,L integrally formed therewith). Each laterally extending portion 410R,L provides a battery box mounting portion 411R,L for instance, by including a set of apertures therein that can be aligned with apertures in the bottom surface 306 of the battery box, whereby a fastening arrangement such as a set of bolts 510R,L and corresponding threaded nuts can respectively secure right and left portions of the bottom surface 306 of the battery box 300 to the right and left laterally extending portions 410R,L of the main metal stay 400. As a result, the right laterally extending portion 410R securely supports the right half of the battery box 300, and the left laterally extending portion 410L securely supports the left half of the battery box 300. In multiple embodiments, one of the laterally extending portions 410R,L extends further than the other laterally extending portion 410L,R to thereby provide an additional mounting portion 413 to which an additional or adjunctive electrical or other type of component or device 110 can be mounted beside the battery box 300. A representative additional electrical component 110 mounted to the left laterally extending portion 410L of the main metal stay 400 is indicated in FIG. 3. Such an
electrical component 110 can be, for instance, a notification device configured for generating an audible signal (e.g., a buzzer configured to output a buzzing sound, or another type of audible notification device). The provision of the additional mounting portion 413 by way of a given laterally extending portion 410 R.L of the main metal stay 400 results in efficient space utilization of what would otherwise be dead space, and eliminates the need for an extra mounting structure for the additional electrical device 110 separate from the headlight mounting structure 200, thereby reducing cost and parts count.

With additional reference again to FIG. 5, the upwardly projecting portion 420 of the main metal stay 400 is disposed at, adjacent, or proximate to a forward portion or segment thereof, and which upwardly or vertically extends a predetermined distance away from the support platform 402. In various embodiments, the main metal stay 400 and its upwardly projecting portion 420 exhibit a generally L-shaped profile from a side view. Additionally, from a side view, the main metal stay's upwardly projecting portion 420, its platform 402, the steering head pipe 86, and the sub metal stay 460 exhibit a somewhat or generally U-shaped profile.

The main metal stay's upwardly projecting portion 420 is configured for (a) alignment and insertion into and mounting engagement with an internal front compartment 321 provided by the front overhang portion 320 of the battery box 300; and (b) mounting engagement with a lower rear portion of the headlight unit 201. More specifically, the upwardly projecting portion 420 of the main metal stay 400 includes a first mounting aperture or opening 422 and a second mounting aperture or opening 424 therein. The first mounting aperture 422 is disposed above the second mounting aperture 424, and aligns with a front aperture or opening 322 of the battery box 300 when the upwardly projecting portion 420 of the main metal stay 400 is disposed within the front internal compartment 321 of the front overhang portion 320 of the battery box 300. The upwardly projecting portion's first mounting aperture 422 can carry a threaded structure, such as a nut 523. Consequently, a fastener such as a metal bolt 522 can be inserted into and through the front aperture 322 of the battery box 300 and the first mounting aperture 422 of the upwardly projecting portion 420 of the main metal stay 400 to engage with the threaded nut 523 to thereby secure the overhang portion 320 of the battery box 300 to the upwardly projecting portion 420 of the main metal stay 400.

The second mounting aperture 424 and a corresponding grommet 426 carried thereby or fitted therewith are configured for receiving a rearwardly projecting pin structure 220 that is
formed in a lower rear portion of the headlight unit’s case, and which extends rearward from a portion of a rear surface 222 of the headlight unit’s case, such that the lower rear portion of the headlight unit 201 can be securely retained in an intended position relative to the upwardly projecting portion 420 of the main metal stay 400 by way of the pin structure 220, the second mounting aperture 424, and the grommet 426. The second mounting aperture 424 and the grommet 426 of the main metal stay's upwardly projecting portion 420 thus form a headlight mounting portion of the main metal stay 400. The cooperative design of the second mounting aperture 424, the grommet 426, and the headlight unit’s rearwardly projecting pin structure 220 eliminates the need for a separate fastening arrangement or fastening element for securely maintaining the lower rear portion of the headlight unit 201 in an intended position.

