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BATTERY MOUNT AND WORKING MACHINE INCLUDING THE SAME

Abstract

A battery mount includes a placement base, a restriction member to restrict rearward movement of the battery, and a securing assembly to secure the battery that extends from a position above or an upper portion of the restriction member to the battery's forward surface. The securing assembly includes a first securer at the same side of the battery as the battery's upper surface, a second securer at the same side of the battery as the battery's forward surface, and a coupler to couple the first and second securers to each other. The coupler includes an inclined portion provided in one of the first and second securers and inclined such that a distance to the battery's rear surface decreases upward, and a retention member to retain a position at which the other of the first and second securers is coupled to the inclined portion such that the position is adjustable.

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Background/Summary

CROSS REFERENCE TO RELATED APPLICATIONS [0001] This application is a continuation application of International Application No. PCT/JP2024/017974, filed on May 15, 2024, which claims the benefit of priority to Japanese Patent Application No. 2023-102747, filed on Jun. 22, 2023. The entire contents of each of these applications are hereby incorporated herein by reference.

BACKGROUND OF THE INVENTION
1. Field of the Invention
[0002] The present invention relates to battery mounts to secure a battery to a working machine, and working machines including such a battery mount.
2. Description of the Related Art
[0003] A battery mount disclosed in Japanese Unexamined Patent Application Publication No. 2020-004668 includes a placement wall, and a restriction member. The placement wall allows selective placement thereon of a first battery and a second battery that are of different mounting configurations. The restriction member is provided to the placement wall to restrict frontward movement of the first battery and the second battery. The restriction member includes a restrictor. The restrictor restricts upward movement of the second battery by engaging a first engagement protrusion provided on a lower forward portion of the second battery.
SUMMARY OF THE INVENTION
[0004] The battery mount in Japanese Unexamined Patent Application Publication No. 2020-004668 enables batteries of different mounting configurations to be mounted.
[0005] With the battery mount in Japanese Unexamined Patent Application Publication No. 2020-004668, however, the battery is secured to the battery mount by use of a pair of rod members (a first rod member and a second rod member) and a mounting stay. Accordingly, mounting or removal of the battery to or from the battery mount requires attachment or detachment of the pair of rod members.
[0006] Example embodiments of the present invention provide battery mounts each of which enables firm and easy securing of a battery, and working machines including the battery mount.
[0007] A battery mount according to an example embodiment of the present invention includes a placement base for placement of a battery, a restriction member to restrict rearward movement of the battery, the restriction member being provided at the same side of the battery as a rear surface of the battery, and a securing assembly to secure the battery, the securing assembly extending from a position above the restriction member or from an upper portion of the restriction member to a forward surface of the battery, wherein the securing assembly includes a first securer provided at the same side of the battery as an upper surface of the battery, a second securer provided at the same side of the battery as the forward surface of the battery, and a coupler to couple the first securer and the second securer to each other, and the coupler includes an inclined portion provided in one of the first securer and the second securer, the inclined portion being inclined in an inclination direction such that a distance between the inclined portion and the rear surface of the battery decreases in an upward direction, and a retention member to retain a position at which the

other of the first securer and the second securer is coupled to the inclined portion such that the position relative to the inclined portion is adjustable.
[0008] The first securer may include one end portion coupled to the position above the restriction member or to the upper portion of the restriction member, and another end portion provided above a forward portion of the battery. The second securer may include one end portion at which the inclined portion of the coupler is provided, and another end portion coupled to the placement base.
[0009] The second securer may be bent at an intermediate portion, and a portion of the second securer that extends from the intermediate portion to the one end portion may define the inclined portion extending in the inclination direction.
[0010] The restriction member may extend from the placement base to a position higher than the battery. The one end portion of the first securer may be coupled to the upper portion of the restriction member such that the first securer is swingable in an up-down direction.
[0011] The other end portion of the second securer may be coupled to the placement base such that the second securer is swingable in a front-rear direction of the battery.
[0012] The retention member may be configured to move along the inclined portion to change the position at which the other of the first securer and the second securer is coupled to the inclined portion relative to the inclined portion.
[0013] The other of the first securer and the second securer may include an inclined surface inclined in a direction crossing the inclination direction. The retention member may be configured to abut the inclined surface to retain the position at which the other of the first securer and the second securer is coupled to the inclined portion relative to the inclined portion.
[0014] The inclined portion may include a thread groove. The retention member may include a fastener to be screwed into the thread groove.
[0015] The securing assembly may be located inside of the battery on the placement base in a width direction of the battery.
[0016] The securing assembly may be a single securing assembly located inside of the battery on the placement base in the width direction of the battery.
[0017] The battery mount may further include a clamp member extending between the upper surface of the battery and the first securer and between the forward surface of the battery and the second securer. The clamp member may be configured such that the first securer causes the clamp member to press the upper surface of the battery downward, and the second securer causes the clamp member to press the forward surface of the battery rearward.
[0018] The battery mount may further include a force transmission member provided between the securing assembly and the battery to transmit a pressing force exerted by the securing assembly to the battery.
[0019] The securing assembly may be configured to directly or indirectly abut an upper forward corner portion of the battery to apply a rearward and downward pressing force to the battery.
[0020] A working machine according to an example embodiment of the present invention includes the battery mount.
[0021] The above and other elements, features, steps, characteristics and advantages of the present invention will become more apparent from the following detailed description of the example embodiments with reference to the attached drawings.

Description

BRIEF DESCRIPTION OF THE DRAWINGS
[0022] A more complete appreciation of example embodiments of the present invention and many of the attendant advantages thereof will be readily obtained as the same becomes better understood by reference to the following detailed description when considered in connection with the

accompanying drawings described below.
[0023] FIG. **1** is a perspective view of a working machine including a battery mount according to the present invention.
[0024] FIG. **2** is a side elevation of the working machine including the battery mount according to the present invention.
[0025] FIG. **3** is a plan view illustrating the position of a battery relative to a machine body.
[0026] FIG. **4** is a perspective view of a battery mount according to a first example embodiment as seen diagonally from the upper right.
[0027] FIG. **5** is a cross-sectional view of the battery mount according to the first example embodiment taken at the center in a left-right direction.
[0028] FIG. **6** illustrates attachment and detachment of the battery to and from the battery mount according to the first example embodiment.
[0029] FIG. **7**A illustrates a securing assembly with a fastener loosened.
[0030] FIG. **7**B illustrates the relationship between a friction surface and a pressing force applied from the securing assembly with the fastener tightened.
[0031] FIG. **8** is a side elevation illustrating the relationship between a retention member, a pressing member, and a bracket according to a second example embodiment.
[0032] FIG. **9**A is a side elevation illustrating an example embodiment in which the securing assembly is caused to indirectly abut a forward upper portion of the battery.
[0033] FIG. **9**B is a side elevation illustrating an example embodiment in which the securing assembly is caused to directly abut the forward upper portion of the battery.

DETAILED DESCRIPTION OF THE EXAMPLE EMBODIMENTS

[0034] Example embodiments will now be described with reference to the accompanying drawings, wherein like reference numerals designate corresponding or identical elements throughout the various drawings. The drawings are to be viewed in an orientation in which the reference numerals are viewed correctly.

First Example Embodiment

[0035] A battery mount **50** according to a first example embodiment of the present invention will now be described.
[0036] FIG. **1** is a perspective view of a working machine **1** including the battery mount **50** according to the first example embodiment. FIG. **2** is a side elevation of the working machine **1**.
[0037] According to the first example embodiment, the battery mount **50** functions to secure a battery BT to the working machine **1** including a working device **4**, such as a construction machine, an agricultural machine, or the like. The battery mount **50** according to the present invention may function to secure the battery BT to a vehicle other than the working machine **1**, for example, a traveling vehicle such as a tractor, a small farm vehicle, or the like. According to the first example embodiment, an example of the working machine **1** is a backhoe, which is a slewing working machine.
[0038] The working machine **1** according to the first example embodiment includes a machine body (slewing base) **2**, a traveling device **3**, and the working device **4**. The machine body **2** is provided with an operator's seat **6**. An operator (driver) can be seated on the operator's seat **6**. The operator's seat **6** is provided at a left forward portion of the machine body **2**.
[0039] With the battery mount **50** according to the first example embodiment, the battery BT is secured with its front surface (which is, among the four lateral surfaces on the periphery of the battery BT, one of the two lateral surfaces extending along the respective long edges of the upper surface of the battery BT; according to the first example embodiment, the “front surface” of the battery BT refers in particular to the lateral surface near a terminal **49**) facing forward of the working machine **1**. However, the direction in which the battery
[0040] BT is secured to the battery mount **50** according to the present invention is not limited to the direction according to the first example embodiment (a direction such that the front surface of the

battery BT faces forward of the working machine **1**). For example, with the battery mount **50** according to the present invention, the battery BT may be secured with its front surface facing in some other direction, such as rearward, leftward, forwardly leftward, or the like of the working machine **1**.

