

(51) International Patent Classification:
B60P 1/28 (2006.01)(21) International Application Number:
PCT/JP2012/006270(22) International Filing Date:
1 October 2012 (01.10.2012)

(25) Filing Language: English

(26) Publication Language: English

(71) Applicant: **HITACHI CONSTRUCTION MACHINERY CO., LTD.** [JP/JP]; 5-1, Koraku 2-chome, Bunkyo-ku, Tokyo, 1128563 (JP).(72) Inventors: **KITAGUCHI, Atsushi**; c/o Intellectual Property Dept., Hitachi Construction Machinery Co., Ltd., Tsuchiura Works, 650, Kandatsumachi, Tsuchiura-shi, Ibaraki, 3000013 (JP). **SATO, Takayuki**; c/o Intellectual Property Dept., Hitachi Construction Machinery Co., Ltd., Tsuchiura Works, 650, Kandatsumachi, Tsuchiura-shi, Ibaraki, 3000013 (JP). **ISHIHARA, Kazunori**; c/o Intellectual Property Dept., Hitachi Construction Machinery Co., Ltd., Tsuchiura Works, 650, Kandatsumachi, Tsuchiura-shi, Ibaraki, 3000013 (JP). **AKINO, Shinji**; c/o Intellectual Property Dept., Hitachi Construction Machinery Co., Ltd., Tsuchiura Works, 650, Kandatsumachi, Tsuchiura-shi, Ibaraki, 3000013 (JP). **SASAKI, Takashi**; c/o Intellectual Property Dept., Hitachi Construction MachineryCo., Ltd., Tsuchiura Works, 650, Kandatsumachi, Tsuchiura-shi, Ibaraki, 3000013 (JP). **TANDAI, Daisuke**; c/o Intellectual Property Dept., Hitachi Construction Machinery Co., Ltd., Tsuchiura Works, 650, Kandatsumachi, Tsuchiura-shi, Ibaraki, 3000013 (JP). **KITA, Yasuki**; c/o Intellectual Property Dept., Hitachi Construction Machinery Co., Ltd., Tsuchiura Works, 650, Kandatsumachi, Tsuchiura-shi, Ibaraki, 3000013 (JP).(74) Agent: **THE PATENT BODY CORPORATE TAKEWA INTERNATIONAL PATENT OFFICE**; Kashiwaya Bldg., 6-13, Nishishinbashi 1-chome, Minato-ku, Tokyo, 1050003 (JP).

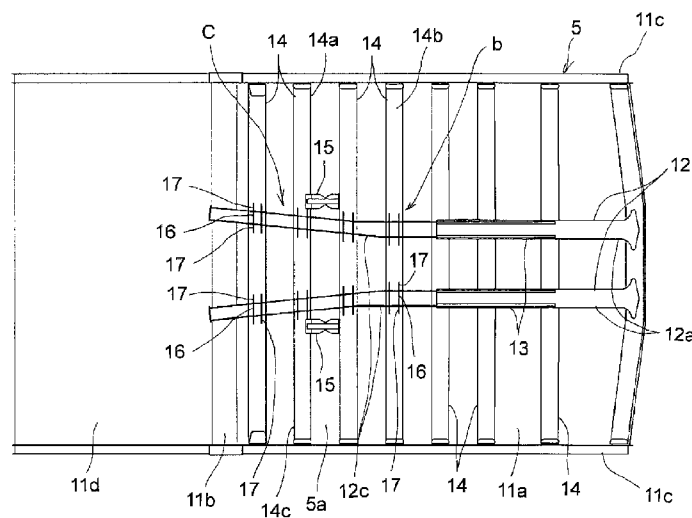
(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ,

[Continued on next page]

(54) Title: BODY STRUCTURE FOR DUMP TRUCK

[Fig. 5]



(57) Abstract: Disclosed is a body structure for a dump truck (1), which is provided with a body (5) tiltably mounted on a body frame (2). The body (5) includes a floor board (11a) forming a floor wall, rails (12) of a hollow structure attached to a lower surface of the floor board and extending in a longitudinal direction of the body frame, and plural stiffeners (14) attached at longitudinal intervals to the lower surface of the floor board such that the stiffeners intersect with the rails and extend along a lateral direction of the body frame. Substantially plate-shaped partition members (16) are arranged in the rails at positions of intersection between at least one of the stiffeners (14) and the rails (12).



UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

— *with international search report (Art. 21(3))*

Description

Title of Invention: BODY STRUCTURE FOR DUMP TRUCK

Technical Field

[0001] The present invention relates to a body structure for a dump truck, which is provided with a body to be tiltably mounted on a body frame.

Background Art

[0002] A dump truck of this type is generally provided with a body frame having four wheels disposed thereon. Above a front section of the body frame, an operator's cab and control box are arranged. On the body frame, a tiltable body is mounted extending from a middle to a rear of the body frame.

[0003] Owing to hinge pins attached to the rear of the body frame, the body is tiltable along a longitudinal direction of the body frame. This body is connected to the body frame by hoist cylinders arranged on the body frame at locations forward of the hinge pins. Extension of the hoist cylinders raises a front part of the body so that the body is brought into an elevated, in other words, "up" position, while retraction of the hoist cylinders lowers the front part of the body so that the body is brought into a laid, in other words, "down" position.

[0004] On the body of the dump truck, an object to be hauled, such as earth, sand or crushed stone, is thus loaded in a large quantity to a height above the body, for example, by a hydraulic excavator with the body being held in its lowered "down" position. By changing the body from the lowered "down" position, where the object to be hauled was loaded on the body, to the raised "up" position, the body is progressively tilted so that the hauled object can be unloaded (see, for example, Patent Citations 1 and 2).

[0005] In the body, a payload section is generally constructed of a floor board forming a floor, a front board located on a front side of the floor board and forming a front wall, and a pair of side boards located on opposite sides of the floor board. To the front board of the body, a canopy is connected extending forward such that the canopy covers an upper front section including an upper part of the front board and the operator's cab and control box.

[0006] Attached to a lower surface of the floor board of the body is a pair of box-shaped rails, which are arranged extending in a longitudinal direction of the body frame. On the lower surface of the floor board, plural stiffeners are also attached at intervals in the longitudinal direction. These plural stiffeners intersect with the paired rails, extend along a lateral direction of the body frame, and are formed in a channel shape (hollow structure). The bottom board, front board, paired side boards and canopy of the body, the paired rails, and the individual stiffeners are welded and connected together. The

rigidity of the floor board of the body is assured by the paired rails and the stiffeners.

[0007] When an object to be hauled is loaded in a heap in the payload section of the body, a high load is applied to the body from the object to be hauled. The load applied to the body is received via the floor board at parts connected to the rails and hinge pins all of which are located underneath the floor board, specifically at hinge brackets. The load applied to the rails of the body is borne by the body frame which supports the rails. On the other hand, the load applied to the hinge brackets of the body is borne by the body frame via the hinge pins.

[0008] The hinge brackets act as an axis of rotation upon raising the body to unload the hauled object, so that a high load is applied to the hinge brackets upon unloading the hauled object. As the hinge brackets are partial members, relatively thick plates are used for them among boards and plates employed in the body, and therefore, high rigidity is assured for them. On the other hand, the rails of the body are arranged over a wide range extending in a longitudinal direction of the lower surface of the floor board of the body, and therefore, relatively thin plates are assembled into a box structure to assure rigidity for the rails.

[0009] Despite the construction of these rails in the box structure, a load applied to these rails may, however, cause a deformation such that by a reaction force from the body frame, the box structure of each rail would be flattened in a vertical direction. Vertical plates of the respective rails may, therefore, undergo a bending deformation in the vertical direction by a load applied to the rails. Accordingly, stress concentration occurs at joints between the vertical plates of these rails and the floor board and also at joints between the vertical plates of these rails and the stiffeners. High stress areas are hence formed at these joints.

[0010] The floor board of the body is constructed such that the load of an object loaded for hauling on the body is received by the plural stiffeners attached to the lower surface of the floor board and extending in the lateral direction. However, the paired rails attached to the lower surface of the floor board and extending in the longitudinal direction lie on and are supported by the body frame. Therefore, the floor board is restrained at a lateral central part thereof from moving in the vertical direction, and undergoes a downward bending deformation at both of lateral side parts thereof by a load of the object under hauling. By the load of the object under hauling, the vertical plates of each rail may also undergo a bending deformation. Accordingly, stress concentration occurs at the joints between the vertical plates of these rails and the floor board. High stress areas are hence formed at these joints.

[0011] As a consequence, in the body structure for the dump truck, high stress areas are formed at the joints between the vertical plates of the rails and the floor board and also at the joints between the vertical plates of the rails and the stiffeners. Depending on the

frequency of application of a high stress, fatigue may hence accumulate at these joints so that they may become prone to damage. For the prevention of the occurrence of damage at these joints, it is effective to reduce a stress, which is to be applied to these joints, to a level within a tolerable range. As a method for reducing a stress to be applied to these joints, the joints may be increased in plate thickness. This method, however, lead to an increase in the mass of the body, thereby raising problems such as a decrease in authorized payload weight, a deterioration in travel fuel economy, a reduction in the service life of tires, and the like. Such a method is, therefore, not expedient.

- [0012] As a method for reinforcing the floor board of the body of the dump truck, there is used a structure that at the positions of intersection between the rails and stiffeners attached to the lower surface of the floor board, plate-shaped or box-shaped, reinforcement ribs are attached extending from the lower surfaces of the stiffeners to their corresponding side surfaces of the rails, respectively (see, for example, Non-patent Citations 1 and 2).

Citation List

Patent Literature

- [0013] [Patent Citation 1] JP-A-2007-176269
[Patent Citation 2] US-A-5,555,699

Non-patent Literature

- [0014] [Non-patent Citation 1] 793F Mining Truck. P.2 and p.9. [online]. Caterpillar Inc., 2010. [retrieved on 2012-02-08]. Retrieved from the Internet: <URL: <http://xml.catmms.com/servlet/ImageServlet?imageId=C584023&imageType=9>>
[Non-patent Citation 2] 960E ELECTRIC DRIVE TRUCK. P.3 and p.5. [online]. Komatsu American Corp., 2011. [retrieved on 2012-02-08]. Retrieved from the Internet: <URL: http://www.equipmentcentral.com/north_america/data/new_equipment/960E_2_AESS832_00_v9_79720.pdf>

Disclosure of Invention

Technical Problem

- [0015] As mentioned above, in the prior art body structure for dump truck as disclosed in each of Non-patent Citations 1 and 2, reinforcement rib members are attached to the positions of intersection between reinforcement stiffeners and rails attached to a lower surface of a floor board of a body. These rib members are formed in a plate shape or box shape, and are attached extending from lower surfaces of the stiffeners to their corresponding side surfaces of the rails, respectively.
- [0016] Therefore, the reinforcement rib members are simply attached to the outer parts of

the stiffeners and rails, although the positions of intersection between these stiffeners and rails are parts where a load concentrates when an object to be hauled is loaded in a payload section of body. There is, accordingly, a problem in that the assurance of further rigidity is required at the stress-concentrating positions of intersection between the stiffeners and rails on the lower surface of the floor board.

[0017] With the above-mentioned circumstances of the prior art in view, the present invention has as an object thereof the provision of a body structure for a dump truck, which can assure still higher rigidity.

Solution to Problem

[0018] To achieve the above-described object, the present invention provides a body structure for a dump truck, said body structure being provided with a body to be mounted on a body frame tiltably in a vertical direction and along a longitudinal direction of the body frame, characterized in that the body comprises:

a floor board forming a floor wall, a rail of a hollow structure attached to a lower surface of the floor board and extending in the longitudinal direction, plural stiffeners attached at intervals in the longitudinal direction to the lower surface of the floor board such that the stiffeners intersect with the rail and extend along a lateral direction of the body frame, and a substantially plate-shaped partition member arranged in the rail at a position of intersection between at least one of the stiffeners and the rail.

[0019] In the present invention constructed as described above, the position of intersection between the at least one stiffener, which is attached intersecting with the rail attached to the lower surface of the floor board of the body, and the rail is a part where a stress, which is caused by a load applied to the body, for example, when an object to be hauled is loaded on the body, concentrates. As the rail has the hollow structure, vertical plates of the rail may undergo a bending deformation in a vertical direction by a load applied to the rail. The substantially plate-shaped partition member is, therefore, arranged in the rail at the position of intersection of the at least one stiffener and the rail, said position being the part where the concentration of a stress occurs. Still higher rigidity can, therefore, be assured for the body, because a load applied to the position of the intersection between the at least one stiffener and the rail can be distributed to reduce the stress concentration at the position of intersection and a bending deformation of the rail at the position of intersection can be reduced.

[0020] Preferably, the partition member may be attached along a longitudinal direction of the stiffener.

[0021] According to the present invention constructed as described immediately above, the attachment of the partition member along the longitudinal direction of the stiffener makes it possible to reduce a bending deformation of the stiffener in the longitudinal

direction by the partition member. Therefore, a load applied to the position of intersection between these stiffener and rail can be distributed more, thereby making it possible to reduce the stress concentration at the position of intersection further.

[0022] The partition member may be attached preferably at right angles to a length of the rail.

[0023] According to the present invention constructed as described immediately above, the attachment of the partition member at right angles to the length of the rail makes it possible to reduce a bending deformation of the rail with higher assurance, and also, to connect the partition member to the rail with higher assurance. Therefore, the stress concentration at the position of intersection between the rail and the stiffener can be reduced further.

[0024] The partition member may preferably be arranged extending from a lower surface of the stiffener to a lower surface of the rail.

[0025] According to the present invention constructed as described immediately above, the arrangement of the partition member such that it extends from the lower surface of the stiffener to the lower surface of the rail can reduce a bending deformation of each of these stiffener and rail at the position of intersection between the stiffener and the rail. In addition, a stress applied to the stiffener at the position of intersection of these stiffener and rail can be distributed to the rail. Therefore, the stress concentration at the position of intersection between the stiffener and the rail can be reduced further, and still higher rigidity can be assured for the body.

[0026] Preferably, the partition member may be connected to the lower surface of the stiffener and may be attached in contact with the lower surface of the rail.

[0027] According to the present invention constructed as described immediately above, the partition member is connected to the lower surface of the stiffener, and this partition member is attached in contact with the lower surface of the rail. As a result, a stress applied to the stiffener can be distributed to the rail via the partition member so that a bending deformation of the lower surface of the rail can be reduced. Therefore, the stress concentration at the position of intersection between the stiffener and the rail can be reduced further.

[0028] Partition members may preferably be attached in a pair at the position of intersection between the stiffener and the rail, and the paired partition members may preferably be arranged in continuation with opposite side surfaces of the stiffener, respectively.

[0029] According to the present invention constructed as described immediately above, the partition members are attached in a pair at the position of intersection between the stiffener and the rail, and the paired partition members are arranged in continuation with the opposite side surfaces of the stiffener, respectively. As a consequence, loads applied to the opposite side surfaces of the stiffener, respectively, at the position of in-

tersection between these stiffener and rail can be transmitted directly to the partition members. Further, the stresses applied to the opposite side surfaces of the stiffener, respectively, can be transmitted and distributed to the rail with higher assurance via the corresponding partition members. Therefore, the stress concentration at the position of intersection between the stiffener and the rail can be reduced with higher assurance.

[0030] The partition member or members may be arranged preferably in a load bearing section, where a load from the floor board of the body is borne.

[0031] According to the present invention constructed as described immediately above, the arrangement of the partition member or members at the position of intersection between the stiffener and the rail in the load bearing section makes it possible to appropriately distribute a stress applied to the position of intersection between the stiffener and the rail, where a stress concentrates in particular by a load from the floor board of the body.

[0032] Preferably, the body may further comprise a substantially plate-shaped reinforcement member arranged on an outer side of the rail at the position of intersection between the stiffener and the rail, where the partition member is attached, and extending from the lower surface of the stiffener to the side surface of the rail.

[0033] According to the present invention constructed as described immediately above, the substantially plate-shaped reinforcement member is attached at the position of intersection between the at least one stiffener and the rail, and extends from the lower surface of the stiffener to the side surface of the rail. As a consequence, a load applied to the position of intersection between these stiffener and rail can be distributed by the partition member attached in the rail at the position of intersection and also by the reinforcement member attached to the outer side of the rail at the position of intersection. Therefore, a deformation of the stiffener in the longitudinal direction at the position of intersection can be reduced further, and a deformation of the side surface of the rail at the position of intersection can also be reduced further. Therefore, the stress concentration at the position of intersection between these stiffener and rail can be reduced further, and still higher rigidity can be assured for the body.

[0034] The reinforcement member and the partition member may preferably be attached linearly side by side.

[0035] According to the present invention constructed as described immediately above, the reinforcement member and the partition member are attached linearly side by side. As a consequence, a load applied to one of these reinforcement member and partition member can be distributed more directly and surely to the other one of these reinforcement member and partition member. Therefore, the stress concentration at the position of intersection between the stiffener and the rail can be reduced further.

