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Jo et al.

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(54) **VEHICLE PARKING DEVICE AND VEHICLE TRANSMISSION INCLUDING THE SAME**

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(52) **U.S. Cl.**
CPC ***F16H 63/3466*** (2013.01); ***F16H 63/3425*** (2013.01)

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USPC 192/219.5; 74/89.14, 109
See application file for complete search history.

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(57) **ABSTRACT**

Provided are a vehicle parking device and a vehicle transmission. The vehicle parking device includes an actuator configured to rotate a worm gear mounted at an end thereof, a loading unit including a rack gear engaged with the worm gear and linearly moving according to a movement of the rack gear, a parking sprag in contact with the loading unit and rotating by a linear movement of the loading unit, and a parking gear provided in a drive shaft that transmits a driving force and selectively engaged according to a rotation of the parking sprag.

5 Claims, 6 Drawing Sheets

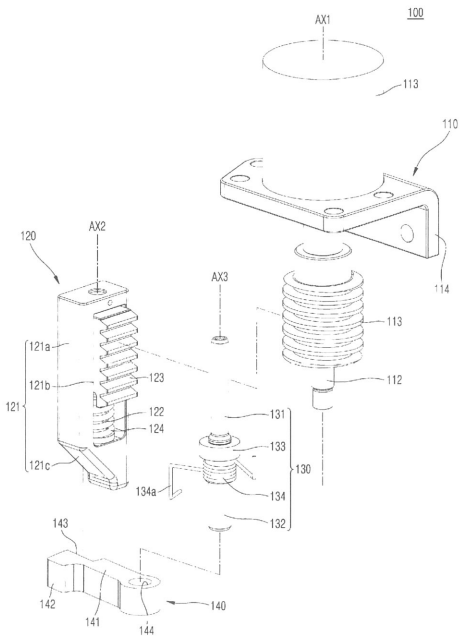


FIG. 1

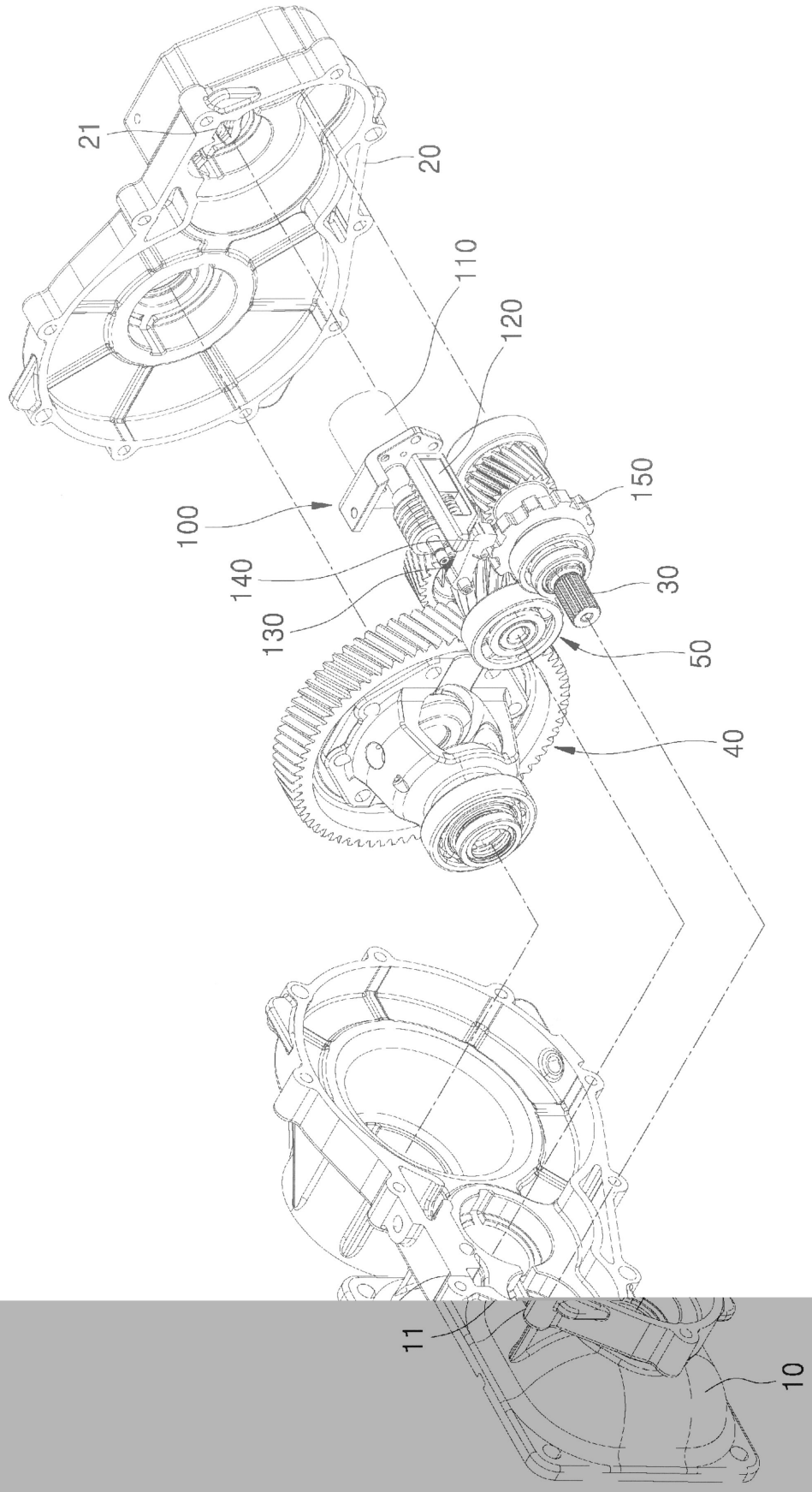


FIG. 2

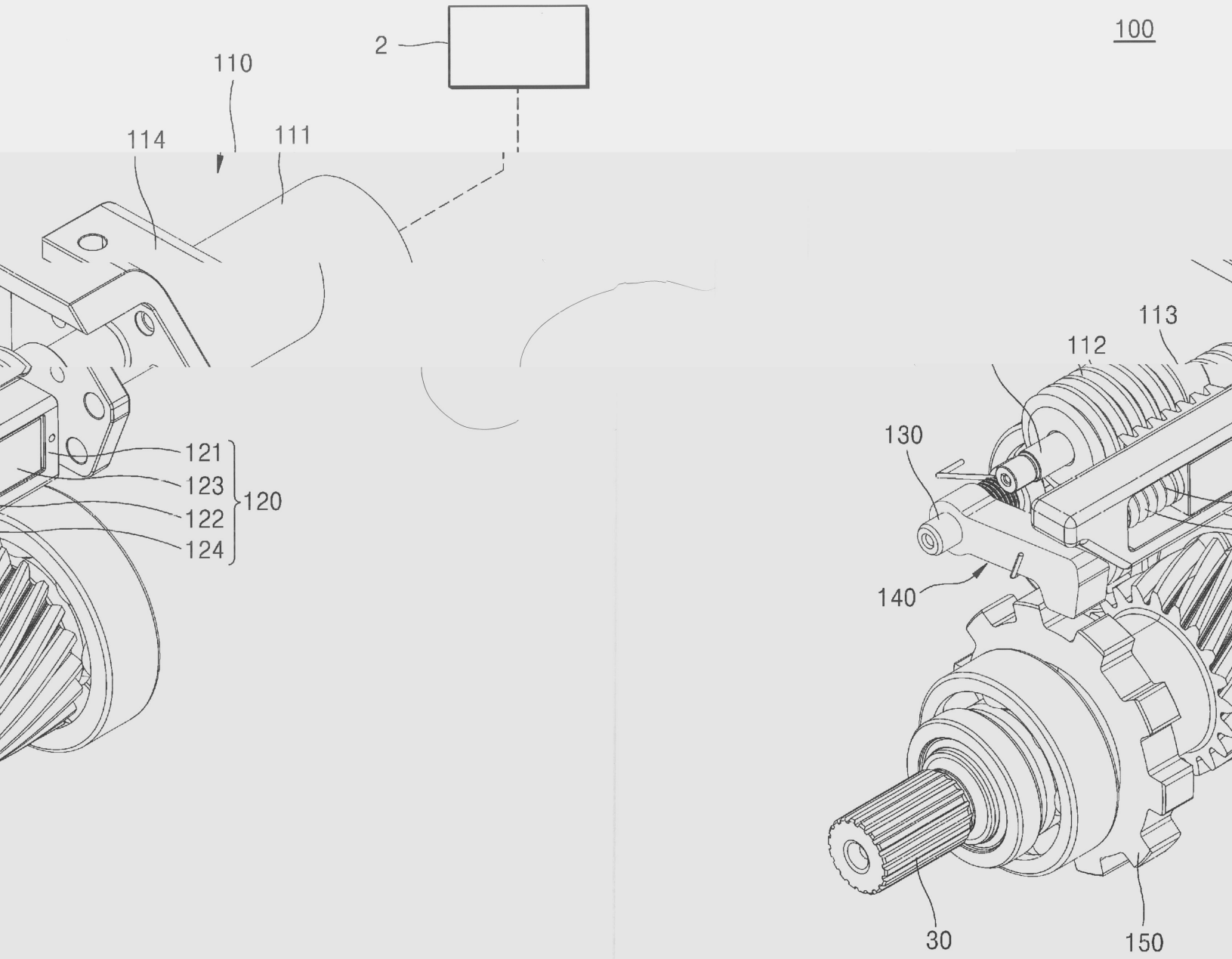


FIG. 3

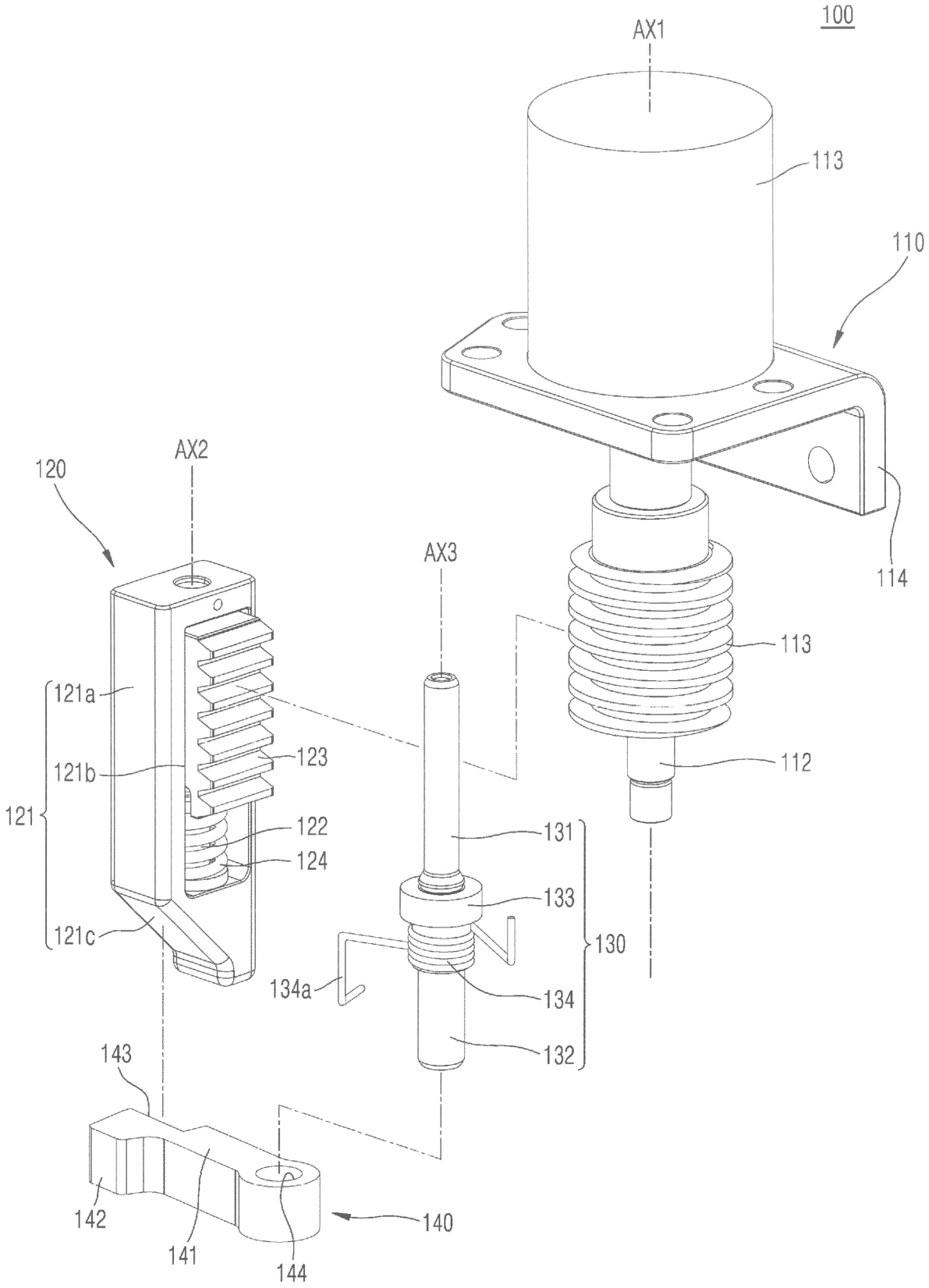

100
AX1
113
110
114
AX2
120
AX3
113
121a
121b
123
121
122
124
121c
112
131
133
130
134a
134
132
143
142
141
144
140

FIG. 4

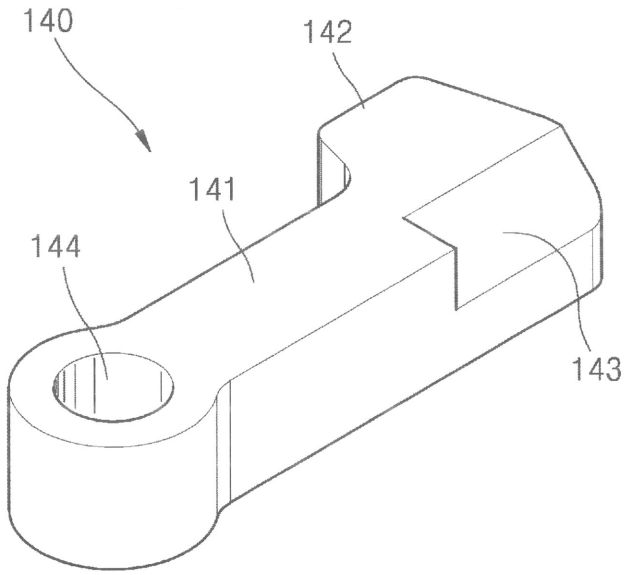


FIG. 5

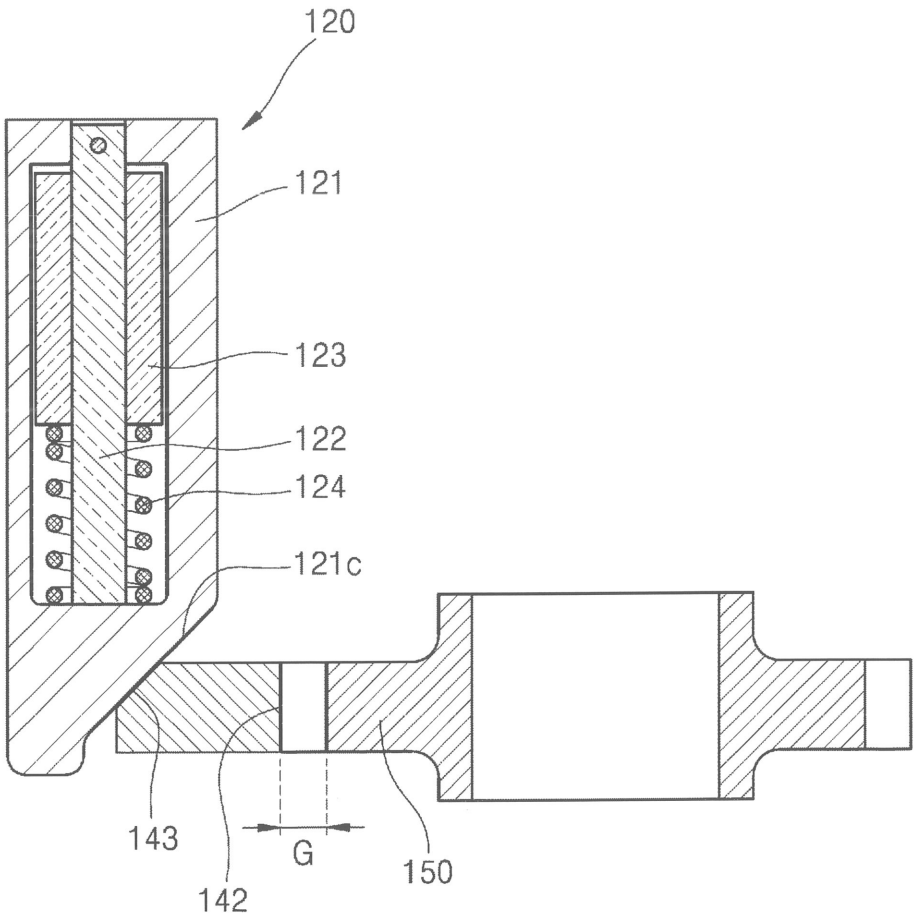


FIG. 6

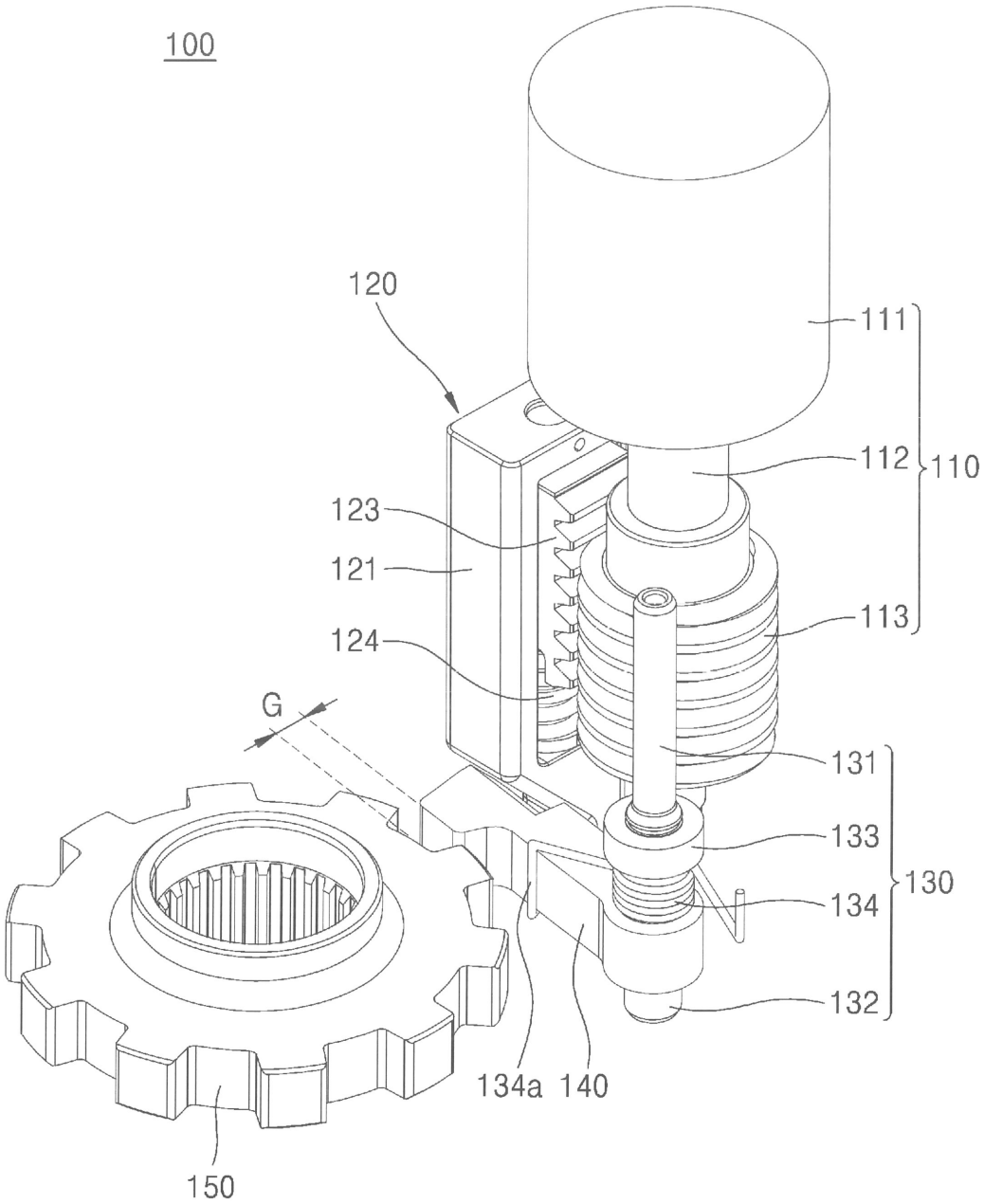
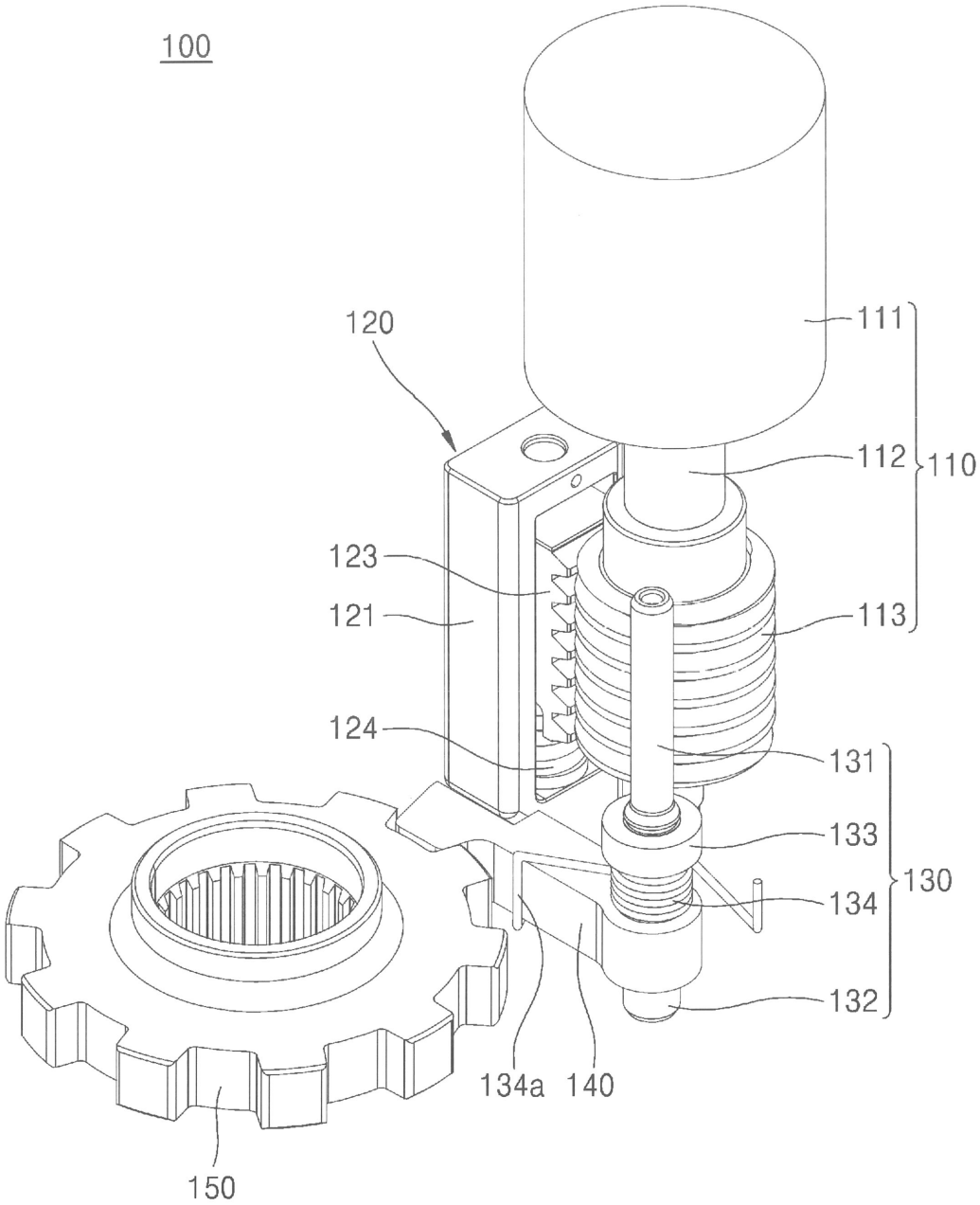

100
120
111
112
110
123
121
113
124
G
131
133
130
134
132
134a
140
150

FIG. 7


100
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VEHICLE PARKING DEVICE AND VEHICLE TRANSMISSION INCLUDING THE SAME

