(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 4 428 308 A2**

(12) **EUROPEAN PATENT APPLICATION**
published in accordance with Art. 153(4) EPC

(43) Date of publication:
**11.09.2024 Bulletin 2024/37**

(21) Application number: **22893130.9**

(22) Date of filing: **07.11.2022**

(51) International Patent Classification (IPC):
***E02F 9/20*** *(2006.01)* ***E02F 9/24*** *(2006.01)*
***E02F 3/43*** *(2006.01)*

(52) Cooperative Patent Classification (CPC):
**E02F 3/43; E02F 9/20; E02F 9/24**

(86) International application number:
**PCT/KR2022/017363**

(87) International publication number:
**WO 2023/085709 (19.05.2023 Gazette 2023/20)**

(84) Designated Contracting States:
**AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC ME MK MT NL NO PL PT RO RS SE SI SK SM TR**
Designated Extension States:
**BA**
Designated Validation States:
**KH MA MD TN**

(30) Priority: **09.11.2021 KR 20210152756**

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(54) **CONSTRUCTION MACHINE BASED ON HIGH DUMP BUCKET, AND POSE CONTROL METHOD THEREFOR**

(57) The present disclosure relates to a construction machine based on a high dump bucket. The construction machine based on a high dump bucket includes a boom that rotatably connected to a main body of the construction machine based on a first rotating shaft; a bucket support rotatably connected to the boom based on a second rotating shaft and configured to support a high dump bucket; the high dump bucket rotatably connected to the bucket support based on a third rotating shaft; a bucket angle sensor configured to detect a rotation angle of the high dump bucket; and a control unit configured to determine a posture of the construction machine based on bucket angle data obtained from the bucket angle sensor.

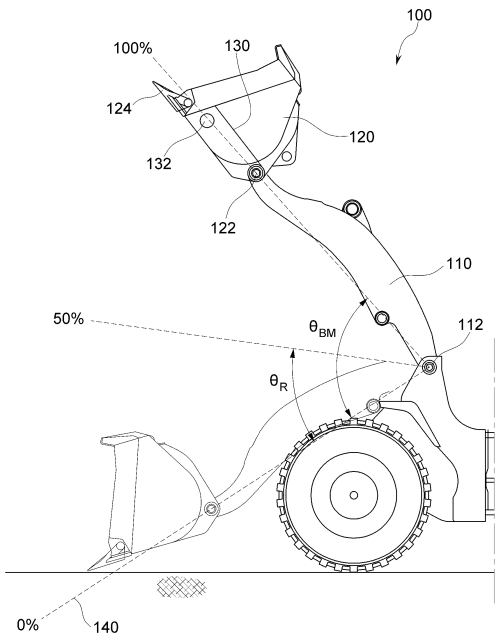


FIG. 1

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## Description

### [TECHNICAL FIELD]

**[0001]** The present disclosure relates to construction machine based on high dump bucket, and pose control method therefor, and specifically, relates to a high dump bucket-based construction machine for automatically switching a posture of the construction machine with a simple operation and a posture control method thereof.

### [BACKGROUND ART]

**[0002]** Construction machines such as wheel loaders are widely used for transporting or loading soil and sand. More specifically, the wheel loader transports soil and sand to a position close to a transportation means such as a truck, then raises a boom and full dumps a bucket to drop the soil and sand onto the transportation means. Then, the wheel loader returns the bucket again to a dig position, lowers the boom, moves to a place where the soil and sand are piled up, loads the soil and sand into the bucket, and adjusts the bucket to a full crowd position. This operation is repeated several times until the transportation means is filled with the soil and sand. Therefore, an operator of the wheel loader has the inconvenience of having to repeatedly perform the operation of raising and lowering the bucket onto the transportation means.

### [DETAILED DESCRIPTION OF INVENTION]

### [TECHNICAL PROBLEMS]

**[0003]** The present disclosure provides a high dump bucket-based construction machine and a posture control method thereof to solve the above problems.

### [TECHNICAL SOLUTION]

**[0004]** The present disclosure may be implemented in a variety of ways, including a method, a device (system), a computer program stored on a computer-readable medium, or a computer-readable medium on which the computer program is stored.

**[0005]** According to one embodiment of the present disclosure, there is provided a high dump bucket-based construction machine including: a boom that rotatably connected to a main body of the construction machine based on a first rotating shaft; a bucket support rotatably connected to the boom based on a second rotating shaft and configured to support a high dump bucket; the high dump bucket rotatably connected to the bucket support based on a third rotating shaft; a bucket angle sensor configured to detect a rotation angle of the high dump bucket; and a control unit configured to determine a posture of the construction machine based on bucket angle data obtained from the bucket angle sensor.

**[0006]** According to one embodiment of the present disclosure, when the control unit receives a first user input for performing a high dump operation, the control unit changes a rotation angle of the high dump bucket to a predetermined first angle through the second rotating shaft based on the bucket angle data.

**[0007]** According to one embodiment of the present disclosure, when a rotation angle of the boom is equal to or greater than a predetermined standard, in a case where the control unit receives a second user input for setting an angle of the high dump bucket, the control unit sets an angle corresponding to the second user input to the predetermined first angle.

**[0008]** According to one embodiment of the present disclosure, the predetermined first angle is tilted further by a predetermined angle toward a front side in a full crowd state of the high dump bucket.

**[0009]** According to one embodiment of the present disclosure, the control unit receives the first user input based on whether a bucket kick-out function is activated and a joystick associated with the construction machine is operated to the first end.

**[0010]** According to one embodiment of the present disclosure, the high dump bucket-based construction machine further includes a boom angle sensor configured to detect a rotation angle of the boom. When the control unit receives a third user input to perform a high dump operation, the control unit changes the rotation angle of the boom to a predetermined second angle through the first rotating shaft based on boom angle data obtained from the boom angle sensor, and changes the rotation angle of the high dump bucket to a predetermined first angle through the second rotating shaft based on the bucket angle data.

**[0011]** According to one embodiment of the present disclosure, the control unit receives the third user input based on whether the joystick is operated to the second end in a state in which a kick-down button of a joystick associated with the construction machine is pressed.

**[0012]** According to one embodiment of the present disclosure, when the joystick is operated while at least one of the rotation angle of the boom and the rotation angle of the high dump bucket is changed, the control unit stops changing the angle.

**[0013]** According to one embodiment of the present disclosure, when the control unit receives a fourth user input for performing a high dump operation, the control unit dumping-drives the high dump bucket through the third rotating shaft.

**[0014]** According to one embodiment of the present disclosure, the control unit receives the fourth user input based on whether a kick-down button of the joystick is pressed.

**[0015]** According to one embodiment of the present disclosure, there is provided a high dump bucket-based construction machine including: a boom that rotatably connected to a main body of the construction machine based on a first rotating shaft; a bucket support rotatably connected to the boom based on a second rotating shaft

and configured to support a high dump bucket; the high dump bucket rotatably connected to the bucket support based on a third rotating shaft; a bucket angle sensor configured to detect a rotation angle of the high dump bucket; a boom angle sensor configured to detect a rotation angle of the boom; and a control unit configured to change the boom to a predetermined second angle while changing the high dump bucket to a predetermined first angle to perform a high dump operation and perform a dumping operation on the high dump bucket.

**[0016]** According to one embodiment of the present disclosure, there is provided a posture control method of a high dump bucket-based construction machine performed by at least one processor, the posture control method including: determining whether a kick-out function associated with the construction machine is activated; determining whether a joystick is operated to a second end in a state where a kick-down button of a joystick associated with the construction machine is pressed; and controlling the high dump bucket of the construction machine to a predetermined first angle and controlling a boom of the construction machine to a predetermined second angle when it is determined whether the kick-out function is activated and whether the joystick is operated.

**[0017]** According to one embodiment of the present disclosure, the posture control method further includes: determining whether the kick-down button of the joystick is input when the angles of the boom and high dump bucket of the construction machine are changed; and performing a dumping operation of the high dump bucket when it is determined that the kick-down button is input.

**[0018]** According to one embodiment of the present disclosure, the posture control method further includes stopping changing of the angle when the joystick is operated while at least one of a rotation angle of the boom and a rotation angle of the high dump bucket is changed.

