

Description

Technical Field

[0001] The present invention relates to a work machine such as a hydraulic excavator or a dismantling work machine dismantling a vehicle.

Background Art

[0002] For example, in a hydraulic excavator, an upper swivel body including an operator cab or the like is laid on a lower traveling body to be swivelable by a swivel device. One end of a boom is rotatably coupled with a front portion of the upper swivel body. One end of an arm is rotatably coupled with another end of the boom. A bucket is rotatably coupled with another end of the arm.

[0003] A swiveling action of the upper swivel body and rotating actions of the boom, the arm, and the bucket are performed by operations, by an operator, of operation levers provided to the operator cab, for example.

[0004] In a case of ground leveling work or the like, precision of actions of the boom, the arm, and the bucket are requested. Accordingly, Patent Literature 1 discloses that switches for adjusting speeds of rotating actions of the boom, the arm, and the bucket are provided to the operation levers (see Patent Literature 1).

Citation List

Patent Literature

[0005] Patent Literature 1: Japanese Patent Laid-Open No. 2000-284849

Summary of Invention

Technical Problem

[0006] In an operation control method disclosed in Patent Literature 1, an operator has to adjust speeds of rotating actions of a boom, an arm, and a bucket by manually operating switches. Consequently, for example, one problem may be raised that in a case where the operator makes wrong switching of the switch, an action can be performed at a speed not intended by the operator.

[0007] An object of the present invention, which has been made in consideration of the above problems in related art, is to provide a work machine that is capable of causing an action object of the work machine to act in a manner intended by an operator.

Solution to Problem

[0008] A work machine of the present invention is a work machine for processing a work target object, the work machine including: a base body; a working unit

which is displaceable with respect to the base body and performs a processing action on the work target object; an operation accepting unit which accepts an operation for the working unit; a controller which controls displacement and the processing action of the working unit in accordance with an operation accepted by the operation accepting unit and an operation amount of the operation; and a distance acquisition unit which acquires a distance between the working unit and one region defined based on a position of the work target object, in which the controller adjusts a displacement amount or an action amount of the processing action of the working unit with respect to the operation amount in accordance with the distance.

Brief Description of Drawings

[0009]

FIG. 1 is a side view of a work machine according to a first embodiment.

FIG. 2 is a plan view of the work machine according to the first embodiment.

FIG. 3 is a perspective view of an operation lever in FIG. 2.

FIG. 4 is a block diagram illustrating function blocks of the work machine according to the first embodiment.

FIG. 5 is an explanatory diagram illustrating a control manner of the work machine by a controller in FIG. 4.

FIG. 6 is an enlarged front view of a grasping mechanism in FIG. 1.

FIG. 7 is a flowchart illustrating an action processing routine of the work machine according to the first embodiment.

FIG. 8 is a flowchart illustrating an output processing routine of the work machine according to the first embodiment.

FIG. 9 is a block diagram illustrating function blocks of a work machine according to a second embodiment.

FIG. 10 is a flowchart illustrating an action processing routine of the work machine according to the second embodiment.

FIG. 11 is a flowchart illustrating an output processing routine of the work machine according to the second embodiment.

Description of Embodiments

[0010] Embodiments of the present invention will hereinafter be described in detail with reference to drawings. However, those may appropriately be altered and combined. Further, in the following descriptions and the attached drawings, descriptions will be made while giving the same reference characters to substantially the same or equivalent portions.

First Embodiment

[0011] FIG. 1 is a side view of a vehicle dismantling machine 100 as a work machine according to a first embodiment. Note that the arrows in FIG. 1 indicate an up-down direction and a front-rear direction of the vehicle dismantling machine 100. The vehicle dismantling machine 100 as the work machine is a machine that dismantles a scrapped vehicle as a work target object into each component, for example.

[0012] As illustrated in FIG. 1, the vehicle dismantling machine 100 has a traveling body 11 as a base body. The traveling body 11 is of a crawler type and causes the vehicle dismantling machine 100 to move forward or rearward.

[0013] A swivel body 12 is provided on the traveling body 11 to be swivelable with respect to the traveling body 11. The swivel body 12 is provided to be swivelable in a direction around a swivel axis CX with respect to the traveling body 11.

[0014] A drive unit DV is provided to the swivel body 12. The drive unit DV includes a swiveling motor (not illustrated) which is capable of causing the swivel body 12 to swivel with respect to the traveling body 11. For example, the swiveling motor is driven by hydraulic oil from a hydraulic pressure generation device (not illustrated) which includes a hydraulic pressure pump to be driven by a driving force of an engine (not illustrated), causing the swivel body 12 to swivel.

[0015] A driver cab CB is disposed in a front side portion of the swivel body 12 in the front-rear direction of the vehicle dismantling machine 100 (the front-rear direction of the arrows in FIG. 1). In the driver cab CB, two operation levers (not illustrated) are provided by which the operator is capable of operating actions such as swiveling of the swivel body 12. Further, in the driver cab CB, a display (not illustrated) is provided which displays a control state of a swiveling action of the swivel body 12.

[0016] A boom 13a as a first arm portion is formed into a rod shape. One end of the boom 13a is connected with a front side of the swivel body 12 to be rotatable with respect to the swivel body 12, that is, to be capable of rising and falling. The boom 13a is rotatable with respect to the swivel body 12 in accordance with an operation of the operation lever by the operator.

[0017] One end of a rod-shaped arm 13b as a second arm portion is connected with another end of the boom 13a to be rotatable, that is, to be capable of rising and falling with respect to the boom 13a. The arm 13b is rotatable with respect to the boom 13a in accordance with an operation of the operation lever by the operator. A working arm 13 is made up of the boom 13a and the arm 13b.

[0018] A grasping mechanism 14 as a working unit is connected with another end of the arm 13b to be rotatable, that is, to be capable of rising and falling with respect to the arm 13b. The grasping mechanism 14 is rotatable with respect to the arm 13b in accordance with an oper-

ation of the operation lever by the operator. The grasping mechanism 14 is capable of making a grasping action for the vehicle as the work target object. As described above, the grasping mechanism 14 is displaceable with respect to the traveling body 11 and is capable of performing a processing action on the vehicle, that is, a grasping action.

[0019] A clamping device 15 has an arm support portion 15a which is provided to a front portion of the traveling body 11. The arm support portion 15a is connected with the traveling body 11.

[0020] The clamping device 15 has a pair of left and right pressing arms 15b which are supported by the arm support portion 15a. The clamping device 15 is capable of rising and falling in the up-down direction, that is, of rotating with respect to the traveling body 11.

[0021] Cameras CM are mounted on a total of four parts such that one camera is mounted on each of both sides in front and rear portions of the swivel body 12. Each of the cameras CM captures an image, and the vehicle dismantling machine 100 is thereby capable of acquiring videos or images on both sides in its front and rear portions.

[0022] FIG. 2 illustrates an upper surface of the vehicle dismantling machine 100. As illustrated in FIG. 2, the swivel body 12 is capable of swiveling around a swiveling center as the center. A control unit 20 controls a swiveling action of the swivel body 12, rotating actions of the boom 13a and the arm 13b, an action of the grasping mechanism 14, and so forth. The control unit 20 is provided to the swivel body 12. The control unit 20 is connected with the cameras CM to be capable of receiving imaged information from the cameras CM. The control unit 20 is capable of performing the control of the above swiveling action and so forth of the vehicle dismantling machine 100 based on the imaged information of the cameras CM.

[0023] In the driver cab CB, a seat ST is provided on which the operator is capable of being seated. Further, in the driver cab CB, an operation lever 30 is provided on a left side when seen from the seat ST. Further, in the driver cab CB, an operation lever 40 is provided on a right side when seen from the seat ST. The operator operates the operation levers 30 and 40 and can thereby cause the swivel body 12 to perform a swiveling action, for example.

[0024] FIG. 3 illustrates the operation lever. As illustrated in FIG. 3, the operation levers 30 and 40 have base portions BS and rod-shaped shafts 31 and 41 which are rotatably mounted on the base portions BS. The shafts 31 and 41 are rotatable in the front-rear direction and a left-right direction. The shafts 31 and 41 have, on their upper end sides, grip portions which are formed into cylindrical shapes. One ends, that is, lower ends of the shafts 31 and 41 are connected with sensors (not illustrated) which are capable of detecting inclination amounts, that is, operation amounts of the operation levers 30 and 40.

[0025] When the shaft 31 is inclined in the left-right

direction by the operator, for example, by control by the control unit 20, the swivel body 12 is caused to rotate, that is, swivel with respect to the traveling body 11. Specifically, when the shaft 31 is inclined rightward by the operator, the swivel body 12 is caused to swivel in a right-hand direction. When the shaft 31 is inclined leftward by the operator, the swivel body 12 is caused to swivel in a left-hand direction. An operation of the operation lever 30 for causing the swivel body 12 with respect to the traveling body 11 as described above will be denoted as a first operation.

[0026] When the shaft 41 is inclined in the front-rear direction by the operator, for example, by control by the control unit 20, the boom 13a is rotated with respect to the swivel body 12. Specifically, when the shaft 41 is inclined forward by the operator, the boom 13a is pushed out forward. When the shaft 41 is inclined rearward by the operator, the boom 13a is pulled rearward. An operation of the operation lever 40 for rotating the boom 13a with respect to the swivel body 12 as described above will be denoted as a second operation.

[0027] When the shaft 31 is inclined in the front-rear direction by the operator, for example, by control by the control unit 20, the arm 13b is rotated with respect to the boom 13a. Specifically, when the shaft 31 is inclined forward by the operator, the arm 13b is pushed out forward. When the shaft 31 is inclined rearward by the operator, the arm 13b is pulled rearward. An operation of the operation lever 30 for rotating the arm 13b with respect to the boom 13a as described above will be denoted as a third operation.

[0028] When the shaft 41 is inclined in the left-right direction by the operator, for example, by control by the control unit 20, the grasping mechanism 14 is rotated with respect to the arm 13b. Specifically, when the shaft 41 is inclined rightward by the operator, the grasping mechanism 14 is pushed out forward. When the shaft 41 is inclined rearward by the operator, the grasping mechanism 14 is pulled rearward.

[0029] The shafts 31 and 41 have, at their other ends, that is, at upper ends, opening portions which are formed by boring in the left-rear direction. Through these opening portions, operation buttons 32 and 42 are inserted.

[0030] The operation buttons 32 and 42 have base bodies 32a and 42a which are formed into rod shapes. Button portions 32b and 42b are integrally formed with other ends, that is, upper ends of the base bodies 32a and 42a. The operation buttons 32 and 42 are rotatable in the left-right direction along opening shapes of the opening portions of the shafts 31 and 41. One ends, that is, lower ends of the base bodies 32a and 42a are connected with sensors (not illustrated) which are capable of detecting inclination amounts, that is, operation amounts of the operation buttons 32 and 42.

[0031] When the operation button 32 is inclined in the left-right direction by the operator, for example, by control by the control unit 20, the grasping mechanism 14 is rotated with respect to the arm 13b. Specifically, when the

operation button 32 is inclined rightward by the operator, the grasping mechanism 14 is rotated in the right-hand direction. When the operation button 32 is inclined leftward by the operator, the grasping mechanism 14 is rotated in the left-hand direction.