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is based on and claims priority under 35 U.S.C. § 119 to Korean Patent Application No. 10-2020-0040470, filed on Apr. 2, 2020, in the Korean Intellectual Property Office, the disclosure of which is incorporated by reference herein in its entirety.

BACKGROUND

1. Field

The disclosure relates to a device, and more particularly, to a vehicle parking device and a vehicle transmission.

2. Description of the Related Art

Electric vehicles refer to environment-friendly vehicles that do not discharge exhaust gas at all by using electricity as their power sources, unlike gasoline or diesel-based vehicles that use gasoline or diesel.

In general, automatic transmissions are devices that reciprocate among a parking mode "P mode", a reverse mode "R mode", a neutral mode "N mode", and a driving mode "D mode".

In this case, the parking mode is to limit movement when a vehicle is parked, and the reverse mode is a driving mode that transmits a driving force for reversing the vehicle. Also, the neutral mode is to separate an engine and a drive shaft from each other, and the driving mode is a driving mode that transmits a driving force for moving the vehicle forward in contrast with the reverse mode.

For a parking system of automatic transmissions of the related art, when the gear is at the P mode, a series of processes moving from a gear lever to a manual shaft, a parking rod, and a parking sprag are performed. As such, the parking system of the automatic transmissions of the related art is operated so that, while the parking rod slidably reciprocates in connection with the operation of the gear lever, the parking gear and the parking sprag are engaged and disengaged.

