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(54) CONSTRUCTION MACHINE

(57) A construction machine reduced in overall body length without shortening arms of operating units and made suitable for use in limited space without sacrificing its working efficiency, wherein a second operating unit (14) is arranged above a traveling truck (11) so that the bases (14a) of the second operating unit (14) are positioned in areas (1d, 1e) between a tangent (1b) to the swiveling circle (1a) of a first base (13), which is parallel to the widthwise direction of the traveling truck (11), and a straight line (1c) passing the center of the swiveling circle (1a) and parallel to the widthwise direction of the traveling truck (11), in the outside vicinity of the swiveling circle (1a).

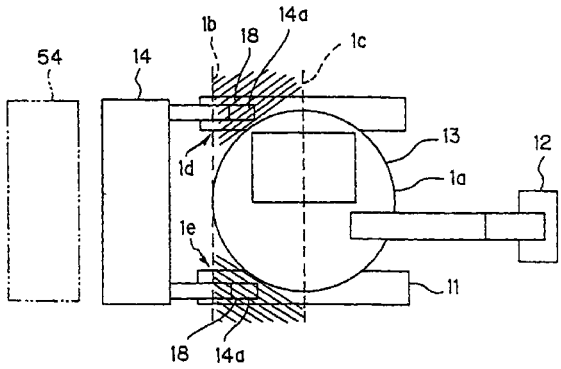

FIG.1(b)

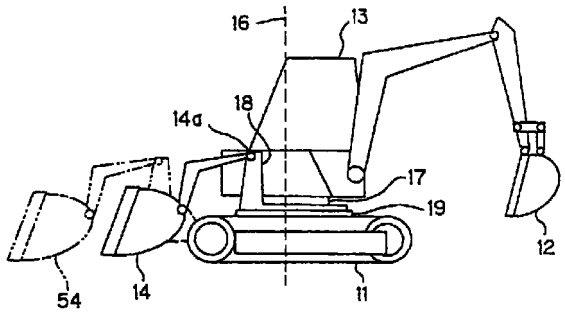

FIG.1(a)

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Description

TECHNICAL FIELD

[0001] The present invention relates to the structure of a construction machine for performing construction work, and the like, by means of a first operating unit and a second operating unit, which travels by means of a traveling truck.

BACKGROUND ART

[0002] Figs. 4(a), (b) illustrate a construction machine for performing construction work equipped with a first and a second operating unit, where Fig. 4(a) is a plan view and Fig. 4(b) is a side view.

[0003] As illustrated in Figs. 4(a) and (b), this construction machine is provided with a back hoe 52, which is an excavating and earth-moving tool, in the rear area of the traveling truck 51, and a loader 54 which is loading tool, in the front area of the traveling truck 51. The back hoe 52 is supported by a first base platform 53, such that it is capable of upward and downward movement, and the first base platform 53 is capable of rotating 360° in a horizontal direction by turning within the range of the circle 55 indicated by the broken line in the diagram, when the back hoe 52 is in a retracted state. Moreover, the back hoe 52 is an excavating tool consisting of an excavating bucket and a multiple-jointed arm. On the other hand, the loader 54 is a loading tool consisting of arms and a bucket installed at the end of these arms, the bases of the loader 54 being installed on attachment members 58, such that it is capable of upward and downward movement.

[0004] The first base platform 53 supporting the back hoe 52 is fixed to a rotating unit 56, and is capable of rotating about an axis of rotation 57. Furthermore, the loader 54 is installed on the attachment members 58 in such a manner that it does not interfere with the first base platform 53, when the first base platform 53 rotates.

[0005] In this way, in a conventional construction machine, since the bases of the loader 54 are positioned in front of the swiveling circle 55 of the first base platform 53, the overall length of the machine is increased, thereby making the machine unsuitable for use in restricted spaces.

[0006] Here, if the overall length of the machine is shortened by reducing the length of the arm of the loader 54, then the loader 54 will not be capable of a large reach, and hence it will not be able to provide a broad operating range. In other words, a new problem will arise in that working efficiency will decline.

DISCLOSURE OF THE INVENTION

[0007] The present invention was devised with the foregoing in view, an object thereof being to provide a construction machine whereby the overall length of the machine can be shortened compared to a conventional construction machine, in such a manner that the machine is suitable for use in restricted spaces, whilst making it possible to achieve a broad operating range and to increase working efficiency.

[0008] In order to achieve the aforementioned objects, the present invention is a construction machine wherein a first base platform supporting a first operating unit is provided rotatably in a horizontal direction on an upper portion of a traveling truck, and a second operating unit is also provided on the upper portion of the traveling truck, characterized in that:

> the second operating unit is installed on the upper part of the traveling truck in such a manner that bases of the second operating unit are located within areas in an outer vicinity of a swiveling circle of the first base platform, extending between a tangent to the swiveling circle running in parallel with a widthwise direction of the traveling truck and a straight line passing through a center of the swiveling circle and running in parallel with the widthwise direction of the traveling truck.

[0009] Therefore, according to the present invention, as shown in Fig.1(a) and (b), a second operating unit 14 is installed on the upper part of a traveling truck 11 in such a manner that the bases 14a of the second operating unit 14 are positioned within areas 1d, 1e (diagonally shaded areas) in the vicinity of the swiveling circle 1a of the first base platform 13, to the outside thereof, extending between a tangent 1b to the swiveling circle 1a running in parallel to the widthwise direction of the traveling truck 11 and a straight line 1c passing through the center of the swiveling circle 1a and running in parallel with the widthwise direction of the traveling truck 11. As a result of this, the position of the second operating unit 14 can be moved further towards the inner portion of the vehicle compared to the position of a conventional second operating unit 15 (as depicted by the broken lines), and hence the overall vehicle length can be reduced without shortening the arms of the second operating unit 14.