[0041] In the following description, the battery mount **50** and the working machine **1** will be described with reference to the direction in which the front surface of the battery BT faces forward of the working machine **1**.

[0042] That is, directions such as forward, rearward, leftward, rightward, and the like used in describing the battery mount **50** and the working machine **1** are defined as described below.

[0043] With the working device **4** in a state (orientation) facing in the direction of forward travel of the traveling device **3**, a direction pointing forward of the operator seated on the operator's seat **6** of the working machine **1** (a direction indicated by an arrow A**1** in FIG. **2**) is defined as forward. A direction pointing rearward of the operator (a direction indicated by an arrow A**2** in FIG. **2**) is defined as rearward. A direction indicated by an arrow K**1** in FIG. **2** is defined as a front-rear direction. A direction pointing leftward of the operator (toward the near side of FIG. **2**) seated on the operator's seat **6** is defined as leftward. A direction pointing rightward of the operator (toward the far side of FIG. **2**) is defined as rightward.

[0044] As illustrated in FIG. **3**, a horizontal direction orthogonal to the front-rear direction K**1** is defined as a machine-body width direction K**2**. A direction pointing rightward or leftward from the center in the width direction of the machine body **2** is defined as a machine-body outboard direction. In other words, the machine-body outboard direction refers to a direction parallel to the machine-body width direction and pointing away from the center in the width direction of the machine body **2**. A direction opposite to the machine-body outboard direction is defined as a machine-body inboard direction. In other words, the machine-body inboard direction refers to a direction parallel to the machine-body width direction and pointing toward the center in the width direction of the machine body **2**.

[0045] As illustrated in FIGS. **1** and **2**, the traveling device **3** includes a traveling frame **9**, and a traveling mechanism **10** provided at left and right portions of the traveling frame **9**. The traveling mechanism **10** according to the first example embodiment is a crawler-type traveling mechanism driven by a hydraulic motor. A dozer **7** is attached to a forward portion of the traveling device **3**.

[0046] As illustrated in FIGS. **1** and **2**, the working device **4** is provided at a forward portion of the machine body **2**, and includes a boom **15**, an arm **16**, and a bucket (working tool) **17**. The proximal portion of the boom **15** is pivotally attached to a swing bracket **14** to be pivotable (swingable in the up-down direction) about a lateral axis (an axis extending in the machine-body width direction K**2**). The swing bracket **14** is supported on a support bracket **18** provided at the forward portion of the machine body **2**, to be pivotable about a vertical axis (an axis extending in the up-down direction). The arm **16** is pivotally attached at the distal end portion of the boom **15** to be pivotable (swingable in the front-rear or up-down direction) about the lateral axis. The bucket **17** is provided at the distal end of the arm **16** to perform shoveling and dumping.

[0047] Instead of the bucket **17** or in addition to the bucket **17**, another working tool (hydraulic attachment) that can be driven by a hydraulic actuator can be attached to the working machine **1**. Such another working tool may be a hydraulic breaker, a hydraulic crusher, an angle boom, an earth auger, a pallet fork, a sweeper, a mower, a snow blower, or the like.

[0048] The swing bracket **14** swings as a hydraulic cylinder extends and retracts. The boom **15** swings as a boom cylinder C**3** extends and retracts. The arm **16** swings as an arm cylinder C**4** extends and retracts. The bucket **17** performs shoveling and dumping as a bucket cylinder (working-tool cylinder) C**5** extends and retracts. The boom cylinder C**3**, the arm cylinder C**4**, and the bucket cylinder C**5** each include a hydraulic cylinder (hydraulic actuator)

[0049] As illustrated in FIGS. **1** and **2**, the machine body **2** is supported on the traveling frame **9** (traveling device **3**) via a slewing bearing **8** so that the machine body **2** can rotate (slew to the left

and right) about a vertical axis.
[0050] As illustrated in FIG. **3**, the machine body **2** includes a slewing frame **41** defining the framework of the machine body **2**. The slewing frame **41** is constructed by securing, to a slewing base plate **42** defining the bottom portion of the machine body **2**, components such as a reinforcing rib **43**, the support bracket **18**, and brackets or stays used for mounting various equipment (including tanks) to be installed on the machine body **2**, other parts, and the like to the machine body **2**.
[0051] As illustrated in FIGS. **1** and **2**, an operation portion **23** including the operator's seat **6** is installed on the machine body **2**.
[0052] The operation portion **23** is provided toward one side (left) relative to the center of the machine body **2**. As illustrated in FIG. **2**, a forward portion of the machine body **2** is provided with a floor step **19**, which defines the floor of the machine body **2** (the floor at an upper portion of the machine body). The floor step **19** covers a forward left portion of the slewing frame **41**. The operation portion **23** is installed rearward of the floor step **19**.
[0053] As illustrated in FIGS. **2** and **3**, a hood **22** is provided rearward of the operation portion **23**. The interior of the hood **22** defines a prime-mover compartment E**2** to accommodate a prime mover E**1**. The prime mover E**1** is, for example, a diesel engine. The prime mover E**1** drives a hydraulic pump P**1**, which delivers a hydraulic fluid (pressurized oil) for driving hydraulic actuators such as a hydraulic motor, a hydraulic cylinder, and the like equipped to the working machine **1**. According to the first example embodiment, the hydraulic pump P**1** is installed inside the hood **22** and below the prime mover E**1**.
[0054] The prime mover E**1** may be a gasoline engine or an electric motor, or may be of a hybrid type including an engine and an electric motor.
[0055] The hood **22** surrounds the prime mover E**1**. A support frame is provided inside the hood **22** to support the hood **22** onto the machine body **2** (slewing frame **41**). The operator's seat **6** is provided forward of the hood **22**.
[0056] As illustrated in FIG. **3**, a fuel tank **45** is provided substantially at the center in the front-rear direction K**1** of a right portion of the slewing base plate **42** (slewing frame **41**). The battery BT is provided forward of the fuel tank **45**.
[0057] As indicated at “A” in FIG. **1**, the battery BT is a storage battery that is provided to the working machine **1**, and that supplies electric power to electronics such as a controller that executes various controls related to the working machine **1**, a meter, and the like. The battery BT according to the first example embodiment is a lead secondary battery with a positive electrode at a left forward portion of the battery and a negative electrode at a right forward portion of the battery. The battery BT according to the present invention may be a lithium ion battery, a solid-state battery, or the like. Wiring cable(s) is/are connected to the terminal(s) **49** of the battery BT. The battery BT supplies electric power to the electronics mentioned above via the wiring cable(s).
[0058] As illustrated in FIG. **4**, the battery BT is mounted to the slewing frame **41** of the machine body **2** by use of the battery mount **50**.
[0059] The battery mount **50** functions to secure the battery BT to the slewing frame **41** (machine body **2**). Specifically, the battery mount **50** includes: a placement base **54** for placement of the battery BT; a restriction member **55** to restrict rearward movement of the battery BT, the restriction member **55** being provided at the same side of the battery BT as the rear surface of the battery BT; and a securing assembly **53** to secure the battery BT, the securing assembly **53** extending from a position above the restriction member **55** or from an upper portion of the restriction member **55** to the forward surface of the battery BT.
[0060] As illustrated in FIGS. **4** and **5**, the placement base **54** is a plate member on which the battery BT can be placed, and the placement base **54** is wider than the battery BT in the left-right direction and the front-rear direction. According to the first example embodiment, the rear end of the placement base **54** is coupled to an intermediate portion in the up-down direction of the

