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United States Patent Application Publication	20250262902
Kind Code	A1
Publication Date	August 21, 2025
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SUSPENSION FOR VEHICLE

Abstract

A suspension for a vehicle includes a lower arm part, an elastically deformable elastic part mounted over the lower arm part, a vehicle body part mounted over the elastic part, a first pad part interposed between the lower arm part and the elastic part and including an elastically deformable material, and a second pad part interposed between the elastic part and the vehicle body part and including an elastically deformable material.

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Appl. No.:	18/930476
Filed:	October 29, 2024

Foreign Application Priority Data

KR	10-2024-0025359	Feb. 21, 2024
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Publication Classification

Int. Cl.: B60G11/24 (20060101); B60G7/00 (20060101)

U.S. Cl.:

CPC B60G11/24 (20130101); B60G7/001 (20130101); B60G7/008 (20130101); B60G2202/14 (20130101); B60G2206/7101 (20130101); B60G2206/72 (20130101)

Background/Summary

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application claims priority from and the benefit under 35 USC § 119 of Korean Patent Application No. 10-2024-0025359, filed on Feb. 21, 2024, in the Korean Intellectual Property Office, the entire disclosure of which is incorporated by reference for all purposes.

BACKGROUND

Field

[0002] Exemplary embodiments of the present disclosure relate to a suspension for a vehicle, and more particularly, to a suspension for a vehicle, which can reduce the weight of a vehicle by an elastic part including a composite material and may be applied to a narrow space.

Description of the Related Art

[0003] In a conventional technology, in a suspension for a vehicle, a coil spring made of a steel material is applied to a chassis module for a rear wheel.

[0004] The outer diameter of the coil spring made of the steel material needs to be increased in order to withstand a heavier weight as the weight of a vehicle is increased. A problem of interference with surrounding parts due the coil spring having an increased outer diameter may occur.

[0005] Furthermore, the coil spring made of the steel material has problems in that the steel of the coil spring has a heavier weight than another lightweight material due to the nature of the material and it is difficult to use the coil spring in a narrow space. Accordingly, there is a need to improve the problems.

[0006] The BACKGROUND of the present disclosure is disclosed in Korean Patent Application Publication No. 10-2022-0157074 (Nov. 29, 2022 entitled “SPRING LINK OF SUSPENSION FOR VEHICLE”).

SUMMARY

[0007] Various embodiments are directed to a suspension for a vehicle, which can reduce the weight of a vehicle by an elastic part including a composite material and may be applied to a narrow space.

[0008] In an embodiment, a suspension for a vehicle includes a lower arm part, an elastically deformable elastic part mounted over the lower arm part, a vehicle body part mounted over the elastic part, a first pad part interposed between the lower arm part and the elastic part and including an elastically deformable material, and a second pad part interposed between the elastic part and the vehicle body part and including an elastically deformable material.

[0009] The elastic part may include a first elastic fixing part mounted on the first pad part, a second elastic fixing part spaced apart from the first elastic fixing part and having the second pad part mounted thereon, and an elastically deformable folding part having a first side connected to the first elastic fixing part and a second side connected to the second elastic fixing part.

[0010] The folding part may be folded at least once.

[0011] The folding part may include a folding body part disposed between the first elastic fixing part and the second elastic fixing part in a plural number so that the plurality of folding body parts is spaced apart from each other, a folding connection part configured to connect the first elastic fixing part to the the folding body part, or to connect the second elastic fixing part to the folding body part, and a composite material part mounted on the folding body part and including a composite material.

[0012] The folding body part may include a folding plate part disposed between the first elastic fixing part and the second elastic fixing part in a plural number so that the plurality of folding plate parts is spaced apart from each other and a folding hole part formed in the folding plate part so that

the folding hole part penetrates the folding plate part.

[0013] The folding hole part may be arranged in a plural number in a width direction of the folding plate part.

[0014] The composite material part may include a composite material body part mounted on one surface of the folding body part and a composite material side part configured to extend from the composite material body part and to surround sides of the folding body part.

[0015] The folding connection part may have a curved shape in which the folding connection part protrudes to an outside of the folding body part.