Advantageous Effects of Invention

[0036] In the present invention, the stiffeners are attached intersecting with the rail attached to the lower surface of the floor board of the body. The positions of intersection of these stiffeners and rail are parts, where a stress, which is caused by a load applied to the body, for example, when an object to be hauled is loaded on the body, concentrates. As the rail has the hollow structure, the rail may undergo a bending deformation in a vertical direction by a load applied to the rail. The substantially plate-shaped partition member is, therefore, arranged in the rail at the position of intersection of the at least one stiffener and the rail, said position being the part where the concentration of a stress occurs. Owing to this construction, the present invention can distribute a load applied to the position of intersection between these stiffener and rail, and therefore, can reduce the stress concentration at the position of intersection. At the same time, a bending deformation of the rail at the position of intersection can be reduced. Therefore, still higher rigidity can be assured for the body.

Brief Description of Drawings

[0037] [fig.1]Fig. 1 is a view illustrating a first embodiment of the body structure according to the present invention for a dump truck.

[fig.2]Fig. 2 is a bottom view of a body with which the first embodiment of the present invention as illustrated in Fig. 1 is provided.

[fig.3]Fig. 3 is a side view of the body with which the first embodiment of the present invention as illustrated in Fig. 1 is provided.

[fig.4]Fig. 4 is a cross-sectional view taken along line A-A of Fig. 2.

[fig.5]Fig. 5 is a cross-sectional view taken along line B-B of Fig. 3.

[fig.6]Fig. 6 is an enlarged fragmentary view of a part a shown in Fig. 3.

[fig.7]Fig. 7 is a cross-sectional view taken along line C-C of Fig. 6.

[fig.8]Fig. 8 is an enlarged fragmentary view of a part b shown in Fig. 5.

[fig.9]Fig. 9 is an enlarged fragmentary view of a part c shown in Fig. 5.

[fig.10]Fig. 10 is a view illustrating a second embodiment of the body structure according to the present invention for the dump truck.

[fig.11]Fig. 11 is a cross-sectional view taken along line D-D of Fig. 10.

[fig.12]Fig. 12 is an enlarged fragmentary view of a part d shown in Fig. 10.

[fig.13]Fig. 13 is a cross-sectional view taken along line E-E of Fig. 12.

[fig.14]Fig. 14 is a view illustrating a third embodiment of the body structure according to the present invention for the dump truck.

[fig.15]Fig. 15 is a bottom view of a body with which the third embodiment of the present invention as illustrated in Fig. 14 is provided.

[fig.16]Fig. 16 is a cross-sectional view taken along line F-F of Fig. 14.

[fig.17]Fig. 17 is an enlarged fragmentary view of a part e shown in Fig. 14.

[fig.18]Fig. 18 is a cross-sectional view taken along line G-G of Fig. 17.

[fig.19]Fig. 19 is an enlarged fragmentary view of a part f shown in Fig. 16.

[fig.20]Fig. 20 is an enlarged fragmentary view of a part g shown in Fig. 16.

[fig.21]Fig. 21 is a view illustrating a fourth embodiment of the body structure according to the present invention for the dump truck.

[fig.22]Fig. 22 is a cross-sectional view taken along line H-H of Fig. 21.

[fig.23]Fig. 23 is an enlarged fragmentary view of a part h shown in Fig. 22.

[fig.24]Fig. 24 is a view illustrating a fifth embodiment of the body structure according to the present invention for the dump truck, in which bottom rail plates of rails have been removed.

[fig.25]Fig. 25 is a view illustrating a sixth embodiment of the body structure according to the present invention for the dump truck.

[fig.26]Fig. 26 is a cross-sectional view taken along line I-I of Fig. 25.

[fig.27]Fig. 27 is a view illustrating a seventh embodiment of the body structure according to the present invention for the dump truck.

[fig.28]Fig. 28 is a cross-sectional view taken along line J-J of Fig. 27.

[fig.29]Fig. 29 is an enlarged fragmentary view of a part i shown in Fig. 27.

[fig.30]Fig. 30 is a cross-sectional view taken along line K-K of Fig. 29.

Modes for Carrying Out the Invention

[0038] Embodiments for carrying out the body structure according to the present invention for the dump truck will hereinafter be described based on the drawings.

First embodiment

[0039] Fig. 1 is a view illustrating the first embodiment of the body structure according to the present invention for the dump truck. Fig. 2 is a bottom view of the body with which the first embodiment of the present invention as illustrated in Fig. 1 is provided. Fig. 3 is a side view of the body with which the first embodiment of the present invention as illustrated in Fig. 1 is provided. Fig. 4 is a cross-sectional view taken along line A-A of Fig. 2. Fig. 5 is a cross-sectional view taken along line B-B of Fig. 3. Fig. 5 is an enlarged fragmentary view of a part a shown in Fig. 3. Fig. 7 is a cross-sectional view taken along line C-C of Fig. 6. Fig. 8 is an enlarged fragmentary view of a part b shown in Fig. 5.

[0040] As illustrated in Fig. 1, the dump truck 1 to which the first embodiment of the body structure according to the present invention is applied is provided with a body frame 2, a pair of front wheels 3, a pair of rear wheels 4, and a body 5. The paired front wheels 3 are rotatably attached to lateral opposite ends of a front part of the body frame 2, respectively. On the other hand, the paired rear wheels 4 are rotatably attached to lateral

opposite ends of a rear part of the body frame 2, respectively. Further, the body 5 is a section in which an object A to be hauled such as earth, sand or crushed stone is to be loaded, and is tiltably mounted on the body frame 2.

[0041] Next, the body frame 2 is a so-called chassis, and is constructed of a pair of frame members 2a. These paired frame members 2a are attached with their lengths extending along a longitudinal direction. Described specifically, approximately rear halves of these paired frame members 2a are attached in parallel to each other along the longitudinal direction of the dump truck 1 with a predetermined interval being held therebetween. These paired frame members 2a are bent in directions opposite to each other at approximately middle parts thereof. Approximately front halves of these paired frame members 2a extend in a flaring pattern such that they become increasingly apart from each other in a substantially inverted "V" shape toward the front of the dump truck 1.

[0042] On the rear part of the body frame 2, hinge pins 6 are attached. These hinge pins 6 act as a center of rotation upon raising or lowering the body 5. At locations forward of the hinge pins 6 on the body frame 2, hoist cylinders 7 are attached as hydraulic cylinders that connect the body frame 2 and the body 5 with each other. The hoist cylinders 7 are attached between the front part and a middle part of the body frame 2. Above the left front wheel 3 on the body frame 2, an operator's cab 8 is arranged as a cab that houses an operator. On the body frame 2 and on a right side of the operator's cab 8, a large control box 8B is arranged. The control box 8B accommodates resistors for dynamic brakes, etc. therein. On the front part of the body frame 2, a power unit 10 is arranged with hydraulic equipment accommodated thereon.

[0043] The hydraulic equipment in the power unit 10 is provided, for example, with a hydraulic pump (not shown) for feeding pressure oil to the hoist cylinders 7 and a hydraulic oil reservoir (not shown) for storing hydraulic oil to be fed to the hydraulic pump. In the dump truck 1, the hydraulic pump in the power unit 10 can, therefore, feed pressure oil from the hydraulic oil reservoir to the hoist cylinders 7 to extend the hoist cylinders 7, so that the front part of the body 5 can be hoisted up about the hinge pins 6 as a center of rotation and the body 5 can be raised in a vertical direction and along a longitudinal direction of the body 5. The dump truck 1 can also return the pressure oil, which has been fed to the hoist cylinders 7 by the hydraulic pump in the power unit 10, to the hydraulic oil reservoir, so that the hoist cylinders 7 can be retracted to lower the body 5 to the "down" position while supporting the body 5.

[0044] The body 5 has a substantially box-shaped payload section 11 which is open at a top and rear thereof. This payload section 11 is provided with a floor board 11a, which forms a floor of the body 5 and is in a rectangular shape as seen in plan. As shown in Fig. 1, the floor board 11a is attached such that its rear section is upwardly inclined in

the lowered "down" position that the body 5 lies on the body frame 2. To a front side of the floor board 11a, a front board 11b that forms a front wall of the body 5 is attached. The front board 11b is leaned forward on an upper side thereof, and is joined and attached at a lower end portion thereof to a front end portion of the floor board 11a.

[0045] To opposite sides of the front board 11b and floor board 11a, side boards 11c that form respective side walls of the body 5 are attached in a pair, respectively. As illustrated in Fig. 2, these side boards 11c are attached substantially vertically. Upper end portions of these side boards 11c are formed in a linear shape such that the upper end portions horizontally extend in the lowered "down" position that the body 5 lies on the body frame 2. Lower end portions of the side boards 11c are joined and attached to lateral edge portions of the floor board 11a, respectively. Further, front end portions of these side boards 11c are joined and attached to lateral edge portions of the front board 11b, respectively.

[0046] To an upper part of the front board 11b, a substantially board-shaped canopy 11d is attached. This canopy 11d is attached extending forward such that the canopy 11d covers from the upper part of the front board 11b to the upper front section of the dump truck 1. Therefore, this canopy 11d is arranged to avoid damage to the operator's cab 8, control box 9, power unit 10 and the like, which would otherwise occur by falling of the object A under hauling from the body 5 in the lowered "down" position that the body 5 lies on the body frame 2. Described specifically, this canopy 11d is attached such that it extends substantially horizontally in the lowered "down" position that the body 5 lies on the body frame 2. The canopy 11d is downwardly curved at a longitudinal rear end part thereof, and this curved rear end part is joined and attached to an upper end portion of the front board 11b.

[0047] To the lower surface of the floor board 11a of the payload section 11, a pair of box-shaped rails 12 is attached. The paired rails 12 are attached extending in the longitudinal direction of the body frame 2. These paired rails 12 are attached along the frame members 2a such that the paired rails 12 lie on upper surfaces of the respective frame members 2a of the body frame 2 in the lowered "down" position that the body 5 lies on the body frame 2. Therefore, these paired rails 12 are attached with their lengths extending in the longitudinal direction like the respective frame members 2a of the body frame 2. A pair of vertical rail plates 12a of each rail 12 is joined and attached at upper end portions thereof to the lower surface of the floor board 11a. Further, a bottom rail plate 12b is attached to lower end portions of the paired vertical rail plates 12a such that the bottom rail plate 12b closes up the space between these paired vertical rail plates 12a, and therefore, each rail 12 is formed in a hollow structure. It is to be noted that as shown in Fig. 7, each bottom rail plate 12b is attached to the lower

end portions of the corresponding vertical rail plates 12a with widthwise side edges of the bottom rail plate 12b protruding outward beyond outer surfaces of the vertical rail plates 12a.

[0048] Further, approximately rear halves of these paired rails 12 are attached in parallel to each other along the longitudinal direction of the dump truck 1 with a predetermined interval being held therebetween. These rails 12 are bent in directions opposite to each other at approximately middle parts thereof. Approximately front halves of these paired rails 12 extend in a flaring pattern such that they become increasingly apart from each other in a substantially inverted "V" shape toward the front of the dump truck 1. To lower surfaces of parts of the rails 12, said parts being located rearward of bent portions 12c formed in the substantially middle parts of the rails 12, hinge brackets 13 are attached, respectively. Through these hinge brackets 13, the hinge pins 6 are rotatably inserted. These hinge brackets 13, therefore, make it possible to raise or lower the body 5 from or to the body frame 2 via the hinge pins 6.

[0049] To the lower surface of the floor board 11a of the payload section 11, plural, for example, seven stiffeners 14 are attached intersecting with the respective rails 12. These stiffeners 14 are horizontally attached at longitudinal intervals to the lower surface of the floor board 11a. Further, these stiffeners 14 are attached extending in the lateral direction of the lower surface of the floor board 11a with their lengths extending along the lateral direction of the lower surface of the floor board 11a. Described specifically, each stiffener 14 is smaller in width dimension than the rails 12, and is formed in a substantially concave shape in cross-section. Side walls 14a, which are located on opposite sides of the stiffener 14, are welded and attached at upper edges thereof to the lower surface of the floor board 11a. The space between lower edges of the respective side walls 14a is closed up by a bottom wall 14b of a linear shape in cross-section, so that the stiffener 14 is formed in a channel shape (hollow structure). Opposite side edge portions of the bottom wall 14b of each stiffener 14 are provided with arcuate walls 14c as curved portions bent in a substantially arcuate form in cross-section toward the corresponding side walls 14a.

[0050] Described specifically, each stiffener 14 is arranged extending in the lateral direction of the lower surface of the floor board 11a. In particular, each stiffener 14 is arranged to structurally and linearly continue in each rail 12 at the position of intersection between the stiffener 14 and the rail 12. As shown in Fig. 2, each stiffener 14 is arranged extending through each rail 12, and is arranged as separate parts including portions between the opposite side edges of the floor board 11a and outer side edges of the corresponding rails 12, portions in the respective rails 12, and a portion between inner side edges of the rails 12. It is to be noted that these portions of the stiffener 14 are welded and connected together as will be described subsequently herein. The floor

board 11a, front board 11b, paired side boards 11c and canopy 11d of the payload section 11 of the body 5, the paired rails 12, and the respective stiffeners 14 are welded and connected together.

[0051] A pair of cylinder brackets 15 is attached as connecting members at locations, which are remote at an equal distance from a lateral center line of the floor board 11a of the body 5. These cylinder brackets 15 are located closer to the front side of the floor board 11a. Described specifically, these cylinder brackets 15 are located between the second stiffener 14 and the third stiffener 14 as counted from the front side of the floor board 11a, and are fixed at locations on outer sides of the paired rails 12. To these cylinder brackets 15, upper end portions of the hoist cylinders 7 are pivotally connected, respectively.

[0052] In each of the rails 12 in the load bearing section 5a including the positions of intersection between the four stiffeners 14 in total, which are located toward the front side of the floor board 11a of the body 5 and primarily receive the load of the body 5, and the rails 12, a pair of substantially plate-shaped partition members 16 is attached. These paired partition members 16 are division plates which as shown in Fig. 5, are attached extending between the paired vertical rail plates 12a and along the lateral direction of the floor board 11a. Therefore, these partition members 16 are attached dividing the space in the rail 12. As shown in Fig. 6, these paired partition members 16 are welded and connected at upper end portions thereof to the opposite widthwise side edge portions of the bottom wall 14b of the corresponding stiffener 14, said opposite widthwise side edge portions being located on inner sides of the corresponding arcuate walls 14c of the corresponding stiffener 14. These partition members 16 are located at an equal distance from a widthwise center line of the bottom plate 14b of the stiffener 14. These partition members 16 extend at right angles with respect to the bottom wall 14b of the stiffener 14 and along the length of the stiffener 14.

[0053] As shown in Fig. 4, each pair of partition members 16 is arranged in the corresponding rail 12, and extends from the lower surface of the bottom wall 14a of the corresponding stiffener 14 to an inner surface, in other words, an upper surface of the bottom rail plate 12b. In the rail 12, the upper end portions of the paired partition members 16 are welded and connected to the lower surface of the bottom wall 14b of the stiffener 14. Lower end portions of the paired partition walls 16 are not fixed to the inner surface of the bottom rail plate 12b of the rail 12, but are attached in contact (metal touch) with the inner surface of the bottom rail plate 12b. The paired partition members 16 cannot be welded to the bottom rail plate 12b of the rail 12, because the paired partition members 16 are received and attached at the position of intersection between the rail 12 and the stiffener 14, that is, between the vertical rail plates 12a and the bottom rail plate 12b is then attached to the lower end portions of the vertical rail

plates 12a to close up the space between the vertical rail plates 12a.

[0054] The partition members 16 attached to the front three stiffeners 14 on the floor board 11a of the body 5 extend along the lengths of the corresponding ones of these stiffeners 14. As the rails 12 intersect at an angle with respect to the front three stiffeners 14, these partition members 16 extend at the angle with respect to the corresponding rails 12. On the other hand, the partition members 16 attached to the fourth stiffener 14 as counted from the front side of the floor board 11a of the body 5 are attached at right angles with respect to the lengths of these rails 12, because the rails intersect at right angles with respect to these stiffeners 14.

