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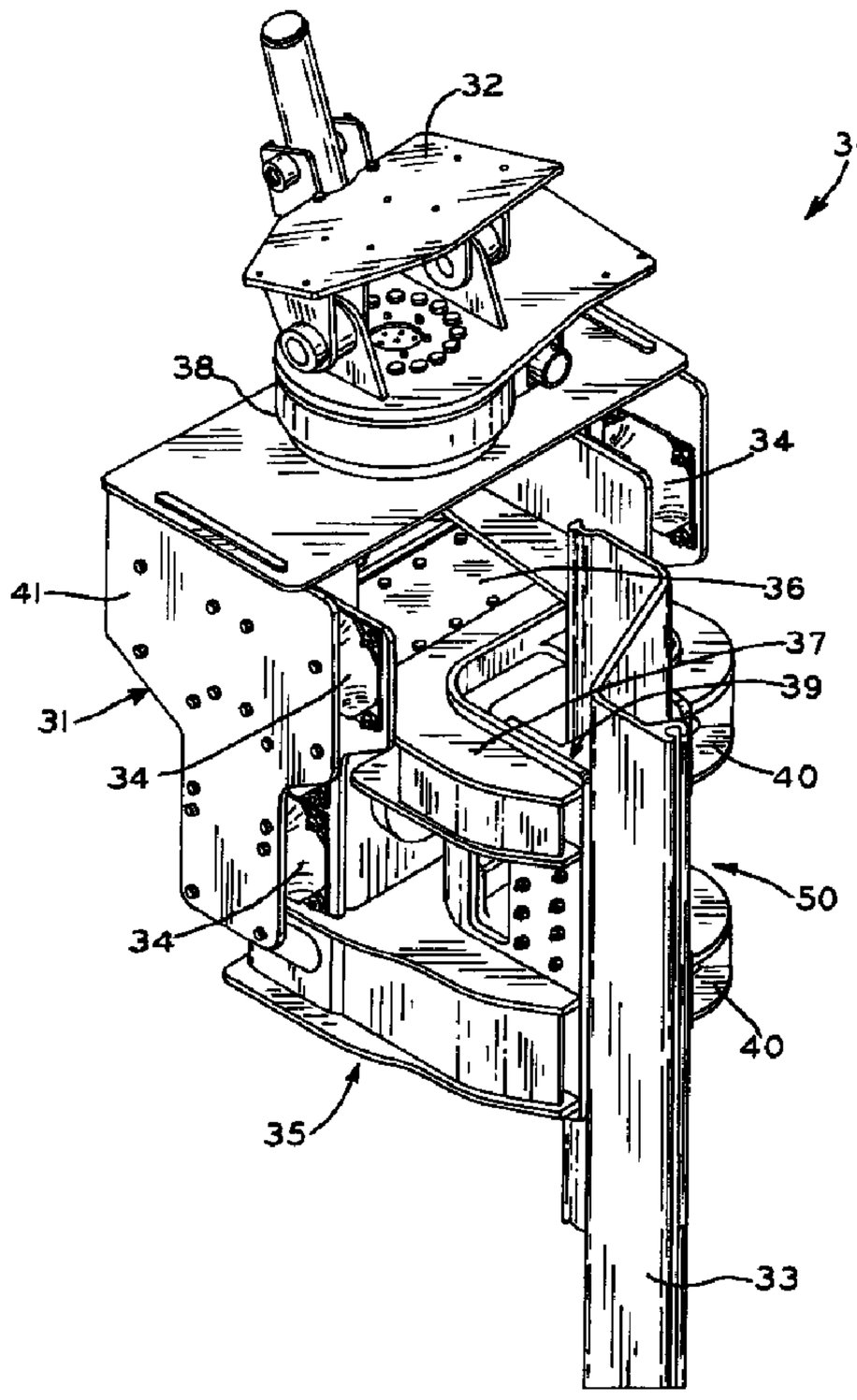

(57) Abrégé/Abstract:
A modular side grip vibratory pile driver system having a housing, a vibratory gear case and a pair of jaws adapted to grip a variety of pile profiles. The housing is rotatably connected to a construction machine such that the jaws can be moved from a position

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(57) Abrégé(suite)/Abstract(continued):
wherein the jaws are oriented vertically and spaced apart horizontally to a position wherein the jaws are oriented horizontally and spaced apart vertically. A plurality of sets of gripping assemblies having different gripping profiles are interchangeably connected to the jaws.

ABSTRACT

A modular side grip vibratory pile driver system having a housing, a vibratory gear case and a pair of jaws adapted to grip a variety of pile profiles. The housing is rotatably connected to a construction machine such that the jaws can be moved from a position wherein the jaws are oriented vertically and spaced apart horizontally to a position wherein the jaws are oriented horizontally and spaced apart vertically. A plurality of sets of gripping assemblies having different gripping profiles are interchangeably connected to the jaws.

MODULAR VIBRATORY PILE DRIVER SYSTEM

BACKGROUND

1. Field of the Disclosure.

[0002] The present disclosure relates to pile driving equipment. More particularly, the present disclosure relates to a modular vibratory side grip pile driver system and method for assembly.

2. Description of the Related Art.

[0003] Vibratory pile drivers are used in a plurality of applications to drive pile, such as sheet pile, pipes, I-beams, H-beams, and poles, for example, into the ground. The pile driver may be mounted on an excavator and include articulating arms and side-gripping jaws to facilitate the pile driving process.

[0004] Current side grip vibratory pile drivers have the disadvantage that they are designed for driving only one type of pile. Therefore, if it is desired to switch from driving sheet pile to H-pile, for example, a separate unit must be employed. This leads to significant increased cost at a job site and requires that the construction company inventory more than type of pile driver for use at its various job sites.

SUMMARY

[0005] The modular vibratory pile driving system of the present invention comprises a base unit having a housing, a vibratory gear case and a mounting base rigidly connected to the housing. It also includes two jaws that are spaced apart longitudinally wherein the jaws include jaw halves that are movable relative to each other to enable a pile to be gripped. In a preferred embodiment, each of the jaws includes a stationary jaw half rigidly connected to the mounting base and a pivotable jaw rotatably connected to the mounting base and caused to open and close through the action of one or more hydraulic cylinders. The pile driver system also includes a set of gripping assemblies having different gripping profiles adapted for gripping a variety of different pile profiles. These gripping assemblies are interchangeable so that the same base unit can be utilized to drive a variety of pile profiles. In one embodiment,

the gripping assemblies include elements that are removably attached to the stationary jaw halves as well as removable pivot arms including gripping profiles that match the profiles of the gripping assemblies mounted to the stationary jaws.

[0006] Advantageously, the modular vibratory pile driver system eliminates the need to obtain a plurality of pile drivers matching the types of pile to be driven. Instead, the modular vibratory pile driver uses the same housing and gear case for all types of pile and utilizes modular sets of gripping assemblies to facilitate driving different types of pile, thereby reducing costs and saving time. Further, the modular vibratory pile drivers of the present disclosure facilitate centering of the pile with the pile driver, thereby enhancing the efficiency of energy transfer to the pile and reducing the stress on the gear case of the pile driver. Moreover, the modular vibratory pile driver facilitates straight driving of the pile because the centerline of the pile matches the centerline provided by the selected modular gripping assembly set.

[0007] In one form thereof, the present invention is a modular side grip vibratory pile driver system comprising a housing that includes a mounting base comprising first jaw halves. A vibratory gear case is mounted to the housing and a pivotable arm assembly forming two second jaw halves is pivotally connected to the housing. The respective first and second jaw halves form a pair of spaced apart jaws adapted for gripping a pile at two longitudinally spaced apart locations. An attachment assembly connects the housing to a construction machine. The housing is rotatably connected to the attachment assembly and rotatable between a first position wherein the jaws are oriented vertically and spaced apart horizontally and a second position wherein the jaws are oriented horizontally and spaced apart vertically. The jaws are open thereby forming a gap so that a pile can enter the jaws laterally. A plurality of sets of gripping assemblies having different gripping profiles adapted for gripping a variety of different pile profiles are interchangeably connected to and form the pile gripping elements of the jaws. The jaws include a single set of the interchangeable gripping assemblies detachably and interchangeably connected thereto.

[0008] In another form thereof, the invention constitutes a method of changing a modular side grip vibratory pile driver from a first configuration to a second configuration. One of the sets of gripping assemblies is selected from the plurality of sets wherein the selected gripping assembly accommodates the profile of a pile to be driven and this gripping assembly is substituted for the current set of gripping assemblies forming the gripping surfaces on each of the jaws. In one embodiment each of the jaws comprises a stationary jaw half and a

removably rotatable jaw half and the step of substituting comprises replacing the current rotatable jaw halves with rotatable jaw halves from the plurality of sets having a gripping profile that accommodates the profile of the pile to be driven. The gripping assembly on the stationary jaw is replaced with a gripping assembly from the plurality of sets that accommodates the pile profile.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] The above-mentioned and other features of the disclosure, and the manner of attaining them, will become more apparent and will be better understood by reference to the following description of embodiments of the disclosure taken in conjunction with the accompanying drawings, wherein:

[0010] Fig. 1 is a perspective view of a first embodiment modular side grip vibratory pile driver of the present disclosure, further illustrating a sheet pile clamped in the jaw assembly of the pile driver;

[0011] Fig. 2 is another perspective view of the modular vibratory pile driver of Fig. 1;

[0012] Fig. 3 is a side view of the modular vibratory pile driver of Fig. 1;

[0013] Fig. 4 is a top view of the modular vibratory pile driver of Fig. 1;

[0014] Fig. 5 is another perspective view of the modular vibratory pile driver of Fig. 1, further illustrating the hydraulic cylinders used to power the jaw assembly of the pile driver;

[0015] Fig. 6 is an exploded view of a portion of the modular vibratory pile driver of Fig. 1;

[0016] Fig. 7 is another exploded view of a portion of the modular vibratory pile driver of Fig. 1;

[0017] Fig. 8 is a perspective view of a second embodiment modular side grip vibratory pile driver of the present disclosure, further illustrating a large diameter pipe clamped in the jaw assembly of the pile driver;

[0018] Fig. 9 is another perspective view of the modular vibratory pile driver of Fig. 8;

[0019] Fig. 10 is a side view of the modular vibratory pile driver of Fig. 8;

[0020] Fig. 11 is a top view of the modular vibratory pile driver of Fig. 8;

[0021] Fig. 12 is a perspective view of a third embodiment modular side grip vibratory pile driver of the present disclosure, further illustrating a small diameter pipe clamped in the jaw assembly of the pile driver;

[0022] Fig. 13 is another perspective view of the modular vibratory pile driver of Fig. 12;

[0023] Fig. 14 is another perspective view of the modular vibratory pile driver of Fig. 12;

[0024] Fig. 15 is a side view of the modular vibratory pile driver of Fig. 12;

[0025] Fig. 16 is a top view of the modular vibratory pile driver of Fig. 12;

[0026] Fig. 17 is an exploded view of a portion of the modular vibratory pile driver of either Fig. 8 or Fig. 12; and

[0027] Fig. 18 is another exploded view of a portion of the modular vibratory pile driver of either Fig. 8 or Fig. 12.

[0028] Corresponding reference characters indicate corresponding parts throughout the several views. The exemplifications set out herein illustrate embodiments of the disclosure and such exemplifications are not to be construed as limiting the scope of the invention in any manner.

DETAILED DESCRIPTION

[0029] Referring now to Figs. 1-5, modular vibratory side grip pile driver 30 is shown and generally includes housing 31, first assembly 35, and jaw assembly 50. Pile driver 30 may be used to grasp and drive sheet or beam, e.g., I-beam and H-beam, pile 33 into the ground. Housing 31 includes vibratory gear case 36 and mounting base 37. Bracket 41 connects housing 31 to attachment assembly 32 which is used to attach pile driver 30 to an excavator or other suitable construction machine for mounting pile driver 30 thereon. Rotational connector 38 is provided along with attachment plate 32 to permit rotation of housing 31 relative to the excavator. Rubber insulators 34 are included on the inner portions of housing 31 to reduce vibration caused by gear case 36 during use of pile driver 30 and to prevent such vibration from vibrating a portion of the excavator. Pile driver 30 is a modification of the Model SPM 15 vibratory pile driver manufactured by Hercules Machinery Corporation of Fort Wayne, Indiana, and incorporates most of the mechanism of such pile driver except for the structure that adds the modularity feature. In other words, the base unit remains the same for the various configurations adapted to grip certain types of sheet, pipe, H or other pile.

[0030] A further example of a side grip vibratory pile driver is disclosed in United States Reissue Patent No. RE37,661.

