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### Straddled vehicle

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#### Abstract

A straddled vehicle includes a footrest including a center step and a rear step. When a perpendicular bisector of a first line segment connecting a front end and a rear end of the rear step is defined as an imaginary first reference line, a center of gravity of the straddled vehicle is ahead of the first reference line and the grounding point of the rear wheel is behind the first reference line when the first line segment is horizontal. When a second line segment connects a front end and a rear end of the center step, and a straight line perpendicular to the second line segment and extending through the rear end of the first step is defined as an imaginary second reference line, the center of gravity of the straddled vehicle is behind the second reference line within a range of about 100 mm or is ahead of the second reference line.

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## Background/Summary

## CROSS REFERENCE TO RELATED APPLICATIONS

(1) This application claims the benefit of priority to Japanese Patent Application No. 2021-178260 filed on Oct. 29, 2021. The entire contents of this application are hereby incorporated herein by reference.

## BACKGROUND OF THE INVENTION

### 1. Field of the Invention

(2) The present invention relates to straddled vehicles, and more specifically to an ATV (All Terrain Vehicle) and the like.

### 2. Description of the Related Art

(3) As an example of conventional techniques of this kind, U.S. Patent Application Publication No. 2009/0250282 discloses an RUV (Recreational Utility Vehicle). As U.S. Patent Application Publication No. 2009/0250282 shows in its FIG. 35, the RUV can carry two or more people, and includes a foot board assembly provided between the front wheels and rear wheels in a side view, a saddle seat assembly provided above the foot board assembly, and a handlebar provided ahead of the saddle seat assembly. The foot board assembly includes a first footrest for the rider, a second footrest for a passenger, and a transition portion connecting the first and the second footrests.

(4) Normally in this type of vehicle, the vehicle's center of gravity is considered to be near a vertical line which passes through the center between the front wheel and the rear wheel in a side view. In the RUV disclosed in U.S. Patent Application Publication No. 2009/0250282, the vehicle's center of gravity is considered to be near a vertical line which passes through the center of the transition portion which connects the first and the second footrests.

(5) In this type of RUV, when climbing a steep hill, the front wheels are higher and the vehicle's body tilts backward such that the vehicle's center of gravity shifts rearward. Therefore, in the vehicle disclosed in U.S. Patent Application Publication No. 2009/0250282, it is considered that when the RUV tilts until the transition portion becomes horizontal, the RUV's center of gravity comes to a position which is more rearward than the perpendicular bisector of the transition portion. This limits the posture of the people on the RUV, and may interfere with riding comfort. There is room for improvement in the drivability of the vehicle disclosed in U.S. Patent Application Publication No. 2009-0250282.

## SUMMARY OF THE INVENTION

(6) Therefore, preferred embodiments of the present invention provide straddled vehicles each having improved drivability.

(7) According to a preferred embodiment of the present invention, a straddled vehicle includes a body, a front wheel at a front portion of the body, a rear wheel at a rear portion of the body, and a footrest in the body and including a first step and a second step behind the first step and rising upward and rearward when the body is horizontal. When a first line segment connects a front end and a rear end of the second step in a side view of the straddled vehicle, and a perpendicular bisector of the first line segment is defined as an imaginary first reference line, a center of gravity of the straddled vehicle is ahead of the first reference line and a grounding point of the rear wheel is behind the first reference line in the side view when the first line segment is horizontal.

(8) According to a preferred embodiment of the present invention, when the first line segment is horizontal in the side view, the center of gravity of the straddled vehicle is ahead of the first reference line and the grounding point of the rear wheel is behind the first reference line. Therefore, it is possible to increase the freedom of a riding posture. When traveling on uphill ground with the straddled vehicle, the rider is able to put his/her foot on the second step, and assume a comfortable riding posture and therefore enjoy a comfortable ride. Thus, the straddled vehicle is able to provide improved drivability.

