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(54) **Modular vibratory pile driver system**

Vibrationsrammensystem

Système de commande de pieu vibratoire modulaire

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Description

[0001] 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.

[0002] 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.

[0003] A pile driver according to the preamble of claim 1 is known from EP-A1-496 167.

[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.

[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.

[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:

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;

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

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

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

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;

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

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

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;

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

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

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

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;

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

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

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

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

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

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

[0010] 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.

[0011] 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 mecha-

nism 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.

[0012] A further example of a side grip vibratory pile driver is disclosed in United States Reissue Patent No. RE37,661. The disclosure of this patent is specifically incorporated herein by reference.

[0013] 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.

[0014] 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.

[0015] 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.

[0016] 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.

[0017] 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.

[0018] 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.

[0019] 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.

[0020] 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.

[0021] 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.

[0022] 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.

[0023] 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.

[0024] 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.

[0025] 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.

[0026] 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.

[0027] 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.

[0028] 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".

[0029] 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.

[0030] 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.

Claims

1. A modular side grip vibratory pile driver system (30), comprising:

a housing (31), said housing including a mounting base (37) comprising two first jaw halves (37a);
 a vibratory gear case (36) mounted to said housing (31);
 an arm assembly forming two second jaw halves (40) pivotally connected to said housing, respective said first and second jaw halves forming a pair of spaced-apart jaws adapted for gripping a pile (33) at two longitudinally spaced apart locations;
 an attachment assembly (32) adapted to connect said housing (31) to a construction machine, said housing being rotatably connected to said attachment assembly and being rotatable between a first position wherein the jaws (37a, 40) are oriented vertically and spaced apart horizontally and a second position wherein the jaws are oriented horizontally and spaced apart vertically; **characterized by:**

a plurality of sets of gripping assemblies (39, 139, 239) having different gripping profiles adapted for gripping a variety of different pile profiles, said sets of gripping assemblies (39, 139, 239) adapted to be interchangeably connected to and forming pile gripping elements of said jaws;
 said jaws (37a, 40) 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 (33) can enter the jaws laterally.

2. The modular pile driver system of Claim 1, **characterized in that** at least some of said sets of gripping assemblies (39, 139, 239) include a first gripping assembly detachably mounted to said mounting base (37).
3. The modular pile driver system of Claim 2, **characterized in that** said gripping assemblies (39, 139, 239) include a plurality of slots (54), said slots configured to permit passage of fasteners (55) to secure said gripping assembly to said mounting base (37) and to permit adjustment of said first gripping assembly relative to said mounting base.
4. The modular pile driver system of Claim 2 or Claim 3, **characterized in that** said at least some of said sets of gripping assemblies (39, 139, 239) include pairs of substitute rotatable arms (40, 140) 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 any of the preceding claims, **characterized in that** at least some of said sets of gripping assemblies (39, 139, 239) include a second gripping assembly (152) that is detachably mounted to said arm assembly (140).
6. The modular pile driver system of Claim 5, **characterized in that** said second gripping assembly (152) includes a plurality of slots (154) configured to permit passage of fasteners (155) 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 any of the preceding claims, **characterized in that** said sets of gripping assemblies (139, 239, 39) are respectively configured to grip a relatively large pipe (133), a relatively small pipe (233), a sheet pile (33) and a pole.
8. The modular pile driver system of any of the preceding claims, **characterized in that** said second jaw halves (40) are moveable from an open configuration to a closed configuration relative to said first jaw halves (37a) wherein when in said closed configuration, said first jaw halves (37a) are interlockingly engaged with said second jaw halves (40).
9. A method of changing a modular side grip vibratory pile driver (30) from a first configuration to a second configuration, said method comprising:

providing a modular side grip vibratory pile driver comprising a housing (31), a vibratory gear case (36) mounted to the housing and a pair of spaced-apart jaws (37a, 40), 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 (33) can enter the jaws laterally, the jaws including a current set of gripping assemblies (39) providing pile gripping surfaces on said jaws;

providing a plurality of sets of gripping assemblies (39, 139, 239) having different gripping profiles adapted for gripping a variety of different pile profiles (33, 133, 233); 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.

10. The method of Claim 9, **characterized in that** the sets of gripping assemblies (139, 239, 39) are configured respectively to grip a relatively large pipe (133), a relatively small pipe (233), a sheet pile (33) and a pole.

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11. The method of Claims 9 or 10, **characterized in that** each of said jaws (37a, 40) comprises a stationary jaw half (37a) and a removable rotatable jaw half (40), and wherein the step of substituting comprises:

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replacing current rotatable jaw halves (40) with rotatable jaw halves (40, 140, 240) 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 (37a) with a gripping assembly (37a) from the plurality of sets that accommodates the profile of the pile to be driven.

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Patentansprüche

1. Modulares Seitengriff-Vibrationsrammensystem (30), umfassend:

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ein Gehäuse (31), wobei das Gehäuse eine Trägerbasis (37) aufweist, die zwei erste Backenhälften (37a) umfasst;

einen Vibrationsgetriebekasten (36), der auf dem Gehäuse (31) angebracht ist;

eine Armanordnung, die zwei zweite Backenhälften (40) bildet, die mit dem Gehäuse verbunden sind, wobei die ersten und die zweiten Backenhälften jeweils ein Paar beabstandeter Backen bilden, die zum Ergreifen eines Rammguts (33) an zwei in Längsrichtung beabstandeten Stellen ausgelegt sind;

eine Befestigungsanordnung (32), die zum Verbinden des Gehäuses (31) mit einer Baumaschine ausgelegt ist, wobei das Gehäuse mit der Befestigungsanordnung drehbar verbunden ist und zwischen einer ersten Position, in der die Backen (37a, 40) senkrecht angeordnet und waagrecht voneinander beabstandet sind, und einer zweiten Position, in der die Backen waagrecht angeordnet und senkrecht voneinander beabstandet sind, drehbar ist, **gekennzeichnet durch:**

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eine Vielzahl von Sätzen von Greifanordnungen (39, 139, 239), die unterschiedliche Greifprofile haben, die zum Greifen einer

Auswahl unterschiedlicher Rammgutprofile angepasst sind, wobei die Sätze von Greifanordnungen (39, 139, 239) dazu ausgelegt sind, mit den Backen austauschbar verbunden zu sein und Rammgutgreifelemente der Backen zu bilden;

wobei die Backen (37a, 40) einen einzelnen Satz der austauschbar verbundenen Greifanordnungen aufweisen, die mit jenen entfernbar und austauschbar verbunden sind;
wobei die Backen offen sind und einen Spalt bilden, so dass ein Rammgut (33) seitlich in die Backen eintreten kann.

2. Modulares Rammensystem nach Anspruch 1, **dadurch gekennzeichnet, dass** mindestens einige der Sätze von Greifanordnungen (39, 139, 239) eine erste Greifanordnung aufweisen, die auf der Trägerbasis (37) entfernbar angebracht ist.

3. Modulares Rammensystem nach Anspruch 2, **dadurch gekennzeichnet, dass** die Greifanordnungen (39, 139, 239) eine Vielzahl von Schlitten (54) aufweisen, wobei die Schlitten dazu ausgelegt sind, das Hindurchführen von Befestigungselementen (55) zu ermöglichen, um die Greifanordnung auf der Trägerbasis (37) zu befestigen und um eine Einstellung der ersten Greifanordnung relativ zur Trägerbasis zu ermöglichen.

4. Modulares Rammensystem nach Anspruch 2 oder Anspruch 3, **dadurch gekennzeichnet, dass** die mindestens einigen der Sätze von Greifanordnungen (39, 139, 239) Paare drehbarer Ersatzarme (40, 140) aufweisen, die mit den Armen austauschbar sind, die die zweiten Backenhälften bilden, wobei die Ersatzarme Greifprofile aufweisen, die mit entsprechenden ersten Greifanordnungen zusammenpassen.

5. Modulares Rammensystem nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** mindestens einige der Sätze von Greifanordnungen (39, 139, 239) eine zweite Greifanordnung (152) aufweisen, die entfernbar an der Armanordnung (140) angebracht ist.

6. Modulares Rammensystem nach Anspruch 5, **dadurch gekennzeichnet, dass** die zweite Greifanordnung (152) eine Vielzahl von Schlitten (154) aufweist, die dazu ausgelegt sind, das Hindurchführen von Befestigungselementen (155) zu ermöglichen, um die zweite Greifanordnung an den Armen zu befestigen und um eine Einstellung der zweiten Greifanordnung relativ zu den Armen zu ermöglichen.

7. Modulares Rammensystem nach einem der vorher-

gehenden Ansprüche, **dadurch gekennzeichnet, dass** die Sätze von Greifanordnungen (139, 239, 39) jeweils ausgelegt sind, ein relativ großes Rohr (133), eine relativ kleine Bohre (233), eine Stahlpundbohle (33) und einen Pfahl zu greifen.

8. Modulares Rammensystem nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** die zweiten Backenhälften (40) relativ zu den ersten Backenhälften (37a) von einer offenen Konfiguration in eine geschlossene Konfiguration beweglich sind, wobei die ersten Backenhälften (37a), wenn sie in der geschlossenen Konfiguration sind, mit den zweiten Backenhälften (40) in formschlüssigem Eingriff sind.

9. Verfahren zum Umrüsten einer modularen Seitengriff-Vibrationsramme (30) von einer ersten Konfiguration in eine zweite Konfiguration, wobei das Verfahren umfasst:

Vorsehen einer modularen Seitengriff-Vibrationsramme, die ein Gehäuse (31), einen Vibrationsgetriebekasten (36), der an dem Gehäuse angebracht ist, und ein Paar beabstandeter Backen (37a, 40) umfasst, wobei das Gehäuse drehbar mit einer Baumaschine verbunden ist und zwischen einer ersten Position, in der die Backen (37a, 40) senkrecht angeordnet und waagrecht voneinander beabstandet sind, und einer zweiten Position, in der die Backen waagrecht angeordnet und senkrecht voneinander beabstandet sind, drehbar ist, wobei die Backen offen sind und einen Spalt bilden, so dass ein Rammgut (33) seitlich in die Backen eintreten kann, wobei die Backen einen aktuellen Satz von Greifanordnungen (39) aufweisen, die Rammgutgreifflächen an den Backen vorsehen; Vorsehen einer Vielzahl von Sätzen von Greifanordnungen (39, 139, 239), die unterschiedliche Greifprofile haben, die zum Greifen einer Auswahl unterschiedlicher Rammgutprofile (33, 133, 233) angepasst sind; und Auswählen eines der Sätze von Greifanordnungen, der zu dem Profil eines zu rammenden Rammguts passt, und Austauschen des aktuellen Satzes von Greifanordnungen durch den ausgewählten Satz, um **dadurch** die Ramme zum Rammen eines Rammguts mit einem entsprechenden Profil zu konfigurieren.