[0016] The folding body part and the folding connection part may each be made of a steel material. The composite material part may be made of a glass fiber reinforced plastic (GFRP) material.

[0017] The first pad part may include a first pad body part seated in the lower arm part, one or more first pad protrusion parts formed in a first surface of the first pad body part and inserted into one or more lower arm groove parts of the lower arm part, respectively, and a first pad burring part formed on the second surface of the first pad body part, configured to surround a lower arm protrusion part of the lower arm part, and inserted into the elastic part.

[0018] The second pad part may include a second pad body part configured to come into contact with the vehicle body part and a second pad burring part formed on one surface of the second pad body part, configured to surround a vehicle body protrusion part of the vehicle body part, and inserted into the elastic part.

[0019] According to the suspension for a vehicle according to an embodiment of the present disclosure, it is possible to reduce the weight of a vehicle while reducing the vibration of the vehicle because the elastic part is elastically deformable and can be made lightweight.

[0020] Furthermore, according to an embodiment of the present disclosure, it is possible to secure a gap with a surrounding part while maintaining stiffness because the elastic part includes a steel material and the composite material.

Description

BRIEF DESCRIPTION OF THE DRAWINGS

[0021] FIG. 1 is a perspective view schematically illustrating a suspension for a vehicle according to an embodiment of the present disclosure.

[0022] FIG. 2 is an assembly-perspective view schematically illustrating the suspension for a vehicle according to an embodiment of the present disclosure.

[0023] FIG. 3 is a perspective view schematically illustrating an elastic part according to an embodiment of the present disclosure.

[0024] FIG. 4 is an assembly-perspective view schematically illustrating the elastic part according to an embodiment of the present disclosure.

[0025] FIG. 5 is a schematic cross-sectional view taken along line A-A in FIG. 3.

[0026] FIG. 6 is a perspective view schematically illustrating a composite material part according to an embodiment of the present disclosure.

[0027] FIG. 7 is an assembly-perspective view schematically illustrating a lower arm part and a first pad part according to an embodiment of the present disclosure.

DETAILED DESCRIPTION

[0028] Hereinafter, a suspension for a vehicle according to embodiments of the present disclosure is described with reference to the accompanying drawings. In this process, the thicknesses of lines or the sizes of components illustrated in the drawings may have been exaggerated for the clarity of a description and for convenience' sake.

[0029] Furthermore, terms to be described below have been defined by taking into consideration their functions in the present disclosure, and may be changed depending on a user or operator's

intention or practice. Accordingly, such terms should be defined based on the overall contents of this specification.

[0030] FIG. 1 is a perspective view schematically illustrating a suspension for a vehicle according to an embodiment of the present disclosure. FIG. 2 is an assembly-perspective view schematically illustrating the suspension for a vehicle according to an embodiment of the present disclosure. FIG. 3 is a perspective view schematically illustrating an elastic part according to an embodiment of the present disclosure. FIG. 4 is an assembly-perspective view schematically illustrating the elastic part according to an embodiment of the present disclosure. FIG. 5 is a schematic cross-sectional view taken along line A-A in FIG. 3. FIG. 6 is a perspective view schematically illustrating a composite material part according to an embodiment of the present disclosure. FIG. 7 is an assembly-perspective view schematically illustrating a lower arm part and a first pad part according to an embodiment of the present disclosure.

[0031] Referring to FIGS. 1 to 7, the suspension for a vehicle according to an embodiment of the present disclosure may include a lower arm part **100**, an elastic part **200**, a vehicle body part **300**, a first pad part **400**, and a second pad part **500**.

[0032] The lower arm part **100** may mean an arm that is disposed on the lower side of a vehicle. The lower arm part **100** may be connected to a cross member by a steering knuckle. In an embodiment of the present disclosure, the lower arm part **100** may be applied to a chassis module for a rear wheel of the vehicle.

[0033] The elastic part **200** is mounted over (e.g., in FIGS. 1 and 2) the lower arm part **100**, and may be elastically deformable. The elastic part **200** can reduce an impact on the vehicle by being elastically deformed.