However, the parking system of the related art may have a problem in that a large operating force is generated due to frictional resistance of a contact surface between the parking gear and the parking sprag during parking or when the parking mode is released, and shock or vibration is generated when the parking mode is released suddenly by ignoring the frictional resistance.

SUMMARY

The disclosure provides a vehicle parking device and a vehicle transmission including the same, capable of stably and accurately implementing a parking mode. However, this is merely an example, and the scope of the disclosure is not limited thereby.

Additional aspects will be set forth in part in the description which follows and, in part, will be apparent from the description, or may be learned by practice of the presented embodiments of the disclosure.

According to an embodiment of the disclosure, a vehicle parking device includes an actuator configured to rotate a worm gear mounted at an end thereof, a loading unit including a rack gear engaged with the worm gear and linearly moving according to a movement of the rack gear, a parking sprag in contact with the loading unit and rotating by a linear movement of the loading unit, and a parking gear provided in a drive shaft that transmits a driving force and selectively engaged according to a rotation of the parking sprag.

The loading unit may include a housing having an inclined surface, at an end thereof, in contact with the parking sprag, a support shaft extending in a longitudinal direction of the housing and having the rack gear mounted thereon, and a first elastic member inserted into the support shaft and in contact with the rack gear.

The rack gear may linearly move according to a rotation of the worm gear, receive a compressive force from the first elastic member, and linearly move together with the housing to rotate the parking sprag.

The parking sprag may include a body, a protruding end arranged at an end of the body and inserted into the parking gear, and an inclined end arranged so that a portion of the loading unit is inserted thereinto, the inclined end being in surface contact with the inclined surface of the loading unit.

The vehicle parking device may further include a rod into which the parking sprag is inserted, and a second elastic member inserted into the rod and arranged so that an end thereof is in contact with the parking sprag.

According to another embodiment of the disclosure, a vehicle transmission includes a casing, a first driving unit provided inside the casing and receiving a driving force, a second driving unit provided inside the casing and spaced apart from the first driving unit, a third driving unit between the first driving unit and the second driving unit to transmit a driving force, and a parking device provided in at least one of the first driving unit to the third driving unit, and the parking device includes an actuator configured to rotate a worm gear mounted at an end thereof, a loading unit inserted into a mounting groove of the casing, including a rack gear engaged with the worm gear, and linearly moving according to a movement of the rack gear, a parking sprag in contact with the loading unit and rotating by a linear movement of the loading unit, and a parking gear provided in at least one of the first driving unit to the third driving unit and selectively engaged according to a rotation of the parking sprag.

These and/or other aspects will become apparent and more readily appreciated from the following detailed description of the embodiments, the accompanying drawings, and claims.

BRIEF DESCRIPTION OF THE DRAWINGS

The above and other aspects, features, and advantages of certain embodiments will be more apparent from the following description taken in conjunction with the accompanying drawings, in which:

FIG. **1** is an exploded perspective view illustrating a vehicle transmission, according to an embodiment of the disclosure;

FIG. **2** is an exploded perspective view illustrating a vehicle parking device in FIG. **1**;

FIG. **3** is an exploded perspective view illustrating a portion of a vehicle parking device in FIG. **2**;

FIG. **4** is a perspective view of a parking sprag in FIG. **2**;

FIG. **5** is a cross-sectional view illustrating an arrangement of a loading unit, a parking sprag, and a parking gear in FIG. **2**; and

FIGS. **6** and **7** are perspective views illustrating driving of a vehicle parking device.

DETAILED DESCRIPTION

Reference will now be made in detail to embodiments, examples of which are illustrated in the accompanying drawings, wherein like reference numerals refer to like elements throughout. In this regard, the present embodiments may have different forms and configuration and should not be construed as being limited to the descriptions set forth herein. Accordingly, the embodiments are merely described below, by referring to the figures, to explain aspects of the present description. As used herein, the term "and/or" includes any and all combinations of one or more of the associated listed items. Expressions such as "at least one of," when preceding a list of elements, modify the entire list of elements and do not modify the individual elements of the list.

Hereinafter, various embodiments of the disclosure will be described in connection with the accompanying drawings. Because various modifications may be applied and one or more embodiments may be implemented, specific embodiments will be shown in the drawings and described in detail in the detailed description. However, the present embodiments should not be construed as being limited to the specific embodiments set forth herein and should be understood as including all modifications and/or equivalents included in the spirit and scope of the disclosure. With regard to the description of the drawings, like reference numerals are used to indicate like elements.

It will be understood that the terms "including," "having," and "comprising" used in various embodiments of the disclosure are intended to indicate the existence of the features, operations, or elements described in the disclosure, and are not intended to limit the existence of additional one or more features, operations, or elements. Also, it will be understood that the terms "including," "having," and "comprising" in various embodiments of the disclosure are intended to indicate the existence of features, numbers, steps, operations, elements, and parts, described in the specification, or combinations thereof, and are not intended to preclude the possibility that one or more other features, numbers, steps, operations, elements, and parts, or combinations thereof may exist or may be added.

The expression "or" used herein includes any and all combinations of the features or elements listed together. For example, the expression "A or B" indicates only A, only B, or both A and B.

It will be understood that although the terms "first", "second", etc. may be used herein to describe various elements, these elements should not be limited by these terms. For example, the order and/or importance of the elements are not limited by these terms. These terms may be used to distinguish one element from another. For example, a first user device and a second user device are both user devices and indicate different user devices. Also, a first element may be referred to as a second element, and similarly, the second element may be referred to as the first element, without departing from the scope of rights of the disclosure.

It will be understood that, when an element is referred to as being "connected" or "coupled" to another element, it can be directly connected or coupled to the other element, or can be connected or coupled to the other element with intervening elements interposed therebetween. In contrast, it will be understood that, when an element is referred to as being "directly connected" or "directly coupled" to another element, there are no intervening elements interposed between the element and the other element.

It should be understood that terms or expressions described herein should be considered in a descriptive sense only and not for purposes of limitation. The singular forms "a," "an," and "the" are intended to include the plural forms as well, unless the context clearly indicates otherwise.

Unless otherwise defined, all terms including technical or scientific terms used herein have the same meaning as commonly understood by those of ordinary skill in the art to which various embodiments of the disclosure belong.

Terms as those defined in commonly used dictionaries should be construed as having meanings consistent with the meanings in the context of the related technologies, and should not be construed as ideal or excessively formal meanings unless explicitly defined in various embodiments of the disclosure.

FIG. **1** is an exploded perspective view illustrating a vehicle transmission **1**, according to an embodiment of the disclosure.

Referring to FIG. **1**, the vehicle transmission **1** may include a first casing **10**, a second casing **20**, a first driving unit **30**, a second driving unit **40**, a third driving unit **50**, and a vehicle parking device **100**.

