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Rack bar support device of vehicle steering device

Abstract

A rack bar support device of a vehicle steering device is provided to render the left/right supporting forces for the support yoke to support the rack bar when the rack bar slides left and right, prevent noise due to impact, reversely coming from the road surface or a gap increased by the wear of the support yoke, and provide a comfortable sense of steering to the driver during steering.

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Background/Summary

CROSS-REFERENCE TO RELATED APPLICATION

(1) This application claims priority from Korean Patent Application No. 10-2023-0140422, filed on Oct. 19, 2023, which is hereby incorporated by reference for all purposes as if fully set forth herein.

BACKGROUND

Field

(2) The present embodiments relate to a rack bar support device of a vehicle steering device. More specifically, the present embodiments relate to a rack bar support device of a vehicle steering device, which may render the left/right supporting forces for the support yoke to support the rack bar when the rack bar slides left and right, prevent noise due to impact, reversely coming from the road surface or a gap increased by the wear of the support yoke, and provide a comfortable sense of steering to the driver during steering.

Description of Related Art

(3) A steering device of a vehicle changes the traveling direction of the vehicle at the driver's will to assist the driver to drive the vehicle in the desired direction by arbitrarily changing the center of rotation around the front wheel.

(4) The vehicle steering device includes, e.g., a pinion gear and a rack bar for converting the rotational force received from the steering shaft when the driver manipulates the steering wheel into linear motion and has a rack bar support device for supporting the rack bar toward the pinion

gear to enable proper engagement between the rack bar and the pinion gear.
(5) The conventional rack bar support device, however, suffers from deterioration of the driver's sense of steering due to a deviation between left and right supporting forces when the rack bar slides left and right and an increase in friction between the rack bar and the pinion gear.
(6) Further, when the support yoke wears out to some degree, an imbalance may occur between the rack bar supporting forces, causing rattle noise in the support yoke and the yoke plug.

SUMMARY

(7) Conceived in the foregoing background, the present embodiments may provide a rack bar support device of a vehicle steering device, which may render the left/right supporting forces for the support yoke to support the rack bar when the rack bar slides left and right, prevent noise due to impact, reversely coming from the road surface or a gap increased by the wear of the support yoke, and provide a comfortable sense of steering to the driver during steering.
(8) The objects of embodiments of the disclosure are not limited to the foregoing and other objects will be apparent to one of ordinary skill in the art from the following detailed description.
(9) According to the present embodiments, a rack bar support device of a vehicle steering device includes a support yoke including a front side configured to support a rack bar of the vehicle steering device and a rear side having a tapered recess formed in a center thereof, the support yoke being configured to be coupled to a mounting hole of a gear box housing. An inner circumferential surface of the tapered recess has a diameter decreasing toward the rack bar. The rack bar support device further includes a yoke plug including a supporting protrusion at a front side thereof to protrude toward the support yoke. The supporting protrusion supports the inner circumferential surface of the tapered recess to support the support yoke toward the rack bar and to cause the support yoke to be fixed in the mounting hole of the gear box housing.
(10) According to the present embodiments, a rack bar support device of a vehicle steering device includes a support yoke including a front side configured to support a rack bar of the vehicle steering device and a rear side having a cylinder recess formed in a center thereof, the support yoke being configured to be coupled to a mounting hole of a gear box housing of the vehicle steering device. An inner circumferential surface of the cylinder recess has a uniform diameter. The rack bar support device further includes a yoke plug including a tapered protrusion at a front side thereof. A diameter of an outer circumferential surface of the tapered protrusion is decreased toward the rack bar. The tapered protrusion is supported on the inner circumferential surface of the cylinder recess to support the support yoke toward the rack bar and to cause the support yoke to be fixed in the mounting hole of the gear box housing.
(11) According to the present embodiments, there may be provided a rack bar support device of a vehicle steering device, which may render the left/right supporting forces for the support yoke to support the rack bar when the rack bar slides left and right, prevent noise due to impact, reversely coming from the road surface or a gap increased by the wear of the support yoke, and provide a comfortable sense of steering to the driver during steering.

