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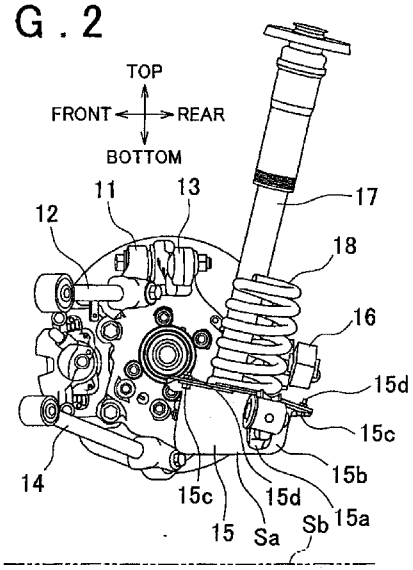
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(54) **Title**: VEHICLE SUSPENSION SYSTEM

FIG. 2



(57) **Abstract**: In a vehicle suspension system, an arm cover (15b) is attached to the undersurface of a suspension arm main body (15a) (lower arm main body) that supports a wheel. The undersurface (5a) of a lower portion of the arm cover (15b) is parallel to a road surface (5b) on which a vehicle is driving. An installation portion on which at least the lower end of a coil spring (18) is installed is formed at a bottom portion of the lower arm main body (15a). The installation portion is tilted at a predetermined angle Θ with respect to a bottom portion of the arm cover, and is covered by the arm cover.

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VEHICLE SUSPENSION SYSTEM

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The invention relates to a vehicle suspension system, and more specifically to a vehicle suspension system in which an arm cover is attached to the undersurface of a suspension arm main body that supports a wheel.

2. Description of Related Art

[0002] This type of vehicle suspension system is described in, for example, Japanese Patent Application Publication No. 2006-56463 (JP 2006-56463 A). In the vehicle suspension system described in JP 2006-56463 A, an arm cover is attached to the undersurface of a suspension arm main body so as to extend along the undersurface.

[0003] In the vehicle suspension system described in JP 2006-56463 A, the arm cover is attached to the undersurface of the suspension arm main body so as to extend along the undersurface. Therefore, the arm cover prevents the undersurface of the suspension arm main body from being damaged by road debris such as gravel. However, if the undersurface of a lower portion of the suspension arm main body is tilted with respect to a road surface on which the vehicle is traveling, the arm cover may hinder effective reduction in air resistance during traveling of the vehicle.

SUMMARY OF THE INVENTION

[0004] An aspect of the invention relates to a vehicle suspension system in which an arm cover is attached to an undersurface of a suspension arm main body that supports a wheel. In the vehicle suspension system, an undersurface of a lower portion of the arm cover is parallel to a road surface on which a vehicle is traveling. In this case, the suspension arm main body may be a lower arm main body, an installation portion on which at least a lower end of a coil spring is installed may be formed at a bottom portion

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of the lower arm main body, and the installation portion may be tilted at a predetermined angle with respect to a bottom portion of the arm cover.

[0005] In the vehicle suspension system according to the aspect of the invention, the arm cover is attached to the undersurface of the suspension arm main body. The arm cover prevents the undersurface of the suspension arm main body from being damaged by road debris such as gravel. As a result, rust prevention performance of the suspension arm main body is improved. Moreover, the undersurface of the lower portion of the arm cover attached to the undersurface of the suspension arm main body is configured to be parallel to the road surface on which the vehicle is traveling. Accordingly, an airflow along the undersurface of the lower portion of the arm cover is parallel to an airflow along the undersurface of the vehicle floor when the vehicle is traveling. Therefore, it is possible to suppress occurrence of the situation where the airflow along the undersurface of the lower portion of the arm cover disturbs the airflow along the undersurface of the vehicle floor. As a result, it is possible to reduce Cd value. Thus, it is possible to reduce air resistance during traveling of the vehicle. Note that "Cd value" signifies a coefficient of drag.

[0006] Moreover, in the case where the suspension arm main body is the lower arm main body, the installation portion on which at least the lower end of the coil spring is installed is formed at the bottom portion of the lower arm main body, and the installation portion is tilted at the predetermined angle with respect to the bottom portion of the arm cover and covered by the arm cover, when the undersurface of the lower arm main body that is wide in the vehicle longitudinal direction and tilted in the vehicle longitudinal direction is covered by the arm cover, the airflow below the installation portion of the lower arm main body is made parallel to the airflow along the undersurface of the vehicle floor. As a result, it is possible to reduce the air resistance during traveling of the vehicle with a simple structure that no longer requires provision of a flow adjusting portion below the installation portion of the lower arm main body.

