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DESCRIPTION

Technical Field

[0001] The present invention relates to an upper turning body for a mobile crane.

Background Art

[0002] Conventionally, a crane including an upper turning body mounted on a lower body to turn freely has been known. The upper turning body of the crane includes a turning frame attached on the lower body to turn freely and a boom attached to the turning frame to be raised and lowered freely. Patent Literature 1 to 4 below disclose an example of such a crane.

[0003] Due to, for example, the influence of inertia force caused by turning of the upper turning body or of wind, force in the left-right direction is applied to the boom in some cases. In such cases, the boom deflects in the left-right direction. Particularly, in recent years, the amount of deflection of the boom in the left-right direction tends to increase, along with an increase in size of the crane or an increase in length of the boom. Under such circumstances, deflection of the boom in the left-right direction cannot be suppressed sufficiently with a conventional structure of the upper turning body, and work under limitations in hoisting load is increasing as a result.

[0004] In order to solve this problem, it is conceivable, for example, to increase the dimension (width) of the boom in the left-right direction and enhance the stiffness of the boom in the left-right direction. However, in this case, there occurs a problem that transportation of the turning frame of the upper turning body is difficult upon transportation of the crane. The reason is as follows.

[0005] As described in Patent Literature 1 to 4, a crane is in some cases transported after being disassembled into various equipment and members forming the crane. Therefore, a crane is configured to enable easy disassembly into units suitable for transportation.

[0006] An upper turning body of a conventional crane schematically includes a structure as shown in Fig. 12. The upper turning body includes a turning frame 720 and a boom 740. The front section of the turning frame 720 is provided with a pair of attachment brackets 721. The boom 740 includes a base end section attached to the pair of attachment brackets 721.

[0007] Upon transportation of the crane, the upper turning body is detached from a lower body. The detached upper turning body is disassembled into the turning frame 720, the boom 740, and various equipment, members, and the like mounted on the turning frame 720. Transportation of the crane is generally performed by a transportation vehicle such as a trailer. Upon the transportation, the turning frame 720 of the upper turning body is, in a state where

the left-right direction thereof matches the left-right direction (car width direction) of the transportation vehicle and where the front-rear direction thereof matches the front-rear direction (car length direction) of the transportation vehicle, loaded on the transportation vehicle. Regarding vehicles passing through public roads, a limit value of the dimension in the left-right direction including a loaded object, i.e., transportation limit width, is specified by laws and regulations. Therefore, it is desired that the dimension in the left-right direction be kept less than or equal to the transportation limit width also for components of the crane, in a state of being loaded on the transportation vehicle.

[0008] However, when a dimension W_B of the boom 740 in the left-right direction is increased in order to suppress deflection of the boom 740 in the left-right direction, it is necessary to increase the interval between the pair of attachment brackets 721 to which the base end section of the boom 740 is attached. In this case, a dimension (width) W_F of the turning frame 720 in the left-right direction also has to be increased. As a result, when the turning frame 720 is to be loaded on a transportation vehicle and transported as described above, the dimension W_F of the turning frame 720 in the left-right direction exceeds the transportation limit width in some cases. In such cases, there is a risk that the turning frame 720 cannot be transported.

[0009] Patent Literature 5 below discloses a crane including a lower operating support that is installed in a fixed manner, and an upper turning body. The upper turning body comprises a turning frame mounted on the lower operating support to turn freely, and a jib provided to the turning frame. The turning frame includes a central frame mounted on the lower operating support, a first frame arranged on a front side of the central frame and separably joined to the central frame, and a second frame arranged on a rear side of the central frame and separably joined to the central frame. A pair of support brackets to which a base end section of the jib is attached are provided to the first frame with an interval in a left-right direction of the turning frame. The dimension of each of the central frame, the first frame and the second frame in a front-rear direction of the turning frame orthogonal to the left-right direction is smaller than the dimension in the left-right direction. The dimensions of the central frame, the first frame and the second frame in the left-right direction are the same.

Citation List

Patent Literature

[0010]

Patent Literature 1: JP 2007 191286 A

Patent Literature 2: JP 2007 119180 A

Patent Literature 3: JP 3939819 B2

Patent Literature 4: JP 2010 195542 A

Patent Literature 5: JP 2012 76924 A

Summary of Invention

[0011] An object of the present invention is to enable transportation of a turning frame of an upper turning body to be carried out upon transportation of a mobile crane, while suppressing deflection of a boom in the left-right direction.

[0012] An upper turning body for a mobile crane according to the present invention is specified in claim 1.

Brief Description of Drawings

[0013]

Fig. 1 is a schematic view, seen from the right side, of a mobile crane to which an upper turning body according to an embodiment of the present invention is applied.

Fig. 2 is a view, seen from above (from the arrow II direction), of the upper turning body shown in Fig. 1.

Fig. 3 is an exploded perspective view of a turning frame of the upper turning body shown in Fig. 2.

Fig. 4A is a schematic view, seen from above, of a state before joining, with a pin, of a front-side joint bracket and a rear-side joint bracket of the turning frame shown in Fig. 3.

Fig. 4B is a schematic view, seen from above, of a state where the front-side joint bracket and the rear-side joint bracket of the turning frame shown in Fig. 3 are joined with a pin.

Fig. 4C is a schematic view, seen from above, of another example of a joint structure of the front-side joint bracket and the rear-side joint bracket of the turning frame.

Fig. 5A is a view partially showing a state before joining of a front-side frame and a rear-side frame according to modified example 1 of the embodiment, the state being seen from the side.

Fig. 5B is a view showing a state, seen from the side, of a joined portion of the front-side frame and the rear-side frame according to modified example 1 of the embodiment.

Fig. 6 is a view corresponding to Fig. 2 for modified example 2 of the embodiment.

Fig. 7 is a view on arrow VII of Fig. 6.

Fig. 8 is a view corresponding to Fig. 2 for modified example 3 of the embodiment.

Fig. 9 is a view corresponding to Fig. 2 showing an upper turning body of a modified example including a vertically asymmetrical lower boom.

Fig. 10 is a view corresponding to Fig. 2 showing an upper turning body of another modified example including a vertically asymmetrical lower boom.

Fig. 11 is a view corresponding to Fig. 2 showing an upper turning body of yet another modified example including a vertically asymmetrical lower boom.

Fig. 12 is a view corresponding to Fig. 2 showing a conventional upper turning body.

Description of Embodiments

[0014] An embodiment of the present invention will be described below with reference to the drawings.

(Embodiment)

[0015] Referring to Fig. 1 to Fig. 4, the configuration of an upper turning body for a mobile crane according to an embodiment of the present invention will be described.

[0016] An upper turning body 16 according to the embodiment is used in a crane 10 as shown in Fig. 1. The crane 10 allows for disassembly into a plurality of component parts. The crane 10 is in an assembled state shown in Fig. 1 when performing hoisting work. The crane 10, upon transportation, is disassembled into the plurality of component parts and in a disassembled transportation state for loading on a transportation vehicle (such as a truck or trailer). When the transportation vehicle passes through a public road, limits in dimensions specified by laws and regulations need to be complied with. Therefore, upon transportation of the crane, the crane needs to be disassembled into component parts of sizes and units of which the dimension is kept less than the limit value, in a state of being loaded on the transportation vehicle. The limit value of dimension upon passing through of a public road is the limit value of length of the transportation vehicle in the front-rear direction and the limit value of width of the transportation vehicle in the left-right direction. The limit value of width in the left-right direction is smaller compared to the limit value of length in the front-rear direction. The crane 10 can be in the assembled state or the disassembled transportation state as described above. Hereinafter, it is assumed that the crane 10 is in the assembled state, unless otherwise stated.

[0017] The crane 10 is a mobile crane. The crane 10 includes a lower traveling body 12, a turn support 14 attached to the lower traveling body 12, and the upper turning body 16 mounted to turn freely on the lower traveling body 12 with the turn support 14 therebetween.

[0018] The lower traveling body 12 is a crawler-type self-propelled carrier. The lower traveling body 12 is an example of a lower body of the present invention. A wheeled carrier may be used as the lower traveling body.

[0019] The turn support 14 supports the upper turning body 16 such that the upper turning body 16 turns freely with respect to the lower body 12. For the turn support 14, a swing bearing is used, for example.

[0020] The upper turning body 16 is attached on the turn support 14. The upper turning body 16 includes a turning frame 20 as a base of the upper turning body 16 and a boom 40 attached to the turning frame 20 to be raised and lowered freely. The upper turning body 16 also includes a counterweight, a cab (operating cabin), an engine, a winch, and the like, although omitted in the drawing.

[0021] The turning frame 20 is mounted on the lower traveling body 12 with the turn support 14 therebetween, so as to turn freely with respect to the lower traveling body 12. The counterweight, the cab, the engine, the winch, and the like, omitted in the drawing, are attached to the turning frame 20. The "front-rear direction" mentioned in the description below is a direction that, when the crane 10 in the assembled state, matches the axial direction of the boom 40 in a state where the boom 40 has been lowered (see the boom 40 shown by solid lines in Fig. 1) such that the axial direction of the boom 40 is parallel to the horizontal plane. The "left-right direction" mentioned in the description below is a direction orthogonal to the front-rear direction and parallel to the horizontal plane.

[0022] The turning frame 20 is configured to allow for disassembly into a plurality of members in the front-rear direction. As shown in Fig. 2, the turning frame 20 includes a front-side frame 21, a rear-side frame 22, a turn support attachment section 27, and a pair of attachment brackets 39.

[0023] The front-side frame 21 forms a front section of the turning frame 20. The front-side frame 21 is included in the concept of a main frame of the present invention. The front-side frame 21 is provided with the turn support attachment section 27 and the pair of attachment brackets 39. The rear-side frame 22 forms a rear section of the turning frame 20. The rear-side frame 22 is included in the concept of a subframe of the present invention. The rear-side frame 22 is arranged in the rear of the front-side frame 21 and separably joined to the front-side frame 21. Thus, the turning frame 20 allows for disassembly in the front-rear direction into the front-side frame 21 provided with the turn support attachment section 27 and the attachment bracket 39 and the rear-side frame 22.

[0024] A dimension W_{FF} of the front-side frame 21 in the left-right direction is larger than a

dimension L_{FF} of the front-side frame 21 in the front-rear direction and larger than a dimension W_{RF} of the rear-side frame 22 in the left-right direction. The front-side frame 21 and the rear-side frame 22 are joined to each other in a state where center positions of the two frames 21 and 22 in the left-right direction are located on the same straight line. In that state, the two frames 21 and 22 are arranged in a T-shape when seen from above.

[0025] Upon transportation of the crane 10, the front-side frame 21 and the rear-side frame 22 are separated from each other and each loaded on a transportation vehicle. At this time, the front-side frame 21 is loaded on the transportation vehicle, in a state where the left-right direction of the front-side frame 21 when the crane 10 is in the assembled state matches the front-rear direction (car length direction) of the transportation vehicle and where the front-rear direction of the front-side frame 21 when the crane 10 is in the assembled state matches the left-right direction (car width direction) of the transportation vehicle. The dimension W_{FF} of the front-side frame 21 in the left-right direction when the crane 10 is in the assembled state is larger than a transportation limit width upon the transportation vehicle passing through a public road. The dimension L_{FF} of the front-side frame 21 in the front-rear direction when the crane 10 is in the assembled state, i.e., the dimension of the front-side frame 21 in the left-right direction when the crane 10 is in the disassembled transportation state, is less than or equal to the transportation limit width. The dimension L_{FF} of the front-side frame 21 in the front-rear direction is preferably equivalent or approximately equivalent to the transportation limit width.

[0026] Upon transportation, the rear-side frame 22 is loaded on the transportation vehicle, in a state where the left-right direction of the rear-side frame 22 when the crane 10 is in the assembled state matches the left-right direction of the transportation vehicle and where the front-rear direction of the rear-side frame 22 when the crane 10 is in the assembled state matches the front-rear direction of the transportation vehicle. The dimension W_{RF} of the rear-side frame 22 in the left-right direction when the crane 10 is in the assembled state is less than or equal to the transportation limit width. The dimension W_{RF} of the rear-side frame 22 in the left-right direction is also preferably equivalent or approximately equivalent to the transportation limit width.

