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(54) **WHEEL LOADER AND METHOD FOR CHANGING COUNTERWEIGHT MOUNTING POSITION**

(57) A wheel loader (1) has a vehicle body frame (10), a right counterweight (32) detachably mounted to the vehicle body frame (10), and a left counterweight (33) detachably mounted to the vehicle body frame (10). The vehicle body frame (10) has a first right counterweight

mounting hole (32a), a second right counterweight mounting hole (32b), a first left counterweight mounting hole (33a), and a second left counterweight mounting hole (33b).

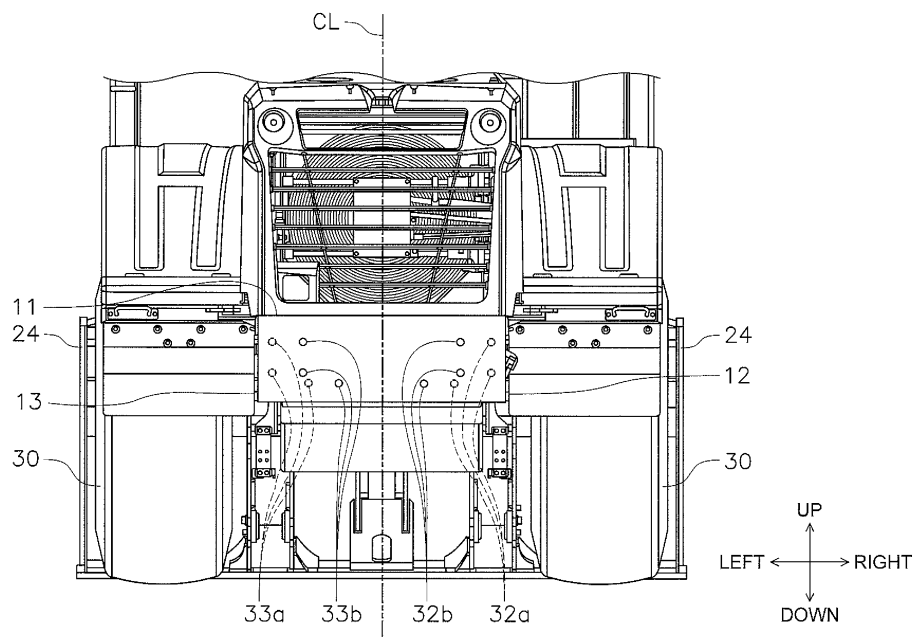


FIG. 2

EP 3 546 661 A1

Description

Technical Field

[0001] The present invention relates to a wheel loader and a method for changing a counterweight mounting position.

Background Art

[0002] A counterweight is mounted to a rear end part of a vehicle body frame as a balance weight in a wheel loader (for example, see Patent Document No. 1).

Citation List

Patent Literature

[0003] Patent Document No. 1: Japanese Patent Laid-open No. 2004-291694

Summary

Technical Problem

[0004] However, there may be desire to change the mounting position of the counterweight in response to the situation in which the wheel loader is used.

[0005] Taking into account the above circumstances, an object of the present invention is to provide a wheel loader in which the mounting position of a counterweight can be changed, and a method for changing the mounting position of a counterweight.

Solution to Problem

[0006] A wheel loader according to the present invention has a vehicle body frame, a right counterweight detachably mounted to the vehicle body frame, and a left counterweight detachably mounted to the vehicle body frame. The vehicle body frame has a first right counterweight mounting hole for mounting the right counterweight, a second right counterweight mounting hole for mounting the right counterweight, a first left counterweight mounting hole for mounting the left counterweight, and a second left counterweight mounting hole for mounting the left counterweight.

Effects of Invention

[0007] According to the present invention, a wheel loader with which the mounting position of a counterweight can be changed, and a method for changing the mounting position of a counterweight can be provided.

Brief Description of Drawings

[0008]

FIG. 1 is a side view of a wheel loader.

FIG. 2 is a rear view of the wheel loader.

FIG. 3A is a rear view of the wheel loader (front view of counterweights).

FIG. 3B is a top view of the wheel loader.

FIG. 4A is rear view of the wheel loader (front view of counterweights).

FIG. 4B is a top view of the wheel loader.

FIG. 5A is a cross-sectional view along line A-A of FIG. 3A.

FIG. 5B is a cross-sectional view along line B-B of FIG. 4A.

FIG. 6A is a rear view of the wheel loader according to another embodiment.

FIG. 6B is a rear view of the wheel loader according to another embodiment.

Description of Embodiments

(Configuration of wheel loader 1)

[0009] FIG. 1 is a side view of a wheel loader 1 according to an embodiment. In the following description, "up," "down," "front," "back," "left," and "right" are terms used with reference to an operator sitting in the driver's seat. "Vehicle width direction" and "left-right direction" have the same meaning.

[0010] The wheel loader 1 is used for transporting excavated earth and sand and the like and loading the earth and sand onto a truck or the like. The wheel loader 1 is provided with a front frame 2, a rear frame 3, and a steering cylinder 4. The front frame 2 and the rear frame 3 constitute a vehicle body frame 10 of the wheel loader 1.

[0011] The front frame 2 is coupled to the rear frame 3 by means of a pin (not illustrated). By extending and contracting the steering cylinder 4, the front frame 2 is able to pivot with respect to the rear frame 3 within the range of a predetermined articulate angle.

[0012] A lift cylinder 21 and a boom 22 are coupled to the front frame 2. Due to the extension and contraction of the lift cylinder 21, a bucket 24 can be moved upward and downward with the boom 22. A tilt cylinder 23 is coupled to the boom 22. Due to the extension and contraction of the tilt cylinder 23, the bucket 24 is tilted via a bell crank 25 and a link 26. The bucket 24 is an example of a work implement mounted on the wheel loader 1. In addition to a bucket, a fork, a snow removing blade, or the like may be used as the work implement.

[0013] The rear frame 3 is arranged to the rear of the front frame 2. A cab 31 is arranged on the rear frame 3. The rear frame 3 supports an engine, a transmission, a hydraulic pump, and the like which are not illustrated. Driving power from the engine is transmitted to a front wheel 20 and a rear wheel 30 via an unillustrated power drivetrain.

[0014] A right counterweight 32 and a left counterweight 33 are detachably mounted to a rear end part of the rear frame 3. However, only the left counterweight

33 is depicted in FIG. 1.

(Mounting positions of right counterweight 32 and left counterweight 33)

[0015] The mounting positions of the right counterweight 32 and the left counterweight 33 are explained with reference to the drawings.

[0016] FIG. 2 is a rear view of the wheel loader 1. A state in which the right counterweight 32 and the left counterweight 33 are removed from the vehicle body frame 10 (specifically, the rear frame 3) is depicted in FIG. 2.

[0017] FIG. 3A is a rear view of the wheel loader 1 in which the right counterweight 32 is mounted in a first right position and the left counterweight 33 is mounted in a first left position. FIG. 3A represents a front view of the counterweights. FIG. 3B is a top view of the right counterweight 32 mounted in the first right position and the left counterweight 33 mounted in the first left position.

