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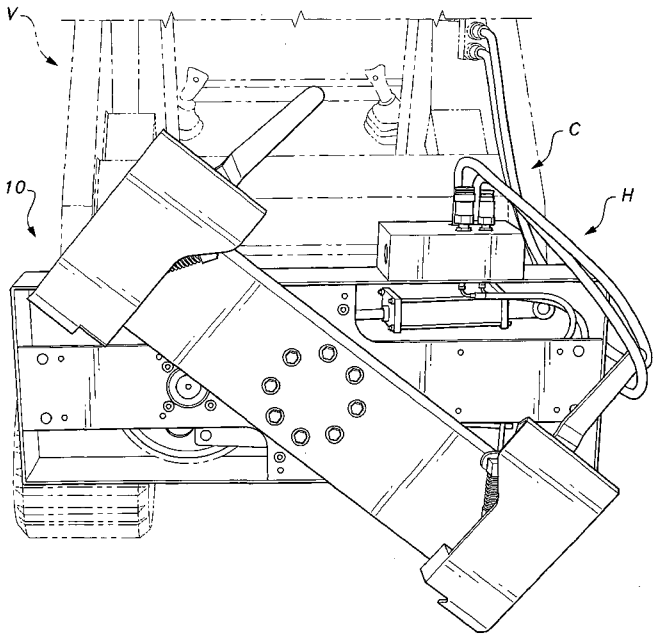

Fig. 1

(57) Abstract: The rotational connector for a lifting machine (10) is a coupler that is releasably mounted on the front end of a lifting machine (V), such as a skid steer. The connector (10) allows an auxiliary lifting apparatus (A) to be mounted to the machine (V) and selectively rotates the auxiliary lifting apparatus (A). The rotational connector (10) includes a housing (12), which is releasably attached to the front end of the machine (V). At least one hydraulic piston (70) is mounted within the housing (12) for selectively driving rotation of a rotating mount (24). A rotating support (14) is secured to the rotating support (24), and selective rotation of the rotating support (24) is driven by rotation of the rotating mount (24). The rotating support (24) includes a quick pin or quick attach connector for releasably securing the auxiliary lifting apparatus (A) thereto.

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ROTATIONAL CONNECTOR FOR LIFTING MACHINE

TECHNICAL FIELD

The present invention relates to attachments for lifting machines, such as skid steers, front end loaders, forklifts, tractors or the like, and more particularly, to a rotational connector for a lifting machine that provides a coupler permitting rotation of any conventional attachment that would otherwise be directly attached to the machine.

BACKGROUND ART

Various attachments have been made to enable lifting machines, such as skid steers, front end loaders, tractors, forklifts, and the like, to lift loads that the conventional bucket, forks, or three-point hitch can handle only with difficulty. However, these attachments are usually single-purpose devices, being specially designed for one particular type of machine and one particular type of load, with each attachment having its own dedicated mounting system. Further, such attachments typically only provide lifting and lowering along the vertical axis. It would be desirable to provide a connector adapted for attachment to a variety of machines that can be adapted to further connect to a wide variety of auxiliary lifting devices, and that further can provide driven and controlled rotation of those devices. Thus, a rotational connector for a lifting machine solving the aforementioned problems is desired.

DISCLOSURE OF INVENTION

The rotational connector for a lifting machine is a connector that is releasably mounted on the front end of a vehicle or lifting machine, such as a skid steer loader, a forklift or the like. The connector allows an auxiliary lifting apparatus, such as a pair of gripping arms, to be mounted to the vehicle, and further allows for the selective, driven rotation of the auxiliary lifting apparatus.

The rotational connector includes a mounting portion, which is releasably mounted to the front end of the vehicle. The mounting portion includes a housing, which defines an open interior region. The housing is releasably secured to the front end of the vehicle through the use of a "quick pin" or "quick attach" connector, as is conventionally provided on lifting machines, such as skid steer loaders, forklifts and the like.

At least one hydraulic piston is mounted within the open interior region of the housing for selectively driving rotation of a first gear, which is also rotatably mounted within the open

interior region of the housing. A rotating mount is rotatably attached to the housing, and a second gear is mounted on the rotating mount and is positioned within the open interior region of the housing. The second gear engages the first gear so that driven rotation of the first gear causes the second gear to rotate, and rotation of the second gear causes the rotating mount to rotate.

A rotating support is attached to the rotating mount, and selective rotation of the rotating support is driven by rotation of the rotating mount. The rotating support includes a quick pin or quick attach connector for releasably attaching the auxiliary lifting apparatus thereto.

These and other features of the present invention will become readily apparent upon further review of the following specification and drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is an environmental, perspective view of a rotational connector for a lifting machine according to the present invention, shown without a lifting attachment.

Fig. 2 is an environmental perspective view of the rotational connector for a lifting machine of Fig. 1, shown with a pair of gripping arms attached to the rotational connector.

Fig. 3 is a partially exploded, perspective view of the rotational connector for a lifting machine according to the present invention, shown with the cover attached to the gear train housing.

Fig. 4 is a rear, perspective view of a rotating support of the rotational connector for a lifting machine according to the present invention.

Fig. 5 is a rear perspective view of the gear train housing of the rotational connector for a lifting machine according to the present invention.

Fig. 6 is a front view of the rotating support of the rotational connector for a lifting machine according to the present invention.

Fig. 7 is a front view of the gear train housing of the rotational connector for a lifting machine according to the present invention, shown with the covers removed and the cruciform support frame partially broken away to show details thereof.

Fig. 8 is a front perspective view of an alternative rotating support of the rotational connector for a lifting machine according to the present invention.

Fig. 9 is a perspective view of adjustable gripping arms for the alternative rotating support of Fig. 8, shown with vertical grapple arms.

Fig. 10 is a perspective view of adjustable gripping arms for the alternative rotating support of Fig. 8, shown with linear gripping arms.

Similar reference characters denote corresponding features consistently throughout the attached drawings.

BEST MODES FOR CARRYING OUT THE INVENTION

As best shown in Figs. 1 and 2, the rotational connector for a lifting machine 10 is a coupler that is releasably mounted on the front end of a lifting machine V, such as a bobcat, a skid steer loader, a forklift or the like. The rotational connector 10 allows a conventional loader attachment or other auxiliary lifting apparatus, such as exemplary gripping arms A, to be mounted to the machine V, and further allows for the selective, driven rotation of the auxiliary lifting apparatus. It should be understood that lifting machine V and gripping arms A are shown for exemplary purposes only.

As best shown in Fig. 3, the rotational connector 10 includes a mounting portion 12, which is releasably mounted to the front end of the machine V (as shown in Figs. 1 and 2). The mounting portion 12 includes a gear train housing 16, which defines an open interior region (as shown in Fig. 7). It should be understood that the dimensions and configuration of housing 16 will be dependent upon the particular type of machine to which the housing 16 is being attached.

Housing 16 includes a pair of longitudinally opposed sidewalls 18, an upper wall 26 and a lower wall 52 (shown in Fig. 5). A hydraulic connector box 20, having a plurality of ports 22 formed therethrough, is mounted on the upper wall 26. As shown in Fig. 1, a plurality of hydraulic lines H, extending from a control system mounted within machine V, are connected to the rotational connector 10 via hydraulic connectors C, which are received within ports 22. The hydraulic drive will be described in detail below, with particular reference to Fig. 7.

The front portion of housing 16 (shown in Fig. 7) is covered by cover 18 (which may be provided in multiple portions, as shown) in order to protect the hydraulic drive from external contaminants. As best shown in Fig. 5, the rear of housing 16 includes a rear frame defined by rear wall 58, an upper frame member 54, a pair of longitudinally opposed side frame members 50, and lower wall 52. Lower wall 52 includes a plurality of openings 56, as shown, that allow housing 16 to be releasably attached to the front end of the machine V through the use of a "quick pin" or "quick attach" connector, as is conventionally provided on

lifting machines, such as skid steer loaders, forklifts and the like. It should be understood that housing 16 may be releasably secured to machine V by any suitable type of connector or mount.