[0034] The vehicle body part **300** may be mounted over (e.g., in FIGS. 1 and 2) the elastic part **200**. The vehicle body part **300** may form the frame of the vehicle.

[0035] The first pad part **400** is interposed between the lower arm part **100** and the elastic part **200**, and may include an elastically deformable material. The first pad part **400** may include rubber, silicon, or urethane as the elastically deformable material.

[0036] The second pad part **500** is interposed between the elastic part **200** and the vehicle body part **300**, and may include an elastically deformable material. The second pad part **500** may include rubber, silicon, or urethane as the elastically deformable material.

[0037] The elastic part **200** may include a first elastic fixing part **210**, a second elastic fixing part **220**, and a folding part **230**.

[0038] The first elastic fixing part **210** may be mounted on the first pad part **400**. The first elastic fixing part **210** may be supported and fixed by the first pad part **400**.

[0039] The first elastic fixing part **210** may include a first elastic fixing body part **211** and a first elastic burring part **213**. The first elastic fixing body part **211** may be formed of a flat plate through which a central part is penetrated. The first elastic fixing body part **211** may be seated in a first pad body part **410** of the first pad part **400**.

[0040] The first elastic fixing body part **211** may be connected to a folding body part **240** that neighbors the first elastic fixing body part **211** on the upper side thereof, by a folding connection part **250**.

[0041] The first elastic burring part **213** may be formed to protrude toward the folding body part **240** of the folding part **230** that neighbors an upper side (e.g., in FIG. 2) of the first elastic fixing body part **211** that is formed to be penetrated, by burring processing. The first elastic burring part **213** may surround the outside of a first pad burring part **430** of the first pad part **400**.

[0042] The second elastic fixing part **220** is spaced apart from the first elastic fixing part **210**. The second pad part **500** may be mounted on the second elastic fixing part **220**. The second elastic fixing part **220** may be disposed over (e.g., in FIG. 2) the first elastic fixing part **210** by being spaced apart from the first elastic fixing part **210**. The second pad part **500** may be supported and fixed to the second elastic fixing part **220**.

[0043] A second elastic fixing body part **221** may be connected to the folding body part **240** that neighbors the second elastic fixing body part **221** on the lower side thereof, by the folding connection part **250**.

[0044] The second elastic fixing part **220** may include the second elastic fixing body part **221** and a second elastic burring part **223**. The second elastic fixing body part **221** may be formed of a flat plate the central part of which is formed to be penetrated. A second pad body part **510** of the second pad part **500** may be seated in the second elastic fixing body part **221**.

[0045] The second elastic burring part **223** may be formed to protrude toward the folding body part **240** of the folding part **230** that neighbors a lower side (e.g., in FIG. 2) of the second elastic fixing body part **221** that is formed to be penetrated, by burring processing. The second elastic burring part **223** may surround the outside of the second pad burring part **520** of the second pad part **500**.

[0046] The folding part **230** has one side (i.e., a lower side of the folding part **230** in FIG. 2) connected to the first elastic fixing part **210** and the other side (i.e., an upper side of the folding part **230** in FIG. 2) connected to the second elastic fixing part **220**. The folding part **230** may be folded at least once and elastically deformable.

[0047] The folding part **230** may be formed to be folded at least once, that is, bent several times in a zigzag form. The folding part **230** is formed to be folded at least once, and may be elastically deformed in up and down directions (e.g., in FIG. 2). The folding part **230** can reduce an impact on the vehicle by being elastically deformed in the up and down directions.

[0048] The folding part **230** may include the folding body part **240**, the folding connection part **250**, and a composite material part **260**. The folding body part **240** may be disposed between the first elastic fixing part **210** and the second elastic fixing part **220** in a plural number so that the plurality of folding body parts **240** is spaced apart from each other. The plurality of folding body parts **240** may be connected by the folding connection part **250**.

[0049] The folding body part **240** may include a folding plate part **241** and a folding hole part **243**. The folding plate part **241** may be disposed between the first elastic fixing part **210** and the second elastic fixing part **220** in a plural number so that the plurality of folding plate parts **241** is spaced apart from each other. The folding plate part **241** may be formed of a flat plate that is disposed between the first elastic fixing part **210** and the second elastic fixing part **220** in a plural number.

