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(54) **REMOTE ADJUSTMENT OF A ROW UNIT OF AN AGRICULTURAL DEVICE**

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RÉGLAGE À DISTANCE D'UNE UNITÉ DE RANGÉE D'UN DISPOSITIF AGRICOLE

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Description**FIELD OF THE INVENTION**

[0001] The present invention generally relates to agricultural devices and, more particularly, to cutting depth adjustment of a row unit of an agricultural device.

BACKGROUND

[0002] Conventional row units in agricultural planters are supported from a toolbar by a parallel linkage which permits each row unit to move vertically independent of the toolbar and other spaced row units based on the contour of the soil. Biasing means such as airbags may extend between the parallel linkage to provide supplemental or additional down force on the row unit. The furrow opening assembly on conventional row units consists of a pair of flat furrow opening disk blades and a pair of gauge wheels. The furrow depth cut by a row unit has long been recognized as having an impact on seed germination and emergence. Seed planted too deep will have delayed emergence while shallow seeding depth may lead to root development problems.

[0003] Past attempts have relied on sensing loads applied to the gauge wheels and then adjusting the biasing means extending between the parallel linkage to provide supplemental or additional down force. One problem with this approach is a lack of accuracy and unpredictability in the system. First, when the biasing means is an airbag, it can be difficult to precisely determine the volume of air in the airbag at a given time and, subsequently, determine needed supplemental down force. Too little down force on the row unit and the seed will be planted to shallow. On the other hand, too much down force will ensure penetration by the opener but also cause over compaction of the soil again leading to root development and germination problems. Second, sensing loads on a gauge wheel do not provide a direct measurement of how deep the seed is actually being planted. Differences in soil types and condition can skew the data and lead to the farmer guessing on the actual furrow depth. Finally, providing supplemental down force on a row unit through conventional biasing means does not actually change the depth at which seed is being planted. Instead, these systems are limited to providing a consistent singular depth.

US4413685 discloses apparatus for remote selective operator adjustment of a plurality of ground supported planting units of a planter. The apparatus includes a planter gauge wheel on each unit adjustably mounted thereto and supporting each unit over the ground. A position sensor on each unit conveys gauge wheel adjustment information for display on a central control box. A hydraulic or electric cylinder mounted on each unit selectively effects positional adjustment of the gauge wheel. The units can be controlled by microprocessor control systems actuated by operator commands.

[0004] Accordingly, there remains a need for an apparatus which does not primarily rely on conventional sensing means, but instead relies on adjusting the row unit based on detection of furrow depth. There also remains a need for an apparatus which can adjust the depth at which seed is being planted.

SUMMARY

[0005] According to the present invention there is provided an agricultural device as set out in accordance with claim 1.

BRIEF DESCRIPTION OF THE DRAWINGS**[0006]**

Fig. 1 is a side elevation view of an exemplary row unit of an agricultural device, the exemplary row unit including an exemplary actuator assembly of a remote depth adjustment system;

Fig. 2 is a side elevation view similar to Fig. 1 with a portion of the row unit broken-away for illustrative purposes;

Fig. 3 is an enlarged side elevation view taken from Fig. 2 of a portion of the row unit;

Fig. 4 is a view taken along line 4-4 in Fig. 3;

Fig. 5 is a cross-sectional view taken along line 5-5 in Fig. 4;

Fig. 6 is a top perspective view of a portion of the actuator assembly with a portion of the actuator assembly broken away to show internal components;

Fig. 7 is a diagram of an exemplary remote depth adjustment system for an agricultural device having a plurality of row units;

Fig. 8 is a side elevation view of a portion of the row unit shown with a sensor according to the invention; and

Fig. 9 is a diagram of another exemplary remote depth adjustment system for an agricultural device having a plurality of row units.

[0007] Before any independent features and embodiments of the invention are explained in detail, it is to be understood that the invention is not limited in its application to the details of the construction and the arrangement of the components set forth in the following description or illustrated in the drawings. The invention is capable of other embodiments and of being practiced or of being carried out in various ways. Also, it is understood that the phraseology and terminology used herein is for the purpose of description and should not be regarded as limiting.

DETAILED DESCRIPTION

[0008] With reference to Fig. 1, an exemplary row unit 20 of an agricultural device 24 (see Fig. 7) is illustrated.

The exemplary row unit 20 may be any of a wide variety of row units having various capabilities and functionalities. Likewise, the agricultural device 24 may be any of a wide variety of agricultural devices capable of including row units and having various capabilities and functionalities. In the illustrated exemplary embodiment, the agricultural device is a planter 24 and the row unit is a planter row unit 20. The following description and associated figures relate to the exemplary embodiment of a planter 24 and a planter row unit 20. However, it should be understood that the illustrated exemplary planter 24 and planter row unit 20 are not intended to be limiting and the present invention is capable of being used with a wide variety of different agricultural devices and row units, and still be within the scope of the present invention as defined by the appended claims.

[0009] In the illustrated exemplary embodiment, the planter 24 may include a plurality of similarly configured planter row units 20, each of which is capable of planting seeds in the soil. For simplicity, only one planter row unit 20 will be illustrated and described herein. However, it should be understood that a planter 24 is capable of having any number of row units 20 and the numerous row units 20 may be similarly configured and have similar functionality to the illustrated and described exemplary planter row unit 20.

[0010] During planting, the furrow depth cut by the row unit 20 may be adjusted from time to time for a variety of reasons including, but not limited to, soil conditions, row unit performance, type of seed, moisture content of soil, soil compaction, opener blade wear, soil type, etc. An exemplary remote cutting depth adjustment system 28 (see Fig. 7) is provided for remotely adjusting the cutting depth of the row unit 20. Such remote adjustment of the row unit cutting depth may be performed from a cab of a tractor (described in greater detail below).

[0011] With continued reference to Fig. 1, an exemplary planter row unit 20 is illustrated and may be coupled to a frame or toolbar (not shown) of a tractor by a coupling 32. The row unit 20 includes a frame 36 coupled to the coupling 32, a furrow opener or pair of flat circular disc blades 40 coupled to the frame 36 to open a seed trench or furrow in the soil, a pair of depth gauge wheels 44 coupled to the frame 36 and located adjacent to and slightly to a rear of the blades 40, a seed meter 48 which "singulates" seed from a seed hopper (not shown) and deposits the seed into the furrow formed by the twin disc opener blades 40, and a pair of spaced apart closing wheels 52 coupled to the frame 36 and positioned to follow after the planted seed for breaking down the furrow side walls on either side of the furrow and cover the seed, close the furrow, and firm the soil over the covered seed. The gauge wheels 44 determine, at least in part, the depth of the furrow formed by the opener blades 40.

[0012] The cutting depth of opener blades 40 may be adjusted through a depth-adjusting lever mechanism 56 that changes the vertical height of the frame 36 relative to gauge wheels 44, which ride on the soil. Opener blades

40 are carried by the frame 36 and the lever mechanism 56 adjusts the operating depth of the blades 40 relative to the gauge wheels 44 and, therefore, relative to the top surface of the soil.

[0013] Referring now to Fig. 2, the frame 36 includes two side panels with a portion of the proximate side panel cut-away to show a portion of the remote cutting depth adjustment system 28, which includes the depth-adjusting lever mechanism 56. The depth-adjusting lever mechanism 56 and associated components are similar to the depth-adjusting lever mechanism and associated components disclosed in U.S. Patent No. 6,148,747. Thus, the components and functionality of the depth-adjusting lever mechanism 56 and associated components will not be described fully herein. Rather, the components and functionality of the depth adjusting lever mechanism 56 necessary to convey the present invention will be identified, illustrated, and described herein in more detail.