[0007] Moreover, the vehicle suspension system may include an attachment member that secures the arm cover to the lower arm main body, and that does not

protrude downward from the undersurface of the lower portion of the arm cover. The attachment member may be substantially flush with the undersurface of the lower portion of the arm cover.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] Features, advantages, and technical and industrial significance of exemplary embodiments of the invention will be described below with reference to the accompanying drawings, in which like numerals denote like elements, and wherein:

FIG. 1 is a view of a vehicle suspension system according to an embodiment of the invention, as viewed from the rear of a vehicle;

FIG. 2 is a side view of the vehicle suspension system in FIG. 1 as viewed from the direction of an arrow II;

FIG. 3 is a sectional view taken along the line III-III in FIG. 1;

FIG. 4 is a rear view of a rear lower arm in FIGS. 1 to 3;

FIG. 5 is a right side view of the lower arm in FIG. 4;

FIG. 6 is a plan view of the lower arm in FIG. 4;

FIG. 7 is a rear view showing only an arm cover in FIGS. 4 to 6;

FIG. 8 is a right side view showing only the arm cover in FIG. 7; and

FIG. 9 is a plan view showing only the arm cover in FIG. 7.

DETAILED DESCRIPTION OF EMBODIMENTS

[0009] Hereafter, an embodiment of the invention will be described with reference to the accompanying drawings. FIGS. 1 to 3 show a vehicle suspension system according to an embodiment of the invention. The vehicle suspension system in the present embodiment is an independent suspension system. The vehicle suspension system includes a pair of front and rear upper arms 12 and 13, a pair of front and rear lower arms 14 and 15, a toe control arm 16, a shock absorber 17, and a coil spring 18. The upper arms 12 and 13, the lower arms 14 and 15 and the toe control arm 16 are used to connect a carrier 11, which holds a right rear wheel (not shown) rotatable, to a vehicle body (not shown). The shock absorber 17 and the coil spring 18 are disposed at

different positions. The upper arms 12 and 13, the lower arms 14 and 15 and the toe control arm 16 are fitted to a sub-frame, together with the shock absorber 17 and the coil spring 18. Thus, a sub-assembly is formed. The sub-assembly is fitted to the vehicle body. The sub-frame may be referred to as a suspension member.

[0010] The inner ends (left ends in FIG. 1) of the upper arms 12 and 13, the lower arms 14 and 15, and the toe control arm 16 are connected to the sub-frame via respective bushings. The outer ends (right ends in FIG. 1) of the upper arms 12 and 13, the lower arms 14 and 15, and toe control arm 16 are connected to the carrier 11 via respective bushings. The lower end of the shock absorber 17 is connected to the lower arm 15 via a bushing. The upper end of the shock absorber 17 is connected to the vehicle body.

[0011] As shown in FIG. 3, the lower end of the coil spring 18 contacts the lower arm 15 via a retainer 18a, and is supported by the lower arm 15. The upper end of the coil spring 18 is connected to the vehicle body via a retainer (not shown). In the present embodiment, the coil spring 18 is disposed so as to tilt such that the upper end is closer to the rear of the vehicle than the lower end and the upper end is closer to the lateral center of the vehicle than the lower end.

[0012] In the present embodiment, the rear lower arm 15 has a metallic lower arm main body 15a and a resin arm cover 15b, and is provided with three attachment bolts 15c and three nuts 15d. In addition, as shown in FIGS. 1 and 2, the rear lower arm 15 is configured such that an undersurface Sa of a lower portion of the arm cover 15b is substantially horizontal so as to be parallel to a road surface Sb on which the vehicle is traveling (see the virtual line in FIG. 2).

[0013] As shown in FIGS. 3 to 6, an annular installation portion 15a1 on which at least the lower end of the coil spring 18 is installed is formed at a bottom portion 15a2 of the lower arm main body 15a. The installation portion 15a1 is tilted at a predetermined angle θ with respect to a bottom portion 15b1 of the arm cover 15b. The installation portion 15a1 is covered by the arm cover 15b. The lower arm main body 15a has a front flange 15a3, a rear flange 15a4, a reinforcing plate 15a5, an inner end

attachment portion 15a6, an outer end attachment portion 15a7, and a shock absorber attachment portion 15a8. Note that the installation portion 15a1 is tilted with respect to the bottom portion 15b1 of the arm cover 15b such that the rear end of the installation portion 15a1 in the vehicle longitudinal direction is located below the front end thereof in the vehicle longitudinal direction.

[0014] As shown in FIGS. 7 to 9, the arm cover 15b has the bottom portion 15b1 and an X-shaped rib 15b2, and has a front flange 15b3, a rear flange 15b4, three attachment holes 15b5, and five drain holes 15b6. The three attachment holes 15b5 are formed in the bottom portion 15b1, the front flange 15b3, and the rear flange 15b4, respectively. Among the three attachment holes 15b5, only the attachment hole 15b5 formed in the bottom portion 15b1 is a counterbore or a countersunk hole. This prevents the head of the attachment bolt 15c from protruding downward from the undersurface Sa of the lower portion of the arm cover 15b. The five drain holes 15b6 are all formed in the bottom portion 15b1. Through the drain holes 15b6, for example, foreign matters such as gravel and water are discharged (removed) from the arm cover 15b.

[0015] The three attachment bolts 15c are inserted into the respective attachment holes 15b5 formed in the arm cover 15b and screwed to the respective nuts 15d that are fixed (welded) to the lower arm main body 15a. Bolt insertion holes (not shown) are formed in portions of the lower arm main body 15a, to which the nuts 15d are fixed.