10. Verfahren nach Anspruch 9, **dadurch gekennzeichnet, dass** die Sätze von Greifanordnungen (139, 239, 39) jeweils ausgelegt sind, ein relativ großes Rohr (133), eine relativ kleine Bohre (233), eine Stahlpundbohle (33) und einen Pfahl zu greifen.

11. Verfahren nach Anspruch 9 oder 10, **dadurch ge-**

kennzeichnet, dass jede der Backen (37a, 40) eine stationäre Backenhälfte (37a) und eine entfernbare drehbare Backenhälfte (40) umfasst, und wobei der Schritt des Austauschens umfasst:

Ersetzen aktueller drehbarer Backenhälften (40) durch drehbare Backenhälften (40, 140, 240) aus der Vielzahl von Sätzen, die ein Greifprofil haben, das zu dem Profil des zu rammen- den Rammguts passt, und Ersetzen einer Greifanordnung an der stationären Backe (37a) durch eine Greifanordnung (39, 139, 239) aus der Vielzahl von Sätzen, die zu dem Profil des zu rammen- den Rammguts passt.

Revendications

1. Système modulaire vibrant d'enfoncement de pieux à serrage latéral (30), comprenant :

un carter (31), ledit carter comportant une base de montage (37) avec deux premières moitiés de mâchoires (37a) ;

un carter de mécanisme vibrant (36) monté sur le carter (31) ;

un ensemble de bras qui forme deux secondes moitiés de mâchoires (40) reliées pivotantes au carter, les premières et secondes moitiés de mâchoires respectives formant une paire de mâchoires espacées aptes à serrer un pieu (33) à deux endroits espacés longitudinalement ;

un ensemble de fixation (32) qui est apte à relier le carter (31) à une machine de construction, ledit carter étant relié en rotation à l'ensemble de fixation et étant apte à tourner entre une première position dans laquelle les mâchoires (37a, 40) sont orientées à la verticale et sont espacées horizontalement, et une seconde position dans laquelle les mâchoires sont orientées à l'horizontale et sont espacées verticalement ; **caractérisé par** :

plusieurs jeux d'ensembles de serrage (39, 139, 239) qui ont différents profils de serrage aptes à serrer une variété de différents profils de pieux, ces jeux d'ensembles de serrage (39, 139, 239) étant aptes à être reliés de manière interchangeable aux mâchoires et formant des éléments de serrage de pieux de celles-ci ;

les mâchoires (37a, 40) comprenant un seul jeu des ensembles de serrage reliés de manière interchangeable qui sont reliés auxdites mâchoires de manière amovible et interchangeable ;

les mâchoires étant ouvertes et formant un espace de telle sorte qu'un pieu (33) puisse

entrer dans les mâchoires latéralement.

2. Système modulaire d'enfoncement de pieux selon la revendication 1, **caractérisé en ce que** quelques-uns au moins des jeux d'ensembles de serrage (39, 139, 239) comprennent un premier ensemble de serrage qui est monté de manière amovible sur la base de montage (37).

3. Système modulaire d'enfoncement de pieux selon la revendication 2, **caractérisé en ce que** les ensembles de serrage (39, 139, 239) comprennent plusieurs fentes (54), lesdites fentes étant conçues pour permettre le passage d'attaches (55) pour fixer l'ensemble de serrage à la base de montage (37), et pour permettre le réglage du premier ensemble de serrage par rapport à la base de montage.

4. Système modulaire d'enfoncement de pieux selon la revendication 2 ou 3, **caractérisé en ce que** les quelques jeux d'ensembles de serrage (39, 139, 239) comprennent des paires de bras rotatifs de remplacement (40, 140) qui sont interchangeables avec les bras qui forment les secondes moitiés de mâchoires, les bras de remplacement ayant des profils de serrage qui correspondent aux premiers ensembles de serrage respectifs.

5. Système modulaire d'enfoncement de pieux selon l'une quelconque des revendications précédentes, **caractérisé en ce que** quelques-uns au moins des jeux d'ensembles de serrage (39, 139, 239) comprennent un second ensemble de serrage (152) qui est monté de manière amovible sur l'ensemble de bras (140).

6. Système modulaire d'enfoncement de pieux selon la revendication 5, **caractérisé en ce que** le second ensemble de serrage (152) comprend plusieurs fentes (154) qui sont conçues pour permettre le passage d'attaches (155) pour fixer le second ensemble de serrage aux bras, et pour permettre le réglage de celui-ci par rapport aux bras.

7. Système modulaire d'enfoncement de pieux selon l'une quelconque des revendications précédentes, **caractérisé en ce que** les jeux d'ensembles de serrage (139, 239, 39) sont conçus respectivement pour serrer un tuyau relativement grand (133), un tuyau relativement petit (233), une palplanche (33) et un poteau.

8. Système modulaire d'enfoncement de pieux selon l'une quelconque des revendications précédentes, **caractérisé en ce que** les secondes moitiés de mâchoires (40) sont mobiles d'une configuration ouverte vers une configuration fermée, par rapport aux premières moitiés de mâchoires (37a), étant précisé

que dans la configuration fermée, les premières moitiés de mâchoires (37a) et les secondes moitiés de mâchoires (40) s'interpénètrent.

rage (37a) à partir des jeux qui reçoivent le profil du pieu à enfoncer.

9. Procédé pour faire passer un engin modulaire vibrant d'enfoncement de pieux à serrage latéral (30) d'une première configuration à une seconde configuration, le procédé comprenant les étapes qui consistent :

à prévoir un engin modulaire vibrant d'enfoncement de pieux à serrage latéral comprenant un carter (31), un carter de mécanisme vibrant (36) qui est monté sur ledit carter et une paire de mâchoires espacées (37a, 40), le carter étant relié en rotation à une machine de construction et étant apte à tourner entre une première position dans laquelle les mâchoires sont orientées à la verticale et sont espacées horizontalement, et une seconde position dans laquelle les mâchoires sont orientées à l'horizontale et sont espacées verticalement, les mâchoires étant ouvertes et formant un espace de telle sorte qu'un pieu (33) peut entrer dans les mâchoires latéralement, les mâchoires comportant un jeu courant d'ensembles de serrage (39) qui offrent des surfaces de serrage de pieu sur les mâchoires ;
à prévoir plusieurs jeux d'ensembles de serrage (39, 139, 239) qui ont différents profils de serrage aptes à serrer une variété de profils de pieu différents (33, 133, 233) ; et
à sélectionner l'un des jeux d'ensembles de serrage qui reçoit le profil d'un pieu à enfoncer, et à substituer le jeu sélectionné au jeu courant d'ensembles de serrage, pour configurer ainsi l'engin d'enfoncement de pieux en vue d'enfoncer un pieu avec un profil complémentaire.

10. Procédé selon la revendication 9, **caractérisé en ce que** les jeux d'ensembles de serrage (139, 239, 39) sont conçus respectivement pour serrer un tuyau relativement grand (133), un tuyau relativement petit (233), une palplanche (33) et un poteau.

11. Procédé selon les revendications 9 ou 10, **caractérisé en ce que** chacune des mâchoires (37a, 40) comprend une moitié fixe (37a) et une moitié rotative amovible (40), et l'étape de la substitution comprenant :

le remplacement des moitiés de mâchoires rotatives courantes (40) par les moitiés de mâchoires rotatives (40, 140, 240) à partir des jeux ayant un profil de serrage qui reçoit le profil du pieu à enfoncer, et
le remplacement d'un ensemble de serrage sur la mâchoire fixe (37a) par un ensemble de ser-