[0050] The composite material part **260** may be seated in the folding plate part **241**. The composite material part **260** may be simply held in the folding plate part **241** or may be coupled to the folding plate part **241** so that the composite material part **260** is firmly fixed to the folding plate part **241**. Alternatively, the composite material part **260** may be molded and combined with the folding plate part **241**.

[0051] Referring to FIG. 4, the folding hole part **243** may be formed in the folding plate part **241** so that the folding hole part **243** penetrates the folding plate part **241**. The folding hole part **243** may be formed in a long hole shape in the length direction (i.e., a horizontal direction in FIG. 4) of the folding plate part **241** so that the folding hole part **243** penetrates the folding plate part **241**. The folding hole part **243** is formed in the folding plate part **241** so that the folding hole part **243** penetrates the folding plate part **241**, and thus can increase the strength of the folding body part **240**, compared to a solid shape having the same weight, while reducing the weight of the folding body part **240**.

[0052] The folding hole part **243** may be arranged in a plural number in the width direction (i.e., a direction W in FIG. 4) of the folding plate part **241**. The plurality of folding hole parts **243** is formed in the width direction of the folding plate part **241** so that the plurality of folding hole parts **243** penetrates the folding plate part **241**, and thus can prevent the occurrence of deformation, such as twisting, in a specific portion while reducing the weight of the folding body part **240**.

[0053] The folding connection part **250** may connect the first elastic fixing part **210**, the folding body part **240**, or the second elastic fixing part **220** to the folding body part **240** that neighbors thereto. The folding connection part **250** may be consecutively formed in the first elastic fixing part

210, the folding body part **240**, or the second elastic fixing part **220**.

[0054] That is, the folding connection part **250** may connect the first elastic fixing part **210**, and the folding body part **240** that neighbors the upper side of the first elastic fixing part **210**. Alternatively, the folding connection part **250** may connect the folding body part **240**, and the second elastic fixing part **220** and the first elastic fixing part **210** that neighbor the upper and lower sides of the folding body part **240**. Alternatively, the folding connection part **250** may connect the second elastic fixing part **220**, and the folding body part **240** that neighbors the lower side of the second elastic fixing part **220**.

[0055] The folding connection part **250** may provide an elastic force to the first elastic fixing part **210**, the folding body part **240**, or the second elastic fixing part **220**, which has an interval therebetween narrowed or widened in up and down directions thereof, by connecting the first elastic fixing part **210**, the folding body part **240**, or the second elastic fixing part **220** to the folding body part **240** that neighbors the first elastic fixing part **210** or the second elastic fixing part **220**.

[0056] The folding connection part **250** may be in a curved shape in which the folding connection part **250** protrudes to the outside of the folding body part **240**. The folding connection part **250** is formed in a curved shape at the end of the folding body part **240**, and thus can prevent the folding body part **240** from being damaged due to stress in addition to an elastic force.

[0057] The folding connection part **250** may be alternately disposed on the left side and right side thereof at the end of the folding body part **240** in up and down directions thereof.

[0058] The composite material part **260** is mounted on the folding body part **240**, and may include a composite material. The composite material part **260** may be formed in a size capable of covering the folding hole part **243** of the folding body part **240**. The composite material part **260** can reduce stress that is applied to the folding body part **240**, by covering the folding hole part **243** that is formed to be penetrated.

[0059] The composite material part **260** may be mounted on the folding body part **240** by prepreg compression molding (PCM).

[0060] The composite material part **260** may include a composite material body part **261** and a composite material side part **263**. The composite material body part **261** may be mounted on one surface (i.e., an upper side of the folding body part **240** in FIG. 4) of the folding body part **240**.

[0061] The composite material side part **263** may extend from both sides of the composite material body part **261** and surround the sides of the folding body part **240**. The composite material side part **263** can prevent the folding body part **240** from breaking away in the width direction (i.e., the direction W in FIG. 4) of the folding body part **240** by surrounding the sides of the folding body part **240**.

[0062] The folding body part **240** and the folding connection part **250** each include a steel material. The composite material part **260** may include a glass fiber reinforced plastic (GFRP) material.