## [EFFECT OF INVENTION]

**[0019]** In various embodiments of the present disclosure, auto high dump posture control of the construction machine can be performed in a loading preparation posture and/or a loading posture by a simple operation of an operator, and thus, convenience of the operator can be effectively improved.

**[0020]** The effect of the present disclosure is not limited to the effects mentioned above, and other effects not mentioned may be clearly understood by a person (referred to as a "person skilled in the art") skilled in the art in the technical field to which the present disclosure pertains from the description of claims.

## [BRIEF DESCRIPTION OF THE DRAWING]

**[0021]** Embodiments of the present disclosure will be described with reference to the accompanying drawings described below, in which like reference numerals indicate like elements, but are not limited thereto.

FIG. 1 is a side view illustrating an example of a high dump bucket-based construction machine according to one embodiment of the present disclosure.

FIGS. 2 and 3 are side views illustrating an example of a loading posture of the high dump bucket-based construction machine according to one embodiment of the present disclosure.

FIG. 4 is a diagram illustrating an example of a control interface associated with a construction machine according to one embodiment of the present disclosure.

FIG. 5 is a flowchart illustrating an example of the posture control method of the high dump bucket-based construction machine according to one embodiment of the present disclosure.

FIG. 6 is a flow chart to explain a method of storing a bucket position in the posture control method of the construction machine according to one embodiment of the present disclosure.

FIG. 7 is a flowchart for explaining a method of moving a bucket to a predetermined bucket loading position in the posture control method of the construction machine according to one embodiment of the present disclosure.

FIG. 8 is a flowchart illustrating a method of moving the boom and bucket to a boom loading position and bucket loading position stored in advance, in the posture control method of the construction machine according to one embodiment of the present disclosure.

## [BEST MODE FOR CARRYING OUT THE INVENTION]

**[0022]** Hereinafter, specific details for implementation of the present disclosure will be described in detail with reference to the attached drawings. However, in the following description, specific descriptions of widely known functions or configurations will be omitted when there is a risk of unnecessarily obscuring the gist of the present disclosure.

**[0023]** In the accompanying drawings, identical or corresponding components are given the same reference numerals. Additionally, in the description of the following embodiments, overlapping descriptions of identical or corresponding components may be omitted. However, even when descriptions of components are omitted, it is not intended that such components are not included in any embodiment.

**[0024]** Advantages and features of the disclosed embodiments and methods for achieving them will become clear by referring to the embodiments described below in conjunction with the accompanying drawings. However, the present disclosure is not limited to the embodiments disclosed below and may be implemented in various different forms. The present embodiments are merely provided to ensure that the present disclosure is complete and to fully inform those skilled in the art of the scope of the invention.

**[0025]** Terms used in the present specification will be briefly described, and the disclosed embodiments will be described in detail. The terms used in the present specification have been selected from widely used general terms as much as possible while considering their function in the present disclosure, but this may vary depending on the intention or precedent of technicians working in the related field, the emergence of new technologies, or the like. In addition, in certain cases, there are terms arbitrarily selected by the applicant, and in this case, the meaning will be described in detail in the description of the relevant invention. Therefore, the terms used in the present disclosure should be defined based on the meaning of the term and the overall content of the present disclosure, rather than simply the name of the term.

**[0026]** In the present specification, singular expressions include plural expressions, unless the context clearly specifies the singular. Additionally, plural expressions include singular expressions, unless the context clearly specifies plural expressions. When it is said that a certain part includes a certain element throughout the specification, this does not mean excluding other elements, but may further include other elements, unless specifically stated to the contrary.

**[0027]** In the present disclosure, terms such as "include", "including", or the like may indicate the presence of features, steps, operations, elements, and/or components, but may indicate that such terms do not include one or more other features, steps, operations, elements, components and/or combinations thereof are added.

**[0028]** In the present disclosure, when a particular component is referred to as being "coupled," "combined," "connected," or "reacting" to any other component, particular components may be coupled, combined, and/or connected to, or react directly with, other components, but are not limited to this. For example, one or more intermediate components may exist between a particular component and another component. Additionally, "and/or" in the present disclosure may include each of one or more of the listed items or a combination of at least some of the one or more items.

**[0029]** In the present disclosure, terms such as "first" and "second" are used to distinguish certain components from other components, and the components described above are not limited by these terms. For example, a "first" component may be an element of the same or similar form as a "second" component.

**[0030]** FIG. 1 is a side view illustrating an example of a high dump bucket-based construction machine 100 according to one embodiment of the present disclosure. According to one embodiment, a high dump bucket-based construction machine 100 may be configured to include a boom 110 rotatably connected to a main body of the construction machine based on a first rotating shaft 112, a bucket support 130 rotatably connected to the boom 110 based on a second rotating shaft 122 and configured to support a high dump bucket 120, the high dump bucket 120 rotatably connected to the bucket support 130 based on a third rotating shaft 132, or the like. Here, the high dump bucket-based construction machine 100 may include a bucket connecting an end of the bucket support 130 and a tip portion 124 of the high dump bucket 120 with a rotating shaft and configured to be rotatable to perform loading to even at a higher loading position and/or at a longer distance.

**[0031]** According to one embodiment, the boom 110 may be configured to perform an upward and/or downward motion based on the first rotating shaft 112. For example, when receiving user input to operate the boom 110, the construction machine (and/or control unit of the construction machine) 100 controls the posture of the boom 110 by supplying hydraulic oil to a boom cylinder.

**[0032]** Additionally, the high dump bucket 120 may be configured to rotate based on the second rotating shaft 122 and/or the third rotating shaft 132 to perform a crowd and/or dump operation. For example, when receiving user input to operate the high dump bucket 120, the construction machine 100 may control the posture of the high dump bucket 120 by supplying the hydraulic oil to the bucket cylinder.

**[0033]** According to one embodiment, the boom 110 rotates within a rotation range between a preset lowest angle (that is, an angle corresponding to 0% of a rotation range) and a preset highest angle (that is, an angle corresponding to 100% of the rotation range) and is positioned. Here, the position of the boom 110 may be defined by the angle of the boom 110. In the illustrated example, when the boom 110 is located at the lowest angle, in a case where a virtual line connecting the first rotating shaft 112 and the second rotating shaft 122 is defined as a base line 140, a rotation angle ($\theta$BM) and/or position of the boom 110 may be determined based on the base line 140.

**[0034]** Additionally, the high dump bucket 120 may be positioned by rotating within a rotation range between a preset lowest angle (that is, the angle in the full crowd state) and the highest angle (that is, the angle in the full dump state). Here, the position of the high dump bucket 120 can be defined as the angle of the high dump bucket 120.

**[0035]** According to one embodiment, the high dump bucket-based construction machine 100 may further include a bucket angle sensor configured to detect the rotation angle of the high dump bucket 120, a boom angle sensor configured to detect the rotation angle of the boom 110, and a control unit configured to determine the posture of the construction machine 100 based on boom angle data obtained from the boom angle sensor and/or bucket angle data obtained from the bucket angle sensor.

**[0036]** According to one embodiment, the control unit may perform an auto high dump operation when receiving arbitrary user input. For example, when receiving a random user input, the control unit changes the rotation angle of the high dump bucket 120 to a predetermined first angle and changes the rotation angle of the boom 110 to a predetermined second angle to control a loading

preparation posture of the construction machine 100. Then, when receiving additional user input, the control unit can control the loading posture of the construction machine 100 by performing a dumping operation of the high dump bucket 120.

**[0037]** With this configuration, auto high dump posture control of the construction machine 100 can be executed to the loading preparation posture and/or loading posture through a simple operation by the operator, and thus convenience of an operator can be effectively improved.

**[0038]** FIGS. 2 and 3 are side views illustrating an example of the loading posture of the high dump bucket-based construction machine 100 according to one embodiment of the present disclosure. According to one embodiment, the loading preparation posture may refer to the posture of raising the boom 110 to a specific position for loading and positioning the high dump bucket 120 at a specific angle. For example, the operator of the construction machine 100 may control the boom 110 and/or the high dump bucket 120 to a specific position for loading using a joystick, function activation button, or the like associated with the construction machine 100.

