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(71) Applicant (for all designated States except US):  
**HUSQVARNA CONSUMER OUTDOOR PRODUCTS  
N.A., INC.** [US/US]; 9335 Harris Corners Parkway, Suite  
500, Charlotte, North Carolina 28269 (US).

(72) Inventor; and

(75) Inventor/Applicant (for US only): **CANONGE, Eric**  
[US/US]; 6139 Waverly Lynn Ln., Charlotte, North Caro-  
lina 28269 (US).

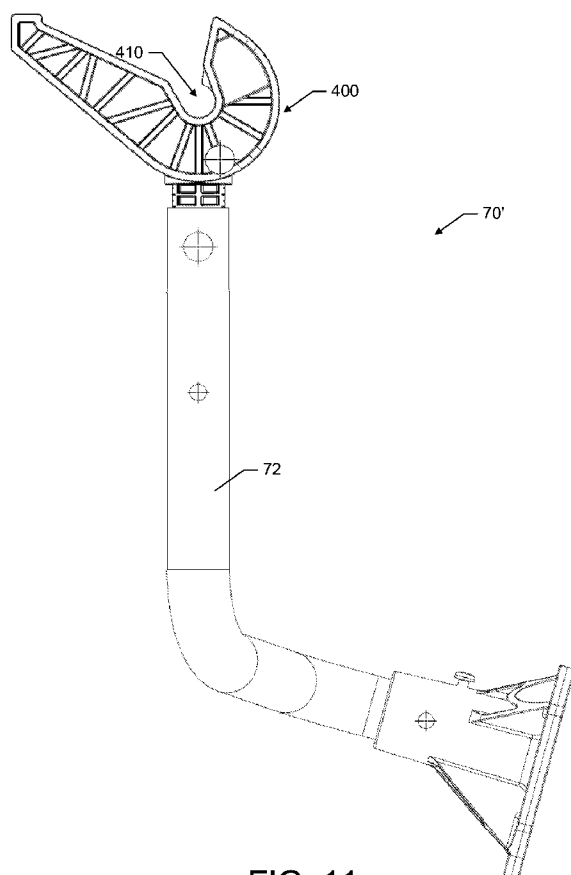
(74) Agents: **THORSON, Chad L.** et al.; Customer No.  
100577, Nelson Mullins Riley & Scarborough LLP, Bank  
of America Corporate Center, 42nd Floor, 100 North Try-  
on Street, Charlotte, North Carolina 28202-4007 (US).

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(54) Title: BAGGING ATTACHMENT DUMP MECHANISM AND VEHICLE ATTACHMENT MECHANISM

(57) Abstract: A pivot assembly for dumping a bagging attachment of a rear discharge riding lawn care vehicle may include at least two pivot sockets, first and second support brackets and a carriage assembly receiver.



**FIG. 11.**



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## BAGGING ATTACHMENT DUMP MECHANISM AND VEHICLE ATTACHMENT MECHANISM

### TECHNICAL FIELD

5           Example embodiments generally relate to vehicle attachments and, more particularly, relate to attachments for vehicles configured for performing lawn maintenance.

### BACKGROUND

10           Lawn care tasks are commonly performed using various tools and/or machines that are configured for the performance of corresponding specific tasks. Certain tasks, like grass cutting, are typically performed by lawn mowers. Lawn mowers themselves may have many different configurations to support the needs and budgets of consumers. Walk-behind lawn mowers are typically compact, have comparatively small engines and are  
15 relatively inexpensive. Meanwhile, at the other end of the spectrum, riding lawn mowers, such as lawn tractors, can be quite large. Riding lawn mowers can sometimes also be configured with various functional accessories (e.g., trailers, tillers and/or the like) in addition to grass cutting components. Riding lawn mowers provide the convenience of a riding vehicle as well as a typically larger cutting deck as compared to a walk-behind  
20 model.

          Some riding lawn mowers and lawn tractors may include attachments, such as bagging attachments that are configured to receive debris such as grass clippings or other yard waste in a container that can be detached or otherwise emptied. For a rear discharge riding lawn mower or lawn tractor, a specifically designed bagging attachment is typically  
25 designed for each model of riding lawn mower or lawn tractor in order to provide a good

seal with the bagging attachment. If the bagging attachment does not mate well with the riding lawn mower or lawn tractor, the contents of the bagging attachment may escape.

In many situations, bagging attachments may be mounted to an assembly that may allow the bagging attachments to pivot during installation and/or operation for dumping activities. A pivot assembly provided for these purposes may wear over time and result in a loose fit, excessive vibration/noise, and/or inferior operation characteristics. This loose fit or noise, for example, may cause an operator or potential purchaser of the lawn mower or lawn tractor to have a perception of inferior quality that may provide a negative impact on current and future sales. Moreover, a loose fit may enable debris to escape from the bagging attachment thereby reducing the effectiveness of the bagging attachment.

### BRIEF SUMMARY OF SOME EXAMPLES

Accordingly, in order to provide a mechanism by which to enable operators to dump a bagging attachment via a low friction dump system that employs advantageous geometric configurations for easy operation, some embodiments may provide a dump system with one or more features described herein to improve dump efficiency and/or performance. For example, some embodiments may provide a dump system that employs a low friction pivot assembly. Some embodiments may provide a dump system that employs a substantially vertically oriented moment arm that lifts a rear portion of the bagging attachment to cause the bagging attachment to rotate via the pivot assembly away from engagement with a back plate or rear portion of the lawn mower.

In one example embodiment, a pivot assembly for dumping a bagging attachment of a rear discharge riding lawn care vehicle is provided. The pivot assembly may include at least two pivot sockets, first and second support brackets and a carriage assembly receiver. The at least two pivot sockets may each be disposed in a corresponding one of at least two support rods disposed to extend from a back plate of the riding lawn care vehicle. Each of the support rods may terminate at a distal end thereof at a respective one of the at least two pivot sockets defining a pivot point of the pivot assembly. The first and second support brackets may each be operably coupled to a respective one of the at least two pivot sockets. The first and second support brackets may be operably coupled to one another by at least one cross tube. The first and second support brackets may support opposing ends of an axle configured to operably couple to the at least two pivot sockets at the pivot point. The carriage assembly receiver assembly may be operably coupled to the first and second support brackets to engage a carriage assembly of the bagging attachment. The carriage

assembly may be operably coupled to a bag frame of the bagging attachment. A moment arm for pivoting the pivot assembly about the pivot point between a first position in which material is collectable in the bagging attachment via the rear discharge and a second position in which contents of the bagging attachment are dumped may be located rearward of the pivot point and may have an initially vertical orientation.

In another example embodiment, a riding lawn care vehicle is provided. The riding lawn care vehicle may include a rear discharge disposed at a rear of the riding lawn care vehicle and a bagging attachment configured to attach to the rear of the riding lawn care vehicle to receive debris discharged via the rear discharge. The bagging attachment may include a carriage assembly to which a bag frame of the bagging attachment is operably coupled. The riding lawn care vehicle may further include a pivot assembly and a bagging attachment support structure. The bagging attachment support structure may be configured to support the carriage assembly relative to the riding lawn care vehicle. The bagging attachment support structure may be operably coupled to the pivot assembly about which the bag frame is pivotable to rotate the bag frame between a first position in which material is collectable in the bagging attachment via the rear discharge, and a second position in which the bag frame is rotated to a dump position for emptying contents of the bagging attachment. The pivot assembly may include at least two pivot sockets each of which is disposed in a corresponding one of at least two support rods of the bagging attachment support structure. The at least two support rods may be disposed to extend from a back plate of the riding lawn care vehicle. Each of the support rods may terminate at a distal end thereof at a respective one of the at least two pivot sockets defining a pivot point of the pivot assembly. The pivot assembly may further include a carriage assembly receiver assembly and first and second support brackets each of which is operably coupled to a respective one of the at least two pivot sockets. The first and second support brackets may be operably coupled to one another by at least one cross tube. The first and second support brackets may support opposing ends of an axle configured to operably couple to the at least two pivot sockets at the pivot point. The carriage assembly receiver assembly may be operably coupled to the first and second support brackets to engage the carriage assembly. A moment arm, which pivots the pivot assembly about the pivot point between a first position in which material is collectable in the bagging attachment via the rear discharge and a second position in which contents of the bagging attachment are dumped, may be located rearward of the pivot point and may have an initially vertical orientation.

Some example embodiments may improve an operator's ability to effectively operate a dump system in a relatively easy manner, while obtaining efficient results that are repeatable over the lifetime of the system. The user experience associated with using attachments on a riding lawn care vehicle, and particularly the bagging attachment of the riding lawn care vehicle may therefore be improved.

#### BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWING(S)

Having thus described the invention in general terms, reference will now be made to the accompanying drawings, which are not necessarily drawn to scale, and wherein:

FIG. 1, which includes FIGS. 1A, 1B, 1C and 1D, illustrates views of a riding lawn care vehicle having a bagging attachment removed (FIG. 1A and 1C) and installed (FIG. 1B and 1D) according to respective different conditions of an example embodiment;

FIG. 2 illustrates an exploded perspective view of a carriage assembly relative to the bagging attachment of the riding lawn care vehicle of FIG. 1 according to an example embodiment;

FIG. 3 illustrates a perspective view of the carriage assembly isolated from other components according to an example embodiment;

FIG. 4 illustrates a perspective view of portions of the bagging attachment support structure according to an example embodiment;

FIG. 5 illustrates a side view of the bagging attachment support structure according to an example embodiment;

FIG. 6 is a side view of the bagging attachment support structure employed without a powered dump (i.e., with a manual dump) according to an example embodiment;

FIG. 7 illustrates an exploded perspective view of a pivot assembly useable in connection with the bagging attachment support structure according to an example embodiment;

FIG. 8 is a side view of an adjustment plate for adjustable mounting of the powered drive relative to the bagging attachment support structure according to an example embodiment;

FIG. 9 illustrates a side view of the bagging attachment support structure and the bag frame to illustrate how the bag frame is supported by the bagging attachment support structure according to an example embodiment;

FIG. 10, which includes FIGS. 10A and 10B, illustrates the bag frame being rotated between a first position and a second position using the powered drive according to

an example embodiment;

FIG. 11 illustrates an example of an alternative bagging attachment support structure that may be implemented in an example embodiment; and

FIG. 12 illustrates the full assembly of a simplified manual dump structure  
5 according to an example embodiment.

## DETAILED DESCRIPTION

Some example embodiments now will be described more fully hereinafter with reference to the accompanying drawings, in which some, but not all example embodiments  
10 are shown. Indeed, the examples described and pictured herein should not be construed as being limiting as to the scope, applicability or configuration of the present disclosure. Rather, these example embodiments are provided so that this disclosure will satisfy applicable legal requirements. Like reference numerals refer to like elements throughout. Furthermore, as used herein, the term “or” is to be interpreted as a logical operator that  
15 results in true whenever one or more of its operands are true. As used herein, operable coupling should be understood to relate to direct or indirect connection that, in either case, enables functional interconnection of components that are operably coupled to each other.

Some example embodiments may provide a bagging attachment that can be emptied via a dump process that may be either manually conducted or initiated via a  
20 powered dump. Notably, providing a bagging attachment that can be emptied via a powered dump process may be accomplished via a number of different ways. For example, a power device (e.g., an electric actuator, hydraulic cylinder, and/or the like) may apply a force to a bagging attachment that rests on a pivot assembly. In some cases, the power device may apply a linear load to the front of the bagging attachment (i.e., at a  
25 point forward of the pivot assembly relative to the front of the lawn mower). However, in such a case, the power device may supply its highest load when the load requirement is the lowest from the bagging attachment. As the bagging attachment opens, the moment created by the grass load increases as the opening angle increases until the grass dumps. Thus, the dump system supplies its highest load at the closed position and loses its  
30 mechanical advantage as the bag opens. As such, the power device must be larger in order to accommodate the fact that the load from the contents of the bagging attachment is greatest at a point when the mechanical advantage of the powered device is not at its peak. Accordingly, such a system may be considered to be costly and inefficient.

Another option may be to rely on a power device to pull a load across the pivot

point in order to pull the bagging attachment open rather than push it open. Such a design may result in a geometry that is not ideal for efficiency. In this regard, the power device may not be able to supply its peak output along with a peak mechanical advantage at a point where the bagging attachment load is highest. Manually operated dump processes  
5 may also be reliant upon the respective geometries and materials employed to determine their lifetime wear characteristics and ease of operation.

Some example embodiments may provide a dump system that employs a power device or manual operator that is disposed rearward of the pivot point to apply a linear force in a substantially vertical direction to a rear portion of a pivot assembly. According  
10 to example embodiments, a more vertically oriented moment arm may be achieved to enable a maximum moment created by the power device or manual operator to occur closer to the maximum moment caused by the grass load. In some cases, the power device may be smaller and less costly and may be placed relatively lower in the bagging attachment to facilitate provision of the more vertically oriented moment arm.  
15 Accordingly, a lower power actuator may achieve less costly, more efficient, and even potentially faster operation than alternative arrangements. Alternatively, the manual operator may operate more easily and efficiently for a better operator experience when conducting bag dumping.

