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Bassett

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(54) **ROW-CLEARING UNIT FOR AGRICULTURAL IMPLEMENT**

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(57) **ABSTRACT**

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USPC 111/63; 111/66; 111/140; 111/143;
111/167; 172/551; 172/624.5; 172/705

(58) **Field of Classification Search**
USPC 111/143, 139, 140, 14, 157, 163, 167,
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172/624.5, 705

An agricultural row-clearing unit for use with an agricultural row unit attached to a towing frame hitched to a tractor comprises an attachment frame adapted to be rigidly connected to the towing frame, a support element having a leading end pivotally connected to the attachment frame for vertical pivoting movement relative to the attachment frame, at least one agricultural tool mounted on the trailing end of the support element, and a hydraulic cylinder connected between the attachment frame and the support element for pivoting the support element around the pivotal connection to the attachment frame. The hydraulic cylinder includes a movable rod coupling the cylinder to the support element, a cavity within the cylinder for receiving pressurized hydraulic fluid for advancing the rod in a direction that pivots the support element downwardly toward the soil, and an energy storage device coupled to the rod and the cylinder to apply a retracting force to the rod to bias the support element in a direction that urges the agricultural tool(s) upwardly away from the soil.

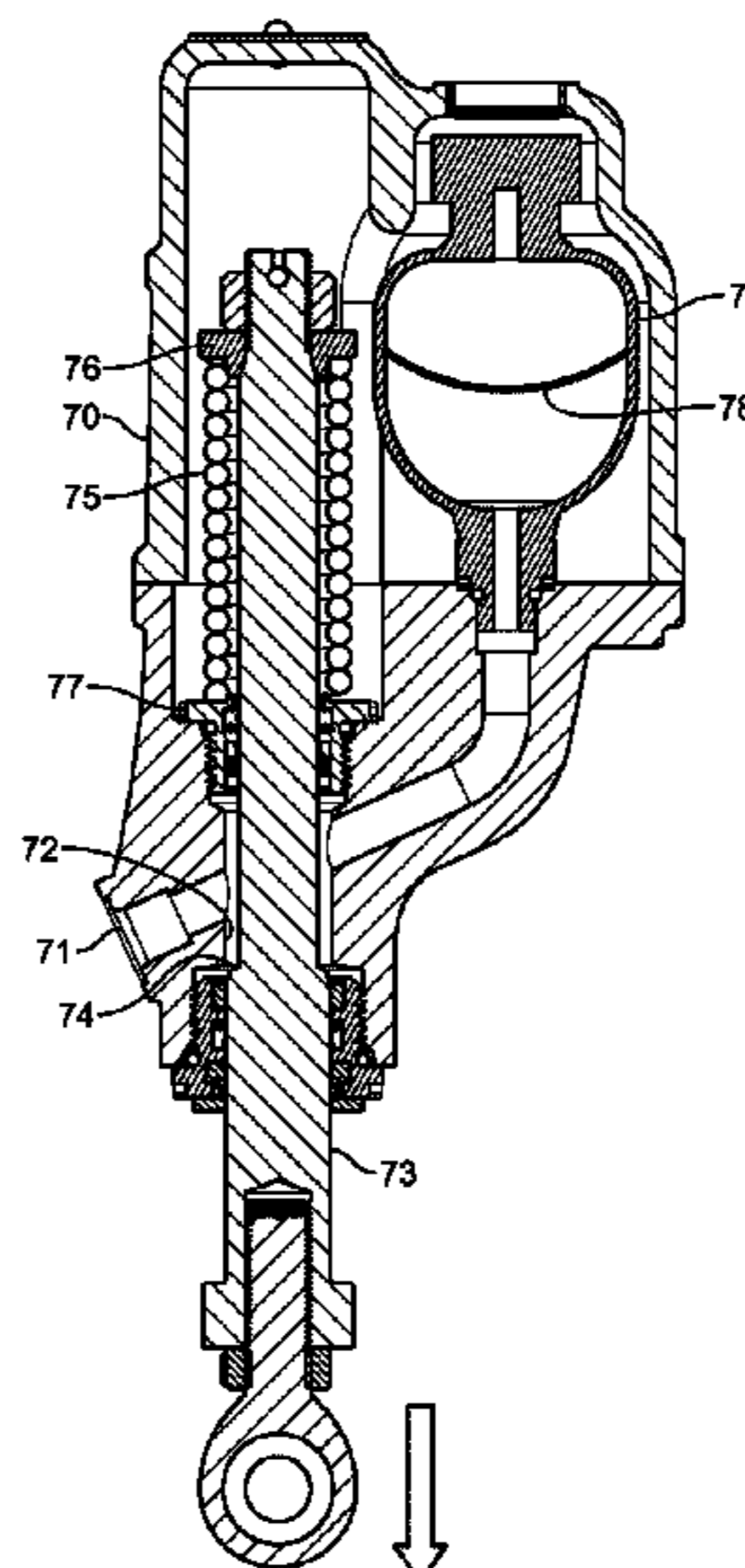
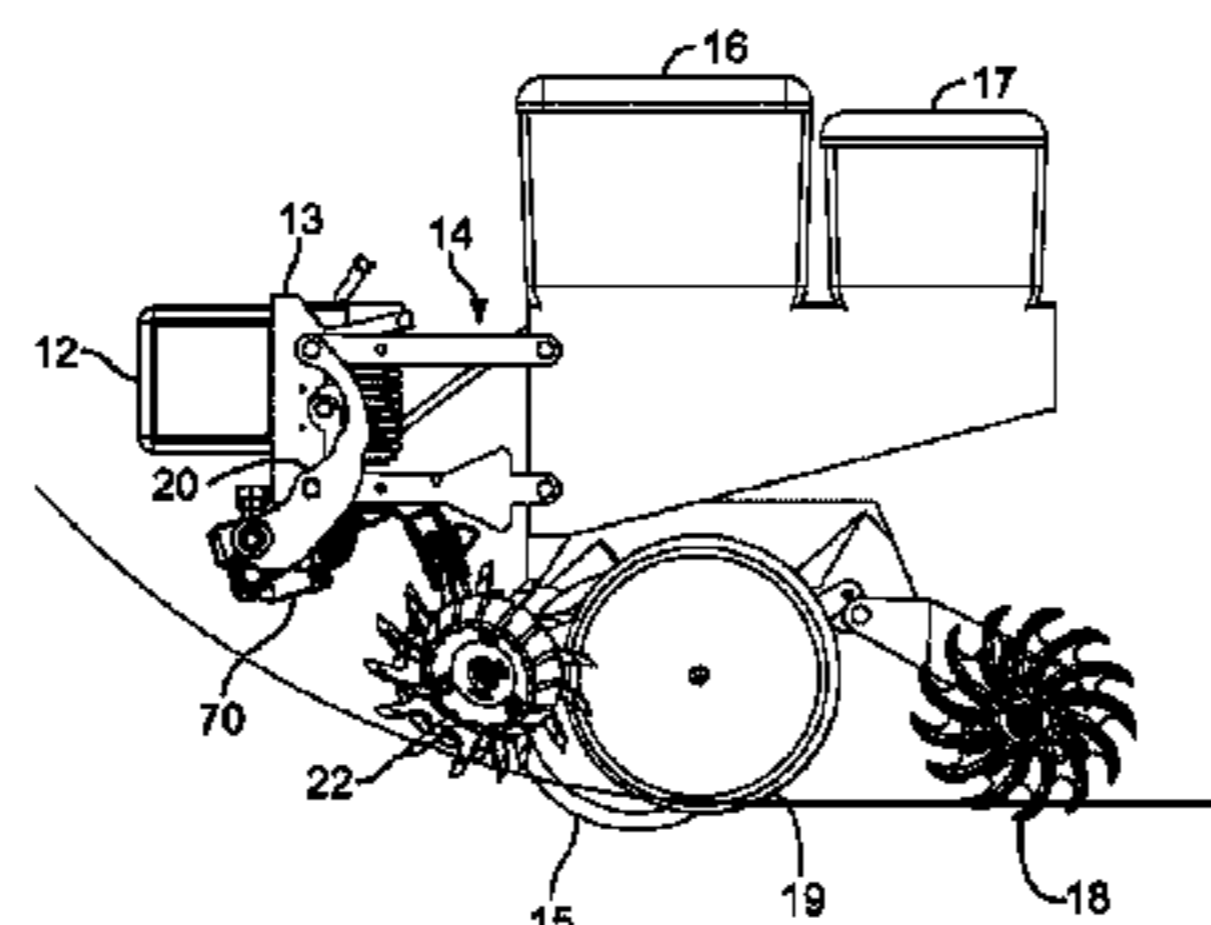
See application file for complete search history.