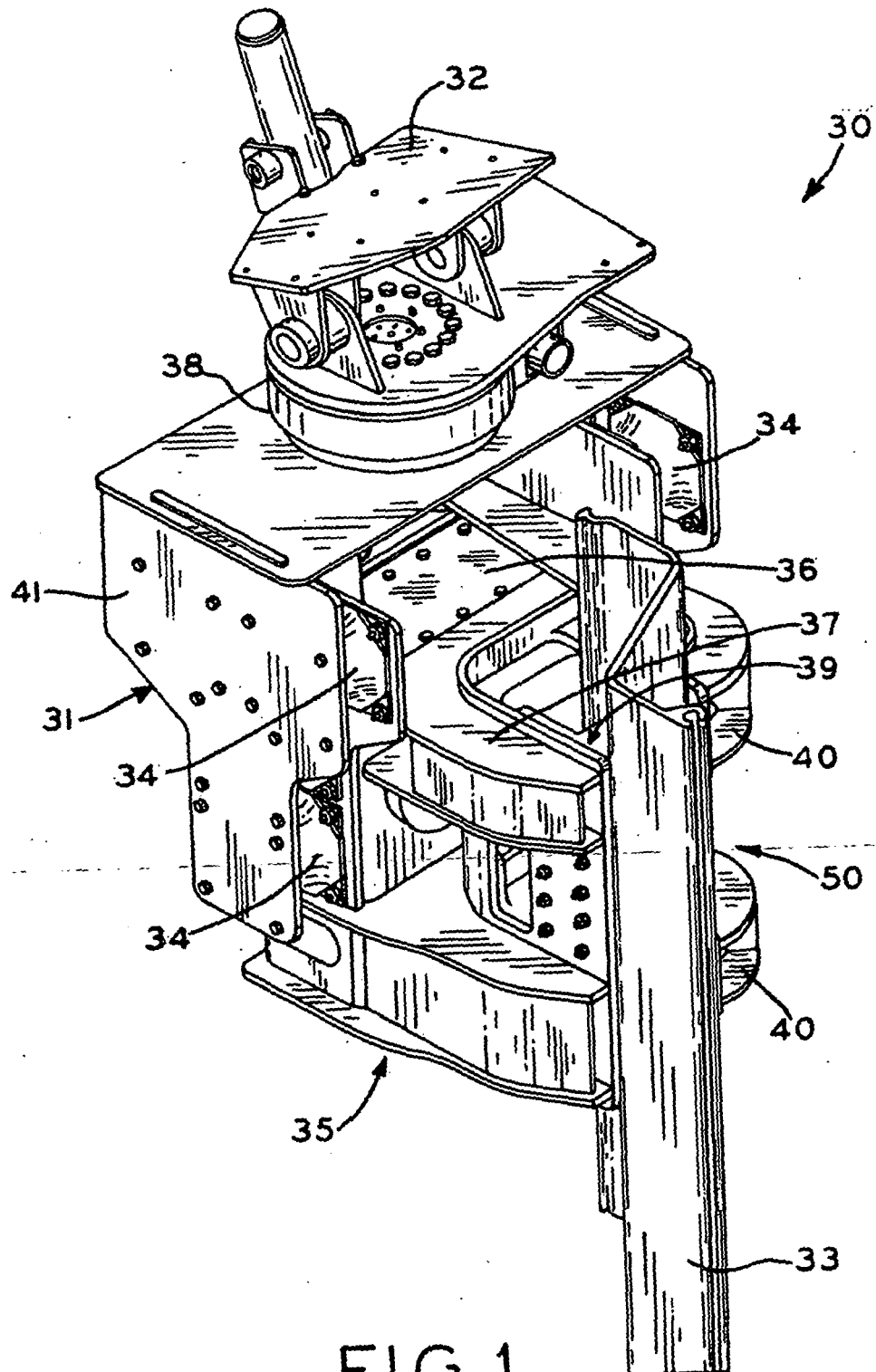


FIG. 1

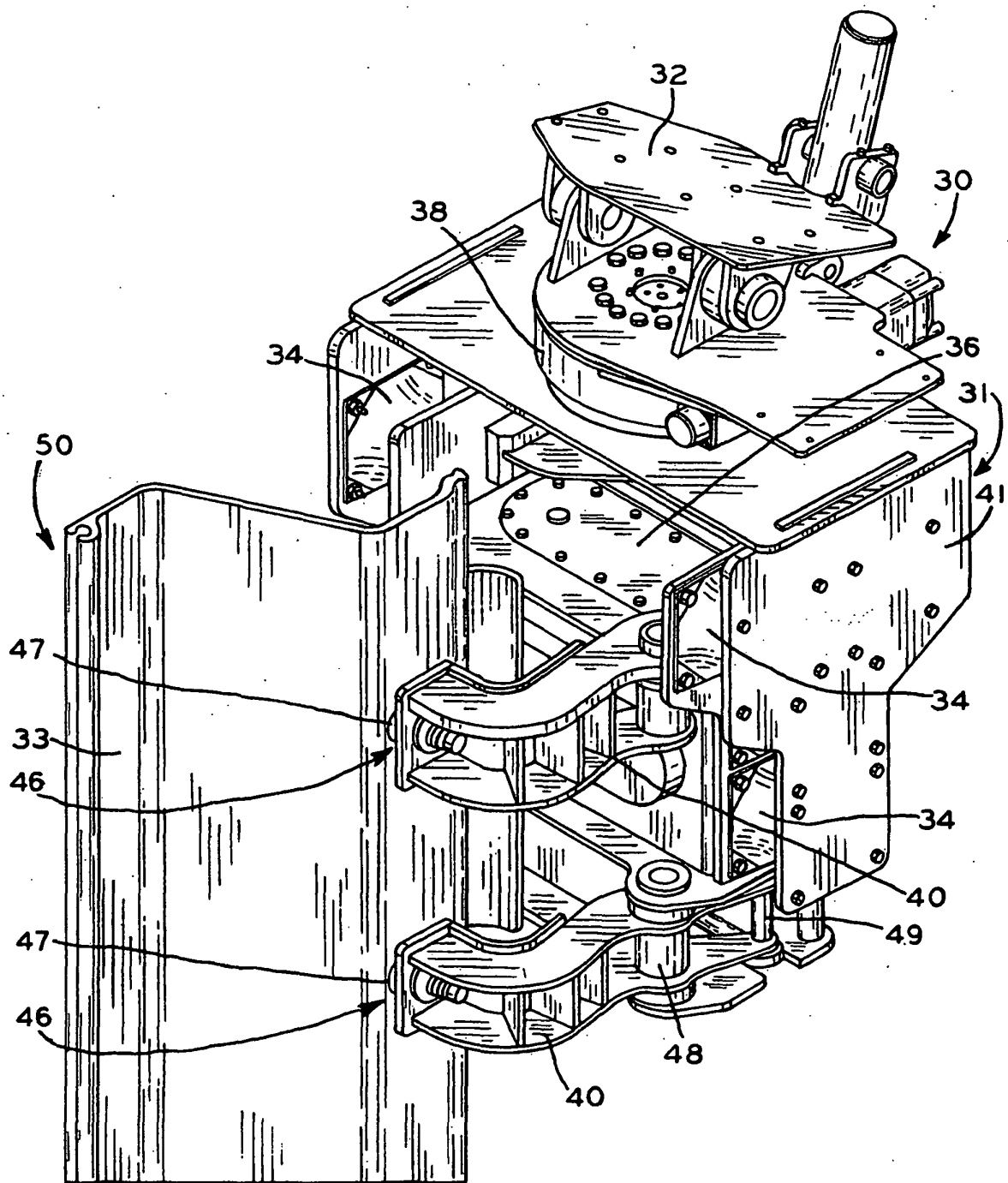


FIG.2

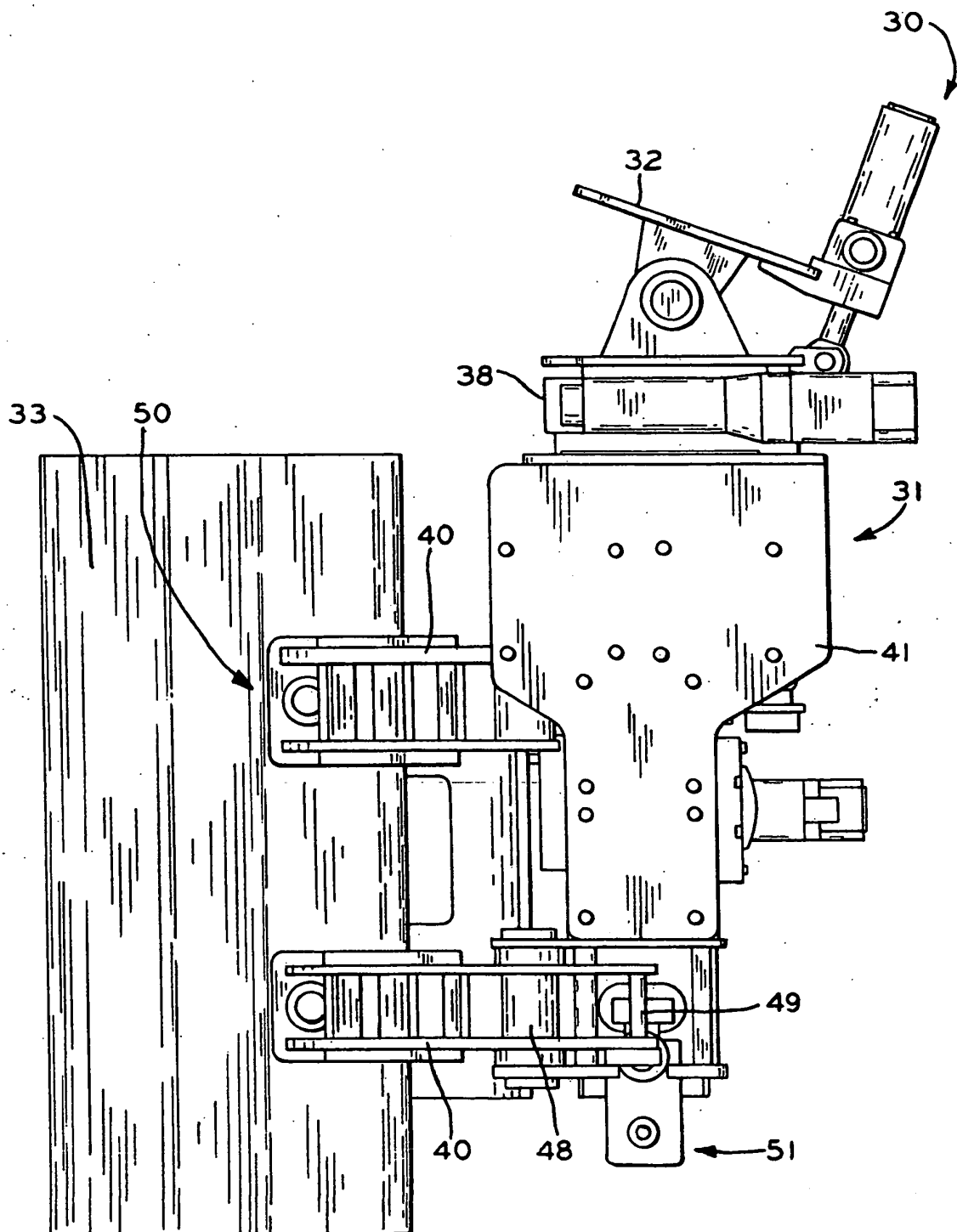