[0055] As shown in Fig. 7, on opposite outer sides of each rail 12 at the position of intersection between each of the four stiffeners 14 in total as counted from the front side of the body 5 and each rail 12, reinforcement members 17 are attached as wear plates of a substantially regular triangle shape as seen in lateral cross-section. These reinforcement members 17 are each formed in the form of a plate having a thickness dimension equal to that of the partition members 16. Such reinforcement members 17 are attached only at the positions of intersection, where the partition members 16 are attached, among the positions of intersection between the stiffeners 14 and the rails 12. These reinforcement members 17 each extend from the outer surface, in other words, the lower surface of the bottom wall 14b of the corresponding stiffener 14 to the outer surface of the corresponding vertical rail plate 12a of the corresponding rail 12. Each reinforcement member 17 is, therefore, attached to a location on an outer side of the position of intersection between the corresponding stiffener 14 and rail 12, in other words, on an outer side of connected portions of the corresponding stiffener 14 and rail 12. Each reinforcement member 17 is in the form of a regular triangle, and is formed such that first and second sides 17a, 17b of the reinforcement member 17, said first and second sides 17a, 17b corresponding to the legs of the regular triangle, have a length dimension of approximately a half or so of a difference between a height dimension of the corresponding rail 12 and that of the corresponding stiffener 14.

[0056] Each reinforcement member 17 is attached such that the first side 17a is in contact with the lower surface of the bottom wall 14b of the corresponding stiffener 14, the second side 17b is in contact with the outer surface of the corresponding vertical rail plate 12a of the corresponding rail 12, and a right angle vertex 17c between these first and second sides 17a, 17b inscribes the position of intersection between the stiffener 14 and the rail 12. Therefore, each reinforcement member 17 is attached with a third side 17d of the reinforcement member 17, said third side 17d corresponding to the hypotenuse of the regular triangle, extending at an angle of approximately 45 degrees with respect to each of the bottom wall 14b of the stiffener 14 and the vertical rail plate 12a of the rail 12. As shown in Fig. 5, these reinforcement members 17 are attached in

pairs to the opposite widthwise side edges of the rail 12, respectively. As shown in Fig. 8 and Fig. 9, these paired reinforcement members 17 extend on and along imaginary extensions of the corresponding ones of the paired partition members 16 located inside the rail 12 such that the reinforcement members 17 extend linearly side by side in structural continuation with the partition members 16. Each pair of reinforcement members 17 is, therefore, in parallel with the length of the corresponding stiffener 14, in other words, the lateral direction of the floor board 11a of the body 5. Owing to the construction as described above, rigidity is assured for the floor board 11a of the body 5 by the paired rails 12, stiffeners 14, partition members 16 and reinforcement members 17.

[0057] As shown in Fig. 9, the paired partition members 16 and the paired reinforcement members 17 at the position of intersection between each of the three stiffeners 14 in total, which are located toward the front side of the lower surface of the floor board 11a of the body 5, and each rail 12 are attached with the lengths of these partition members 16 and reinforcement members 17 extending at an angle with respect to the lengths of the corresponding vertical rail plates 12a of the rail 12. Therefore, these partition members 16 and reinforcement members 17 are attached to parts of the paired rails 12, said parts being forward of the corresponding bent portions 12c and flaring in an inverted "V" shape, and extend corresponding to the angle of the portions of the respective rails 12, said portions being forward of the bent portions 12c, with respect to the stiffeners 14.

[0058] A description will next be made about a welding method for the rails and stiffeners in the body structure of the dump truck.

[0059] First, the four vertical rail plates 12a in total, which are to be used to constitute the paired rails 12, are welded and attached to the lower surface of the floor board 11a while holding the widthwise side edges of the vertical rail plates 12a in contact with the lower surface of the floor board 11a. The respective stiffeners are next attached one by one such that they intersect with the lengths of the vertical rail plates 12a.

[0060] Described specifically, each stiffener 14 has a shape curved in a substantially "U" form in cross-section, and has been cut in predetermined lengths beforehand. The respective portions of the stiffener 14 cut in the predetermined lengths are fitted, welded and attached one by one to the parts extending from the opposite side edges of the floor board 11a to the corresponding vertical rail plates 12a and the parts between the vertical rail plates 12a. It is to be noted that at this time, the respective portions of each stiffener 14 should be arranged to structurally and linearly continue in the lateral direction of the floor board 11a.

[0061] Subsequently, between the paired vertical rail plates 12a of each rail 12, the corresponding pairs of partition members 16 are attached one pair by one pair. As shown in

Fig. 5, these partition members 16 are attached only at the positions of intersection between the front four stiffeners 14 and vertical rail plates 12a located in the load bearing section 5a and attached to the floor board 11a. As shown in Fig. 8, the paired partition members 16 are attached in parallel to each other while intersecting at right angles with the corresponding vertical rail plates 12a. The upper end portion of each partition member 16 is brought into contact with the bottom wall 14b of the corresponding stiffener 14 and is welded and attached to the bottom wall 14b of the corresponding stiffener 14, while the opposite widthwise side portions of each partition member 16 are brought into contact with the inner surfaces of the corresponding vertical rail plates 12a and are welded and attached to the inner surfaces of the corresponding vertical rail plates 12a.

[0062] To the outer surfaces of the paired vertical rail plates 12a with the corresponding partition members 16 attached thereto, the corresponding reinforcement members 17 are next attached in pairs one pair by one pair. At this time, as shown in Fig. 7, each reinforcement member 17 is brought into contact at the first side 17a thereof with the lower surface of the bottom wall 14b of the corresponding stiffener 14 and at the second side 17b thereof with the outer surface of the corresponding vertical rail plate 12a. Further, each reinforcement member 17 is attached with the right angle vertex 17c between the first and second sides 17a, 17b inscribing the position of intersection between the stiffener 14 and the rail 12. As shown in Fig. 8, the reinforcement members 17 in each pair are welded and attached such that they are linearly arranged side by side in continuation with the corresponding, paired partition members 16 attached between the vertical rail plates 12a.

[0063] Between the widthwise lower end portions of the paired vertical rail plates 12a to be used to construct each rail 12, the bottom rail plate 12b is then arranged such that the space between the paired vertical rail plates 12a is closed up by the bottom rail plate 12b. In this state, the bottom rail plate 12b is welded and attached to the lower end portions of the respective vertical rail plates 12.

[0064] As the space between the vertical rail plates 12a has been closed up by the bottom rail plate 12b at this time, the partition members 16 attached between these vertical rail plates 12a cannot be welded to the bottom rail plate 12b. It is, therefore, preferred to permit arranging these partition members 16 such that with the partition member 16 being attached between the paired vertical rail plates 12a, the lower end portions of these partition members 16 extend along the lower end portions of the respective vertical rail plates 12a. Due to a plate working error, however, the lower end portions of these partition members 16 may be located upward of the lower end portions of the vertical rail plates 12b, or conversely, may protrude downwardly from the lower end portions of the vertical rail plates 12b.

- [0065] If the lower end portions of these partition members 16 protrude downwardly from the lower end portions of the corresponding vertical rail plates 12, the bottom rail plate 12b cannot be welded and attached between these vertical rail plates 12a. Therefore, extra work is needed to adjust the heights of these partition members 16 by cutting back their lower end portions with a grinder or the like, resulting in a longer manufacturing time. As the height dimension of each partition member 16, the partition member 16 may, therefore, be preferably provided beforehand with a minus tolerance so that the lower end portion of the partition member 16 is located upward of the lower end portions of the paired vertical rail plates 12a when this partition member 16 is attached between the paired vertical rail plates 12a.
- [0066] When the object A to be hauled, such as earth, sand or crushed stone, is loaded in a heap in the payload section 11 of the body 5, a high load is applied to the body 5 from the object A to be hauled as mentioned above. The high load applied to the body 5 is received via the floor board 11a of the body 5 at the paired rails 12 and hinge brackets 13. Further, the load applied to these paired rails 12 is borne by the body frame 2 on which these rails 12 are supported. On the other hand, the load applied to the hinge brackets 13 is borne by the body frame 2 via the hinge pins 6 which are attached to the hinge brackets 13.
- [0067] Inserted through the hinge brackets 13 are the hinge pins 6 which act as an axis of rotation upon raising the body 5 to unload the hauled object A, so that a high load is applied to the hinge brackets 13 upon raising the body 5 to unload the hauled object A. As these hinge brackets 13 are partial members, relatively thick plates are used for them among boards and plates employed in the body 5, and therefore, high rigidity is assured for them.
- [0068] On the other hand, the paired rails 12 are arranged over a wide range extending in the longitudinal direction of the lower surface of the floor board 11a of the body 5, and therefore, relatively thin plates are assembled into box structures to assure rigidity for the rails 12 without using thick plates from the viewpoint of reducing the mass of the body 5 itself. Despite the construction of each rail 12 in the box structure, a reaction force from the body 2 may cause a deformation such that the vertical rail plates 12a of the rail 12 would be flattened in a vertical direction.
- [0069] The paired vertical rail plates 12a which constitute each rail 12 may, therefore, undergo a bending deformation in the vertical direction by a load applied to the rail 12. Accordingly, stress concentration occurs at the joints between the vertical rail plates 12a and the floor board 11a and also at the joints between the vertical rail plates 12a and the stiffeners 14. High stress areas are hence formed at these joints. By loads from the body 5, fatigue may hence be caused at the joints between the vertical rail plates 12a and the floor board 11a and also at the joints between the vertical rail plates 12a

and the stiffeners 14. As a consequence, damage may accumulate at these joints so that a crack may be eventually formed there to lead to a reduction in service life.

[0070] The load of the object A loaded for hauling in the payload section 11 of body 5 is received by the plural stiffeners 14 extending in the lateral direction and attached to the lower surface of the floor board 11a of the body 5. On the other hand, the paired rails 12 extend in the longitudinal direction and are attached to the lower surface of the floor board 11a, and these paired rails 12 lie and are supported on the body frame 2. Therefore, the floor board 11a is restrained at a lateral central part thereof from moving in the vertical direction, so that the opposite lateral edge portions of the floor board 11a and the opposite lateral end portions of the respective stiffeners 14 may undergo a downward deformation by the load of the object under hauling.

[0071] As a consequence, in the body structure for the dump truck 1, high stress areas are formed at the joints between the vertical rail plates 12a of the rails 12 and the floor board 11a and also at the joints between these vertical rail plates 12a and the stiffeners 14. Depending on the frequency of application of a high stress, fatigue may hence accumulate at these joints so that they may become prone to damage. For the prevention of the occurrence of damage at these joints, it is effective to reduce a stress, which is to be applied to these joints, to a level within a tolerable range. As a method for reducing a stress to be applied to these joints, the vertical rail plates 12a, floor board 11a or stiffeners 14 may be increased in plate thickness at these joints. If these vertical rail plates 12a, floor board 11a or stiffeners 14 are increased in plate thickness, however, the mass of the body 5 increases, thereby raising problems such as a decrease in authorized payload weight, a deterioration in travel fuel economy, a reduction in the service life of tires, and the like.

[0072] Further, the stress, which is caused by the load applied when the object A to be hauled is loaded on the body 5 of the dump truck 1, concentrates at the positions of intersection between the paired rails 12 and the stiffeners 14. As these paired rails 12 are box-shaped, the vertical rail plates 12a of these rails 12 may undergo a bending deformation in the vertical direction by a load applied to the rails 12.

[0073] Between the bottom wall 14b of each stiffener 14 and the bottom rail plate 12b in each rail 12 at the position of intersection between the stiffener 14 and the rail 12, said position being a part where stress concentration occurs, the paired, plate-shaped partition members 16 are attached at right angles with respect to the length of the rail 12. As a consequence, a load applied to the position of intersection between these stiffener 14 and rail 12 can be distributed to the partition members 16 and can then be transmitted to the bottom rail plate 12b and body frame 2. Further, the partition members 16 can be welded and connected with higher assurance to the inner surfaces of the vertical rail plates 12a in the rail 12. It is, therefore, possible to minimize an

increase in mass which takes place as a result of the arrangement of these partition members 16.

[0074] Accordingly, it is possible to reduce and lower stress concentration at the positions of intersection between these stiffeners 14 and rails 12, and hence, to prevent the vertical rail plates 12a of the rails 12 from a bending deformation in the widthwise direction, in other words, in the vertical direction and also the stiffeners 14 from a bending deformation in the longitudinal direction, in other words, in the lateral direction at the positions of intersection. These rails 12 and stiffeners 14 can hence be provided with improved rigidity at the positions of their intersection, thereby making it possible to assure still higher rigidity for the floor board 11a of the body 5.

[0075] Owing to the attachment of these partition members 16 along the lengths of the corresponding stiffeners 14, the stiffeners 14 can be prevented with higher assurance from a longitudinal bending deformation by the partition members 16. Further, a load applied to the position of intersection between each stiffener 14 and each rail 12 can be more adequately distributed to the corresponding partition members 16, and a load applied to the stiffener 14 can be distributed with higher assurance to the rail 12. Therefore, stress concentration at the position of intersection between these stiffener 14 and rail 12 can be reduced with higher assurance, and still higher rigidity can be assured for the body 5.

[0076] As described above, it is possible, while making use of the structures of the rails 12 and stiffeners of the existing box structures, to lower stress concentration to the floor board 11a of the body 5 by a load from the object A loaded for hauling in the payload section 11 of the body 5 and to provide the body 5 with still higher rigidity. Therefore, the occurrence of damage on the body 5 can be prevented with higher assurance, the body 5 can be provided with longer service life, and the body 5 of the dump truck 1 can be provided with improved reliability. Compared with the provision of still higher rigidity for the body 5 by increasing the thickness of the floor board 11a of the body 5, the first embodiment can reduce the quantity of reinforcement components which have heretofore been needed, and can reduce the mass of the body 5 while assuring high rigidity for the body 5, because the first embodiment can provide the body 5 with higher rigidity while reducing an increase in the mass of the body 5.

[0077] On the outer sides of the position of intersection between each stiffener 14 and each rail 12 in the load bearing section 5a where the partition members 16 are attached, the corresponding, substantially plate-shaped reinforcement members 17 are attached extending from the lower surface of the bottom wall 14b of the rail 14 to the outer surfaces of the corresponding vertical rail plates 12a of the rail 12. As a consequence, a load applied to the position of intersection between these stiffener 14 and rail 12 can be distributed and lowered by the partition members 16 at the position of intersection in

the rail 12, and can be further distributed and lowered by the reinforcement members 17 attached at the position of intersection to the outer surfaces of the corresponding vertical rail plates 12a of the rail 12. It is, therefore, possible to reduce with higher assurance a longitudinal bending deformation of the stiffener 14 at the position of intersection and also to reduce with higher assurance a vertical bending deformation of the vertical rail plates 12a of the rail 12 at the position of intersection. Accordingly, stress concentration at the position of intersection between these stiffener 14 and rail 12 can be reduced with higher assurance, and still higher rigidity can be assured for the body 5.

- [0078] As these reinforcement members 17 are attached linearly side by side with the corresponding partition members 16 in the rail 12 and along the imaginary extensions of the partition members 16, a load applied to ones of these reinforcement members 17 and partition members 16 can be more directly and surely transmitted and distributed to the other ones of the reinforcement members 17 and partition members 16. Accordingly, stress concentration at the position of intersection between these stiffener 14 and rail 12 can be reduced with higher assurance.

Second Embodiment

- [0079] Fig. 10 is a view illustrating a second embodiment of the body structure according to the present invention for the dump truck. Fig. 11 is a cross-sectional view taken along line D-D of Fig. 10. Fig. 12 is an enlarged fragmentary view of a part d shown in Fig. 10. Fig. 13 is a cross-sectional view taken along line E-E of Fig. 12.
- [0080] The second embodiment of the present invention is different from the above-described first embodiment in that in the first embodiment, the reinforcement members 17 are attached on opposite sides of each pair of partition members 16, while in the second embodiment, only the partition members 16 are attached at the position of intersection between each rail 12, which is located in the load bearing section 5a of the lower surface of the floor board 11a of the body 5, and each of the front four stiffeners 14. Described specifically, in the second embodiment, the reinforcement members 17 are not attached at the position of intersection between each rail 12 and each stiffener 14, where the corresponding partition members 16 are attached, so that the rail 12 and stiffener 14 are reinforced only by the paired partition members 16 attached inside the rail 12 at the position of intersection. The remaining construction is the same as in the first embodiment, and the like or corresponding elements of structure as in the first embodiment are designated by like signs.
- [0081] The second embodiment of the present invention constructed as described above can bring about similar advantageous effects as the above-described first embodiment, and does not include the reinforcement members attached on the outer sides of the position of intersection between each rail 12 and each stiffener 14. Therefore, no member or

members protrude from the position of intersection between each rail 12 and each stiffener 14 on the lower surface of the floor board 11a of the body 5, thereby making it possible to simplify the construction of the body 5 on the lower side of the floor board 11a and also to achieve a reduction in the mass of the body 5.

Third Embodiment

[0082] Fig. 14 is a view illustrating a third embodiment of the body structure according to the present invention for the dump truck. Fig. 15 is a bottom view of a body with which the third embodiment of the present invention as illustrated in Fig. 14 is provided.

Fig. 16 is a cross-sectional view taken along line F-F of Fig. 14. Fig. 17 is an enlarged fragmentary view of a part e shown in Fig. 14. Fig. 18 is a cross-sectional view taken along line G-G of Fig. 17. Fig. 19 is an enlarged fragmentary view of a part f shown in Fig. 16. Fig. 20 is an enlarged fragmentary view of a part g shown in Fig. 16.