[0014] With continued reference to Fig. 2 and additional reference to Figs. 3-6, the remote cutting depth adjustment system 28 includes an exemplary actuator 60 coupled to a handle 64 of the depth-adjusting lever mechanism 56 for moving the handle 64. In accordance with the disclosure of U.S. Patent No. 6,148,747, movement of the handle 64 ultimately adjusts the cutting depth of the opener blades 40 and the depth of the furrow. The actuator 60 may be any type of actuator such as, for example, a linear actuator, rotary actuator, a pneumatic actuator, a hydraulic actuator, an electrical actuator, any combination thereof, etc., and may be respectively coupled to and powered by a pneumatic source, a hydraulic source, an electrical source, any combination thereof, etc. In the illustrated exemplary embodiment, the actuator is a linear electrical actuator 60 and is coupled to and powered by an electrical power source (described in more detail below). It should be understood that the illustrated exemplary embodiment of the actuator 60 and power source are not intended to be limiting upon the present invention and any type of actuator and power source may be utilized and be within the scope of the present invention as defined by the appended claims.

[0015] With reference to the illustrated exemplary embodiment of the actuator 60, the actuator 60 includes a housing 68 coupled to the frame 36 of the row unit 20, a moveable arm 72 coupled to and linearly translatable relative to the housing 68, and a drive mechanism 76 coupled to the housing 68 and the arm 72 for moving the arm 72 relative to the housing 68.

[0016] The housing 68 defines a cavity 80 therein and includes a first end 84 pivotally coupled to the frame 36 by a pin 88. A second end 92 of the housing 68 opens into the cavity 80. The arm 72 includes a first end 96 positioned and moveable within the housing cavity 80 and a second end 100 pivotally coupled to the handle 64 via a pin 104. The arm 72 also defines a cavity 108 therein with the first end 96 of the arm 72 opening into the arm cavity 108. A nut 112 is coupled to the arm 72 at the first end 96 and may be coupled to the arm 72 in a variety of

manners. In the illustrated exemplary embodiment, the nut 112 includes a shoulder 116, a reduced diameter portion 120, and threads 124 defined in an exterior of the reduced diameter portion 120. The reduced diameter portion 120 including threads 124 therein threads into the open first end 96 of the arm 72. A portion of an interior wall 128 of the arm 72 defines threads 132 therein that are complementary to the threads 124 defined in the exterior of the nut 112. The nut 112 is threaded into the open first end 96 of the arm 72 until the shoulder 116 abuts the first end 96 of the arm 72. A sealing member 144 such as, for example, an O-ring is disposed between the shoulder 116 and an interior surface 148 of the housing 68 to create a seal therebetween, thereby inhibiting contaminants from entering into the housing cavity 80.

[0017] The nut 112 also defines an aperture 152 there-through and threads 156 in an interior surface of the nut 112. The actuator 60 also includes a drive shaft 160 defining threads 164 in at least a portion of an exterior surface of the drive shaft 160 and the drive shaft 160 is positioned within the nut aperture 152 and threadably coupled to the nut 112 via the complementary threads 156, 164. A first end 168 of the drive shaft 160 is positioned within the arm cavity 108 and a second end 172 of the drive shaft 160 is positioned within the housing 60. The drive shaft 160 is supported near its second end 172 by a pair of bushings 176 surrounding the drive shaft 160 and disposed between the drive shaft 160 and an interior shoulder 180 of the housing 68. A pair of washers 184 encircle the drive shaft 160 with one positioned at the end of each bushing 176 to assist with maintaining the bushings 176 in position. The bushings 176 enable the drive shaft 160 to rotate relative to the housing 68 without significant friction. A securement nut 188 is threaded to the second end 172 of the drive shaft 160 to inhibit the drive shaft 160 from translating relative to the housing 68. Specifically, the drive shaft 160 is capable of rotating relative to the housing 68, but is inhibited from translating relative to the housing 68. A gear 192 is fixedly coupled to the drive shaft 160 intermediate the first and second ends 168, 172 of the drive shaft 160 and meshes with an intermediary gear 196 of the drive mechanism 76.

[0018] The drive mechanism 76 may be a wide variety of different mechanisms capable of rotating the drive shaft 160 of the actuator 60. The illustrated exemplary embodiment of the drive mechanism 76 is not intended to be limiting upon the present invention. The illustrated exemplary drive mechanism 76 includes a motor 200 electrically coupled to an electrical power source, an output shaft 204, an output gear 208 coupled to and rotatable by the output shaft 204, and an intermediary gear 196 meshing with the output gear 208 and the drive shaft gear 192. The intermediary gear 196 transfers rotation from the output gear 208 to the drive shaft gear 192, thereby rotating the drive shaft 160 when the motor 200 is activated. The drive mechanism 76 is coupled to a motor support 212 via a plurality of fasteners 216 and the motor support 212 is coupled to the actuator housing 68 via a

plurality of fasteners 220. This configuration rigidly secures the drive mechanism 76 to the actuator housing 68. Other manners of rigidly connecting the drive mechanism 76 to the actuator housing 68 may be employed and all of such alternatives are intended to be within the scope of the present invention as defined by the appended claims. The intermediary gear 196 is secured in place with a support rod 224 extending through a center of the intermediary gear 196 and coupled to the motor support 212. A bearing 228 is disposed between the intermediary gear 196 and the support rod 224 to facilitate rotation of the intermediary gear 196 relative to the support rod 224.

[0019] Now that structural components of the actuator 60 have been described, operation of the actuator 60 will be addressed.

[0020] With continued reference to Figs. 2-6, the drive mechanism 76 may be driven in either direction in order to rotate the drive shaft 160 in either direction. When the drive mechanism 76 is activated, the output shaft 204 rotates the output gear 208, which rotates the intermediary gear 196, the drive shaft gear 192, and ultimately the drive shaft 160. Since the drive shaft 160 is inhibited from translating, the drive shaft 160 merely rotates relative to the housing 68. The coupling of the threads 164 on the exterior of the drive shaft 160 with the threads 156 defined in the aperture 152 of the nut 112 causes the nut 112 to translate along the drive shaft 160, which translates the arm 72 relative to the actuator housing 68. Ultimately, the arm 72 is coupled to the handle 64 of the depth-adjusting lever mechanism 56 and translation of the arm 72 moves the handle 64. Depending on the direction of motor rotation, the arm 72 may be pulled into the housing 68, which results in movement of the handle 64 in a clockwise direction (as viewed in Fig. 2) or toward the actuator 60, or the arm 72 may be pushed out of the housing 68, which results in movement of the handle 64 in a counter-clockwise direction (as viewed in Fig. 2) or away from the actuator 60. Movement of the handle 64 in a clockwise direction reduces the cutting depth of the blades 40 and reduces the depth of the furrow, and movement of the handle 64 in a counter-clockwise direction increases the cutting depth of the blades 40 and increases the depth of the furrow. When the drive mechanism 76 is not activated, the actuator 60 is secured in place to secure the handle 64 in place, thereby maintaining the blades 40 at their cutting depth.

[0021] Referring now to Fig. 7, a diagram of an exemplary remote cutting depth adjustment system 28 is illustrated. The exemplary remote cutting depth adjustment system 28 is not intended to be limiting and a variety of other remote cutting depth adjustment systems may be utilized and still be within the scope of the present invention as defined by the appended claims.

[0022] The illustrated exemplary remote cutting depth adjustment system 28 includes a tractor 232 and an agricultural device 24 such as, for example, a planter coupled to and pulled by the tractor 232. The tractor 232 includes a control system 236 and an electrical power

source 240 for powering the control system 236. The control system 236 includes a user interface 244, a processing unit 248, and memory 252. In some exemplary embodiments, the user interface 244 may have touch-screen capabilities 256, thereby providing the user with an output display for viewing information and a manner of inputting information via a touch-screen keyboard, buttons, or other touch-screen controls and capabilities. In other exemplary embodiments, the user interface 244 may only be an output device to display information and the control system 236 may include a mechanical control panel 260 including a variety of mechanical switches, buttons, etc. manipulatable by a user to input desired information. In further exemplary embodiments, the control system 236 may include a combination of a touch-screen user interface and a mechanical control panel to output and input desired information. The processing unit 248 performs the necessary processing to achieve the desired functionality of the remote cutting depth adjustment system 28 and communicates with the input devices, output devices, memory, and the agricultural device as necessary to achieve such desired functionality.