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46 Claims, 8 Drawing Sheets



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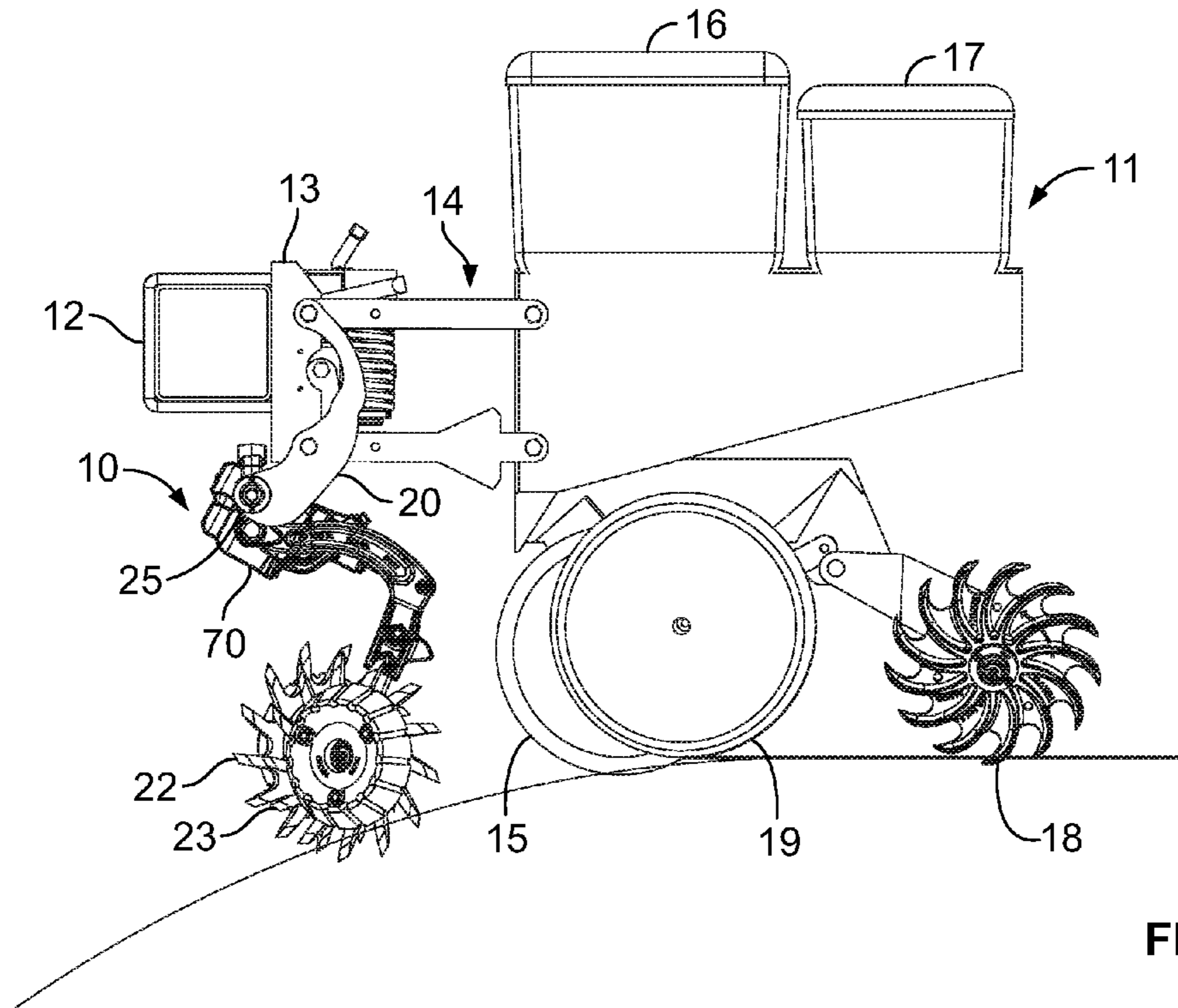


