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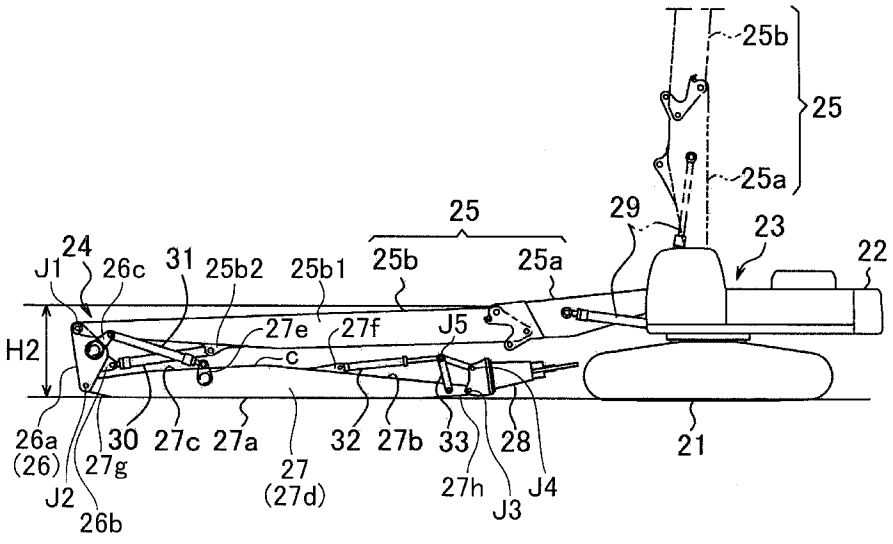
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(54) **WORK ATTACHMENT AND WORK MACHINE**

(57) It is aimed to provide a work attachment capable of being stably supported in a folded state and preventing breakage of a working device cylinder and a link mechanism, and a operating machine provided with this. A working device cylinder 32 and a link mechanism 33 are provided at an upper surface side of an arm 27 in a folded state so as to be located between a leading end part of the arm 27 and a boom 25 in the folded state, an inter-boom cylinder 30 and arm cylinders 31 are located above a base end part of the arm 27 in the folded state, and a grounding part 27a groundable over a length range sufficient to support an entire work attachment 24 is formed on at least a part of the lower surface of the arm 27 in the folded state.

FIG. 1



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Description

TECHNICAL FIELD

[0001] The present invention relates to a operating machine such as a dismantling machine including a base machine and a work attachment attached to the base machine.

BACKGROUND ART

[0002] Conventionally, there has been known a dismantling machine with a super long attachment, for example, used to dismantle a high-rise building.

[0003] As shown in FIG. 5, this dismantling machine is provided with a base machine 3 including a crawler-type lower propelling body 1 and an upper slewing body 2 mounted on this lower propelling body 1 rotatably about a vertical axis, and a work attachment 4 attached to a front part of this base machine 3.

[0004] The work attachment 4 includes a boom 5 attached to the base machine 3 (upper slewing body 2) to be able to raised and lowered, a short inter-boom 6 attached to the leading end of this boom 5 rotatably about a horizontal axis for the purpose of enlarging a working range, an arm 7 attached to the leading end of this inter-boom 6 rotatably about a horizontal axis and a working device 8 attached to the leading end of this arm 7. Although an openable crusher called a nibbler is shown as the working device 8 in FIG. 5, a bucket for excavation or a breaker for crushing may also be mounted as the working device 8.

[0005] The boom 5 includes a main boom 5a at a lower side and a front boom 5b at an upper side which is detachably connected to this main boom 5a.

[0006] The above dismantling machine is transported after being dissolved into a set including the base machine 3 and the main boom 5a and a set including the work attachment 4 excluding the main boom 5a (see FIG. 6) and assembled after the transportation.

[0007] Note that although the front boom 5b normally includes boom bodies in a plurality of stages detachably connected to each other, the front boom 5b formed of a single member is shown to simplify the drawings.

[0008] Further, the dismantling machine includes, as cylinders (hydraulic cylinders) for operating the work attachment 4, a boom cylinder 9 for raising and lowering the boom 5 (entire attachment), an inter-boom cylinder 10 for operating the inter-boom 6, an arm cylinder 11 for rotating the arm 7 and a working device cylinder 12 for rotating the working device 8. The dismantling machine further includes a link mechanism 13 for converting a thrust force of the working device cylinder 12 into a rotational force and transmitting the converted force to the working device 8.

[0009] The inter-boom cylinder 10 is provided between the boom 5 (front boom 5b) and the inter-boom 6 at an attachment front surface side. The arm cylinder 11 is provided between the inter-boom 6 and the arm 7 at the attachment front surface side.

[0010] Further, the working device cylinder 12 is provided between the arm 7 and the working device 8 at an attachment rear surface side.

[0011] The configuration described above is shown in patent literatures 1, 2.

[0012] Further a dismantling machine in which the working device cylinder 12 and the link mechanism 13 are arranged at a side (arm front surface side) opposite to the dismantling machine shown in FIGS. 5 to 7 is shown in patent literature 3.

[0013] Conventionally, the dismantling machine with the super long attachment described above is dissolved and assembled as shown in solid line in FIG. 5 and FIG. 7. Specifically, at the time of dissolving and assembling the dismantling machine, the inter-boom cylinder 10 and the arm cylinder 11 are set in their most contracted states and the work attachment 4 is so folded in three that the boom 5 is located at an upper side of the inter-boom 6 and the arm 7 is located at a lower side of the inter-boom 6.

[0014] At the time of transportation, the main boom 5a and the front boom 5b are separated with the work attachment 4 folded as shown in FIGS. 6 and 7. Specifically, the work attachment 4 is separated into the set including the base machine 3 and the main boom 5a and the set including the work attachment 4 excluding the main boom 5a. Then, the set separated from the base machine 3 is transported after being placed on a transporter 14 such as a trailer as shown in FIG. 6. At this time, the working device 8 is detached from the arm 7.

[0015] An assembling operation after the transportation and, depending on an intended use, an operation of assembling the work attachment 4 in a different way are also performed in the same manner.

[0016] A bracket 15 for grounding provided on an arm lower surface side in the folded state in FIGS. 5 to 7 is not disclosed in patent literatures 1 to 3, but is assumed to limit a grounding position of the work attachment 4.

[0017] However, in the dismantling machine shown in FIGS. 5 to 7, only a part (actually bracket 15) of the arm 7 located on the lower side is grounded as shown in a state where the work attachment 4 is folded and grounded as shown in solid line in FIG. 5 or in a state where the work attachment 4 is loaded on the transporter 14 as shown in FIG. 6 at the time of dissolving, assembling and transporting the work attachment 4. Thus, the work attachment 4 is unstably supported (self-standing) in a situation where the front boom 5b is separated from the main boom 5a.

[0018] Accordingly, the work attachment 4 has been conventionally supported by a stand 16 shown in chain double-dashed line in FIG. 6 at the time of dissolving, assembling and transportation.

[0019] In other words, the shape of the arm and the folded posture are conventionally determined on the premise that the work attachment 4 in the folded state is

supported by the stand 16.

[0020] However, this stand 16 actually needs to be a full-scale stand sufficient to stably support the entire attachment although it is shown in a simplified manner in FIG. 6. Specifically, since the stand 16 having a complicated and large-scale structure and a heavy weight is necessary, it has been disadvantageous in terms of cost and handling.

[0021] Since the entire attachment becomes bulky due to the stand 16, an attachment entire height H1 (see FIG. 5) at the time of assembling and transportation is large. This is disadvantageous in terms of operability and safety since the dissolving and assembling operations have to be performed at a high place and also causes a problem in transportation such as the need to use a low-floor trailer for transportation.

[0022] Further, the working device cylinder 12 and the link mechanism 13 (hereinafter, the both in combination may be referred to as a working device cylinder mechanism) are located at a lower surface side (ground surface side) in the folded state. Thus, the working device cylinder mechanism may be broken due to contact with the ground surface or a loading platform and the attachment entire height H1 becomes even larger since the attachment needs to be folded with a leading end side of the arm lifted to avoid the breakage.

[0023] Note that, the working device cylinder mechanism is located at an arm upper surface side in the folded state of the attachment in a crusher vehicle disclosed in patent literature 3. Thus, there is no possibility of contact of the working device cylinder mechanism with the ground surface and the loading platform, but problems that the attachment is unstably supported, therefore, a stand is necessary and the attachment entire height becomes larger due to the stand cannot be solved.