[0023] With continued reference to Fig. 7, the agricultural device may be a planter 24 and the planter 24 may include a plurality of planter row units 20. The planter 24 may include any number of row units 20, which is exemplified by the annotations: Row Unit #1; Row Unit #2; ...; Row Unit #N. As indicated above, the row units 20 may be substantially the same and, therefore, only details of Row Unit #1 are shown in great detail. It should be understood that all of the row units 20 may include similar components and functionality to that of Row Unit #1, but such components and functionality will not be presented herein for the sake of brevity.

[0024] Row Unit #1 includes actuator 60 described above and illustrated in Figs. 2-6. The actuator 60 is coupled to the handle 64 of the depth-adjusting lever mechanism 56 and is capable of moving the depth-adjusting lever mechanism 56 to control the cutting depth of the blades 40 and the depth of the furrow. Row Unit #1 may include one or more sensors 264, 268 to identify the cutting depth of the blades 40 and the depth of the furrow. The cutting depth and furrow depth may be determined in a variety of manners using a variety of different types of sensors, which may sense a variety of different parameters or characteristics. For example, in the illustrated exemplary embodiment, each row unit 20 may include a first sensor 264 for sensing a position of the handle 64. According to the invention each row unit at least includes a (second) sensor 268 for sensing a furrow depth. It should be understood that beside sensor 268 each row unit 20 may include sensor 264, may include more than these two sensors for sensing additional parameters, or may include any combination of sensors beside sensor 268 for sensing any relevant parameters that ultimately contribute to determining the cutting depth of the blades 40 and the furrow depth. For example, in some exemplary embodiments, the row unit may include three sensors, a

first sensor to sense a position of the handle, a second sensor to sense a furrow depth, and a third sensor to sense soil moisture.

[0025] The first sensor 264 for sensing a position of the handle 64 may be any type of sensor such as, for example, an ultrasonic sensor, laser sensor, etc., and may be coupled to any portion of the row unit 20 as long as it can operate appropriately to sense the position of the handle 64. In some exemplary embodiments, the first sensor 264 may be coupled to an interior of the frame 36 proximate the handle 64. The second sensor 268 for sensing a furrow depth may be any type of sensor such as, for example, an ultrasonic sensor, laser sensor, etc., and may be coupled to any portion of the row unit 20 as long as it can operate appropriately to sense a furrow depth. In some exemplary embodiments, the second sensor 268 may be coupled to the frame 36. According to the invention the second sensor 268 is directed downward toward the soil and the furrow cut therein (see Fig. 8).

[0026] In further exemplary embodiments, the remote cutting depth adjustment system 28 may include an additional sensor such as, for example, a force transducer that is coupled to the depth-adjusting lever mechanism 56 for monitoring and/or measuring a down force occurring in the depth-adjusting lever mechanism 56 and applied to the row unit 20 to force the row unit 20 downward toward the soil. The force transducer may be any type of sensor such as, for example, a load cell, a pressure sensor, a potentiometer, etc., and may be coupled to any portion of the depth-adjusting lever mechanism 56 as long as it can operate appropriately to sense a down force. Such a force transducer may be electronically coupled to the processing unit 248 to enable the processing unit 248 to take readings of the down force and display related information to a user via the user interface 244 or to enable the processing unit 248 to communicate with the necessary components of the remote cutting depth adjustment system 28 to adjust the cutting depth of the row unit 20.

[0027] The sensors 264, 268 generate a signal associated with the sensed parameter and the processing unit 248 communicates with the sensors 264, 268 to receive the signal. The processing unit 248 utilizes signal and the information included therein received by the sensors 264, 268 and displays desired information on the user interface 244 for a user to view. In some exemplary embodiments, the displayed information may include a cutting depth of the blades 40 and/or a furrow depth. The user may alter the cutting depth of the blades 40 and the furrow depth if desired. To do so, the user makes the desired adjustment by inputting a desired cutting depth or furrow depth via one or more of the touch-screen user interface 256, mechanical control panel 260, or any other input device. Then, the processing unit 248 receives the inputted data and communicates with the actuator 60 to move the actuator 60 and adjust the cutting depth of the blades 40 as desired by the user. The one or more sen-

sors 264, 268 monitor their respective parameters as the actuator 60 adjusts the cutting depth, generate signals based on the sensed parameters, communicate the signals associated with the sensed parameters to the processing unit 248, and the processing unit 248 drives the actuator 60 until the one or more sensors 264, 268 sense and communicate the appropriate parameter corresponding to the desired cutting depth of the blades 40. The processing unit 248 deactivates the actuator 60 when the appropriate cutting depth has been achieved. Deactivation of the actuator 60 maintains the actuator 60 in place, thereby securing the row unit 20 at the desired cutting depth.

[0028] In the illustrated exemplary embodiment, the actuators 60 and the sensors 264, 268 of the row units 20 are electrically powered. The actuators 60 and the sensors 264, 268 may be electrically powered in a variety of different manners and all of such manners are intended to be within the scope of the present invention as defined by the appended claims. In some exemplary embodiments, the actuators 60 and the sensors 264, 268 of all the row units 20 may be electrically powered by an electrical power source 272 of the agricultural device (e.g., the planter) 24. In other exemplary embodiments, the actuators 60 and the sensors 264, 268 of all the row units 20 may be electrically powered by the tractor electrical power source 240. In further exemplary embodiments, each row unit 20 may include its own electrical power source 276 and the actuator 60 and sensors 264, 268 on a particular row unit 20 may be electrically powered by the electrical power source 276 on that row unit 20.

[0029] The above described electrical power sources may be a wide variety of types of electrical power sources and all of such various electrical power sources are intended to be within the scope of the present invention as defined by the appended claims. For example, an electrical power source may be an alternator coupled with a hydraulic motor, an alternator coupled mechanically to the tractor engine, an alternator coupled with a ground drive, an alternator coupled with an electric motor, a battery pack, etc.

[0030] As indicated above, in some exemplary embodiments, the actuators 60 on the row units 20 may be pneumatic or hydraulic actuators, thereby requiring a pneumatic source or a hydraulic source to respectively power the actuators. In such exemplary embodiments and similarly to the electrically powered actuators, the actuators may be powered in a variety of manners. In some exemplary embodiments, the pneumatic or hydraulic actuators of all the row units 20 may be respectively powered by a pneumatic or hydraulic power source of the agricultural device (e.g., the planter) 24. In other exemplary embodiments, the pneumatic or hydraulic actuators of all the row units 20 may be respectively powered by a pneumatic or hydraulic source of the tractor 232. In further exemplary embodiments, each row unit 20 may include its own pneumatic or hydraulic power source and the actuator on a particular row unit 20 may be respectively powered

by the pneumatic or hydraulic power source on that row unit 20.

[0031] The remote cutting depth adjustment system 28 may be either an open loop system or a closed loop system. In an open loop system, the cutting depth adjustment system 28 utilizes one or more sensors 264, 268 to sense one or more parameters, the processing unit receives the sensed parameter(s) and displays or otherwise outputs information to the user via a user interface 244, and the user is capable of making a desired adjustment to the cutting depth using input devices such as, for example, a touch-screen user interface 256 or mechanical control panel 260. In a closed loop system, the cutting depth adjustment system 28 utilizes one or more sensors 264, 268 to continuously sense one or more parameters in real-time, and the processing unit 248 receives the sensed parameter(s), displays or otherwise outputs information to the user via a user interface 244, determines if the sensed parameter(s) correspond(s) with a desired cutting depth, and communicates with the necessary components of the system 28 to adjust the cutting depth if the sensed parameter(s) does(do) not correlate to the desired cutting depth. Such a desired cutting depth may be input into the system by a user, may be based on historical data, may be determined based on parameters sensed by sensors, etc.

[0032] Referring now to Fig. 9, another exemplary remote depth adjustment system 28A is illustrated. The components of the system 28A illustrated in Fig. 9 that are similar to components of the system 28 illustrated in Figs. 1-8 are identified with the same reference number and an "A".

[0033] The system 28A illustrated in Fig. 9 has many similarities to the system 28 illustrated in Figs. 1-8. At least one difference between system 28A illustrated in Fig. 9 and system 28 illustrated in Figs. 1-8 is that the agricultural device or planter 24A includes the processing unit 248A and the memory 252A, rather than the tractor 232A, which is the case in system 28. With the processing unit 248A included in the planter 24A, the planter electrical power source 272A may provide electrical power to the processing unit 248A. Even with this difference, the system 28A is capable of performing all the same functionality as the system 28 illustrated in Figs. 1-8.