(9) Preferably, when a second line segment connects a front end and a rear end of the first step in the side view, and a straight line perpendicular to the second line segment and extending through

the rear end of the first step is defined as an imaginary second reference line, the center of gravity of the straddled vehicle is behind the second reference line within a range of about 100 mm or is ahead of the second reference line and the grounding point of the rear wheel is behind the second reference line in the side view when the body is horizontal. In this case, in the side view, when the body is horizontal (in a state in which the second line segment is substantially horizontal), the center of gravity of the straddled vehicle is within about 100 mm behind the second reference line or is ahead of the second reference line, and the grounding point of the rear wheel is behind the second reference line. Therefore, it is possible to increase the freedom of a riding posture. When traveling on flat ground with the straddled vehicle, the rider is able to put his/her foot on the center step, and assume a comfortable riding posture and therefore enjoy a comfortable ride.

(10) Further preferably, the first line segment has an inclination angle with respect to the second line segment within a range of not smaller than about 10 degrees and not greater than about 50 degrees in a side view when the first line segment is horizontal, an angle defined by a straight line connecting a middle point of the first line segment with the center of gravity of the straddled vehicle and the first reference line is within a range of not smaller than about 25 degrees and not greater than about 70 degrees in the side view, and an angle defined by a straight line connecting the middle point of the first line segment with a grounding point of the rear wheel and the first reference line is within a range of not smaller than about 0 degrees and not greater than about 35 degrees in the side view. In this case, the rider is able to travel more comfortably when traveling on uphill ground.

(11) Further, preferably, the straddled vehicle further includes a handle provided in the body at a more forward position than the rear wheel when the first line segment is horizontal, wherein a location where the handle is attached to the body is ahead of the first reference line in the side view when the body is horizontal, and the location where the handle is attached is ahead of the second reference line in the side view. In this case, in the side view, the handle attaching position is not only ahead of the first reference line when the first line segment is horizontal, but also is ahead of the second reference line when the body is horizontal (when the second line segment is substantially horizontal). Therefore, regardless of whether the ground is flat or uphill, it is possible to stabilize the positional relationship between the rider and the handle, and therefore the rider is able to enjoy his/her ride more comfortably.

(12) Preferably, when the first line segment is horizontal, the handle is within a range of not smaller than about -10 degrees and not greater than about 35 degrees with respect to the first reference line in the side view when the body is horizontal, and the handle is within a range of not smaller than about 15 degrees and not greater than about 40 degrees with respect to the second reference line in the side view. In this case, the rider is able to travel more comfortably when traveling on uphill ground.

(13) Further preferably, the first step is where a rider puts his/her foot when the body is horizontal, and the second step is where the rider puts his/her foot when the body is inclined. In this case, when traveling on flat ground with the straddled vehicle, the rider is able to put his/her foot on the first step. On the other hand, when traveling on uphill ground with the straddled vehicle, the rider is able to put his/her foot on the second step. In each of the cases the rider is able to enjoy a comfortable ride.

(14) Further, preferably, the first step is substantially horizontal when the body is horizontal. In this case, when traveling on flat ground with the straddled vehicle, the rider is able to put his/her foot on the first step and enjoy a more comfortable ride.

(15) Preferably, the second step includes a region where the foot is placed such that a line which connects a front end and a rear end thereof rises rearward. In this case, when traveling on uphill ground with the straddled vehicle, the rider is able to put his/her foot on the second step and enjoy a more comfortable ride.

(16) Further preferably, the first step has a length not smaller than about 250 mm, and a width not

smaller than about 130 mm. In this case, when traveling on flat ground with the straddled vehicle, the rider is able to put his/her foot on the first step securely.

(17) Further preferably, the second step has a length not smaller than about 100 mm, and a width not smaller than about 90 mm. In this case, when traveling on uphill ground with the straddled vehicle, the rider is able to put his/her foot on the second step securely.

(18) Preferably, the straddled vehicle further includes an anti-slip surface provided on the first step. In this case, the rider is not only helped by the primary function of the anti-slip surface, but also feels the anti-slip on his/her sole thus recognizing the position of the first step, and therefore is able to put his/her foot easily onto the first step.

(19) Further preferably, the straddled vehicle further includes an anti-slip surface provided on the second step. In this case, the rider is not only helped by the primary function of the anti-slip surface, but also feels the anti-slip surface on his/her sole thus recognizing the position of the second step, and therefore is able to put his/her foot easily onto the second step.

