(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
12 March 2015 (12.03.2015)

WIPO | PCT

(10) International Publication Number
WO 2015/035158 A1

(51) International Patent Classification:
A01C 21/00 (2006.01) *A01C 7/10* (2006.01)
A01C 7/04 (2006.01)

(21) International Application Number:
PCT/US2014/054284

(22) International Filing Date:
5 September 2014 (05.09.2014)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
61/874,113 5 September 2013 (05.09.2013) US
61/938,010 10 February 2014 (10.02.2014) US
61/975,047 4 April 2014 (04.04.2014) US

(71) Applicant: **KINZE MANUFACTURING, INC.** [US/US]; 2172 M Avenue, Williamsburg, Iowa 52361 (US).

(72) Inventors: **KINZENBAW, Jon**; 2172 M Avenue, Williamsburg, Iowa 52361 (US). **ROLFFS, Merlan J.**; 2172 M Avenue, Williamsburg, Iowa 52361 (US). **WILHELMI, Matthew J.**; 2172 M Avenue, Williamsburg, Iowa 52361 (US). **HAHN, Dustan**; 2172 M Avenue, Williamsburg, Iowa 52361 (US). **BECKER, Derrick**; 2172 M Avenue, Williamsburg, Iowa 52361 (US).

(74) Agents: **MOHRHAUSER, Luke T.** et al.; McKee, Voorhees & Sease, P.L.C., 801 Grand Avenue, Suite 3200, Des Moines, Iowa 50309-2721 (US).

(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK,

[Continued on next page]

(54) Title: MULTIPLE AGRICULTURAL PRODUCT APPLICATION METHOD AND SYSTEMS

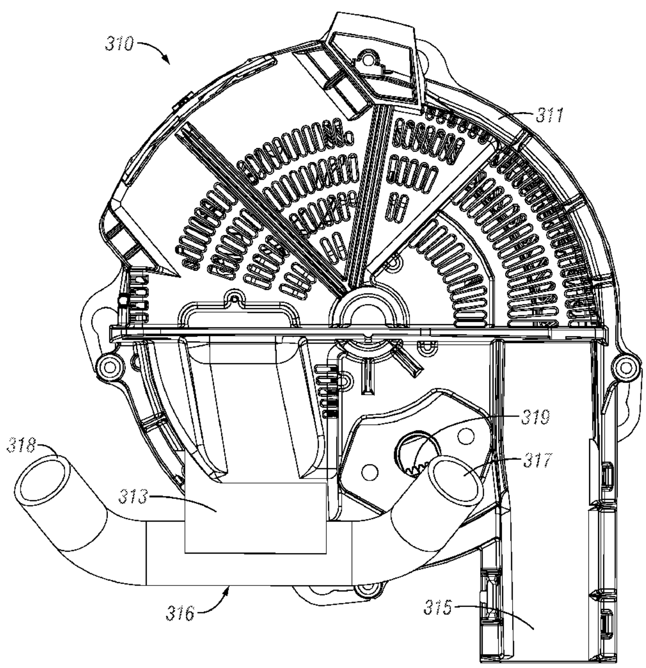


FIG. 62

(57) Abstract: A method and agricultural planter (10) for planting one of a plurality of seed types, hybrids and/or varieties is provided, with a plurality of row units (300) each including at least one seed meter (310) as well as a queuing system (316) to substantially remove a variety of seed from a seed meter before another variety of seed is added. The seed meters are configured such that the seed meters will plant different seed types or varieties. The operation of the seed meters at a time will provide for the planting of a particular seed variety. The invention provides for on-the-go changing of a seed being planted by changing the operation of the seed meters at each of the row units and provides for almost infinite variation among the row units for planting particular seed varieties or not planting at all.

WO 2015/035158 A1

SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Published:

— *with international search report (Art. 21(3))*

TITLE: MULTIPLE AGRICULTURAL PRODUCT APPLICATION METHOD AND SYSTEMS

CROSS REFERENCE TO RELATED APPLICATIONS

This application claims priority under 35 U.S.C. §119 to provisional application U.S. Serial No. 61/874,113 filed September 5, 2013, provisional application U.S. Serial No. 61/938,010, filed February 10, 2014, and provisional application U.S. Serial No. 61/975,047, filed April 4, 2014, all of which are herein incorporated by reference in their entirety.

FIELD OF THE INVENTION

The present invention relates generally to the application of agricultural products by use of agricultural implements. More particularly, but not exclusively, the invention relates to methods, systems, and apparatuses for applying at least one of two or more agricultural products to a field by use of an agricultural implement based upon a characteristic of the field. The invention can also be used to dispense refuge or pollen donation in preselected locations throughout a field.

BACKGROUND OF THE INVENTION

An agricultural row crop planter is a machine built for precisely distributing seed into the ground. The row crop planter generally includes a horizontal toolbar fixed to a hitch assembly for towing behind a tractor or other implement. Row units are mounted to the toolbar. In different configurations, seed may be stored at individual hoppers on each row unit, or it may be maintained in a central hopper and delivered to the row units on an as needed basis. The row units include ground-working tools for opening and closing a seed furrow, and a seed metering system for distributing seed to the seed furrow.

In its most basic form, the seed meter includes a housing, a seed disk, and a seed chute. The housing is constructed such that it creates a reservoir to hold a seed pool. The seed disk resides within the housing and rotates about a generally horizontal central axis. As the seed disk rotates, it passes through the seed pool where it picks up individual seeds. The seeds are subsequently dispensed into the seed chute where they drop into the seed furrow.

There have been many ways in which the seed planting process has been adapted in order to increase the amount of yield per acre. For example, instead of treating an entire farm as the same throughout and planting a single type of seed or seed hybrid, there has been a push for planting multiple types of seed to account for differences in soil characteristics, such as moisture content and nutrient level, as well as climate variances. The seed hybrid is selected to provide for the highest yield according to the different conditions throughout the farms. In addition, the hybrids may be configured to treat pest resistance to certain traits found in some, but not all, hybrids.

Therefore, there is a need in the art for an agricultural planter that allows for a user to plant different seed hybrids or varieties in locations of a field based upon known field characteristics in an on-the-go manner. There is also a need in the art for a planter to allow for a larger number of seed varieties to be planted based upon the field characteristics and with a more accurate location than has been heretofore accomplished.

SUMMARY OF THE INVENTION

Thus, it is a principle object, feature, and/or advantage of the present invention to overcome deficiencies in the art.

It is another object, feature, and/or advantage of the present invention to provide an agricultural implement that allows the planting of a plurality of seed varieties to be accurately planted at field locations based upon known field characteristics.

It is yet another object, feature, and/or advantage of the present invention to provide an agricultural implement for planting a field that provides for on-the-go selection and planting of a number of seed hybrids or varieties.

It is still another object, feature, and/or advantage of the present invention to provide an agricultural implement that includes a system that allows for planting different seed varieties or hybrids within seconds and/or feet of travel.

It is a further object, feature, and/or advantage of the present invention to provide systems to provide different seed varieties or hybrids to the seed meters at each row unit.

It is yet a further object, feature, and/or advantage of the present invention to provide a seed delivery system for an agricultural system that automatically provides at least one of a variety of seed to a row unit based upon the location of the row unit in a field.

These and/or other objects, features, and advantages of the present invention will be apparent to those skilled in the art. The present invention is not to be limited to or by these objects, features and advantages. No single embodiment need provide each and every object, feature, or advantage.

Accordingly, the present invention provides for various apparatuses, systems, means, and methods for planting one or a combination of a plurality of seed hybrid varieties and/or hybrids in different locations of a field. For example, a field may include locations with variations of soil characteristics, weather conditions, etc. Such characteristics may include soil moisture content, amount of sunshine, wind, or rain, soil fertility, CEC, PH, likelihoods of water retention or flooding, etc. The varying soil characteristics can affect the overall yield of a crop. Seed hybrids have been developed which account for different growing conditions in order to provide the highest possible yield based upon the different conditions and/or characteristics. However, this may not be the same throughout the field. The present invention provides methods and means for providing on-the-go changing of seed varieties and/or hybrids to provide for the highest possible yield per acre in a field having various characteristics and/or soil conditions. The on-the-go changing of seed type, variety, and/or hybrid will allow for up-to-date planting of the various seed varieties as the conditions change based upon location in the field.

Therefore, the invention provides a location based determination of a type of seed variety and/or hybrid for planting in a field. The location may be determined using a positioning system, such as known GPS technology. A field can be mapped based upon known characteristics, such as historical data. For example, the field may be mapped according to historical data to include the soil nutrient content, amount of rain, amount of sunshine, and other factors to determine the growing conditions for the varying locations of the field. When a tractor and planter are moving through a field, the location determination will provide for updated data for determining the proper seed, variety and/or hybrid to plant at the updated locations in the field. The positioning system will communicate to a seed delivery system, seed source, one of multiple seed meters, or other system to indicate which of the plurality of available seed hybrids is to be planted at the current location of the planter in the field. The location, and thus type of seed to be planted, will be continually updated by the positioning system while the implement moves through the field. This on-the-go updating of the planting parameters will allow a farmer to continue planting in a normal manner, while ensuring that the seed hybrid appropriate for the field conditions will be planted.

The positioning system can be operatively connected to a seed delivery system, such as a bulk fill system, air seed delivery system, individual hopper system, or some combination thereof. The positioning and seed delivery systems can provide the different types of seed hybrids to one or more seed meters, wherein the seed meter delivers the seed to the ground. Various exemplary aspects of the present invention provide for different ways of delivering one or more of the various seed hybrids from the bulk fill or individual hoppers to the one or more seed meters. In addition, the present invention includes that the systems, methods, and means of the invention provide for automatic, on-the-go selection of one or more of the various types of seed hybrids to the one or more seed meters for planting the different seed varieties as needed. For example, the present invention contemplates that one or more seed varieties may be planted within seconds and/or feet of a different seed variety and/or hybrid while the tractor and planter are moving through a field. Thus, the planting of the different hybrids and/or refuge may be accomplished near instantaneously. As the soil characteristics and conditions change, the selected seed hybrid having growing conditions ideal for the soil condition and/or characteristic can be planted, while ensuring that the seed variety can be changed as the soil conditions and/or characteristics change.

Therefore, according to a method of the present invention, an implement is provided along with a tractor. The implement may be a planting implement (planter) and the tractor connects to the planting implement for moving through a field. The tractor and/or planter include or are connected to a positioning system. The positioning system provides up-to-date location in the field, and may be a GPS or other type of positioning system. The agricultural implement includes a plurality of row units, each having a metering system, and at least one product storage unit operatively attached to the row units. At least one agricultural product is applied (planted) to the field as the implement moves through the field being pulled by the tractor. The positioning system determines and updates the location of the implement in the field. Based upon the said updated location of the implement in the field, the system selects one or more of the plurality of agricultural products to be applied to the field based upon a characteristic of the location of the field.

For example, the characteristic may be characteristics of the soil and/or climate at the particular location of the implement in the field, which can be based upon historical data. The one or more agricultural products may be selected and moved from the at least one product storage unit to the row units based upon the location of the field and can include a seed delivery system.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a top view of a planting implement.

Figure 2 is a perspective view of a row unit including aspects of the invention.

Figure 3 is side elevation view of the row unit of Figure 2.

Figure 4 is a rear view of the row unit of Figure 2.

Figure 5 is a perspective view of showing components of a row unit including aspects of the invention.

Figure 6 is a side elevation view of the row unit of Figure 5.

Figure 7 is a top plan view of the row unit of Figure 5.

Figure 8 is a rear view of the row unit of Figure 5.

Figure 9 is a front view of the row unit of Figure 5.

Figure 10 is a perspective view of another row unit including aspects of the invention.

Figure 11 is a side elevation view of the row unit of Figure 10.

Figure 12 is a rear view of the row unit of Figure 10.

Figure 13 is a top plan view of the row unit of Figure 10.

Figure 14 is a sectional view of the row unit of Figure 10 about line 14-14 of Figure 13.

Figure 15 is a perspective view of another row unit including aspects of the invention.

Figure 16 is a top plan view of the row unit of Figure 15.

Figure 17 is a side elevation view of the row unit of Figure 15.

Figure 18 is a rear view of the row unit of Figure 15.

Figure 19 is a sectional view of the row unit of Figure 15 about line 19-19 of Figure 18.

Figure 20 is a top plan view of the row unit of Figure 15 with the seed meters translated.

Figure 21 is a side elevation view of the row unit of Figure 15 with the seed meters translated.

Figure 22 is a rear view of the row unit of Figure 15 with the seed meters translated.

Figure 23 is a sectional view of the row unit of Figure 15 with the seed meters translated and the section about line 23-23 of Figure 22.

Figure 24 is a perspective view of another row unit including aspects of the invention.

Figure 25 is a top plan view of the row unit of Figure 24.

Figure 26 is a side elevation view of the row unit of Figure 24.

Figure 27 is a rear view of the row unit of Figure 24.

Figure 28 is a sectional view of the row unit of Figure 24 about line 28-28 of Figure 27.

Figure 29 is a top plan view of the row unit of Figure 24 with the seed meters translated.

Figure 30 is a side elevation view of the row unit of Figure 24 with the seed meters translated.

Figure 31 is a rear view of the row unit of Figure 24 with the seed meters translated.

Figure 32 is a sectional view of the row unit of Figure 24 with the seed meters translated and the section about line 32-32 of Figure 31.

Figure 33 is a perspective view of yet another row unit including aspects of the invention.

Figure 34 is a side elevation view of the row unit of Figure 33.

Figure 35 is a rear view of the row unit of Figure 33.

Figure 36 is a sectional view of the row unit of Figure 33 taken about line 36-36 of Figure 35.

Figure 37 is a side elevation view of the row unit of Figure 33 with the seed meters rotated.

Figure 38 is a rear view of the row unit of Figure 33 with the seed meters rotated.

Figure 39 is a sectional view of the row unit of Figure 33 with the seed meters rotated and taken about line 39-39 of Figure 38.

Figure 40 is a perspective view of another row unit including aspects of the invention.

Figure 41 is a top plan view of the row unit of Figure 40.

Figure 42 is a side elevation view of the row unit of Figure 40.

Figure 43 is a rear view of the row unit of Figure 40.

Figure 44 is a sectional view of the row unit of Figure 40 taken about line 44-44 or Figure 43.

Figure 45 is a top plan view of the row unit of Figure 40 with the seed meters rotated.

Figure 46 is a side elevation view of the row unit of Figure 40 with the seed meters rotated.

Figure 47 is a rear view of the row unit of Figure 40 with the seed meters rotated.

Figure 48 is a sectional view of the row unit of Figure 40 with the seed meters rotated and taken about line 48-48 or Figure 47.

Figure 49 is a perspective view of another row unit including aspects of the invention.

Figure 50 is a top plan view of the row unit of Figure 49.

Figure 51 is a rear view of the row unit of Figure 49.

Figure 52 is a sectional view of the row unit of Figure 49 taken about line 52-52 of Figure 51.

Figure 53 is a top view of the row unit of Figure 49 with the seed meters rotated.

Figure 54 is a rear view of the row unit of Figure 49 with the seed meters rotated.

Figure 55 is a sectional view of the row unit of Figure 49 with the seed meters rotated and taken about line 55-55 of Figure 54.

Figure 56 is a perspective view of yet another row unit including aspects of the invention.

Figure 57 is a side elevation view of the row unit of Figure 56.

Figure 58 is a rear view of the row unit of Figure 56.

Figure 59 is a sectional view of the row unit of Figure 56 taken about line 59-59 of Figure 58.

Figure 60 is a perspective view of a seed meter for use with a row unit according to aspects of the invention.

Figure 61 is a bottom perspective view of the seed meter of Figure 60.

Figure 62 is a side elevation view of the seed meter of Figure 60.

Figure 63 is a bottom plan view of the seed meter of Figure 60.

Figure 64 is an end view of the seed meter of Figure 60.

Figure 65 is a sectional view of the seed meter of Figure 60 taken about line 65-65 of Figure 64.

Figure 66 is a diagram of exemplary embodiments of a planting and/or seed delivery system according to the present invention.

Figure 67 is a side elevation view of another row unit including aspects of the invention.

Figure 68 is an enlarged view of a portion of the row unit of Figure 67.

Figure 69 is an enlarged view of a portion of the row unit of Figure 67.

Figure 70 is an enlarged view of a portion of the row unit of Figure 67.

Figure 71 is an enlarged view of a portion of the row unit of Figure 67.

Figure 72 is an enlarged view of a portion of the row unit of Figure 67.

Figure 73 is an enlarged view of a portion of the row unit of Figure 67.

Figure 74 is an enlarged view of a portion of the row unit of Figure 67.

Figure 75 is a perspective view of another row unit including aspects of the invention.

Figure 76 is a side elevation view of the row unit of Figure 75.

Figure 77 is a side elevation view of some of the components of the row unit of Figure 75.

Figure 78 is an end view of the row unit shown in Figure 77.

Figure 79 is a top plan view of the row unit shown in Figure 77.

Various embodiments of the present invention will be described in detail with reference to the drawings, wherein like reference numerals represent like parts throughout the several views. Reference to various embodiments does not limit the scope of the invention. Figures represented herein are not limitations to the various embodiments according to the invention and are presented for exemplary illustration of the invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Figure 1 is a top view of an agricultural planter 10. An example of a planter that may be utilized with the various aspects of the invention is further shown and described in U.S. Patent Application No. 13/927,177, which is hereby incorporated in its entirety. The planter 10 of Figure 1 includes a tongue 12, which may be a telescoping tongue such that the planter is a front or rear folding planter. However, the exact nature of the planter is not to be limiting to the invention. The tongue 12 includes a first end 14 in an opposite second end. The first end 14 includes a hitch 16 for connecting the planter 10 to a tractor (not shown) or other vehicle for pulling the planter 10 through a field and for transporting the planter to different locations. The planter 10 shown in Figure 1 is a front folding planter with telescoping tongue 12 and a pair of draft links 20 extending between a first wing 28 and the tongue 12, as well as from the second wing 30 to the tongue 12. The draft links 20 connect the wings to the tongue such that when the wings fold towards one another by operation of cylinders 18, the draft links 20 will extend the telescoping tongue 12 to lengthen the tongue so that the wing sections 28, 30 are able to be folded generally adjacent one another.

Opposite the hitch 16 of the tongue 12 is a main or central frame 22. The main frame 22 extends generally perpendicular to the tongue 12. The frame 22, which also may be known as a toolbar, can include a housing or support for a plurality of central tanks or hoppers 24. The hoppers 24, which may also be known as bulk fill hoppers, house material, such as seed, insecticide, fertilizer, or the like, which is distributed through a system to individual row units. For example, the bulk fill hoppers can be operatively connected to an air seed delivery system for delivering seed from the hoppers to seed meters of individual row units along the frame and wings. Such an air seed delivery system is disclosed in U.S. Patent Application No. 8,448,585, which is hereby incorporated in its entirety. The central frame or toolbar also includes a plurality of row units extending therefrom for distributing the material to the field. In other words, the row units plant the seed or otherwise provide the material to the field. A plurality of transport wheels 26 extend from the main frame and are used to transport the planter in and to or from the field. The transport wheels 26 also support the planter.

Extending generally from opposite sides of the main frame is first and second wings 28, 30. The first wing includes a first frame or toolbar 29, while the second wing 30 includes a second frame or toolbar 31. Extending from the frames is a plurality of row units 34. Such row units will be further described with regard to the figures. A plurality of wing wheels 32 are also included and extend from the wings to aid in maneuvering the planter. The number of row units used with the implement may vary depending on the size of the implement, the requirements of a field, the type of material being distributed to the field, and the like. The number of row units of a planter is not to be limiting to the invention, and the invention contemplates any number of row units for use with a planter.

Furthermore, it should be appreciated that, while a plurality of central tanks 24 are shown, any number may be included or else a single tank with multiple sections to separate different types of material may also be included and contemplated by the invention. According to some aspects of the invention, the number of tanks corresponds to the number of different seed types, varieties, and/or hybrids that are to be planted by the planter. Furthermore, it is also contemplated that the individual row units include row unit hoppers to provide the material at the row units themselves. In such a situation, the air seed delivery will not be required for the seed varieties stored in the row unit hoppers and not in the bulk tanks. Again, the number of hoppers at the row units can correspond to the number of different seed types, varieties, and/or hybrids that are to be planted by the planter.

As will be understood, the invention provides numerous methods, systems, assemblies, and the like for providing a planter 10 that is able to plant one of a plurality of seed varieties, types, hybrids, or the like, through a field without having to change the planter or material in the storage. As more information is obtained as to particular types, varieties, and/or hybrids, of seeds being able to plant in different conditions, it may be ideal to plant a particular seed hybrid at a known location in a field based on said conditions. For example, a part of a field that does not receive as much water, such as by rain, may require a seed that is able to grow with less water. However, that same seed may not be ideal for planting at the location in the field that does receive more water. Therefore, for some fields, it may be ideal for two different hybrid or seed types to be planted based upon its known information as to field conditions. Planting seed based upon known field conditions and other information will allow a farmer to obtain the highest yield for their crop, which will provide numerous benefits, advantages, and the like.

The planters and components thereof according to the invention will provide for on-the-go changing of seed hybrids in population. The change in seed hybrid being planted may be conducted within a single seed drop, such that there is substantially no gap or overlap when switching from one seed variety or hybrid to another. Such a planter will allow farmers to maximize yield in every part of their field without having to compromise a particular area based on the conditions. For example, in parts of the field with high productivity soil, a "racehorse" or high yield potential seed variety can be utilized, whereas a "workhorse" type seed variety can be used in less productive areas. In fields with poor drainage, a variety that can handle moisture can be planted in the lower areas, where the more productive variety used in field locations of the higher elevation. The various aspects of the invention will allow for farmers to make such on-the-go changing and will provide the opportunity to achieve the highest possible yield. However, while some aspects of the invention disclose the possibility of switching between two seed types, varieties, and/or hybrids, it should also be appreciated that the inventions are not limited to only two. It is contemplated that any plurality of seed types can be hypothetically planted using the concepts herein disclosed, and the invention is not to be limited to the specific aspects.

Figures 2-4 disclose a row unit 40 for use with a planter 10 as shown and described. The row unit 40 can be attached to the planter in known ways. For example, as shown in the figures, a mount 41 is provided for connecting the row unit 40 to a frame or toolbar of a planter. This can be a central toolbar or a wing toolbar. Extending generally from the mount is a linkage system 42, which attaches the row unit to the mount. The linkage 42 also allows for movement of the row unit in a field, and can also include down force members, such as that disclosed in U.S. Application No. 13/457,815, hereby incorporated by reference in its entirety. Additional aspects of a row unit such as that shown and described include a frame 43, gauge wheels 44, a depth adjustment mechanism 48, and opener disks 49. The opener or coulter disks 49 open a furrow in the ground for placing a seed to be planted. The gauge wheels 44 work with the depth adjustment mechanism 48 to set the depth of the furrow being created by the opener disks 49. Thus, the adjustment of the depth adjustment mechanism 48 will manipulate the gauge wheels 44 to change and/or set the depth of the furrow created by the opener wheels 49. A seed metering device is also connected to and positioned at the row unit 40. The metering device is covered in the figures by a seed meter cover 46. The cover 46 aids in protecting the metering device from items that may damage the meter and will enhance the efficiency of the metering system.

The row unit 40 shown in the figures includes a substantially static metering device such as that shown in Figures 5-9. As shown in the figures, the metering device includes a first seed meter 50 and a second seed meter 52. The dual seed meter system of the row unit 40 will allow at least two different seed types, varieties, and/or hybrids to be planted at a single row unit 40. As mentioned, this will provide numerous benefits, advantages, and the like for planting. The seed meters 50, 52 can be air seed meters of the kind shown and described in U.S. Patent Application No. 13/829,726, which is hereby incorporated in its entirety. However, other types of seed meters, including mechanical, brush, finger, or the like may also be used with the invention. When an air seed meter is used, the seed meter can be either positive or negative pressure such that the seed is attached to the disk within the meter housing as the disk rotates based upon the air pressure differential created by the positive or negative pressure source.