restriction member **55**. The placement base **54** is coupled integrally with the restriction member **55**.
[0061] The central portion at the forward end of the placement base **54** projects forward relative to the left and right portions. A second engagement hole **56***b* is provided in the central portion at the forward end of the placement base **54**. The lower end portion of a second securer **53***b* described later is engaged with the second engagement hole **56***b*.
[0062] A first stopper **57***a* and a second stopper **57***b* are provided on the upper surface of the placement base **54**. The first stopper **57***a* is provided at the left end in a forward portion of the upper surface of the placement base **54**, as a combination of intersecting plate members that stand in the vertical direction. Specifically, the first stopper **57***a* includes a lateral restriction piece **58***a* extending in the left-right direction, and a fore-aft restriction piece **58***b* extending in the front-rear direction. The lateral restriction piece **58***a* restricts forward movement of the battery BT relative to the placement base **54**. The fore-aft restriction piece **58***b* restricts leftward movement of the battery BT relative to the placement base **54**.
[0063] The second stopper **57***b* is provided as a vertically standing plate member on the upper surface of the placement base **54**. The second stopper **57***b* includes a left restriction piece **57**L provided at the left end of the placement base **54**, and a right restriction piece **57**R provided at the right end of the placement base **54**. The left restriction piece **57**L restricts leftward movement of the battery BT relative to the placement base **54**. The right restriction piece **57**R restricts rightward movement of the battery BT relative to the placement base **54**.
[0064] An anti-slip mat **59** is provided on the upper surface of the placement base **54** to increase the frictional force between the upper surface of the placement base **54** and the bottom surface of the battery BT. The anti-slip mat **59** according to the first example embodiment is provided at each of a leftward position and a rightward position on the bottom surface of the battery BT. A mat similar to the anti-slip mat **59** may be provided at the back face (rear surface) of the battery BT.
[0065] As illustrated in FIGS. **4** and **5**, the restriction member **55** is provided rearward of the placement base **54**, and is in the form of a plate that stands in the up-down direction. The restriction member **55** restricts rearward movement of the battery BT. The upper end of the restriction member **55** according to the first example embodiment is located higher than the upper surface of the battery BT. One end portion of the securing assembly **53** (rear end portion) is coupled to a position on the restriction member **55** higher than the upper surface of the battery BT.
[0066] In another configuration(s) of the battery mount **50** according to the present invention, the upper end of the restriction member **55** may be located lower than the upper surface of the battery BT. One end portion (rear end portion) of the securing assembly **53** may simply be coupled to a position above the restriction member **55** or to an upper portion of the restriction member **55**, and need not necessarily be directly coupled to the restriction member **55**.
[0067] For example, the restriction member **55** that is shorter in height than the battery BT is provided at the upper surface of the placement base **54**. Then, a support member different from the restriction member **55** may be provided at a position above the restriction member **55** and higher than the height of the battery BT, and the one end portion (rear end portion) of the securing assembly **53** may be coupled to the support member.
[0068] A coupling member **60** to couple the one end portion (rear end portion) of the securing assembly **53** is provided at a position on the restriction member **55** according to the first example embodiment that is located higher than the upper surface of the battery BT. The coupling member **60** is in the form of a plate that projects forward of the forward surface of the restriction member **55**. The coupling member **60** according to the first example embodiment includes a left coupling member **60**L provided at a leftward portion of the restriction member **55** (battery BT), and a right coupling member **60**R provided at a rightward portion of the restriction member **55** (battery BT).
[0069] A first engagement hole **56***a* for engagement with the one end portion (rear end portion) of the securing assembly **53** is provided at the center of the left coupling member **60**L and at the center of the right coupling member **60**R. The first engagement hole **56***a* penetrates the center of

the left coupling member **60**L and the center of the right coupling member **60**R in the up-down direction.

[0070] As illustrated in FIG. **4**, the securing assembly **53** is located inside of the battery BT on the placement base **54** in the width direction, and more specifically, a single securing assembly **53** is provided inside of the battery BT in the width direction. According to the first example embodiment, the securing assembly **53** is provided at the central portion in the width direction of the battery BT on the placement base **54**.

[0071] As illustrated in FIGS. **5** and **6**, the securing assembly **53** includes: a first securer **53***a* provided at the same side of the battery BT as the upper surface of the battery BT; the second securer **53***b* provided at the same side of the battery BT as the forward surface of the battery BT; and a coupler **90** to couple the first securer **53***a* and the second securer **53***b* to each other. The securing assembly **53** is configured to secure the battery BT as the coupler **90** couples the other end portion (forward end portion) of the first securer **53***a,* and one end portion (upper end portion) of the second securer **53***b* to each other. In the securing assembly **53**, one or both of the other end portion (forward end portion) of the first securer **53***a,* and the one end portion (upper end portion) of the second securer **53***b* are inclined relative to both the horizontal direction and the vertical direction.

[0072] The first securer **53***a* and the second securer **53***b* according to the first example embodiment are each formed as a hard member that does not undergo elastic deformation, such as a metal or the like. The first securer **53***a* and the second securer **53***b* may each be an elastic member that undergoes elastic deformation, and this does not imply any limitation.

[0073] The first securer **53***a* according to the first example embodiment is coupled at one end portion (rear end portion) to an upper portion of the restriction member **55** or to a position above the restriction member **55** (a position higher than the upper surface of the battery BT). The one end portion (rear end portion) of the first securer **53***a* is coupled at two spaced locations in the left-right direction to the upper portion of the restriction member **55** or to the position above the restriction member **55**. The other end portion (forward end portion) of the first securer **53***a* is provided above a forward portion of the battery BT. The other end portion (forward end portion) of the first securer **53***a* is coupled at a single location at the center in the left-right direction to the one end portion (upper end portion) of the second securer **53***b* via the coupler **90**.

[0074] The one end portion (rear end) of the first securer **53***a* is coupled to the upper portion of the restriction member **55** such that the other end portion (forward end portion) of the first securer **53***a* is swingable in the up-down direction (toward and away from the battery BT). Specifically, the first securer **53***a* according to the first example embodiment includes: a left rear portion **53**RL coupled to the left coupling member **60**L; a right rear portion **53**RR coupled to the right coupling member **60**R; a forward portion **53**F coupled to the second securer **53***b;* and a middle portion **53**M coupling the above three portions, that is, the left rear portion **53**RL, the rear end of the forward portion **53**F, and the right rear portion **53**RR, in the left-right direction. The left rear portion **53**RL and the right rear portion **53**RR are each in the form of a bar extending in the front-rear direction. The rear end of the left rear portion **53**RL, and the rear end of the right rear portion **53**RR each have a hooked shape (substantially J-shape in side view) that bends downward, and are engaged with the first engagement hole **56***a* of the left coupling member **60**L, and the first engagement hole **56***a* of the right coupling member **60**R, respectively.

[0075] The first engagement hole **56***a* of the left coupling member **60**L, and the first engagement hole **56***a* of the right coupling member **60**R have an opening diameter greater than the outer diameter of the left rear portion **53**RL and the outer diameter of the right rear portion **53**RR, respectively, of the first securer **53***a.* The left rear portion **53**RL is thus in the first engagement hole **56***a* of the left coupling member **60**L such that the first securer **53***a* is swingable in the up-down direction. The right rear portion **53**RR is in the first engagement hole **56***a* of the right coupling member **60**R such that the first securer **53***a* is swingable in the up-down direction.

[0076] The middle portion **53**M of the first securer **53***a* couples the forward end of the left rear portion **53**RL, and the forward end of the right rear portion **53**RR to each other in the left-right direction. The middle portion **53**M is in the form of a bar with a substantially L-shaped cross-section when viewed from the side. The forward end of the left rear portion **53**RL, and the forward end of the right rear portion **53**RR are respectively joined to the left and right ends of the middle portion **53**M so as to cross the middle portion **53**M from above. The rear end of the forward portion **53**F of the first securer **53***a* is joined to the middle in the left-right direction of the middle portion **53**M so as to cross the middle portion **53**M from below.

[0077] The forward end of the left rear portion **53**RL, and the forward end of the right rear portion **53**RR are joined to the middle portion **53**M from above, and the rear end of the forward portion **53**F is joined to the middle portion **53**M from below. That is, as viewed from the left rear portion **53**RL and the right rear portion **53**RR, the forward portion **53**F is located lower than these rear portions by an amount corresponding to the thickness of the middle portion **53**M. Using the first securer **53***a* having a certain thickness in the up-down direction between its forward and rear ends as described above makes it easier to press, against the upper surface of the battery BT, the forward end of the first securer **53***a*, and a member such as a pressing member **67** or the like provided at the forward end.

[0078] The rear end of the forward portion **53**F of the first securer **53***a* is coupled to the center in the left-right direction of the middle portion **53**M. As with the rear portion **53**R, the forward portion **53**F is in the form of a bar extending in the front-rear direction. The pressing member **67** (the upper end portion of the second securer **53***b* in its upright position) is provided at the forward end of the forward portion **53**F.