CITATION LIST

PATENT LITERATURE

[0024]

Patent literature 1: Japanese Unexamined Patent Publication No. H11-193543

Patent literature 2: Japanese Unexamined Utility Model Publication No. H5-67652

Patent literature 3: Japanese Unexamined Patent Publication No. H8-226236

SUMMARY OF INVENTION

[0025] An object of the present invention is to provide a work attachment capable of being stably supported in a folded state and preventing breakage of a working device cylinder and a link mechanism, and a operating machine provided with this.

[0026] To solve the above problem, the present invention is directed to a work attachment attachable to a base machine of a operating machine, including a boom to be attached to the base machine to be able to be raised and lowered; an inter-boom attached to the leading end of the boom rotatably about a horizontal axis; an arm attached to the leading end of the inter-boom rotatably about a horizontal axis; a working device attached to the leading end part of the arm, a boom cylinder for raising and lowering the boom; an inter-boom cylinder provided between the boom and the inter-boom for rotating the inter-boom; an arm cylinder provided between the inter-boom and the arm for rotating the arm; a working device cylinder for rotating the working device; and a link mechanism provided between the working device and the working device cylinder; wherein the boom, the inter-boom and the arm are folded in three so that the boom is located at an upper side of the inter-boom and the arm is located at a lower side of the inter-boom by contracting the inter-boom cylinder and the arm cylinder most; the working device cylinder and the link mechanism are provided at an upper surface side of the arm in the folded state to be located between a leading end part of the arm and the boom in the folded state; the inter-boom cylinder and the arm cylinder are located above a base end part of the arm in the folded state; and the arm is formed with a grounding part groundable over a length range sufficient to support the entire work attachment in the folded state.

[0027] The present invention is also directed to a operating machine, including a base machine; and the work attachment attached to the base machine to be able to be raised and lowered.

[0028] According to the present invention, it is possible to stably support a work attachment in a folded state and prevent breakage of a working device cylinder and a link mechanism.

BRIEF DESCRIPTION OF DRAWINGS

[0029]

FIG. 1 is a schematic side view showing a folded state of a dismantling machine with a super long attachment according to an embodiment of the present invention,

FIG. 2 is a view enlargedly showing a part of FIG. 1,

FIG. 3 is a schematic side view showing a state where a work attachment is separated from a base machine and a main boom and transported,

FIG. 4 is a view, corresponding to FIG. 3, showing a state where an attachment entire height is further reduced by setting a working device cylinder in a most contracted state from the state of FIG. 3 as a modification of a state of transportation,

FIG. 5 is a schematic side view showing a conventional dismantling machine and a configuration assumed for this to describe the above conventional dismantling machine,

FIG. 6 is a schematic side view at the time of trans-

porting an attachment of the dismantling machine shown in FIG. 5, and

FIG. 7 is a partial enlarged view of the dismantling machine shown in FIG. 5 at the time of dissolving/assembling and transportation.

EMBODIMENT OF INVENTION

[0030] Hereinafter, an embodiment of the present invention is described with reference to accompanying FIGS. 1 to 4. Note that the following embodiment is a specific example of the present invention and not of the nature to limit the technical scope of the present invention.

[0031] In the following embodiment, a dismantling machine with a super long attachment is described as an example of a operating machine in conformity with the description of the background art.

[0032] The dismantling machine is provided with a base machine 23 including a crawler-type lower propelling body 21 and an upper slewing body 22 mounted on this lower propelling body 21 rotatably about a vertical axis, and a work attachment 24 attached to a front part of this base machine 23 to be able to be raised and lowered.

[0033] The work attachment 24 includes a boom 25 attached to the base machine 23 (upper slewing body 22) to be able to be raised and lowered, a short inter-boom 26 attached to the leading end of this boom 25 rotatably about a horizontal axis, an arm 27 attached to the leading end of this inter-boom 26 rotatably about a horizontal axis and a working device 28 attached to the leading end of this arm 27.

[0034] The work attachment 24 includes a boom cylinder 29 for raising and lowering the boom 25 (entire work attachment 24) relative to the base machine 23, an inter-boom cylinder 30 for rotating the inter-boom 26 relative to the boom 25, a pair of arm cylinders 31 (only one is shown) for rotating the arm 27 relative to the inter-boom 26, a working device cylinder 32 for rotating the working device 28 relative to the arm 27 and a link mechanism 33 provided between this working device cylinder 32, the arm 27 and the working device 28. The link mechanism 33 is for converting a thrust force of the working device cylinder 32 into a rotational force and transmitting the converted force to the working device 28. The inter-boom cylinder 30 is provided between the boom 25 (front boom 25b) and the inter-boom 26 at a front surface side (at a forward facing surface in a state where the entire work attachment 24 is unfolded and caused to stand) of the work attachment 24. Further, the arm cylinders 31 are provided between the inter-boom 26 and the arm 27 at the front surface side of the work attachment 24.

[0035] In the dismantling machine according to this embodiment, the work attachment 24 can be displaced to a folded state when being dissolved and transported. Specifically, the above folded state is a state where the boom 25, the inter-boom 26 and the arm 27 are folded in three by setting the inter-boom 30 and the arm cylinders 31 in their most contracted states and the boom 25 is located at an upper side of the inter-boom 26 and the arm 27 is located at a lower side of the inter-boom 26 by laying down the boom 25 and grounding the arm 27 as shown in FIGS. 1 to 4. The work attachment 24 in the folded state can be placed on the ground and separated into a set composed of the base machine 23 and a main boom 25a to be described below and a set composed of the work attachment 24 excluding the main boom 25a as shown in FIGS. 3 and 4. The thus separated set composed of the work attachment 24 excluding the main boom 25a can be transported by a transporter 34 and assembled with the base machine 23 in a procedure opposite to the one described above after the transportation.

[0036] The work attachment 24 is specifically described below.

[0037] The boom 25 includes the main boom 25a with a base end part attached to the base machine 23 and the front boom 25b with a base end part detachably connected to a leading end part of this main boom 25a. The front boom 25b includes a front boom main body 25b1 and an inter-boom cylinder attachment part 25b2 provided on a front surface side of this front boom main body 25b1. A leading end part of the front boom main body 25b1 is rotatably attached to the inter-boom 26. One end (head side end) of the inter-boom cylinder 30 is rotatably attached to the inter-boom cylinder attachment part 25b2. Further, the inter-boom cylinder attachment part 25b2 is provided at a central position of the front boom main body 25b1 in a width direction (right-left direction).

[0038] The inter-boom 26 includes an inter-boom main body 26a with a base end part attached to the front boom main body 25b1 rotatably about a horizontal shaft J1, an inter-boom cylinder attachment part 26b provided on the front surface of this inter-boom main body 26a and a pair of arm cylinder attachment parts 26c (only one is shown) respectively provided on side surfaces of the inter-boom main body 26a facing in the width direction (ritht-left direction). A leading end part of the inter-boom main body 26a is attached to the arm 27 rotatably about a horizontal shaft J2 (base end attachment part). One end (rod side end) of the inter-boom cylinder 30 is rotatably attached to the inter-boom cylinder attachment part 26b at a point of attachment A. Further, the inter-boom cylinder attachment part 26b is provided at a central position of the inter-boom 26 in the width direction. Furthermore, the inter-boom cylinder attachment part 26b is provided at a position closer to a leading end part of the inter-boom 26 than an intermediate part thereof. One ends of the arm cylinders 31 are respectively attachable to the pair of arm cylinder attachment parts 26c. Specifically, the pair of arm cylinders 31 are respectively arranged at an opposite side with respect to the inter-boom 26 and the arm 27 in the width direction so as to sandwich the above inter-boom cylinder 30 from left and right sides. One ends (head side ends) of these arm cylinders 31 are respec-

tively rotatably attached to the pair of arm cylinder attachment parts 26c at points of attachment B. Further, the pair of arm cylinder attachment parts 26c are provided at positions closer to a base end side than the inter-boom cylinder attachment part 26b and project forward from side surfaces of the inter-boom 26 beyond the front surface. Note that the pair of arm cylinder attachment parts 26c project obliquely upward toward the back from the inter-boom 26 in the folded state.