[0032] When the operation button 42 is inclined in the left-right direction by the operator, for example, by control by the control unit 20, a pair of claw portions 14b and 14c of the grasping mechanism 14 are caused to open or close. Specifically, when the operation button 42 is inclined rightward by the operator, the pair of claw portions 14b and 14c of the grasping mechanism 14 are separated from each other, that is, the claw portion 14b is opened. When the operation button 42 is inclined leftward by the operator, the pair of claw portions 14b and 14c of the grasping mechanism 14 are caused to approach each other, that is, the claw portion 14b is closed. An operation of the operation button 42 for causing the pair of claw portions 14b and 14c of the grasping mechanism 14 to open and close, that is, for causing grasping as described above will be denoted as a fourth operation.

[0033] FIG. 4 illustrates function blocks of the control unit 20. As illustrated in FIG. 4, an input unit 21 is an interface unit which is connected with the cameras CM and the operation levers 30 and 40. Note that the control unit 20 is capable of acquiring the fact of whether the engine is in operation.

[0034] The control unit 20 is capable of accepting operations performed for the operation levers 30 and 40 via the input unit 21. Further, the control unit 20 is capable of acquiring imaged data of images captured by the cameras CM via the input unit 21.

[0035] An output unit 22 sends out drive signals to drive units (not illustrated) of the swivel body 12, the boom 13a, the arm 13b, and the grasping mechanism 14. The control unit 20 is, by the drive signals from the output unit 22, capable of causing the swivel body 12, the boom 13a, the arm 13b, and the grasping mechanism 14 to perform the above-described actions.

[0036] A controller 23 is realized with a computer which has a CPU (central processing unit) as an arithmetic processing unit, a ROM (read only memory) as a main storage device, and a RAM (random access memory). The CPU reads out a program corresponding to a processing content from the ROM, expands that in the RAM, cooperates with the expanded program, and thereby realizes various kinds of functions.

[0037] An operation accepting unit 23a is capable of accepting input operations by the operation levers 30 and 40. The operation accepting unit 23a is capable of acquiring facts that operations for the operation levers 30 and 40 are performed and amounts of the operations via the input unit 21. Consequently, the operation accepting unit 23a is capable of determining whether or not an operation of the operation levers 30 and 40 is performed.

[0038] Further, the operation accepting unit 23a is capable of accepting input operations by the operation buttons 32 and 42. The operation accepting unit 23a is ca-

pable of acquiring facts that operations for the operation buttons 32 and 42 are performed and amounts of the operations via the input unit 21. Consequently, the operation accepting unit 23a is capable of determining whether or not an operation of the operation buttons 32 and 42 is performed.

[0039] As described above, the operation accepting unit 23a is capable of accepting the first to fourth operations about the swiveling action of the swivel body. Specifically, in addition to the first operation for causing the swivel body 12 to swivel, the operation accepting unit 23a is capable of accepting the second operation about the rotating action of the boom 13a of the working arm 13. The operation accepting unit 23a is capable of accepting the third operation about the rotating action of the arm 13b of the working arm 13. The operation accepting unit 23a is capable of accepting the fourth operation about the grasping action of the grasping mechanism 14. Note that the operation accepting unit 23a is capable of acquiring, via the input unit 21, the fact of whether an operation of turning ON or OFF the engine of the drive unit DV of the vehicle dismantling machine 100 is performed.

[0040] A swiveling controller 23b is capable of controlling a rotating action, that is, a swiveling action of the swivel body 12. The swiveling controller 23b is capable of causing the swivel body 12 to swivel by driving the drive unit DV based on operations of the operation levers 30 and 40, the operations being accepted by the operation accepting unit 23a. Consequently, the swiveling controller 23b is capable of causing the swivel body 12 to perform a swiveling action in accordance with the amount of the first operation which is accepted by the operation accepting unit 23a.

[0041] A rotation controller 23c is capable of controlling a rotating action of the boom 13a. The rotation controller 23c is capable of rotating the boom 13a by driving the drive unit DV based on operations of the operation levers 30 and 40, the operations being accepted by the operation accepting unit 23a. Consequently, the rotation controller 23c is capable of causing the boom 13a of the working arm 13 to perform a rotating action in accordance with the amount of the second operation.

[0042] A rise-fall controller 23d is capable of controlling a rotating action, that is, a rising-falling action of the arm 13b. The rise-fall controller 23d is capable of causing the arm 13b to rise and fall by driving the drive unit DV based on operations of the operation levers 30 and 40, the operations being accepted by the operation accepting unit 23a. Consequently, the rise-fall controller 23d is capable of causing the arm 13b of the working arm 13 to perform a rising-falling action, that is, a rotating action in accordance with the amount of the third operation.

[0043] A grasping controller 23e is capable of controlling a rotating action and a grasping action of the grasping mechanism 14. The grasping controller 23e is capable of rotating the grasping mechanism 14 or causing the grasping mechanism 14 to perform a grasping action

based on operations of the operation buttons 32 and 42, the operations being accepted by the operation accepting unit 23a. Consequently, the grasping controller 23e is capable of causing the grasping mechanism 14 to act in accordance with the amount of the fourth operation.

[0044] A distance acquisition unit 23f is capable of, based on the imaged data of images captured by the cameras CM, for example, acquiring a distance between the grasping mechanism 14 and one region defined based on a position of the vehicle as the work target object. Note that the one region may be set as a work region, which is a region in which work is performed by an action of the grasping mechanism 14. In the present embodiment, descriptions will be made while the one region is set as the work region.

[0045] As described above, the distance acquisition unit 23f is capable of acquiring the distance from the grasping mechanism 14 to the work region, which is the region in which the vehicle dismantling machine 100 works.

[0046] The distance acquisition unit 23f calculates the distance from the grasping mechanism 14 to the work region based on image processing, for example. The work region may be a specific section of a vehicle to be dismantled, for example.

[0047] FIG. 5 illustrates a manner in which the controller 23 controls actions of the swivel body 12. In FIG. 5, a description will be made while the vicinity of a hood of a vehicle OB is set as a work region OA. Note that the work region OA is not limited to the vicinity of the hood of the vehicle OB but can appropriately be changed in accordance with embodiments. Further, in FIG. 5, the clamping device 15 is not illustrated in order to make clear a swiveling manner of the swivel body 12.

[0048] The controller 23 is capable of controlling a swiveling amount of the swivel body 12 in accordance with the distance from the grasping mechanism 14 to the work region OA. For example, the controller 23 controls the above swiveling amount based on a reference distance D1 to be a reference of the distance to the work region OA in which a process is to be performed by actions of the grasping mechanism 14. In this case, the controller 23 is capable of controlling the swiveling amount of the swiveling action of the swivel body 12 based on whether or not the distance from the grasping mechanism 14 to the work region OA is longer than the reference distance D1.

[0049] Note that the work region OA may be input by the operator, for example, by a touch panel of a display provided to the driver cab CB. Further, the work region OA may also be acquired from an external apparatus (not illustrated) connected with the control unit 20.

[0050] As illustrated in FIG. 5, a processing area PR is a region within the reference distance D1 from a center C of the work region OA. A description will be made about a case where a swiveling action of the swivel body 12 is started from a state where the grasping mechanism 14 is present on the outside of the processing area PR, that

is, a state where the vehicle dismantling machine 100 is in a posture illustrated by broken lines in FIG. 5 and the swivel body 12 is caused to swivel until the grasping mechanism 14 enters the processing area PR.

[0051] The controller 23 causes the swivel body 12 to swivel while switching modes of the swiveling action of the swivel body 12 in accordance with whether the grasping mechanism 14 is positioned on the outside of the processing area PR or positioned on the inside of the processing area PR, for example. In other words, the controller 23 switches modes of the swiveling action of the swivel body 12 in accordance with whether the grasping mechanism 14 is positioned within the reference distance D1 from the center C of the work region OA or the grasping mechanism 14 is positioned on the outside of the reference distance D1 from the center C of the work region OA.

[0052] On the outside of the processing area PR, the controller 23 causes the swivel body 12 to perform a swiveling action in a displacement mode as a mode of the swiveling action of the swivel body 12. When the grasping mechanism 14 enters the processing area PR, the controller 23 causes the swivel body 12 to perform a swiveling action in a work mode as a mode of the swiveling action of the swivel body 12.

[0053] In a case where the operation lever 30 is operated by the same operation amount in the displacement mode and the work mode, the swivel body 12 is caused to swivel more precisely in the work mode than the displacement mode. That is, in the work mode, the swivel body 12 is caused to swivel in a manner in which a swiveling speed is slower than the displacement mode.

[0054] As described above, even when the operation amount of the operation lever 30 is the same, the swiveling amount of the swivel body 12 is different in accordance with whether or not the distance from the grasping mechanism 14 to the work region OA is the reference distance D1 or less.

[0055] FIG. 6 illustrates an enlarged front view of the grasping mechanism 14. As illustrated in FIG. 6, the grasping mechanism 14 has a base portion 14a which is connected with the other end of the arm 13b. Specifically, the base portion 14a is connected with the other end of the arm 13b to be turnable around an axis of the arm 13b. Consequently, the grasping mechanism 14 is rotatable around the axis of the arm 13b. The grasping mechanism 14 is rotatable with respect to the arm 13b in accordance with an operation of the operation lever by the operator.

[0056] The grasping mechanism 14 has the pair of claw portions 14b and 14c which are formed into claw shapes. In other words, the grasping mechanism 14 has the pair of claw portions 14b and 14c as gripping members. The claw portion 14b is integrally formed with the base portion 14a. One end of the claw portion 14c is pivotally supported by a shaft SH of the base portion 14a.

[0057] Consequently, the claw portion 14c rotates around an axis of the shaft SH, and the respective other

ends of the pair of claw portions 14b and 14c thereby approach each other or are separated from each other, that is, a grasping action is capable of being performed. The respective other ends of the pair of claw portions 14b and 14c are capable of approaching each other or being separated from each other in accordance with an operation of the operation button 42 by the operator, for example. Note that the arrows in FIG. 6 indicate a movable range RM of a claw portion 14c.

[0058] The controller 23 is capable of controlling an action amount of the grasping action of the grasping mechanism 14 in accordance with the distance from the grasping mechanism 14 to the work region OA. Specifically, the controller 23 causes the grasping mechanism 14 to perform grasp while switching modes of the grasping action of the grasping mechanism 14 in accordance with whether the grasping mechanism 14 is positioned on the outside of the processing area PR or positioned on the inside of the processing area PR. In other words, the controller 23 switches modes of the grasping action of the grasping mechanism 14 in accordance with whether the grasping mechanism 14 is positioned within the reference distance D1 from the center C of the work region OA or the grasping mechanism 14 is positioned on the outside of the reference distance D1 from the center C of the work region OA.

[0059] On the outside of the processing area PR, the controller 23 causes the grasping mechanism 14 to perform a grasping action in a displacement mode as a mode of the grasping action of the grasping mechanism 14. When the grasping mechanism 14 enters the processing area PR, the controller 23 causes the grasping mechanism 14 to perform a grasping action in a work mode as a mode of the grasping action of the grasping mechanism 14.