FIG. 1

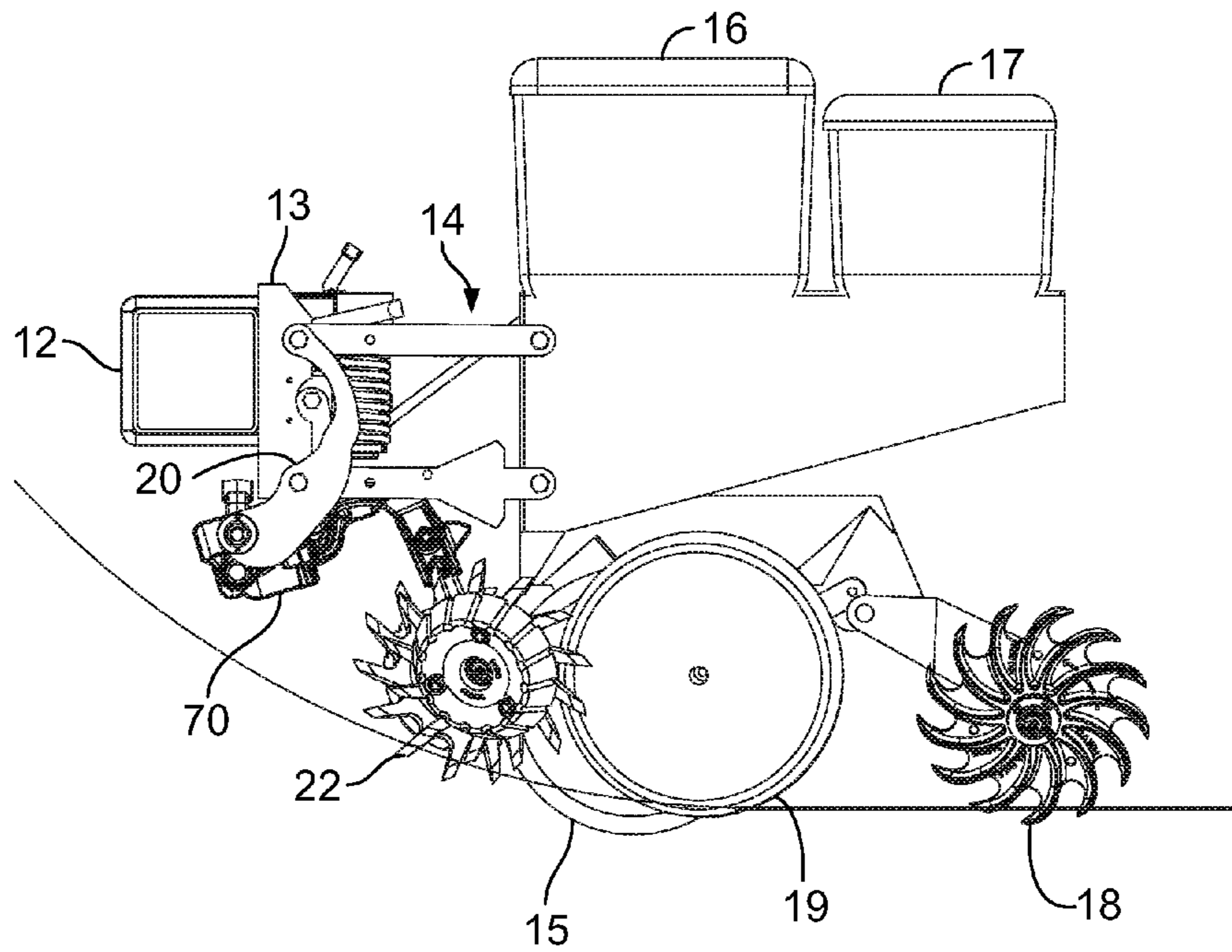


FIG. 2

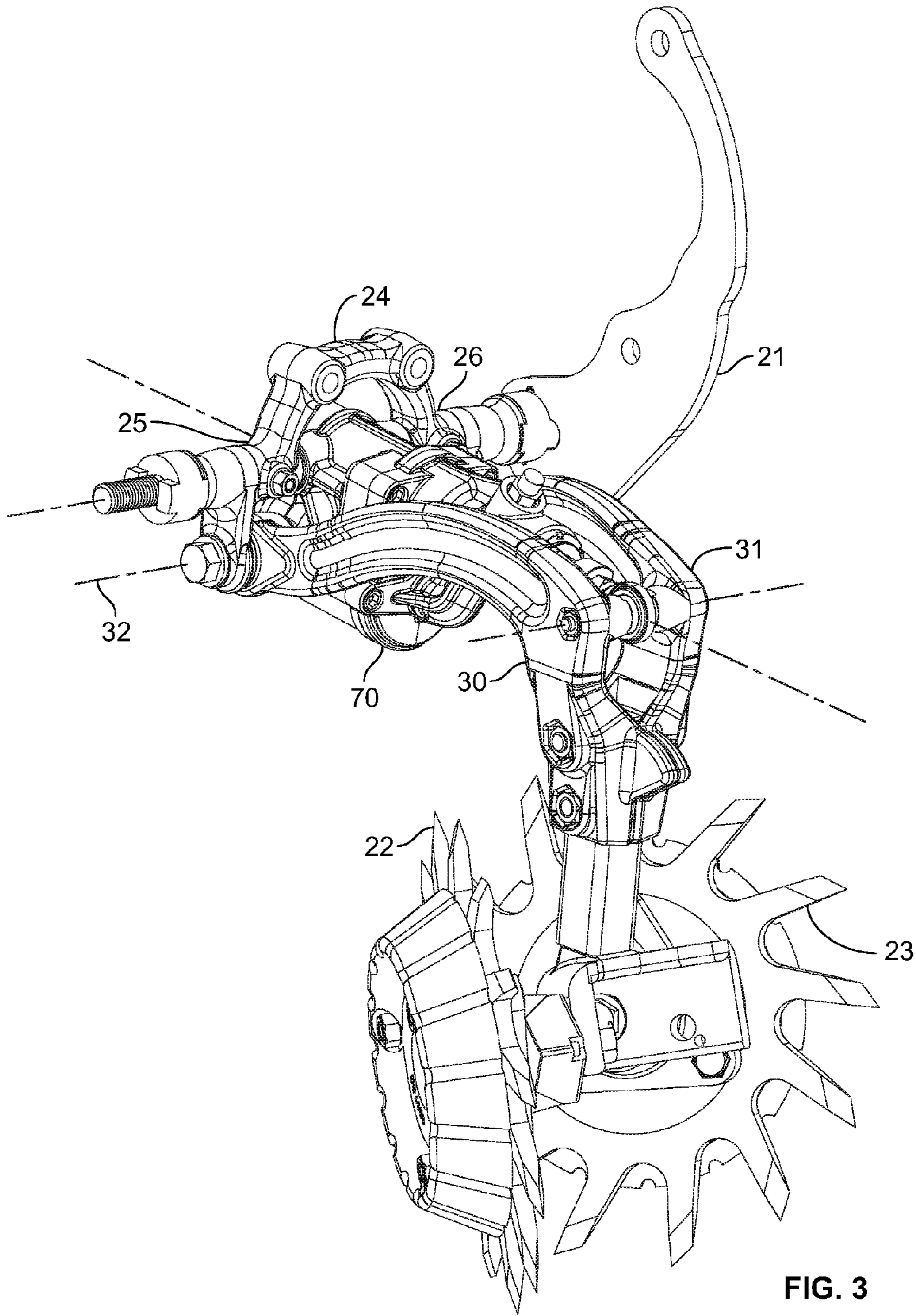


FIG. 3

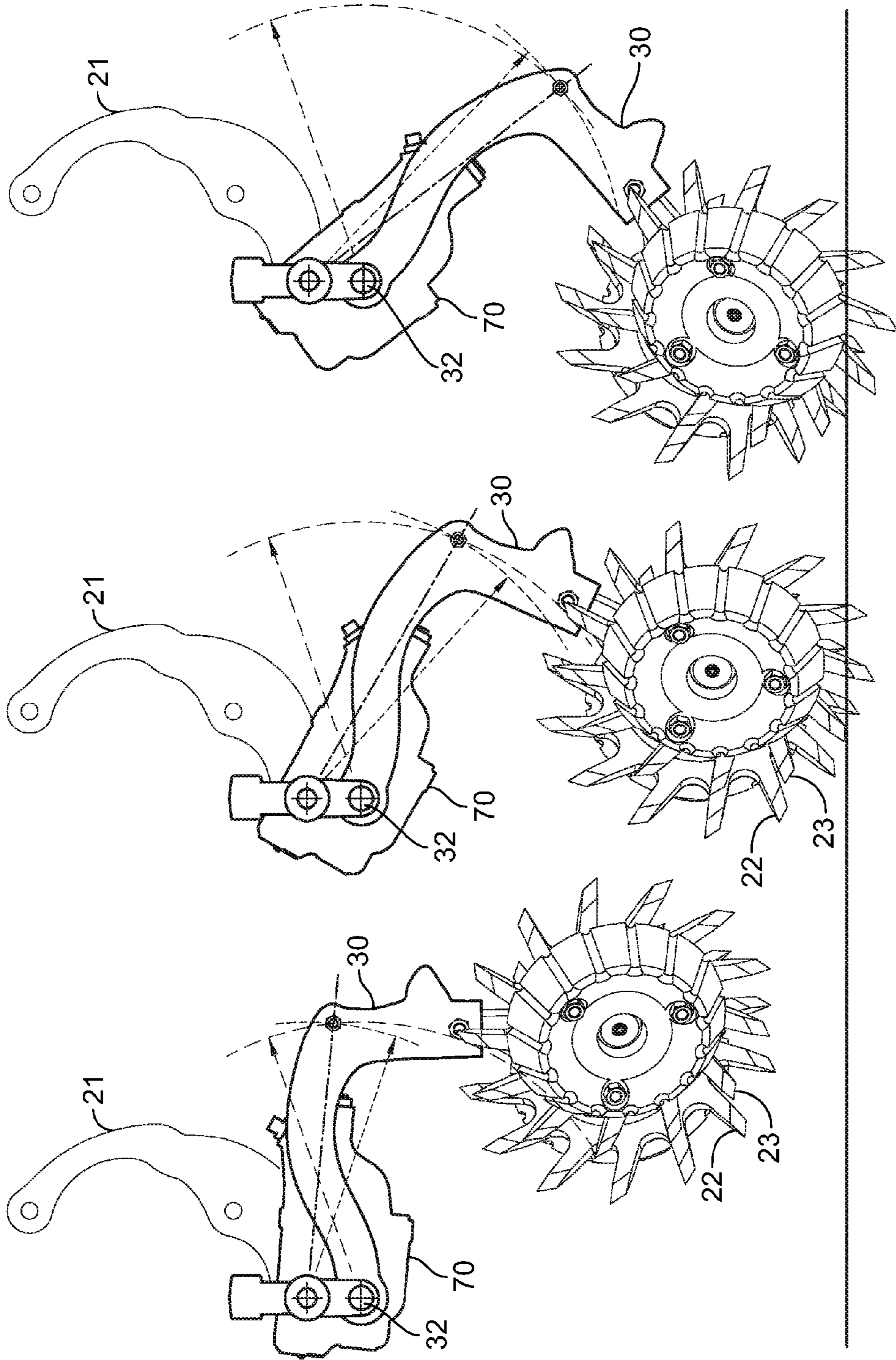


FIG. 6

FIG. 5

FIG. 4

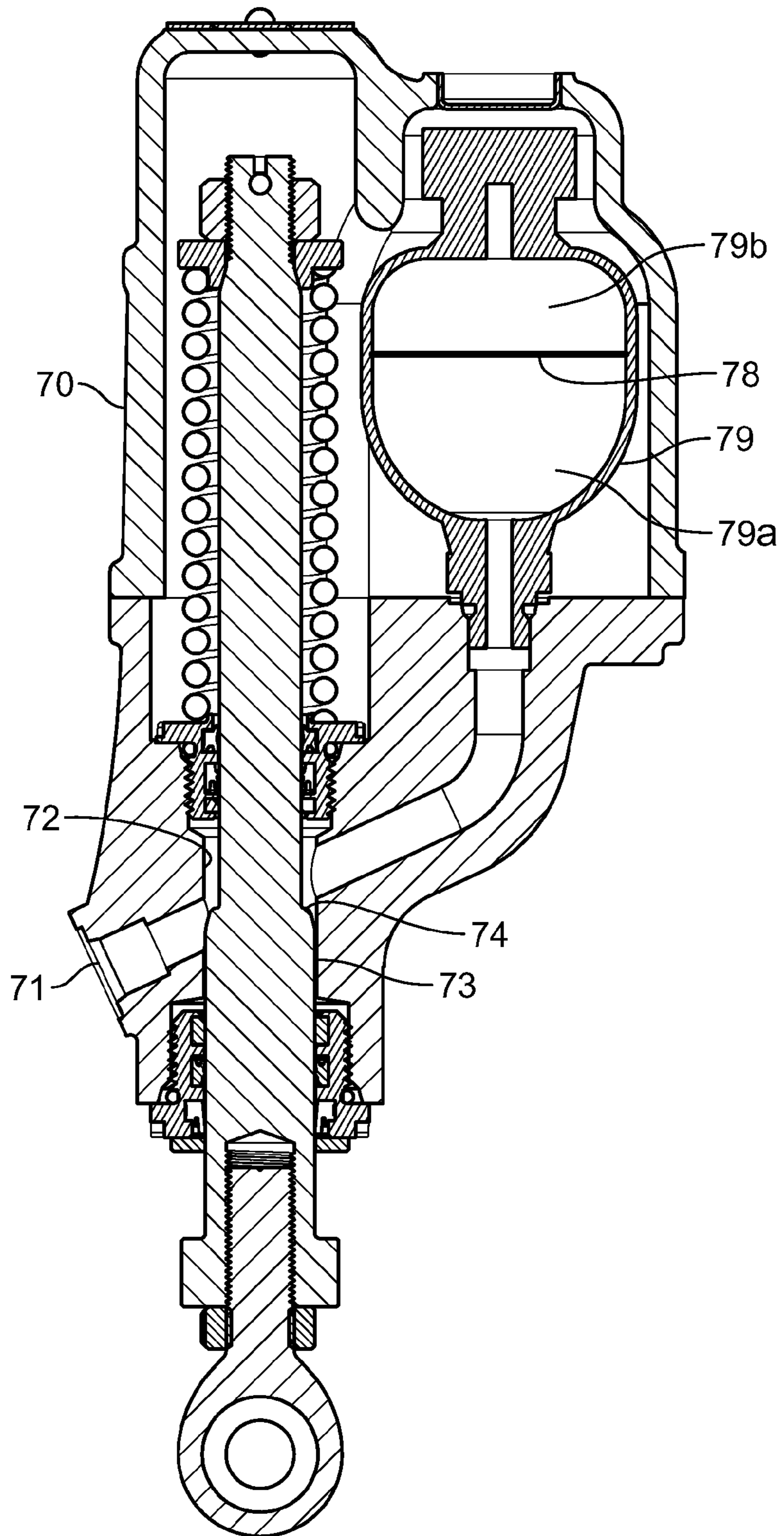


FIG. 7

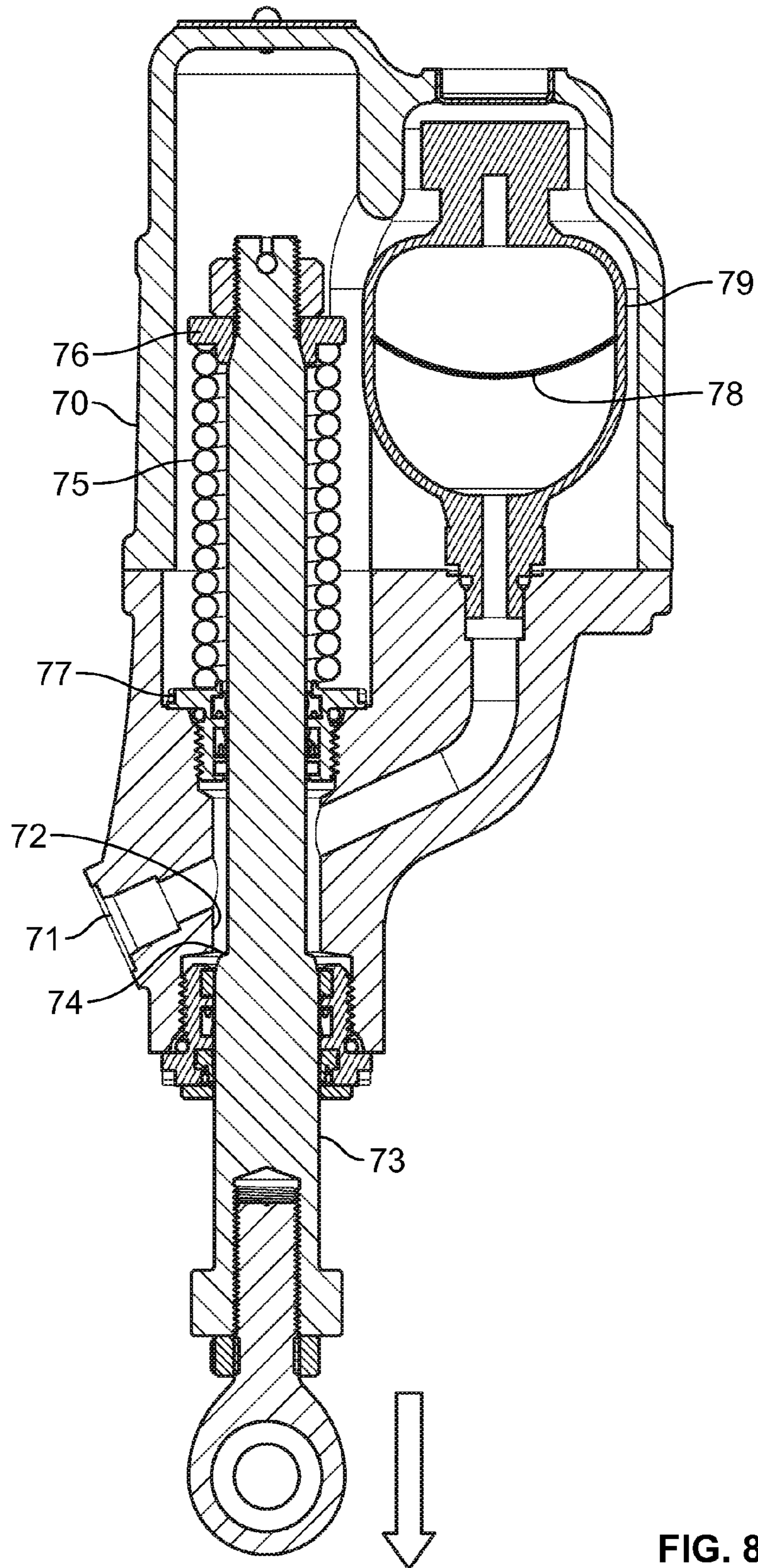


FIG. 8

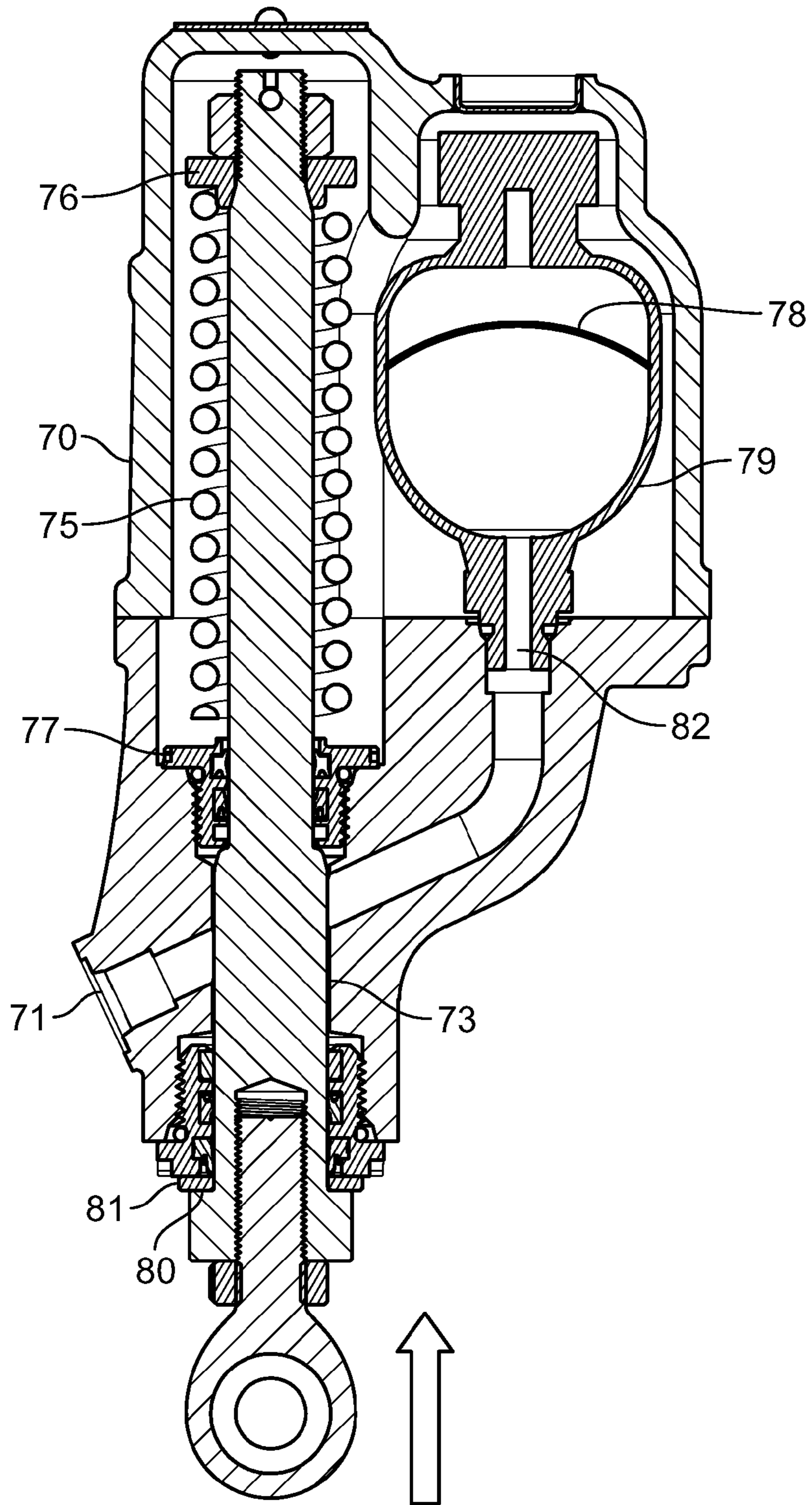


FIG. 9

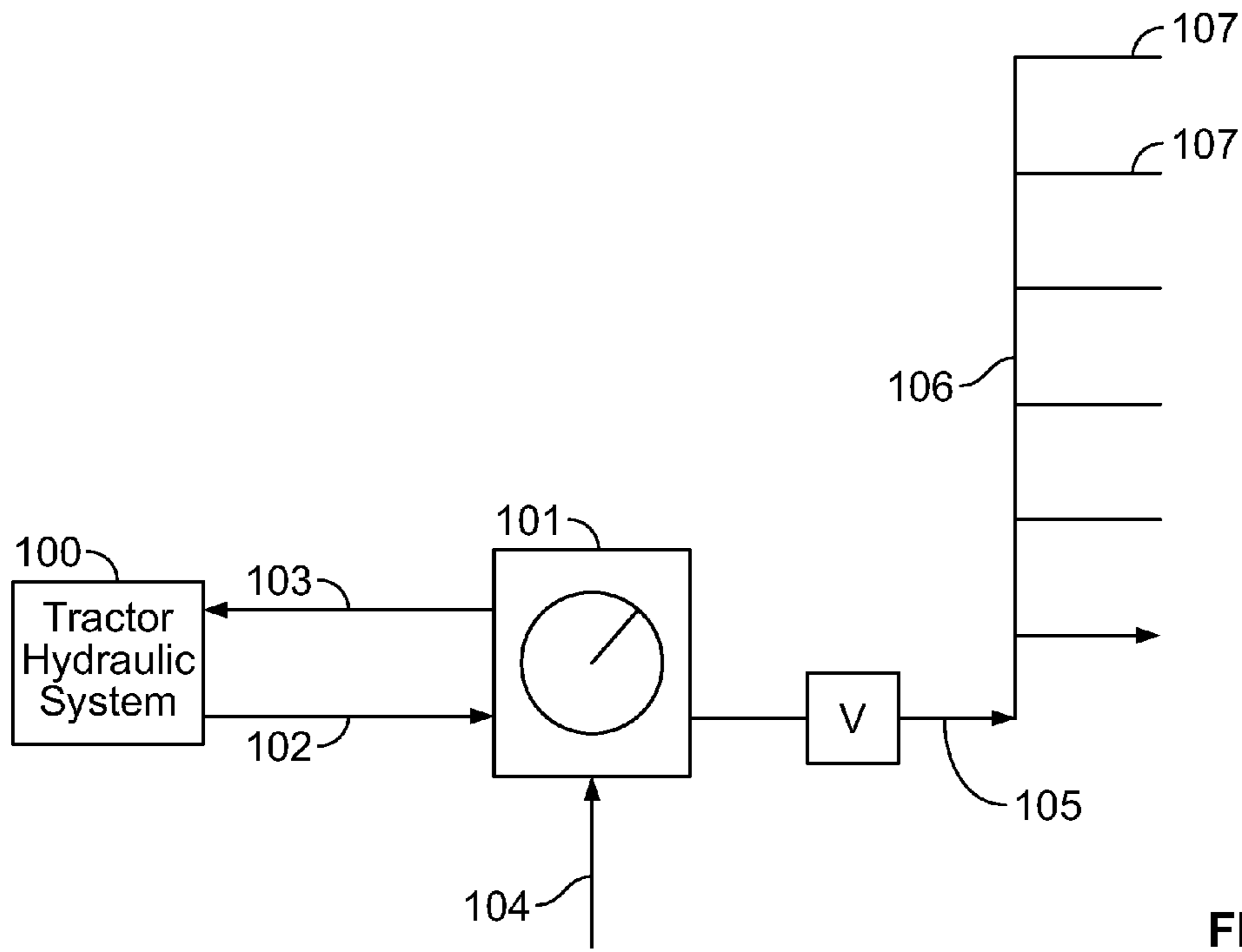


FIG. 10

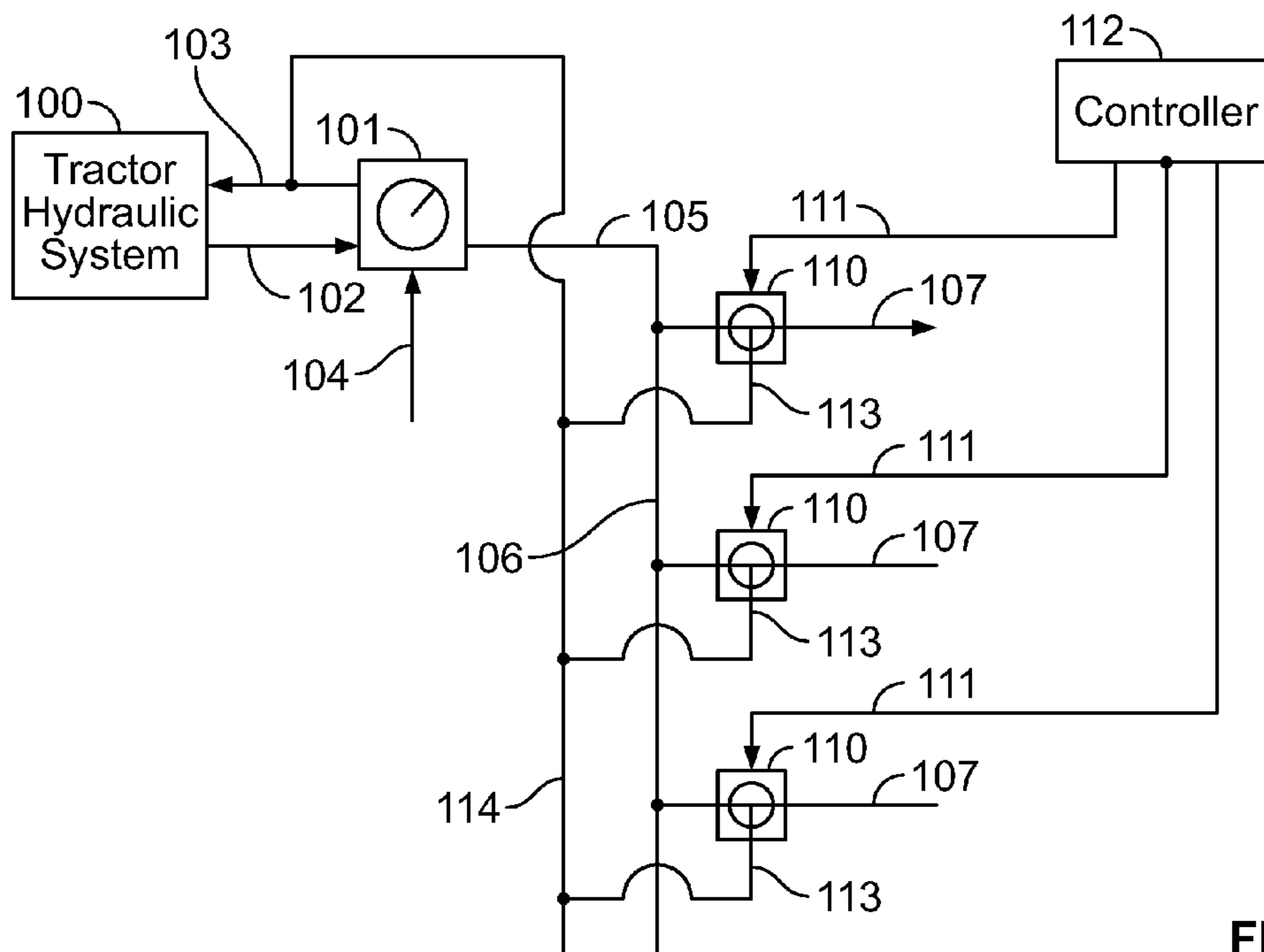


FIG. 11

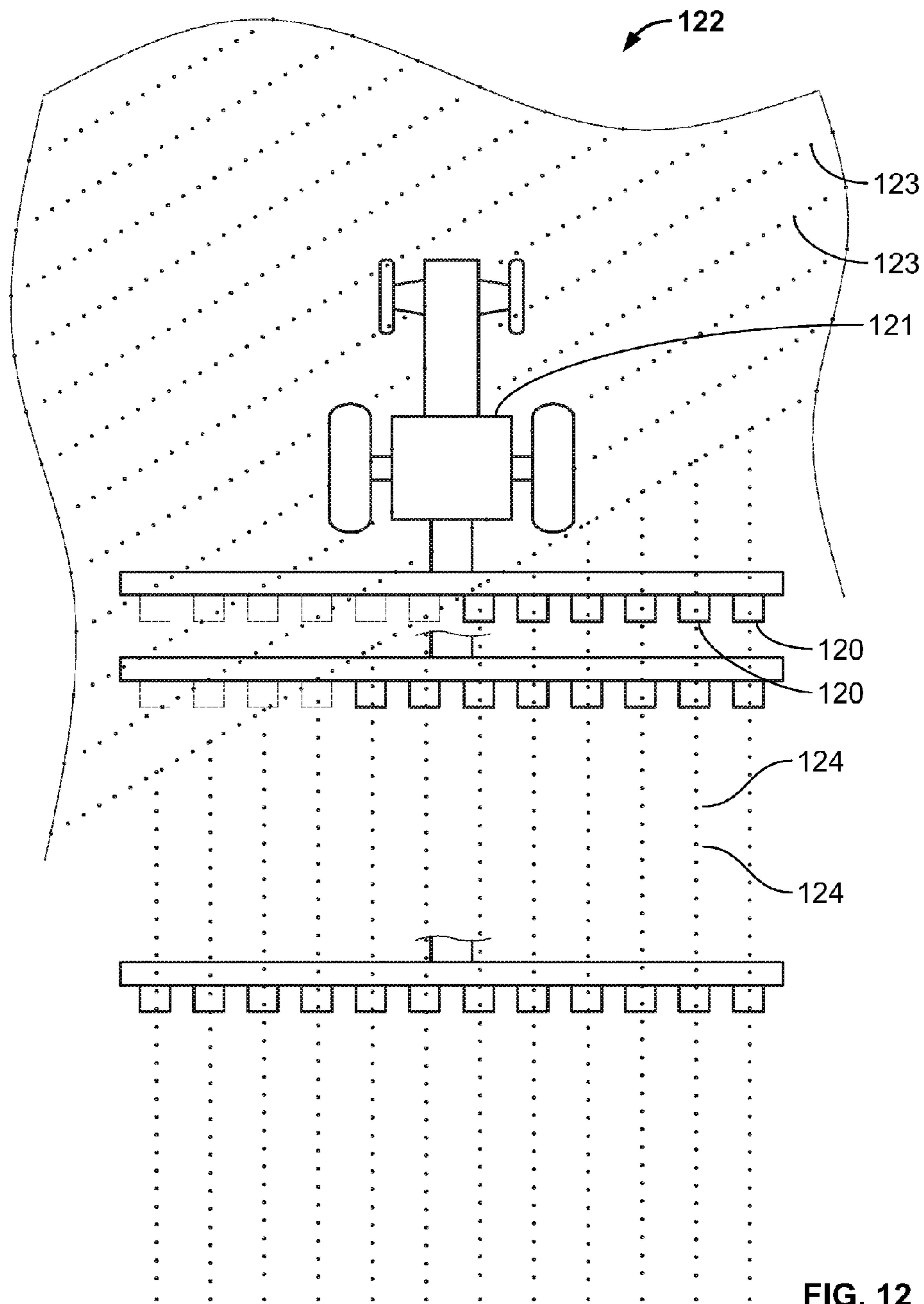


FIG. 12

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ROW-CLEARING UNIT FOR AGRICULTURAL IMPLEMENT

Matter enclosed in heavy brackets [] appears in the original patent but forms no part of this reissue specification; matter printed in italics indicates the additions made by reissue.

FIELD OF THE INVENTION

The present invention relates to agricultural implements and, more particularly, to an agricultural row-clearing unit for use with agricultural implements such as planting row units.

SUMMARY OF THE INVENTION

In one embodiment, an agricultural row clearing unit for use with an agricultural planter row unit attached to a towing frame hitched to a tractor comprises an attachment frame adapted to be rigidly connected to the towing frame, a support element having a leading end pivotally connected to the attachment frame for vertical pivoting movement relative to the attachment frame, at least one agricultural tool mounted on the trailing end of the support element, and a hydraulic cylinder connected between the attachment frame and the support element for pivoting the support element around the pivotal connection to the attachment frame. The hydraulic cylinder includes a movable rod coupling the cylinder to the support element, a cavity within the cylinder for receiving pressurized hydraulic fluid for advancing the rod in a direction that pivots the support element downwardly, and an energy storage device coupled to the rod and the cylinder to apply a retracting force to the rod to bias the support element in a direction that urges the agricultural tool(s) upwardly away from the soil.

One implementation also includes an accumulator having a fluid chamber containing a diaphragm. The portion of the chamber on one side of the diaphragm is connected to the hydraulic-fluid cavity in said hydraulic cylinder, and the portion of the chamber on the other side of the diaphragm contains a pressurized gas.