FIG. 3

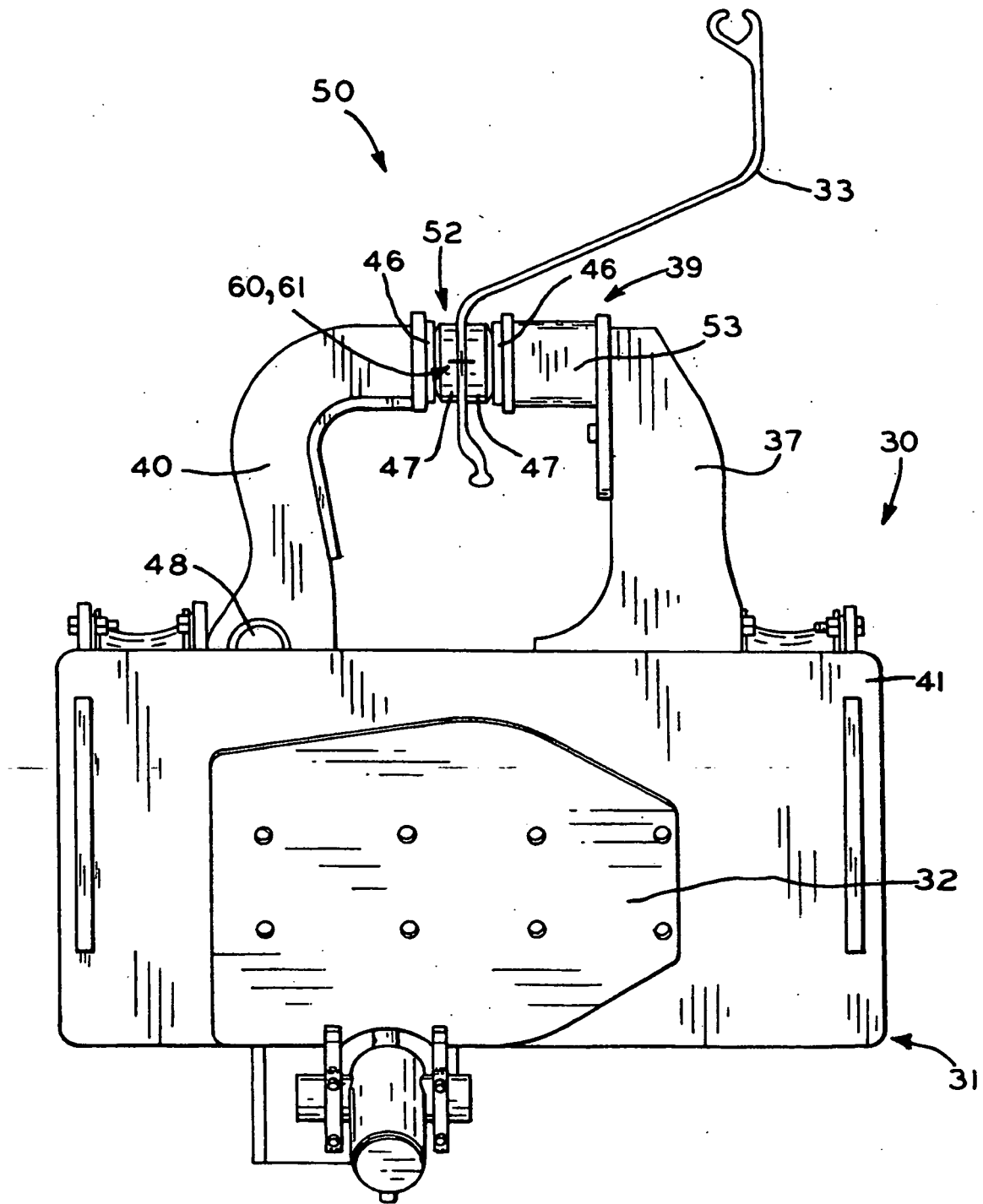


FIG. 4

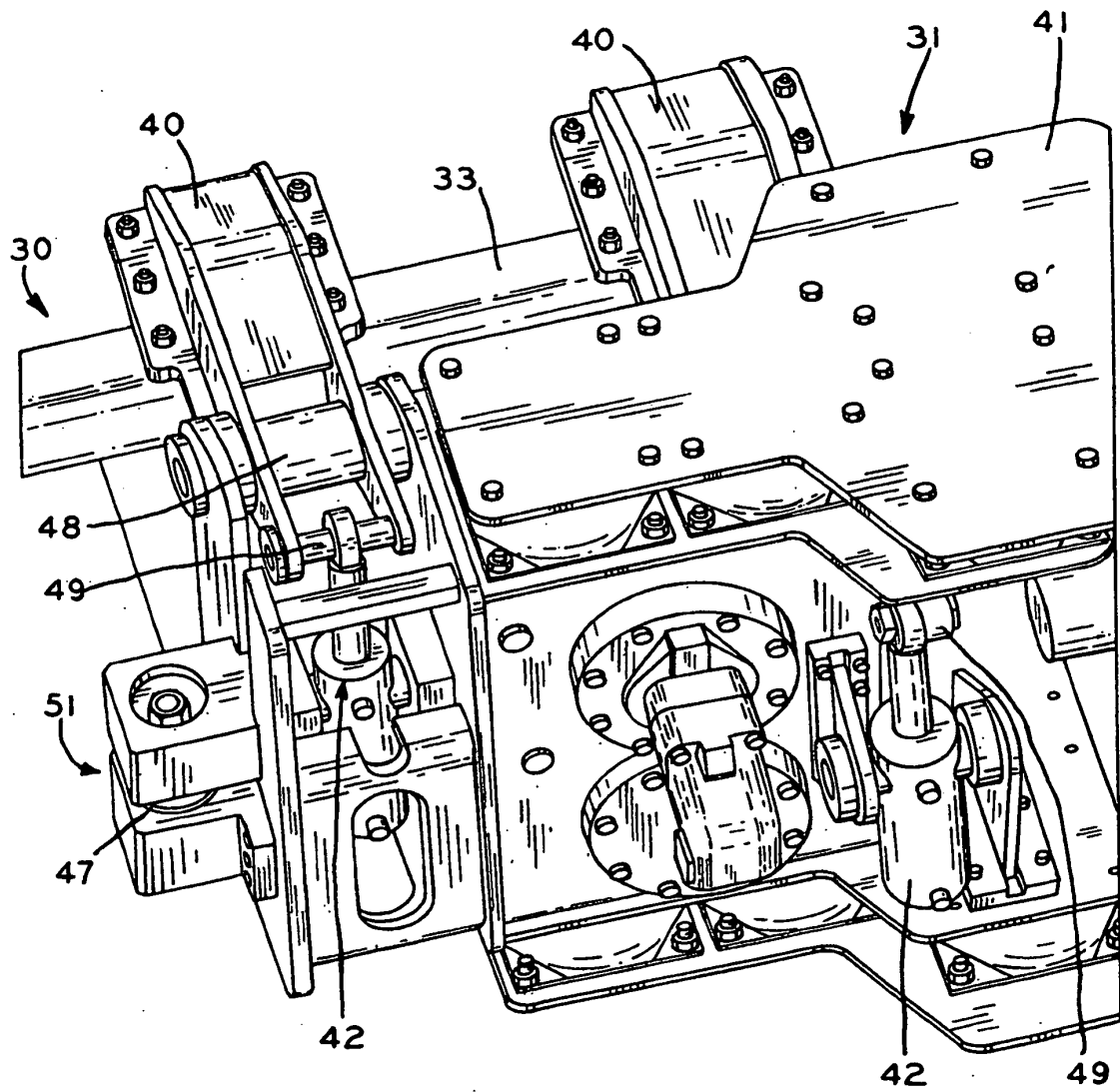


FIG. 5