[0010] Consequently, the construction machine according to the present invention has a shorter overall vehicle length than a conventional construction machine, and it is therefore suitable for use in restricted spaces. Moreover, since it is not necessary to reduce the length of the arms of the second operating unit 14, the second operating unit 14 is able to provide a large reach, thereby improving working efficiency.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011]

Fig. 1(a) is a side view of a first embodiment of the

present invention, and Fig. 1(b) is a plan view of this first embodiment;

Fig. 2(a) is a side view of a second embodiment of the present invention, and Fig. 2(b) is a plan view of this second embodiment;

Fig. 3 is a plan view of a third embodiment of the present invention;

Fig. 4(a) is a plan view of a conventional construction machine, and Fig. 4(b) is a side view of this conventional construction machine;

Fig. 5 is a diagram showing a desirable embodiment with regard to the height of the cab; and

Fig. 6 is a principal oblique view illustrating a case where a foot rest is provided in the cab of the embodiment illustrated in Fig. 5.

BEST MODE FOR CARRYING OUT THE INVENTION

[0012] Below, embodiments of the present invention are described with reference to the drawings.

[0013] Fig. 1(a) is a side view of a construction machine according to an embodiment of the present invention, and Fig. 1(b) is a plan view of same.

[0014] As these diagrams illustrate, traveling truck 11 is a vehicle having a travelling function, which, for example, uses a caterpillar tread system, as shown in the drawings. Moreover, the vehicle may also be based on a wheel system, as illustrated in Fig. 4(a) and (b). The present embodiment is based on the presumption of a construction machine having an ultra-small swiveling circle, wherein the swiveling circle 1a of the first base platform 13 is restricted within the width of the traveling truck 11.

[0015] Moreover, the first base platform 13 is a cab in which an operator rides.

[0016] A rotating unit 17 which rotates freely through 360° in a horizontal direction about a rotational axis 16 is installed on the upper part of the traveling truck 11, and the first base platform 13 is fixed to this rotating unit 17. A back hoe 12 forming a first operating unit is supported on the end portion of this base platform 13. Therefore, by operating the rotating unit 17 appropriately, the back hoe 12 can be positioned in any chosen direction in the horizontal plane.

[0017] Moreover, a loader 14 forming a second operating unit is also installed on the upper part of the traveling truck 11. The bases of this loader 14 are supported by attachment members 18 provided on the side faces of the first base platform 13. The attachment members 18 are fixed to a frame 19 positioned below the first base platform 13, and this frame 19 is fixed to the traveling truck 11.

[0018] Here, the positional relationship between the loader 14 and the first base platform 13 will be described.

[0019] In particular, as illustrated in Fig. 1(b), the loader 14 is installed on the attachment members 18 on the upper part of the traveling truck 11 in such a manner that the bases 14a, which are the sections where the loader 14 is connected to the attachment members 18, are located within areas 1d, 1e (indicated by diagonal shading) which lie in the vicinity of the swiveling circle 1a of the first base platform 13, to the outside thereof, extending between tangent 1b of the aforementioned swiveling circle 1a running in parallel with the widthwise direction of the traveling truck 11, and straight line 1c passing through the center of the aforementioned swiveling circle 1a and also running in parallel with the widthwise direction of the traveling truck 11.

[0020] In the present embodiment, the bases 14a of the loader 14 are attached to attachment members 18 which are separate items from the frame 19, but it is also possible for the bases 14a of the loader 14 to be attached to attachment members formed integrally with the frame 19. In short, the bases 14a of the loader 14 should be attached to attachment members extending from a frame 19 provided between the traveling truck 11 and the first base platform 13.

[0021] Moreover, the bases 14a of the loader 14 may also be installed on attachment members extending from the traveling truck 11, without providing a frame 19 between the traveling truck 11 and the first base platform 13. In this case also, the attachment members may be formed independently from the traveling truck 11, or they may be formed integrally with the traveling truck 11.

[0022] Here, the loader 14 forming the second operating unit may be installed in such a manner that it can rotate freely in a horizontal direction.

[0023] Fig. 2(a) is a side view of an embodiment wherein a loader 14 is capable of rotating, and Fig. 2(b) is a plan view of same. Similar labels to Figs. 1(a) and (b) indicate the same parts.

[0024] As these diagrams show, a rotating unit 27 which is capable of rotating freely through 360° in a horizontal direction about an axis of rotation 26 is installed on the upper part of a traveling truck 11, and a frame 28 is fixed to this rotating unit 27. Attachment members 29 for supporting the bases 14a of the loader 14 are installed on the aforementioned frame 28. Consequently, by operating the rotating unit 27 as necessary, it is possible to position the loader 14 in any direction in the horizontal plane. In this case, the frame 28 which supports the loader 14 by means of the attachment members 29 functions as a second base platform about which the loader 14 rotates.

[0025] In this embodiment, the bases 14a of the loader 14 are installed on attachment members 29 which are formed as independent units from the frame 28 representing the second base platform, but the bases 14a of the loader 14 may also be installed on attachment members which are formed integrally with the frame 28 representing the second base platform. In short, provided that the bases 14a of the loader 14 are installed on attachment members extending from the frame 28 forming the second base platform, the attachment members may fabricated integrally with, or inde-

pendently from, the frame 28.

[0026] Moreover, a rotating unit 2a capable of rotating freely through 360° in a horizontal direction is installed on the upper part of the frame 28, and a first base platform 13 is fixed to this rotating unit 2a. A back hoe 12 forming a first operating unit is supported at the end portion of this first base platform 13. Consequently, by operating the rotating unit 2a in an appropriate manner, the back hoe 12 can be positioned in any direction in the horizontal plane.

[0027] Here, the axis of rotation of the rotating unit 2a which causes the first base platform 13 to turn may be set such that it is coaxial with the axis of rotation 26 of the rotating unit 27 which causes the frame 28 forming the second base platform to turn, or alternatively, these two axes of rotation may be offset from each other by an appropriate amount.