[0027] The front-side frame 21 includes a front-side frame body 21a and a pair of front-side joint brackets 31a.

[0028] The front-side frame body 21a is a portion forming an approximately rectangular frame structure of the front-side frame 21. The front-side frame body 21a takes up most of the front-side frame 21. The pair of front-side joint brackets 31a are provided in an area of the front-side frame body 21a that overlaps with a front surface 22f of a rear-side frame body 22a, described later, when seen from the front-rear direction, and are arranged separately at both left and right end sections of the area. The front-side joint bracket 31a is arranged on the front side relative to a rear surface 21r of the front-side frame body 21a. Specifically, the front-side joint bracket 31a is arranged to extend to the front side from the rear surface 21r of the front-side frame body 21a, as if penetrating inside the front-side frame body 21a. The rear surface 21r of

the front-side frame body 21a is a side surface facing the left or right of the transportation vehicle, when the crane 10 is in the disassembled transportation state. Therefore, by the front-side joint bracket 31a being arranged as described above, the front-side joint bracket 31a does not protrude to the left or right of the front-side frame body 21a, in a state where the front-side frame 21 is loaded on the transportation vehicle.

[0029] The turn support attachment section 27 is a portion to which the turn support 14 (see Fig. 1) is attached. The turn support attachment section 27 is provided in the middle of the bottom surface (lower surface) of the front-side frame body 21a. The turn support attachment section 27 includes a plurality of bolt holes (not shown) or the like provided to be aligned in a circle along the turn support 14.

[0030] The rear-side frame 22 includes the rear-side frame body 22a and a pair of rear-side joint brackets 31b.

[0031] The rear-side frame body 22a is a portion forming an approximately rectangular frame structure of the rear-side frame 22. The rear-side frame body 22a takes up most of the rear-side frame 22. The rear-side frame body 22a is mounted with a counterweight, a winch, and the like, omitted in the drawing.

[0032] The pair of rear-side joint brackets 31b are portions to be joined to the pair of front-side joint brackets 31a of the front-side frame 21. By the rear-side joint bracket 31b being joined to the front-side joint bracket 31a, the rear-side frame 22 and the front-side frame 21 are integrally assembled (joined). The pair of rear-side joint brackets 31b are provided to the front end of the rear-side frame body 22a. Specifically, the pair of rear-side joint brackets 31b are attached to the front surface 22f of the rear-side frame body 22a and arranged with an interval from each other in the left-right direction. The respective rear-side joint brackets 31b are each provided to parts slightly on the inside from both left and right ends of the front surface 22f of the rear-side frame body 22a. Therefore, the rear-side joint brackets 31b do not protrude to both left and right sides from the rear-side frame body 22a, in a state where the rear-side frame 22 is loaded on the transportation vehicle.

[0033] The structure of the front-side joint bracket 31a and the rear-side joint bracket 31b and a joint structure of the two brackets 31a and 31b will be described in detail below.

[0034] The respective front-side joint brackets 31a each include two front-side joint plates 32f fixed to the front-side frame body 21a. Each front-side joint plate 32f is formed with a hole 33a to which a pin P (see Fig. 4A) is inserted and fitted. In Fig. 3, only a part of a plurality of the holes 33a is denoted by a reference sign to avoid complexity. Each rear-side joint bracket 31b is formed of one rear-side joint plate 32r fixed to the rear-side frame body 22a. Each rear-side joint plate 32r is formed with a hole 33b to which the pin P is inserted and fitted. Of the pair of front-side joint brackets 31a, the front-side joint bracket 31a on the right side is joined to the rear-side joint bracket 31b on the right side. Of the pair of front-side joint brackets 31a, the front-side joint bracket 31a on the left side is joined to the rear-side joint bracket 31b on the left

side.

[0035] Each front-side joint bracket 31a and the corresponding rear-side joint bracket 31b are joined in a manner below. Joining of the brackets 31a and 31b on the left side and joining of the brackets 31a and 31b on the right side are similar. Therefore, a representative description will be given for joining of one front-side joint bracket 31a and one corresponding rear-side joint bracket 31b.

[0036] The rear-side joint plate 32r of the rear-side joint bracket 31b is inserted between the two front-side joint plates 32f forming the front-side joint bracket 31a, and in that state, the pin P is inserted to the hole 33a of the front-side joint plate 32f and the hole 33b of the rear-side joint plate 32r. Accordingly, the front-side joint bracket 31a and the rear-side joint bracket 31b are joined to each other.

[0037] Although illustration is omitted in Fig. 2 and Fig. 3, a telescopic cylinder S (see Fig. 4A to Fig. 4C) for insertion and removal of the pin P with respect to the holes 33a and 33b of the joint plates 32f and 32r is attached to the front-side frame body 21a. The telescopic cylinder S may be attached to the rear-side frame body 22a. By extending, the telescopic cylinder S inserts the pin P to the holes 33a and 33b of the joint plates 32f and 32r (see Fig. 4A). By retracting, the telescopic cylinder S removes the pin P from the holes 33a and 33b of the joint plates 32f and 32r (see Fig. 4B). A center line C in Fig. 4A to Fig. 4C is a center line located at the center of the turning frame 20 in the left-right direction and extending in the front-rear direction. The number of the front-side joint plates 32f and the rear-side joint plates 32r may be changed.

[0038] As shown in Fig. 4A and Fig. 4B, one telescopic cylinder S is provided with respect to the front-side joint bracket 31a and the rear-side joint bracket 31b in one part. That is, since the front-side joint bracket 31a and the rear-side joint bracket 31b are provided in two parts in the turning frame 20, two telescopic cylinders S are provided in a corresponding manner. Specifically, the telescopic cylinders S are each arranged in a position on the left side with respect to the front-side joint bracket 31a on the left side in the front-side frame body 21a and the right side with respect to the left side surface of the front-side frame body 21a (position of S1 in Fig. 3) and a position on the right side with respect to the front-side joint bracket 31a on the right side in the front-side frame body 21a and the left side with respect to the right side surface of the front-side frame body 21a (position of S2 in Fig. 3). The telescopic cylinder S is located to the side of the holes 33a and 33b and arranged coaxially with the holes 33a and 33b.

[0039] As shown in Fig. 4C, one common telescopic cylinder S may be provided with respect to the front-side joint brackets 31a and the rear-side joint brackets 31b in two parts. In this case, the telescopic cylinder S is arranged in a position between the front-side joint brackets 31a in two left and right parts in the front-side frame body 21a (position of S3 in Fig. 3) and arranged in a state of extending to the left and right across the center line C in the left-right direction of the turning frame 20. The telescopic cylinder S in this case is configured to be

capable of extending and retracting to both left and right sides. At each of both ends of the telescopic cylinder S, the pin P is attached. By the telescopic cylinder S extending to both left and right sides, the pins P on both sides are each inserted to the holes 33a and 33b of the corresponding joint plates 32f and 32r (in a state of Fig. 4C). By the telescopic cylinder S retracting inward from both left and right sides, the pins P on both sides are each removed from the holes 33a and 33b of the corresponding joint plates 32f and 32r. With this configuration, the pins P can be detached and attached with respect to the brackets on both left and right sides with one telescopic cylinder S.

[0040] To the rear-side frame 22, a force to lower the boom 40 (see Fig. 1) is transferred via a wire rope R and the like. Therefore, a rotating force acts on the rear-side frame 22 to raise and rotate the rear-side frame 22 upward with respect to the front-side frame 21 about the pin P as the axis. At this time, the upper end section of the front surface 22f of the rear-side frame body 22a is held in place by the upper end section of the rear surface 21r of the front-side frame body 21a, thereby inhibiting turning of the rear-side frame 22 about the pin P as the axis.

[0041] The pair of attachment brackets 39 (see Fig. 2 and Fig. 3) are for attachment of a base end section 40f of the boom 40 such that the boom 40 is free to be raised and lowered. The pair of attachment brackets 39 are provided to the front end section of the front-side frame 21 (the front-side frame body 21a). The pair of attachment brackets 39 are formed integrally with the front-side frame 21 (the front-side frame body 21a). The pair of attachment brackets 39 are arranged at the front end section of the front-side frame 21 with a left-right interval. Specifically, the attachment bracket 39 is provided to each of the left end section and right end section of the front end section of the front-side frame 21 (the front-side frame body 21a). The respective left and right attachment brackets 39 are each formed of two attachment plates 39a. Each attachment plate 39a is arranged in a posture in line with the front-rear direction and the up-down direction of the upper turning body 16 (the turning frame 20). Each attachment plate 39a is formed with a hole 39b to which a pin, omitted in the drawing, is inserted and fitted. The hole 39b penetrates the attachment plate 39a in the left-right direction (thickness direction of the attachment plate 39a). The two attachment plates 39a of each attachment bracket 39 holds therebetween a plate section, omitted in the drawing, forming the base end section 40f of the boom 40. By the pin being inserted and fitted in this state to the hole 39b of the attachment plate 39a and a hole, omitted in the drawing, formed in the plate section of the base end section 40f (boom foot), the boom 40 is attached to the front-side frame 21 to be raised and lowered freely.

[0042] As shown in Fig. 1, the boom 40 is a member for suspending a load or the like, omitted in the drawing. The boom 40 extends linearly in a predetermined direction. The boom 40 is a lattice boom including a latticed structure. The boom 40 allows for disassembly in the axial direction thereof (extending direction of the boom 40) into a plurality of members. Specifically, the boom 40 includes an upper boom 42, an intermediate boom 44, and a lower boom 50 arranged in order from the tip end side to the base end side. The upper boom 42 and the intermediate boom 44 are separably joined to each other, and the intermediate boom 44 and the lower boom 50 are separably joined to each other. It is possible to omit the intermediate

boom 44.

[0043] The lower boom 50 is a member forming a region of the boom 40, the region being a region which has a specific length from the base end section 40f to the tip end section side of the boom 40. The lower boom 50 is attached to the pair of attachment brackets 39 provided to the front-side frame 21. The lower boom 50 is tapered to gradually increase in distance between a back surface 50b and a ventral surface 50v, toward the tip end side from the base end section 40f, when seen in the left-right direction (see Fig. 1). The back surface 50b is a surface facing the upper side of the lower boom 50 in a state where the boom 40 is lowered as in Fig. 1. The ventral surface 50v is a surface facing the lower side of the lower boom 50 in the same state. The lower boom 50 is tapered to gradually increase in dimension in the left-right direction, toward the base end section 40f side from the tip end side (see Fig. 2). The tapered shape of the lower boom 50 may not be necessarily formed uniformly from the base end section to the tip end section of the lower boom 50 and may be formed up to some point. The dimension of the base end section of the lower boom 50 (the base end section 40f of the boom 40) in the left-right direction is equivalent or approximately equivalent to the dimension W_{FF} of the front-side frame 21 in the left-right direction. The dimension of the tip end section of the lower boom 50 in the left-right direction is equivalent to a dimension W_{MB} of the intermediate boom 44 in the left-right direction. The dimension W_{MB} of the intermediate boom 44 in the left-right direction is a dimension less than or equal to the transportation limit width and preferably a dimension equivalent to the transportation limit width. In the intermediate boom 44 or the like as well, a tapered portion continuous with the tapered shape of the lower boom 50 may be formed.

[0044] The lower boom 50 allows for disassembly into a plurality of (two in this embodiment) members in the left-right direction (left-right direction when the crane is in the assembled state). Specifically, as shown in Fig. 2, the lower boom 50 includes a right-side divided boom 52 forming the right-side section of the lower boom 50 and a left-side divided boom 54 forming the left-side section of the lower boom 50. The right-side divided boom 52 and the left-side divided boom 54 are separably joined to each other. The right-side divided boom 52 and the left-side divided boom 54 are included in the concept of a divided boom of the present invention.