**[0039]** According to one embodiment, the control unit of the construction machine 100 may perform bucket kick-out control. Here, the bucket kick-out control may refer to a control method in which the high dump bucket 120 moves to a predetermined angle (that is, a predetermined stopping position) and stops. For example, when the control unit receives a first user input to perform the high dump operation, the control unit may change the rotation angle of the high dump bucket 120 to a predetermined first angle through the second rotating shaft 122 based on the bucket angle data obtained from the bucket angle sensor. In this case, the predetermined first angle may refer to a specific angle tilted further by a predetermined angle toward the front side in a fully crowd state of the high dump bucket 120. Additionally, the first user input may refer to the action of activating the bucket kick-out function and pushing the joystick associated with the construction machine 100 to a first end (that is, end in a dump direction) and then releasing the joystick. In other words, when the control unit activates the bucket kick-out function and receives an input of pushing and releasing the joystick to the first end, the control unit may change the angle of the high dump bucket 120 to a predetermined first angle.

**[0040]** According to one embodiment, the control unit of the construction machine 100 may set a predetermined first angle for performing bucket kick-out control. Specifically, when the rotation angle of the boom 110 is equal to or greater than a predetermined standard and a second user input for setting the angle of the high dump bucket 120 is received, the control unit sets the angle corresponding to the second user input to the predetermined first angle. For example, when the operator of the construction machine 100 changes the angle of the high dump bucket 120 at an angle equal to or greater than the reference angle ($\theta R$) where the rotation angle of the boom 110 is 50% from the base line 140 and setting of the kick-out position to the changed angle is required, the control unit may set the angle of the high dump bucket 120 to the predetermined first angle. When the bucket kick-out position is set in this way, an auditory message indicating that the setting has been completed may be output.

**[0041]** Additionally or alternatively, the control unit of construction machine 100 may perform auto high dump control. Here, the auto high dump control is a detent control method of the boom 110 and high dump bucket 120, and may refer to a control method of moving the boom 110 and high dump bucket 120 to a specific position for loading with a simple user input.

**[0042]** According to one embodiment, when receiving a third user input to perform a high dump operation, the control unit may change the rotation angle of boom 110 to a predetermined second angle through the first rotating shaft 112 based on the boom angle data obtained from the boom angle sensor and may change the rotation angle of the high dump bucket 120 to the predetermined first angle through the second rotating shaft 122 based on the bucket angle data. Here, the third user input may refer to an action of pushing the joystick to a second end (that is, end in a boom-up direction) and then releasing the joystick in a state where the kick-down button of the joystick associated with the construction machine 100 is pressed. In other words, when the control unit receives an input of pushing and releasing the joystick to the second end in a state where the kick-down button of the joystick is pressed, the control unit may adjust the angles of the boom 110 and the high dump bucket 120 to the predetermined first and second angles. In this case, the angles of the boom 110 and the high dump bucket 120 may be changed simultaneously or changed sequentially. In the illustrated example, the angles of the boom 110 and the high dump bucket 120 may be changed to a position for dumping a transport unit 210.

**[0043]** According to one embodiment, when receiving a fourth user input for performing the high dump operation, the control unit may perform the dumping operation on the high dump bucket 120 through the third rotating shaft 132. For example, after the boom 110 and the high dump bucket 120 are positioned at the predetermined first angle and second angles, the control unit may perform the dumping operation on the high dump bucket 120 when receiving the fourth user input. Here, the fourth user input may refer to the action of pressing the kick-down button of the joystick. That is, when the control unit receives an input of pressing the kick-down button of the joystick after the boom 110 and the high dump bucket 120 are located at the predetermined first angle and second angle, the dumping operation of the high dump bucket 120 may be performed. In the illustrated example, when the dumping operation of the high dump bucket 120 is performed, a loading operation may be performed on the transport unit 210.

**[0044]** As described above, when the boom joystick

and/or bucket joystick are operated while the kick-out control, the auto high dump control, or the like is performed, the kick-out control, the auto high dump control, or the like may be stopped. That is, the control unit may stop changing of the angle when the joystick is operated while at least one of the rotation angle of the boom and the rotation angle of the high dump bucket is changed. Additionally or alternatively, in the event of a failure of the boom angle sensor and/or bucket angle sensor, the control unit may not perform the kick-out control, the auto high dump control, or the like.

**[0045]** For example, when and the bucket joystick is operated out of a neutral position while the high dump bucket is moving at a predetermined angle, the movement of the high dump bucket will immediately stop. For example, when the output value of the bucket joystick is equal to or greater than 20% and lasts for equal to or more than 150ms while the high dump bucket is moving to a predetermined angle, the movement of the high dump bucket may be stopped.

**[0046]** With this configuration, the operator of the construction machine 100 may automatically control the loading posture of the construction machine 100 with a simple input, and thus, the fatigue of the operator can be effectively reduced in repetitive loading work.

**[0047]** FIG. 4 is a diagram illustrating an example of a control interface 400 associated with the construction machine according to one embodiment of the present disclosure. As illustrated, the control interface 400 may include a display unit 410, a keypad 420, and an operation unit 430. According to one embodiment, the display unit 410 may display or output various information related to the operation of the construction machine. For example, the display unit 410 may display or output a visual message and/or an audible message indicating that the bucket kick-out position has been set, but is not limited to this. For example, the display unit 410 may further display a current angle and reference angle of the boom.

**[0048]** According to one embodiment, the keypad 420 is a device for activating or deactivating the kick-out function of the boom and bucket, and may include a boom setting button 422 and a bucket setting button 424. In addition, the control unit 430 is a device for controlling the positions and/or angles of the boom and high dump bucket of the construction machine, and includes a boom joystick 432, a bucket joystick 434, a kick-down button 436, or the like.

**[0049]** According to one embodiment, the boom setting button 422 and/or the bucket setting button 424 may perform a state switching function and a storage function. For example, each time the boom setup button 422 and/or the bucket setup button 424 is pressed by the operator of the construction machine, the boom kick-out function and/or bucket kick-out function may be converted to an activation state and a deactivation state. When the boom setting button 422 and/or the bucket setting button 424 are activated, a function for moving the boom and/or bucket to a predetermined angle may be activated, and when the boom setting button 422 and/or the bucket setting button 424 are deactivated, the corresponding function may be deactivated.

**[0050]** In addition, when the boom setting button 422 and/or the bucket setting button 424 are pressed for equal to or longer than a preset certain time, a function of storing the current position of the boom and/or bucket in an internal memory of the construction machine may be performed.

**[0051]** The operating unit 430 may include a boom joystick 432 and a bucket joystick 434. Here, the boom joystick 432 may include a kick-down button 436 for lowering a driving gear. For example, when the boom setting button 422 is deactivated, the kick-down button 436 may be used to perform the function of lowering the gear of the construction machine. In another example, when the boom setting button 422 is activated, the kick-down button 436 may be used to operate the boom joystick 432 together with performing other functions (that is, function of moving the boom and high dump bucket to pre-stored positions).

**[0052]** According to one embodiment, when the boom setting button 422 is deactivated, the boom joystick 432 may be used to control the angle and/or position of the boom. Additionally, when the bucket setting button 424 is in the deactivation state, the bucket joystick 434 may be used to control the angle and/or position of the high dump bucket. In this case, the boom joystick 432 may be operated in the boom down direction and/or the boom up direction, and the bucket joystick 434 may be operated in the dump direction and/or crowd direction. The angle and/or position of the boom and high dump bucket may be controlled according to the operation of the boom joystick 432 and/or the bucket joystick 434.

**[0053]** Additionally, when the boom setting button 422 and/or the bucket setting button 424 are activated, the boom joystick 432 and/or bucket joystick 434 may be used to perform an operation of moving the boom and/or bucket to a predetermined angle, or an operation of moving the boom and bucket to a predetermined angle.

**[0054]** According to one embodiment, the operator of the construction machine may control the posture of the construction machine based on the keypad 420 and/or the operation unit 430. For example, the operator may activate the bucket kick-out function by selecting the bucket setting button 424 with a touch input, or the like. Then, the operator may operate the bucket joystick 434 to the end on the dump side to provide the first user input to the control unit of the construction machine. In this case, the control unit may change the rotation angle of the high dump bucket to a predetermined first angle.