[0028] The positional relationship between the loader 14 and the first base platform 13, as shown in Fig.2(b), is such that the bases 14a of the loader 14 are located within areas 1d, 1e lying close outside the swiveling circle 1a of the first base platform 13, similarly to Fig. 1(b).

[0029] The embodiments described above are based on the presumption of a construction machine having an ultra-small swiveling circle, but they may also be applied to a construction machine having a rear-end swiveling circle within the vehicle width, wherein the circle described by rotation of the portion (rear end) on the opposite side to the portion where the back hoe forming the first operating unit is attached to the first base platform is restricted within the width of the traveling truck.

[0030] Moreover, in the embodiments described above, it is presumed that the loader forming the second operating unit comprises two arms, namely, a left and a right arm, but as shown in Fig. 3, the present invention may also be implemented in a construction machine comprising a loader 44 having only one arm.

[0031] In this case, similarly to Fig. 1(b) and Fig. 2(b), the base 44a of the loader 44 is located with a area 1e close outside the swiveling circle 1a of the first base platform 13.

[0032] As described above, according to the embodiments of the present invention, since the bases 14a, 44a of the loader 14 or 44 are located within areas 1d, 1e (diagonally shaded areas) which lie in the vicinity of the swiveling circle 1a of the first base platform 13, to the outside thereof, extending between tangent 1b of the aforementioned swiveling circle 1a running in parallel with the widthwise direction of the traveling truck 11, and straight line 1c passing through the center of the aforementioned swiveling circle 1a and also running in parallel with the widthwise direction of the traveling truck 11, the position of the loader 14 or 44 can be moved towards the inner side of the vehicle compared to the position of a conventional loader 54 (indicated by broken lines in Fig. 1, Fig. 2 and Fig. 3), without giving rise to interference between the loader 14 or 44 and the first base platform 13. Consequently, the overall length of the vehicle can be shortened without reducing the length of the arms of the loader 14, 44.

[0033] Therefore, since the overall vehicle length of the construction machine according to the present embodiments is shorter than that of a conventional construction machine, it is suitable for use in restricted spaces. Moreover, since it is not necessary to shorten the length of the arms of the loader 14, 44, it is possible to achieve a long reach for the loader 14, 44, and working efficiency can be improved.

[0034] Furthermore, in the present embodiments, since a frame 19, 28 covering the lower sides of the cab 13 is provided in addition to the attachment members 18, 29 installed on the side faces of the first base platform 13 formed by the cab, it is possible for the attachment members and frame to function as dirt-protection plates for shielding against dirt flying up when the traveling truck 11 is in motion. Furthermore, the attachment plates 18, 29 and frame 19, 28 can also be utilized as footholds for the operator when climbing into the cab 13.

[0035] Consequently, it becomes unnecessary to provide dirt-protection fenders, or steps forming footholds, as separate items, and therefore the cost of the machine can be reduced.

[0036] Here, the aforementioned attachment members 18, 29 involve the following problems relating to the safety of the operator.

[0037] This will be described with reference to Fig. 5, which gives a more detailed illustration of Fig. 2(a).

[0038] Namely, since the bases 14a of the loader 14, in other words, the attachment members 29 on which these bases 14a are installed, are located close outside the swiveling circle 13 of the cab 13 in which the operator rides, as described above (see Fig. 2(b)), then the distance B from the center of the vehicle to the end tip of arm 14b of the loader 14 can be shortened, thereby making it possible to achieve good stability, and good compactification during transport. Nevertheless, in order to ensure the length of reach A of the loader 14, it is necessary for the distance C' from ground level GL to the upper ends of the attachment members 29 to be long, such that the bases 14a forming the rotational fulcrums of the loader 14 are located in a high position.

[0039] However, if the attachment members 29 are located in a position higher than the floor surface 30a of the cab 13 and in the vicinity of the cab 13, in this way, then there is a risk that when an operator is riding in the cab 13, his or her foot may become trapped between the cab 13 and an attachment member 29, when the cab 13 rotates, or when the loader 14 rotates, or when both the cab 13 and the loader 14 rotate simultaneously (these instances are referred to generally as "relative rotation" of the cab 13).

[0040] Therefore, as illustrated in Fig. 5C, in order to avoid danger of this kind in the present embodiments, the floor height D representing the distance from ground

level GL to the floor surface 30a of the cab 13 is made greater than the distance C from ground level GL to the upper ends of the attachment members 29, in other words, the cab 13 is installed on the upper part of the traveling truck 11 in such a manner that the base surface 30a of the cab 13 is higher than the upper ends of the attachment members 29

[0041] Moreover, in order to improve safety, as shown in Fig. 6, a footrest 31 extending outside the cab 13 beyond the floor surface 30a of the cab 13 may be provided in a position above an attachment member 29, in such a manner that the footrest 31 does not interfere with the loader 14 (arms 14b). In Fig. 6, numeral 32 denotes a side cover made from resin, 30 denotes a floor mat made from rubber, 33 denotes an operating pedal for causing the loader 14 to rotate, for example, and 34 denotes a hand grip.

[0042] The reason that the footrest 31 is provided extending beyond the floor surface 30a in this way is in order that the operator does not get his or her foot trapped between the attachment member 29 and the cab 13 due to the operator's foot falling down below the floor surface 30a. This is because in a vehicle wherein the cab 13 has a narrow floor surface 30a, the operator's foot is particularly liable to fall outside the floor surface 30a. Moreover, as illustrated in Fig. 6, it is also possible to provide a stopper 31a at the end of the footrest 31, in such a manner that the operator's foot does not project outside the footrest 31.

