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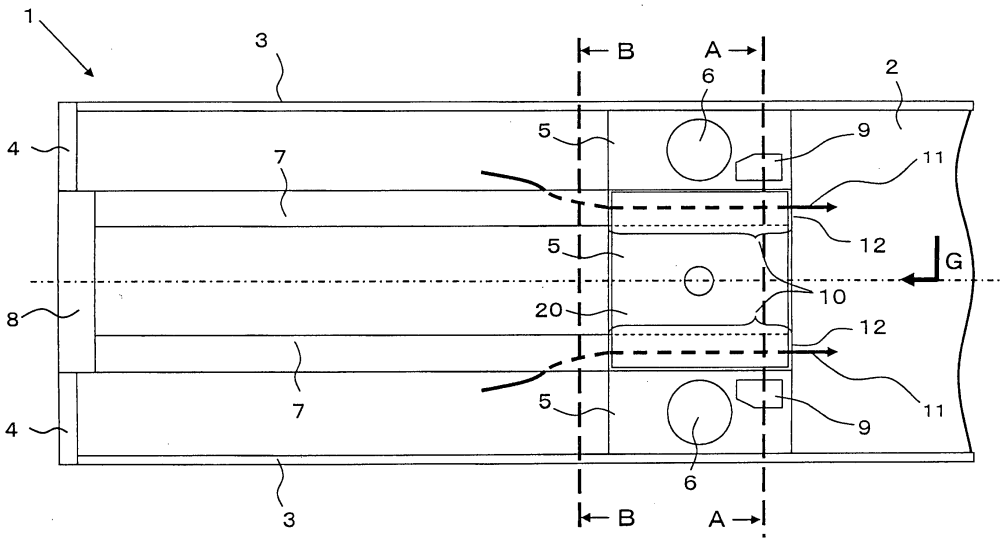
(54) Car body structure

(57) The invention provides a car body structure capable of facilitating the process of laying wires and pipes to penetrate through a body bolster, solving the problem of the prior art car body structure such as the increase of the number of components and manufacturing costs, and ensuring the rigidity and strength of the body bolster efficiently. In an underframe 1, wires and pipes 11 are passed through the inner space of a penetration portion 10 of a centre sill penetrated through a body bolster 5. Further, a bulkhead 13 extending along a diagonal line is formed in the interior of the penetration portion 10. According to this arrangement, there is no need to provide a penetrating pipe dedicated to passing through wires and pipes adopted in prior art body bolsters 5, and the load applied from an antirolling device can be borne by the bulkhead 13, so that the process of laying wires and pipes through the body bolster can be facilitated, the problems of the prior art car body structure caused for example by the increase of the number of components and manufacturing costs can be solved, and the rigidity and strength of the body bolster can be efficiently ensured.

FIG. 1



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Description

BACKGROUND OF THE INVENTION

Field of the invention

[0001] The present invention relates to a car body structure comprising a body bolster and a centre sill intersecting therewith on an underframe, and is especially applicable to such a structure in a railway vehicle. Specifically, the present invention relates to a car body structure having wires and pipes laid under the floor of the car body.

Description of the related art

[0002] Recently, aluminium alloy materials having superior extrusion performance, corrosion resistance and weldability for use in railway vehicles have been developed. Along therewith, themainstreamof railway cars utilize large-sizedmembers formed of aluminium alloy effectively, from viewpoints of weight reduction and rationalized production. Specifically, an underframe constituting a floor portion of the railway vehicle must bear a heavy car-end compressive load, so a car body structure having the underframe formed of hollow aluminium alloy extruded shape members (hereinafter referred to as hollow extruded shape members) having advantageous strength has been proposed. One example of such car body structure is disclosed for example in "Aluminum alloy and lightweight car" (1990, issued by Japan Aluminum Federation) pages 308 and 320 through 368 (non-patent document 1).

[0003] The car body is composed of side structures, end structures, a roof structure and an underframe. The underframe is composed of end sills disposed at both longitudinal car ends, a centre sills connected to the end sills and having couplers for connecting adjacent cars, a body bolster for providing connection with a bogie which is a travelling device of the railway car, a floor capable of having seats and the like arranged thereon, and side sills disposed on both width-direction ends of the car.

[0004] In order to bear the car-end compressive load described above, a car body structure is formed by combining the centre sills and body bolsters provided at both longitudinal car body ends of the underframe so as to have sufficient strength to bear the heavy load acting on the car body via the couplers attached to the centre sill.

[0005] Japanese Utility Model Publication No. 57-56929 (patent document 1) discloses an example of a car body structure in which a centre sill is welded to a lower face plate of a hollow extruded shape member. Further, the present applicant proposes in Japanese patent No. 3624527 (patent document 2) an underframe manufacturing method which enables to efficiently manufacture an underframe composed of a plurality of shape members. Moreover, another example of a car body structure in which a body bolster is welded to a lower surface of the hollow extruded shape member is disclosed on page 308 of the above-mentioned non-patent document 1.

[0006] Conventionally, various equipments such as power systems, control systems and high-pressure air systems are disposed in a crushed state under the floor of railway vehicles. In such state, wires and pipes connected to these equipments are arranged under the floor of the car body, but especially in the area near the bogie, it is difficult to ensure sufficient space for arranging these wires and pipes. Penetration pipes for collectively arranging wires and pipes are efficient means for simplifying the underfloor structure. Currently, penetration pipes are disposed in body bolsters to enable wires and pipes to be laid therethrough, but such arrangement lacks to consider any solution to drawbacks such as the deterioration of strength of the body bolsters and increase in the number of components.

[0007] FIGS. 14 through 16 illustrate one example of a prior art car body structure. FIG. 14 is a bottom view of a prior art car body structure, and FIGS. 15 and 16 are cross-sectional views taken at E-E and F-F of the car body structure of FIG. 14. The illustrated car body structure has two centre sills 7 and 7 arranged side by side in the width direction of the car body. In an underframe 1, reference 2 denotes the floor, reference 3 denotes side sills, reference 4 denotes end sills, reference 5 denotes body bolder, reference 6 denotes air spring supports, reference 8 denotes coupler supports, and reference 9 denotes antirolling device supports. A centre pin support 20 is disposed on the lower surface of the body bolster 5. An antirolling device is a device for suppressing the rolling vibration of the car body, which is attached between the car body and the bogie. On the lower surface of the floor 2 of the underframe 1 are arranged wires and pipes 11 extending in the longitudinal direction of the car body connecting the ends of the car body and the centre of the car body, and the wires and pipes 11 must be passed through the body bolster 5 extending in the width direction of the car body so as not to take up much space in the height direction of the car body by being arranged in a straight line. The wires and pipes 11 are arranged to pass through penetration pipes 15 disposed independently in the body bolster 5. Especially, the body bolster 5 having antirolling device supports 9 receiving large load from the antirolling device must have high rigidity and high strength. According to the above reason, it is not preferable to form openings on the body bolster 5, but by disposing penetration pipes 15, the rigidity and strength of the body bolster 5 is deteriorated. The rigidity of the body bolster 5 is further deteriorated as the number of penetration pipes 15 increases, and the strength of the body bolster 5 is deteriorated greatly as the position of penetration pipes 15 becomes closer to the antirolling device supports 9. Various reinforcement members must be disposed to ensure the rigidity and strength of the body bolster 5 to compensate for the deterioration of rigidity and strength of the body bolster 5 by disposing

penetration pipes 15, which increases the number of components, complicates the underfloor structure, takes up much underfloor height and raises the manufacturing costs of the car body.

SUMMARY OF THE INVENTION

[0008] The object of the present invention is to provide a car body structure having various equipments and wires or pipes connected thereto arranged under the floor of a car body, capable of solving the problem of the prior art car body structure such as the increase in the number of components and increase of manufacturing costs of the car body, and facilitating the laying process of wires and pipes through the body bolster without deteriorating the rigidity of the body bolster, and thereby effectively ensuring the rigidity and strength of the body bolster.

[0009] In order to solve the problems of the prior art, the car body structure according to the present invention comprises a body bolster disposed on an underframe in a width-direction of the car body, and a centre sill intersecting with the body bolster and extending in a longitudinal direction of the car body toward a car end side of the car body, wherein the centre sill has an intersection portion that intersects with the body bolster by penetrating the body bolster from the car end side to the centre side of the car body, and the intersection portion of the centre sill is composed of a square pipe member having a bulkhead that extends along a diagonal line within a cross-section orthogonal to the longitudinal direction of the centre sill.

[0010] The car body structure according to the present invention comprises an intersection portion in which the centre sill penetrates through and intersects with the body bolster, and the inner space of the intersection portion is used as a penetration portion through which wires and pipes are laid. According to the present arrangement, there is no need to provide conventional penetrating pipes dedicated to passing through wires and pipes, and since the load acting on antirolling device supports is borne by the bulkhead extending along a diagonal line within the interior of the centre sill, there is no need to provide reinforcement members for ensuring the rigidity and strength of the body bolster or to increase the plate thickness of the centre sill.