[0039] The arm 27 includes an arm main body 27d with a base end part rotatably attached to the above inter-boom main body 26a, a pair of arm cylinder attachment parts 27e (only one is shown) respectively provided on side surfaces of this arm main body 27d facing in the width direction and a working device cylinder attachment part 27f provided on the front surface of the arm main body 27d. A leading end part of the arm main body 27d is attached to the working device 28 rotatably about a horizontal shaft J3. Further, the upper surface of the arm main body 27d in the folded state is formed to be convex upward so that a cross-sectional area of the arm main body 27d is maximized at an intermediate point C in a length direction of the arm 27. Specifically, in the folded state, a part of the upper surface of the arm main body 27d closer to the leading end than the intermediate point C is an inclined surface 27b inclined downward toward the leading end of the arm main body 27d. On the other hand, in the folded state, a part of the upper surface of the arm main body 27d closer to the base end than the intermediate point C is an inclined surface 27c inclined downward toward the base end of the arm main body 27d. By forming the inclined surface 27b, an arm leading end side space S1 (see FIG. 2) formed between a leading end side of the arm main body 27d and the boom 25 (front boom 25b) can be made larger. Further, by forming the inclined surface 27c, an arm base end side space S2 (see FIG. 2) formed between a base end side of the arm main body 27d and the front boom 25b can be made larger. The arm leading end side space S1 can be used as a space for installing the working device cylinder 32 and the arm base end side space S2 can be used as a space for installing the inter-boom cylinder 30 and the arm cylinders 31.

[0040] A grounding part 27a which can be grounded over a length range sufficient to support the entire work attachment 24 is formed on at least a part of the lower surface of the arm main body 27d in the folded state. This grounding part 27a is a flat surface to be arranged horizontally (parallel to the ground surface) in the folded state. By grounding the grounding part 27a, the work attachment 24 in the folded state can be supported on the ground surface or a loading platform. In this embodiment, the grounding part 27a is provided substantially over the entire length of the arm main body 27d including a part right below a center of gravity of the attachment (work attachment 24 or a part of the work attachment 24 excluding the main boom 25a) in the folded state. Since the grounding part 27a is provided over a wide range in this way, the work attachment 24 can be caused to stand alone and supported in a stable state at the time of dissolving, assembling or transportation. This makes it possible to omit a stand which has been conventionally used to support the work attachment 24 or replace the stand with a complementary simple or small one. This is advantageous in terms of cost and handling of the work attachment 24 and enables improvements in operability and safety of the dissolving or assembling operation and transportability by eliminating or reducing bulkiness caused by the stand to reduce an attachment entire height H2 (height of the entire attachment excluding the main boom 25a; see FIG. 1).

[0041] In this embodiment, the grounding part 27a is provided on the part of the lower surface of the arm main body 27d in the folded state excluding a leading end part and a base end part (hatched parts in FIG. 2). Specifically, the horizontal shaft J2, J3 connecting the arm 27 and the inter-boom 26 or the working device 28 is arranged above the grounding part 27a in the folded state. The lower surface of the arm main body 27d in the folded state has a base end side inclined surface 27g inclined upward from a base end part of the grounding part 27a toward the horizontal shaft J2 and a leading end side inclined surface 27h inclined upward from a leading end part of the grounding part 27a toward the horizontal shaft J3.

[0042] One ends (rod side ends) of the arm cylinders 31 are respectively rotatably attachable to the pair of arm cylinder attachment parts 27e. Specifically, the pair of arm cylinder attachment parts 27e are provided within the length range of the arm main body 27d where the base end side inclined surface 27c of the arm main body 27d is formed and project forward from side surfaces of the arm main body 27d beyond the inclined surface 27c. On the other hand, one end (head side end) of the working device cylinder 32 is rotatably attachable to the working device cylinder attachment part 27f. Specifically, the working device cylinder attachment part 27f projects forward from the leading end side inclined surface 27b of the arm main body 27d. As just described, in this embodiment, the arm cylinder attachment parts 27e are provided at a side of the arm main body 27d closer to the base end than the intermediate point C and the working device cylinder attachment part 27f is provided at a side closer to the leading end side than the intermediate point C.

[0043] The working device 28 is attached to the leading end part of the arm main body 27d rotatably about the horizontal shaft J3. Further, the working device 28 is connected to the link mechanism 33 so as to be rotatable about a horizontal shaft J4 located above the horizontal shaft J3 in the folded state. Further, this link mechanism 33 is connected to the one end (rod side) of the working device cylinder 32 rotatably about a horizontal shaft J5. The horizontal shaft J5 is located above the arm main body 27d in the folded state. Accordingly, the working device 28 and the link mechanism 33 are located above the arm main body 27d in the folded state. That is, in the

folded state, the working device cylinder 32 and the link mechanism 33 (hereinafter, may be referred to as a working device cylinder mechanism) are arranged in the arm leading end side space S1 (see FIG. 2). This can suppress breakage of the working device cylinder mechanism due to contact with the ground surface or a loading platform. Further, by arranging the working device cylinder mechanism at an upper surface side of the arm main body 27d, it is possible to bring the leading end part of the arm main body 27d closer to the ground surface, i.e. to hold the entire arm 27 substantially horizontally. Thus, the grounding part 27a can be formed over the long range extending substantially over the entire length of the arm and the arm leading end side space S 1 can be made sufficiently large to install the working device cylinder mechanism.

[0044] Further, the following effects are achieved by arranging the working device cylinder mechanism at the upper surface side of the arm main body 27d in the folded state of the attachment.

[0045] (1) As compared with the case where the working device cylinder mechanism is arranged at a lower surface side of the arm main body 27d, movements of the working device 28 due to extension and contraction of the working device cylinder 32 are reversed. Thus, an excavation force in the case of using a bucket as the working device 28 is reduced, but a holding force (force for pushing a crusher upward) in the case of using an unillustrated crusher is improved. This point is advantageous since the overwhelming majority of operations performed by the dismantling machine with the super long attachment use this holding force.

[0046] (2) Hydraulic pressure pipes for the working device cylinder mechanism and the working device cylinder 32 can be protected from dismantled debris.

[0047] (3) During an operation, the working device cylinder mechanism is easy to see from an operator sitting in the base machine. Thus, contact between the working device cylinder mechanism and a structure to be dismantled and a stroke end operation of the working device cylinder 32 can be easily avoided.

[0048] Note that the hydraulic pressure pipe (not shown) for the working device cylinder 32 is arranged at the upper surface side (may also be arranged at a lateral side) of the arm main body 27d in the folded state of the attachment in conformity with the working device cylinder mechanism.

[0049] FIG. 3 shows a case of transportation in a state where the working device cylinder 32 is slightly longer than in the most contracted state. FIG. 4 shows a case of transportation in a state where the working device cylinder 32 is most contracted. A state of the working device cylinder 32 at the time of transportation may be either the state shown in FIG. 3 or the state shown in FIG. 4. Specifically, in the state shown in FIG. 3, the front boom 25b needs to be inclined slightly upward toward the boom base end side to avoid interference of the working device cylinder mechanism and the front boom 25b, wherefore the attachment entire height slightly increases. Contrary to this, the state shown in FIG. 4 is more effective in reducing the attachment entire height since the front boom 25b can be held substantially horizontal.

[0050] In this embodiment, the entire height H1 of the work attachment 24 can be reduced by shortening a distance between the boom 25 and the arm 27 in the folded state as compared with the conventional technology shown in FIGS. 5 to 7.

[0051] Specifically, in the dismantling machine of FIGS. 5 to 7, the inter-boom cylinder 10 and the arm cylinder 11 are arranged in the same phase (at the same position in the width direction of the work attachment 4). Thus, a distance between the both cylinders 10 and 11 needs to be kept to prevent interference of these cylinders. Therefore, the both cylinders 10, 11 take up a large space in a height direction.

[0052] As shown in FIG. 7, it is assumed that X1 denotes a point of attachment of the boom 5 to the inter-boom 6, X2 denotes a point of attachment of the arm 7 to the inter-boom 6, Y1 denotes a point of attachment of the inter-boom cylinder 10 to the inter-boom 6 and Y2 denotes a point of attachment (point of application of a cylinder thrust force) of the arm cylinder 11 to the inter-boom 6. In this case, a force for operating the inter-boom 6 and the arm 7 is proportional to a distance $\alpha 1$ between X1 and Y1 and a distance $\alpha 2$ between X2 and Y2 (hereinafter, $\alpha 1$ and $\alpha 2$ are referred to as moment lengths). Thus, the moment lengths $\alpha 1$, $\alpha 2$ need to be specified lengths in securing a necessary operation force.