In one particular implementation, the energy storage device is a compressed coil spring disposed around a portion of the movable rod with one end of the spring coupled to said rod and the other end of the spring coupled to the cylinder so that the spring continuously biases the movable rod in a retracting direction relative to the cylinder.

In modified embodiments, the row-clearing wheels may be replaced with other agricultural tools, such as fertilizer openers or rollers to firm loose soil. With the row-clearing wheels or any other agricultural tools, the unit may be used without a planting row unit, or any other row unit, and the frame element may be connected directly to the towing frame.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention may best be understood by reference to the following description taken in conjunction with the accompanying drawings, in which:

FIG. 1 is a side elevation of a planting row unit and a row-clearing unit, both attached to a towing frame, with the row-clearing unit in a lowered position.

FIG. 2 is the same side elevation shown in FIG. 1 with the row-clearing unit in a raised position.

FIG. 3 is an enlarged perspective of the row-clearing unit shown in FIGS. 1 and 2.

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FIGS. 4, 5 and 6 are side elevations of the main components of the row-clearing unit shown in FIGS. 1-3 in three different vertical positions.

FIGS. 7, 8 and 9 are side elevations of the hydraulic cylinder of the row-clearing unit shown in FIGS. 1-6 with the cylinder rod in three different positions corresponding to the positions shown in FIGS. 5, 6 and 4, respectively.

FIG. 10 is a schematic diagram of a first hydraulic control system for use in the row-clearing unit shown in FIGS. 1-6.

FIG. 11 is a schematic diagram of a second hydraulic control system for use in the row-clearing unit shown in FIGS. 1-6.

FIG. 12 is a diagram illustrating one application of the hydraulic control system of FIG. 11.

DETAILED DESCRIPTION OF ILLUSTRATED EMBODIMENTS

Although the invention will be described in connection with certain preferred embodiments, it will be understood that the invention is not limited to those particular embodiments. On the contrary, the invention is intended to cover all alternatives, modifications, and equivalent arrangements as may be included within the spirit and scope of the invention as defined by the appended claims.