[0045] The right-side divided boom 52 includes a right-side divided boom body 52a and a right-side boom joint bracket 56a. The left-side divided boom 54 includes a left-side divided boom body 54a and a left-side boom joint bracket 56b.

[0046] The right-side divided boom body 52a is formed in a lattice structure. The right-side divided boom body 52a takes up most of the right-side divided boom 52. The right-side divided boom body 52a is externally in a trapezoidal shape when seen from above in a state where the boom 40 is lowered. The right side surface of the right-side divided boom body 52a forms the right side surface of the lower boom 50. The right side surface of the right-side divided boom body 52a is inclined away from the left side surface of the right-side divided boom body 52a toward the base end section side of the lower boom 50. The right-side boom joint bracket 56a

is provided to each of the upper section and lower section of the front end section (end section on the intermediate boom 44 side) of the left side surface and the rear end section (end section on the front-side frame 21 side) of the left side surface of the right-side divided boom 52.

[0047] The left-side divided boom body 54a is structured to be vertically symmetrical to the right-side divided boom body 52a. The left-side divided boom body 54a takes up most of the left-side divided boom 54. The left side surface of the left-side divided boom body 54a forms the left side surface of the lower boom 50. The left side surface of the left-side divided boom body 54a is inclined away from the right side surface of the left-side divided boom body 52a toward the base end section side of the lower boom 50. The left-side boom joint bracket 56b is provided to each of the upper section and lower section of the front end section (end section on the intermediate boom 44 side) of the right side surface and the rear end (end section on the front-side frame 44 side) of the right side surface of the left-side divided boom 52.

[0048] By the right-side boom joint bracket 56a arranged at the front end section of the right-side divided boom body 52a and the left-side boom joint bracket 56b arranged at the front end section of the left-side divided boom body 54a being joined to each other with a pin, and the right-side boom joint bracket 56a arranged at the rear end section of the right-side divided boom body 52a and the left-side boom joint bracket 56b arranged at the rear end section of the left-side divided boom body 54a being joined to each other with a pin, the right-side divided boom 52 and the left-side divided boom 54 are joined to each other. The specific configuration of each right-side boom joint bracket 56a and the left-side boom joint bracket 56b joined thereto is similar to the configuration described above of the front-side joint bracket 31a and the rear-side joint bracket 31b joined thereto.

[0049] The tip end section of the lower boom 50 is provided with a coupling bracket 57 separably joined to a coupling bracket 45 at the base end section of the intermediate boom 44. The coupling bracket 57 is provided to both left and right ends of the tip end section of the lower boom 50, i.e., the left end of the tip end section of the left-side divided boom body 54a and the right end of the tip end section of the right-side divided boom body 52a. The configuration of each coupling bracket 57 of the lower boom 50 and the coupling bracket 45 of the intermediate boom 44 joined thereto is similar to the configuration described above of the front-side joint bracket 31a and the rear-side joint bracket 31b joined thereto.

[0050] Upon transportation of the crane 10, the lower boom 50 is separated from the front-side frame 21 and the intermediate boom 44, and then disassembled into the right-side divided boom 52 and the left-side divided boom 54. That is, the lower boom 50 is disassembled, with the center in the left-right direction thereof as a boundary, into the right-side divided boom 52 and the left-side divided boom 54. The base end section of the right-side divided boom 52 is a part where the dimension in the left-right direction is largest in the right-side divided boom 52. The base end section of the left-side divided boom 54 is a part where the dimension in the left-right direction is largest in the left-side divided boom 54. A dimension W_{RLB} of the base end section of the right-side divided boom 52 in the left-right direction and a dimension W_{LLB} of the

base end section of the left-side divided boom 54 in the left-right direction are dimensions less than or equal to the transportation limit width and preferably dimensions equivalent to the transportation limit width. Upon transportation of the crane 10, the right-side divided boom 52 and the left-side divided boom 54 are separated from each other, and then, in a state where the left-right directions thereof match the left-right direction of the transportation vehicle, loaded on the transportation vehicle.

[0051] In the embodiment, the dimension W_{FF} of the front-side frame 21 in the left-right direction is large, and the interval between the pair of attachment brackets 39 provided to the front-side frame 21 is large. Therefore, the dimension in the left-right direction of the lower boom 50 attached to the pair of attachment brackets 39 can be increased. As a result, the stiffness in the left-right direction (lateral stiffness) near the base end section of the boom 40 can be enhanced. Therefore, deflection in the left-right direction (lateral deflection) of the boom 40 can be suppressed.

[0052] In the embodiment, the dimension L_{FF} of the front-side frame 21 in the front-rear direction is smaller than the dimension W_{FF} of the front-side frame 21 in the left-right direction and less than or equal to the transportation limit width. Therefore, upon transportation of the crane 10, the transportation width of the front-side frame 21 can be reduced to less than or equal to the transportation limit width of a public road, by loading the front-side frame 21 on the transportation vehicle in a state where the front-rear direction of the front-side frame 21 matches the left-right direction of the transportation vehicle. Thus, in the embodiment, transportation of the front-side frame 21 of the upper turning body 16 can be carried out, while suppressing deflection of the boom 40 in the left-right direction.

[0053] In the embodiment, the rear-side frame 22 is connected to the rear of the front-side frame 21 when the crane 10 is in the assembled state. Therefore, the dimension of the upper turning body 16 in the front-rear direction can be increased, and the stability of the upper turning body can be improved. By the rear-side frame 22 being provided, a large installation space for various equipment and members mounted to the upper turning body 16 can be ensured. Therefore, a layout of the various equipment and members mounted to the upper turning body 16 can be performed easily. Since the rear-side frame 22 is separable from the front-side frame 21, separating the rear-side frame 22 from the front-side frame 21 upon transportation of the crane 10 enables the front-side frame 21 to be, in a state where the front-rear direction thereof matches the left-right direction of the transportation vehicle, loaded on the transportation vehicle as described above for transportation in a state where the transportation width of the front-side frame 21 is kept to less than or equal to the transportation limit width. Since the dimension W_{RF} of the rear-side frame 22 in the left-right direction is a dimension less than or equal to the transportation limit width, loading the rear-side frame 22, in a state where the left-right direction thereof matches the left-right direction of the transportation vehicle, on the transportation vehicle also enables the transportation width of the rear-side frame 22 to be reduced to less than or equal to the transportation limit width.

[0054] In the embodiment, the dimension of the lower boom 50 in the left-right direction decreases toward the tip end side, while a large dimension of the base end section of the lower boom 50 in the left-right direction is ensured as described above to suppress deflection of the boom 40 in the left-right direction. Therefore, the weight of the lower boom 50 can be reduced, compared to a case where the lower boom 50 is formed such that the large dimension of the base end section in the left-right direction remains constant up to the tip end section. Thus, in the embodiment, an increase in weight of the boom 40 can be suppressed, while suppressing deflection of the boom 40 in the left-right direction.

[0055] In the embodiment, the lower boom 50 is configured of the right-side divided boom 52 and the left-side divided boom 54 arranged side by side in the left-right direction, and the right-side divided boom 52 and the left-side divided boom 54 are separably joined to each other. Therefore, even when the dimension of the base end section of the lower boom 50 (the base end section 40f of the boom 40) in the left-right direction exceeds the transportation limit width, the transportation width of the lower boom 50 can be reduced upon transportation of the crane 10 by dividing the lower boom 50 into the right-side divided boom 52 and the left-side divided boom 54. As a result, the transportation width of the lower boom 50 can be prevented from exceeding the transportation limit width.

[0056] Since the lower boom 50 decreases in dimension in the left-right direction toward the tip end side in the embodiment, the weight of the lower boom 50 can be reduced, compared to a case where the dimension of the lower boom 50 in the left-right direction is constant, up to the tip end section, at the large dimension of the base end section in the left-right direction. As a result, an increase in weight of the boom 40 can be suppressed.

(Modified example 1 of embodiment)

[0057] Fig. 5A and Fig. 5B show a joint structure of the front-side frame 21 and the rear-side frame 22 of the upper turning body according to modified example 1 of the embodiment. Referring to Fig. 5A and Fig. 5B, the difference of the upper turning body according to modified example 1 from the upper turning body according to the embodiment will be described.

[0058] In the upper turning body according to modified example 1, the two front-side joint plates 32f of each front-side joint bracket 31a each protrude rearward from the rear surface 21r of the front-side frame body 21a. The front-side frame 21 includes a front-side stopper 36f, and the rear-side frame 22 includes a rear-side stopper 36r.

[0059] The front-side stopper 36f and the rear-side stopper 36r are members for inhibiting relative turning of the rear-side frame 22 with respect to the front-side frame 21 about the pin P (see Fig. 5B) as the axis. As shown in Fig. 5A, the front-side stopper 36f is attached to the rear surface 21r of the front-side frame body 21a. The rear-side stopper 36r is attached to the front surface 22f of the rear-side frame body 22a. When the crane 10 is in the assembled state, i.e., when the front-side frame 21 and the rear-side frame 22 are joined to each other, the front-

side stopper 36f and the rear-side stopper 36r are arranged in an adjacent state with a gap existing therebetween or in a state of contact with each other. The front-side stopper 36f is fixed to the upper end of the front-side joint plate 32f. The rear-side stopper 36r is fixed to the upper end of the rear-side joint plate 32r. The respective stoppers 36f and 36r are formed in a cuboid shape, for example.

[0060] A force to lower the boom 40 (see Fig. 1) is transferred to the rear-side frame 22 via the wire rope R and the like. As a result, when a rotating force acts on the rear-side frame 22 to raise and rotate the rear-side frame 22 upward with respect to the front-side frame 21 about the pin P as the axis, the rear-side stopper 36r is held in place by the front-side stopper 36f as shown in Fig. 5B, thereby inhibiting turning of the rear-side frame 22 about pin P as the axis.

[0061] The front-side stopper 36f may be fixed to the lower end of the front-side joint plate 32f, and the rear-side stopper 36r may be fixed to the lower end of the rear-side joint plate 32r.

(Modified example 2 of embodiment)

[0062] Referring to Fig. 6 and Fig. 7, the difference of a turning frame 120 of the upper turning body 16 according to modified example 2 of the embodiment from the turning frame 20 of the upper turning body according to the embodiment above will be described. Fig. 7 is a view on arrow VII of Fig. 6. Fig. 6 is a view on arrow VI of Fig. 7.

[0063] Unlike the turning frame 20 according to the embodiment, the turning frame 120 according to modified example 2 of the embodiment allows for disassembly into a plurality of members in the up-down direction of the crane in the assembled state.

[0064] Specifically, the turning frame 120 includes an upper-side frame 121 and a lower-side frame 123 arranged below the upper-side frame 121 and separably joined to the upper-side frame 121.

[0065] The upper-side frame 121 is provided with the pair of attachment brackets 39. The upper-side frame 121 is included in the concept of the main frame of the present invention. The upper-side frame 121 has a shape similar to the front-side frame 21 (see Fig. 2) of the embodiment. Note that the upper-side frame 121 is not provided with the turn support attachment section 27 (see Fig. 6). A dimension W_{UF} of the upper-side frame 121 in the left-right direction is set similarly to the dimension W_{FF} of the front-side frame 21 of the embodiment in the left-right direction. A dimension L_{UF} of the upper-side frame 121 in the front-rear direction is set similarly to the dimension L_{FF} of the front-side frame 21 of the embodiment in the front-rear direction.

