



(51) International Patent Classification:

*B65D 88/28* (2006.01)      *B65D 88/30* (2006.01)  
*B65D 90/22* (2006.01)      *B65F 1/00* (2006.01)  
*B65G 65/00* (2006.01)

(21) International Application Number:

PCT/AU2008/001681

(22) International Filing Date:

13 November 2008 (13.11.2008)

(25) Filing Language:

English

(26) Publication Language:

English

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(81) Designated States (unless otherwise indicated, for every

kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every

kind of regional protection available): ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MT, NL, NO, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

— with international search report (Art. 21(3))

(54) Title: DUMP BIN SYSTEM

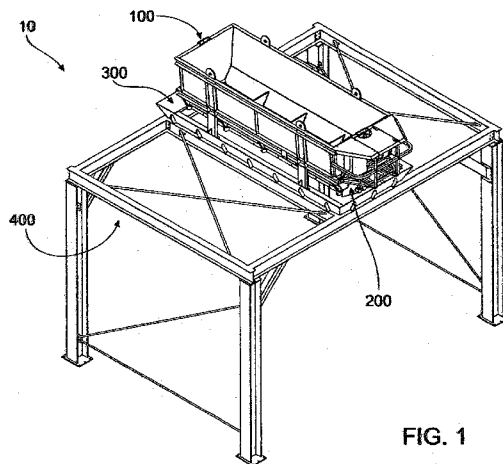


FIG. 1

(57) Abstract: A dump bin system (10) provides for efficient removal of earth from a deep excavation site. The dump bin system (10) includes a dump bin (100) which is located on a support frame (300) supported by a gantry (400). In use, the dump bin (100) is filled with earth at the floor of the excavation site and transported by crane to its position supported on the support frame (300). The dump bin (100) has a drop bottom to discharge earth into a trailer (not shown) positioned below the support frame (300). The dump bin system (10) includes a safety control system (200) which prevents opening of the drop bottom whilst the dump bin (100) is in transit between the floor of the excavation site and the support frame (300).

WO 2010/054422 A1

**TITLE OF THE INVENTION****DUMP BIN SYSTEM****FIELD OF THE INVENTION**

5           The invention relates to drop-bottom bins, and in particular but not exclusively to a dump bin system having safety features.

**BACKGROUND**

10           Drop-bottom bins are well known for holding and transporting material. Drop-bottom bins can quickly discharge their load by releasably swinging open doors that form the floor of the bin. In many circumstances that presents a significant advantage over standard, top-opening bins or skips.

15           However, one of the inherent dangers of a drop-bottom bin is that the doors may accidentally be opened as the bin is being transported. This creates a serious workplace health and safety issue, especially if the bin is being transported overhead above a worksite by crane. A further workplace health and safety issue concerns discharging the contents of the bin while the bin is hanging from a crane.

20

**SUMMARY OF THE INVENTION**

According to one aspect of the invention there is provided a dump bin system including:-

a dump bin having:

25           attachment formations for attaching the dump bin to lifting equipment;

30           one or more dump doors which form the floor of the dump bin in a closed position and which are selectively displaced into an open position so that material in the dump bin may be discharged via the bottom of the dump bin; and

              displacement means for displacing the dump doors between the open position and the closed position; and

a safety control system including:

at least one sensor operable to sense when the dump bin is within a predetermined distance from a support formation on which the dump bin is to be supported; and

5 a logic controller which is in communication with the displacement means and the sensor and which is configured to allow actuation of the displacement means to displace the dump doors from the closed position to the open position only when the sensor senses that the dump bin is within the predetermined distance from the support formation.

10 Preferably the support formation is in the form of a support frame and a gantry which holds the support frame at an elevated position above the ground, the support frame being dimensioned and configured so that at least part of the bottom of the dump bin is unobstructed when the dump bin is supported thereon.

15 Preferably, the gantry and support frame combination are dimensioned and configured to hold the dump bin at an elevated position sufficient for a trailer to be positioned below the support frame.

Preferably the sensor is an ultrasonic sensor.

20 Preferably the support frame includes an upwardly and outwardly diverging guide formation which guides the dump bin into its position supported by the frame.

Preferably the dump bin includes locating formations which protrude from the dump bin to co-act with the guide formation to guide the dump bin into its position supported by the support frame.

25 Preferably the dump bin has two dump doors and a ram; and the dump bin system includes two rods which are each pivotally connected to a distal end of the ram at one end and to a different one of the dump doors at the other end.

30 Preferably the displacement means includes a hydraulic piston connected to the dump door, a hydraulic pump which drives the hydraulic piston, and an engine which drives the hydraulic pump.

According to another aspect of the invention there is provided a dump bin system including:-

a dump bin having:

5 attachment formations for attaching the dump bin to lifting equipment; and

one or more dump doors which form the floor of the dump bin in a closed position and which are selectively displaced into an open position so that material in the dump bin may be discharged via the bottom of the dump bin; and

10 a support formation in the form of a support frame and a gantry which holds the support frame at an elevated position above the ground, the support frame being dimensioned and configured so that it is operable to support the dump bin in an arrangement wherein at least part of the bottom of the dump bin is unobstructed when the dump bin is supported  
15 thereon.

Preferably the gantry is dimensioned and configured to hold the support frame at an elevated position sufficient for a trailer to be positioned below the support frame.

20 Preferably the support frame includes an outwardly diverging guide formation which guides the dump bin into its position supported by the frame.

Preferably the dump bin includes locating formations which protrude from the dump bin to co-act with the guide formation to guide the dump bin into its position supported by the support frame.

25 Preferably the displacement means includes a hydraulic piston connected to the dump doors, an hydraulic pump which drives the hydraulic piston, and an engine which drives the hydraulic pump.

30 Preferably the dump bin has two dump doors, the piston includes a ram, and the dump bin system includes two linkages which are each pivotally connected to a distal end of the ram at one end and to a different one of the dump doors at the other end.

