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Rear wheel suspension device

Abstract

A rear wheel suspension device includes: a swing arm swingably supported with respect to a vehicle body frame, the swing arm rotatably supporting a rear wheel; a rear cushion configured to be extended and contracted in accordance with swing of the swing arm; a cushion lever coupled to a lower end portion of the rear cushion; a cushion rod coupling the cushion lever and the swing arm; and an accumulator storing a working fluid that extends and contracts the cushion rod. A vehicle height is adjusted by displacement of the swing arm in accordance with extension and contraction of the cushion rod. The accumulator is positioned on a lower side of a swing shaft of the swing arm.

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Background/Summary

CROSS-REFERENCE TO RELATED APPLICATIONS

(1) The disclosure of Japanese Patent Application No. 2021-200966 filed on Dec. 10, 2021, including specification, drawings and claims is incorporated herein by reference in its entirety.

BACKGROUND

(2) The present invention relates to a rear wheel suspension device.

(3) In the related art, a rear wheel suspension device (rear suspension) of a swing arm type has been adopted in a straddle-type vehicle (see, for example, Patent Literature 1). In the rear wheel suspension device described in Patent Literature 1, a swing arm is swingably supported by a

vehicle body frame, and a rear wheel is rotatably supported by a rear end of the swing arm. A rear cushion is coupled to the swing arm via a link mechanism, and unevenness of a road surface is absorbed by the rear cushion. In recent years, a vehicle height adjustment device called a ride height adjuster or the like may be additionally provided in such a rear wheel suspension device for the straddle-type vehicle. Patent Literature 1: JP2003-104266A

SUMMARY

(4) A rear wheel suspension device according to an aspect of the present invention is a rear wheel suspension device including a swing arm swingably supported with respect to a vehicle body frame, the swing arm rotatably supporting a rear wheel, the rear wheel suspension device including: a rear cushion configured to be extended and contracted in accordance with swing of the swing arm; a cushion lever coupled to a lower end portion of the rear cushion; a cushion rod coupling the cushion lever and the swing arm; and an accumulator storing a working fluid that extends and contracts the cushion rod, in which a vehicle height is adjusted by displacement of the swing arm in accordance with extension and contraction of the cushion rod, and the accumulator is positioned on a lower side of a swing shaft of the swing arm.

Description

BRIEF DESCRIPTION OF DRAWINGS

(1) FIG. **1** is a left side view of a straddle-type vehicle according to the present embodiment.

(2) FIG. **2** is a left side view of a rear wheel suspension device according to the present embodiment.

(3) FIG. **3** is a bottom view of the rear wheel suspension device according to the present embodiment.

(4) FIG. **4** is a cross-sectional view of the rear wheel suspension device shown in FIG. **3** taken along a line A-A.

(5) FIG. **5**A and FIG. **5**B are schematic view of a vehicle height adjustment device according to the present embodiment.

(6) FIG. **6** is a side view of the vicinity of the vehicle height adjustment device according to the present embodiment.

(7) FIG. **7** is a cross-sectional view of the vehicle height adjustment device shown in FIG. **6** taken along a line B-B.

(8) FIG. **8** is a cross-sectional view of the vehicle height adjustment device shown in FIG. **6** taken along a line C-C.

DESCRIPTION OF EMBODIMENTS

(9) Components of the vehicle height adjustment device are often disposed on an upper side of the vehicle due to the restriction of an arrangement space of the straddle-type vehicle, but in consideration of the stability of the vehicle, the components are preferably disposed on a lower side of the vehicle body so that the center of gravity of the vehicle does not rise.

(10) The present invention has been made in view of the above, and an object of the present invention is to provide a rear wheel suspension device capable of lowering the center of gravity of a vehicle even when a component of a vehicle height adjustment device is added.

(11) According to the rear wheel suspension device of one aspect of the present invention, the vehicle height is adjusted by extending and contracting the cushion rod by the working fluid of the accumulator. The vehicle height of the rear portion of the vehicle is lowered at the time of starting, or at the exit of a corner, so that stable acceleration can be performed in a posture in which the center of gravity is low. In addition, the accumulator is located at the lower portion of the vehicle, so that the center of gravity of the vehicle can be kept low even when a component of the vehicle height adjustment device such as the accumulator is added to the vehicle.