As shown in Fig. 7, at least one hydraulic cylinder 70 is mounted within the open interior region of the gear train housing 16 for selectively driving rotation of a first or drive gear 64, which is mounted within the open interior region of the housing 16, as shown. Preferably, a pair of hydraulic cylinders 70 are provided. Each hydraulic cylinder 70 has a base pivotally attached to rear wall 58 by a pivot pin 76 or the like. Each hydraulic cylinder 70 includes a piston 72, which is pivotally attached at 74 to the first gear 64 by a universal joint, ball and socket joint, or the like. As shown, the piston 72 of the upper hydraulic cylinder 70 is pivotally attached to the upper portion of drive gear 64 and the piston 72 of the lower hydraulic cylinder 70 is pivotally attached to the lower portion of drive gear 64.

Hydraulic lines H and connectors C are in fluid communication with hydraulic cylinders 70, allowing the user to selectively actuate the hydraulic cylinders 70. In order to rotate drive gear 64 about shaft 62 (which extends from rear wall 58 and is attached at the other end to a support frame 60, as shown), one piston 72 is driven to extend while the other is simultaneously retracted, and vice versa to change the direction of rotation.

A second, central shaft 68 is rotatably mounted to rear wall 58 and is rotatably journalled at the other end to support frame 60, as shown. Cruciform support frame 60 extends across the housing 16, as shown, partially covering the front end of the housing 16. A second or driven gear 66 is mounted on second axle 68 for rotation therewith. The driven gear 66 is disposed between support frame 60 and rear wall 58. The driven gear 66, meshes with the drive gear 64 forming a gear train.

A rotating mount 24 (shown as a disk or wheel in Fig. 7) is fixed on shaft 68, as shown. Rotation of the drive gear 64 by extension and retraction of upper and lower pistons 70 causes the driven gear 66 to rotate, and rotation of the driven gear 66 causes the rotating mount 24 to rotate. As shown in Fig. 3, the rotating mount 24 is positioned external to housing 16 and projects beyond cover 18.

As best shown in Fig. 3, a rotating support 14 is fixed to the rotating mount 24 by suitable fasteners. As shown in Fig. 3, a plurality of apertures 38 may be formed through a central member 32 of rotating support 14, corresponding to a plurality of apertures 34 formed through rotating mount 24. A plurality of bolts 30 or the like may pass through apertures 38 and 34 to secure the rotating support 14 to the rotating mount 24. Selective rotation of the rotating support 14 is driven by rotation of the rotating mount 24. It should be understood

that the dimensions and configuration of rotating support 14 may depend upon the particular type of auxiliary apparatus being mounted on the machine V.

As best shown in Figs. 3 and 4, the rotating support 14 includes a pair of front walls (or split front wall) 42, an upper wall 46, a lower wall 45 and a pair of sidewalls 36. The front walls 42 are spaced apart from the central member 32, as shown. As best shown in Figs. 4 and 6, a pair of L-shaped levers 40 are respectively, pivotally mounted to the front walls 42 by pivot pins 44 or the like. Each lever 40 is attached to a sliding arm 80, which is attached to a pin 82, as shown in Fig. 6. Rotation of each lever 40 permits raising and lowering of the corresponding pin 82. Pins 82 are provided so that rotating support 14 may be releasably secured to the auxiliary lifting apparatus via a quick pin or quick attach type connector.

In use, the quick pin or quick attach connector allows the rotational connector 10 to be easily mounted to the front end of any conventional vehicle or lifting machine. The quick pin or quick attach connectors (via pins 82) on the rotating support 14 further allow for the mounting of any suitable auxiliary apparatus, such as the exemplary gripping arms A, to the rotational connector 10. Under control of the user (via controls within the machine V), hydraulic cylinders 70 are actuated to drive translational movement of pistons 72. The translational movement of pistons 72 causes drive gear 64 to rotate, either clockwise or counterclockwise, about shaft 62. This rotation, in turn, causes driven gear 66 and shaft 68 to rotate in the opposite direction. Rotation of the driven gear 66 and shaft 68 produces rotation of rotating mount 24. Rotating support 14 is attached to rotating mount 24 via bolts 30 or the like, and the auxiliary apparatus A is secured to rotating support 14 via quick connect pins 82, thus allowing the auxiliary apparatus A to be selectively rotated. Rotational connector 10 allows for rotation in either direction approximately 98° from the vertical.

Figs. 8 and 9 illustrate an alternative embodiment of the rotational connector 100. As best shown in Fig. 8, the rotating support 14 of Figs. 1-7 is replaced by a support 112 having a central portion 118 for attachment to the gear train housing 16 of the mounting portion of Figs. 1-7. The support 112 is adapted for connection to the gear train housing 16, as described above, or, alternatively, for releasable mounting on the front of the machine V. The support 112 includes an upper portion and a lower portion. Preferably, as shown, the lower portion includes a base 114, a pair of sidewalls 116, an upper frame member 126, with the central portion 118 (for attachment to the gear train housing 16) disposed between the base 114 and upper frame member 126. It should be understood that the particular size and

shape of mounting portion 112 depends upon the type of machine to which the arms are to be attached.

The upper portion of support 112 preferably includes at least one vertical support 132 mounted on the upper frame member 126 for supporting an upper bar 134. Further, a pair of brackets 122 are each mounted to a respective one of a pair of longitudinally opposed surfaces of sidewalls 116 and extend outwardly therefrom. The support 112 may further include upper and lower mounting tubes 133, 137, respectively, depending upon the particular type of machine V to which the support 112 is attached.

As in the previous embodiment, and as shown in Fig. 9, a pair of hydraulic pistons 138 are further provided, with each hydraulic piston 138 having opposed first and second ends. The first end (preferably the cylinder) of each hydraulic piston 138 is pivotally attached to a respective one of the pair of brackets 122. Each bracket 122 has openings 124 formed therethrough for receiving a pivot pin 144 or the like for pivotally attaching the first end of the hydraulic piston 138 to the respective bracket 122.

As shown in Fig. 10, a pair of linear gripping arms 110, for gripping poles or the like, are provided, with each gripping arm 110 having an upper end, a lower end and a central portion. The second ends (preferably the piston or rod) of the pair of hydraulic pistons 138 are each pivotally attached to a respective central portion of a respective one of the pair of gripping arms 110. The upper ends of the pair of gripping arms each have an upper mounting portion 156, so that the upper mounting portions 156 are releasably and pivotally attached to upper bar 134 of the upper portion of the support 112. Similarly, the lower ends of the pair of gripping arms 110 each have lower mounting portions 111, with the lower mounting portions 111 being releasably pivotally attached to the base 114 of the lower portion of the support 112. Once attached, a longitudinal distance between the upper mounting portions 156 and a longitudinal distance between the lower mounting portions 111, with respect to the support frame, are user selectable and adjustable; i.e., the width between the arms 110 is adjustable.

In order to aid in the adjustable attachment of the gripping arms 110 to the support 112, a plurality of upper openings 136 are formed through the upper bar 134 of the upper portion of the support 112, and a plurality of lower openings 120 are formed through the base 114 of the lower portion thereof. The pluralities of upper and lower openings 136, 120, respectively, are arrayed along the longitudinal direction, as shown. A pair of removable upper pivot pins 158 or the like, and a pair of removable lower pivot pins 160 or the like are provided so that the pair of removable upper pivot pins 158 are releasably and removably inserted through a respective pair of the upper openings 136 and a pair of openings formed

through the rear mounts 156. Similarly, the pair of removable lower pivot pins 160 are releasably and removably inserted through a respective pair of openings formed through the lower mounting portions 111 of the pair of gripping arms 110 and a selected pair of the plurality of lower openings 120.