[0083] The third embodiment of the present invention is different from the above-described first embodiment in that in the first embodiment, the partition members 16 and reinforcement members 17 are attached to the positions of intersection between each rail 12 and each of the front four stiffeners 14, while in the third embodiment, plate-shaped cover members 31 are attached between the paired reinforcement members 17 at these positions of intersection to form box structures. The remaining construction is the same as in the first embodiment, and the like or corresponding elements of structure as in the first embodiment are designated by like signs.

[0084] Described specifically, these cover members 31 are members that reinforce the positions of intersection between each rail 12 and each of the front four stiffeners 14. These cover members 31 are each formed in the shape of a flat plate having a width dimension equal to the dimension of an interval between the corresponding, paired reinforcement members 17, and are each attached extending from the corresponding vertical rail plate 12a of the rail 12 to the bottom wall 14b of the corresponding stiffener 14. Each cover member 31 is welded and fixed to the corresponding reinforcement members 17 with the length of the cover member 31 extending along the third sides 17d of the reinforcement members 17, and also, with opposite widthwise side portions of the cover member 31 being in contact with inner surfaces of the third sides 17d. Each cover member 31 is, therefore, attached at an angle of 45 degrees with respect to the length of the corresponding stiffener 14 and the length of the corresponding vertical rail plate 12a of the corresponding rail 12. Each cover member 31 is in contact at one widthwise end thereof with the bottom wall 14b of the corresponding stiffener 14, and is welded and fixed there. The cover member 31 is in contact at the opposite widthwise end thereof with the outer surface of the corresponding vertical rail

plate 12a of the corresponding rail 12, and is welded and fixed there.

- [0085] In particular, the cover members 31 attached to each of the front three stiffeners 14 on the lower surface of the floor board 11a are each formed in a linear shape that its one widthwise end extends along the width of the corresponding stiffener 14. On the other hand, the other widthwise end of each cover member 31 is formed in a linear shape that the other longitudinal end thereof extends along the width of the corresponding vertical rail plate 12a of the corresponding rail 12 and can be welded in linear contact with the outer surface of the corresponding vertical rail plate 12a. Therefore, the cover member 31 is attached aslant along the third sides 17d of the corresponding reinforcement member 17.
- [0086] On the lower surfaces of the bottom rail plate 12b of the respective rails 12, plural rubber pads 32 are attached as shown in Fig. 14 and Fig. 15. These rubber pads 32 are cushioning members for lowering an impact or load between the rails 12 of the body 5 and the body frame 2 in the lowered "down" position that the body 5 lies on the body frame 2. These rubber pads 32 are each formed in the shape of a rectangular flat plate having a width dimension smaller than that of each bottom rail plate 12b. Further, these rubber pads 32 are attached side by side at equal intervals on the lower surfaces of the bottom rail plates 12b in the range of up to the third stiffener 14 as counted from the front side of the floor board 11a. In other words, these rubber pads 32 are arranged in the section of the floor board 11a of the body 5, where a load from the rails 12 is most received, specifically in the load bearing section 5a. The partition members 16 and reinforcement members 17 are attached at the positions of intersection between the respective rails 12 and the front three stiffeners 14.
- [0087] The third embodiment of the present invention constructed as described above can bring about similar advantageous effects as the above-described first embodiment. In addition, the space between the third sides 17d of the paired reinforcement members 17 attached at the position of intersection of each of the front four stiffeners 14, which are located in the load bearing section 5a of the floor board 11a of the body 5, and each rail 12 is closed up by the cover member 31. Therefore, a load applied from each stiffener 14 to each rail 12 can be distributed and lowered by the corresponding reinforcement members 17 and cover members 31, thereby making it possible to reduce a bending deformation of these reinforcement members 17 in the thickness direction. Accordingly, stress concentration at the positions of intersection between the stiffeners 14, which are located in the load bearing section 5a of the body 5, and the rails 12 can be reduced with higher assurance, and still higher rigidity can be assured for the body 5.
- [0088] Moreover, the space between the paired reinforcement members 17 attached on the outer sides of the position of intersection between each of these stiffeners 14 and each

rail 12 and between the corresponding vertical rail plates 12 of the rail 12 and the bottom wall 14b of the stiffener 14 is closed up by the cover member 31, so that the paired reinforcement members 17 are formed in a box structure. As the space between the paired reinforcement members 17 is closed up by the cover member 31, the construction of the body 5 can be simplified on the side of the lower surface of the floor board 11a compared with the first embodiment, and moreover, any entrance of sand, earth or the like into the space between these paired reinforcement member 17 can be avoided.

- [0089] To a load applied from the body 5 to the rails 12 in the lowered "down" position that the body 5 lies on the body frame 2, a reaction force is produced from the body frame 2 to the rails 12 by the rubber pads 32 which exist between these rails 12 and the body frame 2. As a result, the vertical rail plates 12a of these rails 12 may be deformed such that they would be flattened in the vertical direction. Owing to the attachment of the partition members 16 and reinforcement members 17 at the positions of intersection between the respective rails 12 and the front three stiffeners 14, a load applied from the body 5 to the rails 12 can be distributed to the partition members 16 and reinforcement members 17. The vertical rail plates 12a of the respective rails 12 can, therefore, be prevented from a vertical bending deformation, thereby making it possible to lower stress concentration at the joints between these vertical rail plates 12a and the corresponding bottom rail plates 12b.

Fourth Embodiment

- [0090] Fig. 21 is a view illustrating a fourth embodiment of the body structure according to the present invention for the dump truck. Fig. 22 is a cross-sectional view taken along line H-H of Fig. 21. Fig. 23 is an enlarged fragmentary view of a part h shown in Fig. 22.
- [0091] The fourth embodiment of the present invention is different from the above-described first embodiment in that in the first embodiment, each partition member 16 is attached along the length of the corresponding stiffener 14, while in the fourth embodiment, the partition members 16 at the positions of intersection between the rails 12 and the front three stiffeners 14 on the floor board 11a of the body 5 are attached at right angles with respect to the lengths of the rails 12. The remaining construction is the same as in the first embodiment, and the like or corresponding elements of structure as in the first embodiment are designated by like signs.
- [0092] Described specifically, the paired partition members 16 and reinforcement members 17, which are attached at the positions of intersection between the fourth stiffener 4 as counted from the front side of the lower surface of the floor board 11a of the body 5 and the rails 12, are attached, as shown in Fig. 22, along the length of the stiffener 16, in other words, along the lateral direction of the floor board 11a as in the first em-

bodiment. Further, each partition member 16 and its corresponding reinforcement member 17 are attached in continuation with each other such that they extend in a linear form. Described specifically, each partition member 16 attached on the fourth stiffener 14 as counted from the front side of the lower surface of the floor board 11a is attached to a linear part of the corresponding rail 12, said linear part being located rearward of the bent portion 12c.

[0093] On the other hand, the paired partition members 16 attached at the positions of intersection between the front three stiffeners 4 in total, which are located toward the front side of the lower surface of the floor board 11a of the body 5 and the respective rails 12 are attached such that as shown in Fig. 23, the lengths of the respective partition members 16 extend at right angles with respect to the lengths of the corresponding vertical rail plates 12a of the rails 12. Described specifically, the respective partition members 16 attached on the three stiffeners 14 in total, which are located toward the front side, are attached to the parts of the paired rails 12, said parts being located forward of the bent portions 12c and flaring in a substantially inverted "V" shape, as shown in Fig. 22. Therefore, these partition members 16 are attached corresponding to the angle of the part of the respective rails 12, said parts being located forward of the bent portions 12c.

[0094] Further, the reinforcement members 17 attached to up to the third stiffener as counted from the front side of the floor board 11a are each attached such that as shown in Fig. 19, the second side 17b of the reinforcement member 17 is in structural continuation with the widthwise end portion of the corresponding partition member 16. Further, each reinforcement member 17 is attached along the length of the corresponding stiffener 14, in other words, the lateral direction of the floor board 11a.

[0095] The fourth embodiment of the present invention constructed as described above can bring about similar advantageous effects as the above-described first embodiment. In addition, the respective partition members 16 attached to the parts of the paired rails 12, said parts being located forward of the bent portions 12c and flaring in the inverted "V" shape, extend at right angles with respect to the corresponding vertical rail plates 12a of the rails 12. Therefore, each respective partition member can be welded with its widthwise end portions being kept at right angles with the inner surfaces of the corresponding vertical rail plates 12a. As a consequence, the partition members 16 on the parts of the paired rails 12, said parts being located forward of the bent portions 12c, can be firmly welded to the corresponding vertical rail plates 12a, and are surely provided with sufficient weld strength.

[0096] As the partition members 16 on the parts of the paired rails 12, said parts being located forward of the bent portions 12c and flaring in the inverted "V" shape, are attached at right angles with respect to the corresponding vertical rail plates 12a of the

rails 12, a vertical load applied to each vertical rail plate 12a can be distributed with higher assurance to the corresponding partition member 16. Accordingly, stress concentration at the positions of intersection between the three stiffeners 14, which are located in the load bearing section 5a of the floor board 11a of the body 5, and the rails 12 can be reduced with higher assurance, and still higher rigidity can be assured for the body 5.

Fifth Embodiment

[0097] Fig. 24 is a view illustrating a fifth embodiment of the body structure according to the present invention for the dump truck, in which bottom rail plates of rails have been removed.

[0098] The fifth embodiment of the present invention is different from the above-described fourth embodiment in that in the fourth embodiment, the reinforcement members 17 are attached on opposite sides of each pair of partition members 16 to extend linearly side by side with the corresponding partition members 16, while in the fifth embodiment, only the partition members 16 are attached at the positions of intersection between the rails 12 and stiffeners 14 in the load bearing section 5a of the lower surface of the floor board 11a of the body 5. Described specifically, in the fifth embodiment, the reinforcement members 17 are not attached at the positions of intersection between the rails 12 and the stiffeners 14, where the partition members 16 are attached, so that only the paired partition members 16 are attached in the respective rails 12 at the positions of intersection. The remaining construction is the same as in the fourth embodiment, and the like or corresponding elements of structure as in the fourth embodiment are designated by like signs.

[0099] The fifth embodiment of the present invention constructed as described above can bring about similar advantageous effects as the above-described fourth embodiment. In addition, no member or members protrude from the position of intersection between each rail 12 and each stiffener 14 on the lower surface of the floor board 11a of the body 5. As in the above-described second embodiment, it is, therefore, possible to simplify the construction of the body 5 on the lower side of the floor board 11a of the body 5 and also to achieve a reduction in the mass of the body 5.

Sixth Embodiment

[0100] Fig. 25 is a view illustrating a sixth embodiment of the body structure according to the present invention for the dump truck. Fig. 26 is a cross-sectional view taken along line I-I of Fig. 25.

[0101] The sixth embodiment of the present invention is different from the above-described fourth embodiment in that in the fourth embodiment, the partition members 16 and reinforcement members 17 are attached at the positions of intersection between the rails

12 and the front four stiffeners 14, while in the sixth embodiment, the cover members 31 in the above-described third embodiment are attached between the paired reinforcement members 17 at these positions of intersection. The remaining construction is the same as in the third and fourth embodiments, and the like or corresponding elements of structure as in the third and fourth embodiments are designated by like signs.

- [0102] The sixth embodiment of the present invention constructed as described above can bring about similar advantageous effects as the above-described fourth embodiment. In addition, similar to the above-described third embodiment, a load applied from each stiffener 14 to each rail 12 can be distributed to the corresponding reinforcement members 17 and cover members 31, thereby making it possible to reduce a bending deformation of these reinforcement members 17 in the thickness direction. At the same time, as the space between the paired reinforcement members 17 is closed up by the cover member 31, the construction of the body 5 can be simplified on the side of the lower surface of the floor board 11a of the body 5, and moreover, any entrance of sand, earth or the like into the space between the paired reinforcement members 17 can be avoided.

Seventh Embodiment

- [0103] Fig. 27 is a view illustrating a seventh embodiment of the body structure according to the present invention for the dump truck. Fig. 28 is a cross-sectional view taken along line J-J of Fig. 27. Fig. 29 is an enlarged fragmentary view of a part i shown in Fig. 27. Fig. 30 is a cross-sectional view taken along line K-K of Fig. 29.
- [0104] The seventh embodiment of the present invention is different from the above-described first embodiment in that in the first embodiment, the partition members 16 are welded at the upper end portions thereof to the opposite widthwise side end portions of the bottom walls 14b of the corresponding stiffeners 14, while in the seventh embodiment, the partition members 16 and reinforcement members 17 are attached in structural continuation with the side walls 14a of the corresponding stiffeners 14. The remaining construction is the same as in the first embodiment, and the like or corresponding elements of structure as in the first embodiment are designated by like signs.
- [0105] Described specifically, each pair of partition members 16 is attached on the corresponding stiffener 14 with the partition members 16 being spaced from each other by the width dimension of the stiffener 14 or so as shown in Fig. 28 and Fig. 29. Therefore, the paired partition members 16 are attached in flush with the corresponding side walls 14a of the stiffener 14 such that they extend linearly side by side and in structural continuation with the corresponding side walls 14a. Specifically, the paired partition members 16 are welded and attached at the upper end portions thereof

in contact with widthwise outer end portions of the corresponding arcuate walls 14c of the corresponding stiffener 14.

- [0106] Corresponding to the associated pair of partition members 16, each pair of reinforcement members 17 is also attached at an interval as much as the widthwise dimension of the stiffeners 14 or so as shown in Fig. 27 to Fig. 29. Therefore, the paired reinforcement members 17 are attached in flush with the corresponding side walls 14a of the stiffener 14 such that they extend linearly side by side and in structural continuation with the corresponding side walls 14a. Specifically, the paired reinforcing members 17 are welded and attached at the first sides 17a thereof in contact with the widthwise outer end portions of the corresponding arcuate walls 14c of the corresponding stiffener 14.
- [0107] Further, each pair of cover members 31 is attached, as shown in Fig. 27 to Fig. 30, along the third sides 17d of the corresponding pair of reinforcement members 17 and between the corresponding vertical rail plates 12a of the corresponding rail 12 and the corresponding stiffener 14. Therefore, these cover members 31 are each formed with a width dimension equal to the width dimension between the side walls 14a of the stiffener 14. The longitudinal one end portion of each cover member 31 is formed in a shape complementary to the bottom wall 14b and respective arcuate walls 14c of the stiffener 14. Therefore, each cover member 31 is provided at a middle part of its longitudinal one end portion with a linear part 31a complementary to the bottom wall 14b of the stiffener 14. Further, this cover member 31 is also provided at opposite side parts of its longitudinal one end portion with concave arcuate portions 31b complementary to the arcuate walls 14c of the stiffener 14. The cover member 31 is welded and attached such that the linear part 31a is in contact with the bottom wall 14b of the stiffener 14 and the respective concave arcuate portions 31b are in contact with the corresponding arcuate walls 14c of the stiffener 14.
- [0108] The seventh embodiment of the present invention constructed as described above can bring about similar advantageous effects as the above-described fourth embodiment. In addition, the paired partition members 16 and reinforcement members 17 are attached such that they are in linear and structural continuation with the corresponding side walls 14a of the corresponding stiffeners 14. Therefore, a load applied to each side wall 14a of each stiffener 14 can be directly transmitted and distributed to the corresponding partition member 16 and reinforcement member 17. As a consequence, a stress applied to each side wall 14a of this stiffener 14 can be transmitted and distributed with higher assurance to the corresponding vertical rail plate 12a of the corresponding rail 12 via the partition member 16. Accordingly, stress concentration at the positions of intersection between the stiffeners 14, which are located in the load bearing section 5a on the front side of floor board 11a of the body 5, and the rails 12

can be decreased with higher assurance, and still higher rigidity can be assured for the body 5.

Modifications

- [0109] In the above-described embodiments, the partition members 16 are attached only at the positions of intersection in the load-concentrating, load bearing section 5a on the front side of the floor board 11a of the body 5, specifically between the front four stiffeners 14 and the rails 12. However, the present invention shall not be limited to such embodiments. Such partition members and/or reinforcement members may also be attached, as needed, at parts other than the positions of intersection between the first to fourth stiffeners 14, as counted from the front side, and the rails 12.
- [0110] The description has been made about the construction that each pair of reinforcement members 17 is attached to extend in structural continuation with the corresponding paired partition members 16 attached in the corresponding rail 12. However, one or more reinforcement members 17 may be attached on outer side or sides of each rail 12 at each position of intersection where one or more partition members 16 are internally attached. Further, a box structure with a cover member 31 attached between a pair of reinforcement members 17 and/or a structure with a predetermined number of reinforcement member(s) 17 attached therein may be combined and attached as many as needed.
- [0111] In many of the above-described embodiments, each vertical plate 12a of each rail 12 is provided with the reinforcement members 17. However, one or more reinforcement members 17 may be attached only on the outer side of each of vertical rail plates 12a forming the outer walls of a pair of rails 12 or only on the inner side of each of vertical rail plates 12a forming the inner walls of the pair rails 12.