(12) In a rear wheel suspension device according to an aspect of the present invention, a swing arm is swingable supported with respect to a vehicle body frame, and a rear wheel is rotatably supported by the swing arm. With the swing of the swing arm, a rear cushion is extended and contracted to absorb the unevenness of a road surface. A cushion lever is coupled to a lower end portion of the rear cushion, and the cushion lever and the swing arm are connected by a cushion rod. The cushion rod is extended and contracted by a working fluid, and the working fluid is stored in an accumulator. The cushion rod extends and contracts by the working fluid in the accumulator, and a vehicle height is adjusted by displacement of the swing arm accompanying the expansion and contraction of the cushion rod. The vehicle height of the rear portion of the vehicle is lowered at the time of starting, or at the exit of a corner, so that stable acceleration can be performed in a posture in which the center of gravity is low. The accumulator is positioned on the lower side of a swing shaft of the swing arm, and the center of gravity of the vehicle can be maintained low even when a vehicle height adjustment structure such as an accumulator is added to the vehicle.

Embodiment

(13) Hereinafter, an embodiment will be described in detail with reference to the accompanying drawings. FIG. **1** is a left side view of a straddle-type vehicle according to the present embodiment. In the following drawings, an arrow FR indicates a vehicle front side, an arrow RE indicates a vehicle rear side, an arrow L indicates a vehicle left side, and an arrow R indicates a vehicle right side.

(14) As shown in FIG. **1**, a straddle-type vehicle **1** is formed by mounting various components such as an engine **15** and an electrical system on a vehicle body frame **10** formed of a pipe and a sheet metal. A main frame **14** branches from a head pipe **11** of the vehicle body frame **10** to left and right and extends to a rear side. A front side portion of the main frame **14** is a tank rail **12** located on an upper side of the engine **15**, and a fuel tank (not shown) is supported by the tank rail **12** from below. A rear side portion of the main frame **14** is a pivot frame **13** located on the rear side of the engine **15**, and a swing arm **31** is swingably supported by the pivot frame **13**.

(15) A front fork **19** is steerably supported by the head pipe **11** via a steering shaft (not shown). A front wheel **21** is rotatably supported by a lower portion of the front fork **19**, and an upper portion of the front wheel **21** is covered with a front fender **22**. The swing arm **31** extends from the pivot frame **13** to the rear side. A rear wheel **25** is rotatably supported at a rear end of the swing arm **31**, and a front side of the rear wheel **25** is covered with a rear fender **26**. The engine **15** is coupled to the rear wheel **25** via a chain drive type transmission mechanism, and power from the engine **15** is transmitted to the rear wheel **25** via the transmission mechanism.

(16) A rear wheel suspension device **30** of the straddle-type vehicle **1** is additionally provided with a vehicle height adjustment device **50** (see FIG. **2**) for lowering the center of gravity of the vehicle by adjusting the vehicle height for the purpose of increasing the wheelie limit to improve acceleration. The vehicle height adjustment device **50** is provided with an accumulator **51** (see FIG. **2**) that stores oil for vehicle height adjustment (working fluid). The accumulator **51** is often disposed inside a seat cowl or on a side of the vehicle body frame **10**, but if a heavy object such as the accumulator **51** is disposed on the upper side of the vehicle, the center of gravity cannot be sufficiently lowered. Therefore, in the rear wheel suspension device **30** of the present embodiment, an arrangement space for the accumulator **51** is secured on the lower side of the swing shaft **32** of the swing arm **31**.

(17) The rear wheel suspension device for the straddle-type vehicle will be described with reference to FIGS. **2** to **5**. FIG. **2** is a left side view of the rear wheel suspension device according to the present embodiment. FIG. **3** is a bottom view of the rear wheel suspension device according to the present embodiment. FIG. **4** is a cross-sectional view of the rear wheel suspension device shown in FIG. **3** taken along a line A-A. FIG. **5**A and FIG. **5**B are schematic view of the vehicle height adjustment device according to the present embodiment. In FIG. **2**, for convenience of explanation, the vehicle body frame and the swing arm are indicated by two-dot chain lines. FIG.

5A shows an extended state of a link rod, and FIG. **5**B shows a contracted state of the link rod.