[0034] It should be understood that the processing unit, the memory, and any other components of the systems may be included on either the tractor or the planter and in any combination, and be within the scope of the present invention as defined by the appended claims. For example, the planter may include the processing unit and the tractor may include the memory. Also, for example, the tractor may include the processing unit and the planter may include the memory.

[0035] The foregoing description has been presented for purposes of illustration and description, and is not intended to be exhaustive or to limit the invention to the precise form disclosed. The descriptions were selected to explain the principles of the invention and their practical

application to enable others skilled in the art to utilize the invention in various embodiments and various modifications as are suited to the particular use contemplated. Although particular constructions of the present invention have been shown and described, other alternative constructions will be apparent to those skilled in the art and are within the scope of the present invention as defined by the appended claims.

Claims

1. An agricultural device (24) adapted to plant seeds, the agricultural device (24) comprising:

a frame (36);
 a furrow opener (40) coupled to the frame (36) and adapted to cut a furrow including a depth; wherein the agricultural device comprises a row unit (20) including said frame (36) and furrow opener (40),
 a sensor (268) adapted to sense a characteristic associated with planting seeds and generate a signal associated with the sensed characteristic; and
 a processing unit (248) receiving the signal associated with the sensed characteristic; wherein the depth of the furrow is adjustable based on the signal associated with the sensed characteristic; wherein the characteristic associated with planting seeds comprises furrow depth; **characterised in that** the sensor (268) is positioned at least partially behind the furrow opener (40); and
 wherein the sensor (268) is directed downward toward the soil and the furrow cut therein.

2. The agricultural device of claim 1 wherein the sensor is one of
 an ultrasonic sensor;
 a laser sensor;
 a video camera;
 an infra-red sensor;
 an infra-red camera;
 an infra-red scanner; and
 a microwave sensor.

3. The agricultural device of claim 1, further comprising a furrow depth adjustment mechanism (56) and a gauge wheel (44), wherein the gauge wheel (44) is coupled to the frame (36) through the furrow depth adjustment mechanism (56).

4. The agricultural device of claim 3, further comprising a user interface (244) in communication with the processing unit (248) and information associated with the sensed characteristic is displayed on the user interface (244), wherein the furrow depth ad-

justment mechanism (56) includes an actuator (60), and wherein a user is capable of remotely adjusting the actuator (60) to adjust the depth of the furrow based on the information displayed on the user interface (244).

5. The agricultural device of claim 1, wherein the processing unit (248):

communicates with the agricultural device (24) to adjust the depth of the furrow based on the signal; or
 determines whether adjustment of the depth of the furrow is necessary based on the signal.

6. The agricultural device of claim 1, further comprising a first sensor (264), the characteristic is a first characteristic, and the signal is a first signal associated with the first characteristic, wherein the sensor (268) is a second sensor adapted to sense a second characteristic associated with planting seeds and generate a second signal associated with the sensed second characteristic.

7. The agricultural device of claim 6, wherein the processing unit (248) receives the first signal and the second signal, and wherein the depth of the furrow is adjustable based on the first and second signals respectively associated with the sensed first and second characteristics.

Patentansprüche

1. Landwirtschaftliche Vorrichtung (24), die zur Aussaat von Saatgut ausgeführt ist, wobei die landwirtschaftliche Vorrichtung (24) Folgendes umfasst:

einen Rahmen (36);
 einen Furchenzieher (40), der mit dem Rahmen (36) gekoppelt ist und zum Ziehen einer eine Tiefe aufweisenden Furche ausgeführt ist;
 wobei die landwirtschaftliche Vorrichtung eine Reiheneinheit (20) umfasst, die den genannten Rahmen (36) und Furchenzieher (40) aufweist, einen Sensor (268), der zum Erfassen einer mit der Aussaat von Saatgut verbundenen Eigenschaft und Erzeugen eines mit der erfassten Eigenschaft verbundenen Signals ausgeführt ist; und
 eine Verarbeitungseinheit (248), die das mit der erfassten Eigenschaft verbundene Signal empfängt;
 wobei die Tiefe der Furche auf Basis des mit der erfassten Eigenschaft verbundenen Signals einstellbar ist;

wobei die mit der Aussaat von Saatgut verbundene

Eigenschaft die Furchentiefe umfasst;

dadurch gekennzeichnet, dass

der Sensor (268) wenigstens teilweise hinter dem Furchenzieher (40) positioniert ist; und wobei der Sensor (268) nach unten zum Boden und der darin gezogenen Furche gerichtet ist.

2. Landwirtschaftliche Vorrichtung nach Anspruch 1, wobei der Sensor einer ist von einem Ultraschallsensor;

einem Lasersensor;
einer Videokamera;
einem Infrarotsensor;
einer Infrarotkamera;
einem Infrarot-Scanner und
einem Mikrowellensensor.

3. Landwirtschaftliche Vorrichtung nach Anspruch 1, ferner umfassend einen Furchentiefeinstellmechanismus (56) und ein Tastrad (44), wobei das Tastrad (44) durch den Furchentiefeinstellmechanismus mit dem Rahmen (36) gekoppelt ist.

4. Landwirtschaftliche Vorrichtung nach Anspruch 3, ferner umfassend eine Benutzerschnittstelle (244), die mit der Verarbeitungseinheit (248) in Kommunikation steht und bei der mit der erfassten Eigenschaft verbundene Informationen auf der Benutzerschnittstelle (244) angezeigt werden, wobei der Furchentiefeinstellmechanismus (56) einen Stellantrieb (60) aufweist und wobei ein Benutzer den Stellantrieb auf Basis der auf der Benutzerschnittstelle (244) angezeigten Informationen zum Einstellen der Tiefe der Furche ferneinstellen kann.

5. Landwirtschaftliche Vorrichtung nach Anspruch 1, wobei die Verarbeitungseinheit (248):

mit der landwirtschaftlichen Vorrichtung zum Einstellen der Tiefe der Furche auf Basis des Signals kommuniziert oder auf Basis des Signals bestimmt, ob eine Einstellung der Tiefe der Furche notwendig ist.

6. Landwirtschaftliche Vorrichtung nach Anspruch 1, ferner umfassend einen ersten Sensor (264), wobei die Eigenschaft eine erste Eigenschaft ist und das Signal ein mit der ersten Eigenschaft verbundenes erstes Signal ist, wobei der Sensor (268) ein zweiter Sensor ist, der zum Erfassen einer zweiten mit der Aussaat von Saatgut verbundenen Eigenschaft und zum Erzeugen eines mit der erfassten zweiten Eigenschaft verbundenen zweiten Signals ausgeführt ist.

7. Landwirtschaftliche Vorrichtung nach Anspruch 6, wobei die Verarbeitungseinheit (248) das erste Sig-

nal und das zweite Signal empfängt und wobei die Tiefe der Furche auf Basis des mit der ersten bzw. der zweiten Eigenschaft verbundenen ersten und zweiten Signals einstellbar ist.

Revendications

1. Dispositif agricole (24) conçu pour planter des semences, le dispositif agricole (24) comprenant :

un cadre (36) ;
un soc sillonneur (40) couplé au cadre (36) et conçu pour creuser un sillon incluant une profondeur ;
dans lequel le dispositif agricole comprend un rayonneur (20) incluant ledit cadre (36) et le soc sillonneur (40),

un capteur (268) conçu pour détecter une caractéristique associée au plantage de semences et générer un signal associé à la caractéristique détectée ; et

une unité de traitement (248) recevant le signal associé à la caractéristique détectée ;

dans lequel la profondeur du sillon est ajustable sur la base du signal associé à la caractéristique détectée ;

dans lequel la caractéristique associée au plantage de semences comprend la profondeur du sillon ;

caractérisé en ce que le capteur (268) est positionné au moins partiellement derrière le soc sillonneur (40) ; et

dans lequel le capteur (268) est dirigé vers le bas vers le sol et le sillon creusé dans celui-ci.