[0053] As a result of the above, the distance between the boom 5 and the arm 7 (necessary length of the inter-boom 6) in the folded state increases in the conventional dismantling machine, and this has been one of factors that make the entire height H1 of the work attachment 4 larger. Contrary to this, in the dismantling machine according to this embodiment, a point of attachment A of the inter-boom cylinder 30 to the inter-boom 26 is arranged below points of attachment B of the arm cylinders 31 to the inter-boom 26, and the both points of attachment A, B are shifted from each other in the width direction of the inter-boom 26. More specifically, one inter-boom cylinder 30 is attached at a position between the boom 25 (front boom 25b) and an intermediate part (point of attachment A) of the inter-boom 26 in the height direction in central parts of the boom 25 and the inter-boom 26 in the width direction. By this, the both cylinders 30, 31 are crossed in X in a side view while the phases thereof are shifted from each other.

[0054] According to this configuration, as compared with the known technology in which the both cylinders 10, 11 are vertically separated in the same phase as shown in FIGS. 5 to 7, a space taken up by the both cylinders 30, 31 in the height direction can be reduced while necessary moment lengths $\beta 1$, $\beta 2$ (equal to or longer than the moment lengths $\alpha 1$, $\alpha 2$ of the conventional technology) are secured.

[0055] Since this enables the distance between the

boom 25 and the arm 27 (necessary length of the inter-boom 26) in the folded state to be reduced, the attachment entire height H1 can be further reduced and safety and operability of the dissolving or assembling operation can be further improved.

[0056] Further, since the entire height of the attachment at the time of transportation can be reduced, trucking that is not possible with the known technology becomes possible if weight restriction is cleared. This can realize a cost reduction and improve safety at the time of transportation by lowering a center of gravity of the work attachment 24.

[0057] In this case, the following effect is achieved as a synergetic effect brought about by forming the upper surface of the arm in the folded state to have a convex shape. Specifically, by securing the arm base end side space S2 while suppressing the entire height of the work attachment 24 to a low level, the inter-boom cylinder 30 and the arm cylinders 31 can be easily installed.

[0058] Note that the points B of attachment of the arm cylinders 31 to the inter-boom 26 and a linking point of the boom 25 to the inter-boom 26 may be set at the same position as another aspect for shifting the inter-boom cylinder 30 and the arm cylinders 31 from each other in the width direction.

[0059] Further, the same effect as the above embodiment can also be obtained by providing one inter-boom cylinder 30 and one arm cylinder 31 and attaching a link to each of these inter-boom cylinder 30 and arm cylinder 31. Specifically, the above respective links are shifted from each other in the width direction of the inter-boom 26 and are mounted while being crossed in X when viewed sideways. Leading end parts of the both links are attached to the inter-boom 26 as the points of attachment A, B. By doing so, the distance between the boom 25 and the arm 27 can be shortened by crossing the links attached to the both cylinders 30, 31 while arranging the inter-boom cylinder 30 and the arm cylinder 31 in the same phase.

[0060] As described above, in the above embodiment, the grounding part 27a that can be grounded over the length range sufficient to support the entire work attachment 24 is provided on at least a part of the lower surface of the arm 27 in the folded state. Thus, the entire work attachment 24 can be sufficiently stably supported by this grounding part 27a at the time of dissolving, assembling and transportation.

[0061] This can eliminate the need for the stand that has been conventionally used to support the work attachment 24 or can replace such a stand with a complementary simple or small one. Thus, by eliminating or reducing bulkiness caused by the stand, the entire height H2 of the work attachment 24 can be reduced and operability and safety of the dissolving and assembling operations and transportability can be improved. Furthermore, this is advantageous in terms of cost and handling of the work attachment 24.

[0062] Further, in the above embodiment, the working device cylinder 32 and the link mechanism 33 are arranged at the upper surface side of the arm 27 in the folded state. Thus, a possibility of breakage of the working device cylinder mechanism caused by contact with the ground surface can be reduced, and the leading end part of the arm 27 can be brought closer to the ground surface, i.e. the entire arm 27 can be held substantially horizontal. Thus, the grounding part 27a can be formed over the long range and the arm leading end side space S can be made sufficiently large to install the working device cylinder mechanism.

[0063] In the above embodiment, the grounding part 27a is formed substantially over the entire length of the arm. Thus, effects such as an improvement in stability of the work attachment 24 supported in the folded state and a reduction in the entire height H2 of the work attachment 24 are further enhanced.

[0064] In the above embodiment, the base end side inclined surface 27g and the leading end side inclined surface 27h are provided at the opposite end parts of the arm 27. Thus, weight saving and a cost reduction can be achieved by reducing the necessary material at the opposite end parts of the arm 27 while securing necessary strength by a large cross-sectional area of the arm 27 in the range where the grounding part 27a is provided.

[0065] In the above embodiment, the upper surface (inclined surface 27b) at the leading end side of the arm main body 27d is inclined downward toward the leading end of the arm main body 27d. Thus, the arm leading end side space S1 is made even larger and the working device cylinder mechanism is more easily installed.

[0066] In the above embodiment, the upper surface of the arm main body 27d is formed to such a convex shape that the intermediate part is highest in a side view, so that the cross-sectional area of the arm main body 27d is maximized at the intermediate point C in the length direction of the arm 27. Thus, strength can be maintained by securing the cross-sectional area of the arm main body 27d at the intermediate point C.

[0067] Further, in the above embodiment, the arm base end side space S2 formed between the part of the arm 27 closer to the base end side than the intermediate point C and the boom 25 can be made larger. Thus, the inter-boom cylinder 30 and the arm cylinders 31 can be effortlessly installed.

[0068] In the above embodiment, the inclined surfaces 27b, 27c are respectively formed on the leading end side and the base end side of the intermediate point C. Thus, the cross-sectional area of the arm main body 27d can be gradually changed from the intermediate point C toward the leading end side and the base end side. Therefore, as compared with the case where the entire upper surface of the arm main body 27d is inclined downward toward the leading end, the cross-sectional area of the arm main body 27d can be effectively secured at the intermediate point C. Further, as compared with the case where the cross-sectional area of the arm main body 27d is suddenly changed from the intermediate point C to-

ward the leading end side and the base end side, local concentration of a stress on the arm main body 27d can be suppressed.

[0069] In the above embodiment, the arm cylinder attachment part 27e is provided on the part of the arm main body 27d closer to the base end side than the intermediate point C, and the working device cylinder attachment part 27f is provided on the part of the arm main body 27d closer to the leading end side than the intermediate point C. Thus, the arm leading end side space S1 and the arm base end side space S2 secured to be large by forming the arm main body 27d to have the convex upper surface can be effectively utilized as spaces for mounting the inter-boom cylinder 30, the arm cylinders 31 and the working device cylinder 32.

[0070] In the above embodiment, the both cylinders 30, 31 are so attached to the inter-boom 26 that the point of attachment A is located below the points of attachment B and the both points of attachment A, B are shifted from each other in the width direction of the inter-boom 26. Thus, as compared with the conventional technology in which the both cylinders 30, 31 are arranged in the same phase (at the same position in the attachment width direction when viewed from above in the folded state), the space taken up by the both cylinders 30, 31 in the height direction can be reduced while equivalent moment lengths are secured.

[0071] This can shorten the distance between the boom 25 and the arm 27 (necessary length of the inter-boom 26) in the folded state. Thus, the entire height H2 of the work attachment 24 can be further reduced, whereby safety and operability of the dissolving and assembling operations and transportability of the work attachment 24 can be further improved.

[0072] Here, if the inclined surfaces 27b, 27c are respectively provided on the leading end side and the base end side of the arm 27 with respect to the intermediate point C as described above, the inter-boom cylinder 30 and the arm cylinder 31 can be easily installed by securing the arm base end side space S2 while suppressing the entire height H2 of the work attachment 24 to a low level.

[0073] Note that although the grounding part 27a is formed on the lower surface of the arm main body 27d other than on the inclined surfaces 27g, 27h in the above embodiment, it only has to be formed at least over a length range of the arm main body 27d from the arm cylinder attachment part 27e to the working device cylinder attachment part 27f. By doing so, the grounding part 27a can be formed over a sufficient range, utilizing a space below the arm main body 27d secured by arranging the inter-boom 30, the arm cylinders 31 and the working device cylinder 32 above the arm main body 27d in the folded state.

Other Embodiments

[0074] (1) Although the grounding part 27a is desirably formed substantially over the entire length of the arm main body 27d as in the above embodiment in terms of stability in supporting the work attachment 24, there is no limitation to this. For example, the grounding part 27a may be formed over a shorter range than in the above embodiment if a length range including a part right below the center of gravity of the work attachment 24 in the folded state and sufficient to support the entire work attachment 24 can be secured.

