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(54) **FRONT LOADER**

(57) Provided is a front loader capable of improving visibility. Included are a boom 30 with an internal space S30 formed, and a side frame 20 rockably supporting the boom 30 and formed with a first opening 23 through which a tube portion 90 forming a flow path of hydraulic oil can

be inserted, in which the first opening 23 is formed on one side surface of the side frame 20 in a left-right direction, and a second opening 24 through which the tube portion 90 can be inserted is formed on a surface of the side frame 20 facing the boom 30.

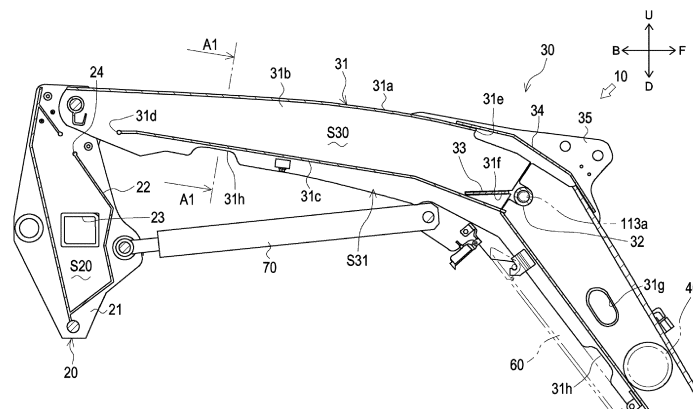


Fig. 8

Description

Technical field

[0001] The present invention relates to a technique of a front loader capable of operating a working tool coupled to a boom with hydraulic oil.

Background art

[0002] Conventionally, a technique of a front loader capable of operating a working tool coupled to a boom with hydraulic oil is known. For example, Patent Literature 1 discloses such a technique.

[0003] The front loader described in Patent Literature 1 includes a sub frame (side frame), a lift arm (boom) rockably supported by the sub frame, a hydraulic hose that guides hydraulic oil used in various hydraulic cylinders, and the like.

[0004] The hydraulic hose described in Patent Literature 1 is provided along one of left and right side surfaces of the sub frame and the lift arm in order to guide hydraulic oil to a hydraulic cylinder provided at a front portion of the lift arm. However, in this case, since the hydraulic hose is exposed to a side of the sub frame and the lift arm, there is a possibility that the hydraulic hose blocks a field of view of an operator and the visibility is deteriorated.

Citation list

Patent literature

[0005] Patent Literature 1: JP H11-241361 A

Summary of invention

Technical problem

[0006] One aspect of the present disclosure has been made in view of the above circumstances, and an object of the present disclosure is to provide a front loader capable of improving visibility.

Solution to problem

[0007] The problem to be solved by one aspect of the present disclosure is as described above, and means for solving the problem will be described below.

[0008] That is, one aspect of the present disclosure includes: a boom; and a side frame rockably supporting the boom and formed with a first opening through which a tube portion forming a flow path for hydraulic oil can be inserted.

[0009] According to one aspect of the present disclosure, since the tube portion can be disposed in the side frame, it is possible to suppress the tube portion from blocking the field of view of the operator.

[0010] In one aspect of the present disclosure, the first

opening is formed on one side surface of the side frame in a left-right direction.

[0011] According to one aspect of the present disclosure, the tube portion can be introduced into the side frame from the left and right outer sides of the side frame.

[0012] In one aspect of the present disclosure, a second opening through which the tube portion can be inserted is formed on a surface of the side frame facing the boom.

[0013] According to one aspect of the present disclosure, the tube portion can be led out from the inside of the side frame toward the boom.

[0014] In one aspect of the present disclosure, the boom is formed with: a third opening that is formed on a surface facing the side frame and through which the tube portion can be inserted; and a fourth opening different from the third opening.

[0015] According to one aspect of the present disclosure, it is possible to effectively suppress the tube portion from blocking the field of view of the operator, and thus, it is possible to effectively improve the visibility.

[0016] An aspect of the present disclosure further includes a coupling frame that couples the boom on a right side and the boom on a left side, in which the tube portion is led out from an inside of the boom to the coupling frame through the fourth opening, branched on the coupling frame, and connected to left and right boom cylinders and left and right bucket cylinders.

[0017] According to one aspect of the present disclosure, since branch portions of the tube portion can be gathered on the coupling frame, assembling and maintenance of the tube portion can be easily performed.

[0018] An aspect of the present disclosure further includes a first cover that covers the tube portion on the coupling frame.

[0019] According to one aspect of the present disclosure, the tube portion on the coupling frame can be hidden by the first cover, and the aesthetic appearance can be improved.

[0020] In one aspect of the present disclosure, an opening is formed in the first cover.

[0021] According to one aspect of the present disclosure, hydraulic pressure can be utilized through the opening.

[0022] An aspect of the present disclosure further includes a second cover that covers the fourth opening.

[0023] According to one aspect of the present disclosure, the fourth opening and the tube portion led out from the fourth opening can be hidden by the second cover, and the aesthetic appearance can be improved.

[0024] In one aspect of the present disclosure, an attitude maintenance mechanism can be attached to the boom, the attitude maintenance mechanism being configured to maintain an attitude of a working tool coupled to the boom by operating according to rocking of the boom, and the boom includes: an attachment portion at least a part of which is disposed inside the boom and that attaches the attitude maintenance me-

chanism; and a guide portion at least a part of which is disposed inside the boom and that guides the tube portion so as to avoid the attachment portion.

[0025] According to one aspect of the present disclosure, the tube portion is easily disposed in the boom by guiding the tube portion by the guide portion.

Advantageous effects of invention

[0026] According to one aspect of the present disclosure, visibility can be improved.

Brief description of drawings

[0027]

- Fig. 1 is a side view illustrating an overall configuration of a tractor including a front loader according to an embodiment of the present invention.
- Fig. 2 is a perspective view illustrating the front loader.
- Fig. 3 is a left side view of the same.
- Fig. 4 is a right side cross-sectional view of the same.
- Fig. 5 is a front view illustrating a coupling frame and a tube portion.
- Fig. 6(a) is a left side view illustrating a side frame. Fig. 6(b) is a left side view illustrating the inside of the side frame.
- Fig. 7 is an exploded perspective view of a boom.
- Fig. 8 is a right side cross-sectional view illustrating the side frame and the boom.
- Fig. 9 is a cross-sectional view taken along line A1-A1.
- Fig. 10 is a right side cross-sectional view of the front loader schematically illustrating the tube portion.
- Fig. 11(a) is a front cross-sectional view schematically illustrating a first tube portion on the coupling frame. Fig. 11(b) is a front cross-sectional view schematically illustrating a second tube portion on the coupling frame.
- Fig. 12 is a cross-sectional view taken along line A2-A2.
- Fig. 13 is a partial rear cross-sectional view schematically illustrating the first tube portion and a third tube portion.
- Fig. 14 is a right side cross-sectional view of the front loader schematically illustrating the third tube portion.
- Fig. 15(a) is a front view illustrating a cover. Fig. 15(b) is a cross-sectional view taken along line A3-A3.

Description of embodiment

[0028] In the following description, directions indicated

by arrows U, D, F, B, L, and R in the drawings are defined as an upward direction, a downward direction, a forward direction, a backward direction, a left direction, and a right direction, respectively.

[0029] Hereinafter, the entire configuration of a tractor 1 including a front loader 10 according to one embodiment of the present invention will be described.

[0030] As illustrated in Fig. 1, the tractor 1 mainly includes a machine body frame 2, an engine 3, a transmission case 4, front wheels 5, rear wheels 6, a bonnet 7, a cabin 8, a steering wheel 9, and a front loader 10.

[0031] The machine body frame 2 is a frame-shaped member formed by appropriately combining a plurality of panel members. The machine body frame 2 is formed in a substantially rectangular shape in plan view. The machine body frame 2 is disposed with its longitudinal direction oriented in a front-rear direction. The engine 3 is fixed to a rear portion of the machine body frame 2. The transmission case 4 is fixed to a rear portion of the engine 3. A front portion of the machine body frame 2 is supported by the pair of left and right front wheels 5 through a front axle mechanism (not illustrated). A rear portion of the transmission case 4 is supported by the pair of left and right rear wheels 6 through a rear axle mechanism (not illustrated). The engine 3 is covered with the bonnet 7.

[0032] Power of the engine 3 can be transmitted to the front wheels 5 through the front axle mechanism and can be transmitted to the rear wheels 6 through the rear axle mechanism after being shifted by a transmission device (not illustrated) stored in the transmission case 4. The front wheels 5 and the rear wheels 6 are rotationally driven by the power of the engine 3, and the tractor 1 can travel.

[0033] The cabin 8 is provided behind the engine 3. Inside the cabin 8, a living space on which an operator boards is formed. In the living space, the steering wheel 9 for adjusting a turning angle of the front wheels 5, various operation tools, a seat on which the operator sits, and the like are disposed.

[0034] The front loader 10 is mounted to a front portion of the tractor 1. Hereinafter, the configuration of the front loader 10 will be briefly described with reference to Figs. 2 to 5.

[0035] As illustrated in Figs. 2 and 3, the front loader 10 mainly includes a side frame 20, a boom 30, a coupling frame 40, a bucket 50, a stand 60, a boom cylinder 70, a bucket cylinder 80, a tube portion 90, a cover 100, an attitude maintenance mechanism 110, and the like.

[0036] The side frame 20 rockably supports the boom 30 described later. The side frame 20 is detachably attached to a vehicle body (the machine body frame 2 and the transmission case 4) of the tractor 1. The side frames 20 are provided on the left and right of the vehicle body. A detailed configuration of the side frames 20 will be described later.

[0037] The booms 30 are rockably supported by the left and right side frames 20. The boom 30 is disposed so as

to extend forward and downward from an upper portion of the side frame 20. A detailed configuration of the boom 30 will be described later.

[0038] The coupling frame 40 couples the left and right booms 30. The coupling frame 40 is formed in a substantially cylindrical shape with its axis oriented to the left and right. The coupling frame 40 is provided across the left and right booms 30.

[0039] The bucket 50 is formed to open forward. The bucket 50 is rockably coupled to the front end of the boom 30.

[0040] The stand 60 allows the front loader 10 detached from the vehicle body of the tractor 1 to stand by itself. One stand 60 (a pair of right and left stands) is provided at each lower front portion of the right and left booms 30. The stand 60 can be switched between a storage position where the stand is stored in the boom 30 and a support position where the stand is grounded to support the weight of the front loader 10. Note that the stand 60 switched to the storage position is illustrated in the drawings.

[0041] The boom cylinder 70 rocks the boom 30 with respect to the side frame 20. The boom cylinder 70 is rockably coupled to the side frame 20 and the boom 30. A pair of the left and right boom cylinders 70 is provided.

[0042] The bucket cylinder 80 rocks the bucket 50 with respect to the boom 30. The bucket cylinder 80 is rockably coupled to the boom 30 and the bucket 50. The bucket cylinder 80 of the present embodiment is rockably coupled to the boom 30 through a second link member 113 of the attitude maintenance mechanism 110 described later. A pair of the left and right bucket cylinders 80 is provided.

[0043] The tube portion 90 illustrated in Figs. 3 to 5 is for forming a flow path of hydraulic oil. The tube portion 90 connects a hydraulic pump (not illustrated) driven by the engine 3, the boom cylinder 70, and the like. The cover 100 is a member that covers the tube portion 90 (see Fig. 2). Detailed configurations of the tube portion 90 and the cover 100 will be described later.

[0044] The attitude maintenance mechanism 110 illustrated in Figs. 2 and 3 operates according to rocking of the boom 30 to maintain an attitude of the bucket 50 (working tool). A pair of the left and right attitude maintenance mechanisms 110 is provided. Since the left and right attitude maintenance mechanisms 110 have substantially the same configuration, the configuration of the attitude maintenance mechanism 110 will be described by taking the attitude maintenance mechanism 110 on the left side as an example, and the description of the configuration of the attitude maintenance mechanism 110 on the right side will be omitted. The attitude maintenance mechanism 110 includes a fixing member 111, a first link member 112, and a second link member 113.

[0045] The fixing member 111 is a member that is fixed to an upper portion of the side frame 20 and supports a rear portion of the first link member 112.

[0046] The first link member 112 is a member provided

between the fixing member 111 and the second link member 113. The first link member 112 is formed in a longitudinal shape extending substantially in the front-rear direction. A rear end portion of the first link member 112 is rockably coupled to the fixing member 111. In this way, the first link member 112 can rock with respect to the fixing member 111 with the left-right direction as an axial direction. A rock fulcrum of the first link member 112 with respect to the fixing member 111 is disposed at a position different from a rock fulcrum of the boom 30 in a side view.

[0047] The second link member 113 is a member coupled to the bucket cylinder 80 and the first link member 112. The second link member 113 is formed in a plate shape with a plate surface facing substantially the left-right direction. The second link member 113 is formed in a substantially triangular shape in a side view. A lower end portion of the second link member 113 is rockably supported by the boom 30 through a substantially columnar coupling portion 113a whose axis is directed to the left and right. Furthermore, the second link member 113 is coupled to the first link member 112 and the bucket cylinder 80 through substantially columnar coupling portions 113b and 113c whose axes are directed to the left and right.