FIGS. 1A and 1B illustrate a perspective view of a riding lawn care vehicle 10  
20 having a bagging attachment 12 removed (FIG. 1A) and installed (FIG. 1B) according to respective different conditions of an example embodiment. FIG. 1C illustrates a side view of the riding lawn care vehicle 10 with the bagging attachment 12 removed and FIG. 1D illustrates a side view of the riding lawn care vehicle 10 with the bagging attachment 12 installed to show fore and aft directions as they will be referred to herein. As shown and  
25 described herein, the riding lawn care vehicle 10 may be a riding lawn mower (e.g., a lawn tractor, front-mount riding lawn mower, a tight or zero-turn riding lawn mower, and/or the like) having a rear discharge. Thus, some example embodiments may apply to lawn care vehicles with rear discharge bagging attachments. In other embodiments of the invention, the adjustable bagging attachment may be used on other lawn care vehicles (e.g., walk-  
30 behind lawn mowers, robotic mowers, and/or the like) and other vehicles.

In some embodiments, the riding lawn care vehicle 10 may include an information panel 14 that may include gauges and/or controls related to operation of the riding lawn care vehicle 10. In an example embodiment, the riding lawn care vehicle 10 may include a steering assembly 20 (e.g., a steering wheel, handle bars, or the like) functionally

connected to front (or rear) wheels 22 of the riding lawn care vehicle 10 to allow the operator to steer the riding lawn care vehicle 10. The operator may sit on a seat 30 positioned rearward of the steering assembly 20, as shown in FIG. 1. However, in other example embodiments, the seat 30 may be positioned in a middle or front portion of the riding lawn care vehicle 10. The riding lawn care vehicle 10 may also include a cutting deck 40 having at least one cutting blade mounted therein. The cutting deck 40 may be positioned behind the front wheels 22 (or forward of the front wheels 22 in some examples) in a position to enable the operator to cut grass using the cutting blade when the cutting blade is rotated below the cutting deck 40 when the cutting deck 40 is in a cutting position. In some embodiments, a footrest 42 (e.g., one on each side of the riding lawn care vehicle 10) may also be positioned above the cutting deck 40 to enable the operator to rest his or her feet thereon while seated in the seat 30. When operating to cut grass, the grass clippings may be expelled from the cutting deck 40 via a rear discharge 44. The rear discharge 44 may be positioned below the seat 30 and may expel the grass clippings out of a discharge path positioned in the center portion of the back of the riding lawn care vehicle 10 into the bagging attachment 12, when the bagging attachment 12 is attached to the riding lawn care vehicle 10. In some example embodiments, the rear discharge 44 may not necessarily be provided in the center portion of the back of the riding lawn care vehicle 10, but may be positioned off to one side (e.g., over the tire).

In the pictured example embodiment, the engine of the riding lawn care vehicle 10 is positioned in front of the operator. However, in other example embodiments, the engine could be in different positions such as below or behind the operator. As shown in FIG. 1, the riding lawn care vehicle 10 may include rear fenders 50 positioned proximate to rear wheels 52. The rear fenders 50 may form a portion of the body of the riding vehicle and the rear fenders 50 may include a rear surface that is shaped to connect to or otherwise mate with top portions of a back plate 60. The back plate 60 may include a seating surface 62 that extends substantially around an external perimeter of the back plate 60 and is shaped to fit in relatively close proximity or otherwise mate with the bagging attachment 12 to form a relatively tight fit or seal between the bagging attachment 12 and the back plate 60. The bagging attachment 12 may include a mating surface 64 that is configured to fit in relatively close proximity or otherwise mate with the seating surface 62 of the back plate 60.

When the mating surface 64 and the seating surface 62 are fit together in relatively close proximity, a good fit or seal may be provided between the back plate 60 and the

bagging attachment 12 to prevent the escape of dust and/or debris from the bagging attachment 12. In some embodiments, there may not be any actual connective features on either the mating surface 64 or the seating surface 62 to actively engage corresponding receptive features on the opposing surface. In other words, although there may be

5 protrusions and/or corresponding recesses on opposing faces to improve sealing characteristics of the components, there may be no clamps, brackets, flanges, bolts, couplings, latches, and/or the like disposed on either the mating surface 64 or the seating surface 62 to secure the surfaces to each other. Instead, the mating surface 64 and the seating surface 62 may simply fit together in close proximity to each other when the

10 bagging attachment 12 is affixed to the riding lawn care vehicle 10 appropriately, as described in greater detail below.

As shown in FIG. 1A, when the bagging attachment 12 is removed, the back plate 60 is exposed and forms a substantial portion of the back end of the riding lawn care vehicle 10. In this regard, the back plate 60 extends to substantially cover an entirety of

15 the rear of the frame of the riding lawn care vehicle 10. In some examples, a bagging attachment support structure 70 extends through the back plate 60 out the rear of the riding lawn care vehicle 10. The bagging attachment support structure 70 of this example embodiment includes two support rods 72. The support rods 72 of this example are substantially L-shaped and connect to the frame of the riding lawn care vehicle 10 via

20 openings in the back plate 60. The support rods 72 initially extend from the back of the riding lawn care vehicle 10 in a direction that is substantially parallel to a plane in which the bottom of the bagging attachment 12 lies when the bagging attachment 12 is attached to the riding lawn care vehicle 10. The support rods 72 may include a bend, forming the L-shape, that extends the support rods 72 away from the bottom of the bagging attachment

25 12. The support rods 72 may facilitate the provision of an assembly for holding at least a portion of a carriage assembly 100 of the bagging attachment 12 and to support the weight of the bagging attachment 12 when the bagging attachment 12 is attached to the riding lawn care vehicle 10 and to provide a mechanism by which to attach the bagging attachment 12 to the bagging attachment support structure 70.

30 In an example embodiment, the bagging attachment 12 may be constructed such that it is assembled around the carriage assembly 100. In this regard, a bag frame 110 (see FIG. 2), bag sidewalls 112, a bag bottom 114, and bag top 116 of the bagging attachment 12 may all be supported (e.g., directly or indirectly) by the carriage assembly 100. In some cases, the carriage assembly 100 may be a weldment of components arranged to

have an externally adjustable pivot point such that, by adjusting the pivot point, the fit between the mating surface 64 and the seating surface 62 may be adjusted without requiring removal of the bagging attachment 12. In this regard, the carriage assembly 100 may allow for fore and aft adjustment of the pivot point of the bagging attachment 12 while the carriage assembly 100 is being supported by the bagging attachment support structure 70.

FIG. 2 illustrates an exploded perspective view of the carriage assembly 100 relative to the bagging attachment 12 of the riding lawn care vehicle 10 of FIG. 1 according to an example embodiment. The bag top 116, which may form a cover for the bagging attachment 12 is removed in FIG. 2 to expose some of the parts within the bagging attachment 12. As can be seen from FIG. 2, the carriage assembly 100 may be attached to portions of the bag frame 110. In this regard, the bag frame 110 may include a top frame member 120, a front frame member 122 and support members 124 (shown in FIG. 1B extending diagonally between a bottom portion of the front frame member 122 and a rear portion of the top frame member 120). In an example embodiment, the top frame member 120 and the front frame member 122 may each be substantially U shaped bars, tubes or other support structures made of metal or other rigid material. The support members 124 may be substantially linear bars, tubes, rods or other support structures that are also made of metal or another rigid material and may be disposed such that opposite longitudinal ends of the support members 124 are affixed to a portion of a respective one of the top frame member 120 and the front frame member 122. In an example embodiment, opposite longitudinal ends of the support members 124 may be bolted, welded or otherwise affixed proximate to corresponding bent portions (used to form the U shape) of respective sides of the top frame member 120 and the front frame member 122.

Although FIG. 2 illustrates the top frame member 120 and the front frame member 122 as each being respective single pieces bent or otherwise formed to include three distinct legs, it should be appreciated that either or both of the top frame member 120 and the front frame member 122 could alternatively be formed by affixing component members (e.g., three separate leg pieces) together. Moreover, in some example embodiments, one or more of the top frame member 120 and the front frame member 122 may have a more rounded or oval shape between the respective ends of each of the top frame member 120 and the front frame member 122.

In an example embodiment, the top frame member 120 may be positioned to lie in a plane that lies substantially perpendicular to a plane in which the front frame member

122 lies when end portions of the top frame member 120 and the front frame member 122 are joined together. A first bracket 130 may engage respective first ends of both the top frame member 120 and the front frame member 122 to connect the top frame member 120 and the front frame member 122. A second bracket 132 may engage respective second  
5 ends of both the top frame member 120 and the front frame member 122 to connect the top frame member 120 and the front frame member 122.

In the example embodiment shown in FIG. 2, the first and second brackets 130 and 132 may be held in a fixed connection with the respective first and second ends of the front frame member 122. In this regard, for example, the first and second brackets 130  
10 and 132 may be welded, bolted, locked or pinned to the respective first and second ends of the front frame member 122. Meanwhile, the first and second brackets 130 and 132 may also be held in a fixed connection with the respective first and second ends of the top frame member 120. Thus, the first and second brackets 130 may form a rigid attachment means between the respective first ends of the top frame member 120 and front frame  
15 member 122 and between the respective second ends of the top frame member 120 and front frame member 122. Each of the first and second brackets 130 and 132 may include an adjustment member such as a bolt, rod, detent and/or the like that provides a fixed attachment point to facilitate slidable engagement of the carriage assembly 100 to the first and second brackets 130 and 132 to permit adjustments to be made with respect to a  
20 position of the carriage assembly 100 relative to the bag frame 110.

The top member 120 may also include one or more rear attachment brackets 140 and 142 to which another portion of the carriage assembly 100 may slidably engage. Of note, although the first and second brackets 130 and 132 and the rear brackets 140 and 142 are provided with slots to allow slidable engagement with the carriage assembly 100, it  
25 should be appreciated that once the carriage assembly 100 is slid to a desired position relative to the top frame member 120, the first and second brackets 130 and 132 and the rear brackets 140 and 142 may be affixed to the carriage assembly 100 to prevent any further sliding.

According to an example embodiment, the front frame member 122 may be  
30 disposed at a front or forward portion of the bagging attachment 12. Meanwhile, bent portions of the top frame member 120 may be disposed at a back or after portion of the bagging attachment 12. A bag may be defined by walls (e.g., three bag sidewalls 112, a bag bottom 114, and bag top 116, as shown in FIG. 1) that may be made of rigid materials, flexible materials, or combinations of rigid and flexible materials over various portions of

the bag. In an example embodiment, the bag bottom 114 and bag top 116 may be made of rigid materials (e.g., plastic and/or a light metal) while the bag sidewalls 112 are made of a flexible material. The bag may be assembled or otherwise positioned around the bag frame 110 such that the bag top 116 rests at least in part on the top frame member 120.

5 The bag bottom 114 may be supported by the bag top 116 via connection with the bag sidewalls 112. As such, the bag sidewalls 112 may extend downward (along the support members 124) from each edge portion of the bag top 116 other than at the forward portion of the bagging attachment 12 to connect to corresponding edges of the bag bottom 114 thereby defining an opening at the forward portion of the bagging attachment 12 to form  
10 or attach to the mating surface 64. By adjusting a position of the carriage assembly 100 in fore and aft directions, the pivot point of the bagging attachment 12 may be correspondingly adjusted.

FIG. 3 illustrates a perspective view of the carriage assembly 100 isolated from other components. A further description of the carriage assembly 100 will now be  
15 provided in reference to FIGS. 2 and 3. The carriage assembly 100 includes a first adjustable bracket assembly 150 and a second adjustable bracket assembly 152. The first adjustable bracket assembly 150 may be slidably connected to the first bracket 130. The second adjustable bracket assembly 152 may be slidably connected to the second bracket 132. The first and second adjustable bracket assemblies 150 and 152 may each be  
20 operably coupled to corresponding respective ones of first and second legs 160 and 162. The first and second legs 160 and 162 may be spaced apart from each other but otherwise extend substantially parallel to each other over portions thereof that mirror one another. In some cases, the first and second legs 160 and 162 may have respective proximal ends that are proximate to the front of the bagging attachment 12 (and the front frame member 122)  
25 and distal ends that are proximate to the top frame member 120 at portions of the top frame member 120 that are proximate to the rear brackets 140 and 142. As such, the distal ends of the first and second legs 160 and 162 may terminate at respective third and fourth adjustable bracket assemblies 166 and 168, which may be slidably connected to the rear brackets 140 and 142.

30 In an example embodiment, the first and second externally adjustable bracket assemblies 150 and 152 may each be embodied as sleeve brackets having respective guide slots therein. The sleeve brackets and the guide slots may be disposed at opposite longitudinal ends of a first connecting member 180 and a second connecting member 182 forming a portion of the carriage assembly 100. The first and second connecting members

180 and 182 may extend between a middle portion of the first and second legs 160 and 162 and extend in a direction substantially perpendicular to a direction of extension of the middle portion of the first and second legs 160 and 162. The first and second connecting members 180 and 182 may be tubes, bars, rods or other elongate members that may be

5 straight, include bent portions, or have a combination of straight and bent portions.

However, in some embodiments, a middle portion of each of the first and second connecting members 180 and 182 may be substantially straight to facilitate engagement with the bagging attachment support structure 70. In some embodiments, the first and second connecting members 180 and 182 may include or be operably coupled with a

10 centrally positioned handle or handle mount 192 that may connect to portions of the bag top 116 or be accessible through the bag top 116 to facilitate engagement or disengagement of the first and second connecting members 180 and 182 with the bagging attachment support structure 70 when installing or removing the bagging attachment 12.