The first casing **10** and the second casing **20** are assembled and thus form an external appearance of the vehicle transmission **1**. The first driving unit **30**, the second driving unit **40**, the third driving unit **50**, and the vehicle parking device **100** may be provided in an inner space of the first casing **10** and the second casing **20**.

The first driving unit **30** may receive a driving force, and one end of the first driving unit **30** may be inserted into an opening of the first casing **10** to protrude to the outside. The first driving unit **30** may be set to an input shaft of the vehicle transmission **1**.

The second driving unit **40** may be spaced apart from the first driving unit **30** and may be selectively drive-connected to the first driving unit **30**. The second driving unit **40** may be set to an output shaft.

The third driving unit **50** may be provided between the first driving unit **30** and the second driving unit **40**. Bearings fixed to the first casing **10** and the second casing **20** may be arranged on both ends of the third driving unit **50**.

The vehicle parking device **100** may be provided in at least one of the first driving unit **30** to the third driving unit **50**. A parking gear **150** is provided in a drive shaft of the first driving unit **30** to the third driving unit **50**, and a parking sprag **140** of the vehicle parking device **100** is engaged with the parking gear **150** upon driving of an actuator **110**, and thus, the vehicle parking device **100** may be set to a parking mode. However, for convenience of description, a case where the vehicle parking device **100** is provided in the first driving unit **30** will be mainly described hereinbelow.

FIG. **2** is an exploded perspective view illustrating the vehicle parking device **100** in FIG. **1**, and FIG. **3** is an exploded perspective view illustrating a portion of the vehicle parking device **100** in FIG. **2**.

Referring to FIGS. **2** and **3**, the vehicle parking device **100** may include the actuator **110**, a loading unit **120**, a shaft unit **130**, the parking sprag **140**, and the parking gear **150**.

The vehicle parking device **100** is connected to a controller **2**, and as the actuator **110** is driven according to a signal from the controller **2**, the vehicle parking device **100** may switch to the parking mode. That is, when a user switches a gear knob (not shown) to the parking mode, the

vehicle parking device **100** may be driven by an electrical signal generated by the controller **2**.

The actuator **110** may rotate a worm gear **113** provided at an end thereof. The actuator **110** may include a driver **111**, a drive shaft **112**, and the worm gear **113**. The actuator **110** may rotate the drive shaft **112** by receiving a signal from the controller **2**.

The worm gear **113** may be provided at an end of the drive shaft **112** and engaged with a rack gear **123**. A driving force is generated in the driver **111**, and the drive shaft **112** rotates with respect to a first axis AX1. In this case, the worm gear **113** may also rotate with the drive shaft **112**.

The actuator **110** may rotate clockwise or counterclockwise. For example, the loading unit **120** may descend by rotating the actuator **110** clockwise, or the loading unit **120** may ascend by rotating the actuator **110** counterclockwise. Also, in contrast, the loading unit **120** may descend by rotating the actuator **110** counterclockwise, or the loading unit **120** may ascend by rotating the actuator **110** clockwise.

The actuator **110** may control the number of rotations or a rotation speed of the drive shaft **112**. When the number of rotations of the drive shaft **112** is controlled according to the signal from the controller **2**, a moving distance of the rack gear **123** or a moving distance of the loading unit **120** may be set. Also, when the rotation speed of the drive shaft **112** is controlled according to the signal from the controller **2**, a moving speed of the rack gear **123** or an ascending/descending speed of the loading unit **120** may be set.

The actuator **110** may include a joint block **114**. The joint block **114** may support the driver **111** and may be attached to the second casing **20**. The joint block **114** may fix a position of the actuator **110**.

The loading unit **120** may linearly reciprocate according to driving of the actuator **110**. One side of the loading unit **120** is in contact with the actuator **110**, and the other side of the loading unit **120** is in contact with the parking sprag **140**. The loading unit **120** may rotate the parking sprag **140** while moving up and down according to the driving of the actuator **110**.

The loading unit **120** may include a housing **121**, a support shaft **122**, the rack gear **123**, and a first elastic member **124**.

The housing **121** extends to a certain length along a second axis AX2. The housing **121** may include a main body **121***a*, a front opening **121***b*, and an inclined surface **121***c*. The housing **121** may have the inclined surface **121***c* in surface contact with the parking sprag **140**.

The housing **121** may be inserted into a first mounting groove **11** of the first casing **10** and/or a second mounting groove **21** of the second casing **20** and may linearly move in the mounting grooves. For example, the housing **121** is inserted into the first mounting groove **11** of the first casing **10** and the second mounting groove **21** of the second casing **20**, and linearly moves in the first mounting groove **11** and the second mounting groove **21** when the loading unit **120** is driven.

The support shaft **122**, the rack gear **123**, and the first elastic member **124** may be arranged in an inner space at an upper end of the main body **121***a*. The inclined surface **121***c* may be arranged at a lower end of the main body **121***a*.

The rack gear **123** protruding from the front opening **121***b* may be connected with the worm gear **113**. The front opening **121***b* may extend to a certain length in a longitudinal direction of the main body **121***a*, and the rack gear **123** may move along the front opening **121***b*.

The inclined surface **121***c* may be arranged at the lower end of the main body **121***a* and may be in contact with an inclined end **143** of the parking sprag **140**. The inclined surface **121***c* may have a same slope as the inclined end **143** to be in contact with the inclined end **143**. When the housing **121** moves downward, the inclined surface **121***c* and the inclined end **143** slide so as to rotate the parking sprag **140**.

The support shaft **122** may extend in a longitudinal direction of the housing **121** and have the rack gear **123** mounted thereon. The support shaft **122** is arranged along the second axis AX2 to guide movement of the rack gear **123** and is provided in the inner space of the main body **121***a*. The rack gear **123** may be arranged on an upper end of the support shaft **122**, and the first elastic member **124** may be arranged at a lower end of the support shaft **122**.

The rack gear **123** is engaged with the worm gear **113** and is inserted into the support shaft **122**. The rack gear **123** protruding from the front opening **121***b* may linearly reciprocate along the support shaft **122** according to rotation of the worm gear **113**. The rack gear **123** linearly moves according to the rotation of the worm gear **113**, receives a repulsive force from the first elastic member **124**, and linearly moves together with the housing **121** so that the housing **121** may apply a force to the parking sprag **140**.

The first elastic member **124** may be inserted into the support shaft **122** and may be in contact with the rack gear **123**. The first elastic member **124** may be defined as a member provided in the housing **121** to generate a repulsive force against the rack gear **123**. For example, the first elastic member **124** may be a spring having a certain elasticity.

The first elastic member **124** may provide a repulsive force to the rack gear **123**. When the rack gear **123** moves downward, the first elastic member **124** is compressed so as to generate a repulsive force with respect to a moving direction of the rack gear **123**. Also, when the rack gear **123** moves upward, the first elastic member **124** expands so as to accelerate the movement of the rack gear **123**.