### BRIEF SUMMARY OF THE DRAWINGS

Preferred embodiments of the invention will be described with respect to the accompanying drawings, of which:

5 FIG. 1 shows a perspective view of a dump bin system, according to some embodiments of the present invention;

FIG. 2 shows a perspective view of the dump bin of the dump bin system of FIG.1;

FIG. 3 shows an alternative perspective view of the dump bin of FIG.2;

10 FIG. 4 shows a bottom perspective view of the dump bin of FIG. 2;

FIG. 5 shows an end view of the dump bin of FIG. 2;

FIG. 6 shows another end view of the dump bin of FIG. 2;

FIG. 7 shows a perspective view of a gantry and support frame of the dump bin system of FIG. 1; and

15 FIG. 8 shows a diagrammatic layout of the hydraulic circuit and safety system of the dump bin system of FIG. 1

### DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

20 Embodiments of the present invention comprise a dump bin and a dump bin system. Elements of the invention are illustrated in concise outline form in the drawings, showing only those specific details that are necessary to understanding the embodiments of the present invention, but so as not to clutter the disclosure with excessive detail that will be obvious to those of ordinary skill in the art in light of the present description.

25 In this patent specification, adjectives such as first and second, left and right, front and back, top and bottom, etc., are used solely to define one element from another element without necessarily requiring a specific relative position or sequence that is described by the adjectives. Words such as "comprises" or "includes" are not used to define an exclusive set  
30 of elements or method steps. Rather, such words merely define a minimum set of elements or method steps included in a particular embodiment of the present invention. It will be appreciated that the

invention may be implemented in a variety of ways, and that this description is given by way of example only.

With reference to FIG. 1, an embodiment of a dump bin system in accordance with the invention is designated generally by reference numeral 10. The dump bin system 10 comprises a dump bin 100, a safety control system 200, and a support frame 300 supported by a gantry 400.

Referring to FIG's 2 to 5, the dump bin 100 is open-topped, having upstanding surrounding walls 102. The dump bin 100 is generally rectangular in top plan view. The walls 102 are reinforced by a shell of structural profile tubing 104. A lower part of the dump bin 10 has inwardly converging chute walls 106 forming a chute which converges to a mouth opening 108 through which material in the dump bin 100 is discharged. Spaced reinforcement webs 110 extend between the chute walls 106.

The dump bin 100 includes two dump doors 112 which are hingedly connected to the outside of the chute walls 106. The dump doors 112 run the length of the dump bin 100. The dump doors 112 are displaceable between a closed position wherein they close off the mouth opening 108, thereby forming a floor of the dump bin 100 and an open position wherein the mouth opening 108 is left open. In the closed position the dump doors 112 each close off half of the mouth opening 108. In the closed position, distal edges of the opposite dump doors 112 abut to close off the mouth opening 108.

Attachment formations in the form of four lifting lugs 126 are fixed to the shell and project upwardly from the top of the walls 102. The lifting lugs 126 each have a hole there through for receiving a shackle or hook, thereby to attach the bin 100 to a crane via chains.

Referring to FIG. 5, the dump doors 112 are hingedly displaced away from the mouth opening into the open position by displacement means. The displacement means include a hydraulic piston 114 and a linkage arrangement at each end of the dump bin 100.

The dump bin 100 further includes four legs 122 which extend downwardly from the opposite lateral sides of the bin 100. The legs 122

include feet 124 on which the dump bin 100 stands. The legs 122 also include locating formations 130 having flat slanted outer faces 132.

Each hydraulic piston 114 includes a ram 116 which is displaceable between an extended position and a retracted position. The linkage arrangement comprises a triangular link plate 118 and two connecting rods 120. The link plate 118 is hingedly connected to the distal end of the ram 116 at an apex of the link plate 118. The connecting rods 120 each extend between a base of the link plate 118 and the distal end of a different one of the dump doors 112. The connecting rods 120 are hingedly connected to the link plate 118 and the dump doors 112 at their opposite ends by clevis and pin arrangements. The dump doors 112 include face plates 134 at their ends to prevent material in the dump bin from spilling from the side ends of the mouth opening 108.

Referring to FIG. 6, the displacement means includes a pump 140 driven by an internal combustion engine 142. The pump 140 is connected to a hydraulic fluid reservoir 144 at an inlet end and to a control valve 146 at an outlet end. The displacement means is controlled via a control box 204 as is more fully described with reference to FIG. 8.

Referring to FIG 7, the gantry 400 elevates the support frame 300 above the ground 12. For example, the support frame 300 may be suspended several metres above the ground to enable a truck trailer to be parked below the support frame 300. The gantry 400 has four legs 402 and a rectangular gantry frame comprising two spaced longitudinal beams 406 and two end beams 408. The gantry 400 also includes two spaced cross beams 410 which has the support frame 300 located thereon.

The support frame 300 comprises two spaced platforms 302, a surrounding guide formation 304 and deflection plates 306. The platforms 302 are generally rectangular, fixed on top of the cross beams 410 and supported by spaced ribs. The platforms 302 are of sufficient width and sufficiently spaced relative to each other so that when the bin 100 is centralized relative to the support frame 300, the feet 124 of all four legs 122 stand on the platforms 302. The guide formation 304 comprises

slanting walls 310 which slant inwardly from a rim 312 to the platforms 302. The angle of slant of the walls 310 are the same as the angle of slant of the faces 132 of the locating formations 130.

In use, as the bin 100 is lowered onto the support frame 300, the  
5 faces 132 of the locating formations 130 may bump the sides of the walls 310, thereby guiding the bin 100 into the correct orientation relative to the frame 300, centralized between the walls 310. The feet 124 also engage the deflection plates 306 as the dump bin 100 is lowered onto the support frame 300, thereby centralizing the dump bin 100 on a longitudinal axis of  
10 the support frame 300.

Referring to FIG.8, a diagrammatic layout of the hydraulic system and safety control system 200 is shown.

The hydraulic system comprises the hydraulic pump 140, combustion engine 142, tandem directional control valve 146, double  
15 acting pistons 114, reservoir 144, bypass valve 148 and low pressure lockout valves 150. The engine 142 is connected to the pump 140 by a shaft to drive the pump 140. The pump 140 is connected to the reservoir 144 at a low pressure end via a hydraulic hose. The pump 140 pumps high pressure hydraulic fluid to the pistons 114 via hydraulic hoses and  
20 the control valve 146. The control valve 146 is actuated by an actuator 152 between the following positions:-

a retracting position wherein the pistons 114 are pressurized so that the rams 116 retract, thereby closing the doors 112;

an extending position wherein the pistons 114 are pressurized so  
25 that the rams 116 extend, thereby opening the doors 112; and

a neutral position wherein the pistons 114 are not pressurized so that the rams 116 are locked in position by the low pressure lockout valves 150.