[0048] The boom 30 of the front loader 10 configured as described above is rocked with respect to the side frame 20 according to expansion and contraction of the boom cylinder 70. Thus, the boom 30 is raised and lowered. The first link member 112 and the second link member 113 are rocked as the boom 30 moves up and down. The attitude maintenance mechanism 110 can maintain the attitude of the bucket 50 by rocking of the link members 112 and 113 without allowing the operator to expand and contract the bucket cylinder 80.

[0049] Hereinafter, details of the left and right side frames 20 will be described with reference to Figs. 6 and 7. First, the right side frame 20 will be described. The right side frame 20 includes a side surface portion 21, a connection portion 22, a first opening 23, and a second opening 24.

[0050] The side surface portion 21 forms left and right side surfaces of the side frame 20. The side surface portion 21 is formed in a plate shape with a plate surface facing substantially the left-right direction. The side surface portions 21 are disposed at intervals in the left and right.

[0051] The connection portion 22 connects the left and right side surface portions 21. The connection portion 22 is formed in a substantially rectangular annular shape in a side view. A space surrounded by the side surface portions 21 and the connection portion 22 is an internal space S20 of the side frame 20.

[0052] The first opening 23 is a portion through which the tube portion 90 described later can be inserted. The first opening 23 is formed so as to penetrate the left side surface portion 21 in the left-right direction. Thus, the first opening 23 is formed on the left side surface of the side frame 20. The first opening 23 communicates with the

internal space S20 of the side frame 20. The first opening 23 is formed in a substantially quadrangular shape in a side view.

[0053] The second opening 24 illustrated in Fig. 6(b) is a portion through which the tube portion 90 can be inserted. The second opening 24 is formed so as to penetrate the upper portion of the connection portion 22. The second opening 24 is formed above first opening 23 (on a side of the boom 30). The second opening 24 communicates with the internal space S20 of the side frame 20.

[0054] The left side frame 20 is configured similarly to the right side frame 20 except that the first opening 23 and the second opening 24 are not provided.

[0055] Hereinafter, the left and right booms 30 will be described in detail with reference to Figs. 3 and 7 to 9. First, the right boom 30 will be described. As illustrated in Figs. 3 and 7, the boom 30 includes a boom frame 31, a boss portion 32, a guide portion 33, a closing portion 34, and a side plate 35.

[0056] The boom frame 31 forms a main structural body of the boom 30. As illustrated in Figs. 8 and 9, the boom frame 31 is formed in a hollow shape having an internal space S30 surrounded by an upper surface 31a, left and right side surfaces 31b, and a bottom surface 31c. Lower end portions of the left and right side surfaces 30b are formed so as to protrude downward from the bottom surface 30a of the boom 30. In this way, a space surrounded by the left and right side surfaces 31b and the bottom surface 31c is formed in a lower portion of the boom frame 31. Hereinafter, the space is referred to as a "storage space S31". The storage space S31 is formed over both ends in the longitudinal direction of the boom frame 31. As illustrated in Figs. 7 to 9, the boom frame 31 includes a third opening 31d, a through hole 31e, a slit 31f, a fourth opening 31g, and a cutout portion 31h.

[0057] The third opening 31d illustrated in Fig. 8 is a portion through which the tube portion 90 can be inserted. The third opening 31d is formed at a rear end of the bottom surface 31c. The third opening 31d allows the outside of the boom frame 31 to communicate with the internal space S30.

[0058] The through hole 31e illustrated in Figs. 7 and 8 is a hole penetrating the upper surface 31a of the boom frame 31. The through hole 31e is formed at a front-rear middle portion of the upper surface 31a.

[0059] The slit 31f is a horizontally long hole penetrating the boom frame 31 in the left-right direction. The slits 31f are formed on the left and right side surfaces 31b. Each of the slits 31f is formed below the through hole 31e.

[0060] The fourth opening 31g is a portion through which the tube portion 90 can be inserted. The fourth opening 31g is formed so as to penetrate the left side surface 31b in the left-right direction. The fourth opening 31g is formed in a substantially elliptical shape in a side view. The fourth opening 31g is formed on the front lower side (a side of the bucket 50) of the through hole 31e.

Furthermore, the fourth opening 31g is formed on the rear upper side of the coupling frame 40 in a side view.

[0061] The cutout portion 31h illustrated in Figs. 8 and 9 is formed in the left side surface 31b. The cutout portion 31h is formed in a recessed shape in which an end portion of the side surface 31b is cut out. The cutout portion 31h is formed in a rear portion and a front portion of the side surface 31b. The rear cutout portion 31h is formed between the third opening 31d and the slit 31f in a side view. The front cut out portion 31h is formed below the fourth opening 31g and behind the coupling frame 40 in a side view.

[0062] As illustrated in Figs. 7 and 8, the rear end portion of the boom frame 31 configured as described above is disposed between the side surface portions 21 of the side frame 20 and coupled to the side surface portions 21. Accordingly, the boom frame 31 is supported by the side frame 20. The bottom surface 31c of the boom frame 31 faces the connection portion 22 of the side frame 20. As described above, the second opening 24 of the present embodiment is formed on a surface (the connection portion 22) of the side frame 20 facing the boom 30. Furthermore, the third opening 31d is formed on a surface of the boom 30 facing the side frame 20 (bottom surface 31c).

[0063] The boss portion 32 is for attaching the second link member 113 of the attitude maintenance mechanism 110. The boss portion 32 is formed in a substantially cylindrical shape with an axis line facing the left and right. A length of the boss portion 32 in the axial direction is formed to be longer than a left-right width of the boom frame 31. The boss portion 32 is provided so as to penetrate the left and right side surfaces 31b. In this way, the boss portion 32 is provided so as to cross the internal space S30 of the boom 30. The boss portion 32 is fixed to the side surfaces 31b of the boom frame 31 by welding or the like.

[0064] The coupling portion 113a that couples the boom frame 31 and the second link member 113 is inserted into the boss portion 32. As described above, in the present embodiment, the second link member 113 is supported by the boss portion 32 crossing the internal space S30 of the boom 30. Accordingly, the second link member 113 can be disposed at a relatively low position. Therefore, it is possible to suppress the second link member 113 from greatly protruding upward from the boom 30 and to suppress the second link member 113 from blocking the field of view of the operator.

[0065] The guide portion 33 is for guiding the tube portion 90 described later. The guide portion 33 is formed in a plate shape with a plate surface facing substantially the vertical direction. A left-right width of the guide portion 33 is formed to be substantially equal to the left-right width of the boom frame 31. The guide portion 33 is fixed to the left and right slits 31f by welding or the like. In this manner, substantially the entire guide portion 33 is disposed inside the boom 30. Furthermore, the guide portion 33 is provided so as to extend between the boss

portion 32 and the bottom surface 31c of the boom frame 31. More specifically, the guide portion 33 is provided so as to extend rearward from the vicinity of a top portion of the boss portion 32 to approach the bottom surface 31c of the boom frame 31 and have a rear end portion located in the vicinity of the bottom surface 31c so as to guide the tube portion 90 upward of the boss portion 32.

[0066] The closing portion 34 is a plate-shaped member that closes the through hole 31e of the boom frame 31. The closing portion 34 is fixed to the boom frame 31 after the boss portion 32 and the guide portion 33 are fixed to the boom frame 31. As a result, the boss portion 32 and the guide portion 33 can be easily welded to the inside of the boom frame 31 through the through hole 31e.

[0067] The side plate 35 is formed in a plate shape with a plate surface facing substantially the left-right direction. The side plates 35 are provided on the left and right of the boom frame 31. The left and right side plates 35 are fixed to a front-rear middle portion of the boom frame 31.

[0068] The left boom 30 is configured similarly to the right boom 30 except that the third opening 31d, the slit 31f, the fourth opening 31g, the rear cutout portion 31h, and the guide portion 33 are not provided.

[0069] Hereinafter, the configuration of the tube portion 90 will be described with reference to Figs. 4, 5, and 10 to 14. Note that, in Figs. 10 to 14, the tube portion 90 is schematically illustrated for convenience. The tube portion 90 is formed by appropriately connecting a metal pipe and a flexible hose. As illustrated in Figs. 4 and 5, the tube portion 90 includes a first tube portion 91, a second tube portion 92, and a third tube portion 93.

[0070] The first tube portion 91 connects a hydraulic pump driven by the engine 3 and the boom cylinder 70. Note that the boom cylinder 70 of the present embodiment is provided with two ports (a first port and a second port). The first tube portion 91 connects these two ports and the hydraulic pump. That is, the first tube portion 91 includes a total of two tube portions including a tube portion connecting the hydraulic pump and the first port and a tube portion connecting the hydraulic pump and the second port. As illustrated in Figs. 10 and 11(a), the first tube portion 91 is connected to the boom cylinder 70 after passing through the side frame 20 and the internal spaces S20 and S30 of the boom 30. Hereinafter, a specific description will be given. Note that, in Figs. 10 to 12, the two first tube portions 91 are indicated by one line.

[0071] As illustrated in Fig. 10, the first tube portion 91 is introduced from the hydraulic pump into the side frame 20 through the first opening 23. The first tube portion 91 is led out from the internal space S20 of the side frame 20 to the outside of the side frame 20 through the second opening 24, and is introduced into the boom frame 31 through the third opening 31d. The first tube portion 91 introduced into the boom frame 31 extends toward the fourth opening 31g in the internal space S30 of the boom 30.

[0072] Here, the boom 30 is provided with the boss portion 32 that crosses the internal space S30. For this reason, when the first tube portion 91 is assembled, if the first tube portion 91 is fed out from the third opening 31d toward the fourth opening 31g, the boss portion 32 becomes an obstacle, and there is a concern that it becomes difficult to assemble the first tube portion 91. Therefore, in the present embodiment, the guide portion 33 is provided so that the tube portion 90 can be guided to the upper side of the boss portion 32. The guide portion 33 can guide the first tube portion 91 and the second tube portion 92 to the fourth opening 31g so as to avoid the boss portion 32 (pass above the boss portion 32). As a result, it is possible to suppress the boss portion 32 from being an obstacle when the first tube portion 91 is provided, and to easily dispose the first tube portion 91 in the boom 30.

[0073] As illustrated in Figs. 10 to 12, the first tube portion 91 having passed through the boss portion 32 is led out from the internal space S30 of the boom frame 31 onto the coupling frame 40 through the fourth opening 31g.

[0074] As described above, the first tube portion 91 of the present embodiment is disposed in the side frame 20 and the boom frame 31 from the first opening 23 to the fourth opening 31g. As a result, it is possible to suppress the first tube portion 91 from blocking the field of view of the operator, and thus, visibility can be improved. Furthermore, by improving the visibility, the work by the front loader 10 can be easily performed, and the workability can also be improved. Furthermore, the first tube portion 91 can be hidden by the side frame 20 and the boom frame 31, and the aesthetic appearance can be improved. Furthermore, even if the first tube portion 91 is damaged by any chance, it is possible to prevent the hydraulic oil from scattering in a wide range.

[0075] In particular, in the present embodiment, the first tube portion 91 is introduced into the side frame 20 from the first opening 23. As a result, it is difficult for the hose to be exposed to the side of the side frame 20 and the boom frame 31, and it is possible to effectively prevent the first tube portion 91 from blocking the field of view of the operator.

[0076] Furthermore, in a case where the attitude maintenance mechanism 110 (see Fig. 3) that operates according to the rocking of the boom 30 is provided as in the present embodiment, the first tube portion 91 is disposed in the side frame 20 and the boom 30, so that the attitude maintenance mechanism 110 can be prevented from interfering with the first tube portion 91 and being damaged.

[0077] As illustrated in Fig. 11(a), the first tube portion 91 led out onto the coupling frame 40 is branched by a branch portion 91a provided on the coupling frame 40. Note that, although not illustrated in Fig. 11(a), two branch portions 91a (the same number as the first tube portions 91) are provided. The branch portions 91a are disposed so as to be shifted from each other in the left-

right direction.

[0078] The first tube portion 91 branched by the branch portion 91a extends toward the left and right boom frames 31. As illustrated in Figs. 12 and 13, the first tube portion 91 is introduced into the storage space S31 through the front cutout portion 31h. As illustrated in Figs. 10 and 13, the first tube portion 91 extends rearward and upward in the storage space S31. Thus, the first tube portion 91 is guided from the coupling frame 40 to the vicinity of the right and left boom cylinders 70. The first tube portion 91 is connected to the right and left boom cylinders 70.

[0079] As described above, the first tube portion 91 of the present embodiment is disposed in the storage space S31 from the front cutout portion 31h to the vicinity of the boom cylinder 70. With such a configuration, the first tube portion 91 can be hidden in the storage space S31 to make the first tube portion 91 less visible, and visibility can be improved. Furthermore, even if the first tube portion 91 is damaged by any chance, it is possible to prevent the hydraulic oil from scattering in a wide range.

[0080] Furthermore, the first tube portion 91 branched by the branch portion 91a is constituted by a pipe 91b made of metal except for a part thereof. Specifically, the first tube portion 91 is constituted by the pipe 91b made of metal except for the vicinities of the left and right boom cylinders 70 (from the lower side of the boss portion 32 to the upper side of the front end portion of the boom cylinder 70 in a side view). Furthermore, in the first tube portion 91, a portion (near the boom cylinder 70) other than the metal pipe 91b is constituted by a hose 91c having flexibility.