**[0055]** Additionally or alternatively, the operator of the construction machine may operate the boom joystick 432 to control the rotation angle of the boom to be equal to or greater than a predetermined standard, and operate the bucket joystick 434 to change the rotation angle of the high dump bucket to a specific angle. Then, the operator may provide the second user input to the control

unit of the construction machine by pressing and holding the bucket setting button 424 for equal to or more than a preset certain time. In this case, the control unit may store the current angle of the high dump bucket in memory.

**[0056]** Additionally or alternatively, the operator of the construction machine may operate the boom joystick 432 to a second end (for example, an end in the boom up direction) in a state where the kick-down button 436 of the boom joystick 432 is pressed to provide the third user input to the control unit of the construction machine. In this case, the control unit may change the rotation angle of the boom to the predetermined second angle through the first rotating shaft and change the rotation angle of the high dump bucket to the predetermined first angle through the second rotating shaft.

**[0057]** In this way, after the rotation angles of the boom and the high dump bucket are changed and the loading preparation posture control is completed, the operator of the construction machine presses the kick-down button 436 of the boom joystick 432 to provide a fourth user input to the control unit of the construction machine. In this case, the control unit can perform a dumping operation on the high dump bucket through the third rotating shaft.

**[0058]** In FIG. 4, the operating unit 430 is illustrated as including the boom joystick 432 and the bucket joystick 434 that can be operated in two directions, but the present disclosure is not limited thereto. For example, the operation unit 430 may include one joystick that can be operated in four directions.

**[0059]** FIG. 5 is a flowchart illustrating an example of a posture control method 500 of the high dump bucket-based construction machine according to one embodiment of the present disclosure. The posture control method 500 of the high dump bucket-based construction machine may be performed by at least one processor (for example, at least one processor of the control unit associated with the construction machine). The posture control method 500 of the high dump bucket-based construction machine may be initiated by the processor determining whether a kick-out function associated with the construction machine is activated (S510).

**[0060]** The processor may determine whether the joystick is operated to the second end in a state where the kick-down button of the joystick associated with the construction machine is pressed (S520). In addition, when it is determined whether the kick-out function is activated and whether the joystick is operated, the processor may control the high dump bucket of the construction machine at a predetermined first angle and controls the boom of the construction machine at a predetermined second angle (S530).

**[0061]** The processor may determine whether the kick-down button of the joystick is input when the angles of the boom and the high dump bucket of the construction machine are changed. When it is determined that the kick-down button is input, the processor may perform the dumping operation of the high dump bucket. Additionally, the processor may stop the changing of the angle when the joystick is operated while at least one of the rotation angle of the boom and the rotation angle of the high dump bucket is changed.

**[0062]** FIG. 6 is a flowchart illustrating a method 600 of storing the bucket position in the posture control method of the construction machine according to one embodiment of the present disclosure. First, calibration of the angle sensor may be performed (S610). For example, a zeroing operation may be performed on a boom angle sensor and a bucket angle sensor. This step can be repeated until calibration of the boom angle sensor and bucket angle sensor is completed.

**[0063]** When the calibration of the angle sensors is successfully completed, the current position of the boom and the current position of the bucket may be input respectively (S620). Afterwards, the angle at the current position of the boom and the reference angle (that is, the angle at 50% of the base line) may be compared (S630). As a result of comparison, when the input angle at the current position of the boom is smaller than the reference angle, the current position of the boom and the current position of the bucket can be set as a boom excavation position and a bucket excavation position respectively and stored in the memory (S640).

**[0064]** Meanwhile, when the angle at the current position of the boom is greater than or equal to the reference angle, the input current position of the boom and current position of the bucket may be set as the boom loading position and bucket loading position respectively and stored in the memory (S650).

**[0065]** FIG. 7 is a flowchart illustrating a method 700 of moving the bucket to a predetermined bucket loading position in the posture control method of a construction machine according to one embodiment of the present disclosure. First, an automatic bucket movement operation can be input (S710). For example, the operator may activate the bucket setting button, move the bucket joystick as far as possible in the dump direction in a state of holding the bucket joystick, and then release the bucket joystick.

**[0066]** Subsequently, it may be determined whether the boom setting button is activated (S720). When the boom setting button is activated, the position of the bucket may be controlled through a bucket driving current controlled by an electromagnetic proportional pressure reducing valve (EPPR) (S730). The hydraulic pressure supplied to the cylinder of the bucket is controlled by this bucket driving current so that the bucket moves toward the bucket loading position. Meanwhile, when the boom setting button is in the deactivation state, the corresponding task is terminated. In this case, the bucket may be changed in position in response to the manipulation amount of the bucket joystick.

**[0067]** Next, it may be determined whether the angle of the bucket measured from the bucket angle sensor has reached the angle corresponding to the above-de-

scribed bucket loading position (S940). When the angle of the bucket measured from the bucket angle sensor matches the angle corresponding to the bucket loading position described above, it is determined that the bucket has reached the bucket loading position, and the corresponding task may be terminated. Meanwhile, when the angle of the bucket measured from the angle sensor of the bucket does not match the angle corresponding to the above-described bucket loading position, the bucket driving current can be adjusted by the electromagnetic proportional pressure reducing valve until these angles match.

**[0068]** FIG. 8 is a flowchart illustrating a method 800 of moving the boom and bucket to the pre-stored boom loading position and the bucket loading position, respectively, in the posture control method of the construction machine according to one embodiment of the present disclosure. First, the boom/bucket automatic movement operation may be input (S810). For example, the operator may activate the boom setting button and the bucket setting button, respectively, then hold the boom joystick and moves the boom joystick as far as possible in the boom up direction while pressing the kick-down button. Thereafter, the operator may perform the operation of releasing the boom joystick and the kick-down button in a situation where the boom joystick is placed at the maximum position in the boom up direction.

**[0069]** Subsequently, it may be determined whether both the boom setting button and the bucket setting button are activated (S820). When both the boom setting button and the bucket setting button are activated, it may be determined whether the kick-down button is pressed (S830).

**[0070]** Thereafter, it may be determined whether the current position of the bucket to be moved is in a crowd state (S840). When the current position of the bucket is in the crowd state, the position of the boom may be controlled through the boom driving current controlled by the electromagnetic proportional pressure reducing valve (S850). The hydraulic pressure supplied to the cylinder of the boom is controlled by this boom driving current, and thus, the boom may move toward the loading position.

**[0071]** Next, it is determined whether the angle of the boom measured from the boom angle sensor has reached the angle corresponding to the above-described boom loading position (S860). When the angle of the boom measured from the boom angle sensor matches the angle corresponding to the above-mentioned boom loading position, the position of the bucket is controlled through the bucket driving current controlled by the electromagnetic proportional pressure reducing valve (S870). The hydraulic pressure supplied to the cylinder of the bucket is controlled by this bucket driving current, and thus, the bucket may move toward the bucket loading position. In FIG. 8, it is described in detail that the angle of the bucket is changed after the angle of the boom is changed, but the present invention is not limited to this, and the angles of the boom and bucket may be changed at the same time.

**[0072]** Next, it may be determined whether the angle of the bucket measured from the bucket angle sensor has reached the angle corresponding to the above-described bucket loading position (S880). When the angle of the bucket measured from the bucket angle sensor matches the angle corresponding to the bucket loading position described above, it is determined that the bucket has reached the loading position.

**[0073]** Thereafter, it may be determined whether the kick-down button is input (S890). When it is confirmed that the kick-down button is input, a dumping operation current controlled by the electronic proportional pressure reducing valve of a spool (for example, third spool) is output (S910). The hydraulic pressure supplied to the dumping cylinder of the bucket is controlled by this dumping operation current, and thus, the dumping operation of the bucket may be performed. Meanwhile, when it is confirmed that the kick-down button is not input, the task may be terminated.

**[0074]** Subsequently, it may be determined whether the operation of the boom joystick, the operation of the bucket joystick, or the operation of the gear (for example, forward operation and reverse operation of the driving gear) is input (S920). When all of the operations listed above are not input, the dumping operation of the bucket may be performed normally by controlling the hydraulic pressure according to the dumping current described above. Meanwhile, when any of the operations listed above are input, the task may be terminated.

**[0075]** Meanwhile, when the current position of the bucket is not in the crowd state (that is, when the angle of the bucket is tilted more in the dump direction than the predetermined first angle of the stored bucket), the position of the boom may be controlled through the boom driving current (S930).