[0075] (2) Brackets for grounding may be provided at a plurality of positions spaced apart in the length direction of the arm 27 on the lower surface side of the arm main body 27d in the folded state. By doing so, the arm 27 can be stably supported even if the grounding surface is slightly uneven and damage and removal of paint caused by directly grounding the lower surface of the arm main body 27d can be prevented.

[0076] (3) Although the point of attachment A of the inter-boom cylinder 30 is set to be lower than the points of attachment B of the arm cylinders 31 and the both points of attachments A, B are shifted from each other in the width direction to reduce the entire height H2 of the work attachment 24 in the folded state in the above embodiment, there is no limitation to this. Specifically, the both cylinders 30, 31 may be arranged one above the other in the same phase as in the known technology shown in FIGS. 5 to 7.

[0077] Even in this case, the work attachment 24 in the folded state can be stably supported by omitting the stand or using a simple or small stand. Thus, the basic effect of reducing the entire height H2 of the work attachment 24 by enabling the omission or simplification of the stand and arranging the entire arm 27 substantially horizontally is ensured.

[0078] (4) The present invention can also be applied to an excavation machine mounted with a bucket as a working device at the leading end of an attachment, a breaking machine mounted with a breaker as a working device and the like without being limited to the dismantling machine.

[0079] Note that the specific embodiment described above mainly includes inventions having the following configurations.

[0080] The present invention provides a work attachment attachable to a base machine of a operating machine, the work attachment including a boom to be attached to the base machine to be able to be raised and lowered, an inter-boom attached to the leading end of the boom rotatably about a horizontal axis, an arm with a base end part attached to the leading end of the inter-boom rotatably about a horizontal axis, a working device attached to a leading end part of the arm, a boom cylinder for raising and lowering the boom, an inter-boom cylinder provided between the boom and the inter-boom for rotating the inter-boom, an arm cylinder provided between the inter-boom and the arm for rotating the arm, a working device cylinder for rotating the working device, and a link mechanism provided between the working device and

the working device cylinder, wherein the boom, the inter-boom and the arm are folded in three by contracting the inter-boom cylinder and the arm cylinder most and foldable into a state where the boom is located at an upper side of the inter-boom and the arm is located at a lower side of the inter-boom by laying down the boom to ground the arm; and the working device cylinder and the link mechanism are provided at an upper surface side of the leading end part of the arm in the folded state and the inter-boom cylinder and the arm cylinder are provided at an upper surface side of a base end part of the arm in the folded state so that a grounding part groundable over a length range sufficient to support the entire work attachment in the folded state is formed on the arm.

[0081] In the present invention, the grounding part groundable over the length range sufficient to support the entire work attachment in the folded state is provided on the arm. Thus, the entire work attachment can be sufficiently stably supported by this grounding part at the time of dissolving, assembling and transportation.

[0082] This enables the stand conventionally used to support the work attachment to be omitted or replaced with a complementary simple or small one. Thus, the attachment entire height can be reduced by eliminating or reducing bulkiness caused by the stand, and operability and safety of dissolving and assembling operations and transportability can be improved. Further, the above is advantageous in cost and handling of the work attachment.

[0083] Further, in the present invention, the working device cylinder and the link mechanism (hereinafter, the both in combination may be referred to as a working device cylinder mechanism) are arranged at the upper surface side of the arm. Thus, it is possible to reduce a possibility of breakage of the working device cylinder mechanism due to contact with the ground surface and bring the leading end part of the arm closer to the ground surface, i.e. hold the entire arm substantially horizontally.

[0084] Thus, the grounding part can be formed over a long range and the space at the upper surface side of the arm can be made sufficiently large to install the working device cylinder mechanism.

[0085] Specifically, the working device cylinder and the link mechanism can be arranged between the leading end part of the arm and the boom in the folded state.

[0086] In the above work attachment, the grounding part is preferably a flat surface formed on the arm.

[0087] By forming the grounding part into a flat surface in this way, the work attachment can be more stably supported.

[0088] In the above work attachment, the grounding part is preferably formed substantially over the entire length of the arm.

[0089] In this aspect, the grounding part is formed substantially over the entire length of the arm. Thus, effects such as an improvement in stability of the work attachment supported in the folded state and a reduction in the entire height of the work attachment are further enhanced.

[0090] In the above work attachment, it is preferable that the arm includes an arm cylinder attachment part to which one end of the arm cylinder is attached and a working device cylinder attachment part to which one end of the working device cylinder is attached, and the grounding part is formed at least over a length range of the arm from the arm cylinder attachment part to the working device cylinder attachment part.

[0091] In the above aspect, the grounding part is formed at least over the length range of the arm from the arm cylinder attachment part to the working device cylinder attachment part. Thus, the grounding part can be formed over a sufficient range, utilizing a space below the arm secured by arranging the arm cylinder and the working device cylinder above the arm in the folded state.

[0092] In the above work attachment, the upper surface of a leading end side of the arm in the folded state is preferably an inclined surface inclined downward toward the leading end of the arm.

[0093] In this aspect, the upper surface of the leading end side of the arm is inclined downward toward the leading end of the arm. Thus, the arm leading end side space is made even larger and the working device cylinder mechanism is more easily installed.

[0094] In the above work attachment, the upper surface of the arm in the folded state is formed to have such a convex shape that an intermediate point in a length direction of the arm is highest in a side view so that a cross-sectional area of the arm is maximized at the intermediate point.

[0095] In this aspect, the upper surface of the arm is formed to have such a convex shape that the intermediate point in the length direction of the arm is highest in the side view so that the cross-sectional area of the arm is maximized at the intermediate point. Thus, strength can be maintained by securing the cross-sectional area of the arm at the intermediate point.

[0096] Further, in the above aspect, a space formed between a part of the arm closer to the base end than the intermediate point and the boom (hereinafter, referred to as an arm base end side space) can be made larger. Thus, the inter-boom cylinder and the arm cylinder can be effortlessly installed.

[0097] In the case of inclining the upper surface of the arm downward toward the leading end, if the entire upper surface of the arm is inclined downward toward the leading end, it may lead to a reduction in strength due to an insufficient cross-sectional area of the arm.

[0098] Accordingly, in the work attachment, it is preferable that a part of the upper surface of the arm in the folded state closer to the leading end side than the intermediate point is an inclined surface inclined downward toward the leading end of the arm and a part of the upper surface of the arm in the folded state closer to the base end side than the intermediate point is an inclined surface inclined downward toward the base end of the arm.

[0099] In this aspect, the inclined surfaces are respec-

tively formed at the leading end side and the base end side of the intermediate point. Thus, the cross-sectional area of the arm can be gradually changed from the intermediate point toward the leading end side and the base end side. Therefore, as compared with the case where the entire upper surface of the arm is inclined downward toward the leading end, the cross-sectional area of the arm can be effectively secured at the intermediate point. Further, as compared with the case where the cross-sectional area of the arm is suddenly changed from the intermediate point toward the leading end side and the base end side, local concentration of a stress on the arm can be suppressed.

[0100] In the above work attachment, the arm preferably includes an arm main body having an upper surface formed to have such a convex shape that an intermediate point in a length direction of the arm is highest in a side view in the folded state so that a cross-sectional area of the arm is maximized at the intermediate point, an arm cylinder attachment part which is provided on a side of the upper surface of the arm main body closer to the base end than the intermediate point and to which one end of the arm cylinder is attached, and a working device cylinder attachment part which is provided on a side of the upper surface of the arm main body closer to the leading end than the intermediate point and to which one end of the working device cylinder is attached.

[0101] In this aspect, the arm cylinder attachment part is provided on the side of the arm main body closer to the base end than the intermediate point and the working device cylinder attachment part is provided on the side of the arm main body closer to the leading end than the intermediate point. Thus, an arm base end side space and an arm leading end side space secured to be large by forming the upper surface of the arm to have the convex shape can be effectively utilized as spaces for mounting the arm cylinder and the working device cylinder.

[0102] In the above work attachment, it is preferable that the inter-boom cylinder and the arm cylinder are so attached to the inter-boom that, in the folded state, a first point of attachment of the inter-boom cylinder to the inter-boom is located below a second point of attachment of the arm cylinder to the inter-boom and the first and second points of attachment are shifted from each other in a width direction of the inter-boom.

[0103] In the above aspect, the both cylinders are so attached to the inter-boom that the first point of attachment is located below the second point of attachment and the both points of attachment are shifted from each other in the width direction of the inter-boom. Thus, as compared with the conventional technology in which the both cylinders are arranged in the same phase (at the same position in the attachment width direction when viewed from above in the folded state), a space taken up by the both cylinders in a height direction can be reduced while equivalent moment lengths are secured.