The sub metal stay 460 projects or protrudes a predetermined distance in an upward and forward direction away from an upper front portion of the steering head pipe 86. The sub metal stay 460 is configured to enable secure mounting of an upper rear portion 360 of the battery box 300 thereto. With additional reference to FIG. 6, in various embodiments the sub metal stay 460 includes battery box mounting portions 462R.L that respectively form or which are respectively disposed on right and left sides of the sub metal stay 460, and which have apertures or openings formed therein that can be aligned with a corresponding rear apertures formed in sub stay interface portions 362R.L of the upper rear portion 360 of the battery box 300. A fastening arrangement such as left and right metal bolts 562R.L and corresponding left and right threaded nuts 563R.L can be utilized such that after the battery box mounting portions 462R.L of the sub metal stay 460 are appropriately aligned with respect to the right and left sub stay interface portions 362R.L of the upper rear portion 360 of the battery box 300, the metal bolts 562R.L can respectively be inserted therethrough to engage with their counterpart threaded nuts 563R.L. As a result, the upper rear portion 360 of the battery box 300 is securely held in position and supported by the sub metal stay 460.

The battery box 300 includes a housing having a battery receptacle 301 therein for receiving and holding the battery 302, such that the battery's positive and negative electrical terminals can be easily connected to corresponding electrical connectors (e.g., as a result of the battery's positive (+) and negative (-) electrical terminals facing upward, and remaining exposed or accessible while the battery 302 resides within the receptacle 301. The battery box 300 includes right and left side surfaces or sides 304R.L; the bottom surface 306; the
overhang portion 320 providing a set of front or forward facing surfaces 332, 333, 334; an upper surface 340; and a set of rear surfaces 352, 354, including an upper rear surface 352 and/or upper rear edges 352R,L corresponding to the upper rear portion 360 of the battery box 300 and a lower rear surface 354 that forms a lower rear outer portion of the battery box 300.

In FIG. 7A, the upper surface 340 of the battery box 300 has an aperture formed therein, which defines an upper border of the battery receptacle 301. The upper surface 340 of the battery box 300 extends a predetermined distance forward of the battery receptacle 301, until interfacing with a first or upper front surface or edge 332 of the battery box 300. In various embodiments, this forward projecting section of the upper surface 340 of the battery box 300 forms the top of the overhang portion 320 of the battery box 300.

The battery box 300 carries, includes, or provides a set of headlight mounting portions 342R,L forward of the battery receptacle 301 on the upper surface 340 of the battery box 300, at which upper rear portions 242R,L of the headlight unit 201 are securable or secured to upper front portions of the battery box 300. More particularly, as shown in FIGs. 2, 4, and 7A, in various embodiments forward of the battery receptacle 301, the upper surface 340 of the battery box 300 forms upward facing areas of the battery box’s overhang portion 320, and the headlight mounting portions 342R,L of the battery box 300 are laterally disposed on right and left sides of such upward facing areas of the overhang portion 320 of the battery box 300. The battery box’s headlight mounting portions 342R,L include apertures or openings therein, which align with corresponding apertures or openings in the upper rear portions 242R,L of the headlight unit 201. As a result, a fastening arrangement that includes right and left headlight mounting bolts 542R,L that are insertable into and through the apertures of the battery box’s headlight mounting portions 342R,L when such apertures are aligned with counterpart apertures provided in the upper rear portions 242R,L of the headlight unit 201 enables secure mounting of the upper rear portions 242R,L of the headlight unit 201 to upper front portions of the battery box 300.

In FIG. 7B, which corresponds to section line B-B of FIG. 7A, a representative fastening arrangement that utilizes the left headlight mounting bolt 542L and corresponding left steel clip nut 543L to secure the upper left rear portion 242L of the headlight unit 201 to the upper left front portion of the battery box 300 is shown. The steel clip nut 543L includes apertures...
therein that can be cooperatively aligned relative to an aperture of a corresponding headlight mounting portion 342L of the battery box 300 and the aperture of a corresponding upper rear portion 242L of the headlight unit 201, such that a counterpart bolt 542L can be inserted through each of such apertures for mounting the upper rear portion 242L of the headlight unit 201 to the top surface 340 of the battery box 300 forward of the battery compartment 301. In such an embodiment, clip nut 543L can be inserted on its corresponding headlight mounting portion 342L of the battery box 300 from the rear of the battery box 300. In fact, this left side structure is same as the right side structure.

With reference again to FIG. 4, in a number of embodiments the front cover 100 is secured to the upper rear portions 242R,L of the headlight unit 201 as well as upper front portions of the battery box 300 adjacent to the battery box's headlight mounting portions 342R,L by way of front cover screws 500R,L. As a result, the front cover 100 is also secured to portions of the headlight mounting structure 200.

