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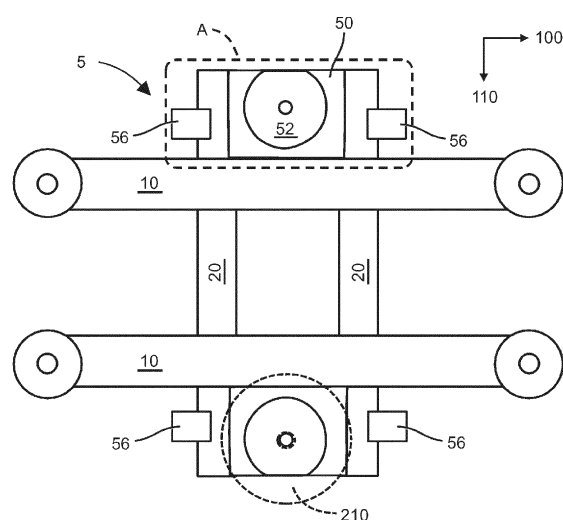
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(54) **BOGIE FOR RAILWAY VEHICLE**

(57) Provided is an inner-frame type railroad-car bogie in which reduction in weight is promoted and stress on connection portions between side beams and crossbeams forming secondary spring receivers can be reduced. A railroad-car bogie includes: two side beams separately arranged in a rail direction; two crossbeams separately arranged in a railroad tie direction; and secondary spring receivers on each of which a secondary spring supporting a car body is placed, in which: each of the secondary spring receivers is a box including end portions in the railroad tie direction of the crossbeams, a center portion in the rail direction of the side beam, an upper plate connecting upper portions of the end portions and an upper portion of the center portion, a lower plate connecting lower portions of the end portions and a lower portion of the center portion, and a side plate connecting end portions in the railroad tie direction of the upper plate and the lower plate; and the lower plate has a lighting hole.

FIG.2



Description

Technical Field

[0001] The present invention relates to a railroad-car bogie including secondary spring receivers in both end portions in a railroad tie direction of crossbeams forming an inner-frame bogie frame.

Background Art

[0002] A railroad-car bogie includes a bogie frame, wheel sets, axle-box support devices, and the like. The bogie frame mainly includes two side beams separately arranged in a rail direction and crossbeams arranged in a railroad tie direction and connecting center portions in the rail direction of the side beams. The wheel set is configured so that two wheels are fastened by an axle, and the axle-box support device includes an axle box that rotatably supports this wheel set at the bogie frame, a primary spring placed on the axle box and elastically supporting the axle box, and the like.

[0003] In order to reduce a mass of the bogie, there is a bogie frame in which lengths of the crossbeams and the wheel sets in the railroad tie direction are reduced and the two side beams are arranged to be closer to center in the railroad tie direction of the crossbeams than a pair of wheels. This bogie frame is called "inner-frame bogie frame" (see PTL 1).

Citation List

Patent Literature(s)

[0004] PTL 1: JP-A-2010-149808

Summary of Invention

Technical Problem(s)

[0005] An inner-frame bogie frame includes a pair of right and left secondary springs (air springs or coil springs) which are placed in a center portion in a rail direction and elastically support a car body. In order to restrain rolling vibration that swings the car body around an axis in a longitudinal direction of the car body, it is desirable to provide primary springs and secondary springs so that an interval between the primary springs and an interval between the secondary springs in a railroad tie direction are increased as large as possible.

[0006] However, in the inner-frame bogie frame in which an axle box is arranged to be closer to a center portion in the railroad tie direction than wheels, the interval between the primary springs in the railroad tie direction tends to be small. In order to restrain the above-mentioned rolling vibration, the inner-frame bogie frame in which the secondary springs are placed at a large interval in the railroad tie direction includes a secondary

spring receiver having a cantilever structure in which crossbeams penetrating a side beam project from a center portion in a longitudinal direction of the side beam forming the bogie frame toward outside in the railroad tie direction (direction away from center portion in railroad tie direction).

[0007] The secondary spring receiver of the inner-frame bogie frame has a cantilever structure, and therefore high stress tends to be generated in a joining portion of the side beam and the crossbeam which is a base of the secondary spring receiver. Thus, there is a problem in obtaining high strength without increasing a mass of the bogie.