[0018] FIG. 4A is a rear view of the wheel loader 1 in which the right counterweight 32 is mounted in a second right position and the left counterweight 33 is mounted in a second left position. FIG. 4A represents a front view of the counterweights. FIG. 4B is a top view of the right counterweight 32 mounted in the second right position and the left counterweight 33 mounted in the second left position.

[0019] As illustrated in FIG. 2, the vehicle body frame 10 has a rear plate 11, a right side plate 12, and a left side plate 13.

[0020] The rear plate 11, the right side plate 12, and the left side plate 13 are all formed as plate-like members. The rear plate 11 is installed upright in the vehicle width direction. The rear plate 11 extends in the vehicle width direction and in the up-down direction. The counterweights 32 and 33 abut the rear plate 11. The right side plate 12 and the left side plate 13 are both installed upright in the front-back direction. The right side plate 12 and the left side plate 13 both extend in the front-back direction and in the up-down direction.

[0021] As illustrated in FIG. 2, the rear plate 11 has three first right counterweight mounting holes 32a, three second right counterweight mounting holes 32b, three first left counterweight mounting holes 33a, and three second left counterweight mounting holes 33b.

[0022] The first right counterweight mounting holes 32a are used for mounting the right counterweight 32 in the first right position as illustrated in FIG. 3A and 3B. The first right position is a position further to the right than a center line CL which indicates the center in the vehicle width direction of the vehicle body frame 10. The second right counterweight mounting holes 32b are used for mounting the right counterweight 32 in the second right position as illustrated in FIG. 4A and 4B. The second right position is a position further to the right than the center line CL. As can be seen by comparing FIG. 3A and 3B and FIG. 4A and 4B, the second right position is

a position that is offset toward the inside in the vehicle width direction from the first right position. Therefore as illustrated in FIG. 2, the second right counterweight mounting holes 32b are positioned to the inside of the first right counterweight mounting holes 32a in the vehicle width direction. In the present embodiment, the second right counterweight mounting holes 32b are formed in positions which are translated in parallel toward the inside in the vehicle width from the first right counterweight mounting holes 32a. The interval between the first right counterweight mounting holes 32a and the second right counterweight mounting holes 32b is not limited in particular.

[0023] The first left counterweight mounting holes 33a are used for mounting the left counterweight 33 in the first left position as illustrated in FIG. 3A and 3B. The first left position is a position further to the left than the center line CL which indicates the center in the vehicle width direction of the vehicle body frame 10. The second left counterweight mounting holes 33b are used for mounting the left counterweight 33 in the second left position as illustrated in FIG. 4A and 4B. The second left position is a position further to the left than the center line CL. As can be seen by comparing FIG. 3A and 3B and FIG. 4A and 4B, the second left position is a position that is offset toward the inside in the vehicle width direction from the first left position. Therefore as illustrated in FIG. 2, the second left counterweight mounting holes 33b are positioned to the inside of the first left counterweight mounting holes 33a in the vehicle width direction. In the present embodiment, the second left counterweight mounting holes 33b are formed in positions which are translated in parallel toward the inside in the vehicle width from the first left counterweight mounting holes 33a. The interval between the first left counterweight mounting holes 33a and the second left counterweight mounting holes 33b is not limited in particular.

[0024] The right counterweight 32 mounted in the first right position (see FIG. 3A, 3B) is positioned further to the outside in the width direction than the right counterweight 32 mounted in the second right position (see FIG. 4A, 4B).

[0025] Similarly, the left counterweight 33 mounted in the first left position (see FIG. 3A, 3B) is positioned further to the outside in the width direction than the left counterweight 33 mounted in the second left position (see FIG. 4A, 4B).

[0026] In addition, three right bolt through-holes 32c are formed in the right counterweight 32 as illustrated in FIG. 3A and 4A. Fastening bolts 32d are inserted into each of the right bolt through-holes 32c. The right counterweight 32 is secured to the vehicle body frame 10 by fastening the fastening bolts 32d into the first right counterweight mounting holes 32a or the second right counterweight mounting holes 32b.

[0027] Similarly, three left bolt through-holes 33c are formed in the left counterweight 33 as illustrated in FIG. 3A and 4A. Fastening bolts 33d are inserted into each of

the left bolt through-holes 33c. The left counterweight 33 is secured to the vehicle body frame 10 by fastening the fastening bolts 33d to the first left counterweight mounting holes 33a or the second left counterweight mounting holes 33b.

[0028] In addition, a right rear lamp 34 is mounted to the right counterweight 32. In the present embodiment the right rear lamp 34 is mounted to the rear surface of the right counterweight 32. The right rear lamp 34 is positioned to the inside of the outer edge of the right counterweight 32 when viewing the front surface of the right counterweight 32 as illustrated in FIG. 3A and 4A. Therefore, the right rear lamp 34 does not protrude to the outside of the right counterweight 32.

[0029] Similarly, a left rear lamp 35 is mounted to the left counterweight 33. In the present embodiment, the left rear lamp 35 is mounted to the rear surface of the left counterweight 33. The left rear lamp 35 is positioned to the inside of the outer edge of the left counterweight 33 when viewing the front surface of the left counterweight 33 as illustrated in FIG. 3A and 4A. Therefore, the left rear lamp 35 does not protrude to the outside of the left counterweight 33.

[0030] A tail lamp, a turn indicator, a back-up lamp, or a brake lamp may be installed in the respective right rear lamp 34 and the left rear lamp 35. Alternatively, a common lamp may be used for the tail lamp and the brake lamp.

[0031] As illustrated in FIG. 3A, when the right counterweight 32 is mounted in the first right position and the left counterweight 33 is mounted in the first left position, the interval W1 in the vehicle width direction from the outermost right side of the vehicle body to the right outside edge of the right rear lamp 34 is preferably 400 mm or less, and the interval W2 in the vehicle width direction from the outermost left side of the vehicle body to the left outside edge of the left rear lamp 35 is preferably 400 mm or less. Consequently, visibility of the wheel loader 1 can be improved and the safety standards according to the obligatory motor-vehicle inspection system under the respective national legislations for road travel can be satisfied.

[0032] Conversely as illustrated in FIG. 4A, when the right counterweight 32 is mounted in the second right position, the interval W3 in the vehicle width direction from the outermost right edge of the vehicle body to the right outer edge of the right rear lamp 34 is greater than the interval W1. The interval W3 may be 400 mm or less or may be greater than 400 mm. Similarly as illustrated in FIG. 4A, when the left counterweight 33 is mounted in the second left position, the interval W4 in the vehicle width direction from the outermost left edge of the vehicle body to the left outer edge of the left rear lamp 35 is greater than the interval W2. The interval W2 may be 400 mm or less or may be greater than 400 mm. In addition, the right outermost edge of the vehicle body may be the right edge of the bucket and the left outermost edge of the vehicle body may be the left edge of the bucket.