[0081] Since the first tube portion 91 is constituted by the pipe 91b made of metal except for a part thereof in this manner, a length of the hose 91c can be shortened to suppress the sagging of the first tube portion 91. As a result, it is possible to suppress the first tube portion 91 from being exposed to the outside and to suppress deterioration in appearance.

[0082] The second tube portion 92 connects the hydraulic pump and the bucket cylinder 80. Note that the bucket cylinder 80 of the present embodiment is provided with two ports (a first port and a second port). The second tube portion 92 connects these two ports and the hydraulic pump. That is, the second tube portion 92 includes a total of two tube portions including a tube portion connecting the hydraulic pump and the first port and a tube portion connecting the hydraulic pump and the second port. As illustrated in Figs. 10 and 11(b), similarly to the first tube portion 91, the second tube portion 92 is led out onto the coupling frame 40 through the side frame 20 and the internal spaces S20 and S30 of the boom 30. Note that, in Figs. 10 to 13, the two second tube portions 92 are indicated by one line.

[0083] As illustrated in Fig. 11(b), the second tube portion 92 is branched by a branch portion 92a provided on the coupling frame 40. Note that, although not illustrated in Fig. 11(b), two branch portions 92a (the same number as the second tube portions 92) are provided.

The branch portions 92a are disposed so as to be shifted from each other in the left-right direction. Furthermore, the branch portion 92a is disposed to be shifted in position in the left-right direction with respect to the branch portion 91a of the first tube portion 91. In this way, in the present embodiment, all the branch portions 91a and 92a are disposed with their positions shifted from each other in the left-right direction.

[0084] The second tube portion 92 branched by the branch portion 92a extends toward the left and right boom frames 31. The second tube portion 92 extends substantially upward along the side surface 31b of the boom frame 31 and is connected to the left and right bucket cylinders 80 (see Figs. 2 and 13).

[0085] The third tube portion 93 is for connecting a device (for example, a snow blower, a snow blade, a sweeper, and the like.) different from the boom cylinder 70 and the bucket cylinder 80 to the hydraulic pump. Similarly to the first tube portion 91, the third tube portion 93 includes two tube portions. Note that, in Figs. 13 and 14, the two third tube portions 93 are indicated by one line.

[0086] As illustrated in Fig. 14, the third tube portion 93 extends from the hydraulic pump along the left side surface of the side frame 20 and the boom 30. The third tube portion 93 is introduced into the storage space S31 through the cutout portion 31h on the rear side. The third tube portion 93 extends forward and downward in the storage space S31.

[0087] As illustrated in Figs. 13 and 14, the third tube portion 93 in the storage space S31 is led out onto the coupling frame 40 through the front cutout portion 31h. As described above, the third tube portion 93 is disposed in the storage space S31 from the rear cutout portion 31h to the front cutout portion 31h, so that the third tube portion 93 can be hidden by the boom 30.

[0088] Furthermore, the third tube portion 93 is constituted by a metal pipe 93a at least from the front cutout portion 31h to the rear cutout portion 31h. As a result, the third tube portion 93 can be prevented from hanging down and being exposed to the outside.

[0089] The third tube portion 93 led out onto the coupling frame 40 extends leftward on the coupling frame 40. The third tube portion 93 is exposed to the outside of the cover 100 through an opening 101a of a first cover 101 described later (see Fig. 15).

[0090] Hereinafter, the configuration of the cover 100 will be described with reference to Figs. 11 to 13 and 15. The cover 100 is a hollow member that covers the tube portion 90 and the like. As illustrated in Fig. 15, the cover 100 includes the first cover 101, a second cover 102, and a third cover 103.

[0091] The first cover 101 covers the tube portion 90 on the coupling frame 40. The first cover 101 is formed in a longitudinal shape along the axial direction of the coupling frame 40. The first cover 101 is formed in a substantially inverted U shape with an opening facing downward in a cross-sectional view of a side surface (long-

itudinal direction). The first cover 101 is provided on an upper portion of the coupling frame 40. The first cover 101 includes the opening 101a.

[0092] The opening 101a is a portion through which the third tube portion 93 can be inserted. The opening 101a is formed on the front surface of the first cover 101. The opening 101a is covered with a stay 101b having a plate surface facing substantially the front-rear direction. The third tube portion 93 is provided so as to penetrate the stay 101b in the front-rear direction. In this way, the third tube portion 93 is exposed from the first cover 101.

[0093] As described above, in the present embodiment, all the branch portions 91a and 92a are disposed to be shifted from each other in the left-right direction. As a result, a height of the first cover 101 covering the branch portions 91a and 92a and the like can be reduced, and the cover 100 can be downsized.

[0094] The second cover 102 covers the fourth opening 31g and the like. The second cover 102 is formed in a substantially box shape with a right portion opened. The second cover 102 is formed in a vertically long shape having a height higher than that of the first cover 101. As illustrated in Fig. 11(a), the second cover 102 includes a first cutout portion 102a and a second cutout portion 102b.

[0095] The first cutout portion 102a is formed on the upper surface of the second cover 102. The first cutout portion 102a is appropriately formed so as not to interfere with the second tube portion 92. The second cutout portion 102b is formed on the rear surface of the second cover 102. As illustrated in Figs. 12 and 13, the second cutout portion 102b is appropriately formed so as not to interfere with the first tube portion 91 and the third tube portion 93.

[0096] The second cover 102 configured as described above is provided between the right boom frame 31 and the first cover 101. The fourth opening 31g and the tube portion 90 in the vicinity of the fourth opening 31g are covered with the second cover 102. Furthermore, the second tube portion 92 branched by the branch portion 92a is led out to the outside of the cover 100 through the first cutout portion 102a (see Fig. 11(b)). Furthermore, the first tube portion 91 branched by the branch portion 91a is introduced into the storage space S31 from the cover 100 through the second cutout portion 102b and the front cutout portion 31h.

[0097] Furthermore, the third tube portion 93 is introduced into the cover 100 from the storage space S31 through the second cutout portion 102b and the front cutout portion 31h.

[0098] The third cover 103 illustrated in Fig. 15(a) covers the first tube portion 91 and the second tube portion 92. The third cover 103 is formed in a substantially bilaterally symmetrical shape with the second cover 102. The third cover 103 includes a first cutout portion 103a and a second cutout portion 103b formed substantially in the same manner as the second cover 102 (see Fig. 11). The third cover 103 is provided between the left boom

frame 31 and the first cover 101. The third cover 103 covers the first tube portion 91 and the second tube portion 92 extending from the branch portions 91a and 92a toward the left boom frame 31. Furthermore, the first tube portion 91 and the second tube portion 92 branched by the branch portion 92a are led out to the outside of the cover 100 through the first cutout portion 103a and the second cutout portion 103b.

[0099] As described above, the front loader 10 according to the present embodiment includes the boom 30, and the side frame 20 that rockably supports the boom 30 and is provided with the first opening 23 through which the tube portion 90 (the first tube portion 91 and the second tube portion 92 in the present embodiment) for forming a flow path of hydraulic oil can be inserted.

[0100] With such a configuration, since the tube portion 90 can be disposed in the side frame 20, it is possible to suppress the tube portion 90 from blocking the field of view of the operator. Thus, the visibility can be improved. Furthermore, the tube portion 90 can be hidden by the side frame 20, and the aesthetic appearance can be improved.

[0101] Furthermore, the first opening 23 is formed on one side surface (left side surface in the present embodiment) of the side frame 20 in the left-right direction (see Fig. 7).

[0102] With such a configuration, the tube portion 90 can be introduced into the side frame 20 from the left and right outer sides of the side frame 20.

[0103] Furthermore, the second opening 24 through which the tube portion 90 can be inserted is formed on a surface of the side frame 20 facing the boom 30 (see Fig. 8).

[0104] With such a configuration, the tube portion 90 can be led out from the inside of the side frame 20 toward the boom 30.

[0105] Furthermore, in the boom 30, the third opening 31d formed on a surface facing the side frame 20 and through which the tube portion 90 can be inserted, and the fourth opening 31g different from the third opening 31d are formed.

[0106] With such a configuration, it is possible to effectively suppress the tube portion 90 from blocking the field of view of the operator, and to effectively improve the visibility.

[0107] Furthermore, the front loader 10 further includes the coupling frame 40 that couples the left and right booms 30, and the tube portion 90 that is led out from the inside of the boom 30 onto the coupling frame 40 through the fourth opening 31g, is branched on the coupling frame 40, and is connected to the left and right boom cylinders 70 and the left and right bucket cylinders 80 (see Figs. 4 and 5).

[0108] With such a configuration, the branch portions 91a and 92a of the tube portion 90 can be gathered on the coupling frame 40. This facilitates assembly and maintenance of the tube portion 90.

[0109] Furthermore, the front loader 10 further in-

cludes the first cover 101 that covers the tube portion 90 on the coupling frame 40.

[0110] With such a configuration, the tube portion 90 on the coupling frame 40 can be hidden by the first cover 101, and the aesthetic appearance can be improved.

[0111] Furthermore, the opening 101a is formed in the first cover 101 (see Fig. 15).

[0112] With this configuration, the hydraulic pressure can be used through the opening 101a.

[0113] Furthermore, the front loader 10 further includes the second cover 102 that covers the fourth opening 31g.

[0114] With such a configuration, the fourth opening 31g and the tube portion 90 led out from the fourth opening 31g can be hidden by the second cover 102, and the aesthetic appearance can be improved.

[0115] Furthermore, the attitude maintenance mechanism 110 that maintains an attitude of the bucket 50 (working tool) coupled to the boom 30 by operating according to rocking of the boom 30 can be attached to the boom 30, and the boom 30 includes the boss portion 32 (attachment portion) at least a part of which is disposed inside the boom 30 and to which the attitude maintenance mechanism 110 is attached, and the guide portion 33 at least a part of which is disposed inside the boom 30 and that guides the tube portion 90 so as to avoid the boss portion 32.

[0116] With such a configuration, the tube portion 90 can be easily disposed in the boom 30.

[0117] Note that the bucket 50 according to the present embodiment is an embodiment of a working tool according to the present invention.

[0118] Furthermore, the boss portion 32 according to the present embodiment is an embodiment of an attachment portion according to the present invention.

[0119] Although the embodiment of the present invention has been described above, the present invention is not limited to the above configurations, and various modifications can be made within the scope of the invention described in the claims.

[0120] For example, although the first opening 23 is formed on the left side surface of the side frame 20, a portion where the first opening 23 is formed is not particularly limited, and can be arbitrarily changed. For example, the first opening 23 may be formed on the bottom surface of the right side frame 20 or the right side surface portion 21. Furthermore, the first opening 23 may be formed in the left side frame 20 instead of the right side frame 20.

[0121] Furthermore, although the second opening 24 is formed in the upper portion of the connection portion 22 of the side frame 20, a portion where the second opening 24 is formed is not particularly limited, and can be arbitrarily changed. For example, the second opening 24 may be formed at a portion other than the upper portion of the connection portion 22.

[0122] Furthermore, the third opening 31d is formed in the bottom surface 31c of the boom frame 31, but a portion where the third opening 31d is formed is not

particularly limited, and can be arbitrarily changed.

[0123] Furthermore, the fourth opening 31g is formed on the left side surface of the boom frame 31, but a portion where the fourth opening 31g is formed is not particularly limited, and can be arbitrarily changed.

[0124] Furthermore, although the opening 101a of the first cover 101 is formed on the front side surface of the first cover 101, a portion where the opening 101a is formed is not particularly limited, and can be arbitrarily changed.

[0125] Furthermore, although both left and right end portions of the boss portion 32 protrude from the boom 30, this is an example, and at least a part thereof may be disposed in the boom 30.

[0126] Furthermore, although the substantially entire guide portion 33 is disposed in the boom 30, this is merely an example, and at least a part thereof may be disposed in the boom 30.

[0127] Furthermore, although the first tube portion 91 and the second tube portion 92 are provided so as to pass above the boss portion 32, this is an example, and a portion where the first tube portion 91 and the like pass through the boss portion 32 is not particularly limited. For example, the first tube portion 91 and the like may be provided so as to pass below the boss portion 32. In this case, the guide portion 33 may be provided, for example, from the boss portion 32 to the upper surface 31a of the boom frame 31 so as to guide the first tube portion 91 and the like below the boss portion 32.

[0128] Furthermore, although the tube portion 90 includes the third tube portion 93, this is an example, and in a case where a hydraulic device such as a snow blower is not provided, the third tube portion 93 may not be installed.

[0129] Furthermore, although the front loader 10 includes the attitude maintenance mechanism 110, this is an example, and the present invention is also applicable to a front loader not including the attitude maintenance mechanism 110.

Industrial applicability

[0130] The present invention can be used for a technique of a front loader in which a working tool coupled to a boom can be operated by hydraulic oil.