[0008] An object of the invention is to provide an inner-frame type railroad-car bogie in which reduction in weight is promoted and stress on connection portions between side beams and crossbeams forming secondary spring receivers can be reduced.

Solution to Problem(s)

[0009] In order to solve such a problem, in the invention, a railroad-car bogie includes: two side beams separately arranged in a rail direction; two crossbeams separately arranged in a railroad tie direction; and secondary spring receivers on each of which a secondary spring supporting a car body is placed, in which: each of the secondary spring receivers is a box including end portions in the railroad tie direction of the crossbeams, a center portion in the rail direction of the side beam, an upper plate connecting upper portions of the end portions and an upper portion of the center portion, a lower plate connecting lower portions of the end portions and a lower portion of the center portion, and a side plate connecting end portions in the railroad tie direction of the upper plate and the lower plate; and the lower plate has a lighting hole for keeping a balance of rigidity.

Advantageous Effects of Invention

[0010] According to the invention, it is possible to promote reduction in weight and reduce stress on connection portions between side beams and crossbeams forming secondary spring receivers.

Brief Description of Drawings

[0011]

[Fig. 1] Fig. 1 is a plan view of a railroad-car bogie in this embodiment.

[Fig. 2] Fig. 2 is a plan view of a bogie frame of the railroad-car bogie.

[Fig. 3] Fig. 3 is an enlarged plan view of a secondary spring receiver A in Fig. 2.

[Fig. 4] Fig. 4 is an enlarged bottom view of the secondary spring receiver A in Fig. 2.

[Fig. 5] Fig. 5 is a cross-sectional view taken along

B-B in Fig. 3.

[Fig. 6] Fig. 6 is a cross-sectional view taken along C-C in Fig. 3.

[Fig. 7] Fig. 7 is a cross-sectional view taken along B-B in a secondary spring receiver A in another embodiment.

Description of Embodiments

[0012] Hereinafter, an embodiment of the invention will be described in detail with reference to the drawings. Note that directions used in the following description are a rail (longitudinal) direction 100, a railroad tie (width) direction 110, and a height direction 120, and those directions will be simply referred to as "rail direction 100", "railroad tie direction 110", and "height direction 120".

(1) Configuration of railroad-car bogie

[0013] Fig. 1 is a plan view of a railroad-car bogie in this embodiment. A railroad-car bogie (hereinafter, bogie) 1 includes a bogie frame 5, wheel sets each of which includes two wheels 240 in both end portions in the railroad tie direction 110 of an axle 230, axle-box support devices (not illustrated) that rotatably hold the wheel sets at the bogie frame 5, and braking devices 56 that generate brake force in the wheels 240.

[0014] The bogie frame 5 includes two side beams 10 separately arranged in the rail direction and two crossbeams 20 that are horizontally placed and connect center portions in the rail direction 100 of the two side beams 10.

[0015] The railroad-car bogie 1 in this embodiment is an inner frame bogie whose wheels 240 are provided on the outside of the side beams 10 in the railroad tie direction 110 (direction away from center portions in railroad tie direction of crossbeams 20). A car body is elastically supported via secondary springs 210 (normally, air springs or coil springs) placed on an upper surface of the bogie frame 5 of the railroad-car bogie 1.

[0016] A lower surface (not illustrated) of an under-frame forming a floor surface of the car body includes a center pin 250 whose tip portion is hung downward, and this tip portion of the center pin 250 is inserted into a center portion formed by the side beams 10 and the crossbeams 20 forming the bogie frame 5. In a case where the car body passes a curve, the railroad-car bogie 1 turns on a horizontal surface around a vertical axis of the center pin 250.

(2) Configuration of bogie frame

[0017] Fig. 2 is a plan view of the bogie frame 5 of the railroad-car bogie 1. The bogie frame 5 includes the two side beams 10 separately arranged in the rail direction 100, the two crossbeams 20 that penetrate the center portions in the rail direction 100 of the side beams 10, and secondary spring receivers A provided in both end portions in the railroad tie direction 110 of the two cross-

beams 20 and on which the secondary springs 210 are placed.