[0066] A dimension W_{LF} of the lower-side frame 123 in the left-right direction is set similarly to the dimension W_{RF} of the rear-side frame 22 of the embodiment in the left-right direction. The

dimension of the lower-side frame 123 in the front-rear direction is larger than the dimension of the rear-side frame 22 of the embodiment in the front-rear direction. The lower-side frame 123 is arranged such that the front section thereof overlaps with the lower side of the upper-side frame 121, and is joined to the upper-side frame 121 in that state. The upper-side frame 121 and the lower-side frame 123 are arranged in a T-shape when seen from above, in a state of being joined to each other. In parts corresponding to four corners of an area where the upper-side frame 121 and the lower-side frame 123 overlap, the upper-side frame 121 is provided with the joint bracket 31a, and the lower-side frame 123 is provided with the joint bracket 31b. By the corresponding brackets 31a and 31b being joined with a pin, the upper-side frame 121 and the lower-side frame 123 are joined. The configuration of the respective brackets 31a and 31b is similar to the configuration of the brackets 31a and 31b in the embodiment. The turn support attachment section 27 is provided to the bottom surface of the lower-side frame 123. In detail, the turn support attachment section 27 is provided in an area of the bottom surface of the lower-side frame 123 that overlaps with the upper-side frame 121 when seen from above.

(Modified example 3 of embodiment)

[0067] Referring to Fig. 8, the difference of a boom 140 of the upper turning body 16 according to modified example 3 of the embodiment from the boom 40 according to the embodiment above will be described.

[0068] Unlike the lower boom 50 of the boom 40 according to the embodiment, a lower boom 150 of the boom 140 according to modified example 3 of the embodiment allows for disassembly into three members in the left-right direction.

[0069] Specifically, the lower boom 150 includes a right-side divided boom 152, a middle divided boom 153, and a left-side divided boom 154. The lower boom 150 is dividable into the divided booms 152 to 154 in the left-right direction. The right-side divided boom 152, the middle divided boom 153, and the left-side divided boom 154 are included in the concept of the divided boom of the present invention. In the left-right direction, the middle divided boom 153 out of the divided booms 152, 153, and 154 is arranged in the middle. On the right side of the middle divided boom 153, the right-side divided boom 152 is arranged. On the left side of the middle divided boom 153, the left-side divided boom 154 is arranged. The right-side divided boom 152 and the middle divided boom 153 are separably joined to each other. The left-side divided boom 154 and the middle divided boom 153 are separably joined to each other.

[0070] The right-side divided boom 152 includes a right-side divided boom body 152a and the right-side boom joint bracket 56a. The right-side divided boom body 152a is formed in a lattice structure and takes up most of the right-side divided boom 152. The right-side boom joint bracket 56a is provided to the right-side divided boom body 152a. The left-side divided boom 154 includes a left-side divided boom body 154a and the left-side boom joint bracket 56b. The left-side divided boom body 154a is formed in a lattice structure and takes up most of the left-side divided boom 154. The left-side boom joint bracket 56b is provided to the left-side divided

boom body 154a.

[0071] The right-side divided boom body 152a and the left-side divided boom body 154a are each formed in a triangle when seen from above in a state where the boom 140 is lowered, and arranged to be symmetrical to each other in the left-right direction. That is, the right side surface of the right-side divided boom body 152a is inclined gradually away from the left side surface of the right-side divided boom body 152a toward the base end section side of the lower boom 150, and the left side surface of the left-side divided boom body 154a is inclined gradually away from the right side surface of the left-side divided boom body 154a toward the base end section side of the lower boom 150. The right-side divided boom body 152a and the left-side divided boom body 154a may be formed in externally a trapezoidal shape when seen from above in a state where the boom 140 is lowered.

[0072] The right-side boom joint bracket 56a is provided to each of the front end section and rear end section of the left side surface of the right-side divided boom body 152a. The left-side boom joint bracket 56b is provided to each of the front end section and rear end section of the right side surface of the left-side divided boom body 154a.

[0073] The middle divided boom 153 includes a divided boom body 153a and a middle boom joint bracket 153b. The divided boom body 153a is formed in a lattice structure and takes up most of the middle divided boom 153. The middle divided boom body 153a is formed in externally a rectangular shape when seen from above in a state where the boom 140 is lowered. The middle boom joint bracket 153b is provided to each of the front end section and rear end section of the right side surface of the middle divided boom body 153a and to the front end section and rear end section of the left side surface of the middle divided boom body 153a.

[0074] The middle boom joint bracket 153b provided to the right side surface of the middle divided boom body 153a and the left-side boom joint bracket 56a provided to the left side surface of the right-side divided boom body 152a are separably joined to each other with a pin. Accordingly, the middle divided boom 153 and the right-side divided boom 152 are integrated. The middle boom joint bracket 153b provided to the left side surface of the middle divided boom body 153a and the left-side boom joint bracket 56b provided to the right side surface of the left-side divided boom body 154a are separably joined to each other with a pin. Accordingly, the middle divided boom 153 and the left-side divided boom 154 are integrated.

[0075] A dimension W_{CLB} of the middle divided boom 153 in the left-right direction is equivalent to the dimension W_{MB} of the intermediate boom 44 in the left-right direction and less than or equal to the transportation limit width. The dimension W_{CLB} is preferably a dimension equivalent to the transportation limit width. Upon transportation of the crane, the middle divided boom 153 is, in a state where the left-right direction thereof matches the left-right direction of the transportation vehicle, loaded on the transportation vehicle. The dimensions of the right-side divided boom 152 and the left-side divided boom 154 in the left-right direction are also less than or equal to the transportation limit width.

(Alternative modified examples of embodiment)

[0076] Various modified examples of the embodiment can be given, other than modified examples 1 to 3 described above.

[0077] For example, the turning frame may be unable to be disassembled into a plurality of members in the front-rear direction. That is, it may be such that the turning frame includes the front-side frame, but does not include the rear-side frame.

[0078] The turning frame may allow for disassembly into three or more members in the front-rear direction. For example, in addition to the turning frame allowing for disassembly into the front-side frame and the rear-side frame, at least one of the front-side frame and the rear-side frame may allow for disassembly into a plurality of members in the front-rear direction.

[0079] In the configuration in which the turning frame allows for disassembly into the plurality of divided frames in the front-rear direction, the divided frame provided with the attachment bracket may not be a divided frame arranged on the frontmost side out of the plurality of divided frames.

[0080] The turning frame may allow for disassembly into three or more members in the up-down direction. For example, at least one of the upper-side frame and the lower-side frame forming the turning frame may allow for disassembly into a plurality of members in the up-down direction.

[0081] In the configuration in which the turning frame allows for disassembly into the plurality of divided frames in the up-down direction, the divided frame provided with the attachment bracket may not be a divided frame arranged on the uppermost side out of the plurality of divided frames. For example, another divided frame may be further arranged on the upper-side frame provided with the attachment bracket.

[0082] The lower boom may allow for disassembly into four or more members in the left-right direction.

[0083] The lower boom may be unable to be disassembled into a plurality of members in the left-right direction.

[0084] As in respective modified examples shown in Fig. 9 to Fig. 11, the boom 40 may include a lower boom 650 formed to be vertically asymmetrical. The configurations of the upper turning body 16 according to the respective modified examples of Fig. 9 to Fig. 11 will each be specifically described below.

[0085] The upper turning body 16 according to the modified example of Fig. 9 includes a cab

660 in which operation of the crane by an operator is performed. The cab 660 is arranged in a position offset toward one side (the right side in the modified example) from the turning center O of the turning frame 20 (the upper turning body 16) in the left-right direction and is attached to the turning frame 20. Specifically, the cab 660 is attached to the right end of the front-side frame 21. The turning center O matches the center of the turn support 14 (omitted in Fig. 9) and the center of the turn support attachment section 27.

[0086] The lower boom 650 includes the right-side divided boom 52 and the left-side divided boom 54, the right-side divided boom 52 being arranged on one side of the turning center O in the left-right direction, the one side being the cab 660 side, the left-side divided boom 54 being arranged on the other side of the turning center O in the left-right direction, the other side being a side opposite to the cab 660 side. In the modified example, the right-side divided boom 52 is included in the concept of a first segment according to the present invention, and the left-side divided boom 54 is included in the concept of a second segment according to the present invention. The right-side divided boom 52 has a width W_{RLB} in the left-right direction that is smaller than a width W_{LLB} of the left-side divided boom 54 in the left-right direction. Specifically, the width W_{RLB} of the base end section in the left-right direction, the largest width in the left-right direction within the right-side divided boom 52, is smaller than the width W_{LLB} of the base end section in the left-right direction, the largest width in the left-right direction within the left-side divided boom 54. Accordingly, the cab 660 side end of the right-side divided boom 54, i.e., the right end of the base end section of the right-side divided boom 54, is disposed in a position offset toward the turning center O from the cab 660 in the left-right direction.

[0087] The attachment bracket 39R on the cab 660 side (right side) provided to the front-side frame 21 is arranged on the turning center O side with respect to the cab 660 in the left-right direction. The base end section 40f of the lower boom 650 joined to the attachment bracket 39R on the cab 660 side is arranged on the turning center O side with respect to the cab 660 in the left-right direction to correspond to the attachment bracket 39R.

[0088] In the modified example of Fig. 9, the right-side divided boom 52 has the width W_{RLB} in the left-right direction smaller than the width W_{LLB} of the left-side divided boom 54 in the left-right direction, and the cab 660 side end of the right-side divided boom 52 is disposed in a position offset toward the turning center O from the cab 660. Therefore, the forward field of vision from the cab 660 is not blocked by the lower boom 650, and a favorable forward field of vision from the cab 660 can be ensured. The lower boom 650 does not interfere with the cab 660 when the boom 40 is raised, and therefore does not limit the angle by which the boom 40 is raised. Since the attachment bracket 39R on the cab 660 side is arranged on the turning center O side with respect to the cab 660, the installed position of the attachment bracket 39R does not interfere with the cab 660. Therefore, work of attaching the attachment bracket 39R with respect to the front-side frame 21 can be performed easily. With the attachment bracket 39R on the cab 660 side being arranged on the turning center O side with respect to the cab 660, the cab 660 does not become a hindrance upon attaching the base end section of the lower boom 650 with respect to the attachment bracket 39R. Therefore, work of attaching the

boom 40 can be prevented from becoming complex.

[0089] The upper turning body 16 according to the modified example of Fig. 10 includes the cab 660 arranged in a similar manner to the case of the modified example of Fig. 9. In the modified example of Fig. 10, the lower boom 650 includes the right-side divided boom 152, the middle divided boom 153, and the left-side divided boom 154, and the right-side divided boom 152 has the width W_{RLB} in the left-right direction smaller than the width W_{LLB} of the left-side divided boom 154 in the left-right direction. With this configuration, the width in the left-right direction of a right-side segment 655 of the lower boom 650 arranged on the cab 660 side (right side) from the turning center O in the left-right direction is smaller than the width in the left-right direction of a left-side segment 656 of the lower boom 650 arranged on the opposite side (left side) to the cab 660 from the turning center O in the left-right direction. The right-side segment 655 is included in the concept of the first segment of the present invention. The left-side segment 656 is included in the concept of the second segment of the present invention. The cab 660 side end of the right-side segment 655, i.e., the right end of the base end section of the right-side divided boom 154, is disposed in a position offset toward the turning center O from the cab 660 in the left-right direction. The configuration of the upper turning body 16 other than the above according to the modified example of Fig. 10 is similar to the configuration of the upper turning body according to the modified example of Fig. 9. With the modified example of Fig. 10, an effect similar to the modified example of Fig. 9 can be obtained.

[0090] The upper turning body 16 according to the modified example of Fig. 11 includes the cab 660 arranged in a similar manner to the case of the modified example of Fig. 9. In the modified example of Fig. 11, the right-side segment 655 of the lower boom 650 is configured of only a portion of the middle divided boom 153 arranged on the cab 660 side from the turning center O. The left-side segment 656 of the lower boom 650 is configured of a portion of the middle divided boom 550 arranged on the opposite side to the cab 660 from the turning center O and the left-side divided boom 154. With this configuration, the width of the right-side segment 655 in the left-right direction is smaller than the width of the left-side segment 656 in the left-right direction. The cab 660 side (right side) end of the right-side segment 655, i.e., the cab 660 side (right side) end of the middle divided boom 550, is disposed in a position offset toward the turning center O from the cab 660 in the left-right direction. The configuration of the upper turning body 16 other than the above according to the modified example of Fig. 11 is similar to the configuration of the upper turning body according to the modified examples of Fig. 9 and Fig. 10. With the modified example of Fig. 11 as well, an effect similar to the modified example of Fig. 9 can be obtained.