FIG. 4 illustrates a perspective view of portions of the bagging attachment support structure 70 with a powered dump according to an example embodiment. FIG. 5 illustrates a side view of the bagging attachment support structure of FIG. 4 according to an example embodiment. FIG. 6 is a side view of the bagging attachment support structure 70 employed without a powered dump (i.e., with a manual dump) according to an example embodiment. FIG. 7 illustrates an exploded perspective view of a pivot assembly 210

20 useable in connection with the bagging attachment support structure 70 according to an example embodiment. FIG. 8 is a side view of an adjustment plate for adjustable mounting of the powered drive 200 relative to the bagging attachment support structure 70 according to an example embodiment. FIG. 9 illustrates a side view of the bagging attachment support structure 70 and the bag frame 110 to illustrate how the bag frame 110

25 is supported by the bagging attachment support structure 70 according to an example embodiment. FIG. 10, which includes FIGS. 10A and 10B, illustrates the bag frame 110 being rotated between a first position and a second position using the powered drive 200 according to an example embodiment.

An example embodiment will now be described referring primarily to FIGS. 4-10.

30 In this regard, as shown in FIGS. 4 and 5, the bagging attachment support structure 70 may include the support rods 72. The support rods 72 may be coupled to the frame or body of the riding lawn care vehicle 10 via support rod mounts 220 that may be operably coupled to the back plate 60 of the riding lawn care vehicle 10. The support rods 72 may, in some cases, be supported from locations relatively close to each other and bend outward

and vertically to provide a distance between distal ends of the support rods 72 that is less than the length of the first and second connecting members 180 and 182 of the carriage assembly 100.

At least one of the support rods 72 may be coupled to the powered drive 200 via an adjustable support bracket 230. The adjustable support bracket 230, which is shown in greater detail in FIG. 8, may include vertical adjustment slots 232 disposed to extend substantially vertically within a mounting plate 234. The mounting plate 234 may be operably coupled to the support rods 72 (directly or indirectly) via pins, bolts, rivets, screws, weld joints, or other fixing mechanisms. The powered drive 200 may be slidably coupled to the mounting plate 234 via bolts whose position may be vertically adjusted within the vertical adjustment slots 232. The bolts may be loosened to permit vertical adjustment and then tightened in order to fix the powered drive 200 at a desired position.

In an example embodiment, the powered drive 200 may include a hydraulic, electric or other powered actuator. The powered drive 200 may be oriented substantially vertically so that the force exerted by the powered drive 200 is initially in a vertical direction. The powered drive 200 may include a main body 202 and an extendible member 204 configured to extend linearly out of the main body 202 responsive to powered operation of the powered drive 200. For example, the operator may actuate a button, lever, or other user interface control in order to cause a signal to be applied to the hydraulic or electrical actuator that initiates extension of the extendible member 204 out of the main body 202 or retraction of the extendible member 204 into the main body 204. However, in some embodiments, the extendible member 204 may be manually urged or released from the main body 202 via manual interaction via a locally disposed lever (e.g., operating lever 133 seen in FIG. 1D).

In an example embodiment, respective ends of the powered drive 200 may be pivotably coupled to the mounting plate 234 and a portion of the pivot assembly 210 that is rearward of the pivot point of the carriage assembly 100 responsive to operation of the powered drive 200 so that the extendible member 204 extends to push off the mounting plate 234 exert a force onto the pivot assembly 210 to cause movement of the pivot assembly 210. In some embodiments, the main body 202 or the extendible member 204 could be connected to a portion of the pivot assembly 210. However, as an alternative, some embodiments may employ an intermediate lift plate 238 disposed between the pivot assembly 210 and either of the extendible member 204 or the main body 202. In such an example, the connection between the pivot assembly 210 and the intermediate lift plate

238 may be flexible to allow some movement of the powered drive 200 out of the completely vertical direction (e.g., as shown in FIG. 10) during operation.

The pivot assembly 210, which is shown in greater detail in FIG. 7, may include pivot sockets 240 that may each be received within or at a respective end of one of the support rods 72. The pivot sockets 240 may define a pivot point for the pivot assembly 210. Although the pivot sockets 240 shown in FIG. 7 are essentially fixed receivers for holding an axle rod 241 that is rotatably received in the corresponding fixed receiving holes 242, it should be appreciated that the pivot point could alternatively be provided via other structural arrangements. For example the pivot point could incorporate a hinge assembly, bearings, shafts or any of a number of other structures capable of enabling rotation about a pivot point. As shown in FIG. 7, the pivot assembly 210 may further include a first support bracket 244 and a second support bracket 246 that are operably coupled to one another via one or more cross tubes 248. In the example of FIG. 7, the cross tubes 248 extend in a direction substantially perpendicular to the direction of extension of the first and second support brackets 244 and 246. Moreover, a portion of the cross tubes 248 proximate to opposing ends of one of the cross tubes 248 may be supported by the first and second support brackets 244 and 246 while the axle rod 241 forms the end of the corresponding cross tube 248 to extend into its corresponding receiving hole 242. The axle rod 241 may rotate within the receiving hole 242 with a relatively low amount of friction by employing low friction material. As such, for example, the material forming and/or coating the receiving hole 242 and/or the axle rod 241 may be Nylon, Acetal, High-density polyethylene (HDPE), a low friction plastic, or other engineering material having a relatively low friction. Accordingly, for example, the entirety of one or more of the cross tubes 248 may be made of the low friction material or the axle rod 241 portion of the cross tube 248 may be coated with the low friction material. Alternatively or additionally, an entirety of the pivot sockets 240 may be made of the low friction material or an inner periphery of the receiving holes 242 may be coated with the low friction material. As such, example embodiments may provide a relatively smooth operating pivot point that provides consistent operation over a very long lifetime. Therefore, for example, rather than experiencing wear over time that either wears away an initially present coating material or wears metal parts down over time, the structures of an example embodiment may provide consistent operation over the life of the riding lawn care vehicle 10.

In an example embodiment, a carriage assembly receiver 250 may be operably coupled to the first and second support brackets 244 and 246 to receive the first and

second connecting members 180 and 182 of the carriage assembly 100. FIG. 9 illustrates how the first and second connecting members 180 and 182 of the carriage assembly 100 may fit into respective receiving slots 252 of the carriage assembly receiver 250.

Although not required, in some embodiments, the carriage assembly receiver 250 (or at least the receiving slots 252) may be made of or coated using the low friction material.

As shown in FIGS. 5, 7, 9 and 10, one of the support brackets (e.g., the first support bracket 244 or the second support bracket 246) may include a lift bracket 260 that is operably coupled to the powered drive 200. In some embodiments, the intermediate lift plate 238 may be in pivotable or flexible engagement with the lift bracket 260 at one end of the intermediate lift plate 238 and with the powered drive 200 at the other end of the intermediate lift plate 238. Accordingly, as the powered drive 200 operates to extend, a force may initially be exerted in a substantially vertical direction to a rear portion of the pivot assembly. In this regard, for example, the bag frame 110 may start in a first position (where the bagging attachment 12 may be positioned to receive discharged material from the rear discharge of the riding lawn care vehicle 10) shown in FIG. 10A. As the powered drive 200 operates, the extendible member 204 may begin to linearly extend out of the main body 202 and apply an upward force to the lift bracket 260 via the intermediate lift plate 238. The theoretical angle of the moment arm created between the pivot and the upper mounting point of the powered drive 200 may be about 55 degrees. As such, when an upward force is provided to the lift bracket 260, the load of the bagging attachment 12 can be relatively easily overcome in order to lift a rear portion of the pivot assembly 210 so that the bag frame 110 rotates about the pivot point as the pivot assembly 210 pivots. As the upward force continues to be applied while the extendible member 204 extends, the intermediate lift plate 238 rotates to keep applying pressure to the rear of the pivot assembly 210 to cause the bag frame 110 to continue to rotate from the first position to a second position shown in FIG. 10B. As such, the pivot assembly 210 pivots about a discrete point (e.g., the pivot point) while carrying or otherwise supporting the bag frame 110 via the carriage assembly 100 such that the bag frame 110 moves like a hinge between the first and second positions.

In some embodiments, the provision of the substantially vertically oriented lift force to a rear portion of the pivot assembly 210 enables less power to be required from the powered drive 200 in order to rotate the bagging attachment 12 between the first position (e.g., a collection position) and the second position (e.g., a dump position). The use of a low friction material at the pivot point may further reduce power requirements for

pivoting, and may also improve consistency of operation over time as well as improving the customer's perception of operation and quality of the riding lawn care vehicle 10. The pivot point is located within the bagging attachment 12 when the bagging attachment 12 is shifted between the first and second positions. However, the bagging attachment 12 is still enabled to rotate or pivot to and from the dumping position from/to a secure fit with the back plate 60 of the riding lawn care vehicle. As such, the pivot point may be positioned at a point such that, when the bagging attachment 12 is installed, the normal resting position of the bagging attachment 12 may be such that the bagging attachment 12 tends to pivot into snug engagement with the back plate 60. However, when the vertical lifting force is applied to the rear of the pivot assembly 210, a rear of the bagging attachment 12 may be elevated to rotate the bagging attachment 12 away from engagement with the back plate 60 to dump the contents of the bagging attachment 12.

In an alternative embodiment where manual operation is accomplished, e.g., via the lever 133 of FIG. 1D, no powered drive may be employed, as shown in FIG. 6. In such an embodiment, the lever 133 may engage a lift bracket 245 (directly or indirectly through intermediate linkages). The lift bracket 245 may form a portion of one of the support brackets of the pivot assembly 210. The lift bracket 245 may be disposed rearward of its corresponding pivot socket 240. Accordingly, for example, the lift bracket 245 may receive an initially upward force to lift the pivot assembly 210 and initiate rotation of the pivot assembly 210 about the pivot point (e.g., the pivot sockets 240). The motion of the lever 133 or linkages provided between the lever 133 and the lift bracket 245 may then be translated to allow continued rotation of the pivot assembly 210 around the pivot point. Notably, although shown in connection with the operation of the powered drive 200, FIGS. 10A and 10B may also be understood to show the path of rotation of the pivot assembly 210 from the first position to the second position responsive to manual operation instead of responsive to operation of the powered drive 200 if the powered drive 200 was removed.

As shown in FIG. 10A, the powered drive 200 is rotatably connected to the intermediate lift plate 238, which is in turn also rotatably connected to the pivot assembly 210 (e.g., via the lift bracket 260). The intermediate lift plate 238 may be configured to define an angle between a plane in which the pivot assembly 210 lies and a line between the pivot socket 240 and a top of the powered drive 200 of about 55 degrees  $\pm$  about 15 degrees. The intermediate lift plate 238 may be configured to provide an initially upward force to lift a rear portion of the pivot assembly 210. However, due to the rotatably or

flexible connection to both the pivot assembly 210 and the powered drive 200, the intermediate lift plate 238 can swing through a plurality of angles and continue to translate force applied to the intermediate lift plate 238 to the pivot assembly 210 over a plurality increasing angles relative to a vertically oriented plane as shown while transitioning from the first position (FIG. 10A) to the second position (FIG. 10B). In this example, the flexible connection provided by the intermediate lift plate 238 also allows for the powered drive 200 to shift its orientation slightly out of alignment with the vertically oriented plane as shown in FIG. 10B. Furthermore, as is shown in FIG. 10, the front frame member 122 is configured to mate with the back plate 60 responsive to the bag frame 110 being in the first position (FIG. 10A) and the front frame member 122 lies in a plane within about 15 degrees of horizontal when rotated to the second position (FIG. 10B). Accordingly, as can be seen in FIG. 10, the pivot point is disposed forward of a midway point of the legs of the top frame member and the powered drive 200 is operably coupled to the pivot assembly 210 (e.g., via the intermediate lift plate 238) at a point that is rearward of the midway point.

In some embodiments in which manual dumping of the bagging attachment 12 is to be provided, a more simple structure than that which is shown in FIGS. 4-10 may be provided. In this regard, FIG. 11 illustrates an example of an alternative bagging attachment support structure 70' that may be implemented in some cases. The alternative bagging attachment support structure 70' may include releasable pivot sockets 400. The releasable pivot sockets 400 may be disposed at the distal ends of the support rods 72. The releasable pivot sockets 400 may be configured to include a pivot slot 410 that is open at one portion thereof to enable the carriage assembly 100 to be removably inserted into the releasable pivot sockets 400. Thus, for example, the pivot assembly 210 of FIGS. 4-10 may be removed to decrease the complexity of the structure. In such an example, the carriage assembly 100 may fit within the pivot slot 410 and a dump lever may be used to cause the carriage assembly 100 to rotate within the pivot slot 410 to dump the bagging attachment 12. As such, the releasable pivot sockets 400 may hold the bagging attachment 12 proximate to the back plate 60 of the riding lawn care vehicle 10 when the bagging attachment 12 is in the first position. However, the releasable pivot sockets 400 may further enable the carriage assembly 100 to rotate about a pivot point (e.g., defined where one of the connecting members, e.g., second connecting member 182, fits within the pivot slot 410) responsive to operation of the dump lever (e.g., lever 133 of FIG. 1D). The releasable pivot sockets 400 may also enable the operator to completely remove the

bagging attachment 12 from the riding lawn care vehicle 10 by using the handle mount 192.

5 In an example embodiment, at least the pivot slot 410 may be coated with low friction material as described above. However, in some embodiments, the entire releasable pivot socket 400 may be made of the low friction material. FIG. 12 illustrates the full assembly of a simplified manual dump structure according to an example embodiment.