When the control valve 146 is in the neutral position, pressurized hydraulic  
30 fluid is returned to the reservoir 144 via the by-pass valve 148.

The safety control system 200 also comprises ultra sonic distance sensors 202 and a control unit 204 to which the sensors 202 are

connected. The safety control system 200 includes two ultrasonic distance sensors 202, although one ultrasonic distance sensor is also sufficient for operation of the safety control system 200. The locations of the ultrasonic distance sensors 202 on the bin 100 are shown in FIG's 2 to 4. The ultrasonic distance sensors 202 are fixed on either side of the bin 100. The sensors 202 are located on the lower surround of structural profile tubing of the shell at the level of the beginning of the chute defined by the chute walls 106. The sensors 202 are aimed downwardly to the ground.

10 The control unit 204 includes a Programmable Logic Control (PLC) 206 and a number of relays 208. One of the relays 208 is connected to the actuator 152, which enables the control unit 204 to control the control valve 146. The sensors 202 sense the height of the bin 100 above a support. Concerning the present embodiment, reference to a support is  
15 interpreted to mean either the ground or the support frame 300. More specifically, the PLC 206 is configured to not actuate the control valve 146 to the extending position unless the sensors 202 sense that the feet 124 of the bin 100 is within half a metre from a support. Instructions to the control 204 unit are sent wirelessly from a remote controller 210. The  
20 remote controller 210 has an open button 212 and a close button 214. Pressing the open button 212 sends a signal to the control unit 204 to actuate the control valve 146 to open the doors 112; and conversely pressing the close button 214 actuates the control valve 146 to close the doors 112. Actuation of the control valve 146 to the extending position to  
25 open the doors 112 is subject to the sensors 202 measuring the distance of the bin 100 to a support to be less than half a metre.

The dump bin system 10 of the preferred embodiment is specifically designed for use with a crane in excavating operations. During building operations it may be necessary to do deep excavation if the building has a  
30 sizable subterranean foundation. One of the problems facing excavators in such circumstances is how to transport excavated earth from a deep pit to above ground trucks. In use, the bin 100 is lowered by crane to the

bottom of the excavation, where the bin 100 is filled with excavated earth. The bin 100 is then hoisted up to the support frame 300 by the crane. During the hoisting operation it is critical that the dump doors 112 not be accidentally opened, as this could endanger workers below the dump bin

5 100. As a contingency for this, the safety control system 200 of the present invention prohibits opening of the dump doors 112 until such a time as the dump bin 100 is at least half a metre from the ground or the support frame 300. Should an operator accidentally actuate the open

10 button 214 on the remote controller 210 during the hoisting operation, the control valve 146 will not be actuated, as the sensors 202 will sense that the dump bin 100 is not within the requisite distance of a support.

However, once the dump bin 100 is positioned on the support frame 300, the sensors 202 again measure the distance between the feet 124 of the dump bin 100 and the platforms 302 of the support frame 300.

15 As this distance is now less than half a metre, an operator is able to open the dump doors 112 by pushing the open button 214 on the remote controller 210. Earth in the dump bin 100 is then discharged into the trailer of a truck positioned below the support frame 300. After discharge, the dump doors 112 are closed by the operator and a new cycle of

20 collecting and dumping of the bin contents starts.

The above description of various embodiments of the present invention is provided for purposes of description to one of ordinary skill in the related art. It is not intended to be exhaustive or to limit the invention to a single disclosed embodiment. As mentioned above, numerous

25 alternatives and variations to the present invention will be apparent to those skilled in the art of the above teaching. Accordingly, while some alternative embodiments have been discussed specifically, other embodiments will be apparent or relatively easily developed by those of ordinary skill in the art. Accordingly, this patent specification is intended to

30 embrace all alternatives, modifications and variations of the present invention that have been discussed herein, and other embodiments that fall within the spirit and scope of the above described invention.

Limitations in the claims should be interpreted broadly based on the language used in the claims, and such limitations should not be limited to specific examples described herein. In this specification, the terminology “present invention” is used as a reference to one or more aspects within  
5 the present disclosure. The terminology “present invention” should not be improperly interpreted as an identification of critical elements, should not be improperly interpreted as applying to all aspects and embodiments, and should not be improperly interpreted as limiting the scope of the claims.

CLAIMS

1. A dump bin system including:-  
a dump bin having:
  - 5 attachment formations for attaching the dump bin to lifting equipment;  
one or more dump doors which form the floor of the dump bin in a closed position and which are selectively displaced into an open position so that material in the dump bin may be discharged via the bottom of the  
10 dump bin; and  
displacement means for displacing the dump doors between the open position and the closed position; and  
a safety control system including:
    - at least one sensor operable to sense when the dump bin is  
15 within a predetermined distance from a support formation on which the dump bin is to be supported; and  
a logic controller which is in communication with the displacement means and the sensor and which is configured to allow actuation of the displacement means to displace the dump doors from the  
20 closed position to the open position only when the sensor senses that the dump bin is within the predetermined distance from the support formation.
2. The dump bin system of claim 1, including the support formation in the form of a support frame and a gantry which holds the support frame at  
25 an elevated position above the ground, the support frame being dimensioned and configured so that at least part of the bottom of the dump bin is unobstructed when the dump bin is supported thereon.
3. The dump bin system of claim 2, wherein the gantry is dimensioned  
30 and configured to hold the support frame at an elevated position sufficient for a trailer to be positioned below the support frame.

4. The dump bin system of any one of claims 1 to 3, wherein the sensor is an ultrasonic sensor.
5. The dump bin system of claim 2, wherein the support frame includes an upwardly and outwardly diverging guide formation which guides the dump bin into its position supported by the frame.
6. The dump bin system of claim 5, wherein the dump bin includes locating formations which protrude from the dump bin to co-act with the guide formation to guide the dump bin into its position supported by the support frame.
7. The dump bin system of any one of the preceding claims, wherein the dump bin has two dump doors and a ram; and the dump bin system includes two rods which are each pivotally connected to a distal end of the ram at one end and to a different one of the dump doors at the other end.
8. The dump bin system of any one of the preceding claims, wherein the displacement means includes a hydraulic piston connected to the dump door, a hydraulic pump which drives the hydraulic piston, and an engine which drives the hydraulic pump.
9. A dump bin system including:-  
a dump bin having:  
attachment formations for attaching the dump bin to lifting equipment; and  
one or more dump doors which form the floor of the dump bin in a closed position and which are selectively displaced into an open position so that material in the dump bin may be discharged via the bottom of the dump bin; and  
a support formation in the form of a support frame and a gantry which holds the support frame at an elevated position above the ground,

the support frame being dimensioned and configured so that it is operable to support the dump bin in an arrangement wherein at least part of the bottom of the dump bin is unobstructed when the dump bin is supported thereon.