(Right harness 36 for right rear lamp 34)

[0033] Laying of a right harness 36 connected to the right rear lamp 34 will be explained below with reference to the drawings. FIG. 5A is cross-sectional view along line A-A in FIG. 3. FIG. 5B is a cross-sectional view along line B-B in FIG. 4A.

[0034] As illustrated in FIG. 5A and 5B, the right harness 36 is electrically connected to the right rear lamp 34. The right harness 36 is inserted into the right counterweight 32 and pulled out of the right counterweight 32 toward the front. The right harness 36 is then inserted through a right harness through-hole 12a formed in the right side plate 12.

[0035] The right harness through-hole 12a penetrates the right side plate 12. The right harness through-hole 12a is formed in the vehicle width direction. As a result, even when the right counterweight 32 is mounted in either of the first right position or the second right position, the right harness through-hole 12a can be used in common for both cases for laying the right harness 36.

[0036] As illustrated in FIG. 5B, when the right counterweight 32 is mounted in the second right position, the excess portion of the right harness 36 can be accommodated on the inside of the right side plate 12.

[0037] Although not depicted in the drawings, a left harness connected to the left rear lamp 35 is also inserted through a left harness through-hole formed in the left side plate 13 in the same way as the right harness 36.

(Method for changing mounting positions of right counterweight 32 and left counterweight 33)

[0038] A method for changing the mounting positions of right counterweight 32 and left counterweight 33 will be explained below. The following is an explanation of a case in which, after mounting the right counterweight 32 in the first right position and mounting the left counterweight 33 in the first left position for traveling on public roads, the right counterweight 32 is mounted in the second right position and the left counterweight 33 is mounted in the second left position for improving work efficiency at the work site.

[0039] First, the positions of the first right counterweight mounting holes 32a of the vehicle body frame 10 and the positions of the right bolt through-holes 32c of the right counterweight 32 are aligned, and the fastening bolts 32d are fastened to the first right counterweight mounting holes 32a.

[0040] Next, the positions of the first left counterweight mounting holes 33a of the vehicle body frame 10 and the positions of the left bolt through-holes 33c of the left counterweight 33 are aligned, and the fastening bolts 33d are fastened to the first left counterweight mounting holes 33a.

[0041] As indicated above, the right counterweight 32 is mounted in the first right position and the left counterweight 33 is mounted in the first left position. As a result,

traveling on public roads is possible while meeting safety standards.

[0042] Next, after reaching the work site, the fastening bolts 32d and the fastening bolts 33d are taken out and the counterweights 32 and 33 are removed from the vehicle body frame 10.

[0043] Next, the positions of the second right counterweight mounting holes 32b of the vehicle body frame 10 and the positions of the right bolt through-holes 32c of the right counterweight 32 are aligned, and the fastening bolts 32d are fastened to the second right counterweight mounting holes 32b.

[0044] In addition, the positions of the second left counterweight mounting holes 33b of the vehicle body frame 10 and the positions of the left bolt through-holes 33c of the left counterweight 33 are aligned, and the fastening bolts 33d are fastened to the second left counterweight mounting holes 33b.

[0045] As indicated above, the right counterweight 32 is mounted in the second right position and the left counterweight 33 is mounted in the second left position. As a result, work efficiency can be improved because interference with the counterweights 32 and 33 by surrounding structures and the like at the work site can be suppressed.

(Characteristics)

[0046]

(1) The vehicle body frame 10 has: the first right counterweight mounting holes 32a for mounting the right counterweight 32 in the first right position which is positioned to the right of the center line CL; the second right counterweight mounting holes 32b for mounting the right counterweight 32 in the second right position which is offset from the first right position toward the inside in the vehicle width direction; the first left counterweight mounting holes 33a for mounting the left counterweight 33 in the first left position which is positioned to the left of the center line CL; and second left counterweight mounting holes 33b for mounting the left counterweight 33 in the second left position which is offset from the first left position toward the inside in the vehicle width direction.

Therefore, the counterweights 32 and 33 can be moved in the vehicle width direction in response to the situation in which the wheel loader 1 is to be used. As a result, the mounting positions of the counterweights 32 and 33 can be changed according to the case of traveling on a public road while meeting safety standards, and the case of working at a work site.

(2) The right side plate 12 of the vehicle body frame 10 has the right harness through-hole 12a through which the right harness 36 is inserted.

Therefore, even when the mounting position of the right counterweight 32 is changed, the right harness

through-hole 12a can be used in common for both cases for laying the right harness 36.

The same result can be achieved by forming a left harness through-hole into which the left harness is inserted in the left side plate 13.

(3) The right rear lamp 34 is positioned to the inside of the outer edge of the right counterweight 32 when viewing the front surface of the right counterweight 32.

[0047] Therefore, in comparison to when the right rear lamp 34 protrudes to the outside of the right counterweight 32, damage caused by the right rear lamp 34 coming into contact with a surrounding structure or the like can be suppressed.

[0048] The same effect can also be achieved by positioning the left rear lamp 35 to the inside of the outer edge of the left counterweight 33.

(Other embodiments)

[0049] The present invention is not limited to the above embodiment and various changes and modifications may be made without departing from the spirit of the invention.

[0050] While the three first right counterweight mounting holes 32a, three second right counterweight mounting holes 32b, three first left counterweight mounting holes 33a, and three second left counterweight mounting holes 33b are all formed in the rear plate 11 in the above embodiment, the present invention is not limited in this way. The number of each of the mounting holes is not limited in particular, and the number of each of the mounting holes may be different. However, it is preferable that the counterweights be mounted with at least two mounting holes.

[0051] While the right rear lamp 34 is mounted to the rear surface of the right counterweight 32 in the above embodiment, the present invention is not limited in this way. For example, the right rear lamp 34 may be arranged in a recessed part formed on the rear surface of the right counterweight 32. Moreover, the right rear lamp 34 may be mounted on the upper surface, the lower surface, or the side surface of the right counterweight 32. Similarly, while the left rear lamp 35 is mounted to the rear surface of the left counterweight 33 in the above embodiment, the present invention is not limited in this way.

[0052] While the counterweights 32 and 33 each have one type of bolt through-hole and the rear plate 11 of the rear frame 3 has two types of left and right mounting holes, the present invention is not limited in this way. The rear plate 11 may have one type of left and right mounting holes and the counterweights 32 and 33 may each have two types of bolt through-holes.

[0053] Specifically as illustrated in FIG. 6A, the rear plate 11 has three right counterweight mounting holes 32e and three left counterweight mounting holes 33e. As illustrated in FIG. 6B, the right counterweight 32 has three first right bolt through-holes 32f and three second right

bolt through-holes 32g. The first right bolt through-holes 32f are used for mounting the right counterweight 32 in the first right position (see FIG. 3), and the second right bolt through-holes 32g are used for mounting the right counterweight 32 in the second right position (see FIG. 4). In addition as illustrated in FIG. 6B, the left counterweight 33 has three first left bolt through-holes 33f and three second left bolt through-holes 33g. The first left bolt through-holes 33f are used for mounting the left counterweight 33 in the first left position (see FIG. 3), and the second left bolt through-holes 33g are used for mounting the left counterweight 33 in the second left position (see FIG. 4).