Reference signs list

[0131]

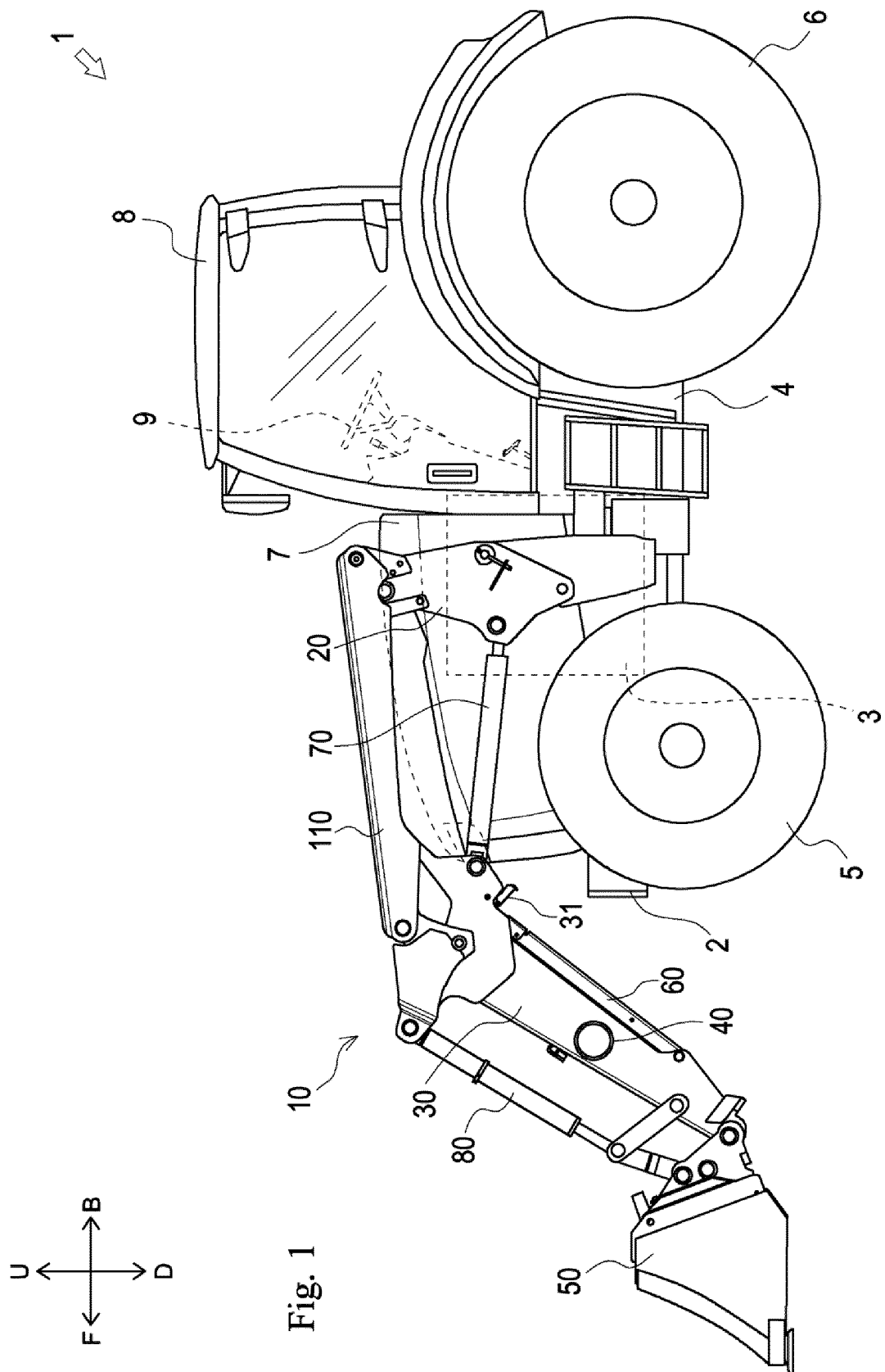
- 10: Front loader
- 20: Side frame
- 23: First opening
- 30: Boom
- 90: Tube portion

Claims

1. A front loader comprising:
 - a boom; and 5
 - a side frame rockably supporting the boom and formed with a first opening through which a tube portion forming a flow path for hydraulic oil can be inserted. 10
2. The front loader according to claim 1, wherein the first opening is formed on one side surface of the side frame in a left-right direction.
3. The front loader according to claim 2, wherein a 15 second opening through which the tube portion can be inserted is formed on a surface of the side frame facing the boom.
4. The front loader according to any one of claims 1 to 3, 20 wherein the boom is formed with:
 - a third opening that is formed on a surface facing the side frame and through which the tube portion can be inserted; and 25
 - a fourth opening different from the third opening.
5. The front loader according to claim 4, further comprising a coupling frame that couples the boom on a 30 right side and the boom on a left side, wherein the tube portion is led out from an inside of the boom to the coupling frame through the fourth opening, branched on the coupling frame, and connected to left and right boom cylinders and left and right bucket 35 cylinders.
6. The front loader according to claim 5, further comprising a first cover that covers the tube portion on the coupling frame. 40
7. The front loader according to claim 6, wherein an opening is formed in the first cover.
8. The front loader according to any one of claims 5 to 7, 45 further comprising a second cover that covers the fourth opening.
9. The front loader according to any one of claims 4 to 8, 50 wherein an attitude maintenance mechanism can be attached to the boom, the attitude maintenance mechanism being configured to maintain an attitude of a working tool coupled to the boom by operating in accordance with rocking of the boom, and the boom includes: 55
 - an attachment portion at least a part of which is disposed inside the boom and that attaches the

attitude maintenance mechanism; and

- a guide portion at least a part of which is disposed inside the boom and that guides the tube portion so as to avoid the attachment portion.