10 Many modifications and other embodiments of the inventions set forth herein will come to mind to one skilled in the art to which these inventions pertain having the benefit of the teachings presented in the foregoing descriptions and the associated drawings. Therefore, it is to be understood that the inventions are not to be limited to the specific embodiments disclosed and that modifications and other embodiments are intended to be included within the scope of the appended claims. Moreover, although the foregoing descriptions and the associated drawings describe exemplary embodiments in the context  
15 of certain exemplary combinations of elements and/or functions, it should be appreciated that different combinations of elements and/or functions may be provided by alternative embodiments without departing from the scope of the appended claims. In this regard, for example, different combinations of elements and/or functions than those explicitly described above are also contemplated as may be set forth in some of the appended claims.

20 In cases where advantages, benefits or solutions to problems are described herein, it should be appreciated that such advantages, benefits and/or solutions may be applicable to some example embodiments, but not necessarily all example embodiments. Thus, any advantages, benefits or solutions described herein should not be thought of as being critical, required or essential to all embodiments or to that which is claimed herein.

25 Although specific terms are employed herein, they are used in a generic and descriptive sense only and not for purposes of limitation.

## THAT WHICH IS CLAIMED:

1. A pivot assembly for dumping a bagging attachment of a rear discharge riding lawn care vehicle, the pivot assembly comprising:

5 at least two pivot sockets each of which is disposed in a corresponding one of at least two support rods disposed to extend from a back plate of the riding lawn care vehicle, each of the support rods terminating at a distal end thereof at a respective one of the at least two pivot sockets defining a pivot point of the pivot assembly; and

a carriage assembly of the bagging attachment, the carriage assembly being  
10 operably coupled to a bag frame of the bagging attachment, the carriage assembly being disposable within the at least two pivot sockets to facilitate rotation of the bag frame between a first position in which material is collectable in the bagging attachment via the rear discharge and a second position in which contents of the bagging attachment are dumped,

15 wherein the at least two pivot sockets each comprise a low friction material.

2. The pivot assembly of claim 1, wherein the pivot assembly further comprises:

first and second support brackets each of which is operably coupled to a respective  
20 one of the at least two pivot sockets, the first and second support brackets being operably coupled to one another by at least one cross tube, the first and second support brackets supporting opposing ends of an axle configured to operably couple to the at least two pivot sockets at the pivot point; and

a carriage assembly receiver assembly operably coupled to the first and second  
25 support brackets to engage the carriage assembly,

wherein a moment arm for pivoting the pivot assembly about the pivot point between the first position and the second position is located rearward of the pivot point and has an initially vertical orientation.

30 3. The pivot assembly of claim 2, wherein the pivot assembly is rotated about the pivot point via a powered dump.

4. The pivot assembly of claim 3, wherein the powered dump is configured to extend in a substantially vertical direction to deliver a force to a portion of the pivot

assembly that is rearward of one of the at least two support rods to cause the bag frame to rotate between the first position and the second position.

5           5.       The pivot assembly of claim 3 or 4, wherein the powered dump comprises an electrical or hydraulic actuator.

10           6.       The pivot assembly of any of claims 3 to 5, wherein the powered dump is operably coupled to the one of the support rods via an adjustable support bracket configured to enable a vertical position of the powered dump to be adjusted.

            7.       The pivot assembly of claim 1 or 2, wherein the pivot assembly is rotated about the pivot point via manual operation.

15           8.       The pivot assembly of claim 7, wherein one of the first and second support brackets comprises a lift bracket operably coupled to a lever configured to apply a lifting force in a substantially vertical direction to a portion of the pivot assembly that is rearward of one of the at least two support rods to cause the bag frame to rotate between the first position and the second position.

20           9.       The pivot assembly of claim 1, wherein at least a portion of the pivot socket that receives the axle at the pivot point is coated with a low friction material.

            10.      The pivot assembly of claim 9, wherein the low friction material comprises Nylon, Acetal or High-density polyethylene.

25

            11.      The pivot assembly of claim 2, wherein the bag frame comprises a top frame member and a front frame member disposed in respective planes that lie substantially perpendicular to each other, the front frame member being configured to mate with the back plate responsive to the bag frame being in the first position and lie in a plane within about 15 degrees of horizontal when rotated to the second position.

30

            12.      The pivot assembly of claim 11, wherein the pivot point is disposed forward of a midway point of the legs of the top frame member and wherein the moment arm of the pivot assembly is rearward of the midway point.

13. The pivot assembly of claim 2, wherein the carriage assembly receiver assembly comprises at least one carriage assembly receiver disposed proximate to each respective one of the first and second support brackets.

5

14. The pivot assembly of claim 13, wherein each carriage assembly receiver comprises at least a forward slot and a rear slot configured to receive corresponding ones of a first connecting member and a second connecting member of the carriage assembly, the first and second connecting members extending between opposing sides of the carriage assembly.

10

15. The pivot assembly of claim 2, wherein the cross tube forms the axle.

16. The pivot assembly of claim 15, wherein the axle comprises low friction material.

15

17. A riding lawn care vehicle comprising:  
a rear discharge disposed at a rear of the riding lawn care vehicle;  
a bagging attachment configured to attach to the rear of the riding lawn care vehicle to receive debris discharged via the rear discharge, the bagging attachment comprising a carriage assembly to which a bag frame of the bagging attachment is operably coupled; and

20

a bagging attachment support structure configured to support the carriage assembly relative to the riding lawn care vehicle, the bagging attachment support structure being operably coupled to a pivot assembly about which the bag frame is pivotable to rotate the bag frame between a first position in which material is collectable in the bagging attachment via the rear discharge, and a second position in which the bag frame is rotated to a dump position for emptying contents of the bagging attachment,

25

the pivot assembly comprising:

at least two pivot sockets each of which is disposed in a corresponding one of at least two support rods disposed to extend from a back plate of the riding lawn care vehicle, each of the support rods terminating at a distal end thereof at a respective one of the at least two pivot sockets defining a pivot point of the pivot assembly,

30

wherein the at least two pivot sockets each comprise a low friction material.

18. The riding lawn care vehicle of claim 17, wherein the pivot assembly further comprises:

5 first and second support brackets each of which is operably coupled to a respective one of the at least two pivot sockets, the first and second support brackets being operably coupled to one another by at least one cross tube, the first and second support brackets supporting opposing ends of an axle configured to operably couple to the at least two pivot sockets at the pivot point; and

10 a carriage assembly receiver assembly operably coupled to the first and second support brackets to engage the carriage assembly,

wherein a moment arm for pivoting the pivot assembly about the pivot point between the first position and the second position is located rearward of the pivot point and has an initially vertical orientation.

15 19. The riding lawn care vehicle of claim 18, wherein the pivot assembly is rotated about the pivot point via a powered dump.

20 20. The riding lawn care vehicle of claim 19, wherein the powered dump is configured to extend in a substantially vertical direction to deliver a force to a portion of the pivot assembly that is rearward of one of the at least two support rods to cause the bag frame to rotate between the first position and the second position.

21. The riding lawn care vehicle of claim 19 or 20, wherein the powered dump comprises an electrical or hydraulic actuator.

25

22. The riding lawn care vehicle of any of claims 19 to 21, wherein the powered dump is operably coupled to the one of the support rods via an adjustable support bracket configured to enable a vertical position of the powered dump to be adjusted.

30 23. The riding lawn care vehicle of claim 18, wherein the pivot assembly is rotated about the pivot point via manual operation.

24. The riding lawn care vehicle of claim 23, wherein one of the first and second support brackets comprises a lift bracket operably coupled to a lever configured to

apply a lifting force in a substantially vertical direction to a portion of the pivot assembly that is rearward of one of the at least two support rods to cause the bag frame to rotate between the first position and the second position.

5           25.     The riding lawn care vehicle of claim 17, wherein at least a portion of the pivot socket that receives the axle of the pivot assembly at the pivot point is coated with a low friction material.

10           26.     The riding lawn care vehicle of claim 25, wherein the low friction material comprises Nylon, Acetal or High-density polyethylene.

15           27.     The riding lawn care vehicle of any of claims 17 to 26, wherein the bag frame comprises a top frame member and a front frame member disposed in respective planes that lie substantially perpendicular to each other, the front frame member being configured to mate with the back plate responsive to the bag frame being in the first position and lie in a plane within about 15 degrees of horizontal when rotated to the second position.

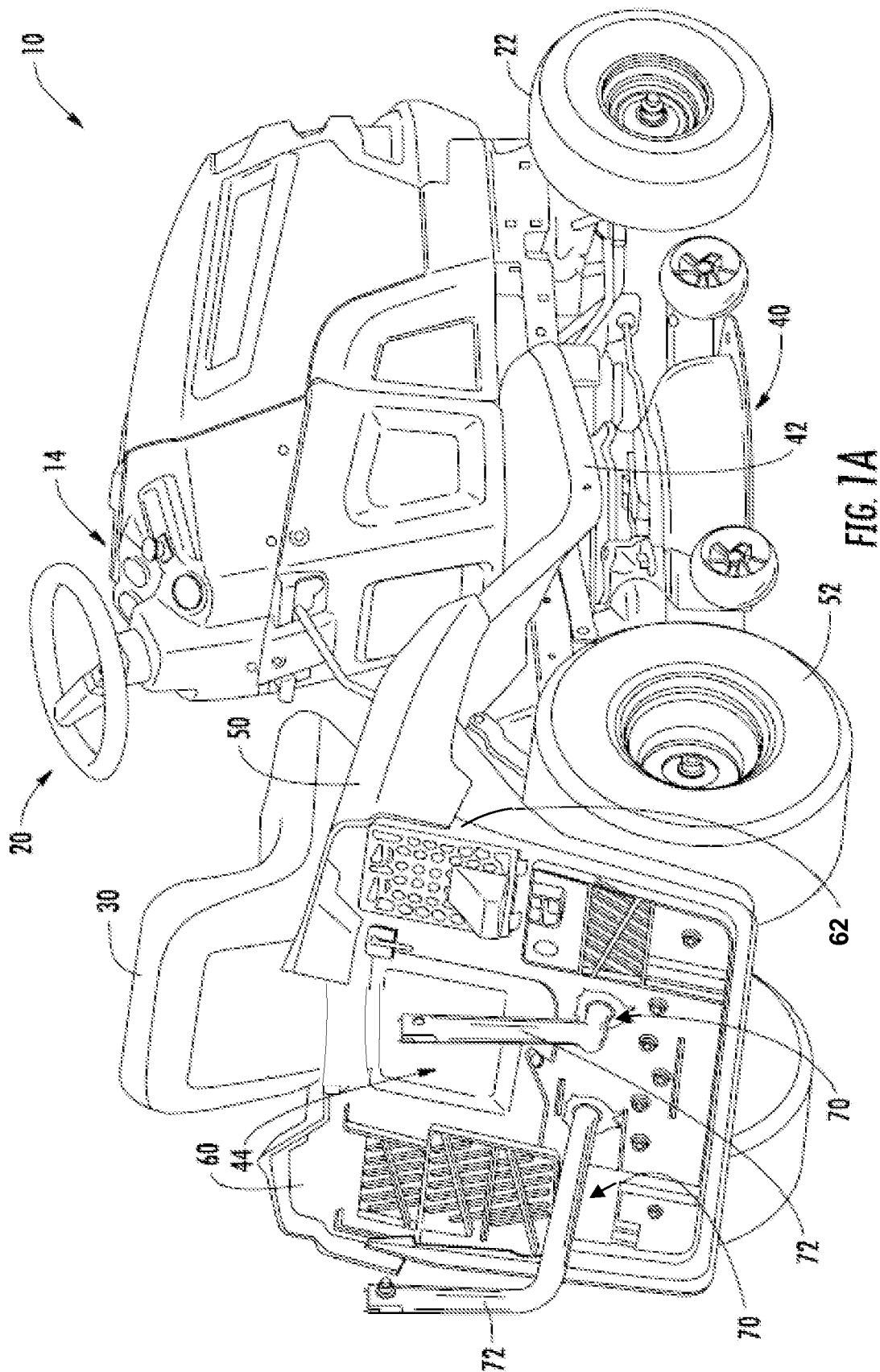
20           28.     The riding lawn care vehicle of claim 27, wherein the pivot point is disposed forward of a midway point of the legs of the top frame member and wherein the moment arm of the pivot assembly is rearward of the midway point.

25           29.     The riding lawn care vehicle of any of claims 18 to 28, wherein the carriage assembly receiver assembly comprises at least one carriage assembly receiver disposed proximate to each respective one of the first and second support brackets.

30           30.     The riding lawn care vehicle of claim 29, wherein each carriage assembly receiver comprises at least a forward slot and a rear slot configured to receive corresponding ones of a first connecting member and a second connecting member of the carriage assembly, the first and second connecting members extending between opposing sides of the carriage assembly.