Turning now to the drawings, the illustrative implement includes a row-clearing unit 10 mounted in front of a planting row unit 11. A common elongated hollow towing frame 12 (typically hitched to a tractor by a draw bar) is rigidly attached to the front frame 13 of a four-bar linkage assembly 14 that is part of the row unit 11. The four-bar (sometimes referred to as "parallel-bar") linkage assembly 14 is a conventional and well known linkage used in agricultural implements to permit the raising and lowering of tools attached thereto.

As the planting row unit 11 is advanced by the tractor, a coulter wheel 15 works the soil and then other portions of the row unit part the cleared soil to form a seed slot, deposit seed in the seed slot and fertilizer adjacent to the seed slot, and close the seed slot by distributing loosened soil into the seed slot with a closing wheel 18. A gauge wheel 19 determines the planting depth for the seed and the height of introduction of fertilizer, etc. Bins 16 and 17 on the row unit carry the chemicals and seed which are directed into the soil. The planting row unit 11 is urged downwardly against the soil by its own weight. If it is desired to have the ability to increase this downward force, or to be able to adjust the force, a hydraulic or pneumatic cylinder and/or one or more springs may be added between the front frame 13 and the linkage 14 to urge the row unit downwardly with a controllable force. Such a hydraulic cylinder may also be used to lift the row unit off the ground for transport by a heavier, stronger, fixed-height frame that is also used to transport large quantities of fertilizer for application via multiple residue-clearing and tillage row units. This hydraulic or pneumatic cylinder may be controlled to adjust the downward force for different soil conditions such as is described in U.S. Pat. Nos. 5,709,271, 5,685,245 and 5,479,992.

The row-clearing unit 10 includes an attachment frame that includes a pair of rigid arms 20 and 21 adapted to be rigidly connected to the towing frame 12. In the illustrative embodiment, the arms 20 and 21 are bolted to opposite sides of the front frame 13 of the row unit 11, which in turn is rigidly attached to the towing frame 12. An alternative is to attach the row-clearing unit 10 directly to the towing frame 12. At the bottom of the row-clearing unit 10, a pair of cooperating toothed clearing wheels 22 and 23 are positioned upstream of the coulter wheel 15 of the planting row unit 11.