[0060] In a case where the operation lever 30 is operated by the same operation amount in the displacement mode and the work mode, the grasping mechanism 14 is caused to operate more precisely in the work mode than the displacement mode. That is, in the work mode, the grasping mechanism 14 is caused to operate in a manner in which a grasping speed is slower than the displacement mode. Further, a maximum opening is set narrower than the displacement mode such that the grasping mechanism 14 operates suitably for work in a narrow and small space.

[0061] Further, the controller 23 may change modes of the grasping action of the grasping mechanism 14 in accordance with an attribute of the work region. For example, in a step of detaching a harness from the vehicle OB, the grasping mechanism 14 has to be caused to act more precisely than a step of removing the hood from the vehicle. Consequently, for example, in a case where the grasping mechanism 14 is caused to perform a grasping action for an object, for which the grasping mechanism 14 is caused to precisely act, such as a harness (also referred to as precise processing target), the controller 23 may cause the grasping mechanism 14 to act

in a fine operation mode for performing a grasping action in a manner in which a grasping action speed is slower than the work mode.

[0062] FIG. 7 illustrates one example of an action processing routine R1 of an object to be operated by the controller 23. Note that a description will be made on the assumption that in FIG. 7 and FIG. 8, the objects to be operated are the swivel body 12, the boom 13a, the arm 13b, and the grasping mechanism 14.

[0063] As illustrated in FIG. 7, the controller 23 determines whether or not the engine of the vehicle dismantling machine 100 is ON (STEP 101). In STEP 101, the controller 23 acquires the fact of whether an operation of turning ON or OFF the engine of the vehicle dismantling machine 100 is performed via the input unit 21, for example. That is, the controller 23 functions as the operation accepting unit 23a.

[0064] In a case where it is determined that the engine is not ON in the determination in STEP 101 (STEP 101: N), the controller 23 finishes the process.

[0065] In a case where it is determined that the engine is ON in the determination in STEP 101 (STEP 101: Y), the controller 23 determines whether or not the distance from the grasping mechanism 14 to the work region OA is the reference distance D1 or less (STEP 102).

[0066] The determination in STEP 102 is made, for example, based on image data of images captured by the cameras CM and in accordance with whether the grasping mechanism 14 is positioned on the inside of the processing area PR. In other words, the controller 23 acquires the distance from the grasping mechanism 14 to the work region OA based on the image data. Consequently, the controller 23 functions as the distance acquisition unit 23f which acquires the distance from the grasping mechanism 14 to the work region OA.

[0067] In a case where the distance acquisition unit 23f of the controller 23 determines, in the determination in STEP 102, that the distance is longer than the reference distance D1, that is, not the reference distance D1 or less (STEP 102: N), the controller 23 sets a control mode for the object to be operated to the above-described displacement mode (STEP 103). Note that as described above, the displacement mode is a control mode for performing an action in a manner in which an action speed is faster than the work mode.

[0068] In a case where it is determined that the distance is the reference distance D1 or less in the determination in STEP 102 (STEP 102: Y), the controller 23 sets the control mode for the object to be operated to the above-described work mode (STEP 104). Note that as described above, the work mode is a control mode for performing an action in a manner in which an action of the object to be operated is precise and the action speed is faster than the fine operation mode.

[0069] After STEP 103 or STEP 104, the controller 23 determines whether or not the engine of the vehicle dismantling machine 100 is OFF (STEP 105).

[0070] In a case where it is determined that the engine

is ON, that is, the engine is not OFF in the determination in STEP 105 (STEP 105: N), the controller 23 returns to the determination in STEP 102 and repeats subsequent processes.

5 **[0071]** In a case where it is determined that the engine is OFF in the determination in STEP 105 (STEP 105: Y), the controller 23 finishes the process.

[0072] FIG. 8 illustrates one example of an output processing routine R2 for the drive unit in each control mode to be executed by each of the swiveling controller 23b to the grasping controller 23e of the controller 23. The controller 23 performs an output to the drive unit while making correction, which corresponds to each of the control modes, to an input amount of the first operation to the fourth operation.

10 **[0073]** As illustrated in FIG. 8, the controller 23 determines whether or not an operation about an action of the object to be operated is accepted (STEP 201). In STEP 201, the controller 23 makes the determination based on whether or not an operation by the operation button 42 is accepted. Consequently, the controller 23 functions as the operation accepting unit 23a.

15 **[0074]** In a case where it is determined that the operation is not accepted in the determination in STEP 201 (STEP 201: N), the controller 23 finishes the process.

20 **[0075]** In a case where it is determined that the operation is accepted in the determination in STEP 201 (STEP 201: Y), the controller 23 determines whether or not the control mode is the work mode (STEP 202). In STEP 202, the determination about whether or not the control mode is the work mode is made by acquiring a result of a determination process in STEP 102 illustrated in FIG. 7.

25 **[0076]** In a case where it is determined that the control mode is the work mode in the determination in STEP 202 (STEP 202: Y), the controller 23 performs an output to the drive unit while multiplying the operation amount of the operation accepted in STEP 201 by a first correction value defined in advance, that is, performs a first correction output (STEP 203). Note that the first correction value is a numerical value which is smaller than one and greater than zero, for example.

30 **[0077]** In STEP 203, the controller 23 outputs the action amount corresponding to the accepted operation amount to the drive unit of the object to be operated and causes the object to be operated to act. That is, the controller 23 functions as from the swiveling controller 23b to the grasping controller 23e. Consequently, the controller 23 adjusts the action amounts of the objects for action, with respect to the amounts of the first operation to the fourth operation in accordance with the distance from the grasping mechanism 14 to the work region OA.

35 **[0078]** In a case where the distance acquisition unit 23f of the controller 23 determines that the control mode is not the work mode in the determination in STEP 202 (STEP 202: N), the controller 23 outputs the operation amount accepted in STEP 201 to the drive unit, that is, performs an output (STEP 204).

40 **[0079]** In STEP 204, the controller 23 outputs the ac-

tion amount corresponding to the accepted operation amount to the drive unit of the object to be operated and causes the object to be operated to act. That is, the controller 23 functions as from the swiveling controller 23b to the grasping controller 23e. Consequently, the controller 23 adjusts the action amounts of the objects for action, with respect to the amounts of the first operation to the fourth operation in accordance with the distance from the grasping mechanism 14 to the work region OA.

[0080] After STEP 203 or STEP 204, the controller 23 determines whether or not the engine of the vehicle dismantling machine 100 is OFF (STEP 205).

[0081] In a case where it is determined that the engine is not OFF in the determination in STEP 205 (STEP 205: N), the controller 23 returns to the determination in STEP 201 and repeats subsequent processes.

[0082] In a case where it is determined that the engine is OFF in the determination in STEP 205 (STEP 205: Y), the controller 23 finishes the process.

[0083] As described above, the controller 23 adjusts the action amounts of the objects to be operated, which are caused to act, with respect to the operation amounts of the first operation to the fourth operation in accordance with the distance to the work region OA. Note that the objects to be operated whose action amounts are adjusted by the controller 23 are not limited to the swivel body 12, the boom 13a, the arm 13b, or the grasping mechanism 14 but may be the clamping device 15, for example.

[0084] As described above, in the vehicle dismantling machine 100 according to the present embodiment, the controller 23 adjusts the action amounts of the objects for action, with respect to the operation amount of the first operation, the amount of the second operation, the amount of the third operation, and the amount of the fourth operation in accordance with the distance to the work region OA. Accordingly, for example, in a case where the distance to the work region OA is long, the actions of the swivel body 12 and so forth can largely and quickly be performed. Further, for example, in a case where the distance to the work region OA is short, the actions of the swivel body 12 and so forth can small and slowly be performed. Consequently, it becomes possible to cause an action object of the vehicle dismantling machine 100 to act in a manner intended by the operator.

Second Embodiment

[0085] A vehicle dismantling machine 100 according to a second embodiment of the present invention will be described. The vehicle dismantling machine 100 according to the second embodiment is different from the vehicle dismantling machine 100 of the first embodiment in the point that the action amount of the object caused to act is adjusted in accordance with a section of the vehicle OB as an object to be dismantled, in other words, an attribute of the work region OA. The other points are the same as the vehicle dismantling machine 100 of the first embodiment, and descriptions thereof will thus not be

made.

[0086] FIG. 9 illustrates function blocks of the control unit 20 of the vehicle dismantling machine 100 of the second embodiment. As illustrated in FIG. 9, the control unit 20 of the second embodiment is different from the control unit 20 of the first embodiment in the point that the controller 23 has an attribute information acquisition unit 23g.

[0087] The attribute information acquisition unit 23g is capable of acquiring attribute information of the work region OA such as the vicinity of the hood, the vicinity of a door, or a bottom surface side of the vehicle OB, for example, based on imaged data of image captured by the cameras CM, for example. Consequently, the attribute information acquisition unit 23g is capable of acquiring the attribute information of the work region OA.

[0088] FIG. 10 illustrates one example of an action processing routine R3 of the object to be operated by the controller 23. Note that a description will be made on the assumption that in FIG. 10 and FIG. 11, the objects to be operated are the swivel body 12, the boom 13a, the arm 13b, and the grasping mechanism 14.

[0089] As illustrated in FIG. 10, the controller 23 determines whether or not the engine of the vehicle dismantling machine 100 is ON (STEP 301). In STEP 301, the controller 23 acquires the fact of whether an operation of turning ON or OFF the engine of the vehicle dismantling machine 100 is performed via the input unit 21, for example. That is, the controller 23 functions as the operation accepting unit 23a.

[0090] In a case where it is determined that the engine is not ON in the determination in STEP 301 (STEP 301: N), the controller 23 finishes the process.

[0091] In a case where it is determined that the engine is ON in the determination in STEP 301 (STEP 301: Y), the controller 23 determines whether or not the distance from the grasping mechanism 14 to the work region OA is the reference distance D1 or less (STEP 302).

[0092] The determination in STEP 302 is made, for example, based on image data of images captured by the cameras CM and in accordance with whether the grasping mechanism 14 is positioned on the inside of the processing area PR. In other words, the controller 23 acquires the distance from the grasping mechanism 14 to the work region OA based on the image data. Consequently, the controller 23 functions as the distance acquisition unit 23f which acquires the distance from the grasping mechanism 14 to the work region OA.

[0093] In a case where the distance acquisition unit 23f of the controller 23 determines, in the determination in STEP 302, that the distance is longer than the reference distance D1, that is, not the reference distance D1 or less (STEP 302: N), the controller 23 sets the control mode for the object to be operated to the above-described displacement mode (STEP 303). Note that as described above, the displacement mode is a control mode for performing an action in a manner in which the action speed is faster than the work mode.

[0094] In a case where it is determined that the distance is the reference distance D1 or less in the determination in STEP 302 (STEP 302: Y), the controller 23 determines whether or not the attribute of the work region OA is the precise processing target (STEP 304). In STEP 304, the determination about whether or not the attribute of the work region OA is the precise processing target may be performed based on input information input by the operator by a touch panel of a display provided to the driver cab CB, for example, as described above or may be performed based on information acquired from an external apparatus (not illustrated) connected with the control unit 20.