[0016] According to the present embodiment configured as described above, the arm cover 15b attached to the undersurface of the lower arm main body 15a prevents the undersurface of the lower arm main body 15a from being damaged by road debris such as gravel. As a result, rust prevention performance is improved. Moreover, the undersurface Sa of the lower portion of the arm cover 15b attached to the undersurface of the lower arm main body 15a is configured to be parallel to the road surface Sb on which the vehicle is traveling. Accordingly, an airflow along the undersurface Sa of the lower portion of the arm cover 15b is parallel to an airflow along the undersurface of the

vehicle floor when the vehicle is traveling. Therefore, it is possible to suppress occurrence of the situation where the airflow along the undersurface Sa of the lower portion of the arm cover 15b disturbs the airflow along the undersurface of the vehicle floor. As a result, it is possible to reduce air resistance during traveling of the vehicle.

[0017] In the present embodiment, the installation portion 15a1 on which at least the lower end of the coil spring 18 is installed is formed at the bottom portion 15a2 of the lower arm main body 15a. In addition, the installation portion 15a1 is tilted at the predetermined angle θ with respect to the bottom portion 15b1 of the arm cover 15b and covered by the arm cover 15b. In the present embodiment, the undersurface of the lower arm main body 15a that is wide in the vehicle longitudinal direction and tilted in the vehicle longitudinal direction is covered by the arm cover 15b. This makes the airflow below the installation portion 15a1 of the lower arm main body 15a parallel to the airflow along the undersurface of the vehicle floor. As a result, it is possible to reduce the air resistance during traveling of the vehicle with a simple structure that no longer requires provision of a flow adjusting portion below the installation portion 15a1 of the lower arm main body 15a.

[0018] In the present embodiment described above, the invention is applied to a rear lower arm of an independent suspension system for a right rear wheel. However, the invention is not limited to the above embodiment. The invention may be implemented, in the same manner as the above-described embodiment or with appropriate modifications, in any vehicle suspension systems in which an arm cover (corresponding to the arm cover 15b in the above-described embodiment) is attached to the undersurface of a suspension arm main body (corresponding to the lower arm main body 15a in the above-described embodiment) that supports a wheel.

CLAIMS:

1. A vehicle suspension system in which an arm cover is attached to an undersurface of a suspension arm main body that supports a wheel, wherein

an undersurface of a lower portion of the arm cover is parallel to a road surface on which a vehicle is traveling.

2. The vehicle suspension system according to claim 1, wherein:

the suspension arm main body is a lower arm main body;

an installation portion on which at least a lower end of a coil spring is installed is formed at a bottom portion of the lower arm main body; and

the installation portion is tilted at a predetermined angle with respect to a bottom portion of the arm cover, and is covered by the arm cover.

3. The vehicle suspension system according to claim 2, wherein the installation portion is tilted with respect to the bottom portion of the arm cover such that a rear end of the installation portion in a vehicle longitudinal direction is located below a front end of the installation portion in the vehicle longitudinal direction.

4. The vehicle suspension system according to claim 2, further comprising:

an attachment member that secures the arm cover to the lower arm main body, wherein the attachment member does not protrude downward from the undersurface of the lower portion of the arm cover.

5. The vehicle suspension system according to claim 2, further comprising:

an attachment member that secures the arm cover to the lower arm main body, wherein a bottom of the attachment member is substantially flush with the undersurface of the lower portion of the arm cover.

6. The vehicle suspension system according to any one of claims 1 to 5, wherein the vehicle suspension system is a suspension system for a rear wheel.

7. The vehicle suspension system according to any one of claims 1 to 6, wherein:

the suspension arm main body is made of metal; and

the arm cover is made of resin.