Description

BRIEF DESCRIPTION OF THE DRAWINGS

(1) The above and other objects, features, and advantages of the disclosure will be more clearly understood from the following detailed description, taken in conjunction with the accompanying drawings, in which:
(2) FIG. **1** is a perspective view illustrating a rack bar support device of a vehicle steering device according to the present embodiments;
(3) FIGS. **2** and **3** are exploded perspective views illustrating a rack bar support device of a vehicle steering device according to the present embodiments;

(4) FIG. **4** is a perspective view illustrating a rack bar support device of a vehicle steering device according to the present embodiments;
(5) FIG. **5** is a cross-sectional view illustrating a rack bar support device of a vehicle steering device according to the present embodiments;
(6) FIG. **6** is a perspective view illustrating a rack bar support device of a vehicle steering device according to the present embodiments; and
(7) FIGS. **7**, **8**, **9**, **10**, and **11** are cross-sectional views illustrating a rack bar support device of a vehicle steering device according to the present embodiments.

DETAILED DESCRIPTION

(8) In the following description of examples or embodiments of the disclosure, reference will be made to the accompanying drawings in which it is shown by way of illustration specific examples or embodiments that can be implemented, and in which the same reference numerals and signs can be used to designate the same or like components even when they are shown in different accompanying drawings from one another. Further, in the following description of examples or embodiments of the disclosure, detailed descriptions of well-known functions and components incorporated herein will be omitted when it is determined that the description may make the subject matter in some embodiments of the disclosure rather unclear. The terms such as “including”, “having”, “containing”, “constituting” “make up of”, and “formed of” used herein are generally intended to allow other components to be added unless the terms are used with the term “only”. As used herein, singular forms are intended to include plural forms unless the context clearly indicates otherwise.

(9) Terms, such as “first”, “second”, “A”, “B”, “(A) “, or” (B)” may be used herein to describe elements of the disclosure. Each of these terms is not used to define essence, order, sequence, or number of elements etc., but is used merely to distinguish the corresponding element from other elements.

(10) When it is mentioned that a first element “is connected or coupled to”, “contacts or overlaps” etc. a second element, it should be interpreted that, not only can the first element “be directly connected or coupled to” or “directly contact or overlap” the second element, but a third element can also be “interposed” between the first and second elements, or the first and second elements can “be connected or coupled to”, “contact or overlap”, etc. each other via a fourth element. Here, the second element may be included in at least one of two or more elements that “are connected or coupled to”, “contact or overlap”, etc. each other.

(11) When time relative terms, such as “after,” “subsequent to,” “next,” “before,” and the like, are used to describe processes or operations of elements or configurations, or flows or steps in operating, processing, manufacturing methods, these terms may be used to describe non-consecutive or non-sequential processes or operations unless the term “directly” or “immediately” is used together.

(12) In addition, when any dimensions, relative sizes etc. are mentioned, it should be considered that numerical values for an elements or features, or corresponding information (e.g., level, range, etc.) include a tolerance or error range that may be caused by various factors (e.g., process factors, internal or external impact, noise, etc.) even when a relevant description is not specified. Further, the term “may” fully encompasses all the meanings of the term “can”.

(13) FIG. **1** is a perspective view illustrating a rack bar support device of a vehicle steering device according to the present embodiments. FIGS. **2** and **3** are exploded perspective views illustrating a rack bar support device of a vehicle steering device according to the present embodiments. FIG. **4** is a perspective view illustrating a rack bar support device of a vehicle steering device according to the present embodiments. FIG. **5** is a cross-sectional view illustrating a rack bar support device of a vehicle steering device according to the present embodiments. FIG. **6** is a perspective view illustrating a rack bar support device of a vehicle steering device according to the present embodiments. FIGS. **7**, **8**, **9**, **10**, and **11** are cross-sectional views illustrating a rack bar support

device of a vehicle steering device according to the present embodiments.

(14) Referring to FIGS. **1** to **8**, a rack bar support device **110** of a vehicle steering device includes a support yoke **120** including a front side supporting a rack bar **101** and a rear side having a tapered recess **122** formed in a center thereof and coupled to a mounting hole **103***a* or **103***b* of a gear box housing **103**, wherein an inner circumferential surface **122***a* of the tapered recess **122** has a diameter decreasing toward the rack bar **101**. The rack bar support device **110** further includes a yoke plug **130** including a supporting protrusion **133** at a front side thereof to protrude toward the support yoke **120** to be supported on the inner circumferential surface of the tapered recess **122**. The supporting protrusion **133** of the yoke plug **130** supports the support yoke **120** toward the rack bar **101** and causes the support yoke **120** to be fixed into the mounting hole **103***a* or **103***b*.