2. Dispositif agricole de la revendication 1, dans lequel le capteur est un poste parmi :

un capteur ultrasonique ;
un capteur laser ;
une caméra vidéo ;
un capteur à infrarouge ;
une caméra à infrarouge ;
un scanner à infrarouge ; et
un capteur à micro-ondes.

3. Dispositif agricole de la revendication 1, comprenant en outre un mécanisme d'ajustement de profondeur de sillon (56) et une roulette de terrage (44), dans lequel la roulette de terrage (44) est couplée au cadre (36) par l'intermédiaire du mécanisme d'ajustement de profondeur de sillon (56).

4. Dispositif agricole de la revendication 3, comprenant en outre une interface utilisateur (244) en communication avec l'unité de traitement (248) et des informations associées à la caractéristique détectée sont

affichées sur l'interface utilisateur (244), dans lequel le mécanisme d'ajustement de profondeur de sillon (56) inclut un actionneur (60), et dans lequel un utilisateur est apte à ajuster à distance l'actionneur (60) afin d'ajuster la profondeur du sillon sur la base des informations affichées sur l'interface utilisateur (244). 5

5. Dispositif agricole de la revendication 1, dans lequel l'unité de traitement (248) : communique avec le dispositif agricole (24) afin d'ajuster la profondeur du sillon sur la base du signal ; ou 10
détermine si l'ajustement de la profondeur du sillon est nécessaire sur la base du signal. 15

6. Dispositif agricole de la revendication 1, comprenant en outre :

un premier capteur (264), la caractéristique est une première caractéristique, et le signal est un premier signal associé à la première caractéristique, 20
dans lequel le capteur (268) est un deuxième capteur conçu pour détecter une deuxième caractéristique associée au plantage de semences et générer un deuxième signal associé à la deuxième caractéristique détectée. 25

7. Dispositif agricole de la revendication 6, dans lequel l'unité de traitement (248) reçoit le premier signal et le deuxième signal, et dans lequel la profondeur du sillon est ajustable sur la base des premier et deuxième signaux respectivement associés aux première et deuxième caractéristiques détectées. 30
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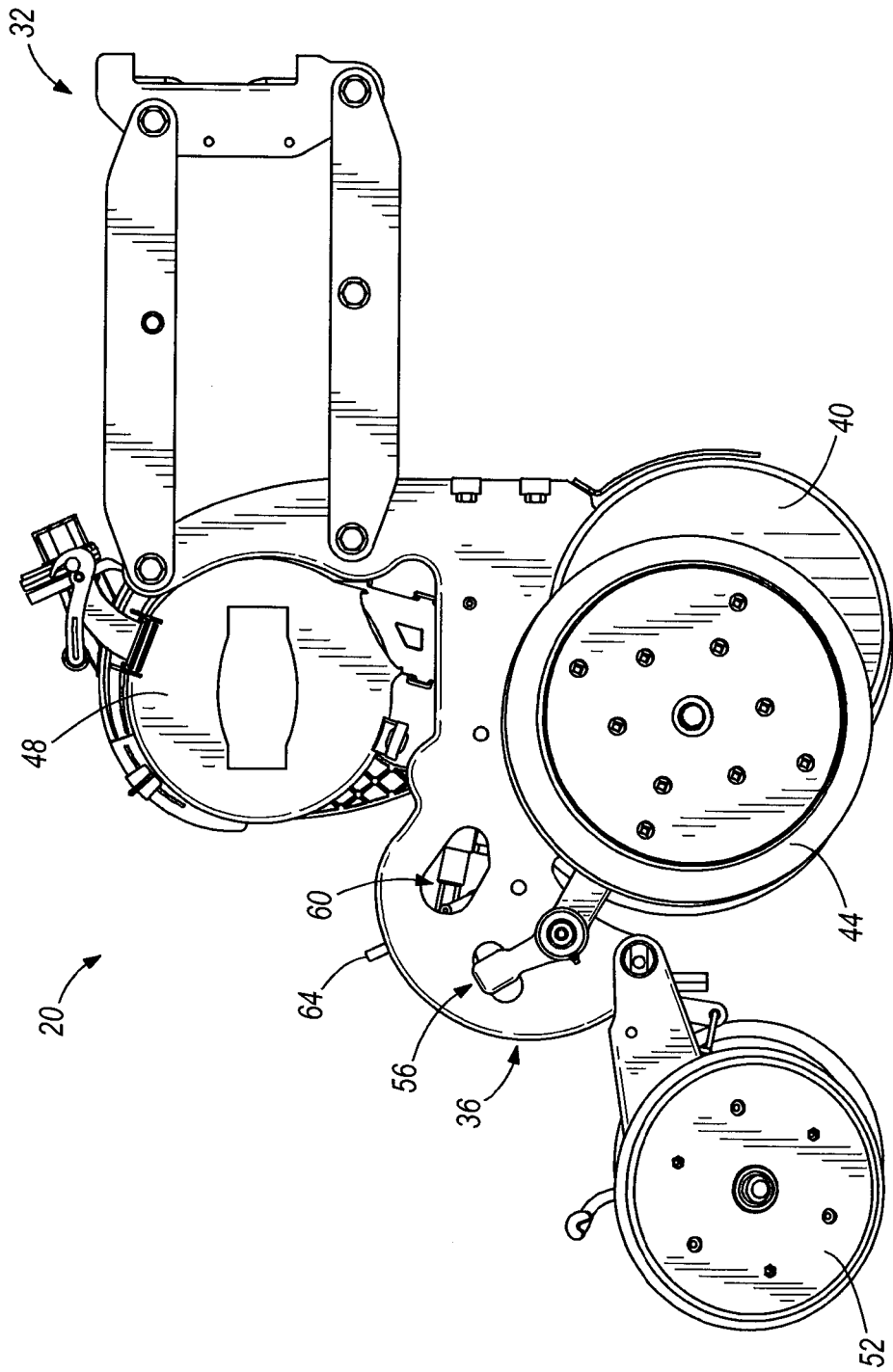