(18) As shown in FIG. **2**, the rear wheel suspension device **30** of a swing arm type is attached to the engine **15** and the pivot frame **13**. The double-supported swing arm **31** is swingably supported at an intermediate position in a height direction of the pivot frame **13** via the swing shaft **32**. The swing arm **31** is coupled to the engine **15** and the pivot frame **13** via a rear cushion **33**, a cushion lever **34**, and a cushion rod **35**. The rear cushion **33** extends and contracts in accordance with the swing of the swing arm **31**, so that unevenness of a road surface is absorbed, vibration is reduced, and ground contact between the road surface and the rear wheel **25** is improved.

(19) An upper end portion of the rear cushion **33** is supported by upper portions of the engine **15** and the pivot frame **13**, and a rear apex portion of the cushion lever **34** having a substantially triangular shape in a side view is coupled to a lower end portion of the rear cushion **33**. A front apex portion of the cushion lever **34** is coupled to a lower portion of the pivot frame **13**, and a lower apex portion (see FIG. **4**) of the cushion lever **34** is coupled to a lower portion of the swing arm **31** via the extensible cushion rod **35**. Along with the swing of the swing arm **31**, the cushion lever **34** is swung with the front apex portion as a fulcrum, and an impact or the like from the road surface is transmitted from the swing arm **31** to the rear cushion **33**.

(20) An accumulator bracket **82** is attached to a lower portion of the engine **15** via a suspension bracket **81**. The accumulator **51** is supported by the accumulator bracket **82**, and oil for extending and contracting the cushion rod **35** is stored in the accumulator **51**. The accumulator **51** is provided with a plunger switch **52**, and the plunger switch **52** is coupled to the cushion rod **35** via a coupling hose **53**. The movement of the oil in the coupling hose **53** is controlled by the plunger switch **52**. An operation portion (not shown) is coupled to the plunger switch **52** via an operation cable **54**.

(21) In the rear wheel suspension device **30**, the cushion rod **35** is extended and contracted by the hydraulic pressure, and the swing arm **31** is displaced in accordance with the extension and contraction of the cushion rod **35**, so that the vehicle height of the straddle-type vehicle **1** is adjusted. As described above, the vehicle height adjustment device **50** including the cushion rod **35**, the accumulator **51**, the plunger switch **52**, the coupling hose **53**, and the operation cable **54** is provided in a lower portion of the rear wheel suspension device **30**. At this time, the accumulator **51**, which is a heavy component, is positioned on the lower side of the vehicle body frame **10** to lower the center of gravity of the straddle-type vehicle **1**. A detailed configuration of the vehicle height adjustment device **50** will be described later.

(22) As shown in FIGS. **2** and **3**, a muffler pipe **90** extends to the rear side from a front surface of the engine **15** through a side (right side in the present embodiment) of the accumulator **51**. In front of the accumulator **51**, the muffler pipe **90** is divided into four left and right branch pipes **91***a* to **91***d*. On the side of the accumulator **51**, two left branch pipes **91***a* and **91***b* are collected into a lower pipe **92***e*, and two right branch pipes **91***c* and **91***d* are collected into an upper pipe **92***f*. At the rear side of the accumulator **51**, the lower pipe **92***e* and the upper pipe **92***f* are collected into one collecting pipe **93**, and the collecting pipe **93** is connected to a muffler (not shown) in the vicinity of the rear wheel **25**.

(23) At the lower side of the vehicle body frame **10**, the lower pipe **92***e* and the upper pipe **92***f* of the muffler pipe **90** are disposed closer to the right side (one side in the left-right direction), and the vehicle height adjustment device **50** is disposed closer to the left side (the other side in the left-right direction). The front and right sides of the vehicle height adjustment device **50** are covered by the accumulator bracket **82**, and the vehicle height adjustment device **50** and the muffler pipe **90** are partitioned by the accumulator bracket **82**. Even if the vehicle height adjustment device **50** is provided adjacent to the muffler pipe **90**, each component of the vehicle height adjustment device **50** is protected from the hot air of the muffler pipe **90**. The detailed configuration of the accumulator bracket **82** will be described later.