As shown best in Figures 5 and 6, the seed meters of the row unit 40 are positioned generally fore and aft of one another and can be referred to as inline multi-hybrid seed meters. For example, the first seed meter 50 is positioned generally in front of the second seed meter 52, as shown in Figure 7. The alignment of the inline seed meters provides that the row unit will not increase in width due to the addition of a second seed meter at the row unit. The first seed meter 50 includes a seed meter housing comprising a seed side 56 and a vacuum side 57. Seed is added to the seed side 56 of the housing and collects in a seed pool, which may be shown by reference numeral 69 in Figure 9. The seed pool 69 is adjacent a seed disk (not shown). The seed disk rotates within the housing and includes a plurality of radially spaced seed cells comprising a seed path. An air source, such as a vacuum source, may be attached to the vacuum side 57 or another portion of the seed meter 50 to provide a negative pressure source within the seed housing. As the seed disk rotates within the housing, the negative pressure at the seed cells causes seed of the seed pool to be attached to the rotating disk at the seed cells. The seed is rotated through a singulating device (not shown) that provides a single seed at each seed cell along the seed path. The seed continues along the rotation to an area of no pressure differential where the seed is released from the seed cell and is directed towards an exit 60, which is shown in the figures to be a seed chute. After a seed leaves the chute 60, it is directed by a seed-to-ground mechanism, which is shown in the figures to be a seed tube 65, to the furrow created by the opener disks. Once in the bottom of the furrow, the soil is moved back over the seed to plant the seed in the ground of a field.

As shown in the figures, the first seed meter 50 is oriented such that the seed chute is in the rear of the meter 50 and at least partially over an opening 66 of the seed tube 65.

The second seed meter 52 is oriented in an opposite manner such that a seed chute 61 of the second seed meter 52 is oriented towards the front of the meter and substantially adjacent the first seed chute 60. Therefore, the seed chutes 60, 61 are substantially adjacent one another and both are at least partially positioned over the seed tube entrance 66 such that seed that is metered by either of the seed meters 50, 52 can be directed into and through the seed tube 65 for planting.

The second seed meter 52 also includes a seed side of the housing 58 and a vacuum side 59. It is shown in Figure 6 that the vacuum side of the first housing 57 is on the same side as the seed side 58 of the housing of the second meter 52. Therefore, the seed meters are oriented generally opposite one another such that the seed chutes 60, 61, can both be positioned at least partially over the seed tube entrance 66. When a particular seed type, variety, and/or hybrid is to be planted by one of the seed meters, the seed meter can be activated and seed can be exited therefrom knowing that seed from either meter will be directed through the seed tube and towards the ground for planting. It is contemplated that both seed meters can be operated at the same time such that when alternating or a different seed is to be planted, the seed can be switched for planting on-the-go as the planter moves through the field, with subsequent seeds being able to be of different types, varieties, and/or hybrids.

To operate the seed meters, a first motor 54 is operatively attached to the first meter 50, and a second motor 55 is operatively attached to the second meter 52. As is disclosed in U.S. Patent Application No. 13/829,726, the motors can be connected to an interior of the seed disk to rotate the seed disk in the meter housing. Therefore, having a dedicated motor for each of the first and second meters 50, 52 allows for each of the meters to be independently driven such that they can be activated on the ready to meter the seed associated with each meter to be planted as determined by the location in the field.

Furthermore, as can be understood, each seed meter can be associated with a separate and dedicated seed type, variety, and/or hybrid. The first seed meter 50 includes a meter inlet 51, and the second seed meter 52 includes a seed inlet 53. The inlets 51, 53 are shown to be portions of a hose that can be connected to an air seed delivery system or other seed delivery system. The seed meters can be divided with a seed from separate tanks, such as separate bulk tanks on the planter. When only two types of seed are to be planted in a field, the first seed meter 50 can be dedicated to receive a first seed type or variety, and a second seed meter 52 can be configured to receive and be dedicated for planting a separate seed type or variety. This can be provided by the seed inlets 51, 53 that direct the particular type of seed into the seed pools of the seed meters.

Furthermore, as has been mentioned, the seed meters shown in Figures 2-9 are shown to be air seed meters and in particular, vacuum seed meters. To provide the vacuum pressure for each of the meters, a vacuum splitter 62 may be utilized. The splitter 62 is configured to connect to a vacuum source, such as on the planter. A hose can be connected to the inlet of the splitter 62. The splitter 62 branches into first and second hoses 63, 64, which are connected to the respective first and second seed meters to provide the vacuum pressure within the seed meter housings. Thus, the splitter 62 allows for a planter to not have to increase the number of vacuum hoses on the planter, while still providing vacuum pressure for separate seed meters at the single row unit. It is contemplated both that the vacuum pressure to both meters be maintained at all times, or a baffle or other member can be included in the hoses to selectively allow the vacuum pressure to be provided to only one of the seed meters at a time. The invention is not to be limited to either situation.

Additional aspects of the row unit 40 as shown in the figures includes that the motors 54, 55 for the respective first and second seed meters 50, 52 can be adapted and configured with the ground speed of the planter as it moves through the field to adjust or otherwise dictated the seed drop rate, which is a function of planter speed and target population.

As shown in Figure 6, the seed flow will be directed in a direction as shown by the arrows 68 as it exits the seed tube 65. With some of the aspects of the seed-to-ground systems of the invention, the seed traveling in the direction of the arrow 68 can be manipulated such that it experiences substantially zero relative velocity with the ground. The seed-to-ground systems can manipulate such speed of the seed after it has been metered by one of the plurality of seed meters and en route to the formed furrow, such as by increasing or decreasing the speed of the seed through the seed-to-ground system. As is known, an angular velocity includes an X component and a Y component. The Y component will be substantially equal to the gravity, while the X component will be substantially equal to the ground speed of the planter as it moves through the field. Using these known values, a system can be configured such that the seed exiting in the direction of the arrow 68 from the seed tube 65 can experience relatively zero velocity as it is dropped from the seed tube 65 and is directed towards the bottom of the furrow. This will provide that the seed will experience little to no bounce, roll, or other movement in the furrow such that ideal placement and/or spacing is provided between subsequent and adjacent seeds that are planted.

Having the first and second seed meters 50, 52 with dedicated motors 54, 55 will allow all of the meters of all of the row units to be independently controlled such that the planting can be adjusted as the speed of the planter is changed through a field, and including when a planter turns. The independent control of each of the seed meters at each of the row units allows some or all or the seed meters at some or all of the row units to be turned off when needed, while allowing others to be sped up, slowed down, or maintained. For example, if going over a waterway or other non-planting location, the seed meters of specific row units can be shut off via the motors, such that no seed is planted over said waterway, while on the opposite side of the planter, the row units can continue planting as normal. During a turn, the row units at the interior of the turn can be turned off or slowed down, while the seed meters at the generally exterior or outer radius of the turn can be sped up as needed such that the spacing is maintained for the subsequent seeds. The speed of the meters may also be varied to provide different seed populations based on field conditions, soil characteristics, or other variables which may impact the desired plant density for different areas within a field. In addition to the ideal spacing and independent control, each of the row units including the first and second meters 50, 52 can be planting either the same or different seed types, varieties, and/or hybrids on-the-go, and can continuously change the seed being planted to account for the field conditions at the location of the planter. All this is provided with the row unit 40 as shown and described.

Other changes may also be provided. For example, in some planters, each seed meter 50, 52 of each row unit 40 can include its own hopper that is filled before planting and when empty. Such systems do not utilize a central hopper or air seed delivery or other type of seed delivery, and include dedicated hoppers at the row units themselves. Thus, having dedicated hoppers for each seed meter, with each hopper for each meter including a different hybrid than the other at a particular row unit will allow the same benefits to be obtained. Furthermore, a single hopper with compartments dedicated for different seed types, hybrids, and/or varieties at a particular row unit such that a particular seed is able to be planted by a seed meter is also to be included and contemplated as part of the invention. Still other modifications are also included to be as part of the invention.

It should also be appreciated that, while one row unit 40 is shown in the figures, each of the row units of the planter shown in Figure 1 can include the row unit 40 having the first and second inline seed meters as shown in the figures, such that each row unit is able to plant a plurality of hybrids, seed types, or seed varieties on-the-go as the planter moves through the field. Furthermore, while two seed meters are shown with a particular row unit, additional meters can be added such that more than two seed meters are positioned at each row unit to be selectively operated to plant one of a plurality of seed varieties. It is also possible to utilize different systems (e.g. utilizing a hopper system for one hybrid and a bulk seed delivery system for a second hybrid) in combination to provide multiple hybrid planting capability.

Figures 10-14 show another row unit 70 including aspects of the invention for providing that multiple or a plurality of seed types, varieties, and/or hybrids to be planted at a particular row unit with the seed types changing as the planter moves through the field. Similar to the row unit 40 as shown and described, the row unit 70 includes first and second meters 79, 83 that are substantially inline with one another in a fore and aft manner, and which are substantially static. For example, the seed meters, while capable of some movement, do not move to differentiate alignment with a seed tube or other seed-to-ground delivery system when switching from the use of one meter to the other.

As shown in the figures, the row unit 70 includes many of the similar components as that previously shown and described. For example, the row unit includes a mount 71 for attaching to a planter toolbar and a linkage 72 extending therefrom. The row units also include a frame 73, opening wheels 76, gauge wheels 74, and a depth adjustment mechanism 75. Thus, the row unit can be adjusted and operates as previously disclosed.

However, as shown in Figures 10-14, the row unit 70, which is but one of a plurality of row units for use on a planter, such as that shown in Figure 1, includes a first and second meter 79, 83, with the first meter 79 forward of the second meter 83. However, alternatively to the row unit 40, the seed meters of the row unit 70 include a shared housing member 78. The shared housing 78 provides the seed disk or the seed side of the meter housing for both the first and second seed meters. A vacuum or other air pressure housing side, which is shown as reference numeral 81 for the first seed meter 79, and 85 for the second seed meter 83, is attachable to the single shared housing 78 to enclose a seed disk, singulator, and other components (not shown) for each of the seed meters. Therefore, the seed meter of the row unit 70 provides a streamlined and more efficiently designed row unit 70, which is able to take up less space, while still providing the ability to change the planting of different seed types or varieties in and on-the-go manner.

As mentioned, the first seed meter 79 includes an area for receiving seed that may be known as a first seed pool 80. The seed is collected in the seed pool and is distributed to the meter by a system, such as an air seed delivery system. The seed disk within the seed meter will rotate such that seed cells agitate seed in the pool and, along with the pressure source, attach a seed to the seed cells. The rotation of the disk continues as the seed is passed through a singulating device and towards an area of substantially no pressure differential such that the seed is released from the first seed disk at the seed exit or chute 90, which can be seen in Figure 14 to be a shared seed exit.

Likewise, the second seed meter 83 also includes a seed pooling area 84 for collecting a different seed type, variety, or hybrid within the pool 84. The second seed disk within the second seed meter 83 passes through said seed pool and a singulating device and towards an area of little to no pressure differential therein. At said location, seed in the second seed meter 83 is released from the seed disk such that the seed is passed through the shared seed chute 90 of the seed meter housing 78. Thus, depending on the seed meter that is activated to meter the desired seed type, hybrid, or variety, will provide for which seed is to be planted. The first seed meter may be dedicated to plant a first seed type and the second seed meter 83 may be dedicated to plant the second seed type. For example, the first seed meter may be associated with a workhorse seed while the second seed meter is associated with a racehorse type seed. The ever-changing field conditions as the planter moves through a field will dictate which seed is to be planted by which seed meter. Furthermore, as the seed meters have a shared housing 78 with a shared seed exit 90, the seed will always be directed at approximately the same location such that it is passed through the entrance 93 of the seed tube 92 and towards its exit 94, where it is directed in a manner such as that by the arrow 95 in Figure 14 towards the furrow in the ground.

To operate the separate seed meters 79, 83, the meters will be associated with dedicated seed motors, which may be electrically driven seed motors similar to those shown with regard to the row unit 40 as previously disclosed. The motors can independently operate the rotation of the disks within the seed meters such that a particular disk is rotating to plant a desired seed. Other precautions and additions to the invention may include that both motors be rotating at all times but that only one seed be planted by a particular meter and associated with a desired trait for providing the yield at a particular location in the field as well. However, having a dedicated motor for each meter will allow the disk to be instantaneously operated upon the change for a seed to be planted. For example, when the first seed meter is planting seed in a continuous manner, the second seed disk of the second seed meter 83 may not be in operation. However, when the planter recognizes a need to change the type of seed to be planted based upon known information, the second seed meter can be instantaneously operated by the activation of the second motor to begin rotation of the second disk through the seed pool to begin planting the second seed type or variety.

Furthermore, the first and second seed meters can be connected to air sources, such as vacuum sources in a similar manner to the row unit 40 as previously disclosed. A vacuum hose can be connected to a splitter mechanism, which is then connected to air inlets or vacuum inlets of the vacuum sides 81, 85 of the seed meters to provide a constant source of vacuum pressure within the shared meter housings. The constant vacuum pressure within the housing will ensure that seed is always to be attached to the seed disks when needed.

Additional advantages of the row unit 70 shown in the figures include that the seed meters be positioned such that they are oppositely facing one another and with the seed disk rotating in opposite manners. For example, as shown in Figure 14, the seed disk associated with the first seed meter 79 will rotate in a counter clockwise manner and the seed disk associated with a second seed meter 83 will operate in a clockwise manner according to the view of Figure 14. This will allow the release point for each of the meters to be at the shared seed chute 90 and above the entrance 93 of the seed tube 92. Therefore, no matter which seed meter is being operated, the seed should fall at substantially the same location from either meter. This is due in part to a partial overlap 88 of the seed meters and disks housed within. As shown best in Figure 14, a portion of the seed disks will overlap with one another with enough spacing such that there is little to no interference between the seed disks. The overlap provides a shared or common release point relative to the seed chute and tube 90, 92 such that the seed will fall in a manner with the least amount of bounce through the seed tube 92 as the seed approaches the exit 94 in the direction of the arrow 95. Thus, the streamline design of the shared housing 78 as shown in the figures provides additional advantages for a row unit 74 providing a system that can plant multiple or a plurality of types, varieties, or hybrids of seed from a planter while the planter travels through a field.

In addition, similar to previously disclosed, each of the row units of the planter can include a row unit 70 with a shared housing 78 and first and second seed meters 79, 83. The independent control of the meters at each of the row units will allow the planting to be as streamlined as possible with ideal spacing between such seeds planted in the furrow. Additional benefits and advantages obvious to those skilled in the art are also to be included.

Furthermore, as mentioned, the seed provided to each of the meters 79, 83 of the row unit 70 can be provided in any number of ways. An air seed delivery system can be utilized such that seed is transported from separate or shared central hoppers or bulk tanks to each of the meters. For example, two hoppers may be utilized with each hopper containing a separate seed variety. Each hopper may include its own air seed delivery system which connects to only one of the meters at each row unit. The other hopper can be operably connected to the opposite or other seed meter at the row unit such that each hopper supplies seed to only one of the meters at a row unit. This will aid in keeping the seed variety separate, while also providing a more efficient manner of planting the desired seed at the desired time through the field.

Figure 15 is a perspective view of yet another row unit 100 capable of planting one of a plurality of separate seed types, varieties, or the like by a planter in the field in an on-the-go manner such that a desired seed variety is planted which accounts for field conditions, such as moisture content, soil type, soil temperature, and the like. While the previous row units have included systems in which the seed meters are substantially static and fixed in place above a shared or common seed tube or other seed-to-ground delivery system, the row unit 100 discloses a system that is more dynamic. For example, the row unit 100 shown in Figure 15 includes a dynamic system in which a plurality of seed meters can be translated or otherwise moved in a direction to selectively align one or said plurality of seed meters with a seed-to-ground delivery system, such as a seed tube, to plant the seed associated with the aligned seed meter. When a separate or different seed type, hybrid, and/or variety is to be planted, the meters are dynamically translated such that a different seed meter associated with the different seed type, variety, or hybrid is aligned with the seed-to-ground system to singulate and meter the seed through the seed-to-ground delivery system and into a created furrow. The system allows for a constant on-the-go changing of meters aligned with the seed to the ground delivery system such that the different seed types can be planted without having to change the seed in a seed tank, hopper, or the like.

As shown in Figures 15-23, the row unit 100 includes many of the standard row unit components, including a mount 101, a linkage 102, a frame 103, gauge wheels 104, a depth adjustment mechanism 105, and opener disks 106. As has been disclosed, these components support the row units and create a furrow for planting the seed therein.

While it is to be appreciated that the row unit 100 is capable of supporting any number of seed meters associated with any number of a plurality of different seed types, the embodiment shown in the figures includes two seed meters. A first seed meter 108 is shown with a second seed meter 115. The first seed meter is at least partially forward of the second seed meter 115. The fore and aft positioning of the seed meters will allow the row unit to be maintained as little width as needed to support the plurality of row units. Furthermore, and similar to previous row units, the seed meters of the row unit 100 are positioned such that they are opposite one another, as will be understood, such that the seed chutes or other exits of the seed meters will be substantially adjacent to one another such that the meters will need the least amount of movement or translation to substantially align or at least partially align the seed chute of the desired seed meter with the seed-to-ground delivery system.

The row unit 100 includes a first seed meter 108. The first seed meter is similar to those previously disclosed in that its housing includes a vacuum side 110 and a seed side 112. The seed side of the housing 112 includes an inlet for accepting seed to collect in a seed pool 109. The vacuum housing 110 of the seed meter 108 includes a vacuum inlet 111 for attaching to a vacuum source. Furthermore, the seed meter 108 includes a seed chute or exit 113 for directing seed that has been released from a seed disk towards the seed-to-ground delivery system, in this case, a seed tube 124.

The second seed meter 115 includes similar components in that it includes a housing comprising a vacuum housing side 117 and a seed housing side 119. The seed side of the housing 119 includes an inlet for seed to create a seed pool 116, while the vacuum housing side 117 includes a vacuum inlet 118 for connecting to a vacuum or other air source for providing air to the interior of the housing such that seed is attached to a seed disk rotated therein. Additional components not shown will be a first motor operably connected to the first seed meter 108 to independently and selectively drive the seed disk rotation therein, and a second dedicated motor operably attached to the second seed meter 115 such that the dedicated motor of the second seed meter can selectively rotate the seed disk housed within as well. The operation of the seed meters will be substantially similar to those previously disclosed and that the seed disk rotates through the seed pool, through a singulator, and to an area of little to no pressure differential where the seed is released from a seed disk and is directed by a seed chute towards a seed-to-ground delivery system.

As disclosed, the seed meters of the row unit 100 are substantially dynamic and that the seed chute of each of the seed meters is not always aligned with the seed-to-ground delivery system. For example, as shown in Figures 16-19, the seed chute of the first seed meter 108 is at least partially aligned with the seed-to-ground delivery system, while the seed chute of the second seed meter is substantially not. Figure 19 shows the seed chute 113 of the first seed meter 108 at least partially aligned with an entrance 125 of a seed tube 124. In the orientation shown in Figures 16-19, the first seed meter is the operating seed meter such that the seed type, variety, and/or hybrid associated with the first seed meter will be planted by the row unit. The second seed meter 115 does not have alignment between its seed chute and the seed tube such that the seed associated with said seed meter will not be planted.

However, when the tractor, planter, or some intelligent control associated therewith determines a change in known and obtained information related to field conditions (e.g., soil moisture content, amount of rain, soil temperature, soil hardness, and soil nutrients, etc.), the system will operate to adjust or dynamically move the seed meters to change the seed type being planted. This may be done with a system such as a dynamic control system 122. The dynamic control system 122 may be an actuator, which may be hydraulic, electric, pneumatic, or some combination thereof, and can be utilized to dynamically translate the first and second seed meters to change the alignment with the seed tube, which changes the type of seed being planted based on the type in seed meter.

Thus, as shown in Figures 20-23, the dynamic control system 122 has translated the seed meters in a direction shown by the arrow 123 to move the first seed meter 108 such that it is no longer at least partially aligned with the seed tube. However, in the configuration shown in Figure 20, the second seed meter 115 has been likewise translated such that its seed chute is at least partially aligned with the entrance of the seed tube 124 so that seed being metered and dispensed by the second meter 115 will be passed through the seed tube 124 and towards the direction shown by the arrow 127 in Figure 23.

The seed meters have been translated about the direction of the arrow 123 as shown in the figures, and in particular, in a side-to-side manner wherein the first meter 108 and second meter 115 have been translated horizontally towards the left of the row unit in relation to the direction of travel of the planter. The translation may be done by sliding the first and second seed meters via the dynamic control system 122, which can include the meters moving on rails, guides, or other members, to selectively align one of the two seed meters with the seed-to-ground system. The seed meter aligned with the seed-to-ground system will be operated to plant the seed associated or contained with the said meter. However, when a change is desired, the dynamic system will operate to selectively align the opposite seed meter with the seed-to-ground system. This changing of the seed meters or translating in the horizontal direction will allow for the on-the-go changing of the type, variety, and/or hybrid of seed being planted with a single planter through a field.

It is to be appreciated that, with the row unit 100 shown in the figures, it may be desired to have the first and second meters connected to one another such that the movement of one will cause the movement of other via the dynamic system 122. Thus, the housings may include a portion that is shared or else the seed meters be mounted to a track or other system such that movement of the dynamic system causes both the seed meters to move so that the desired one of the plurality of seed meters is substantially or at least partially aligned with the seed-to-ground system for planting the seed therefrom.

Furthermore, it is to be contemplated that the seed delivered to each of the seed meters be in a manner as previously shown and disclosed. The operation of the motors associated with the dedicated seed meters will also be similar to that as previously shown and disclosed.

While the seed-to-ground system has been shown to be a seed tube 124 with an entrance 125 and an exit 126, it should be appreciated that other systems may be contemplated and utilized with this and/or all of the other row units and seed meter systems of the invention. For example, brushes, endless members, belts, or other carrier members can be utilized to control the delivery of the seed from the meter to the furrow. While the seed tube is shown and described, it may be desired in some areas to provide a more controlled delivery of the seed from the seed exit of the meter to or towards the furrow. In such a situation, a seed belt or other control delivery apparatus may be utilized to control the delivery such that the seed will experience little to no bounce or roll during the delivery from the meter to and towards the furrow. The control of the seed to the furrow decreases the likelihood of bounce or roll in the furrow such that ideal and desired seed spacing is provided between each of the subsequently planted seeds. For example, a belt-type system is shown in Figures 77-79 for delivering seed from a seed meter to a ground, and can be utilized with any of the metering configurations disclosed.

Figure 24 shows yet another row unit 130 for providing a seed metering system that includes a plurality of seed meters to provide the ability to on-the-go change the planting of a seed type, variety, and/or hybrid, as a planter moves through the field and based upon pre-determined information related to the field and/or environmental conditions to give a particular seed type, variety and/or hybrid the best chance of thriving in said condition to achieve the highest possible yield for the planted seed. Similar to the row unit 100 previously shown and disclosed, the row unit 130 includes a system for providing a plurality of seed meters each capable of planting a different seed type, variety, and/or hybrid, with the system being dynamic in nature, such that the seed meters can be moved to selectively align, at least a portion of, a seed chute associated with an individual seed meter with a seed-to-ground delivery system to plant seed from the aligned seed meter.

As with previous row units, the components of the row unit 130 are similar with regard to the mount 131, linkage 132, gauge wheel 134, depth adjustment 135, and opener disks 136.