FIG. 1

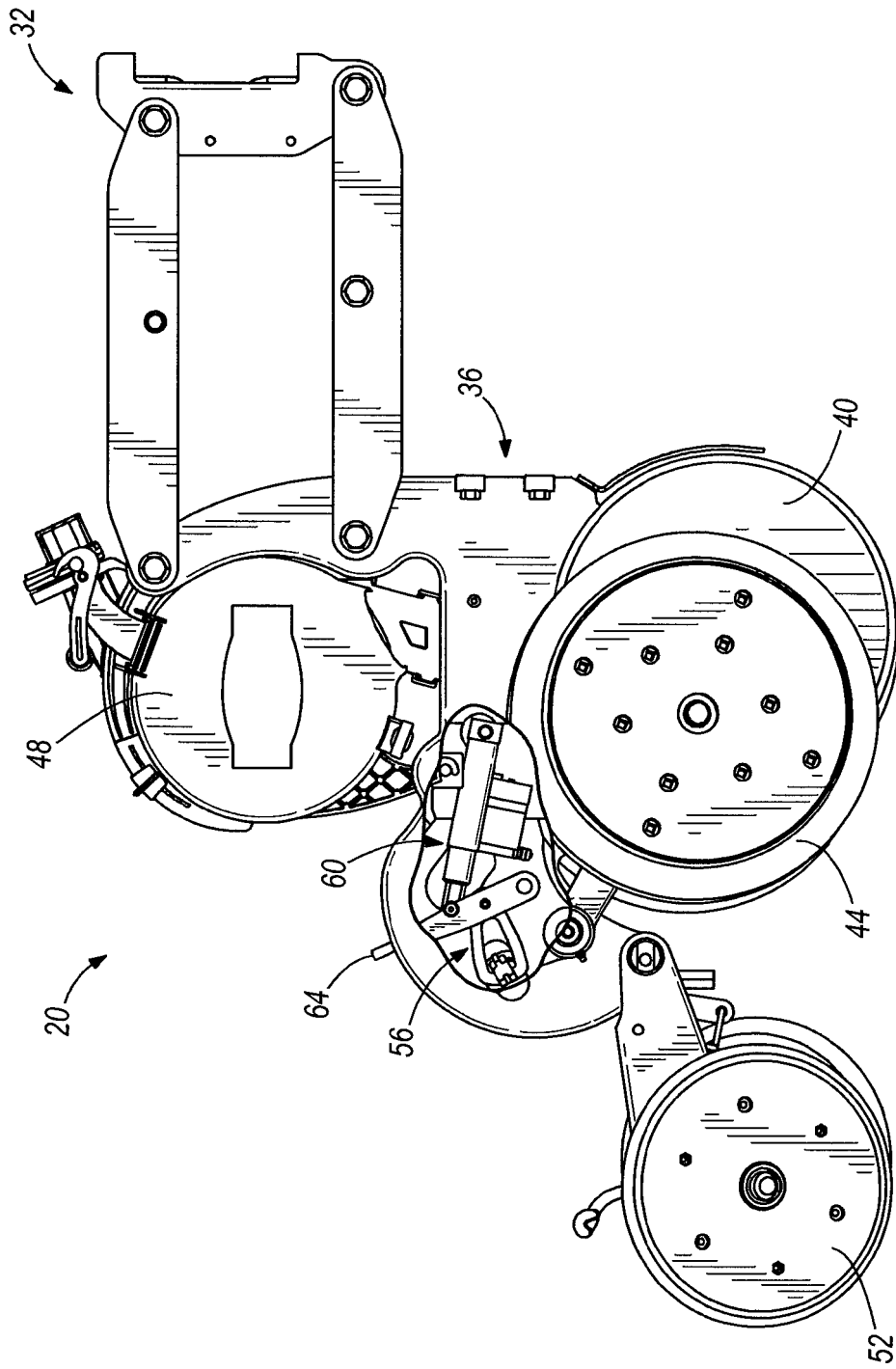


FIG. 2

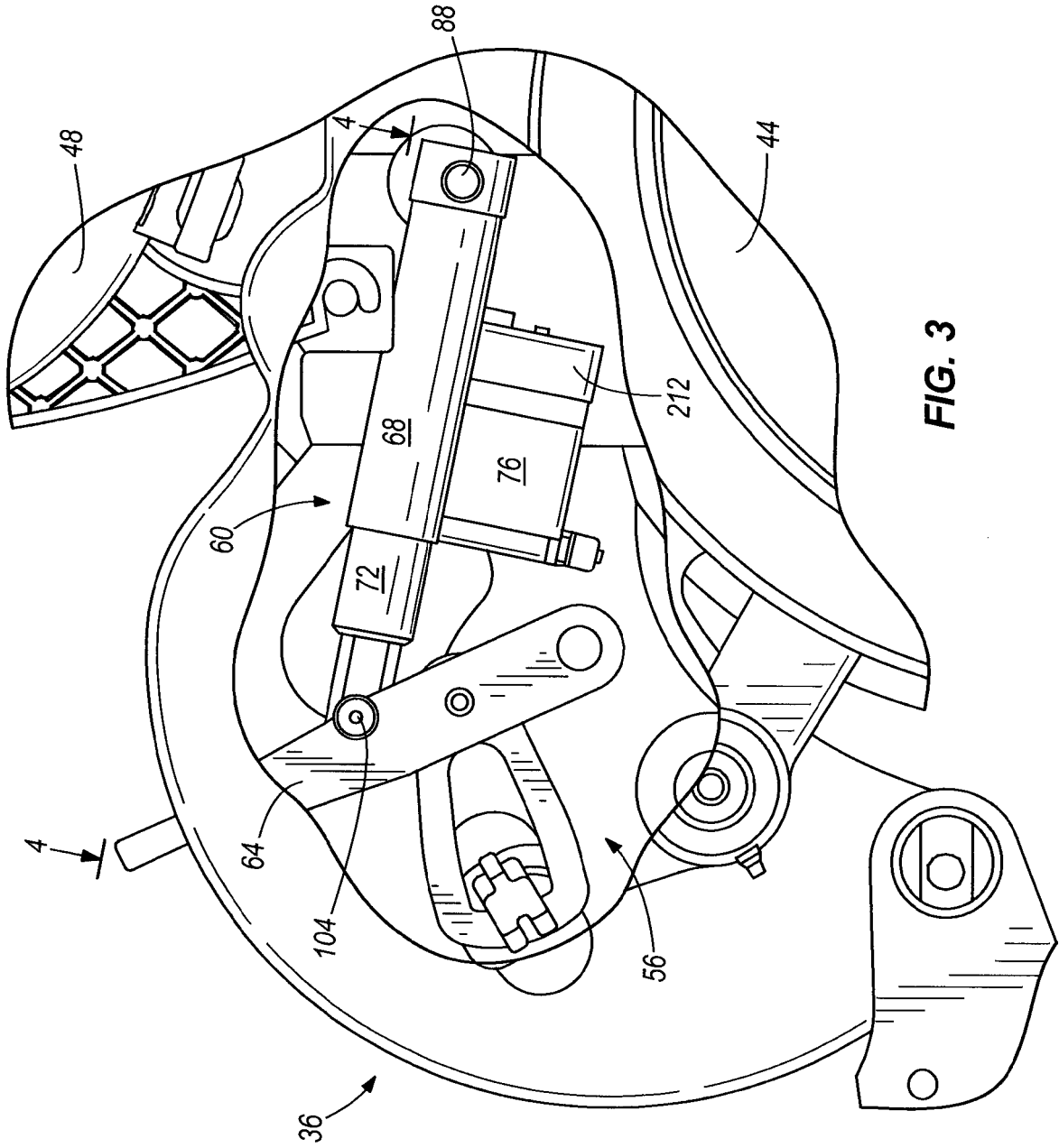


FIG. 3

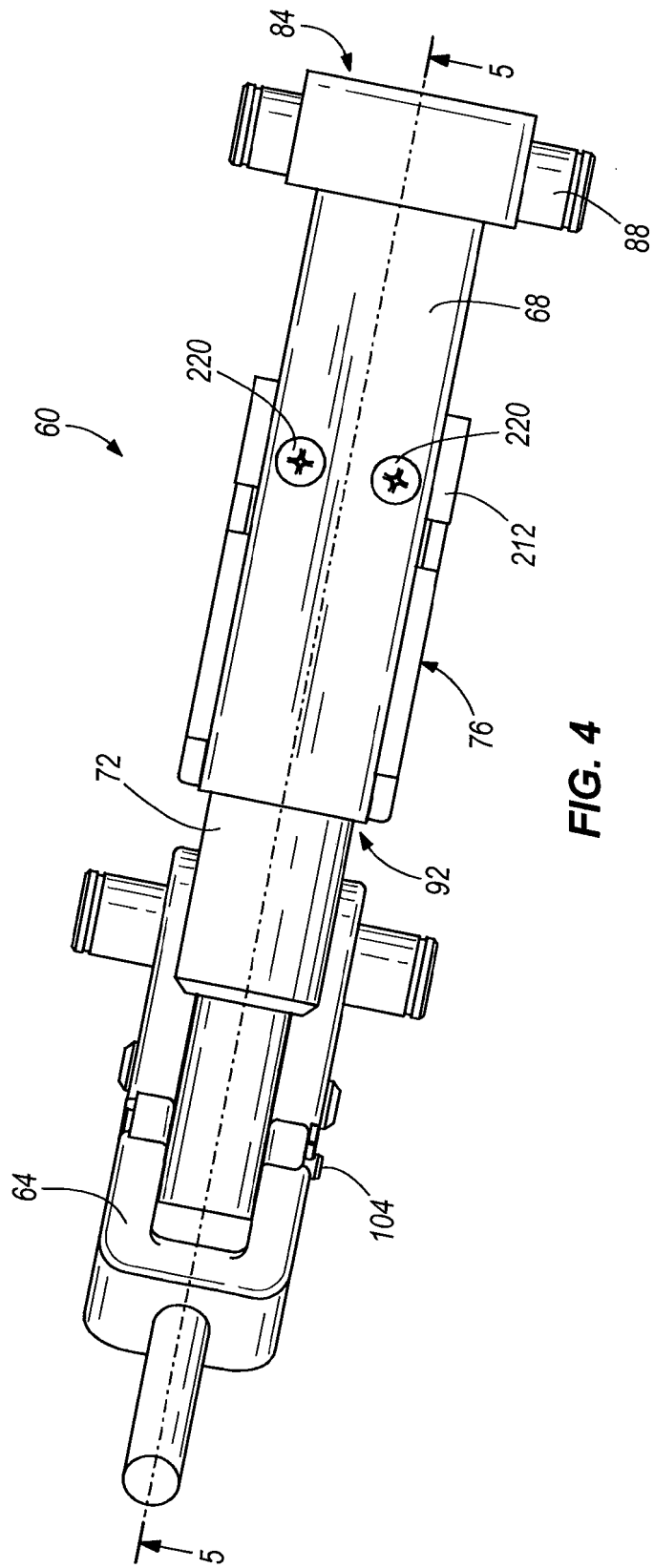