[0031] Mounting assembly 35 includes a mounting base 37 rigidly connected to the housing 31 and forming a first pair of jaw halves 37a and first gripping assembly 39. In an exemplary embodiment, mounting base 37 having jaws 37a is stationary relative to gear case 36. In an alternative embodiment, mounting base 37 is movable relative to gear case 36. Referring to Figs. 6 and 7, first gripping assembly 39 includes first gripping mount 53 which

may include a plurality of slots 54 for mating engagement with a plurality of fasteners 55 for securing first gripping mount 53 to mounting base 37. Slots 54 are provided instead of holes or apertures sized to accept fasteners 55 because slots 54 allow first gripping mount 53 to move and slightly adjust front-to-back and side-to-side relative to mounting base 37, thereby allowing first gripping mount 53 to align with arm gripping assembly 52 in a complementary engagement to securely hold sheet pile 33. First gripping assembly 39 also includes two contact plates 47 for providing direct contact with sheet pile 33. In an exemplary embodiment, contact plates 47 have a knurled or otherwise roughened surface to enhance and facilitate gripping of sheet pile 33. Each contact plate 47 is assembled to first gripping mount 53 with rubber washer 46, bolt 43, spring 45, and nut 44. Spring 45 advantageously allows contact plate 47 to adjust during engagement of sheet pile 33.

[0032] Referring now to Figs. 2, 3, 5, 6, and 7, jaw assembly 50 comprises a pair of jaws including first gripping assembly 39, arms 40, and arm gripping assemblies 52. Each arm 40 is pivotally and detachably affixed to housing 31 and preferably to an extension of mounting base 37 via pin 48 which creates a pivot joint of arm 40 relative to base 37. Each arm 40 is connected via pin 49 to hydraulic cylinder 42 which is connected to a hydraulic system (not shown) of the excavator to which pile driver 30 is attached to provide pivot control of arms 40. Each arm 40 includes an arm gripping assembly 52 detachably affixed thereto. Each arm gripping assembly 52 includes contact plate 47 which is connected to arm 40 via rubber washer 46, bolt 43, spring 45, and nut 44.

[0033] Referring now to Figs. 3, 5, 6, and 7, pile driver 30 preferably includes lower jaws 51 which provide mating contact plates 47 for gripping a top portion of sheet pile 33 to facilitate final driving of pile 33 into the ground.

[0034] In operation and referring to Figs. 1-7, jaw assembly 50 provides side-gripping force on pile 33 in which arms 40 are hydraulically actuated to grasp and move sheet pile 33 into a desired location for driving pile 33 into the ground. The upper and lower sets of jaw halves forming the jaws of jaw assembly 50 are open so that a pile 33 can enter the jaws laterally and then be gripped when the jaws 50 are closed. Arms 40 secure pile 33 while gear case 36 provides vibration while the excavator guides modular vibratory pile driver 30 towards the ground and sheet pile 33 into the ground. Modular vibratory pile driver 30 defines centerline 60 (Fig. 4) along which the most focused and concentrated power is developed in pile driver 30. Advantageously, centerline 60 matches centerline 61 of sheet pile 33, thereby enhancing the efficiency of energy transfer to pile 33 and reducing stress on

gear case 36. Moreover, modular vibratory pile driver 30 facilitates substantially straight driving of pile 33 because centerline 60 matches centerline 61.

[0035] Referring now to Figs. 8-11, modular vibratory pile driver configuration 130 is shown and is substantially identical to modular vibratory pile driver 30, described above with reference to Figs. 1-7, except for arms 140, arm gripping assembly 152, and first gripping assembly 139, as described below that have been installed in place of arms 40 and gripping assemblies 52 and 39, respectively. In other words, housing 31 remains the same in the configuration shown in Figs. 8-11 as compared with the configuration shown in Figs. 1-7.

[0036] Referring still to Figs. 8-11, modular vibratory side grip pile driver 130 configured as a cylindrical pile driver is shown and generally includes housing 31, assembly 135, and jaws 150. Pile driver 130 may be used to grasp and drive large pipe pile 133 into the ground or other desirable location.

[0037] Mounting assembly 135 includes mounting base 37 and first gripping assembly 139. First gripping assembly 139 includes first gripping mount 153 detachably mounted to base 37. First gripping assembly 139 also includes two contact surfaces 147 for providing direct contact with pile 133. In an exemplary embodiment, contact surfaces 147 are arcuate to match the outer diameter of pile 133 and are knurled to enhance and facilitate gripping of pile 133.

[0038] Jaw assembly 150 includes mounting base 37, first gripping assembly 139, arms 140, and arm gripping assemblies 152. Each arm 140 is pivotally and detachably affixed to base 37 via pin 48 which creates a pivot joint of arm 140 relative to mounting base 37. Each arm 140 is connected via pin 49 to hydraulic cylinder 42 which is connected to a hydraulic system (not shown) of the excavator to which pile driver 130 is attached to provide pivot control of arms 140. Each arm 140 includes an arm gripping assembly 152 detachably affixed thereto. Arm gripping assembly 152 includes arm gripping mount 156 with contact surfaces 147 for providing direct contact with pile 133. In an exemplary embodiment, contact surfaces 147 are arcuate to match an outer diameter of pile 133 and are knurled to enhance and facilitate gripping of pile 133.

[0039] Arm gripping assembly 152 and first gripping assembly 139 encircle pile 133 and form pipe grip engagement 157 therebetween, as shown in Fig. 11. Pipe grip engagement 157 between arm gripping assembly 152 and first gripping assembly 139 prevents deformation of pile 133 when jaw assembly 150 is clamped shut and also enhances the hold of pile 133 in pile driver 130. Referring now to Fig. 10, pile driver configuration 130 may

optionally include lower jaws 151 which provide mating contact surfaces 147 for gripping a top portion of pile 133 for final driving of pile 133 into the ground. When pile 133 is engaged by only lower jaws 151 (Fig. 10) to finally drive pile 133 into the ground, the interlocking engagement provided by pipe grip engagement 157 prevents arms 140 from flopping around due to the vibration.

[0040] In operation and referring again to Figs. 8-11, jaw assembly 150 provides side gripping force on pile 133 in a substantially similar manner as jaw assembly 50, described above with respect to Figs. 1-7. Advantageously, modular vibratory pile driver configuration 130 defines centerline 160 (Fig. 11) which substantially matches centerline 161 of pile 133.

[0041] To switch from the configuration shown in Figs. 1-7 to the configuration shown in Figs. 8-11, a user of pile driver 30 removes pins 48, 49 associated with arms 40. Arms 40 are then removed from mounting base 37. Arms 140 may then be attached to mounting base 37 with pins 48, 49 to form configuration 130 which is now equipped to grip pile 133.

[0042] Referring now to Figs. 12-16, modular vibratory pile driver configuration 230 is shown and is substantially identical to configurations 30, 130, described above with reference to Figs. 1-7 and 8-11, except for arm gripping assembly 252 and first gripping assembly 239, as described below, i.e., all of the structure, including housing 31, remains the same in the configuration shown in Figs. 12-16 as compared with the configurations shown in Figs. 1-7 and 8-11, and arms 140 remain the same in the configuration shown in Figs. 12-16 as compared with the configuration shown in Figs. 8-11. Replacement gripping assemblies 235, 239, 250 and 252, gripping mounts 253 and 256 and contact services 247 are sized to match the smaller diameter cylindrical pipe pile 233.

[0043] In operation, jaw assembly 250 provides side gripping force on pile 233 in a substantially similar manner as jaws 50, 150, described above with respect to Figs. 1-7 and 8-11. Advantageously, modular vibratory pile driver 230 defines centerline 260 (Fig. 16) which substantially matches centerline 261 of pile 233.

[0044] To switch from the embodiment shown in Figs. 8-11 to the embodiment shown in Figs. 12-16, the user removes fasteners 155 from first gripping assembly 139 and arm gripping assemblies 152 to detach first gripping assembly 139 and arm gripping assemblies 152. First gripping assembly 239 and arm gripping assemblies 252 may then be respectively attached to mounting base 37 and arms 140 with fasteners 255, thereby forming configuration 230 which is equipped to grip smaller diameter pile 233.

[0045] Referring to Figs. 17 and 18, first gripping assembly 139 includes first gripping mount 153 which includes a plurality of slots 154 for mating engagement with a plurality of fasteners 155 for detachably affixing first gripping mount 153 to mounting base 37. Slots 154 are provided instead of holes or apertures sized to accept fasteners 155 because slots 154 allow first gripping mount 153 to move and slightly adjust front-to-back and side-to-side relative to base 37, thereby allowing first gripping mount 153 to align with arm gripping assembly 152 to securely hold pile 133. First gripping assembly 139 also may include two contact surfaces 147 for providing direct contact with pile 133.

[0046] Piles 133, 233 may be formed as Schedule 40 piping having an outer diameter as small as approximately ½", 1", 1½", 2", 3", 4", or 4½", or as large as 40", 30", 20", 15", 10", 9", 8", 7", 6⅝", 6", 5½", or 5".

[0047] In operation, modular vibratory pile driver configurations 30, 130, 230 provide flexibility and options depending on the type of pile to be driven into the ground. For example, pile driver configuration 30 may be used to drive a sheet pile, e.g., sheet pile 33, into the ground. Subsequently, a user of pile driver 30 may want to drive a pipe pile. Advantageously, the user simply removes arms 40 from pile driver 30 and replaces them with arms 140 using the same attachments, i.e., pins 48, 49, to attach arms 140 to mounting base 37 and hydraulic cylinders 42 to form configuration 130. In one embodiment, arms 140 have arm gripping assembly 152 detachably affixed thereto and mounting base 37 has complementary first gripping assembly 153 detachably affixed thereto to accommodate large pipe pile 133. Alternatively, arms 140 have arm gripping assemblies 252 detachably affixed thereto and base 37 has complementary first gripping assembly 253 detachably affixed thereto to accommodate small pipe pile 233. Therefore, arms 40, 140, arm gripping assemblies 152, 252, and first gripping assemblies 153, 253 are modular attachments that may be interchanged depending on the size and type of pile to be driven into the ground.

[0048] Advantageously, the modular vibratory pile driver configuration described in the present application provide various degrees of modularity to provide variability and flexibility in selecting components to provide the optimum outcome for a desired pile driving procedure. For example, the pivotable arms are replaced with a different set of pivotable arms. In another example, the arms remain attached to the first portion but the gripping assemblies are replaced with a different set of gripping assemblies. Advantageously, the modular vibratory pile driver configurations of the present application all utilize the same housing 31 including gear case 36 and mounting base 37. Thus, a user of the pile driver only

needs to purchase a single base unit, instead of purchasing three or more separate pile drivers. The modular attachments of the present application are advantageously used interchangeably with the base unit to provide a modular side grip vibratory pile driver. Therefore, the overall cost of the pile driving system is substantially reduced. Moreover, the efficiency of the pile driving system is maintained.

[0049] While this disclosure has been described as having exemplary designs, the present disclosure can be further modified within the spirit and scope of this disclosure. This application is therefore intended to cover any variations, uses, or adaptations of the disclosure using its general principles. Further, this application is intended to cover such departures from the present disclosure as come within known or customary practice in the art to which this disclosure pertains and which fall within the limits of the appended claims.

WHAT IS CLAIMED IS:

1. A modular side grip vibratory pile driver system, comprising:

a housing, said housing including a mounting base comprising two first jaw halves;

a vibratory gear case mounted to said housing;

an arm assembly forming two second jaw halves pivotally connected to said housing, respective said first and second jaw halves forming a pair of spaced-apart jaws adapted for gripping a pile at two longitudinally spaced apart locations;

an attachment assembly adapted to connect said housing to a construction machine, said housing being rotatably connected to said attachment assembly and being rotatable between a first position wherein the jaws are oriented vertically and spaced apart horizontally and a second position wherein the jaws are oriented horizontally and spaced apart vertically;

a plurality of sets of gripping assemblies having different gripping profiles adapted for gripping a variety of different pile profiles, said sets of gripping assemblies adapted to be interchangeably connected to and forming pile gripping elements of said jaws;

said jaws including a single set of said interchangeably connected gripping assemblies detachably and interchangeably connected thereto;

said jaws being open and forming a gap so that a pile can enter the jaws laterally.

2. The modular pile driver system of Claim 1, wherein at least some of said sets of gripping assemblies include a first gripping assembly detachably mounted to said mounting base.

3. The modular pile driver system of Claim 2, wherein said first gripping assembly includes a plurality of slots, said slots configured to permit passage of fasteners to secure said first gripping assembly to said mounting base and to permit adjustment of said first gripping assembly relative to said mounting base.

4. The modular pile driver system of Claim 2, wherein said at least some of said sets of gripping assemblies include pairs of substitute rotatable arms that are interchangeable with the arms forming the second jaw halves, said substitute arms having gripping profiles matching respective said first gripping assemblies.