The clearing wheels **22**, **23** are arranged for rotation about transverse axes and are driven by the underlying soil as the wheels are advanced over the soil. The illustrative wheels **22**, **23** are a type currently sold by the assignee of the present invention under the trademark TRASHWHEEL. The toothed wheels **22**, **23** cooperate to produce a scissors action that breaks up compacted soil and simultaneously clears residue out of the path of planting. The wheels **21** and **22** kick residue off to opposite sides, thus clearing a row for planting. To this end, the lower edges are tilted outwardly to assist in clearing the row to be planted. This arrangement is particularly well suited for strip tilling, where the strip cleared for planting is typically only about 10 inches of the 30-inch center-to-center spacing between planting rows.

In FIGS. **1** and **2**, the clearing wheels **22** and **23** are shown in two different vertical positions. Specifically, the wheels **22**, **23** are in a lower position in FIG. **1**, where the elevation of the soil is decreasing, than in FIG. **2**, where the soil elevation is increasing.

The row-clearing unit **10** is shown in more detail in FIGS. **3-9**. The two frame arms **20**, **21** are interconnected by an arched crossbar **24** that includes a pair of journals **25** and **26** for receiving the leading ends of a pair of laterally spaced support arms **30** and **31**. The support arms **30**, **31** are thus pivotally suspended from the crossbar **24** of the attachment frame, so that the trailing ends of the support arms **30**, **31** can be pivoted in an arc around a horizontal axis **32** extending through the two journals **25**, **26**.

The row-clearing wheels **22** and **23** are mounted on the trailing ends of the support arms **30** and **31**, which are bolted or welded together. As can be seen in FIGS. **4-6**, the wheels **22**, **23** can be raised and lowered by pivoting the support arms **30**, **31** around the horizontal axis **32**. The pivoting movement of the support arms **30**, **31** is controlled by a hydraulic cylinder **70** connected between the fixed crossbar **24** and the trailing ends of the support arms **30**, **31**. FIGS. **4-6** show the support arms **30**, **31**, and thus the clearing wheels **22**, **23**, in progressively lower positions. The downward pressure applied to the support arms **30**, **31** to urge the clearing wheels **22**, **23** against the soil is also controlled by the hydraulic cylinder **70**.