FIG. 4

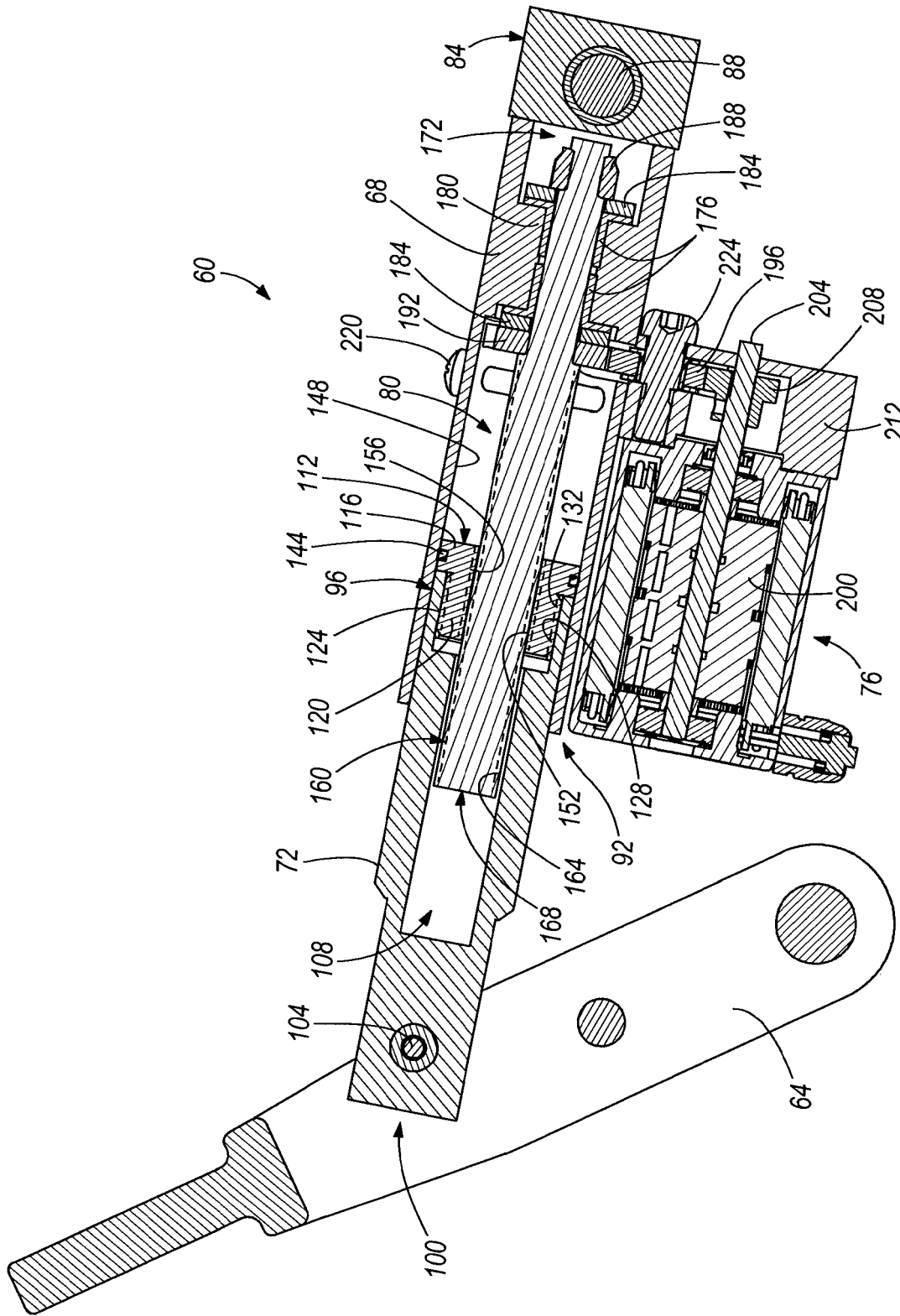


FIG. 5

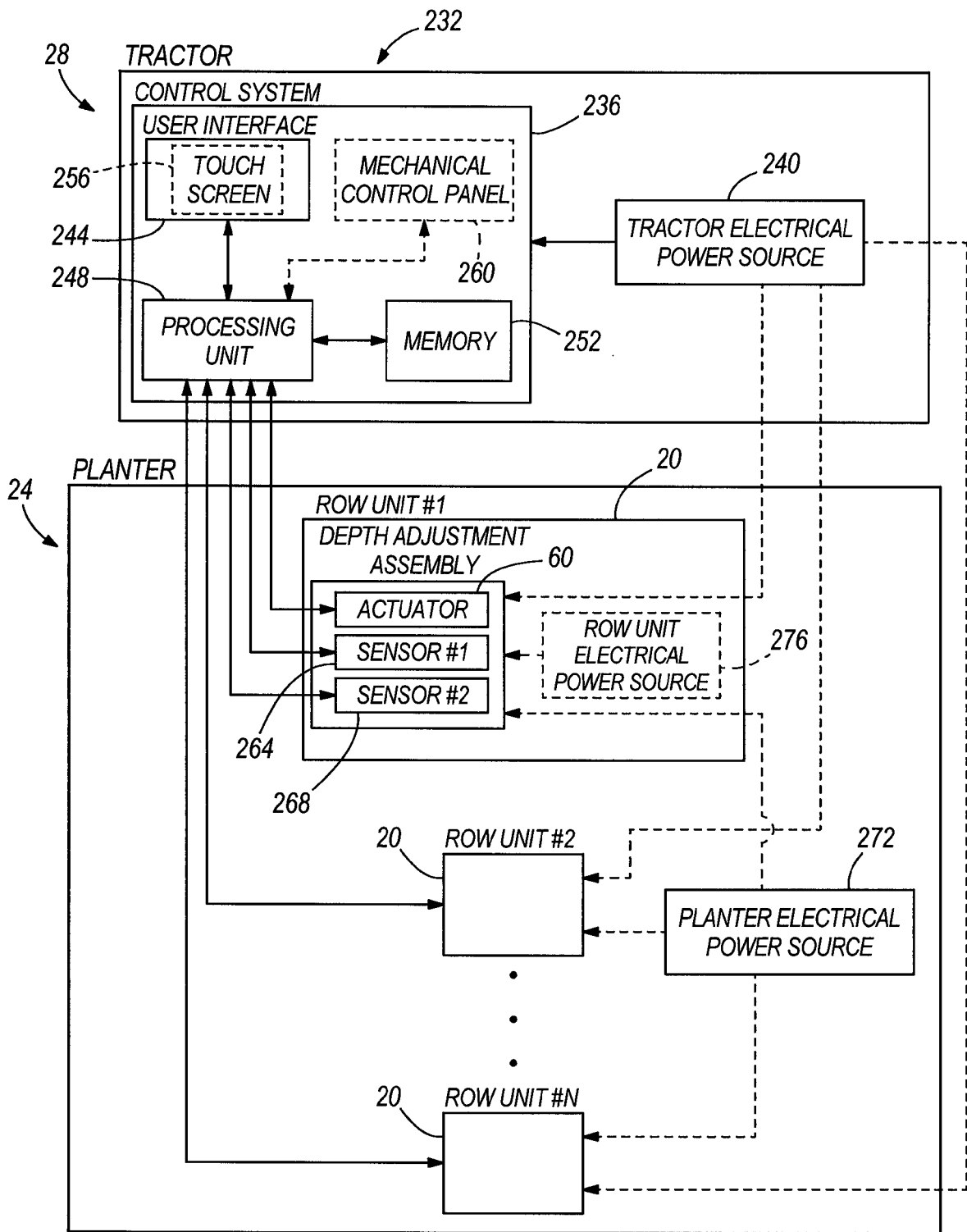


FIG. 7

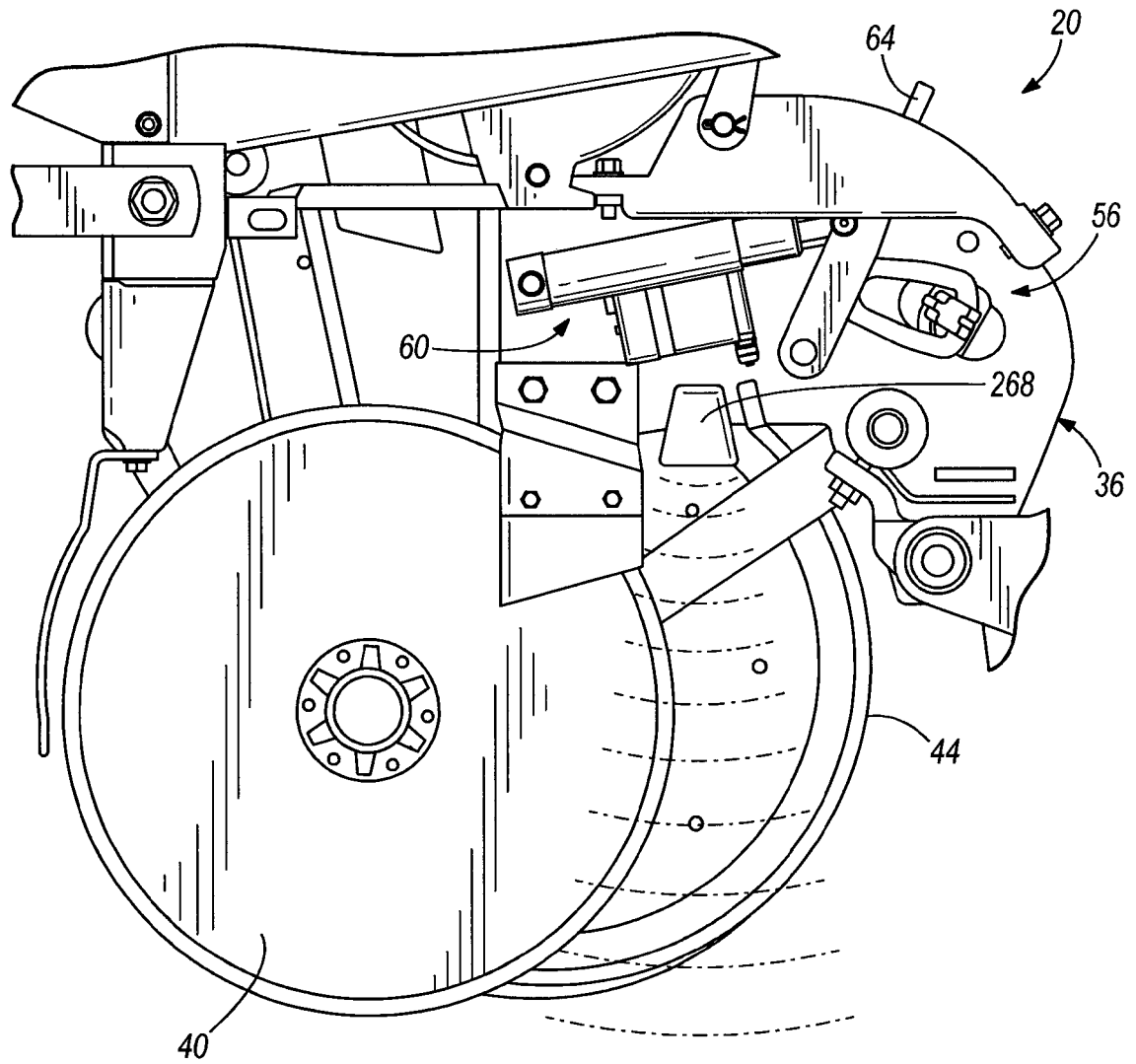