**[0076]** Next, it may be determined whether the angle of the boom measured from the boom angle sensor has reached the angle corresponding to the boom loading position (S940). When the measured angle of the boom matches the angle corresponding to the boom loading position, it is determined that the boom has reached the boom loading position, and thus, the task may be terminated.

## Claims

1. A high dump bucket-based construction machine comprising:

   a boom that rotatably connected to a main body of the construction machine based on a first rotating shaft;

   a bucket support rotatably connected to the boom based on a second rotating shaft and configured to support a high dump bucket;

the high dump bucket rotatably connected to the bucket support based on a third rotating shaft;
a bucket angle sensor configured to detect a rotation angle of the high dump bucket; and
a control unit configured to determine a posture of the construction machine based on bucket angle data obtained from the bucket angle sensor.

**2.** The high dump bucket-based construction machine of claim 1, wherein when the control unit receives a first user input for performing a high dump operation, the control unit changes a rotation angle of the high dump bucket to a predetermined first angle through the second rotating shaft based on the bucket angle data.

**3.** The high dump bucket-based construction machine of claim 2, wherein when a rotation angle of the boom is equal to or greater than a predetermined standard, in a case where the control unit receives a second user input for setting an angle of the high dump bucket, the control unit sets an angle corresponding to the second user input to the predetermined first angle.

**4.** The high dump bucket-based construction machine of claim 2, wherein the predetermined first angle is tilted further by a predetermined angle toward a front side in a full crowd state of the high dump bucket.

**5.** The high dump bucket-based construction machine of claim 2, wherein the control unit receives the first user input based on whether a bucket kick-out function is activated and a joystick associated with the construction machine is operated to the first end.

**6.** The high dump bucket-based construction machine of claim 1, further comprising a boom angle sensor configured to detect a rotation angle of the boom,
wherein when the control unit receives a third user input to perform a high dump operation, the control unit changes the rotation angle of the boom to a predetermined second angle through the first rotating shaft based on boom angle data obtained from the boom angle sensor, and changes the rotation angle of the high dump bucket to a predetermined first angle through the second rotating shaft based on the bucket angle data.

**7.** The high dump bucket-based construction machine of claim 8, wherein the control unit receives the third user input based on whether the joystick is operated to the second end in a state in which a kick-down button of a joystick associated with the construction machine is pressed.

**8.** The high dump bucket-based construction machine of claim 7, wherein when the joystick is operated while at least one of the rotation angle of the boom and the rotation angle of the high dump bucket is changed, the control unit stops changing the angle.

**9.** The high dump bucket-based construction machine of claim 1, wherein when the control unit receives a fourth user input for performing a high dump operation, the control unit dumping-drives the high dump bucket through the third rotating shaft.

**10.** The high dump bucket-based construction machine of claim 9, wherein the control unit receives the fourth user input based on whether a kick-down button of the joystick is pressed.

**11.** A high dump bucket-based construction machine comprising:

a boom that rotatably connected to a main body of the construction machine based on a first rotating shaft;
a bucket support rotatably connected to the boom based on a second rotating shaft and configured to support a high dump bucket;
the high dump bucket rotatably connected to the bucket support based on a third rotating shaft;
a bucket angle sensor configured to detect a rotation angle of the high dump bucket;
a boom angle sensor configured to detect a rotation angle of the boom; and
a control unit configured to change the high dump bucket to a predetermined first angle when the boom is change to a predetermined second angle to perform a high dump operation.

**12.** A posture control method of a high dump bucket-based construction machine performed by at least one processor, the posture control method comprising:

determining whether a kick-out function associated with the construction machine is activated;
determining whether a joystick is operated to a second end in a state where a kick-down button of a joystick associated with the construction machine is pressed; and
controlling the high dump bucket of the construction machine to a predetermined first angle and controlling a boom of the construction machine to a predetermined second angle when it is determined whether the kick-out function is activated and whether the joystick is operated.

**13.** The posture control method of claim 12, further comprising:

determining whether the kick-down button of the

joystick is input when the angles of the boom and high dump bucket of the construction machine are changed; and

performing a dumping operation of the high dump bucket when it is determined that the kick-down button is input.

**14.** The posture control method of claim 12, further comprising stopping changing of the angle when the joystick is operated while at least one of a rotation angle of the boom and a rotation angle of the high dump bucket is changed.