[0011] According to the car body structure of the present invention having an intersection portion in which the centre sill penetrates through and intersects with the body bolster, the inner space of the intersection portion being used as a penetration portion through which wires and pipes are laid, there is no need to provide conventional penetrating pipes dedicated to passing through wires and pipes, and since the load acting on antirolling device supports is borne by the bulkhead extended along a diagonal line within the interior of the centre sill, there is no need to provide reinforcement members for ensuring the rigidity and strength of the body bolster or to increase the plate thickness of the centre sill. Therefore, the present invention enables to facilitate the process of laying wires and pipes through the body bolster and to overcome the drawbacks of the prior art car body structure such as the increase in the number of components and increase of manufacturing costs, and to ensure the rigidity and strength of the body bolster effectively.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012]

FIG. 1 is a bottom view showing one preferred embodiment of a car body structure according to the present invention;
FIG. 2 is a cross-sectional view taken at A-A of the car body structure illustrated in FIG. 1;
FIG. 3 is a cross-sectional view taken at B-B of the car body structure illustrated in FIG. 1;
FIG. 4 is a cross-sectional view taken at A-A of an underframe of a car body structure not according to the present invention;
FIG. 5 is a deformation diagram (view G) of the car body structure illustrated in FIG. 4;
FIG. 6 is a deformation diagram (view G) of the car body structure illustrated in FIG. 2;
FIG. 7 is a cross-sectional view taken at A-A showing another embodiment of a car body structure according to the present invention;
FIG. 8 is a cross-sectional view taken at A-A showing another embodiment of a car body structure according to the present invention;
FIG. 9 is a bottom view showing another embodiment of a car body structure according to the present invention;
FIG. 10 is a cross-sectional view taken at C-C of the car body structure illustrated in FIG. 9;
FIG. 11 is a cross-sectional view taken at D-D of the car body structure illustrated in FIG. 9;
FIG. 12 is a cross-sectional view taken at A-A showing yet another embodiment of the car body structure according to the present invention;
FIG. 13 is a cross-sectional view taken at B-B showing yet another embodiment of the car body structure according to the present invention;
FIG. 14 is a bottom view of an underframe according to a prior art car body structure;
FIG. 15 is a cross-sectional view taken at E-E of the car body structure illustrated in FIG. 14; and
FIG. 16 is a cross-sectional view taken at F-F of the car body structure illustrated in FIG. 14.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0013] Now, the preferred embodiments of a car body structure according to the present invention will be described with reference to the accompanying drawings. FIG. 1 is a bottom view showing one preferred embodi-

ment of a car body structure according to the present invention (viewing a bottom side of the car body from the side where the bogie is disposed), FIG. 2 is an A-A cross-section of the car body structure shown in FIG. 1, and FIG. 3 is a B-B cross-section of the car body structure shown in FIG. 1. The car body structure illustrated in FIGS. 1 through 3 includes two centre sills, similar to the car body structure illustrated in FIGS. 14 through 16. FIG. 1 illustrates a car body structure in a partial view showing one longitudinal end of the car body.

[0014] In the car body structure illustrated in FIGS. 1 through 3, the underframe 1 is composed of a floor 2 formed by arranging a plurality of members side by side and welding them together in a flat plane, side sills 3 attached to both width-direction ends of the floor 2 of the car body, end sills 4 attached to both longitudinal car ends of the floor 2, and body bolsters 5 and centre sills 7 disposed on the lower surface of the floor 2. Although not shown in detail, the floor 2 is formed by arranging a plurality of members formed of hollow extruded shape members so that their longitudinal direction corresponds to the longitudinal direction of the car body, and welding the width-direction ends of the adjacent members together.

Normally, the floor 2 is joined together by welding upper and lower surfaces, or both surfaces, of adjacent members. Side sills 3 and 3 are arranged on both width-direction ends of the car body of the floor 2 along the longitudinal direction of the car body. The side sills 3 are hollow extruded shape members, and as shown in FIGS. 2 and 3, the perpendicular dimension thereof is greater than that of the floor 2. The end sills 4 are arranged so that their longitudinal directions correspond to the width-direction of ongitudinal car ends of the floor 2.

[0015] The body bolster 5 is disposed toward the centre in the longitudinal direction of the car body at a predetermined distance from the end sill 4 on the lower surface of the floor 2. The body bolster 5 is disposed at a position in which the car body is supported via the bogie, and extends to cover the whole length in the width direction of the car body between side sills 3 and 3. The body bolster 5 has a predetermined width in the longitudinal direction of the car body, and at both ends thereof are disposed air spring supports 6 and 6. The weight of the car body is supported by the bogie via air springs (not shown) provided on the bogie at positions of the air spring supports 6 and 6 disposed on the body bolster 5 placed on the lower surface of the floor 2.

[0016] Two centre sills 7 and 7 are provided between the end sill 4 and the body bolster 5 in a symmetric arrangement with respect to the centre line in the width direction of the car body so as to extend along the longitudinal direction of the car body. A coupler support 8 is disposed at the longitudinal car endportion of the centre sills 7 and 7 to which is attached a coupler (not shown) for connecting adjacent cars together. The ends of the centre sills 7 and 7 at the longitudinal centre side of the car body are intersected with and connected to the body bolster 5. The body bolster 5 has antirolling device supports 9 and 9 for fixing an antirolling device (not shown) for suppressing the rolling vibration of the car body disposed near the air spring supports 6 and 6, which in the present example is in the space near the longitudinal car centre-side of the air spring supports 6 and 6. The car end compressive load received via the coupler is transmitted via centre sills 7 and 7 supporting the coupler support 8 to the floor 2 and the body bolster 5 connected to the centre sills 7 and 7.

[0017] According to the present embodiment, the centre sills 7 pass through and intersects with the body bolster 5, forming a penetration portion 10 at the intersecting portion with the body bolster 5. As shown in FIG. 2, the centre sills 7 at the penetration portion 10 is formed of a hollow extruded shape member having a rectangular cross-section and having formed integrally in the interior thereof a bulkhead 13 extended diagonally in the cross-section orthogonal to the longitudinal direction. The bulkhead 13 is disposed diagonally from the corner portion 7a of the centre sill 7 close to the centre of car width adjacent to the floor 2 to a corner portion 7b close to the end of car width on the opposite side thereof. In other words, the inner space of the penetration portion 10 at the intersection point between the centre sills 7 and the body bolster 5 constitutes a space that communicates the longitudinal car-end side and the longitudinal car-centre side of the body bolster 5. Then, by connecting the plurality of separated body bolsters 5 and the centre sills 7 and 7, the body bolster can be formed to extend across the whole length in the width direction of the car body. According to this structure, the lines and pipes 11 extending in the longitudinal direction of the car body are arranged in the hollow interior space of the centre sill 7 including the penetration portion 10. The side of the longitudinal car-centre portion of the penetration portion 10 is opened as an open end 12.

[0018] The upper surfaces of the body bolster 5 and the centre sills 7 are attached to the lower surface of the floor 2, and the corner portions 7a and 7a' of the centre sills 7 arranged on the floor 2 are attached close to the intersection point of the surface plate 2a and the ribs 2b of the hollow extruded shape member. In order to provide a centre pin support 20 disposed across both lower surfaces of the body bolster 5 and the centre sills 7, the thickness (dimension corresponding to the height direction of the car body) of the body bolster 5 and the thickness (dimension corresponding to the height direction of the car body) of the centre sills 7 are set equal to constitute a flat plane. The above-illustrated arrangement in which the centre sills 7 are penetrated through the body bolster 5 includes a state in which the body bolster 5 is formed to extend across the whole length of the car body in the width direction by connecting centre sills 7 and a body bolster 5 having substantially the same thickness so as to form a body bolster having a continuous plane covering both the centre sills 7 and the body bolster 5 regardless of the perpendicular cross-sectional shape in

the longitudinal direction of the centre sills 7 or the number thereof. According to the present embodiment, each centre sill 7 excluding the penetration portion 10 has a U-shaped cross-section in which the centre sill 7 of the penetration portion 10 is extended with one side wall and the bulkhead 13 removed therefrom. However, it is possible to attach another member having a U-shaped cross-section, a partially opened hollow cross-section or an I-shaped cross-section to the centre sills 7 at the penetration portion 10. Further, even if the thickness of the centre sills 7 (dimension in the car height direction) is smaller than the thickness of the body bolster 5 (dimension in the car height direction), it becomes possible to form a penetration portion capable of passing through wires and pipes 11 in the interior of the centre sills 7 by adopting the above arrangement to the intersection point between the centre sills 7 and the body bolster 5 as described above.

[0019] According to this arrangement, there is no need to provide penetrating pipes dedicated to passing through wires and pipes in the body bolster 5, so that the number of components and the manufacturing costs can be cut down. Furthermore, since the bulkhead 13 disposed diagonally in the interior of the centre sills 7 in the penetration portion 10 bears the load acting on the antirolling device supports 9, there is no need to dispose reinforcement members for ensuring the rigidity and strength of the body bolster 5 or to increase the thickness of the centre sills 7, according to which the rigidity and strength of the body bolster 5 can be ensured effectively. The principles of the above arrangement are described as follows.

[0020] FIG. 4 shows a cross-sectional view taken at A-A of a car body structure according to FIG. 1 in which no bulkhead 13 is disposed in the interior of the centre sills 7 at the penetration portion 10, and FIG. 5 shows a deformed diagram (view G in FIG. 1) in which a load 14 from the antirolling device acts on the car body structure shown in FIG. 4. The corner portions 7a' and 7a' of the centre sills 7 attached to the floor 2are joined close to the intersection point of the face plate 2a and ribs 2b of the hollow extruded shape member constituting the floor 2. In order to suppress vibration when rolling vibration of the car body occurs, a load acting toward the upper direction is applied on one antirolling device support 9 and a load acting toward the lower direction is applied on the other antirolling device support 9. In other words, a shear load in the thickness direction (car height direction) is applied on floor 2, the body bolster 5, and the centre sills 7 at the penetration portions 10. At this time, the centre sills 7 at the position of the penetration portions 10 having a continuous hollow space in the longitudinal direction of the car body cannot support the shear load sufficiently and deform greatly via shear deformation, by which the strength of the body bolster 5 disposed near the centre sills is challenged. In order to overcome this problem, it is necessary to dispose reinforcement members or to increase the plate thickness of centre sills 7 at the penetration portions 10, leading to the increase in the number of components and increase of manufacturing costs. On the other hand, FIG. 6 shows a deformation diagram in which the load 14 from the antirolling device is applied on the car body structure illustrated in FIG. 2. The bulkhead 13 arranged at an angle close to 45 degrees which is a principal stress direction with respect to the shear load in the thickness direction (car height direction) efficiently suppresses the shear deformation of the centre sills 7 at the penetration portion 10. Further, since the area close to the antirolling device supports 9 and the area close to the intersection point between the face plate 2a and the ribs 2b of the hollow extruded shape member of the floor 2 are connected via bulkheads 13, the load 14 from the antirolling device can be transmitted smoothly to the floor 2. In other words, the rigidity and strength of the body bolster 5 can be ensured effectively.