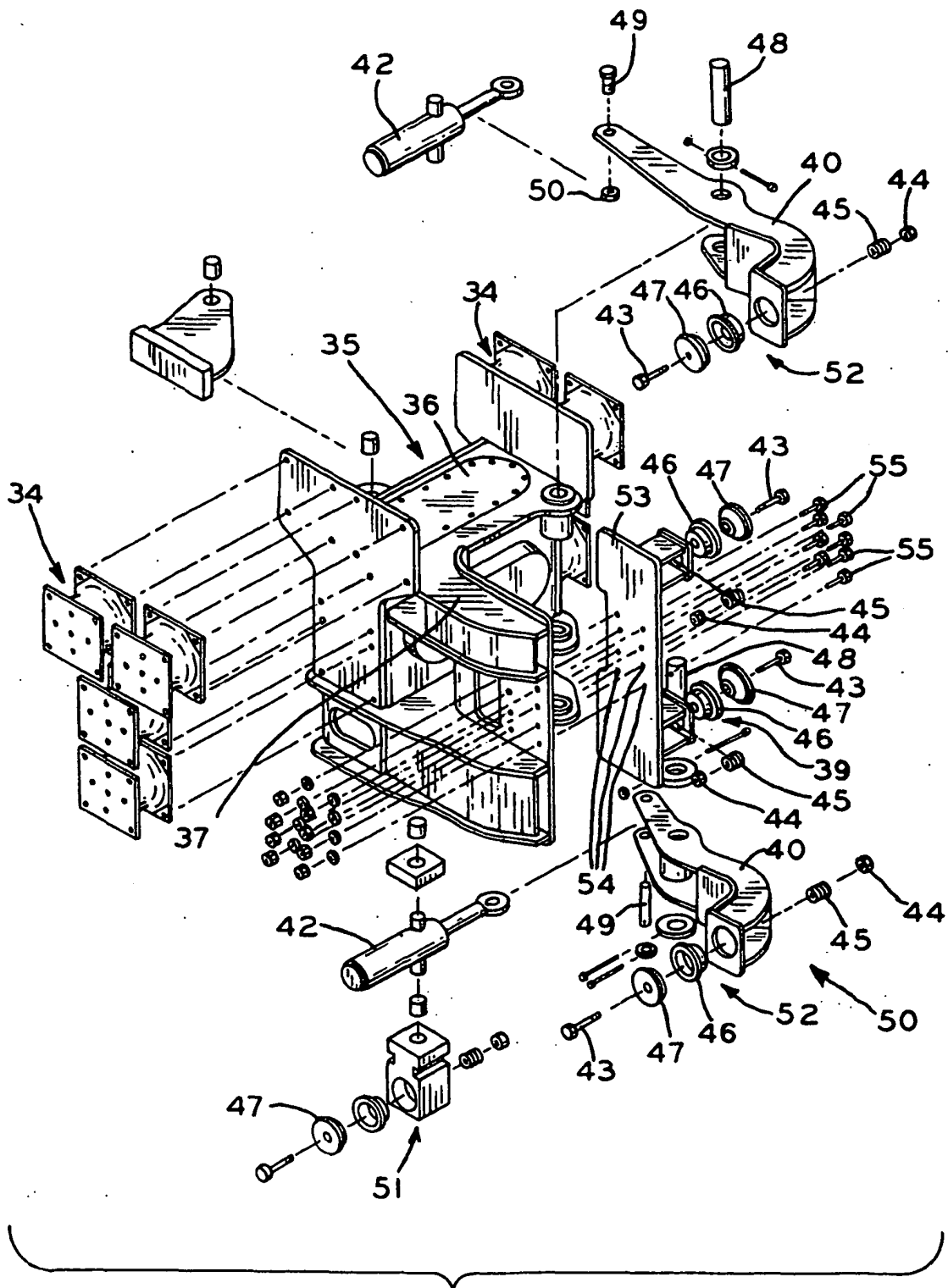


FIG. 6

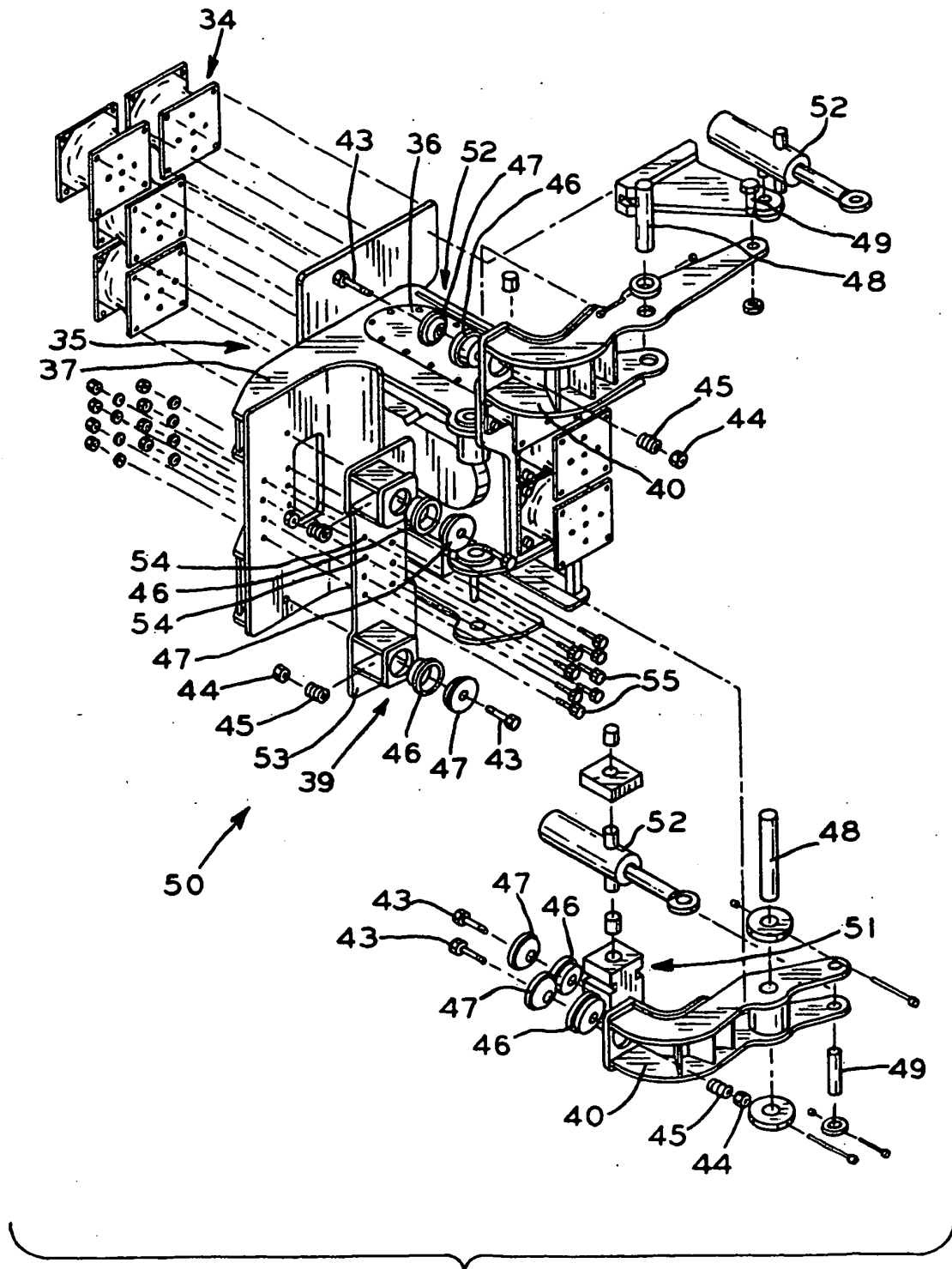
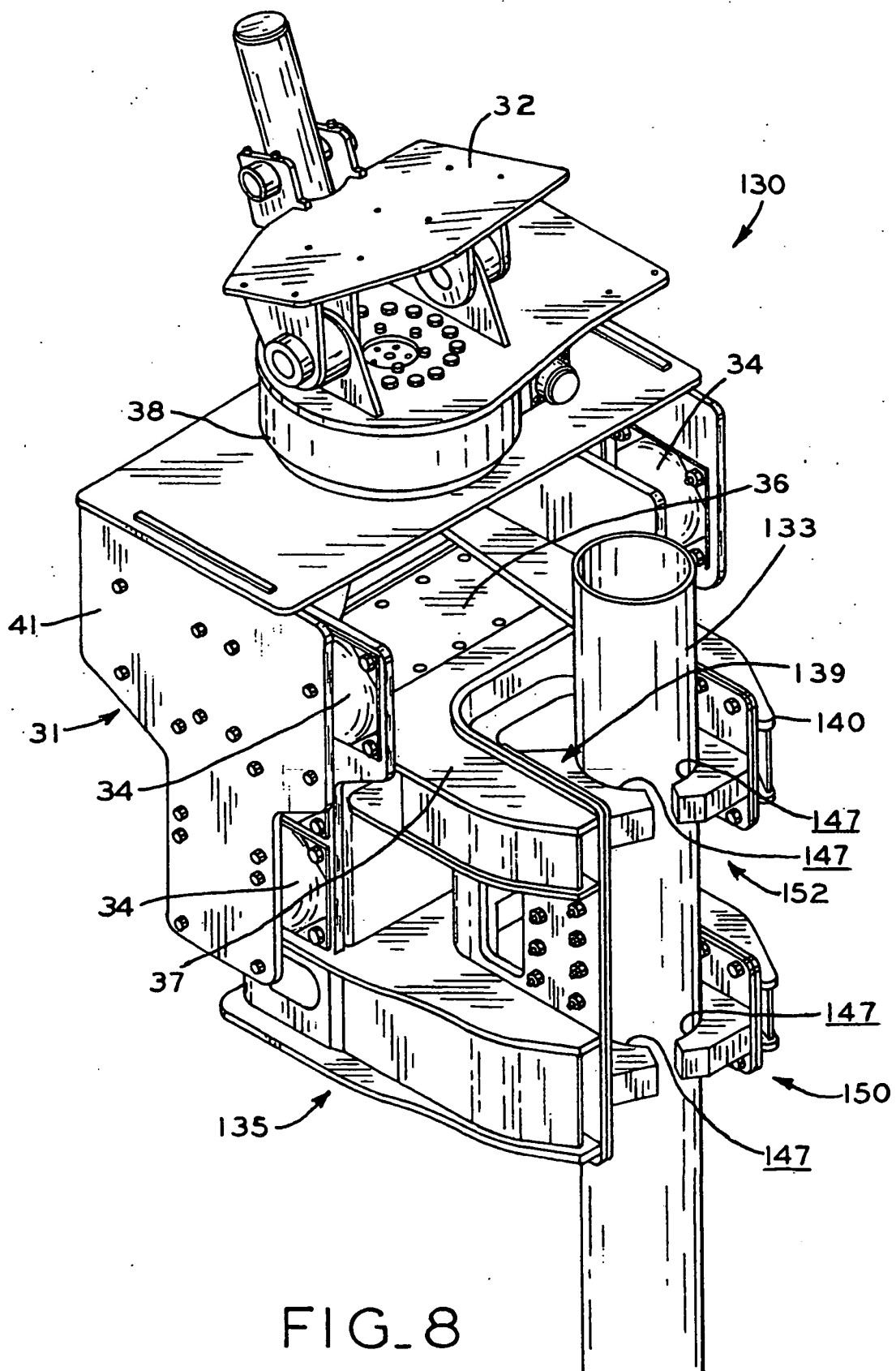