In several embodiments, the upper front surface 332 of the battery box 300 projects a predetermined distance downward in a vertical or generally vertical direction. Below this upper front surface 332, a second or middle front surface 333 of the battery box 300 extends downward at one or more rearwardly directed angles, for instance, at a plurality of angles between approximately 15 - 60 degrees with respect to the vertical direction (e.g., along a first or upper angle of approximately 30 degrees, and a second or lower angle of approximately 45 degrees). A third or lower front surface 334 of the battery box 300 is disposed below the middle front surface 333 and rearward of a lower boundary of the middle front surface 333, to form portions of a lower front section of the battery box 300.

Along a lower portion of the battery box's middle front surface 333, the middle front surface 333 includes an aperture therein, which forms an entryway for the battery box's internal front compartment 321. The internal front compartment 321 is formed by internal forward surfaces or walls of the battery box 300 disposed in a central region thereof, for instance, in a manner indicated in FIG. 5. When the battery box 300 is mounted to the laterally projecting portions 410R,L of the main metal stay 400, the upwardly projecting portion 420 of the main metal stay 400 extends into the internal front compartment 321 of the battery box 300, such that the front aperture 322 of the overhang portion 320 of the battery box 300 is aligned with the first mounting aperture 422 of the upwardly projecting portion 420 of the main metal stay.
400. As a result, the front overhang portion 320 of the battery box 300 can be securely mounted or attached to the main metal stay's upwardly projecting portion 420 by way of a fastening arrangement such as the aforementioned bolt 522 and threaded nut 523.

Because the main metal stay 400 and its upwardly projecting portion 420 are made of metal whereas the battery box 300 is made of molded plastic, and the main metal stay 400 is attached to the motorcycle's steering head pipe 86, the overall strength of the overhang portion 320 of the battery box 300, and hence front portions of the battery box 300, is enhanced when the overhang portion 320 is mounted to the upwardly projecting portion 420 of the main metal stay 400. The structural integrity of the main metal stay 400 including that of its upwardly projecting portion 420, as well as the coupling of the main metal stay 400 to the steering head pipe 86, compensates for deficiencies in the strength of the battery box 300 by itself, thereby significantly enhancing the structural integrity and stability of the headlight mounting structure 200 while simultaneously eliminating a need to form the battery box 300 with a significantly larger profile than conventional or typical battery boxes; thicker or significantly thicker walls than conventional or typical battery boxes; and/or stronger or significantly stronger materials than conventional or typical molded plastic materials. Were the too large, there would be less space available beneath the motorcycle's front cover 100 for carrying other motorcycle components.

As indicated above, the headlight mounting structure 200 also includes a battery band 380, which is typically made of metal. As particularly shown in FIGs. 4 and 7A, the battery band 380 includes an elongate strip of material that extends in a forward-rearward direction across a central portion of the battery box 300. The battery band 380 is configured for exerting a downward force across top portions of the battery 302 (e.g., top central portions of the battery, between the battery's positive (+) and negative (-) terminals). That is, the battery band 380 downwardly presses upon such portions of the battery 300.

The battery band 380 includes a first end 381 that is mechanically engageable with or engaged to the sub metal stay 460; and a second end 382 that is mechanically secured to a battery band mounting portion 384 on an upper front portion of the battery box 300 between (e.g., centrally or midway between) the headlight mounting portions 342R,L of the battery box 300. FIG. 7E is a perspective view illustrating a representative battery band engagement structure 390 by which the battery band is engageable with the sub metal stay 460. In an
embodiment, the battery band engagement structure 390 includes a hanging portion 392 at the first end 381 of the battery band 380; and a curved hooking portion 494 carried by or disposed on an upper portion of the sub metal stay 460, which projects in an upward and rearward direction. The battery band’s hanging portion 392 is insertably engageable with the sub metal stay’s hooking portion 494, and can be securely retained thereby as a result of a pressure or force that the hanging portion 392 exerts on the hooking portion 494 in a forward direction. Such forward pressure or force is established when the battery band's second end 382 is secured to the battery band mounting portion 384 of the battery box 300.