[0095] Further, the work region OA may be acquired based on the imaged data of image captured by the cameras CM as described below. The controller 23 acquires plural sets of imaged data of images captured by the cameras CM in each regular time period, for example. By image processing, the controller 23 assesses to which section of the vehicle OB the grasping mechanism 14 is moving based on the plural sets of imaged data. The controller 23 acquires the attribute information while setting a section of the vehicle OB, the section being positioned in a moving direction of the grasping mechanism 14, as the attribute of the work region OA.

[0096] For example, in a case where the attribute of the work region OA is the hood, the grasping mechanism 14 gradually moves toward the hood. The controller 23 is capable of, by image processing, assessing that the grasping mechanism 14 is moving to the hood of the vehicle OB based on the plural sets of imaged data of images captured in each regular time period. The controller 23 acquires the attribute information while setting the hood of the vehicle OB as the attribute of the work region OA. Consequently, the controller 23 functions as the attribute information acquisition unit 23g.

[0097] In a case where the distance acquisition unit 23f of the controller 23 determines that the attribute of the work region OA is the precise processing target in the determination in STEP 304 (STEP 304: Y), the controller 23 sets the control mode for the object to be operated to the above-described fine operation mode (STEP 305). Note that as described above, the fine operation mode is a control mode for performing an action in a manner in which an action of the object to be operated is precise and the action speed is slower than the work mode.

[0098] In a case where the distance acquisition unit 23f of the controller 23 determines that the attribute of the work region OA is not the precise processing target in the determination in STEP 304 (STEP 304: N), the controller 23 sets the control mode for the object to be operated to the above-described work mode (STEP 306). Note that as described above, the work mode is a control mode for performing an action in a manner in which an action of the object to be operated is precise and the action speed is faster than the fine operation mode.

[0099] After STEP 303, STEP 305, or STEP 306, the

controller 23 determines whether or not the engine of the vehicle dismantling machine 100 is OFF (STEP 307).

[0100] In a case where it is determined that the engine is not OFF in the determination in STEP 307 (STEP 307: N), the controller 23 returns to the determination in STEP 302 and repeats subsequent processes.

[0101] In a case where it is determined that the engine is OFF in the determination in STEP 307 (STEP 307: Y), the controller 23 finishes the process.

[0102] As described above, the controller 23 adjusts the action amounts of the objects to be operated, which are caused to act, with respect to the operation amounts of the first operation to the fourth operation in accordance with the distance to the work region OA. Note that the objects to be operated whose action amounts are adjusted by the controller 23 are not limited to the swivel body 12, the boom 13a, the arm 13b, or the grasping mechanism 14 but may be the clamping device 15, for example.

[0103] FIG. 11 illustrates one example of an output processing routine R4 for the drive unit in each control mode to be executed by each of the swiveling controller 23b to the grasping controller 23e of the controller 23. The controller 23 performs an output to the drive unit while making correction, which corresponds to the displacement mode, the work mode, or the fine operation mode, to an input amount of the first operation to the fourth operation.

[0104] As illustrated in FIG. 11, the controller 23 determines whether or not an operation about an action of the object to be operated is accepted (STEP 401). In STEP 401, the controller 23 makes the determination based on whether or not an operation by the operation button 42 is accepted. Consequently, the controller 23 functions as the operation accepting unit 23a.

[0105] In a case where it is determined that the operation is not accepted in the determination in STEP 401 (STEP 401: N), the controller 23 finishes the process.

[0106] In a case where it is determined that the operation is accepted in the determination in STEP 401 (STEP 401: Y), the controller 23 determines whether or not the control mode is the work mode (STEP 402). In STEP 402, the determination about whether or not the control mode is the work mode is made by acquiring a result of a determination process in STEP 304 illustrated in FIG. 10.

[0107] In a case where it is determined that the control mode is the work mode in the determination in STEP 402 (STEP 402: Y), the controller 23 performs an output to the drive unit while multiplying the operation amount of the operation accepted in STEP 401 by a first correction value defined in advance, that is, performs a first correction output (STEP 403). Note that the first correction value is a numerical value which is smaller than one and greater than zero, for example.

[0108] In STEP 403, the controller 23 outputs the action amount corresponding to the accepted operation amount to the drive unit of the object to be operated and causes the object to be operated to act. That is, the con-

troller 23 functions as from the swiveling controller 23b to the grasping controller 23e. Consequently, the controller 23 adjusts the action amounts of the objects for action, with respect to the amounts of the first operation to the fourth operation in accordance with the attribute of the work region OA.

[0109] In a case where the distance acquisition unit 23f of the controller 23 determines that the control mode is not the work mode in the determination in STEP 402 (STEP 402: N), the distance acquisition unit 23f determines whether or not the control mode is the fine operation mode (STEP 404). In STEP 404, the determination about whether or not the control mode is the fine operation mode is made by acquiring a result of a determination process in STEP 304 illustrated in FIG. 10.

[0110] In a case where the controller 23 determines that the control mode is the fine operation mode in the determination in STEP 404 (STEP 404: Y), the controller 23 performs an output to the drive unit while multiplying the operation amount accepted in STEP 401 by a second correction value defined in advance, that is, performs a second correction output (STEP 405). Note that the second correction value is a numerical value which is smaller than one and greater than zero and is a numerical value which is smaller than the first correction value, for example.

[0111] In STEP 405, the controller 23 outputs the action amount corresponding to the accepted operation amount to the drive unit of the object to be operated and causes the object to be operated to act. That is, the controller 23 functions as from the swiveling controller 23b to the grasping controller 23e.

[0112] Consequently, the controller 23 adjusts the action amounts of the objects for action, with respect to the amounts of the first operation to the fourth operation in accordance with the attribute of the work region OA.

[0113] In a case where the controller 23 determines that the control mode is not the fine operation mode in the determination in STEP 404 (STEP 404: N), the controller 23 outputs the operation amount accepted in STEP 401 to the drive unit, that is, performs an output (STEP 406).

[0114] In STEP 406, the controller 23 outputs the action amount corresponding to the accepted operation amount to the drive unit of the object to be operated and causes the object to be operated to act. That is, the controller 23 functions as from the swiveling controller 23b to the grasping controller 23e.

[0115] Consequently, the controller 23 adjusts the action amounts of the objects for action, with respect to the amounts of the first operation to the fourth operation in accordance with the attribute of the work region OA.

[0116] After STEP 403, STEP 405, or STEP 406, the controller 23 determines whether or not the engine of the vehicle dismantling machine 100 is OFF (STEP 407).

[0117] In a case where it is determined that the engine is not OFF in the determination in STEP 407 (STEP 407: N), the controller 23 returns to the determination in STEP

401 and repeats subsequent processes.

[0118] In a case where it is determined that the engine is OFF in the determination in STEP 407 (STEP 407: Y), the controller 23 finishes the process.

5 **[0119]** Note that the objects whose action amounts are changed by the controller 23 are not limited to the swivel body 12, the boom 13a, the arm 13b, or the grasping mechanism 14 but may be the clamping device 15, for example.

10 **[0120]** Further, in the above-described embodiment, a description is made while the working unit is set as the grasping mechanism 14. However, the working unit is not limited to the grasping mechanism 14 but may be a bucket used for an excavator, for example.

15 **[0121]** In addition, in the above-described embodiment, a description is made while the working machine is set as the vehicle dismantling machine 100. However, the working machine may be used not only for the vehicle dismantling machine 100 but also for machines such as a construction demolition machine, a hydraulic shovel, and a scrap loader, for example.

20 **[0122]** For example, in a step of detaching a harness from a vehicle, the grasping mechanism 14 has to be caused to act more finely than a step of removing a hood from the vehicle. In the vehicle dismantling machine 100 according to the present embodiment, the controller 23 adjusts the action amounts of the objects for action, with respect to the amount of the first operation, the amount of the second operation, the amount of the third operation, and the amount of the fourth operation in accordance with the attribute of the work region OA, in other words, in accordance with whether a target of work is tearing of the hood of the vehicle OB or detachment of the harness, for example, and the vehicle dismantling machine 100 thereby adjusts the action amounts of the objects for action. Consequently, it becomes possible to adjust the action amount of the object for action, in accordance with the work intended by the operator.

25 **[0123]** The controller 23 adjusts a displacement amount or an action amount of a processing action of the grasping mechanism 14 with respect to the operation amount in accordance with a distance between the grasping mechanism 14 (working unit) and one region. Accordingly, for example, in a case where the distance is long, the grasping mechanism 14 can be caused to quickly act while its displacement amount is made large. Further, for example, in a case where the distance is short, the grasping mechanism 14 can be caused to slowly act while its displacement amount is made small. Consequently, it becomes possible to cause the grasping mechanism 14 to be displaced or to act in a manner intended by the operator.

30 **[0124]** Further, the one region is the work region OA as a region in which work is performed by an action of the grasping mechanism 14. In such a manner, the one region is the work region OA, and the controller 23 thereby adjusts the displacement amount or the action amount of the processing action of the grasping mechanism 14

with respect to the operation amount in accordance with the distance from the grasping mechanism 14 to the region where work is performed, that is, the distance to the work region OA. Consequently, it becomes possible to cause the grasping mechanism 14 to be displaced or to act in a manner corresponding to work to be performed by the operator.

[0125] Further, the work machine has the attribute information acquisition unit 23g which acquires the attribute information indicating the attribute of a process to be performed in the one region, and the controller 23 adjusts the displacement amount or the action amount of the grasping mechanism 14 with respect to the operation amount in accordance with the attribute information of the one region. In such a manner, the controller 23 adjusts the displacement amount or the action amount of the grasping mechanism 14 in accordance with the attribute information of the work region OA, in other words, in accordance with whether a target of work is tearing of the hood of the vehicle OB or detachment of the harness, for example. Consequently, it becomes possible to adjust the action amount of the object for action, in accordance with the work intended by the operator.

[0126] The work machine includes the swivel body 12 which is swivelable with respect to the traveling body 11 and the working arm 13 that has the boom 13a (first arm portion) whose one end is rotatably coupled with the swivel body 12 and the arm 13b (second arm portion) whose one end is coupled with the other end of the boom 13a rotatably with respect to the boom 13a and whose other end is coupled with the grasping mechanism 14. The operation accepting unit 23a accepts the first operation about the swiveling action of the swivel body 12, the second operation about the rotating action of the boom 13a of the working arm 13, the third operation about the rotating action of the arm 13b of the working arm 13, or the fourth operation about the action of the grasping mechanism 14. The controller 23 causes the swivel body 12 to perform the swiveling action by the swiveling amount corresponding to the operation amount of the first operation accepted by the operation accepting unit 23a, causes the boom 13a of the working arm 13 to perform the rotating action by a first rotation amount corresponding to the operation amount of the second operation, causes the arm 13b of the working arm 13 to perform the rotating action by a second rotation amount corresponding to the operation amount of the third operation, causes the grasping mechanism 14 to perform the action by the action amount corresponding to the operation amount of the fourth operation, and adjusts the swiveling amount with respect to the operation amount of the first operation, the first rotation amount with respect to the operation amount of the second operation, the second rotation amount with respect to the operation amount of the third operation, or the action amount with respect to the operation amount of the fourth operation in accordance with the distance to the one region.