(15) The vehicle steering device includes, e.g., a steering wheel placed in the driver's seat, a steering shaft connected to the steering wheel, a steering column for fixing the steering shaft to the vehicle body, a gear box housing **110** including a rack gear and a pinion gear **102** for converting the rotational force received from the steering shaft into linear motion, a rack bar **101** having inner ball joints at two opposite end portions thereof, and tie rods integrally formed with the inner ball joints.

(16) The rack bar **101** is engaged with the pinion gear **102** to convert rotation into linear motion. The rack bar support device **110** is provided behind the rack bar **101** to support the rack bar **101** toward the pinion gear **102** so that the rack bar **101** and the pinion gear **102** are properly engaged with each other.

(17) Hereinafter, unless specifically stated in connection to the description of directions, the direction from the rack bar **101** to the pinion gear **102** is referred to as forward, and the opposite direction is referred to as rearward.

(18) The rack bar support device **110** has a structure that includes a support yoke **120**, a yoke supporting member **113**, and a yoke plug **130**. The support yoke **120** is positioned behind the rack bar **101** and is inserted into the mounting hole **103***a* or **103***b* of the gear box housing **103** to be movable in front and rear directions perpendicular to the rack bar **101**.

(19) In the operation of the vehicle steering device, if the driver manipulates the steering wheel, the steering shaft **105** connected with the steering wheel is rotated, allowing the pinion gear **102** connected to a lower end of the steering shaft to drive the rack bar **101**.

(20) The gear box housing **103** is hollow to receive the rack bar **101** and, on one side thereof, an assembly portion **107** for assembling the pinion gear **102** is formed with the mounting hole **103***a* or **103***b* for mounting the rack bar support device **110** supporting the rack bar **101** toward the pinion gear **102**.

(21) The rack bar **101** is engaged with the pinion gear **102** to convert the rotation of the steering shaft **105** into linear motion. The rack bar support device **110** is provided behind the rack bar **101** to support the rack bar **101** toward the pinion gear **102** so that the rack bar **101** and the pinion gear **102** are properly engaged with each other.

(22) The rack bar support device **110** absorbs the vibration and impact transferred from the road surface when the vehicle travels in the rack-pinion steering device and properly maintains engagement between the rack bar **101** and the pinion gear **102**.

(23) Accordingly, it is possible to reduce rattle noise due to collision between the support yoke **120** and the gear box housing **103**.

(24) In the present embodiments, the rack bar support device **110** includes the support yoke **120** and the yoke plug **130**.

(25) The rack bar support device **110** may further include a yoke supporting member **113** that is coupled to the tapered recess **122** provided in the support yoke **120** to elastically support the rear side of the support yoke **120** away from the front side of the yoke plug **130**.

(26) The support yoke **120** is coupled to the mounting hole **103***a* or **103***b* of the gear box housing **103**. The support yoke **120** has a front side supporting the rack bar **101**. The tapered recess **122** whose inner circumferential surface has a diameter decreasing toward the rack bar **101** is provided