5. The modular pile driver system of Claim 1, wherein at least some of said sets of gripping assemblies include a second gripping assembly that is detachably mounted to said arm assembly.

6. The modular pile driver system of Claim 5, wherein said second gripping assembly includes a plurality of slots configured to permit passage of fasteners to secure said

second gripping assembly to said arms and to permit adjustment of said second gripping assembly relative to said arms.

7. The modular pile driver system of Claim 1, wherein said sets of gripping assemblies are respectively configured to grip a relatively large pipe, a relatively small pipe, a sheet pile and a pole.

8. The modular pile driver system of Claim 1, wherein said second jaw halves are moveable from an open configuration to a closed configuration relative to said first jaw halves wherein when in said closed configuration, said first jaw halves are interlockingly engaged with said second jaw halves.

9. A modular side grip vibratory pile driver system, comprising:

a housing including a rigid mounting base, said mounting base including a pair of first jaw halves rigidly connected thereto;

a vibratory gear case mounted to said housing;

a plurality of sets of interchangeable pivotable arm assemblies, each set forming a pair of second jaw halves pivotally connected to said mounting base, said respective first and second jaw halves forming a pair of spaced apart jaws adapted for gripping a pile at two longitudinally spaced-apart locations, said sets of arms being detachably mounted to said mounting base, said sets of arms having different gripping profiles for gripping a variety of different pile profiles in conjunction with said first jaw halves;

a plurality of sets of first gripping assemblies having different gripping profiles for gripping a variety of different pile profiles, each of said sets of gripping assemblies adapted to be detachably connected to said first jaw halves;

an attachment assembly adapted to connect said housing to a construction machine, said housing being rotatably connected to said attachment assembly and being rotatable between a first position wherein the jaws are oriented vertically and spaced apart horizontally and a second position wherein the jaws are oriented horizontally and spaced apart vertically;

said jaws being open and forming a gap so that a pile can enter the jaws laterally.

10. The modular pile driver system of Claim 9, wherein said arm assemblies include a plurality of respective second gripping assemblies detachably connected thereto, said second gripping assemblies having respective said different gripping profiles.

11. The modular pile driver system of Claim 10, wherein said sets of interchangeable arms and gripping assemblies are respectively configured to grip a relatively large pipe, a relatively small pipe, a sheet pile and a pole.

12. A method of changing a modular side grip vibratory pile driver from a first configuration to a second configuration, said method comprising:

providing a modular side grip vibratory pile driver comprising a housing, a vibratory gear case mounted to the housing and a pair of spaced-apart jaws, the housing being rotatably connected to a construction machine and being rotatable between a first position wherein the jaws are oriented vertically and spaced apart horizontally and a second position wherein the jaws are oriented horizontally and spaced apart vertically, the jaws being open and forming a gap so that a pile can enter the jaws laterally, the jaws including a current set of gripping assemblies providing pile gripping surfaces on said jaws;

providing a plurality of sets of gripping assemblies having different gripping profiles adapted for gripping a variety of different pile profiles; and

selecting one of said sets of gripping assemblies that accommodates the profile of a pile to be driven and substituting said selected set for the current set of gripping assemblies to thereby configure the pile driver for driving a pile with a complementary profile.

13. The method of Claim 12 wherein the sets of gripping assemblies are configured respectively to grip a relatively large pipe, a relatively small pipe, a sheet pile and a pole.

14. The method of Claim 12 wherein each of said jaws comprises a stationary jaw half and a removable rotatable jaw half, and wherein the step of substituting comprises:

replacing current rotatable jaw halves with rotatable jaw halves from the plurality of sets having a gripping profile that accommodates the profile of the pile to be driven, and

replacing a gripping assembly on the stationary jaw with a gripping assembly from the plurality of sets that accommodates the profile of the pile to be driven.

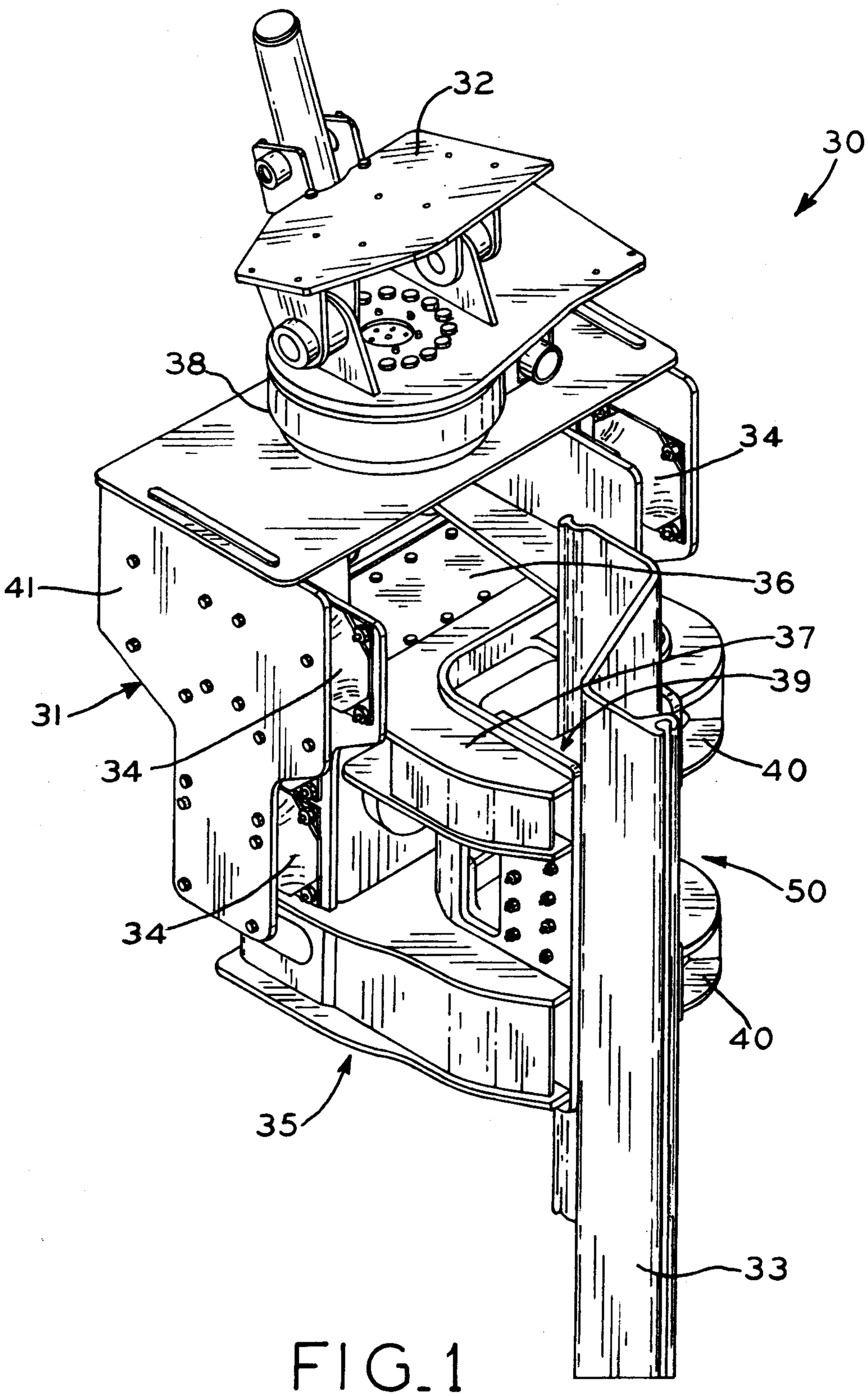


FIG_1

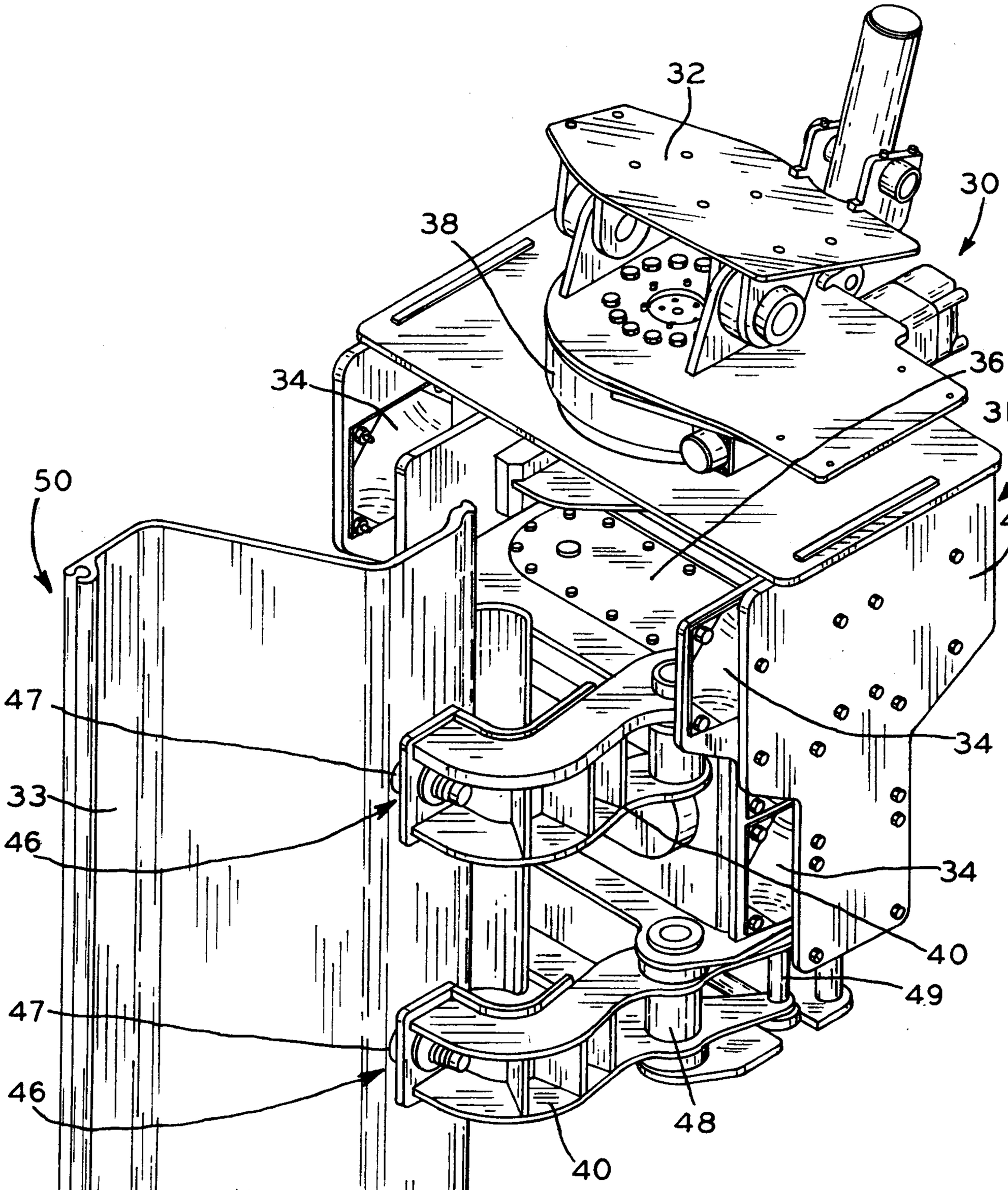
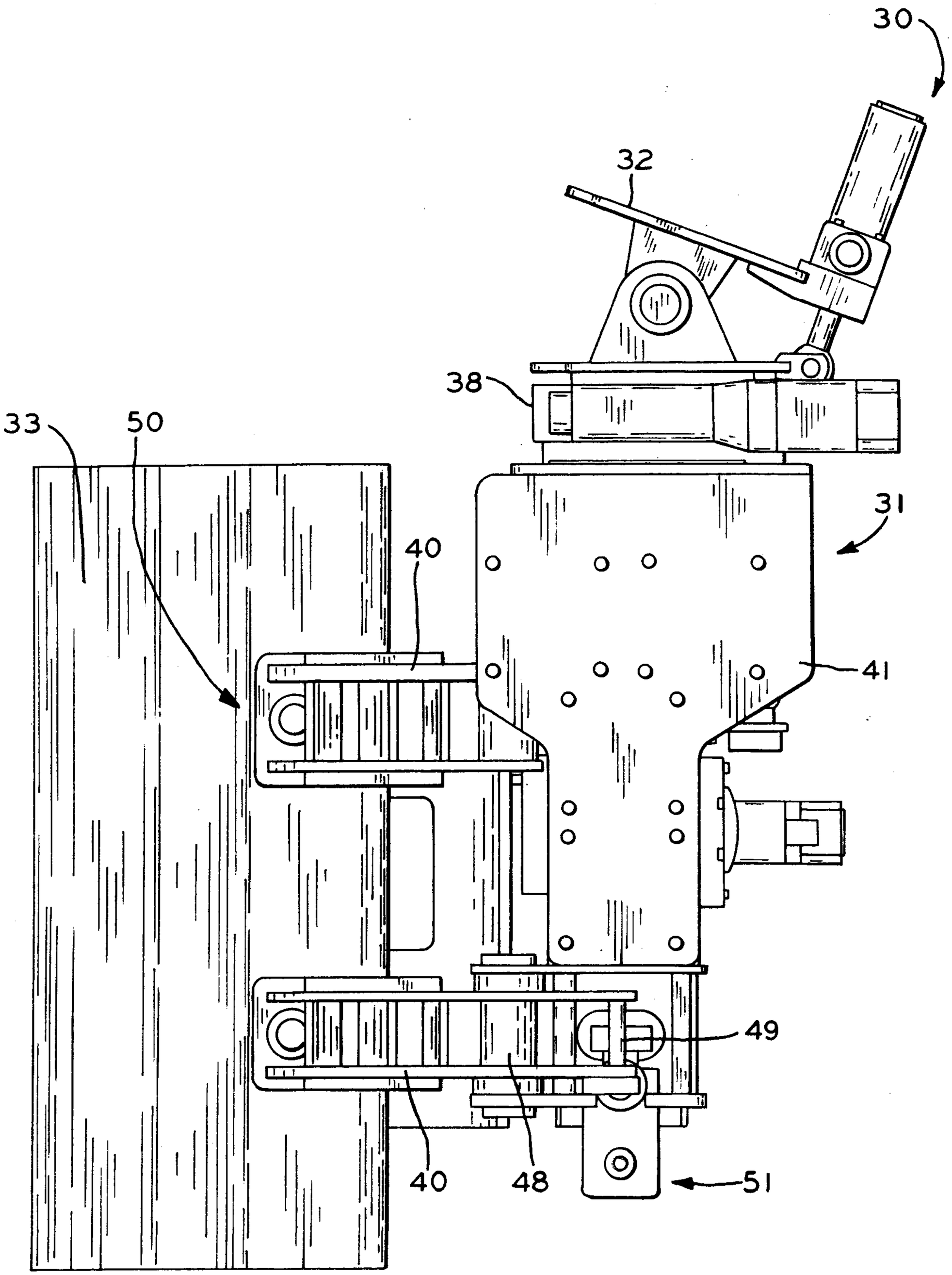


