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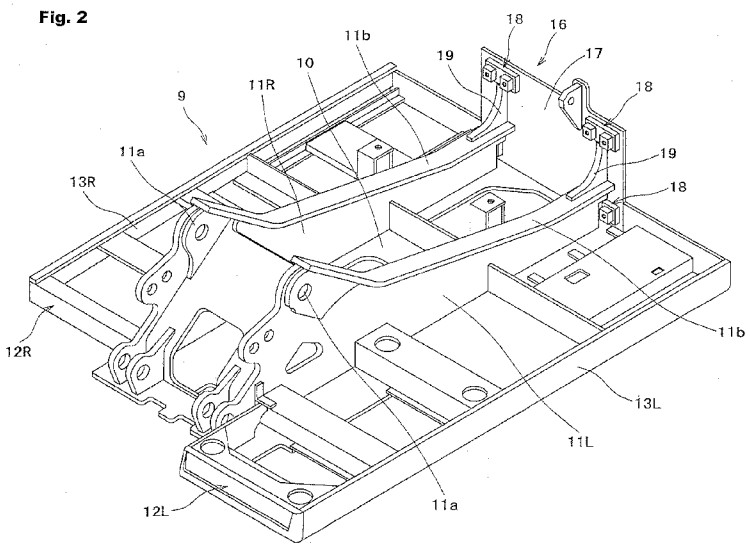
(54) **Title**: COUNTERWEIGHT SUPPORTING STRUCTURE FOR CONSTRUCTION MACHINE

Fig. 2



(57) **Abstract**: PROBLEM : To improve the precision of position of a fastener hole and a seating face for mounting a counterweight provided at a counterweight supporting member when the counterweight is mounted to the counterweight supporting member through a fastener bolt. SOLUTION : A counterweight supporting member (16) is comprised of a supporting plate (17) erected and fixed at the rear end of a revolving frame (9) and a supporting member (18) attached to the supporting plate (17) that is fixed to the revolving frame (9), and the supporting member (18) is comprised of a base member (20) that is locked and secured to a through hole (17a) opened on the supporting plate (17) in a back and forth adjustable manner and has a counterweight fixing surface (20a) and a bolt fastening member (21) in which a fastener hole (21a) to be fastened by a fastener bolt (15) is formed.

WO 2016/202811 A1

[DESCRIPTION]

[Title of Invention]

COUNTERWEIGHT SUPPORTING STRUCTURE FOR CONSTRUCTION MACHINE

[Technical Field]

[0001] The present invention relates to the technical field of a counterweight supporting structure for a construction machine such as a hydraulic shovel.

[Background Art]

[0002] Some construction machines have a counterweight for ensuring the balance of the machine body. These construction machines are generally known to have a configuration in which the counterweight, when mounted on the machine body, is supported by a counterweight support through fastening bolts, the counterweight support being provided in the rear portion of the vehicle body frame. For instance, in a hydraulic shovel, an example of a construction machine, the counterweight support is provided in the rear portion of the vehicle body frame (slewing frame) configuring the base of an upper slewing body, wherein the counterweight is supported by the counterweight support through fastening bolts fastened thereto. In such a construction machine, the counterweight support has a counterweight mounting seat surface that is integrally fixed by adhesion or the like to the rear portion of the

vehicle body frame to configure a part of the vehicle body frame and comes into surface-contact with the counterweight, wherein the counterweight mounting seat surface is sometimes machined to ensure a flat surface or to form fastener holes (screw holes) for the fastening bolts by using machine tools.

Incidentally, many of the construction machines are large vehicles, and the larger the vehicle sizes, the more difficult it is to machine the counterweight mounting seat surface after the completion of the assembly of the vehicle body frame, because of the size of the machine tools. Therefore, the counterweight support in which the counterweight mounting seat surface has already been machined beforehand is welded to form the vehicle body frame. In this case, however, the counterweight support might become shifted from a predetermined regular position thereof due to welding stress or the like that occurs upon the assembly of the vehicle body frame, resulting in shifting of the counterweight mounting seat surface and fastener holes from their regular positions. Especially when the reference for positioning is set at the front side of the vehicle body frame or a slewing bearing portion, the counterweight support located on the rear end side of the vehicle body frame is displaced significantly due to the

accumulation of welding stress. This makes it difficult to attach the counterweight and generates a gap or level difference between the counterweight and a vehicle body cover or a skirt channel disposed in front of the counterweight, because the counterweight is attached with the counterweight support being displaced, resulting in damaging the appearance.

There have conventionally been known a technique for configuring the counterweight support by using a vertical plate extending from the vehicle body frame, a back plate and a bottom plate adhered respectively to upper and lower end surfaces of the vertical plate, and a pipe member that is capable of sliding vertically between the back plate and the bottom plate and has a counterweight mounting seat surface (counterweight supporting surface) on its upper surface, wherein the pipe member is adhered to a back plate and the bottom plate after the back plate and the bottom plate are adhered to the vertical plate (see, for example, PTL 1), and a technique for adhering the back plate to the vertical plate extending from the vehicle body frame and thereafter adhering a block having a counterweight mounting seat surface on its upper surface to a cutout portion of the back plate (see, for example, Fig. 7 of PTL 1).

Furthermore, there has also been known a technique for forming a boss fitting hole in the rear portion of the vehicle body frame, forming a boss capable of coming into engagement with the boss fitting hole in a front surface of the counterweight, and attaching the counterweight to the vehicle body frame by fastening a bolt passing through the boss, wherein the boss fitting hole is shaped into an oval having the horizontal length greater than the vertical length, and the boss fitting position in the boss fitting hole can be displaced/adjusted by a small amount in the lateral direction (see, for example, PTL 2).

[Citation List]

[Patent Literature]

[0003]

[PTL 1] Japanese Patent Application Laid-open No. 2001-32328

[PTL 2] Japanese Patent Application Laid-open No. H9-209407

[Summary of Invention]

[Technical Problem]

[0004] According to the technique described in PTL 1, the pipe member and/or the block with the counterweight mounting seat surface is adhered after assembling the vehicle body frame. Therefore, it is considered that the positions for attaching the pipe member and the block can

be adjusted at the time of the adhesion thereof. However, although vertical adjustment of the position of the pipe member is possible because the pipe member is fitted in a vertically movable manner into pipe holes that are opened in the back plate and the bottom plate, the position of the pipe member cannot be adjusted in the longitudinal direction and the lateral direction. Moreover, since the block is attached to the cutout portion of the back plate with the longitudinal and lateral positions of the block being determined, then similarly to the case of the pipe, the vertical position of the block can be adjusted but the position of the block cannot be adjusted in the longitudinal direction and the lateral direction. Furthermore, in a case where the vertical plate, the back plate, and the bottom plate configuring the counterweight support are inclined due to welding stress and the like occurring when assembling the vehicle body frame, the counterweight mounting seat surface of the pipe member and/or the block becomes also inclined, creating a risk of not being able to ensure the perpendicularity of these components with respect to the horizontal reference of the machine body.

According to the technique described in PTL 2, on the other hand, the position for attaching the counterweight

can be adjusted in the lateral direction because the boss fitting position in the boss fitting hole of the vehicle body frame can be changed in the lateral direction, but the position for attaching the counterweight cannot be adjusted in the vertical direction and the longitudinal direction. In addition, PTL 2 describes a configuration in which the front end surface of the boss of the counterweight comes into abutment with the bottom surface portion of the boss fitting hole; in other words, the bottom surface portion of the boss fitting hole is the counterweight mounting seat surface. However, in a case where the counterweight mounting seat surface is inclined due to welding stress and the like occurring when assembling the vehicle body frame, the perpendicularity thereof with respect to the horizontal reference of the machine body cannot be ensured, as with the technique described in PTL 1; here lie the problems that are to be solved by the present invention.