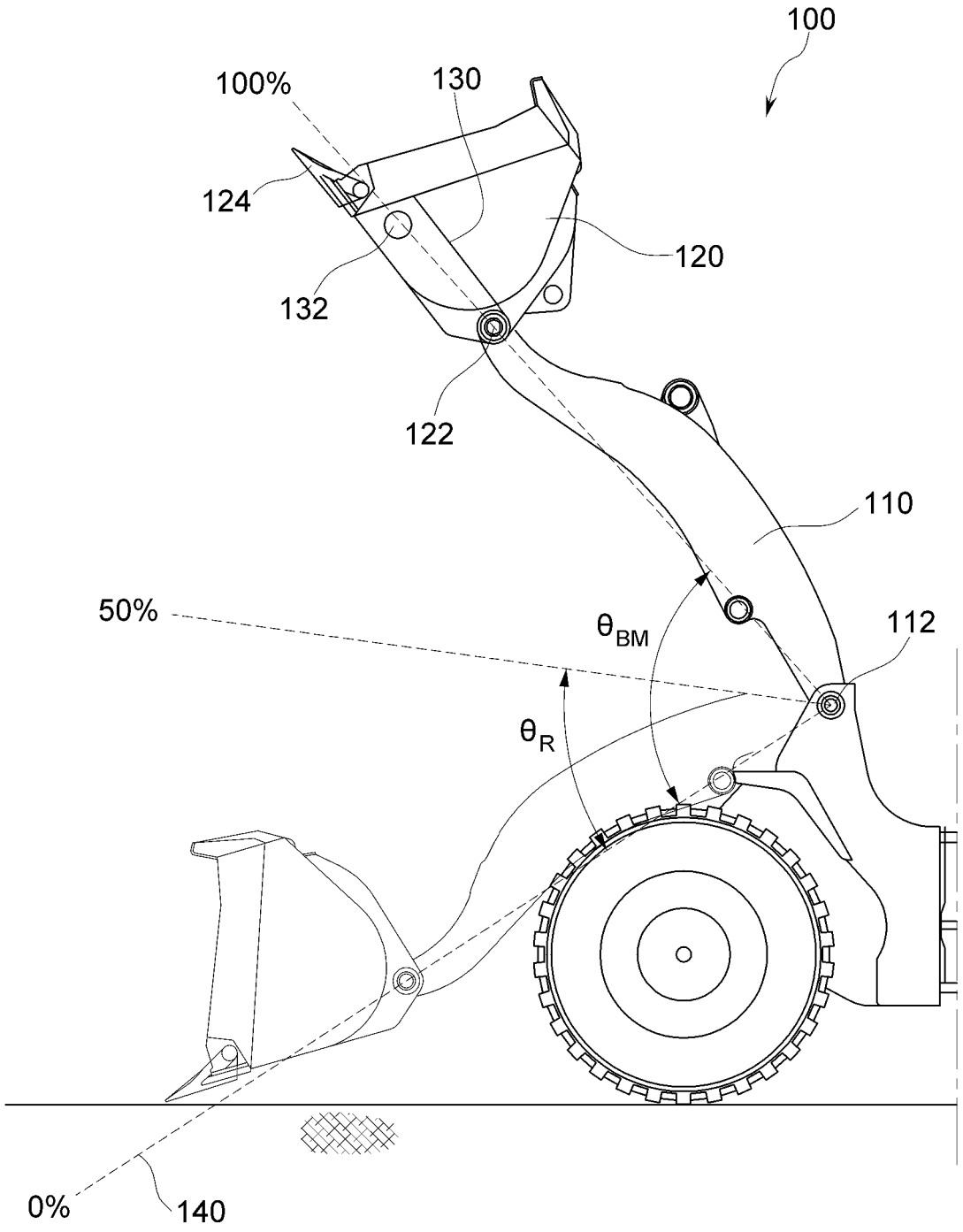


FIG. 1

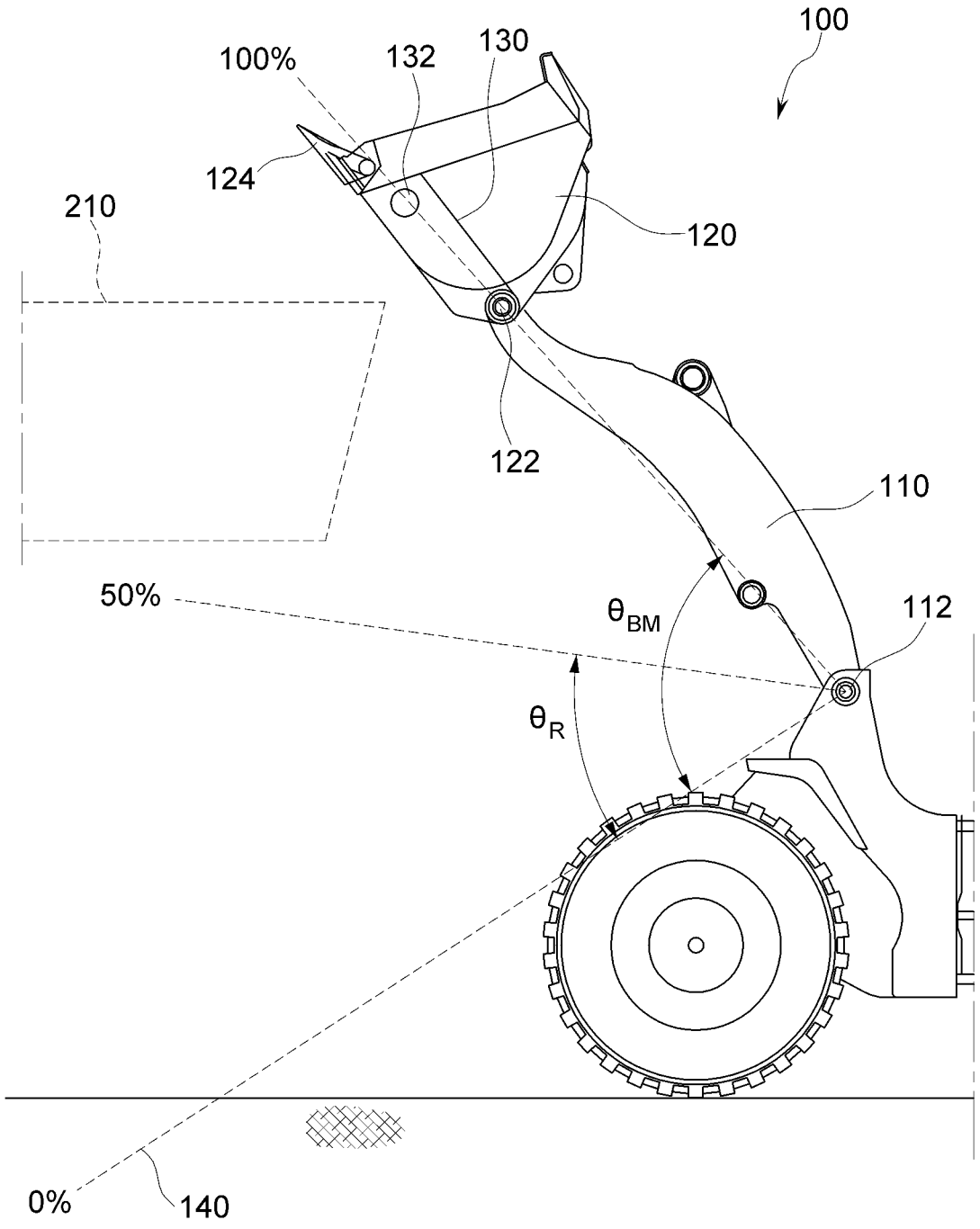


FIG. 2

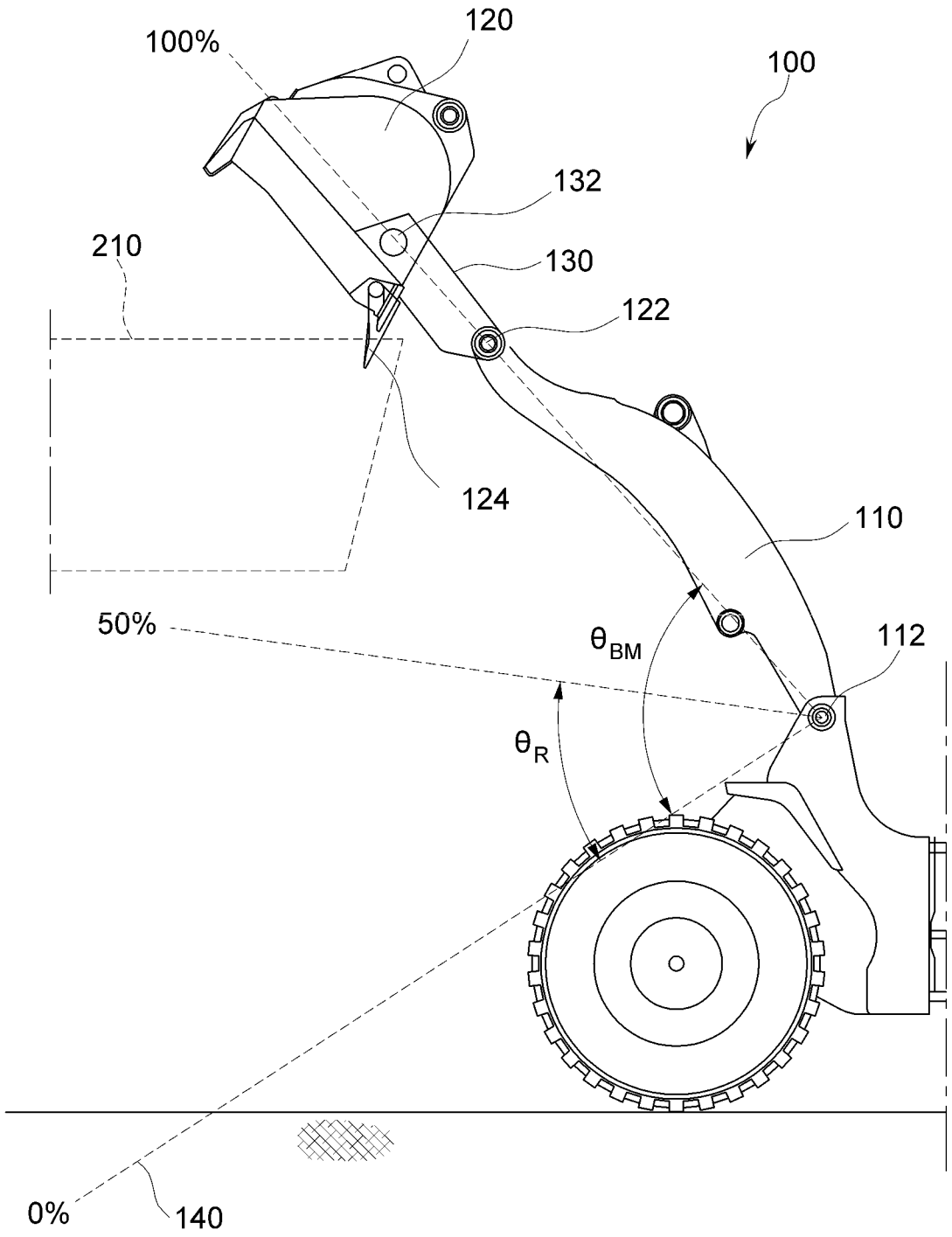


FIG. 3

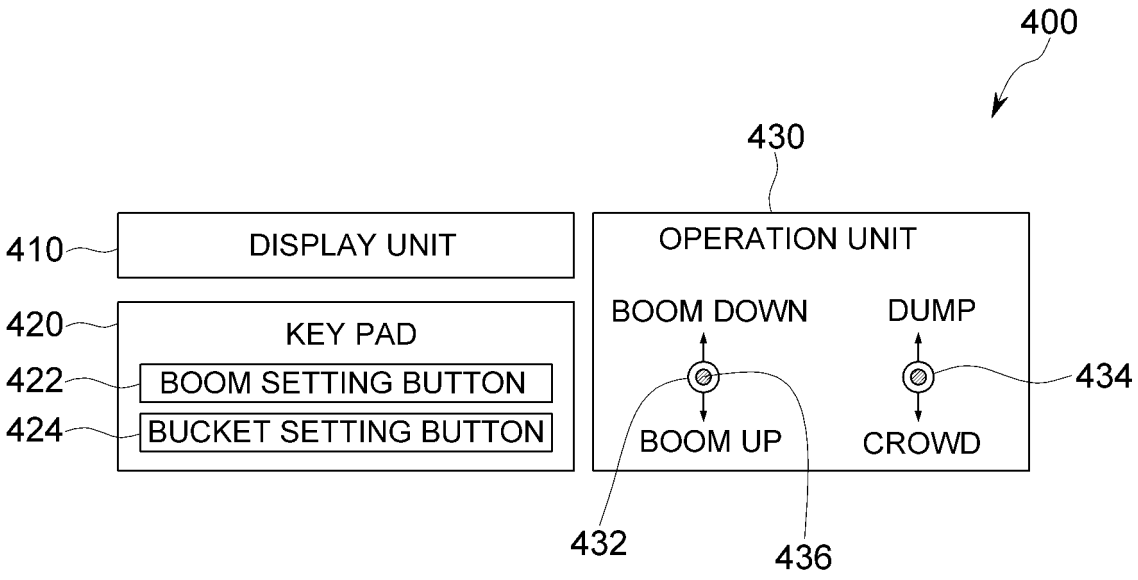
400
430
410
DISPLAY UNIT
OPERATION UNIT
420
KEY PAD
BOOM DOWN
DUMP
422
BOOM SETTING BUTTON
434
424
BUCKET SETTING BUTTON
BOOM UP
CROWD
432
436

FIG. 4

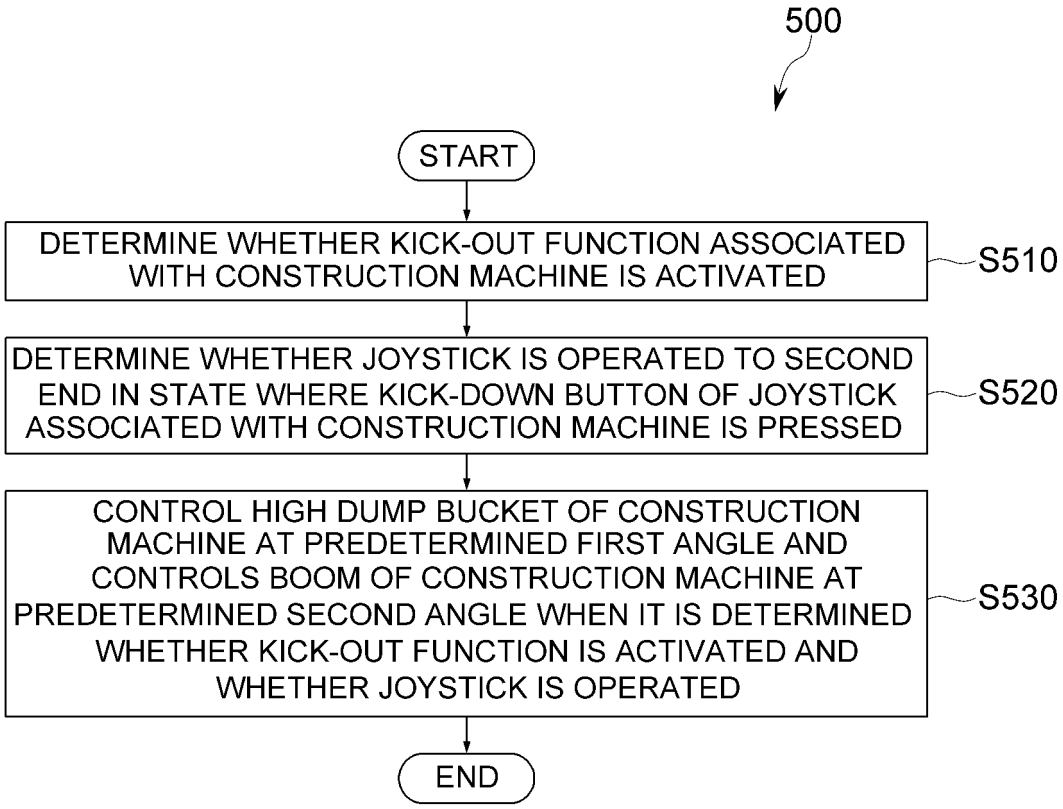
500
START
DETERMINE WHETHER KICK-OUT FUNCTION ASSOCIATED WITH CONSTRUCTION MACHINE IS ACTIVATED
S510
DETERMINE WHETHER JOYSTICK IS OPERATED TO SECOND END IN STATE WHERE KICK-DOWN BUTTON OF JOYSTICK ASSOCIATED WITH CONSTRUCTION MACHINE IS PRESSED