The row unit 130 is capable of including and controlling any number or plurality of seed meters, with each of the seed meters capable of being associated with a different seed type, hybrid, and/or variety for planting. Furthermore, as will be understood, the seed meters may be configured to each plant a variety of seed types, hybrids, and/or varieties as well. However, the Figures 24-32 disclose a row unit 130 with two seed meters attached thereto. Thus, for purposes of disclosure, the system with a first seed meter 138 and second seed meter 145 will be disclosed.

While the row unit 100 previously disclosed included a dynamic system that moved the first and second meters in a generally side to side manner with regard to the row unit, the row unit 130 shown in the figures includes a system wherein the first and second meters 138, 145 are translated in a forward and aft manner to selectively align at least a portion of the meters with a seed-to-ground delivery system. For example, as is shown through the figures, a first seed meter 138 and second seed meter 145 is included. The first seed meter 138 includes a housing with a vacuum side 140 and a seed side 142. The vacuum side 140 includes an inlet 141 for attaching to a vacuum or other air pressure source. The seed side 142 includes an opening for a seed pool collection point 139.

Likewise, the second seed meter includes a housing with a vacuum side 147 and a seed side 149, with the vacuum side having an air hookup or inlet 148 and a seed side including an aperture for seed to collect in the seed pool 146. As can be viewed throughout the figures, the first seed meter 138 is positioned generally forward of the second seed meter and in an opposite orientation. For example, as shown best in Figure 25, the first seed meter 138 includes its vacuum side 140 on the lower portion of the figure while the second seed meter 145 includes an oppositely oriented seed meter with the vacuum side 147 being towards the top of the figure. Furthermore, as shown best in Figure 25, the meters are substantially inline with one another with regard to forward and aft alignment and are not staggered as was the case with the row unit 100 that previously shown and described. The inline orientation and configuration of the seed meters will allow the seed meters to be narrow with regard to the row unit such that few to no modifications will not need to be made to existing planters.

Furthermore, the Figures 25-28 show that the first seed meter 138 includes a seed chute 143 that is at least partially and substantially aligned with an entrance 155 of a seed tube 154. Thus, in said configuration, the first seed meter 138 will be the active seed meter for metering and planting seed therefrom. Seed that is released from the meter will be passed through the seed tube 154 and out of the tube in the direction as shown generally by the arrow 157. As previously disclosed, the rotation of the seed disk can control the rate of the delivery of the seed delivered to the furrow, and a seed-to-ground system can take into account the ground speed of the planter such that the seed will experience substantially zero velocity when planting in a formed furrow.

However, when an intelligent control or other system associated with the planter recognizes that a change in the seed type, variety, and/or hybrid is needed to account for a change in field conditions, the row unit 130 can be manipulated to dynamically translate the seed meter such that the second meter 145 will become aligned with the seed tube 154. This is shown generally in Figures 29-32. For example, as shown in the figures, the seed meters have been translated in a forward manner similar to the direction shown by the arrow 153 in the figures. The movement of the meters may be facilitated by a dynamic control 152. The dynamic control and system 152 may include an actuator, pulley system, gear system, or the like. Furthermore, the seed meters may be operatively attached to rails, guides, tracks, or other members that allow the meters to slide or otherwise be translated in a forward and aft direction to selectively align one of said meters with the seed tube or other seed-to-ground system.

For example, the figures show an actuator 152, which may be a hydraulic, pneumatic, electric, or a combination actuator that is operably attached to the meters to extend and retract to slide the meters selectively inline with an opening 155 of the seed tube 154. This dynamically translating system can be continuously varied according to the known and pre-plotted field conditions to selectively align and thus, selectively plant a particular seed variety via a particular seed meter as the planter travels through the field. This on-the-go control of the changing of the seed being planted will provide the opportunity for a farmer to obtain a highest possible yield for a particular field that has been pre-plotted.

Additional aspects not explicitly shown in the figures include first and second motors associated with the first and second seed meters to selectively control the rotation of the disk therein, a pressure source, which may be a vacuum hose with a splitter to separate the vacuum pressure to the separate seed meters, as well as other aspects of a row unit that has been previously shown and described.

Figures 33-39 show yet another row unit 160 that includes a dynamically activated metering system to selectively align one of a plurality of seed meters of a particular row unit with a seed tube around delivery system to plant a seed type, variety, and/or hybrid associated with said meter. The dynamic system of Figures 33-39 provides additional ways to control the ability to selectively plant one of a plurality of types of seeds and to on-the-go change the planting of seed type while the planter moves through the field according to a predetermined field map or pre-plotted area.

The row unit 160 includes a first meter 168 and a second seed meter 175 positioned in a substantially forward and aft, inline manner. The meters are oriented opposite one another with the first meter vacuum side of the housing 171 being on the opposite side of the second meter 175 vacuum housing 177. Thus, the first seed chute 173 will be at least partially adjacent the second seed chute 180 of the second seed meter 175. As is shown in the figures, the first and second seed meters 168, 175 are oriented such that one of said meters will be substantially or at least partially aligned with an entrance 185 of a seed tube 184 or other seed-to-ground mechanism such that the aligned seed meter can be operated to plant seed associated with said meter. For example, in Figures 34-36, the first seed meter 168 is aligned with the seed-to-ground system 184 and as such, the seed associated with the first seed meter 168 will be planted. The seed that is in or otherwise associated with the seed pool 169 will be metered and exited out the seed chute 173, through the entrance of an entrance 185 of a seed tube 184, and out the exit 186 in the general direction of the arrow 187. The speed of the seed meter can control the rate of the delivery of the seed delivered to the furrow, and a seed-to-ground system can take into account the ground speed of the planter such that the seed will experience substantially zero velocity when planting in a formed furrow.

However, when the system determines that a different seed type, hybrid and/or variety of seed is to be planted, the meters can be dynamically reconfigured to align the second meter with the seed tube 184. For example, as is shown in the figures, the seed meters 168, 175 are configured to be rotated about a generally horizontal axis in a manner that is shown by the arrow 183. The rotation of the meters, which can be done via a dynamic system and/or control 182, can selectively align which of said meters is aligned with the seed tube 184. While Figures 34-36 show the first meter aligned with the seed tube, Figures 37-39 show a situation in which the dynamic control 182 has rotated the seed meters such that the second seed meter 175 is now substantially aligned with the entrance 185 with the seed tube 184. Seed that has been collected in or that is otherwise associated with the seed pool 176 of the second seed meter 175 can be metered and released via the second seed chute 180, through the seed tube entrance 185, and out the seed tube exit 186 towards the direction of the arrow 187 as shown in Figure 39.

The dynamic system and control 182 of the row unit 160 can be configured to rotate the seed meters as needed to selectively plant a desired seed hybrid, variety, and/or type in an ever changing manner to control the seed being planted at a particular location in a field and based upon known and obtained field conditions and/or other information, and which has been pre-determined or otherwise pre-plotted. Furthermore, the dynamic system and control 182 could be operated based upon on-the-go analysis of soil, seed, and/or weather conditions. For example, a sensing system, such as that shown and described in U.S. Application No. 13/458,012, hereby incorporated in its entirety, could be utilized in which the sensing system obtains information on the fly, and even in front of the row units such that the seed type or variety to be planted at a particular location could be determined during planting.

It should be further appreciated that other components not explicitly shown and described that obtain or provide advantages or benefits that have been previously shown and described may also be utilized with the row unit 160 to best operate said row unit and plurality of seed meters mounted therewith. It should be further appreciated that, while the row unit shows two seed meters, any number of seed meters are contemplated to be used with the dynamically rotating system of the figures.

Figures 40-48 show yet another system in which a plurality of seed meters are mounted at a row unit 190 and configured to be dynamically rotated to selectively align one of the plurality of meters with a seed-to-ground delivery system in order to select a particular seed type, hybrid and/or variety to be planted in an ever changing manner as a planter moves through a field. However, contrary to the row unit 160 previously shown and described, the row unit 190 includes a dynamic system in which the plurality of seed meters is rotated about a substantially vertical axis.

As shown in the figures, the row unit 190 includes a first seed meter 198 and a second seed meter 205. The meters each include vacuum housings 200 and 207, seed housings 202 and 209, seed pools 199 and 206, vacuum or pressure inlets 201 and 208, and seed chutes 203 and 210. The components of the plurality of seed meters, and in this instance two seed meters, are similar to one another. The difference being the type, hybrid and/or variety seed being delivered to the seed meter and being planted thereby. Thus, while the row units 190 includes two seed meters capable of planting two separate types, hybrids and/or varieties, it should be appreciated that any number of seed meters and any number of different seed types, hybrids and/or varieties are contemplated to be planted using a similar system as that shown and described.

As shown in Figures 42-44, the first seed meter 198 is initially aligned such that the seed chute 203 thereof is aligned with an opening 215 of a seed tube 214. Therefore, seed being metered by the seed meter 198 can be passed through the seed chute 203, through the seed tube 214 and out the exit 216 thereof towards the direction of the arrow tube 217. As with the previously disclosed meters, a dedicated motor operably attached to the seed meter can aid in controlling the release of the seed such that the spacing between such seeds is obtained. Furthermore, a different seed-to-ground system besides the seed tube could be utilized such that the seed experiences relative zero velocity when exiting the seed-to-ground system and entering the formed furrow in the field.

However, when a system associated with the planter, row unit, or some combination thereof, determines that a different seed type, hybrid and/or variety is to be planted, a dynamic control system 212 could be operated to dynamically rotate the seed meters. This could be pre-plotted, or could be done on-the-fly, such as by use of the sensing system on the planter, tractor, or otherwise, and could be determined in front of the row units to determine which seed meter is to be activated (i.e., aligned with seed-to-ground) to plant the seed associated with said seed meter. As shown in the figures, the seed meters are rotatable in the direction of the arrow 213, which is generally about a vertical or substantially vertical axis. The dynamic control system, which can include pulleys, belts, gears, actuators, or some combination thereof, can rotate the seed meters such that the row unit moves from the configuration shown in Figure 41 to the configuration shown in Figure 45.

As shown in Figure 45, the seed meters have been rotated such that the second seed meter 205 is now positioned generally over the seed tube 214 such that the second seed chute 210 is substantially or at least partially aligned with the opening 215 of the seed tube 214 so seed released therefrom will be directed to the seed tube. The seed that is metered by the second seed meter 205 can be passed through the seed tube and out the exit tube 216 towards direction 217 as shown in Figure 48. The row unit 190 shown in the Figures 40-

48 provides a system in which the on-the-go changing of the seed type or hybrid is possible. The dynamic control system 212 can provide a situation in which the seed meters are continuously or as needed rotated about the substantially vertical axis to align the seed meter associated with the desired seed to be aligned with the seed-to-ground system such that the desired seed is planted in the furrow. The amount of rotation may be exaggerated in the figures to describe the row unit, and slight amounts of rotation may be all that is required. The slight or small amount of rotation will allow a quick change from the alignment of one seed meter to another, and can also accommodate more than two seed meters being rotated about the same axis.

Additional components not explicitly shown and described with reference to Figures 40-48 which have been previously shown and described with regard to other embodiments, aspects and figures, may be considered to be part of the row unit 190.

Figures 49-55 show yet another row unit 220 in which a plurality of seed meters are rotatable to selectively align one of said plurality of meters with a seed-to-ground delivery system. As shown in the figures, the first and second seed meter 228, 235 are provided with the row unit 220, with the seed meters being rotatable about a substantially horizontal axis extending longitudinally with the row unit. The seed meters each include housings with vacuum housings 230 and 237, seed housings 232 and 239, seed pools 229 and 236, vacuum inlets 231 and 238, and seed chutes 233 and 240, respectively. Thus, the seed meters themselves are similar to those previously shown and described. It is noted that the meters will further include motors dedicated for operating each of said meters, however.

As shown in Figures 50-52, the first seed meter 228 is aligned such that the seed exit chute 233 is substantially vertical and is also aligned with an opening 245 of the seed tube 244. Seed that has been delivered to or is otherwise stored at the first seed meter 228 will be metered and passed through the seed tube and out the exit 246 towards the direction of the arrow 247. The seed will be planted via the first seed meter until an intelligent controller or other system associated with the planter, row unit, or some combination thereof determines that a different type, hybrid and/or variety of seed is to be planted, at least temporarily.

At such a point, a dynamic control mechanism 242 can be activated to rotate the first and second seed meters about the substantially horizontal axis extending in a longitudinal manner of the row unit to selectively align the second seed meter for planting.

This is shown best in Figures 53-55. Note that the seed chute 240 of the second seed meter 235 is now in a substantially vertical orientation and is aligned with the opening 245 of the seed tube 244. The seed meter can be activated such that the seed metered by said second meter 235 is passed through the seed tube 244 and out the exit 246 in the direction of the arrow 247. The seed is thus planted via the second seed meter and can continue until the system determines that the seed of the first seed meter needs to be planted, which may be for only a single seed. This can be based on field conditions, soil conditions, temperature, environmental conditions, climate, and the like.

Therefore, the row unit 220 includes a system that allows the two or more seed meters to be rotated about the axis in the manner of the arrow 243 shown in the figures. The dynamic control operates to rotate the meters such that at least one of the plurality of meters will be aligned with the seed-to-ground system for planting.

It should be appreciated that the dynamic translation and rotation systems of the row units shown and described can be combined with one another or with the more statically oriented row units in any manner to provide for additional variations for the row units. For example, when more than two seed meters are associated with a row unit, there may be forward and aft sets or pairs of seed meters wherein the pairs can be both translated and/or rotated in a manner such that one or more of the seed meters is aligned with a seed-to-ground system to direct seed metered by said meter towards a furrow created in the ground. Thus, while the row units of the invention have been shown and described with regard to two meters, it is further contemplated that any number of meters be utilized with any of the row units of the invention. Still further, it is to be appreciated that the systems provided show and describe a system in which a near instantaneous change of one seed type, hybrid and/or variety can be changed to plant a second and separate seed type, hybrid and/or variety in an on-the-go manner such that a field can be optimized to be planted with various seed hybrids that can provide the highest possible yield outcome for a crop.

As has been mentioned, the field can be pre-plotted or programmed to determine the optimal seed hybrid or type to be planted for the variable locations through a field. Agronomists, agronomy information, climate information, and field information can all be utilized to determine the optimal type of seed to be planted throughout the field. For example, climate conditions and field testing associated with the soil moisture content, soil temperature, soil nutrient level, and other conditions can provide a vast amount of information such that one seed optimal for a particular location would not be optimal for a location just 18 inches on one side or the other. Therefore, as each of the row units can be equipped to plant one of a plurality of types of seed via the pluralities of seed meters associated with the row units, side-by-side row units can be planting separate seed types and can continuously change as needed throughout the field.

Alternatively, the field, soil, and or other conditions associated with planting could be determined on the fly as the planter and tractor move through the field. As previously disclosed, a sensing system could be located at the tractor, planter, row unit, or in multiple places such that a sensor tracks soil and/or seed characteristics in a real time basis to communicate to the intelligent control and/or row units to selectively activate one of the plurality of seed meters (static, dynamic, or some combination thereof) to plant a seed associated with the seed meter that will have the best chance to thrive in said conditions.

Figures 56-59 show a row unit 300 equipped with a queuing system for use with a single seed meter or which can be used with any combination of any of the other row units disclosed. The queuing system, as will be understood, provides for yet an additional way to more efficiently plant a plurality of seed types, varieties, and/or hybrids in a single field without having to continuously stop and change the seed type of a planter. Instead, multiple seed types can be provided via multiple bulk tanks or other seed housings and the system can be utilized to on-the-go change the seed being planted.

Therefore, as shown in Figures 56-59, a row unit 300 is provided. The row unit 300 includes components such as a mount 301 for mounting the row unit to a planter toolbar, a linkage 302, a frame 303, gauge wheels 304, a depth adjustment mechanism 305, and opener wheels 306. Furthermore, a seed meter 310 is provided with the row unit 300. Attached to the seed meter 310 is a mini hopper 308 with a hopper lid 309 covering. The mini hopper 308 may be of the sort shown and described in U.S. Application No. 14/176,198, which is herein incorporated by reference in its entirety. The hopper may be a mechanism to receive seed from a bulk tank and to store at least some seed at the row unit without having to fill the seed meter completely. While a single seed meter 310 is shown with the row unit 300, additional aspects of the row unit will provide that the single row unit can plant one of a plurality of seed types, varieties, and/or hybrids at said row unit and with said single seed meter 310.

The seed meter 310 includes a seed housing with a disk side 311 and a vacuum side 312. A seed pool 313 is formed on the seed disk side and allows for the accumulation of the seed within the seed housing, such as via the mini hopper 308. An air source or vacuum connect 314 is included, which can connect to an air source to provide a pressure differential within the seed meter housing. A seed chute 315 extends generally downwardly from the seed housing and directs a seed towards a seed-to-ground system such as a seed tube 324, which can include an entrance 325 and exit 326 for directing seed in the direction of an arrow 327 as shown in Figure 59.

Furthermore, the seed meter includes a queuing system, which takes the form of a clearing tube 316 extending at least partially through the seed pool 313 or another portion of the seed housing. The queuing system is shown in greater detail with regard to Figures 60-65. As shown in the figures, the clearing tube 316 of the queuing system is a tube which includes an first end 317 and a second end 318, and which extends at least partially through the seed pool 313 of the seed meter 310. The clearing tube and queuing system 316 provides a way to clear the seed meter housing of a particular type of seed before providing a separate type or hybrid of seed to the seed meter for singulating, metering, and delivering to the furrow. For example, as seed is delivered via the seed pool opening 313, it will collect adjacent the spinning seed disk within the seed meter housing. A seed delivery system, such as an air seed delivery system, can be configured to include baffles, chambers, or other mechanisms that can selectively deliver one or a plurality of types, hybrids, or varieties of seed to a single seed meter at a row unit. When a different type of seed is to be planted, the second seed variety can be delivered to the meter via the delivery system. However, if there is residual seed remaining in the seed pool of a seed meter of the first type, the second desired type may not be immediately planted at the desired location. Thus, the clearing tube and queuing system of the invention provides way to clear a seed pool of a seed meter of a first type of seed before providing or delivering the second type of seed to the meter such that the second variety of seed will be planted immediately when desired by the single meter.

An air hose or other fluid hose can be connected to the first end 317 of the clearing tube 316, and a hose connected to the second end 318 can be connected to the bulk tank associated with a seed type. When a particular seed variety or combination variety is being planted, an amount of seed is going to be collected in the seed pool 313. When a system associated with the planter determines that a new variety or type of seed is to be planted, the queuing system may be activated to clear the seed pool of any access first type of seed. Air or another fluid source can be provided through the clearing tube to pass through the seed pool to push any excess or residual seed out of the second end 318, and can be directed towards the bulk tank or another holding area of the first type of seed. The second type of seed can then be planted via the seed meter until the system determines that the first or yet another type of seed is to be planted. The system will again queue up to remove any excess or residual seed from the seed pool before delivering the next type of seed to be planted to the seed meter, wherein the seed is then metered and planted as has been shown and described.

The queuing system provides numerous advantages. For example, the queuing system allows for the use of a single seed meter at each row unit during planting. This reduces the number of components to be used for planting the different seed types and/or hybrids. The queuing system can provide for greater accuracy in planting of a particular variety by flushing out any excess or residual seed before supplying a new or second type of seed. Furthermore, the queuing system prevents or mitigates waste of a particular seed variety by passing any excess or residual seed from the seed meter and back to the hopper or seed source containing the particular seed variety. This can provide that any number of seed varieties can be utilized.

Furthermore, the queuing system can be used with any of the row units and/or seed meters as has been shown and described in the invention. The system provides a unique way to clear a particular seed meter of a first type of seed before providing a second or another type of seed to be planted through the system. Thus, for a row unit with a plurality of seed meters, the system can provide for more than two seed varieties to be planted with two seed meters. The queuing system can be utilized to queue up or prepare one of the seed meters by clearing said seed meter of an unwanted or undesired seed to be planted before providing the next type of seed to be planted to the seed meter. The queuing system provides a manner of preparing or otherwise setting up a seed meter for future use as well.

While the air seed delivery system has been described, other methods of providing seed to the meters may also be included. For example, a seed meter can include multiple seed pools that each contains separate seed types or varieties. The pools can be manipulated to align one of said pools with a seed disk to have the seed meter plant seed from the pool. This can be done by baffles, slides, indexing systems, or other systems that control the seed pool containing separate seed types for interaction with the seed disk.

Different embodiments of seed disks can also be included. For example, an embodiment of a seed disk for use with one or more of the planting and/or row units for providing methods and means for planting one or more of a plurality of seed hybrid varieties in a field includes a seed disk that is a conical-shaped disk that includes a first seed aperture path, second seed aperture path, third seed aperture path, and fourth seed aperture path, which are generally defined by rows of seed apertures positioned radially away from a seed disk axis and spaced generally evenly from one another. Each of the seed aperture paths are in communication with their own separate seed pool, wherein each of the separate seed pools contains a different seed hybrid variety.

Due to the conical shape of the seed disk, each separate aperture path is allowed to be driven separately or concurrently. An internal drive can include a clutch or other mechanism such that the operation of the drive system rotates one section of the conical disk, which corresponds with one of the seed aperture paths rotating. For example, if the seed hybrid variety 3 is to be planted at a particular location, the disk drive mechanism can be operated to rotate the section containing the third seed aperture path. This will pass the seed apertures of the seed aperture path through a seed pool containing the seed hybrid variety 3. The seed can then be released into and through a seed tube and towards the grown for planting.

The cone can be pitched at an angle to allow for seeds to fall away in a similar path such that the different seed hybrid varieties can travel down a same seed tube, as has been shown and described previously. When hybrid 2 is to be planted, a positioning and/or control system communicates with the drive mechanism to rotate only the section containing the second seed aperture path. As the location of the planter and the field changes, the positioning system is updated to determine when a different seed hybrid variety is to be planted. For example, if the hybrid 1 is to be planted, the positioning system communicates to the drive mechanism to stop rotating the section containing the second seed aperture path and to begin rotating the section containing the first seed aperture path. This will pass through the seed pool containing the hybrid 1 to begin planting said hybrid variety instantaneously.

In addition, it should be appreciated that all of the seed aperture paths of the seed disk can be rotated at the same time, with only one of the paths "activated" to acquire seed from the corresponding seed pool. For example, when the system is an air seed meter, the air source can be manipulated to be moved to align with one of the seed aperture paths corresponding with the seed variety to be planted. When the system, either manually or automatically, indicates a change in the seed to be planted, the air source can be moved, either by moving the source itself or by moving a different portion thereof to open a path to the desired seed path, such that the new seed path will have seed adhere thereto when passing through a seed pool. Furthermore, an actuated knockout could be used to dislodge a seed from one or more of the seed aperture paths for planting. The actuated knockout could also be used to knockout undesired seed from the disk and back to the seed pool prior to reaching a dispensing location as the disk is rotated.

Figure 66 shows yet another aspect of a planting and/or seed delivery system 350 according to the invention that allows for planting of at least one of a plurality of different seed hybrid varieties during on-the-go planting. With the planting system 350 shown in Figure 66, a seed tape 351 is utilized. The seed tape 351 may be biodegradable. One or more seed sources include a first hybrid 353, second hybrid 354, and third hybrid or variety 355. One of the types of hybrid is selected based upon the location of the planter in the field, the user's choice or some other condition. For example, a positioning system can indicate to the planter which of the seed the hybrid variety says to be planted based upon known field conditions. The corresponding seed source supplies the seed variety through a seed chute 352. The seed chute may be a funnel, gate, tube, baffle, or the like. Opposite the seed chute is a seed tape, wherein the seed of the seed hybrid variety is adhered or otherwise attached to the tape 351. In other configurations, there can be multiple seed tapes stored at seed sources, with the seed tape containing the desired and hybrid variety move through the chute 352 and the rest of the system 350.