Explanation of References

- [0112] 1 Dump truck
2 Body frame
2a Frame member
3 Front wheel
4 Rear wheel
5 Body
5a Load bearing section
6 Hinge pin
7 Hoist cylinder
8 Operator's cab
9 Control box
10 Power unit

- 11 Payload section
 - 11a Floor board
 - 11b Front board
 - 11c Side board
 - 11d Canopy
- 12 Rail
 - 12a Vertical rail plate
 - 12b Bottom rail plate
 - 12c Bent portion
- 13 Hinge bracket
- 14 Stiffener
 - 14a Side wall
 - 14b Bottom wall
 - 14c Arcuate wall
- 15 Cylinder bracket
- 16 Partition member
- 17 Reinforcement member
 - 17a First side
 - 17b Second side
 - 17c Right angle vertex
 - 17d Third side
- 31 Cover member
 - 31a Linear part
 - 31b Concave arcuate part
- 32 Rubber pad
- A Object to be hauled

Claims

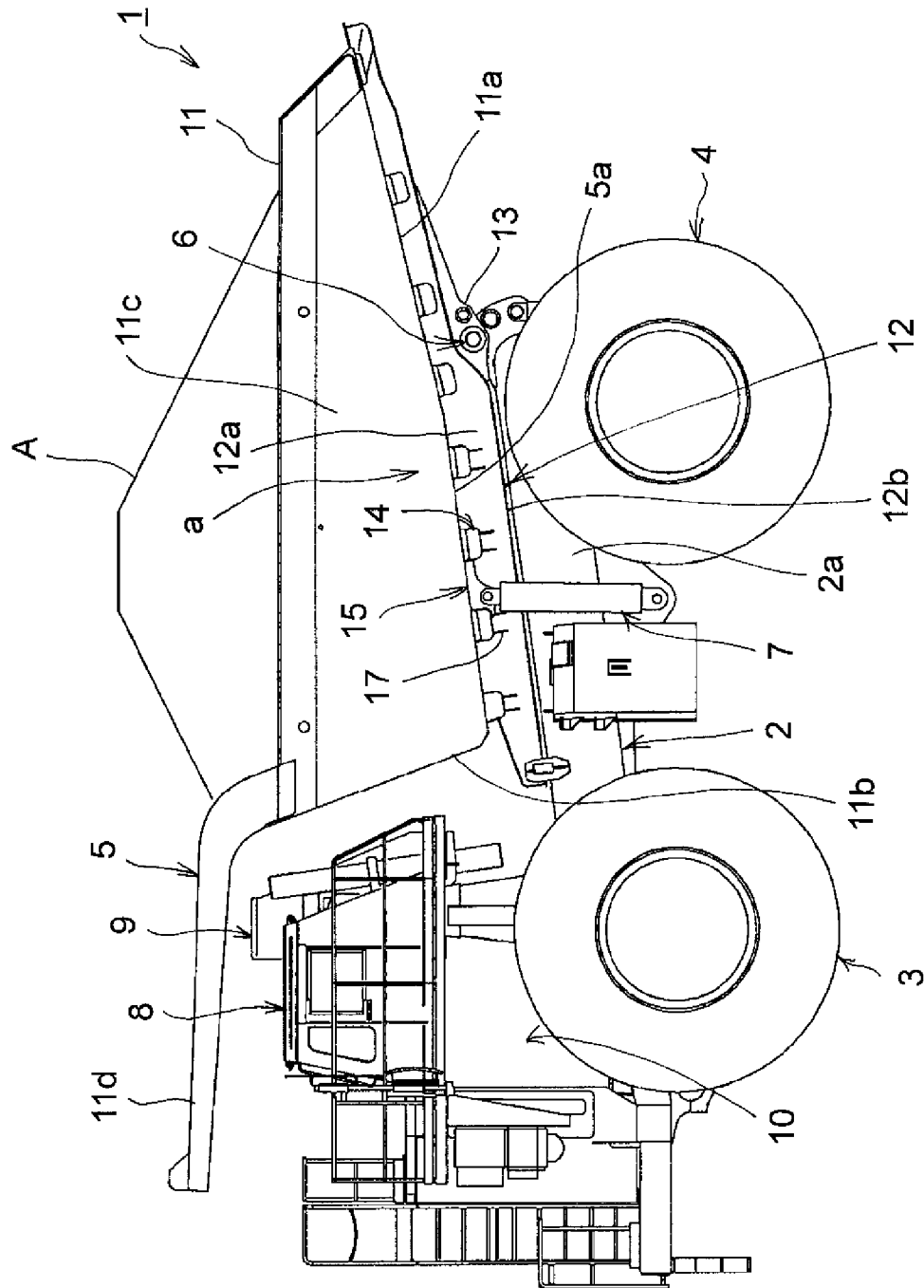
- [Claim 1] A body structure for a dump truck, said body structure being provided with a body (5) to be mounted on a body frame (2) tiltably in a vertical direction and along a longitudinal direction of the body frame, characterized in that the body (5) comprises:
a floor board (11a) forming a floor wall,
a rail (12) of a hollow structure attached to a lower surface of the floor board and extending in the longitudinal direction,
plural stiffeners (14) attached at intervals in the longitudinal direction to the lower surface of the floor board such that the stiffeners intersect with the rail and extend along a lateral direction of the body frame, and
a substantially plate-shaped partition member (16) arranged in the rail at a position of intersection between at least one of the stiffeners (14) and the rail (12).
- [Claim 2] The body structure according to claim 1, wherein the partition member (16) is attached along a length of the stiffener (14).
- [Claim 3] The body structure according to claim 1, wherein the partition member (16) is attached at right angles to a length of the rail (12).
- [Claim 4] The body structure according to any one of claims 1-3, wherein the partition member (16) is arranged extending from a lower surface of the stiffener (14) to a lower surface of the rail (12).
- [Claim 5] The body structure according to claim 4, wherein the partition member (16) is connected to the lower surface of the stiffener (14) and is attached in contact with the lower surface of the rail (12).
- [Claim 6] The body structure according to any one of claims 1-5, wherein partition members (16) are attached in a pair at the position of intersection between the stiffener (14) and the rail (12), and the paired partition members (16) are arranged in continuation with opposite side surfaces of the stiffener (14), respectively.
- [Claim 7] The body structure according to any one of claims 1-6, wherein the partition member or members (16) are arranged in a load bearing section (5a), where a load from the floor board (11a) of the body (5) is borne.
- [Claim 8] The body structure according to any one of claims 1-7, wherein the body (5) further comprises a substantially plate-shaped reinforcement member (17) arranged on an outer side of the rail (12) at the position of intersection between the stiffener (14) and the rail (12), where the

partition member (16) is attached, and extending from the lower surface of the stiffener to the side surface of the rail.

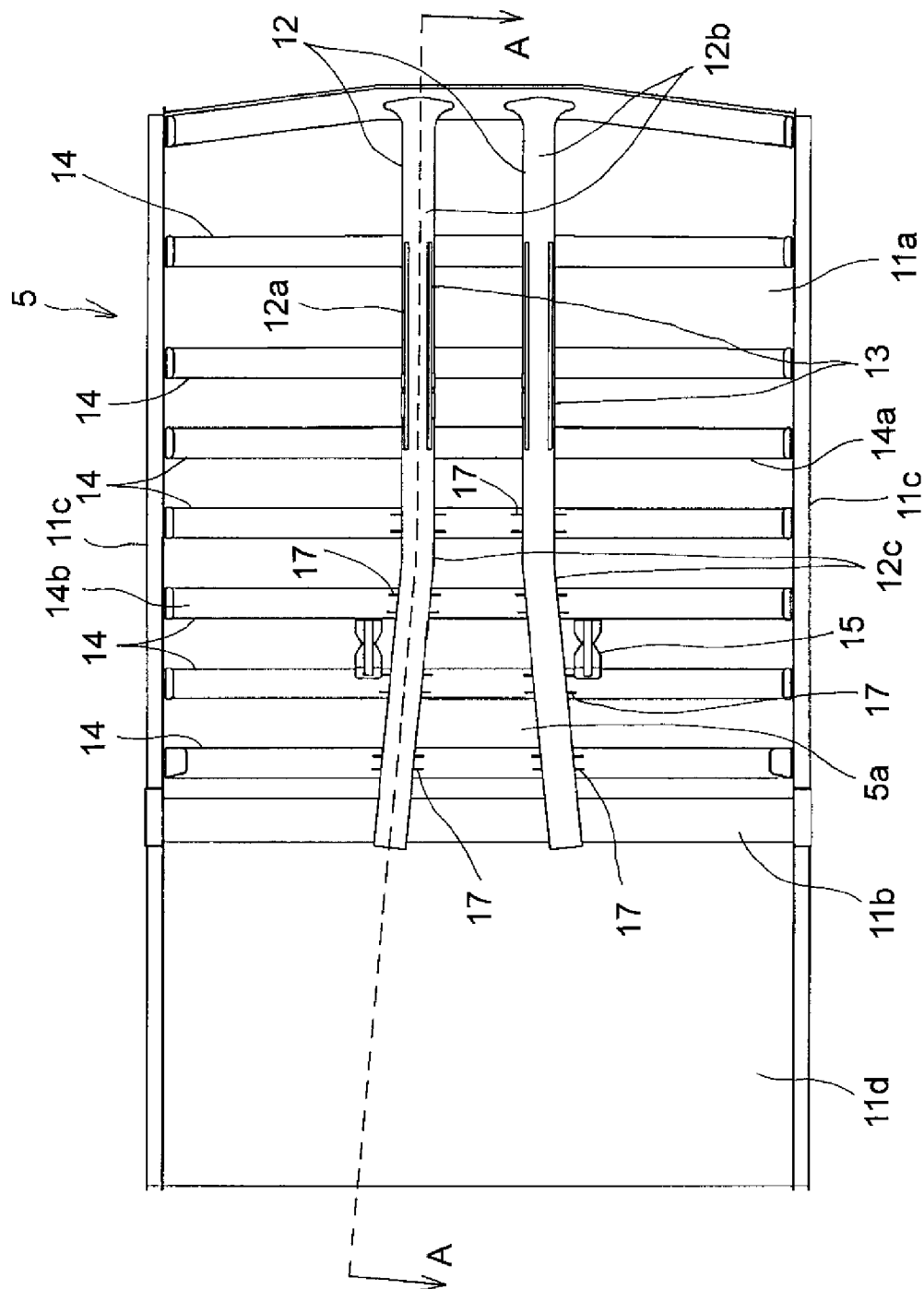
[Claim 9]

The body structure according to claim 8, wherein the reinforcement member (17) and the partition member (16) are attached linearly side by side.

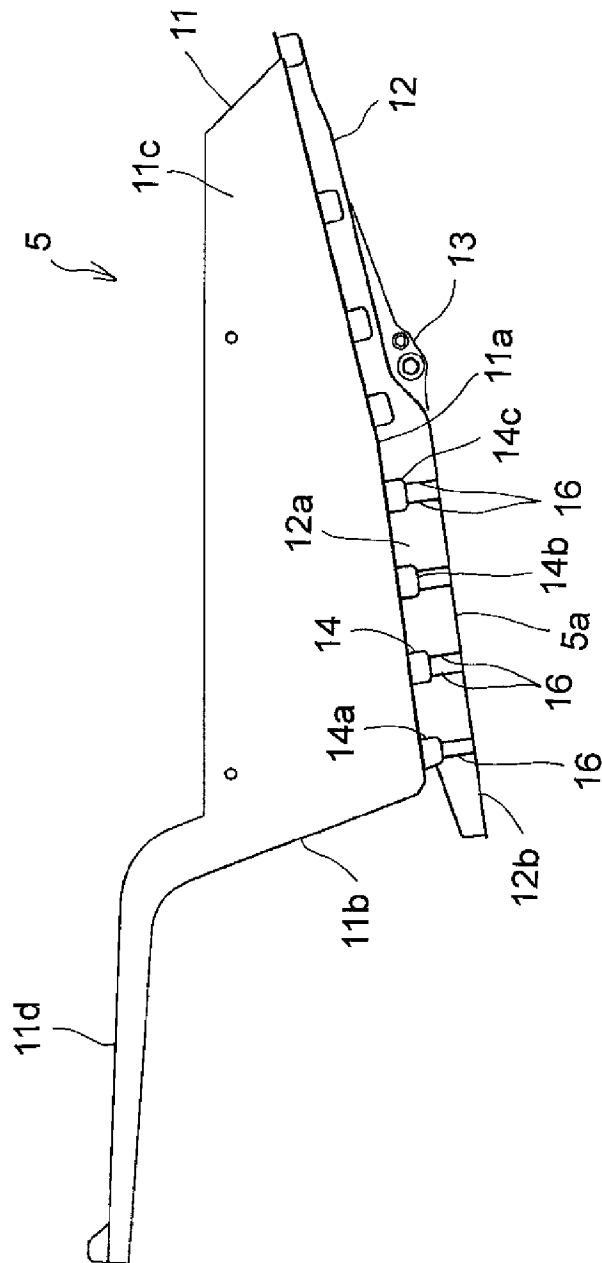
[Fig. 1]



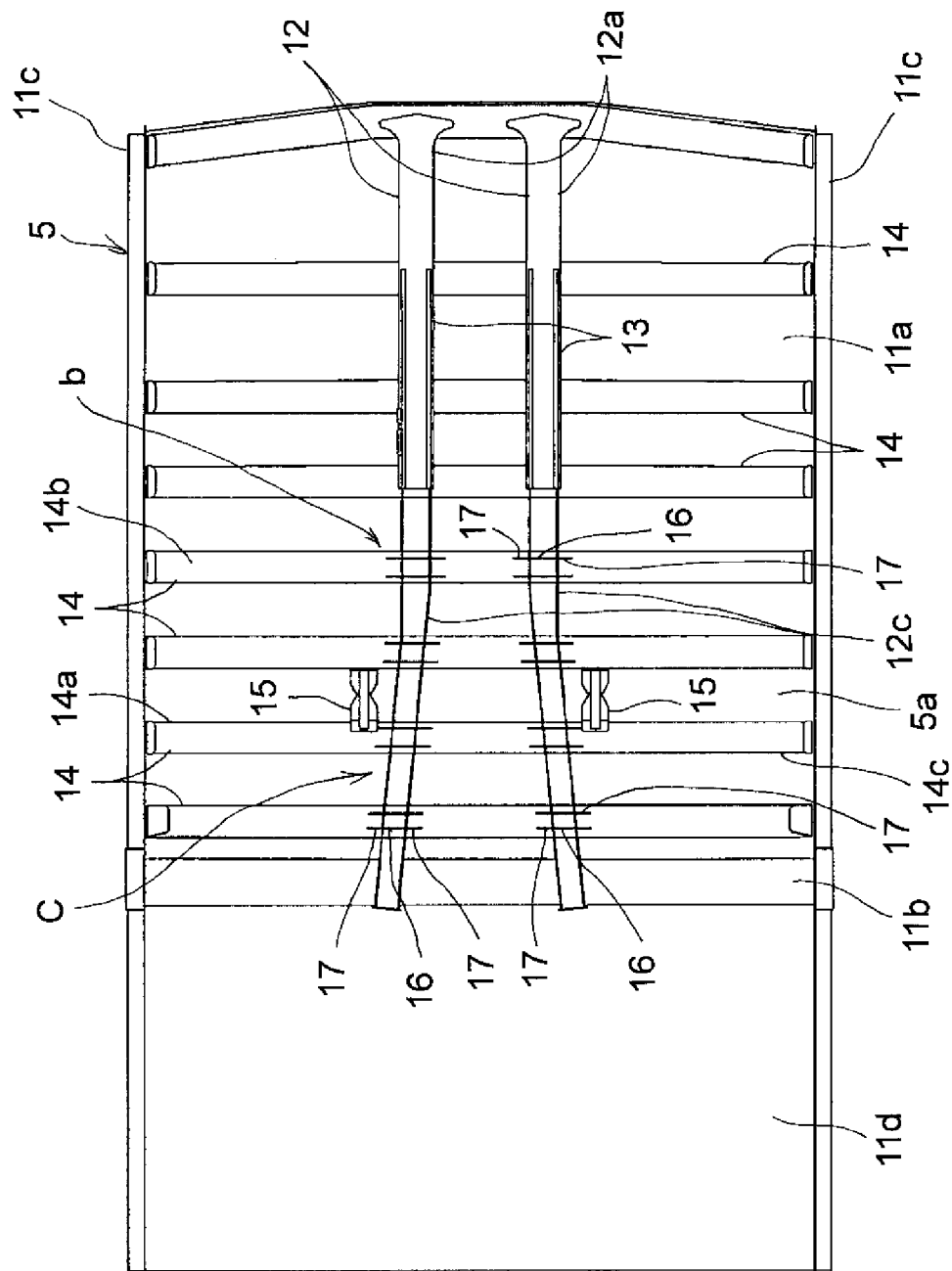
[Fig. 2]