Lifting machines, such as skid steer loaders, forklifts and the like are conventionally provided with auxiliary hydraulic controls. In use, the hydraulic cylinders 138 are attached to the auxiliary hydraulic inputs of the machine V, allowing the operator of the machine V to selectively actuate the hydraulic cylinders 138 to open and close the gripping arms 110 about the object to be lifted or moved.

As best shown in Fig. 10, each gripping arm 110 includes a laterally extending upper strut 154 attached to the upper mounting portion 156 and extending forwardly therefrom, along with a laterally extending lower strut 150 attached to the lower mounting portion 111 and extending forwardly therefrom. Each gripping arm 110 further includes a pair of a vertically extending supports 152 joined to laterally opposed ends of the laterally extending upper strut and the laterally extending lower strut 154, 150 and extending therebetween. Each gripping arm 110 further includes a laterally extending bracket 148 attached to, and extending between, central portions of the pair of vertically extending supports 152, with each second end of the pair of hydraulic pistons 138 being pivotally attached to a respective one of the laterally extending brackets 148 by a pivot pin 146 or the like.

Each gripping arm 110 further includes an upper clamping member 164 attached to an inner surface of the laterally extending upper strut 154 and a lower clamping member 162 attached to an inner surface of the laterally extending lower strut 150. The clamping members 164, 162 are formed from a resilient material, such as plastic, having a high coefficient of friction for gripping the object without causing damage from pressure thereto.

In Fig. 9, the pole clamp gripping arms of Fig. 10 are replaced by a pair of vertical grapple gripping arms 200, each gripping arm 200 having a laterally extending upper strut 175 attached to the upper mounting portion 170, a laterally extending lower strut 177 attached to the lower mounting portion 179, and a plurality of laterally extending central struts 174. Each of the laterally extending upper, lower and central struts 175, 177, 174 is substantially arcuate, so that the pair of gripping arms 200 are adapted for releasably grasping a substantially cylindrical object therebetween.

Each gripping arm 200 further includes a plurality of a vertically extending supports 176 joined to the laterally extending upper, lower and central struts 175, 177, 174 and vertically extending therebetween. Each second end (preferably the piston or rod) of the pair

of hydraulic pistons 138 is pivotally attached between a respective adjacent pair of the laterally extending central struts 174 by a pivot pin 178 or the like.

It is to be understood that the present invention is not limited to the embodiments described above, but encompasses any and all embodiments within the scope of the following claims.

CLAIMS

1. A rotational connector for a lifting machine, comprising:

a gear train housing defining an open interior region, the gear train housing being adapted for releasable attachment to the lifting machine;

a rotating mount rotatably extending from the housing;

means for selectively driving rotation of the rotating mount; and

a support attached to the rotating mount, the support being adapted for attaching a lifting accessory to the rotating mount.

2. The rotational connector for a lifting machine as recited in claim 1, wherein said means for selectively driving rotation comprises:

at least one hydraulic piston mounted within said gear train housing;

a drive gear rotatably mounted within said housing, the at least one hydraulic piston selectively driving rotation of the drive gear;

a shaft rotatably mounted in said gear train housing, the shaft having a portion extending from the housing, said rotating mount being coaxially mounted on the portion of the shaft extending from the gear train housing; and

a driven gear mounted on the shaft, the driven gear being disposed within the gear train housing and meshing with the drive gear, whereby selective actuation of the hydraulic cylinder selectively rotates said rotating mount.

3. The rotational connector for a lifting machine as recited in claim 2, wherein said support comprises:

a frame;

a pair of brackets, each of the brackets being mounted to a respective one of a pair of longitudinally opposed sides of the frame;

a pair of hydraulic pistons each having opposed first and second ends, the first end of each said hydraulic piston being pivotally attached to a respective one of the brackets; and

a pair of gripping arms, each of the gripping arms having an upper end, a lower end and a central portion, the second ends of the hydraulic pistons being pivotally attached to a respective central portion of a respective one of the gripping arms, the upper ends of the gripping arms each having an upper mounting portion, the upper mounting portions being releasably and pivotally attached to an upper surface of the upper portion of the frame, the lower ends of the gripping arms having lower mounting portions, the lower mounting

portions being releasably and pivotally attached to a lower surface of the lower portion of the frame.

4. A rotational connector for a lifting machine, comprising:

a gear train housing adapted for attachment to the lifting machine;

a rotating mount disposed outside the housing;

at least one hydraulic piston mounted within the housing;

a gear train disposed within the housing;

a shaft attached to the gear train, the shaft extending from the housing, the rotating mount being disposed on the shaft for rotation therewith, the at least one hydraulic piston selectively driving the gear train;

an accessory support attached to the rotating mount; the accessory support being adapted for attachment of a lifting machine accessory thereto.

5. A rotational connector for a lifting machine, comprising:

a gear train housing defining an open interior region, the gear train housing being adapted for releasable attachment to the lifting machine;

a rotating mount rotatably extending from the housing;

means for selectively driving rotation of the rotating mount; and

a support attached to the rotating mount, the support being adapted for attaching a lifting accessory to the rotating mount, the support comprising:

a frame;

a pair of brackets mounted to a respective one of a pair of longitudinally opposed side edges of the frame;

a pair of hydraulic pistons, each of the hydraulic pistons having opposed first and second ends, the first end of the hydraulic pistons being pivotally attached to a respective one of the brackets; and

a pair of gripping arms, each of the gripping arms having an upper end, a lower end and a central portion, the second ends of the hydraulic pistons being pivotally attached to a respective central portion of a respective one of the gripping arms, the upper ends of the gripping arms each having an upper mounting portion, the upper mounting portions being releasably and pivotally attached to an upper surface of the upper portion of the frame, the lower ends of the gripping arms each having lower mounting portions, the lower mounting portions being releasably and pivotally attached to a lower surface of the lower portion of the frame.

6. The rotational connector for a lifting machine as recited in claim 5, wherein a plurality of upper openings are formed through the upper surface of the upper portion and a plurality of lower openings are formed through a lower surface of the lower portion, the pluralities of upper and lower openings being arrayed along the longitudinal direction.

7. The rotational connector for a lifting machine as recited in claim 6, further comprising a pair of removable upper pivot pins and a pair of removable lower pivot pins, the pair of removable upper pivot pins being releasably and removably inserted through a respective pair of openings formed through the upper mounting portions of the pair of gripping arms and a selected pair of said plurality of upper openings, the pair of removable lower pivot pins being releasably and removably inserted through a respective pair of openings formed through the lower mounting portions of the pair of gripping arms and a selected pair of said plurality of lower openings.

8. The rotational connector for a lifting machine as recited in claim 7 wherein each said gripping arm includes a laterally extending upper strut attached to the upper mounting portion, and a laterally extending lower strut attached to the lower mounting portion.

9. The rotational connector for a lifting machine as recited in claim 8, wherein each said gripping arm further includes a pair of a vertically extending supports joined to laterally opposed ends of the laterally extending upper strut and the laterally extending lower strut and extending therebetween.

10. The rotational connector for a lifting machine as recited in claim 9, wherein each said gripping arm further includes a laterally extending bracket attached to, and extending between, central portions of said pair of vertically extending supports, the second end of each said hydraulic piston being pivotally attached to a respective one of said laterally extending brackets.

11. The rotational connector for a lifting machine as recited in claim 8, wherein each said gripping arm further includes an upper clamping member attached to an inner surface of the laterally extending upper strut, and a lower clamping member attached to an inner surface of the laterally extending lower strut.

12. The rotational connector for a lifting machine as recited in claim 7, wherein each said gripping arm includes a laterally extending upper strut attached to the upper mounting portion, a laterally extending lower strut attached to the lower mounting portion, and a plurality of laterally extending central struts.

13. The rotational connector for a lifting machine as recited in claim 12, wherein each of the laterally extending upper, lower and central struts is substantially arcuate,

whereby said pair of gripping arms are adapted for releasably grasping a substantially cylindrical object therebetween.

14. The rotational connector for a lifting machine as recited in claim 13, wherein each said gripping arm further includes a plurality of a vertically extending supports joined to the laterally extending upper, lower and central struts and vertically extending therebetween.