Rollers 357 move the tape through the system 350. A seed meter or singulator 356 may be positioned along the seed tape 351 in order to ensure that only one seed is associated at a particular location of the seed tape 351. This can enhance or otherwise provide for greater efficiency with regard to seed spacing along the seed tape. The rollers 357 continue the movement of the tape to a dispensing position adjacent the closing wheels 358 and at least partially behind the opening wheels 359, wherein the seed is planted in the field. When a different hybrid variety is to be planted, the selected seed source or seed tape can be changed at the seed chute 352 to provide for a different hybrid to pass to the seed tape 351 for planting in the field at a particular location. Thus, the system 350 shown in Figure 66 provides for a method and means for changing the seed hybrid variety being planted while continuing on-the-go planting by a farmer.

The seed tape could also be pre-made and stored on the planter in such a manner that multiple seed tapes are included, with each of the seed tapes containing a separate seed type, variety, and/or hybrid. For example, the tapes could be stored in rolls, either at the central toolbar or at each row unit, such that one of the rolls is utilized at a time to plant the seed associated therewith. When a different seed is to be planted, a different roll could be activated to begin planting the tape with the different seed incorporated in said tape. The pre-made seed tapes could be operated in a similar manner as that shown in Figure 66 such that the tape is rolled through the row unit and into a furrow, before being covered by closing wheels. In addition, a cutting mechanism could be incorporated, either at the row unit or at the central toolbar or some other location, such that the cutting mechanism would cut the tape being planted to stop the seed tape before starting the next seed tape. The same or different mechanism could then attach to the subsequent tape to begin planting thereof.

It should also be appreciated that insecticide, fertilizer, and/or other seed treatments or refuge could be added to the seed tape with the seed, either on-the-go or in a pre-made manner. These additions could be dynamically adjusted according to the ever-changing soil, seed, and/or climate conditions as the planter and tractor move through a field. Otherwise, these could be determined as part of a pre-plotted manner. Furthermore, it is contemplated that a drip tube/tape could be included with the seed tape to provide the ability to irrigate the planted seed. For example, the drip tube (not shown) could be planted adjacent the seed tape in the ground as the planter is planting the seed tape. The drip tape could be operatively connected to a water source, which could also include nutrients. When needed, water could be introduced to the drip tube to provide water at or near the location of the seed in the tape that has been planted. The drip tube could include perforations or other holes that are spaced substantially equal to the ideal seed spacing such that the seed will be positioned substantially adjacent one of the perforations in the field to be able to best utilize the water being provided.

Figures 67-74 disclose yet additional aspects of a method and means for selective planting one or several possibilities of seed hybrid varieties during on-the-go planting in the field, for example based upon location of the planter in the field. The row unit 400 shown in Figures 67-74 are used to plant a particular seed variety or combination of seed hybrid varieties based upon, for example, the position of known field characteristics or conditions that have been mapped out to a positioning system. The choice can also be made by operator, who can automatically select a particular seed hybrid variety to be planted. Therefore, the row unit 400 shown in Figures 67-74 provide for yet additional ways to allow a farmer or operator to automatically or manually plant a seed hybrid variety or combination of varieties that will provide the highest yield per acre for the crop. Figures 67 is a side elevation view of a row unit 400. The row unit 400 includes many of the similar components that have been previously shown and disclosed. However, the row unit 400 does not include a standard seed meter, as has been shown and disclosed. In place of a seed meter is a seed drum 411 attached to the components of the row unit 400. The seed drum 411, according to some aspects of the invention, is connected to the four-bar linkage 402 of the row unit 400 and includes a seed chute 417 and a seed dispenser 418 from passing seed from the seed drum and into the field. The drum 411 is a cylindrically shaped object that is rotatable about a shaft 416. The orientation and configuration of the drum 411 is not to be limited to that shown in the figures, and the orientation of the drum in the figures for exemplary purposes only.

As shown throughout the figures, the drum includes a plurality of seed aperture paths 415A, 415B, 415C, and 415D. The seed aperture paths 415 of the drum 411 each correspond to a different seed hybrid variety, type, or the like of seed in a seed pool within the drum. For example, the interior of the drum, which is shown in Figure 73, includes a seed pool corresponding to each of the seed aperture pass. The figures show a first seed pool 420A, second seed pool 420B, third seed pool 420C, and fourth seed pool 420D. The seed pools 420 are located within the drum and are positioned such that when the apertures pass the seed pools, a positive or negative pressure differential between the interior and exterior of the drum will adhere a seed to each of the apertures along the seed paths.

Shown to be positioned generally at the upper portion of the drum 411 is a plurality of seed aperture path wheels 412. They are shown to be at least one wheel position at each of the seed aperture paths 415. The seed wheels 412 are configured such that they aid in blocking or plugging an aperture at a location where there would otherwise be no pressure differential, such that the seed would fall from the aperture. Thus, when no seeds are to be released from the seed drum 411, each of the wheels 412 corresponding to each of the seed aperture paths would be in contact with the drum to close the seed aperture paths at the location of the wheels 412. As the closed aperture ensures that there is a pressure differential between interior and exterior of the seed drum 411, the seeds will pass through the area while adhering to the interior of the seed drum 411 and would fall back into the respective seed pools, as opposed to a seed chute for planting.

However, when a selected seed type, hybrid, or variety is to be planted, a seed arm 414 attached to the seed wheels 412 can be operated such that each wheel 412 can be independently displaced from the exterior of the seed drum 411. This creates no pressure differential at the location of the seed wheel 412 such that when the seed approaches the area adjacent the wheel 412, the lack of pressure differential will cause the seed to become dislodged from the interior of the drum 411. The seed can then be directed into a corresponding chute 417 and towards the seed dispenser 418 and into a furrow created in the ground. The seed chutes 417 are shown in Figure 74. As shown in the figure, there are an equal number of chutes corresponding to the number of seed aperture paths. Therefore, there is first seed chute opening 417A, a second seed chute opening 417B, a third seed chute opening 417C and a fourth seed chute opening 417D. The seed chutes 417 combine at a centralized location such that each of the seed varieties of the seed drum 411 may be dispensed about a common seed chute into the common seed dispenser 418 where they are taken to the furrow in the ground.

Also included in the row unit 400 are a wheel drive 419 and a drive mechanism 421. The drive mechanism 421 may be an electro turbo motor that rotates one or more gears driving the wheel drive 419. The wheel drive 419 includes gears that operate to rotate the drum 411 in a circular manner such that the seed aperture paths pass adjacent the corresponding seed pools in the interior of the drum 411. A separate mechanism will operate the wheel arm 414 to selectively lift one or more of the aperture wheels 412 away from the seed aperture paths on the exterior of the wheel drum 411 to allow the one or more seed types, hybrids and/or varieties to drop from the seed drum 411 and into the seed chute 417.

In addition, instead of aperture wheels, any dislodging member is contemplated to be used with the row unit 400. For example, a finger or other pecking member may be used to selectively knock one or more seeds from a particular seed path to select a specific seed type, hybrid and/or variety to pass through the seed chute 417 and dispenser to be planted. Other members may also be used to dislodge the seed from the interior of the seed drum 411 along the seed aperture path for passing into the seed dispenser.

The row unit 400 provides the advantage of providing a system that does not waste unused seed hybrid or types. The seeds that do not get dislodged from the drum 411 for dispensing and planting continue to be adhered to the respective seed apertures of the paths beyond a dislodging point. The seed remain engaged to the interior of the seed drum 411 until passing over a wall within the seed drum, which creates a pressure difference to dislodge the seed from the seed apertures. The seeds then pass back into their respective seed pools where they await to be re-adhered to the seed drum 411 for passing along the seed aperture path. Thus, the seeds are not dislodged from the row unit and are simply reused in the seed pool until such time that they are to be planted in the field. This reduces waste and costs associated therewith of unwanted dislodging or unwanted use of the seed.

There is also the advantage that, due to the seeds being dislodged on an as needed basis, there is greater control over the planting of the desired seed type. For example, the seeds are only adhered to the interior of the drum from approximately a 7 o'clock position to a 12 o'clock along the interior of the seed drum 411. The seed dislodging member, such as the wheel 413, can selectively knock off or dislodge each individual seed adhered to the seed aperture. There can be a change from one seed hybrid dislodging to another from one seed aperture to the next along the seed aperture path. This provides greater control and accuracy over the selection of seed hybrid being dislodged and planted in a field at a particular location.

In addition, as the dislodging member can be operatively connected to a positioning system of the planter, the positioning system will control the dislodging of the particular seed hybrid variety based upon program field conditions along the varying locations in the field. The row unit 400 will provide another way to obtain on-the-go selection of accurately planting one of a plurality of seed types, hybrids, and/or varieties based on the location of the planter in the field, and can provide substantially instantaneous changing or selection of a particular seed type, hybrid and/or variety to be planted.

Figures 75 and 76 disclose yet another row unit 500 which includes a plurality of seed meters for changing on-the-go planting of one seed type, hybrid and/or variety to another. The row unit 500 is similar to previously shown and described row units in that a first seed meter 520 and second seed meter 522 include a shared housing 510 for a metering system 505. The shared housing 510 of the metering system 505 includes a first hopper inlet 512 and a second hopper inlet 514. The first hopper 512 is configured to store and receive a first seed type associated with the first seed meter 520. The second hopper member 514 is configured to receive and store a second seed type associated with the second seed meter 522. The housing 510 is similar to the housing 78 associated with the previous figures in that the housing 510 provides a single unitary member for the seed meter side of the seed meters, while the vacuum side is attached thereto for each of the meters. Furthermore, as will be understood, the housing 510 of the metering system 505 includes a situation in which the seed meters may have a partial overlap such that they share a substantially similar common release point for the seed being metered and released by the seed disks (not shown).

Figures 77-79 include more detailed use of the metering system 505 of the row unit 500. As shown, the housing 510 provides for the shared housing for at least a portion of the first meter 520 and second meter 522 and also includes the hopper portion 512 and second hopper portion 514. Thus, seed can be delivered, such as by air seed delivery to the hopper portions 512, 514 to be delivered to the seed meters 520, 522. Furthermore, one of the seed meters will be operating to meter and dispense one of the seed types at a time. For example, either the first or the second meter 520, 522 will be operated but not both at the same time. The operating meter will release a seed approximately at the location of the common or shared seed chute 521, which is adjacent a seed-to-ground delivery system 550. However, it is also contemplated that both of the meters could be operated at the same time. This would be a way to do very high planting rates, effectively cutting the needed metering rate by each meter in half. The operation of both meters would ensure that the meters are on-the-ready to plant when needed, or could simply be planting alternatively as the planter goes through the field.

The seed-to-ground delivery system 550 is not a seed tube, as has been shown and described. Instead, the seed-to-ground delivery system 550 is a system which includes a first belt 552 and a second belt 553. The belts are tensioned and comprise an elastomeric material. Any pliable material is contemplated to be used for the belt materials. The first belt 552 is positioned on a first roller 556 and includes a motor for rotating the belt. Likewise, the second belt 553 includes a second roller 558 that is operably attached to a motor that provides for the rotation of the second belt 553. The belts will rotate in a manner such that they will move substantially in sync with one another. Spacing between the first and second belts at the location 555 can be taller such that a seed can fit in between the pliable materials of the belts, but can be held in place thereat. Thus, when seed is released by one of the first or second meters 520, 522, the seed can be placed between the two belts. As the belts rotate, they will carry or deliver the seed between the belts towards the exit 560, which is substantially adjacent, a furrow in the field.

The rotational speed of the belts can be configured with the travel speed of the planter in with the known height about the furrow bottom of the belt opening 560 such that the seed will experience generally zero relative velocity when landing in the furrow. This will prevent the seed from bouncing or otherwise moving in the furrow which will increase the accuracy of the seed spacing between adjacent and subsequent seeds.

It should be contemplated that the seed belt of the seed-to-ground system shown in Figures 77-79 can be utilized with any of the row units that have been previously shown and described. While the seed tube has previously been disclosed, the seed belt can be utilized as well or in place of the seed tube to minimize the possibility of bounce or interference after the seed is released from the seed meter and before it reaches the bottom of the furrow. The seed belt provides the advantage of controlling the seed from the release of the seed from a seed meter and fill at the location of the seed-to-ground opening 560, which is substantially adjacent the bottom of a furrow in the field. Thus, the control delivery of the seed will provide for greater accuracy and seed spacing and seed placement in the ground such that it will have its best chance of growing when recovered with dirt.

As has been mentioned, the system shown and described allows an operator to plant one of a plurality of varieties of seed types or hybrids. In addition, the systems allow for the interchanging of seed and seed refuge (e.g., planting of certain percentage of non-insect resistant crop dispersed throughout the resisting crop), pollen donation, or other agricultural product. Additionally, multiple hybrids may be planted in the same general area to take advantage of cross pollination between different plant types, further increasing the yield potential. The invention contemplates generally any scenario wherein it is desired or needed to change the planting from one seed variety to another.

It is to be appreciated that the embodiments of the invention provide numerous advantages. The invention includes numerous methods, means, and systems for providing on-the-go selection and planting of one of a plurality of different seeds. This will allow an operator to increase and maximize their yield per acre based upon historical data and other field characteristics or conditions. As seed hybrid varieties are ever changing to account for different conditions, including soil and climate, it is useful that an operator be able to utilize varying hybrids without having to stop planting one variety and changing the seed manually. The on-the-go manner of the invention allows for efficient planting of multiple and different seed varieties, types and/or hybrids.

Furthermore, a control system may be provided with any of the aspects of the invention. The control system may include an automatic (GPS) positioning system, or a manual control system. The positioning system may include memory, an intelligent control, and a communication means. For example, the communication means may be wireless communication or wire communication electrically connecting the components of the system. The memory is included to provide data to the system, which includes field conditions and/or characteristics. These include historical data based upon testing of the field at various locations and can include, but is not limited to, moisture content, sunlight, amount of rain, water retention, wind conditions, soil compaction, and the like. Other data may also be included to be input into the positioning system memory. From that information, a user is able to determine the preferred seed hybrid variety to be planted at the various locations of a field based upon the data input. Thus, a hybrid that is better to be planted in dry conditions can be planted at a location that has lower moisture content or may receive less rain than other locations in the field. Other seed hybrid varieties can also be used based upon the field conditions and/or characteristics that are input into the system. In addition, a farmer is able to create sections of a single variety of seed, or they can control the ratio of the seed type throughout the section or area.

Data, such as the data as to which seed type is being planted, along with other information including, but not limited to, remaining seed, field map, upcoming switch, etc., can be viewed in the tractor and/or at a remote location on a display. This logged data can then be reviewed after the planting and/or harvesting seasons in order to help determine the type of seed to be used the next year, in order to maximize the yield obtained from the seed. For example, a farmer may be able to work with a seed provided in order to determine the soil conditions and an optimized seed type to use with such condition. After the season, the yield from the particular harvest can be reviewed in order to determine if the best seed type was selected, and to update if needed, with the goal of maximizing the yield obtained. Furthermore, a higher return on investment can be achieved utilizing the invention herein disclosed. In addition to high yield, an operator may also lower planting rates and use a less expensive seed in less productive areas, which would lower input costs, while still maintaining yield, which would increase the return on the investment for the operator, which may be the farmer.

As has been mentioned, the systems shown and described allow a farmer to change the seed variety being planted throughout the sections of a field. In addition, the systems allow for the interchanging of seed and seed refuge (e.g., planting a certain percentage of non-insect resistant crop dispersed throughout the resistant crop), pollen donation (e.g., planting a certain percentage of a plant line with desirable pollen intermixed with the remaining plant line that will receive the pollen), or other agricultural product. Additionally, multiple hybrids may be planted in the same general area to take advantage of cross pollination between different plant types, further increasing the yield potential. The invention contemplates generally any scenario wherein it is desired or needed to changing the planting from one seed variety to another seed variety or other agricultural product.

The manual control can function in much the same way, but is determinative upon a farmer's commands to control which of the plurality of seed types are to be planted. Either control will communicate to the planter as to what seed delivery or planting system to activate in order to provide the proper seed hybrid type.

The control system is operatively connected to a planter. The planter may include seed sources such as bulk fill hoppers including seed delivery systems, row hoppers, air seed delivery systems, seed meters, row units, control systems, and other intelligent controls. The control system indicates to the planter what type of seed hybrid variety to plant based upon the location of the planter in the field or the instructions of a user. The communication may be wired or wireless. Once the positioning system indicates that a different type of seed hybrid variety is to be planted, the intelligent control of the planter can control the seed delivery systems, seed sources, seed meters, and/or row units to change the seed type to be planted. The system provides for varying planting of different seed hybrid varieties almost instantaneously. For example, it is contemplated that various seed hybrid varieties can be planted within feet or even seconds of one another as a planter moves on-the-go through the field.

In addition, the planter and positioning systems are operatively connected to the tractor such that a display in the tractor may provide to the user the location of the tractor and planter in the field, as well as the type of seed hybrid being planted based upon that location. The display may also have additional controls to allow the farmer to manually select one of the types of seed variety to be planted. It is contemplated that the display may include a map to show the location of the tractor and planter, along with what seed types will be planted in the locations adjacent and about the field. Therefore, the user may be aware beforehand when the planter will be switching from one seed variety to another. In addition, the display may indicate any quantitative value such as the amount of the different seed hybrid varieties being planted in the field so that the user knows when one or more of the seed hybrid quantities are getting low, such as to be replaced. Other data and information is contemplated to be displayed in the tractor as well.

It is to be appreciated that the embodiments of the present invention provide numerous advantages over the art. For example, the invention includes numerous methods, means, and systems for providing on-the-go selection in planting of one of a plurality of different seed hybrid varieties, or a combination thereof. The present invention will allow a farmer to increase and maximize his or her yield per acre based upon historical data of field characteristics or conditions. As seed hybrid varieties are ever changing to account for extreme conditions, it is useful that a farmer be able to utilize the varying seed hybrids without having to stop planting one variety and changing the seed type manually. The on-the-go manner of the present invention allows an efficient planting of multiple and different seed varieties.

Therefore, the system, method, and means of planting one of a plurality of seed variety types based upon the location of a planter in a field have been disclosed. The invention contemplates numerous variations, options, and alternatives, and it is not to be limited to the specific embodiments described herein. Those skilled in the art will appreciate that, while the invention has been heretofore disclosed, various other changes may also be included within the scope of the invention.

What is claimed is:

1. A method of applying at least one of two or more seed varieties to a field at a single time, the method comprising:

providing an agricultural implement including a plurality of row units each having a metering system, and at least two product storage units operatively connected to the row units and each product storage unit containing a different seed variety;

planting at least one of the seed varieties as the implement moves through the field;

determining an updated location of the implement in the field; and

based on the updated location of the implement in the field, determining which of the one or more seed varieties to be planted based upon a characteristic of the location of the field.

2. The method of claim 1, wherein the metering system of the row units comprises a single seed meter, a seed to ground system, and a queuing system.

3. The method of claim 2, further comprising clearing the seed meter of a first variety of seed with the queuing system before changing the seed varieties being planted based upon location of the row units.

4. The method of claim 3, wherein the step of clearing the seed meter comprises passing a fluid through the queuing system of the seed meter of a row unit to substantially empty said seed meter of the first variety of seed before providing a second variety of seed to be planted by the seed meter of the row unit based upon the updated location of the row unit in the field.

5. The method of claim 4, further comprising providing the seed meter with a second seed variety after clearing the seed meter of the first variety to plant said second variety.

6. The method of claim 1, further comprising passing a fluid through at least a portion of a seed pool within the seed meter to substantially clear the meter of a first seed variety.

7. The method of claim 6, further comprising providing a second seed variety to the seed meter during or after the first seed variety has been substantially cleared from the seed meter.

8. The method of claim 7, wherein the location of the row unit in the field determines which variety of seed is to be provided to the seed meter and planted thereby.

9. A seed meter for use with an agricultural implement and capable of planting a plurality of varieties of seed provided thereto as the implement travels through a field, the seed meter comprising:

a seed meter housing and defining a seed pool reservoir;

a seed disc mounted in said housing for rotation about an axis and having a plurality of seed cells spaced radially about the axis for retaining seeds as the disc passes through said seed pool reservoir; and

a queuing system comprising a fluid passage at least partially through the seed pool reservoir to substantially remove a variety of seed before another variety of seed is added to be planted in the same field.

10. The seed meter of claim 9, wherein the seed variety being planted by the seed meter is determined based upon the location of the seed meter in the field.

11. The seed meter of claim 9, further comprising a seed delivery system for providing at least one of a variety of seed to the seed meter at a time.

12. The seed meter of claim 11, wherein the seed delivery system comprises at least one hose operatively connected to tanks holding different seed varieties.

13. The seed meter of claim 9, further comprising an electric drive motor operatively attached to the seed meter housing and seed disc such that the drive motor rotates the seed disc within the housing.

14. The seed meter of claim 9, wherein the queuing system is formed as part of the seed meter housing.

15. An agricultural planter for planting a variety of seed in a field and capable of switching the variety of seed being planted as the planter travels through the field, the planter comprising:

a plurality of row units spaced along the central toolbar, and the first and second wings, the row units including at least one seed meter to provide seed to a field; and

a seed delivery system for providing at least one of a variety of seed to the at least one seed meter of each row unit;

wherein the seed delivery system provides the at least one of a variety of seed to the at least one seed meter of each row unit based upon a constantly updated location of the implement in the field;

wherein the selected variety of seed is selected based upon known field characteristics; and

wherein said at least one seed meter further comprising a queuing system comprising a fluid passage at least partially through a seed pool reservoir of the meter to substantially remove a variety of seed before another variety of seed is added to be planted in the same field.

16. The planter of claim 15, wherein the row units further comprise a seed to ground system for directing seed from the seed meter to the ground.

17. The planter of claim 16, wherein the seed to ground system comprises a seed tube extending from the seed meter to a location adjacent a trench in the ground.

18. The planter of claim 15, wherein the seed delivery system comprises at least one hose connected to at least one seed tank that holds a variety of seed.

19. The planter of claim 15, further comprising an intelligent control operatively connected to each row unit and comprising a location device, wherein said location device determines the location of each row unit as the planter moves through the field, and the variety of seed to be provided to the row unit for planting is determinative on said location.

20. The planter of claim 19, wherein the intelligent control is operatively connected to the seed delivery system and queuing system to determine when to activate a fluid through the queuing system to substantially remove a variety of seed from a seed meter before another variety of seed is provided to the seed meter via the seed delivery system.