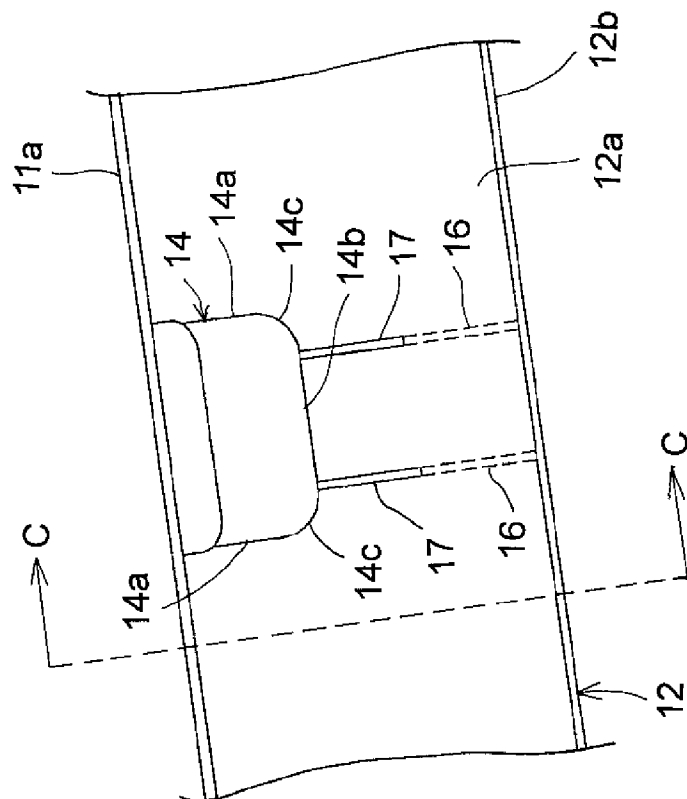
[Fig. 4]



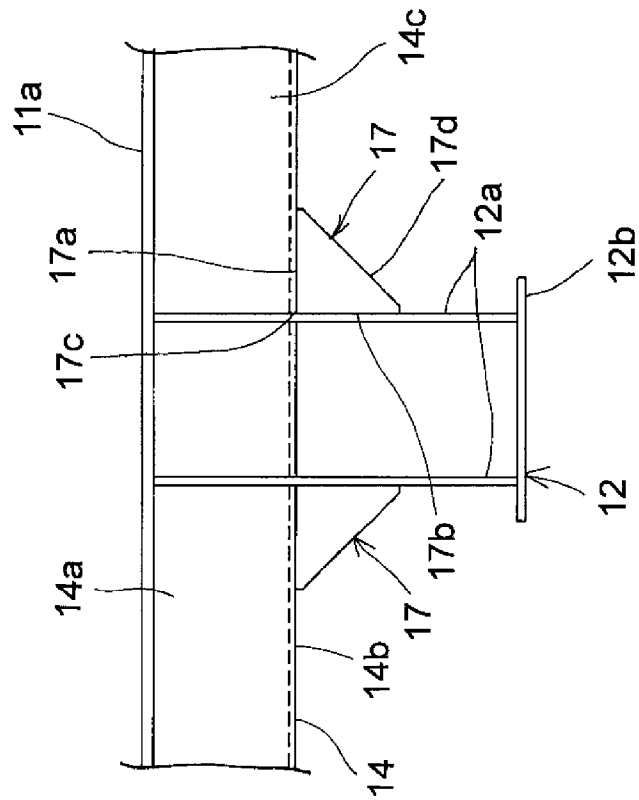
[Fig. 5]



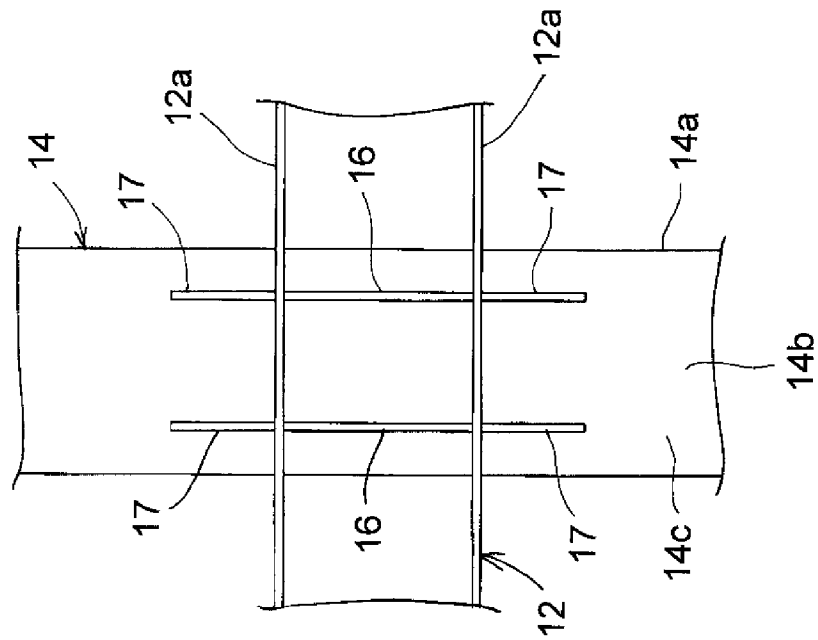
[Fig. 6]



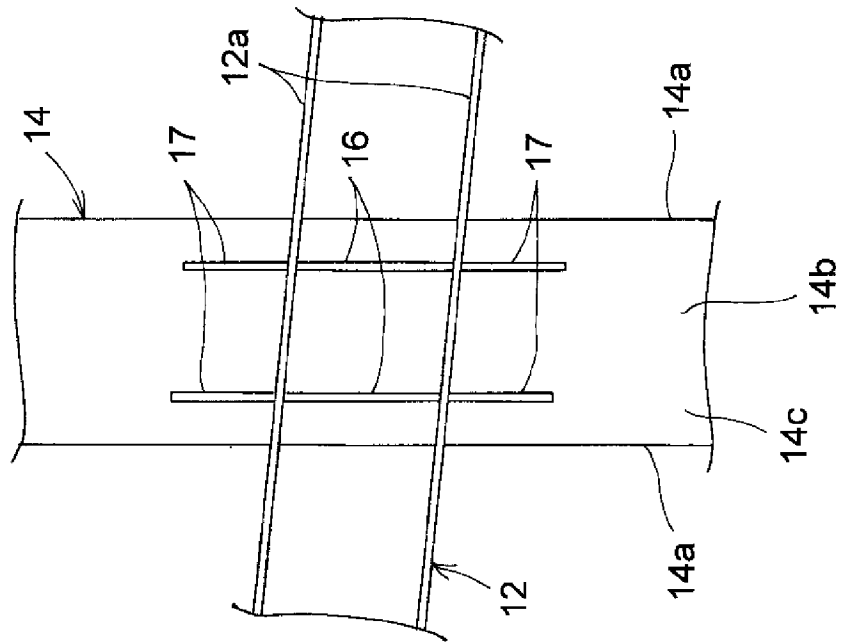
[Fig. 7]



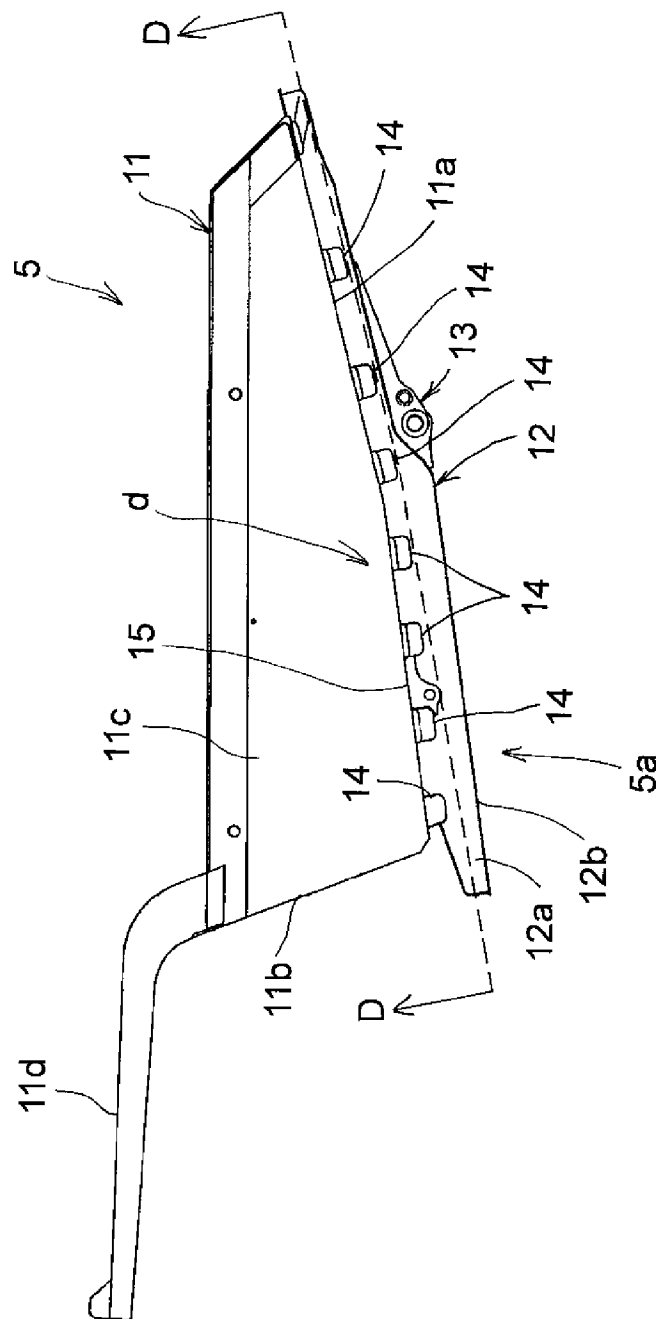
[Fig. 8]



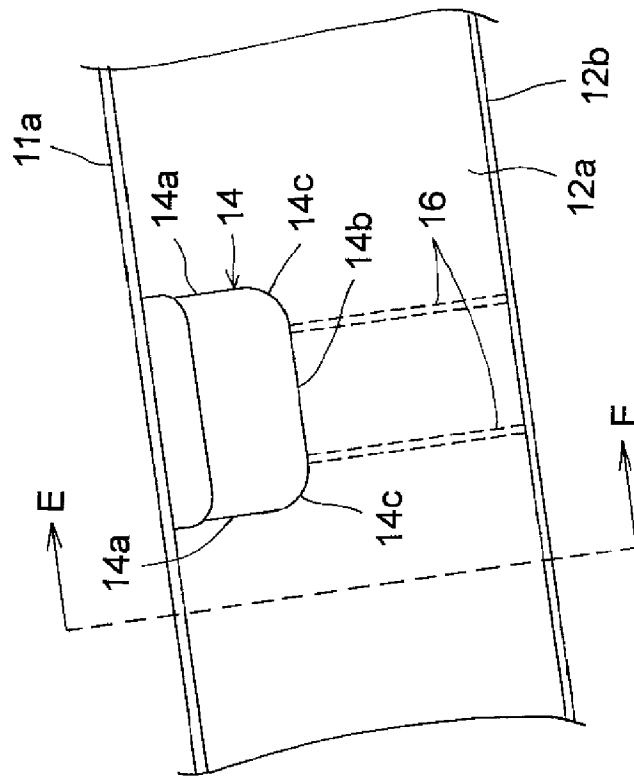
[Fig. 9]



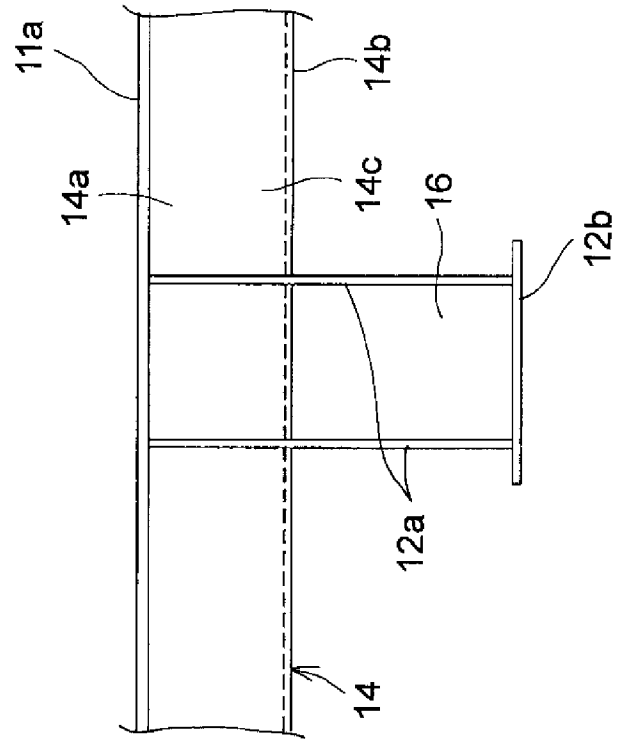
[Fig. 10]



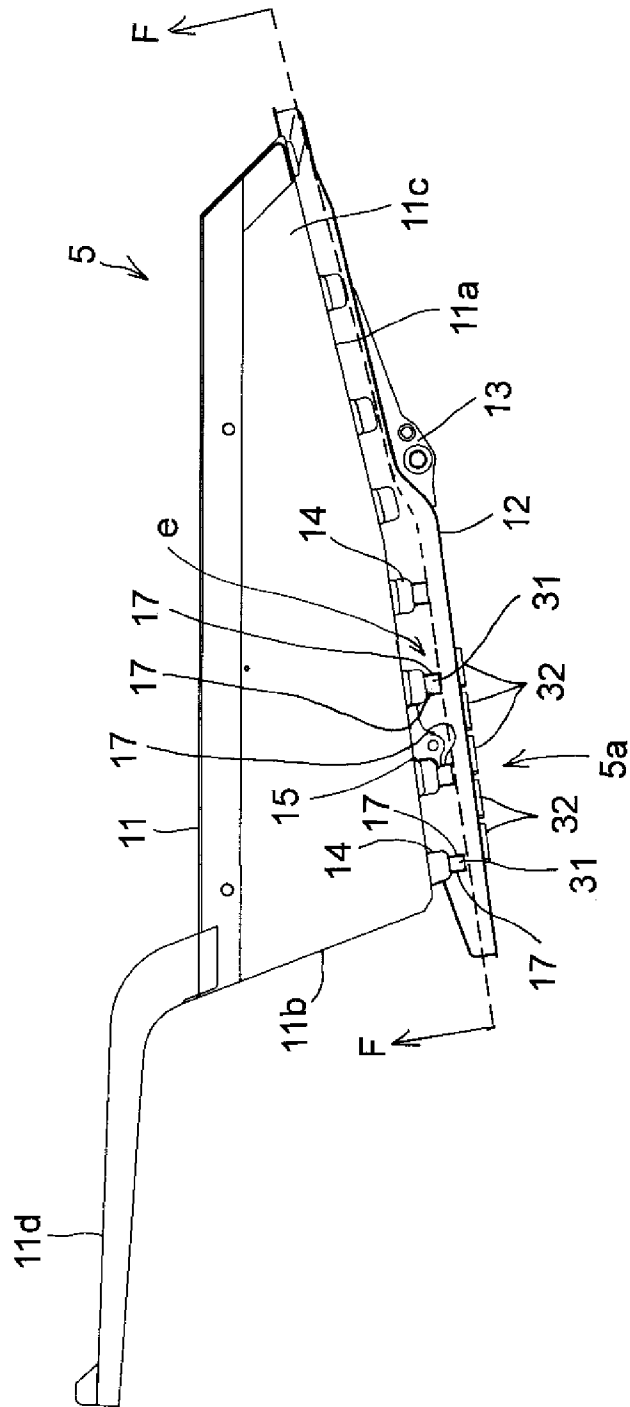
[Fig. 12]