FIG. 1

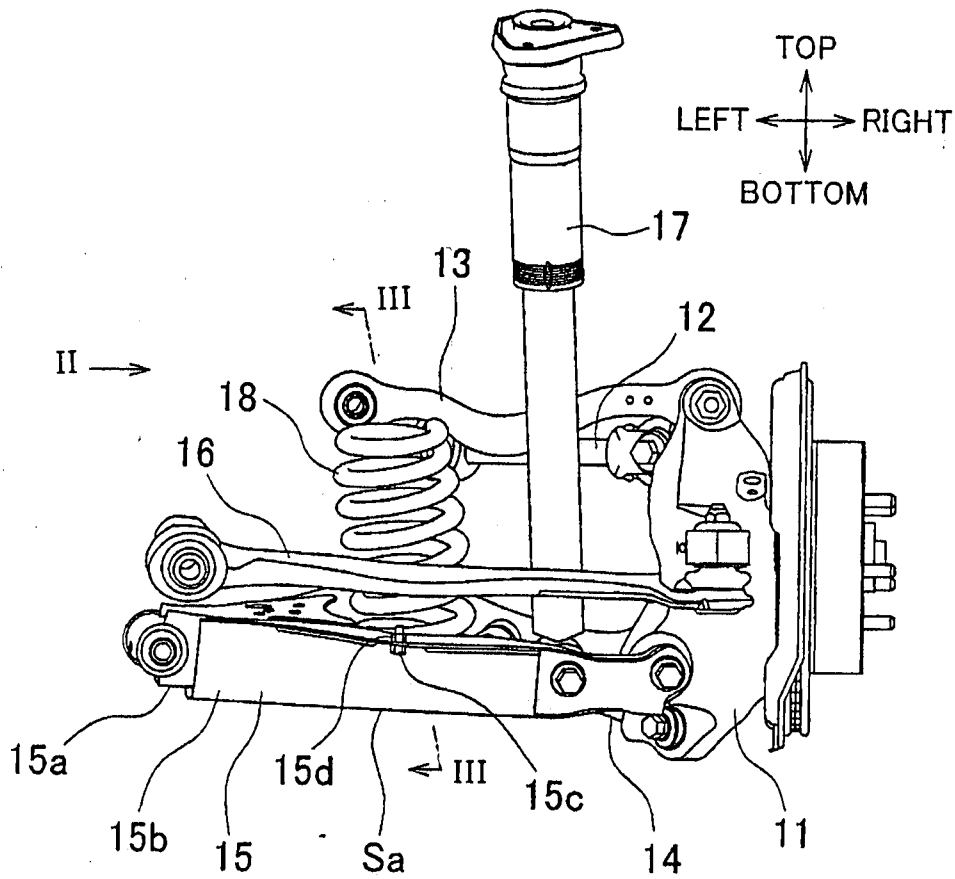

TOP
LEFT
RIGHT
BOTTOM
17
13
III
12
II
18
16
15a
15b
15
15d
Sa
III
15c
14
11

FIG. 2

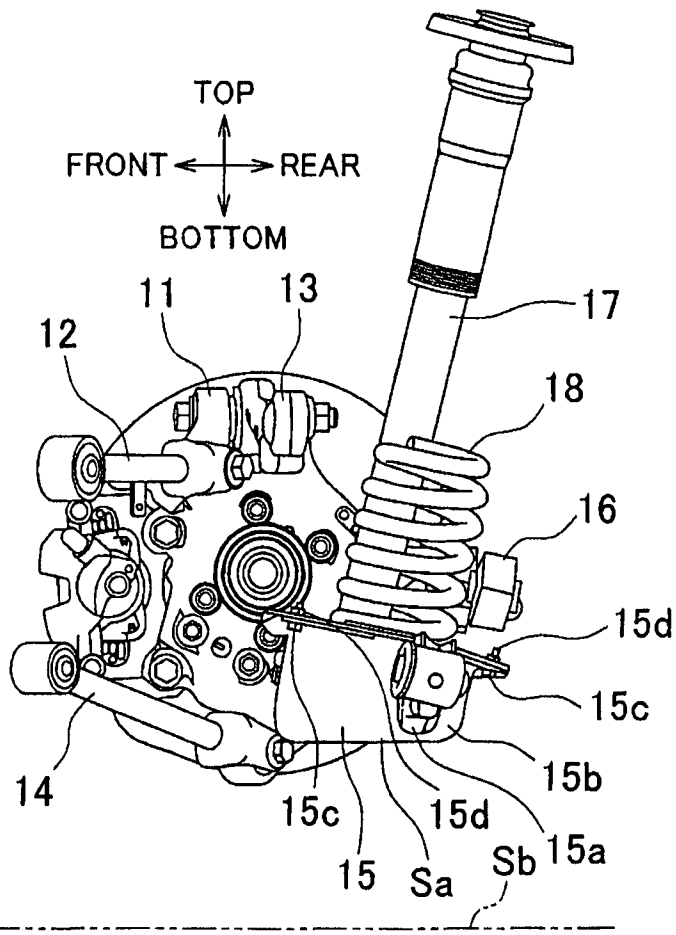

TOP
FRONT
REAR
BOTTOM