[0021] Furthermore, as shown in FIG. 3, the centre sills 7 at the area close to the longitudinal car-end side of the body bolster 5 has a U-shaped cross-section, and the wires and pipes 11 extended along the centre sills 7 are drawn into the centre sills from the opened side of the U-shaped cross-section, passed through the interior of the centre sills 7 at the penetration portions 10, and extended from the open end 12 (refer to FIG. 1) at the longitudinal car-centre side of the penetration portion 10 to the longitudinal car-centre side of the underframe 1. In other words, the wires and pipes 11 are passed through the interior of the centre sills 7 at the penetration portion 10 and extended from the longitudinal car-end side of the body bolster 5 to the longitudinal car-centre side thereof.

[0022] FIGS. 7 and 8 are views showing other embodiments of a car body structure according to the present invention, which are A-A cross-sections of the car body structure of FIG. 1. The embodiment illustrated in FIG. 7 has the bulkheads 13 of the centre sills 7 at the penetration portions 10 disposed along a diagonal line opposite to that of the embodiment shown in FIG. 2, and the embodiment illustrated in FIG. 8 has the bulkheads 13 of the centre sills 7 at the penetration portions 10 extend along both diagonal lines. Both embodiments have similar effects as the embodiment illustrated in FIG. 2.

[0023] FIGS. 9 through 11 illustrate a car body structure in which a single centre sill is disposed at the centre in the width direction of the car body. FIG. 9 is a bottom view of the car body structure having a single centre sill disposed at the centre in the width direction of the car body, and FIGS. 10 and 11 are cross-sectional views taken at C-C and D-D of the car body structure shown in FIG. 9. The car body structure illustrated in FIGS. 9 through 11 adopts the same structure as the car body structure illustrated in FIGS. 1 through 3 except for the structure of the centre sill and the body bolster regarding the centre sill, so the explanations on the components equivalent to those in the car body structure of FIGS. 1 through 3 are omitted.

[0024] The underframe 1 illustrated in FIGS. 9 through 11 has a single centre sill 7 intersecting with a body bol-

ster 5 at the centre in the width direction of the car body. The centre sill 7 penetrates the body bolster 5, and a penetration portion 10 is formed at the intersection between the centre sill 7 and the body bolster 5. The centre sill 7 at the penetration portion 10 is formed of a hollow extruded shape member having a hollow rectangular cross-section having formed integrally in the interior thereof a bulkhead 13 extended from corner 7a to corner 7b along a diagonal line in a cross-section orthogonal to the longitudinal direction of the centre sill. In other words, the inner space of the penetration portion 10 at the intersection between the centre sill 7 and the body bolster 5 constitutes a space communicating the longitudinal car end side and the longitudinal car centre side of the body bolster 5. The centre sill 7 is welded to the body bolster 5 at the penetration portion 10. The wires and pipes 11 disposed to extend in the longitudinal direction of the car body are passed through the hollow inner space of the centre sill 7 including the penetration portion 10. The upper surfaces of the body bolster 5 and the centre sill 7 are attached to a lower surface of the floor 2, and the corner portions 7a and 7a' of the centre sill 7 adjacent to the floor 2 are attached close to the intersection points of the face plate 2a and the ribs 2b of the hollow extruded shape member constituting the floor 2.

[0025] As illustrated in FIG. 11, the centre sill 7 disposed near the longitudinal car end side of the body bolster 5 has openings formed on both sides thereof, through which the wires and pipes 11 arranged on the outer side of the centre sill 7 enters and passes through the interior of the centre sill 7 at the penetration portion 10, and extends through the opening end 12 at the longitudinal car-centre side of the penetration portion 10 (refer to FIG. 9) toward the longitudinal car-centre side of the underframe 1. In other words, the wires and pipes 11 are passed through the inner side of the penetration portion 10 of the centre sill 7 to extend from the longitudinal car-end side of the body bolster 5 to the longitudinal car-centre side thereof. Further according to the embodiment illustrated in FIGS. 9 through 11, the bulkhead 13 is disposed only along one diagonal line, but as shown in FIGS. 7 and 8 of the former embodiment, the bulkhead 13 can be disposed along the other diagonal line or along both diagonal lines.

[0026] FIGS. 12 and 13 illustrate yet another embodiment of the car body structure according to the present invention, which are cross-sections taken at A-A and B-B of FIG. 1. The underframe 1 illustrated in FIGS. 12 and 13 have the upper surfaces of the centre sills 7 and the body bolster 5 disposed to constitute the same plane as the face plate 2c of the floor 2, according to which the floor portion of the railway car is composed of the centre sills 7, the body bolster 5 and the floor 2. The car body structure excluding the above arrangement is the same as the car body structure of the embodiment illustrated in FIGS. 1 through 3, so the detailed descriptions of the components equivalent to the car body structure illustrated in FIGS. 1 through 3 are omitted.

[0027] The corner portions 7a and 7a' of the centre sills 7 at the car width-direction centre side of the floor 2 are welded to the face plate 2c of the floor 2, by which the floor portion is formed. The upper surface of the body bolster 5 at the longitudinal car-end side thereof is also welded to the face plate 2c of the floor 2, by which the floor portion is formed. Thereby, as illustrated in FIG. 12, the whole cross-section perpendicular to the longitudinal direction at the intersection of the centre sills 7 are formed as penetration portions 10, having wires and pipes 11 disposed in the interior thereof.

[0028] Further, as shown in FIG. 13, the centre sills 7 at the position near the longitudinal car-end side of the body bolster 5 has a U-shaped cross-section. The wires and pipes 11 disposed to extend along the centre sills 7 are drawn into the interior of the centre sills 7 through clearances 7c formed between the open surface of the U-shaped cross-section of the centre sills 7 and the floor 2 close to the body bolster 5, passes through the interior of the centre sills 7 at the penetration portions 10, and extends through the open ends 12 at the longitudinal car-centre side of the penetration portions 10 (refer to FIG. 1) toward the longitudinal car-centre side of the underframe 1. In other words, the wires and pipes 11 are passed through the inner side of the penetration portions 10 of the centre sills 7 to extend from the longitudinal car-end side of the body bolster 5 to the longitudinal car-centre side thereof.

[0029] According to the present arrangement, there is no need to provide penetrating pipes dedicated to passing wires and pipes through the body bolster 5, so that the number of components and the manufacturing costs can be cut down. Furthermore, since the bulkhead 13 extending diagonally in the interior of the centre sills 7 in the penetration portion 10 bears the load acting on the antirolling device supports 9, there is no need to dispose reinforcement members for ensuring the rigidity and strength of the body bolster 5 or to increase the thickness of the centre sills 7, and the rigidity and strength of the body bolster 5 can be ensured efficiently. In addition, the thickness of the underframe 1 can be advantageously reduced. Further, if the thickness of the underframe 1 is equivalent to that of the car body structure illustrated in FIG. 1, the space within the centre sills 7 at the position of the penetration portions 10 can be widened in correspondence to the thickness of the underframe 2, and the amount of wires and pipes 11 passed through the centre sills 7 at the penetration portions 10 can be increased correspondingly.

[0030] If the height of the platform is small, the floor height of the railway car must also be lowered. In a car having a low floor height, the thickness of the body bolster (the dimension in the height direction of the car body) tends to be small. Not a sufficient amount of wires and pipes can be disposed by providing a penetrating pipe to the body bolster extending in the longitudinal direction of the car body, but according to the present invention, a sufficient amount of wires and pipes can be disposed

through centre sills having sufficient cross-sectional spaces. More wires and pipes can be disposed by using both penetrating pipes and penetration portions in the centre sills.

[0031] The technical range of the present invention is not restricted to the terms used in the claims or the terms appearing in the summary of the present application, but covers the range conceivable to those in the field of art.

Claims

1. A car body structure having a body bolster disposed on an underframe in a width-direction of the car body, and a centre sill intersecting with the body bolster and extending in a longitudinal direction of the car body toward an end side of the car body; wherein
the centre sill has an intersection portion that intersects with the body bolster by penetrating through the body bolster from the car end side to the car centre side of the body bolster; and
the intersection portion of the centre sill is formed of a square pipe member having a bulkhead that extends along a diagonal line within a cross-section orthogonal to the longitudinal direction of the centre sill.

2. The car body structure according to claim 1, wherein the bulkhead is disposed diagonally to one lower side corner in the perpendicular direction of the square pipe member from either one of an upper side corner closer to a centre of width of the car body or an upper side corner closer to an end of width of the car body in the perpendicular direction of the square pipe member.

3. The car body structure according to claim 1, wherein the bulkhead is disposed from both perpendicular upper side corners in the width direction of the car body diagonally to both perpendicular lower side corners in the width direction of the car body.

4. The car body structure according to any one of claims 1 through 3, wherein
wires and pipes are passed through the inner side of the square pipe member.

5. The car body structure according to claim 4, wherein an opening is formed at a portion of the centre sill not intersecting with the body bolster on any one of the sides of the centre sill excluding the side facing the perpendicular upper direction.

6. The car body structure according to claim 5, wherein wires and pipes are drawn into the interior of the square pipe member through said opening.

7. The car body structure according to claim 6, wherein the portion of the centre sill not intersecting with the body bolster is formed by processing the square pipe member.

8. The car body structure according to any one of claims 1 through 3, wherein
two centre sills are arranged side by side in the width direction of the car body.

9. The car body structure according to any one of claims 1 through 3, wherein
a single centre sill is arranged at a centre in the width direction of the car body.

10. The car body structure according to any one of claims 1 through 3, wherein
the body bolster is divided by the centre sill, and the body bolster is formed to extend across the whole width-direction length of the car body by joining the divided body bolsters and the centre sill together.