[0127] In such a manner, the controller 23 adjusts the

swiveling amount with respect to the operation amount of the first operation, the first rotation amount with respect to the operation amount of the second operation, the second rotation amount with respect to the operation amount of the third operation, or the action amount with respect to the operation amount of the fourth operation in accordance with the distance to the one region. Consequently, it is possible to perform minute adjustment by adjusting the action amount or the like of each of the objects caused to act, and it becomes possible to cause the object to perform the action corresponding to an intention of the operator.

[0128] The grasping mechanism 14 has the base portion connected with the arm 13b and the pair of claw portions 14b and 14c (gripping members) which are pivotally supported by the base portion and are capable of pinching and retaining an object by an opening-closing action, and the controller 23 causes the grasping mechanism 14 to act in plural work action modes among which an opening-closing action amount of the pair of claw portions 14b and 14c with respect to the operation amount of the fourth operation is different.

[0129] In such a manner, the controller 23 adjusts the action amount of the grasping mechanism 14 and can thereby cause the pair of claw portions 14b and 14c of the grasping mechanism 14 to perform a proper action corresponding to a work step. Specifically, for example, in a case where precise work such as detaching the harness from the vehicle OB is needed, it is possible to cause the grasping mechanism 14 to more minutely act than work needing a large action such as removing the hood from the vehicle OB.

[0130] The controller 23 may cause the swivel body 12 to swivel in plural work action modes among which the swiveling amount of the swivel body 12 with respect to the operation amount of the first operation is mutually different. In such a manner, it becomes possible to cause the swivel body 12 to swivel, that is, cause the grasping mechanism 14 to be displaced in a manner intended by the operator.

Reference Signs List

[0131]

100	vehicle dismantling machine
11	traveling body (base body)
12	swivel body
13	working arm
13a	boom
13b	arm
14	grasping mechanism (working unit)
20	control unit
23	controller
23g	attribute information acquisition unit
OB	vehicle

Claims

1. A work machine for processing a work target object, the work machine comprising:

a base body;

a working unit which is displaceable with respect to the base body and performs a processing action on the work target object;

an operation accepting unit which accepts an operation for the working unit;

a controller which controls displacement and the processing action of the working unit in accordance with an operation accepted by the operation accepting unit and an operation amount of the operation; and

a distance acquisition unit which acquires a distance between the working unit and one region defined based on a position of the work target object, wherein

the controller adjusts a displacement amount or an action amount of the processing action of the working unit with respect to the operation amount in accordance with the distance.

2. The work machine according to claim 1, wherein the one region is a work region, which is a region in which work is performed by an action of the working unit.

3. The work machine according to claim 2, further comprising

an attribute information acquisition unit which acquires attribute information indicating an attribute of a process to be performed in the one region, wherein

the controller adjusts the displacement amount or an action amount of the working unit with respect to the operation amount in accordance with the attribute information of the one region.

4. The work machine according to claim 1, further comprising:

a swivel body which is swivelable with respect to the base body; and

a working arm which has a first arm portion whose one end is rotatably coupled with the swivel body and a second arm portion whose one end is coupled with another end of the first arm portion rotatably with respect to the first arm portion and whose other end is coupled with a grasping mechanism, wherein

the operation accepting unit accepts a first operation about a swiveling action of the swivel body, a second operation about a rotating action of the first arm portion of the working arm, a third

operation about a rotating action of the second arm portion of the working arm, or a fourth operation about an action of the working unit, and the controller

causes the swivel body to perform the swiveling action by a swiveling amount corresponding to an operation amount of the first operation accepted by the operation accepting unit, causes the first arm portion of the working arm to perform the rotating action by a first rotation amount corresponding to an operation amount of the second operation, causes the second arm portion of the working arm to perform the rotating action by a second rotation amount corresponding to an operation amount of the third operation, causes the working unit to perform the action by an action amount corresponding to an operation amount of the fourth operation, and

adjusts the swiveling amount with respect to the operation amount of the first operation, the first rotation amount with respect to the operation amount of the second operation, the second rotation amount with respect to the operation amount of the third operation, or the action amount with respect to the operation amount of the fourth operation in accordance with the distance to the one region.

5. The work machine according to claim 4, wherein

the working unit has a base portion connected with the second arm portion and a pair of gripping members which are pivotally supported by the base portion and are capable of pinching and retaining an object by an opening-closing action, and

the controller causes the working unit to act in plural work action modes among which an opening-closing action amount of the pair of gripping members with respect to the operation amount of the fourth operation is different.

6. The work machine according to claim 4 or 5, wherein the controller causes the swivel body to swivel in plural work action modes among which the swiveling amount of the swivel body with respect to the operation amount of the first operation is mutually different.