FIG_2



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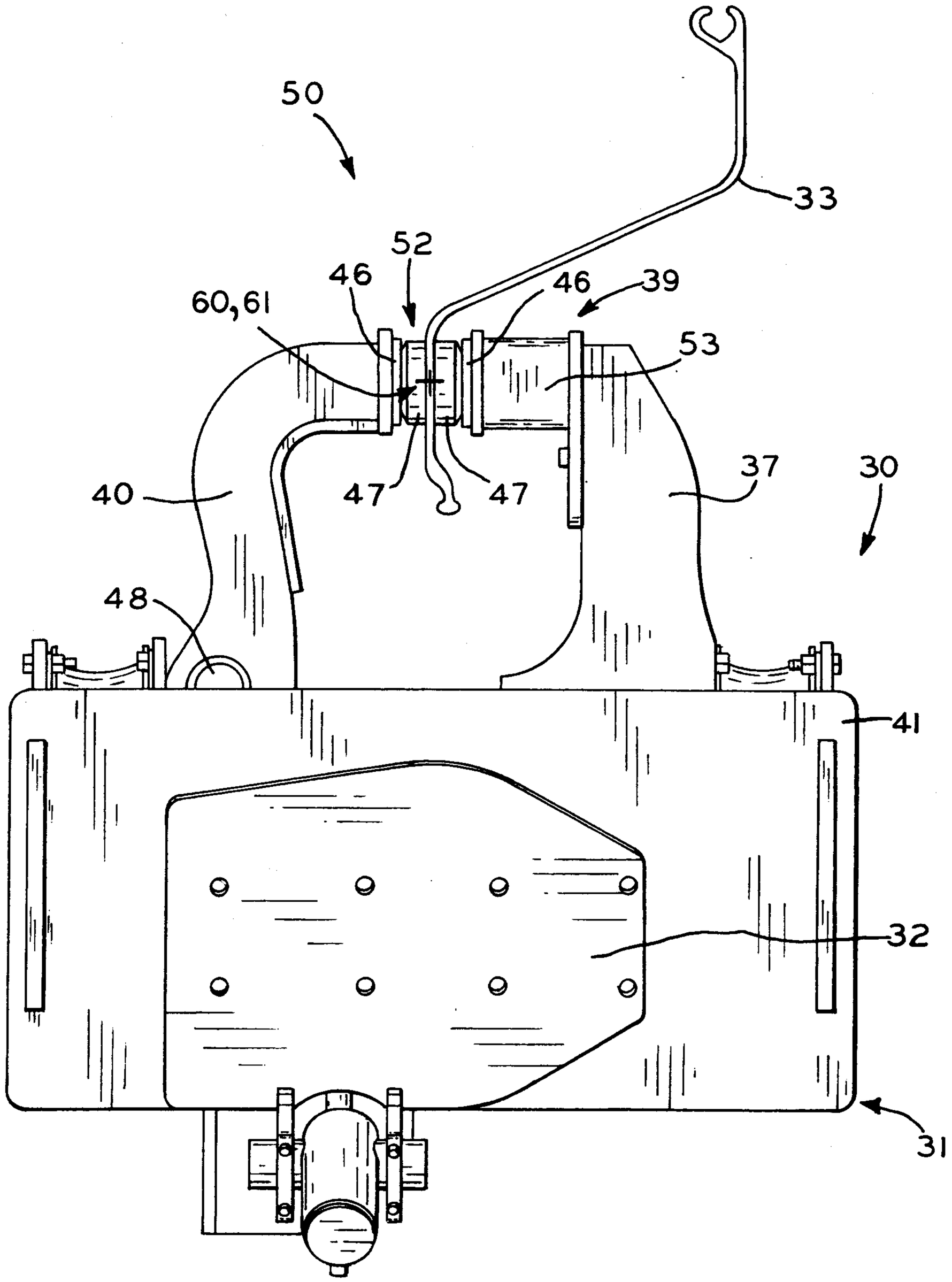

FIG_4

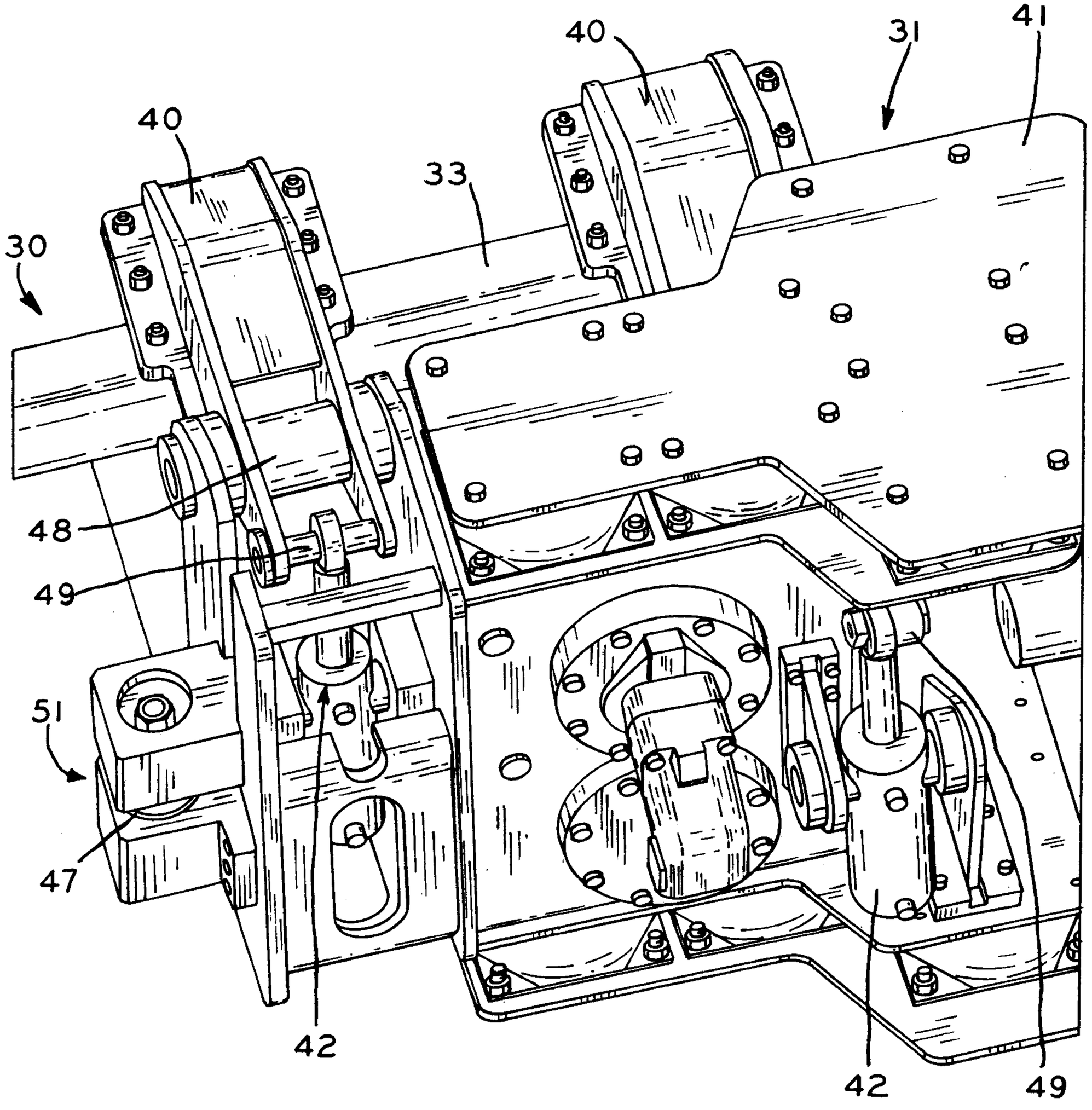

FIG_5

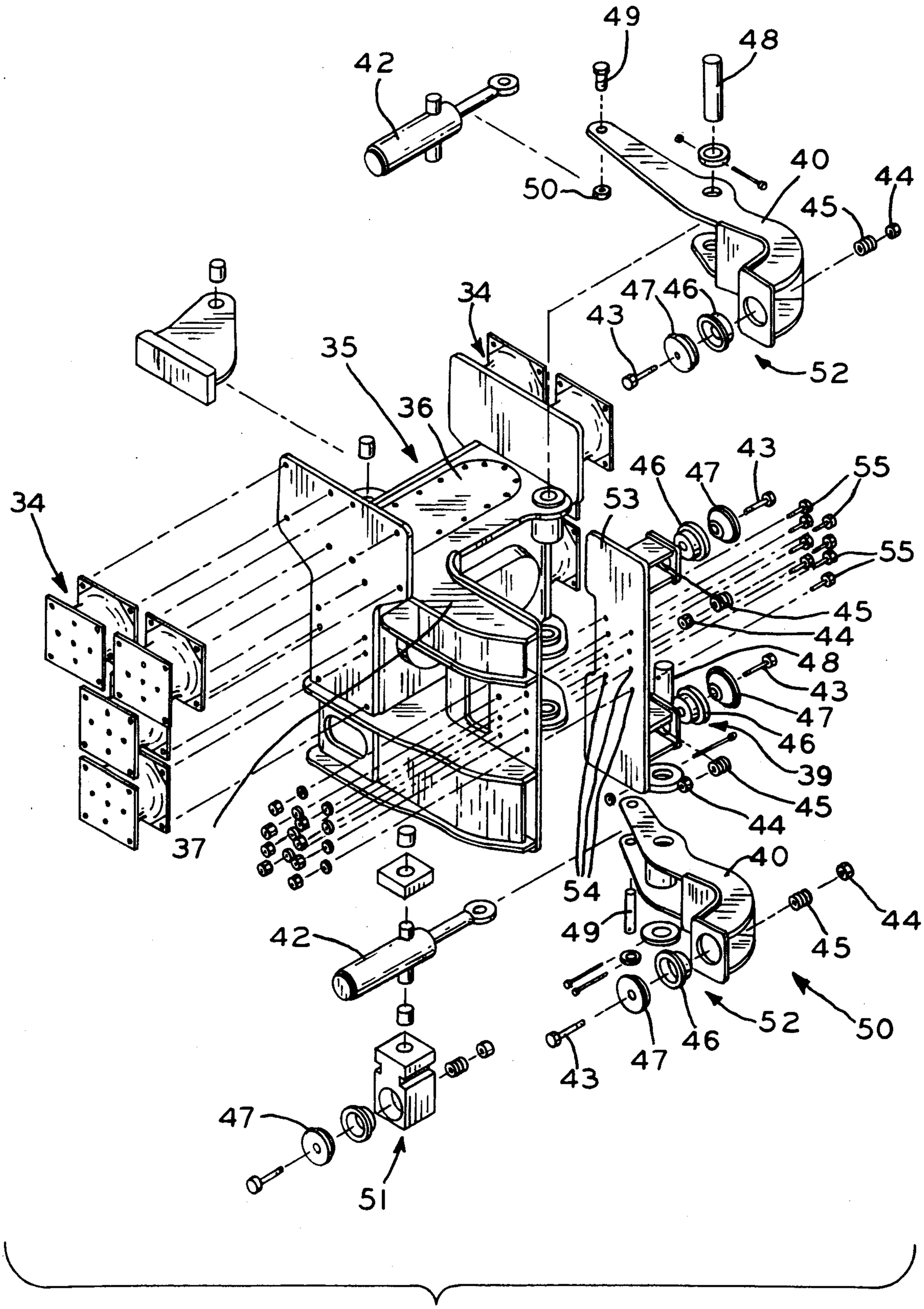
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FIG_6