FIG. 7



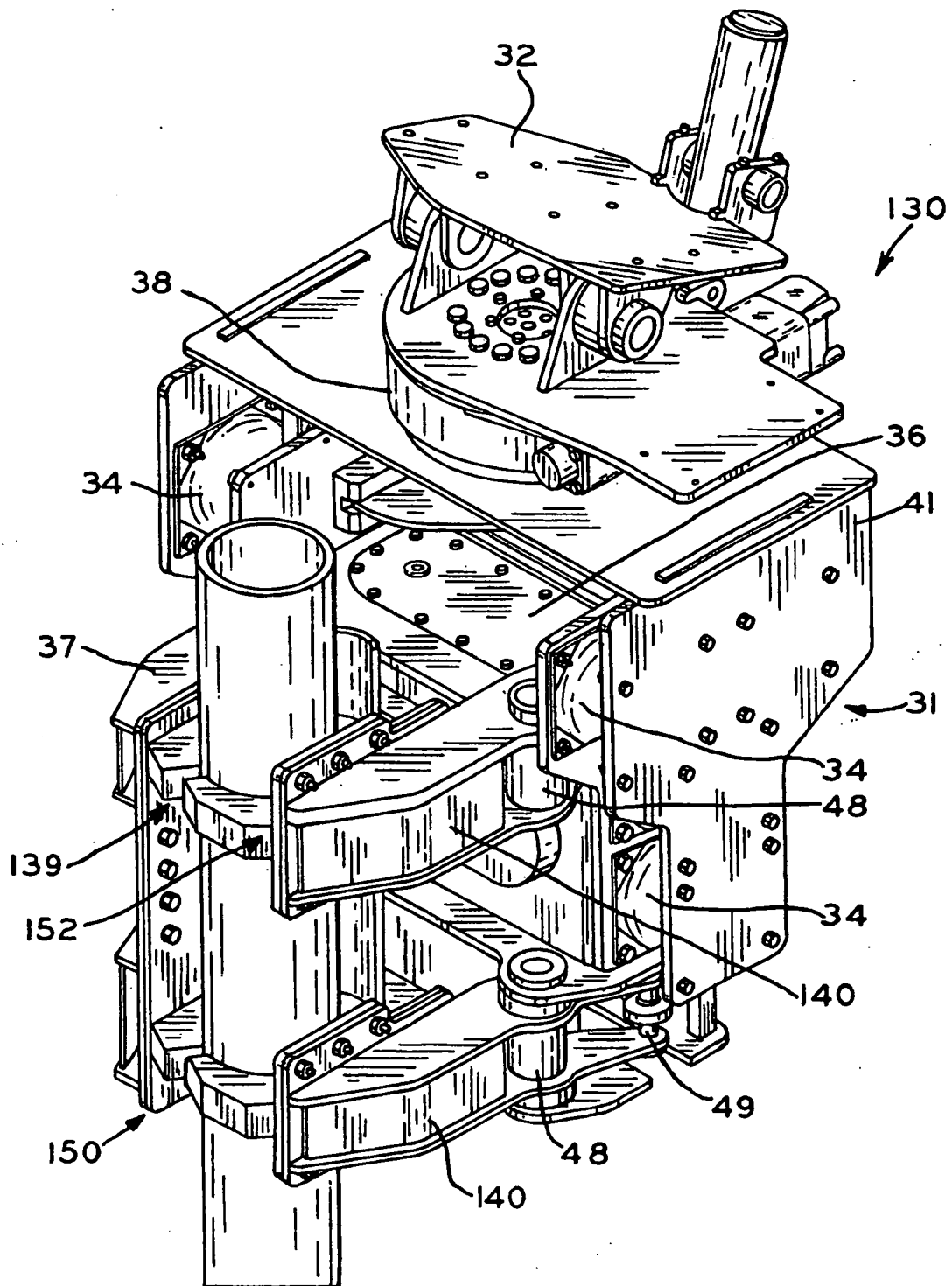


FIG. 9

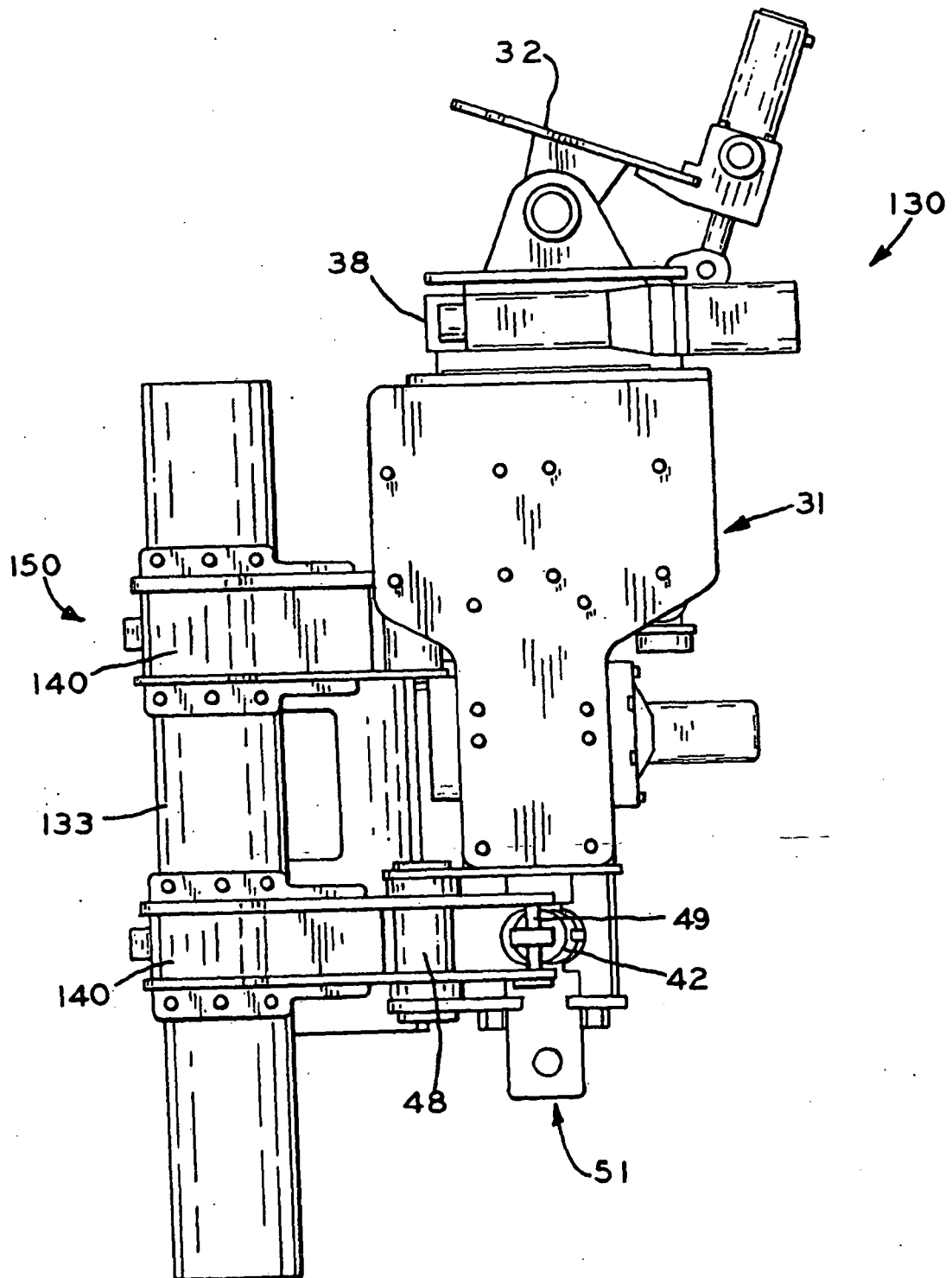
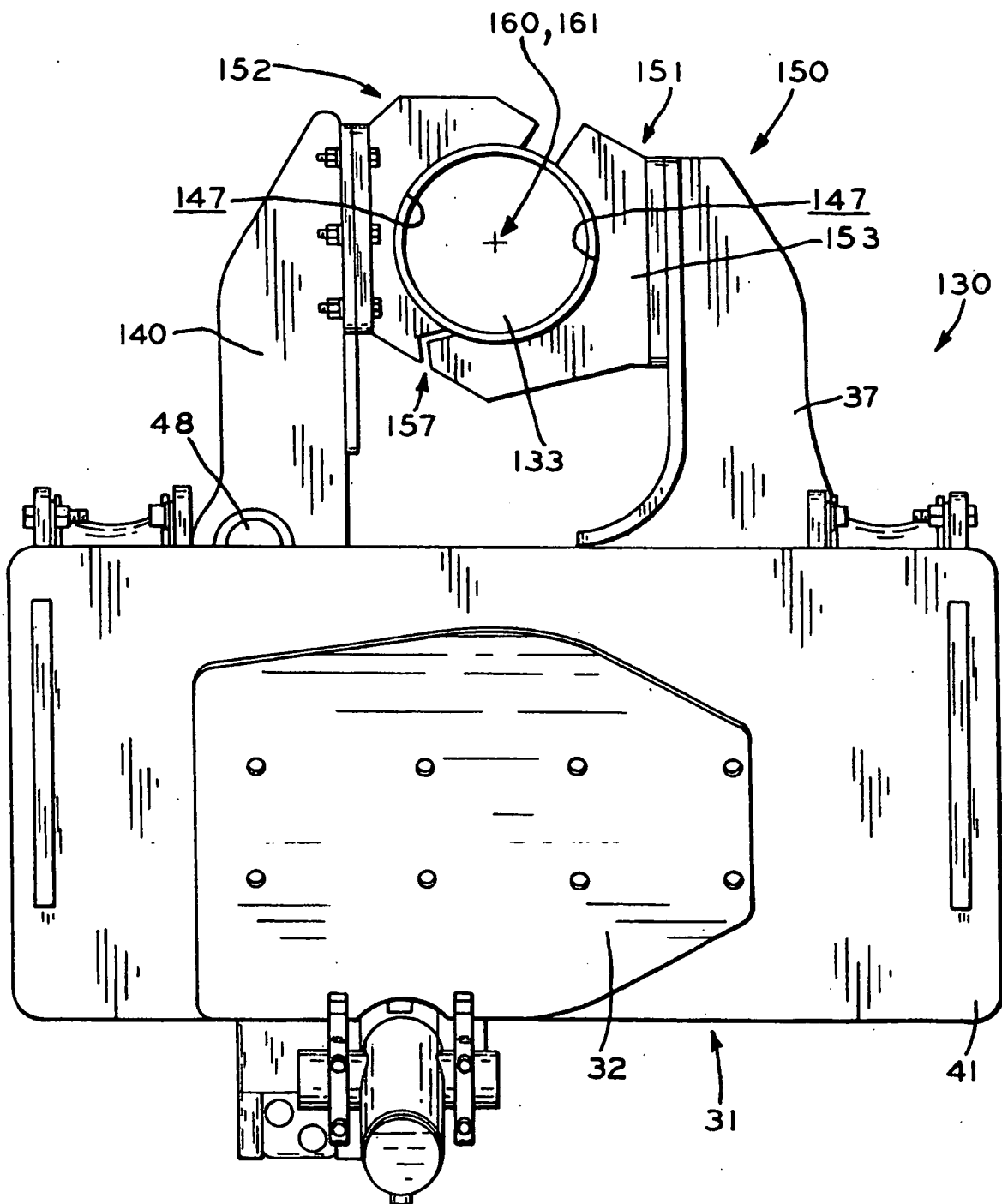