in the center of the rear side of the support yoke **120**.
(27) The front side of the support yoke **120** has a rack bar supporting surface **121** that is formed as a semi-circular or arc-shaped recess to come in tight contact with the rear surface of the rack bar **101**. The support yoke **120** further has a yoke sheet **120***a* on its front surface to reduce friction with the rear surface of the rack bar **101** and is coupled to the mounting hole **103***a* or **103***b* of the gear box housing **103**.
(28) The yoke sheet **120***a* has a coupling protrusion **120***b* on its rear surface to couple to the coupling recess **121***a* formed in the rack bar supporting surface **121** of the support yoke **120**.
(29) The front side of the yoke plug **130** has a supporting protrusion **133** that protrudes toward the support yoke **120** to be supported on the inner circumferential surface **122***a* of the tapered recess **122** and is fixed to the mounting hole **103***a* or **103***b* while supporting the support yoke **120** toward the rack bar **101**.
(30) The rack bar support device **110** may further include a lock nut **105** provided on the outer circumferential surface of the yoke plug **130**. The yoke plug **130** has a threaded portion **131***a* on the outer circumferential surface thereof to be screwed to the mounting hole **103***a* or **103***b* of the gear box housing **103** and is fixed while being prevented from being released by the lock nut **105** outside the gear box housing **103**.
(31) The rack bar support device **110** may further include a plug **111**. Further, the yoke plug **130** has a tool fastening portion **135** on the rear side thereof to allow easier assembly. The plug **111** is coupled to a through hole **137** formed in the tool fastening portion **135** to prevent entrance of dust or moisture from the outside.
(32) The supporting protrusion **133** provided on the front side of the yoke plug **130** is inserted into the tapered recess **122** and is in contact with the inclined surface of the tapered recess **122** to elastically deform the support yoke **120** radially outward such that the support yoke **120** tightly contacts the inner circumferential surface of the mounting hole **103***a* or **103***b* of the gear box housing **103**.
(33) Accordingly, although impact is transferred from the road surface, it is possible to reduce rattle noise due to collision between the support yoke **120** and the gear box housing **103**.
(34) The yoke supporting member **113** coupled to the tapered recess **122** of the support yoke **120** elastically supports the rear side of the support yoke **120** away from the front side of the yoke plug **130**, thereby supporting the rack bar **101** toward the pinion gear **102** to achieve proper engagement between the rack bar **101** and the pinion gear **102**.
(35) The yoke supporting member **113** is elastically compressed and mounted in the tapered recess **122** formed in the center of the rear side of the support yoke **120**. In the present embodiments, an example in which the yoke supporting member **113** is a coil spring is shown.
(36) The support yoke **120** is formed of a material capable of absorbing vibration and noise with a predetermined level of elasticity and rigidity. Thus, the support yoke **120** is formed of an elastic material such as engineering plastic with such properties.
(37) The support yoke **120** has a protruding end portion **123** that protrudes toward the yoke plug **130** on the bottom surface of the tapered recess **122** provided on the rear side. The protruding end portion **123** is formed in a pillar shape spaced apart from the inner circumferential surface **122***a* of the tapered recess **122**.
(38) The inner circumferential surface of the yoke supporting member **113** is supported on the outer circumferential side of the protruding end portion **123**, and the outer circumferential surface of the yoke supporting member **113** is spaced apart from the inner circumferential surface of the supporting protrusion **133** provided in the yoke plug **130**.
(39) Accordingly, as the position of the yoke supporting member **113** is fixed by the protruding end portion **123**, rattle noise due to collision with the inner circumferential surface of the supporting protrusion **133** is prevented.
(40) The rack bar support device **110** may further include a plug supporting member **115**. A seating

groove **127**, which is an annular seating groove, is provided in the rear side of the support yoke **120**, between the outer circumferential surface of the support yoke **120** and the inner circumferential surface of the tapered recess **122**. The plug supporting member **115** is coupled to the seating groove **127** to elastically support the yoke plug **130**.

(41) The plug supporting member **115** damps the impact transferred from the road surface through the rack bar **101** while preventing rattle noise due to collision between the support yoke **120** and the yoke plug **130**.

(42) The support yoke **120** has a cutout portion **125** cut from the outer circumferential surface to the inner circumferential surface of the tapered recess **122**. A plurality of cutout portions **125** may be formed by cutting radially from the center of the support yoke **120**.

(43) Therefore, when the supporting protrusion **133** of the yoke plug **130** is mounted while supporting the inner circumferential surface of the tapered recess **122**, separated protrusions **126** separated by the cutout portions **125** may be easily elastically deformed in the radial direction and the circumferential direction.

(44) The cutout portions **125** may have the same cut width along the circumferential direction, so that deformation of the separated protrusions **126** in the circumferential direction and the radial direction may be more uniformly achieved.

(45) The rack bar support device **110** may further include a housing supporting member **117**. An outer circumferential groove **129** is provided in the outer circumferential surface of the support yoke **120** in the circumferential direction to communicate with the cutout portions **125**. The housing supporting member **117** is coupled to the outer circumferential groove **129** to elastically support the inner circumferential surface of the mounting hole **103***a* or **103***b* of the gear box housing **103**.

(46) Accordingly, when impact is transferred from the road surface, the housing supporting member **117** may reduce rattle noise due to collision between the support yoke **120** and the gear box housing **103**.

(47) Further, if a gap occurs between the support yoke **120** and the rack bar **101** due to wear, it is possible to prevent rattle noise due to collision between the support yoke **120** and the gear box housing **103** by increasing the mounting depth of the yoke plug **130**.