[Solution to Problem]

[0005] The present invention was contrived in view of the foregoing circumstances and for the purpose of solving these problems. The invention described in claim 1 is a counterweight supporting structure for a construction machine having a counterweight, wherein, in order to support the counterweight on a counterweight support

provided in a rear portion of a vehicle body frame by using a fastening bolt, the counterweight support is configured using a support plate that is fixed upright to the rear portion of the vehicle body frame, and a support member that is attached to the support plate fixed to the vehicle body frame, brought into abutment with the counterweight, and has the fastening bolt fastened thereto, the support member being configured with a base member that is fixed to the support plate in such a manner that a longitudinal position of the base member is adjustable, a bolt fastening member which is fixed to the base member in such a manner that vertical and lateral positions of the bolt fastening member are adjustable and which has a fastener hole to which the fastening bolt is fastened, and a counterweight mounting seat surface that is formed in the base member or the bolt fastening member and comes into abutment with the counterweight.

The invention described in claim 2 is, according to claim 1, a counterweight supporting structure for a construction machine, wherein the base member has a bolt hole that leads to the fastener hole in a state where the bolt fastening member is fixed to the base member, and a diameter of the bolt hole is made large so as to be able to allow displacement of the fastener hole caused by

adjustment of the vertical and lateral positions of the bolt fastening member.

The invention described in claim 3 is, according to claim 1 or 2, a counterweight supporting structure for a construction machine, wherein the base member is fixed to the support plate in such a manner that inclination of the base member with respect to the support plate is adjustable.

[Advantageous Effects of Invention]

[0006] According to the invention described in claim 1, the positional accuracy of the counterweight mounting seat surface and of the fastener hole can reliably be improved by adjusting the longitudinal position of the base member and the vertical and lateral positions of the bolt fastening member in order to attach the support member to the support plate.

According to the invention described in claim 2, even when the fastener hole is displaced as a result of adjusting the bolt fastening member in the vertical and lateral directions, the bolt hole can be punched and fastened to the fastener hole without having the fastening bolt interfere with the base member.

According to the invention described in claim 3, not only is it possible to ensure the perpendicularity of the

base member with respect to the horizontal reference of the machine body, but also the flatness of the mounting seat surface can be ensured without performing any machining, but by adjusting the inclination of the base member with respect to the support plate.

[Brief Description of Drawings]

[0007]

[Fig. 1]

Fig. 1 is a side view of a hydraulic shovel.

[Fig. 2]

Fig. 2 is a perspective view of a slewing frame.

[Fig. 3]

Fig. 3 is a perspective view of a counterweight support, viewed from the front.

[Fig. 4]

Fig. 4 is a perspective view of the counterweight support, viewed from the rear.

[Fig. 5]

Fig. 5(A) is a cross-sectional view showing substantial parts of the counterweight support, and Fig. 5(B) is a cross-sectional view of the counterweight support to which a counterweight is attached.

[Fig. 6]

Fig. 6(A) is a perspective view showing how a base member is attached, and Fig. 6(B) a perspective view showing how a bolt fastening member is attached.

[Fig. 7]

Fig. 7(A) is a cross-sectional view of the counterweight support to which is attached a counterweight according to a second embodiment, and Fig. 7(B) is a cross-sectional view of the counterweight support to which is attached a counterweight according to a third embodiment.

[Fig. 8]

Fig. 8 is a cross-sectional view showing how a base member according to a fourth embodiment is attached.

[Fig. 9]

Fig. 9 is a perspective view of a counterweight support according to a fifth embodiment.

[Description of Embodiments]

[0008] Embodiments of the present invention are now described hereinafter with reference to the drawings. In the diagrams, reference numeral 1 represents a hydraulic shovel, an example of a construction machine. The hydraulic shovel 1 is configured with parts such as a crawler-type lower traveling body 2, an upper slewing body 4 supported in a slewable manner by the lower traveling

body 2 through a slewing bearing 3, and a front working unit 5 installed on the upper slewing body 4. The upper slewing body 4 is provided with an operator's cab 6 and an engine room 7, and a rear end portion of the upper slewing body 4 is provided with a counterweight 8 for balancing the load with respect to the front working unit 5.

[0009] Reference numeral 9 represents a slewing frame configuring the base of the upper slewing body 4 (corresponding to a vehicle body frame according to the present invention). The slewing frame 9 is configured with various frame materials such as a bottom surface plate 10 to which the slewing bearing 3 is attached, left and right main frames 11L, 11R taken in pairs that are provided upright on the bottom surface plate 10, have a working unit mounting seat 11a axially supporting a base end portion of the front working unit 5, and extend in the longitudinal direction, left and right side frames 12L, 12R provided on the outside of the left and right main frames 11L, 11R and having various pieces of equipment such as the operator's cab 6 and the engine (not shown) mounted therein, and left and right skirt channels 13L, 13R provided on the outer end portions of the left and right side frames 12L, 12R and extending in the longitudinal direction. These frame materials are welded integrally. A counterweight support

16 for supporting the counterweight 8 using fastening bolts 15 is provided at the rear portion of the slewing frame 9.

[0010] The counterweight support 16 is configured using a support plate 17, described hereinafter, which is fixed upright at the rear portion of the slewing frame 9, and support members 18, described hereinafter, which are attached to the support plate 17, brought into abutment with a front surface 8a of the counterweight 8, and have the fastening bolts 15 fastened thereto.

[0011] The support plate 17, one of the frame materials configuring the slewing frame 9, is integrally fixed by welding to the rear end portions of the left and right main frames 11L, 11R and of the bottom surface plate 10, with the surface of the support plate 17 being oriented vertically so as to face the front surface 8a of the counterweight 8 supported by the counterweight support 16. Rectangular through-holes 17a are opened at a total of four portions of the support plate 17, i.e., the upper left portion, the upper right portion, the lower left portion, and the lower right portion. The support members 18 are attached to these through-holes 17a. In the diagram, reference numeral 19 represents a reinforcing plate that is adhered to each of the corners formed between the support plate 17 and upper surfaces 11b of the left and right main

frames 11L, 11R. Reference numeral 17b represents a projection that is formed on the rear surface of the support plate 17 (the surface facing the front surface 8a of the counterweight 8) and comes into engagement with a depression (not shown) formed in a lower portion of the front surface 8a of the counterweight 8.

[0012] The support members 18 are each configured using a base member 20, described hereinafter, which is attached to the support plate 17 fixed to the slewing frame 9, after the assembly of the slewing frame 9, fitted and fixed to the corresponding through-hole 17a of the support plate 17 in such a manner that the longitudinal position of the base member 20 is adjustable, and has a counterweight mounting seat surface 20a, and a bolt fastening member 21, described hereinafter, which is fixed to the base member 20 in such a manner that the vertical and lateral positions of the bolt fastening member 21 are adjustable, and has fastener holes (screw holes) 21a to which the fastening bolts 15 are fastened.