[0043] Incidentally, the footrest 31 does not necessarily have to extend beyond the floor surface 30a, and a footrest may be provided in such a manner that it is contained within the existing floor surface 30a.

[0044] The footrest described above may be provided on only one side of the floor surface 30a of the cab 13 (in particular, on the side where the operator's foot is liable to stray outside the cab,) or it may be provided on both the left and right-hand side of the floor surface 30a.

[0045] The embodiment in Fig. 6 is based on the presumption of a vehicle of a type wherein the loader 14 illustrated in Figs. 2(a), (b) rotates, but it may also be applied suitably to a vehicle of a type wherein the loader 14 illustrated in Figs. 1(a), (b) does not rotate. In short, the foregoing embodiment may be applied to a machine wherein the cab 13 rotates relatively with respect to the loader 14, and it may also be applied to a vehicle wherein the cab 13 does not rotate but the loader 14 does rotate.

[0046] The foregoing embodiment is desirable in respect of ensuring the safety of the operator. Naturally, in a large-scale vehicle, wherein the cab 13 has a large floor surface 30a and it is difficult to imagine that the operator's foot will fall outside the cab 13, the foregoing embodiment can be omitted.

[0047] In the embodiment illustrated in Figs. 2(a), (b), in particular, since the loader 14 is capable of turning fully through 360° in a similar manner to the back hoe 12, it is possible to withdraw the loader 14 to a position and direction where it will not pose an obstacle to the excavating and earth-moving work carried out by the back hoe 12.

[0048] Moreover, by positioning the loader 14 in the same direction as the rotational direction of the back hoe 12, and making it contact and fix to the ground surface, it is possible to utilize the loader 14 as an outrigger for ensuring the stability of the machine when work is being carried out using the back hoe 12.

[0049] Here, an excavating blade is generally affixed to a small-scale hydraulic shovel in a position in front of the vehicle, and this excavating blade can be utilized as an outrigger for ensuring the stability of the machine during digging work, but the stability of the machine can only be ensured sufficiently if the shovel is orientated towards the front of the machine similarly to the excavating blade.

[0050] However, according to the construction machine in the embodiment illustrated in Figs.2(a), (b), whatever rotational direction the back hoe 12 is facing, the loader 14 performing as an outrigger can be positioned in the corresponding direction, and therefore the stability of the machine can be ensured throughout the full direction of rotation, thereby causing stability to improve dramatically.

[0051] Furthermore, since the loader 14 is also capable of turning fully through 360°, loading operations can be carried out in all horizontal directions. Therefore, the machine is capable of performing operations in a flexible range of loading positions, rather than being restricted in such a manner that loading operations can only be performed to the front side of the machine, as is the case with the conventional construction machine comprising two types of operating unit illustrated in Figs. 4(a), (b), and hence working efficiency can be improved dramatically. When performing loading operations by means of the loader 14 in this way, it is possible to carry out the loading operations in a smooth manner, if the first base platform 13 is caused to rotate in a direction where it will not impede operations and if the back hoe 12 is stored in a retracted state.

[0052] Moreover, by turning the loader 14 and the back hoe 12 in the same direction, it is possible to carry out combined tasks whereby, for example, soil, gravel, or the like, excavated by the back hoe 12 is removed directly by the loader 14, and hence working efficiency can be improved dramatically.

[0053] Furthermore, in the present embodiment, the operating tools 12, 14 are rotatable through fully 360° in a horizontal direction, but it is also possible to adopt an embodiment wherein the range of rotation is restricted according to requirements. For example, in order to carry out combined tasks using both of the aforementioned operating units, it is simply necessary for the loader 14 and the back hoe 12 to be positionable in the same rotational direction, and therefore the range of rotation may be limited to 90° to left and right, respec-

tively.

[0054] Moreover, in the present embodiment, it is presumed that the operating units are a loader 14 and a back hoe 12, but it is also possible to adopt embodiments wherein these are replaced by other appropriate types of operating unit, depending on the tasks to be performed.

[0055] For example, a vertically movable excavating blade may be provided in place of the vertically movable loader 14.

[0056] Moreover, in the present embodiment, a first operating unit 12 is provided, rotatably in a horizontal direction, on the upper part of a second operating unit 14 which is also rotatable in a horizontal direction, but the present invention is not limited to this, and other types of operating unit may also be provided, rotatably in a horizontal direction, on the upper part of the first operating unit 12, in accordance with the tasks to be performed.

Claims

1. A construction machine wherein a first base platform supporting a first operating unit is provided rotatably in a horizontal direction on an upper portion of a traveling truck, and a second operating unit is also provided on the upper portion of the traveling truck, characterized in that:

   the second operating unit is installed on the upper part of the traveling truck in such a manner that bases of the second operating unit are located within areas in an outer vicinity of a swiveling circle of the first base platform, extending between a tangent to the swiveling circle running in parallel with a widthwise direction of the traveling truck and a straight line passing through a center of the swiveling circle and running in parallel with the widthwise direction of the traveling truck.

2. The construction machine according to claim 1, wherein the bases of the second operating unit are installed on attachment members extending from the traveling truck.

3. The construction machine according to claim 1, wherein the bases of the second operating unit are installed on attachment members extending from a frame provided between the traveling truck and the first base platform.

4. The construction machine according to claim 1, wherein a second base platform supporting the second operating unit is provided rotatably in a horizontal direction, below the first base platform, the bases of the second operating unit being installed on attachment members extending from the second base platform.

5. The construction machine according to claim 4, wherein the second base platform is provided below the first base platform, in such a manner that a rotational axis of the second base platform is virtually coaxial with a rotational axis of the first base platform.

6. The construction machine according to claim 1, wherein the swiveling circle of the first base platform is restricted within the width of the traveling truck.

7. The construction machine according to claim 1, wherein a circle described by the rotation of a portion of the first base platform on an opposite side to the portion thereof where the first operating unit is attached is restricted within the width of the traveling truck.