(48) Referring to FIGS. **9** to **11** together with FIGS. **1** to **8**, a rack bar support device **110** of a vehicle steering device according to the disclosure includes a support yoke **220** including a front side supporting a rack bar **101** and a rear side having a cylinder recess **222** formed in a center thereof. The cylinder recess **222** has a uniform diameter defined by an inner circumferential surface **222***a* of the cylinder recess **222**. The support yoke **220** is coupled to a mounting hole **103***a* or **103***b* of a gear box housing **103**. The rack bar support device **110** further includes a yoke plug **230** including a tapered protrusion **233** at a front side thereof. A diameter of an outer circumferential surface of the tapered protrusion **233** is decreased toward the rack bar **101**. The tapered protrusion **233** of the yoke plug **230** is inserted into the cylinder recess **222** of the support yoke **220** such that the support yoke **220** is supported by the yoke plug **230** toward the rack bar **101** and fixed into the mounting hole **103***a* or **103***b*.

(49) The other components than the cylinder recess **222** of the support yoke **220** and the tapered protrusion **233** of the yoke plug **230** are identical as those shown in FIGS. **1** to **8**, and the following description thus focuses primarily on the differences without a detailed description.

(50) As shown in FIGS. **9** and **11**, a cylinder recess **222** having the uniform diameter of the inner circumferential surface **222***a* is provided in the center of the rear side of the support yoke **220**.

(51) As shown in FIGS. **10** and **11**, a tapered protrusion **233**, which protrudes while decreasing in the diameter of the outer circumferential surface toward the rack bar **101**, is provided on the front side of the yoke plug **230**.

(52) The outer circumferential surface of the tapered protrusion **233** provided on the front side of the yoke plug **230** is an inclined surface so that the tapered protrusion **233** is mounted while

supporting the inner circumferential surface **222***a* of the cylinder recess **222** which has the uniform diameter.
(53) When the tapered protrusion **233** is inserted into the cylinder recess **222**, the support yoke **220** is elastically deformed radially outward, and is thus brought in tight contact with the inner circumferential surface of the mounting hole **103***a* or **103***b* of the gear box housing **103**.
(54) Accordingly, when impact is transferred from the road surface, it is possible to reduce rattle noise due to collision between the support yoke **220** and the gear box housing **103**.
(55) Further, if a gap occurs between the support yoke **220** and the rack bar **101** due to wear, it is possible to prevent rattle noise due to collision between the support yoke **220** and the gear box housing **103** by increasing the mounting depth of the yoke plug **230**.
(56) The front side of the support yoke **220** has a rack bar supporting surface **221** that is formed as a semi-circular or arc-shaped recess to come in tight contact with the rear surface of the rack bar **101**. The support yoke **220** further has a yoke sheet **120***a* on its front surface to reduce friction with the rack bar **101** and is coupled to the mounting hole **103***a* or **103***b* of the gear box housing **103**.
(57) The yoke sheet **120***a* has a coupling protrusion **120***b* on its rear surface to couple to the coupling recess **221***a* formed in the rack bar supporting surface **221** of the support yoke **220**.
(58) The yoke plug **230** has a threaded portion **231***a* on the outer circumferential surface thereof to be screwed to the mounting hole **103***a* or **103***b* of the gear box housing **103** and is fixed while being prevented from being released by the lock nut **105** outside the gear box housing **103**.
(59) The yoke supporting member **113** coupled to the cylinder recess **222** of the support yoke **220** elastically supports the rear side of the support yoke **220** away from the front side of the yoke plug **230**, thereby supporting the rack bar **101** toward the pinion gear **102** to achieve proper engagement between the rack bar **101** and the pinion gear **102**.
(60) The support yoke **220** has a protruding end portion **223** that protrudes toward the yoke plug **230** on the bottom surface of the cylinder recess **222** provided on the rear side. The protruding end portion **223** is formed in a pillar shape spaced apart from the inner circumferential surface **222***a* of the cylinder recess **222**.
(61) The inner circumferential surface of the yoke supporting member **113** is supported on the outer circumferential side of the protruding end portion **223**, and the outer circumferential surface of the yoke supporting member **113** is spaced apart from the inner circumferential surface of the tapered protrusion **233** provided in the yoke plug **230**.
(62) Accordingly, as the position of the yoke supporting member **113** is fixed by the protruding end portion **223**, rattle noise due to collision with the inner circumferential surface of the tapered protrusion **233** is prevented.
(63) A seating groove **227**, which is an annular seating groove, is provided in the rear side of the support yoke **220**, between the outer circumferential surface of the support yoke **220** and the inner circumferential surface of the cylinder recess **222**. A plug supporting member **115** is coupled to the seating groove **227** to elastically support the yoke plug **230**.
(64) The plug supporting member **115** damps the impact transferred from the road surface through the rack bar **101** while preventing rattle noise due to collision between the support yoke **220** and the yoke plug **230**.
(65) The support yoke **220** has a cutout portion **125** cut from the outer circumferential surface to the inner circumferential surface of the cylinder recess **222**. A plurality of cutout portions **125** may be formed by cutting radially from the center of the support yoke **220**.
(66) The cutout portions **125** may have the same cut width along the circumferential direction, so that deformation of the separated protrusions **126** in the circumferential direction and the radial direction may be more uniformly achieved.
(67) An outer circumferential groove **229** is provided in the outer circumferential surface of the support yoke **220** in the circumferential direction to communicate with the cutout portions **125**, and a housing supporting member **117** is coupled to the outer circumferential groove **229** to elastically