5

10. The dump bin system of claim 9, wherein the gantry is dimensioned and configured to hold the support frame at an elevated position sufficient for a trailer to be positioned below the support frame.

10 11. The dump bin system as claimed in claim 10, wherein the support frame includes an outwardly diverging guide formation which guides the dump bin into its position supported by the frame.

15 12. The dump bin system as claimed in claim 11, wherein the dump bin includes locating formations which protrude from the dump bin to co-act with the guide formation to guide the dump bin into its position supported by the support frame.

20 13. The dump bin system as claimed in any one of claims 9 to 12, wherein the displacement means includes a hydraulic piston connected to the dump door, an hydraulic pump which drives the hydraulic piston, and an engine which drives the hydraulic pump.

25 14. The dump bin system of claim 13, wherein the dump bin has two dump doors, the piston includes a ram, and the dump bin system includes two linkages which are each pivotally connected to the distal end of the ram at one end and to a different one of the dump doors at the other end.

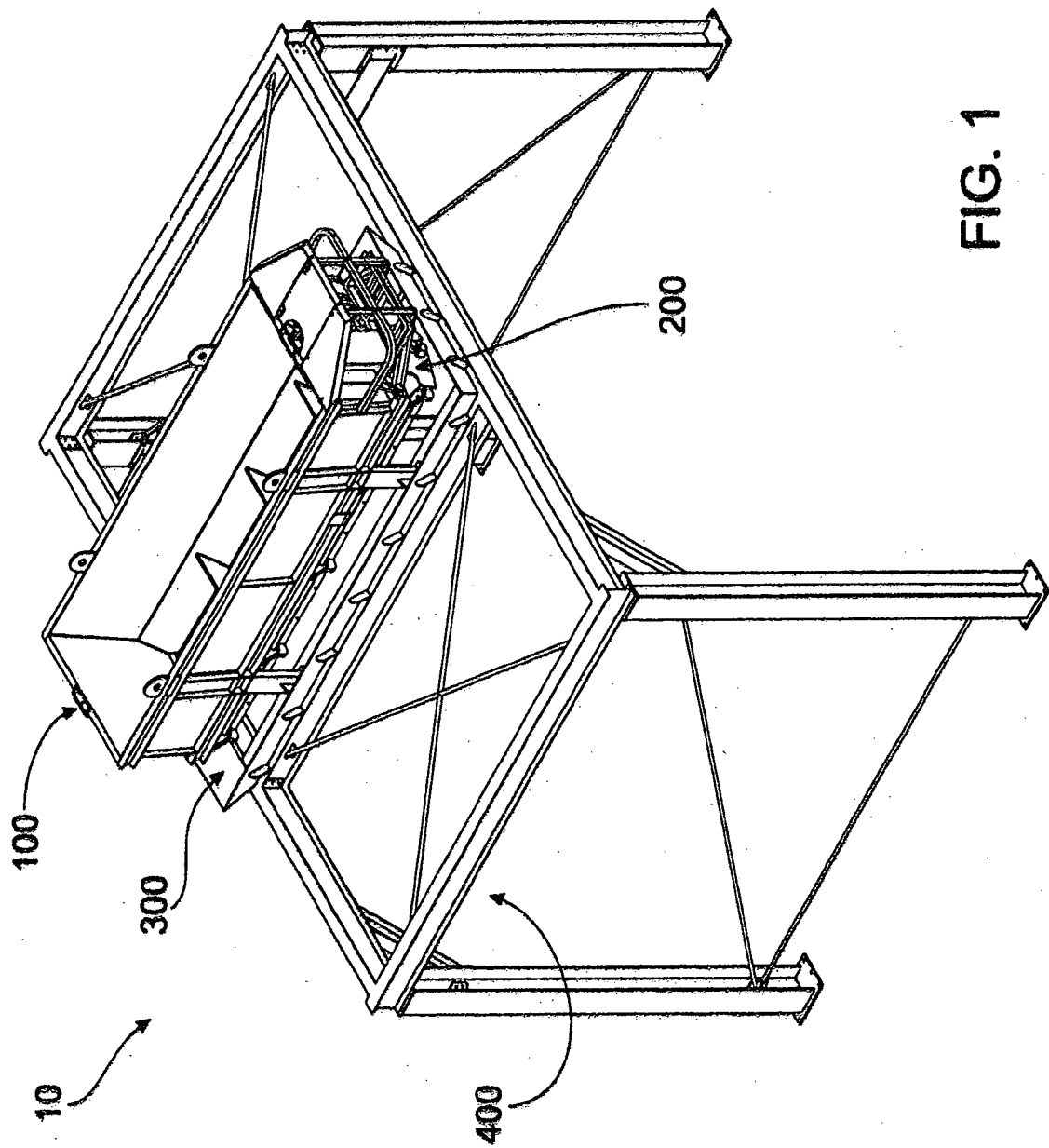


FIG. 1

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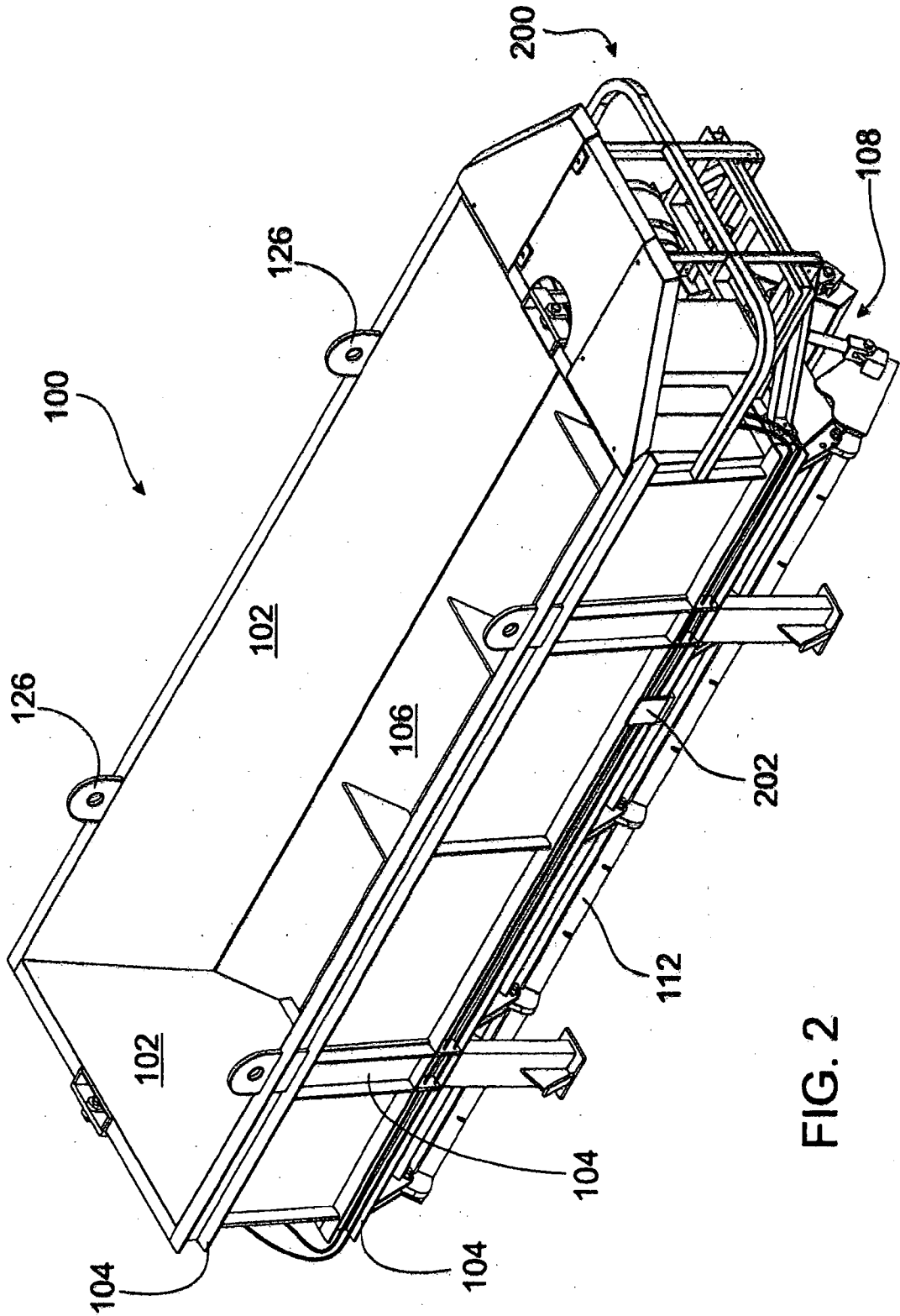