S520
CONTROL HIGH DUMP BUCKET OF CONSTRUCTION MACHINE AT PREDETERMINED FIRST ANGLE AND CONTROLS BOOM OF CONSTRUCTION MACHINE AT PREDETERMINED SECOND ANGLE WHEN IT IS DETERMINED WHETHER KICK-OUT FUNCTION IS ACTIVATED AND WHETHER JOYSTICK IS OPERATED
S530
END

FIG. 5

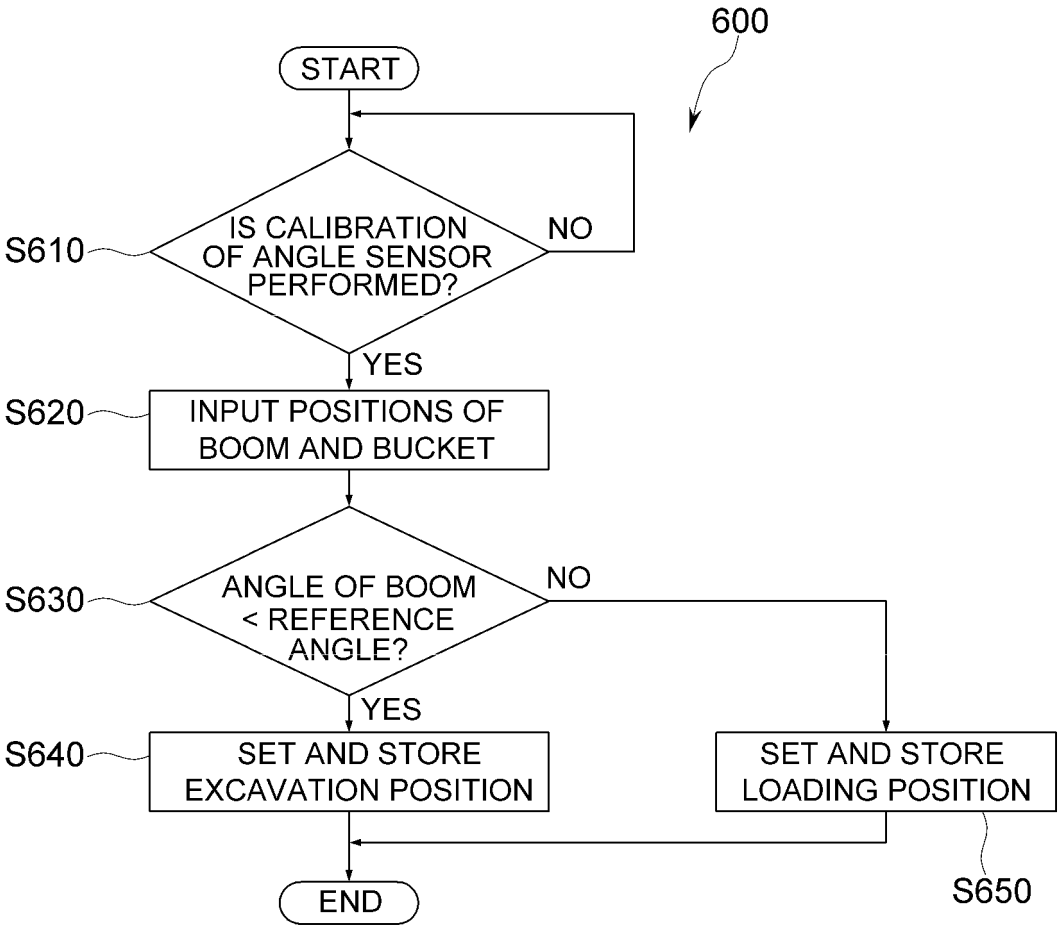
600
START
S610
IS CALIBRATION OF ANGLE SENSOR PERFORMED?
NO
YES
S620
INPUT POSITIONS OF BOOM AND BUCKET
S630
ANGLE OF BOOM < REFERENCE ANGLE?
NO
YES
S640
SET AND STORE EXCAVATION POSITION
SET AND STORE LOADING POSITION
S650
END