11
13
12
17
18
16
15d
15c
15b
14
15c
15d
15a
15
Sa
Sb

FIG. 3

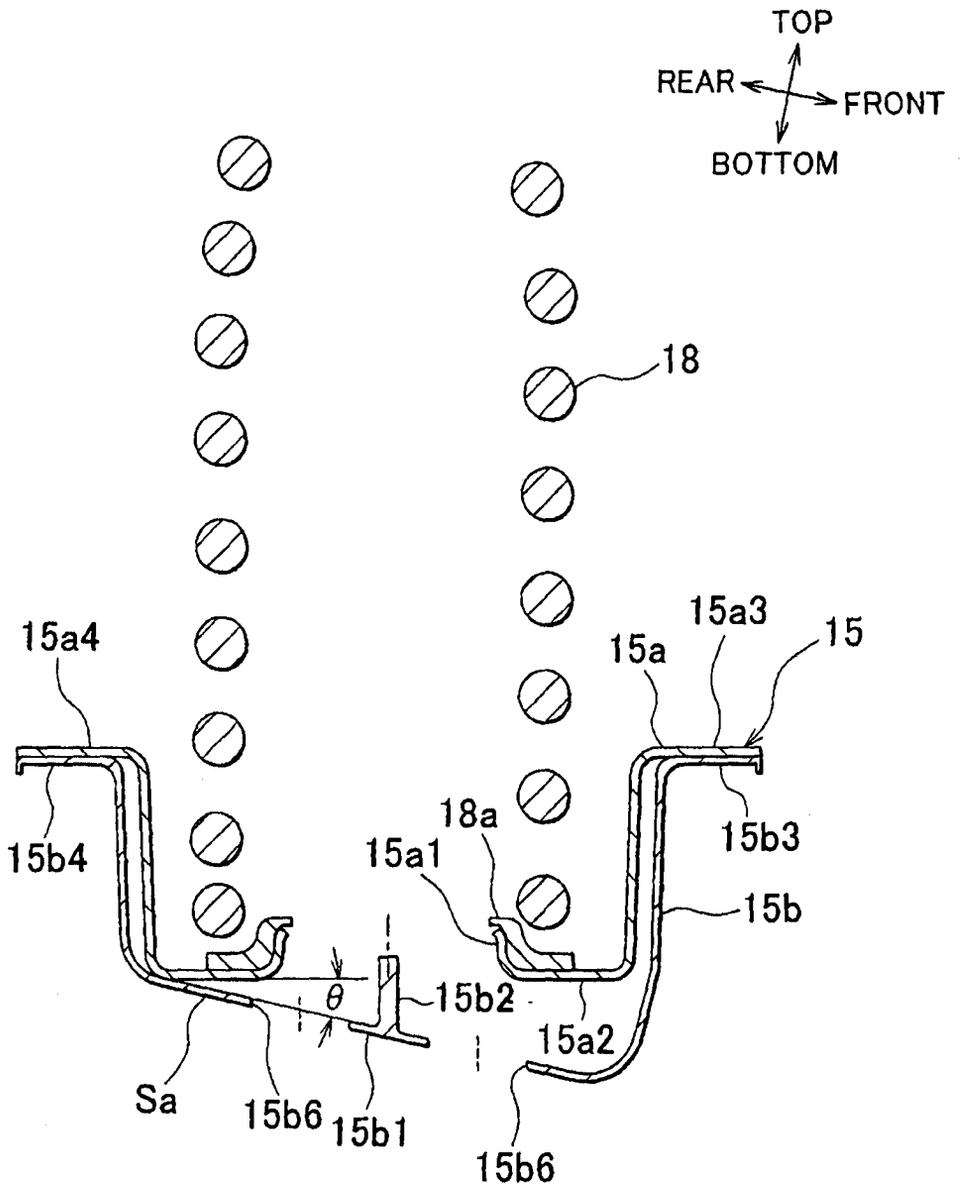

TOP
REAR
FRONT
BOTTOM
18
15a4
15a3
15a
15
15b4
18a
15a1
15b3
15b
θ
15b2
15a2
Sa
15b6
15b1
15b6