FIG. 2

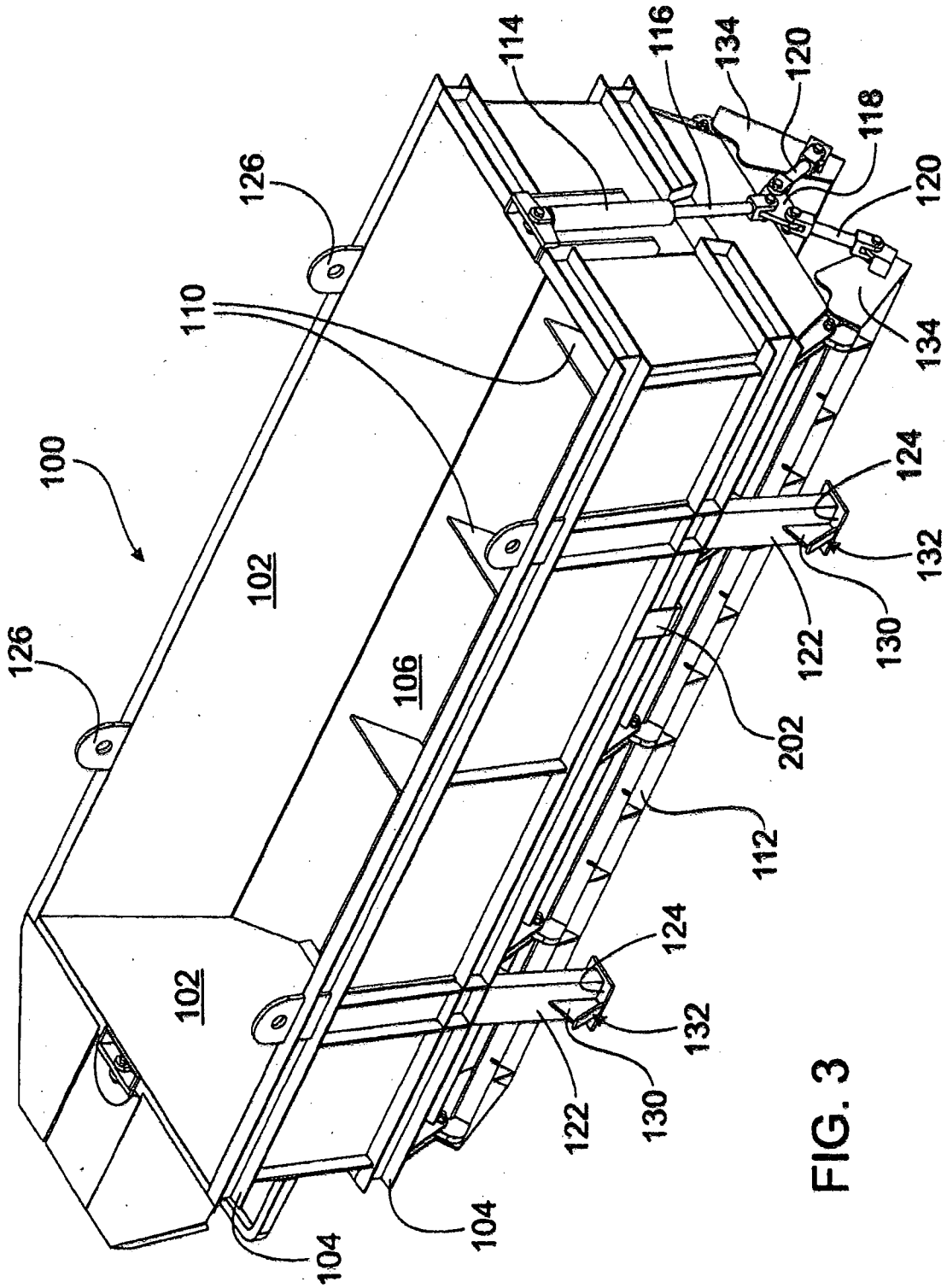


FIG. 3

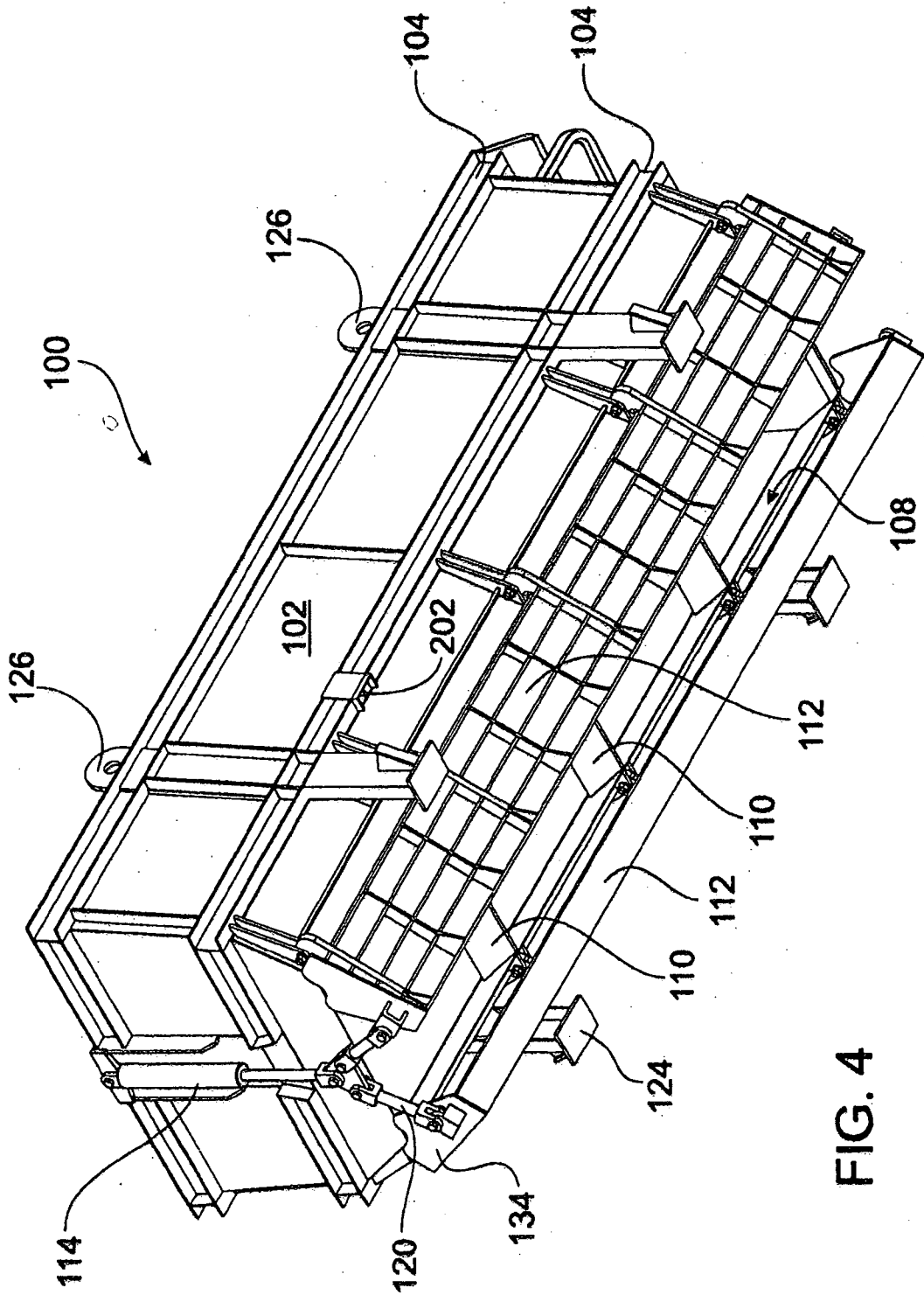