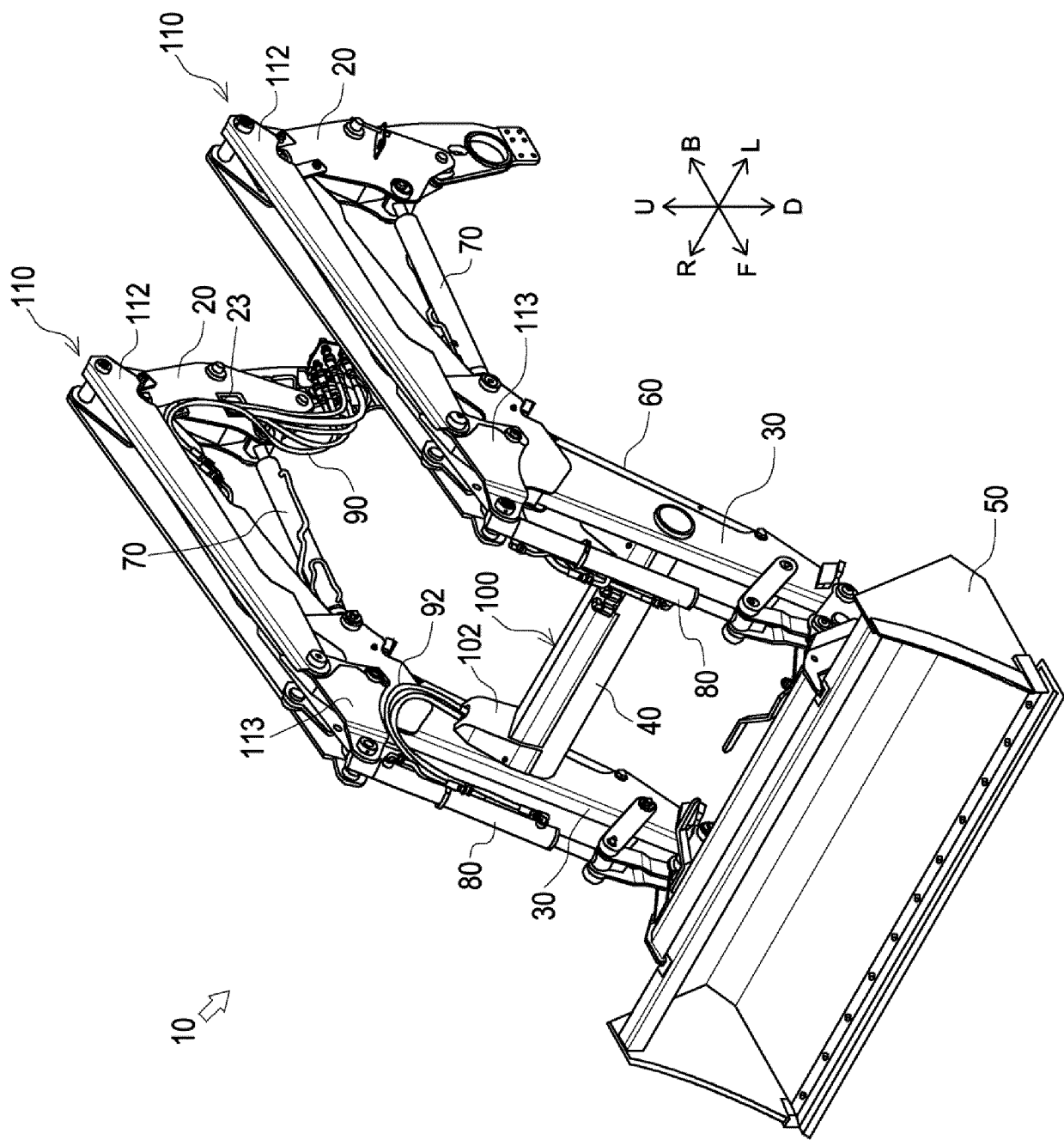


Fig. 2

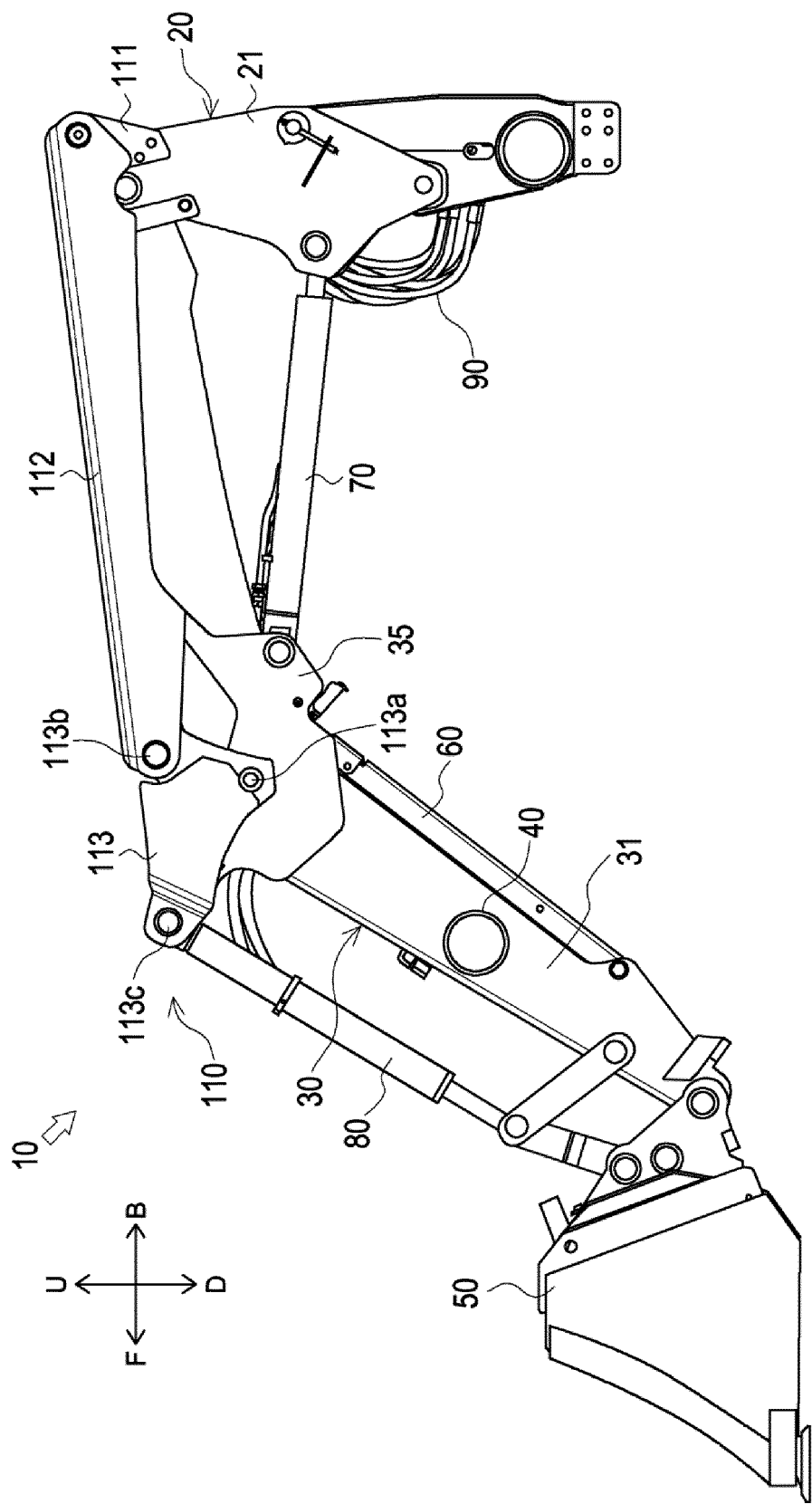


Fig. 3

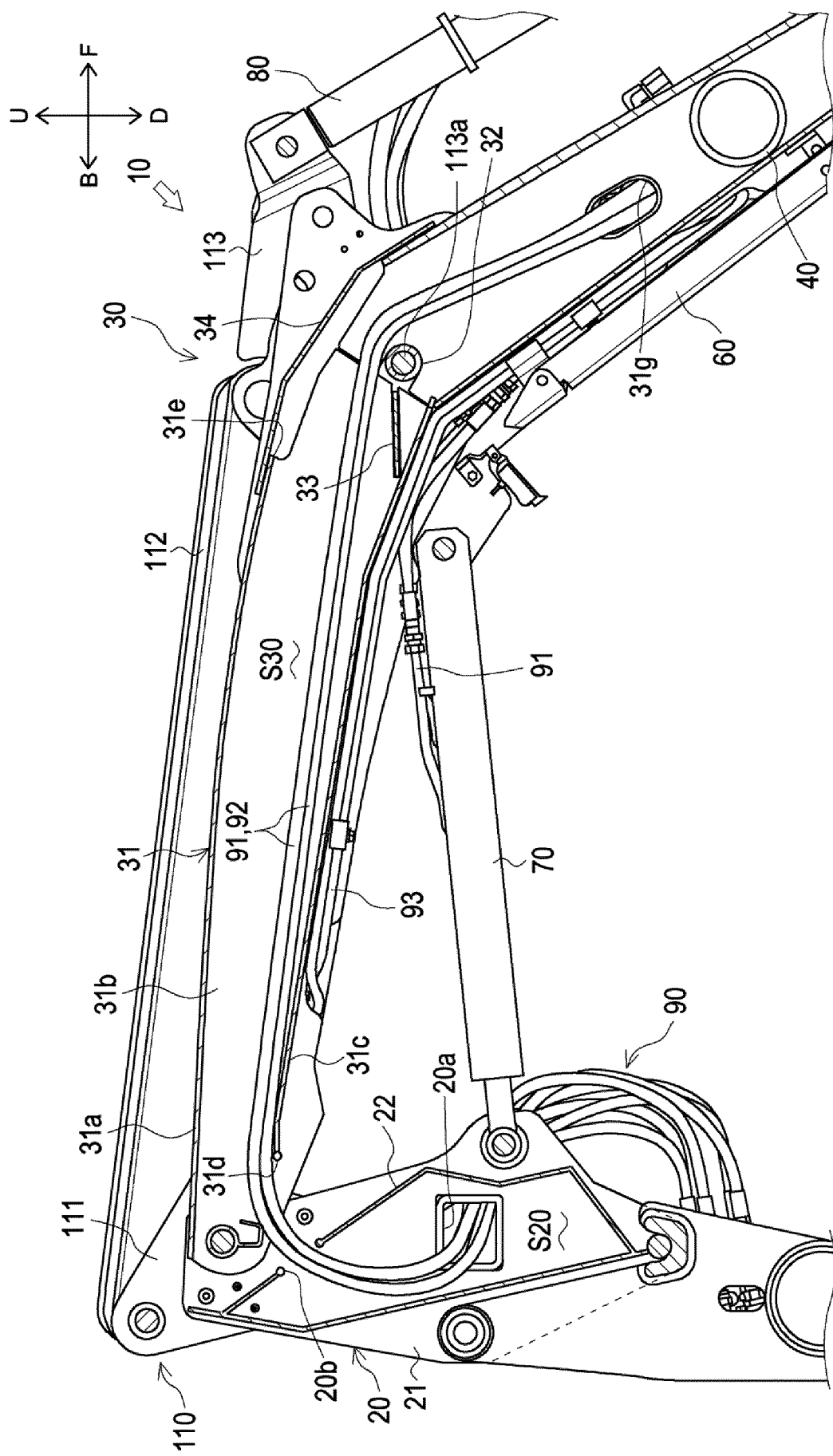


Fig. 4

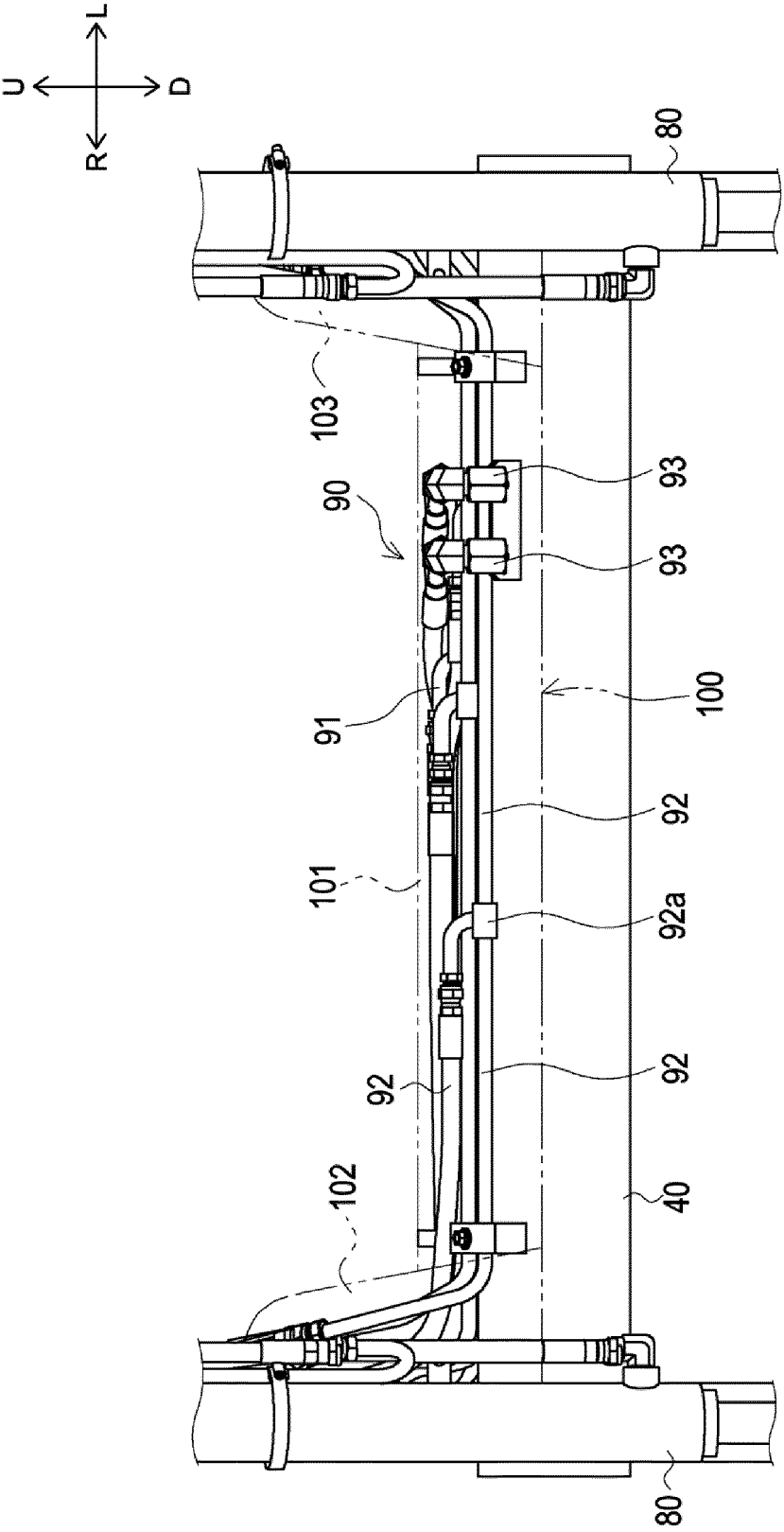


Fig. 5

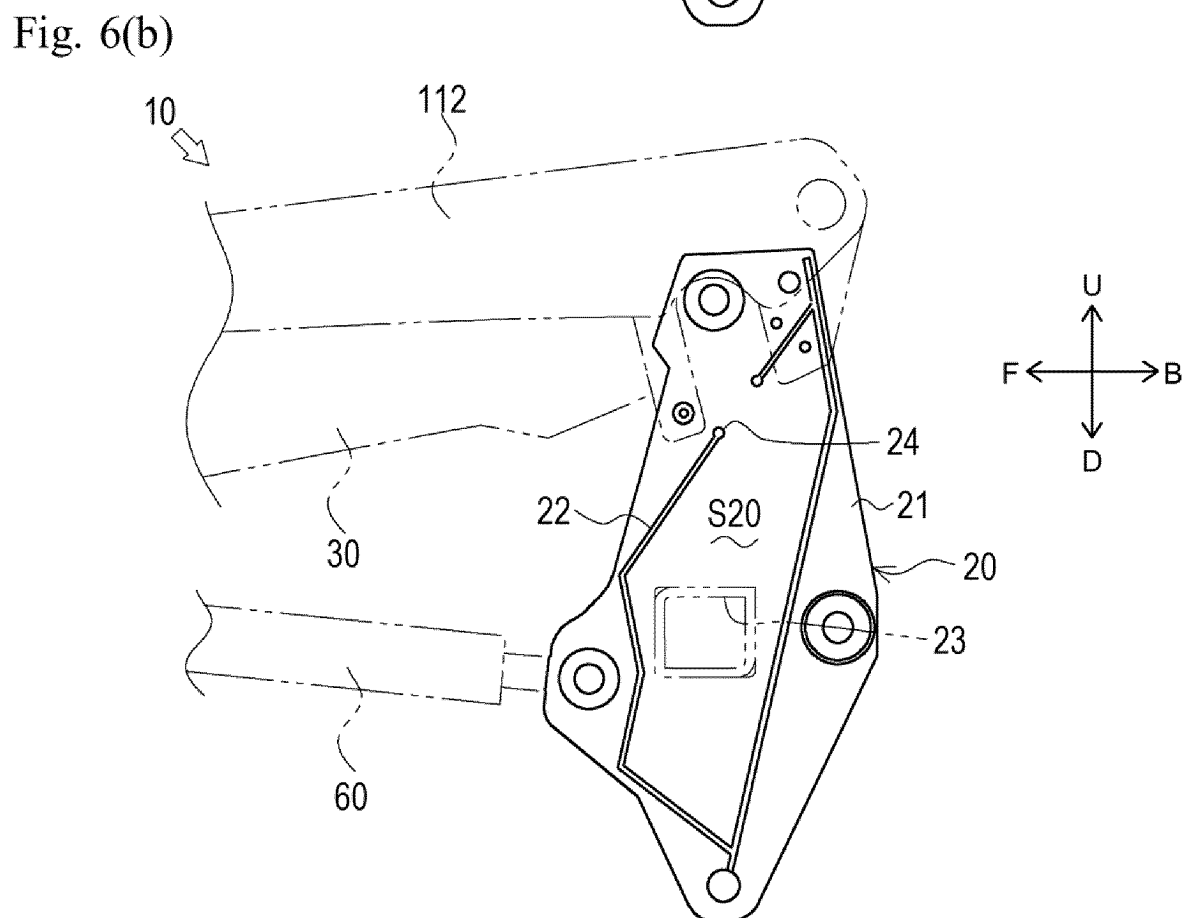
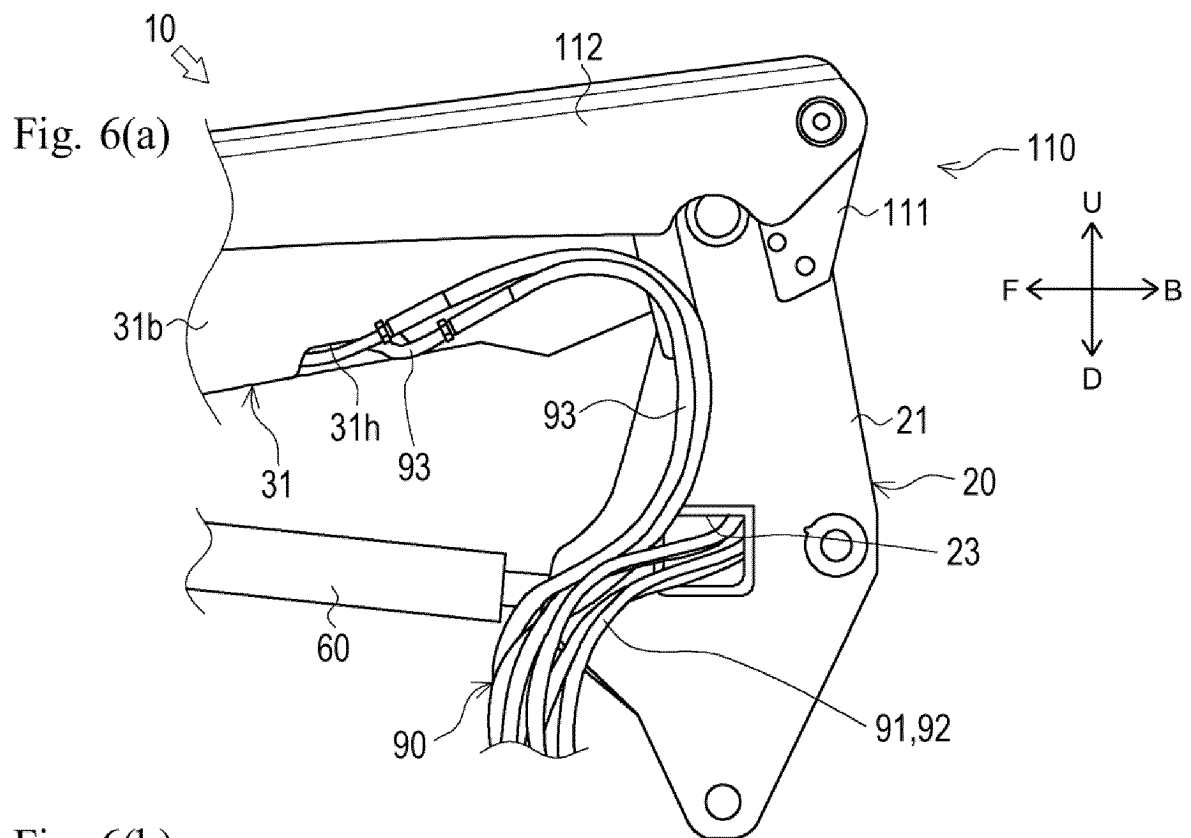
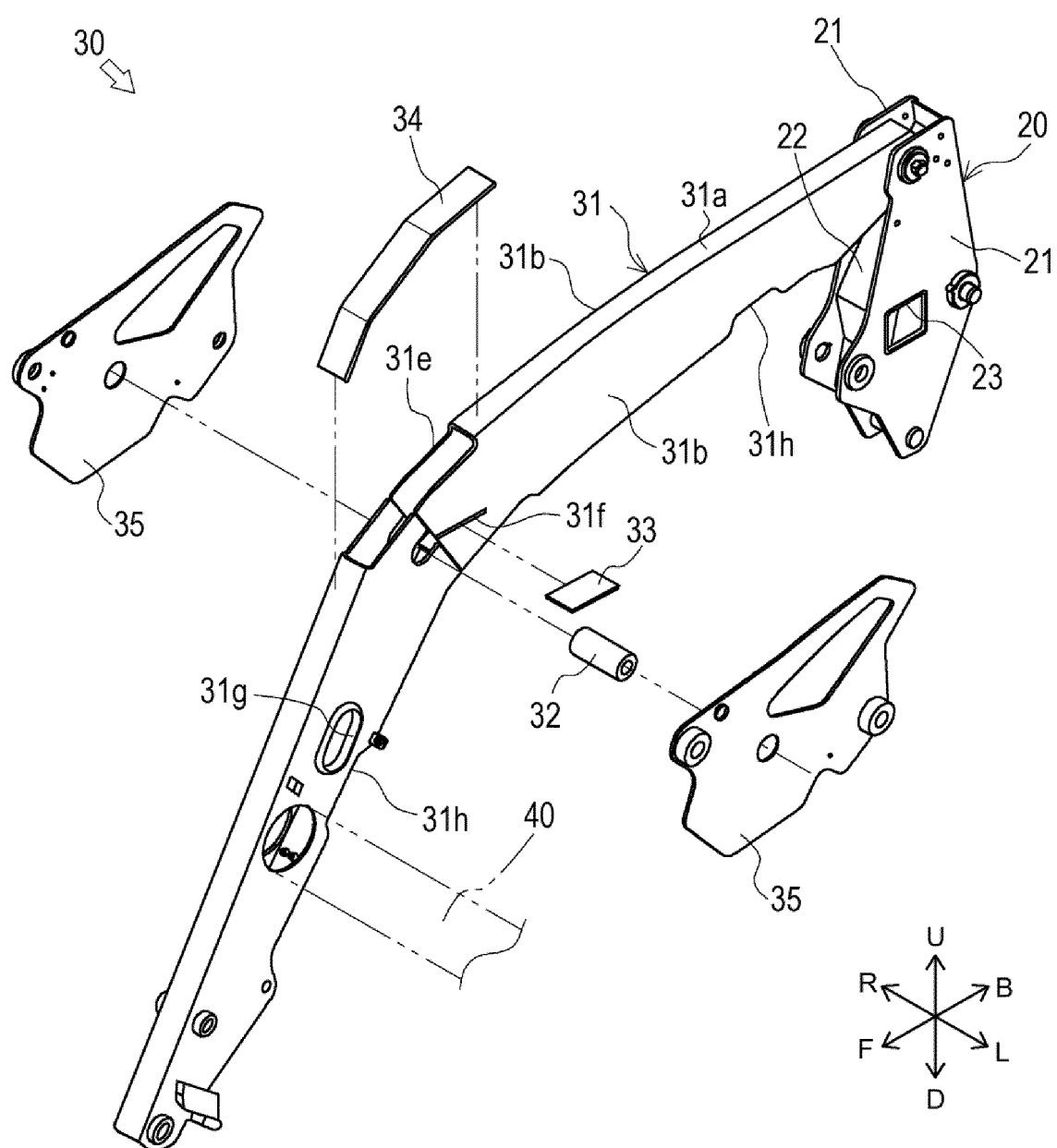