support the inner circumferential surface of the mounting hole **103***a* or **103***b* of the gear box housing **103**.
(68) According to the present embodiments having the above-described structure and shape, it is possible to render the left/right supporting forces for the support yoke to support the rack bar when the rack bar slides left and right, prevent noise due to impact, reversely coming from the road surface or a gap increased by the wear of the support yoke, and provide a comfortable sense of steering to the driver during steering.
(69) The above description has been presented to enable any person skilled in the art to make and use the technical idea of the disclosure, and has been provided in the context of a particular application and its requirements. Various modifications, additions and substitutions to the described embodiments will be readily apparent to those skilled in the art, and the general principles defined herein may be applied to other embodiments and applications without departing from the spirit and scope of the disclosure. The above description and the accompanying drawings provide an example of the technical idea of the disclosure for illustrative purposes only. That is, the disclosed embodiments are intended to illustrate the scope of the technical idea of the disclosure. Thus, the scope of the disclosure is not limited to the embodiments shown, but is to be accorded the widest scope consistent with the claims. The scope of protection of the disclosure should be construed based on the following claims, and all technical ideas within the scope of equivalents thereof should be construed as being included within the scope of the disclosure.

Claims

1. A rack bar support device of a vehicle steering device, the rack bar support device comprising: a support yoke including a front side configured to support a rack bar of the vehicle steering device and a rear side having a tapered recess formed in a center thereof, the support yoke being configured to be coupled to a mounting hole of a gear box housing of the vehicle steering device, wherein an inner circumferential surface of the tapered recess has a diameter decreasing toward the rack bar; and a yoke plug including a supporting protrusion at a front side thereof to protrude toward the support yoke, wherein the supporting protrusion supports the inner circumferential surface of the tapered recess to support the support yoke toward the rack bar and to cause the support yoke to be fixed in the mounting hole of the gear box housing, wherein the support yoke includes a cutout portion cut from an outer circumferential surface of the support yoke to the inner circumferential surface of the tapered recess.
2. The rack bar support device of claim 1, further comprising a yoke supporting member coupled to the tapered recess of the support yoke to elastically support the rear side of the support yoke away from the front side of the yoke plug.
3. The rack bar support device of claim 2, wherein the support yoke includes a protruding end portion protruding toward the yoke plug on a bottom surface of the tapered recess.
4. The rack bar support device of claim 3, wherein the yoke supporting member has an inner circumferential surface supported on an outer circumferential side of the protruding end portion and an outer circumferential surface spaced apart from an inner circumferential surface of the supporting protrusion.
5. The rack bar support device of claim 1, wherein the rear side of the support yoke includes an annular seating groove between the outer circumferential surface of the support yoke and the inner circumferential surface of the tapered recess, and wherein the rack bar support device further comprises a plug supporting member coupled to the annular seating groove to elastically support the yoke plug.
6. A rack bar support device of a vehicle steering device, the rack bar support device comprising: a support yoke including a front side configured to support a rack bar of the vehicle steering device and a rear side having a tapered recess formed in a center thereof, the support yoke being