FIG. 4

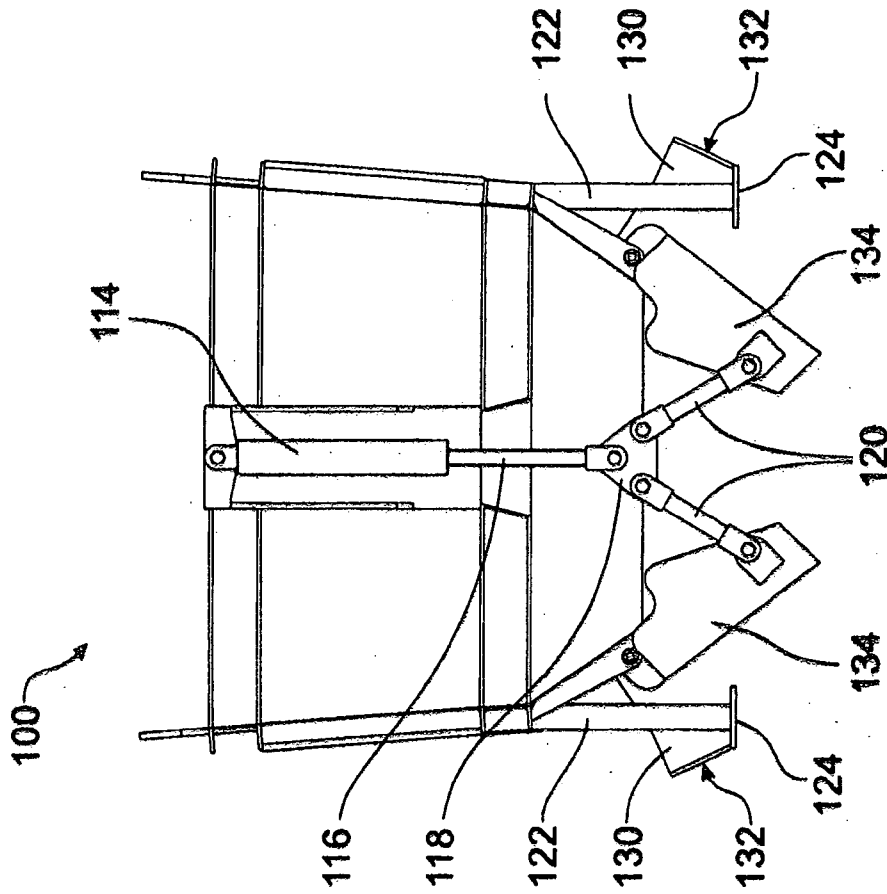
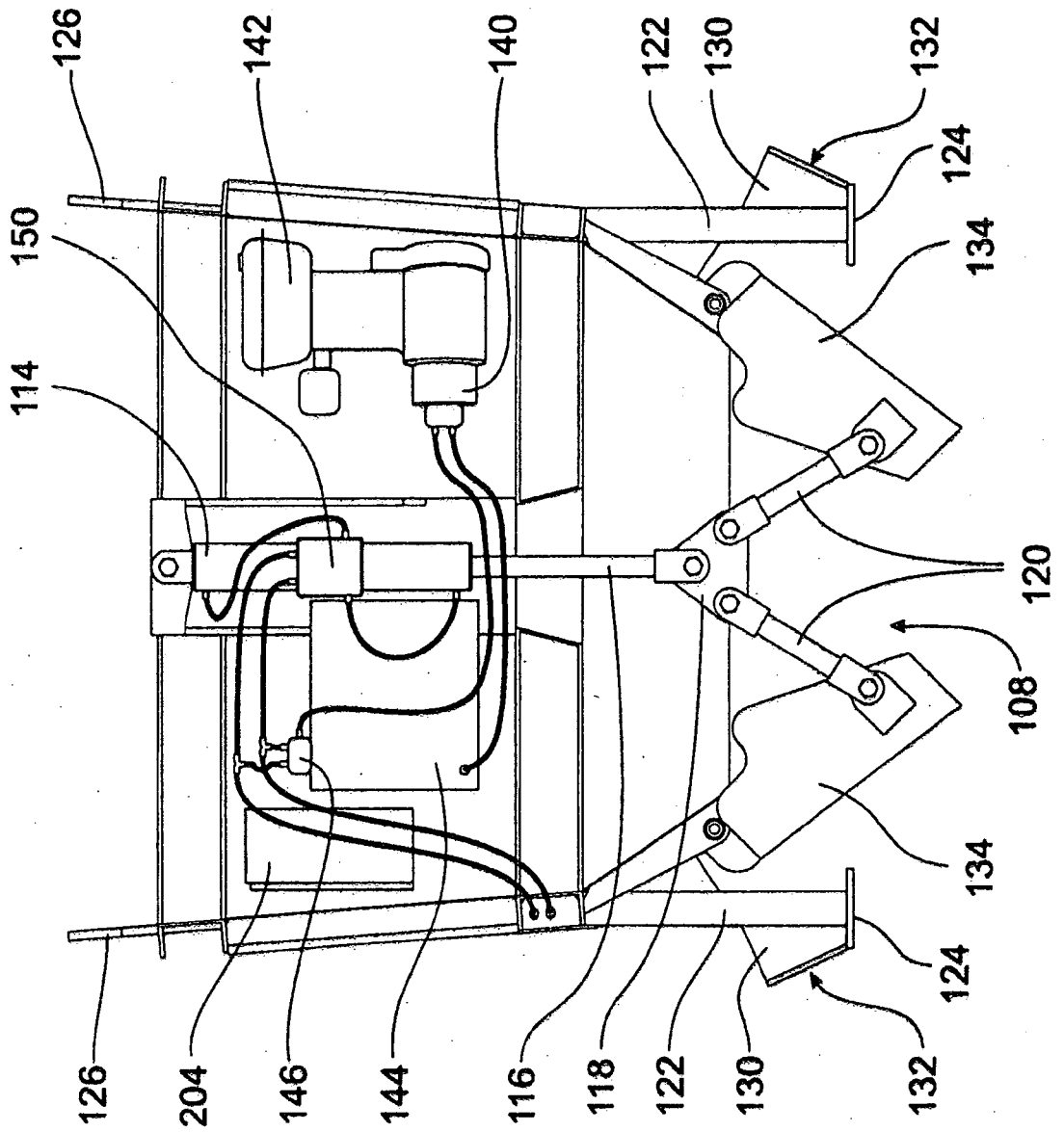