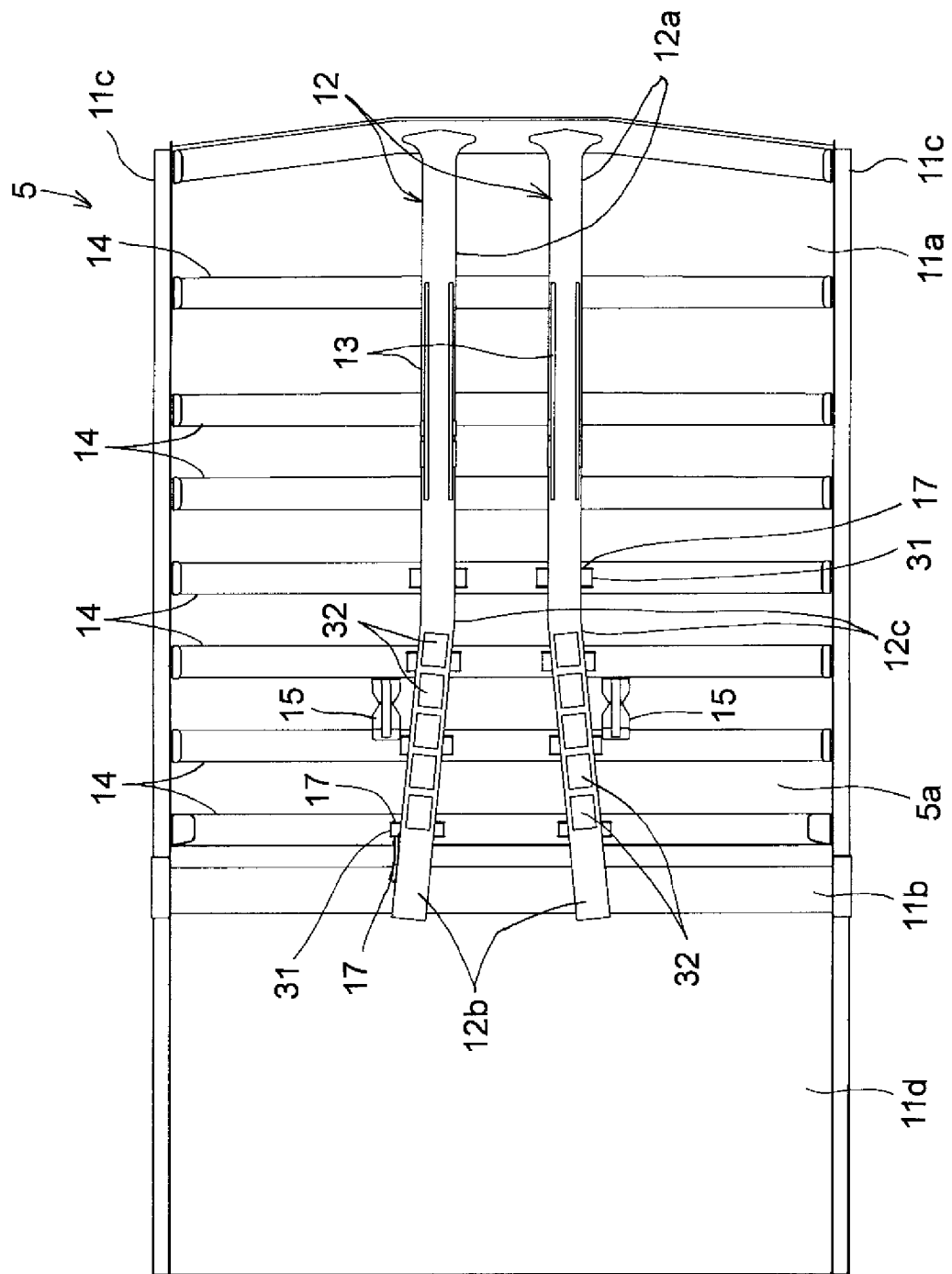
[Fig. 13]



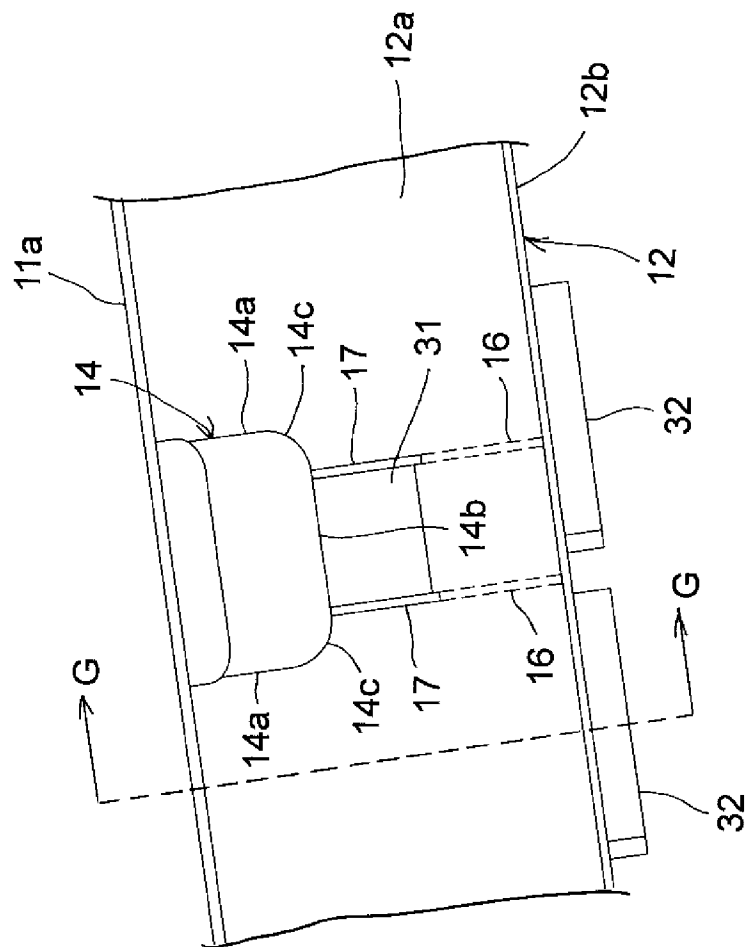
[Fig. 14]



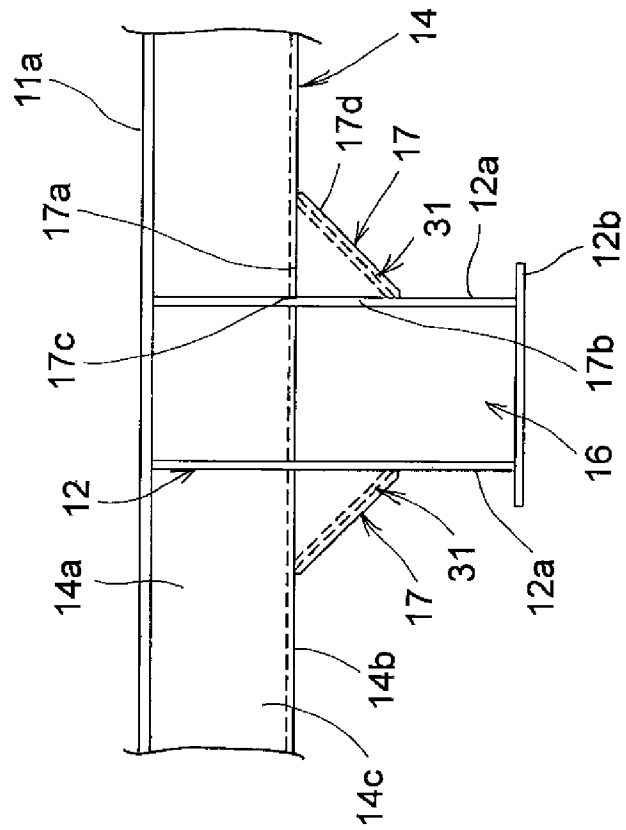
[Fig. 15]



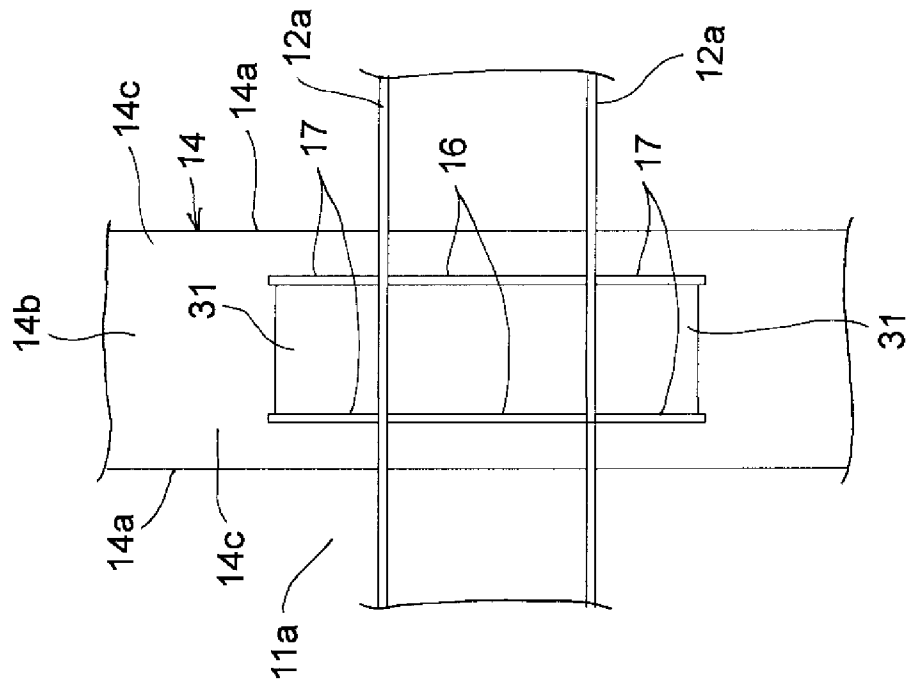
[Fig. 17]



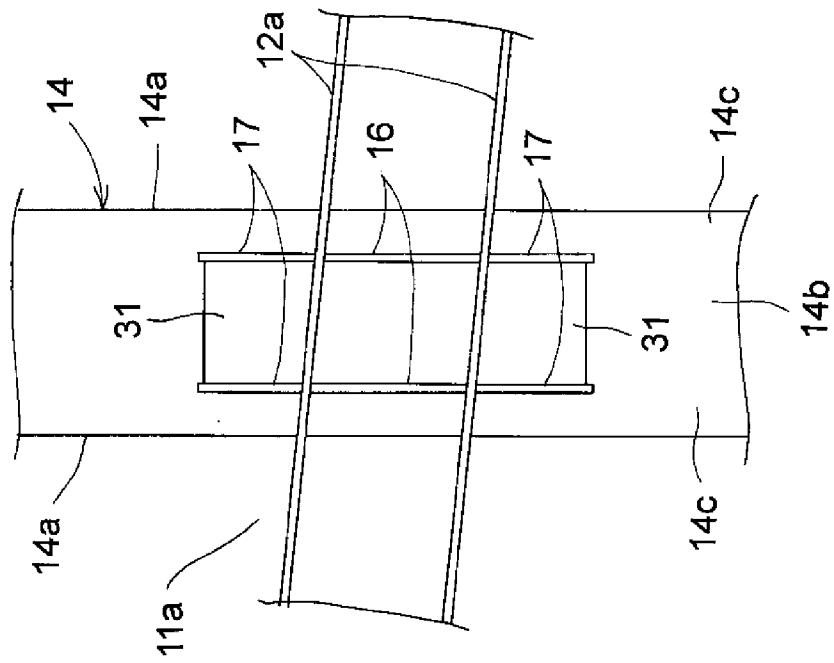
[Fig. 18]



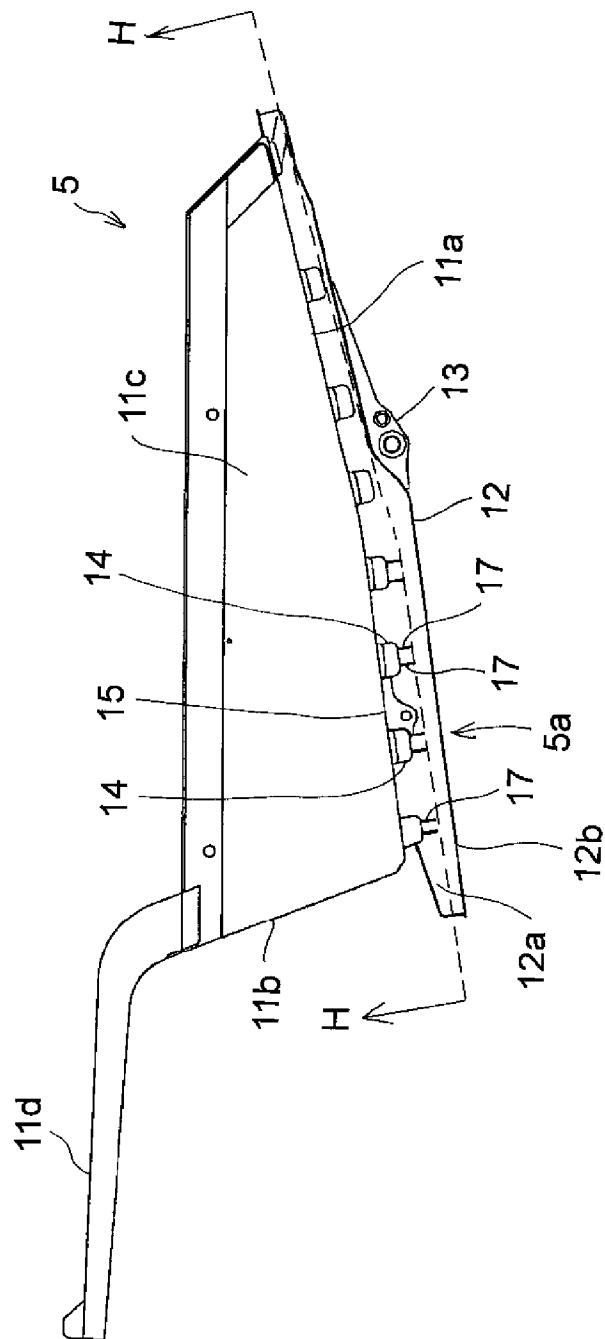
[Fig. 19]



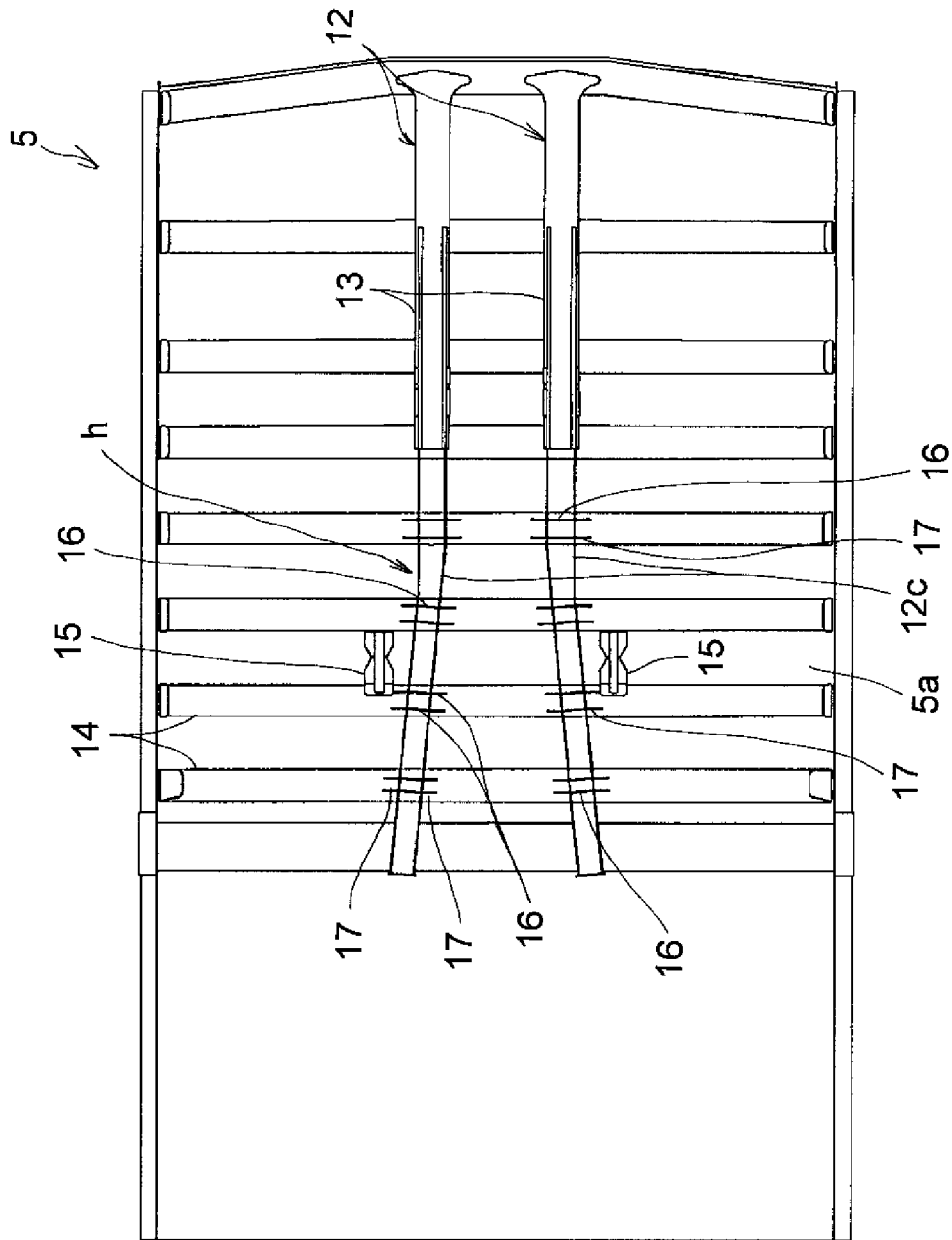
[Fig. 20]