[0079] As illustrated in FIG. **5**, a cover **79** for covering the battery BT is provided atop the first securer **53***a*. The cover **79** is made of electrically non-conductive resin or the like. The cover **79** is wider than the upper surface of the battery BT in the left-right direction and in the front-rear direction. That is, the cover **79** has a larger area than the upper surface of the battery BT. This allows the cover **79** to cover the entire upper surface of the battery BT. Using the cover **79** to cover the entire upper surface of the battery BT makes it possible to improve insulation for the terminal **49**, and reduce the risk of electrical leakage or electric shock.

[0080] The second securer **53***b* is provided at the same side of the battery BT as the forward surface of the battery BT. The one end portion (upper end portion) of the second securer **53***b* is coupled to the other end portion (forward end portion) of the first securer **53***a*. The other end portion (lower end portion) of the second securer **53***b* extends at or near the forward surface of the battery BT, and is coupled to the placement base **54**. The second securer **53***b* is a bar-shaped member that extends upward at a position forward of the battery BT, and that is bent at an intermediate portion (a bend portion **53***c*) in the up-down direction. That is, the second securer **53***b* according to the first example embodiment is bent at a position substantially the same in the up-down direction as the upper surface of the battery BT, and the substantially same position in the up-down direction as the upper surface of the battery BT corresponds to the bend portion **53***c* of the second securer **53***b* according to the first example embodiment. A portion of the second securer **53***b* according to the first example embodiment below the bend portion **53***c* is a linear portion **62** extending linearly in the up-down direction. The portion of the second securer **53***b* below the bend portion **53***c* defines the other end portion (lower end portion) of the second securer **53***b*. A portion (a portion above the bend portion **53***c*) of the second securer **53***b* according to the first example embodiment that extends from the intermediate portion (bend portion **53***c*) to the one end portion defines an inclined portion **63** extending in an inclination direction in which the inclined portion **63** is inclined rearward relative to the linear portion **62**. A portion (inclined portion **63**) of the second securer **53***b* above the bend portion **53***c* defines the one end portion (upper end portion) of the second securer **53***b*.

[0081] The other end portion (lower end) of the second securer **53***b* is coupled to the placement

base **54** such that the one end portion (upper end) of the second securer **53***b* is swingable in the front-rear direction. Specifically, as with the rear end of the left rear portion **53**RL and the rear end of the right rear portion **53**RR described above, the lower end of the linear portion **62** has a hooked shape that is bent forward. The lower end of the linear portion **62** is engaged with the second engagement hole **56***b* provided in the placement base **54**. The second engagement hole **56***b* of the placement base **54** has an opening diameter greater than the outer diameter of the linear portion **62**. Therefore, the lower end of the linear portion **62** is coupled to the placement base **54** such that the one end portion (upper end portion) is swingable in the front-rear direction of the battery BT (toward and away from the battery BT).

[0082] An anti-detachment member **64** with respect to the second engagement hole **56***b* is provided at a lower portion of the linear portion **62**. The anti-detachment member **64** is larger in size than the opening diameter of the second engagement hole **56***b*. The presence of the anti-detachment member **64** eliminates or reduces the risk that the linear portion **62** (second securer **53***b*) located higher than the anti-detachment member **64** may pass through the second engagement hole **56***b* and drop below the placement base **54**.

[0083] The inclined portion **63** is inclined in an inclination direction in which the inclined portion **63** is positioned closer to the rear surface of the battery BT as the inclined portion **63** extends upward. With the linear portion **62** oriented in the up-down direction, the inclined portion **63** is inclined rearward at an inclination angle of approximately 45 degrees with respect to the upward direction serving as a reference (0 degrees). According to the first example embodiment, the inclination angle of the inclined portion **63** is approximately 45 degrees. However, the inclination angle of the inclined portion **63** is not limited to approximately 45 degrees but may be approximately 30 degrees or approximately 60 degrees. According to the first example embodiment described above, the inclined portion **63** is inclined rearward due to the bending of the bend portion **53***c*. However, it may suffice that the inclined portion **63** be inclined. The intermediate portion (the bend portion **53***c* according to the first example embodiment) may be a portion where a bar-shaped member defining the second securer **53***b* is curved rearward.

[0084] For example, if the battery BT used is heavy, a large weight is exerted downward on the placement base **54**, and thus the frictional force generated between the bottom surface of the battery BT and the placement base **54** also increases in magnitude. In such a case, the inclination angle of the inclined portion **63** can be made smaller than approximately 45 degrees so that an increased force is exerted on the restriction member **55** in the horizontal direction (the force acting in the vertical direction is mitigated). If the battery BT used is light, the inclination angle of the inclined portion **63** can be made larger than approximately 45 degrees, so that a decreased force is exerted in the horizontal direction on the restriction member **55** and an increased force is exerted downward on the placement base **54**. That is, with the battery mount **50** according to the present invention, the inclination angle of the inclined portion **63** can be changed to any angle.

[0085] The upper end of the inclined portion **63** includes a thread groove **65**. The thread groove **65** is in a spiral with respect to the axis of the inclined portion **63** (the axis of a bar-shaped member defining the inclined portion **63**). A retention member **52** of the coupler **90** described later can be screwed into the thread groove **65**.

[0086] In the battery mount **50** according to the present invention, the coupler **90** functions to change, along the inclination direction of the securing assembly **53**, the position at which the first securer **53***a* and the second securer **53***b* are coupled to each other. This allows the securing assembly **53** to change at least one of the following lengths: the length of the first securer **53***a* from the first engagement hole **56***a* to the coupler **90**; and the length of the second securer **53***b* from the second engagement hole **56***b* to the coupler **90**. That is, the securing assembly **53** is configured to be capable of changing the effective length of the securing assembly **53** (the length of its portion that contributes to the pressing/securing of the battery BT), which is the length extending from the first engagement hole **56***a* to the second engagement hole **56***b* along the upper and forward surfaces

of the battery BT.
[0087] Specifically, the coupler **90** includes the inclined portion **63** provided in one of the first securer **53***a* and the second securer **53***b*, and the retention member **52** which retains the position at which the other of the first securer **53***a* and the second securer **53***b* is coupled to the inclined portion **63** relative to the inclined portion **63**. According to the first example embodiment, the one end portion (upper end portion) of the second securer **53***b* is provided with the inclined portion **63**, and the coupler **90** functions to adjust, by use of the retention member **52**, the position at which the inclined portion **63** of the second securer **53***b*, and the other end portion (forward end portion) of the first securer **53***a* are coupled to each other.
[0088] As described above, according to the first example embodiment, the one end portion (upper end portion) of the second securer **53***b* is provided with the inclined portion **63**. However, it is only necessary that the inclined portion **63** be provided in one of the first securer **53***a* and the second securer **53***b*, and inclined in an inclination direction such that the distance between the inclined portion **63** and the rear surface of the battery BT decreases in the upward direction. The inclined portion **63** may be provided in the first securer **53***a*. In such a case, the coupler **90** functions to adjust, by use of the retention member **52**, the position at which the inclined portion **63** of the first securer **53***a*, and the one end portion (upper end portion) of the second securer **53***b* are coupled to each other.
[0089] The retention member **52** will now be described in detail. The retention member **52** moves along the inclined portion **63** to change the position at which the other of the first securer **53***a* and the second securer **53***b* is coupled to the inclined portion **63** relative to the inclined portion **63**. The retention member **52** according to the first example embodiment is provided on the inclined portion **63** at the one end portion (upper end portion) of the second securer **53***b* to retain the position of the other end portion (forward end portion) of the first securer **53***a* relative to the inclined portion **63**. According to the first example embodiment, a fastener such as a nut or the like is used as the retention member **52**. That is, in the battery mount **50** according to the first example embodiment, the retention member **52** is a fastener **77** such as a nut or the like to be screwed into the thread groove **65** provided on the inclined portion **63**. With the fastener **77** described above used as the retention member **52**, as the fastener **77** moves in the inclination direction along the inclined portion **63** at the one end portion (upper end portion) of the second securer **53***b*, the position (relative position) of the other end portion (forward end portion) of the first securer **53***a* is changed in the inclination direction relative to the one end portion (upper end portion) of the second securer **53***b*. This makes it possible to change the coupling position between the first securer **53***a* and the second securer **53***b*.
[0090] The other one of the first securer **53***a* and the second securer **53***b* is provided with an inclined surface **74**, which is inclined in a direction crossing the inclination direction of the inclined portion **63**. According to the first example embodiment, the inclined surface **74** is provided at the other end portion (forward end portion) of the first securer **53***a*, and the inclined surface **74** is inclined in a direction crossing the inclined surface of the inclined portion **63** of the second securer **53***b*. That is, the inclined surface **74** is provided at the other end portion (forward end portion) of the first securer **53***a*. The inclined surface **74** is provided so as to face toward the one end portion (rearward and upward) of the first securer **53***a*. The retention member **52** (fastener **77**) abuts the inclined surface **74** to retain the position of the one end portion (upper end portion) of the second securer **53***b* relative to the inclined surface **74**.
[0091] If the second securer **53***b* is provided with the inclined surface **74**, the retention member **52** (fastener **77**) abuts the inclined surface **74** to retain the position of the other end portion (forward end portion) of the first securer **53***a* relative to the inclined surface **74**.
[0092] The retention member **52** (fastener **77**) of the coupler **90** according to the first example embodiment, and the inclined surface **74** of the first securer **53***a* will now be described.
[0093] As illustrated in FIG. **6**, the fastener **77** (retention member **52**) according to the first

example embodiment is of a double-nut type, and includes two nuts to be screwed into the thread groove **65**. Using the fastener **77** of a double-nut type makes it possible to prevent or reduce loosening of the fastener **77** from the thread groove **65**.