31.     The riding lawn care vehicle of any of claims 18 to 30, wherein the cross tube forms the axle.

32. The riding lawn care vehicle of claim 31, wherein the axle comprises low friction material.



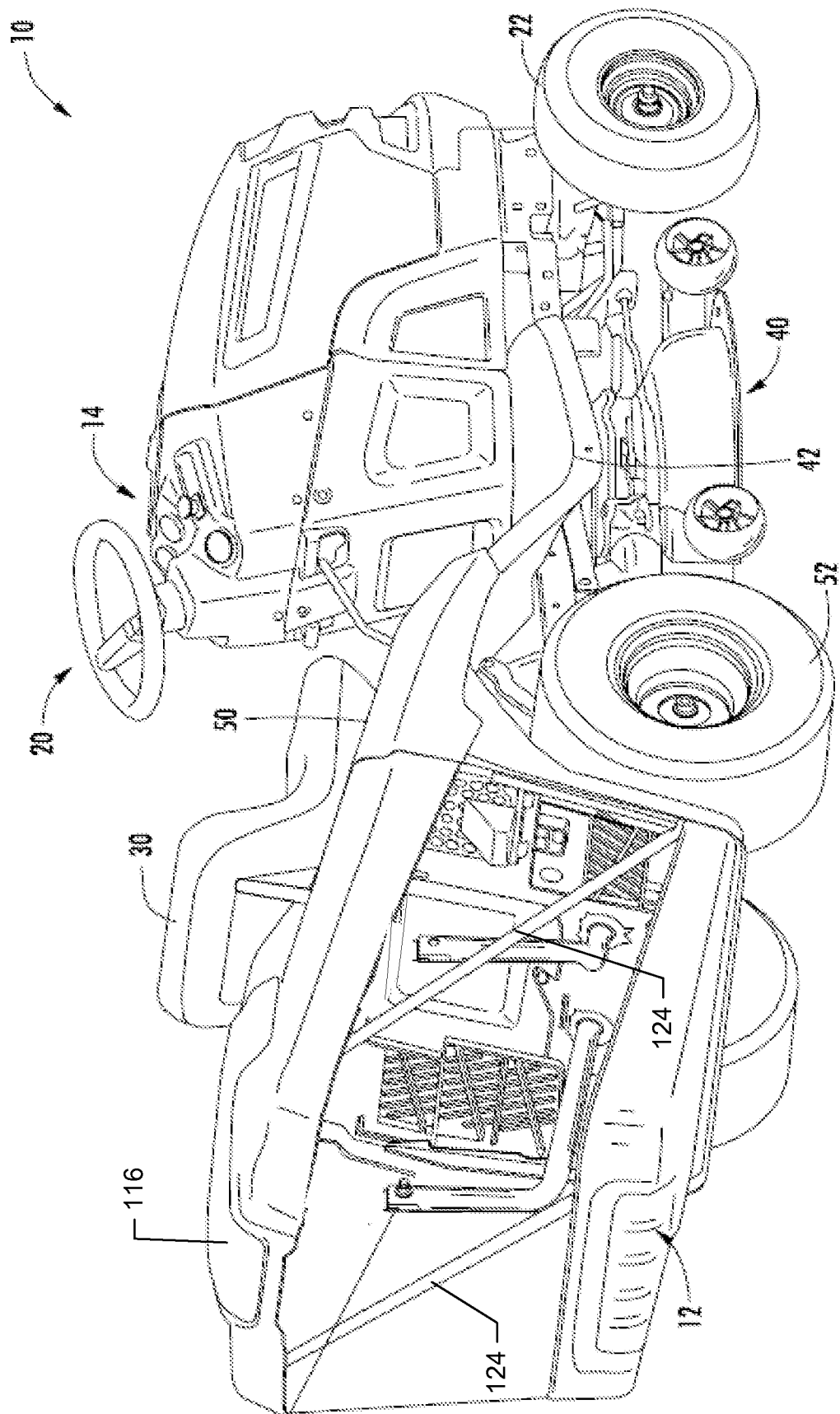


FIG. 1B

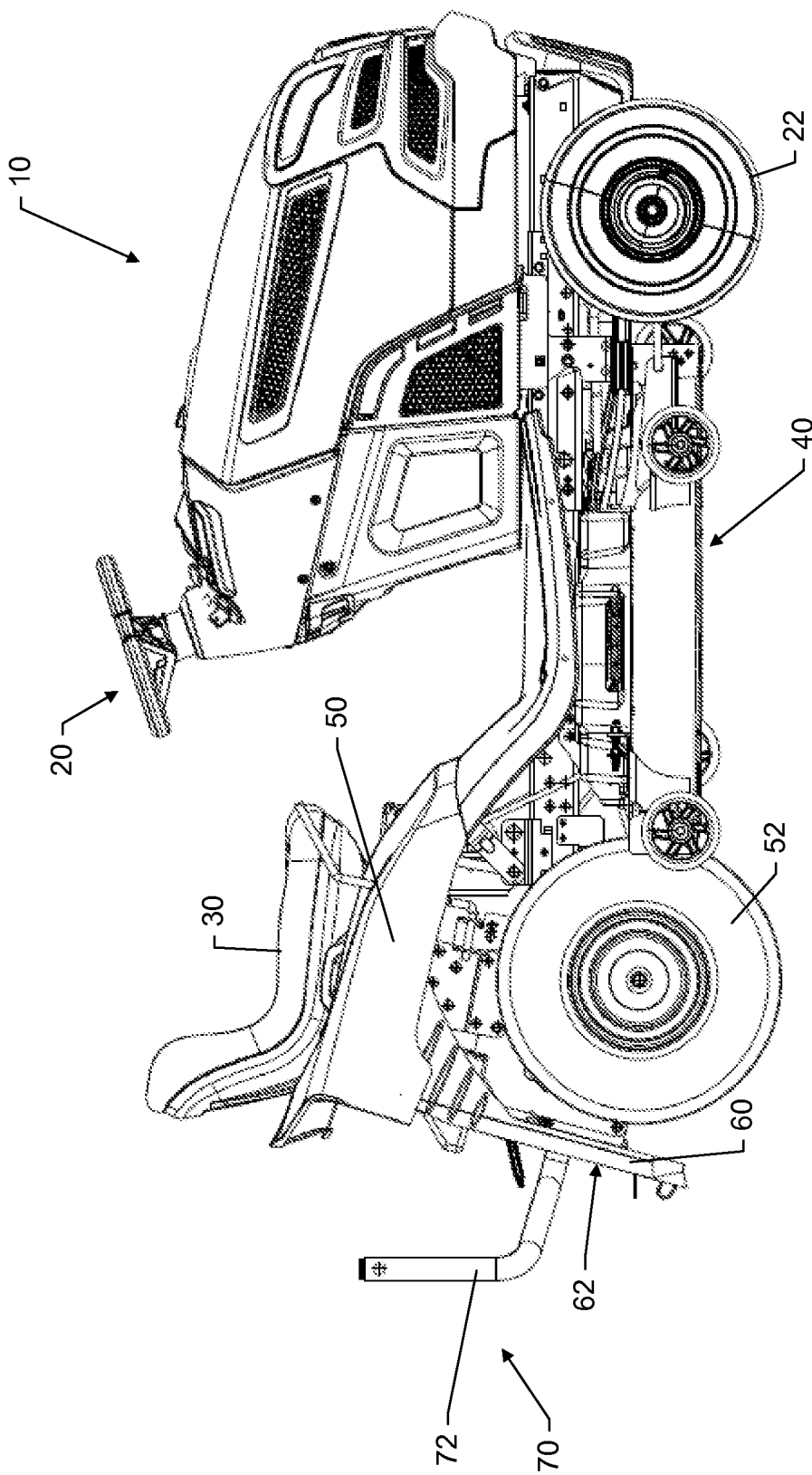
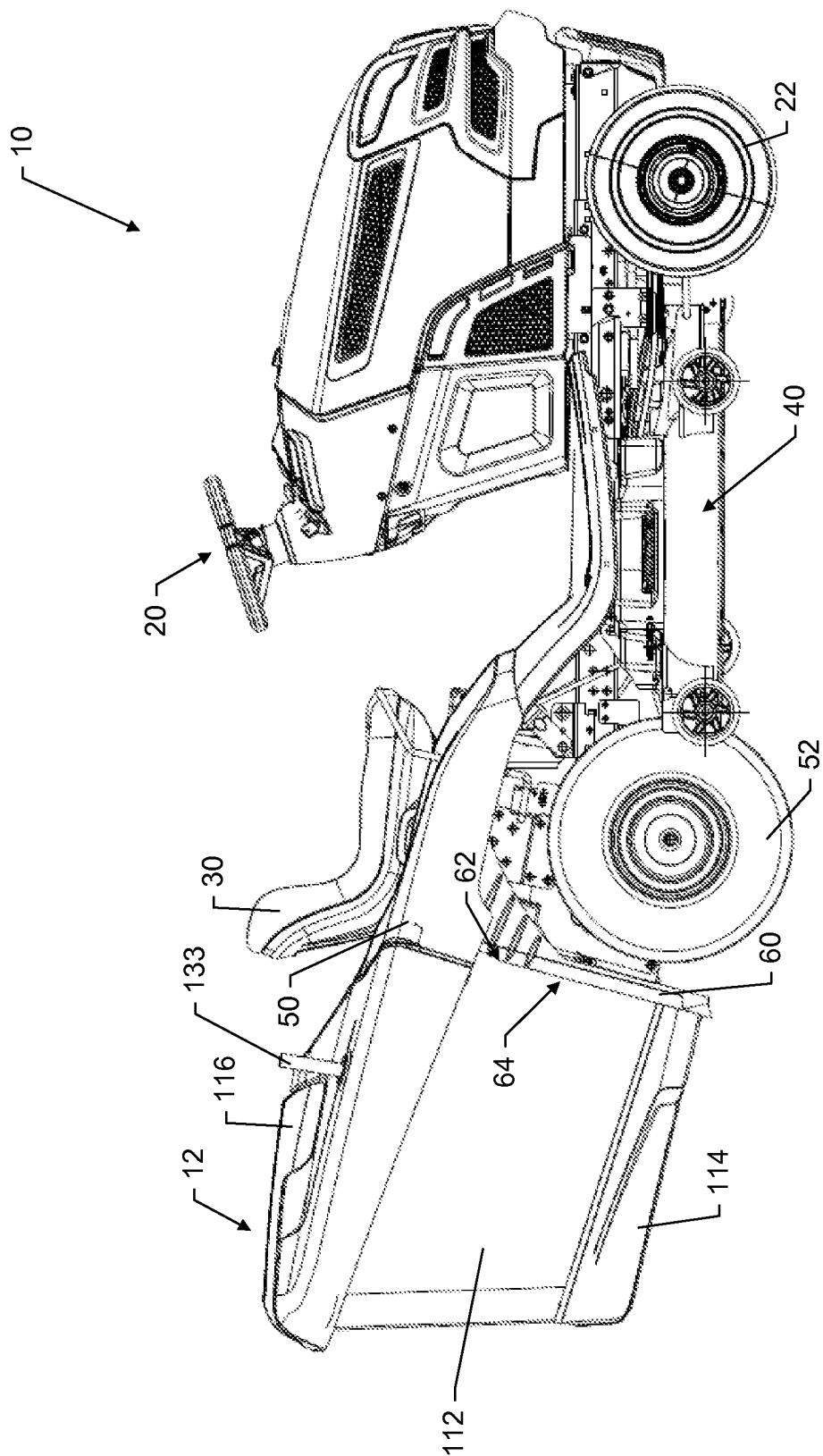
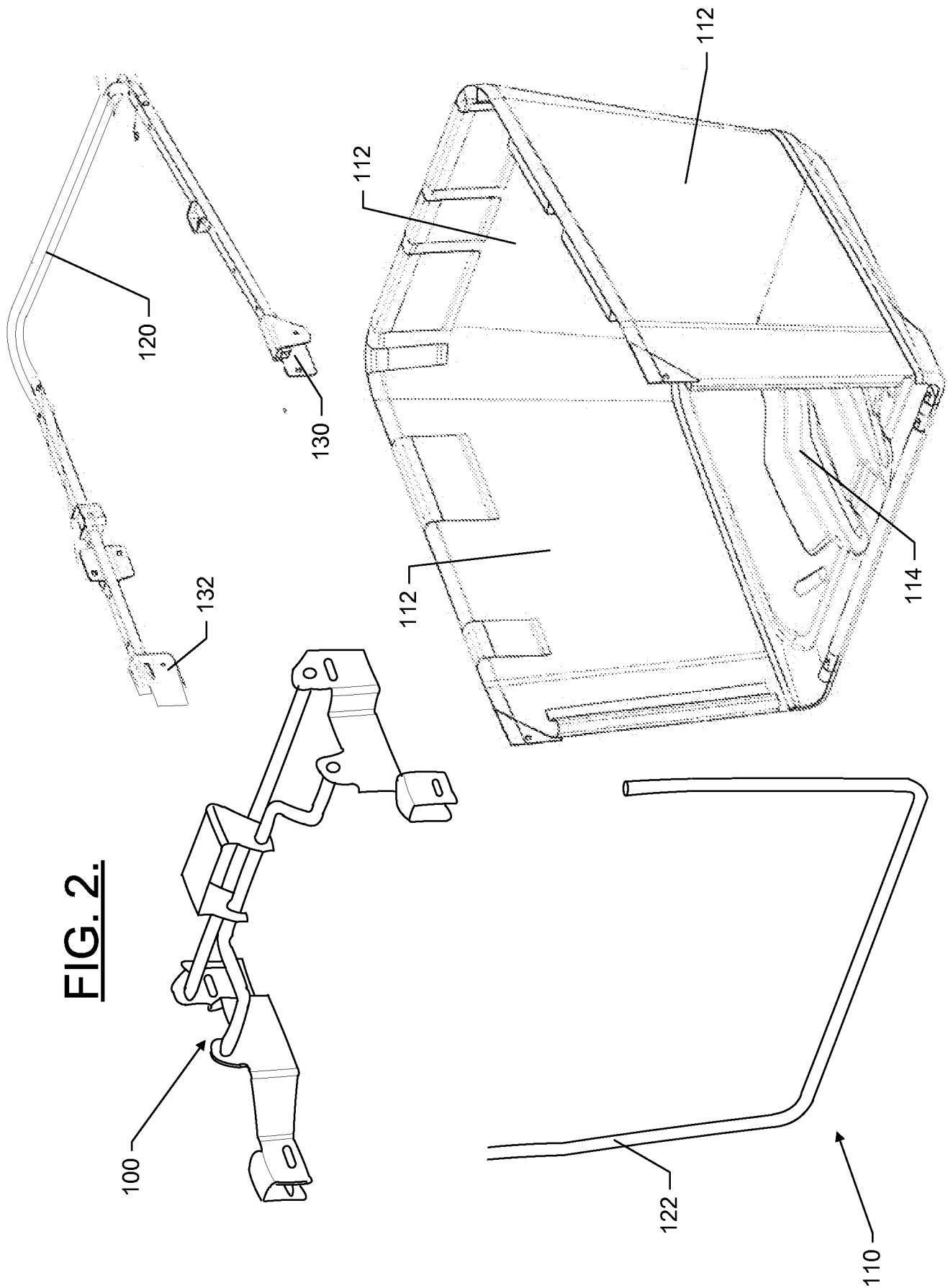
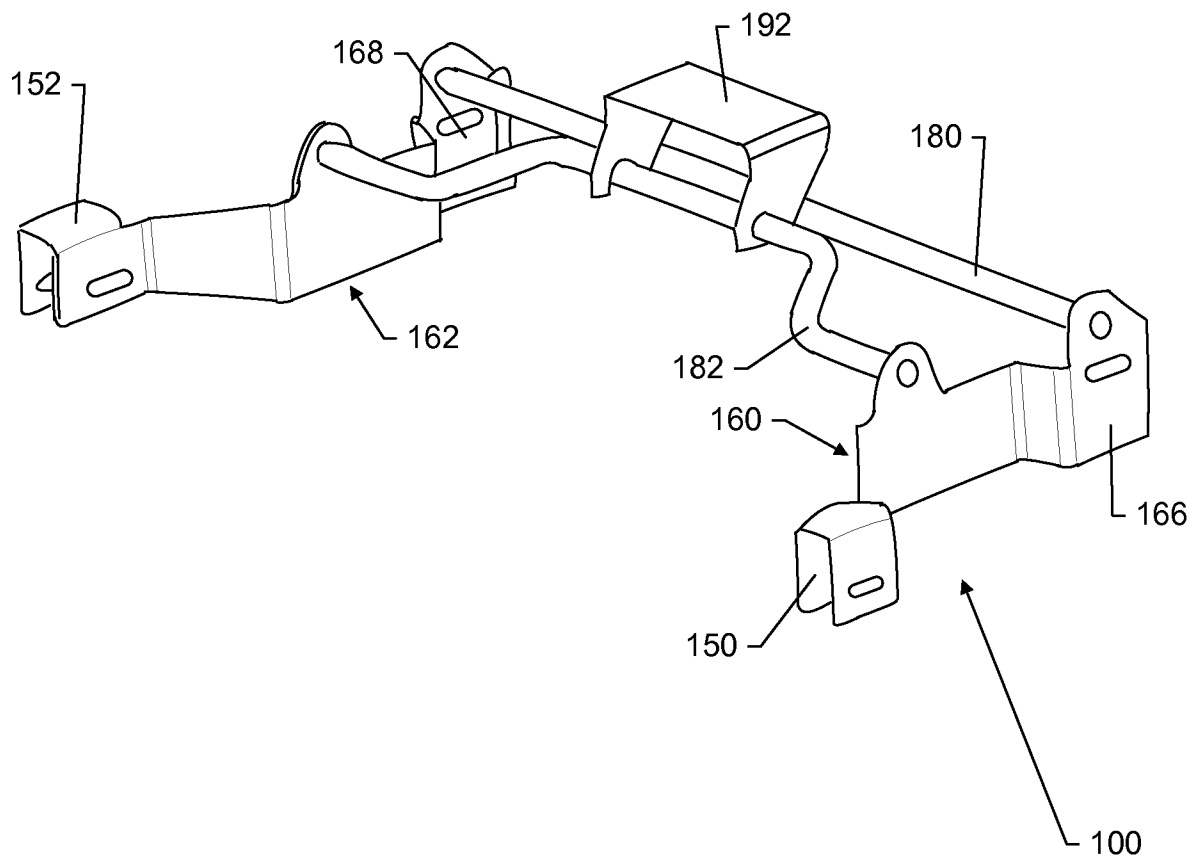