[0018] Fig. 3 is an enlarged plan view of the secondary spring receiver A in Fig. 2, and Fig. 4 is an enlarged bottom view of the secondary spring receiver A in Fig. 2. Further, Fig. 5 is a vertical cross-sectional view (cross-sectional view taken along B-B in Fig. 3) in the railroad tie direction of the secondary spring receiver A in Fig. 2, and Fig. 6 is a vertical cross-sectional view (cross-sectional view taken along C-C in Fig. 3) in the rail direction of the secondary spring receiver A in Fig. 2.

[0019] The secondary spring receiver A is formed as a box including the end portions in the railroad tie direction 110 of the two crossbeams 20, the center portion in the rail direction 100 of the side beam 10 (between the two crossbeams 20), an upper plate 50a connected to upper portions of the end portions of the crossbeams 20 and an upper portion of the center portion of the side beam 10, a lower plate 50e connected to lower portions of the end portions of the crossbeams 20 and a lower portion of the center portion of the side beam 10, a reinforcing plate 51b connecting, in the height direction 120, center portions in the railroad tie direction 110 of the upper plate 50a and the lower plate 50e, and a side plate 51a connecting, in the height direction 120, end portions in the railroad tie direction 110 of the upper plate 50a and the lower plate 50e. Further, the braking devices 56 are provided in both end portions of the crossbeams 20 forming the secondary spring receiver A.

[0020] As illustrated in Fig. 4, the lower plate 50e has lighting holes 80. Note that, in this example, the reinforcing plate 51b is provided in the rail direction substantially in parallel to the side plate 51a, and both end portions thereof in the rail direction are welded to a side surface of each crossbeam 20, the upper plate 50a, and the lower plate 50e. The braking device 56 is provided in a range intersecting a surface 51bP (see Fig. 3) obtained by virtually extending the reinforcing plate 51b. A placing base 52 is placed on an upper surface of the upper plate 50, and the secondary spring 210 is provided on the placing base 52.

(3) Effect of this embodiment

[0021] A mass of the car body of the railroad car is supported by the secondary springs 210 provided in the railroad-car bogie 1, and a downward load (mass of car body) that the secondary springs 210 receive is a moment load that acts in a direction in which the secondary spring receivers A provided in the bogie frame 5 are pressed down. This moment load is supported by the two crossbeams 20, the upper plate 50a, and the lower plate 50e forming the box-shaped secondary spring receiver A via the placing base 52.

[0022] Because of this moment load, a tensile load is generated in the railroad tie direction 110 in a joining portion of an upper surface of the secondary spring receiver A and the side beam 10, and the tensile load is

borne by the upper plate 50a. Further, because of this moment load, a compressive load is generated in the railroad tie direction 110 in a joining portion of a lower surface of the secondary spring receiver A and the side beam 10, and the compressive load is borne by the lower plate 50e. Furthermore, the lower plate 50e of the secondary spring receiver A has the lighting holes 80 so that the secondary spring receiver A does not have excessively high rigidity. This prevents a sudden change in rigidity at an abutting portion of the secondary spring receiver A and the side beam 10. The rigidity of the secondary spring receiver A can be adjusted by a thickness of the lower plate 50b, the number of lighting holes 80 and a shape thereof, and the like.

[0023] Therefore, even in a cantilever structure in which the secondary spring receiver A projects from the side beam 10 in the railroad tie direction 110, it is possible to prevent stress from being concentrated in an abutting portion (E portion in Fig. 5) of the upper plate 50a and the side beam 10 and an abutting portion (F portion in Fig. 5) of the lower plate 50e and the side beam 10 and restrain generation of high stress. Further, because generation of high stress can be restrained, a reinforce member is not necessary, and therefore it is possible to promote reduction in weight of the railroad-car bogie 1.

[0024] Furthermore, the braking devices 56 are provided to the crossbeams 20 so as to be included in the extended surface 51bP of the reinforcing plate 51b forming the secondary spring receiver A. Therefore, even in a case where the braking devices 56 grasp the wheels 240 and a moment load acts on the braking devices 56 around axes along the railroad tie direction 110 of the crossbeams 20 and even in a case where a large moment load caused by the braking devices 56 acts, it is possible to restrain generation of high stress because one crossbeam 20 and the other crossbeam 20 are connected by the reinforcing plate 51b, an upper edge of the reinforcing plate 51b is connected to the first upper plate 50a, and a lower edge of the reinforcing plate 51b is connected to the lower plate 50e.