8. The construction machine according to claim 1, wherein the first base platform is a cab in which an operator rides, the bases of the second operating unit being installed on a frame covering lower sides of this cab.

9. A construction machine wherein a cab in which an operator rides is installed on an upper portion of a traveling truck, attachment members on which bases of an operating unit are installed being provided between the cab and the traveling truck, in positions in a vicinity of a swiveling circle of the cab, to an outside thereof, and tasks being carried out by means of the cab rotating relatively with respect to the attachment members, characterized in that:

   the cab is installed on the upper portion of the traveling truck in such a manner that a floor surface of the cab is higher than upper ends of the attachment members.

10. The construction machine according to claim 9, wherein the operating unit carries out tasks by means of arms rotating about rotational fulcrums formed at positions where the bases are attached to the attachment members.

11. The construction machine according to claim 8, wherein a footrest extending outside a floor surface of the cab is provided in a position above the attachment members when the cab performs relative rotation, in such a manner that it does not interfere with the operating unit.

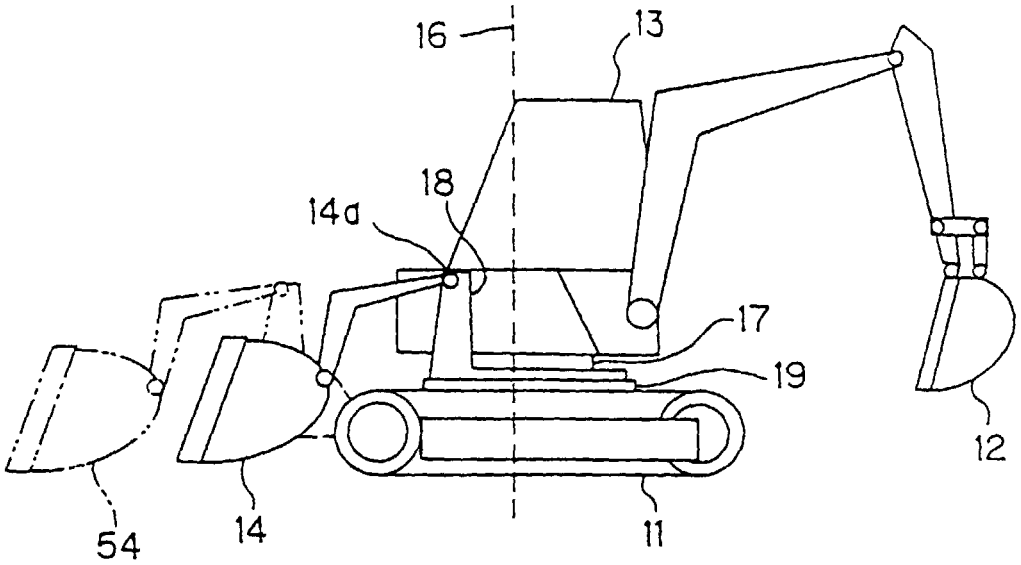
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FIG.1(a)

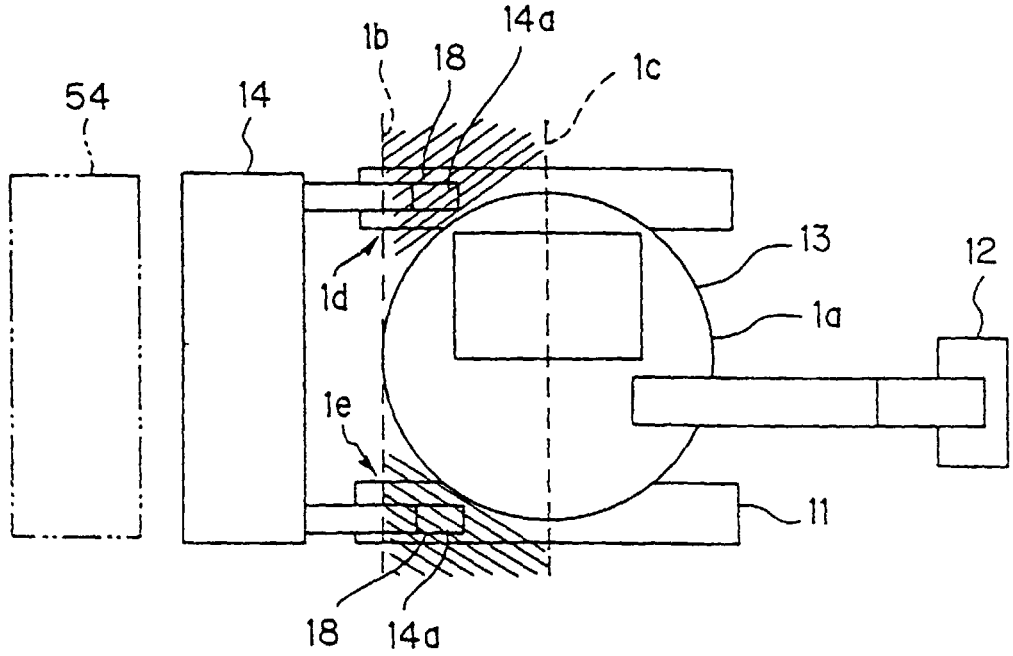
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FIG.1(b)