The hydraulic cylinder **70** is shown in more detail in FIGS. **7-9**. Pressurized hydraulic fluid from the tractor is supplied by a hose (not shown) to a port **71** that leads into an annular cavity **72** surrounding a rod **73**, and then on into an accumulator **79**. After the internal cavities connected to the port **71** are filled with pressurized hydraulic fluid, the port is closed by a valve, as will be described in more detail below. The lower end of the annular cavity **72** is formed by a shoulder **74** on the rod **73**, so that the hydraulic pressure exerted by the hydraulic fluid on the surface of the shoulder **74** urges the rod **73** downwardly (as viewed in FIGS. **7-9**), with a force determined by the pressure of the hydraulic fluid and the area of the exposed surface of the shoulder **74**. The hydraulic fluid thus urges the rod **73** in an advancing direction (see FIG. **8**).

When the rod **73** is advanced outwardly from the cylinder **70**, the rod pivots the support arms **30**, **31** downwardly, thereby lowering the clearing wheels **22**, **23**. Conversely, retracting movement of the rod **73** pivots the support arms **30**, **31** upwardly, thereby raising the clearing wheels **22**, **23**.

The accumulator **79** includes a diaphragm that divides the interior of the accumulator into a hydraulic-fluid chamber **79a** and a gas-filled chamber **79b**, e.g., filled with pressurized nitrogen. FIG. **7** shows the rod **73** in a position where the diaphragm is not deflected in either direction, indicating that the pressures exerted on opposite sides of the diaphragm are substantially equal. In FIG. **8**, the hydraulic force has

advanced the rod **73** to its most advanced position, which occurs when the resistance offered by the soil to downward movement of the clearing wheels **22**, **23** is reduced (e.g., by softer soil or a depression in the soil).

As can be seen in FIG. **8**, advancing movement of the rod **73** is limited by the "bottoming out" of a coil spring **75** located between a flange **76** attached to the inner end of the rod **73** and a flange **77** attached to the interior of the cylinder **70**. As the rod **73** is advanced, the coil spring **75** is progressively compressed until it reaches its fully compressed condition illustrated in FIG. **8**, which prevents any further advancement of the rod **73**. Advancing movement of the rod **73** also expands the size of the annular cavity **72** (see FIG. **8**), which causes the diaphragm **78** in the accumulator **79** to deflect to the position illustrated in FIG. **8** and reduce the amount of hydraulic fluid in the accumulator **80**. When the rod **73** is in this advanced position, the support arms **30**, **31** and the clearing wheels **22**, **23** are pivoted to their lowermost positions relative to the row unit **11**.

In FIG. **9**, the rod **73** has been withdrawn to its most retracted position, which can occur when the clearing wheels **22**, **23** encounter a rock or other obstruction, for example. When the rod **73** is in this retracted position, the support arms **30**, **31** and the clearing wheels **22**, **23** are pivoted to their uppermost positions relative to the row unit. As can be seen in FIG. **9**, retracting movement of the rod **73** is limited by engagement of a shoulder **80** on the rod **73** with a ring **81** on the trailing end of the cylinder **70**. As the rod **73** is retracted by forces exerted on the clearing wheels **22**, **23**, the coil spring **75** is progressively expanded, as illustrated in FIG. **9**, but still applies a retracting bias to the rod **73**.

Retracting movement of the rod **73** virtually eliminates the annular cavity **72** (see FIG. **9**), which causes a portion of the fixed volume of hydraulic fluid in the cylinder **70** to flow into the chamber **79a** of the accumulator **79**, causing the diaphragm **78** to deflect to the position illustrated in FIG. **9**. This deflection of the diaphragm **78** into the chamber **79b** compresses the gas in that chamber. To enter the chamber **79a**, the hydraulic fluid must flow through a restriction **82**, which limits the rate at which the hydraulic fluid flows into the accumulator. This controlled rate of flow of the hydraulic fluid has a damping effect on the rate at which the rod **73** retracts or advances, thereby avoiding sudden large movements of the moving parts of the row-clearing unit.

When the external obstruction causing the row cleaners to rise is removed from the clearing wheels, the combined effects of the pressurized gas in the accumulator **79** on the diaphragm **78** and the pressure of the hydraulic fluid move the rod **73** to a more advanced position. This downward force on the clearing wheels **22**, **23** holds them against the soil and prevents uncontrolled bouncing of the wheels over irregular terrain, but is not so excessive as to leave a trench in the soil. The downward force applied to the clearing wheels **22**, **23** can be adjusted by changing the pressure of the hydraulic fluid supplied to the cylinder **70**.

FIG. **10** is a schematic of a hydraulic control system for supplying pressurized hydraulic fluid to the cylinders **70** of multiple row-clearing units. A source **100** of pressurized hydraulic fluid, typically located on a tractor, supplies hydraulic fluid under pressure to a valve **101** via supply line **102** and receives returned fluid through a return line **103**. The valve **101** can be set by an electrical control signal **S1** on line **104** to deliver hydraulic fluid to an output line **105** at a desired constant pressure. The output line is connected to a manifold **106** that in turn delivers the pressurized hydraulic fluid to individual feed lines **107** connected to the ports **71** of the respective hydraulic cylinders **70** of the individual row-clear-

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ing units. With this control system, the valve 101 is turned off, preferably by a manually controlled on/off valve V, after all the cylinders 70 have been filled with pressurized hydraulic fluid, to maintain a fixed volume of fluid in each cylinder.

FIG. 11 is a schematic of a modified hydraulic control system that permits individual control of the supply of hydraulic fluid to the cylinder 70 each separate row-clearing unit via feed lines 107 connected to the ports 71 of the respective cylinders 70. Portions of this system that are common to those of the system of FIG. 10 are identified by the same reference numbers. The difference in this system is that each separate feed line 107 leading to one of the row-clearing units is provided with a separate control valve 110 that receives its own separate control signal on a line 111 from a controller 112. This arrangement permits the supply of pressurized hydraulic fluid to each row-clearing unit to be turned off and on at different times by the separate valve 110 for each unit, with the times being controlled by the separate control signals supplied to the valves 110 by the controller 112. The individual valves 110 receive pressurized hydraulic fluid via the manifold 106, and return hydraulic fluid to a sump on the tractor via separate return line 113 connected to a return manifold 114 connected back to the hydraulic system 100 of the tractor.

FIG. 12 illustrates an application for the controllable hydraulic control system of FIG. 11. Modern agricultural equipment often includes GPS systems that enable the user to know precisely where a tractor is located in real time. Thus, when a gang of planting row units 120 towed by a tractor 121 begins to cross a headland 122 in which the rows 123 are not orthogonal to the main rows 124 of a field, each planting row unit 120 can be turned off just as it enters the headland 122, to avoid double-planting while the tractor 121 makes a turn through the headland. With the control system of FIG. 11, the hydraulic cylinder 70 of each row unit can also be separately controlled to turn off the supply of pressurized hydraulic fluid at a different time for each row-clearing unit, so that each row-clearing unit is raised just as it enters the headland, to avoid disrupting the rows already planted in the headland.

One benefit of the system of FIG. 11 is that as agricultural planters, seeders, fertilizer applicators, tillage equipment and the like become wider with more row units on each frame, often 36 30-inch rows or 54 20-inch rows on a single 90-foot wide toolbar, is that each row-clearing unit can float vertically independently of every other row-clearing unit. Yet the following row units still have the down force remotely adjustable from the cab of the tractor or other selected location. This permits very efficient operation of a wide planter or other agricultural machine in varying terrain without having to stop to make manual adjustment to a large number of row-clearing units, resulting in a reduction in the number of acres planted in a given time period. One of the most important factors in obtaining a maximum crop yield is timely planting. By permitting remote down force adjustment of each row-clearing unit (or group of units), including the ability to quickly release all down force and let the row cleaner quickly rise, e.g., when approaching a wet spot in the field, one can significantly increase the planter productivity or acres planted per day, thereby improving yields and reducing costs of production.

On wide planters or other equipment, at times 90 feet wide or more and planting at 6 mph or more forward speed, one row-clearing unit must often rise or fall quickly to clear a rock or plant into an abrupt soil depression. Any resistance to quick movement results in either gouging of the soil or an uncleared portion of the field and reduced yield. With the row-clearing unit having its own hydraulic accumulator, the clearing

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wheels and the rod of the hydraulic cylinder can move quickly and with a nearly constant down force. Oil displaced by or required by quick movement of the rod and clearing wheels (or other agricultural tool) is quickly moved into or out of the closely mounted accumulator which is an integral part of each row-clearing unit. The accumulator diaphragm or piston supplies or accepts fluid as required at a relatively constant pressure and down force as selected manually or automatically by the hydraulic control system. By following the soil profile closely and leaving a more uniform surface, the toolbar-frame-mounted row-clearing unit permits the planter row unit following independently behind to use less down force for its function, resulting in more uniform seed depth control and more uniform seedling emergence. More uniform seedling stands usually result in higher yields than less uniform seedling stands produced by planters with less accurate row cleaner ground following.