(24) As shown in FIG. **4**, a shock absorber **41** of the rear cushion **33** is divided into an upper cylinder **42** and a lower piston rod **43** (the piston is not shown). The cylinder **42** of the shock

absorber **41** is supported by the engine **15**, and the piston rod **43** of the shock absorber **41** is coupled to the cushion lever **34**. The cylinder **42** and the piston rod **43** of the shock absorber **41** are elastically coupled by a coil spring **44**. The rear cushion **33** absorbs the impact from the road surface by the coil spring **44**, and attenuates the amplitude of the coil spring **44** by the shock absorber **41**.

(25) The rear cushion **33** is inserted into an opening on the front side of the swing arm **31**, and the rear cushion **33** is brought close to the swing shaft **32** of the swing arm **31**. The cushion lever **34** is positioned on the lower side of the swing shaft **32**, and the pivot frame **13**, the rear cushion **33**, and the swing arm **31** are coupled by the cushion lever **34**. A lower portion of the cushion lever **34** is formed in a U shape in a sectional view (see FIG. **8**), and the cushion rod **35** is accommodated in a lower portion of the U shape. A link mechanism that couples the swing arm **31** and the rear cushion **33** is formed by the cushion lever **34** and the cushion rod **35**.

(26) As shown in FIGS. **4** and **5**A, the cushion rod **35** of the vehicle height adjustment device **50** includes a cylinder **61** formed in a tubular shape and a rod main body **62** protruding from the cylinder **61**. The cylinder **61** is formed with a lever-side coupling portion **63**, and the cylinder **61** is coupled to the cushion lever **34** via the lever-side coupling portion **63**. A piston **64** that slides in the cylinder **61** is formed at a front end of the rod main body **62**, and the inside of the cylinder **61** is divided into an atmospheric chamber **65** and an oil chamber **66** by the piston **64**. An arm-side coupling portion **67** is provided on a rear end of the rod main body **62**, and the rod main body **62** is coupled to the swing arm **31** via the arm-side coupling portion **67**.

(27) The oil chamber **66** of the cylinder **61** of the cushion rod **35** communicates with a high pressure oil chamber **72** of the accumulator **51** through the coupling hose **53** and the plunger switch **52**. The accumulator **51** is formed in a tubular shape, and the inside of the accumulator **51** is divided into the high pressure oil chamber **72** and a high pressure gas chamber **73** by a piston **71**. The plunger switch **52** is provided with a control valve **75** that controls the movement of oil between the accumulator **51** and the cushion rod **35**. The operation cable **54** is coupled to the control valve **75**, and movement of oil from the cushion rod **35** to the accumulator **51** is allowed by operating the operation cable **54**.

(28) When the oil moves between the cushion rod **35** and the accumulator **51**, a length of the cushion rod **35** changes. When the oil moves from the cushion rod **35** to the accumulator **51**, the oil chamber **66** of the cushion rod **35** is narrowed and the cushion rod **35** becomes longer. When the oil moves from the accumulator **51** to the cushion rod **35**, the oil chamber **66** of the cushion rod **35** is expanded and the cushion rod **35** becomes shorter. When the cushion rod **35** becomes longer, the swing arm **31** moves to the upper side and the vehicle height of the rear portion of the vehicle becomes lower, and when the cushion rod **35** becomes shorter, the swing arm **31** moves to the lower side and the vehicle height of the rear portion of the vehicle returns to the original height.

(29) More specifically, as shown in FIG. **5**A, an upward force acts on the swing arm **31** due to a reaction force of the weight of the vehicle and an occupant. At this time, a tensile force acts on the cushion rod **35**, and the oil in the cylinder **61** is compressed by the piston **64** of the cushion rod **35**. When the operation cable **54** is operated by the occupant, the control valve **75** of the plunger switch **52** coupled to the operation cable **54** is opened. The oil is pushed out from the cylinder **61** of the cushion rod **35**, and the oil moves to the high pressure oil chamber **72** of the accumulator **51** through the coupling hose **53**.

(30) The piston **64** of the cushion rod **35** moves in a direction to narrow the oil chamber **66**, and the rod main body **62** integrated with the piston **64** protrudes from the cylinder **61**, so that the cushion rod **35** becomes longer. When the cushion rod **35** becomes longer, the swing arm **31** is inclined upward from an initial state. As a result, the vehicle height of the rear portion of the vehicle is lowered, and stable acceleration can be achieved in a posture in which the center of gravity is low. The vehicle height of the rear portion of the vehicle is lowered at the time of starting, or at the exit of a corner, so that stable acceleration can be performed in a posture in which the center of gravity

is low. In addition, energy from the engine **15** or the like is not used when the vehicle height is lowered.