(20) Further, preferably, the straddled vehicle further includes a discharge hole provided in the first step. In this case, even if the footrest becomes dirty with water, mud, and other foreign matters, it is possible to discharge these foreign matters smoothly from the hole in the first step.

(21) Preferably, the footrest includes a surface continuous from the first step to the second step. In this case, it is possible to switch foot positions smoothly between the first step and the second step.

(22) Further preferably, the surface includes a flat surface in each of the first step and the second step. In this case, it is possible to put the foot comfortably on each of the first step and the second step.

(23) Further, preferably, the first step includes a slanted surface such that an outboard side of the slanted surface is higher than an inboard side in a width direction of the vehicle. In this case, it is possible to provide the rider with options of riding positions.

(24) Preferably, the straddled vehicle further includes a seat provided in the body. With this arrangement, a front end of the first step is located at a more forward position than a front end of the seat in a side view of the straddled vehicle and a rear end of the first step is located at a more forward position than a rear end of the seat in the side view. In this case, when performing a standing ride on flat ground, the rider is able to put his/her foot on the first step and also use his/her knees to sandwich the saddle-style seat to provide a comfortable ride.

(25) Further preferably, the straddled vehicle further includes a seat provided in the body, and the front end and the rear end of the second step end are located at more forward positions than a rear end of the seat in the side view. In this case, when performing a standing ride on uphill ground, the rider is able to put his/her foot on the second step and also use his/her knees to sandwich the saddle-style seat to enjoy a comfortable ride.

(26) It is noted here that in preferred embodiments of the present invention, the term “grounding point of the rear wheel” refers to a contact point of the rear wheel with a horizontal surface, and if the rear wheel is in surface contact with the horizontal surface, the term refers to the center of the contact surface in the side view.

(27) Also, if the first step and the second step are connected with each other by a curved line in the side view, an imaginary point of intersection between an extension of the first step and an extension of the second step is obtained when the body is horizontal as a reference, and then, a point of intersection of a vertical line extending through the imaginary intersection and the curved line is taken as the rear end of the first step and the front end of the second step.

(28) 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 preferred embodiments with reference to the attached drawings.

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## Description

## BRIEF DESCRIPTION OF THE DRAWINGS

- (1) FIG. 1 is a perspective view which shows a straddled vehicle according to a preferred embodiment of the present invention.
- (2) FIG. 2 is a side view which shows the straddled vehicle in FIG. 1.
- (3) FIG. 3 is an illustration of a section of a footrest.
- (4) FIG. 4 is a side view which shows the footrest.
- (5) FIG. 5 is a plan view which shows the footrest.
- (6) FIG. 6A is a sectional A-A end view of the footrest.
- (7) FIG. 6B is a sectional B-B end view of the footrest.
- (8) FIG. 7 is a side view which shows a riding posture in a situation when a first line segment is horizontal.
- (9) FIG. 8 is a side view which shows a riding posture when a body is horizontal.
- (10) FIG. 9 is an illustrative drawing which shows another example of an anti-slip surface provided on the footrest.
- (11) FIG. 10 is an enlarged partial view of the anti-slip surface shown in FIG. 9.
- (12) FIGS. 11A and 11B are illustrative drawings for describing a rear end of a center step and a front end of a rear step.

## DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

- (13) Hereinafter, preferred embodiments of the present invention will be described with reference to the drawings.
- (14) In the drawings, “Fr” indicates forward, “Rr” indicates rearward, “R” indicates rightward, “L” indicates leftward, “U” indicates upward, and “Lo” indicates downward.
- (15) Referring to FIG. 1 and FIG. 2, a straddled vehicle **10** according to a preferred embodiment of the present invention is, for example, a four-wheel type ATV for one person, and includes a body **12**, a pair of front wheels **14** provided in a forward portion of the body **12**, a pair of rear wheels **16** provided in a rearward portion of the body **12**, a bar handle **18** provided in the body **12**, a saddle-style seat **20** provided in the body **12**, and a pair of footrests **22** provided in the body **12**. Note that FIG. 1 shows only left ones of the pair of rear wheels **16** and the pair of footrests **22**. The bar handle **18** is provided at an intermediate region in the vehicle's width direction, and in a side view at a position above the front wheels **14** and more forward than the rear wheels **16**. The saddle-style seat **20** is provided at an intermediate portion in the vehicle's width direction, and in a side view at a higher position than the front wheels **14** and the rear wheels **16**, between the front wheels **14** and the rear wheels **16**.
- (16) Hereinafter, the left footrest **22** will be described. The pair of footrests **22** are symmetrical to each other, and the right footrest **22** is arranged essentially the same as the left footrest **22**, so description therefor will be skipped.
- (17) Referring also to FIG. 3 through FIG. 5, the footrest **22** is for the rider to put his/her foot, is provided between the front wheel **14** and the rear wheel **16** in a side view, and includes a center step **24**, a front step **26**, and a rear step **28**.
- (18) The center step **24** is where the rider puts his/her foot when the body is horizontal, and is substantially horizontal when the body is horizontal. For example, the center step **24** is angled with respect to the horizontal plane with a forward and downward inclination of not smaller than about 0 degrees and not greater than about 4 degrees. Also, the center step **24** includes a slanted surface **24a** which has an outboard side higher than an inboard side in a width direction of the vehicle (see FIGS. 6A and 6B).
- (19) The front step **26** is provided ahead of the center step **24** and extends diagonally upward and forward. In other words, the front step **26** inclines diagonally upward and forward with respect to the center step **24**. This gives the footrest **22** an angle of attack at its front portion.
- (20) The rear step **28** is provided behind the center step **24** and rises upward and rearward when the

body is horizontal. The rear step **28** is a portion where the rider is able to put his/her foot when the body is tilted, and is oriented such that a line which connects a front end **E1** with a rear end **E2** of a foot-resting area rises rearward. In other words, the rear step **28** inclines diagonally upward and rearward with respect to the center step **24** so that a rear portion of the rear step **28** is at a higher position than the center step **24**.

(21) The footrest **22** includes a surface **S** that is continuous from the center step **24** through the rear step **28**. The surface **S** has flat surfaces **P1**, **P2** in the center step **24** and the rear step **28** respectively. Preferably, the center step **24** has a length not smaller than about 250 mm, and a width not smaller than about 130 mm; and the rear step **28** has a length not smaller than about 100 mm and a width not smaller than about 90 mm.

(22) The center step **24** is further provided with anti-slip surfaces **30**, **32** and a hole **34** to discharge foreign matters. The anti-slip surface **30** is, for example, bar-shaped, and extends in a width direction of the vehicle in an area slightly behind a fore-aft center of the center step **24**. The anti-slip surface **30** includes a metal plate **30a** which has serration-shaped spikes. The anti-slip surface **32** extends in a fore-aft direction in an outboard end region of the center step **24**. The anti-slip surface **32** includes a concavo-convex portion **32a** including a large number of cone-shaped convexities. The hole **34** is provided on a front inboard side of the center step **24**.

(23) Referring to FIG. 2, the center step **24** includes a front end **E3** at a more forward position than a front end **E5** of the saddle-style seat **20** in a side view. The center step **24** has a rear end **E4** at a more forward position than a rear end **E6** of the saddle-style seat **20** in a side view. The front end **E1** and the rear end **E2** of the rear step **28** are at more forward positions than the rear end **E6** of the saddle-style seat **20** in a side view.

(24) Referring to FIG. 2, FIG. 3, and FIG. 7, in a side view, a first line segment **L1** connects the front end **E1** and the rear end **E2** of the rear step **28**, and a perpendicular bisector of the first line segment **L1** is an imaginary first reference line **R1**. In this case, in a side view, when the first line segment **L1** is horizontal, the center of gravity **G** of the straddled vehicle **10** is ahead of the first reference line **R1** and a grounding point **C1** of the rear wheel **16** is behind the first reference line **R1**.