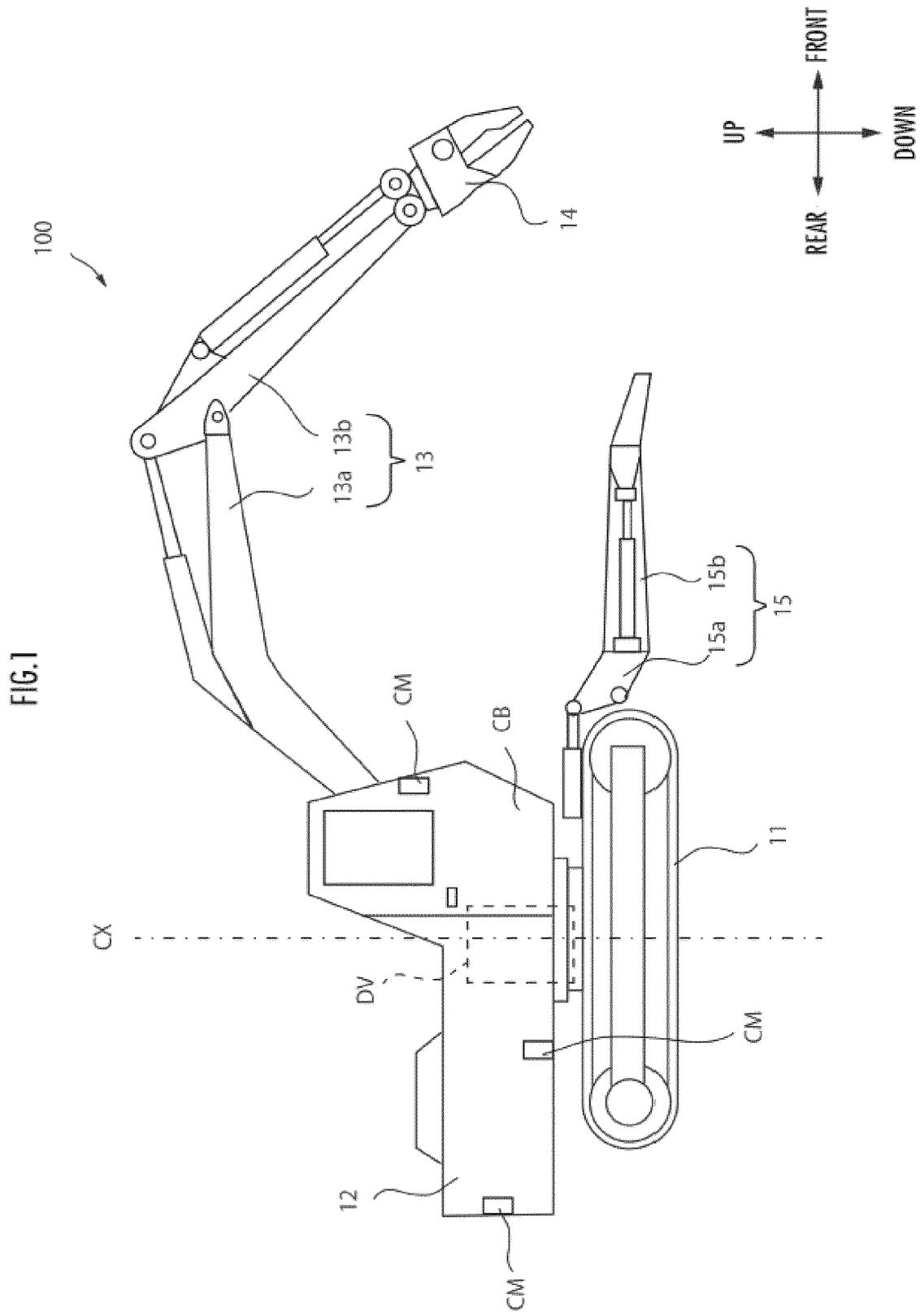


FIG.2

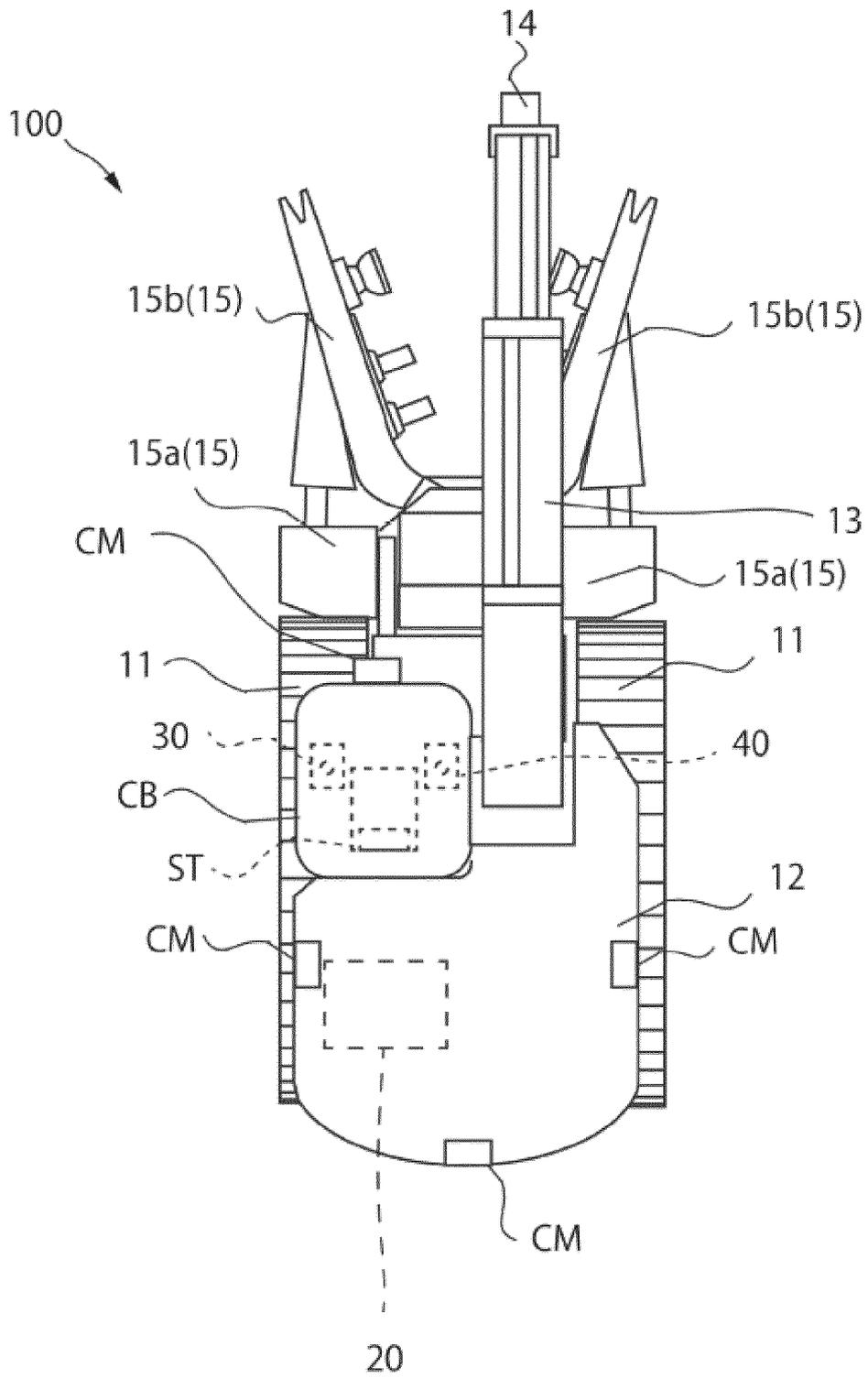


FIG.3

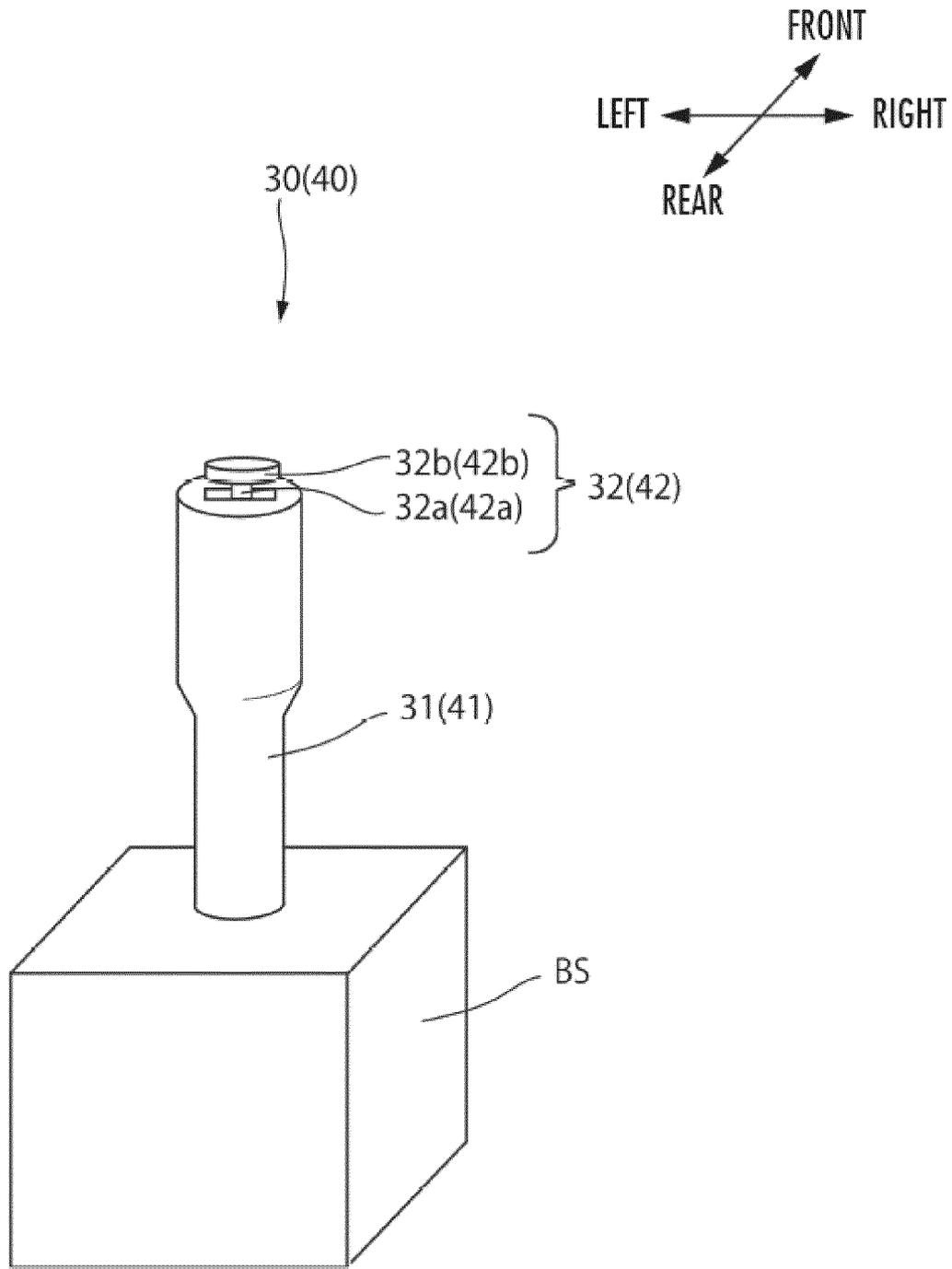


FIG.4

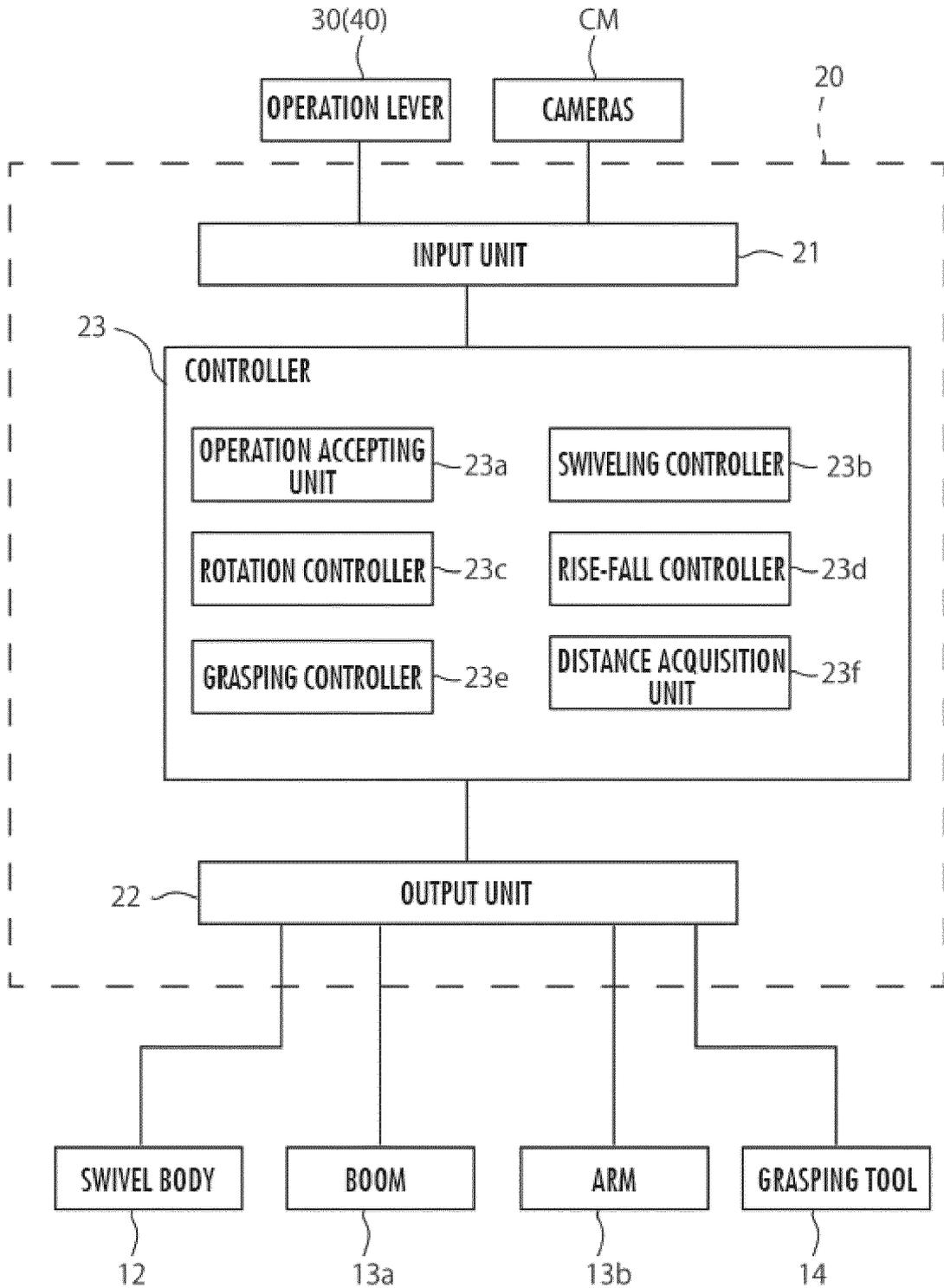


FIG.6

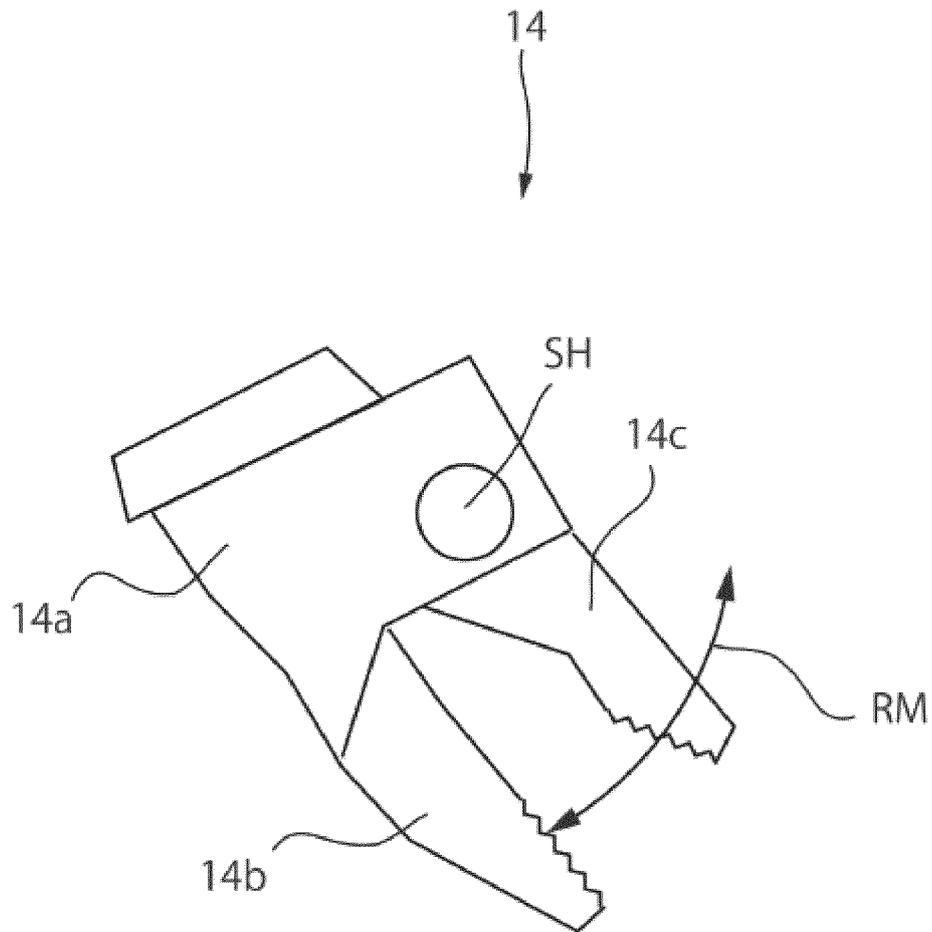


FIG.7

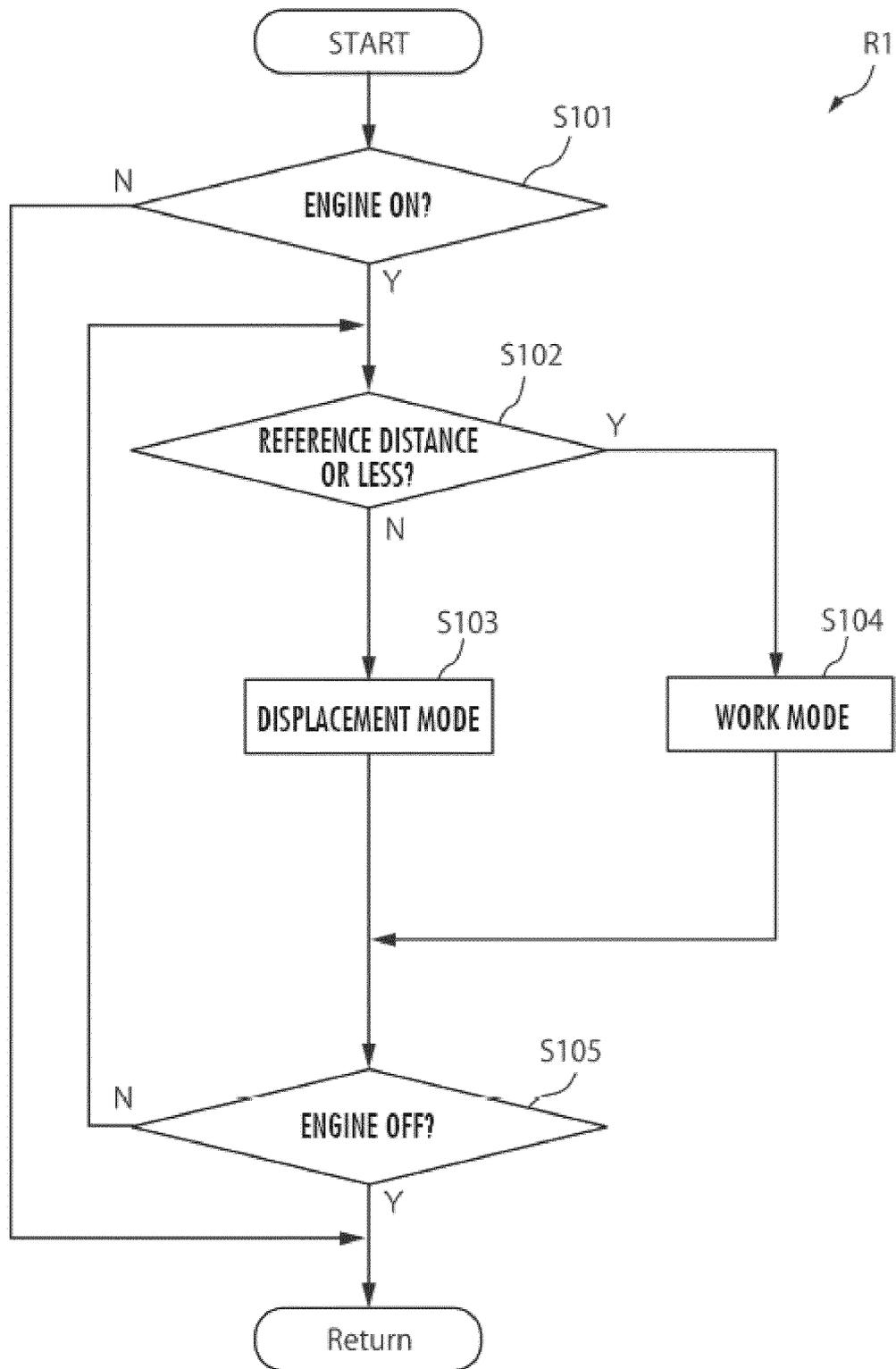


FIG.8

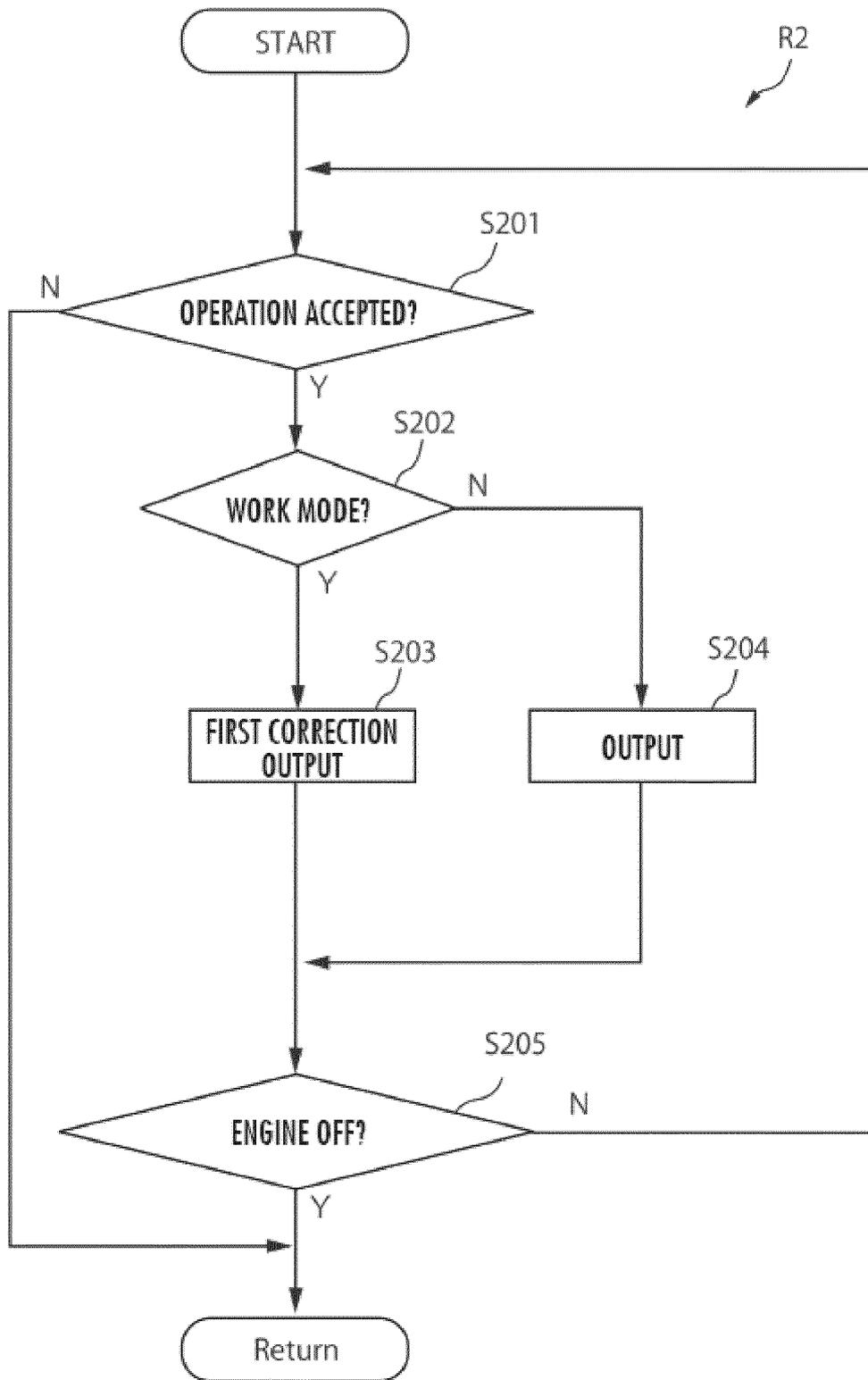


FIG.9

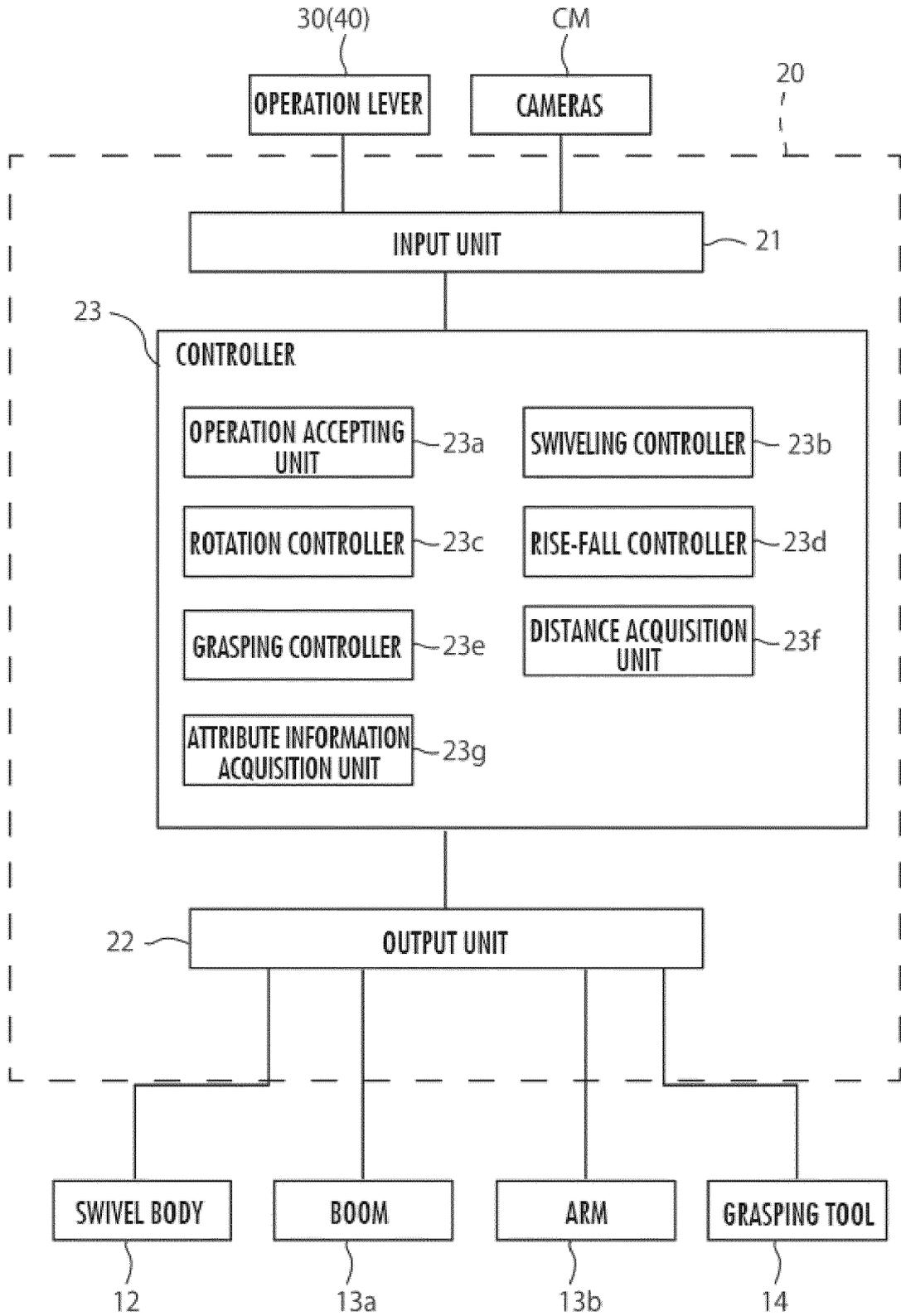


FIG.10

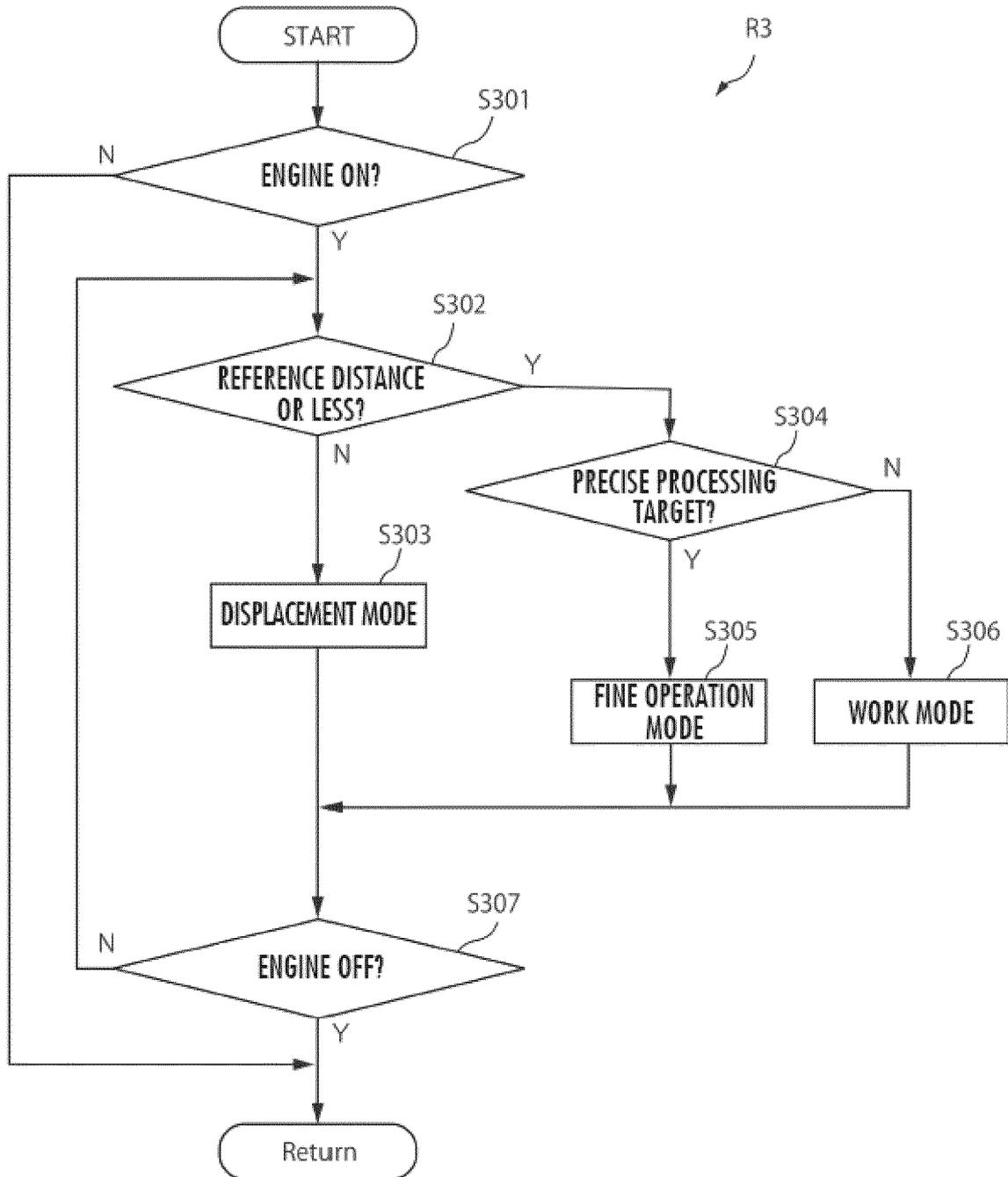
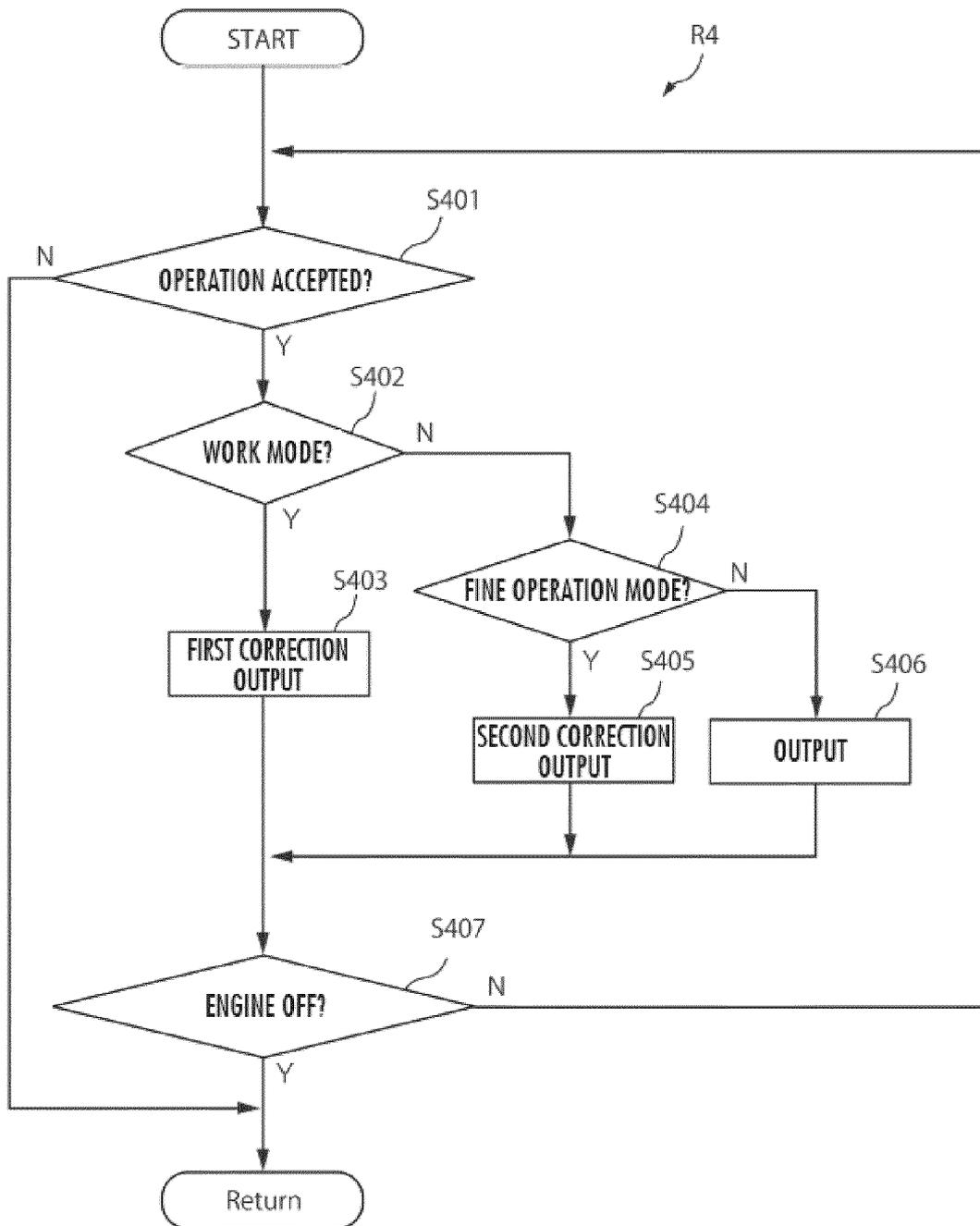


FIG.11



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2020/016300

5

A. CLASSIFICATION OF SUBJECT MATTER
Int. Cl. E02F9/20 (2006.01) i, B02C1/04 (2006.01) i, B02C1/06 (2006.01) i
FI: E02F9/20 Q, B02C1/04, B02C1/06
According to International Patent Classification (IPC) or to both national classification and IPC

10

B. FIELDS SEARCHED
Minimum documentation searched (classification system followed by classification symbols)
Int. Cl. E02F9/20, B02C1/02, E04G23/08

15

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 1971-2020
Registered utility model specifications of Japan 1996-2020