FIG. 4

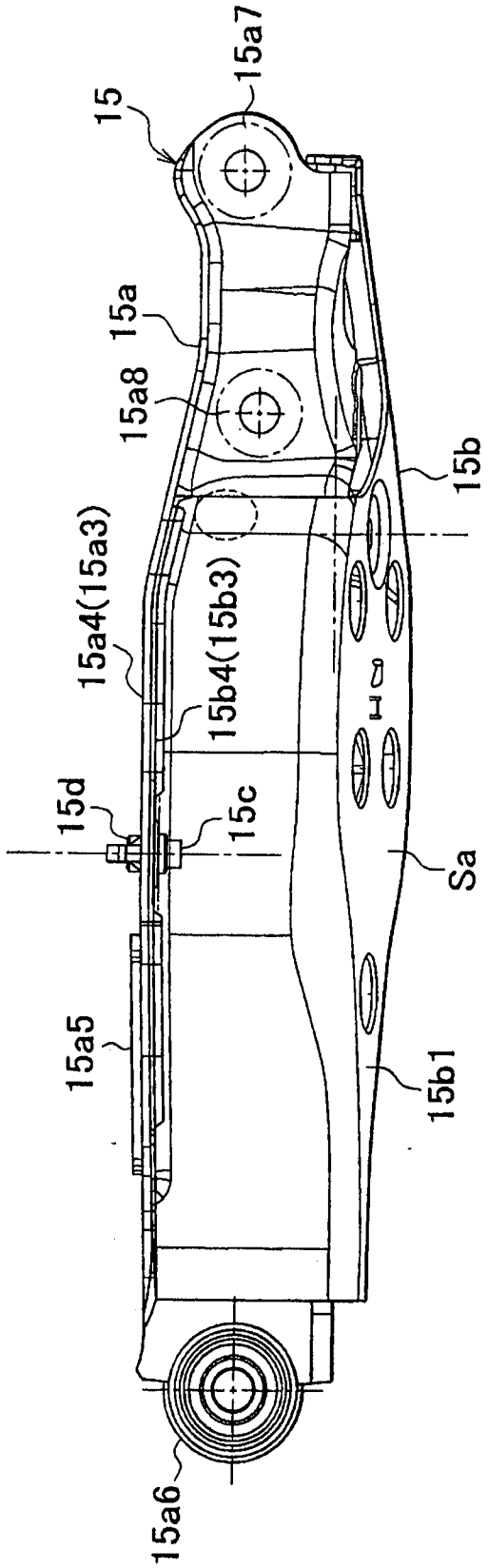

15
15a7
15a
15a8
15b
15a4(15a3)
15b4(15b3)
15d
15c
Sa
15a5
15b1
15a6

FIG. 5

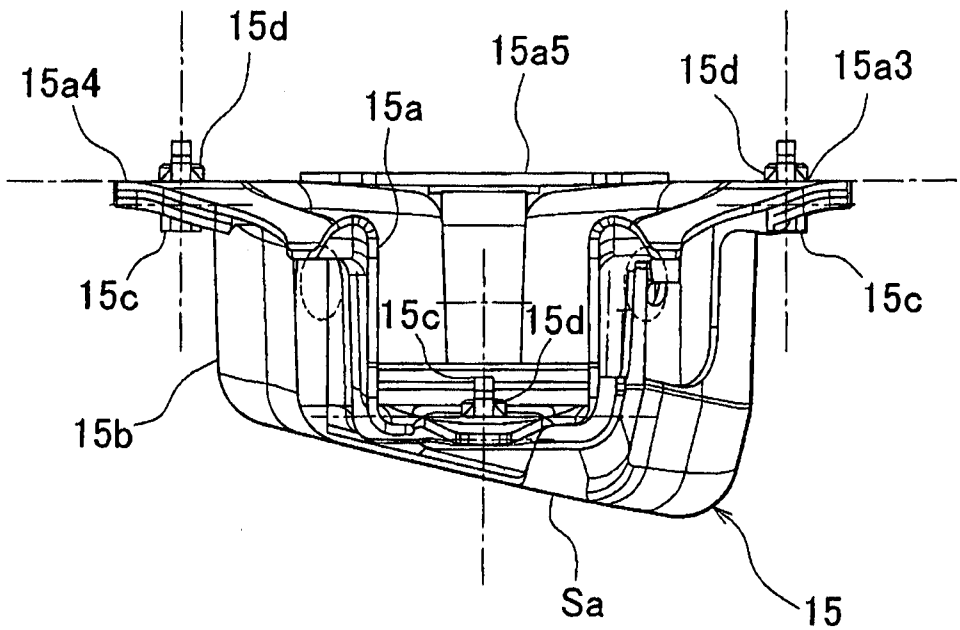