[0054] In this way, even when the rear plate 11 has one type of left and right mounting holes and the counterweights 32 and 33 each have two types of bolt through-holes, the mounting positions of the counterweights 32 and 33 can be changed in response to the situation in which the wheel loader 1 is to be used.

List of Reference Numerals

[0055]

1:	Wheel loader	5
10:	Vehicle body frame	10
11:	Rear frame	15
12:	Right side plate	20
13:	Left side plate	25
13:	Left harness through-hole	30
24:	Bucket	35
32:	Right counterweight	40
32a:	First right counterweight mounting holes	
32b:	Second right counterweight mounting holes	
33:	Left counterweight	
33a:	First left counterweight mounting holes	
33b:	Second left counterweight mounting holes	
34:	Right rear lamp	
35:	Left rear lamp	
36:	Right harness	

Claims

1. A method for changing a counterweight mounting position, the method comprising:
 - removing a right counterweight from a first right position which is positioned to the right of a center in a vehicle width direction of a vehicle body frame;
 - removing a left counterweight from a first left position which is positioned to the left of the center in the vehicle width direction of the vehicle body frame;
 - mounting the right counterweight in a second right position which is offset from the first right position toward the inside in the vehicle width

direction; and
 mounting the left counterweight in a second left position which is offset from the first left position toward the inside in the vehicle width direction.

2. A wheel loader comprising:

a vehicle body frame;
 a right counterweight detachably mounted to the vehicle body frame;
 a left counterweight detachably mounted to the vehicle body frame; wherein
 the vehicle body frame has:

a first right counterweight mounting hole for mounting the right counterweight in a first right position which is positioned to the right of a center in a vehicle width direction of the vehicle body frame;
 a first left counterweight mounting hole for mounting the left counterweight in a first left position which is positioned to the left of the center in the vehicle width direction of the vehicle body frame;
 a second right counterweight mounting hole for mounting the right counterweight in a second right position which is offset from the first right position toward the inside in the vehicle width direction; and
 a second left counterweight mounting hole for mounting the left counterweight in a second left position which is offset from the first left position toward the inside in the vehicle width direction.

3. The wheel loader according to claim 2, wherein the vehicle body frame has a rear plate, and the rear plate has the first right counterweight mounting hole, the second right counterweight mounting hole, the first left counterweight mounting hole, and the second left counterweight mounting hole.
4. The wheel loader according to claim 2 or 3, further comprising
 - a right rear lamp mounted to the right counterweight, and
 - a right harness connected to the right rear lamp, wherein
 - the vehicle body frame has a right plate which includes a right harness through-hole through which the right harness is inserted.
5. The wheel loader according to any one of claims 2 to 4, further comprising
 - a left rear lamp mounted to the left counterweight, and
 - a left harness connected to the left rear lamp, wherein

the vehicle body frame has a left plate which includes a left harness through-hole through which the left harness is inserted.

6. The wheel loader according to claim 2 or 3, further comprising
 a right rear lamp mounted to the right counterweight,
 and
 a left rear lamp mounted to the left counterweight,
 wherein
 the right rear lamp is positioned to the inside of an
 outer edge of the right counterweight when viewing
 a front surface of the right counterweight; and
 the left rear lamp is positioned to the inside of an
 outer edge of the left counterweight when viewing a
 front surface of the left counterweight.

7. A wheel loader comprising:

a vehicle body frame;
 a right counterweight detachably mounted to the
 vehicle body frame;
 a left counterweight detachably mounted to the
 vehicle body frame; wherein
 the vehicle body frame has a right counterweight
 mounting hole for mounting the right counter-
 weight, and a left counterweight mounting hole
 for mounting the left counterweight; and
 the right counterweight has a first right bolt
 through-hole for mounting the right counter-
 weight in a first right position which is positioned
 to the right of a center in a vehicle width direction
 of the vehicle body frame, and a second bolt
 through-hole for mounting the right counter-
 weight in a second right position which is offset
 from the first right position toward the inside in
 the vehicle width direction; and
 the left counterweight has a first left bolt through-
 hole for mounting the left counterweight in a first
 left position which is positioned to the left of the
 center in the vehicle width direction of the vehicle
 body frame, and a second left bolt through-hole
 for mounting the left counterweight in a second
 left position which is offset from the first left po-
 sition toward the inside in the vehicle width di-
 rection.

8. The wheel loader according to claim 7, wherein:

the vehicle body frame has a rear plate, and
 the rear plate has the first right counterweight
 mounting hole, the second right counterweight
 mounting hole, the first left counterweight
 mounting hole, and the second left counter-
 weight mounting hole.