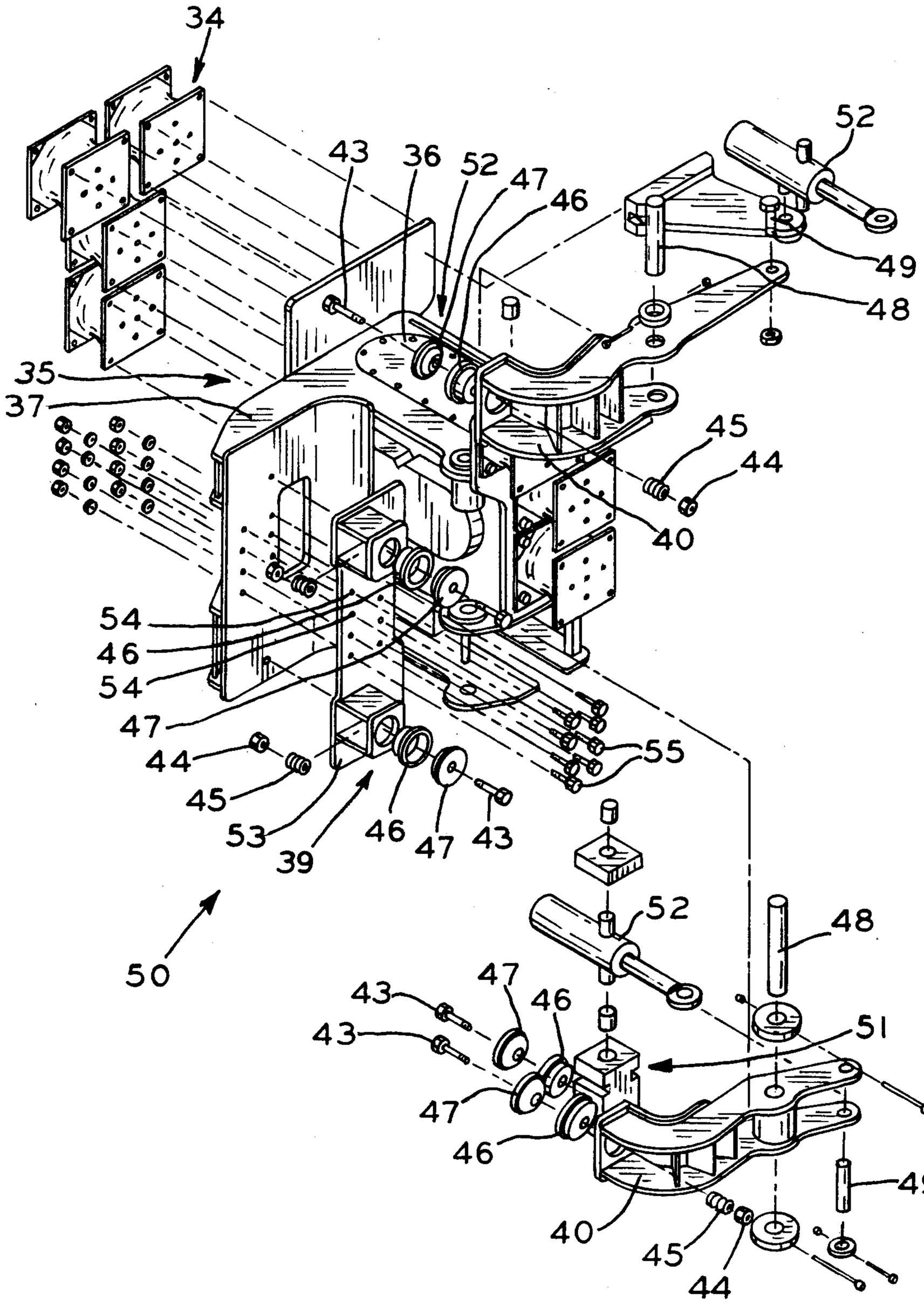
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FIG. 7

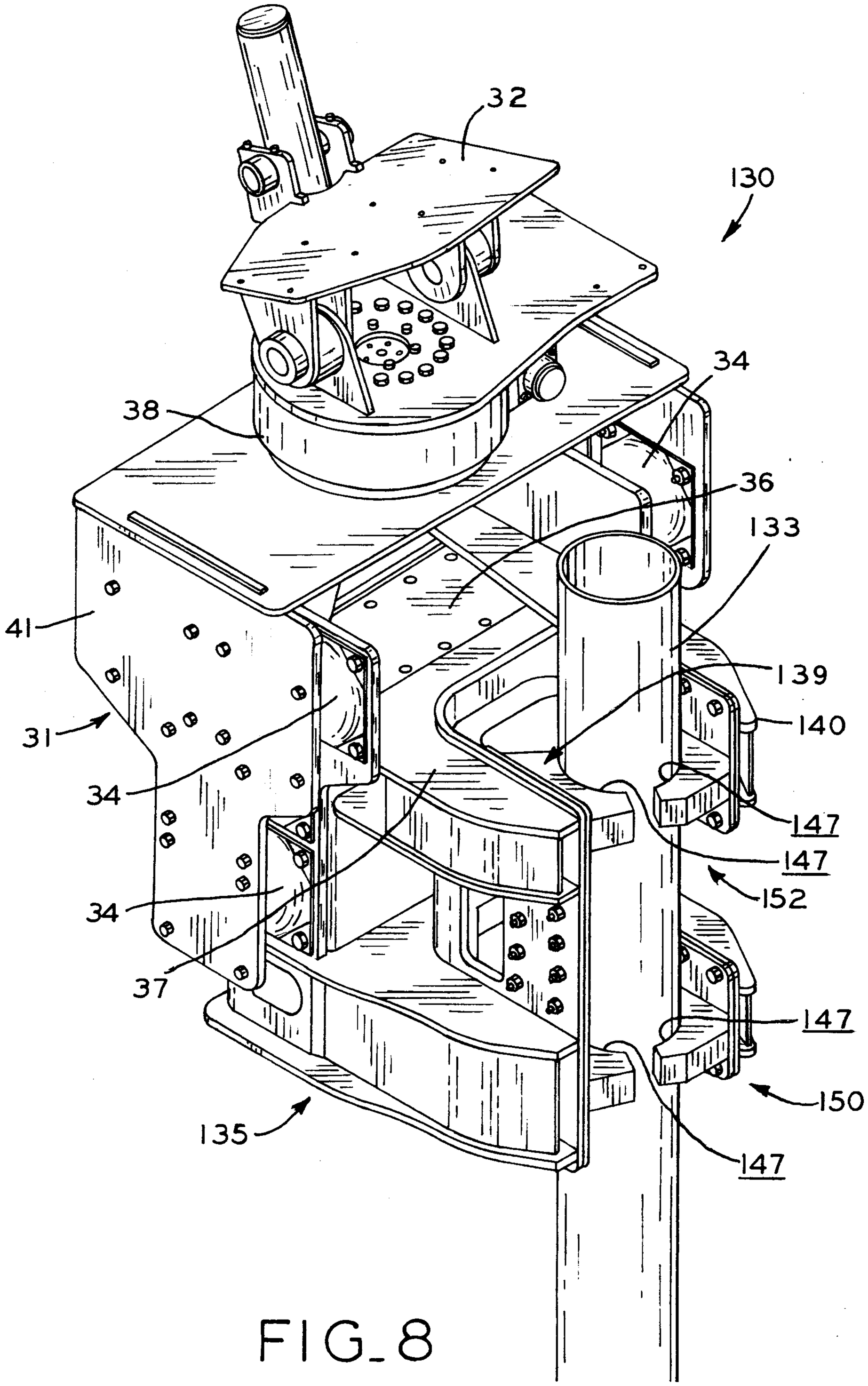
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FIG_8