Fig. 7



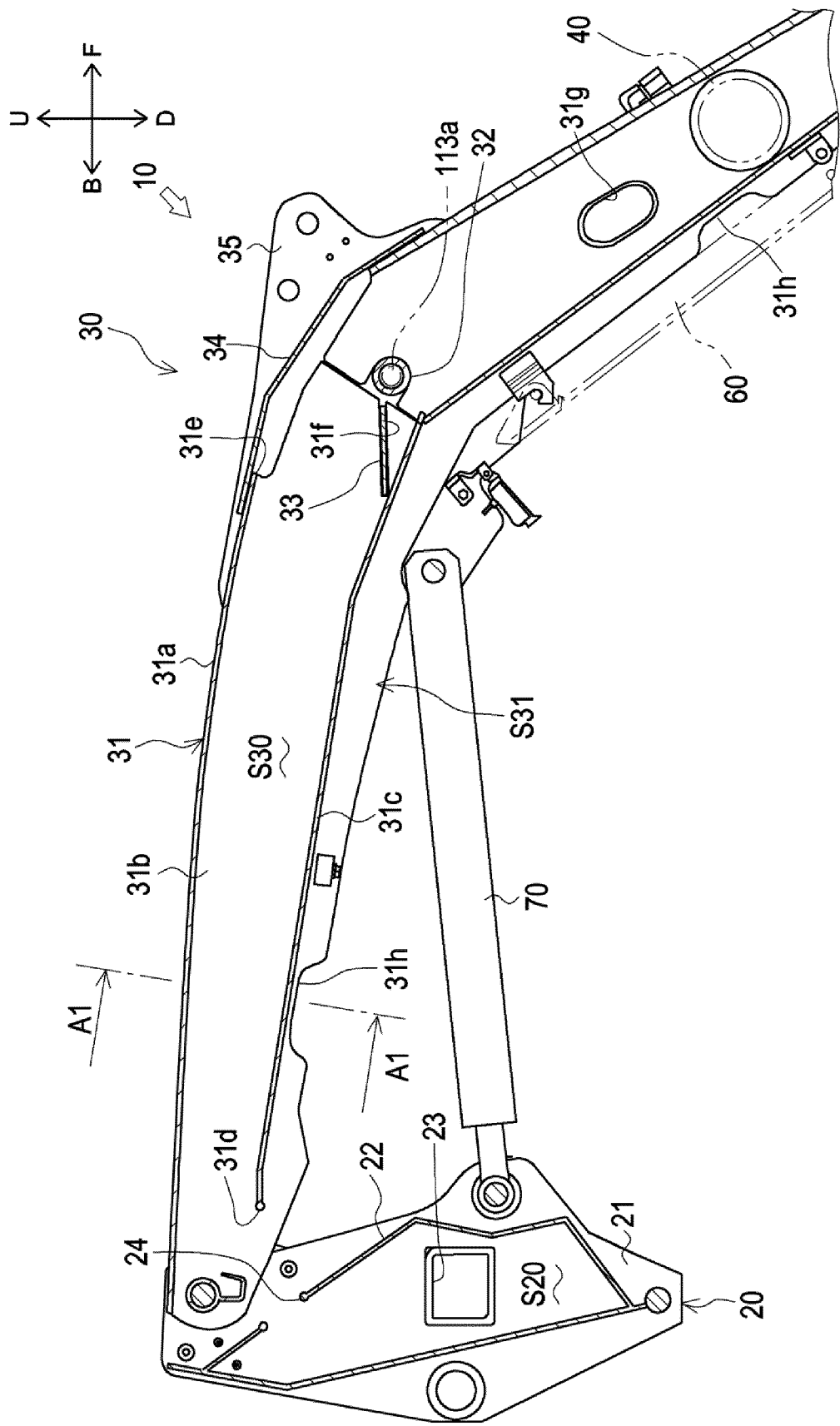
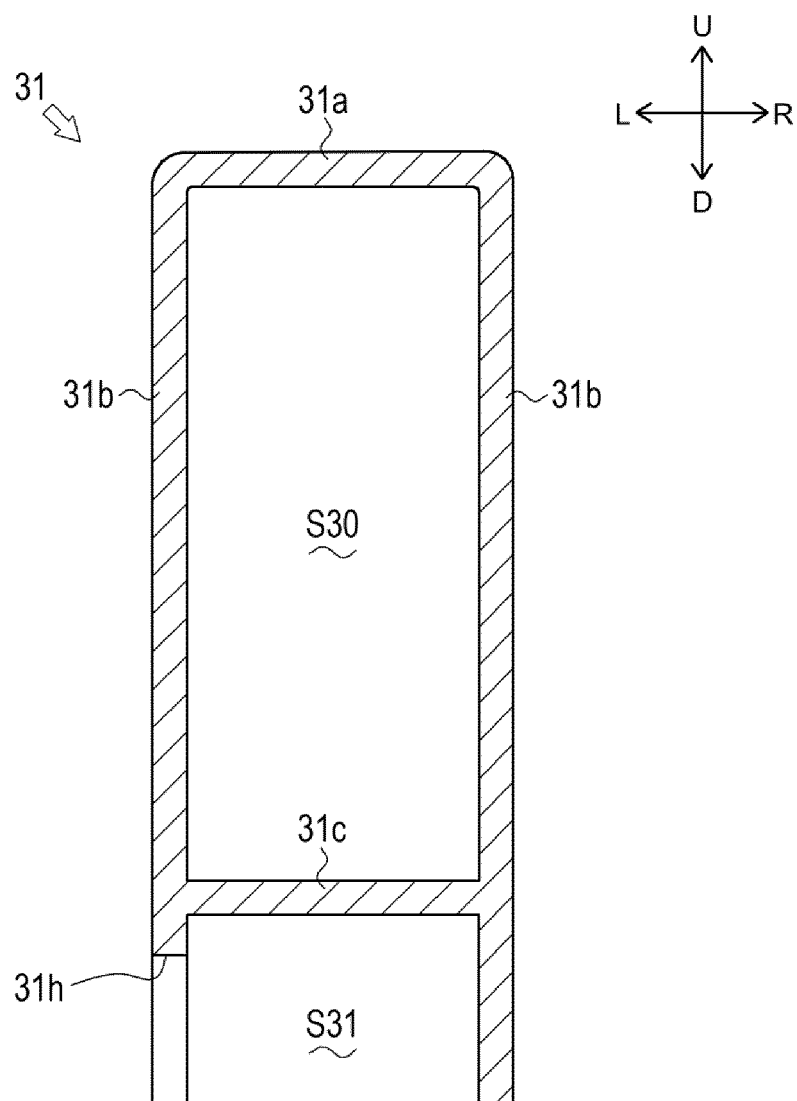


Fig. 8

Fig. 9



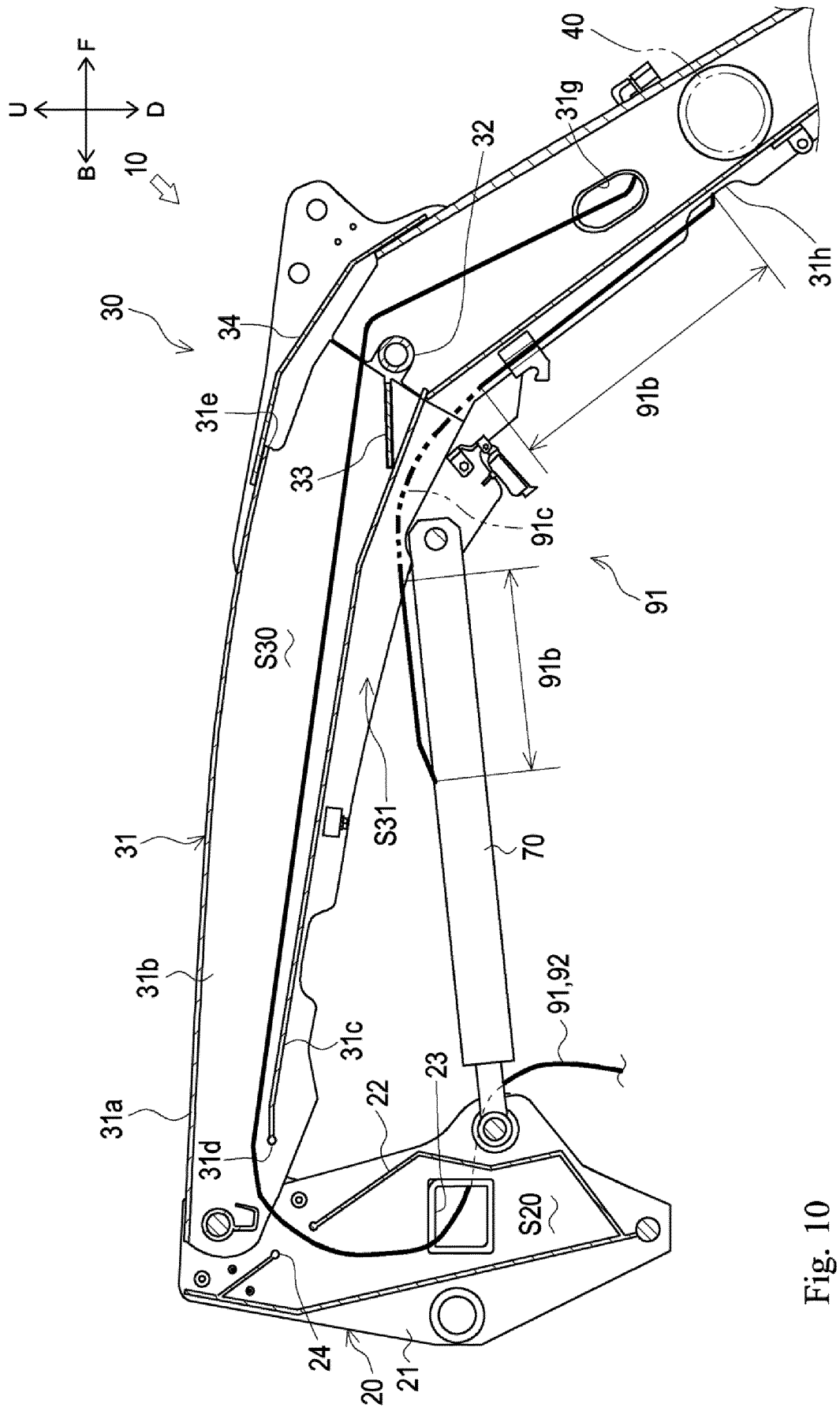


Fig. 10

Fig. 11(a)