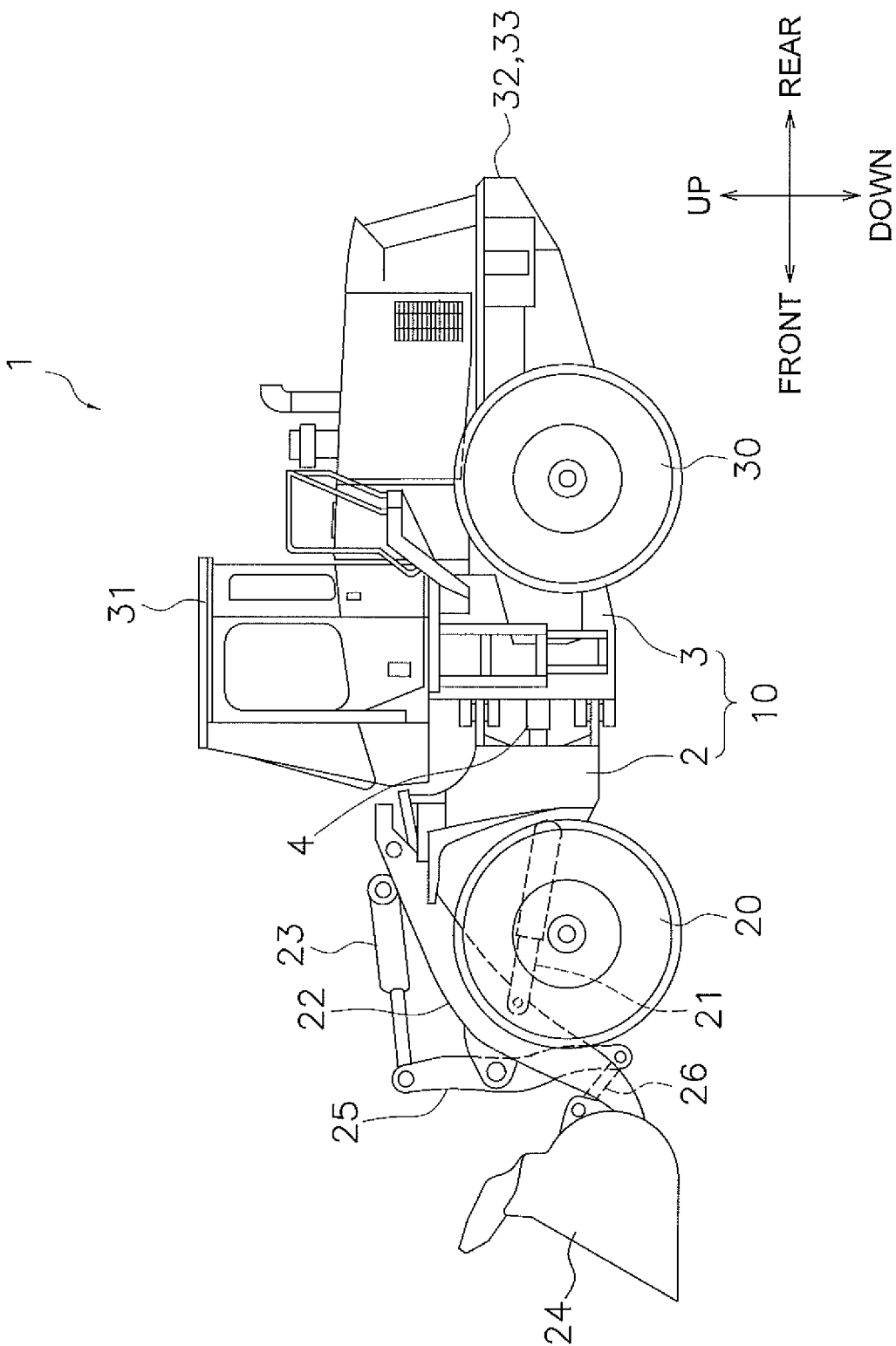


FIG. 1

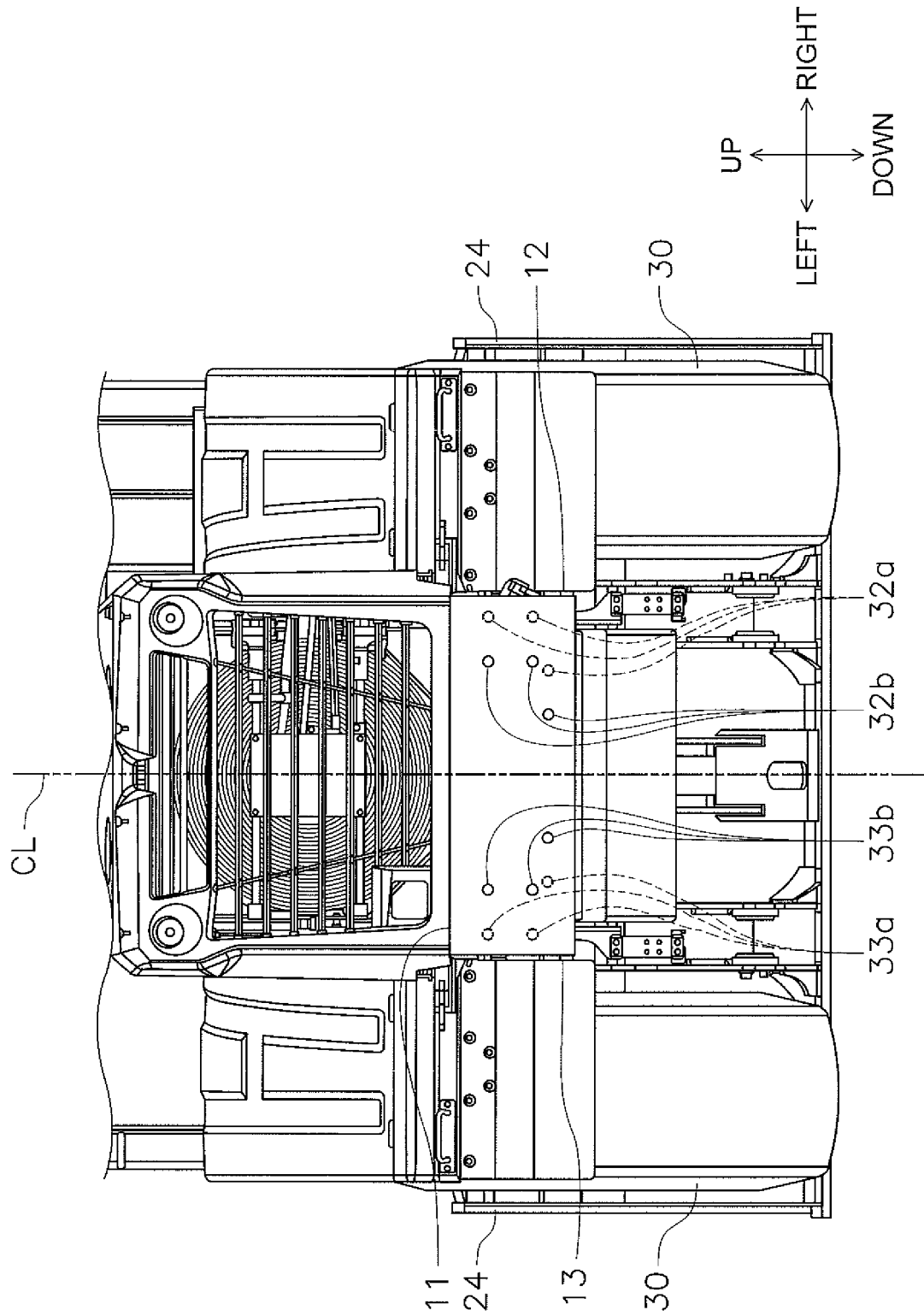


FIG. 2

FIG. 3A

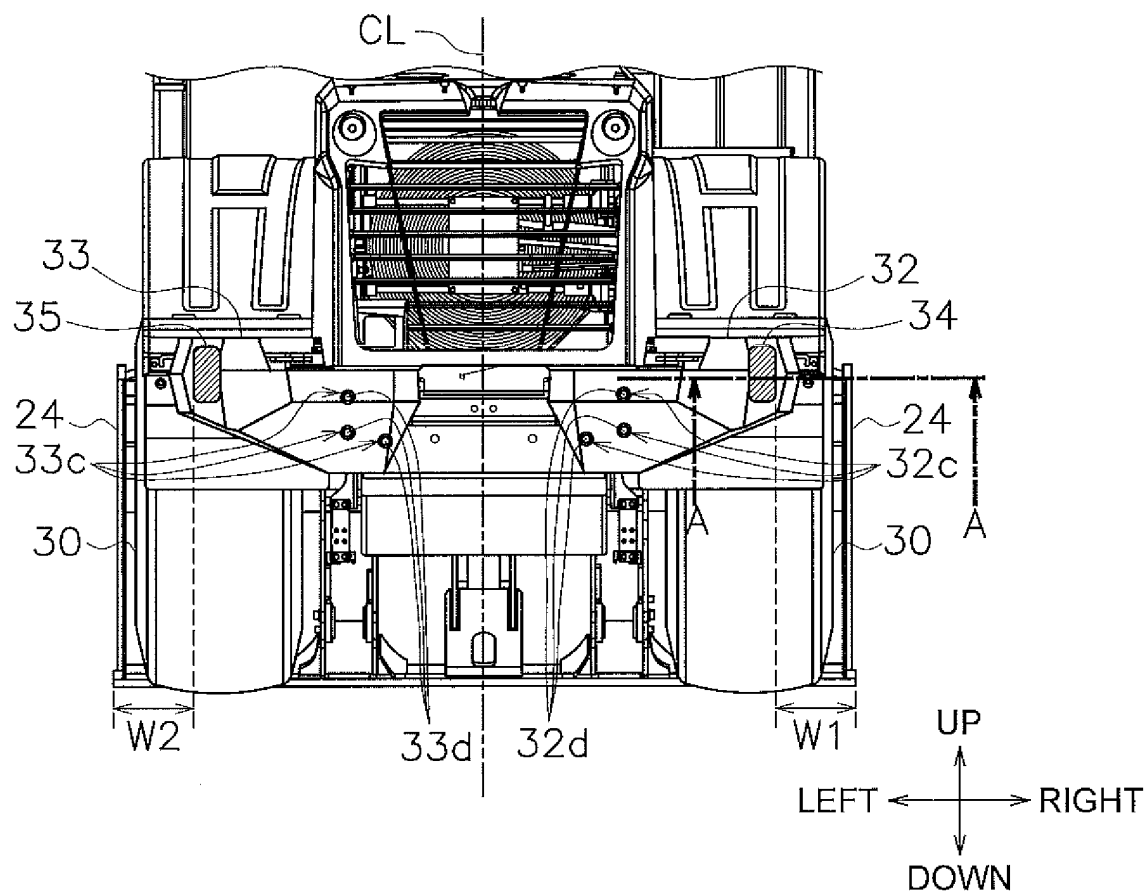


FIG. 3B

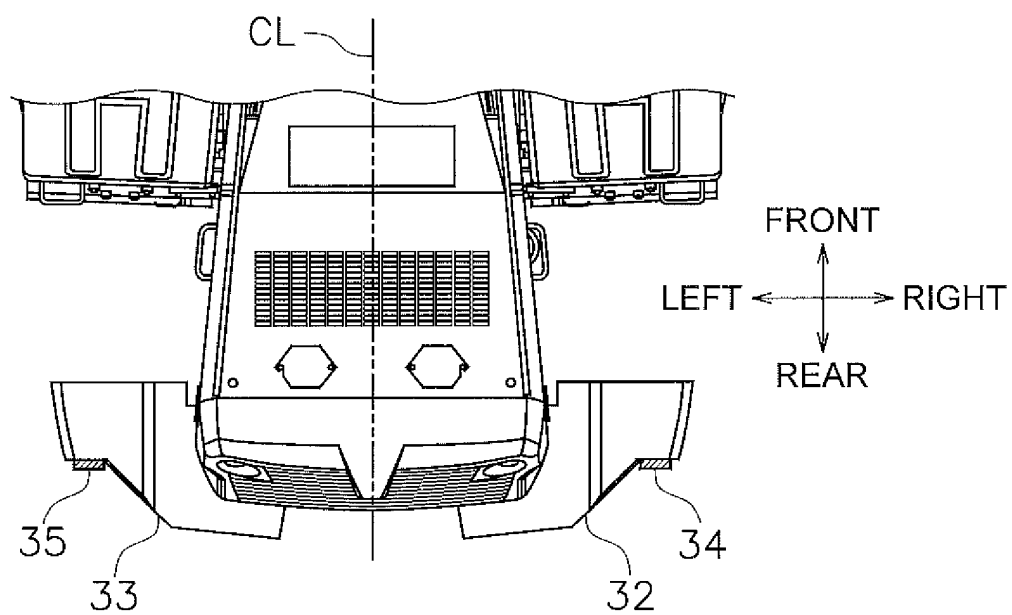


FIG. 4A

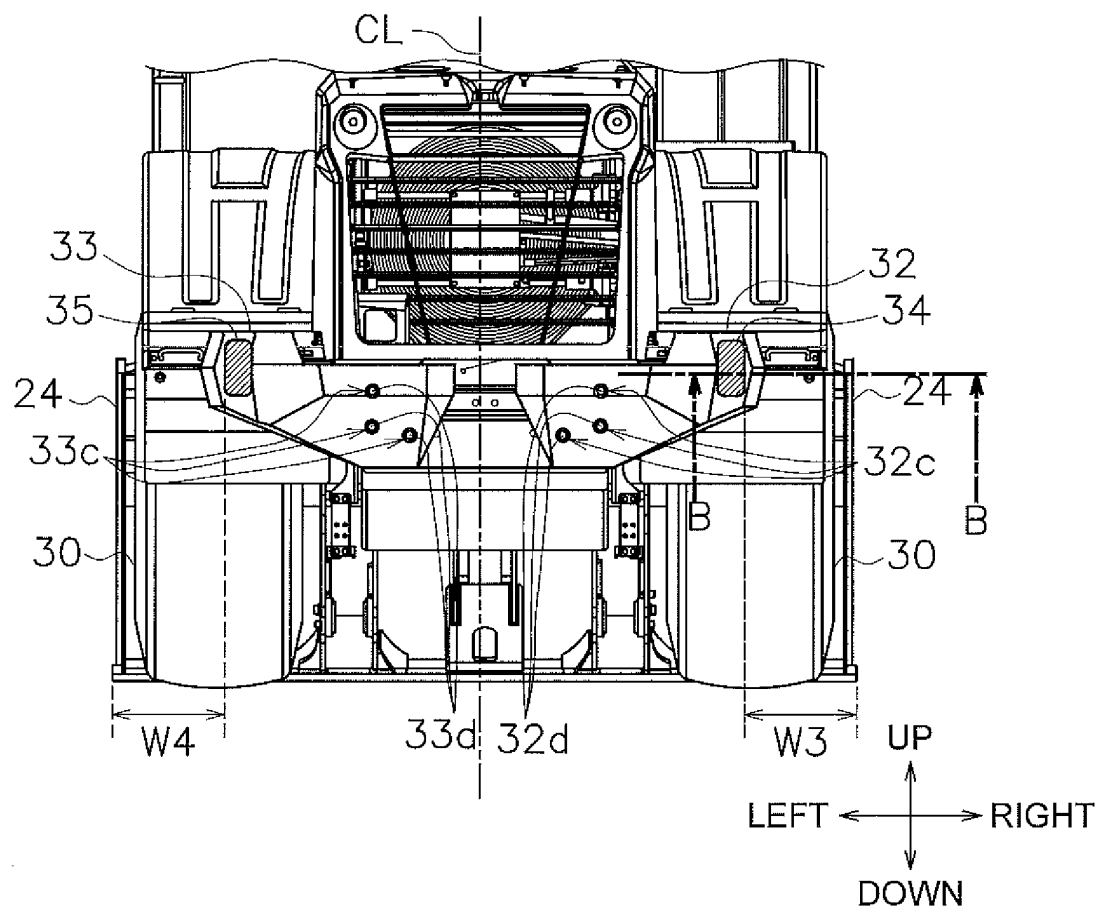


FIG. 4B

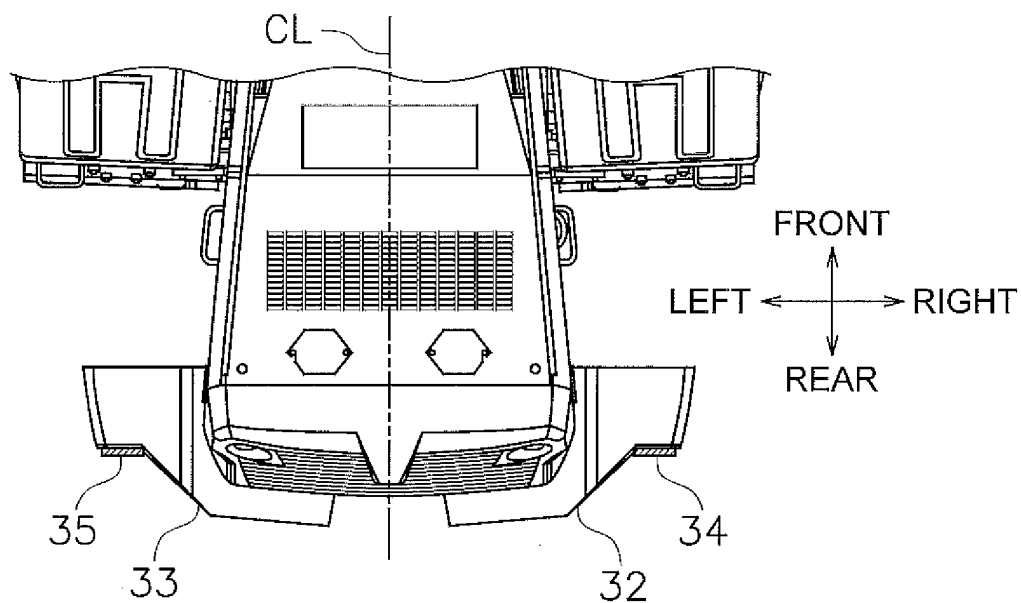


FIG. 5A

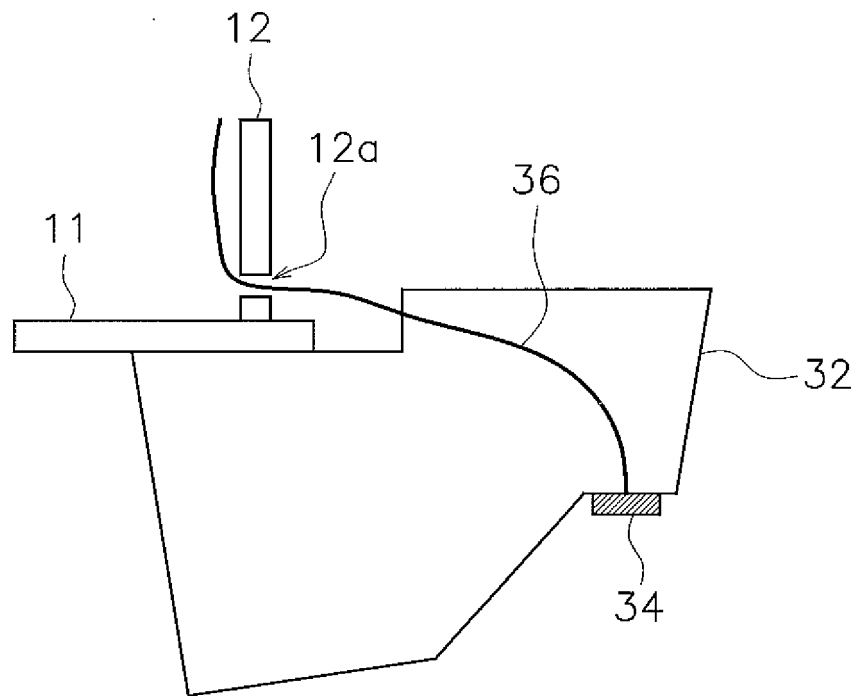


FIG. 5B

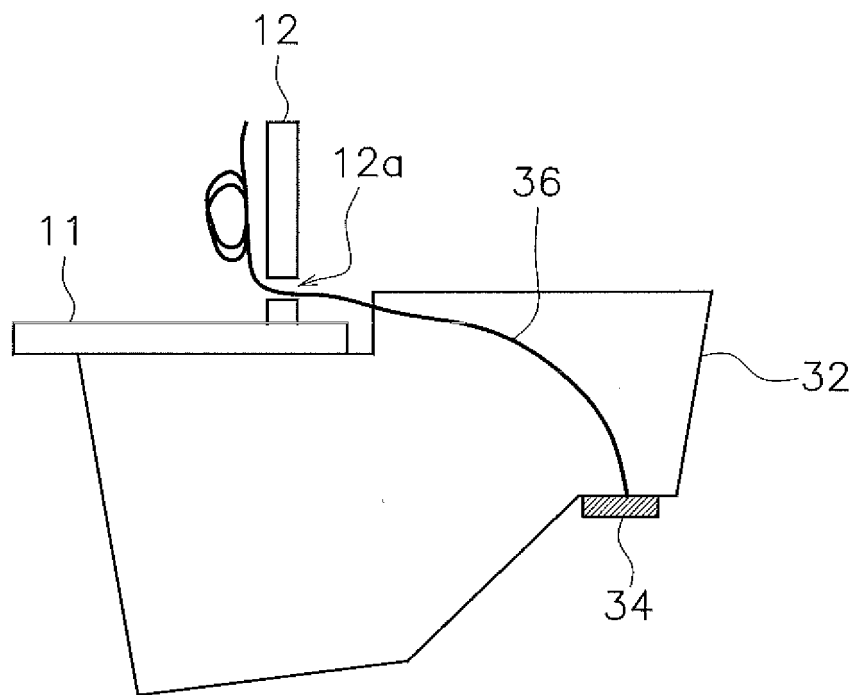


FIG. 6A

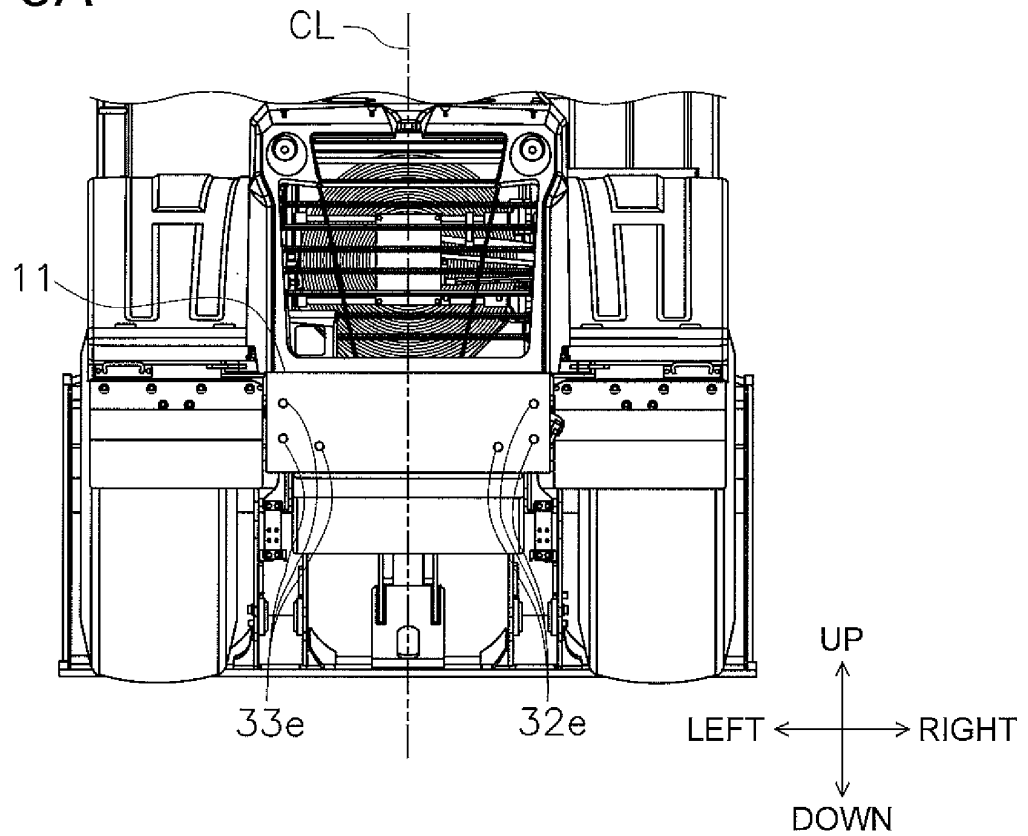
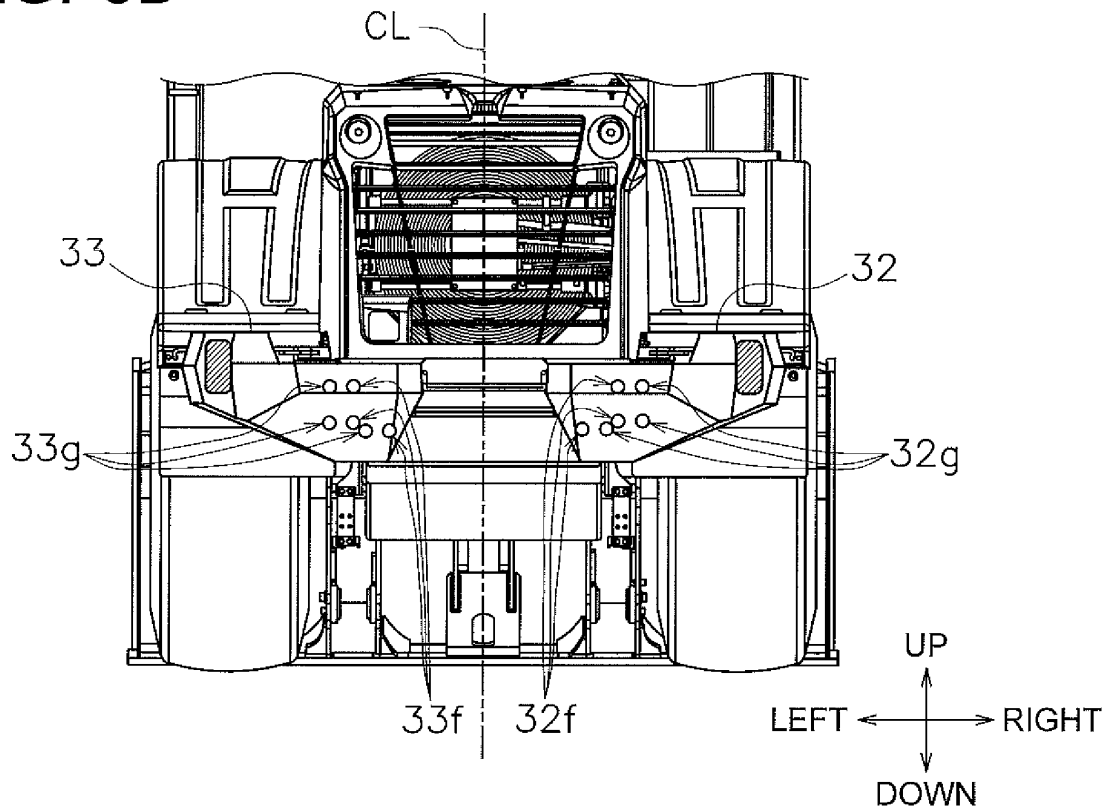


FIG. 6B



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2018/010172

A. CLASSIFICATION OF SUBJECT MATTER