FIG. 6

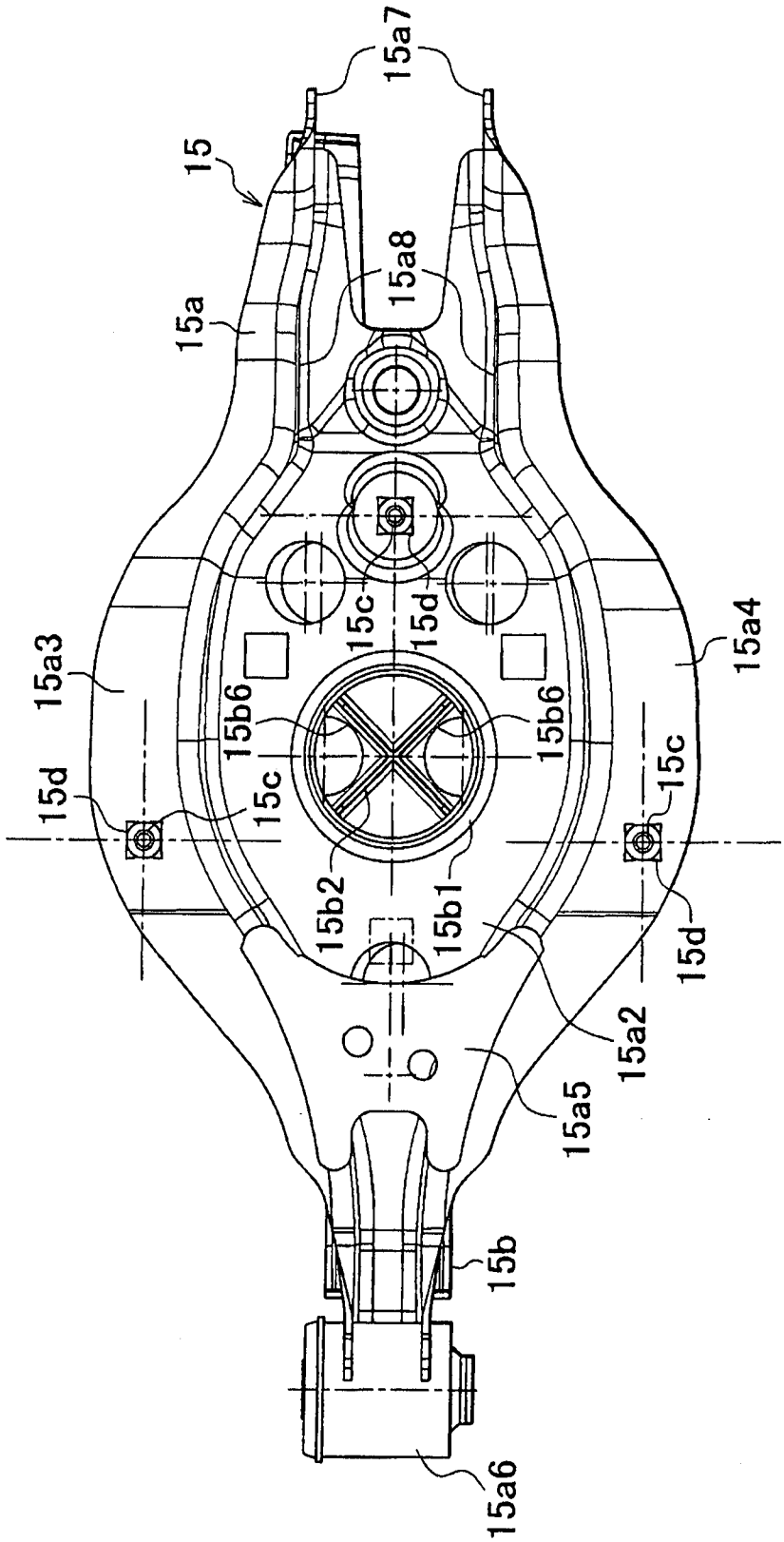

15a7
15
15a8
15a
15c
15d
15a3
15a4
15b6
15b6
15d
15c
15c
15b2
15b1
15d
15a2
15a5
15b
15a6