(31) As shown in FIG. **5**B, when the operation cable **54** is not operated, the control valve **75** of the plunger switch **52** is closed and switched to a one-way valve. The one-way valve restricts the movement of the oil from the cushion rod **35** to the accumulator **51**, and therefore, the cushion rod **35** is prevented from becoming long. Since the oil is allowed to move from the accumulator **51** to the cushion rod **35** through the one-way valve, the cushion rod **35** is not restricted from being shortened. In this way, only the contraction of the cushion rod **35** is allowed by closing the control valve **75** of the plunger switch **52**.

(32) When a load moves to a front portion of the vehicle and a load of the rear portion of the vehicle decreases during braking of the vehicle, a downward force acts on the swing arm **31** due to the weights of the swing arm **31** and the rear wheel **25** and a repulsive force of the rear cushion **33**. At this time, a compressive force acts on the cushion rod **35**, and the piston **64** of the cushion rod **35** expands the oil chamber **66** of the cylinder **61**. Although the control valve **75** is closed, the oil is allowed to move toward the cushion rod **35** through the one-way valve. The oil is drawn into the cylinder **61** of the cushion rod **35**, and the oil moves from the high pressure oil chamber **72** of the accumulator **51** through the coupling hose **53**.

(33) The piston **64** of the cushion rod **35** moves in a direction to expand the oil chamber **66**, and the rod main body **62** integrated with the piston **64** enters the cylinder **61**, so that the cushion rod **35** is shortened. When the cushion rod **35** is shortened, the swing arm **31** is inclined downward and returned to the initial state, and the rear portion of the vehicle is raised to an original vehicle height. In addition, even if the vehicle body load is slightly changed during linear travel, the oil is gradually moved from the accumulator **51** to the cushion rod **35**, and the vehicle height of the rear portion of the vehicle is gradually returned. In addition, energy from the engine **15** or the like is not used when the vehicle height is returned.

(34) The layout of the accumulator and the accumulator bracket will be described with reference to FIGS. **6** to **8**. FIG. **6** is a side view of the vicinity of the vehicle height adjustment device according to the present embodiment. FIG. **7** is a cross-sectional view of the vehicle height adjustment device shown in FIG. **6** taken along a line B-B. FIG. **8** is a cross-sectional view of the vehicle height adjustment device shown in FIG. **6** taken along a line C-C. In FIG. **8**, for convenience of explanation, the swing arm is indicated by a two-dot chain line.

(35) As shown in FIG. **6**, the accumulator **51** is positioned on the lower side of the pivot frame (vehicle body frame) **13** in the upper-lower direction of the vehicle, so that the center of gravity of the vehicle is kept low. In the front-rear direction of the vehicle, the accumulator **51** is closer to the swing shaft **32** of the swing arm **31** than the lower end portion of the rear cushion **33** (see FIG. **4**), and the center of gravity of the vehicle is closer to the center in the vehicle front-rear direction. At this time, since the accumulator **51** is brought close to the vicinity of a swing center of the swing arm **31**, the accumulator **51** is deviated from a swing range of the swing arm **31**, and interference between the swing arm **31** and the accumulator **51** is prevented.

(36) As shown in FIGS. **6** and **7**, the accumulator **51** is positioned on the side of the cushion lever **34** and the cushion rod **35**, and the accumulator **51** is overlapped the cushion lever **34** and the cushion rod **35** in a side view of the vehicle. Accordingly, the components of the vehicle height adjustment device **50** are collectively disposed, and the coupling hose **53** coupling the accumulator **51** and the cushion rod **35** is shortened, so that the maintainability is improved. In the side view of the vehicle, the accumulator **51** is located directly below the pivot frame **13** and is overlapped the muffler pipe **90** passing below the pivot frame **13**. The accumulator **51** is arranged in the muffler pipe **90**, so that the center of gravity is lowered.