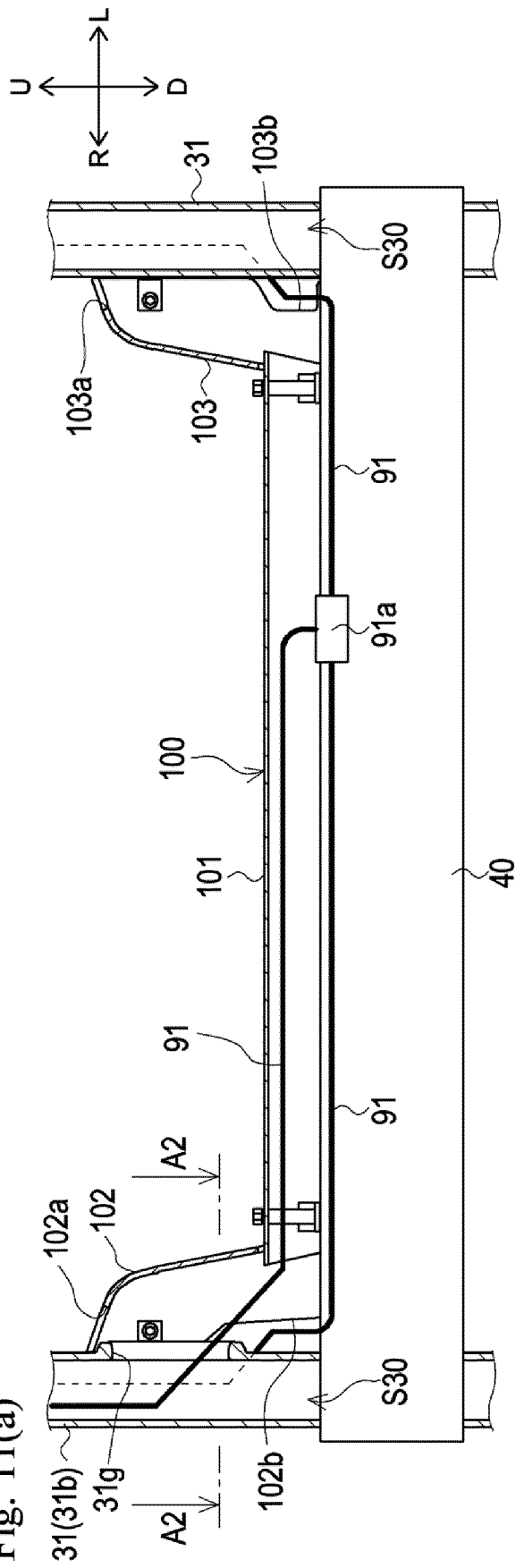


Fig. 11(b)

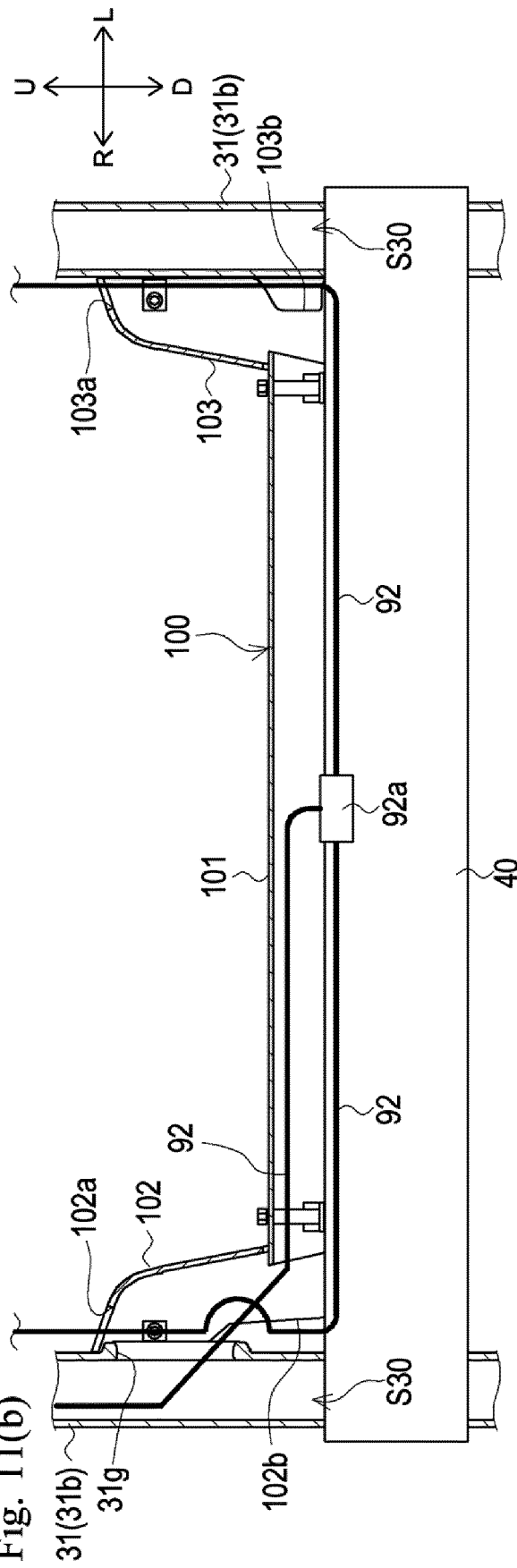


Fig. 12

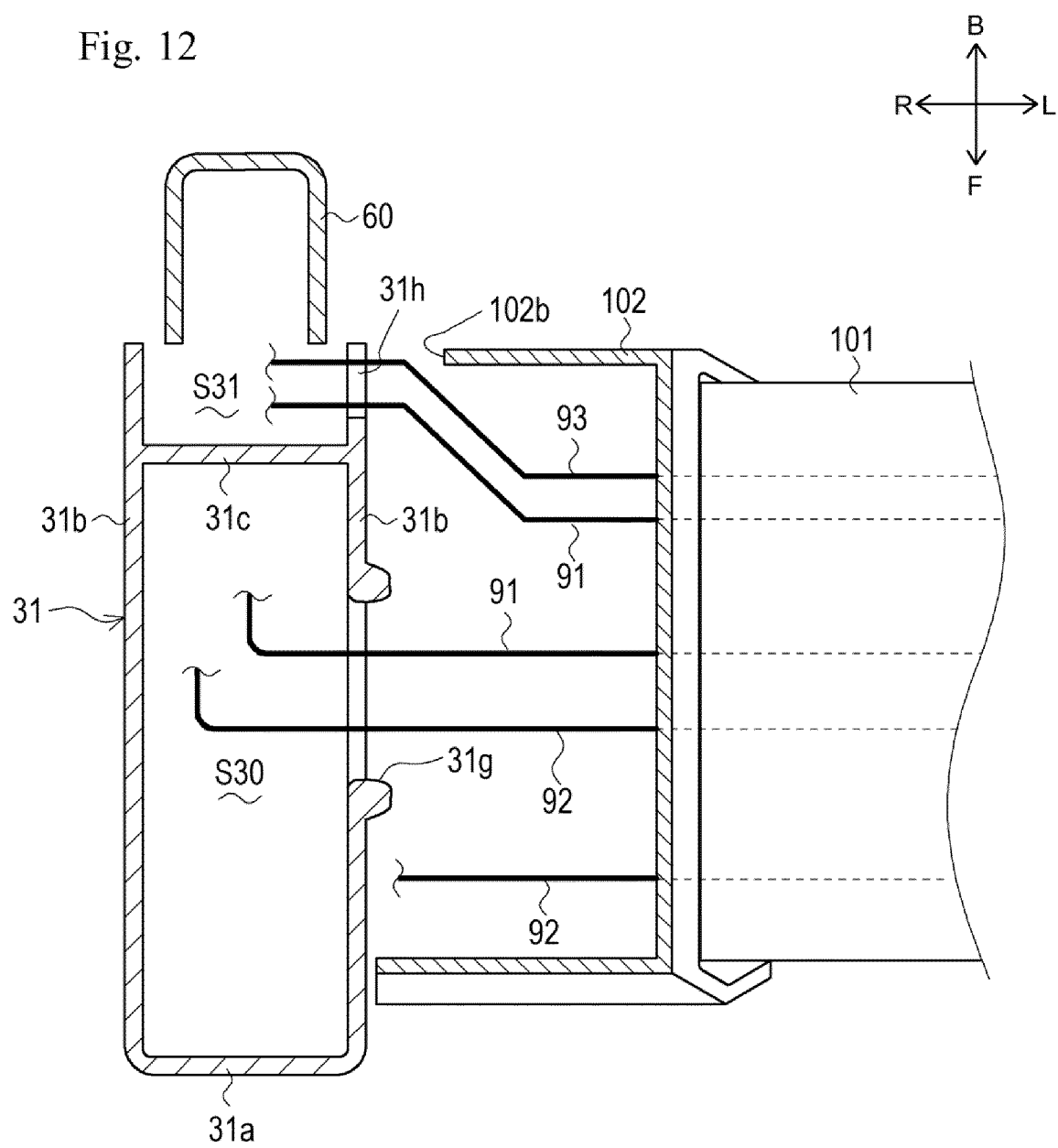
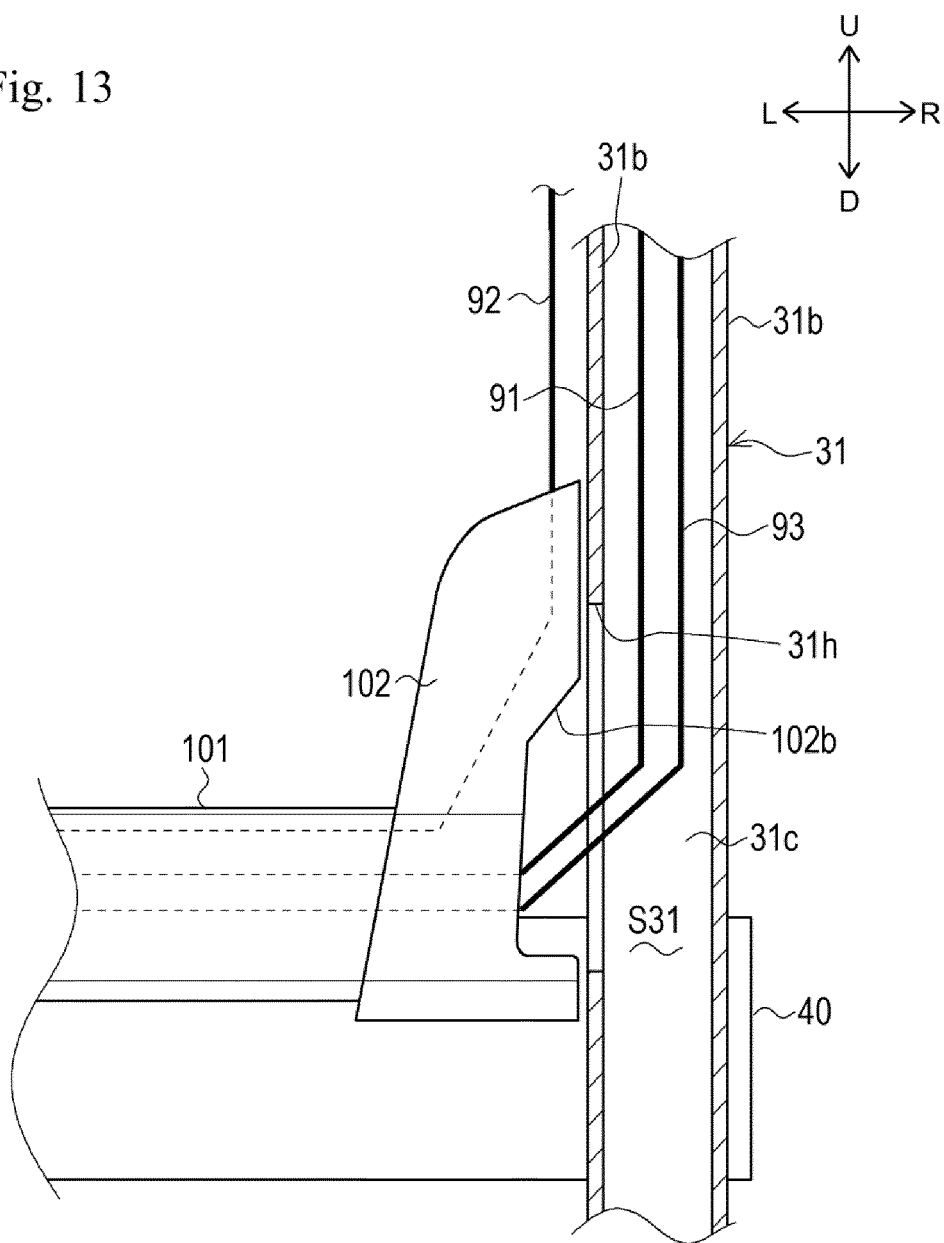