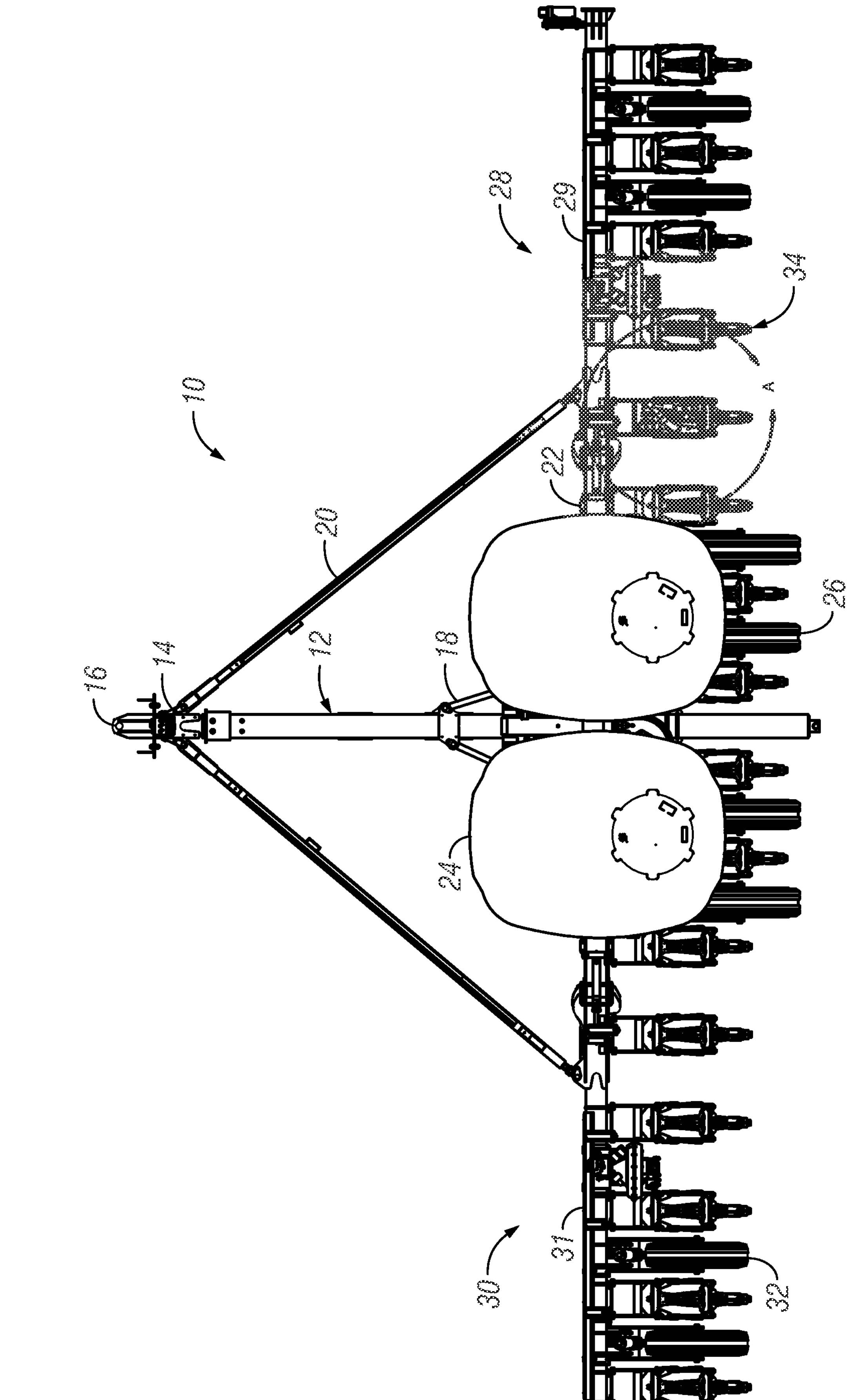


FIG. 1

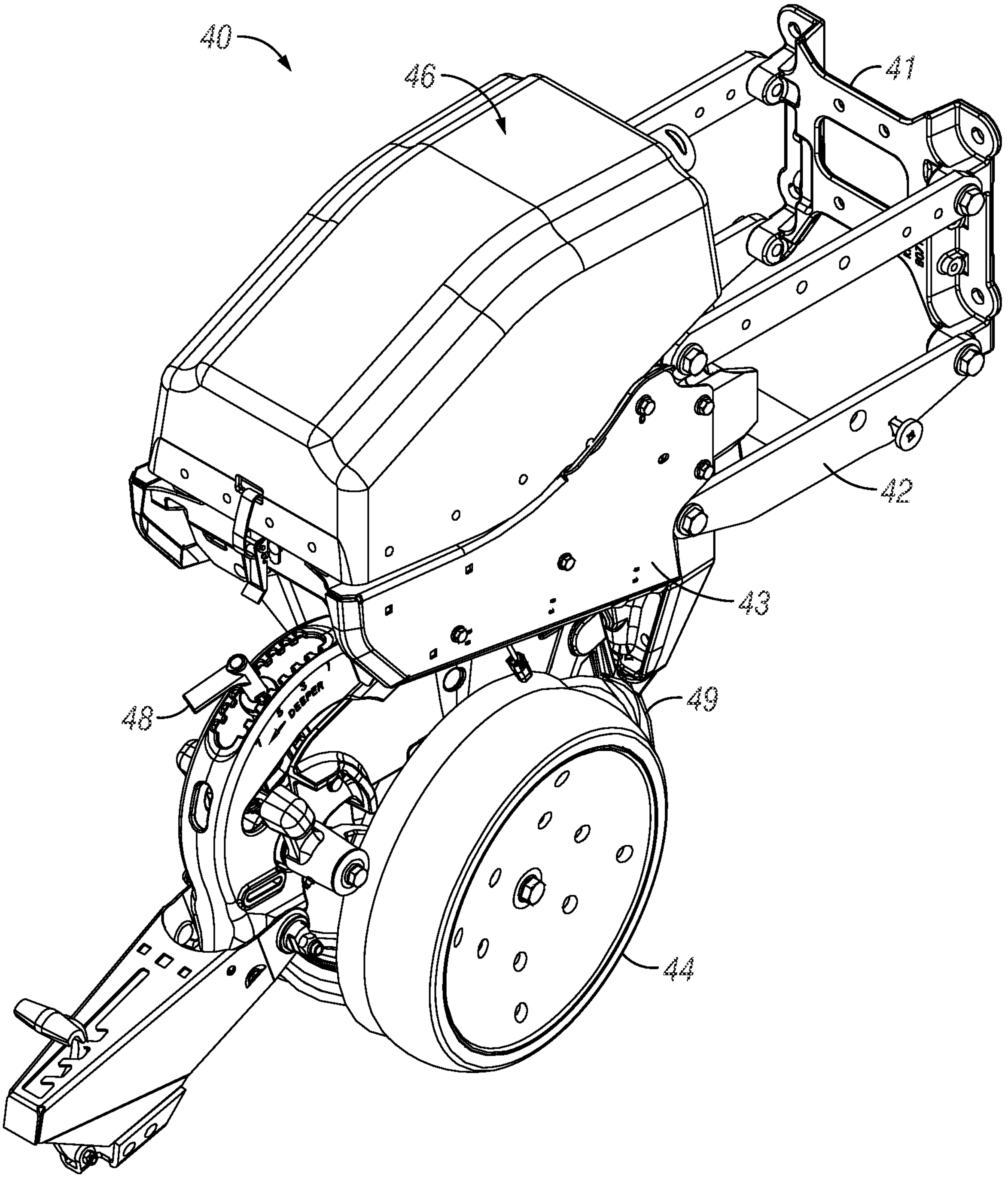


FIG. 2

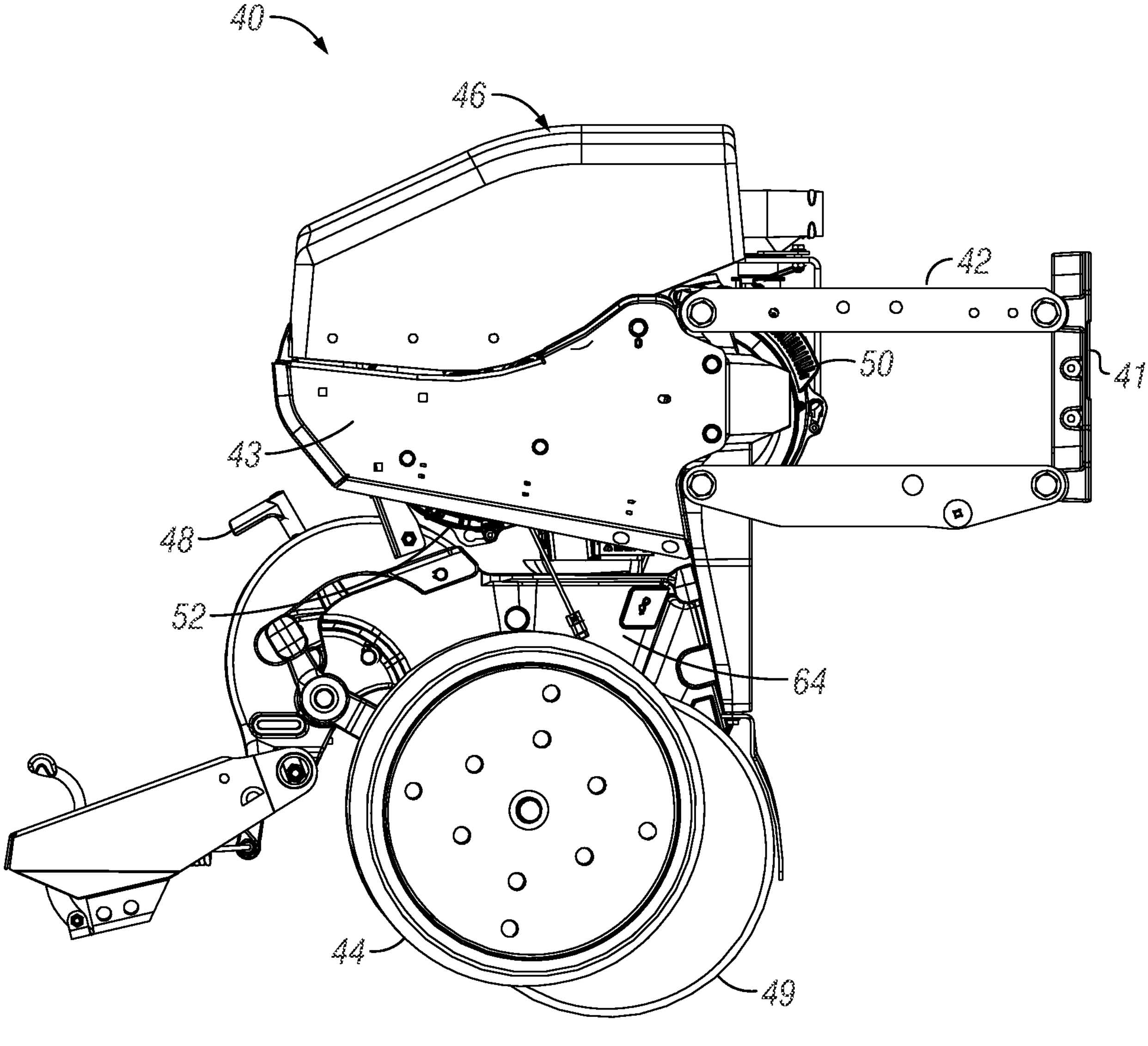


FIG. 3

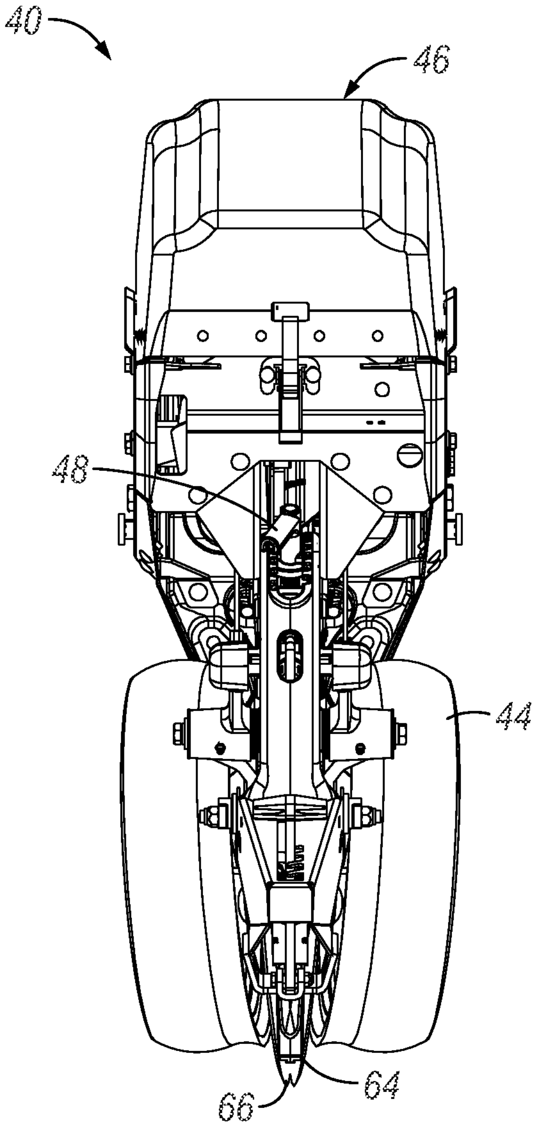


FIG. 4

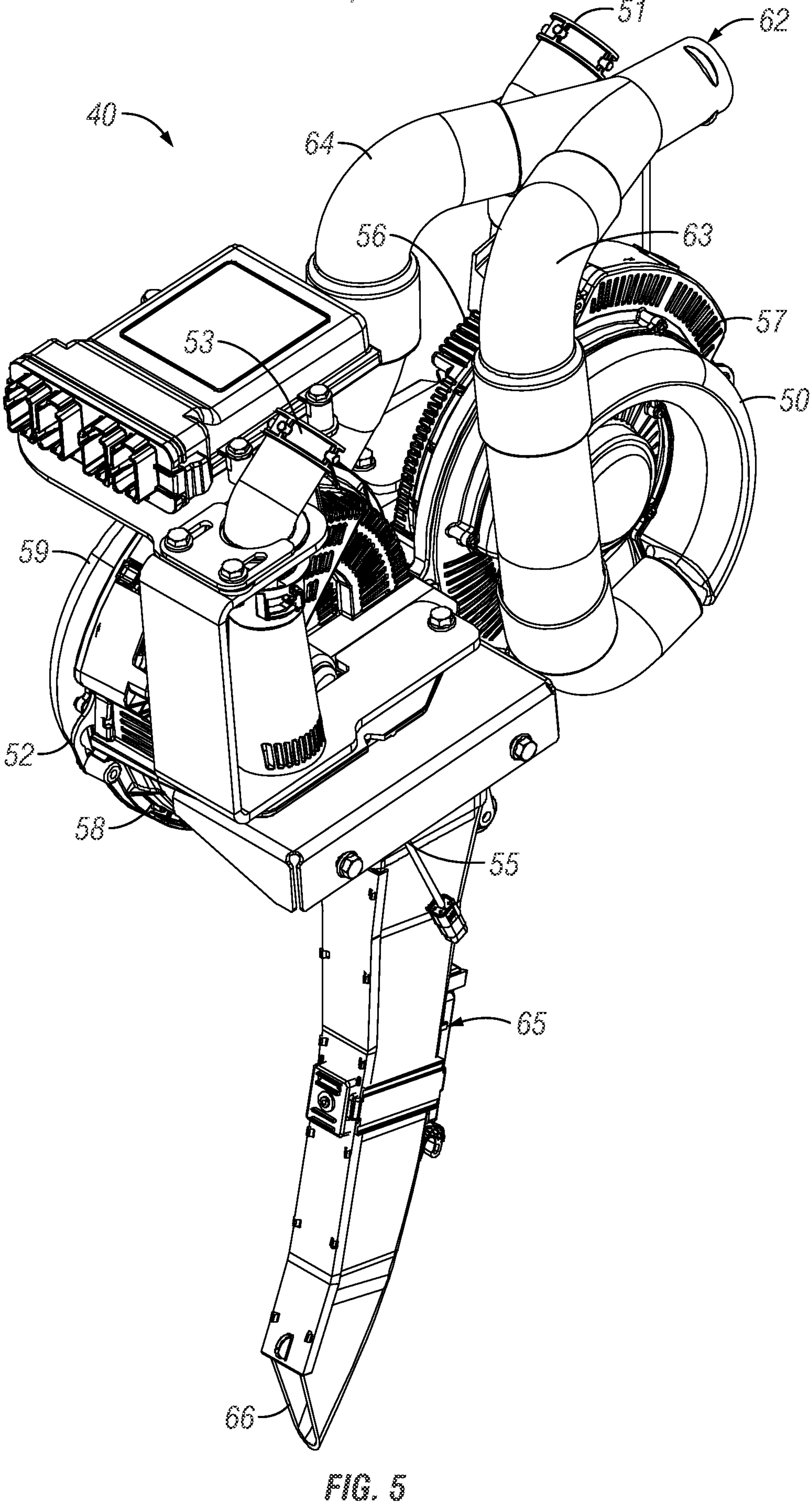


FIG. 5

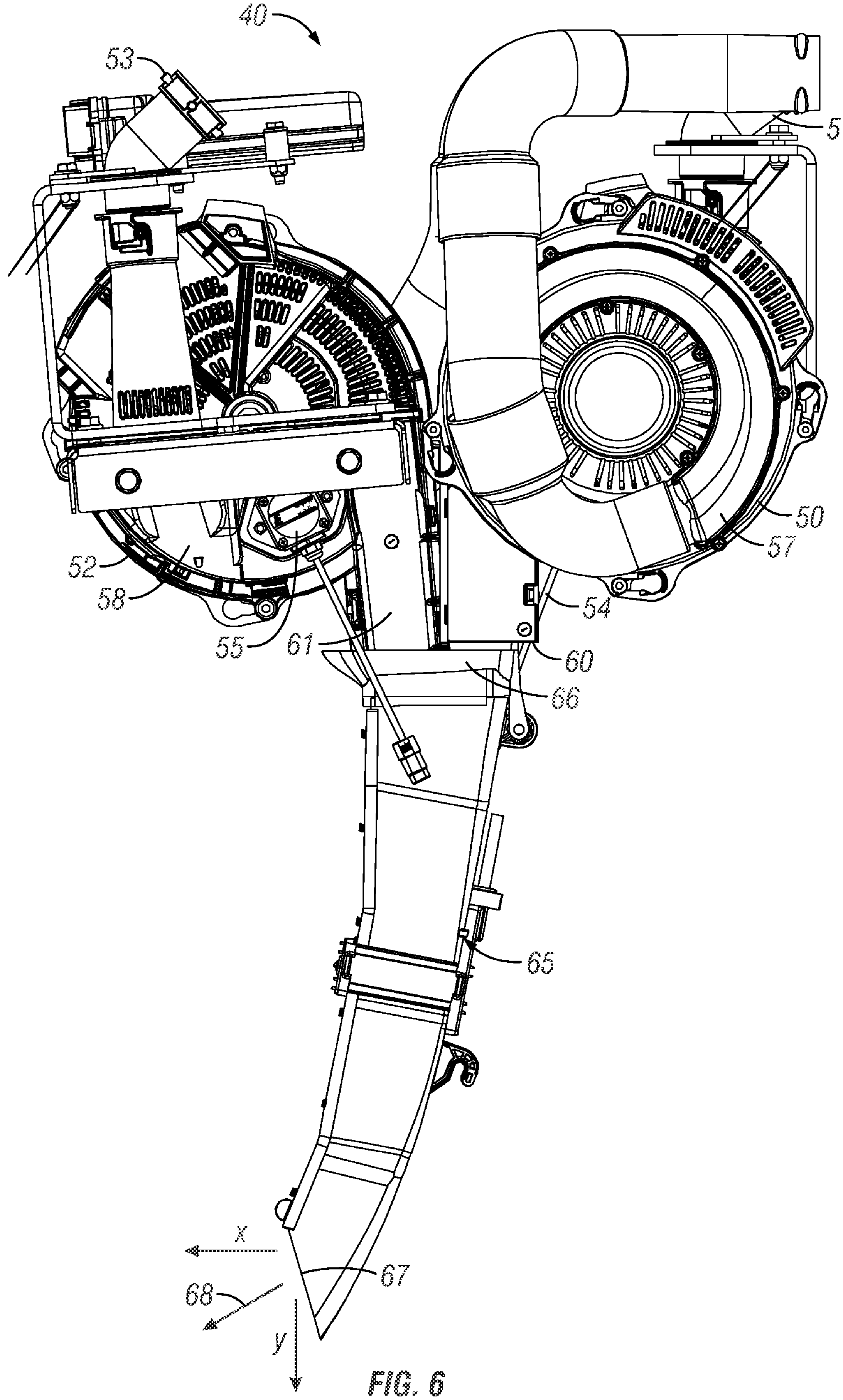


FIG. 6

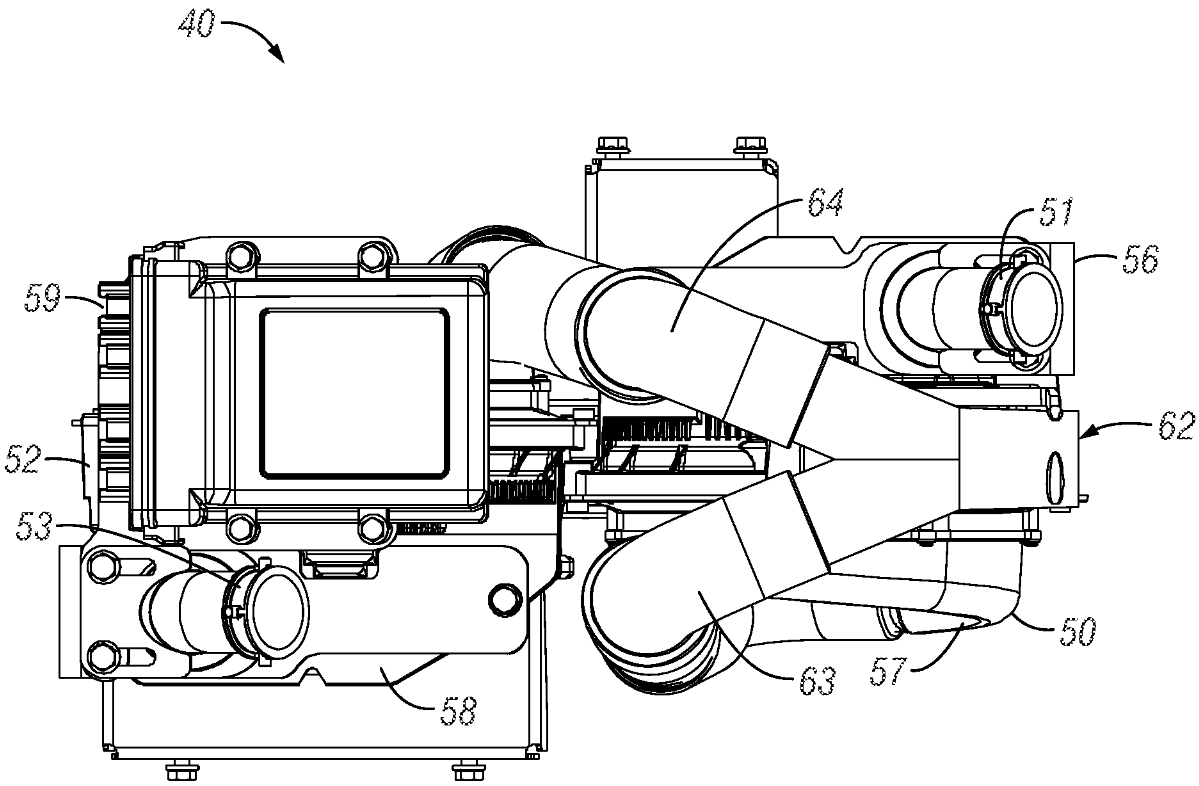


FIG. 7

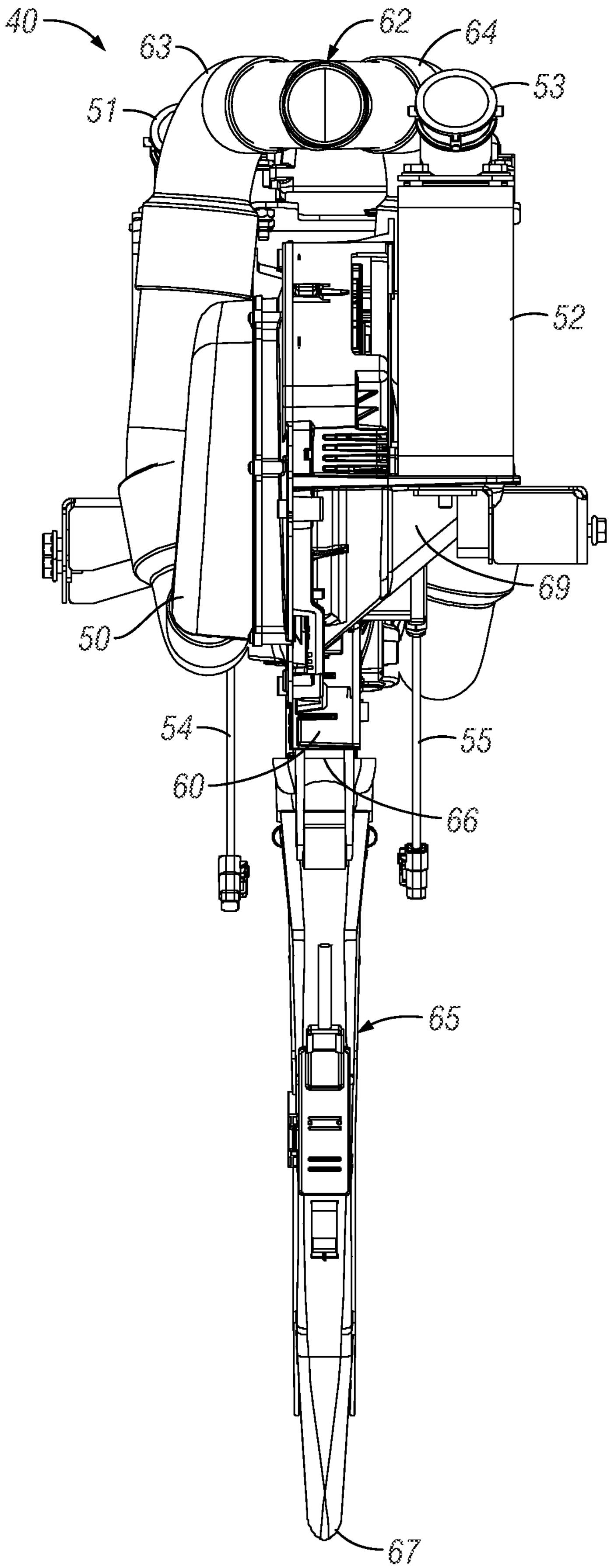


FIG. 8

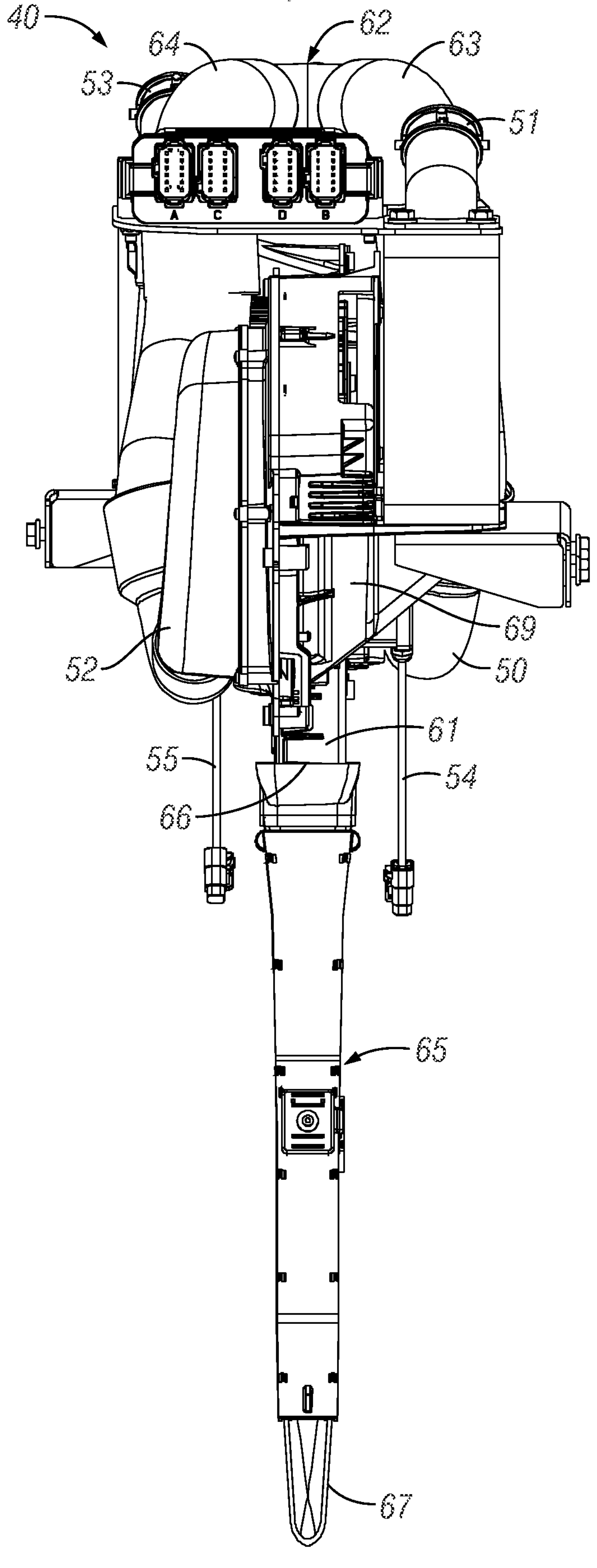