FIG. 1C.

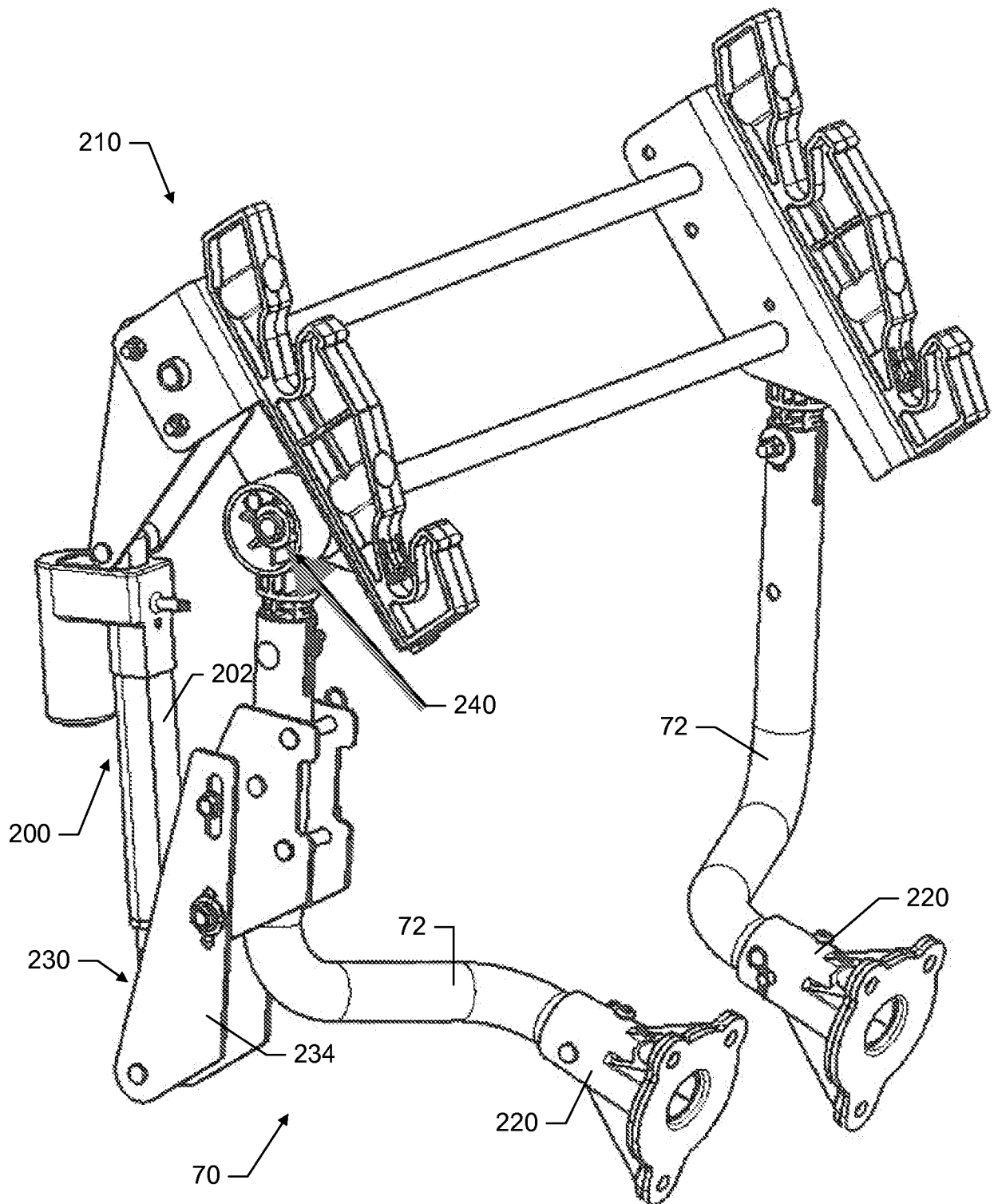


**FIG. 1D.**

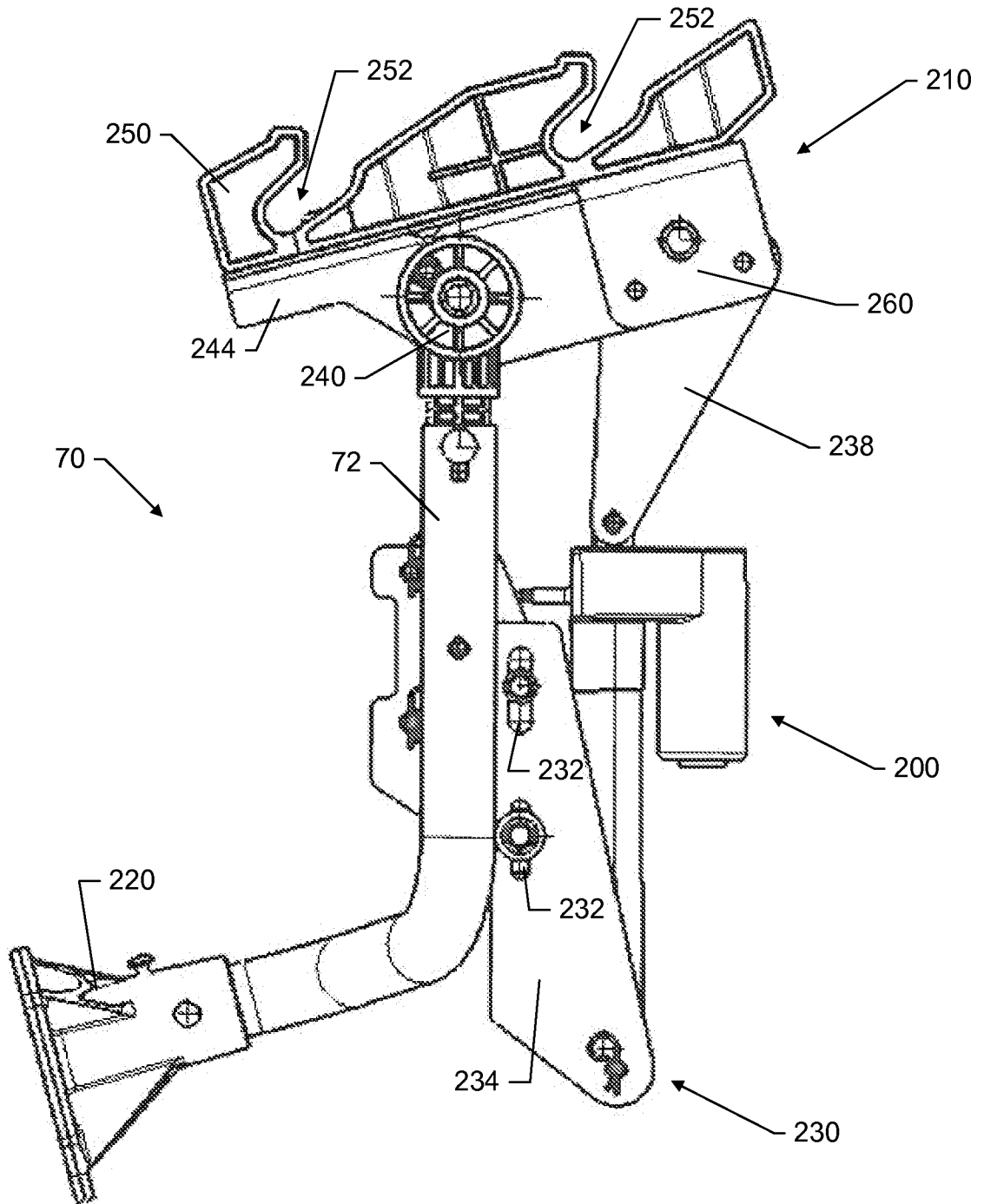




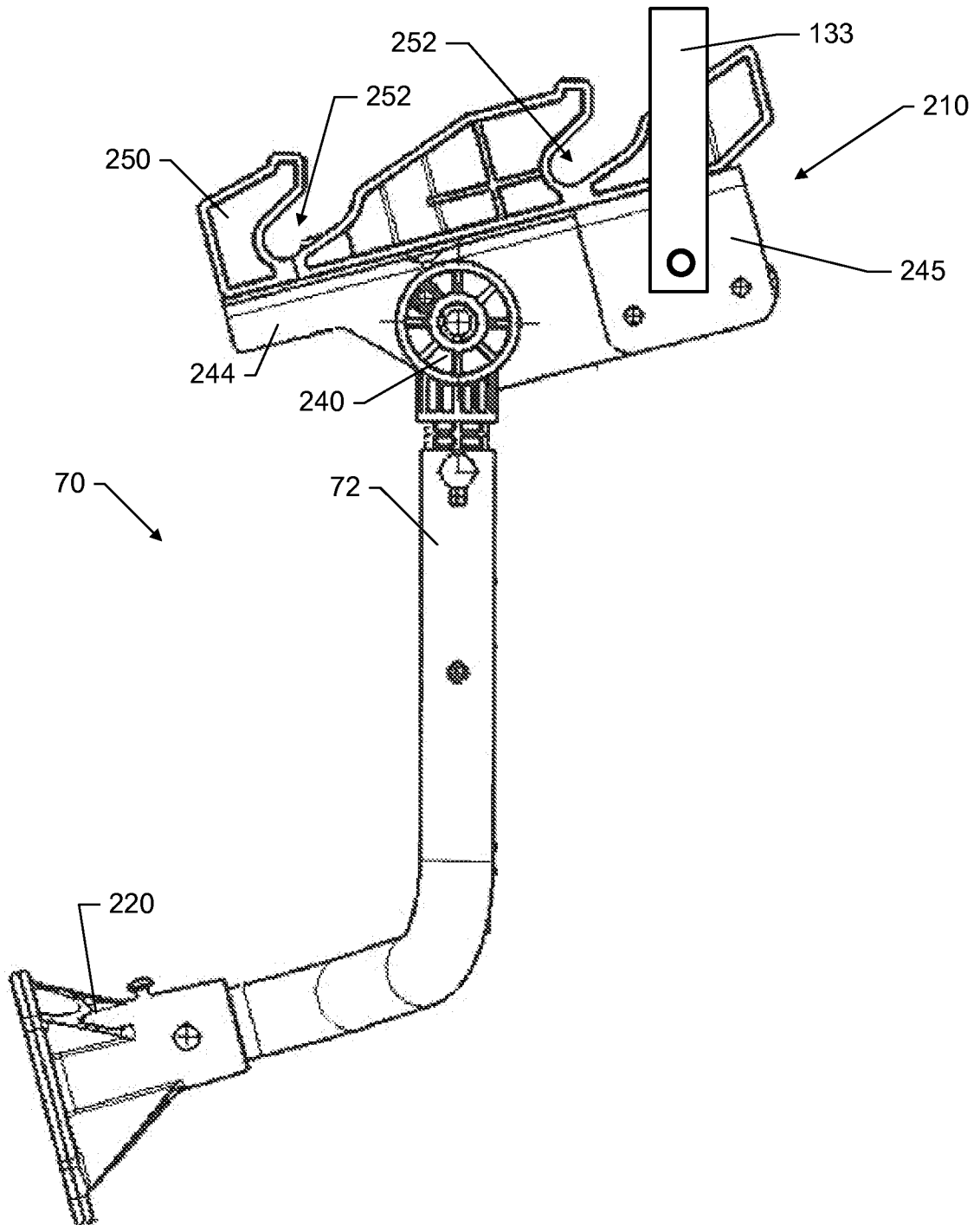
**FIG. 3.**

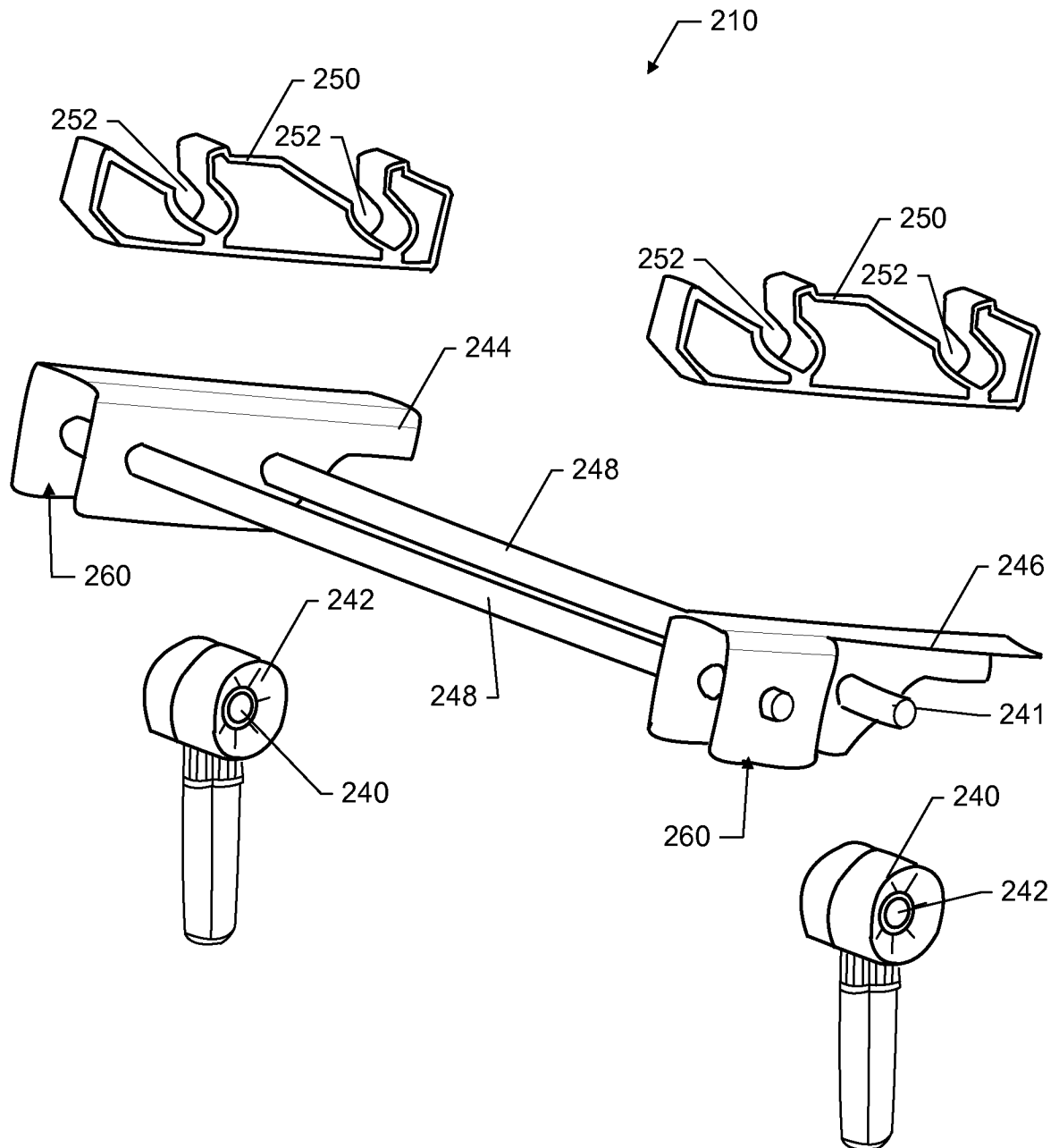