FIG. 5

FIG. 6



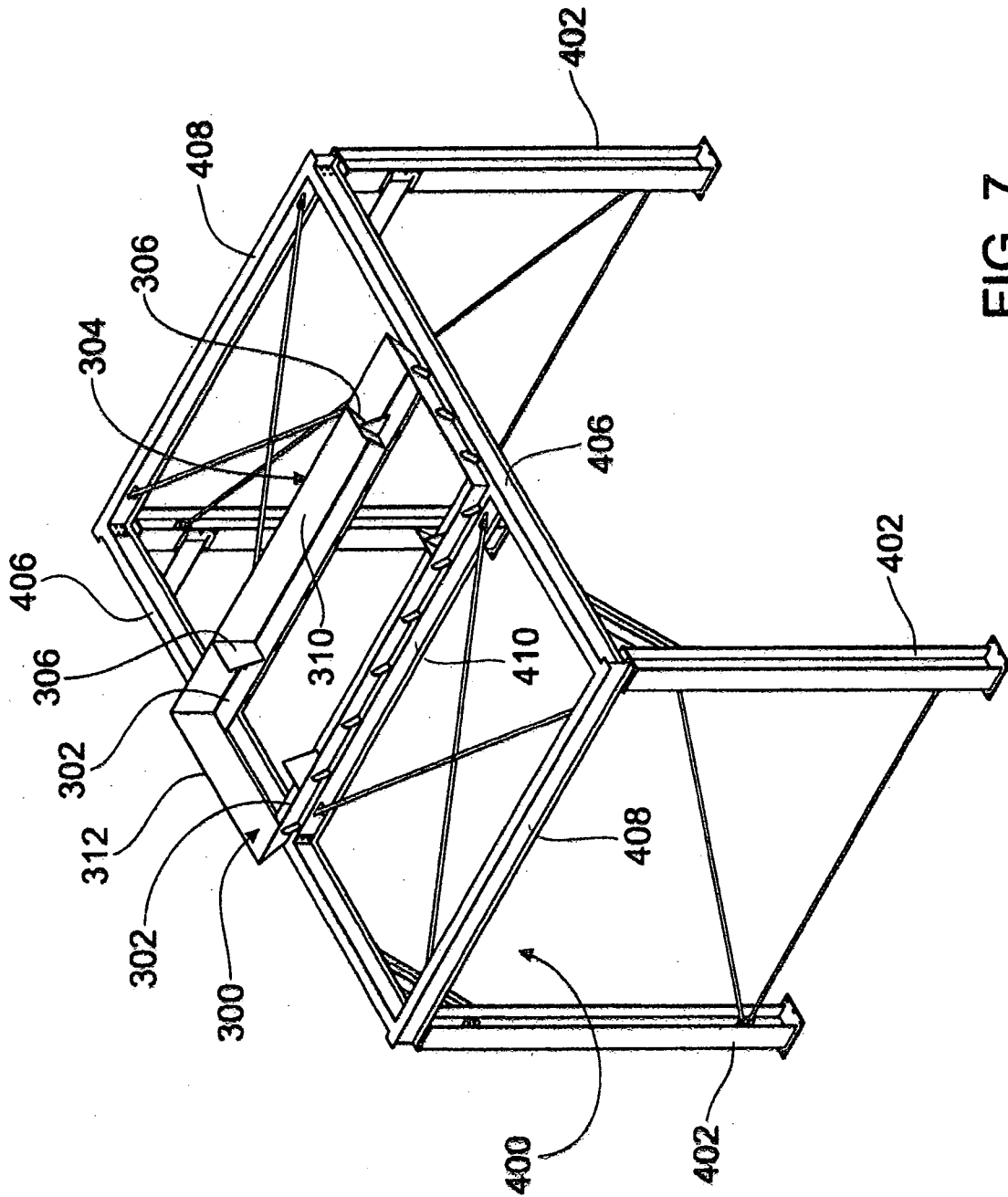


FIG. 7

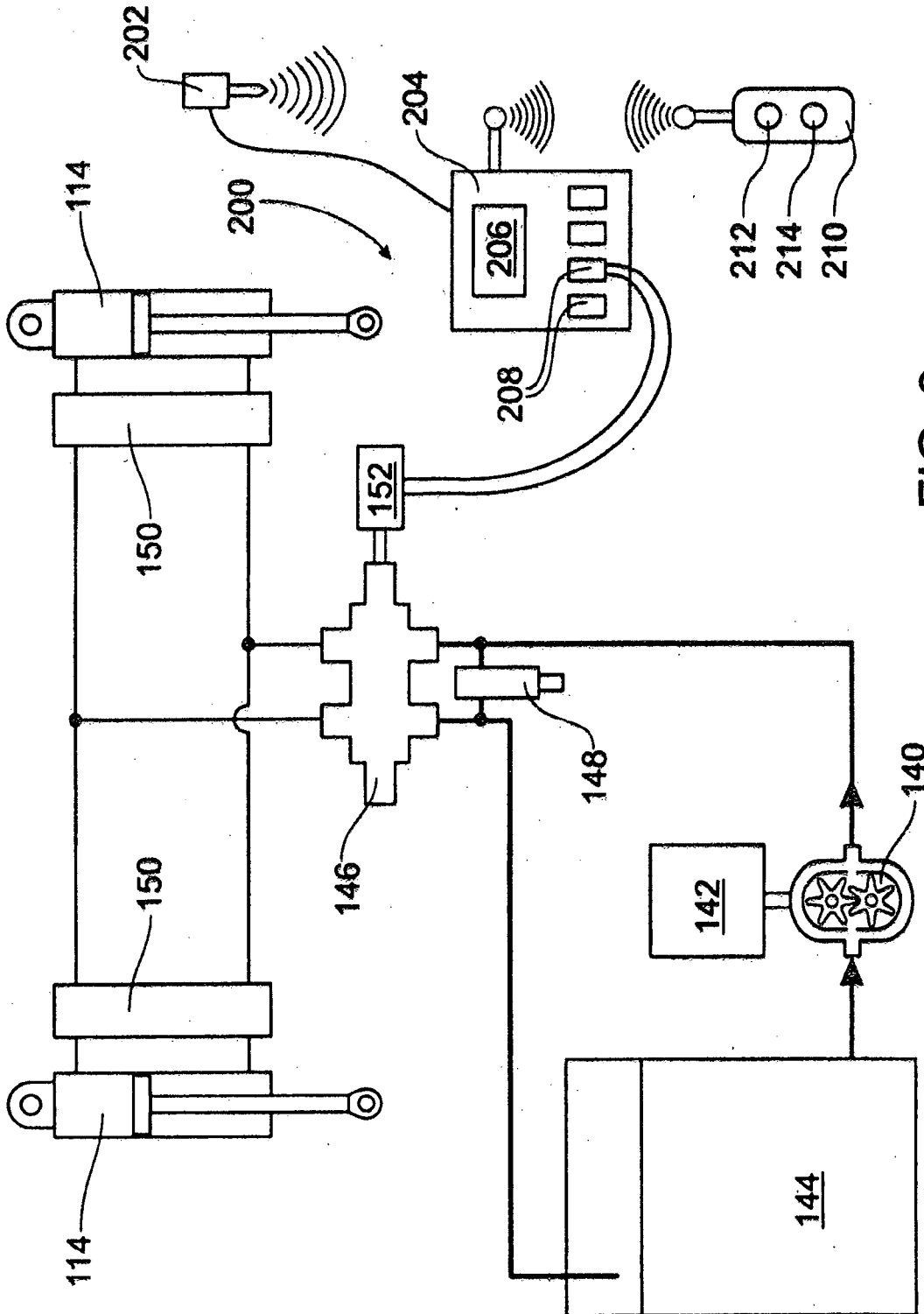


FIG. 8