(37) Further, the muffler pipe **90** is bent in front of the accumulator **51** and extends rearward through the right side of a vehicle center line L, and the accumulator **51** is positioned on the left side of the vehicle center line L. More specifically, the cushion lever **34** and the cushion rod **35** are

offset by 10 mm to one side (left side) with respect to the vehicle center line L extending in the vehicle front-rear direction, and the accumulator **51** is disposed on the left side with respect to the cushion lever **34** and the cushion rod **35**. Since the muffler pipe **90** is shifted to the right side with respect to the vehicle center line L, an arrangement space of the accumulator **51** is secured on the left side of the vehicle center line L.

(38) As shown in FIGS. **7** and **8**, the vehicle height adjustment device **50** and the muffler pipe **90** are partitioned by the accumulator bracket **82**. The accumulator bracket **82** is fixed to a crankcase **16** of the engine **15** (see FIG. **6**) via the suspension bracket **81**. The accumulator bracket **82** is formed in a substantially L-shaped plate shape in a top view by a front wall portion **83** that covers the vehicle height adjustment device **50** from the front side and a side wall portion **84** that covers the vehicle height adjustment device **50** from the right side (one side). The accumulator bracket **82** is preferably formed of an aluminum alloy having a high thermal reflectance, stainless steel having a low thermal conductivity, or the like.

(39) A C-shaped tubular accumulator holder **85** for holding the accumulator **51** is fixed to a left end side of a rear surface of the front wall portion **83** of the accumulator bracket **82**. A flange **86** is formed at a front end of the accumulator holder **85**, and the flange **86** is screwed to the front wall portion **83** of the accumulator bracket **82**, so that the accumulator holder **85** is cantilevered on the front wall portion **83**. The accumulator **51** is inserted into a tubular portion **87** of the accumulator holder **85**, and a fastening band **88** is fastened from the outside of the tubular portion **87**, so that the accumulator **51** is held by the accumulator holder **85**.

(40) In front of the vehicle height adjustment device **50**, the muffler pipe **90** is bent to the right side, and a bent portion **94** of the muffler pipe **90** is positioned in front of the front wall portion **83** of the accumulator bracket **82**. The front wall portion **83** of the accumulator bracket **82** extends in a plate shape in the upper-lower and left-right directions, and the front wall portion **83** partitions components such as the accumulator **51**, the cushion lever **34**, and the cushion rod **35** from the bent portion **94** of the muffler pipe **90**. Traveling wind is blocked by the front wall portion **83** of the accumulator bracket **82**, and the components such as the accumulator **51**, the cushion lever **34**, and the cushion rod **35** are protected from the hot air flowing to the rear side together with the traveling wind from the bent portion **94** of the muffler pipe **90**.

(41) On the right side of the vehicle height adjustment device **50**, a downstream portion **95** (the lower pipe **92***e* and the upper pipe **92***f*) extends to the rear side from the bent portion **94** of the muffler pipe **90**, and the downstream portion **95** of the muffler pipe **90** is positioned on the right side of the side wall portion **84** of the accumulator bracket **82**. The side wall portion **84** of the accumulator bracket **82** extends in a plate shape in the upper-lower and front-rear directions, and the side wall portion **84** partitions components such as the accumulator **51**, the cushion lever **34**, and the cushion rod **35** from the downstream portion **95** of the muffler pipe **90**. The heat of the downstream portion **95** of the muffler pipe **90** is blocked by the side wall portion **84** of the accumulator bracket **82**, and the components such as the accumulator **51**, the cushion lever **34**, and the cushion rod **35** are protected.

(42) In this way, the muffler pipe **90** is bent to the right side in front of the cushion lever **34**, so that an arrangement space of the accumulator **51** is secured on the left side of the cushion lever **34**. The muffler pipe **90** and the accumulator **51** are arranged on the left and right sides with the cushion lever **34** interposed therebetween, so that the center of gravity of the vehicle is lowered. In addition, the accumulator **51** is covered by the accumulator bracket **82** from the front side and the right side, so that the accumulator **51** is protected from the heat of the muffler pipe **90**. Therefore, the center of gravity of the vehicle is lowered while the influence of the heat from the muffler pipe **90** is reduced.