[0104] This can shorten a distance between the boom and the arm (necessary length of the inter-boom) in the folded state. Thus, the entire height of the work attachment can be further reduced, whereby safety and operability of dissolving and assembling operations and transportability of the work attachment can be further improved.

[0105] Here, if inclined surfaces are respectively provided on the leading end side and the base end side of the arm with respect to the intermediate point, the inter-boom cylinder and the arm cylinder can be easily installed by securing the arm base end side space while suppressing the entire height of the work attachment to a low level.

[0106] Further, the present invention provides a operating machine including a base machine and the work attachment attached to the base machine to be able to be raised and lowered.

Industrial Applicability

[0107] According to the present invention, it is possible to provide a work attachment capable of being stably supported in a folded state and preventing breakage of a working device cylinder and a link mechanism and a operating machine provided with this.

List of Reference Signs

[0108]

A	point of attachment (first point of attachment)
B	point of attachment (second point of attachment)
C	intermediate point
H2	attachment entire height
J1 to J5	horizontal shaft
S1	arm leading end side space
S2	arm base end side space
23	base machine
24	work attachment
25	boom
25b2	inter-boom cylinder attachment part
26	inter-boom
27	arm
27a	grounding part
27b, 27c	inclined surface
27d	arm main body
27e	arm cylinder attachment part
27f	working device cylinder attachment part
27g	base end side inclined surface
27h	leading end side inclined surface
28	working device
29	boom cylinder
30	inter-boom cylinder
31	arm cylinder
32	working device cylinder
33	link mechanism
34	transporter

Claims

1. A work attachment attachable to a base machine of a operating machine, comprising:

   a boom to be attached to the base machine to be able to be raised and lowered;
   an inter-boom attached to the leading end of the boom rotatably about a horizontal axis;
   an arm with a base end part attached to the leading end of the inter-boom rotatably about a horizontal axis;
   a working device attached to a leading end part of the arm;
   a boom cylinder for raising and lowering the boom;
   an inter-boom cylinder provided between the boom and the inter-boom for rotating the inter-boom;
   an arm cylinder provided between the inter-boom and the arm for rotating the arm;
   a working device cylinder for rotating the working device; and
   a link mechanism provided between the working device and the working device cylinder;
   wherein:

      the boom, the inter-boom and the arm are folded in three by contracting the inter-boom cylinder and the arm cylinder most and foldable into a state where the boom is located at an upper side of the inter-boom and the arm is located at a lower side of the inter-boom by laying down the boom to ground the arm; and
      the working device cylinder and the link mechanism are provided at an upper surface side of the leading end part of the arm in the folded state and the inter-boom cylinder and the arm cylinder are provided at an upper surface side of a base end part of the arm in the folded state so that a grounding part groundable over a length range sufficient to support the entire work attachment in the folded state is formed on the arm.

2. A work attachment according to claim 1, wherein the working device cylinder and the link mechanism are arranged between the leading end part of the arm and the boom in the folded state.

3. A work attachment according to claim 1 or 2, wherein the grounding part is a flat surface formed on the arm.

4. A work attachment according to any one of claims 1 to 3, wherein the grounding part is formed substantially over the entire length of the arm.

5. A work attachment according to any one of claims 1 to 4, wherein:

   the arm includes an arm cylinder attachment part to which one end of the arm cylinder is attached and a working device cylinder attachment part to which one end of the working device cylinder is attached; and
   the grounding part is formed at least over a length range of the arm from the arm cylinder attachment part to the working device cylinder attachment part.

6. A work attachment according to any one of claims 1 to 5, wherein the upper surface of a leading end side of the arm in the folded state is an inclined surface inclined downward toward the leading end of the arm.

7. A work attachment according to claim 6, wherein the upper surface of the arm in the folded state is formed to have such a convex shape that an intermediate point in a length direction of the arm is highest in a side view so that a cross-sectional area of the arm is maximized at the intermediate point.

8. A work attachment according to claim 7, wherein:

   a part of the upper surface of the arm in the folded state closer to a leading end side than the intermediate point is an inclined surface inclined downward toward the leading end of the arm; and
   a part of the upper surface of the arm in the folded state closer to a base end side than the intermediate point is an inclined surface inclined downward toward the base end of the arm.

9. A work attachment according to any one of claims 1 to 5, wherein the arm includes an arm main body having an upper surface formed to have such a convex shape that an intermediate point in a length direction of the arm is highest in a side view in the folded state so that a cross-sectional area of the arm is maximized at the intermediate point, an arm cylinder attachment part which is provided on a side of the upper surface of the arm main body closer to the base end than the intermediate point and to which one end of the arm cylinder is attached, and a working device cylinder attachment part which is provided on a side of the upper surface of the arm main body closer to the leading end than the intermediate point and to which one end of the working device cylinder is attached.

10. A work attachment according to any one of claims 1 to 9, wherein the inter-boom cylinder and the arm cylinder are so attached to the inter-boom that, in

the folded state, a first point of attachment of the inter-boom cylinder to the inter-boom is located below a second point of attachment of the arm cylinder to the inter-boom and the first and second points of attachment are shifted from each other in a width direction of the inter-boom.

11. A operating machine, comprising:

a base machine; and
a work attachment according to any one of claims 1 to 10 attached to the base machine to be able to be raised and lowered.

FIG. 1

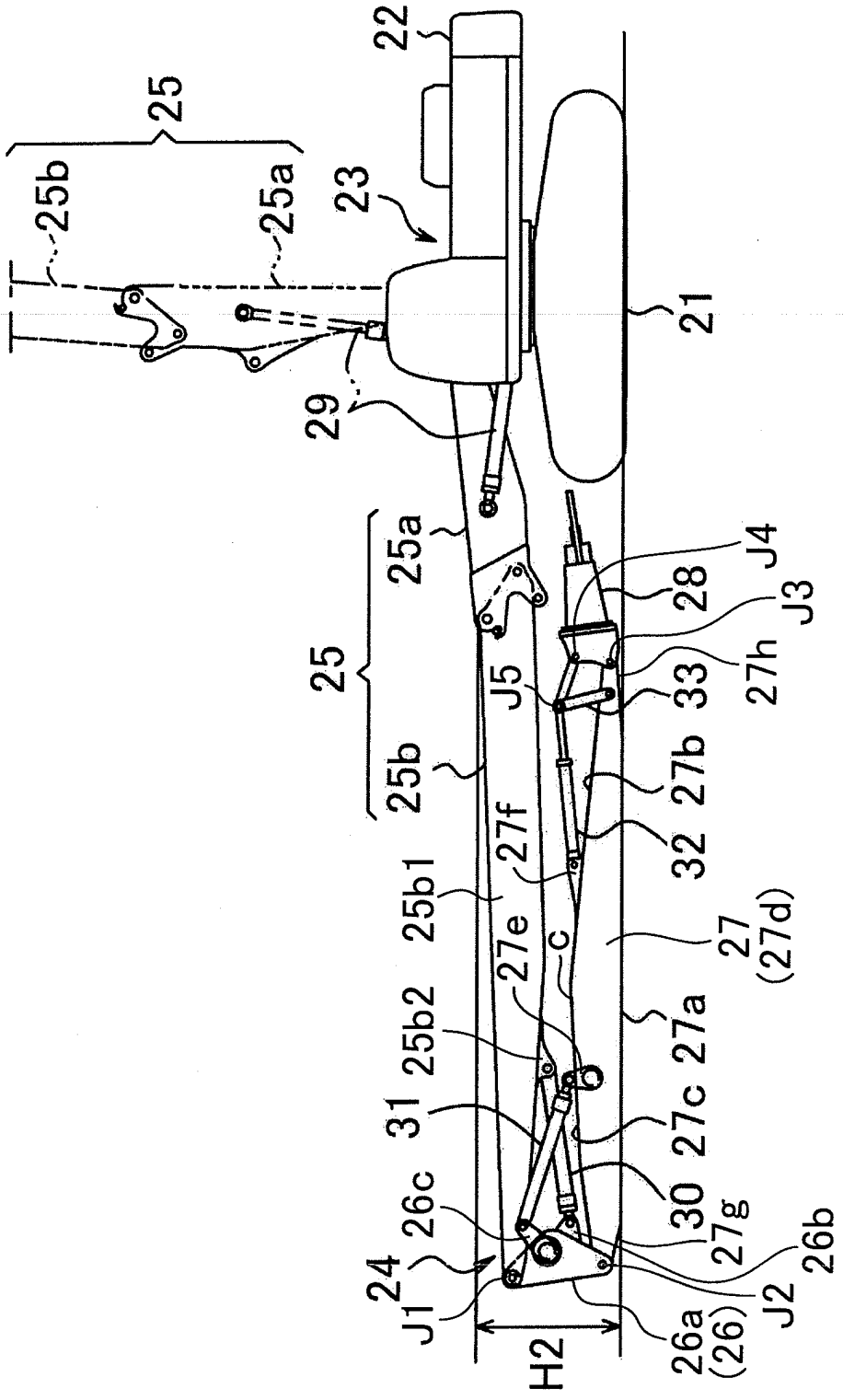

22
25
25b
25a
23
21
29
25a
J4
28
J3
25
J5
27h
33
25b
27b
27f
32
25b1
27e
c
27
(27d)
25b2
27a
31
27c
26c
30
27g
24
J1
J2
26b
26a
(26)
H2