With reference also to FIGs 5 as well as 7C, which corresponds to section line C-C of FIG. 7A, the second end 382 of the battery band 380 can be secured to the battery band mounting portion 384 of the battery box 300 by way of a fastening arrangement in which a battery band mounting bolt 584 is inserted into and through an aperture proximate to the battery band's second end 382, an aperture provided by the battery box's battery band mounting portion 384, and apertures of a battery band clip nut 585 (e.g., a steel clip nut 585). The battery band clip nut 585 can be inserted on the battery band mounting portion 384 of the battery box 300 in a forward direction.

Once the hanging portion of the battery band 380 engages with the hooking portion 494 of the sub metal stay 460 and the front segment of the battery band 380 is secured to the battery band mounting portion 384 of the battery box 300, an underside of the battery band exerts the aforementioned downward pressure or force upon an upper surface of the battery 302. Depending upon embodiment details, the thickness of the battery band 380 and/or the contour of the battery band's cross sectional area can be selected such that the battery band 380 applies downward pressure upon the battery 302 that is expected to be sufficient to substantially or essentially prevent or limit vertical and lateral displacement of the battery 302 within the battery box 300 when the motorcycle 20 is ridden. Additionally, because the battery band 380 is made of metal, the battery band 380 augments the strength of the battery box 300, and decreases the magnitude of torsional or twisting force(s) exerted upon the battery box 300 when the motorcycle is ridden as a result of inertial forces that the battery 302 exerts upon the battery box 300. Consequently, the metal battery band 380 further enhances headlight mounting structure strength and stability.
In view of the foregoing description, an individual having ordinary skill in the relevant art will recognize that the molded plastic battery box 300 is mounted to a plurality of metal structures or elements including the main metal stay 400 by way of the laterally extending portions 410R,L and the upwardly projecting portion 420 thereof; the sub metal stay 460; and the battery band 380. Such metal structures aid or establish secure mechanical coupling of the battery box 300 to the motorcycle’s steering head pipe 86, and hence to the motorcycle’s underlying structural frame, and correspond to or form metal "cage elements" or "cage members" that enhance the structural integrity and stability of each of the battery box’s sides, to compensate for battery box structural weakness that may exist because the battery box itself is made of plastic. Additionally, such cage elements / members eliminate the need to provide a larger or thicker battery box 300 than necessary, thereby saving cost.

In several embodiments, the battery box 300 additionally includes an integrally formed fuse holder 370 that mounts (e.g., directly mounts) with a fuse unit 170 at one side of the battery box 300, for instance, at the battery box’s right side 304R (e.g., a lower portion of the right side 304R of the battery box 300). An individual having ordinary skill in the relevant art will understand that in the prior art, a fuse unit 170 is a very lightweight item that is closely mounted to a conventional battery box. The provision of the integrally formed fuse holder 370 that mounts to a fuse unit 170 results in a more effective utilization of lateral space next to the battery box 300 and eliminates the need to provide an additional mounting structure for the fuse unit 170 separate from the battery box 300, thereby reducing cost and parts count.

Various embodiments of the present invention described herein address at least one problem, limitation, and/or disadvantage associated with existing headlight mounting structures for motorcycles. While certain features and/or advantages associated with certain embodiments have been described herein, other embodiments may also exhibit such features and/or advantages, and not all embodiments need necessarily exhibit such features and/or advantages to fall within the scope of the following claims. It will be appreciated by a person of ordinary skill in the art that several of the above-disclosed structures, elements, components, or alternatives thereof can be desirably combined into other different structures, elements, or components, while remaining within the scope of the claims below. In addition, a person having ordinary skill in the art can make various modifications, alterations, and/or
improvements to the embodiments disclosed herein, and consequently embodiments in accordance with the present disclosure are limited only by the following claims.
Claims

1. A headlight mounting structure for a motorcycle, comprising:
   a head pipe mounted to a frame of the motorcycle; and
   a battery box made from plastic for supporting a battery in an internal portion thereof,
   the battery box mounted at a front portion of said head pipe by a metal stay,
   characterized in that:
   a headlight unit is mounted in front of said battery box, and said headlight unit is
   supported by each of a set of headlight mounting portions of said battery box and
   a headlight mounting portion of said metal stay.