(43) As described above, according to the present embodiment, the cushion rod **35** is extended and contracted by the oil of the accumulator **51** to adjust the vehicle height. The vehicle height of the rear portion of the vehicle is lowered at the time of starting, or at the exit of a corner, so that stable

acceleration can be performed in a posture in which the center of gravity is low. In addition, the accumulator **51** is located at the lower portion of the vehicle, so that the center of gravity of the vehicle can be kept low even when a component of the vehicle height adjustment device **50** such as the accumulator **51** is added to the vehicle.

(44) In the present embodiment, the accumulator is positioned on the lower side of the pivot frame. Alternatively, the accumulator may be positioned on the lower side of the swing shaft of the swing arm. Even if the accumulator is added, the center of gravity of the vehicle can be kept low if the accumulator is positioned on the lower side of the swing shaft of the swing arm.

(45) Further, in the present embodiment, the cushion rod is extended and contracted by the oil. Alternatively, the cushion rod may be extended and contracted by a working fluid other than oil. The working fluid is not limited to a liquid, and a gas may be used.

(46) Further, in the present embodiment, the accumulator bracket is fixed to the engine. Alternatively, the accumulator bracket may be fixed to the vehicle body frame.

(47) Further, in the present embodiment, the upper end portion of the rear cushion is supported by the engine and the vehicle body frame. Alternatively, the upper end portion of the rear cushion may be supported by the engine or the vehicle body frame.

(48) Further, in the present embodiment, the cushion lever is supported by the vehicle body frame. Alternatively, the cushion rod may be supported by the engine.

(49) Further, in the present embodiment, the accumulator is overlapped the cushion lever and the cushion rod in the side view of the vehicle. Alternatively, the accumulator may be overlapped the cushion lever or the cushion rod.

(50) Further, in the present embodiment, the downstream portion of the muffler pipe is positioned on the right side of the vehicle center line, and the accumulator is positioned on the left side of the vehicle center line. Alternatively, the downstream portion of the muffler pipe may be positioned on the left side of the vehicle center line, and the accumulator may be positioned on the right side of the vehicle center line.

(51) Further, in the present embodiment, the accumulator, the cushion lever, and the cushion rod are partitioned from the muffler pipe by the accumulator bracket. Alternatively, at least the accumulator and the muffler pipe may be partitioned.

(52) In addition, the straddle-type vehicle is not limited to a general vehicle on which a rider rides in a posture of straddling a seat, and also includes a small-sized scooter type vehicle on which a rider rides without straddling a seat.

(53) As described above, a rear wheel suspension device according to the present embodiment is a rear wheel suspension device (**30**) including a swing arm (**31**) swingably supported with respect to a vehicle body frame (**10**), the swing arm rotatably supporting a rear wheel (**25**), the rear wheel suspension device including: a rear cushion (**33**) configured to be extended and contracted in accordance with swing of the swing arm; a cushion lever (**34**) coupled to a lower end portion of the rear cushion; a cushion rod (**35**) coupling the cushion lever and the swing arm; and an accumulator (**51**) storing a working fluid that extends and contracts the cushion rod, in which a vehicle height is adjusted by displacement of the swing arm in accordance with extension and contraction of the cushion rod, and the accumulator is positioned on a lower side of a swing shaft (**32**) of the swing arm. According to this configuration, the vehicle height is adjusted by extending and contracting the cushion rod by the working fluid of the accumulator. The vehicle height of the rear portion of the vehicle is lowered at the time of starting, or at the exit of a corner, so that stable acceleration can be performed in a posture in which the center of gravity is low. In addition, the accumulator is located at the lower portion of the vehicle, so that the center of gravity of the vehicle can be kept low even when a component of the vehicle height adjustment device such as the accumulator is added to the vehicle.