[0013] The base members 20 are in the shape of a rectangular block so as to be fitted to the respective rectangular through-holes 17a opened in the support plate 17, in such a manner that the base members can be moved in the longitudinal direction. The thickness of each base

member 20 in the longitudinal direction is set to be greater than the thickness of the support plate 17 in the longitudinal direction, and the base members 20 can be moved in the longitudinal direction by the difference between the thicknesses excluding the weld leg length. The base members 20 are fitted into the through-holes 17a in such a manner that the rear surfaces of the base members 20 (the surfaces facing the front surface 8a of the counterweight 8) project farther than the rear surface of the support plate 17, wherein the rear surfaces of the base members 20 configure the counterweight mounting seat surfaces 20a, with which the front surface 8a of the counterweight 8 comes into surface-contact. Moreover, bolt holes 20b through which the fastening bolts 15 loosely pass are punched in the respective base members 20. The bolt holes 20b lead to the fastener holes 21a of the bolt fastening members 21 in a state where the bolt fastening members 21 are fixed to the base members 20, wherein the bolt holes 20b are formed to have a diameter larger than that of the fastener holes 21a so as to be able to allow displacement of the fastener holes 21a that is caused as a result of adjusting the vertical and lateral positions of the bolt fastening members 21, as will be described hereinafter. With the longitudinal positions of the base

members 20 adjusted, the base members 20 fitted into the through-holes 17a of the support plate 17 are fixed by welding to the support plate 17 so that the counterweight mounting seat surfaces 20a adjusted to predetermined regular positions. In the present embodiment, left and right bolt holes 20b taken in pairs are punched in the base members 20 of the respective support members 18 attached to the upper left and upper right through-holes 17a of the support plate 17. Also, a single bolt hole 20b is punched in the center of each of the base members 20 of the respective support members 18 attached to the lower left and lower right through-holes 17a.

[0014] The bolt fastening members 21 are in the shape of a rectangular block smaller than the base member 20, in which the fastener holes 21a to which the fastening bolts 15 are fastened are formed in the middle. The bolt fastening members 21 are fixed in such a manner that the bolt holes 20b of the base members 20 and the fastener holes 21a lead to the front surfaces of the base members 20 (the surfaces opposite to the counterweight mounting seat surfaces 20a). In this case, the diameter of the bolt holes 20b is greater than the diameter of the fastener holes 21a as described above, and the position for fixing the bolt fastening members 21 to the base members 20 are

set in such a manner that the entire regions of the fastener holes 21a can be moved vertically and laterally along the front surfaces of the base members 20, within a range leading to the bolt holes 20b of the base members 20. With the vertical and lateral positions of the bolt fastening members 21 being adjusted so that the vertical and lateral positions of the fastener holes 21a are located in the predetermined regular positions, the bolt fastening members 21 are fixed to the base members 20 by welding. Note that the bolt fastening members 21 are provided to correspond to the bolt holes 20b of the base members 20 individually. In the present embodiment, left and right bolt fastening members 21 taken in pairs, corresponding to left and right bolt holes 20b taken in pairs, are fixed to the base members 20 that are fixed to the through-holes 17a on the upper left portion and the upper right portion of the support plate 17, and one bolt fastening member 21 corresponding to one bolt hole 20b is fixed to the base members 20 that are fixed to the through-holes 17a on the lower left portion and the lower right portion of the support plate 17.

[0015] Then, after assembling the slewing frame 9, the counterweight support 16 is formed by fixing the base members 20 to the support plate 17 configuring the slewing

frame 9 and then by fixing the bolt fastening members 21 to the base members 20. In this case, the longitudinal positions of the counterweight mounting seat surfaces 20a can be positioned to the regular positions by adjusting the longitudinal positions of the base members 20, and the vertical and lateral positions of the fastener holes 21a can be positioned to the regular positions by adjusting the vertical and lateral positions of the bolt fastening members 21. In order to fix the base members 20 and the bolt fastening members 21, the base members 20 and the bolt fastening members 21 are placed in the regular positions and held using a jig, and then fixed by welding.

[0016] On the other hand, the counterweight 8 is provided with bolt insertion holes 8b that have the fastening bolts 15 inserted therethrough and penetrate from the front to the rear of the counterweight 8. When supporting the counterweight 8 using the counterweight support 16, the fastening bolts 15, which are inserted into the bolt insertion holes 8b from the rear side of the counterweight 8, pass through the bolt holes 20b of the base members 20 and are threaded and fastened to the fastener holes 21a of the bolt fastening members 21, while having the front surface 8a of the counterweight 8 in surface-contact with the counterweight mounting seat

surfaces 20a of the base members 20. In this manner, the counterweight 8 is supported by the counterweight support 16. In this case, however, the positions of the counterweight mounting seat surfaces 20a and the fastener holes 21a are adjusted to the regular positions as described above, whereby the counterweight 8 can be attached to the regular position.

[0017] In the embodiment that is configured as described above, the counterweight 8 is supported by the counterweight support 16 in the rear portion of the slewing frame 9 through the fastening bolts 15, wherein the counterweight support 16 is configured using the support plate 17 fixed upright to the rear portion of the slewing frame 9, and the support members 18 that are attached to the support plate 17 fixed to the slewing frame 9, come into abutment with the counterweight 8, and have the fastening bolts 15 fastened thereto. The support members 18 are configured using the base members 20 with the counterweight mounting seat surfaces 20a, which are fitted and fixed to the through-holes 17a opened in the support plate 17, in such a manner that the longitudinal positions of the base members 20 are adjustable, and come into abutment with the counterweight 8, and the bolt fastening members 21 that are fixed to the base members 20 in such a

manner that the vertical and lateral positions of the bolt fastening members 21 are adjustable, and have the fastener holes 21a to which the fastening bolts 15 are fastened.

[0018] According to the present embodiment, as described above, when the support members 18 are attached to the support plate 17 fixed to the slewing frame 9, the support members 18 can be attached in view of displacement of the support plate 17 caused by welding stress or the like occurring during the assembly of the slewing frame 9. In this case, the support members 18 are configured with the base members 20 with the counterweight mounting seat surfaces 20a, the longitudinal positions of which are adjustable with respect to the support plate 17, and the bolt fastening members 21 with the fastener holes 21a, which have the vertical and lateral positions thereof adjustable with respect to the base members 20. Then, the longitudinal positions of the counterweight mounting seat surfaces 20a can be adjusted by adjusting the longitudinal positions of the base members 20, and the vertical and lateral positions of the fastener holes 21a can be adjusted by adjusting the vertical and lateral positions of the bolt fastening members 21, significantly improving the positional accuracy of the counterweight mounting seat surfaces 20a and of the fastener holes 21a. Consequently,

not only is it possible to perform the work of attaching the counterweight 8 accurately, but it is also possible to reliably prevent the appearance of the configuration from being ruined by a gap or level difference that can be generated between the counterweight 8 and the cover body covering the engine room 7 or the skirt channels 13L, 13R due to displacement of the counterweight mounting seat surfaces 20a or fastener holes 21a.

[0019] In this configuration, the base members 20 have the bolt holes 20b that lead to the fastener holes 21a of the bolt fastening members 21, in a state where the bolt fastening members 21 are fixed to the base members 20. The fastening bolts 15 that are inserted from the counterweight 8 side pass through the bolt holes 20b of the base members 20 and are then fastened to the fastener holes 21a of the bolt fastening members 21. In such a case, the diameter of the bolt holes 20b is made large so as to be able to allow displacement of the fastener holes 21a caused as a result of adjusting the vertical and lateral positions of the bolt fastening members 21. Thus, even when the axial centers of the fastener holes 21a are shifted from the axial centers of the bolt holes 20b as a result of adjusting and moving the bolt fastening members 21 in the vertical and lateral directions, the fastening bolts 15 can be allowed to pass

through the bolt holes 20b and fastened to the fastener holes 21a without interfering with the base members 20.