FIG. 6

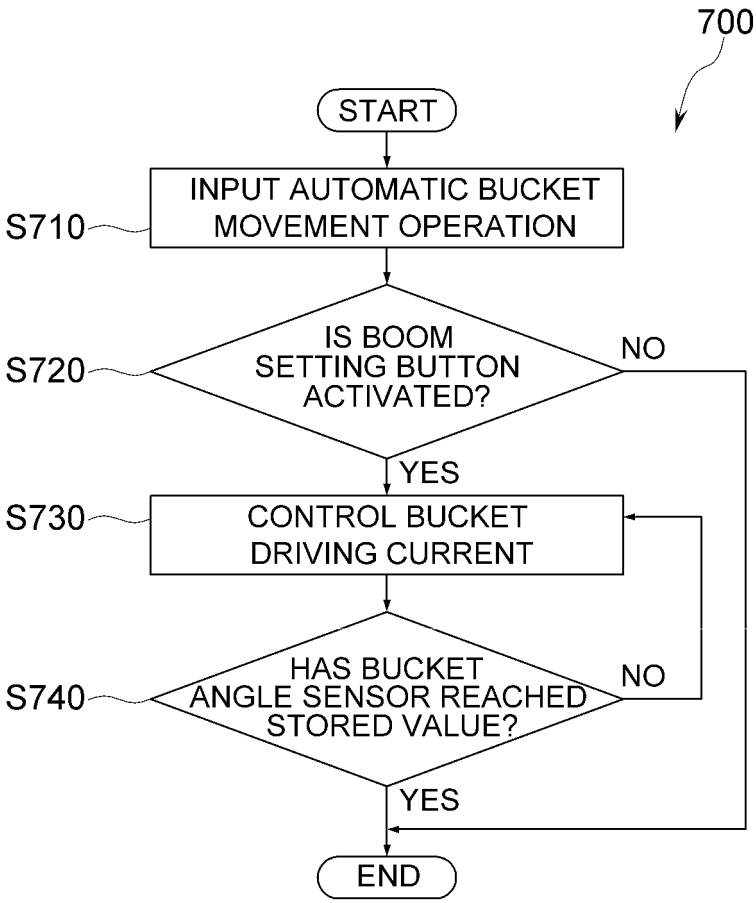
700
START
INPUT AUTOMATIC BUCKET MOVEMENT OPERATION
S710
IS BOOM SETTING BUTTON ACTIVATED?
S720
NO
YES
CONTROL BUCKET DRIVING CURRENT
S730
HAS BUCKET ANGLE SENSOR REACHED STORED VALUE?
S740
NO
YES
END

FIG. 7

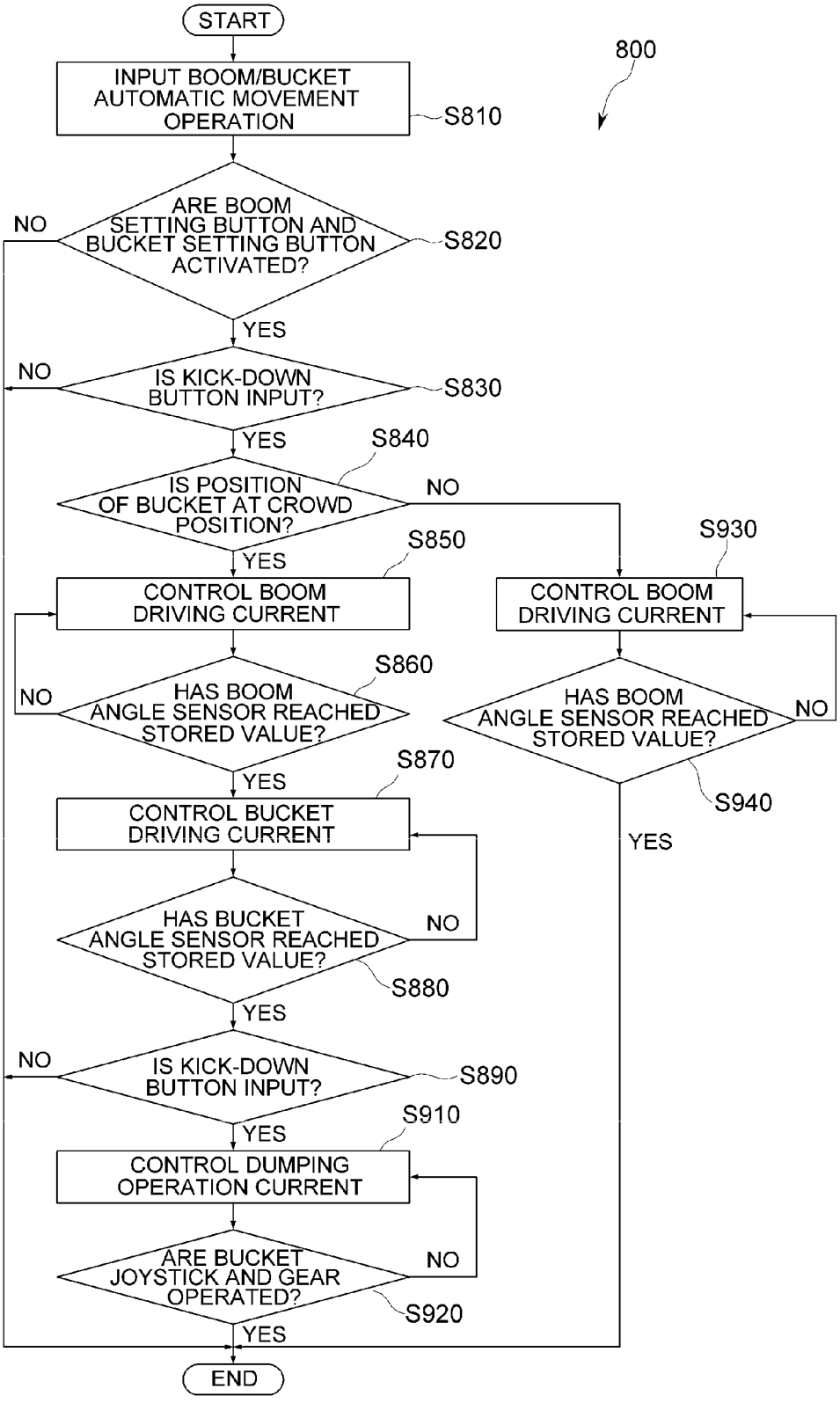
START
800
INPUT BOOM/BUCKET AUTOMATIC MOVEMENT OPERATION
S810
ARE BOOM SETTING BUTTON AND BUCKET SETTING BUTTON ACTIVATED?
S820
NO
YES
IS KICK-DOWN BUTTON INPUT?
S830
NO
YES
S840
IS POSITION OF BUCKET AT CROWD POSITION?
NO
YES
S850
CONTROL BOOM DRIVING CURRENT
S860
HAS BOOM ANGLE SENSOR REACHED STORED VALUE?
NO
YES
S870
CONTROL BUCKET DRIVING CURRENT
HAS BUCKET ANGLE SENSOR REACHED STORED VALUE?
NO
S880
YES
IS KICK-DOWN BUTTON INPUT?
S890
NO
YES
S910
CONTROL DUMPING OPERATION CURRENT
ARE BUCKET JOYSTICK AND GEAR OPERATED?
NO
S920
YES
S930
CONTROL BOOM DRIVING CURRENT
HAS BOOM ANGLE SENSOR REACHED STORED VALUE?
NO
S940
YES
END

FIG. 8