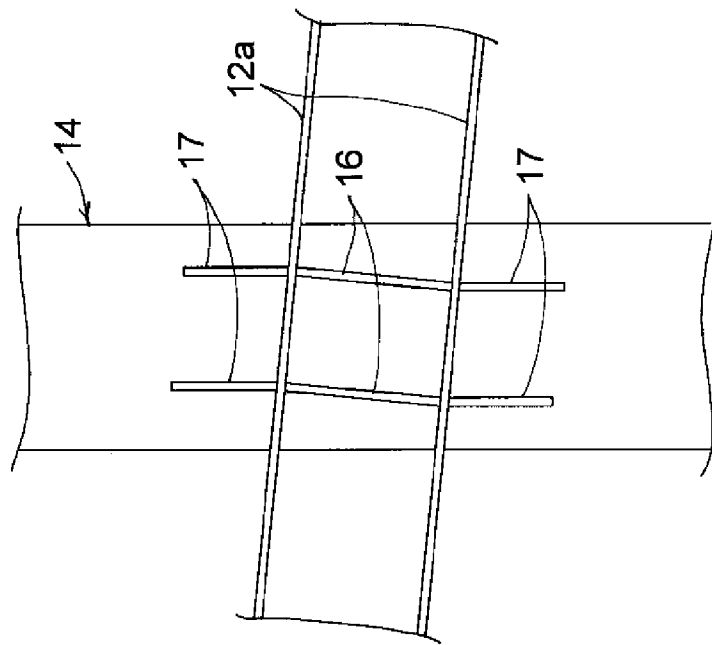
[Fig. 21]



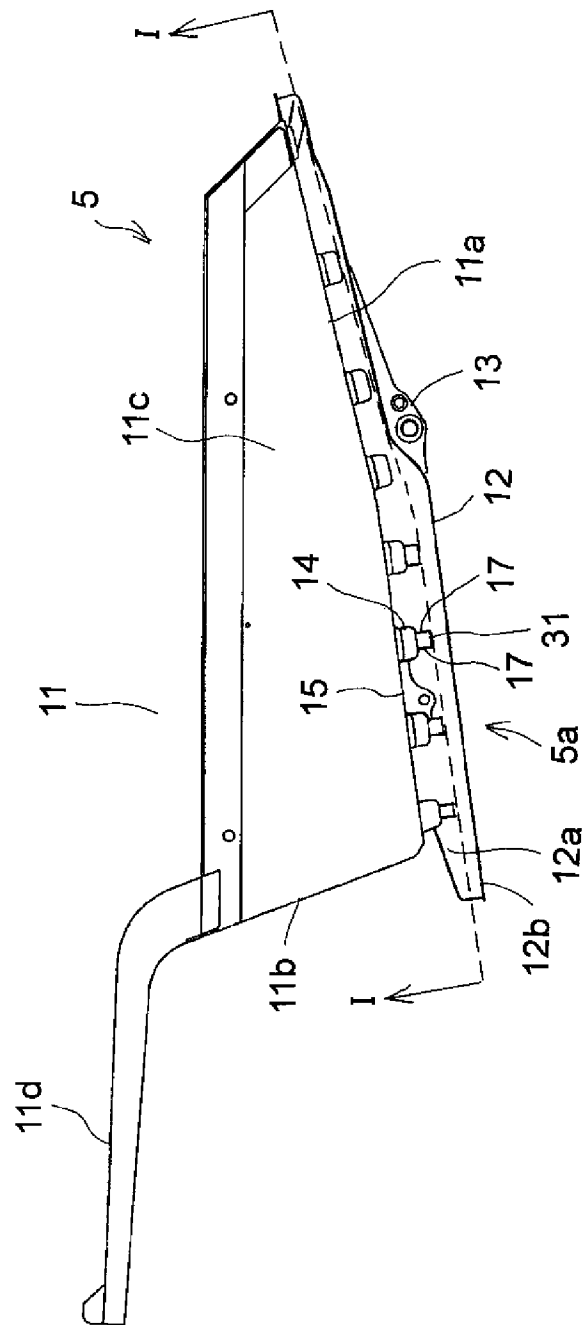
[Fig. 22]



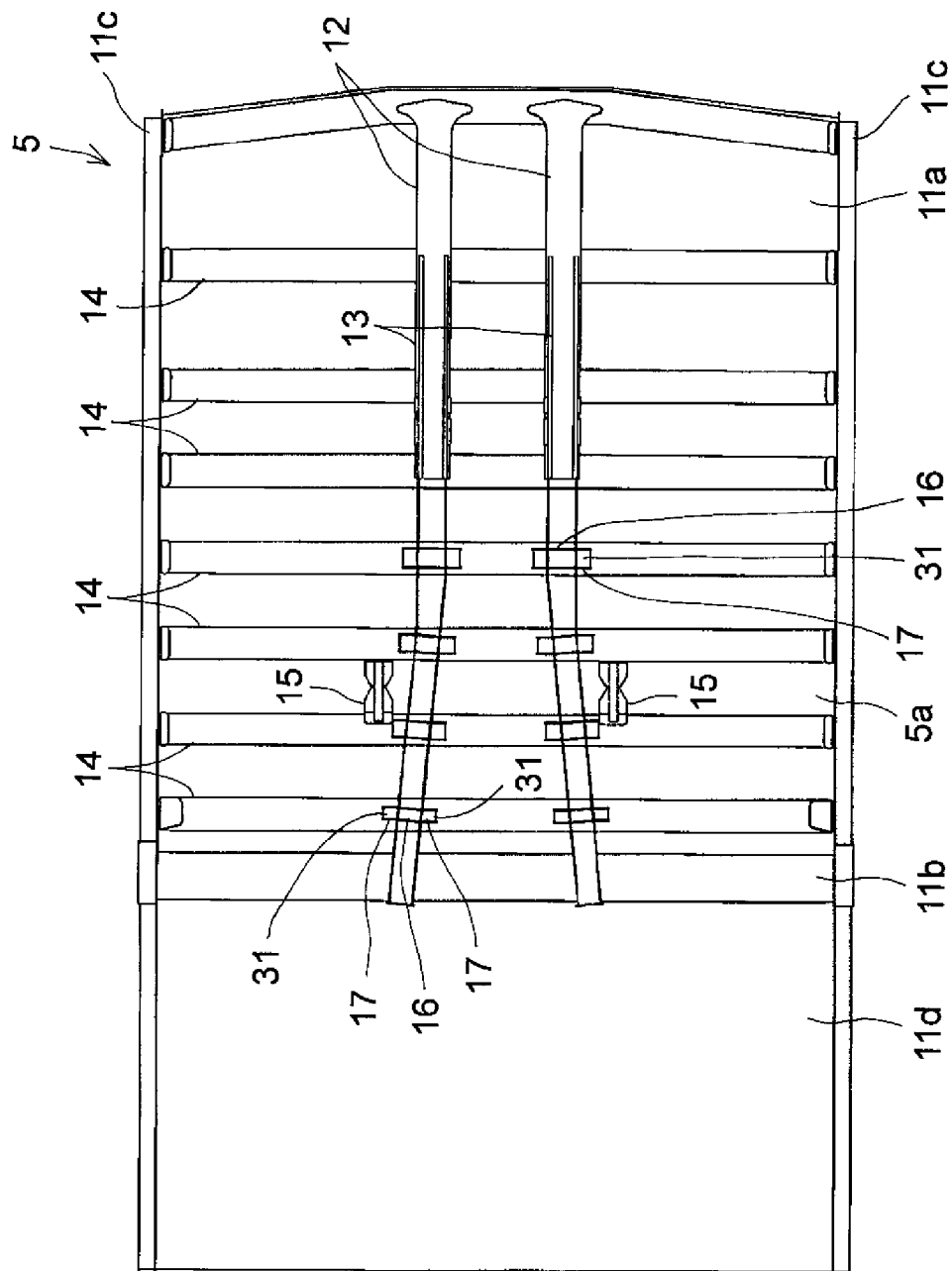
[Fig. 23]



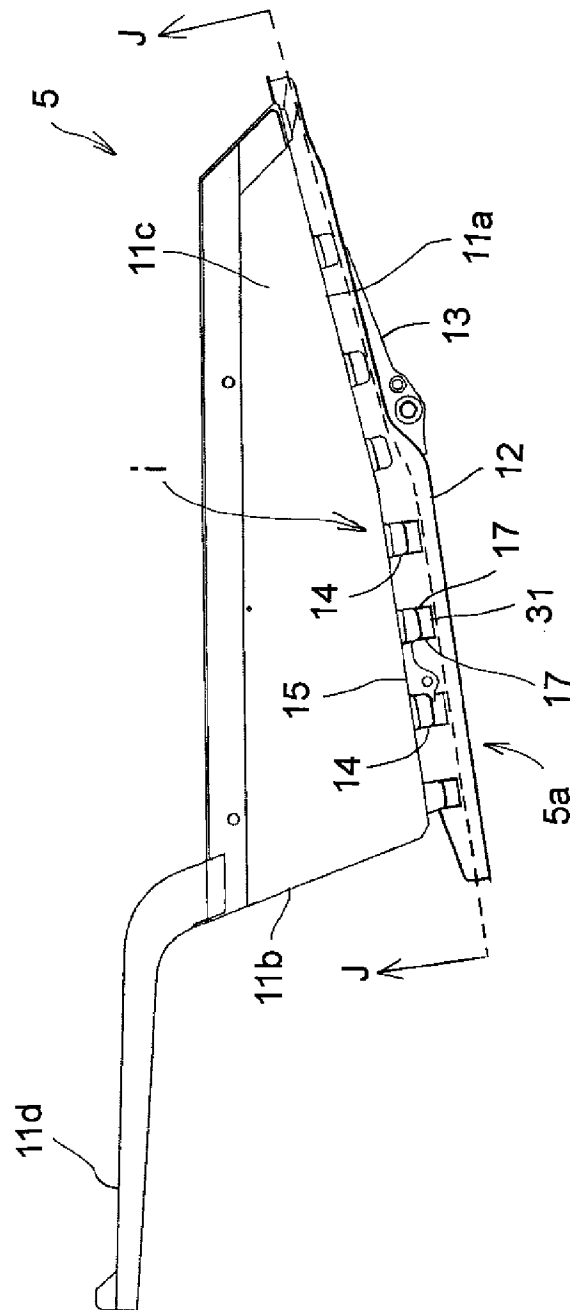
[Fig. 25]



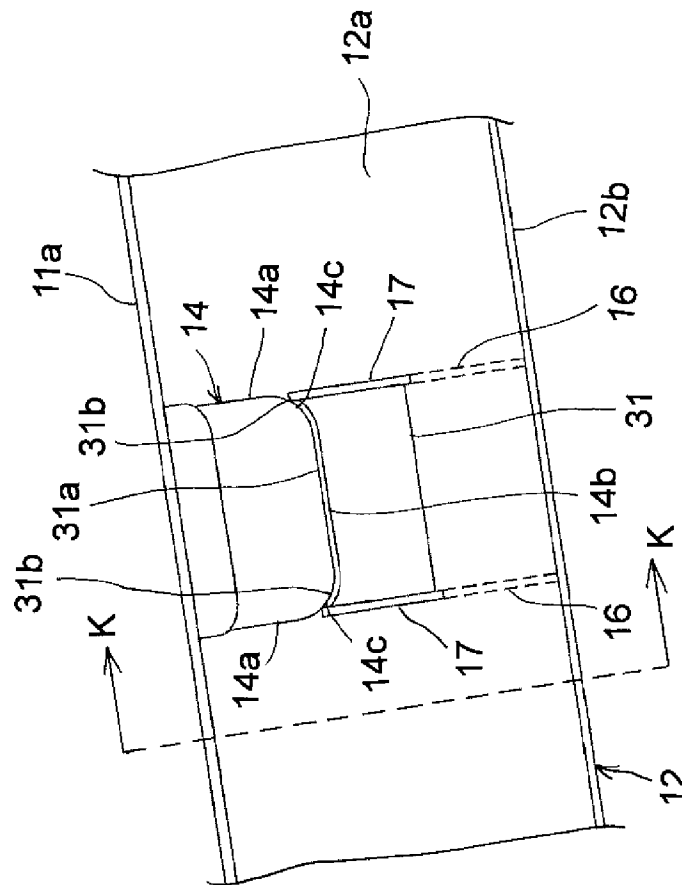
[Fig. 26]



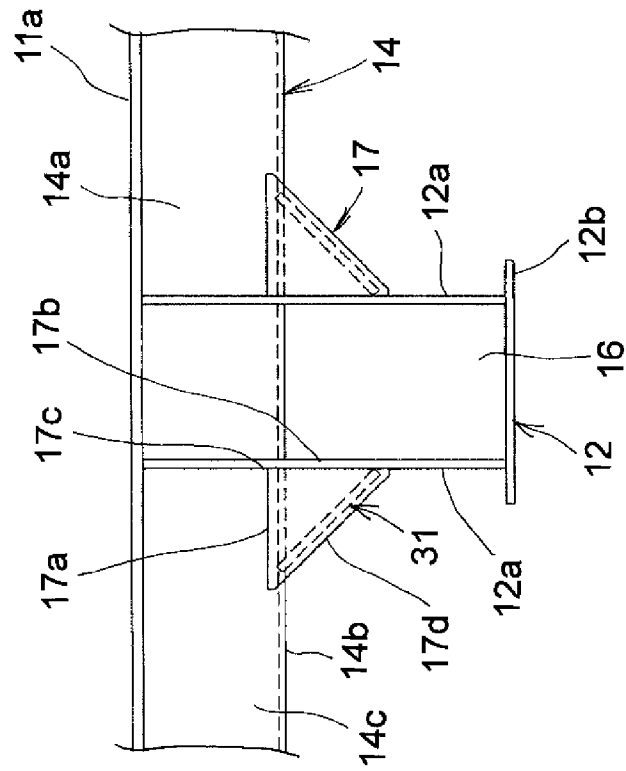
[Fig. 27]



[Fig. 29]



[Fig. 30]



INTERNATIONAL SEARCH REPORT

International application No

PCT/JP2012/006270

A. CLASSIFICATION OF SUBJECT MATTER
INV. B60P1/28
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)
B60P

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2008/112359 A2 (MINE RITE TECHNOLOGIES LLC [US]; D AMICO JOHN A [US]; FRANK DENNIS A []) 18 September 2008 (2008-09-18) claims 1-10; figures 1-2 -----	1,2,7
A	US 3 938 238 A (KERSHAW SAMUEL L ET AL) 17 February 1976 (1976-02-17) figure 3 -----	1-9
A	WO 2012/007994 A1 (HITACHI CONSTRUCTION MACHINERY [JP]; KITAGUCHI ATSUSHI [JP]; SATOU TAK) 19 January 2012 (2012-01-19) claim 1; figure 4 -----	1-9
A	WO 2010/020925 A1 (REENEN STEEL PTY LTD VAN [ZA]; HAASBROEK ALBERTUS JACOBUS [ZA]) 25 February 2010 (2010-02-25) claims 1-2; figures 1-3 ----- -/-	1-9



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" 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

3 December 2012

Date of mailing of the international search report

07/12/2012

Name and mailing address of the ISA/

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040,
Fax: (+31-70) 340-3016

Authorized officer

Szaip, András

INTERNATIONAL SEARCH REPORT

International application No

PCT/JP2012/006270

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 2011/075355 A1 (WESTERN TECHNOLOGY SERVICES INTERNATIONAL INC [US]; REYNOLDS FREDERICK) 23 June 2011 (2011-06-23) claims 1-2; figure 1 -----	1-9

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/JP2012/006270

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2008112359	A2	18-09-2008	CA 2622128 A1 12-09-2008
		CA 2734733 A1 12-09-2008	
		US 2007182208 A1 09-08-2007	
		WO 2008112359 A2 18-09-2008	
US 3938238	A	17-02-1976	NONE
WO 2012007994	A1	19-01-2012	NONE
WO 2010020925	A1	25-02-2010	NONE
WO 2011075355	A1	23-06-2011	AU 2010332139 A1 15-12-2011
		CA 2768403 A1 23-06-2011	
		CN 102470789 A 23-05-2012	
		US 2012153705 A1 21-06-2012	
		WO 2011075355 A1 23-06-2011	