FIG. 10



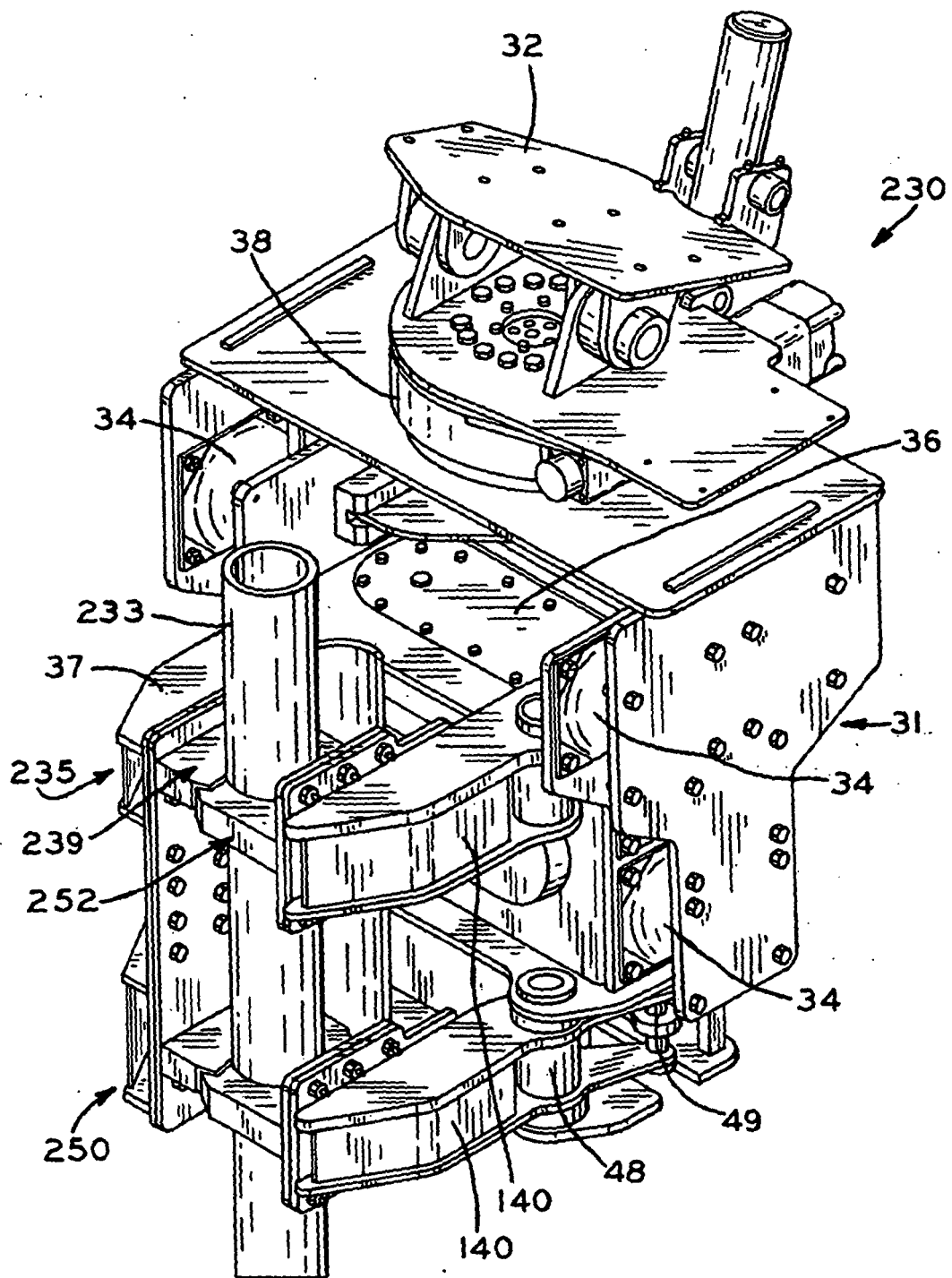


FIG.12

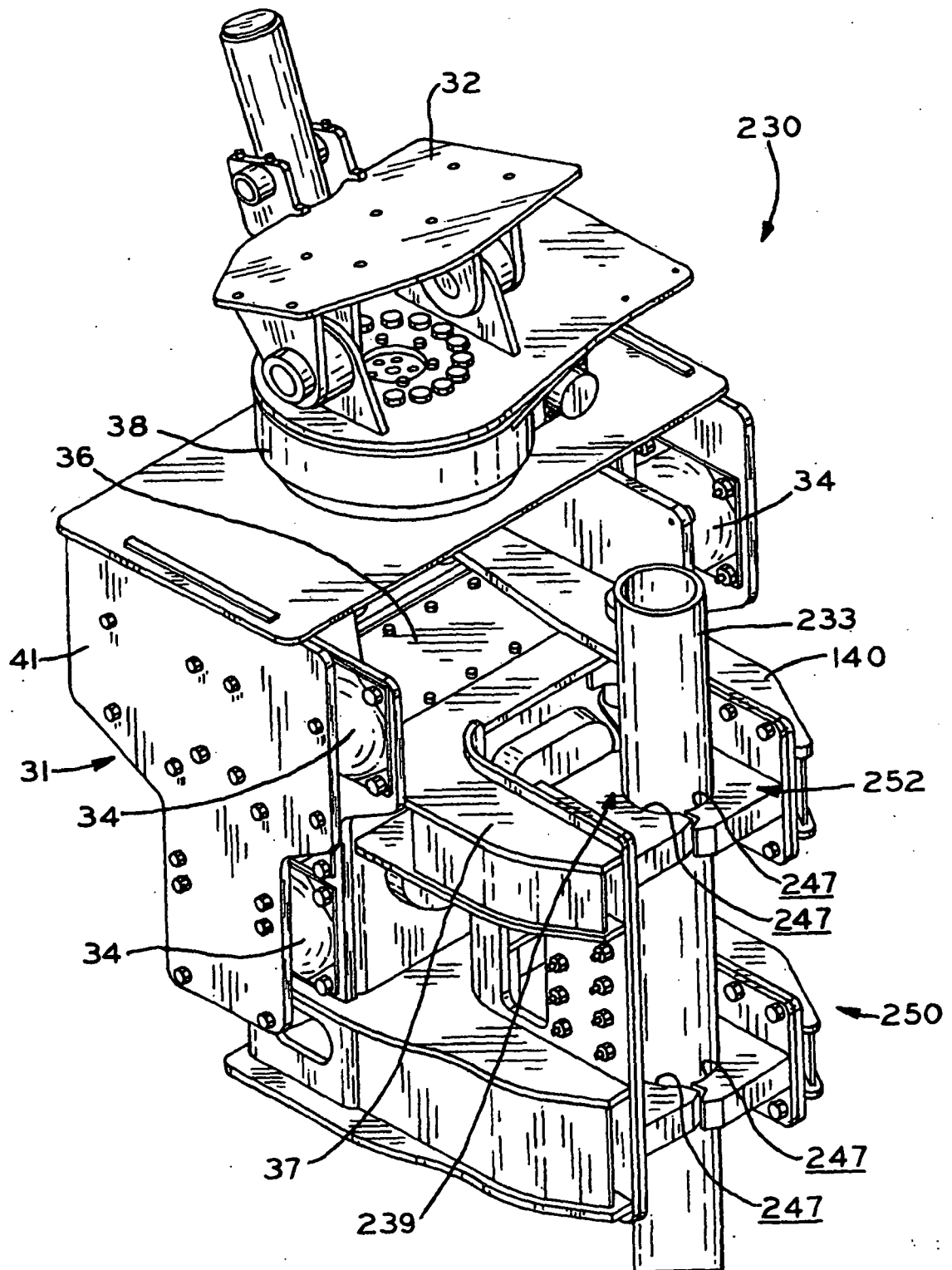


FIG. 13

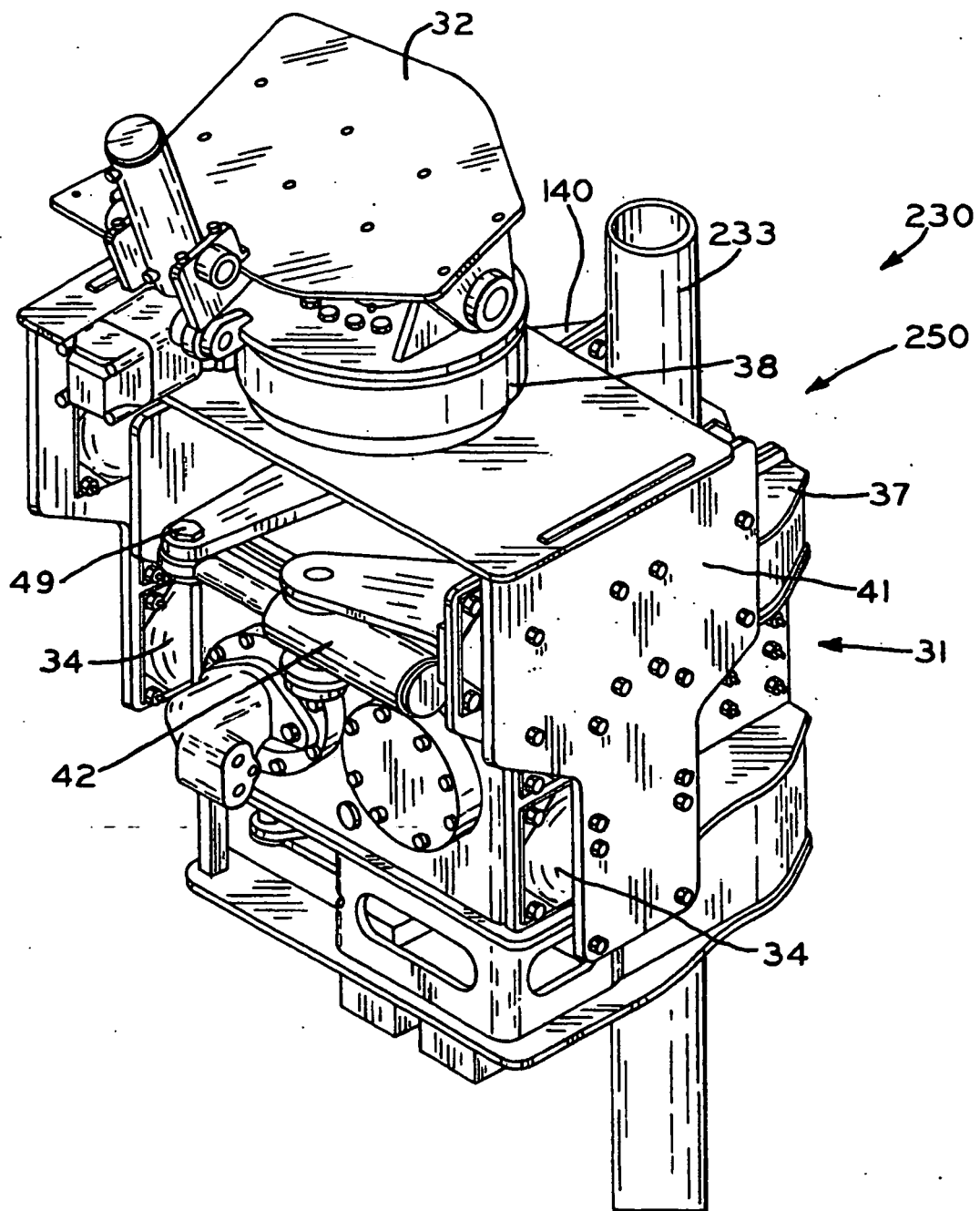


FIG. 14

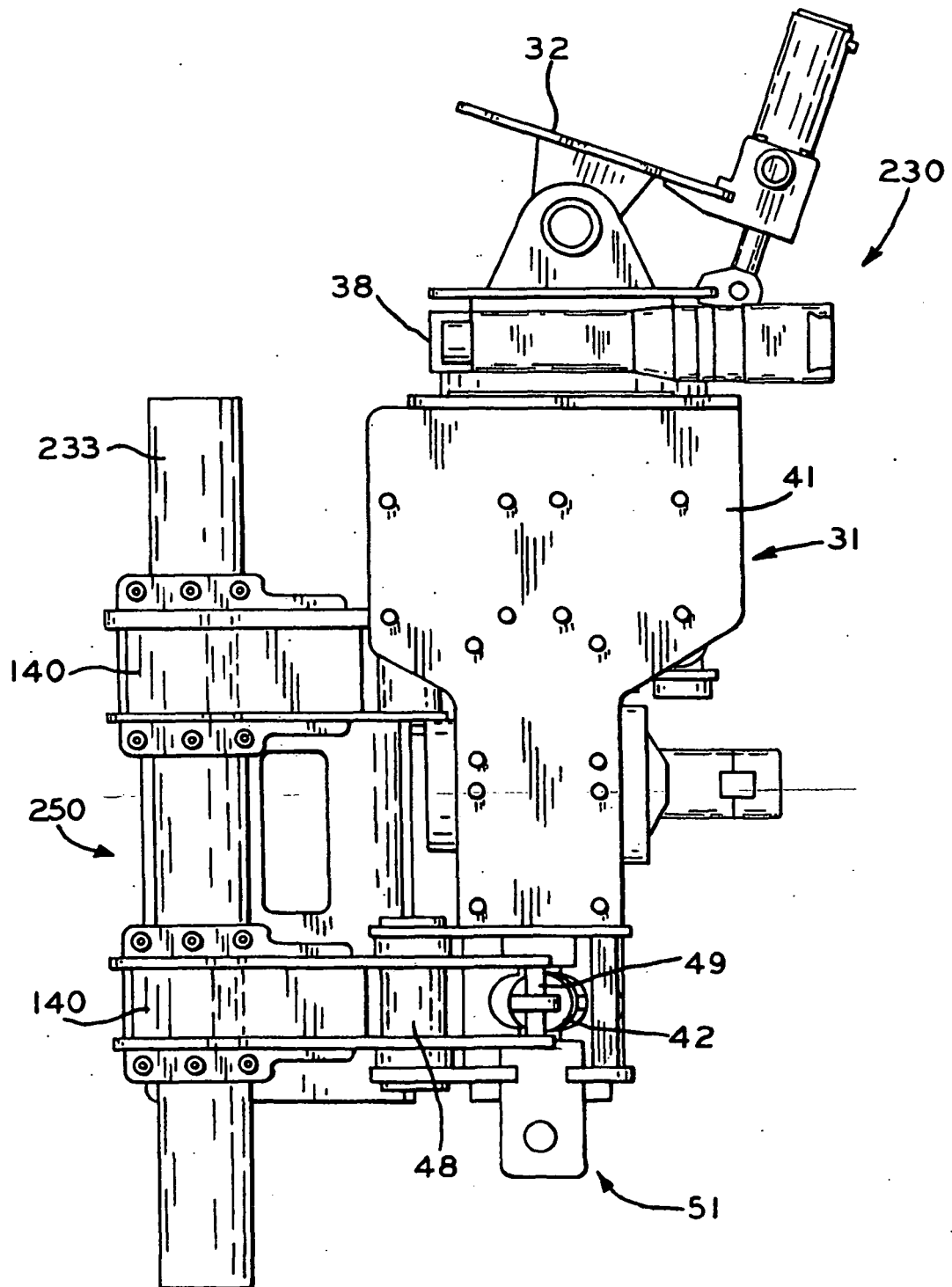


FIG. 15