FIG. 9

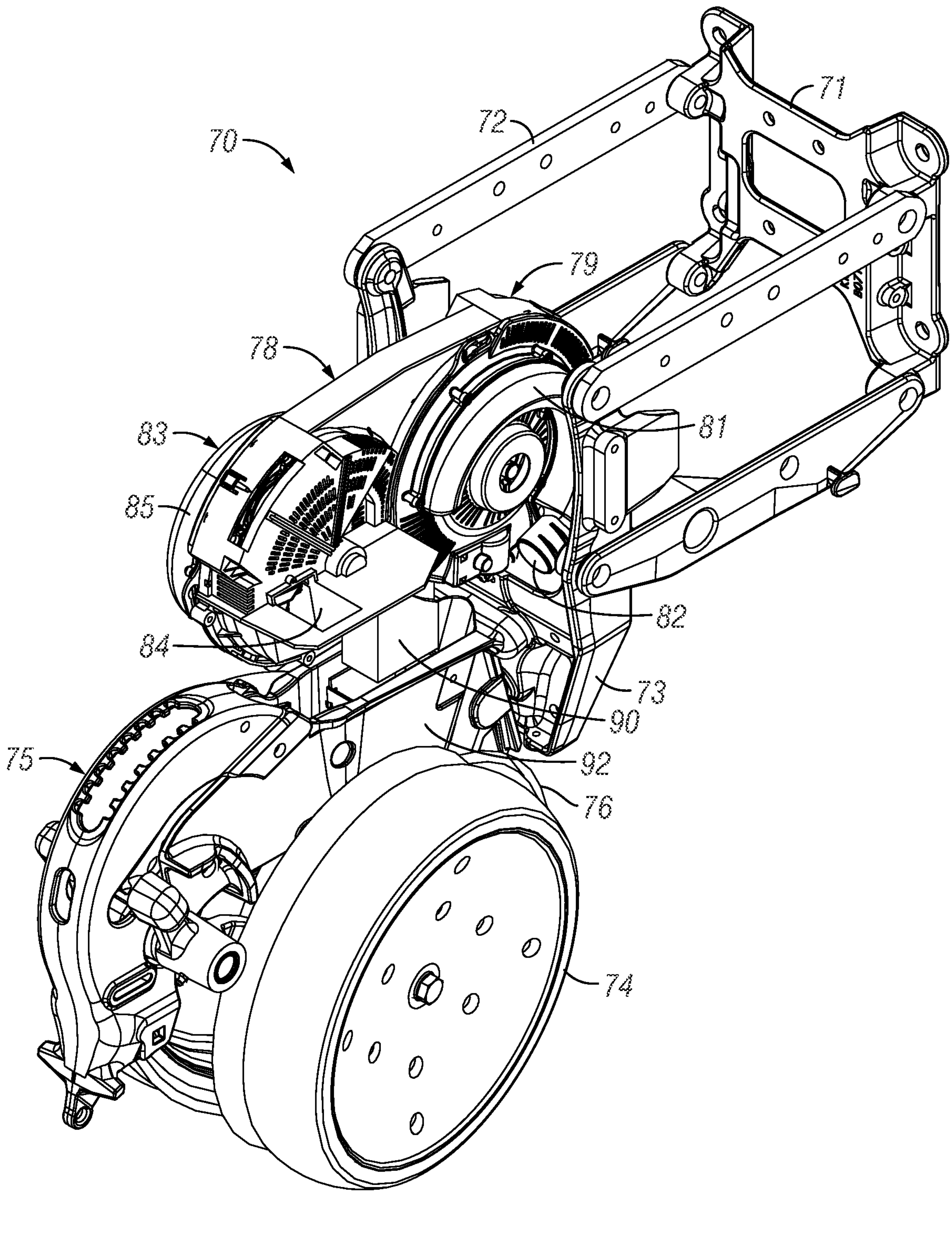


FIG. 10

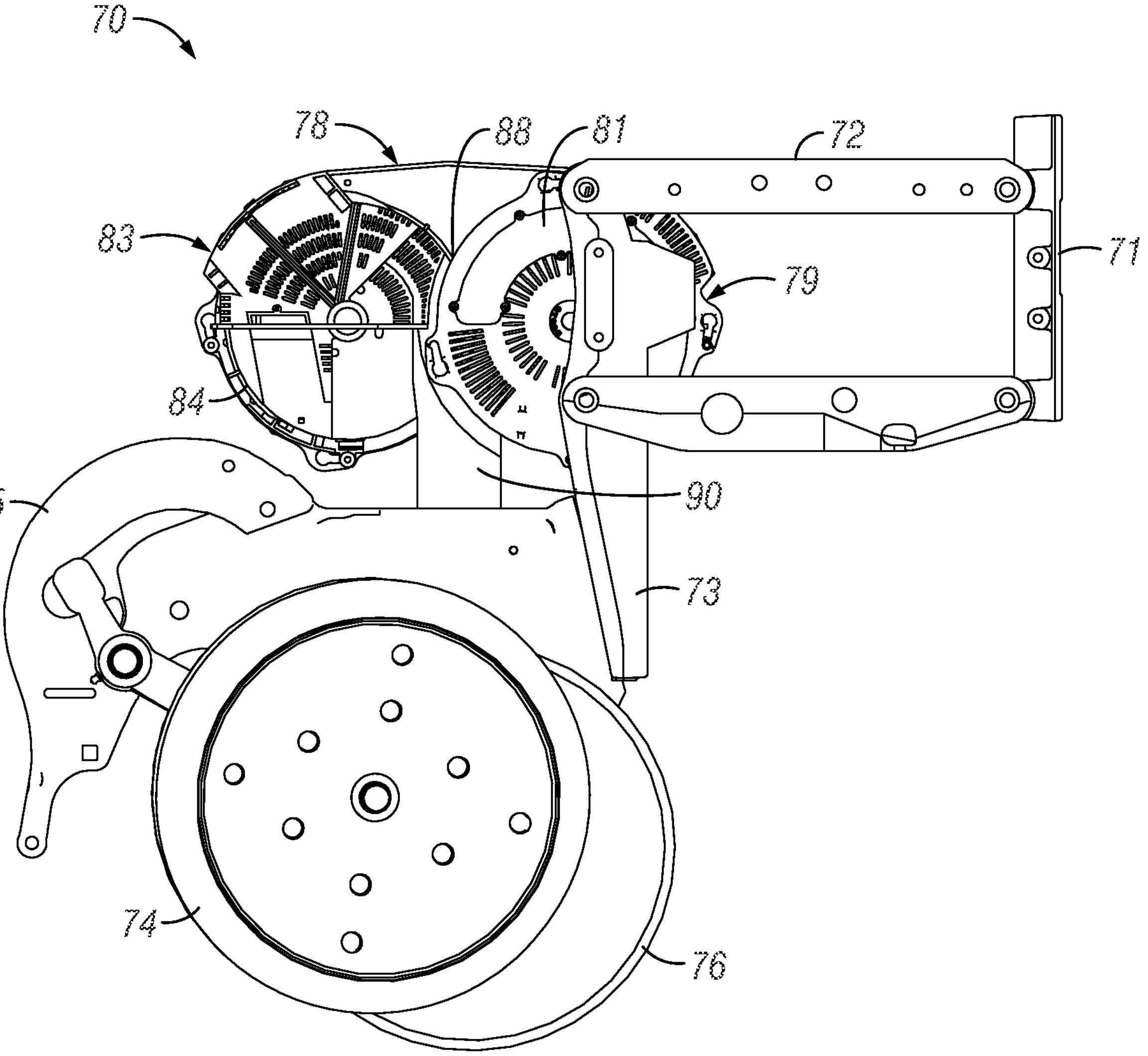
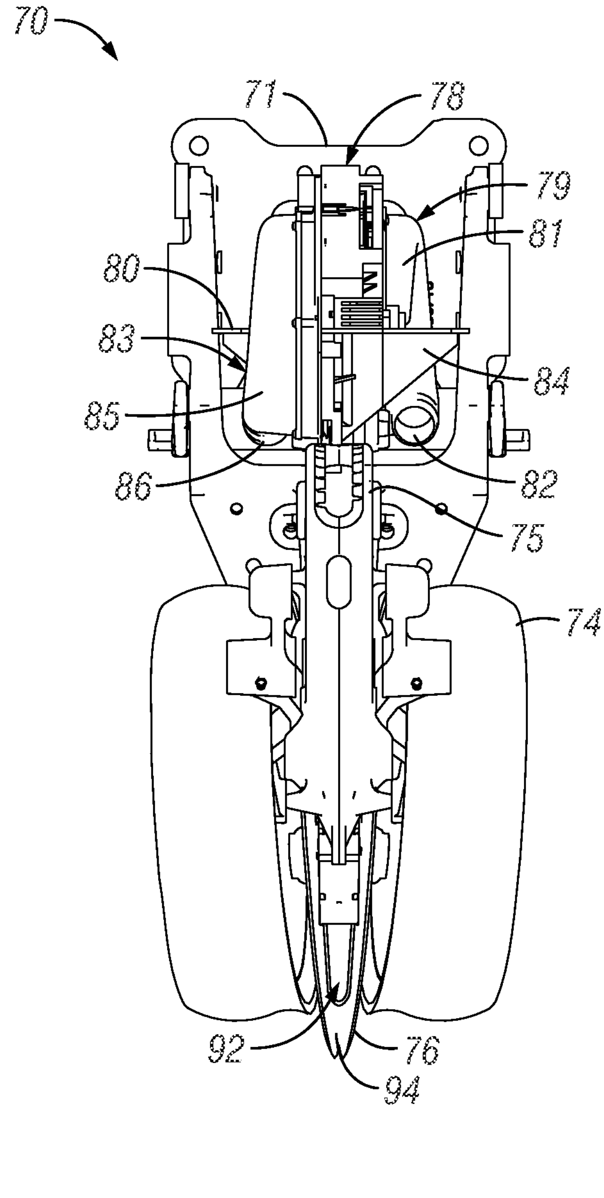


FIG. 11



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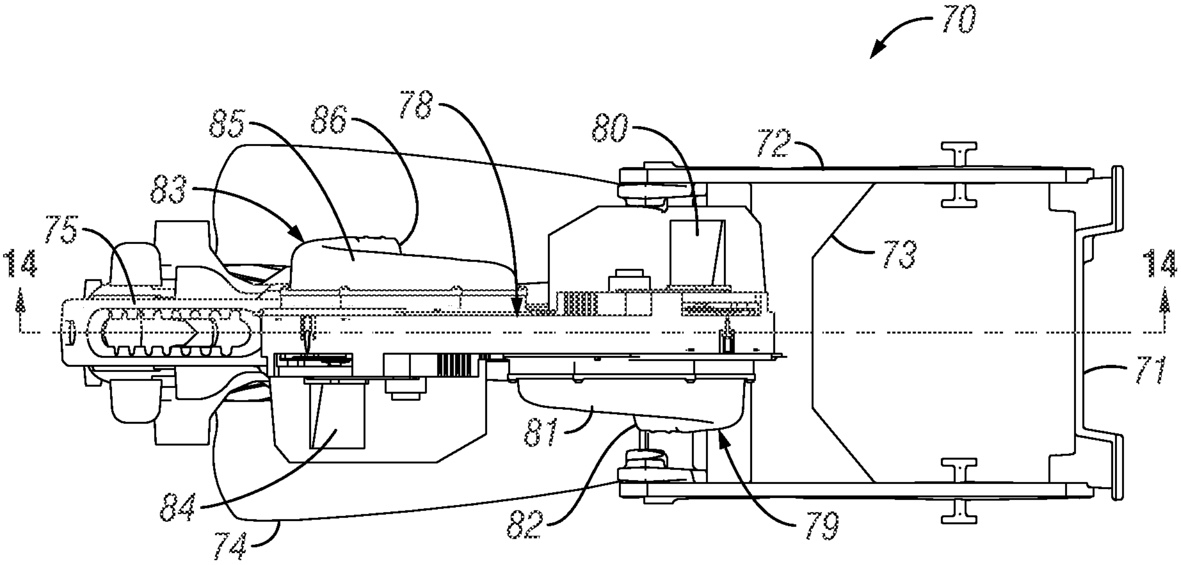

FIG. 13

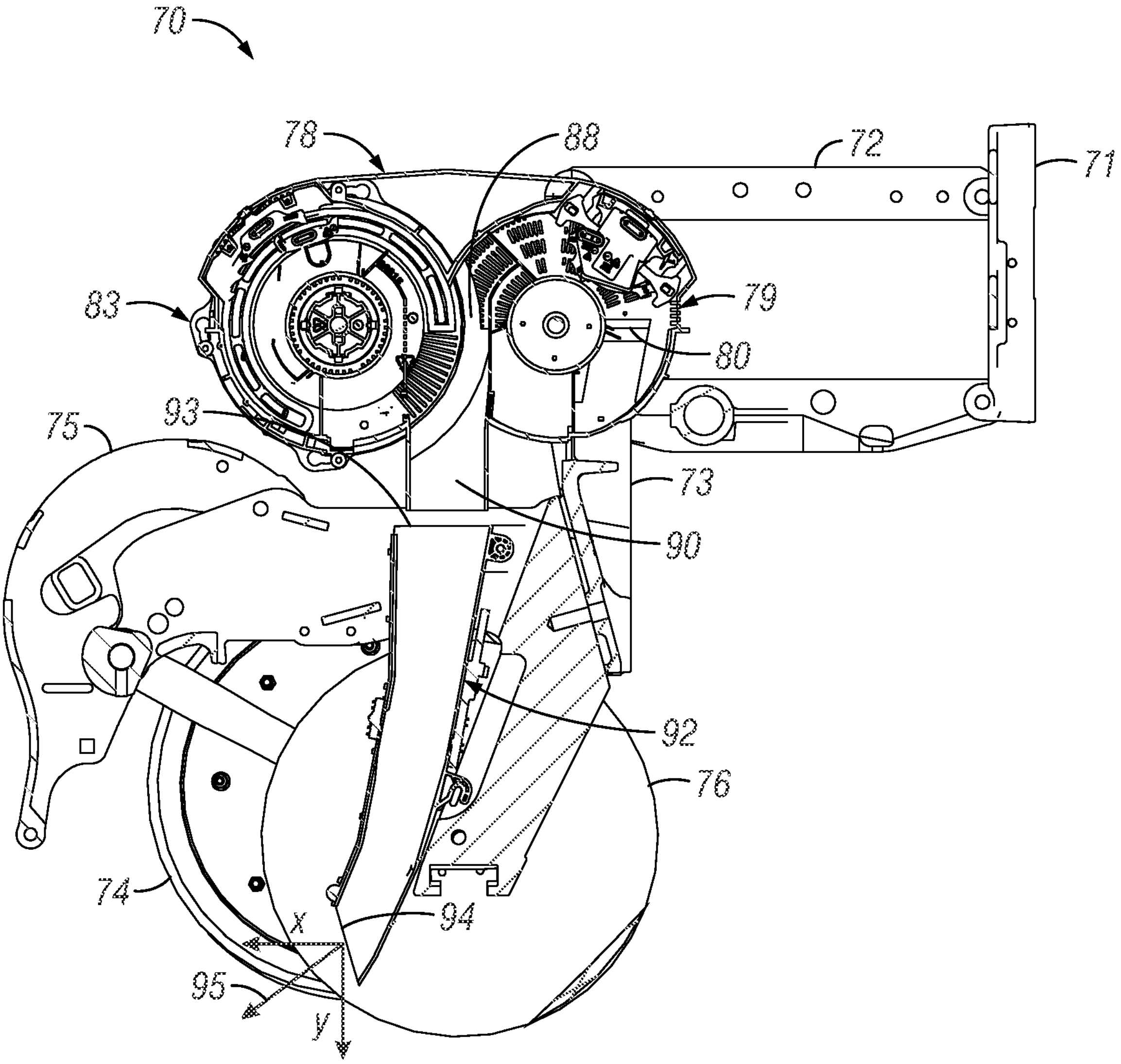

FIG. 14

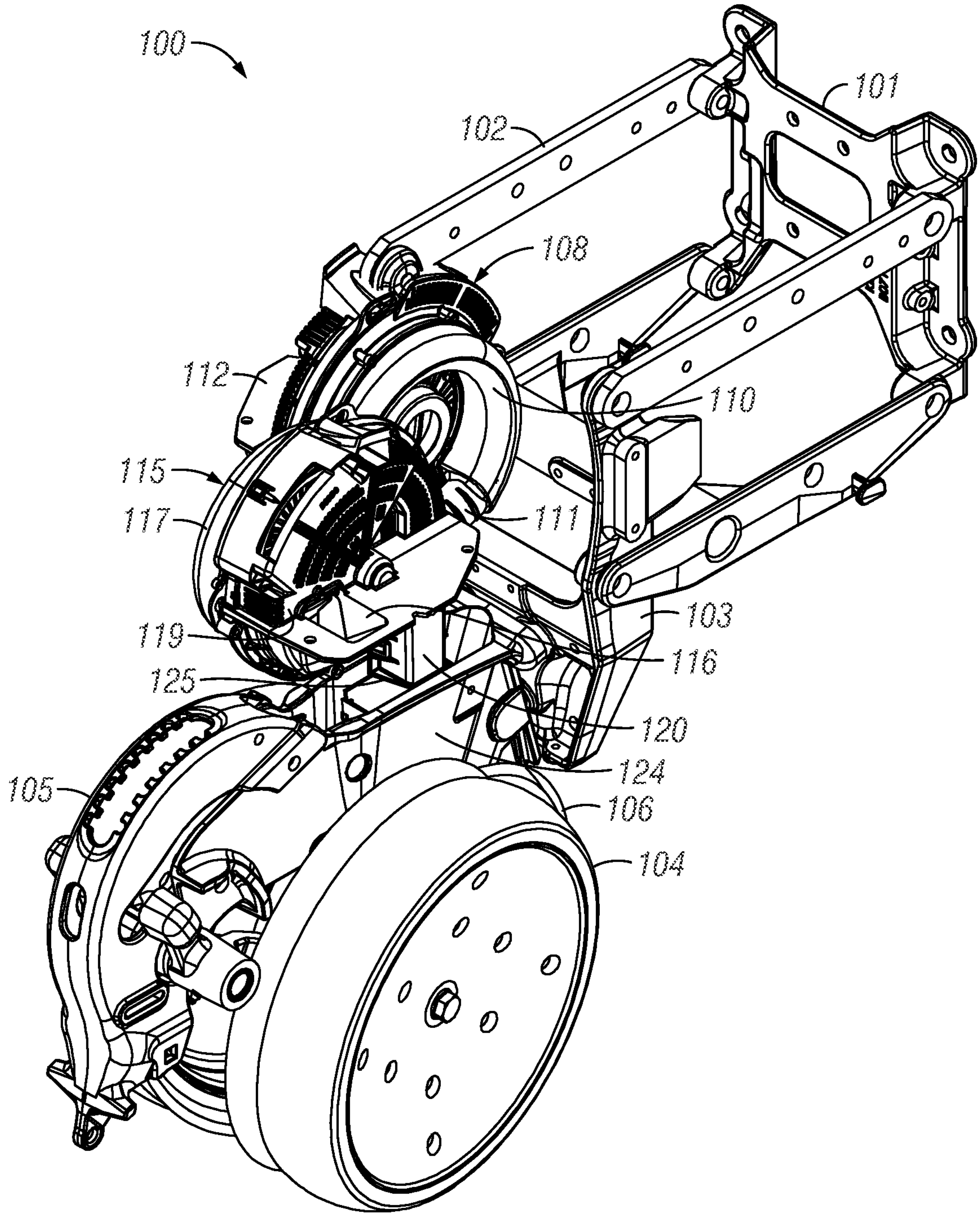
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FIG. 15