11. The car body structure according to any one of claims 1 through 3, wherein
the underframe floor is formed of a hollow extruded shape member composed of two face plates and a plurality of ribs connecting the face plates; and
the floor-side corner portion of the square pipe member disposed perpendicularly below the floor is positioned near an intersection point between the face plate and the ribs.

12. The car body structure according to any one of claims 1 through 3, wherein
upper surfaces of the centre sill and the body bolster are arranged to be level with the face plate of the underframe floor, and constitute a portion of the underframe floor.

13. The car body structure according to claim 11, wherein
a corner portion in the car width-direction of the centre sill and a longitudinal car-end portion of the body bolster are welded to the face plate of the underframe floor.

14. The car body structure according to any one of claims 1 through 3, wherein
air spring supports and antirolling device supports are disposed at both car width-direction ends of the body bolster.

FIG. 1

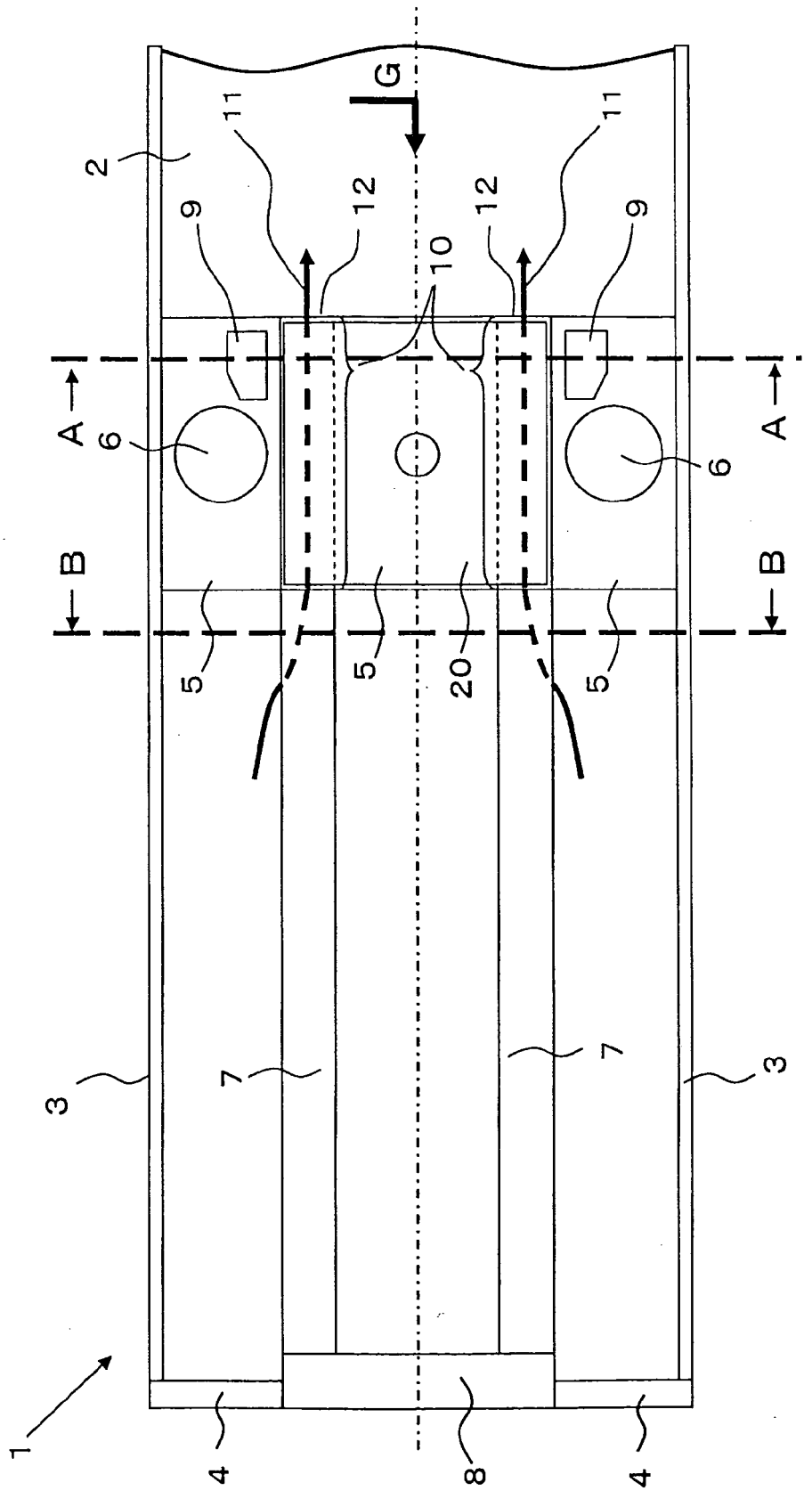


FIG. 2

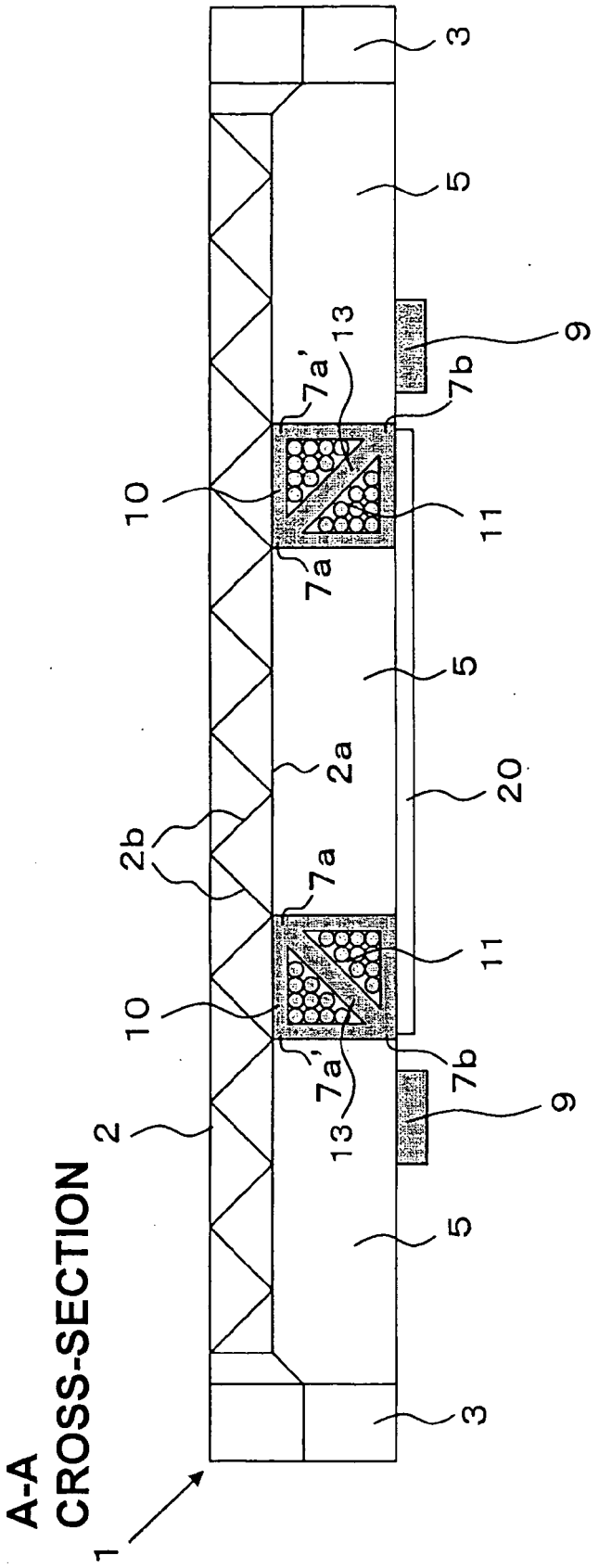


FIG. 3

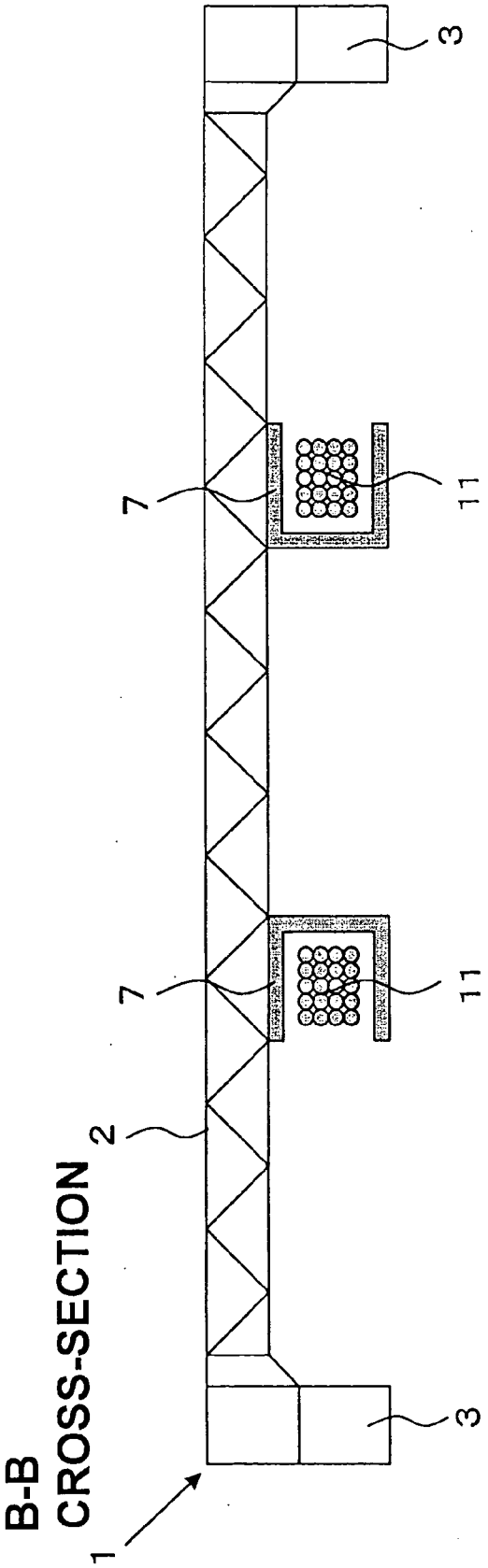


FIG. 4

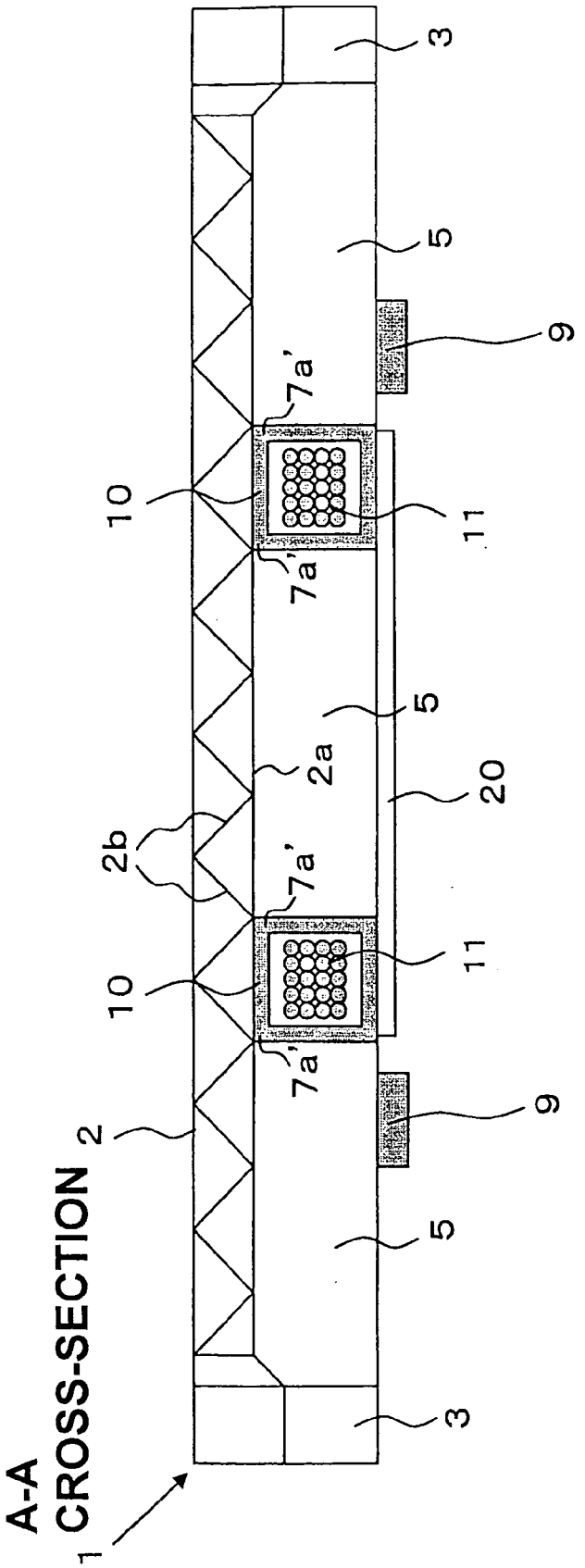


FIG. 5

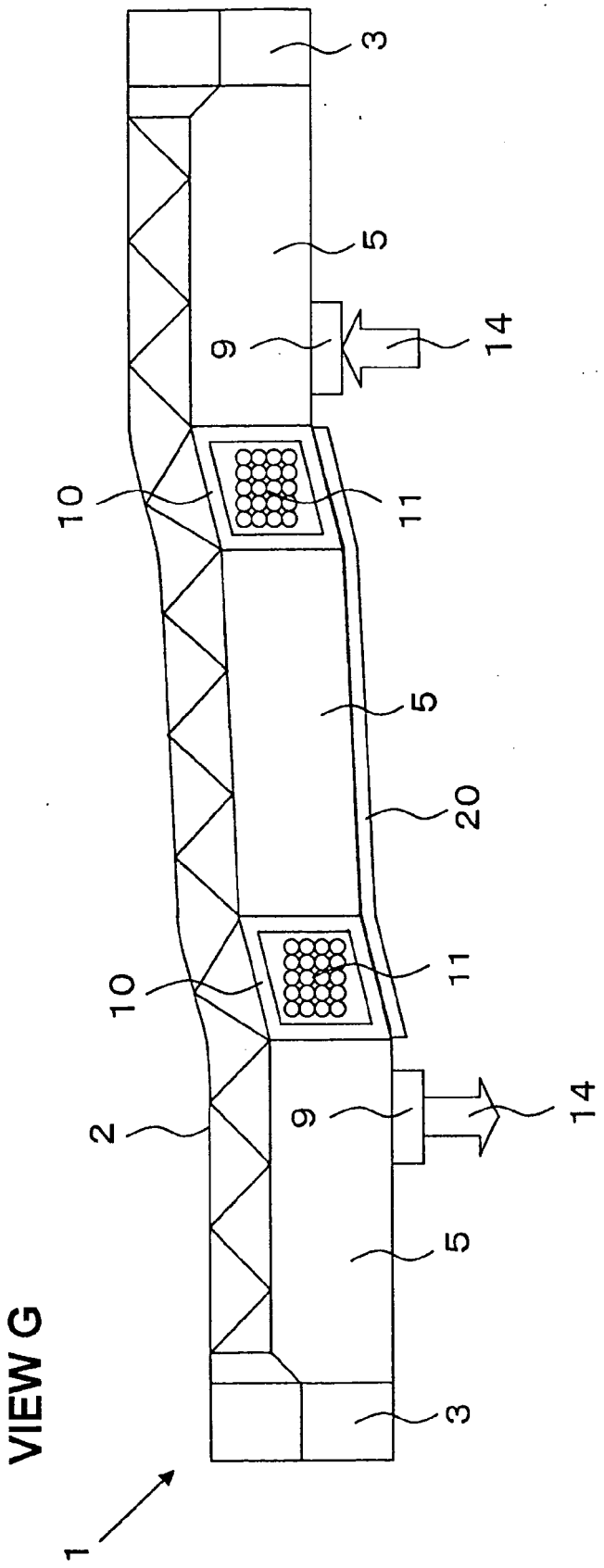


FIG. 6

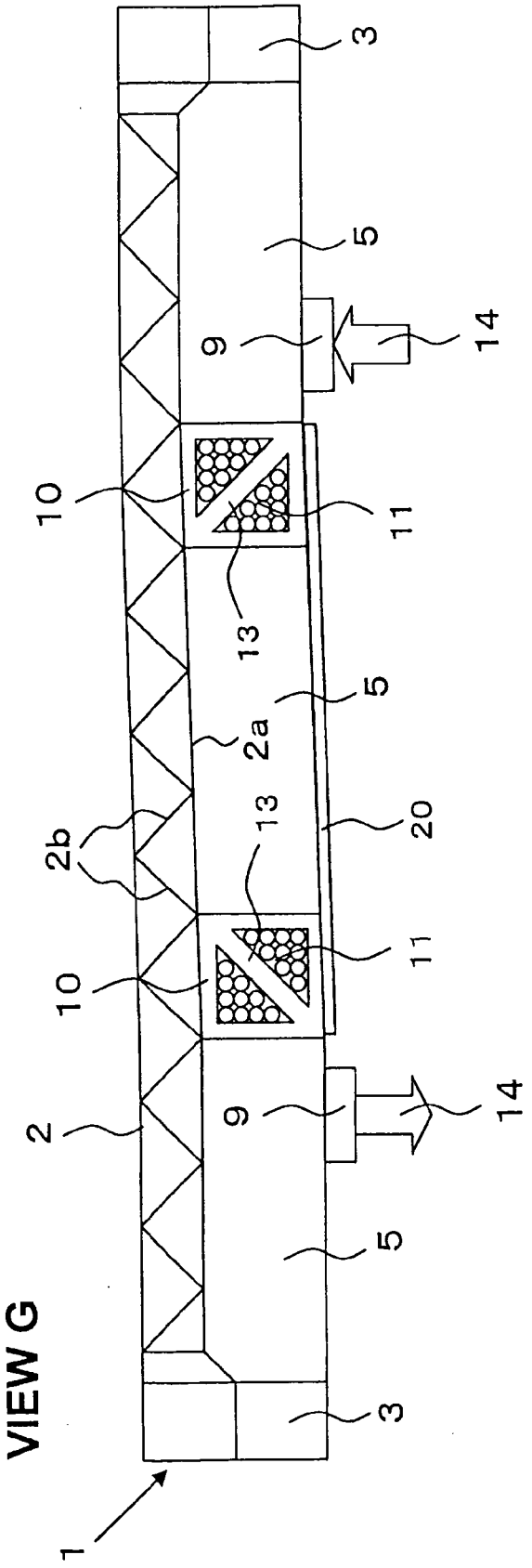


FIG. 7

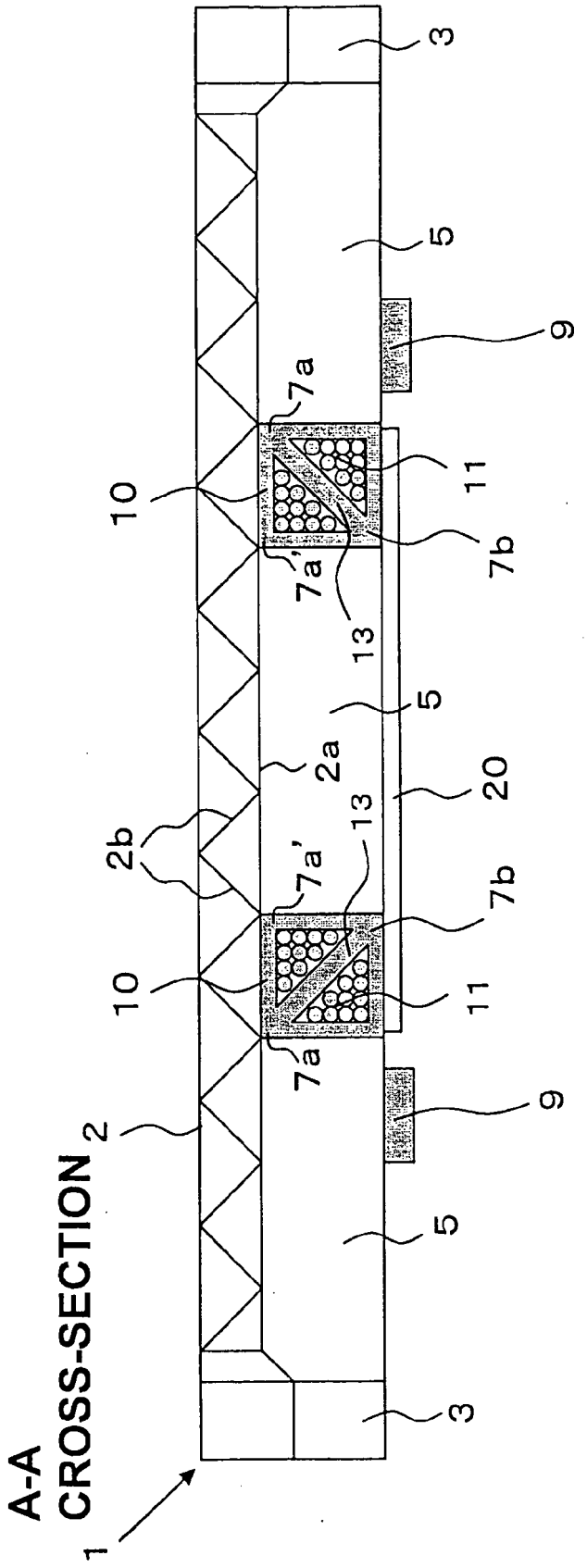


FIG. 8

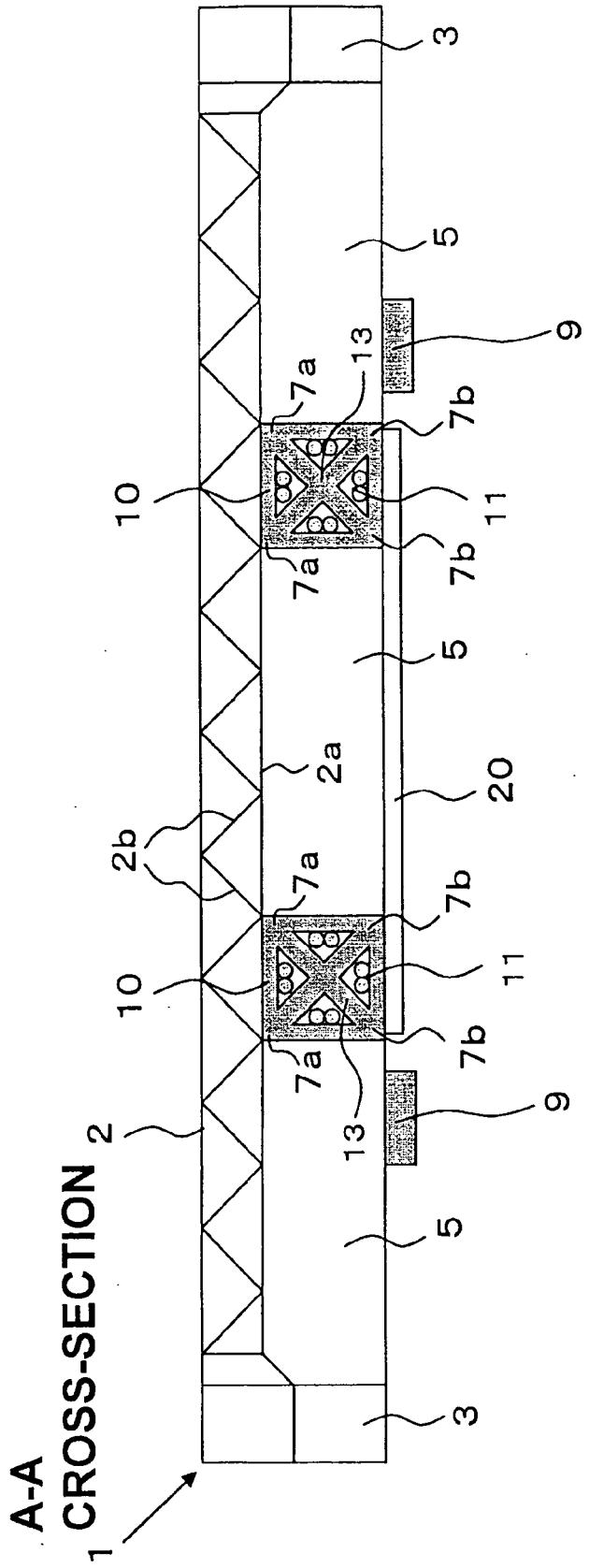


FIG. 9

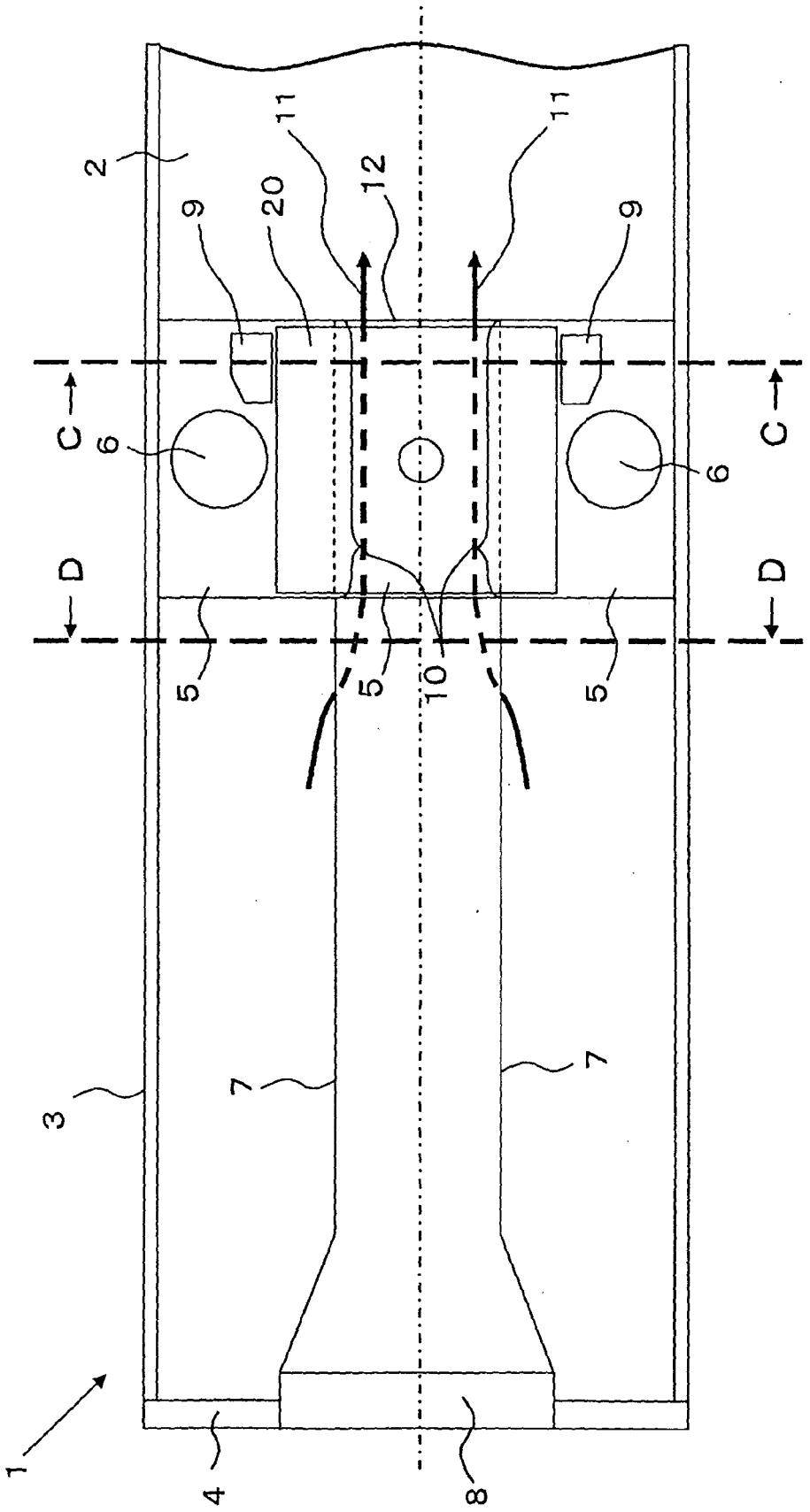


FIG. 10

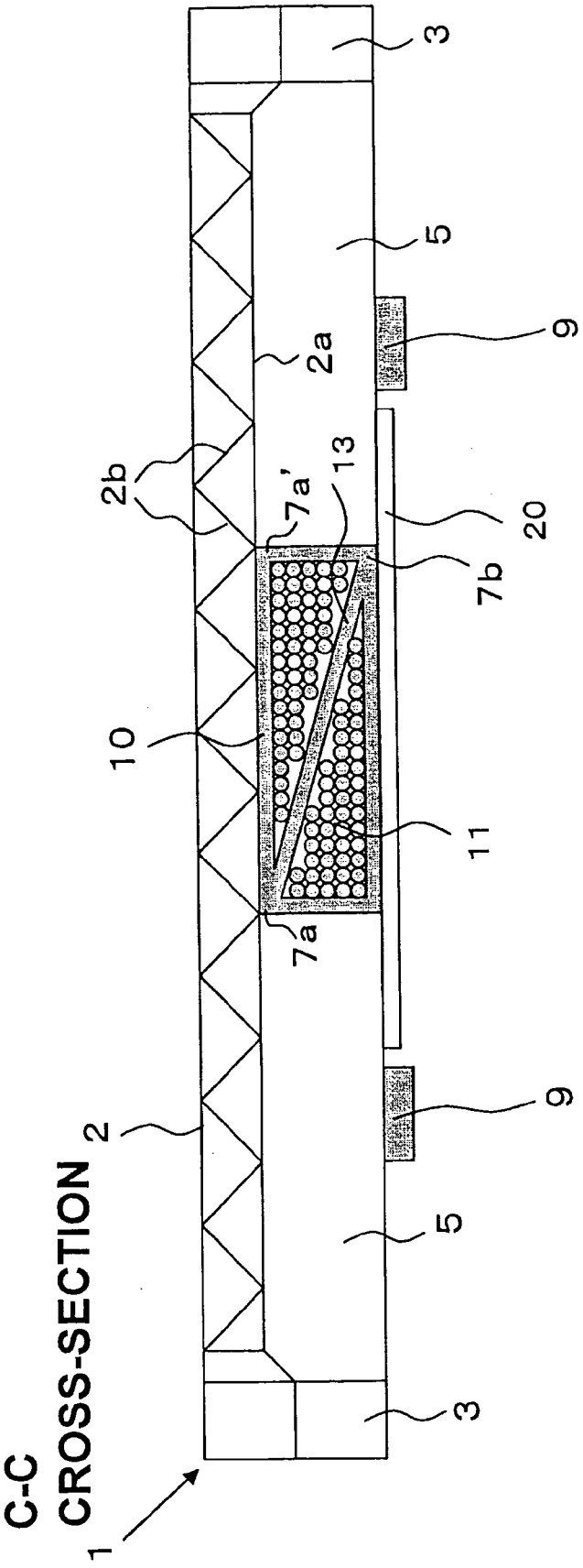


FIG. 11

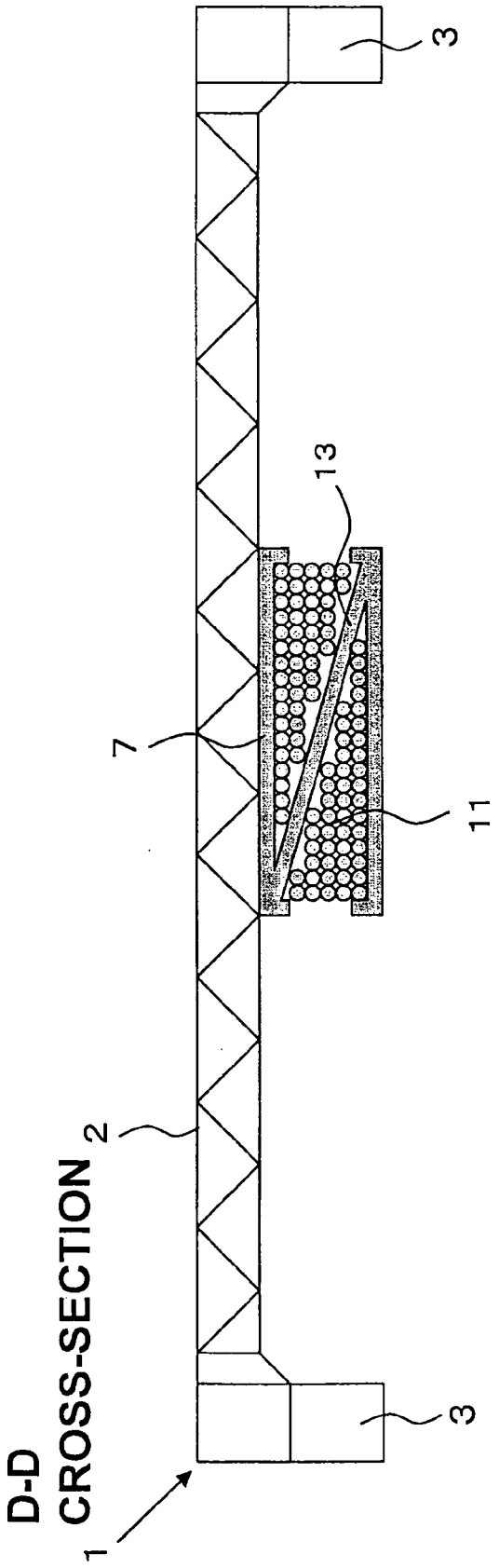