(25) Now assume further that “a” represents an inclination angle of the first line segment **L1** with respect to a second line segment **L2**; “b” represents an angle defined by a straight line which connects the middle point **M** of the first line segment **L1** with the center of gravity **G** of the straddled vehicle **10** and the first reference line **R1**; and “c” represents an angle defined by a straight line which connects the middle point **M** of the first line segment **L1** and the grounding point **C1** of the rear wheel **16** and the first reference line **R1**. In this case, the inclination angle “a” is within a range of not smaller than about 10 degrees and not greater than about 50 degrees in a side view; and when the first line segment **L1** is horizontal, the angle “b” is within a range of not smaller than about 25 degrees and not greater than about 70 degrees in a side view; and the angle “c” is within a range of not smaller than about 0 degrees and not greater than about 35 degrees in a side view.

(26) In a side view, when the first line segment **L1** is horizontal, an attaching position **18a** of the bar handle **18** is ahead of the first reference line **R1**. Also, in a side view, when the first line segment **L1** is horizontal, the bar handle **18** (the center of the grip) is within a range of not smaller than about -10 degrees and not greater than about 35 degrees with respect to the first reference line **R1**. In other words, assume an angle “d” as an angle defined by a straight line which connects the middle point **M** of the first line segment **L1** with the center of grip of the bar handle **18** and the first reference line **R1**. In this case, the angle “d” is within a range of not smaller than about -10 degrees and not greater than about 35 degrees in a side view.

(27) Referring to FIG. 2, FIG. 3, and FIG. 8, in a side view, assume an imaginary second reference line **R2** is a straight line perpendicular to the second line segment **L2** that connects the front end **E3** and the rear end **E4** of the center step **24**, and extends through the rear end **E4** of the center step **24**.

In this case, in a side view, when the body is horizontal, i.e., in a state where the straddled vehicle **10** is on a horizontal plane (under a state in which the second line segment **L2** is substantially horizontal), the center of gravity **G** of the straddled vehicle **10** is behind the second reference line **R2** within a range of about 100 mm or is ahead of the second reference line **R2**, and a grounding point **C2** of the rear wheel **16** is behind the second reference line **R2**. In other words, in the side view, when the body is horizontal, the center of gravity **G** of the straddled vehicle **10** is ahead of a line **R3** parallel to the second reference line **R2** about 100 mm behind the second reference line **R2**, and the grounding point **C2** of the rear wheel **16** is behind the second reference line **R2**.

(28) In a side view, when the body is horizontal, the attaching position **18a** of the bar handle **18** is ahead of the second reference line **R2**. Also, in a side view, when the body is horizontal, the bar handle **18** (the center of the grip) is within a range of not smaller than about 15 degrees and not greater than about 40 degrees with respect to the second reference line **R2**. In other words, assume an angle “e” as an angle defined by a straight line which connects the middle point **M** of the first line segment **L1** with the center of grip of the bar handle **18** and the second reference line **R2**. In this case, the angle “e” is within a range of not smaller than about 15 degrees and not greater than about 40 degrees in a side view.

(29) In a preferred embodiment of the present invention, the center step **24** represents the first step and the rear step **28** represents the second step.

(30) According to the straddled vehicle **10** described thus far, in a side view, when the first line segment **L1** is horizontal, the center of gravity **G** of the straddled vehicle **10** is ahead of the first reference line **R1** and the grounding point **C1** of the rear wheel **16** is behind the first reference line **R1**. Therefore, it is possible to increase the freedom of a riding posture. When traveling on uphill ground with the straddled vehicle **10**, the rider is able to put his/her foot on the rear step **28**, and assume a comfortable riding posture and therefore enjoy a comfortable ride.

(31) In a side view, when the body is horizontal (in the state in which the second line segment **L2** is substantially horizontal), the center of gravity **G** of the straddled vehicle **10** is within about 100 mm behind the second reference line **R2** or is ahead of the second reference line **R2**, and the grounding point **C2** of the rear wheel **16** is behind the second reference line **R2**. Therefore, it is possible to increase the freedom of a riding posture. When traveling on flat ground with the straddled vehicle **10**, the rider is able to put his/her foot on the center step **24**, and assume a comfortable riding posture and therefore enjoy a comfortable ride.