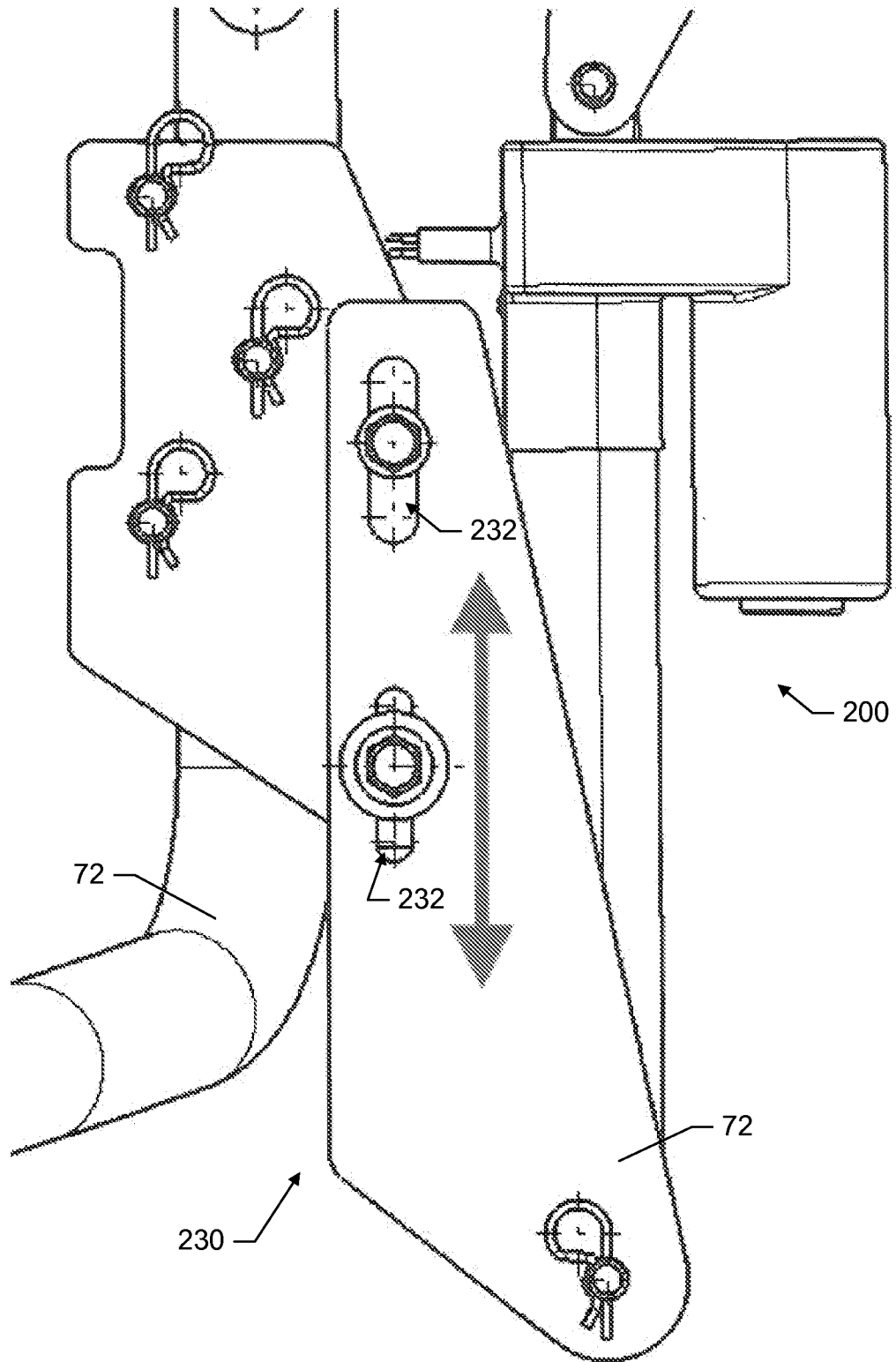
**FIG. 4.**



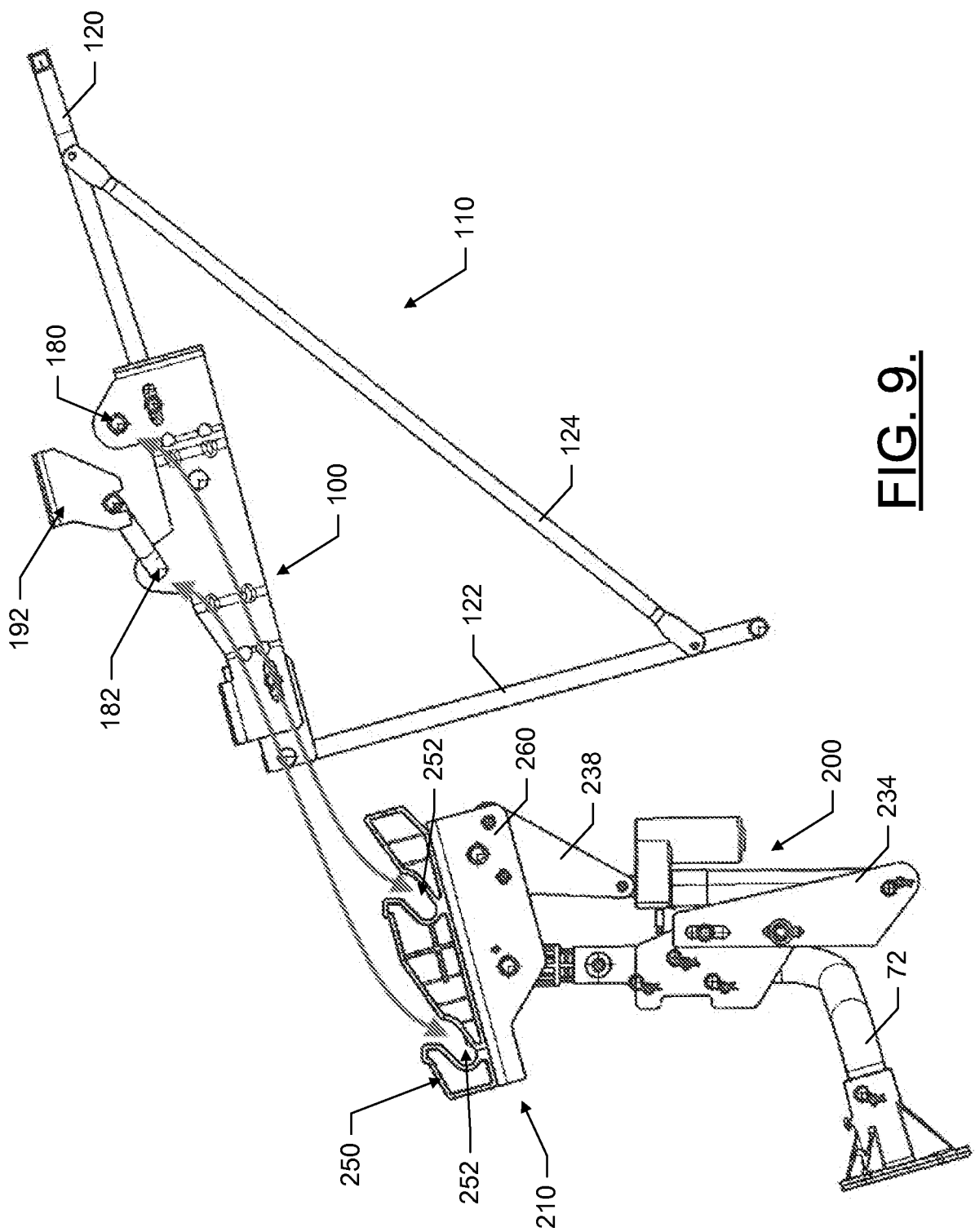
**FIG. 5.**

**FIG. 6.**

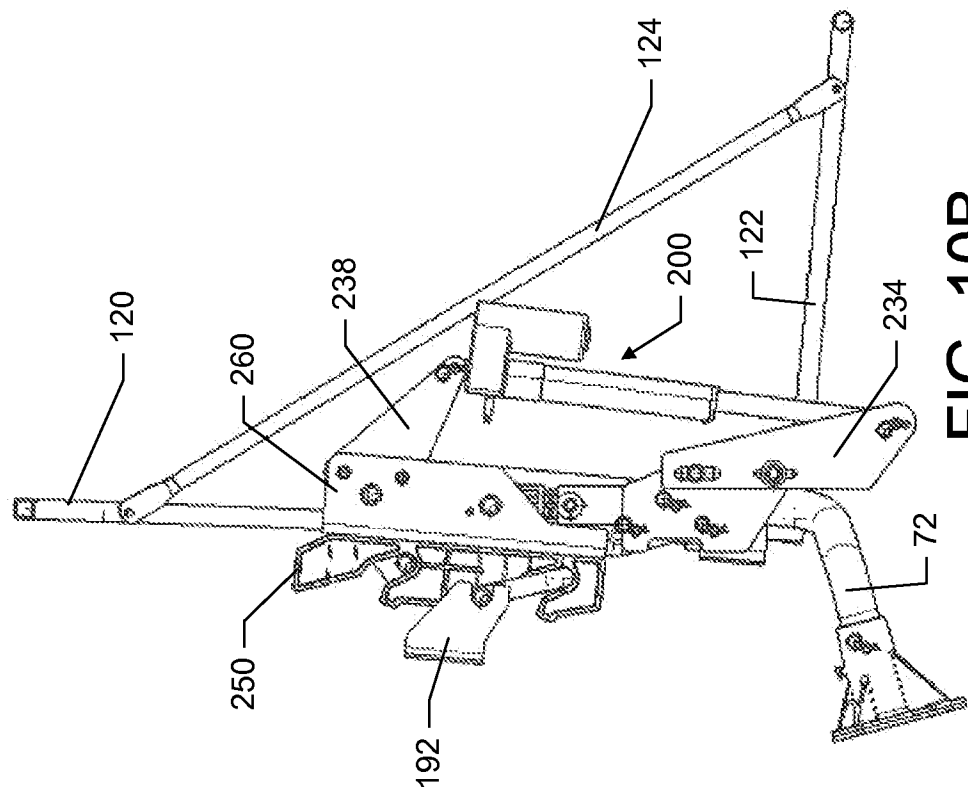
**FIG. 7.**



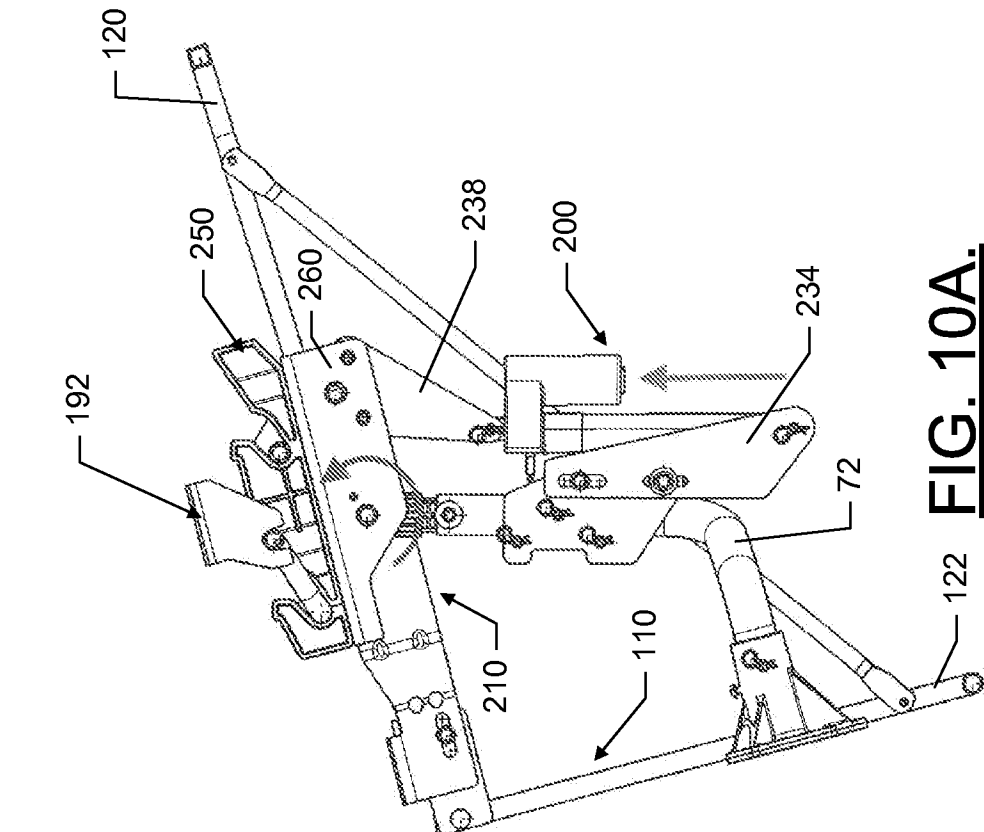