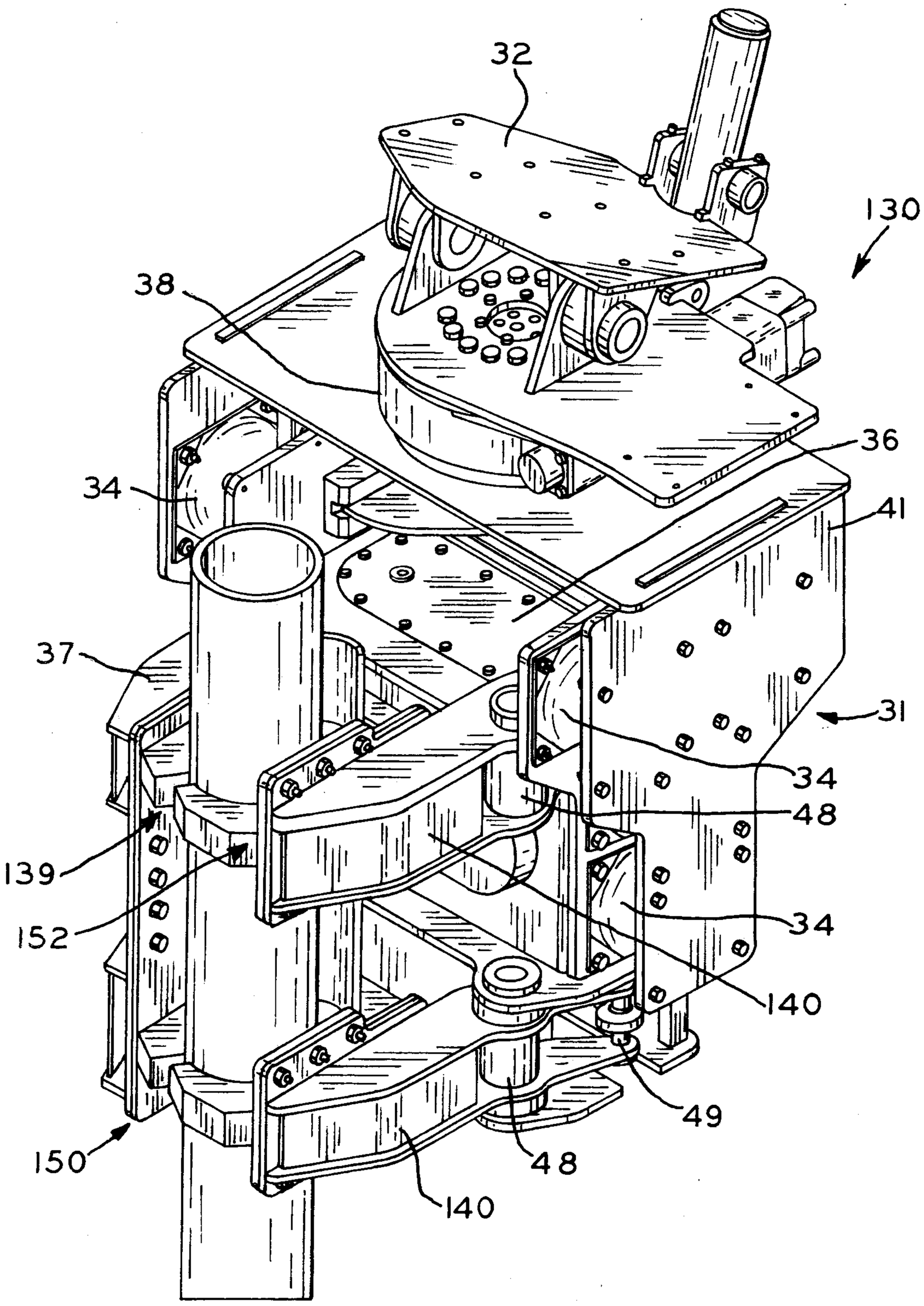


FIG_9

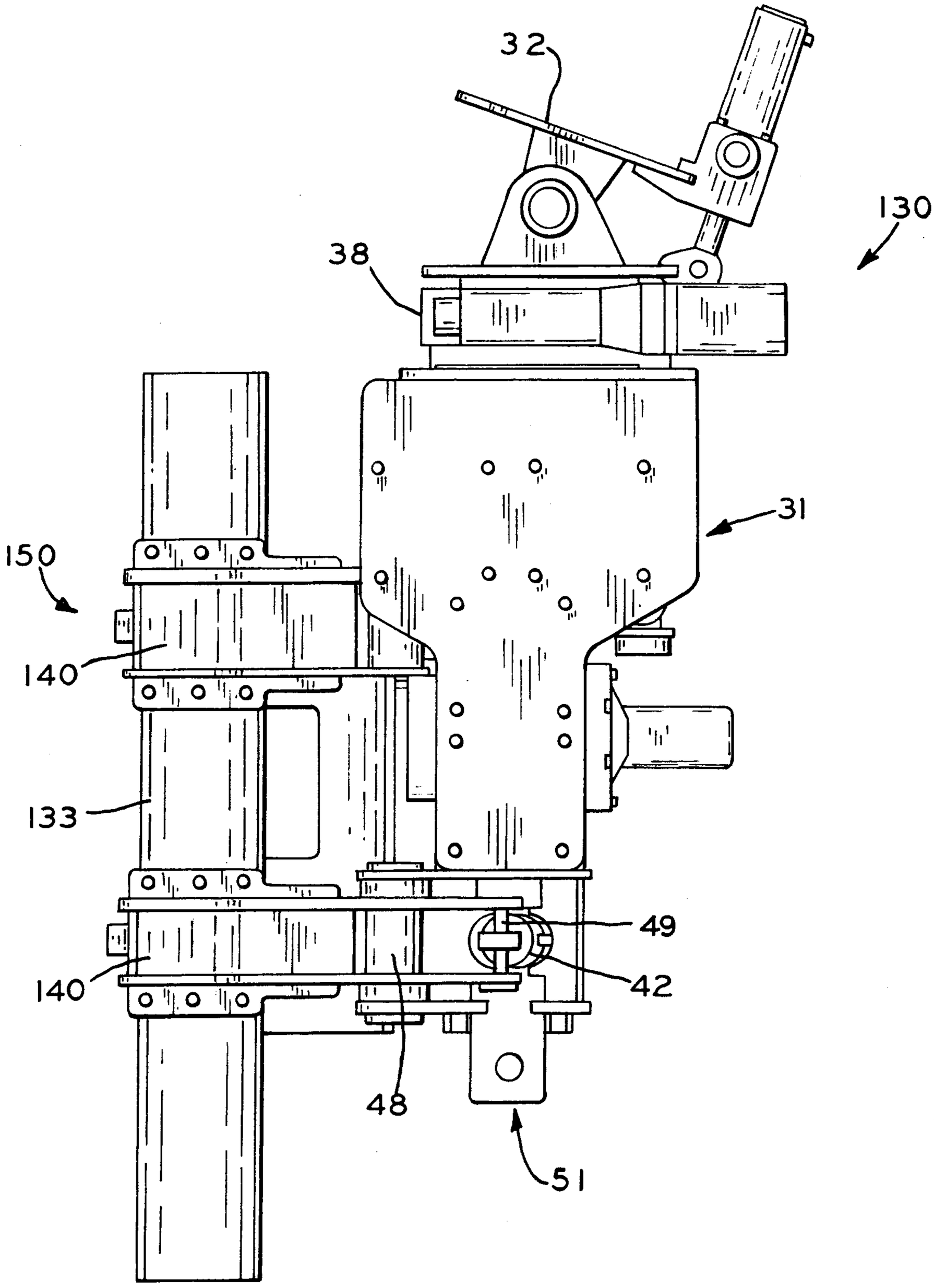


FIG_10

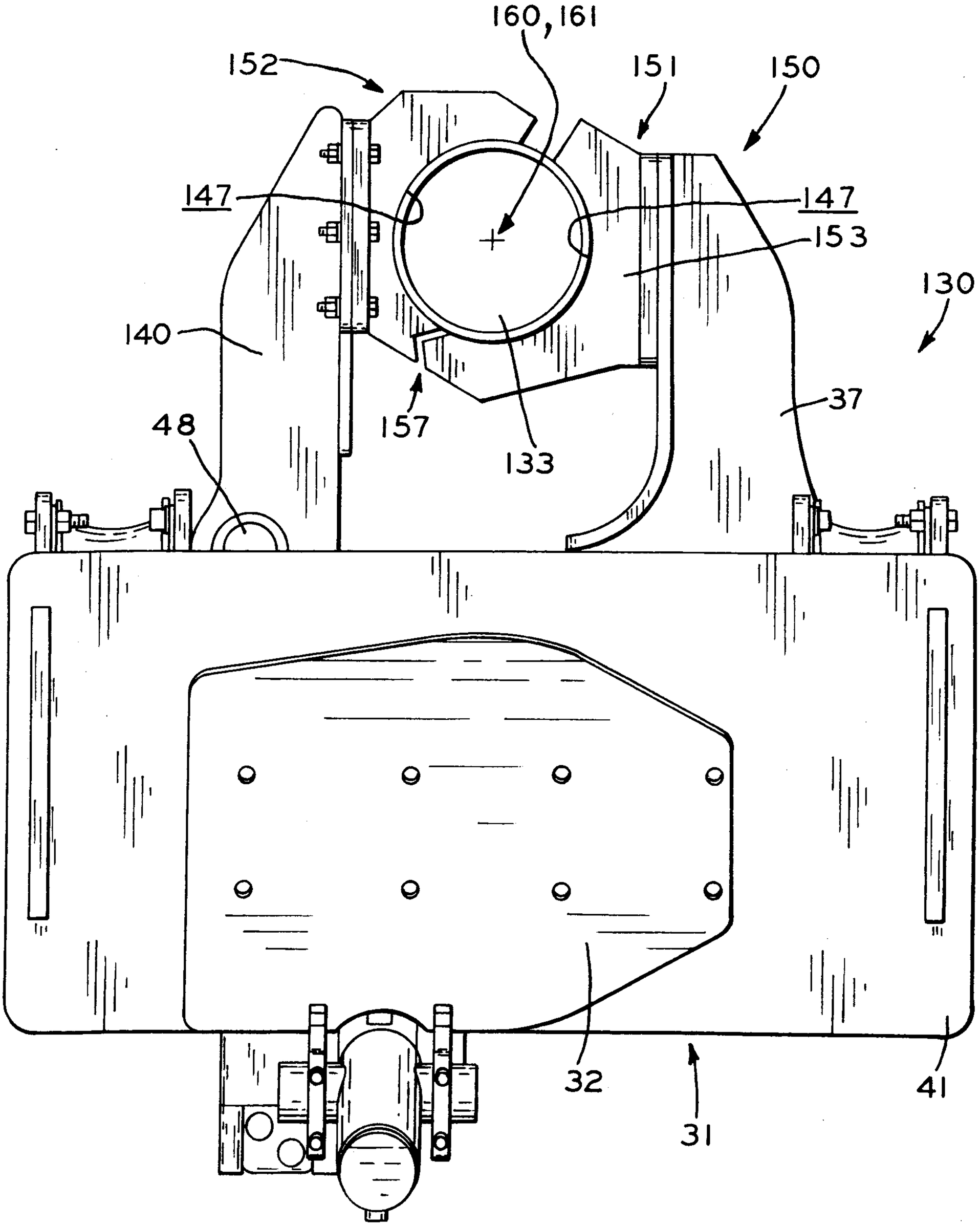


FIG_11

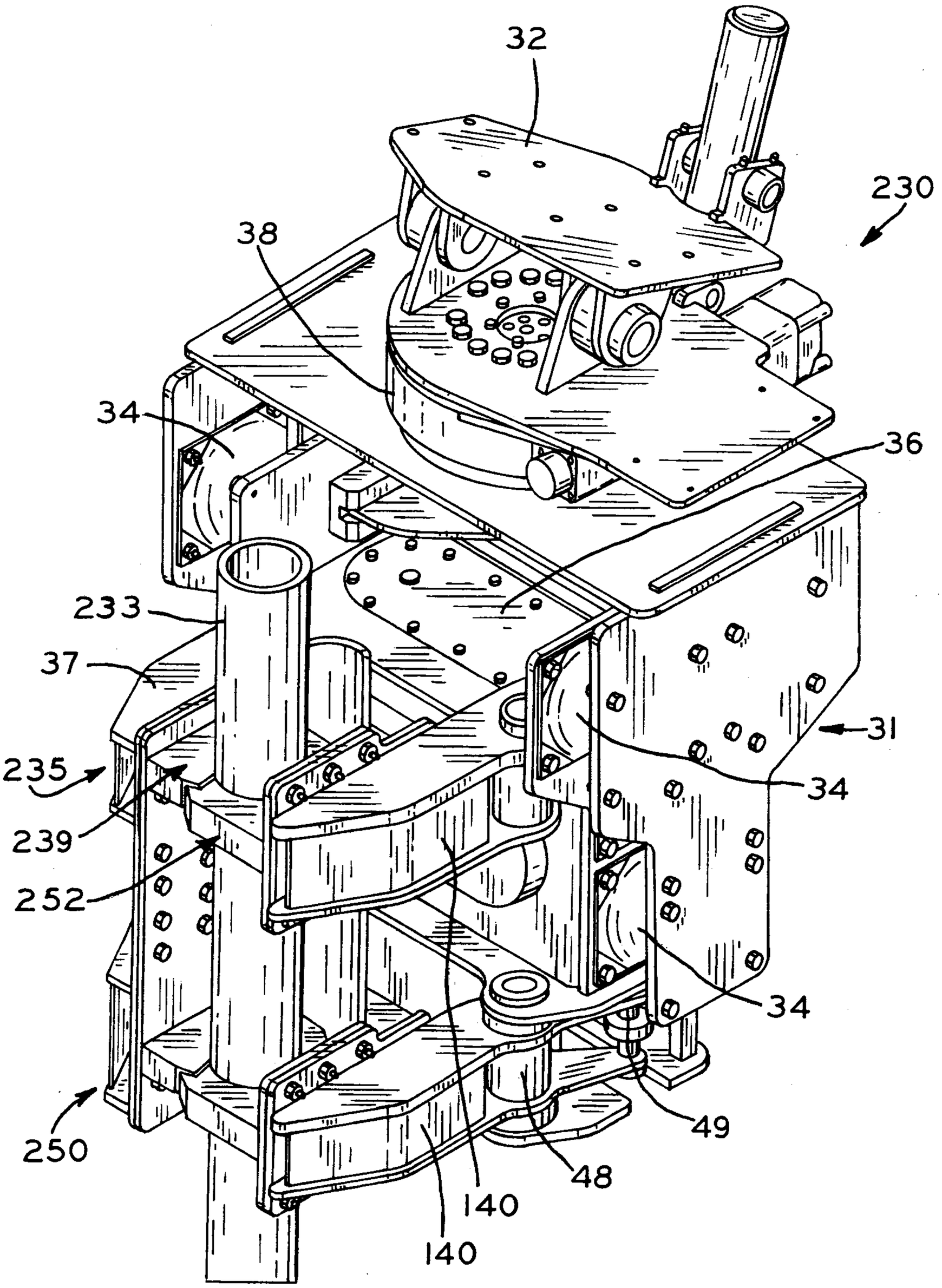


FIG_12

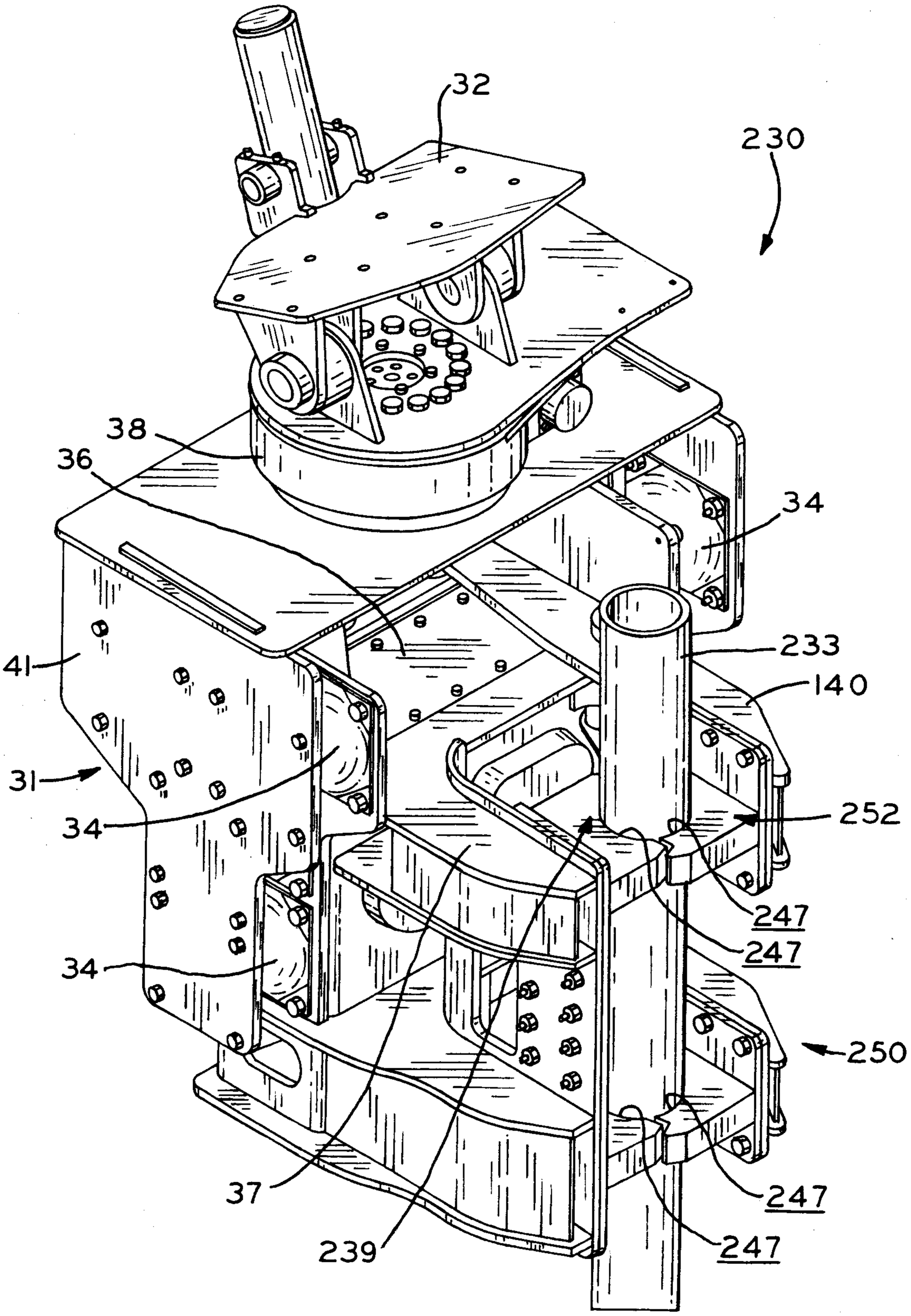