(32) When the inclination angle “a” of the first line segment **L1** with respect to the second line segment **L2** is within the range of not smaller than about 10 degrees and not greater than about 50 degrees and the first line segment **L1** is horizontal in a side view, the angle “b” defined by the straight line which connects the middle point **M** of the first line segment **L1** with the center of gravity **G** of the straddled vehicle **10** and the first reference line **R1** is within the range of not smaller than about 25 degrees and not greater than about 70 degrees in the side view, and the angle “c” defined by the straight line which connects the middle point **M** of the first line segment **L1** with the grounding point **C1** of the rear wheel **16** and the first reference line **R1** is within the range of not smaller than about 0 degrees and not greater than about 35 degrees in the side view. With this arrangement, the rider is able to enjoy his/her ride more comfortably when traveling on uphill ground.

(33) In a side view, the attaching position **18a** of the bar handle **18** is not only ahead of the first reference line **R1** when the first line segment **L1** is horizontal, but also is ahead of the second reference line **R2** when the body is horizontal (when the second line segment **L2** is substantially horizontal). Therefore, regardless of whether the ground is flat or uphill, it is possible to stabilize the positional relationship between the rider and the bar handle **18**, and therefore the rider is able to enjoy his/her ride more comfortably.

(34) In a side view, when the first line segment **L1** is horizontal, the bar handle **18** is within the range of not smaller than about -10 degrees and not greater than about 35 degrees with respect to



the first reference line R1. In a side view, when the body is horizontal (when the second line segment L2 is substantially horizontal), the bar handle **18** is within the range of not smaller than about 15 degrees and not greater than about 40 degrees with respect to the second reference line R2. Therefore, the rider is able to travel more comfortably when traveling on uphill ground.

(35) When traveling on flat ground with the straddled vehicle **10**, the rider is able to put his/her foot on the center step **24**. On the other hand, when traveling on uphill ground with the straddled vehicle **10**, the rider is able to put his/her foot on the center step **28**. In each of the cases the rider is able to enjoy a comfortable ride.

(36) Since the center step **24** is substantially horizontal when the body is horizontal, the rider is able to put his/her foot on the center step **24** and enjoy his/her ride more comfortably when traveling on flat ground with the straddled vehicle **10**.

(37) The rear step **28** is oriented so that the line which connects the front end E1 with the rear end E2 of the foot-resting area rises rearward. Therefore, when traveling on uphill ground with the straddled vehicle **10**, the rider is able to put his/her foot on the rear step **28**, and enjoy his/her ride more comfortably.

(38) Since the center step **24** has the length not smaller than about 250 mm and the width not smaller than about 130 mm, the rider is able to put his/her foot on the center step **24** securely when traveling on flat ground with the straddled vehicle **10**.

(39) Since the rear step **28** has the length not smaller than about 100 mm and the width not smaller than about 90 mm, the rider is able to put his/her foot on the rear step **28** securely when traveling on uphill ground with the straddled vehicle **10**.

(40) Since the center step **24** has the anti-slip surface **30**, the rider is not only helped by the primary function of the anti-slip surface, but also feel the anti-slip surface **30** on his/her sole thus recognizing where the center step **24** is, and able to put his/her foot easily onto the center step **24**.

(41) Even if the footrest **22** becomes dirty with water, mud, and other foreign matters, they can be smoothly discharged from the hole **34** in the center step **24**.

(42) Since the footrest **22** includes the surface S continuous from the center step **24** through the rear step **28**, the rider is able to smoothly switch positions of his/her foot between the center step **24** and the rear step **28**.

(43) Since the surface S of the footrest **22** has the flat planes P1, P2 respectively in the center step **24** and the rear step **28**, the rider is able to put his/her foot comfortably on each of the center step **24** and the rear step **28**.

(44) Since the center step **24** includes the slanted surface **24a** which has an outboard side higher than an inboard side in the vehicle's width direction, it is possible to provide the rider with options of riding positions.