[0091] The structure of the upper turning body 16 of the modified examples of Fig. 9 to Fig. 11 may be formed with the left and right reversed.

[0092] In the upper turning body 16 of the modified examples of Fig. 9 to Fig. 11, the configuration of the turning frame 20 is changeable. For example, in the upper turning body 16 of the modified examples of Fig. 9 to Fig. 11, the turning frame 120 shown in Fig. 6 and Fig. 7 may be employed instead of the turning frame 20.

[Summary of embodiment]

[0093] The embodiment is summarized as follows.

[0094] An upper turning body for a mobile crane according to the embodiment is an upper turning body to be mounted on a lower body for a mobile crane, including a turning frame to be mounted on the lower body to turn freely and a boom provided to the turning frame to be raised and lowered freely, wherein the turning frame includes a pair of attachment brackets to which a base end section of the boom is attached such that the boom is free to be raised and lowered, and a main frame to which the pair of attachment brackets are provided with an interval in a left-right direction of the upper turning body, and a dimension of the main frame in a front-rear direction of the upper turning body orthogonal to the left-right direction is smaller than a dimension of the main frame in the left-right direction.

[0095] In the upper turning body for a mobile crane, the dimension of the main frame in the front-rear direction is smaller than the dimension in the left-right direction. Therefore, even in the case where the dimension of the boom in the left-right direction is increased in order to improve the stiffness of the boom in the left-right direction and suppress deflection of the boom in the left-right direction, and, in accordance therewith, the interval of the pair of attachment brackets to which the base end section of the boom is attached and the dimension of the main frame in the left-right direction provided with the pair of attachment brackets are increased, the transportation width of the turning frame can be reduced by loading, on a transportation vehicle, the turning frame in a state where the front-rear direction of the main frame matches the left-right direction of the transportation vehicle, upon transportation of the mobile crane. That is, it is possible to prevent the transportation width of the turning frame from exceeding a transportation limit width of a public road. Thus, with the upper turning body for a mobile crane, transportation of the turning frame of the upper turning body can be carried out upon transportation of the mobile crane, even in the case where the dimension of the boom in the left-right direction is increased to suppress deflection of the boom in the left-right direction.

[0096] In the upper turning body for a mobile crane, the turning frame further includes a subframe arranged on a rear side of the main frame and separably joined to the main frame, and a dimension of the subframe in the left-right direction is smaller than the dimension of the main frame in the left-right direction.

[0097] With this configuration, the subframe is connected to the rear side of the main frame when the mobile crane is in the assembled state. Therefore, the dimension of the upper turning body in the front-rear direction can be increased, and the stability of the upper turning body can be improved. Addition of the subframe increases the installation space for various equipment and members mounted to the upper turning body, and therefore a layout of the equipment and members can be performed easily. Moreover, with this configuration, the subframe is separable from the main frame. Therefore, upon transportation of the mobile

crane, separating the subframe from the main frame and loading, on the transportation vehicle, the main frame in a state where the front-rear direction thereof matches the left-right direction of the transportation vehicle enables the main frame to be transported in a state where the transportation width is reduced. Since the dimension of the subframe in the left-right direction is smaller than the dimension of the main frame in the left-right direction, loading, on the transportation vehicle, the subframe in a state where the left-right direction thereof matches the left-right direction of the transportation vehicle can also reduce the transportation width of the subframe.

[0098] In the upper turning body for a mobile crane, it is preferable that the boom includes a lower boom attached to the pair of attachment brackets and forming a region of the boom, the region being a region which has a specific length from the base end section of the boom to a tip end section side of the boom, and a dimension of the lower boom in the left-right direction increases toward a base end section side of the lower boom.

[0099] With this configuration, the stiffness in the left-right direction near the base end section of the boom can be enhanced, and deflection of the boom in the left-right direction can be suppressed. With this configuration, the dimension of the lower boom in the left-right direction decreases toward the tip end section side of the lower boom. Therefore, an increase in weight of the lower boom can be suppressed, compared to a case where the dimension of the lower boom in the left-right direction is constant and large from the base end section up to the tip end section.

[0100] In this case, it is preferable that the lower boom is formed of a plurality of divided booms arranged side by side in the left-right direction, and adjacent divided booms of the plurality of divided booms are separably joined to each other.

[0101] With this configuration, the transportation width of the lower boom can be reduced by dividing the lower boom into the plurality of divided booms upon transportation of the mobile crane, even in the case where the lower boom is configured such that the dimension of the lower boom in the left-right direction is increased toward the base end section side to improve the stiffness in the left-right direction near the base end section of the boom. It is possible to prevent the transportation width of the lower boom from exceeding the transportation limit width of a public road.

[0102] Further, in this case, it is preferable that the plurality of divided booms include a middle divided boom, a left-side divided boom arranged on a left side of the middle divided boom and separably joined to the middle divided boom, and a right-side divided boom arranged on a right side of the middle divided boom and separably joined to the middle divided boom.

[0103] With the configuration, the lower boom can be configured of the middle divided boom and the left-side divided boom and the right-side divided boom arranged to the left and right of the middle divided boom. Therefore, the balance in terms of structure and strength of the lower boom in the left-right direction can be improved.

[0104] Further, in this case, it is preferable that a left side surface of the left-side divided boom is inclined away from a right side surface of the left-side divided boom toward the base end section side of the lower boom, and a right side surface of the right-side divided boom is inclined away from a left side surface of the right-side divided boom toward the base end section side of the lower boom.

[0105] The configuration in which the boom includes the lower boom may be such that the upper turning body further includes a cab in which operation of the mobile crane by an operator is performed, the cab is arranged in a position offset leftward or rightward from a turning center of the turning frame and attached to the turning frame, the lower boom includes a first segment and a second segment, the first segment being arranged on one side of the turning center in the left-right direction, the one side being a side on which the cab is disposed, the second segment being arranged on the other side of the turning center in the left-right direction, the other side being a side opposite to the one side, the first segment has a width in the left-right direction which is smaller than a width of the second segment in the left-right direction, and the first segment has a cab-side end which is one end in the left-right direction, and the cab-side end is disposed in a position offset toward the turning center from the cab in the left-right direction.

[0106] With this configuration, the first segment of the lower boom arranged on the cab side has a width in the left-right direction that is smaller than the width in the left-right direction of the second segment of the lower boom arranged on the opposite side to the cab, and the cab-side end of the first segment in the left-right direction is disposed in a position offset toward the turning center from the cab. Therefore, the forward field of vision from the cab is not blocked by the lower boom, and a favorable forward field of vision from the cab can be ensured. The lower boom does not interfere with the cab when the boom is raised, and therefore does not limit the angle by which the boom is raised. By the cab-side end of the first segment in the left-right direction being disposed in a position offset toward the turning center from the cab, the installed position of the attachment bracket on the cab side out of the pair of attachment brackets to which the lower boom is attached is arranged on the turning center side with respect to the cab. Therefore, the installed position of the attachment bracket does not interfere with the cab, and work of attaching the attachment bracket with respect to the turning frame can be performed easily. With the attachment bracket on the cab side being arranged on the turning center side with respect to the cab, the cab does not become a hindrance upon attaching the base end section of the lower boom with respect to the attachment bracket. Therefore, work of attaching the boom can be prevented from becoming complex.

[0107] As described above, with the embodiment, transportation of the frame of the upper turning body can be carried out upon transportation of the mobile crane, while suppressing deflection of the boom in the left-right direction through an increase in dimension of the boom in the left-right direction.

REFERENCES CITED IN THE DESCRIPTION

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P A T E N T K R A V

1. Øvre drejelegeme (16) til en mobilkran (10), der indbefatter et nedre bevægelseslegeme (12), en drejestøtte (14) fastgjort til det nedre bevægelseslegeme (12), og det
5 øvre drejelegeme (16), som skal monteres, til at dreje frit på det nedre bevægelseslegeme (12) med drejestøtten (14) derimellem, hvor det øvre drejelegeme (16) omfatter:

en drejeramme (20), som skal monteres på det nedre bevægelseslegeme (12) til at dreje frit; og

en udligger (40) tilvejebragt ved drejerammen (20) for at blive hævet og sænket frit,
10 hvor drejerammen (20) indbefatter et par fastgørelsesbeslag (39) hvortil en fodendesektion (40f) af udliggeren (40) er fastgjort, således at udliggeren (40) kan blive hævet og sænket frit, og en hovedramme (21) hvortil parret af fastgørelsesbeslag (39) er tilvejebragt med et interval i en venstre-højre retning af det øvre drejelegeme (16), og

en dimension (L_{FF}) af hovedrammen (21) i en forende-bagende retning af det øvre
15 drejelegeme (16) vinkelret på venstre-højre retningen er mindre end en dimension (W_{FF}) af hovedrammen (21) i venstre-højre retningen, hvor

drejelegemet (20) yderligere indbefatter en underramme (22) arrangeret på en bag-
side af hovedrammen (21) og aftagelig sammenføjet til hovedrammen (21),

en dimension (W_{RF}) af underrammen (22) i venstre-højre retningen er mindre end
20 dimensionen (W_{RF}) af hovedrammen (21) i venstre-højre retningen, og

en dimension af underrammen (22) i forende-bagende retningen er større end dimen-
sionen (W_{RF}) af underrammen (22) i venstre-højre retningen, og

hovedrammen (21) og underrammen (22) er arrangeret i en T-form når betragtet
ovenfra.

25

2. Øvre drejelegeme (16) til en mobilkran (10) ifølge krav 1,
hvor udliggeren (40) indbefatter en nedre udligger (50; 150; 650) fastgjort til parret af
fastgørelsesbeslag (39) og danner et område af udliggeren, hvor området er et område,
som har en specifik længde fra fodendesektionen (40f) af udliggeren (40) til en topende-
30 sektion af udliggeren (40), og

en dimension af den nedre udligger (50; 150; 650) i venstre-højre retningen bliver større
mod en fodendesektionsside af den nedre udligger (50; 150; 650).

3. Øvre drejelegeme (16) til en mobilkran (10) ifølge krav 2, hvor den nedre udligger
35 (50; 150) er dannet af en flerhed af opdelte udliggere (52, 54, 152, 153, 154) arrangeret
side om side i venstre-højre retningen, og tilstødende opdelte udliggere af flerheden af
opdelte udliggere (52; 54; 152; 153; 154) er aftagelig sammenføjet til hinanden.

4. Øvre drejelegeme (16) til en mobilkran (10) ifølge krav 3, hvor flerheden af

opdelte udliggere indbefatter en opdelt midterudligger (153), en opdelt venstre-side udligger (154) arrangeret på en venstre side af den opdelte midterudligger (153) og aftagelig sammenføjet til den opdelte midterudligger (153), og en opdelt højre-side udligger (152) arrangeret på en højre side af den opdelte midterudligger (153) og aftagelig sammenføjet til den opdelte midterudligger (153).

5 5. Øvre drejelegeme (16) til en mobilkran (10) ifølge krav 4, hvor en venstre sideflade af den opdelte venstre-side udligger (154) hælder væk fra en højre sideoverflade af den opdelte venstre-side udligger (154) med fodendesektionssiden af den nedre udligger (150), og

10 en højre sideflade af den opdelte højre-side udligger (152) hælder væk fra en venstre side flade af den opdelte højre side udligger (152) mod fodendesektionssiden af den nedre udligger (150).