[0063] The folding body part **240** and the folding connection part **250** each include the steel material and can maintain predetermined stiffness. The composite material part **260** includes the GFRP material as a composite material, and thus can reduce stress that is applied to the folding hole part **243** of the folding body part **240** while reducing the weight of the folding body part **240** compared to a case in which the composite material part **260** is made of a steel material.

[0064] The first pad part **400** may include the first pad body part **410**, one or more first pad protrusion parts **420**, and the first pad burring part **430**. The first pad body part **410** may be seated in one surface (i.e., an upper side of the lower arm part **100** in FIGS. 2 and 7) of the lower arm part **100**. The first pad body part **410** includes an elastically deformable material, and may be elastically deformed while coming into contact with the lower arm part **100** and the first elastic fixing part **210** of the elastic part **200**.

[0065] The first pad protrusion parts **420** may be formed on first surface (i.e., a lower side of the first pad body part **410** in FIGS. 2 and 7) of the first pad body part **410** so that the first pad protrusion parts **420** protrude from the first pad body part **410**, and may be inserted into lower arm

groove parts **110** of the lower arm part **100**, respectively. The first pad protrusion parts **420** each include an elastically deformable material, and may be elastically deformed while being inserted into the lower arm groove parts **110** of the lower arm part **100**.

[0066] The lower arm groove part **110** of the lower arm part **100** into which the first pad protrusion part **420** is inserted may be concavely formed. The lower arm groove part **110** may be formed to have a size and number corresponding to the size and number of the first pad protrusion part **420**.

[0067] The first pad burring part **430** may be formed on second surface of (i.e., an upper side of the first pad body part **410** in FIGS. 2 and 7) of the first pad body part **410** so that the first pad burring part **430** protrudes from the first pad body part **410**. The first pad burring part **430** may surround the lower arm protrusion part **120** of the lower arm part **100** and may be inserted into the elastic part **200**. A lower arm protrusion part **120** may be formed at the central part of the lower arm part **100** so that the lower arm protrusion part **120** protrudes from the lower arm part **100**.

[0068] The first pad burring part **430** surrounds the outside of the lower arm protrusion part **120**, and may be inserted into the first elastic burring part **213** of the first elastic fixing part **210** of the elastic part **200**. The first pad burring part **430** includes an elastically deformable material, and may be elastically deformed between the lower arm protrusion part **120** and the first elastic burring part **213**.

[0069] The second pad part **500** may include the second pad body part **510** and a second pad burring part **520**. The second pad body part **510** may come into contact with one surface (i.e., a lower side of the vehicle body part **300** in FIG. 2) of the vehicle body part **300**. The second pad body part **510** includes an elastically deformable material, and may be elastically deformed while coming into contact with the vehicle body part **300** and the second elastic fixing part **220** of the elastic part **200**.

[0070] The second pad burring part **520** may be formed on one surface (i.e., a lower side of the second pad body part **510** in FIG. 2) of the second pad body part **510** so that the second pad burring part **520** protrudes from the second pad body part **510**. The second pad burring part **520** surrounds the vehicle body protrusion part **310** of the vehicle body part **300**, and may be inserted into the elastic part **200**. A vehicle body protrusion part **310** may be formed at the central part of the vehicle body part **300** so that the vehicle body protrusion part **310** protrudes from the vehicle body part **300**.

[0071] The second pad burring part **520** surrounds the outside of the vehicle body protrusion part **310**, and may be inserted into the second elastic burring part **223** of the second elastic fixing part **220** of the elastic part **200**. The second pad burring part **520** includes an elastically deformable material, and may be elastically deformed between the vehicle body protrusion part **310** and the second elastic burring part **223**.

[0072] An assembly process of the suspension for a vehicle, which has the aforementioned construction, according to an embodiment of the present disclosure is described below.

[0073] The first pad protrusion parts **420** of the first pad part **400** may be inserted into the lower arm groove parts **110** of the lower arm part **100**. The first pad burring part **430** of the first pad part **400** may surround the outside of the lower arm protrusion part **120** of the lower arm part **100**.