FIG. 2

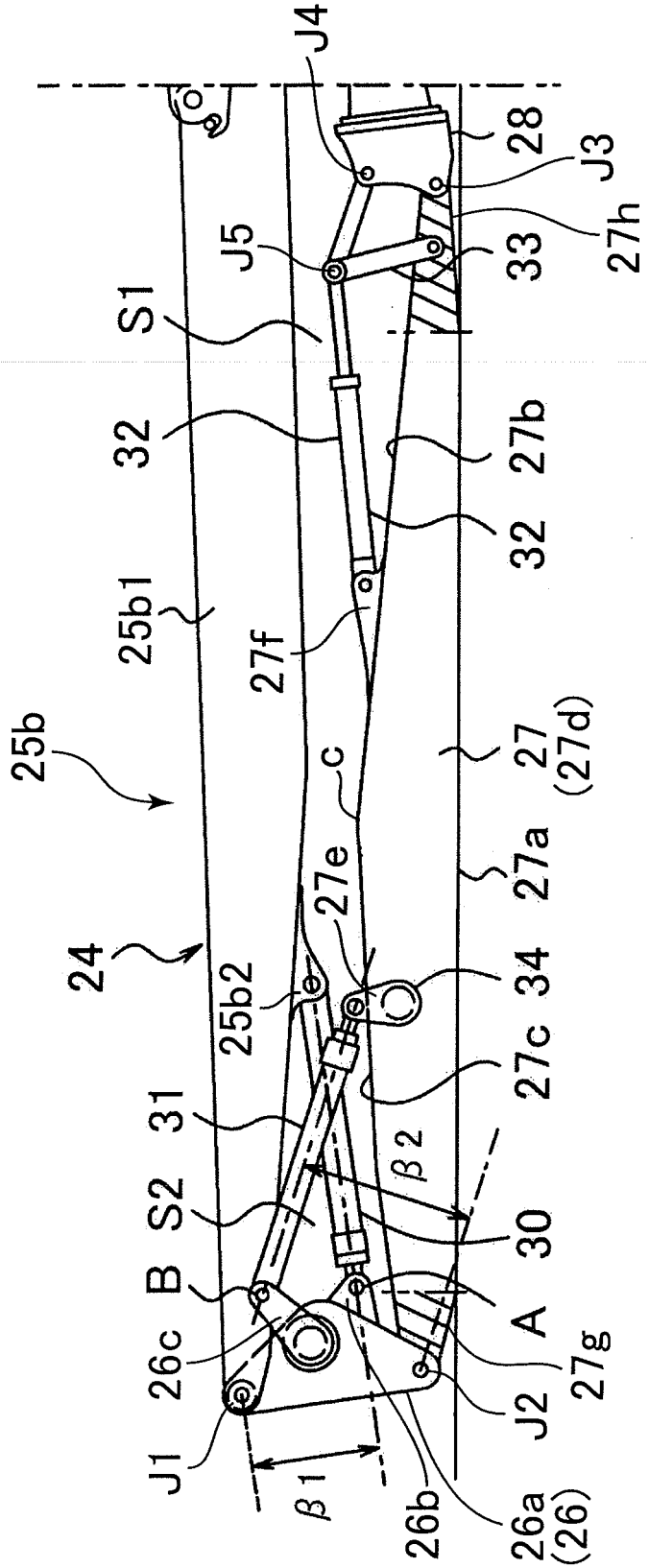

J4
28
J3
27h
J5
33
S1
32
27b
32
25b1
27f
25b
27
(27d)
c
27e
27a
24
25b2
34
27c
31
β2
S2
30
B
A
26c
27g
J2
J1
β1
26b
26a
(26)