[0020] It goes without saying that the present invention is not limited to the foregoing embodiment (the first embodiment). In the support members 18 of the first embodiment, the front surfaces of the base members 20 are the counterweight mounting seat surfaces 20a coming into abutment with the counterweight 8, and the bolt fastening members 21 are fixed to the rear surfaces of the base members 20. In support members 22 of a second embodiment shown in Fig. 7(A), on the other hand, bolt fastening members 24 are fixed to the front surfaces of base members 23, and the front surfaces of the bolt fastening members 24 are counterweight mounting seat surfaces 24a coming into abutment with the counterweight 8. Even with the counterweight mounting seat surfaces 24a formed on the bolt fastening members 24 as described above, the longitudinal positions of the counterweight mounting seat surfaces 24a can be adjusted by adjusting the longitudinal positions of the base members 23. The components shown in Fig. 7(A) same as those of the first embodiment are given the same reference numerals. In Fig. 7(A), reference numeral 23a represents bolt holes formed in the base members 23, and 24b fastener holes formed in the bolt fastening members 24.

The configuration of the second embodiment is the same as that of the first embodiment in that the diameter of the bolt holes 23a of the base members 23 is made large so as to be able to allow displacement of the fastener holes 24b caused as a result of adjusting the vertical and lateral positions of the bolt fastening members 24.

[0021] Support members 27 of a third embodiment shown in Fig. 7(B) are configured such that, as with the second embodiment, bolt fastening members 29 are fixed to the front surfaces of base members 28, and the front surfaces of the bolt fastening members 29 are counterweight mounting seat surfaces 29a coming into abutment with the counterweight 8. In the third embodiment, the longitudinal length of the bolt fastening members 29 is set long, and the tip ends of the fastening bolts 15 are configured not to project from the rear ends of fastener holes 29b formed in the bolt fastening members 29. This configuration does not require the bolt holes of the base members 28. The components shown in Fig. 7(B) same as those of the first embodiment are given the same reference numerals.

[0022] According to a fourth embodiment shown in Fig. 8, a space S for adjusting the inclination of each base member 26 with respect to a support plate 25 is formed between the corresponding through-hole 25a opened in the support plate

25 and the base member 26 fitted into this through-hole 25a, prior to fixing the base member 26 to the through-hole 25a. While having the inclination of the base member 26 adjusted in such a manner that a counterweight mounting seat surface 26a thereof becomes parallel to the front surface 8a of the counterweight 8 at the regular position, the base member 26 is fixed to the support plate 25 by welding, and thereby the space S is filled as a result of this welding. By fixing the base member 26 to the support plate 25 in such a manner that the inclination of the base member 26 is adjustable with respect to the support plate 25, the inclination of the base member 26 can be adjusted in such a manner that the counterweight mounting seat surface 26a thereof becomes parallel to the front surface 8a of the counterweight 8 in the regular position, even when the support plate 25 is fixed to the slewing frame 9 while being inclined in the longitudinal, vertical, and lateral directions due to welding stress or the like. Thus, not only is it possible to ensure perpendicularity of the base member 26 with respect to the horizontal reference of the machine body (vehicle body frame), but also the flatness of mounting seat surface of the counterweight and the corresponding support member can be ensured without performing any machining. Fig. 8 shows an example in which

the support plate 25 is inclined in the vertical direction, wherein the inclination and the space S are enlarged for the purpose of facilitating the understanding thereof. In addition, in Fig. 8, the base members 26 are provided with the counterweight mounting seat surfaces 26a, but needless to say the perpendicularity of the base members 26 with respect to the horizontal reference of the machine body can be ensured by adjusting the inclination of the base members with respect to the support plate, even if the counterweight mounting seat surfaces are provided in the bolt fastening members as in the second and third embodiments described above.

[0023] According to the configurations of the first to fourth embodiments, in order to attach the base members to the support plate in such a manner that the longitudinal positions of the base members are adjustable, the base members are fitted and fixed to the through-holes opened in the support plate, in such a manner that the longitudinal positions of the base members are adjustable. However, the first to fourth embodiments are not limited to this configuration in which the through-holes are opened in the support plate. For instance, in a fifth embodiment shown in Fig. 9, depressions 30a are cut out on the upper left and the upper right of a support plate 30, so that base

members 31 can be fixed to the depressions 30a in such a manner that the longitudinal positions of the base members 31 are adjustable. Moreover, in the fifth embodiment, the base members 31 are attached to the depressions 30a while in abutment with the left-hand side and the right-hand side of reinforcing plates 19 that are adhered to the corners formed between the support plate 30 and the upper surfaces 11b of the left and right main frames 11L and 11R, thereby reinforcing the attachment of the base members 31. In addition, through-holes 30b same as those of the first embodiment are formed at the lower left portion and the lower right portion of the support plate 30, and the base members 31 are attached to the through-holes 30b in the same manner as in the first embodiment. The components shown in Fig. 9 same as those of the first embodiment are given the same reference numerals. Also, in Fig. 9, reference numeral 32 represents bolt fastening members that are fixed to the respective base members 31 in such a manner that the longitudinal and lateral positions of the bolt fastening members are adjustable, and reference numeral 32a represents fastener holes formed in the respective bolt fastening members 32. Furthermore, in the fifth embodiment, counterweight mounting seat surfaces are provided in the base members 31, but needless to say the

configuration of the fifth embodiment is possible in which the base members are fixed to the depressions formed on the support plates, in such a manner that the longitudinal positions of the base members are adjustable, even if the counterweight mounting seat surfaces are provided in the bolt fastening members as in the foregoing second and third embodiments. In addition, according to the fifth embodiment, as in the fourth embodiment, the perpendicularity of the base members 31 with respect to the horizontal reference of the machine body can be ensured by adjusting the inclination of the base members 31 with respect to the support plate 30.

[Industrial Applicability]

[0024] The present invention can be utilized in order to attach a counterweight for ensuring the balance of the machine body in a construction machine such as a hydraulic shovel.

[Reference Signs List]

[0025]

8 Counterweight

9 Slewing frame

15 Fastening bolt

16 Counterweight support

17 Support plate

17a Through-hole

18 Support member

20 Base member

20a Counterweight mounting seat surface

20b Bolt hole

21 Bolt fastening member

21a Fastener hole

22 Support member

23 Base member

23a Bolt hole

24 Bolt fastening member

24a Counterweight mounting seat surface

24b Fastener hole

25 Support plate

25a Through-hole

26 Base member

26a Counterweight mounting seat surface

27 Support member

28 Base member

29 Bolt fastening member

29a Counterweight mounting seat surface

29b Fastener hole

30 Support member

31 Base member

32 Bolt fastening member

32a Fastener hole

[CLAIMS]

[Claim 1] A counterweight supporting structure for a construction machine having a counterweight, wherein, in order to support the counterweight on a counterweight support provided in a rear portion of a vehicle body frame by using a fastening bolt,

the counterweight support is configured using a support plate that is fixed upright to the rear portion of the vehicle body frame, and a support member that is attached to the support plate fixed to the vehicle body frame, brought into abutment with the counterweight, and has the fastening bolt fastened thereto,

the support member being configured with a base member that is fixed to the support plate in such a manner that a longitudinal position of the base member is adjustable, a bolt fastening member which is fixed to the base member in such a manner that vertical and lateral positions of the bolt fastening member are adjustable and which has a fastener hole to which the fastening bolt is fastened, and a counterweight mounting seat surface that is formed in the base member or the bolt fastening member and comes into abutment with the counterweight.