FIG_13

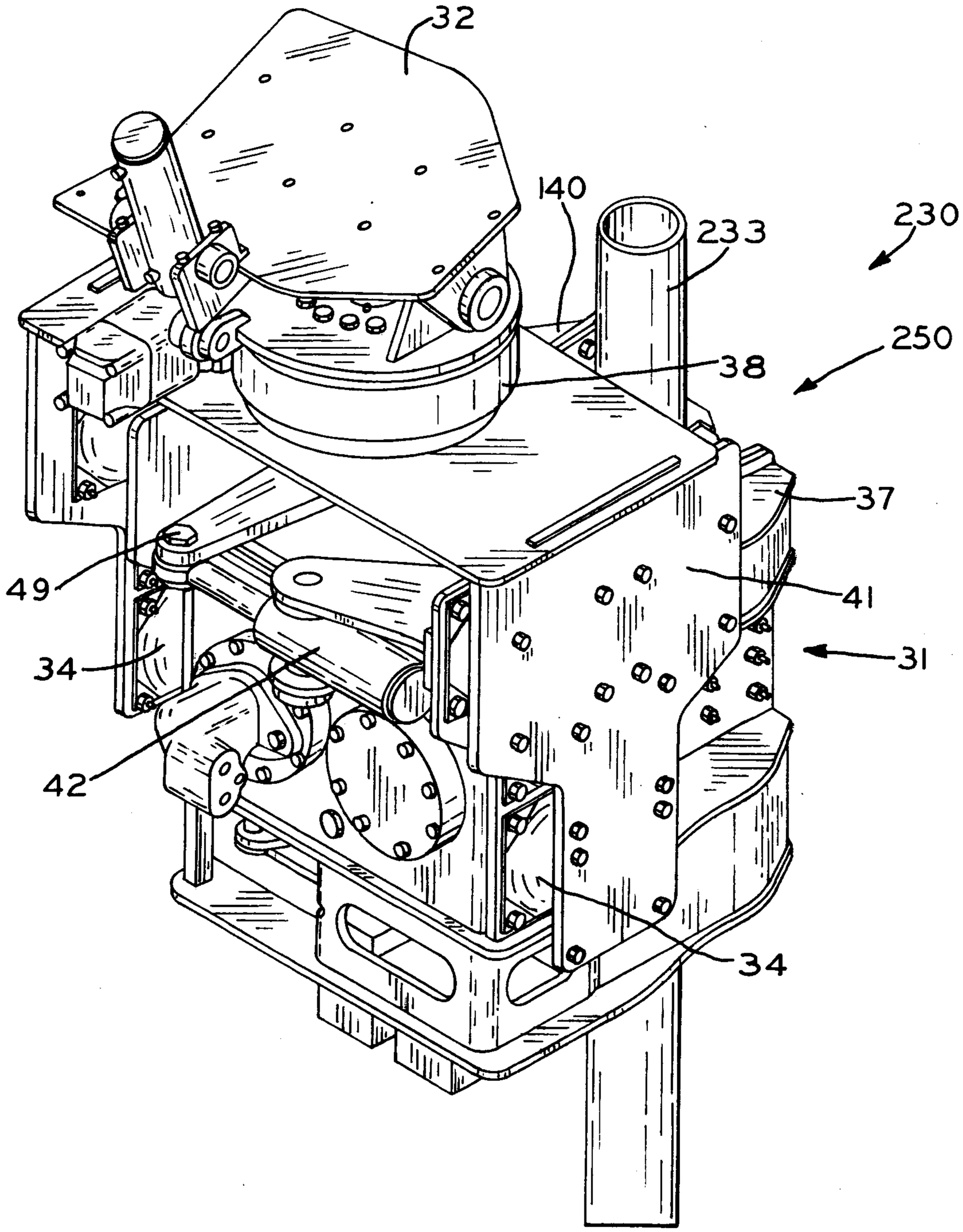


FIG_14

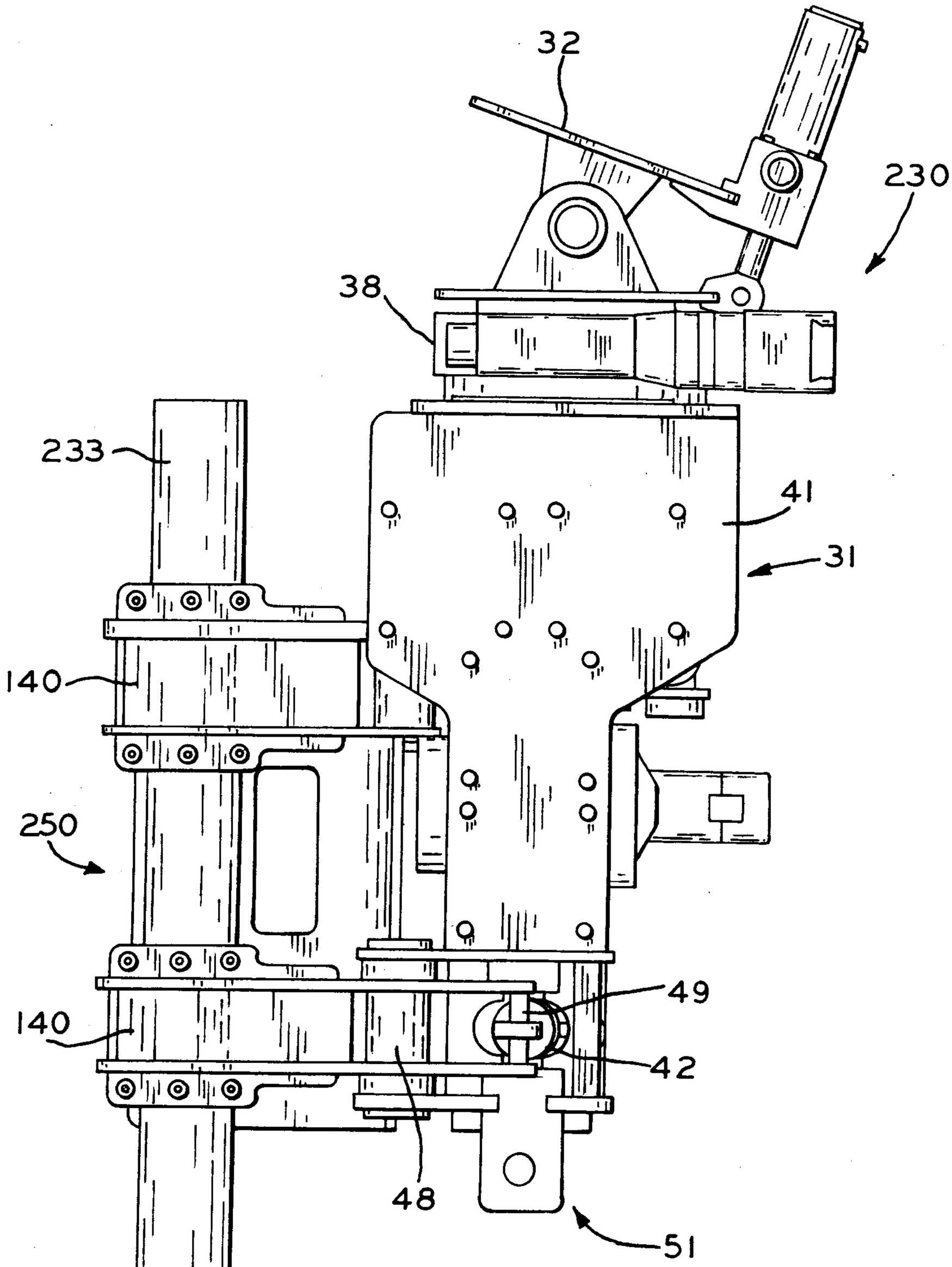


FIG. 15

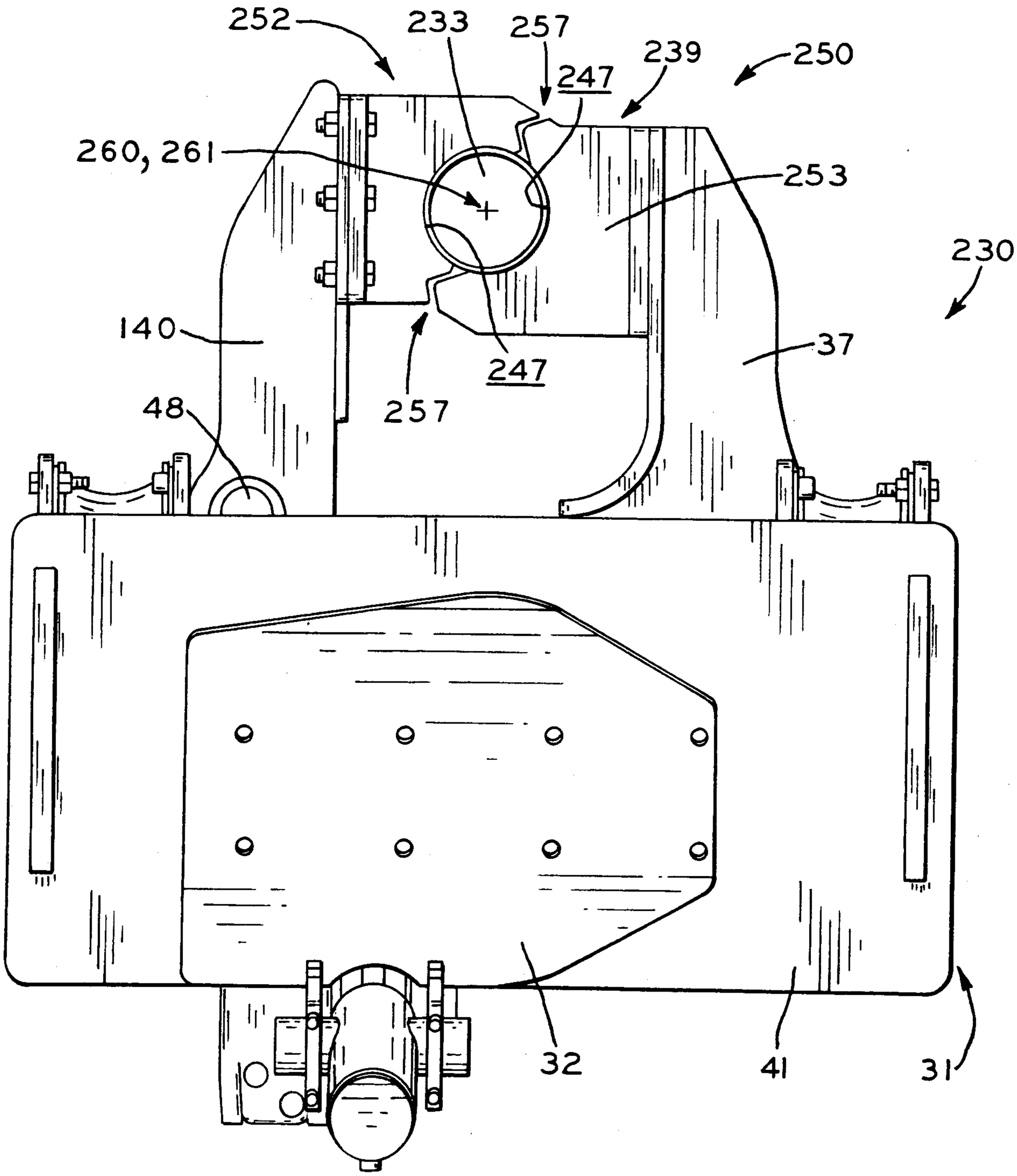
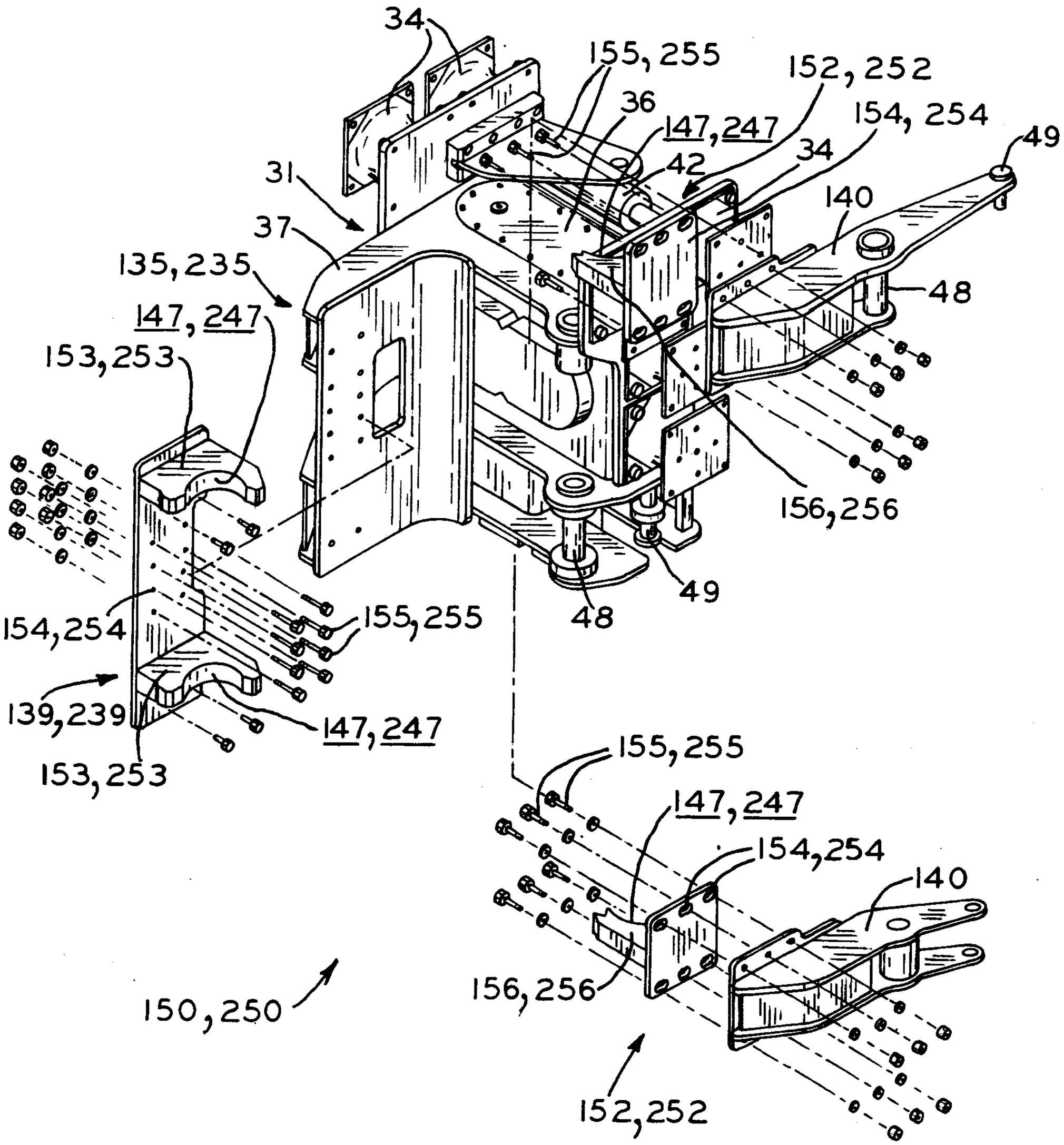