Although the illustrative embodiments described above utilize clearing wheels as the agricultural tools, it should be understood that the invention is also applicable to row units that utilize other agricultural tools, such as fertilizer openers or rollers for firming loose soil.

It will be evident to those skilled in the art that the invention is not limited to the details of the foregoing illustrated embodiments and that the present invention may be embodied in other specific forms without departing from the spirit or essential attributes thereof. The present embodiments are therefore to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claims rather than by the foregoing description, and all changes which come within the meaning and range of equivalency of the claims are therefore intended to be embraced therein.

The invention claimed is:

1. An agricultural row-clearing unit for use with an agricultural planting row unit attached to a towing frame hitched to a tractor, said row clearing unit comprising:

an attachment frame adapted to be rigidly connected to said towing frame,

a support element having a leading end pivotally connected to said attachment frame at a pivotal connection for vertical pivoting movement relative to said attachment frame,

at least one row-clearing wheel mounted on the trailing end of said support element,

a hydraulic cylinder pivotally connected between said attachment frame and said support element for pivoting said support element around said pivotal connection to said attachment frame, said hydraulic cylinder including a movable rod coupling said cylinder to said support element,

a cavity within said cylinder for receiving pressurized hydraulic fluid for advancing said rod in a direction that pivots said support element downwardly toward the soil, and

an energy storage device coupled to said rod and said cylinder to apply a retracting force to said rod to pivotally bias said support element in a direction that urges said at least one row-clearing wheel upwardly away from the soil.

2. The row-clearing unit of claim 1 which includes an accumulator having a fluid chamber containing a diaphragm, the portion of said chamber on one side of said diaphragm connected to said hydraulic-fluid cavity in said hydraulic cylinder, and the portion of said chamber on the other side of said diaphragm containing a pressurized gas.

3. The row-clearing unit of claim 2 in which said cavity is closed so that the volume of hydraulic fluid in said cylinder and accumulator is fixed.

4. The row-clearing unit of claim 1 in which said energy storage device is a compressed coil spring disposed around a portion of said rod with one end of said spring coupled to said rod and the other end of said spring coupled to said cylinder so that said spring continuously biases said movable rod in a retracting direction relative to said cylinder.

5. The row-clearing unit of claim 1 in which said rod forms a shoulder within said cavity so that the pressure of said hydraulic fluid urges said rod in an advancing direction.

6. The row-clearing unit of claim 1 in which said agricultural row unit is a planting row unit.

7. The row-clearing unit of claim 6 which said attachment frame is adapted to be rigidly connected to said towing frame via an attachment frame of a planting row unit.

8. An agricultural implement for use with a towing frame adapted to be hitched to a tractor, said implement comprising an attachment frame adapted to be rigidly connected to said towing frame,

a support element having a leading end pivotally connected to said attachment frame at a pivotal connection for vertical pivoting movement relative to said attachment frame,

at least one agricultural tool mounted on the trailing end of said support element,

a hydraulic cylinder pivotally connected between said attachment frame and said support element for pivoting said support element around said pivotal connection to said attachment frame, said hydraulic cylinder including a movable rod coupling said cylinder to said support element,

a cavity within said cylinder for receiving pressurized hydraulic fluid for advancing said rod in a direction that pivots said support element downwardly toward the soil, and

an energy storage device coupled to said rod and said cylinder to apply a retracting force to said rod to pivotally bias said support element in a direction that urges said at least one agricultural tool upwardly away from the soil.

9. An agricultural implement for use with a towing frame adapted to be hitched to a tractor, said implement comprising a planting row unit having

a frame element rigidly adapted to be rigidly attached to said towing frame, and

a planting assembly pivotally connected to said frame element, and

a row-clearing unit having

a frame element adapted to be rigidly connected to said towing frame,

a support element having a leading end pivotally connected to said frame element of said row-clearing unit at a pivotal connection for vertical pivoting movement of said support element,

at least one clearing wheel mounted on the trailing end of said support element,

a hydraulic cylinder pivotally connected between said frame element of said row-clearing unit and said support element for pivoting said support element around said pivotal connection, said hydraulic cylinder including

a movable rod coupling said cylinder to said support element,

a cavity within said cylinder for receiving pressurized hydraulic fluid for advancing said rod in a direction that pivots said support element downwardly, and an energy storage device coupled to said rod and said cylinder to apply a retracting force to said rod to pivotally bias said support element in a direction that urges said at least one clearing wheel upwardly away from the soil to be cleared.

10. The agricultural implement of claim 9 in which said frame element of said row-clearing unit is adapted to be rigidly connected to said towing frame via said frame element of said planting row unit.

11. *The agricultural implement of claim 8, in which said energy storage device is a compressed coil spring.*

12. *The agricultural implement of claim 11, in which a bias force of said compressed coil spring is adjustable.*

13. *The agricultural implement of claim 12, in which said compressed coil spring is configured to provide an upward bias force.*

14. *The agricultural implement of claim 11, in which said compressed coil spring is disposed around a portion of said rod with one end of said spring coupled to said rod and the other end of said spring coupled to said cylinder so that said spring continuously biases said movable rod in a retracting direction relative to said cylinder.*

15. *The agricultural implement of claim 11, in which said compressed spring coil is disposed between a flange attached to an inner end of said rod and a flange attached to an interior of said cylinder.*

16. *The agricultural implement of claim 8, in which said agricultural implement is part of a planting row unit or a row-clearing unit.*

17. *The agricultural implement of claim 15, in which a downward force is a function of a weight of the planting row unit.*

18. *The agricultural implement of claim 8, in combination with a hydraulic control system having a controller, said hydraulic cylinder including a control valve coupled via a line to the controller to control a supply of said pressurized hydraulic fluid.*

19. *The agricultural implement of claim 8, in which a bias force of said energy storage device is adjustable.*

20. *The agricultural implement of claim 8, in which said hydraulic cylinder is configured to apply said retracting force as a function of a force exerted on the at least one agricultural tool.*

21. *The agricultural implement of claim 8, in which said hydraulic cylinder is configured to apply a compression force as a function of a resistance offered by the soil on the at least one agricultural tool.*

22. *The agricultural implement of claim 8, in which the at least one agricultural tool includes a clearing wheel, a fertilizer opener, or a roller for firming loose soil.*

23. *The agricultural implement of claim 8, in which the agricultural implement is an agricultural planter, a seeder, a fertilizer applicator, or a tillage equipment.*

24. *The agricultural implement of claim 8, in which a downward force is held on the at least one agricultural tool to prevent uncontrolled bouncing of the at least one agricultural tool over the soil.*

25. *The agricultural implement of claim 8, in combination with a GPS system that tracks a location of the tractor.*

26. *The agricultural implement of claim 25, in combination with a control system that avoids double-planting of rows.*

27. The agricultural implement of claim 26, wherein the control system is configured to selectively turn off the supply of the hydraulic fluid to avoid disrupting a row already planted.

28. The agricultural implement of claim 8, wherein the hydraulic fluid includes oil.

29. The agricultural implement of claim 28, wherein the oil is displaced by the energy storage device.

30. The agricultural implement of claim 29, wherein the energy storage device is configured to displace the oil.

31. The agricultural implement of claim 28, wherein the energy storage device includes an accumulator diaphragm or piston that supplies or accepts the oil.

32. The agricultural implement of claim 31, wherein the accumulator diaphragm or piston operates at a relatively constant pressure.

33. The agricultural implement of claim 31, wherein the hydraulic cylinder is pneumatic.

34. The agricultural implement of claim 8, further comprising one or more springs to urge the implement downwardly with a controllable force.

35. The agricultural implement of claim 8, wherein the energy storage device includes a piston that supplies or accepts the hydraulic fluid.

36. The agricultural implement of claim 35, wherein the energy stored by the energy storage device includes oil or a gas.

37. The agricultural implement of claim 8, wherein the cavity includes a hydraulic-fluid chamber and a gas-filled chamber.

38. The agricultural implement of claim 37, wherein a gas or fluid or both a gas and fluid is stored with the energy storage device.

39. The agricultural implement of claim 8, wherein the energy storage device is coupled to said rod, and wherein a retracting movement of said rod raises said at least one agricultural tool.

40. The agricultural implement of claim 8, in combination with a hydraulic control system and at least one other agricultural implement, wherein the hydraulic control system comprises a plurality of ports supplied by a plurality of feed lines separately controllable via separate control signals supplied by a controller.

41. The agricultural implement of claim 40, wherein a downforce on the agricultural implement is remotely adjustable and a downforce on the at least one other agricultural implement is remotely adjustable.

42. The agricultural implement of claim 41, wherein the downforce is adjustable from a cab of the tractor.

43. The agricultural implement of claim 40, wherein a downforce on the agricultural implement and the at least one other agricultural implement is releasable to allow the agricultural implement and the at least one other agricultural implement to rise quickly.

44. The agricultural implement of claim 40, wherein the controller is configured to control the supply of the hydraulic fluid at different times to selective ones of the feed lines.

45. The agricultural implement of claim 40, wherein a down force is selected manually or automatically by the hydraulic control system.

46. The agricultural implement of claim 45, wherein the down force is remotely adjustable from a cab of the tractor.

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