FIG. 7

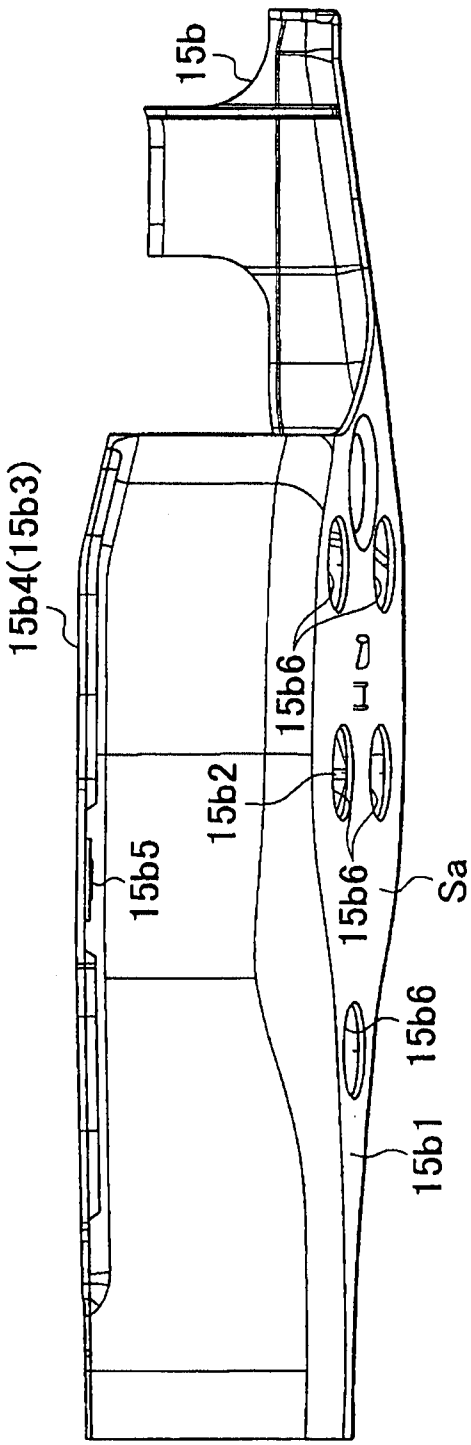


FIG. 8

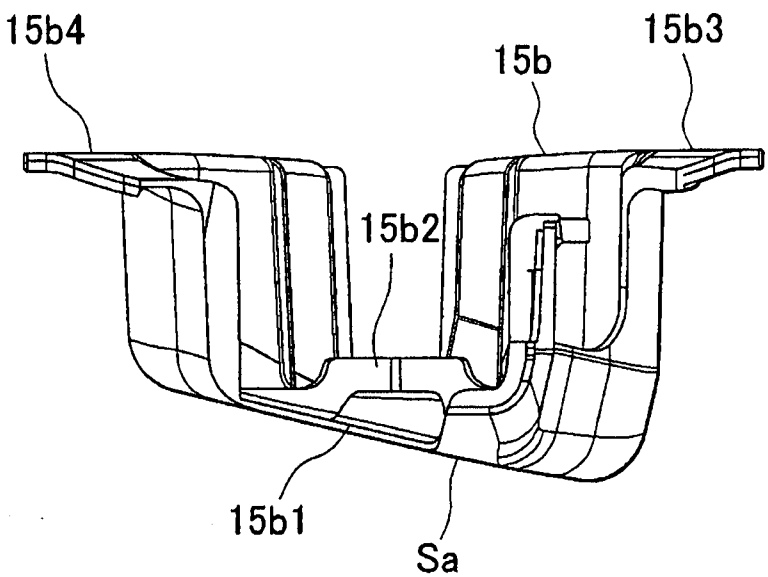
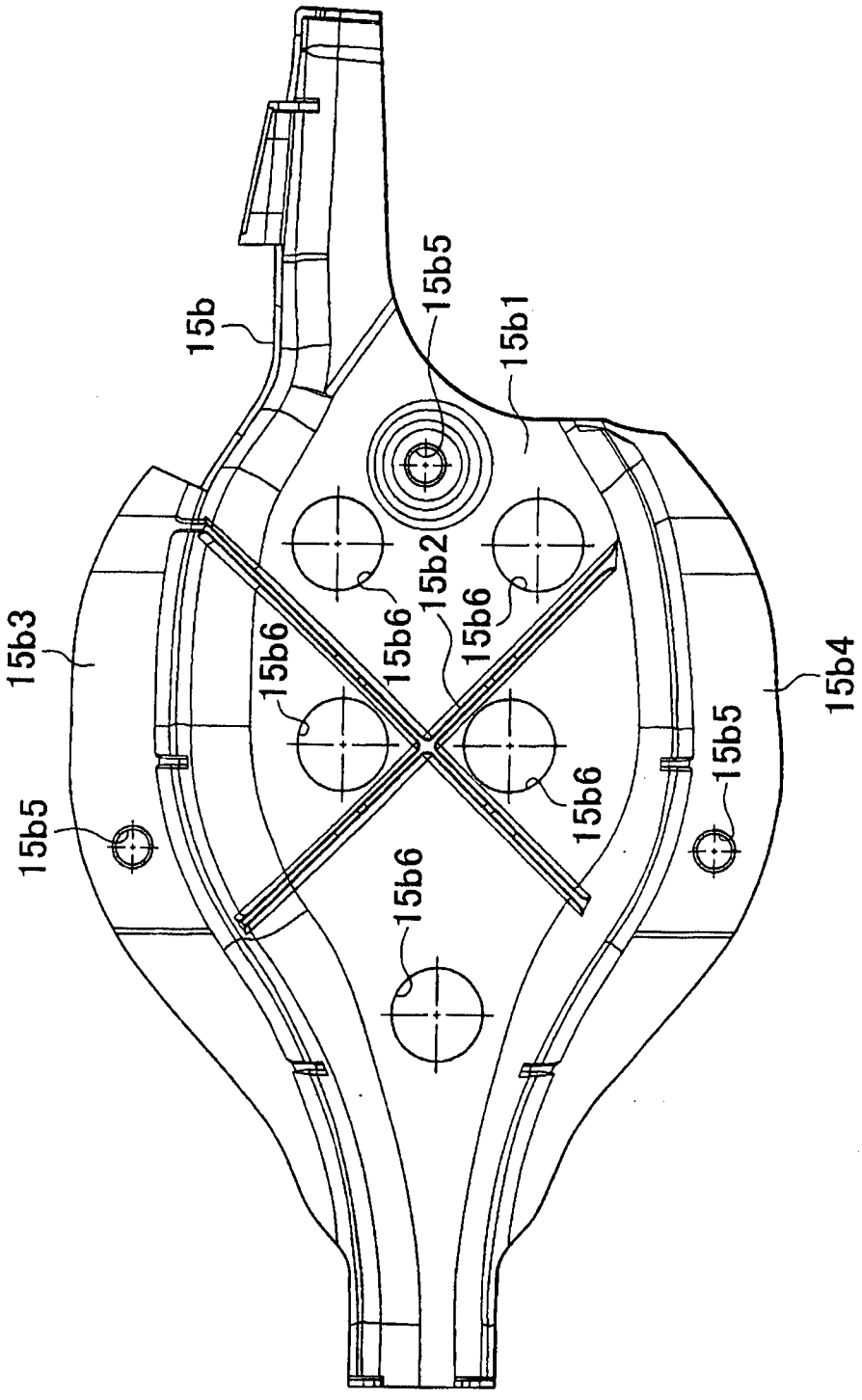


FIG. 9


15b
15b5
15b1
15b2
15b6
15b6
15b6
15b3
15b6
15b5
15b6
15b4
15b5

INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2012/001045

A. CLASSIFICATION OF SUBJECT MATTER
INV. B60G7/00
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
B62D B60G

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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X	JP 2004 338458 A (HONDA MOTOR CO LTD) 2 December 2004 (2004-12-02) paragraphs [0005], [0024] - [0030]; figures 1-7	1-7
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A	JP 2006 056463 A (HONDA MOTOR CO LTD) 2 March 2006 (2006-03-02) cited in the application figures	1-7

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[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

* Special categories of cited documents :

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Date of the actual completion of the international search	Date of mailing of the international search report
21 August 2012	30/08/2012

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Cavallo, Frédéric

INTERNATIONAL SEARCH REPORT

International application No
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