FIG_16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152,252

FIG.17

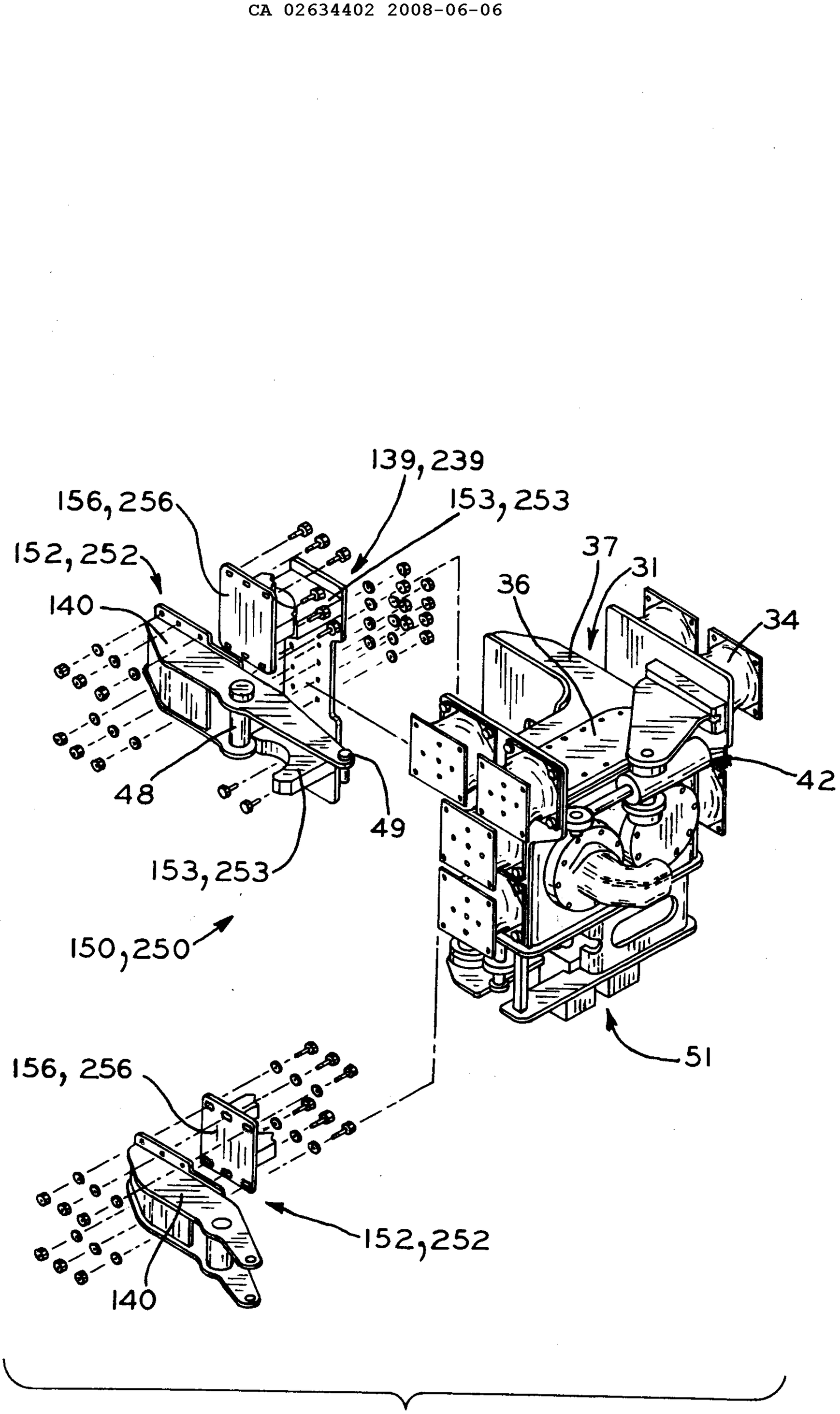
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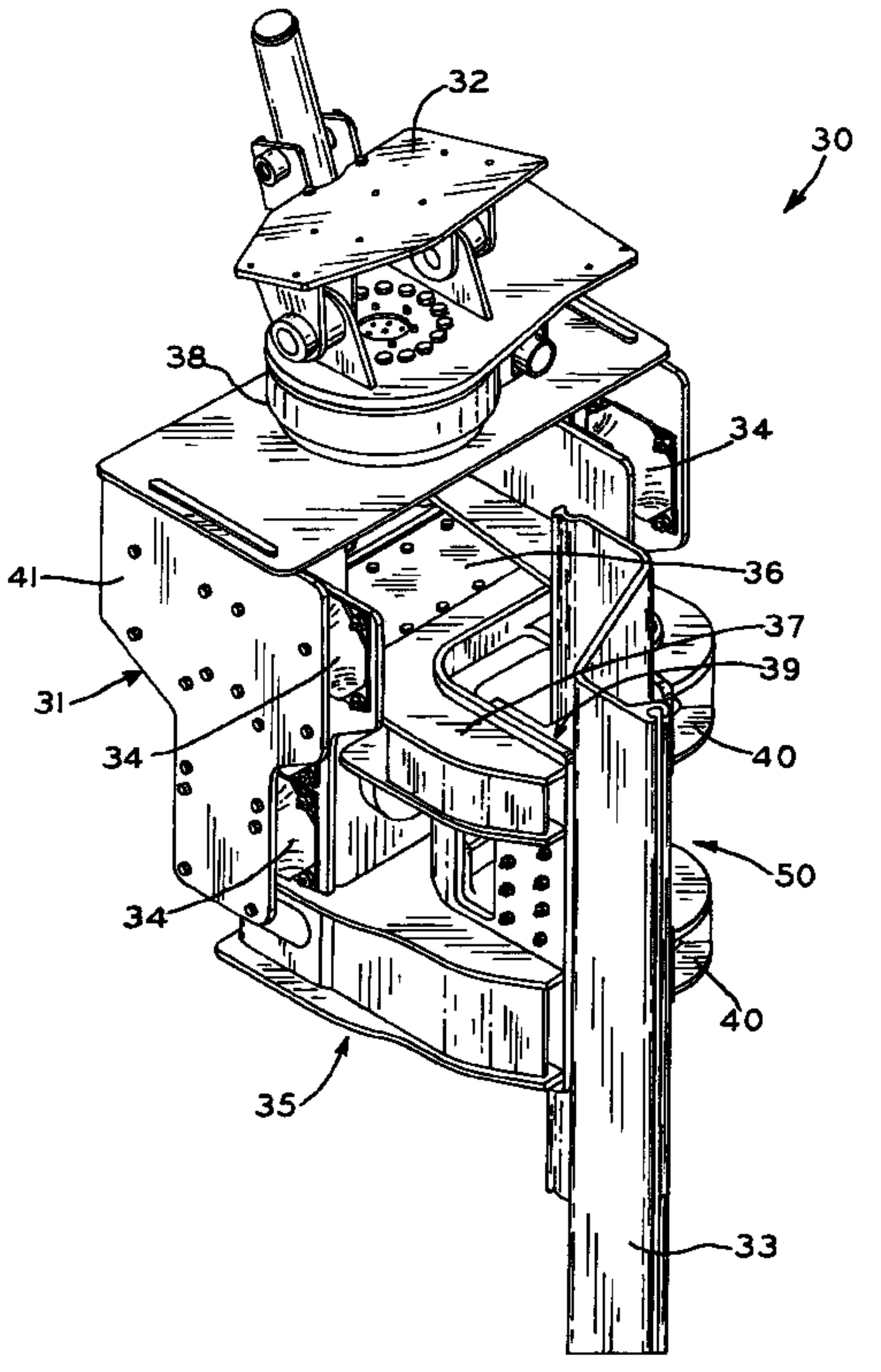
FIG_18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