[0094] Although a double-nut fastener is used as the fastener **77** according to the first example embodiment, the fastener **77** according to the present invention is not limited to a double-nut fastener. For example, a nut with a locking function can be used, such as a locking nut whose contact with the thread groove **65** creates a frictional force, a nut pre-coated with cured resin at the location of contact with the thread groove **65**, a flanged nut, a disc spring nut, or the like.

[0095] The inclined surface **74** is inclined forwardly upward at an inclination angle of approximately 45 degrees with respect to the upward direction serving as a reference (0 degrees). Specifically, in the battery mount **50** according to the first example embodiment, the other end portion (forward end portion) of the first securer **53***a* is provided with a slope member **75** including the inclined surface **74**. The pressing member **67** to press the battery BT downward is provided between the slope member **75**, and the other end portion (forward end portion) of the first securer **53***a*. If the inclined surface **74** of the slope member **75** is inclined forward at 45 degrees, the inclined surface **74** crosses the inclined portion **63** of the second securer **53***b*, which is inclined rearward at 45 degrees, at approximately 90 degrees. As a result, the fastening force due to the fastener **77** described later can be exerted in a direction normal to the inclined surface **74**. This allows the fastening force due to the fastener **77** to be reliably exerted on the upper surface of the battery BT via the inclined surface **74** (slope member **75**), the pressing member **67**, and a clamp member **69**.

[0096] The pressing member **67** is provided between the other end portion (forward end portion) of the first securer **53***a*, and the slope member **75**. The pressing member **67** is a plate-shaped member provided with its plate faces opposite to each other in the up-down direction. The pressing member **67** is capable of making surface contact with the upper surface of the battery BT. The slope member **75** is provided on the upper surface of a forward portion of the pressing member **67**.

[0097] The slope member **75** is an angular member provided on the upper surface of the pressing member **67**. An upper portion of the slope member **75** is provided with the inclined surface **74**, which is inclined forward at 45 degrees. A lower portion of the slope member **75** is provided with a rib member **91**.

[0098] The inclined surface **74** of the slope member **75** has an insertion hole **76** through which the inclined portion **63** of the second securer **53***b* is to be inserted. The insertion hole **76** is provided in the inclined surface **74** as an elongated hole elongated in the front-rear direction. The insertion hole **76** is provided between the forward end of the inclined surface **74** and an intermediate portion in the front-rear direction of the inclined surface **74**. The insertion hole **76** is oriented forward. The inclined portion **63** of the second securer **53***b* can be inserted into the insertion hole **76** from forward of the insertion hole **76** while being allowed to swing. The insertion hole **76** has an opening width in the left-right direction greater than the outer diameter of the second securer **53***b* (inclined portion **63**). Making the opening width of the insertion hole **76** greater than the outer diameter of the second securer **53***b* allows the second securer **53***b* to be insertable through the insertion hole **76**.

[0099] A guide hole **78** is provided in a portion of the pressing member **67** below the slope member **75** to allow deep insertion of the inclined portion **63** of the second securer **53***b* into the insertion hole **76**. As with the insertion hole **76**, the guide hole **78** is provided at a forward portion of the pressing member **67** as an elongated hole elongated in the front-rear direction, and is oriented forward.

[0100] As illustrated in FIGS. **4** and **5**, the slope member **75** includes the rib member **91** on the upper surface of the pressing member **67**. The rib member **91** on the upper surface of the pressing member **67** is provided on each of the left and right of the guide hole **78**. The rib member **91** on each of the left and right is in the form of a triangular plate when viewed from the left or the right.

The rib member **91** on each of the left and right extends in the front-rear direction and up-down direction. The presence of the rib member **91** on the left and right allows the inclined surface **74** to be supported stably at a predetermined inclination angle (45 degrees toward the rear according to the first example embodiment) relative to the upper surface of the pressing member **67**.

[0101] Due to the presence of the rib member **91** on both the left and right of the guide hole **78**, the guide hole **78** is located between the rib member **91** on the left and the rib member **91** on the right. This allows the second securer **53***b* (inclined portion **63**) to be smoothly guided to the guide hole **78**.

[0102] Reference is now made to FIGS. **7**A and **7**B to describe a pressing force (force Ft) that is generated on the battery BT due to the fastener **77** screwed into the thread groove **65**.

[0103] FIG. **7**A illustrates the battery mount **50** before the fastener **77** is screwed into the thread groove **65**, in other words, in a state with the fastener **77** loosened. FIG. **7**B illustrates the battery mount **50** after the fastener **77** is screwed into the thread groove **65**, in other words, in a state with the fastener **77** fastened and the pressing force (force Ft) generated.

[0104] As illustrated in FIG. **7**A, before the fastener **77** is screwed into the thread groove **65**, the fastener **77** is located at the distal end of the inclined portion **63** (the coupling position of the coupler **90** is at the distal end of the inclined portion **63**). Accordingly, a length L.sub.1 from the bend portion **53***c* to the fastener **77** in the inclination direction of the second securer **53***b* is greater than a length L.sub.2 illustrated in FIG. **7**B when the fastener **77** is in a fastened state.

[0105] As the fastener **77** is tightened, the fastener **77** moves toward the proximal end (toward the bend portion **53***c*) of the inclined portion **63**, and the length of the second securer **53***b* from the bend portion **53***c* to the fastener **77** decreases from L.sub.1 to L.sub.2. As a result, the coupling position of the coupler **90** moves from the distal end of the inclined portion **63** toward the proximal end. This causes the first securer **53***a* to pivot downward (in a direction indicated at R**1** in FIGS. **7**A and **7**B), and causes the second securer **53***b* to pivot rearward (in a direction indicated at R**2** in FIGS. **7**A and **7**B).

[0106] As illustrated in FIG. **7**B, as the fastener **77** is deeply screwed into the thread groove **65**, the coupling position of the coupler **90** moves further toward the proximal end (toward the bend portion **53***c*) of the inclined portion **63**, and the pressing member **67** presses downward the upper surface of the battery BT. This causes a downward pressing force Fd to be generated on the upper surface of the battery BT. Meanwhile, the second securer **53***b* comes into contact with the forward surface of the battery BT as the second securer **53***b* pivots rearward. This causes a rearward pressing force Fr to be generated on the forward surface of the battery BT.

[0107] As a result, a pressing force Ft (Ft indicated by an open arrow in FIG. **7**B) that is directed rearward and downward is generated on the battery BT as the resultant of the downward pressing force Fd and the rearward pressing force Fr. Due to the pressing force Fd exerted on the bottom surface of the battery BT and the upper surface of the placement base **54**, when the battery BT is about to move in the horizontal direction, a frictional force is generated on the bottom surface of the battery BT to restrict movement of the battery BT in the horizontal direction. In addition to the frictional force on the bottom surface of the battery BT, a frictional force is also generated on the rear surface of the battery BT when the pressing force Fr is exerted on the rear surface of the battery BT and the forward surface of the restriction member **55**. As a result, a frictional force is generated on two faces, the bottom surface and the rear surface, of the battery BT. This makes it possible to more reliably prevent or reduce movement of the battery BT in the horizontal direction.

[0108] According to the first example embodiment, the clamp member **69** extends between the upper surface of the battery BT and the forward end portion of the first securer **53***a*, and between the forward surface of the battery BT and the second securer **53***b*. That is, the securing assembly **53** presses the battery BT in two directions, downward and rearward, via the clamp member **69**.