15. The rotational connector for a lifting machine as recited in claim 14, wherein the second end of each said hydraulic piston is pivotally secured between a respective adjacent pair of said laterally extending central struts.

16. The rotational connector for a lifting machine as recited in claim 5, wherein said means for selectively driving rotation comprises:

at least one hydraulic piston mounted within said gear train housing;

a drive gear rotatably mounted within said housing, the at least one hydraulic piston selectively driving rotation of the drive gear;

a shaft rotatably mounted in said gear train housing, the shaft having a portion extending from the housing, said rotating mount being coaxially mounted on the portion of the shaft extending from the gear train housing; and

a driven gear mounted on the shaft, the driven gear being disposed within the gear train housing and meshing with the drive gear, whereby selective actuation of the hydraulic cylinder selectively rotates said rotating mount.

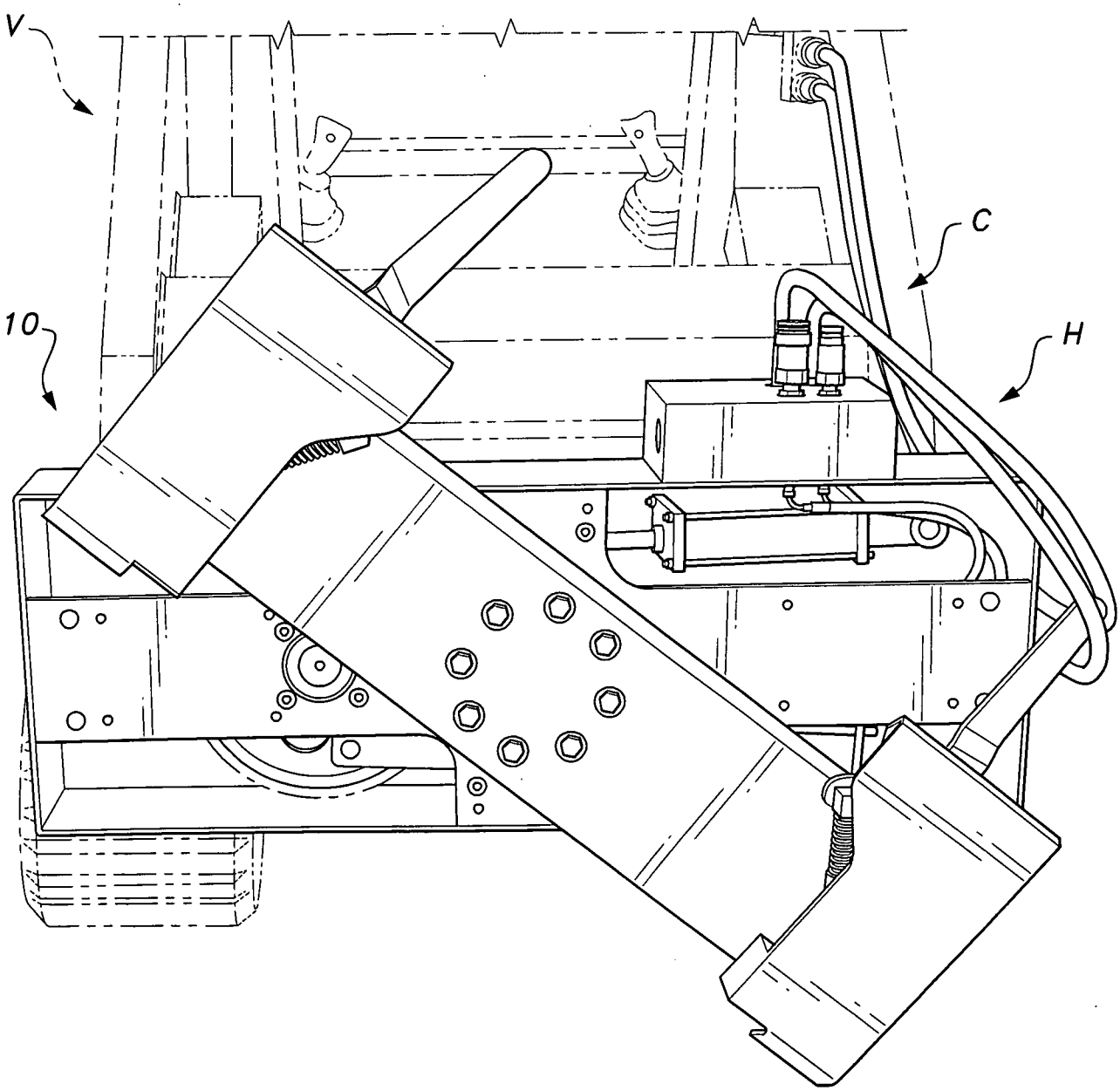

Fig. 1

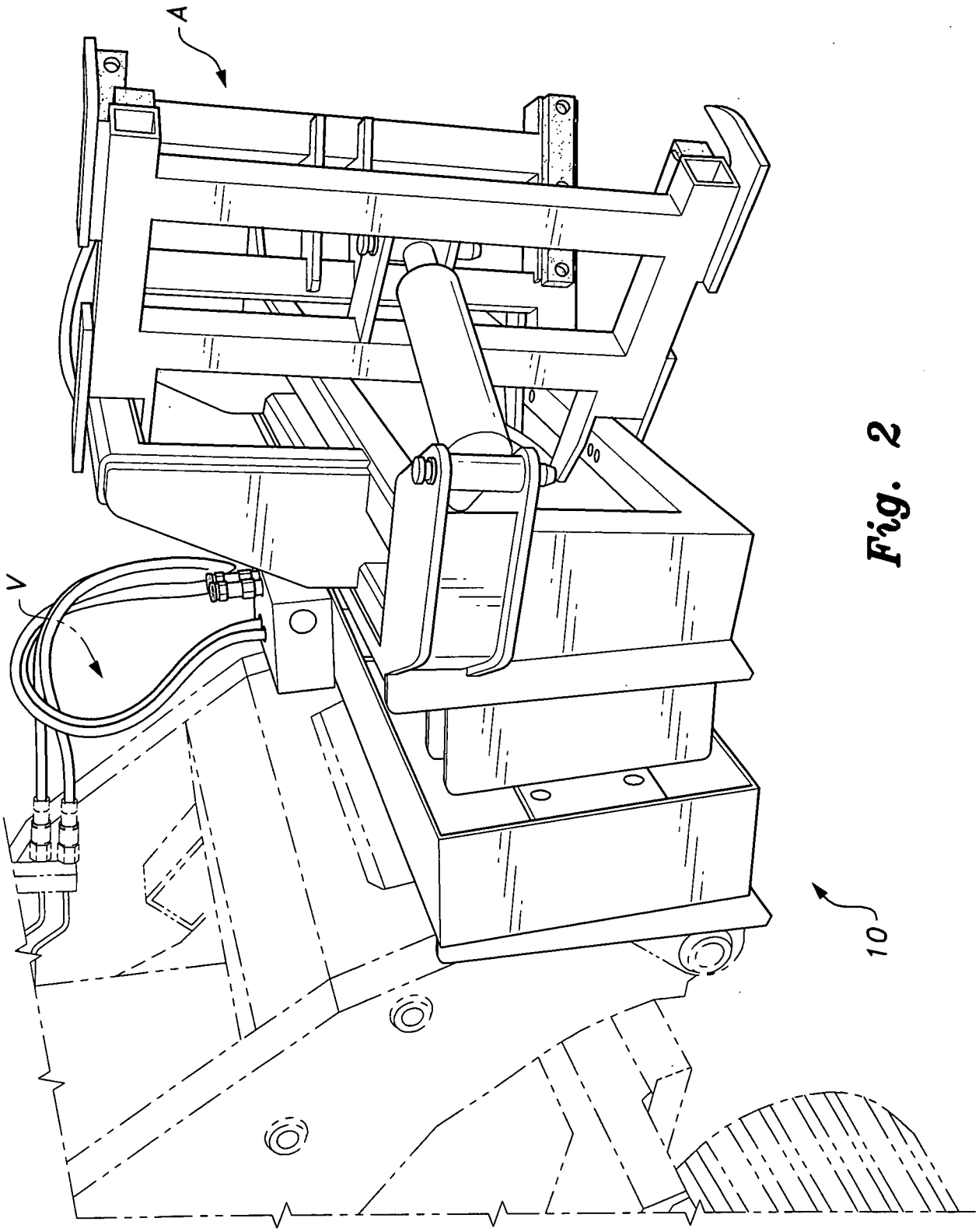

Fig. 2

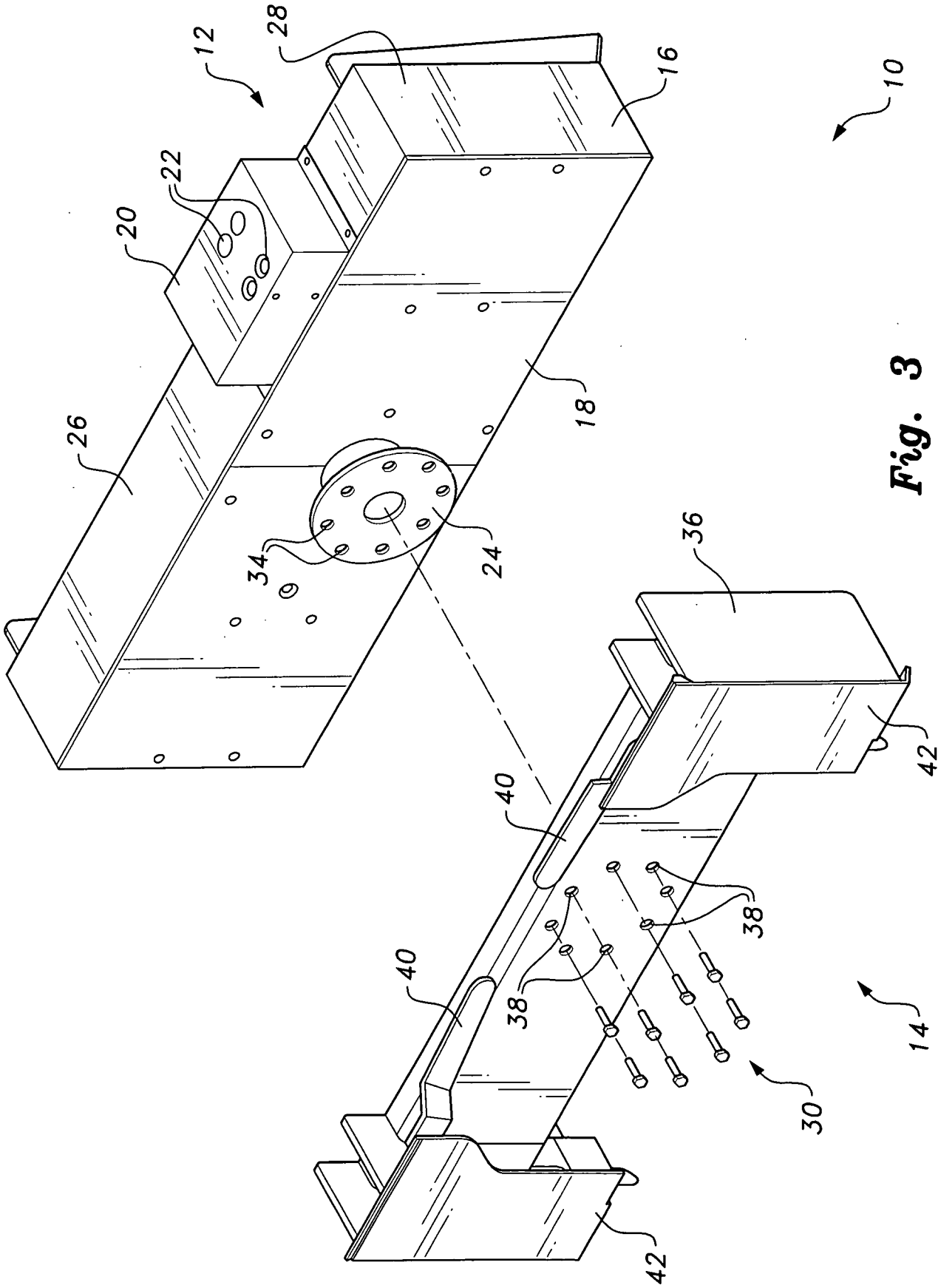

Fig. 3

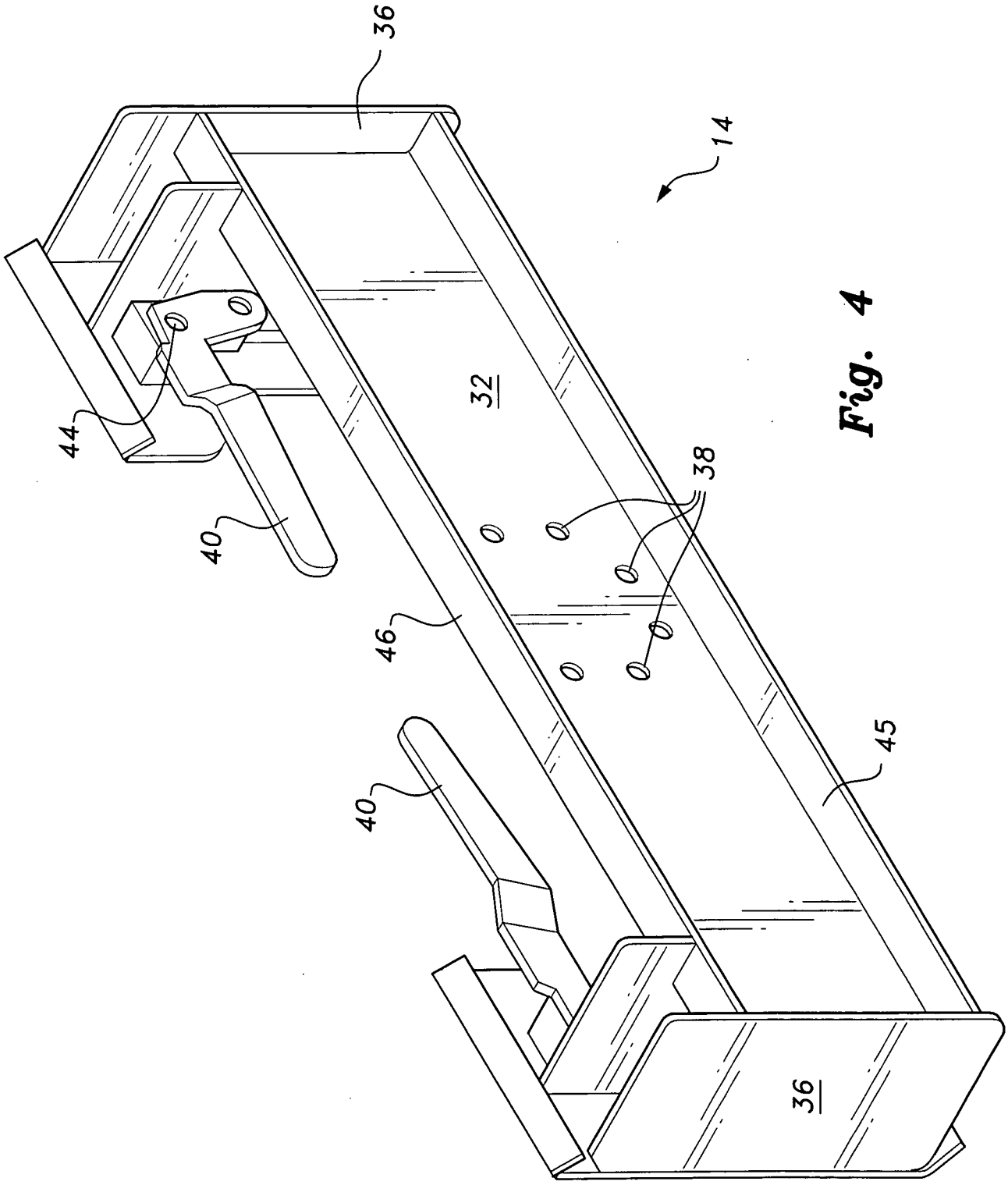

Fig. 4

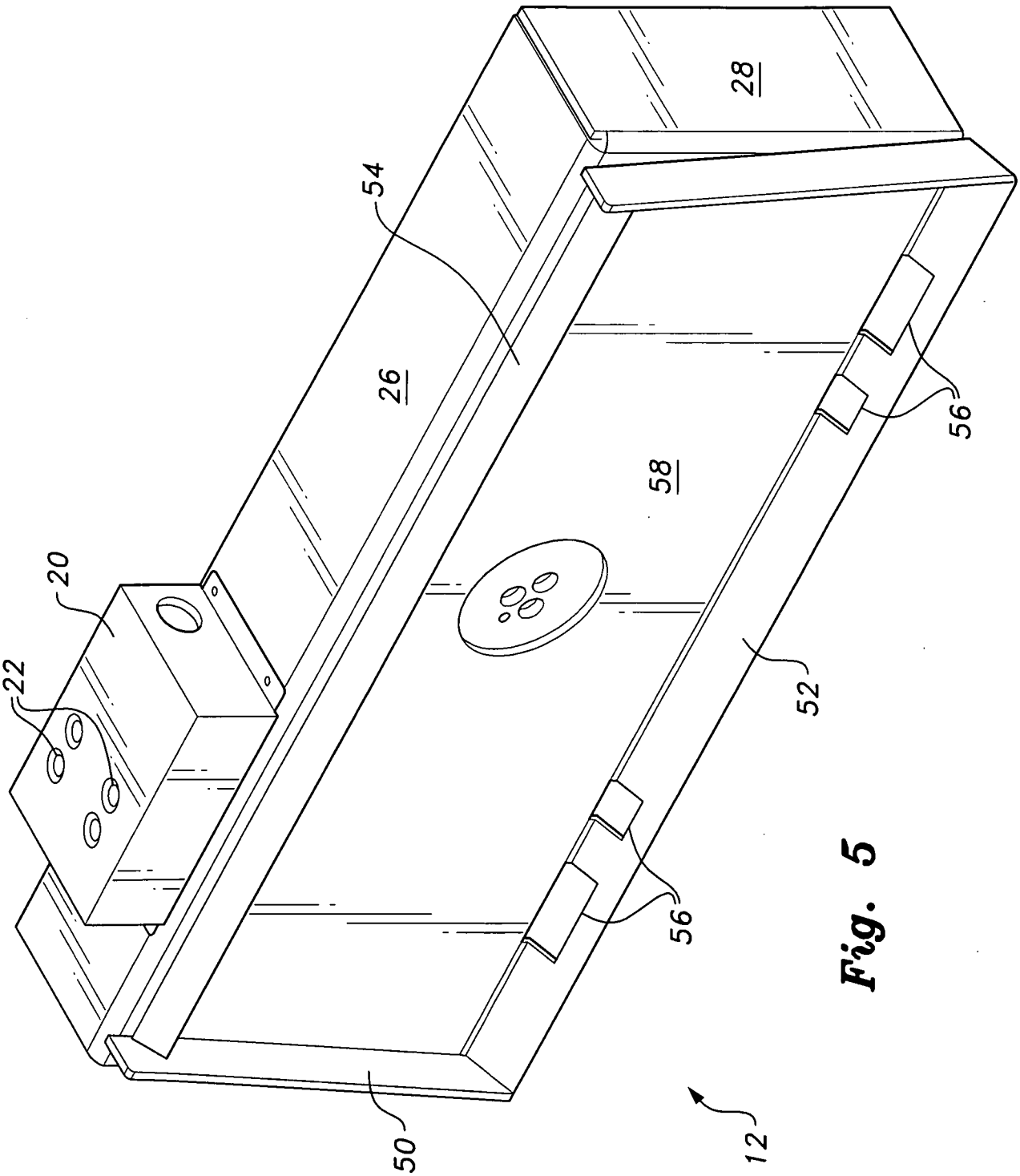

Fig. 5

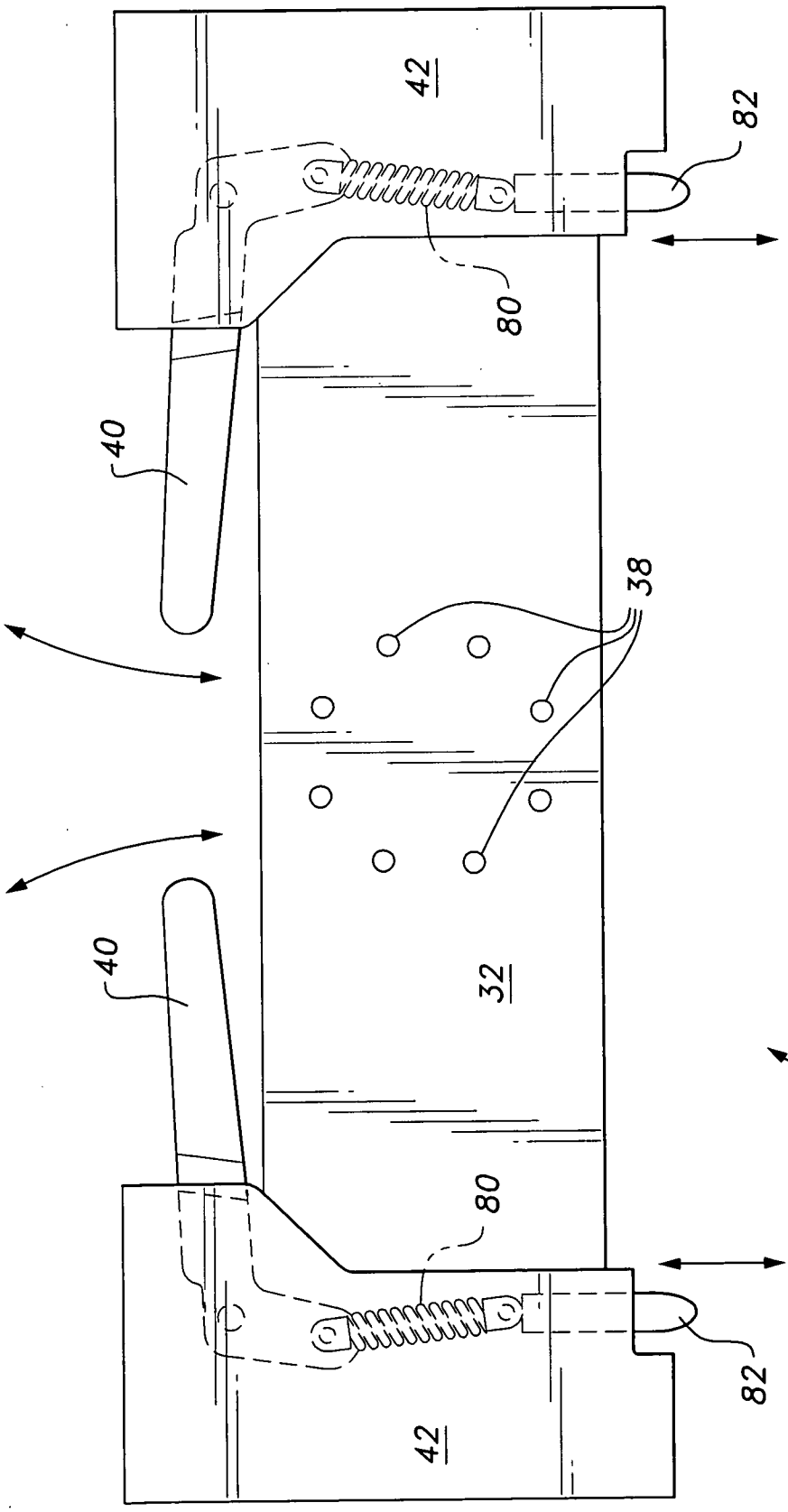