[0025] Furthermore, as illustrated in Fig. 7, the upper plate 50a of the secondary spring receiver A may be divided into a first upper plate 50a and a second upper plate 50b arranged in the railroad tie direction. With this, in a case where an assembly D (see Fig. 7) including the lower plate 50e, the first upper plate 50a, the side plate 51a, and the reinforcing plate 51b is welded to the crossbeams 20 and the side beam 10, it is possible to weld (welded portion 90b) the abutting portion of the lower plate 50e and the side beam 10 also from above in the height direction 120, and therefore it is possible to further increase strength of the joining portion of the lower surface of the secondary spring receiver A and the side beam 10.

[0026] Furthermore, the inside of the secondary spring receiver A (welded portions 90a in Fig. 5 and welded portions 90c in Fig. 6) can be welded by a welding torch inserted through the lighting hole 80 of the lower plate

50e. Therefore, the box-shaped secondary spring receiver A having higher strength can be provided in the bogie frame 5, and thus it is possible to promote reduction in weight without including a reinforcing member.

Reference Signs List

[0027]

10	1 bogie
	5 bogie frame
	10 side beam
	20 crossbeam
	50a ... first upper plate
15	50b ... second upper plate
	50e ... lower plate
	51a side plate
	51b ... reinforcing plate
	52 ... placing base
20	80 opening
	90 weld bead
	210 secondary spring
	230 ... wheel set
	240 wheel
25	250 ... center pin
	100 ... rail direction
	110 railroad tie direction
	120 ... height direction
	A ... secondary spring receiver
30	D assembly

Claims

1. A railroad-car bogie, comprising:

two side beams separately arranged in a rail direction;
two crossbeams separately arranged in a railroad tie direction; and
secondary spring receivers on each of which a secondary spring supporting a car body is placed, wherein:

each of the secondary spring receivers is a box including
end portions in the railroad tie direction of the crossbeams,
a center portion in the rail direction of the side beam,
an upper plate connecting upper portions of the end portions and an upper portion of the center portion,
a lower plate connecting lower portions of the end portions and a lower portion of the center portion, and
a side plate connecting end portions in the railroad tie direction of the upper plate and

the lower plate; and
the lower plate has a lighting hole for adjusting rigidity of the secondary spring receiver.

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2. The railroad-car bogie according to claim 1, wherein the secondary spring receiver includes a reinforcing plate provided substantially in parallel to the side plate and connected to the upper plate, the lower plate, and the crossbeams.

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3. The railroad-car bogie according to claim 1, wherein the upper plate includes a first upper plate and a second upper plate arranged in the railroad tie direction.

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4. The railroad-car bogie according to claim 2, wherein:

a braking device is provided to the end portion in the railroad tie direction of the crossbeam; and
the braking device is provided to the crossbeam at a position intersecting an extended surface of the reinforcing plate.