2. The headlight mounting structure of claim 1, wherein said metal stay comprises:
   a main metal stay protruding forward from a lower front portion of said head pipe, and
   supporting a bottom portion of said battery box; and
   a sub metal stay protruding upwardly from an upper front portion of said head pipe and
   connected to a rear portion of said battery box,
   wherein said main metal stay includes an upwardly projecting portion extending upward
   from the bottom portion of said battery box, and further including a headlight
   mounting portion for said headlight unit and a battery box mounting portion for said
   battery box.

3. The headlight mounting structure of claim 2, wherein said main metal stay further
   comprises a lateral extending portion protruding leftward and rightward from said main metal
   stay to form battery box mounting portions on left and right sides of said main metal stay, and
   wherein said lateral extending portion includes an additional mounting portion for an
   electrical device.

4. The headlight mounting structure of claim 2, wherein said headlight unit comprises a pin
   structure at a rearward portion thereof, and wherein said pin structure is connected to said
   headlight mounting portion of said upwardly projecting portion of said main metal stay,
   wherein said headlight mounting portion of said upwardly projecting portion comprises a
   hole and a grommet to receive said pin structure.
5. The headlight mounting structure of claim 2, wherein said battery box is connected to said upwardly projecting portion of said main metal stay at a position between said set of headlight mounting portions of said battery box and said headlight mounting portion of said upwardly protruding portion of said main metal stay.

6. The headlight mounting structure of claim 5, wherein said battery box further includes an overhang portion, wherein said set of headlight mounting portions of said battery box is integrally formed with said overhang portion, and wherein said overhang portion is connected to said upwardly projecting portion of said main metal stay by way of a fastening element from a front side of said battery box above said headlight mounting portion of said upwardly projecting portion of said main metal stay.

7. The headlight mounting structure of claim 2, wherein said battery box includes a battery band made from metal, configured to downwardly press upon said battery from above, wherein a first end of said battery band is coupled to said sub metal stay, and a second end of said battery band is coupled to said battery box at a center point between left and right boundaries of said set of headlight mounting portions of said battery box.

8. The headlight mounting structure of claim 6, wherein said sub metal stay further comprises a hooking portion for connecting to said battery band, and said battery band includes a hanging portion for engaging said hooking portion.

9. The headlight mounting structure of claim 1, wherein said battery box is supported by metal structures at front, rear, upper, and bottom sides of said battery box.

10. The headlight mounting structure of claim 7, wherein said battery box is mounted to a plurality of metal means including each of said main metal stay, said sub metal stay, said upwardly projecting portion of said main metal stay, and said battery band.

11. The headlight mounting structure of claim 1, wherein said battery box mounts with a fuse unit at one side of said battery box and said battery box mounts closely with an electrical device at the other side of said battery box.
12. The headlight mounting structure of claim 11, wherein said battery box integrally includes a fuse holder for mounting to said fuse unit.
A. CLASSIFICATION OF SUBJECT MATTER

Int.Cl. B62 J6/ 02 (2006. 01)i

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)

Int.Cl. B62 J6/ 02

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

- Published examined utility model applications of Japan 1922-1996
- Published unexamined utility model applications of Japan 1971-2015
- Registered utility model specifications of Japan 1996-2015
- Published registered utility model applications of Japan 1994-2015

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
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<tr>
<th>Category</th>
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<th>Relevant to claim No.</th>
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<tbody>
<tr>
<td>A</td>
<td>JP 11-115853 A (HONDA MOTOR CO., LTD.) 1999. 04. 27, Paragraphs [0008] to [0010], [0029] to [0037], figures 3 and 13 to 15 &amp; IT TO980863 A1</td>
<td>1-12</td>
</tr>
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<td>A</td>
<td>JP 2007-38727 A (HONDA MOTOR CO., LTD.) 2007.02.15, Paragraphs [0025] to [0033], figures 5 to 8 &amp; CN 1907792 A &amp; TW 001292375 B</td>
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Further documents are listed in the continuation of Box C. See patent family annex.

- Special categories of cited documents:
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Date of the actual completion of the international search: 25.06.2015
Date of mailing of the international search report: 07.07.2015

Name and mailing address of the ISA/JP
Japan Patent Office
3-4-3, Kasumigaseki, Chiyoda-ku, Tokyo 100-8915, Japan

Authorized officer
HAYASHI, Masamichi
3D 3729
Telephone No. +81-3-358 1-1101 Ext. 3341