[Claim 2] The counterweight supporting structure for a construction machine according to claim 1, wherein the base member has a bolt hole that leads to the fastener hole in a state where the bolt fastening member is fixed to the base member, and a diameter of the bolt hole is made large so as to be able to allow displacement of the fastener hole caused by adjustment of the vertical and lateral positions of the bolt fastening member.

[Claim 3] The counterweight supporting structure for a construction machine according to claim 1 or 2, wherein the base member is fixed to the support plate in such a manner that inclination of the base member with respect to the support plate is adjustable.

Fig. 1

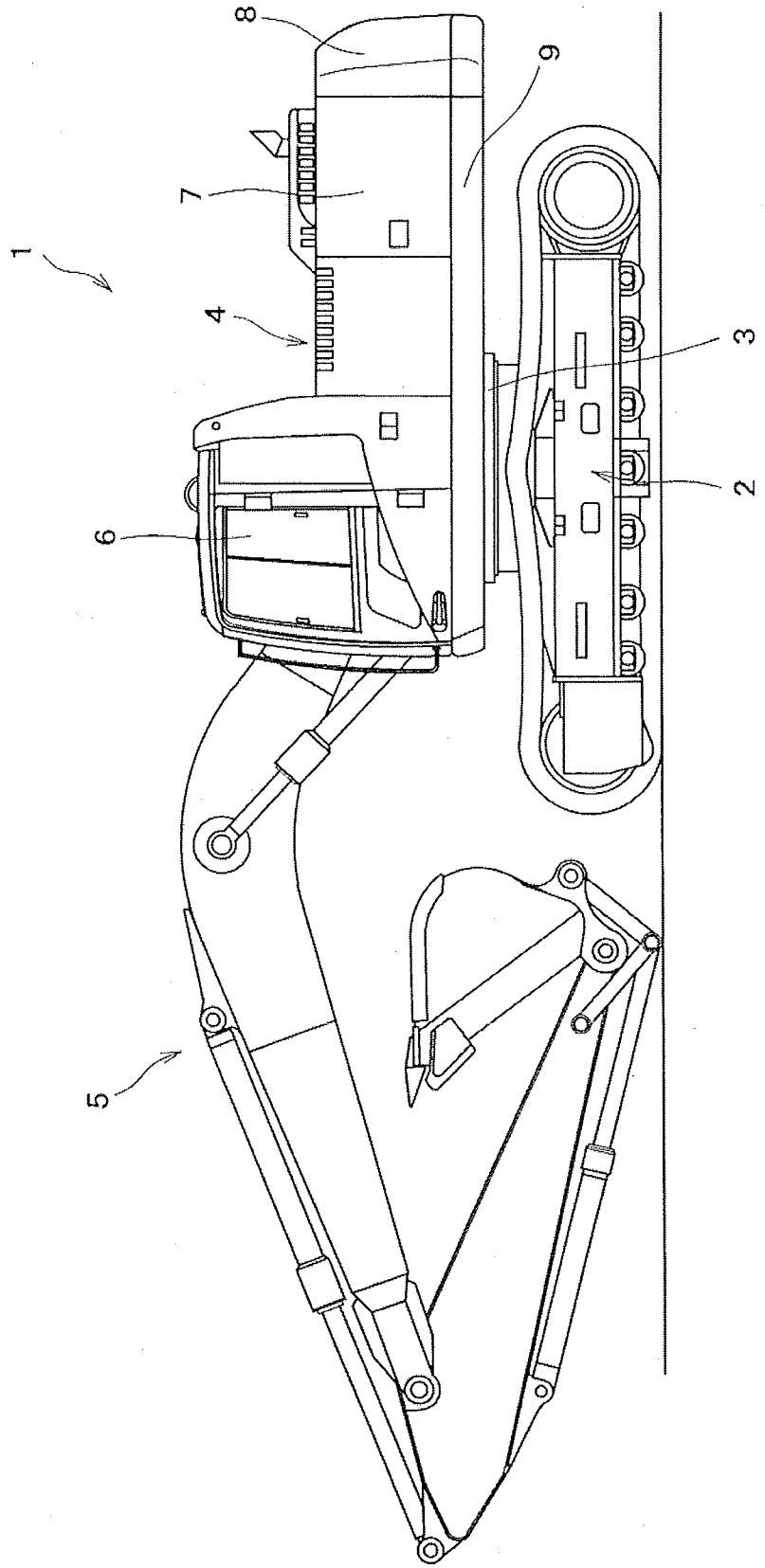


Fig. 2

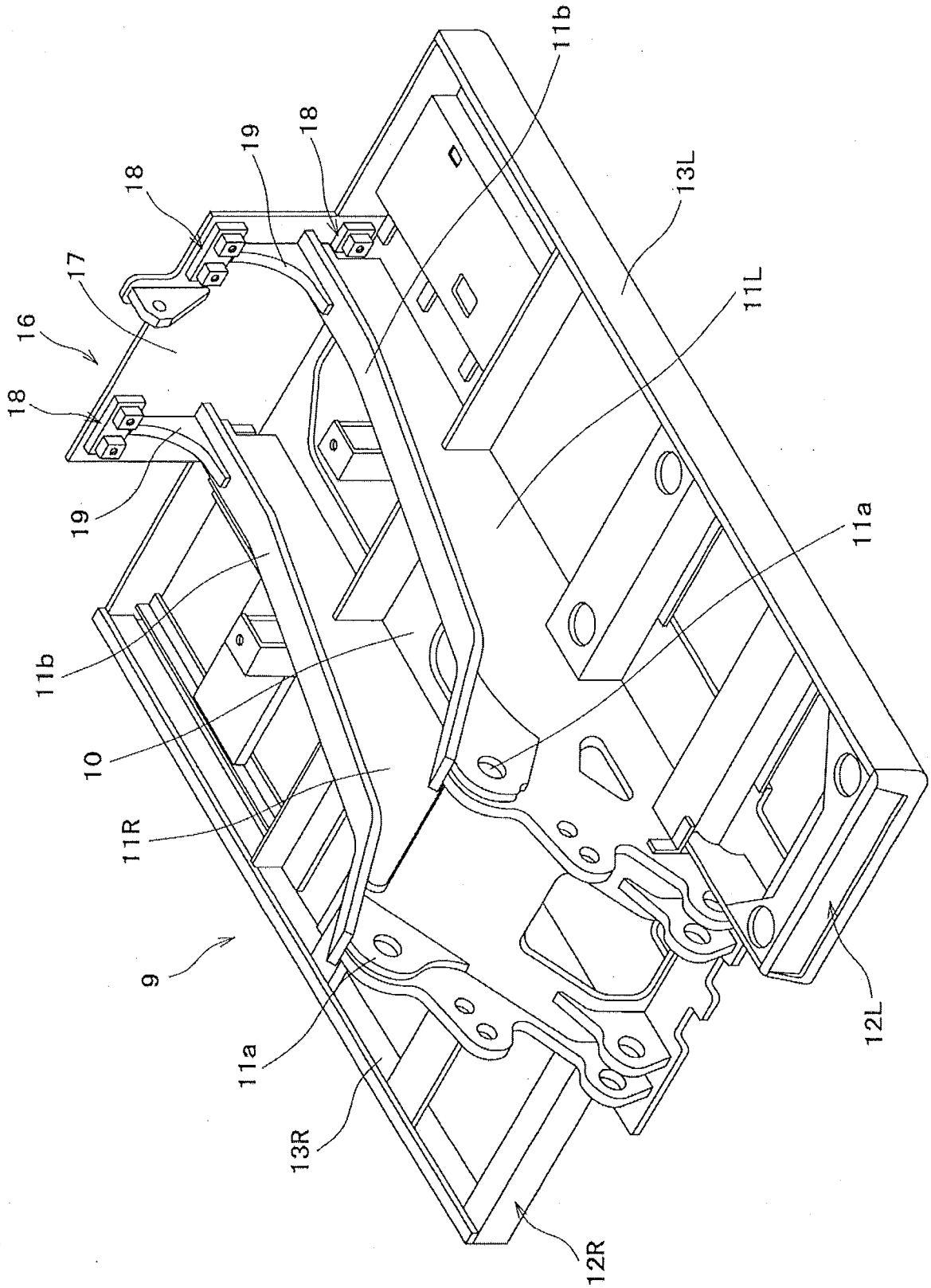
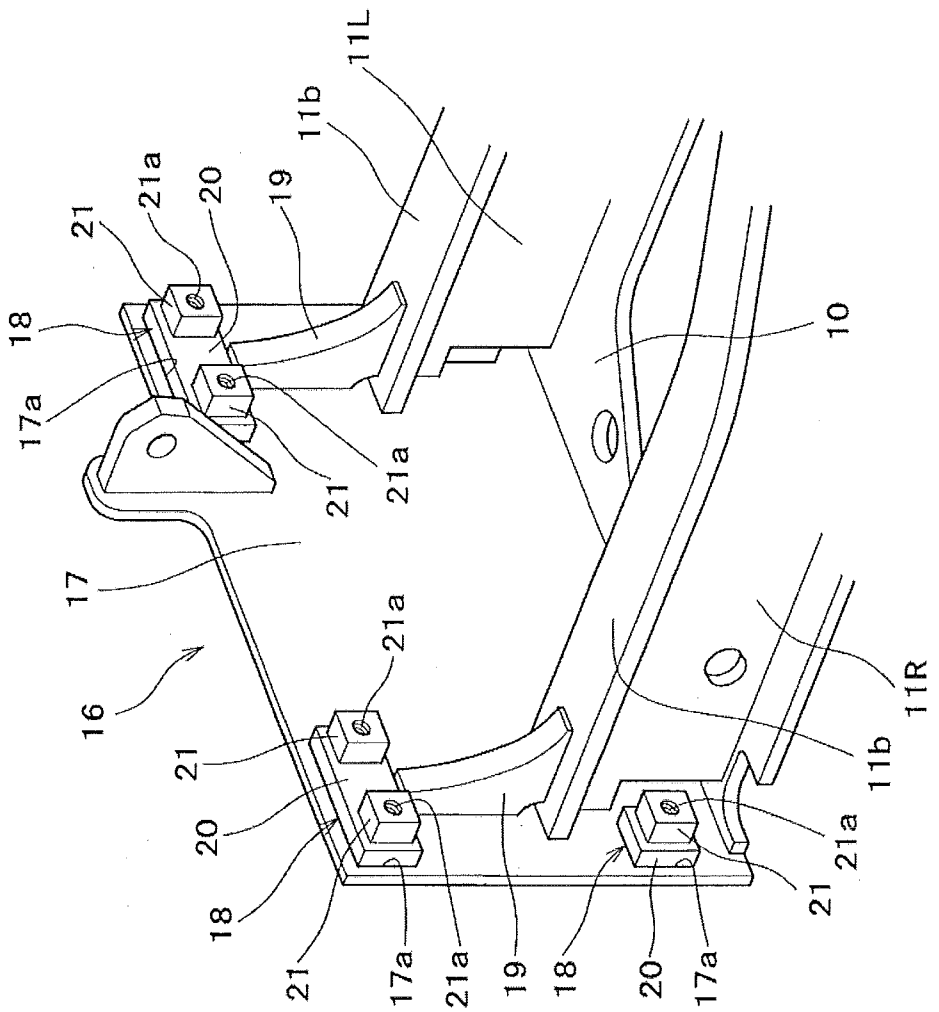


Fig. 3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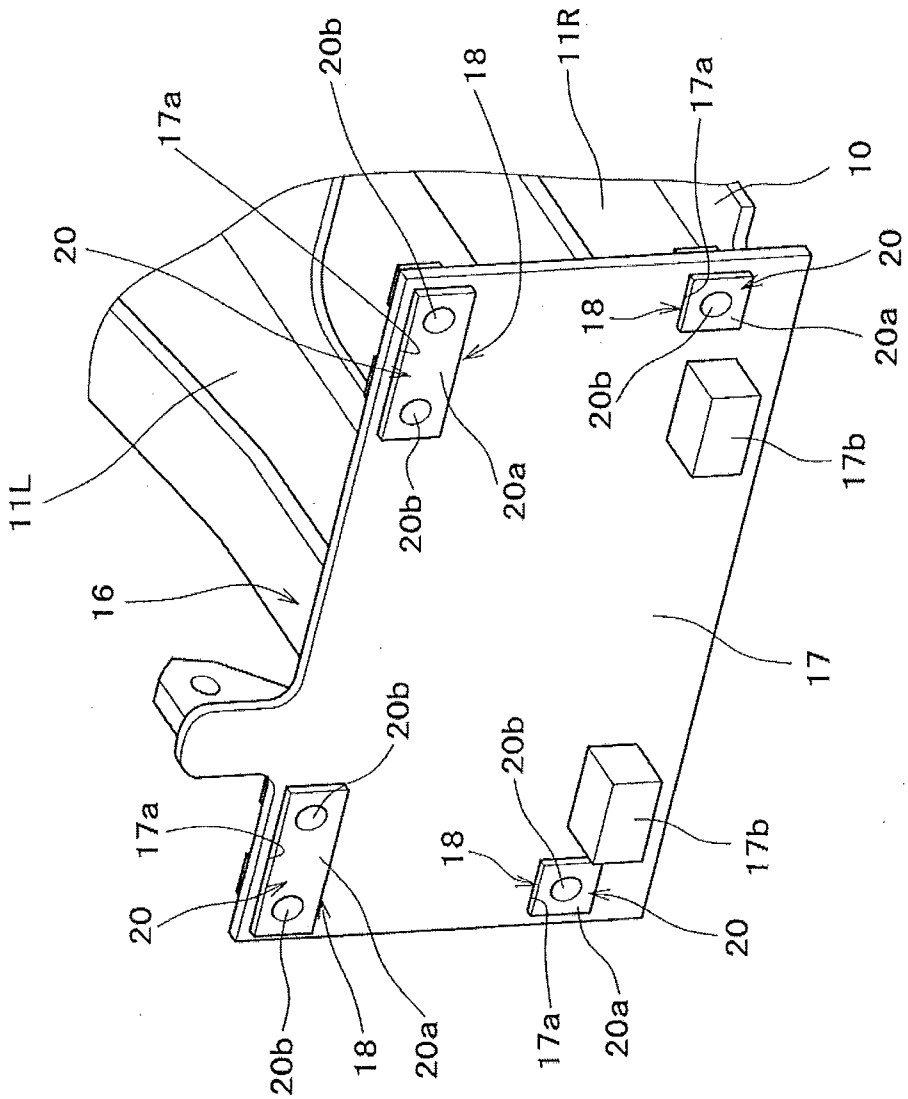
21a
11b
11R