(45) The front end E3 of the center step **24** is at a more forward position than the front end E5 of the saddle-style seat **20** in a side view. The rear end E4 of the center step **24** is at a more forward position than the rear end E6 of the saddle-style seat **20** in a side view. Therefore, when performing a standing ride on flat ground, the rider is able to put his/her foot on the center step **24** and also use his/her knees to sandwich the saddle-style seat **20** to provide a comfortable ride.

(46) The front end E1 and the rear end E2 of the rear step **28** are at more forward positions than the rear end E6 of the saddle-style seat **20** in a side view. Therefore, when performing a standing ride on uphill ground, the rider is able to put his/her foot on the rear step **28** and also use his/her knees to sandwich the saddle-style seat **20** to provide a comfortable ride.

(47) With the arrangement that the footrest **22** has an angle of attack at its front portion, it is possible to deflect obstacles from ahead with the front portion of the footrest **22** during riding.

(48) It is noted here with reference to FIG. 5, that the rear step **28** may have an anti-slip surface **36**. The anti-slip surface **36** includes two metal plates **36a** which have serration-shaped spikes. Each metal plate **36a** extends in a fore-aft direction on the rear step **28**. By providing the rear step **28** with the anti-slip surface **36** as described, the rider is not only helped by the primary function of the

anti-slip surface, but also feel the anti-slip **36** on his/her sole thus recognizing where the rear step **28** is, and able to put his/her foot easily onto the rear step **28**.

(49) As another arrangement, the center step **24** may be provided with an anti-slip surface **38** as shown in FIG. **9** and FIG. **10**, instead of the anti-slip surface **30**. For example, the anti-slip surface **38** may include a large number of cone-shaped convexities, and is integral with the center step **24**.

(50) In a preferred embodiment of the present invention, the rear end of the center step and the front end of the rear step are determined in the manner described below.

(51) Referring to FIG. **11A**, in a case where the center step and the rear step are connected with each other in a folding fashion in a side view, a point of intersection **X1** between the center step and the rear step is taken as the rear end of the center step and the front end of the rear step.

(52) Referring to FIG. **11B**, in a case where the center step and the rear step are connected with each other by a curved line in a side view, an imaginary point of intersection **X2** between an extension of the center step and an extension of the rear step is obtained. Using a case when the body is horizontal as a reference, a point of intersection **X3** made by a vertical line **V** extending through the imaginary intersection **X2** and the curved line is taken as the rear end of the center step and the front end of the rear step. The footrest **22** shown in FIG. **3** represents the present case.

(53) Also, preferred embodiments of the present invention are not limited to the case where the center step and the rear step are connected with (continuous to) each other. They may be spaced apart from each other. There may be a step provided between the center step and the rear step.

(54) The center step and the rear step may each be a surface formed by a combination of a plurality of flat surfaces. Also, the steps are not limited to flat surfaces but may be curved surfaces.

(55) In a preferred embodiment of the present invention described above, description was made for a case where the center step **24** is slanted and becomes higher as it extends outboard of the vehicle. In a preferred embodiment of the present invention, the rear step may also be slanted and become higher as it extends outboard of the vehicle.

(56) In a preferred embodiment of the present invention described above, description was made for a case where the footrest **22** includes a front step **26**. However, in a preferred embodiment of the present invention the footrest need not necessarily include a front step.

(57) In a preferred embodiment of the present invention described above, description was made for a case where the straddled vehicle **10** includes a pair of front wheels **14** and a pair of rear wheels **16**. However, the present invention is not limited to this. The present invention is applicable to a straddled vehicle which includes a front and rear wheels, including a plurality of at least one of the front and rear wheels.

(58) While preferred 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 one person straddled vehicle comprising: a body; a front wheel at a front portion of the body; a rear wheel at a rear portion of the body; a seat on the body configured so that one person rides the straddled vehicle; and a footrest in the body and including a first step that is substantially horizontal when the body is horizontal and a second step behind the first step and rising upward and rearward when the body is horizontal; wherein when a first line segment connects a front end and a rear end of the second step in a side view of the straddled vehicle, and a perpendicular bisector of the first line segment is defined as an imaginary first reference line; a center of gravity of the straddled vehicle is ahead of the first reference line and a grounding point of the rear wheel is behind the first reference line in the side view when the first line segment is horizontal.
2. The one person straddled vehicle according to claim 1, wherein in the side view when the body

is horizontal, a second line segment connects a front end and a rear end of the first step in the side view, and a straight line perpendicular to the second line segment and extending through the rear end of the first step is defined as an imaginary second reference line; (1) the center of gravity of the straddled vehicle is behind the second reference line within a range of about 100 mm or is ahead of the second reference line, and (2) the grounding point of the rear wheel is behind the second reference line.