[0074] The second pad burring part **520** of the second pad part **500** may surround the side of the vehicle body protrusion part **310** of the vehicle body part **300**.

[0075] The first elastic fixing part **210** and second elastic fixing part **220** of the elastic part **200** may come into contact with the first pad part **400** and the second pad part **500**, respectively.

[0076] The first pad burring part **430** of the first pad part **400** may be inserted and mounted on the first elastic burring part **213** of the first elastic fixing part **210**.

[0077] The second pad burring part **520** of the second pad part **500** may be inserted and mounted on the second elastic burring part **223** of the second elastic fixing part **220**.

[0078] The suspension for a vehicle, which has been assembled through the aforementioned process, can reduce an impact on a vehicle as the folding part **230** of the elastic part **200** is

elastically deformed up and down when the vehicle travels.

[0079] According to the suspension for a vehicle according to an embodiment of the present disclosure, the weight of a vehicle can be reduced while the vibration of the vehicle is reduced because the elastic part **200** can be elastically deformed and reduced in weight.

[0080] Furthermore, according to an embodiment of the present disclosure, a gap between the elastic part **200** and a surrounding part can be secured while the stiffness of the elastic part **200** is maintained because the elastic part **200** includes the steel material and the composite material.

[0081] Although specific embodiments of the present disclosure have been described above, the spirit and range of the present disclosure is not limited to the specific embodiments. A person having ordinary knowledge in the art to which the present disclosure pertains may modify and change the present disclosure without departing from the gist of the present disclosure written in the claims.

Claims

1. A suspension for a vehicle, comprising: a lower arm part; an elastically deformable elastic part mounted over the lower arm part; a vehicle body part mounted over the elastic part; a first pad part interposed between the lower arm part and the elastic part and comprising an elastically deformable material; and a second pad part interposed between the elastic part and the vehicle body part and comprising an elastically deformable material.
2. The suspension of claim 1, wherein the elastic part comprises: a first elastic fixing part mounted on the first pad part; a second elastic fixing part spaced apart from the first elastic fixing part and having the second pad part mounted thereon; and an elastically deformable folding part having a first side connected to the first elastic fixing part and a second side connected to the second elastic fixing part.
3. The suspension of claim 2, wherein the folding part is folded at least once.
4. The suspension of claim 3, wherein the folding part comprises: a folding body part disposed between the first elastic fixing part and the second elastic fixing part in a plural number so that the plurality of folding body parts is spaced apart from each other; a folding connection part configured to connect the first elastic fixing part to the folding body part, or to connect the second elastic fixing part to the folding body part; and a composite material part mounted on the folding body part and comprising a composite material.
5. The suspension of claim 4, wherein the folding body part comprises: a folding plate part disposed between the first elastic fixing part and the second elastic fixing part in a plural number so that the plurality of folding plate parts is spaced apart from each other; and a folding hole part formed in the folding plate part so that the folding hole part penetrates the folding plate part.
6. The suspension of claim 5, wherein the folding hole part is arranged in a plural number in a width direction of the folding plate part.
7. The suspension of claim 4, wherein the composite material part comprises: a composite material body part mounted on one surface of the folding body part; and a composite material side part configured to extend from the composite material body part to surround sides of the folding body part.
8. The suspension of claim 4, wherein the folding connection part has a curved shape in which the folding connection part protrudes to an outside of the folding body part.
9. The suspension of claim 4, wherein: the folding body part and the folding connection part are each made of a steel material, and the composite material part is made of a glass fiber reinforced plastic (GFRP) material.
10. The suspension of claim 1, wherein the first pad part comprises: a first pad body part seated in the lower arm part; one or more first pad protrusion parts formed in a first surface of the first pad body part and inserted into one or more lower arm groove parts of the lower arm part, respectively;

and a first pad burring part formed on a second surface of the first pad body part, configured to surround a lower arm protrusion part of the lower arm part, and inserted into the elastic part.

11. The suspension of claim 1, wherein the second pad part comprises: a second pad body part configured to come into contact with the vehicle body part; and a second pad burring part formed on one surface of the second pad body part, configured to surround a vehicle body protrusion part of the vehicle body part, and inserted into the elastic part.