configured to be coupled to a mounting hole of a gear box housing of the vehicle steering device, wherein an inner circumferential surface of the tapered recess has a diameter decreasing toward the rack bar; and a yoke plug including a supporting protrusion at a front side thereof to protrude toward the support yoke, wherein the supporting protrusion supports the inner circumferential surface of the tapered recess to support the support yoke toward the rack bar and to cause the support yoke to be fixed in the mounting hole of the gear box housing, wherein the support yoke includes a plurality of cutout portions cut radially from a center of the support yoke, each of the plurality of cutout portions being cut from an outer circumferential surface of the support yoke to the inner circumferential surface of the tapered recess.

7. The rack bar support device of claim 6, wherein the plurality of cutout portions has a same cut width in a circumferential direction of the support yoke.

8. The rack bar support device of claim 1, wherein the support yoke includes an outer circumferential groove extending in a circumferential direction of the support yoke, and the outer circumferential groove is provided in the outer circumferential surface of the support yoke to communicate with the cutout portion.

9. The rack bar support device of claim 8, wherein a housing supporting member is coupled to the outer circumferential groove to elastically support an inner circumferential surface of the mounting hole of the gear box housing.

10. A rack bar support device of a vehicle steering device, the rack bar support device comprising: a support yoke including a front side configured to support a rack bar of the vehicle steering device and a rear side having a cylinder recess formed in a center thereof, the support yoke being configured to be coupled to a mounting hole of a gear box housing of the vehicle steering device, wherein an inner circumferential surface of the cylinder recess has a uniform diameter; and a yoke plug including a tapered protrusion at a front side thereof, a diameter of an outer circumferential surface of the tapered protrusion being decreased toward the rack bar, the tapered protrusion being supported on the inner circumferential surface of the cylinder recess to support the support yoke toward the rack bar and to cause the support yoke to be fixed in the mounting hole of the gear box housing, wherein the support yoke includes a cutout portion cut from an outer circumferential surface of the support yoke to the inner circumferential surface of the cylinder recess.

11. The rack bar support device of claim 10, further comprising a yoke supporting member coupled to the cylinder recess of the support yoke to elastically support the rear side of the support yoke away from the front side of and the yoke plug.

12. The rack bar support device of claim 11, wherein the support yoke includes a protruding end portion protruding toward the yoke plug on a bottom surface of the cylinder recess.

13. The rack bar support device of claim 12, wherein the yoke supporting member has an inner circumferential surface supported on an outer circumferential side of the protruding end portion and an outer circumferential surface spaced apart from an inner circumferential surface of the tapered protrusion.

14. The rack bar support device of claim 10, wherein the rear side of the support yoke includes an annular seating groove between the outer circumferential surface of the support yoke and the inner circumferential surface of the cylinder recess, and wherein the rack bar support device further comprises a plug supporting member coupled to the annular seating groove to elastically support the yoke plug.

15. A rack bar support device of a vehicle steering device, the rack bar support device comprising: a support yoke including a front side configured to support a rack bar of the vehicle steering device and a rear side having a cylinder recess formed in a center thereof, the support yoke being configured to be coupled to a mounting hole of a gear box housing of the vehicle steering device, wherein an inner circumferential surface of the cylinder recess has a uniform diameter; and a yoke plug including a tapered protrusion at a front side thereof, a diameter of an outer circumferential surface of the tapered protrusion being decreased toward the rack bar, the tapered protrusion being

supported on the inner circumferential surface of the cylinder recess to support the support yoke toward the rack bar and to cause the support yoke to be fixed in the mounting hole of the gear box housing, wherein the support yoke includes a plurality of cutout portions cut radially from a center of the support yoke, each of the plurality of cutout portions being cut from an outer circumferential surface of the support yoke to the inner circumferential surface of the cylinder recess.

16. The rack bar support device of claim 15, wherein the plurality of cutout portions has a same cut width in a circumferential direction of the support yoke.

17. The rack bar support device of claim 10, wherein the support yoke includes an outer circumferential groove extending in a circumferential direction of the support yoke, and the outer circumferential groove is provided in the outer circumferential surface of the support yoke to communicate with the cutout portion.

18. The rack bar support device of claim 17, wherein a housing supporting member is coupled to the outer circumferential groove to elastically support an inner circumferential surface of the mounting hole of the gear box housing.