[0109] The clamp member **69** is a member provided at the forward upper edge of the battery BT so as to extend across the upper and forward surfaces of the battery BT. The clamp member **69** is bent

in an L-shape when viewed in cross-section in the left-right direction. A portion of the clamp member **69** located rearward of where the clamp member **69** is bent in the L-shape defines a first surface contact portion **70** that is in surface contact with a forward portion of the upper surface of the battery BT. A portion of the clamp member **69** located lower than where the clamp member **69** is bent in the L-shape defines a second surface contact portion **71** that is in surface contact with an upper portion of the forward surface of the battery BT.

[0110] The rear end of the first surface contact portion **70** is bent to protrude upward to define a protrusion **73**. The protrusion **73** includes a left protrusion **73**L provided at the rear left end of the first surface contact portion **70**, and a right protrusion **73**R provided at the rear right end of the first surface contact portion **70**. The area between the left protrusion **73**L and the right protrusion **73**R is flush with the forward end of the first surface contact portion **70**. The pressing member **67** of the retention member **52** is overlapped with the first surface contact portion **70** (the upper surface of the first surface contact portion **70**) between the left protrusion **73**L and the right protrusion **73**R such that the pressing member **67** is movable in the front-rear direction.

[0111] A force transmission member **72** is provided between the securing assembly **53** and the battery BT. The force transmission member **72** transmits the pressing force exerted by the securing assembly **53** to the battery BT. More specifically, the force transmission member **72** is provided on the second surface contact portion **71** of the clamp member **69**, and makes contact with an upper portion of the linear portion **62** of the second securer **53***b* to transmit the pressing force to the second surface contact portion **71**. The force transmission member **72** is a bar-shaped member provided with its axis oriented in the left-right direction. The force transmission member **72** is capable of transmitting the pressing force evenly across the entire width from the left end to the right end of the second surface contact portion **71**. The force transmission member **72** is overlapped in the front-rear direction with the surface (forward surface) of the second surface contact portion **71**.

[0112] Although the first example embodiment uses the force transmission member **72** in the form of a cylindrical bar, the configuration of the force transmission member **72** is not limited to this. For example, the force transmission member **72** may have an elliptical shape or a polygonal shape in cross-section and, additionally or alternatively, may be a solid structure or may be a hollow structure. The force transmission member **72** may be formed by curving or bending the plate-shaped member defining each of the first surface contact portion **70** and the second surface contact portion **71**.

[0113] As illustrated in FIG. **9**A, the force transmission member **72** may be omitted, and the second securer **53***b* may be made to directly abut the second surface contact portion **71** of the clamp member **69**. In other words, it can be also said that in the example illustrated in FIG. **9**A, the securing assembly **53** (second securer **53***b*) indirectly abuts an upper forward corner portion **92** of the battery BT via the clamp member **69** to apply the rearward pressing force Fr and the downward pressing force Fd to the battery BT.

[0114] As illustrated in FIG. **9**B, the force transmission member **72** and the clamp member **69** may be omitted, and the second securer **53***b* may be made to directly abut the upper forward corner portion **92** of the battery BT. This also makes it possible to apply the rearward pressing force Fr and the downward pressing force Fd to the battery BT.

[0115] The force transmission member **72** may be mounted to the second securer **53***b* or the first securer **53***a* rather than to the clamp member **69**. The force transmission member **72** may be held between the clamp member **69** and the second securer **53***b* without being secured to any one of the clamp member **69**, the second securer **53***b*, and the first securer **53***a*.

[0116] A locking and unlocking procedure for the battery mount **50** according to the first example embodiment, in other words, a method for mounting and removing the battery BT to and from the battery mount **50** according to the present invention will now be described.

[0117] As illustrated in the left of FIG. **6**, in removing the battery BT secured on the battery mount

50 according to the first example embodiment, the fastener **77** is turned in the loosening direction relative to the thread groove **65** to loosen the fastener **77** relative to the thread groove **65**. The loosening of the fastener **77** causes the coupling position of the coupler **90** to move in the inclination direction from the proximal end of the inclined portion **63** toward the distal end, and the inclined portion **63** of the second securer **53***b*, which has been secured in the insertion hole **76**, becomes able to disengage from the insertion hole **76**. Moreover, the first securer **53***a* becomes swingable in a direction (upward) away from the upper surface of the battery BT. This results in the disappearance of the downward pressing force Fd that has been exerted on the upper surface of the battery BT. Further, the second securer **53***b* becomes swingable in a direction (forward) away from the forward surface of the battery BT. This results in the disappearance of the rearward pressing force Fr that has been exerted on the forward surface of the battery BT. As a result, as illustrated in the right of FIG. **6**, the battery BT that has been secured on the battery mount **50** becomes removable.

[0118] In securing the battery BT to the battery mount **50**, the operation performed for removing the battery BT is performed in the reverse order. This allows the battery BT to be secured to the battery mount **50**.

[0119] A battery mount **50** as has been described includes a placement base **54** for placement of a battery BT, a restriction member **55** to restrict rearward movement of the battery BT, the restriction member **55** being provided at the same side of the battery BT as a rear surface of the battery BT, and a securing assembly **53** to secure the battery BT, the securing assembly **53** extending from a position above the restriction member **55** or from an upper portion of the restriction member **55** to a forward surface of the battery BT, wherein the securing assembly **53** includes a first securer **53***a* provided at the same side of the battery BT as an upper surface of the battery BT, a second securer **53***b* provided at the same side of the battery BT as the forward surface of the battery BT, and a coupler **90** to couple the first securer **53***a* and the second securer **53***b* to each other, and the coupler **90** includes an inclined portion **63** provided in one of the first securer **53***a* and the second securer **53***b*, the inclined portion **63** being inclined in an inclination direction such that a distance between the inclined portion **63** and the rear surface of the battery BT decreases in an upward direction, and a retention member **52** to retain a position at which the other of the first securer **53***a* and the second securer **53***b* is coupled to the inclined portion **63** such that the position relative to the inclined portion **63** is adjustable.

[0120] Since the position at which the first securer **53***a* and the second securer **53***b* are coupled to each other, along the inclination direction of the securing assembly **53**, is changed as described above, the effective length of the securing assembly **53** (the length of its portion that contributes to the pressing/securing of the battery BT) can be changed.

[0121] The first securer **53***a* includes one end portion coupled to the position above the restriction member **55** or to the upper portion of the restriction member **55**, and another end portion provided above a forward portion of the battery BT. The second securer **53***b* includes one end portion at which the inclined portion **63** of the coupler **90** is provided, and another end portion coupled to the placement base **54**.

[0122] Since the position at which the securers **53***a* and **53***b* are coupled to each other is adjusted along the inclination direction as described above, the effective length of the securing assembly **53** can be changed.

[0123] The second securer **53***b* is bent at an intermediate portion **53***c* (bent portion **53***c*), and a portion of the second securer **53***b* that extends from the intermediate portion **53***c* to the one end portion defines the inclined portion **63** extending in the inclination direction.

[0124] Using the second securer **53***b* as described above makes it possible to change the position at which the other end portion (forward end portion) of the first securer **53***a* is coupled to the inclined portion **63**, extending from the intermediate portion **53***c* to the one end portion of the second securer **53***b*, relative to the inclined portion **63**. This makes it possible to easily change the effective