FIG. 12

A-A
CROSS-SECTION

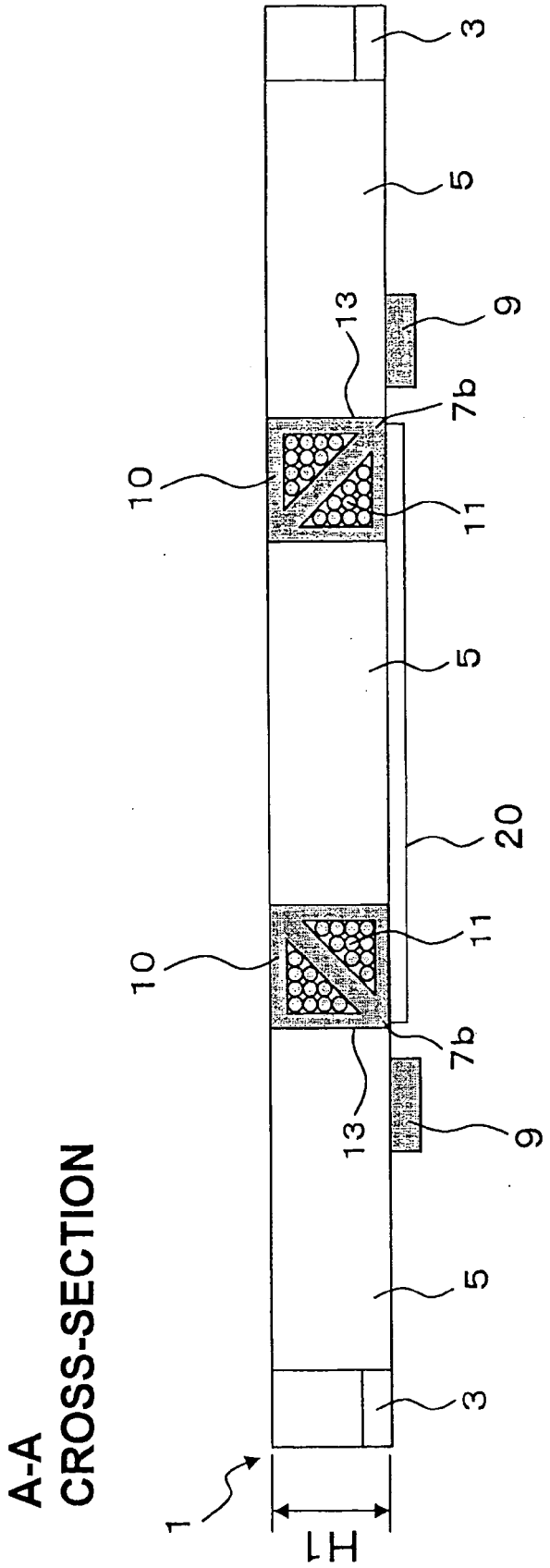


FIG. 13

B-B
CROSS-SECTION

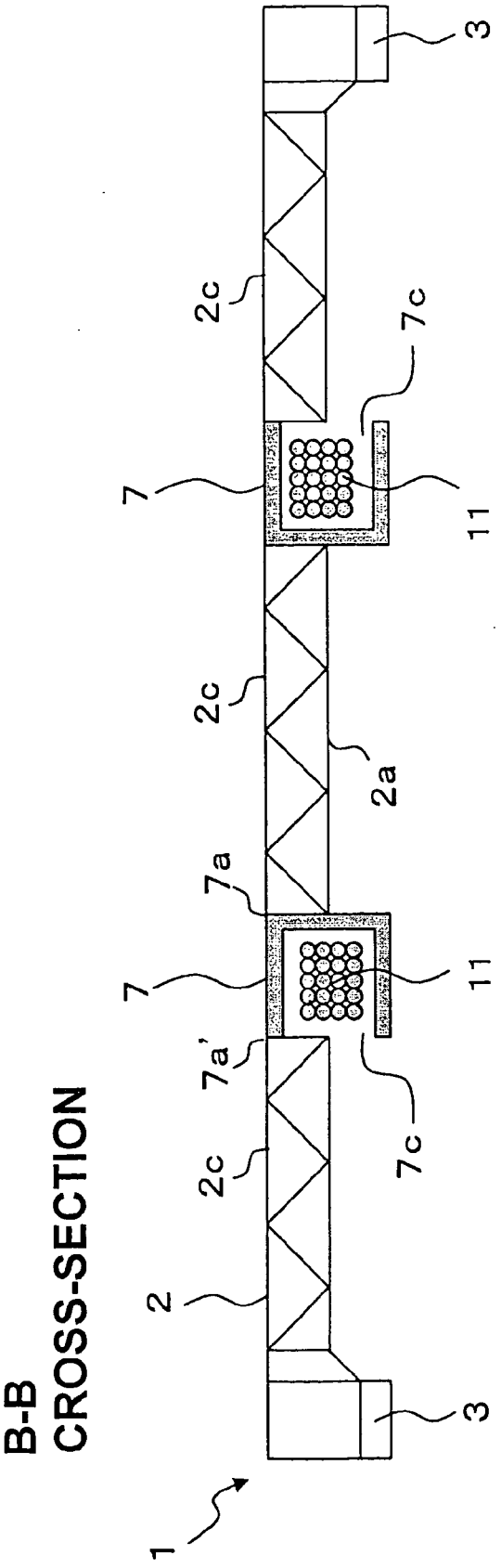


FIG. 14

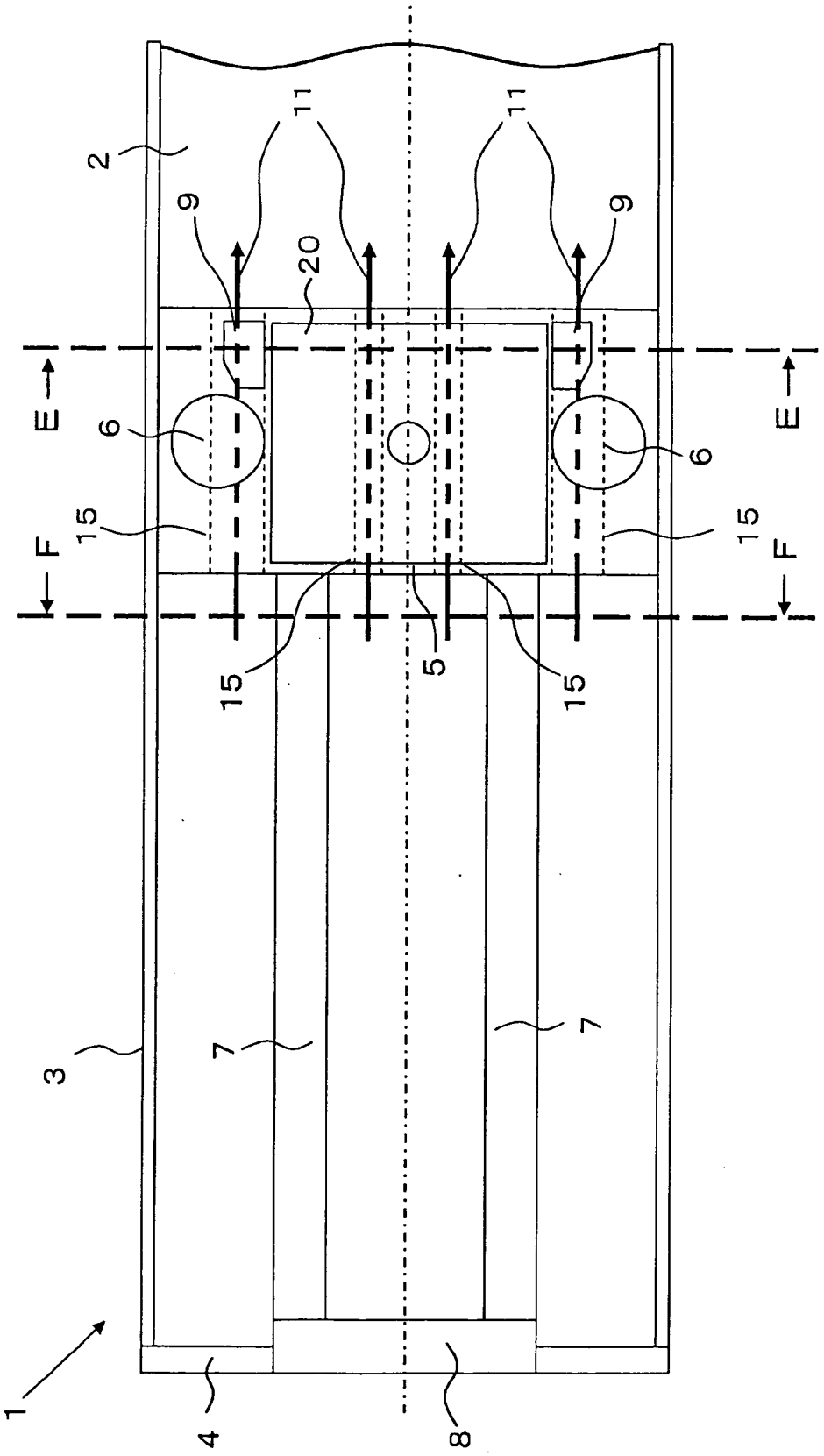


FIG. 15

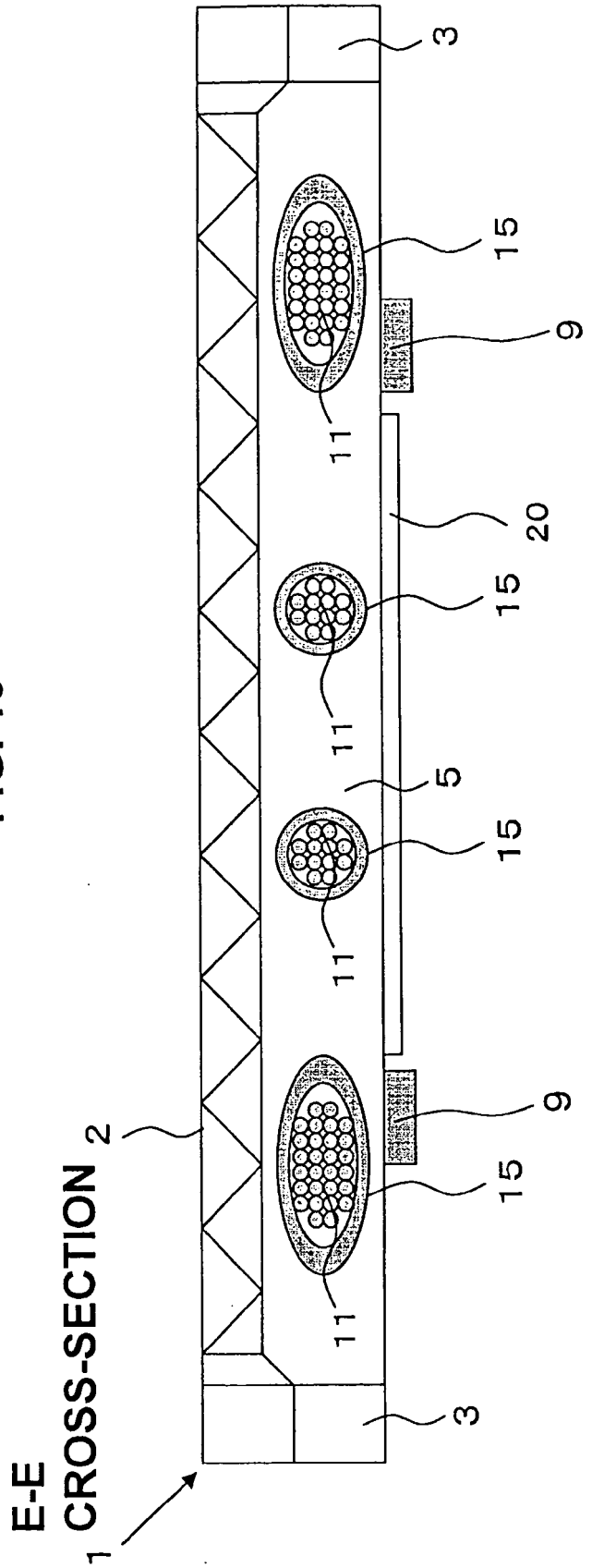
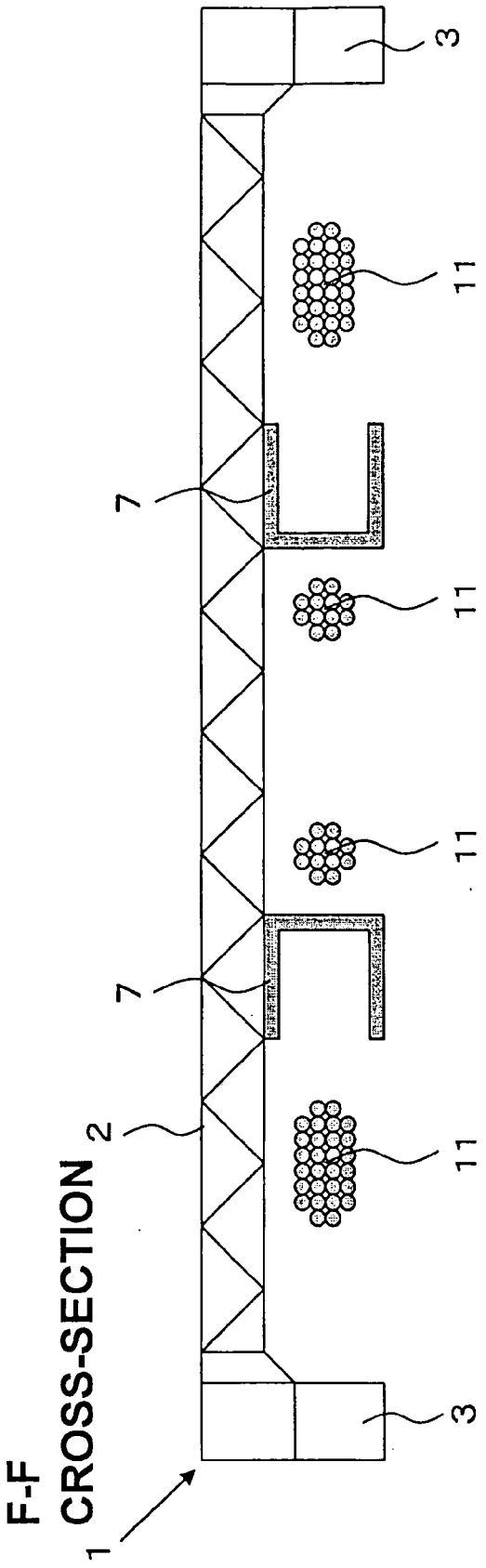


FIG. 16



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EUROPEAN SEARCH REPORT

Application Number
EP 09 25 1772

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	US 2 504 113 A (DEAN WALTER B) 18 April 1950 (1950-04-18) * column 3, line 21 - column 6, line 33; figures 1-12 * -----	1,9-10	INV. B61F1/02 B61F1/12
A	US 2 132 232 A (DURYEA OTHO C) 4 October 1938 (1938-10-04) * page 2, line 13 - page 3, line 10; figures 1-8 * -----	1,8,10	

TECHNICAL FIELDS SEARCHED (IPC)

B61F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	23 March 2010	Chlosta, Peter

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23-03-2010

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- Aluminum alloy and lightweight car. Japan Aluminum Federation, 1990, 308, 320, 368 **[0002]**