Fig. 4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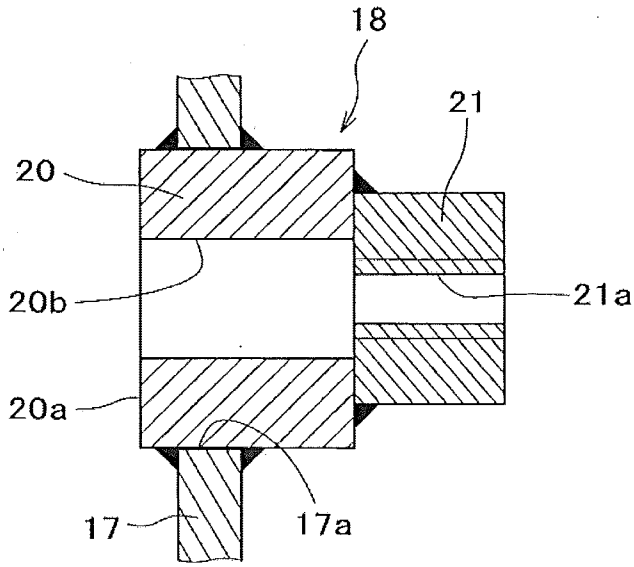
20a

Fig. 5

(A)



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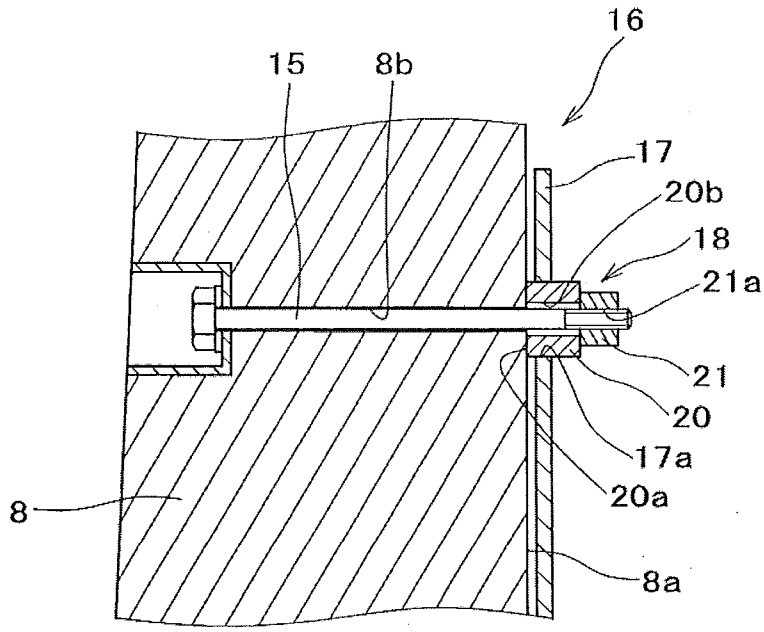
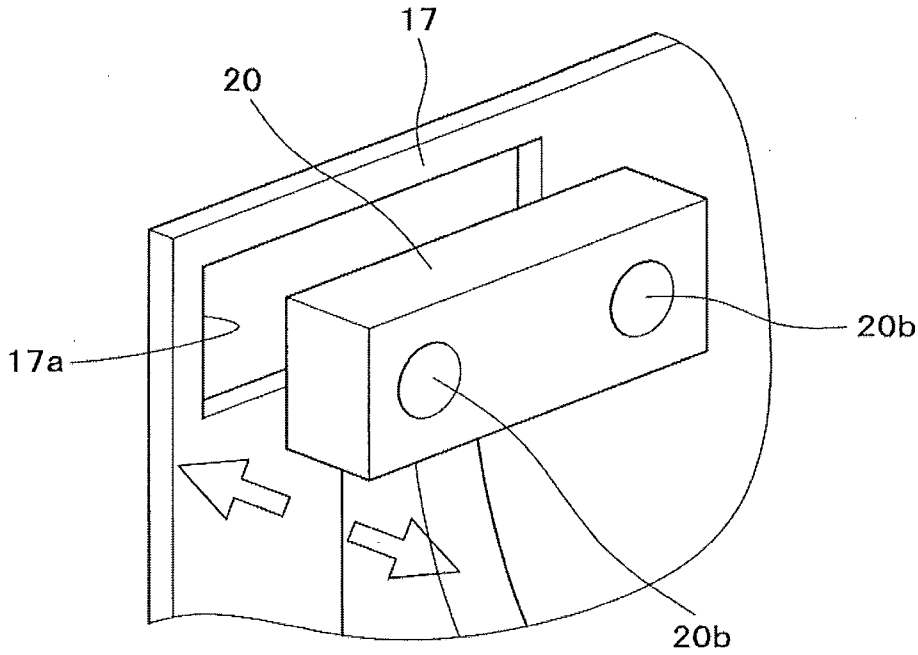


Fig. 6

(A)



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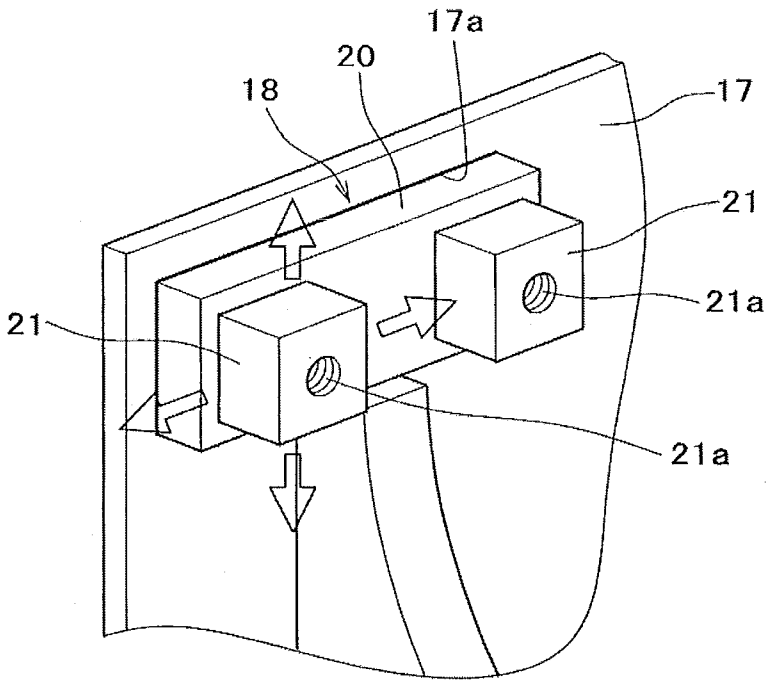
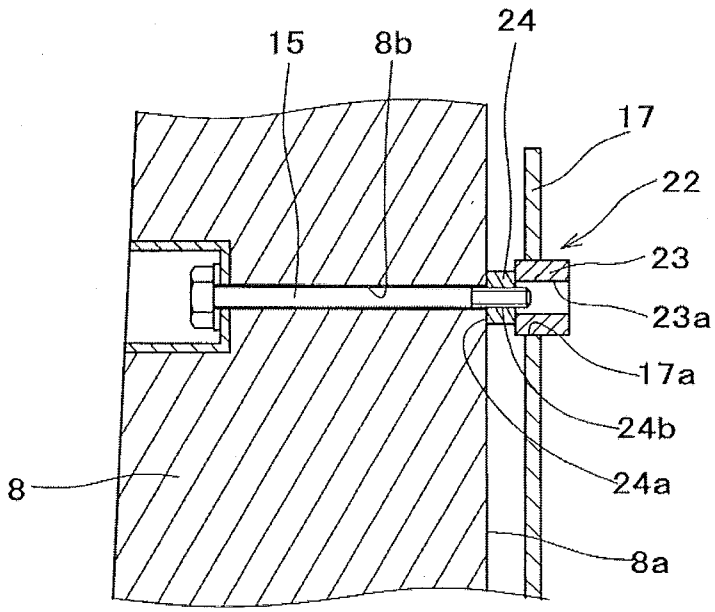