length of the securing assembly **53**.
[0125] The restriction member **55** extends from the placement base **54** to a position higher than the battery BT. The one end portion (rear end portion) of the first securer **53***a* is coupled to the upper portion of the restriction member **55** such that the first securer **53***a* is swingable in an up-down direction. The other end portion of the second securer **53***b* is coupled to the placement base **54** such that the second securer **53***b* is swingable in a front-rear direction of the battery BT.
[0126] Since the first securer **53***a* swingable in the up-down direction is provided at the upper portion of the restriction member **55** and the second securer **53***b* swingable in the front-rear direction of the battery BT is provided as described above, it is possible to easily change the effective length of the securing assembly **53** to thus apply a pressing force on the upper and forward surfaces of the battery BT. It follows that a frictional force can be generated on two faces, i.e., the bottom surface and the rear surface, of the battery BT.
[0127] The retention member **52** is configured to move along the inclined portion **63** to change the position at which the other of the first securer **53***a* and the second securer **53***b* is coupled to the inclined portion **63** relative to the inclined portion **63**.
[0128] The presence of the retention member **52** as described above makes it possible to change the position at which the other of the first securer **53***a* and the second securer **53***b* is coupled to the inclined portion **63** relative to the inclined portion **63**. This makes it possible to easily change the effective length of the securing assembly **53**.
[0129] The other of the first securer **53***a* and the second securer **53***b* includes an inclined surface **74** inclined in a direction crossing the inclination direction. The retention member **52** is configured to abut the inclined surface **74** to retain the position at which the other of the first securer **53***a* and the second securer **53***b* is coupled to the inclined portion **63** relative to the inclined portion **63**.
[0130] The presence of the retention member **52** that abuts the inclined surface **74** as described above makes it possible to retain the position at which the other of the first securer **53***a* and the second securer **53***b* is coupled to the inclined portion **63** relative to the inclined portion **63**.
[0131] The inclined portion **63** includes a thread groove **65**. The retention member **52** includes a fastener **77** to be screwed into the thread groove **65**.
[0132] The inclined portion **63** includes the thread groove **65**, and the fastener **77** to be screwed into the thread groove **65** is provided as the retention member **52**. This makes it possible to not only retain the position at which the other of the first securer **53***a* and the second securer **53***b* is coupled to the inclined portion **63** relative to the inclined portion **63**, but also easily change the effective length of the securing assembly **53**.
[0133] The securing assembly **53** is located inside of the battery BT on the placement base **54** in a width direction of the battery BT.
[0134] The securing assembly **53** is provided inside of the battery BT in the width direction. This configuration makes the battery mount **50** compact in the width direction, and enables its installation without the need for a large space.
[0135] The securing assembly **53** is a single securing assembly **53** located inside of the battery BT on the placement base **54** in the width direction of the battery BT.
[0136] Only a single securing assembly **53** is provided inside of the battery BT in the width direction. Thus, the operation required for fastening or the like need only be performed only once. This enables quick securing of the battery BT.
[0137] The battery mount **50** further includes a clamp member **69** extending between the upper surface of the battery BT and the first securer **53***a* and between the forward surface of the battery BT and the second securer **53***b*. The clamp member **69** is configured such that the first securer **53***a* causes the clamp member **69** to press the upper surface of the battery BT downward, and the second securer **53***b* causes the clamp member **69** to press the forward surface of the battery BT rearward.
[0138] The presence of the clamp member **69** allows a pressing force to be evenly transmitted,

from the securing assembly **53** that swings, to the upper surface of the battery BT to thus appropriately press the battery BT.
[0139] The battery mount **50** further includes a force transmission member **72** provided between the securing assembly **53** and the battery BT to transmit a pressing force exerted by the securing assembly **53** to the battery BT.
[0140] With the force transmission member **72** as described above, a force transmitted to the force transmission member **72** can be appropriately applied to the battery BT as a pressing force.
[0141] The securing assembly **53** is configured to directly or indirectly abut an upper forward corner portion **92** of the battery BT to apply a rearward and downward pressing force to the battery BT.
[0142] A force is directly or indirectly transmitted from the securing assembly **53** to the upper forward corner portion **92** of the battery BT as described above. This allows a pressing force to be appropriately applied to the battery BT by means of a simple hardware configuration with no force transmission member **72** or clamp member **69** used.
[0143] A working machine **1** includes the battery mount **50** described above. This makes it possible to provide a working machine **1** that achieves the specific effect(s) mentioned above.
Second Example Embodiment
[0144] The battery mount **50** according to a second example embodiment will now be described.
[0145] FIG. **8** is a cross-section of the battery mount **50** according to the second example embodiment as viewed from the right side. As illustrated in FIG. **8**, the battery mount **50** according to the second example embodiment uses, as the retention member **52**, a clamping fixture **83** such as a toggle clamp or the like, rather than the fastener **77** such as a nut or the like.
[0146] Specifically, as with the first example embodiment, the slope member **75** is provided for the retention member **52** according to the second example embodiment, and the inclined surface **74** of the slope member **75** is provided with a hook member **84**. The hook member **84** is a fixture whose forward upper portion is formed into a recessed shape. The hook member **84** allows a latch **86** of the clamping fixture **83** to be latched thereon.
[0147] As with the first example embodiment, the second securer **53***b* according to the second example embodiment also includes the inclined portion **63**. The inclined portion **63** according to the second example embodiment is in the form of a flat plate, with the clamping fixture **83** mounted to the upper surface of the inclined portion **63**.
[0148] The clamping fixture **83** is a toggle clamp, and includes a lever member **87** to pull the latch **86** forward. With the clamping fixture **83**, tilting the lever member **87** forward against the elastic force of an elastic member (not illustrated) allows the latch **86** to be locked in a forwardly pulled state (fastened state).
[0149] That is, with the battery mount **50** according to the second example embodiment, as the lever member **87** is tilted forward to bring the latch **86** into a forwardly pulled state, the distance between the other end portion (forward end portion) of the first securer **53***a*, and the one end portion (upper end portion) of the second securer **53***b* decreases. This allows the length of the securing assembly **53** to decrease as with the first example embodiment. As a result, the first securer **53***a* comes into proximity with the upper surface of the battery BT, and the second securer **53***b* comes into proximity with the forward surface of the battery BT. That is, the first securer **53***a* comes into abutment with the upper surface of the battery BT, and the downward pressing force Fd is generated on the upper surface of the battery BT. Further, the rearward pressing force Fr is generated on the forward surface of the battery BT. Therefore, as with the first example embodiment, a frictional force can be generated on two faces, the bottom surface and the rear surface, of the battery BT.
[0150] Example embodiments of the present invention provide the battery mount **50** and the working machine **1** described in items below.
[0151] (Item 1) A battery mount **50** including a placement base **54** for placement of a battery BT, a

restriction member **55** to restrict rearward movement of the battery BT, the restriction member **55** being provided at the same side of the battery BT as a rear surface of the battery BT, and a securing assembly **53** to secure the battery BT, the securing assembly **53** extending from a position above the restriction member **55** or from an upper portion of the restriction member **55** to a forward surface of the battery BT, wherein the securing assembly **53** includes a first securer **53***a* provided at the same side of the battery BT as an upper surface of the battery BT, a second securer **53***b* provided at the same side of the battery BT as the forward surface of the battery BT, and a coupler **90** to couple the first securer **53***a* and the second securer **53***b* to each other, and the coupler **90** includes an inclined portion **63** provided in one of the first securer **53***a* and the second securer **53***b*, the inclined portion **63** being inclined in an inclination direction such that a distance between the inclined portion **63** and the rear surface of the battery BT decreases in an upward direction, and a retention member **52** to retain a position at which the other of the first securer **53***a* and the second securer **53***b* is coupled to the inclined portion **63** such that the position relative to the inclined portion **63** is adjustable.

[0152] With the battery mount **50** according to item 1 above, the effective length of the securing assembly **53** (the length of its portion that contributes to the pressing/securing of the battery BT) can be changed by changing the position at which the first securer **53***a* and the second securer **53***b* are coupled to each other along the inclination direction of the securing assembly **53**.

[0153] (Item 2) The battery mount **50** according to item 1, wherein the first securer **53***a* includes one end portion coupled to the position above the restriction member **55** or to the upper portion of the restriction member **55**, and another end portion provided above a forward portion of the battery BT, and the second securer **53***b* includes one end portion at which the inclined portion **63** of the coupler **90** is provided, and another end portion coupled to the placement base **54**.

[0154] With the battery mount **50** according to item 2 above, the effective length of the securing assembly **53** can be changed by adjusting the position at which the securers **53***a* and **53***b* are coupled to each other along the inclination direction.

[0155] (Item 3) The battery mount according to item 2, wherein the second securer **53***b* is bent at an intermediate portion **53***c*, and a portion of the second securer **53***b* that extends from the intermediate portion **53***c* to the one end portion defines the inclined portion **63** extending in the inclination direction.

[0156] With the battery mount **50** according to item 3 above, using the second securer **53***b* makes it possible to change the position at which the other end portion (forward end portion) of the first securer **53***a* is coupled to the inclined portion **63**, which extends from the intermediate portion **53***c* to the one end portion of the second securer **53***b*, relative to the inclined portion **63**. This makes it possible to easily change the effective length of the securing assembly **53**.

[0157] (Item 4) The battery mount **50** according to any one of items 1 to 3, wherein the restriction member **55** extends from the placement base **54** to a position higher than the battery BT, the one end portion of the first securer **53***a* is coupled to the upper portion of the restriction member **55** such that the first securer **53***a* is swingable in an up-down direction, and the other end portion of the second securer **53***b* is coupled to the placement base **54** such that the second securer **53***b* is swingable in a front-rear direction of the battery BT.