Fig. 13



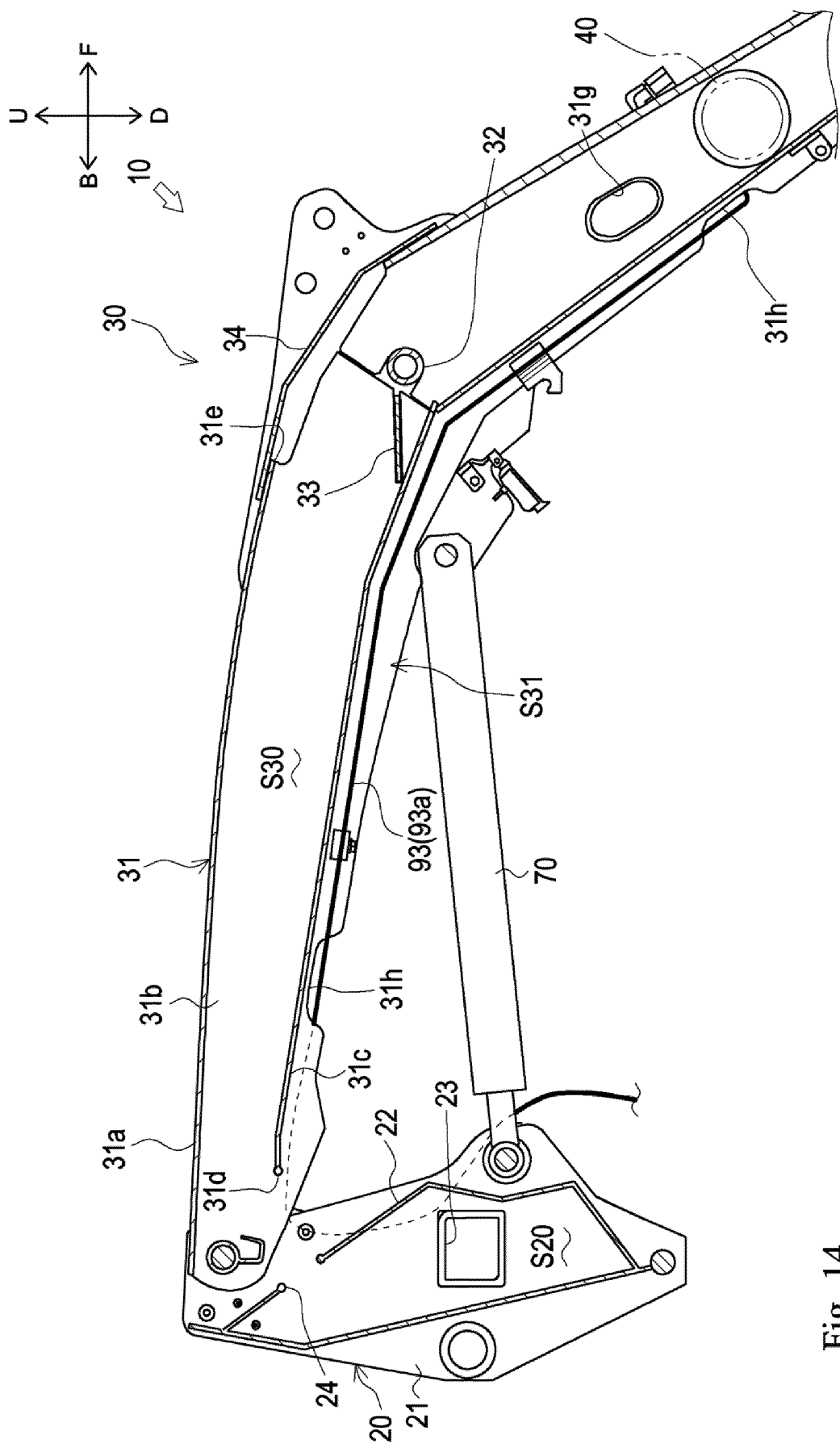
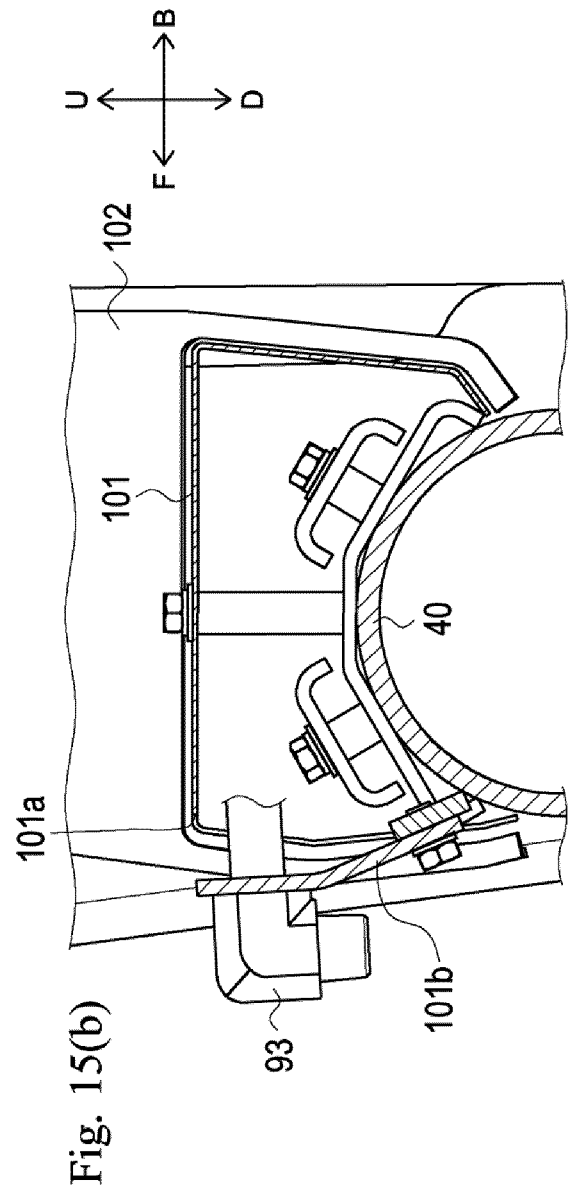
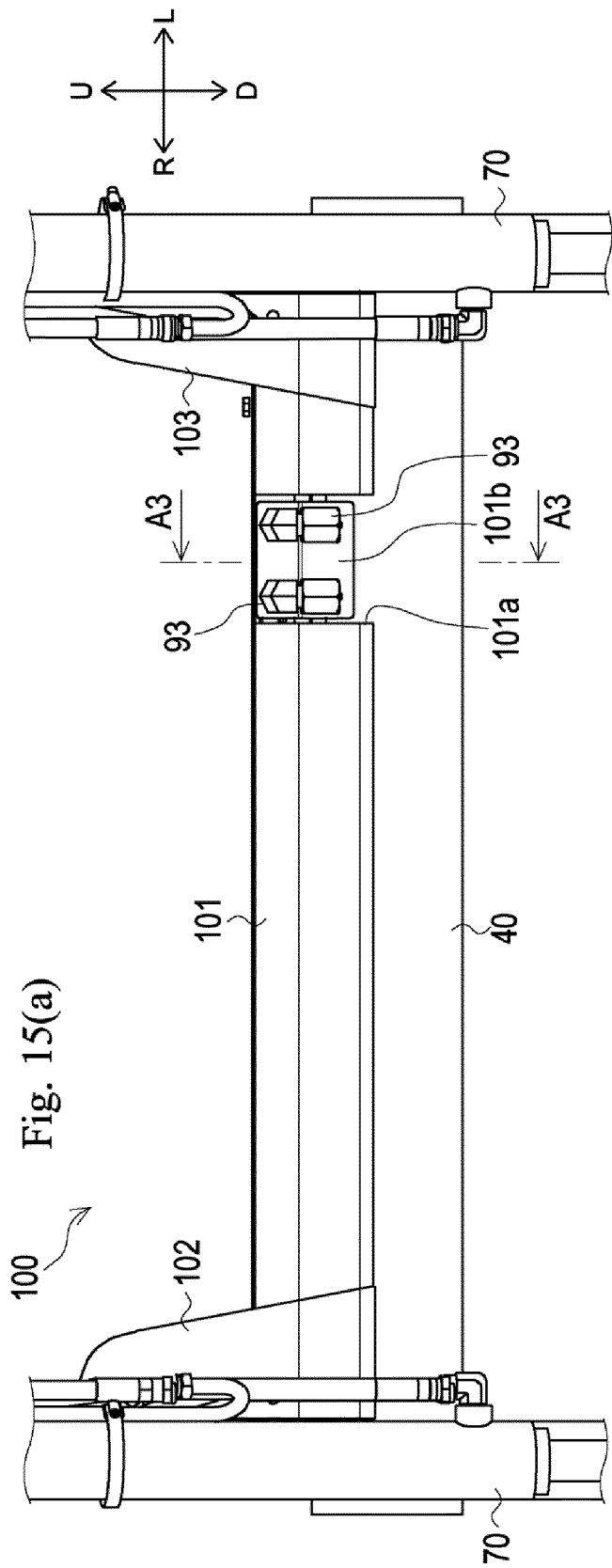


Fig. 14



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2022/041544

A. CLASSIFICATION OF SUBJECT MATTER		
<i>E02F 3/36</i> (2006.01)i; <i>E02F 9/00</i> (2006.01)i		
FI: E02F3/36 C; E02F9/00 H		
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)		
E02F3/36; E02F9/00		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
Published examined utility model applications of Japan 1922-1996		
Published unexamined utility model applications of Japan 1971-2023		
Registered utility model specifications of Japan 1996-2023		
Published registered utility model applications of Japan 1994-2023		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2005/0172795 A1 (WESTENDORF MANUFACTURING CO., INC.) 11 August 2005 (2005-08-11) paragraphs [0027]-[0041], fig. 1-3, etc.	1, 4
Y	paragraphs [0027]-[0041], fig. 1-3, etc.	2-9
X	JP 2008-025193 A (KUBOTA CORP) 07 February 2008 (2008-02-07) paragraphs [0026]-[0031], fig. 1-7, etc.	1-2
Y	paragraphs [0026]-[0031], fig. 1-7, etc.	2-9
X	JP 2006-249886 A (YANMAR CO LTD) 21 September 2006 (2006-09-21) paragraph [0038], fig. 7, etc.	1-2
Y	JP 2010-037810 A (KUBOTA CORP) 18 February 2010 (2010-02-18) paragraph [0022], etc.	5-8
Y	JP 2016-017338 A (SANYO KIKI CO LTD) 01 February 2016 (2016-02-01) claims, claim 3, paragraphs [0035]-[0053], fig. 2A-2C, fig. 5-7B, etc.	5-8
☒ 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 "E" earlier application or patent but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family		
Date of the actual completion of the international search		Date of mailing of the international search report
13 January 2023		24 January 2023
Name and mailing address of the ISA/JP		Authorized officer
Japan Patent Office (ISA/JP) 3-4-3 Kasumigaseki, Chiyoda-ku, Tokyo 100-8915 Japan		
		Telephone No.

Form PCT/ISA/210 (second sheet) (January 2015)

INTERNATIONAL SEARCH REPORT

International application No. PCT/JP2022/041544

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C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	WO 2008/134820 A1 (CHALLENGE IMPLEMENTS HOLDINGS PTY LIMITED) 13 November 2008 (2008-11-13) fig. 1, 4, 10-12, columns etc.	5-8
Y	JP 2011-017204 A (KUBOTA CORP) 27 January 2011 (2011-01-27) paragraphs [0019], [0022], [0024], fig. 4-5, etc.	9

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.

PCT/JP2022/041544

Patent document cited in search report	Publication date (day/month/year)	Patent family member(s)	Publication date (day/month/year)
US 2005/0172795 A1	11 August 2005	US 2005/0111953 A1	
		CA 2488208 A1	
JP 2008-025193 A	07 February 2008	US 2007/0243052 A1 paragraphs [0075]-[0085], fig. 1-7, etc.	
JP 2006-249886 A	21 September 2006	US 2009/0238634 A1 paragraphs [0079]-[0081], fig. 7, etc.	
		WO 2006/098082 A1	
		EP 1870525 A1	
JP 2010-037810 A	18 February 2010	(Family: none)	
JP 2016-017338 A	01 February 2016	(Family: none)	
WO 2008/134820 A1	13 November 2008	US 2010/0158653 A1	
		EP 2152975 A1	
		AU 2008247328 A1	
JP 2011-017204 A	27 January 2011	(Family: none)	

Form PCT/ISA/210 (patent family annex) (January 2015)

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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