Fig. 7

(A)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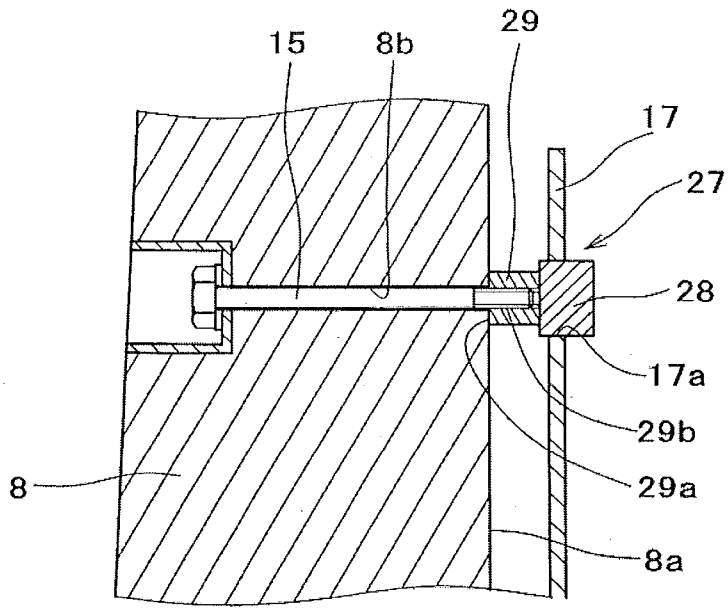
8a

(B)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29a
8
8a

Fig. 8

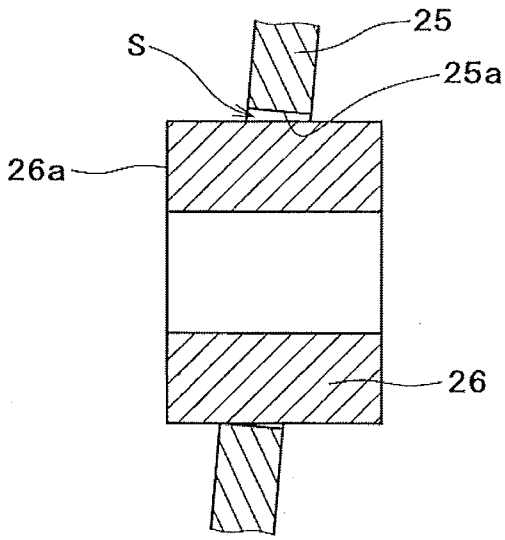
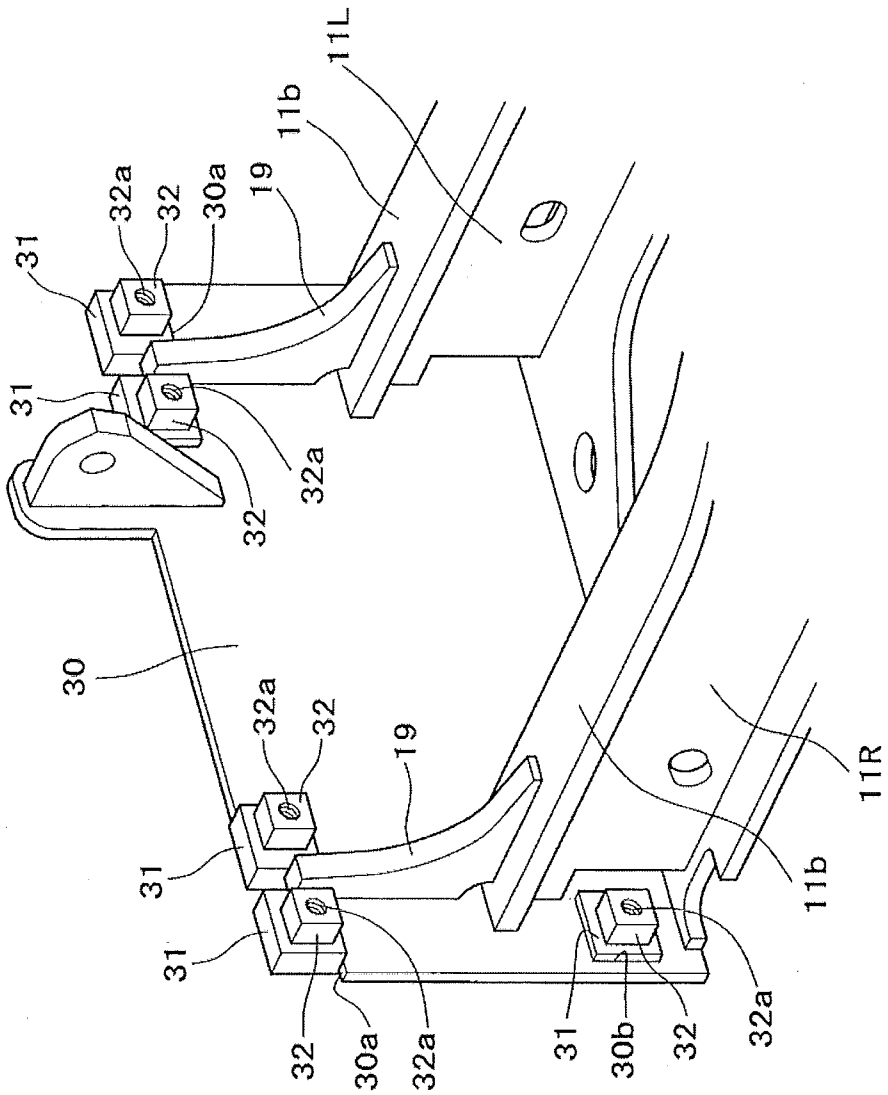


Fig. 9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30b
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32a

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2016/063658

A. CLASSIFICATION OF SUBJECT MATTER
INV. E02F9/18 B66C23/72
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)
E02F B66C

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

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 2001 032328 A (KOBELCO CONSTR MACHINERY LTD; KOBE STEEL LTD) 6 February 2001 (2001-02-06) cited in the application abstract; figures 5,7	1-3
Y	KR 2010 0091443 A (VOLVO CONSTR EQUIP HOLDING SE [SE]) 19 August 2010 (2010-08-19) figure 3	1-3
X	KR 2010 0020567 A (VOLVO CONSTR EQUIP HOLDING SE [SE]) 23 February 2010 (2010-02-23) figures 1-4	1-3

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

[X] See patent family annex.

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
12 August 2016	23/08/2016

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1

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INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2016/063658

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP H09 209407 A (YUTANI JUKO KK) 12 August 1997 (1997-08-12) cited in the application abstract; figures 1-14	1-3
A	KR 2011 0045364 A (VOLVO CONSTR EQUIP AB) 4 May 2011 (2011-05-04) figures 3,5	1-3

1

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/EP2016/063658

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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KR 20100091443 A	19-08-2010	NONE	
KR 20100020567 A	23-02-2010	NONE	
JP H09209407 A	12-08-1997	NONE	
KR 20110045364 A	04-05-2011	NONE	