15 6. Øvre drejelegeme (16) til en mobilkran (10) ifølge krav 2, yderligere omfattende et førerhus (660), i hvilket drift af mobilkranen (10) udføres af en operatør,

hvor førerhuset (660) er arrangeret i en position forskudt til venstre eller højre fra et drejecenter (O) af drejerammen (20) og er fastgjort til drejerammen (20),

den nedre udligger (650) indbefatter et første segment (52; 655) og et andet

20 segment (54; 656), hvor det første segment (52; 655) er arrangeret på én side af drejecentret (O) i venstre-højre retningen, hvor den ene side, er en side på hvilken førerhuset (660) er anbragt, hvor det andet segment (54; 656) er arrangeret på den anden side af drejecentret (O) i venstre-højre retningen, hvor den anden side er en side modsat til den ene side,

25 det første segment (52; 655) har en bredde (W_{RLB}) i venstre-højre retningen, som er mindre end en bredde (W_{LLB}) af det andet segment (54; 656) i venstre-højre retningen, og

30 det første segment (52; 655) har en førerhussideende, som er én ende i venstre-højre retningen, og førerhussideenden er anbragt i en position forskudt fra drejecentret (O) fra førerhuset (660) i venstre-højre retningen.

7. Øvre drejelegeme (16) til en mobilkran (10) ifølge et hvilket som helst af kravene 1 til 6, hvor hovedrammen (21) er forsynet med en drejestøttefastgørelsessektion (27) til hvilken drejestøtten (14) skal fastgøres.