Int.Cl. E02F9/18 (2006.01) i, E02F9/00 (2006.01) i

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

Int.Cl. E02F9/18, E02F9/00, B66F9/075, B62D49/08, B66C23/74

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

Published examined utility model applications of Japan 1922-1996

Published unexamined utility model applications of Japan 1971-2018

Registered utility model specifications of Japan 1996-2018

Published registered utility model applications of Japan 1994-2018

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
P, X P, A	JP 2017-166158 A (KCM CORPORATION) 21 September 2017, paragraphs [0001], [0008]-[0041], fig. 1-11 (Family: none)	1-3, 7-8 4-6
X A	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 12876/1989 (Laid-open No. 103885/1990) (KUBOTA TEKKO KABUSHIKI KAISHA) 17 August 1990, page 5, line 17 to page 7, line 13, fig. 1-3 (Family: none)	1 2-8
X A	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 76804/1983 (Laid-open No. 180969/1984) (YANMAR AGRICULT EQUIP CO., LTD.) 03 December 1984, page 3, line 20 to page 8, line 16, fig. 1-6 (Family: none)	1 2-8
A	JP 4-19244 A (TOYOTA AUTOMATIC LOOM WORKS, LTD.) 23 January 1992, entire text, all drawings (Family: none)	1-8
A	US 2012/0153605 A1 (CATERPILLAR INC.) 21 June 2012, entire text, all drawings (Family: none)	1-8

☐ Further documents are listed in the continuation of Box C.
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Date of the actual completion of the international search
31 May 2018 (31.05.2018)Date of mailing of the international search report
12 June 2018 (12.06.2018)Name and mailing address of the ISA/
Japan Patent Office
3-4-3, Kasumigaseki, Chiyoda-ku,
Tokyo 100-8915, Japan

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Patent documents cited in the description

- JP 2004291694 A [0003]