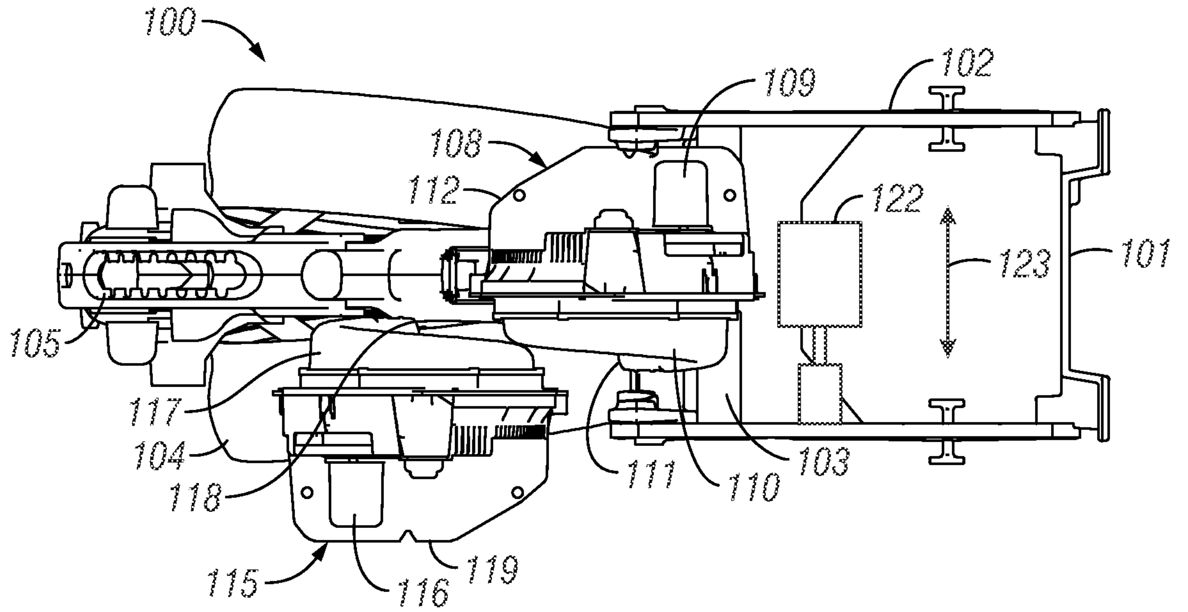
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FIG. 16

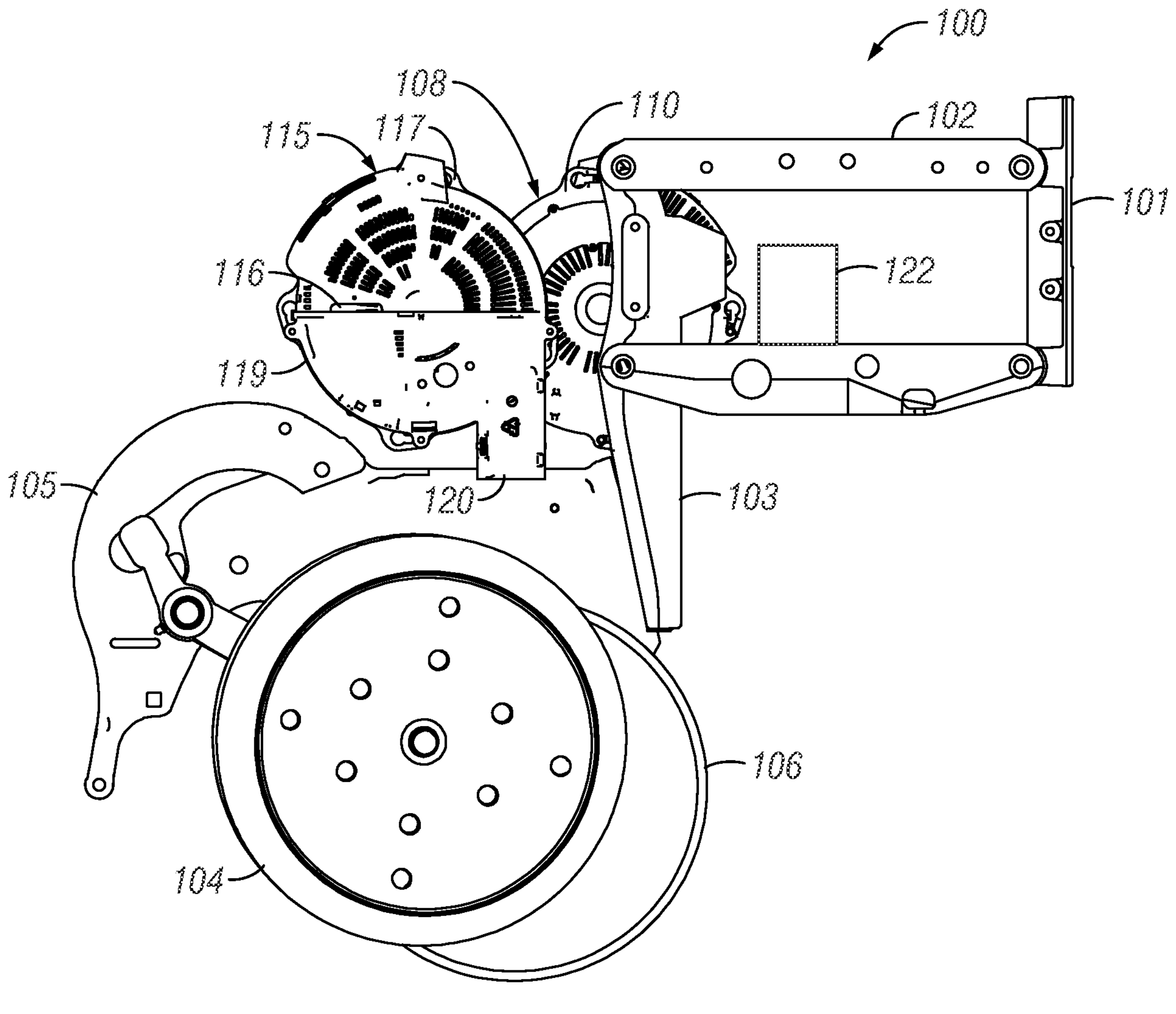
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FIG. 17

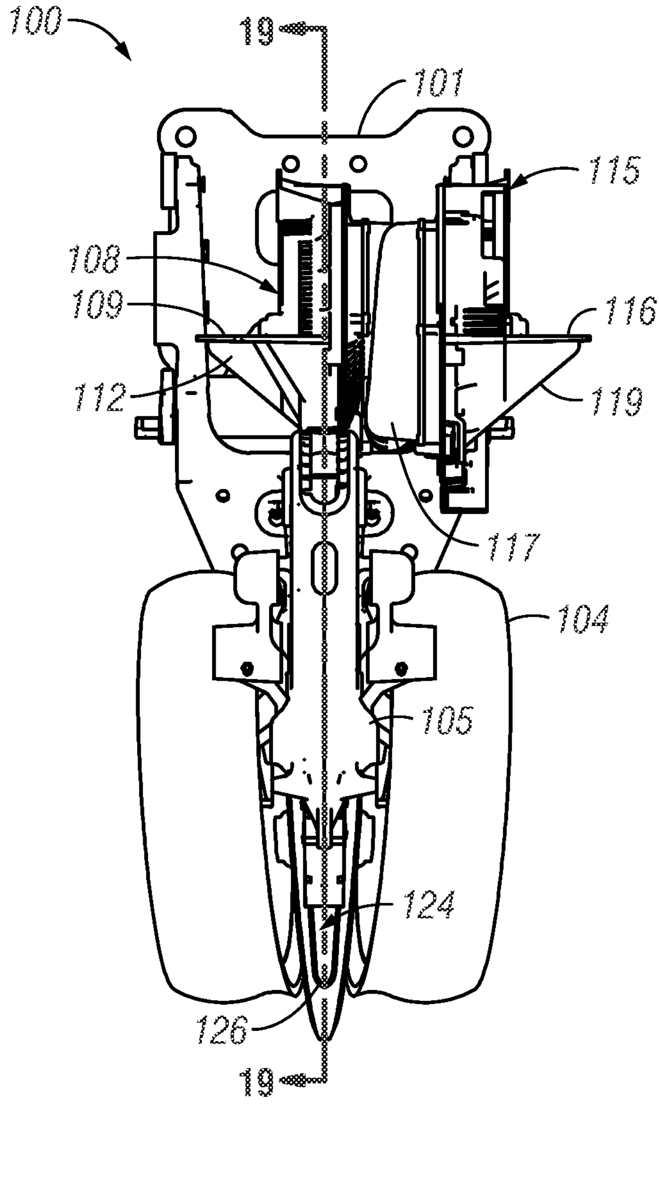

FIG. 18

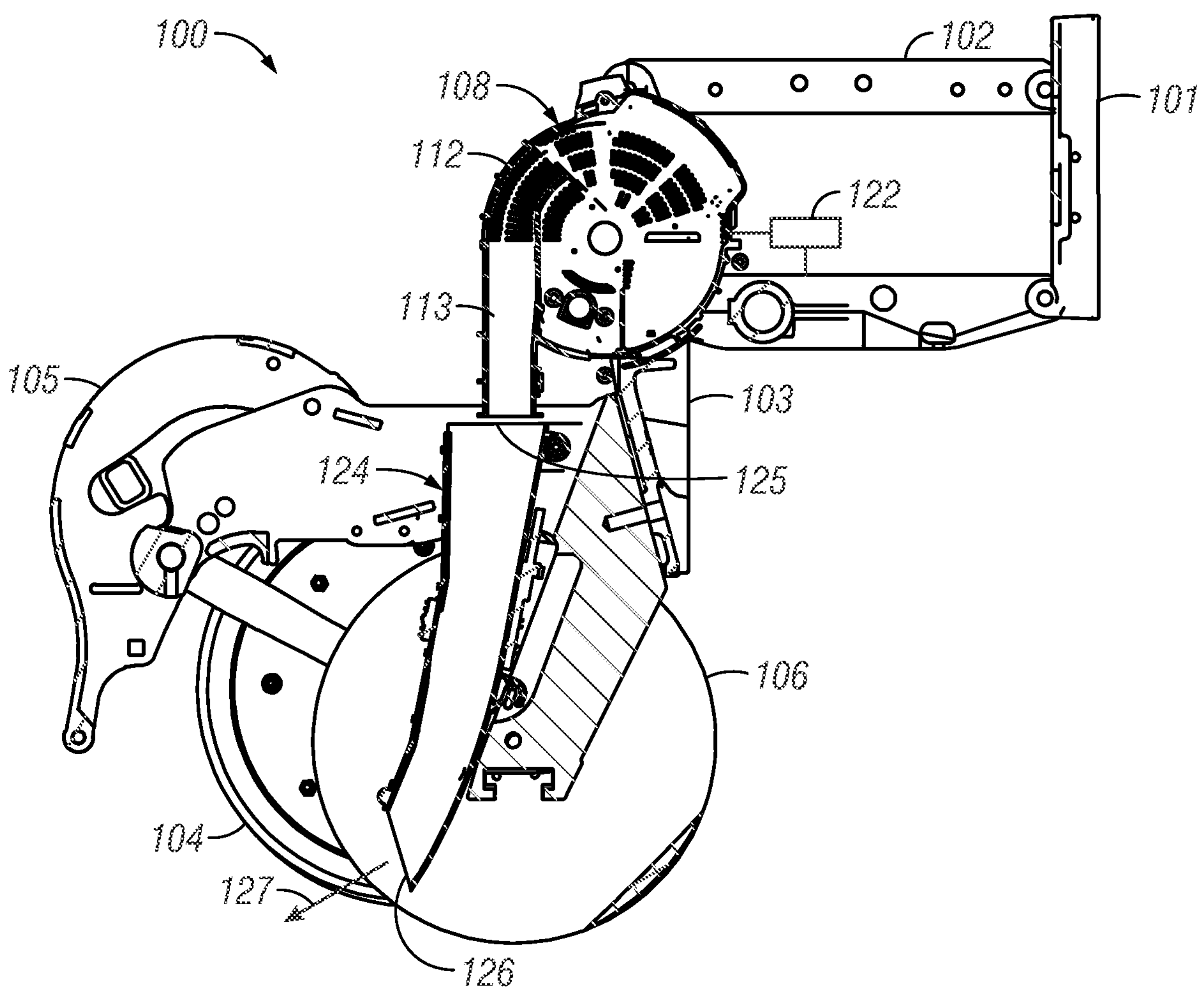

FIG. 19

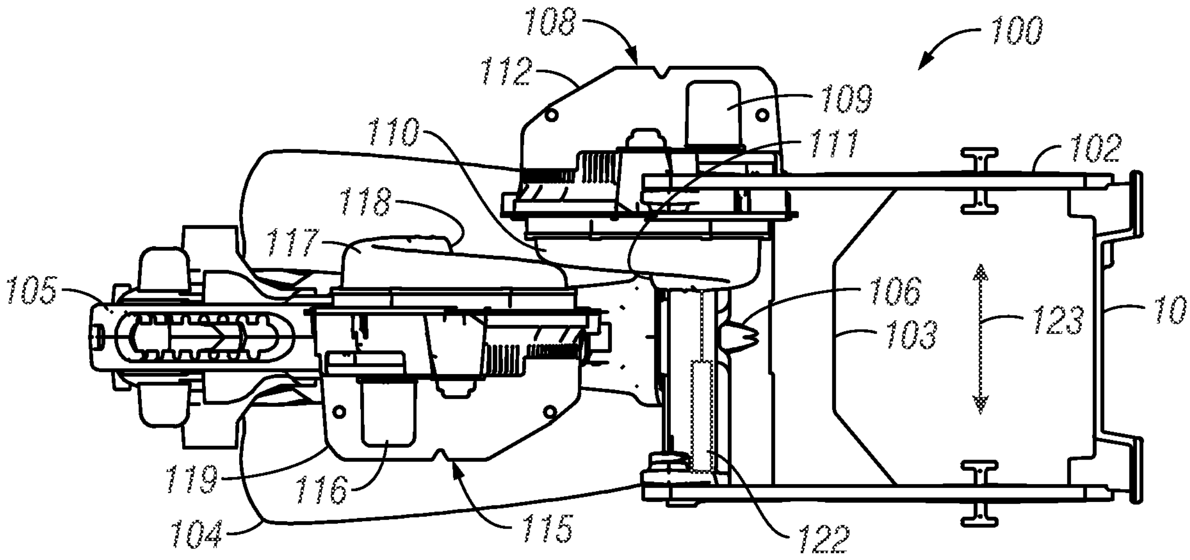
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FIG. 20

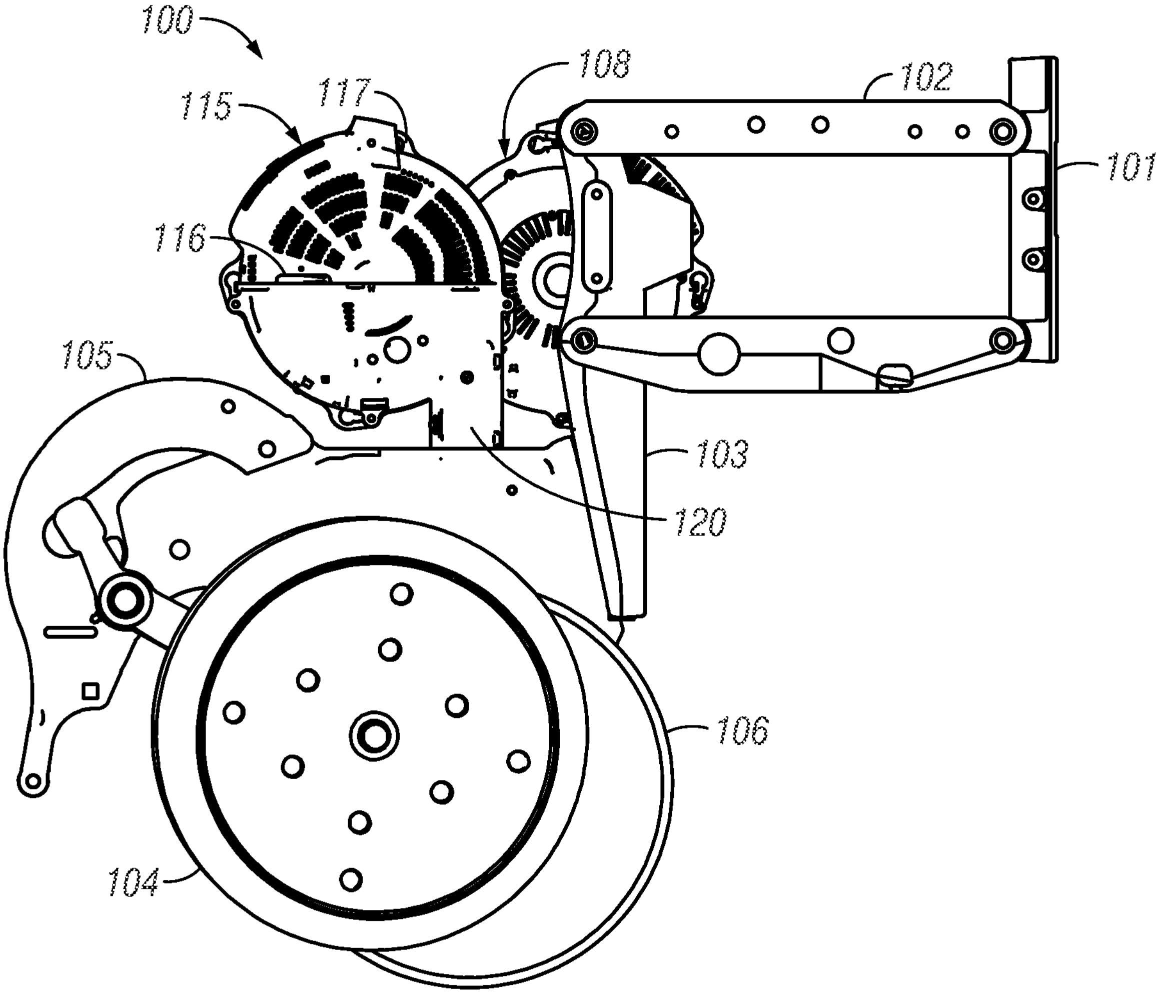
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FIG. 21

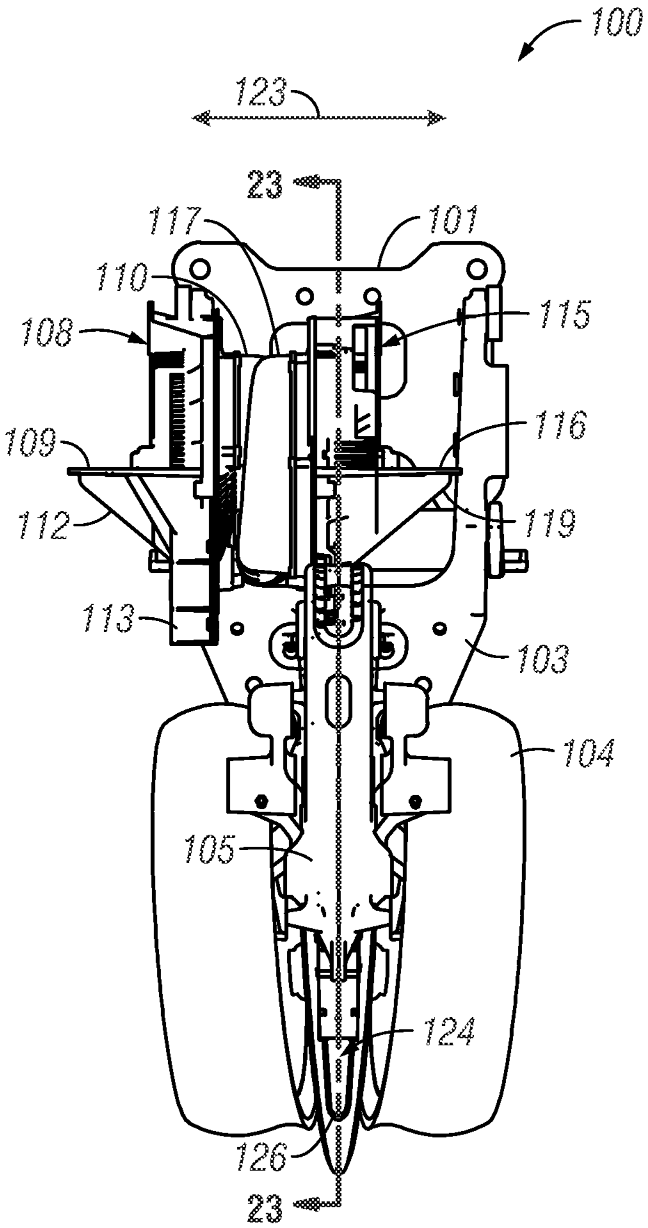
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FIG. 22