DRAWINGS

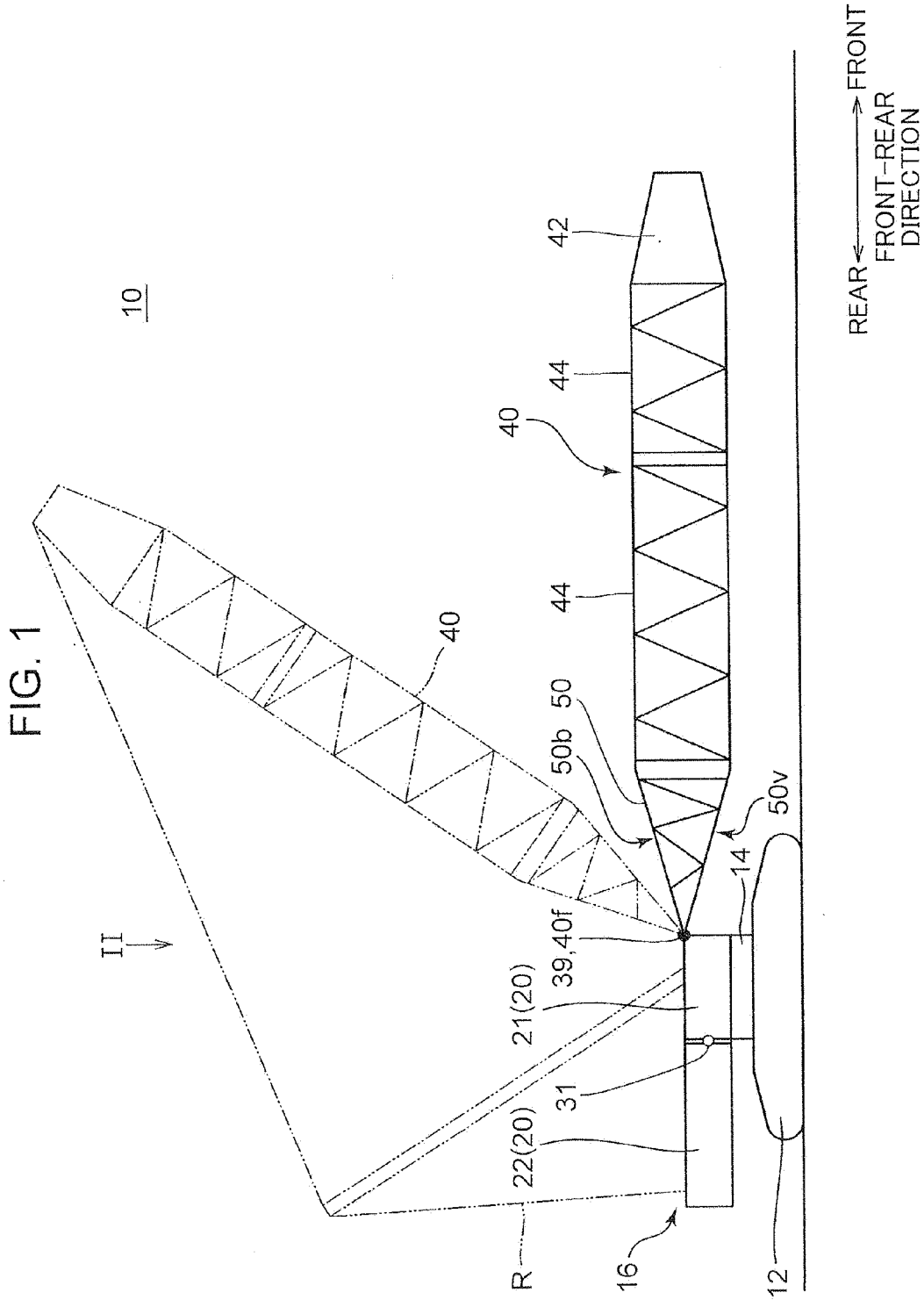


FIG. 2

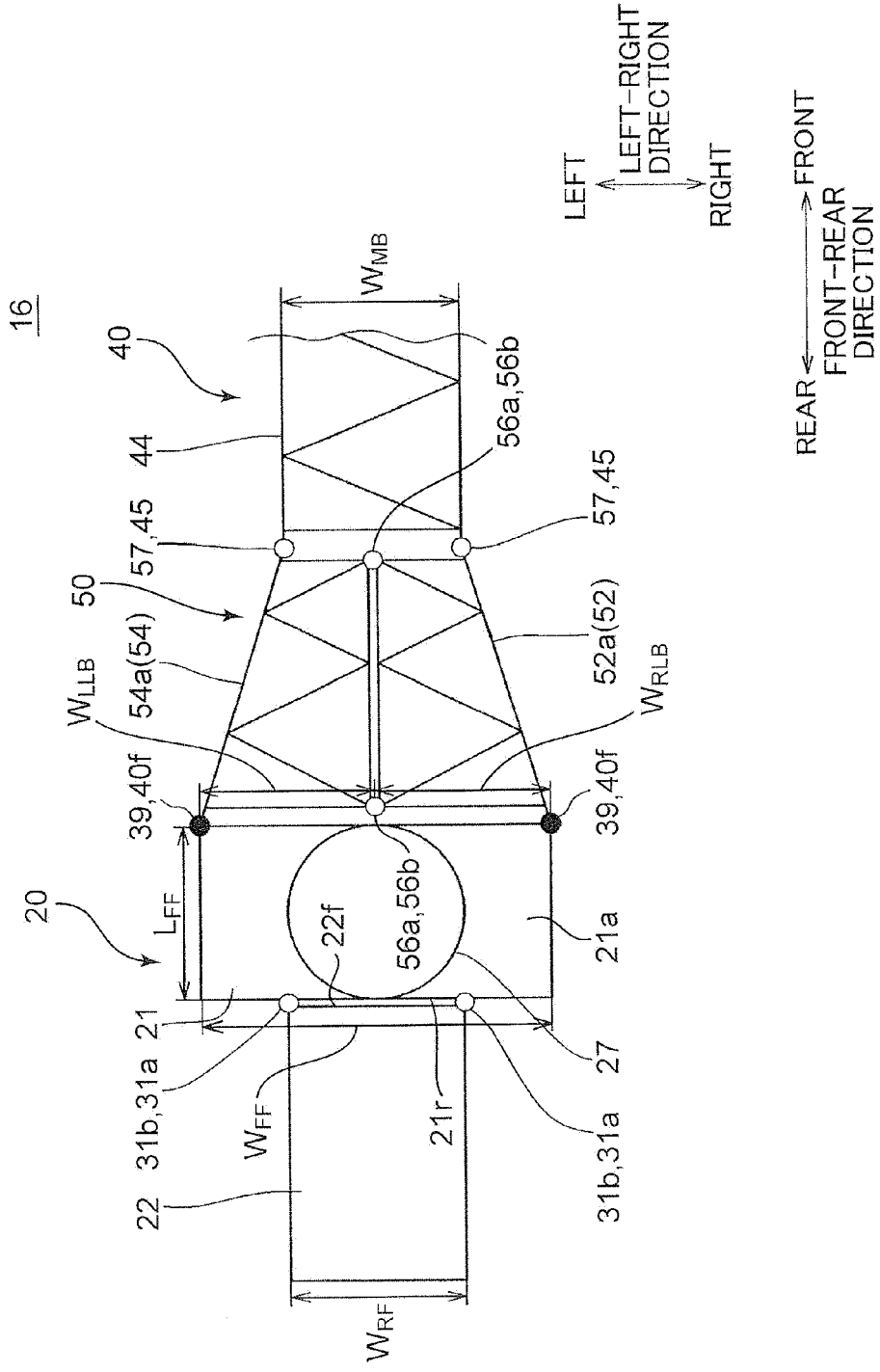


FIG. 3

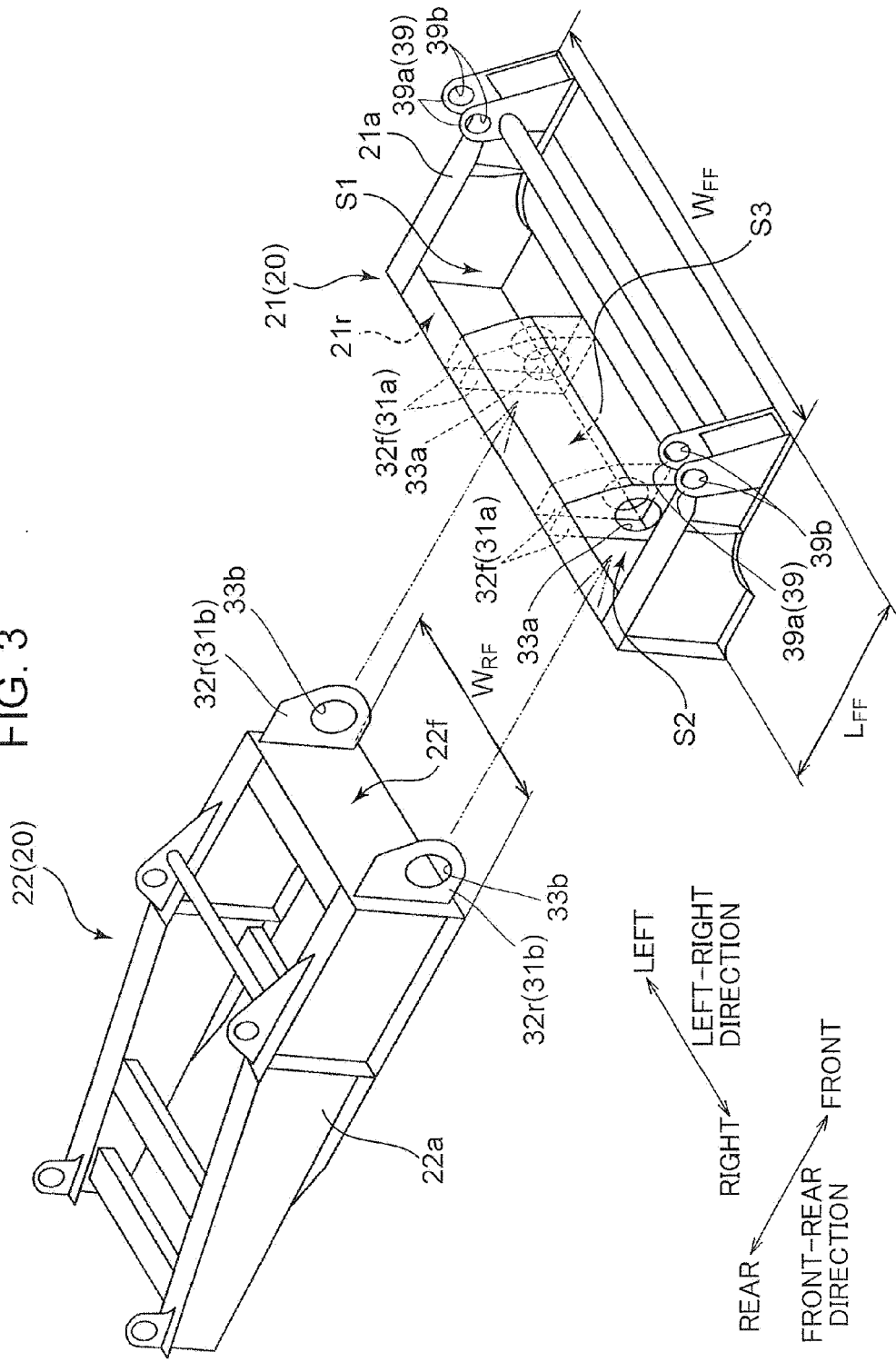


FIG. 4A

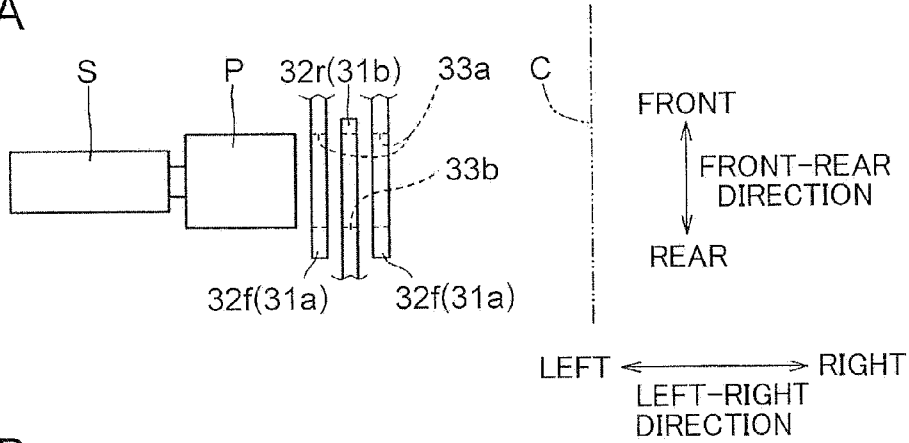


FIG. 4B

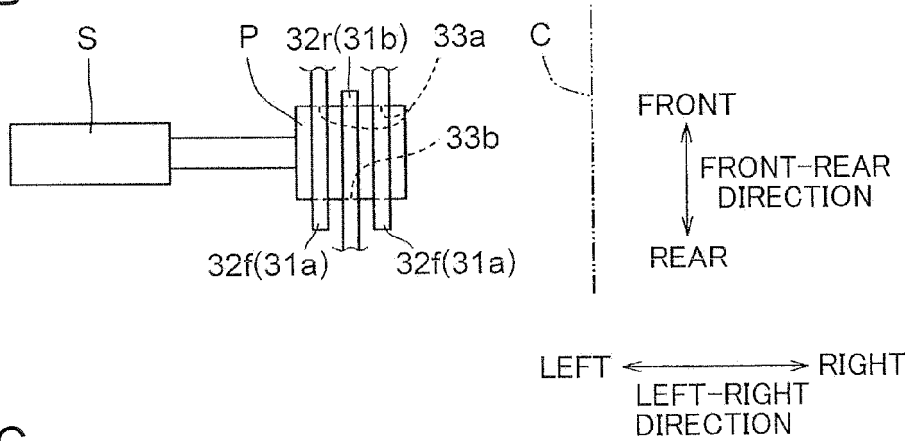


FIG. 4C

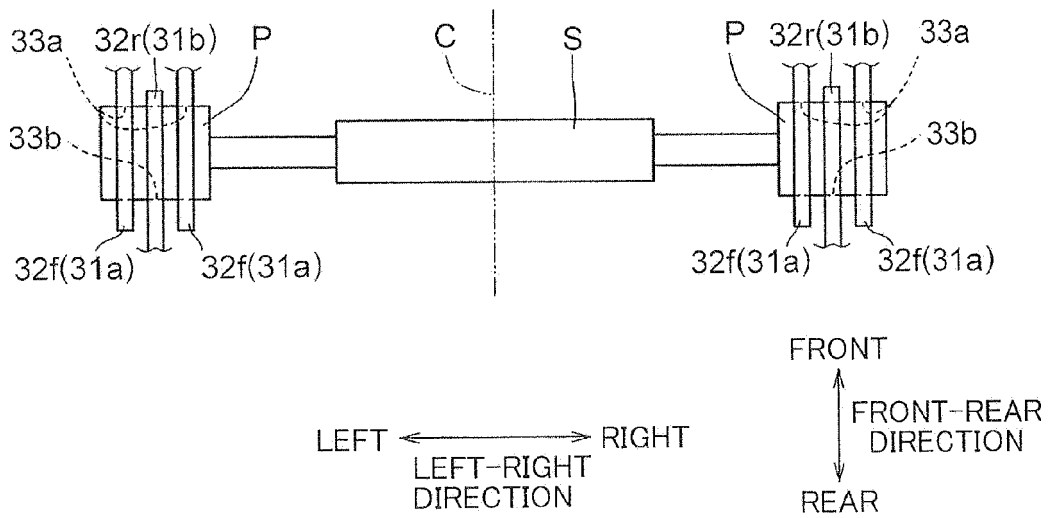
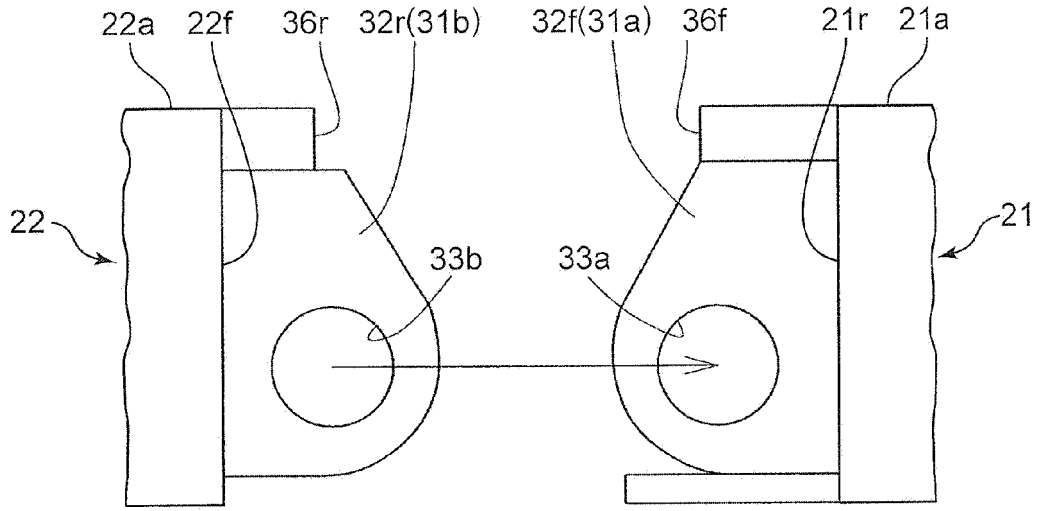
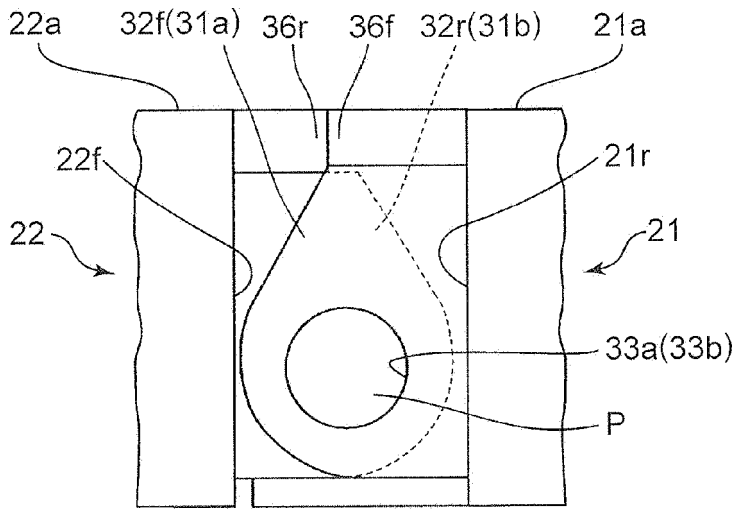