FIG. 3

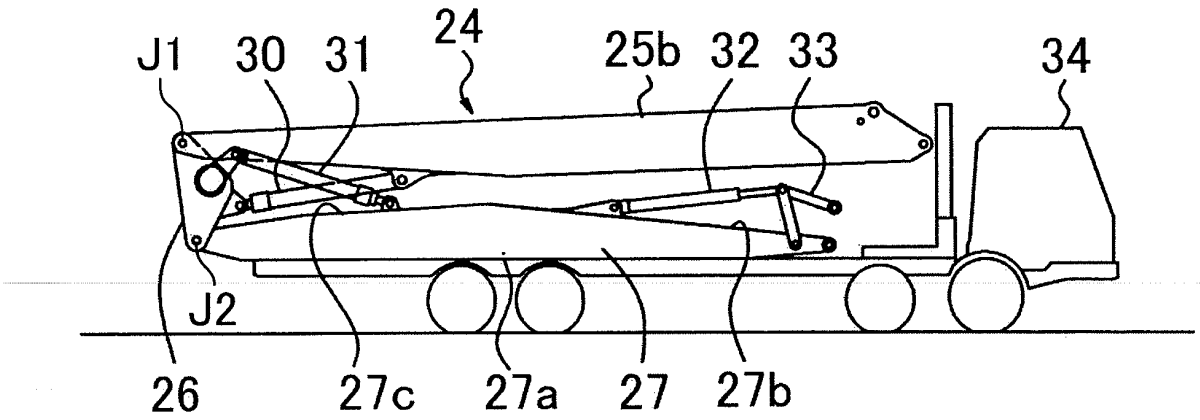

J1
30
31
24
25b
32
33
34
J2
26
27c
27a
27
27b

FIG. 4

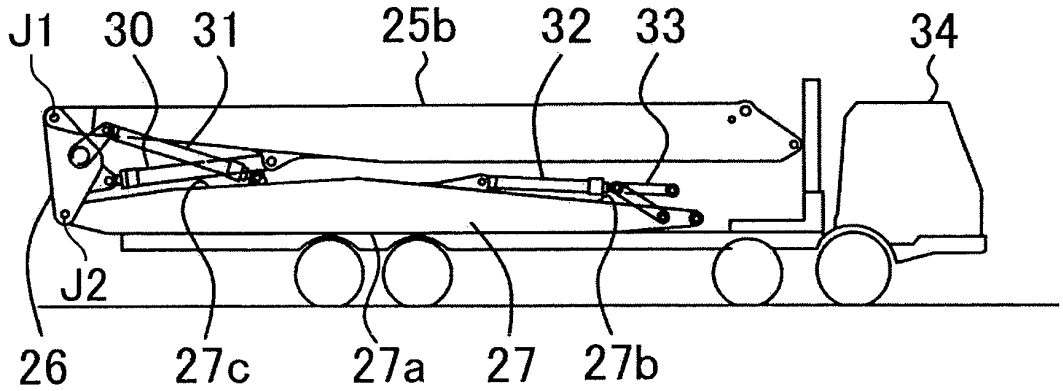

J1
30
31
25b
32
33
34
J2
26
27c
27a
27
27b

FIG. 5

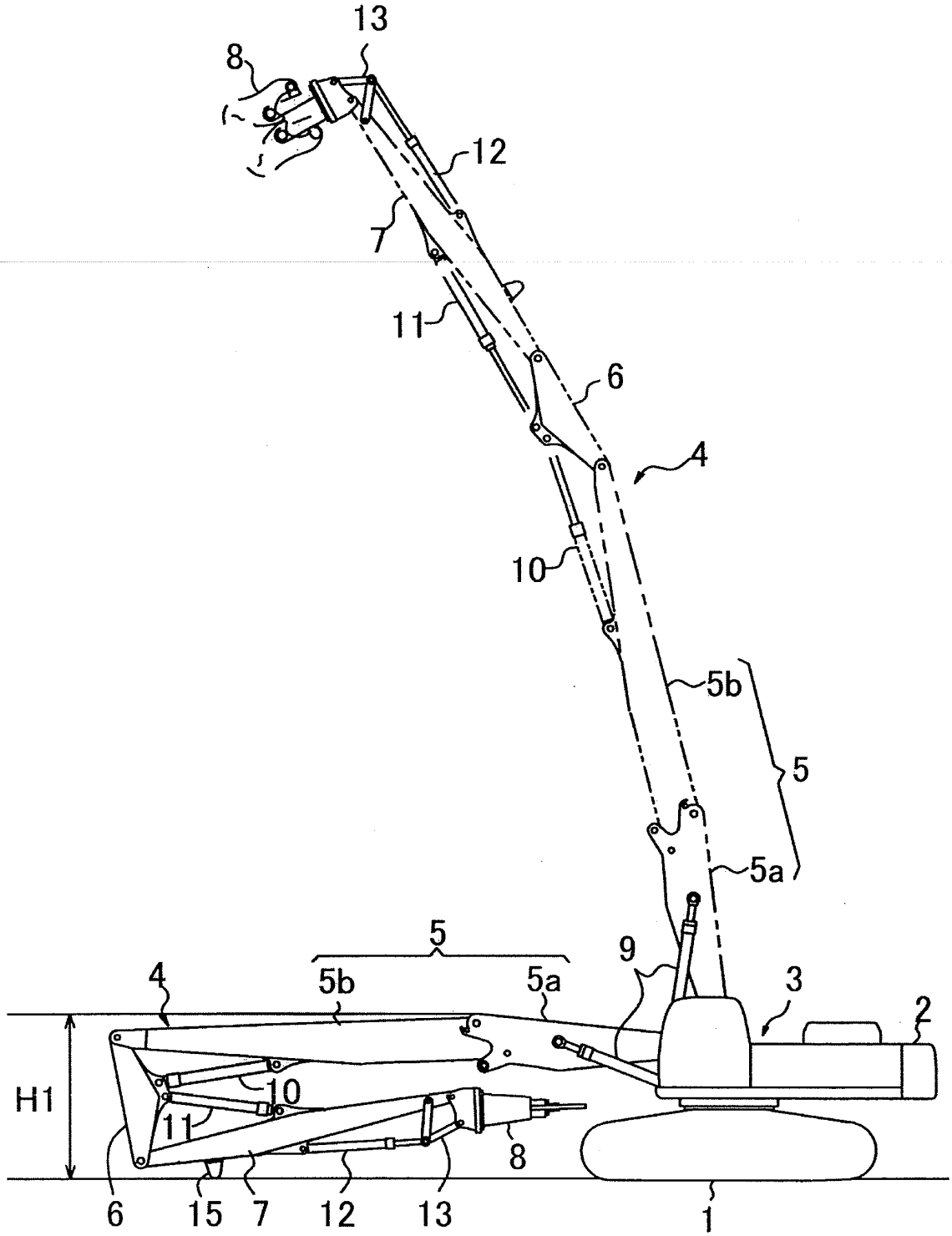


FIG. 6

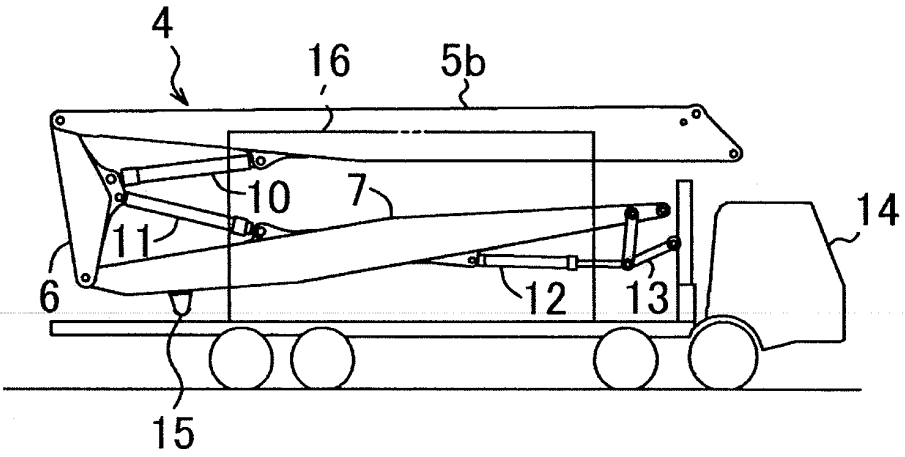
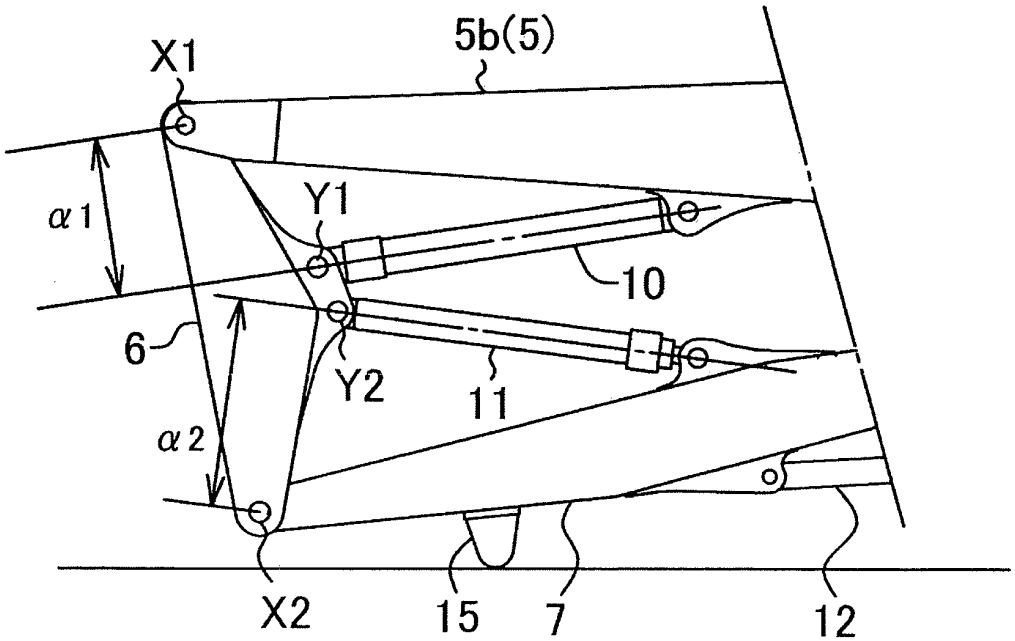


FIG. 7



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2011/002814

A. CLASSIFICATION OF SUBJECT MATTER
E02F3/38(2006.01)i

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
E02F3/38

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2011
Kokai Jitsuyo Shinan Koho 1971-2011 Toroku Jitsuyo Shinan Koho 1994-2011

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 2005-105521 A (Kobelco Construction Machinery Co., Ltd.), 21 April 2005 (21.04.2005), entire text; all drawings (Family: none)	1-11
A	JP 2005-105520 A (Kobelco Construction Machinery Co., Ltd.), 21 April 2005 (21.04.2005), entire text; all drawings (Family: none)	1-11
A	JP 11-193542 A (Hitachi Construction Machinery Co., Ltd.), 21 July 1999 (21.07.1999), entire text; all drawings (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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"P" document published prior to the international filing date but later than the priority date claimed
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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
10 August, 2011 (10.08.11)	23 August, 2011 (23.08.11)
Name and mailing address of the ISA/ Japanese Patent Office Facsimile No.	Authorized officer Telephone No.

Form PCT/ISA/210 (second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2011/002814

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 11-193543 A (Hitachi Construction Machinery Co., Ltd.), 21 July 1999 (21.07.1999), entire text; all drawings (Family: none)	1-11
A	CD-ROM of the specification and drawings annexed to the request of Japanese Utility Model Application No. 14053/1992(Laid-open No. 67652/1993) (Yutani Heavy Industries, Ltd.), 07 September 1993 (07.09.1993), entire text; all drawings (Family: none)	1-11
A	JP 8-226236 A (Tadano Inc.), 03 September 1996 (03.09.1996), entire text; all drawings (Family: none)	1-11

Form PCT/ISA/210 (continuation of second sheet) (July 2009)

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP H11193543 B **[0024]**
- JP H567652 B **[0024]**
- JP H8226236 B **[0024]**