[0158] With the battery mount **50** according to item 4 above, the first securer **53***a* swingable in the up-down direction is provided at the upper portion of the restriction member **55**, and the second securer **53***b* swingable in the front-rear direction of the battery BT is provided. This enables easy changing of the effective length of the securing assembly **53** to thus apply a pressing force on the upper and forward surfaces of the battery BT. It follows that a frictional force can be generated on two faces, i.e., the bottom surface and the rear surface, of the battery BT.

[0159] (Item 5) The battery mount **50** according to any one of items 1 to 4, wherein the retention member **52** is configured to move along the inclined portion **63** to change the position at which the other of the first securer **53***a* and the second securer **53***b* is coupled to the inclined portion **63**

relative to the inclined portion **63**.
[0160] With the battery mount **50** according to item 5 above, the presence of the retention member **52** makes it possible to change the position at which the other of the first securer **53***a* and the second securer **53***b* is coupled to the inclined portion **63** relative to the inclined portion **63**. This makes it possible to easily change the effective length of the securing assembly **53**.
[0161] (Item 6) The battery mount **50** according to any one of items 1 to 5, wherein the other of the first securer **53***a* and the second securer **53***b* includes an inclined surface **74** inclined in a direction crossing the inclination direction, and the retention member **52** is configured to abut the inclined surface **74** to retain the position at which the other of the first securer **53***a* and the second securer **53***b* is coupled to the inclined portion **63** relative to the inclined portion **63**.
[0162] With the battery mount **50** according to item **6** above, the presence of the retention member **52** that abuts the inclined surface **74** makes it possible to retain the position at which the other of the first securer **53***a* and the second securer **53***b* is coupled to the inclined portion **63** relative to the inclined portion **63**.
[0163] (Item 7) The battery mount **50** according to any one of items 1 to 6, wherein the inclined portion **63** includes a thread groove **65**, and the retention member **52** includes a fastener **77** to be screwed into the thread groove **65**.
[0164] With the battery mount **50** according to item 7 above, the inclined portion **63** includes the thread groove **65**, and the fastener **77** to be screwed into the thread groove **65** is provided as the retention member **52**. This makes it possible to not only retain the position at which the other of the first securer **53***a* and the second securer **53***b* is coupled to the inclined portion **63** relative to the inclined portion **63**, but also easily change the effective length of the securing assembly **53**.
[0165] (Item 8) The battery mount **50** according to any one of items 1 to 7, wherein the securing assembly **53** is located inside of the battery BT on the placement base **54** in a width direction of the battery BT.
[0166] With the battery mount **50** according to item 8 above, the securing assembly **53** is provided inside of the battery BT in the width direction. This configuration makes the battery mount **50** compact in the width direction, and enables its installation without the need for a large space.
[0167] (Item 9) The battery mount **50** according to item 8, wherein the securing assembly **53** is a single securing assembly located inside of the battery BT on the placement base **54** in the width direction of the battery BT.
[0168] With the battery mount **50** according to item 9 above, only a single securing assembly **53** is provided inside of the battery BT in the width direction. Thus, the operation required for fastening or the like need only be performed only once. This enables quick securing of the battery BT.
[0169] (Item 10) The battery mount **50** according to any one of items 1 to 9, further including a clamp member **69** extending between the upper surface of the battery BT and the first securer **53***a* and between the forward surface of the battery and the second securer **53***b*, wherein the clamp member **69** is configured such that the first securer **53***a* causes the clamp member **69** to press the upper surface of the battery BT downward, and the second securer **53***b* causes the clamp member **69** to press the forward surface of the battery BT rearward.
[0170] With the battery mount **50** according to item 10 above, the presence of the clamp member **69** allows a pressing force to be evenly transmitted, from the securing assembly **53** that swings, to the upper surface of the battery BT to thus appropriately press the battery BT.
[0171] (Item 11) The battery mount **50** according to any one of items 1 to 10, further including a force transmission member **72** provided between the securing assembly **53** and the battery BT to transmit a pressing force exerted by the securing assembly **53** to the battery BT.
[0172] With the battery mount **50** according to item 11 above, a force transmitted to the force transmission member **72** can be appropriately applied to the battery BT as a pressing force.
[0173] (Item 12) The battery mount **50** according to any one of items 1 to 11, wherein the securing assembly **53** is configured to directly or indirectly abut an upper forward corner portion **92** of the

battery BT to apply a rearward and downward pressing force to the battery BT.
[0174] With the battery mount **50** according to item 12 above, a force is directly or indirectly transmitted from the securing assembly **53** to the upper forward corner portion **92** of the battery BT. This allows a pressing force to be appropriately applied to the battery BT by means of a simple hardware configuration with no force transmission member **72** or clamp member **69** used.
[0175] (Item 13) A working machine **1** including the battery mount **50** according to any one of items 1 to 12.
[0176] With the working machine **1** according to item 13 above, it is possible to provide a working machine **1** that achieves the specific effect(s) mentioned above.
[0177] While example embodiments of the present invention have been described above, it is to be understood that variations and modifications will be apparent to those skilled in the art without departing from the scope and spirit of the present invention. The scope of the present invention, therefore, is to be determined solely by the following claims.

Claims

1. A battery mount comprising: a placement base for placement of a battery; a restriction member to restrict rearward movement of the battery, the restriction member being provided at the same side of the battery as a rear surface of the battery; and a securing assembly to secure the battery, the securing assembly extending from a position above the restriction member or from an upper portion of the restriction member to a forward surface of the battery; wherein the securing assembly includes: a first securer provided at the same side of the battery as an upper surface of the battery; a second securer provided at the same side of the battery as the forward surface of the battery; and a coupler to couple the first securer and the second securer to each other; and the coupler includes: an inclined portion provided in one of the first securer and the second securer, the inclined portion being inclined in an inclination direction such that a distance between the inclined portion and the rear surface of the battery decreases in an upward direction; and a retention member to retain a position at which the other of the first securer and the second securer is coupled to the inclined portion such that the position relative to the inclined portion is adjustable.
2. The battery mount according to claim 1, wherein the first securer includes one end portion coupled to the position above the restriction member or to the upper portion of the restriction member, and another end portion provided above a forward portion of the battery; and the second securer includes one end portion at which the inclined portion of the coupler is provided, and another end portion coupled to the placement base.
3. The battery mount according to claim 2, wherein the second securer is bent at an intermediate portion, and a portion of the second securer that extends from the intermediate portion to the one end portion defines the inclined portion extending in the inclination direction.
4. The battery mount according to claim 3, wherein the restriction member extends from the placement base to a position higher than the battery, the one end portion of the first securer is coupled to the upper portion of the restriction member such that the first securer is swingable in an up-down direction; and the other end portion of the second securer is coupled to the placement base such that the second securer is swingable in a front-rear direction of the battery.
5. The battery mount according to claim 1, wherein the retention member is configured to move along the inclined portion to change the position at which the other of the first securer and the second securer is coupled to the inclined portion relative to the inclined portion.
6. The battery mount according to claim 5, wherein the other of the first securer and the second securer includes an inclined surface inclined in a direction crossing the inclination direction; and the retention member is configured to abut the inclined surface to retain the position at which the other of the first securer and the second securer is coupled to the inclined portion relative to the inclined portion.

7. The battery mount according to claim 6, wherein the inclined portion includes a thread groove; and the retention member includes a fastener to be screwed into the thread groove.
8. The battery mount according to claim 1, wherein the securing assembly is located inside of the battery on the placement base in a width direction of the battery.
9. The battery mount according to claim 8, wherein the securing assembly is a single securing assembly located inside of the battery on the placement base in the width direction of the battery.
10. The battery mount according to claim 1, further comprising a clamp member extending between the upper surface of the battery and the first securer and between the forward surface of the battery and the second securer; wherein the clamp member is configured such that the first securer causes the clamp member to press the upper surface of the battery downward, and the second securer causes the clamp member to press the forward surface of the battery rearward.
11. The battery mount according to claim 1, further comprising a force transmission member provided between the securing assembly and the battery to transmit a pressing force exerted by the securing assembly to the battery.
12. The battery mount according to claim 1, wherein the securing assembly is configured to directly or indirectly abut an upper forward corner portion of the battery to apply a rearward and downward pressing force to the battery.
13. A working machine comprising the battery mount according to claim 1.