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FIG.1

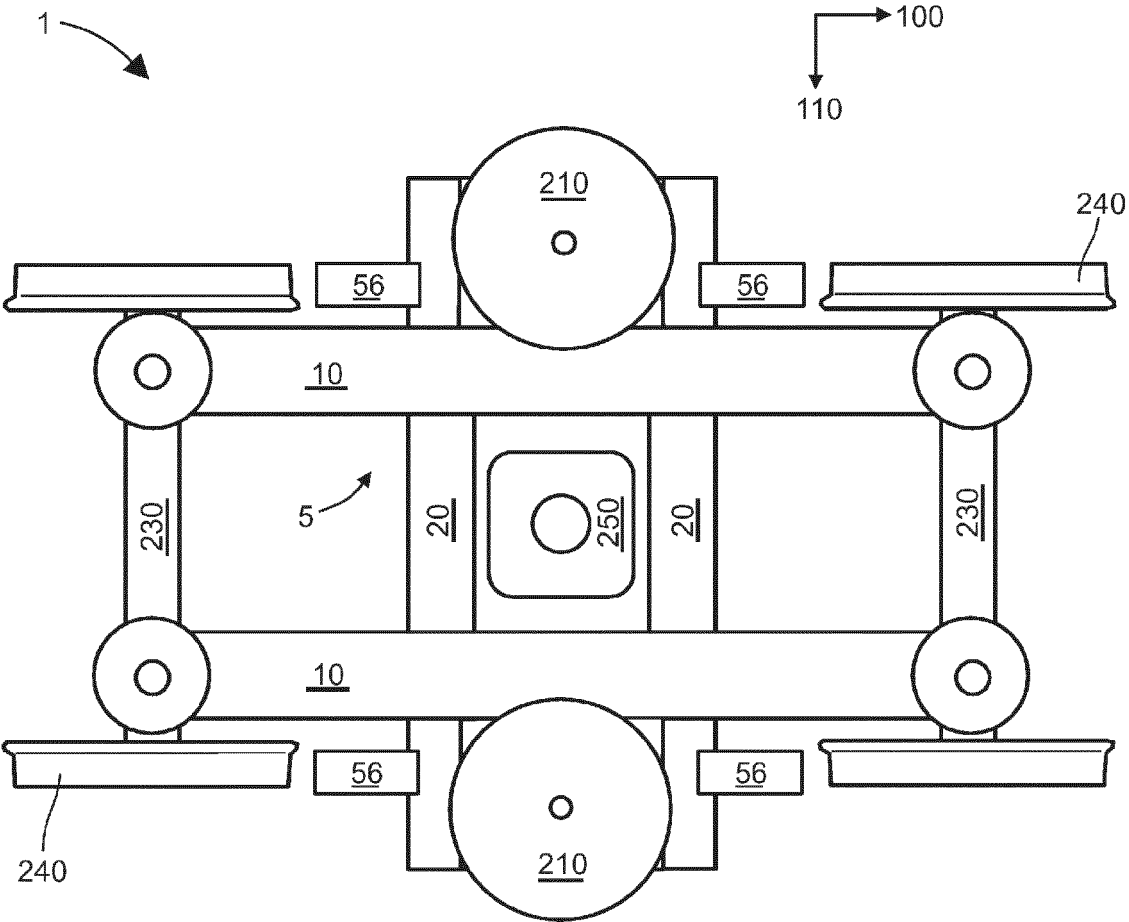


FIG.2

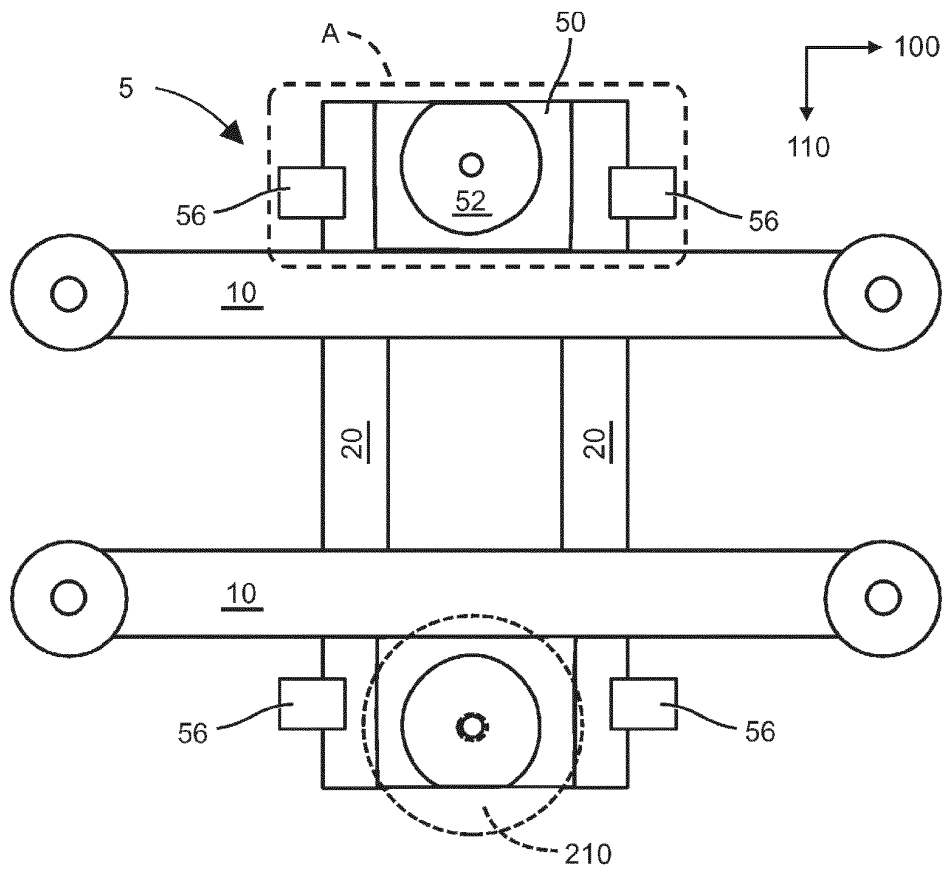


FIG.3

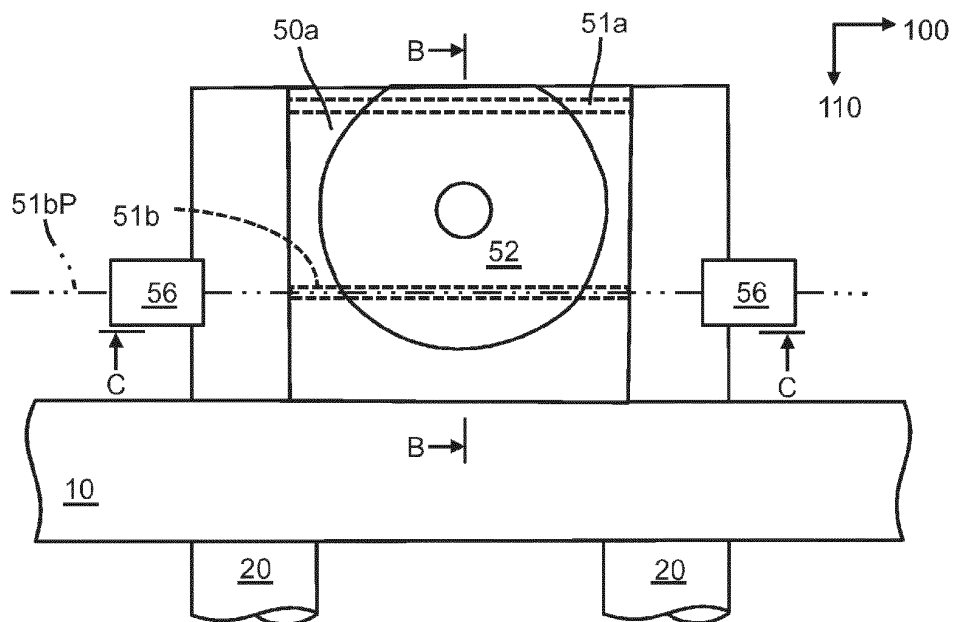


FIG.4

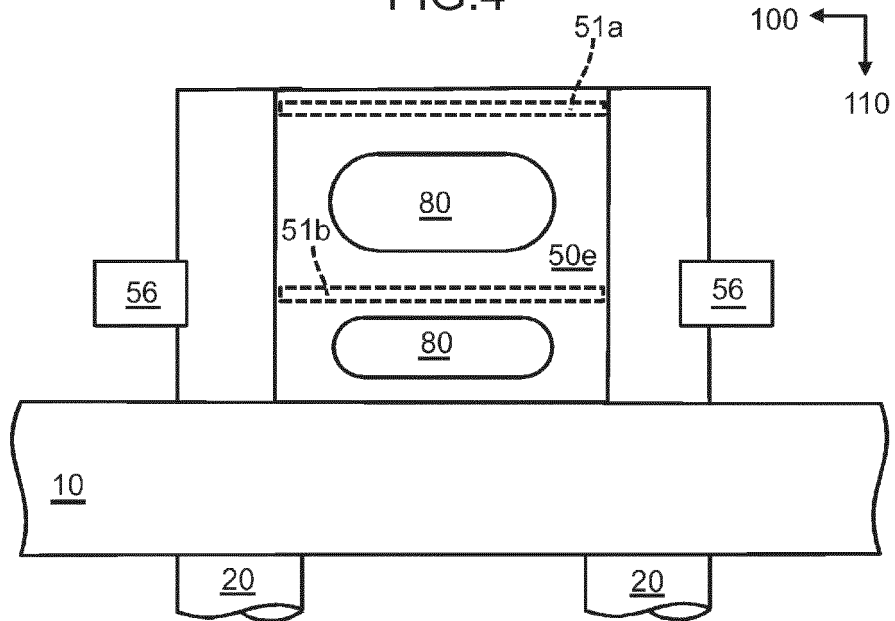


FIG.5

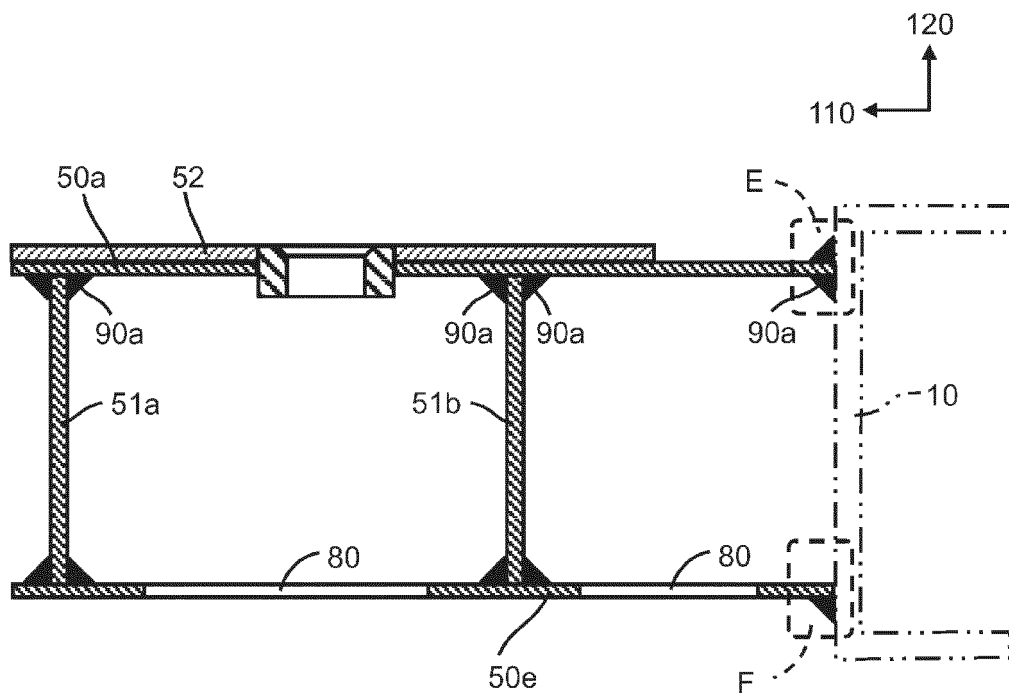


FIG.6

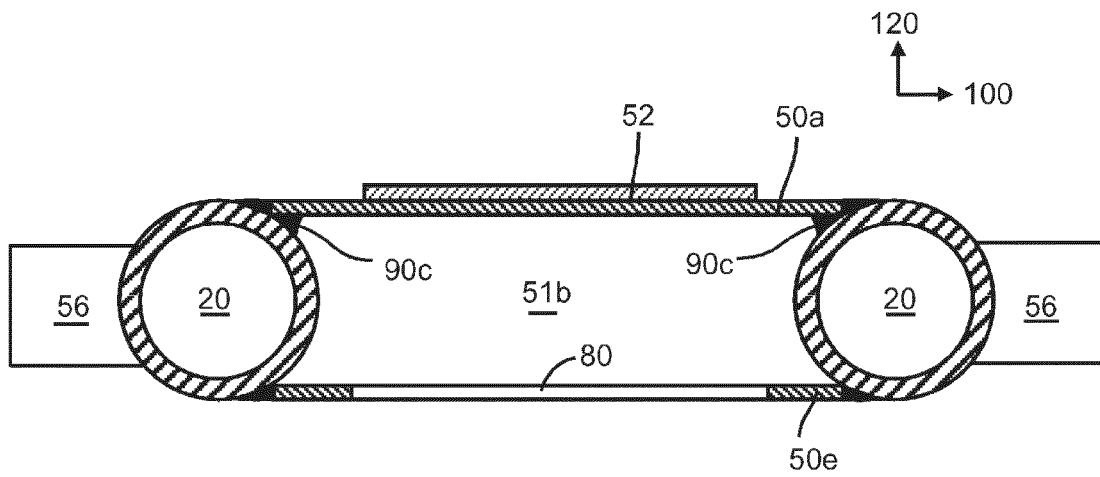
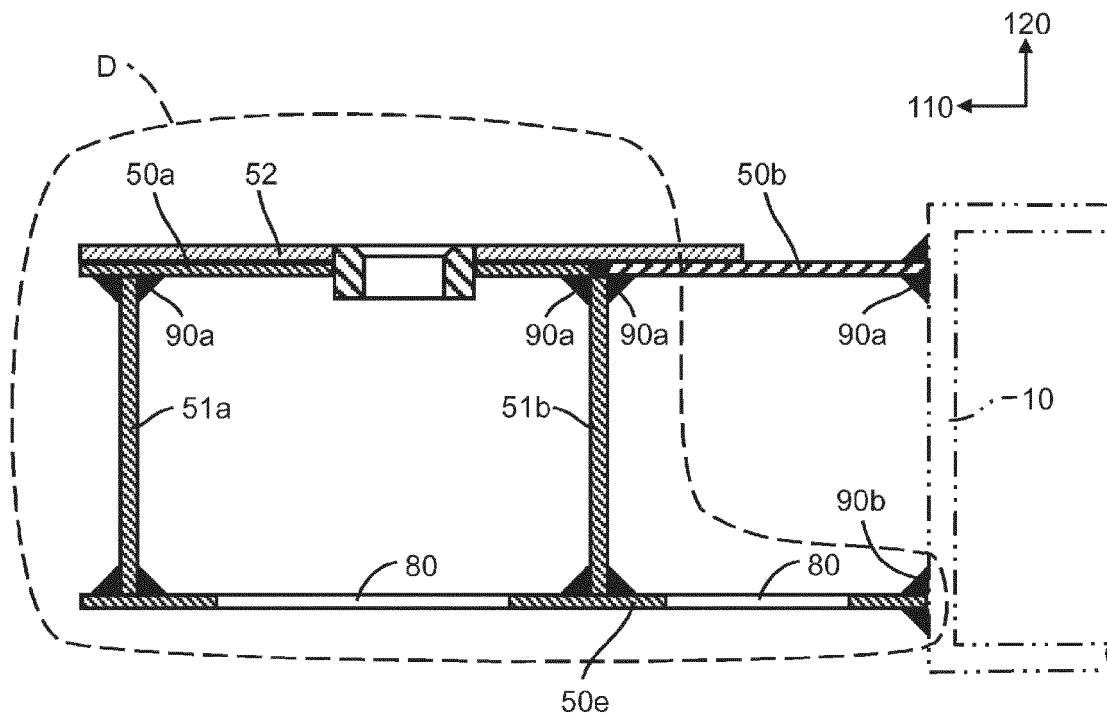


FIG.7



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2015/073216

A. CLASSIFICATION OF SUBJECT MATTER

B61F5/52 (2006.01) i

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)