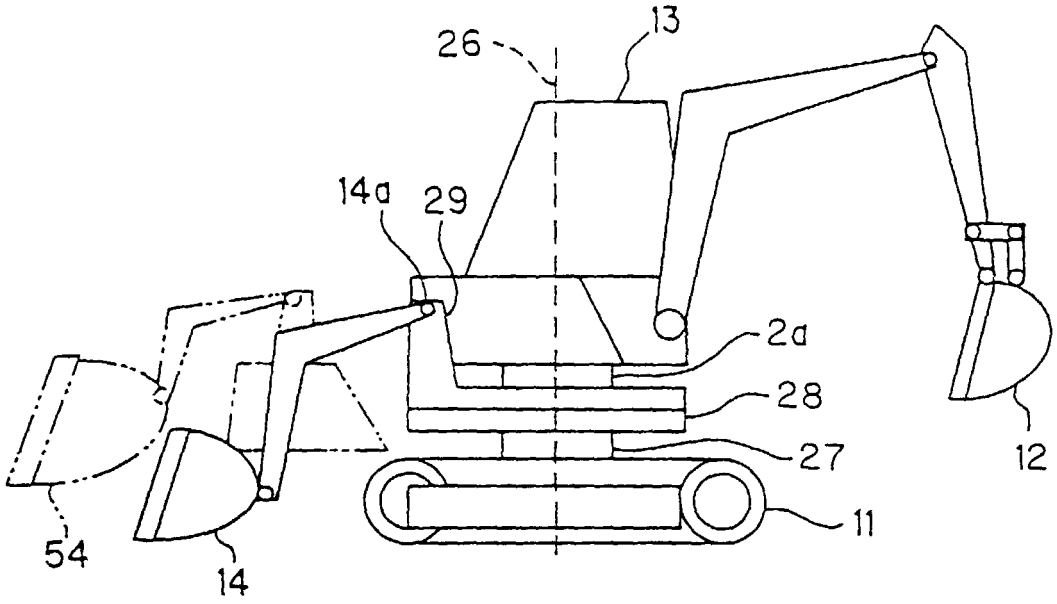
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FIG.2(a)

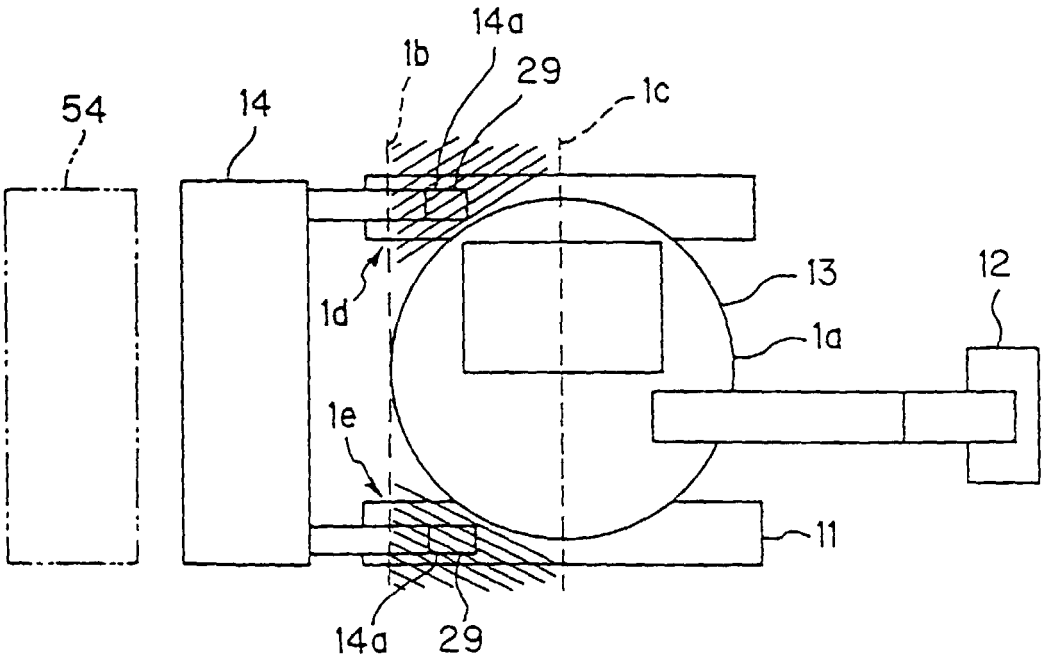
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FIG.2(b)