When the shaft unit **130** is provided in the first casing **10** and the second casing **20**, the shaft unit **130** may be connected to the parking sprag **140**. A rotation axis of the parking sprag **140** is the same as a third axis AX3 extending in a longitudinal direction of the shaft unit **130**, and the parking sprag **140** may rotate with respect to the third axis AX3.

The shaft unit **130** may include a first rod **131** inserted into the second casing **20**, and a second rod **132** into which the parking sprag **140** is inserted. A diameter of the second rod **132** may be greater than a diameter of the first rod **131**.

A stopping protrusion **133** may be between the first rod **131** and the second rod **132**. The stopping protrusion **133** is formed to be stepped, and may prevent a second elastic member **134** from deviating toward the first rod **131**.

The second elastic member **134** is inserted into the second rod **132** and is between the parking sprag **140** and the stopping protrusion **133**. One end **134***a* of the second elastic member **134** may support the parking sprag **140**. The second elastic member **134** may have a shape of an elastic spring in which the end **134***a* is bent, and the parking sprag **140** may be supported on a bent end.

The second elastic member **134** may provide a restoring force to the parking sprag **140**. When the parking sprag **140** is engaged with the parking gear **150**, the second elastic member **134** generates a repulsive force against the parking sprag **140**. When the rack gear **123** moves upward again, the parking sprag **140** returns to its original position and is separated from the parking gear **150** by the restoring force of the second elastic member **134**.

FIG. **4** is a perspective view of the parking sprag **140** in FIG. **2**.

Referring to FIGS. **3** and **4**, the parking sprag **140** may be arranged in contact with the loading unit **120** and may be rotated by the linear reciprocation of the loading unit **120**. The parking sprag **140** may be supported on the shaft unit **130** and selectively engaged with the parking gear **150**.

The parking sprag **140** may include a body **141**, a protruding end **142**, the inclined end **143**, and a rotation hole **144**. The body **141** may extend in one direction to have a certain length. The rotation hole **144** may have the second rod **132** inserted thereinto and may be set to a drive shaft of the parking sprag **140**.

The protruding end **142** is arranged on one side of an end of the body **141**. The protruding end **142** may be inserted into a gear tooth of the parking gear **150**. When the parking sprag **140** rotates in one direction, the protruding end **142** is engaged with the gear tooth of the parking gear **150**. On the contrary, when the parking sprag **140** rotates in the other direction, the protruding end **142** is separated from the gear tooth of the parking gear **150**.

The inclined end **143** is arranged on the other side of the end of the body **141**. The inclined end **143** may be arranged on a side opposite to the protruding end **142**. The inclined end **143** may be arranged so that an end of the loading unit **120** is inserted thereinto and may be in contact with the inclined surface **121***c* of the loading unit **120**. The inclined end **143** may have substantially the same inclination angle as the inclined surface **121***c*. As a result, the inclined end **143** and the inclined surface **121***c* may be in surface contact with each other.

A position of the parking gear **150** is determined according to a position at which the vehicle parking device **100** is provided. The parking gear **150** may be provided on a drive shaft of any one of the first driving unit **30** to the third driving unit **50**. However, for convenience of description, a case where the parking gear **150** is provided on the drive shaft of the first driving unit **30** will be mainly described hereinbelow.

The parking gear **150** is provided on the drive shaft that transmits a driving force, and may be selectively engaged according to rotation of the parking sprag **140**. The parking gear **150** is integrally assembled to the drive shaft and rotates together with the drive shaft. Accordingly, when the parking gear **150** is locked, the drive shaft also does not move, and thus, the parking mode may be set.

FIG. **5** is a cross-sectional view illustrating an arrangement of the loading unit **120**, the parking sprag **140**, and the parking gear **150** in FIG. **2**, and FIGS. **6** and **7** are perspective views illustrating driving of the vehicle parking device **100**.

Referring to FIGS. **5** and **6**, when the parking mode is not set, the parking sprag **140** and the parking gear **150** are separated from the vehicle parking device **100**.

The inclined surface **121***c* of the housing **121** maintains its contact with the inclined end **143** of the parking sprag **140**. The protruding end **142** of the parking sprag **140** is arranged to be spaced apart from the gear tooth of the parking gear **150** by G, and the parking sprag **140** and the parking gear **150** are separated in a driving manner. Accordingly, when the parking mode is not set, when the drive shaft rotates, the parking gear **150** rotates together.

Referring to FIG. **7**, when it switches to the parking mode, the parking sprag **140** and the parking gear **150** are engaged in the vehicle parking device **100**.

When the worm gear **113** rotates in one direction upon driving of the actuator **110**, the rack gear **123** moves downward. Because the first elastic member **124** supports below the rack gear **123**, the first elastic member **124** is compressed by descending of the rack gear **123**.

Also, as the rack gear **123** descends, the housing **121** also moves downward, and when the inclined surface **121***c* of the housing **121** moves downward, the inclined end **143** of the parking sprag **140** moves upward of the inclined surface **121***c* and rotates with respect to the shaft unit **130**, and the protruding end **142** of the parking sprag **140** is engaged with the parking gear **150**.

Because the end **134***a* of the second elastic member **134** is supported on the parking sprag **140**, when the parking sprag **140** rotates, a repulsive force is generated in an opposite direction.

A vertical movement of the loading unit **120** generates a rotational movement of the parking sprag **140**, and thus, the vehicle parking device **100** may execute the parking mode simply and securely. The inclined surface **121***c* of the loading unit **120** and the inclined end **143** of the parking sprag **140** are inclined to be in surface contact with each other so that the vertical movement of the loading unit **120** is converted into a force applied to the parking sprag **140** in a lateral direction. The vehicle parking device **100** may switch directions without loss of a force and thus implement the parking mode stably.

The vehicle parking device **100** may accurately couple the parking sprag **140** to the parking gear **150** by using a compressive force of the first elastic member **124**. When the rack gear **123** moves downward, the first elastic member **124** is also compressed. The compressive force generated by the first elastic member **124** is transmitted to the parking sprag **140**, and thus, the protruding end **142** of the parking sprag **140** may be engaged with the parking gear **150**. In particular, when there is a phase difference between the protruding end **142** of the parking sprag **140** and a groove of the parking gear **150**, the protruding end **142** may be inserted into the parking gear **150** by using the compressive force of the first elastic member **124** applied to the parking sprag **140**.

Thereafter, when the actuator **110** rotates the worm gear **113** in an opposite direction, the rack gear **123** ascends. In this case, as the first elastic member **124** expands, the movement of the rack gear **123** may be guided. At the same time, by the restoring force generated by the second elastic member **134**, the parking sprag **140** may be separated from the parking gear **150**.