3. The one person straddled vehicle according to claim 2, further comprising: a handle in the body at a more forward position than the rear wheel; wherein when the first line segment is horizontal, a location where the handle is attached to the body is ahead of the first reference line in the side view; and when the body is horizontal, the location where the handle is attached is ahead of the second reference line in the side view.

4. The one person straddled vehicle according to claim 1, wherein when the first line segment is horizontal, the handle is within a range of not smaller than about 10 degrees and not greater than about 35 degrees with respect to the first reference line in the side view; and when the body is horizontal, the handle is within a range of not smaller than about 15 degrees and not greater than about 40 degrees with respect to the second reference line in the side view.

5. The one person straddled vehicle according to claim 1, wherein the second step includes a region where a foot is to be placed such that a line which connects a front end and a rear end of the second step rises upward and rearward in the side view when the body is horizontal.

6. The one person straddled vehicle according to claim 1, wherein the first step has a length not smaller than about 250 mm, and a width not smaller than about 130 mm.

7. The one person straddled vehicle according to claim 1, wherein the second step has a length not smaller than about 100 mm, and a width not smaller than about 90 mm.

8. The one person straddled vehicle according to claim 1, further comprising an anti-slip surface on the first step.

9. The one person straddled vehicle according to claim 1, further comprising an anti-slip surface on the second step.

10. The one person straddled vehicle according to claim 1, further comprising a discharge hole in the first step.

11. The one person straddled vehicle according to claim 1, wherein the footrest includes a surface that is continuous from the first step to the second step.

12. The one person straddled vehicle according to claim 11, wherein the surface includes a flat surface in each of the first step and the second step.

13. The one person straddled vehicle according to claim 1, wherein the first step includes a slanted surface such that an outboard side of the slanted surface is higher than an inboard side of the slanted surface in a width direction of the vehicle.

14. The one person straddled vehicle according to claim 1, wherein a front end of the first step is located at a more forward position than a front end of the seat in the side view, and a rear end of the first step is located at a more forward position than a rear end of the seat in the side view.

15. The one person straddled vehicle according to claim 1, wherein the front end and the rear end of the second step are located at more forward positions than a rear end of the seat in the side view.

16. A straddled vehicle comprising: a body; a front wheel at a front portion of the body; a rear wheel at a rear portion of the body; and a footrest in the body and including a first step and a second step behind the first step and rising upward and rearward when the body is horizontal; wherein when a first line segment connects a front end and a rear end of the second step in a side view of the straddled vehicle, and a perpendicular bisector of the first line segment is defined as an imaginary first reference line; a center of gravity of the straddled vehicle is ahead of the first reference line and a grounding point of the rear wheel is behind the first reference line in the side view when the first line segment is horizontal; in the side view when the body is horizontal, a second line segment connects a front end and a rear end of the first step in the side view, and a

straight line perpendicular to the second line segment and extending through the rear end of the first step is defined as an imaginary second reference line; (1) the center of gravity of the straddled vehicle is behind the second reference line within a range of about 100 mm or is ahead of the second reference line, and (2) the grounding point of the rear wheel is behind the second reference line; the first line segment has an inclination angle with respect to the second line segment within a range of not smaller than about 10 degrees and not greater than about 50 degrees in the side view when the first line segment is horizontal; an angle defined by a straight line connecting a middle point of the first line segment with the center of gravity of the straddled vehicle and the first reference line is within a range of not smaller than about 25 degrees and not greater than about 70 degrees in the side view; and an angle defined by a straight line connecting the middle point of the first line segment with the grounding point of the rear wheel and the first reference line is within a range of not smaller than about 0 degrees and not greater than about 35 degrees in the side view.

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