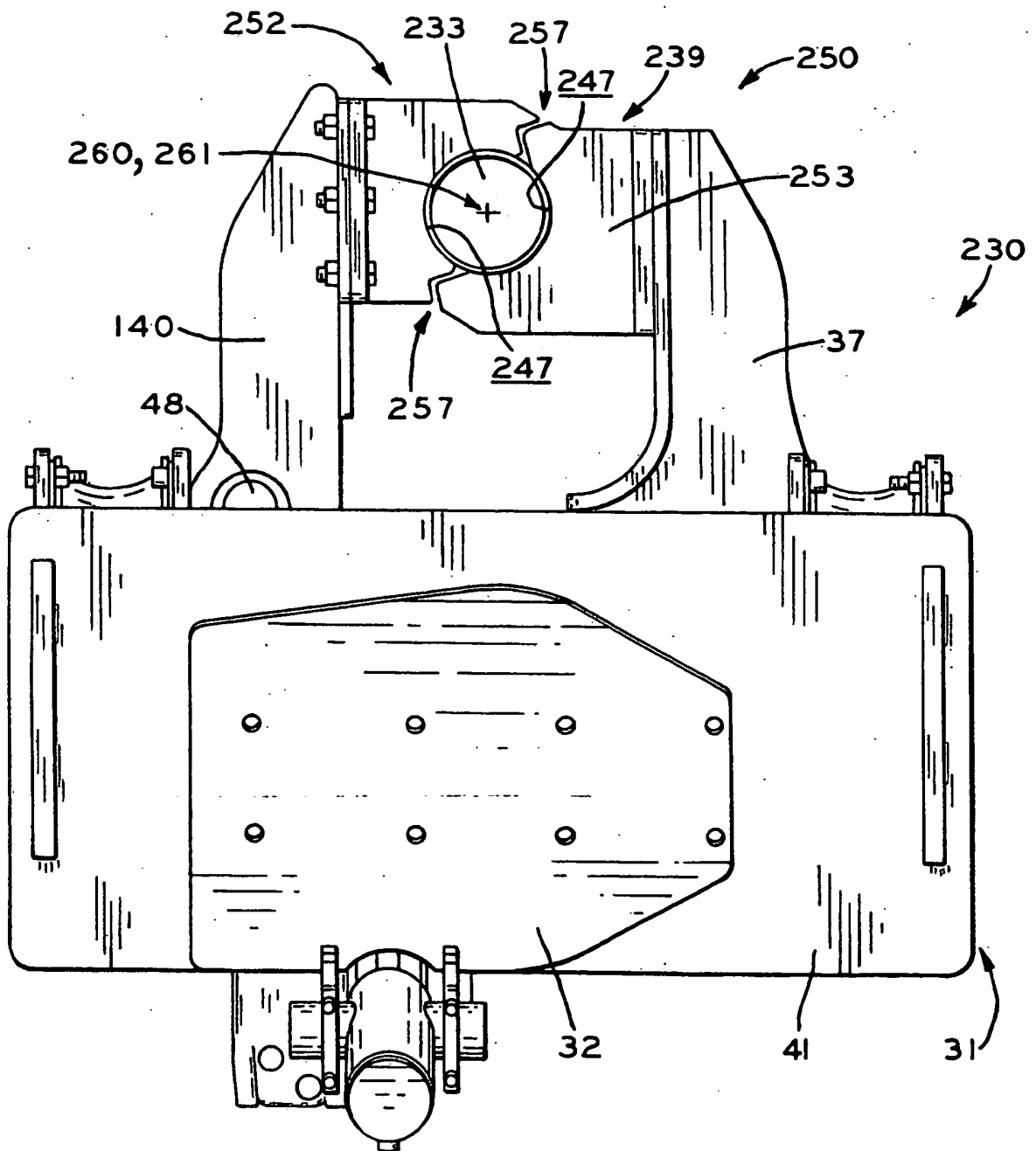
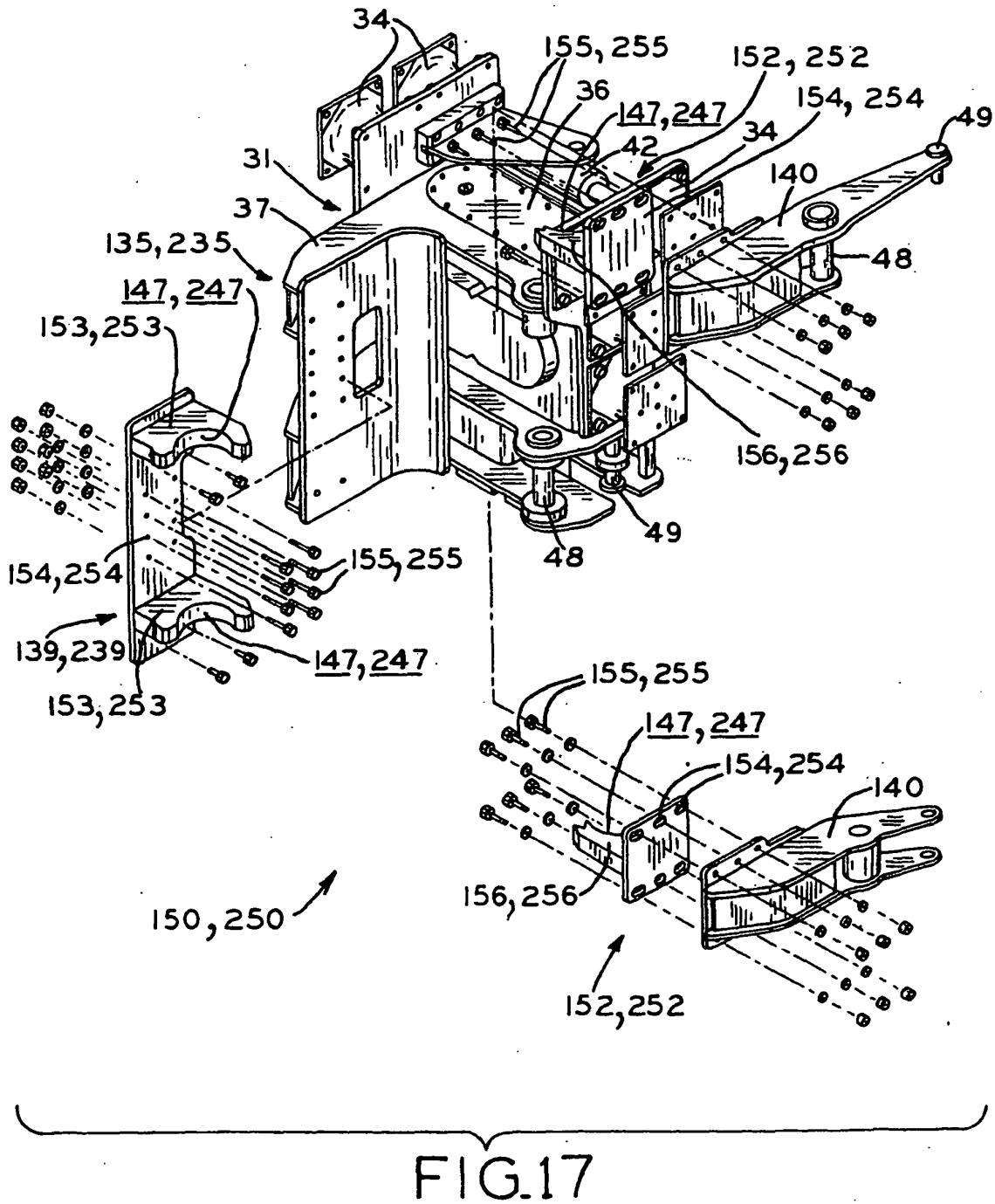


FIG. 16



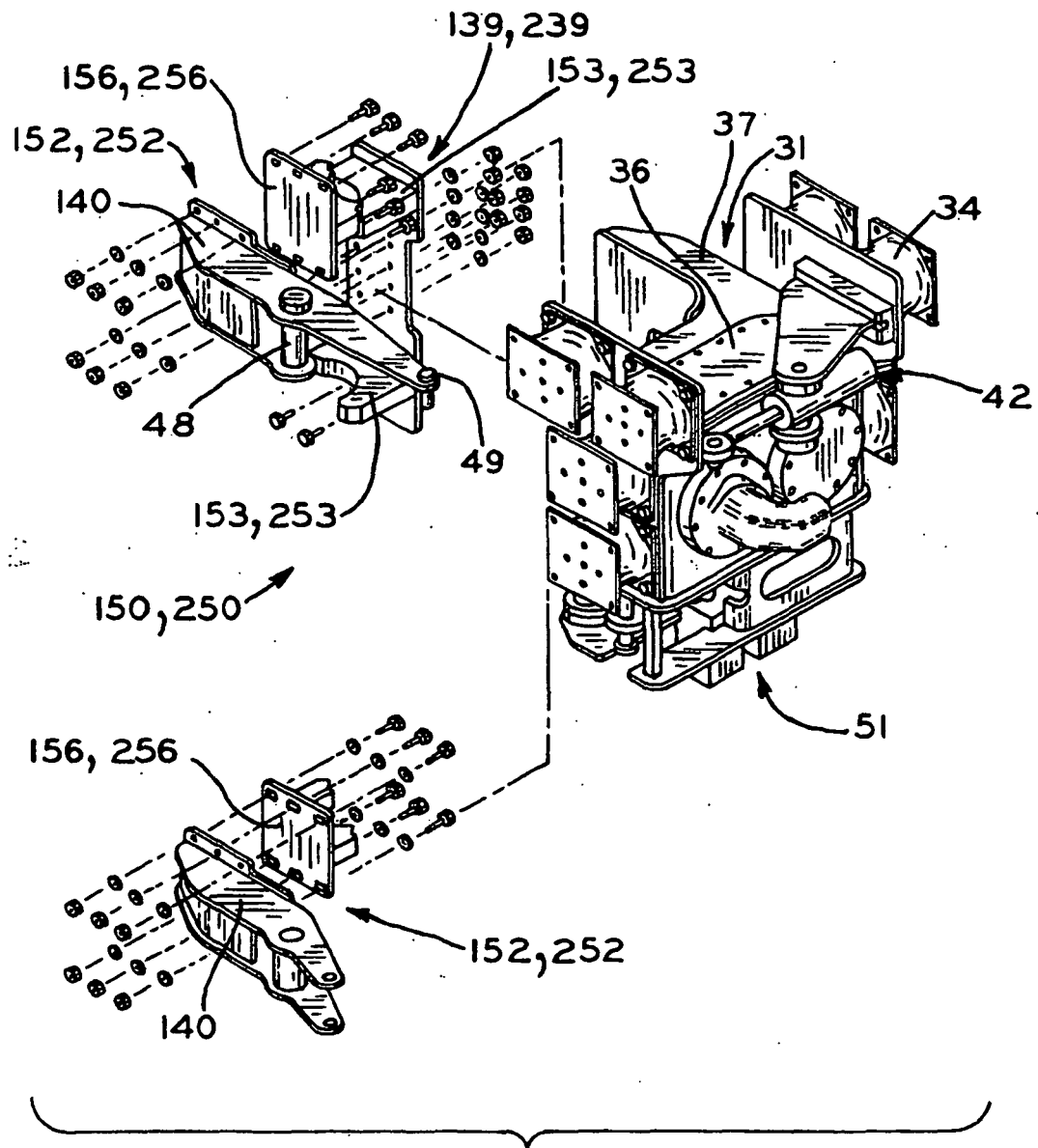


FIG. 18

REFERENCES CITED IN THE DESCRIPTION

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