Because the end **134***a* of the second elastic member **134** maintains its contact with the parking sprag **140**, a repulsive force acts when the parking sprag **140** rotates for parking. When the rack gear **123** ascends, the repulsive force of the second elastic member **134** causes the parking sprag **140** to return to its original position. That is, when the loading unit **120** ascends, the second elastic member **134** applies a force to the parking sprag **140** so that the inclined end **143** returns to its original position while moving downward of the inclined surface **121***c*.

According to an embodiment of the disclosure, the vehicle transmission **1** and the vehicle parking device **100** selectively couple the parking sprag **140** to the parking gear **150** upon driving of the actuator **110**, and thus may implement the parking mode accurately and precisely. In detail, because the worm gear **113** of the actuator **110** and the rack gear **123** of the loading unit **120** are engaged with each other, the loading unit **120** moves up and down upon driving of the actuator **110**. Thus, a moving distance of the loading unit **120** and a rotation angle of the parking sprag **140** may be precisely controlled by adjusting the driving of the actuator **110**.

According to an embodiment of the disclosure, the vehicle transmission **1** and the vehicle parking device **100** convert the vertical movement of the loading unit **120** into the rotational movement of the parking sprag **140**, and thus, may implement the parking mode accurately. Because the inclined surface **121***c* of the loading unit **120** and the inclined end **143** of the parking sprag **140** are arranged to be in surface contact with each other, the vertical movement of the loading unit **120** may be converted into the rotational movement of the parking sprag **140** without energy loss.

According to an embodiment of the disclosure, the parking sprag **140** may be engaged with or disengaged from the parking gear **150** due to a compressive force or a repulsive force generated upon driving of the vehicle transmission **1** and the vehicle parking device **100**. In detail, when the loading unit **120** moves downward, the first elastic member **124** is compressed so that the protruding end **142** is engaged with the parking gear **150** with a strong impact. In particular, even though there is a phase difference between the parking gear **150** and the parking sprag **140**, the compressive force generated by the first elastic member **124** may cause the parking sprag **140** to be engaged with the parking gear **150**. Also, when the loading unit **120** moves upward, the repulsive force of the second elastic member **134** causes the parking sprag **140** to return to its original position so that the parking mode may be quickly released.

According to an embodiment of the disclosure, the vehicle transmission **1** and the vehicle parking device **100** are compactly configured, and thus have a number of parts and a volume less than those of a parking device of the related art. Furthermore, a self-reduction ratio of the worm gear **113** and the rack gear **123** may be used so that the actuator **110** may be lightened, and parts may be easily assembled and exchanged and thus may be easily maintained. Also, the vehicle parking device **100** may be prevented from being secondarily released due to engagement between the worm gear **113** and the rack gear **123**.

According to an embodiment of the disclosure, a vehicle transmission and a vehicle parking device may implement the parking mode accurately and precisely. Because a worm gear of an actuator and a rack gear of a loading unit are engaged with each other, the loading unit moves up and down upon driving of an actuator. Thus, a moving distance of the loading unit and a rotation angle of a parking sprag may be precisely controlled by adjusting the driving of the actuator. Also, an inclined surface of the loading unit and an inclined end of the parking sprag are arranged to be in surface contact with each other, a vertical movement of the loading unit may be converted into a rotational movement of the parking sprag without energy loss.

According to an embodiment of the disclosure, the parking sprag may be engaged with or disengaged from a parking gear due to a compressive force or a repulsive force generated upon driving of the vehicle transmission and the vehicle parking device. When the loading unit moves downward, a first elastic member is compressed so that a protruding end is engaged with the parking gear with a strong impact. In particular, even though there is a phase difference between the parking gear and the parking sprag, the compressive force generated by the first elastic member may cause the parking sprag to be engaged with the parking gear. Also, when the loading unit moves upward, a repulsive force of a second elastic member causes the parking sprag to return to its original position so that the parking mode may be quickly released.

According to an embodiment of the disclosure, the vehicle transmission and the vehicle parking device are compactly configured, and thus have a number of parts and a volume less than those of a parking device of the related art. Furthermore, a self-reduction ratio of the worm gear and the rack gear may be used so that the actuator may be lightened, and parts may be easily assembled and exchanged and thus may be easily maintained. Also, the vehicle parking device may be prevented from being secondarily released due to engagement between the worm gear and the rack gear. However, the scope of the disclosure is not limited by this effect.

It should be understood that the embodiments described herein should be considered in a descriptive sense only and not for purposes of limitation. Descriptions of features or aspects within each of the embodiments should typically be considered as available for other similar features or aspects in other embodiments. While one or more embodiments have been described with reference to the figures, it will be understood by those of ordinary skill in the art that various changes in form and details may be made therein without departing from the spirit and scope of the disclosure as defined by the following claims.

What is claimed is:

1. A vehicle parking device comprising:
- an actuator configured to rotate a worm gear mounted at an end thereof;
- a loading unit including a rack gear engaged with the worm gear and linearly moving according to a movement of the rack gear;
- a parking sprag in contact with the loading unit and rotating by a linear movement of the loading unit; and
- a parking gear provided on a drive shaft that transmits a driving force and selectively engaged according to a rotation of the parking sprag, and
- wherein the loading unit comprises:
- a housing having an inclined surface, at an end thereof, in contact with the parking sprag;
- a support shaft extending in a longitudinal direction of the housing and having the rack gear mounted thereon; and
- a first elastic member into which the support shaft is inserted and in contact with the rack gear.

2. The vehicle parking device of claim **1**, wherein the rack gear linearly moves according to a rotation of the worm gear, receives a compressive force from the first elastic member, and linearly moves together with the housing to rotate the parking sprag.

3. The vehicle parking device of claim **1**, wherein the parking sprag comprises:
- a body;
- a protruding end arranged at an end of the body, wherein the protruding end is engaged with the parking gear or separated from the parking gear depending on a direction of the rotation of the parking sprag; and
- an inclined end contacted with the inclined surface of the loading unit.

4. The vehicle parking device of claim **1**, further comprising:
- a rod inserted into the parking sprag; and
- a second elastic member inserted into the rod and arranged so that an end thereof is in contact with the parking sprag.

5. A vehicle transmission comprising:
- a casing;
- a first driving unit provided inside the casing and receiving a driving force;
- a second driving unit provided inside the casing and spaced apart from the first driving unit;

a third driving unit between the first driving unit and the second driving unit to transmit a driving force; and

a parking device provided in at least one of the first driving unit to the third driving unit,

wherein the parking device comprises:

an actuator configured to rotate a worm gear mounted at an end thereof;

a loading unit inserted into a mounting groove of the casing, including a rack gear engaged with the worm gear, and linearly moving according to a movement of the rack gear;

a parking sprag in contact with the loading unit and rotating by a linear movement of the loading unit; and

a parking gear provided on at least one of the first driving unit to the third driving unit and selectively engaged according to a rotation of the parking sprag.

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