Published registered utility model applications of Japan 1994-2020

20

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

25

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 2010-37036 A (TOKYU KENSETSU KK) 18 February 2010, paragraphs [0013]-[0048], fig. 1-8	1-6
Y	WO 2015/181989 A1 (KOMATSU LTD.) 03 December 2015, paragraphs [0024]-[0203], fig. 1-36	1-6
A	JP 2019-52472 A (HITACHI CONSTRUCTION MACHINERY CO., LTD.) 04 April 2019, entire text, all drawings	1-6
A	JP 2019-108775 A (KOBELCO CONSTRUCTION MACHINERY CO., LTD.) 04 July 2019, entire text, all drawings	1-6
A	JP 2012-97544 A (HITACHI CONSTRUCTION MACHINERY CO., LTD.) 24 May 2012, entire text, all drawings	1-6

40

Further documents are listed in the continuation of Box C. See patent family annex.

45

* 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
 "I" 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

50

Date of the actual completion of the international search 19.06.2020	Date of mailing of the international search report 30.06.2020
---	--

55

Name and mailing address of the ISA/ Japan Patent Office 3-4-3, Kasumigaseki, Chiyoda-ku, Tokyo 100-8915, Japan	Authorized officer Telephone No.
--	---

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2020/016300

5
10
15
20
25
30
35
40
45
50
55

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 2011-102633 A (KOBE STEEL, LTD.) 26 May 2011, entire text, all drawings	1-6
A	JP 2010-189921 A (CATERPILLAR JAPAN LTD.) 02 September 2010, entire text, all drawings	1-6

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/JP2020/016300

5
10
15
20
25
30
35
40
45
50
55

Patent Documents referred to in the Report	Publication Date	Patent Family	Publication Date
JP 2010-37036 A	18.02.2010	(Family: none)	
WO 2015/181989 A1	03.12.2015	US 2016/0244950 A1	
		paragraphs [0066]-[0251], fig. 1-36	
JP 2019-52472 A	04.04.2019	US 2020/0032482 A1	
		entire text, all drawings	
JP 2019-108775 A	04.07.2019	WO 2019/124043 A1	
		entire text, all drawings	
JP 2012-97544 A	24.05.2012	(Family: none)	
JP 2011-102633 A	26.05.2011	(Family: none)	
JP 2010-189921 A	02.09.2010	(Family: none)	

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- JP 2000284849 A [0005]