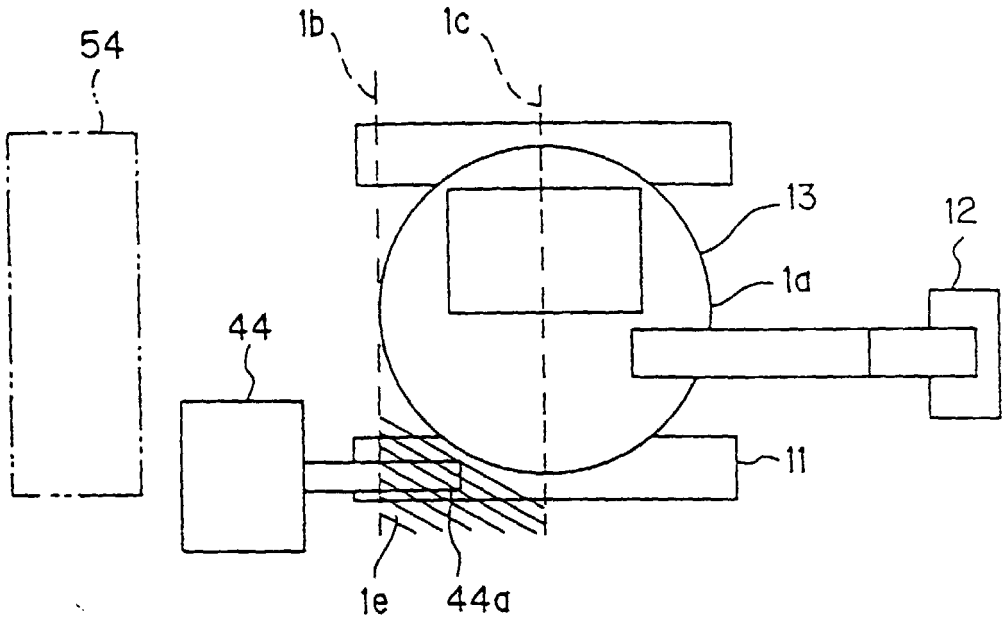

FIG.3

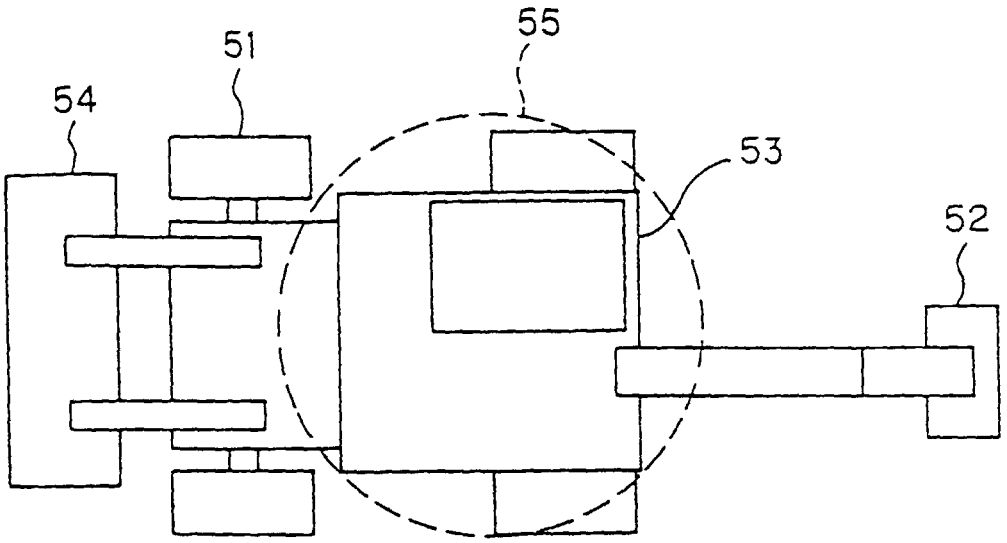

FIG.4(a)

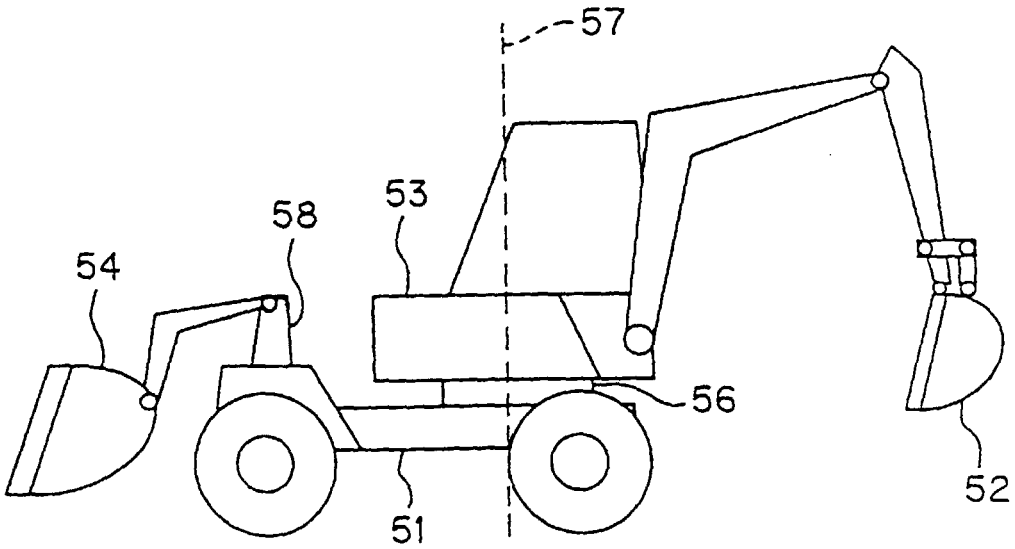

FIG.4(b)