**FIG. 8.**



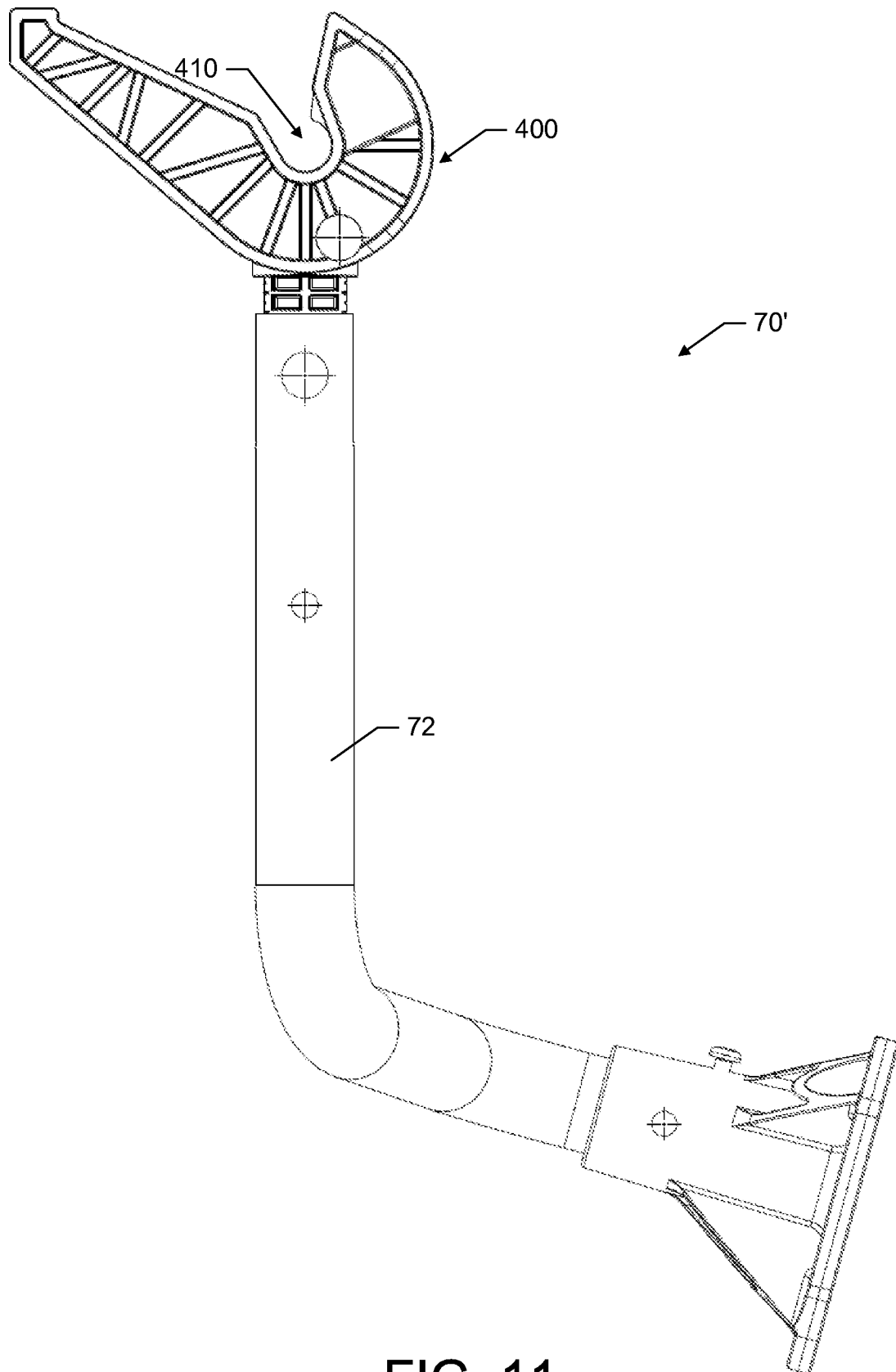
**FIG. 9.**



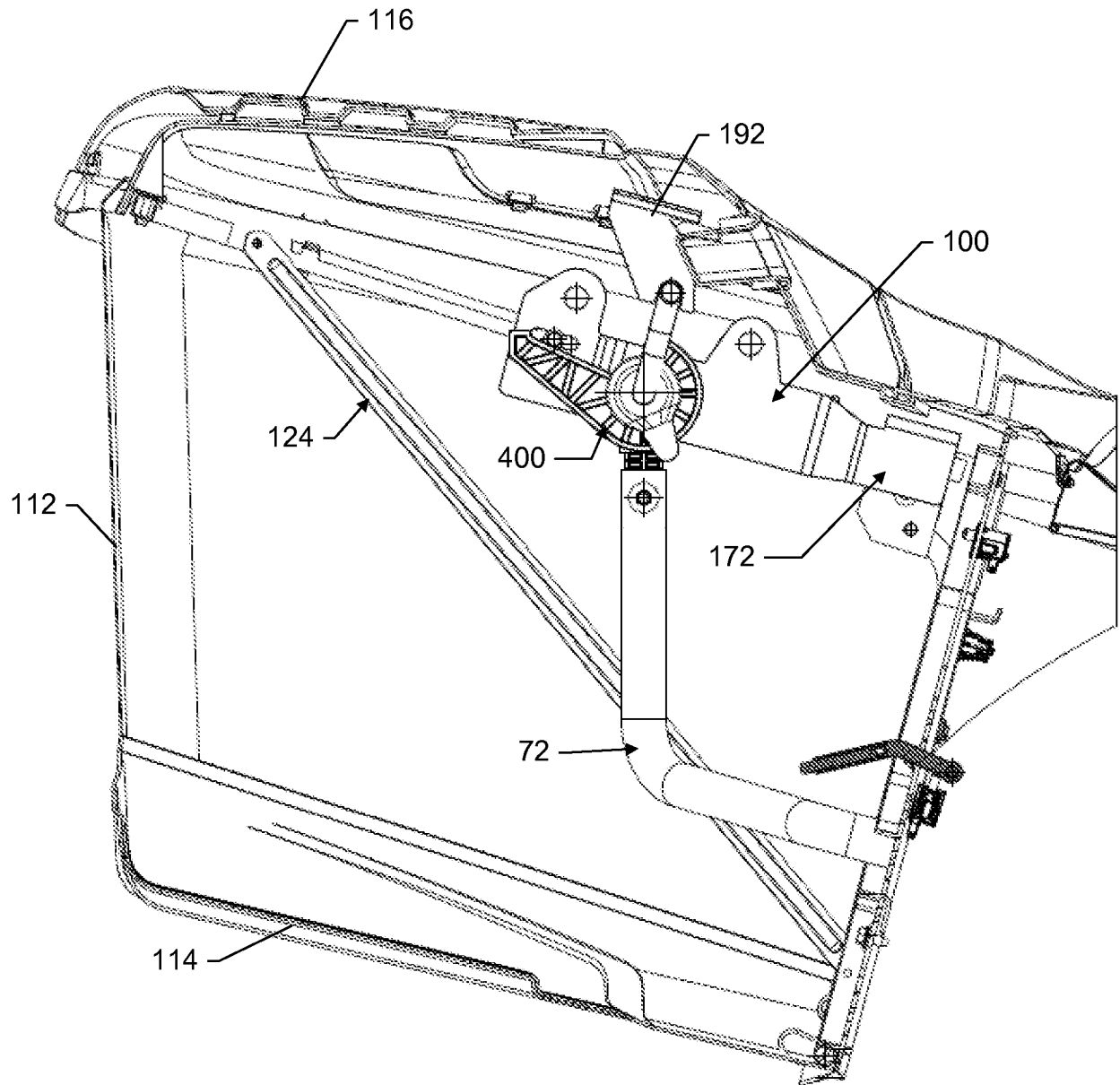
**FIG. 10A.**



**FIG. 10B.**



**FIG. 11.**



**FIG. 12.**