FIG. 8

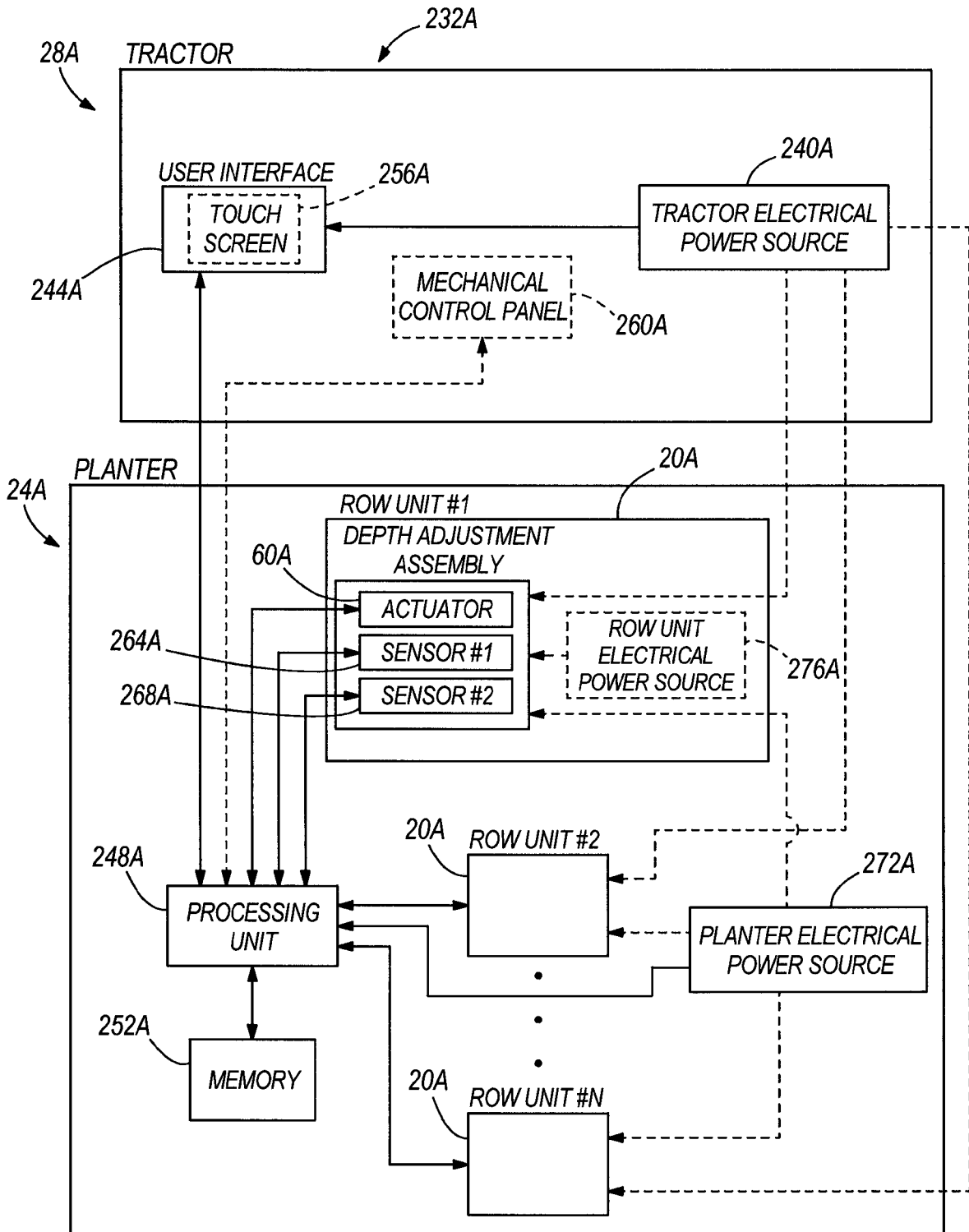


FIG. 9

REFERENCES CITED IN THE DESCRIPTION

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