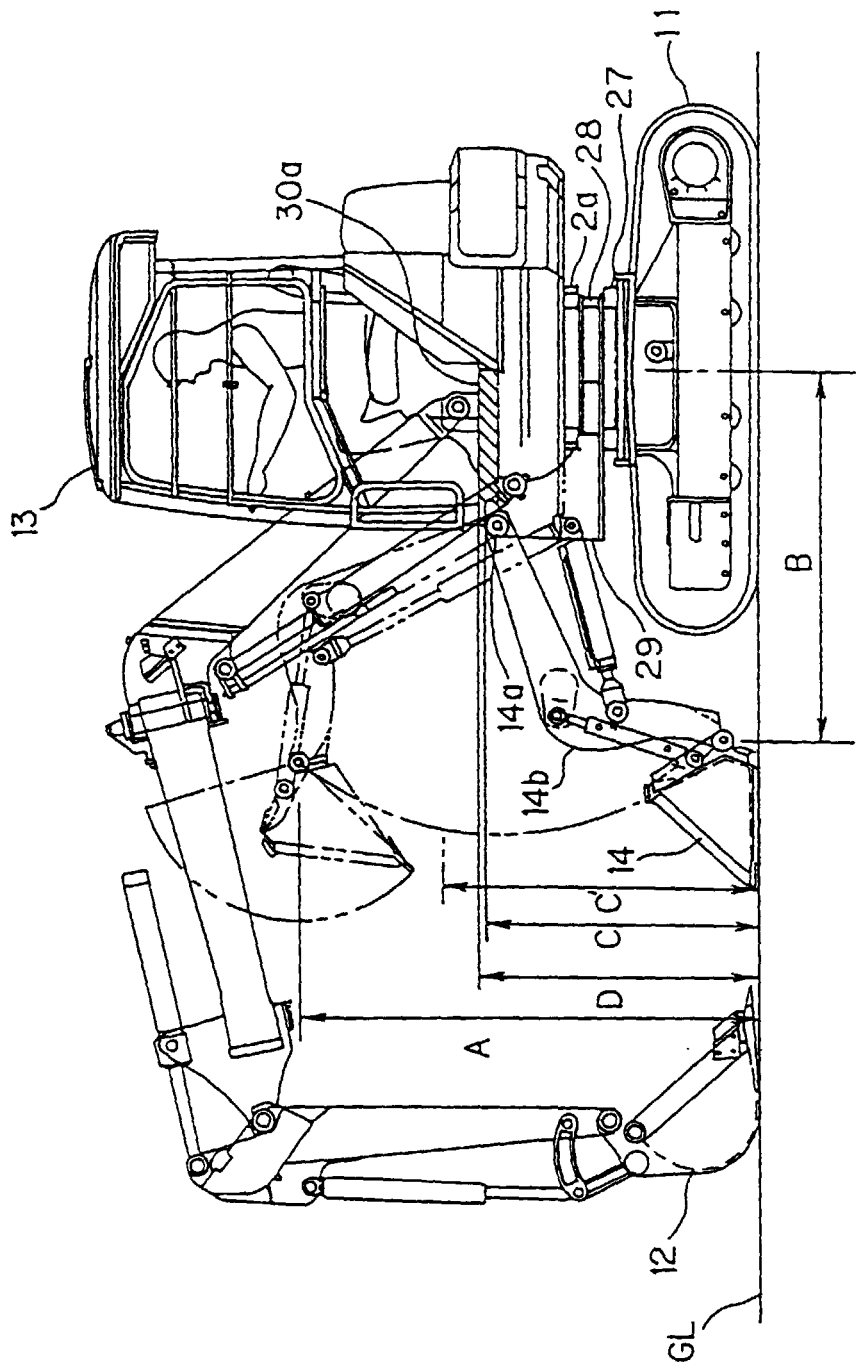

FIG.5

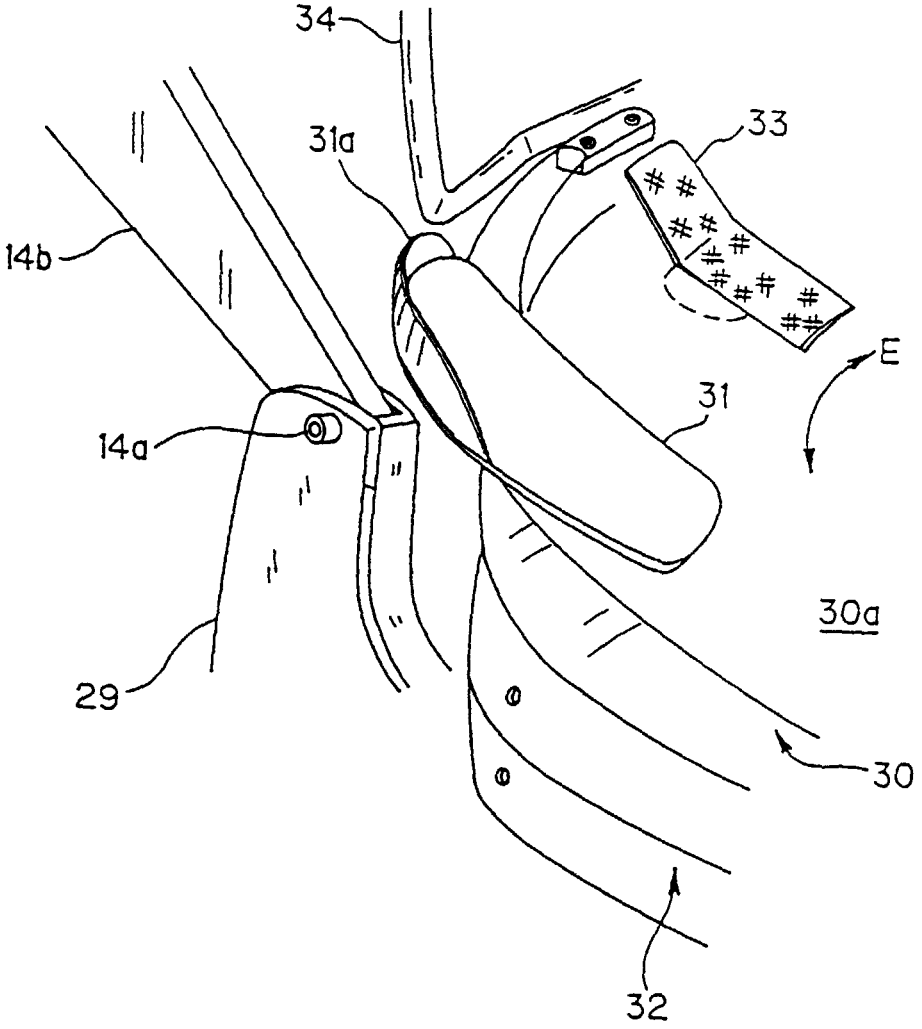

FIG.6

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP98/02047

A. CLASSIFICATION OF SUBJECT MATTER
Int.Cl[6] E02F3/96, E02F9/16

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[6] E02F3/96, E02F9/16

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Jitsuyo Shinan Koho 1926-1996 Toroku Jitsuyo Shinan Koho 1994-1998
Kokai Jitsuyo Shinan Koho 1971-1998 Jitsuyo Shinan Toroku Koho 1996-1998

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP, 50-12882, Y (S.A. Poclain), April 21, 1975 (21. 04. 75) (Family: none)	1-11

☐ 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
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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
August 4, 1998 (04. 08. 98)	August 11, 1998 (11. 08. 98)
Name and mailing address of the ISA/ Japanese Patent Office	Authorized officer
Facsimile No.	Telephone No.

Form PCT/ISA/210 (second sheet) (July 1992)