Fig. 6

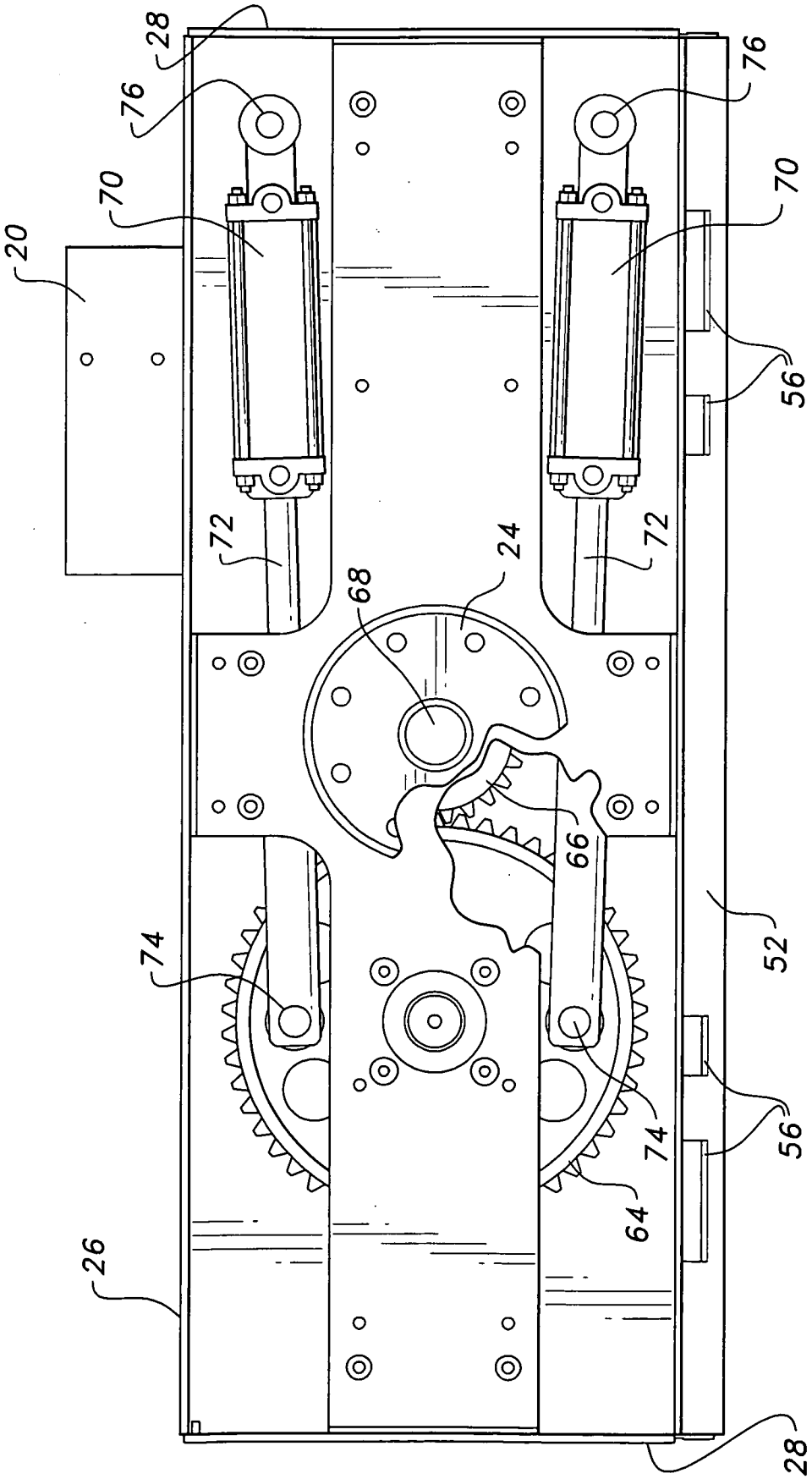

Fig. 7

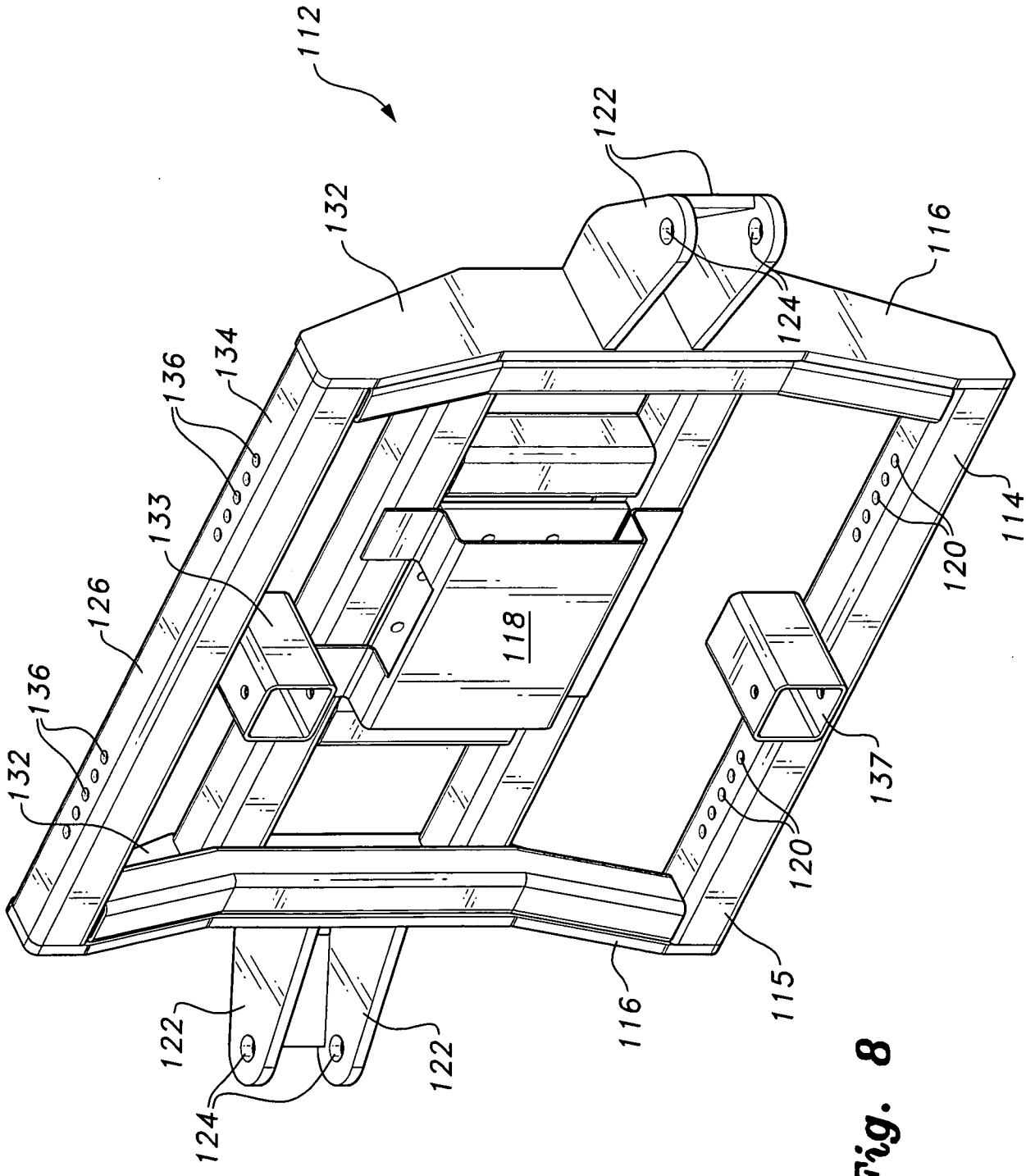

Fig. 8

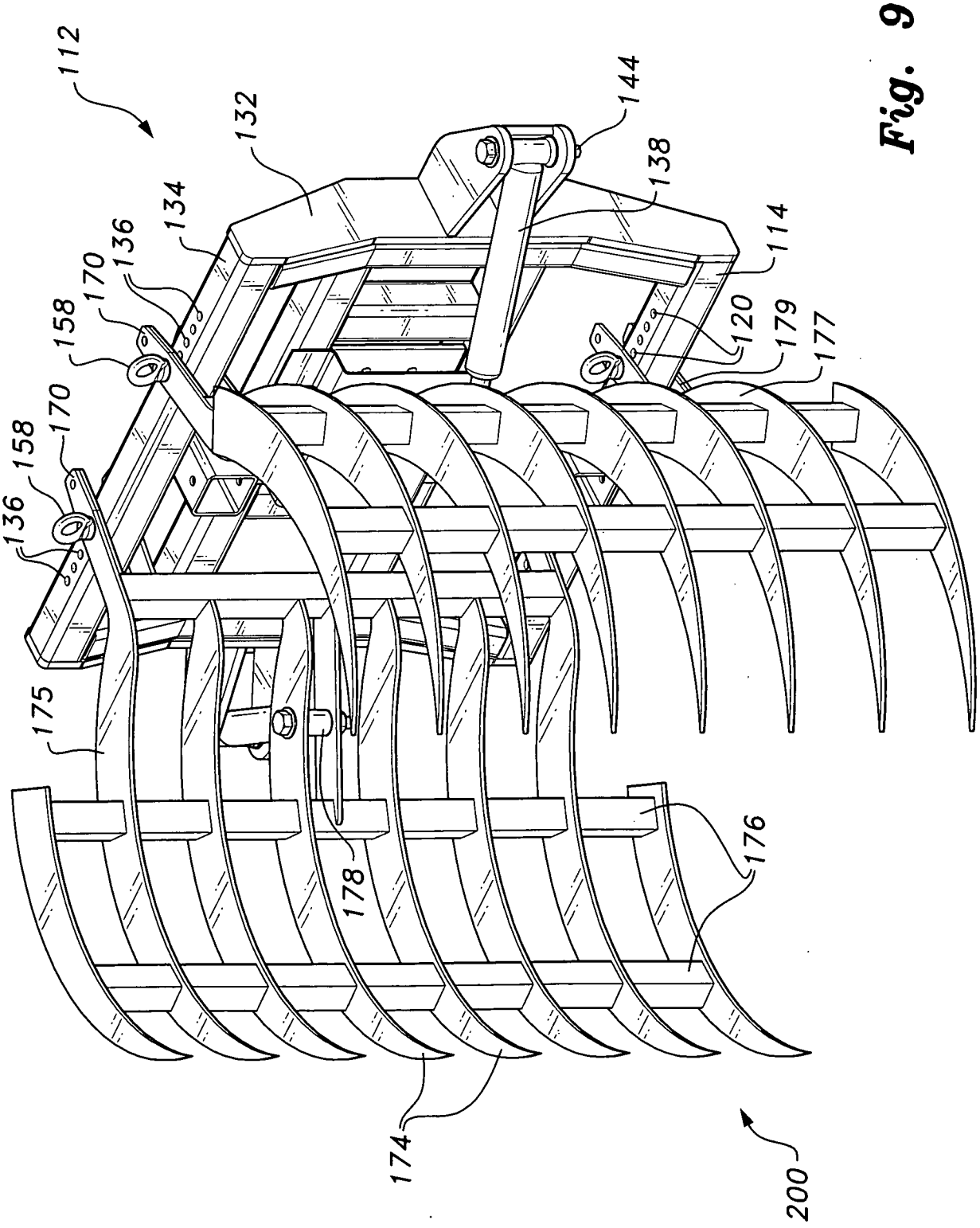
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Fig. 9

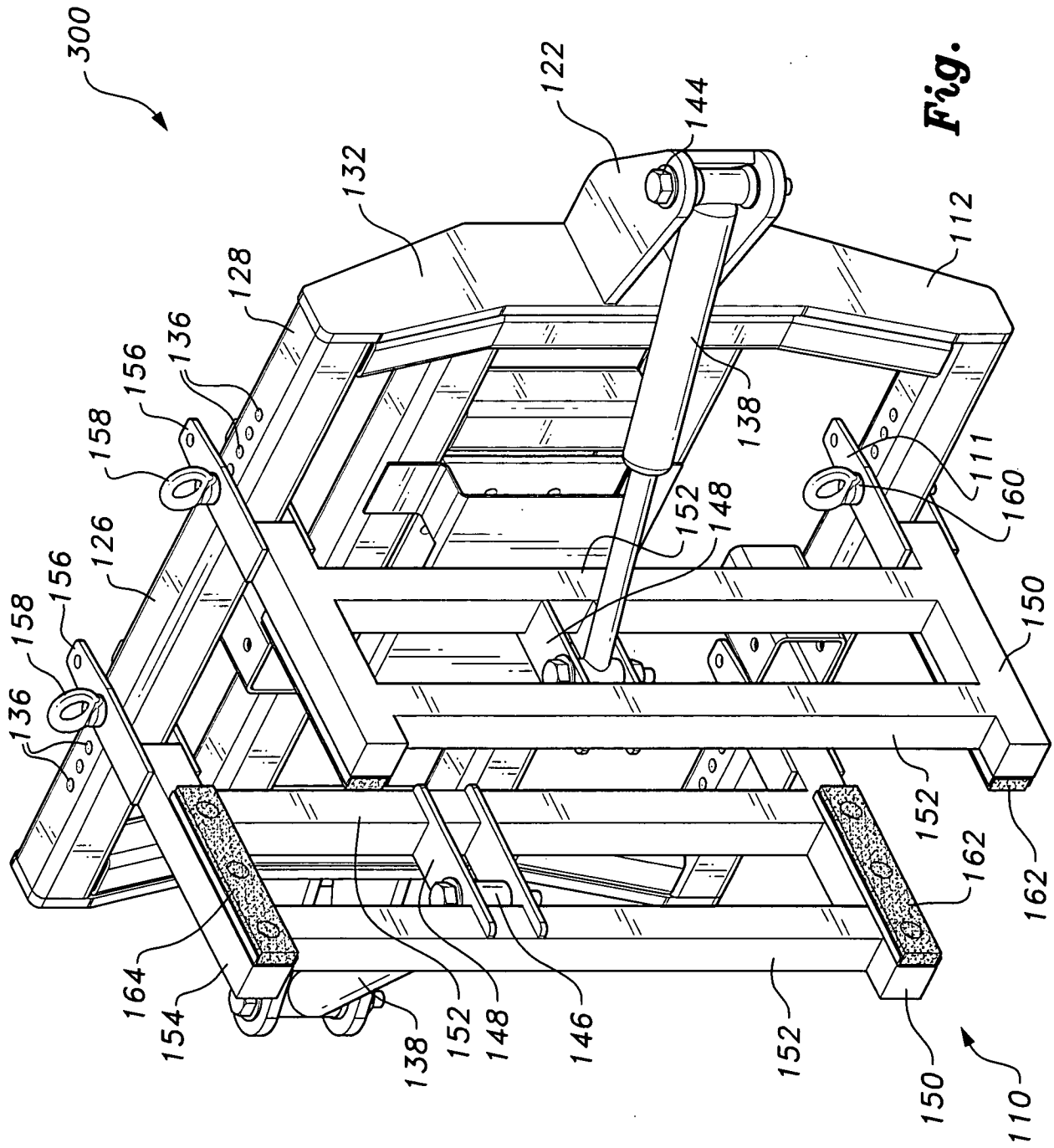
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Fig. 10