B61F5/52

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

Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2015
 Kokai Jitsuyo Shinan Koho 1971-2015 Toroku Jitsuyo Shinan Koho 1994-2015

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 2006-15820 A (Sumitomo Metal Industries, Ltd.), 19 January 2006 (19.01.2006), paragraphs [0011] to [0023]; fig. 1 to 6 (Family: none)	1-4
A	JP 2011-57153 A (Nippon Sharyo, Ltd.), 24 March 2011 (24.03.2011), paragraphs [0025] to [0027]; fig. 2 (Family: none)	1
A	JP 57-91838 A (Kawasaki Heavy Industries, Ltd.), 08 June 1982 (08.06.1982), entire text; all drawings (Family: none)	1



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents:

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document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&"

document member of the same patent family

Date of the actual completion of the international search

28 October 2015 (28.10.15)

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10 November 2015 (10.11.15)

Name and mailing address of the ISA/

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Form PCT/ISA/210 (second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2015/073216

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 2010-149808 A (Hitachi, Ltd.), 08 July 2010 (08.07.2010), paragraphs [0011] to [0025]; fig. 1 to 7 & EP 2202127 A2 paragraphs [0016] to [0029]; fig. 1 to 7	1-4
A	JP 2011-255754 A (Railway Technical Research Institute), 22 December 2011 (22.12.2011), paragraphs [0017] to [0035]; fig. 1 to 7 (Family: none)	1-4

Form PCT/ISA/210 (continuation of second sheet) (July 2009)

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2010149808 A [0004]