FIG. 5A



REAR ← → FRONT
FRONT-REAR
DIRECTION

FIG. 5B



REAR ← → FRONT
FRONT-REAR
DIRECTION

FIG. 6

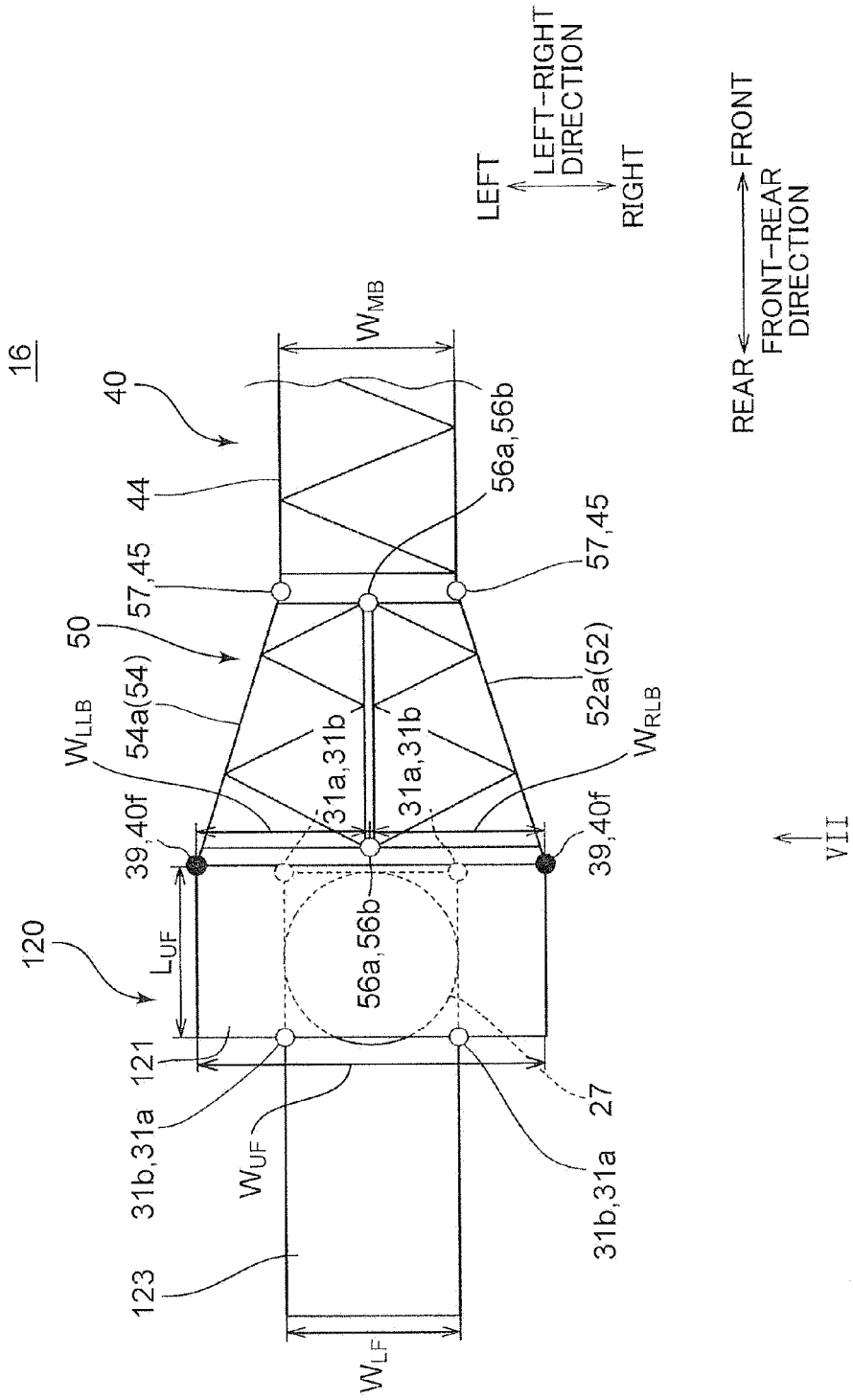


FIG. 8

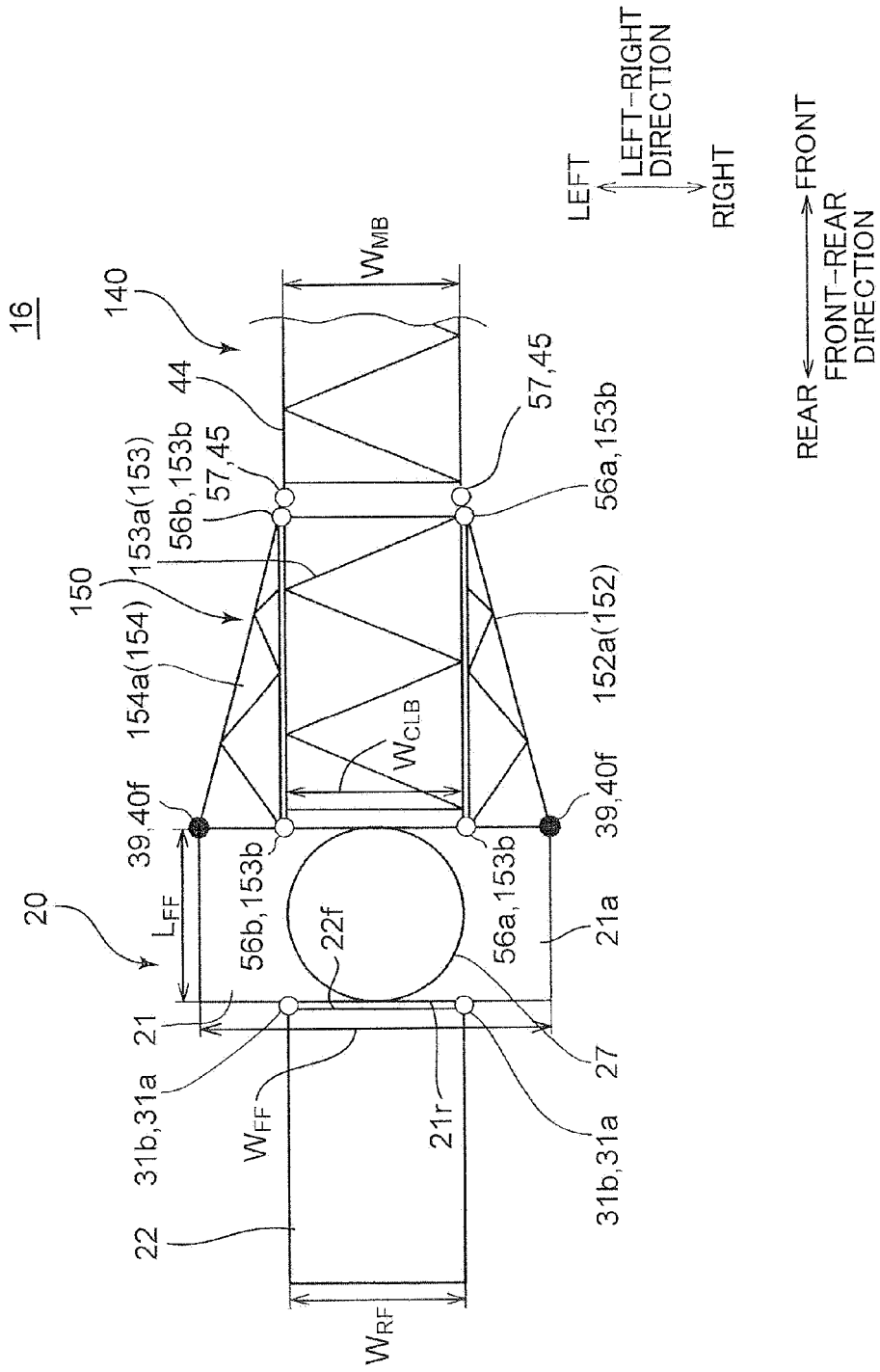


Fig. 9

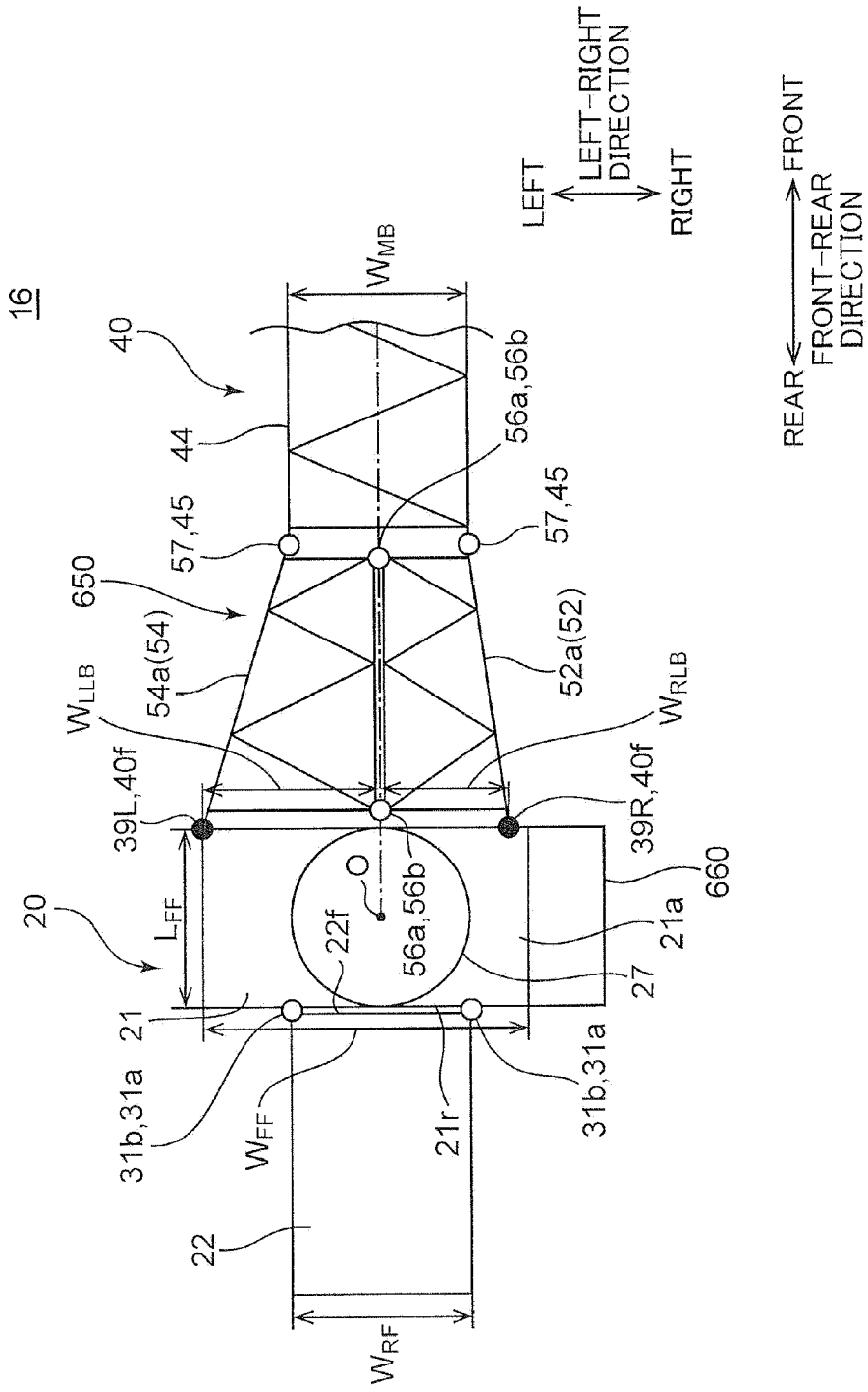


Fig. 10

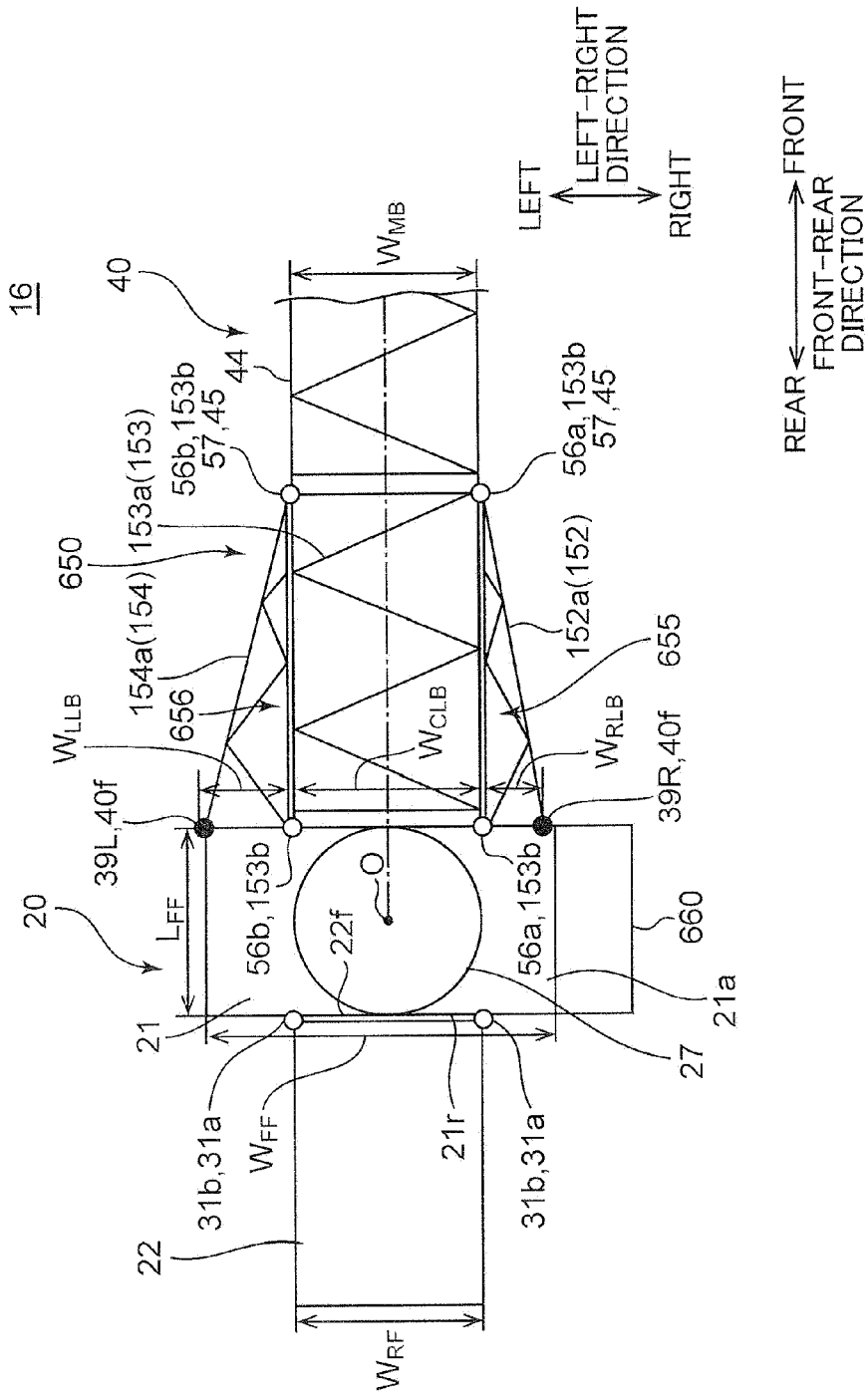


FIG. 12