(54) In the rear wheel suspension device for a straddle-type vehicle according to the present embodiment, the accumulator is closer to the swing shaft of the swing arm than a lower end portion

of the rear cushion in a vehicle front-rear direction. According to this configuration, the accumulator is brought close to the swing shaft of the swing arm, so that the center of gravity of the vehicle is brought close to the center in the vehicle front-rear direction, and the stability of the vehicle is improved.
(55) In the rear wheel suspension device for a straddle-type vehicle according to the present embodiment, the accumulator is positioned on a lower side of the vehicle body frame. According to this configuration, the center of gravity of the vehicle can be kept lower.
(56) In the rear wheel suspension device for a straddle-type vehicle according to the present embodiment, the accumulator is positioned on a side of the cushion lever and the cushion rod, and the accumulator is overlapped the cushion lever and/or the cushion rod in a vehicle side view. According to this configuration, the components of the vehicle height adjustment device are collectively disposed, the pipe is shortened, and maintainability is improved.
(57) In the rear wheel suspension device for a straddle-type vehicle according to the present embodiment, a muffler pipe (**90**) extends rearward from an engine through a side of the accumulator, and the accumulator is overlapped the muffler pipe in a vehicle side view. According to this configuration, the accumulator is arranged to be aligned with the muffler pipe, so that the center of gravity of the vehicle can be kept lower.
(58) In the rear wheel suspension device for a straddle-type vehicle according to the present embodiment, the muffler pipe is bent in front of the accumulator and extends rearward through one side in a left-right direction with respect to a vehicle center line extending in a vehicle front-rear direction, and the accumulator is positioned on the other side in the left-right direction with respect to the vehicle center line. According to this configuration, the downstream side of the bent portion of the muffler pipe is closer to the one side in the left-right direction than the vehicle center line, so that an arrangement space of the accumulator can be secured on the other side in the left-right direction of the vehicle center line.
(59) Although the present embodiment has been described, the above-described embodiment and the modification may be combined entirely or partially as another embodiment.
(60) The technique of the present invention is not limited to the above-described embodiment, and various changes, substitutions, and modifications may be made without departing from the spirit of the technical idea of the present invention. The present invention may be implemented by other methods as long as the technical idea can be implemented by the methods through advance of the technique or other derivative techniques. Therefore, the claims cover all embodiments that may be included within the scope of the technical idea.

Claims

1. A rear wheel suspension device including a swing arm swingably supported with respect to a vehicle body frame, the swing arm rotatably supporting a rear wheel, the rear wheel suspension device comprising: a rear cushion configured to be extended and contracted in accordance with swing of the swing arm; a cushion lever coupled to a lower end portion of the rear cushion; a cushion rod coupling the cushion lever and the swing arm; and an accumulator storing a working fluid that extends and contracts the cushion rod, wherein a vehicle height is adjusted by displacement of the swing arm in accordance with extension and contraction of the cushion rod, and wherein the accumulator is positioned on a lower side of a swing shaft of the swing arm.
2. The rear wheel suspension device according to claim 1, wherein the accumulator is closer to the swing shaft of the swing arm than to the lower end portion of the rear cushion in a vehicle front-rear direction.
3. The rear wheel suspension device according to claim 1, wherein the accumulator is positioned on a lower side of the vehicle body frame.
4. The rear wheel suspension device according to claim 1, wherein the accumulator is positioned on

a side of the cushion lever and the cushion rod, and wherein the accumulator is overlapped the cushion lever and/or the cushion rod in a vehicle side view.

5. The rear wheel suspension device according to claim 1, wherein a muffler pipe extends rearward from an engine through a side of the accumulator, and wherein the accumulator is overlapped by the muffler pipe in a vehicle side view.

6. The rear wheel suspension device according to claim 5, wherein the muffler pipe is bent in front of the accumulator and extends rearward through one side in a left-right direction with respect to a vehicle center line extending in a vehicle front-rear direction, and wherein the accumulator is positioned on the other side in the left-right direction with respect to the vehicle center line.

7. The rear wheel suspension device according to claim 1, wherein, in a vehicle side view, an upper end of the accumulator is positioned below the swing shaft of the swing arm.

8. The rear wheel suspension device according to claim 1, wherein, in a vehicle bottom view, the accumulator overlaps the swing arm.

9. The rear wheel suspension device according to claim 1, wherein, in a vehicle side view, a distance in a vehicle front-rear direction between the rear end of the accumulator and the swing shaft of the swing arm is shorter than a distance in a vehicle front-rear direction between lower end portion of the rear cushion and the swing shaft of the swing arm.

10. The rear wheel suspension device according to claim 1, wherein, in a vehicle side view, a rear end of the accumulator is located rearward of the swing shaft of the swing arm, and a front end of the accumulator is located forward of the swing shaft of the swing arm.