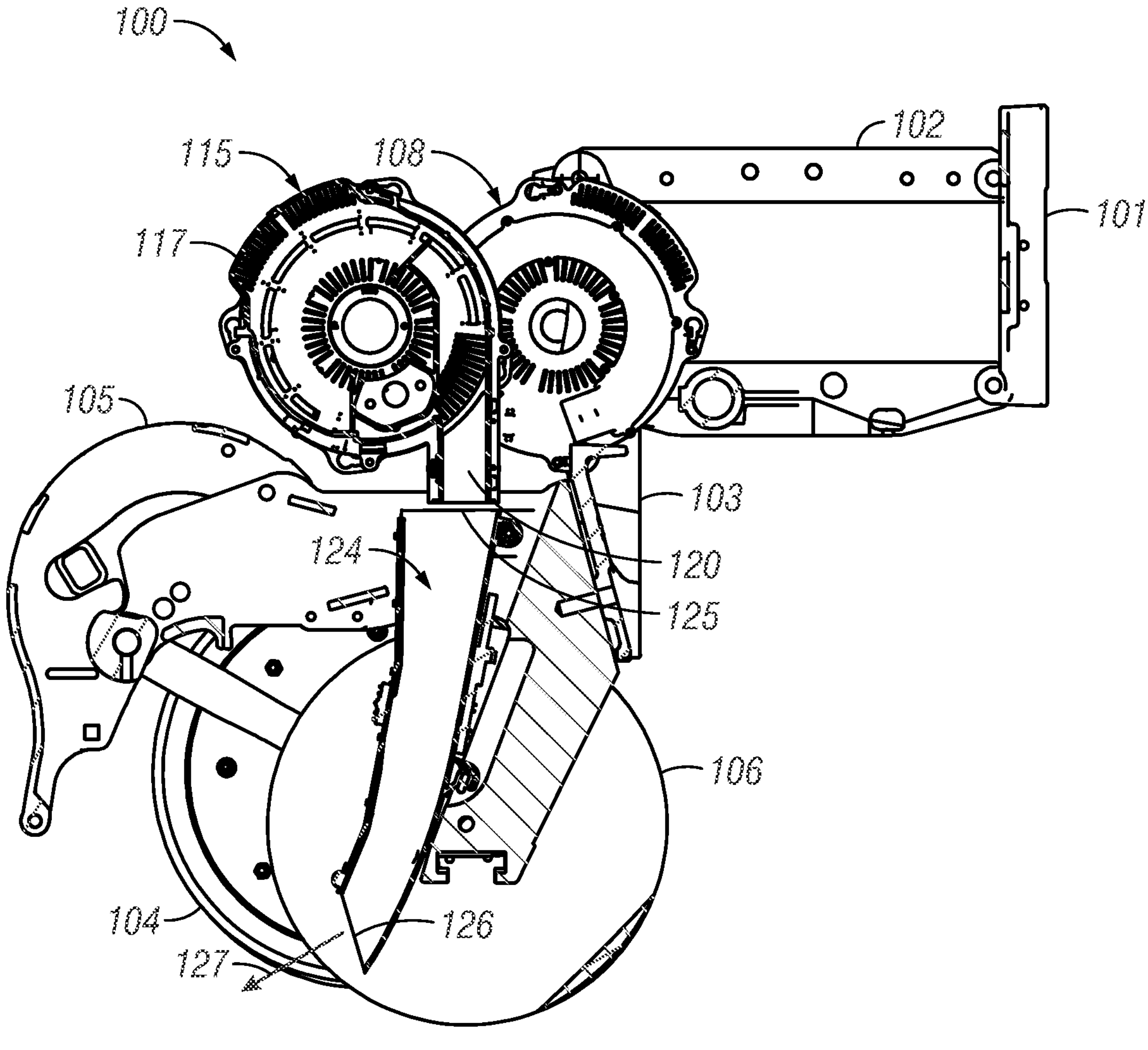

FIG. 23

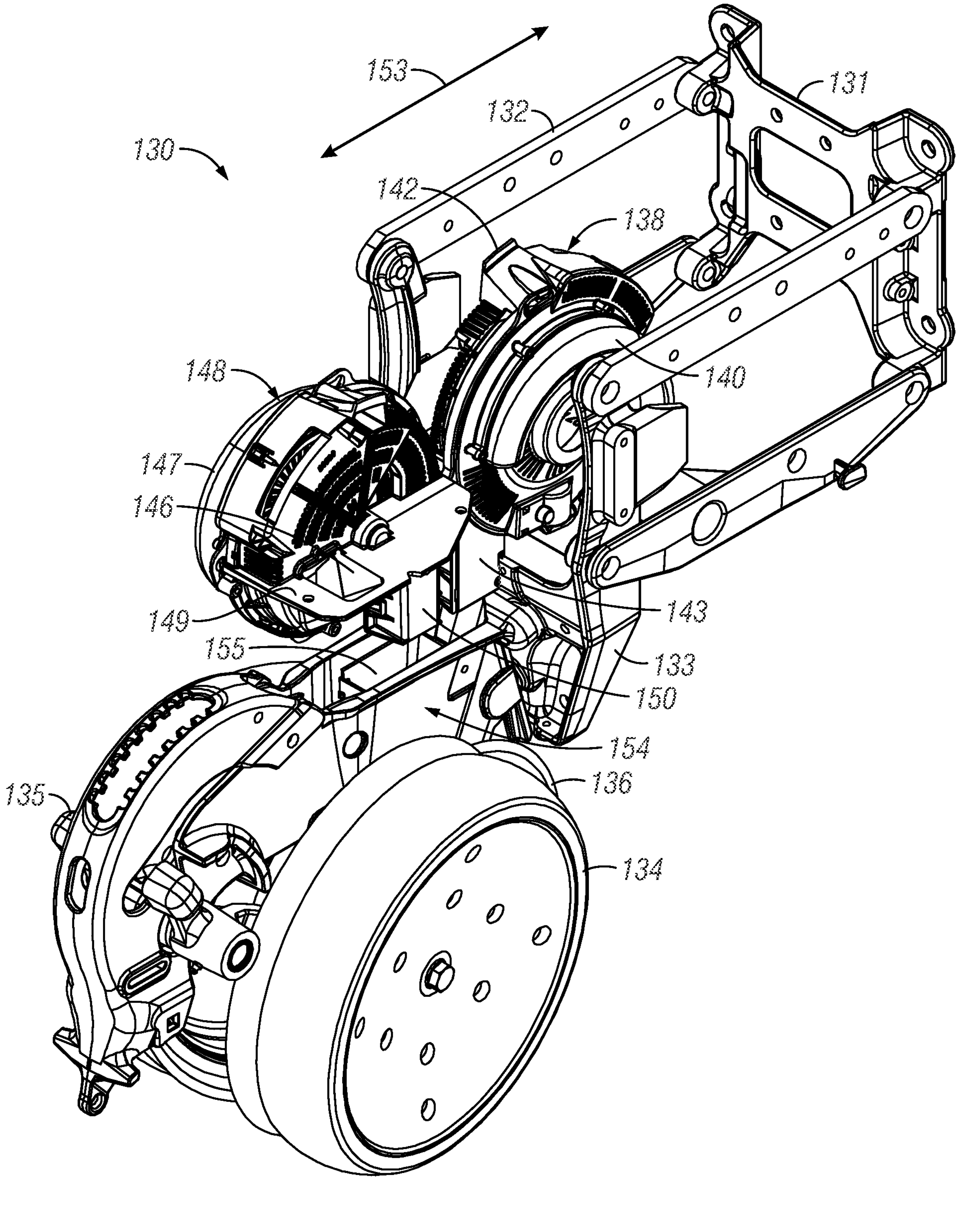

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FIG. 24

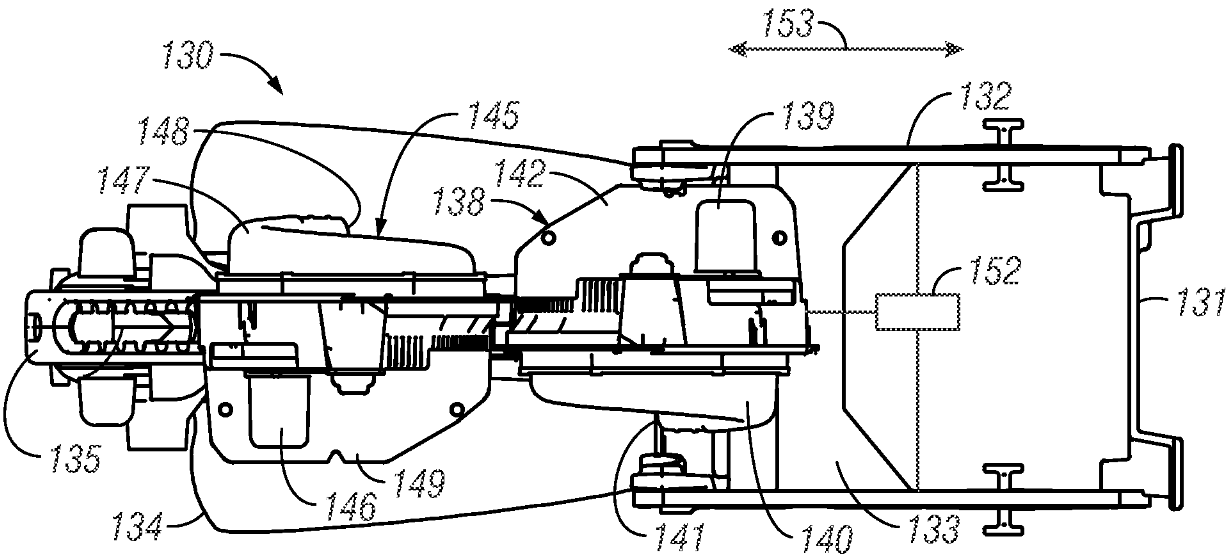
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FIG. 25

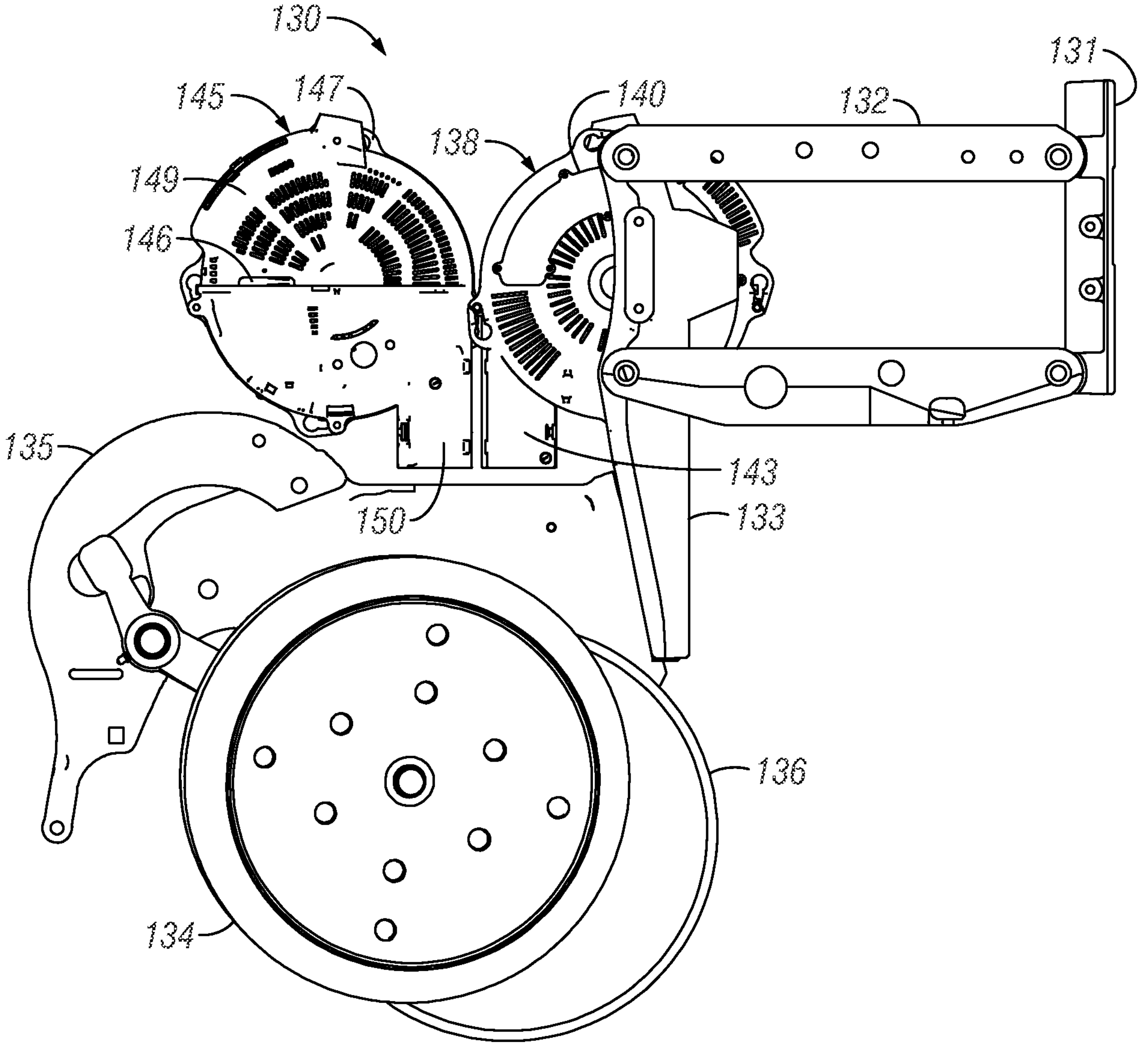
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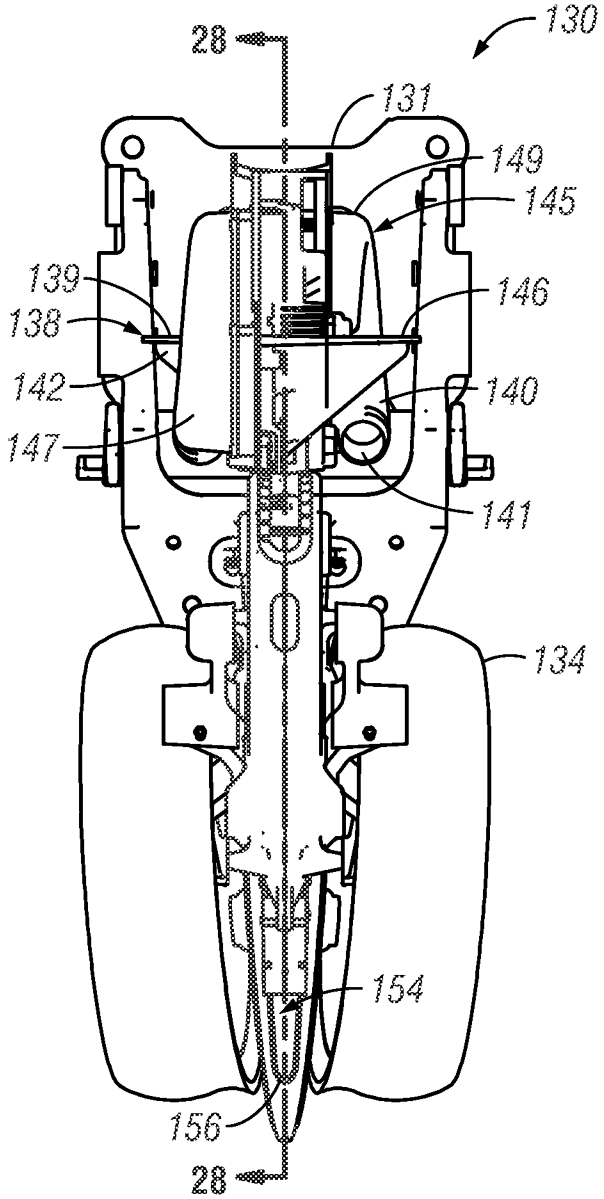
FIG. 26



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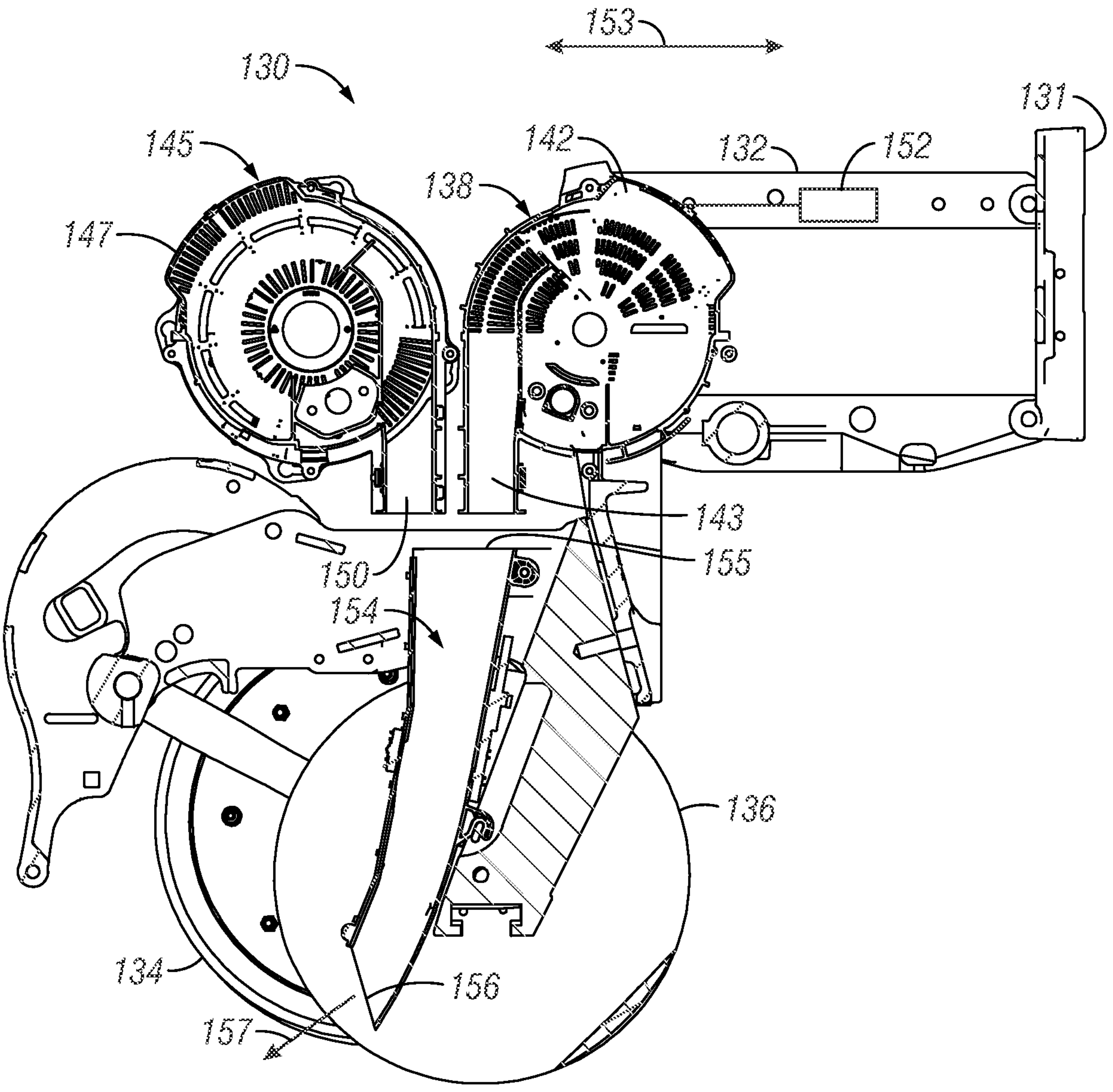
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FIG. 28

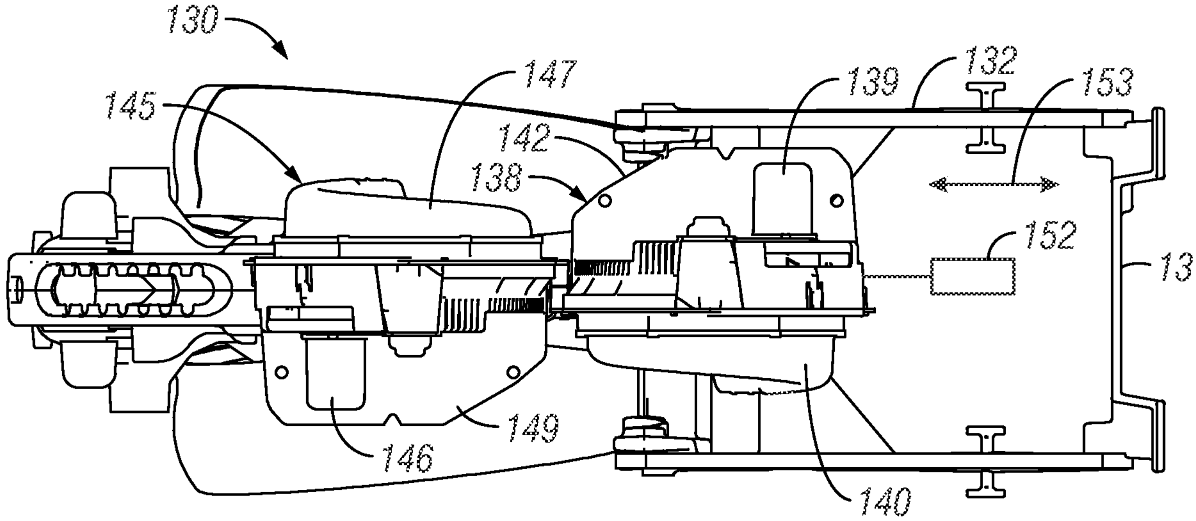
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FIG. 29

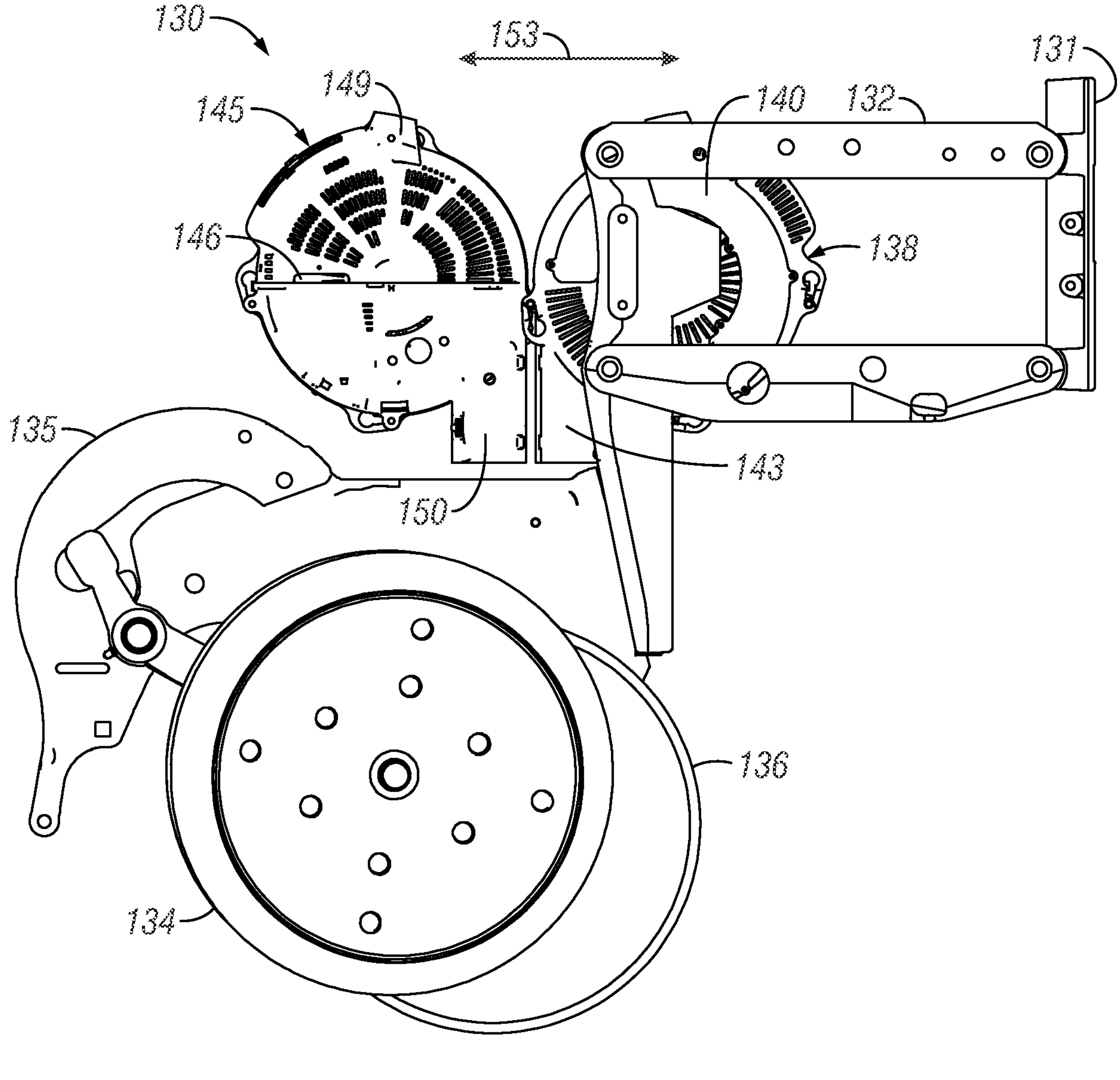
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FIG. 30

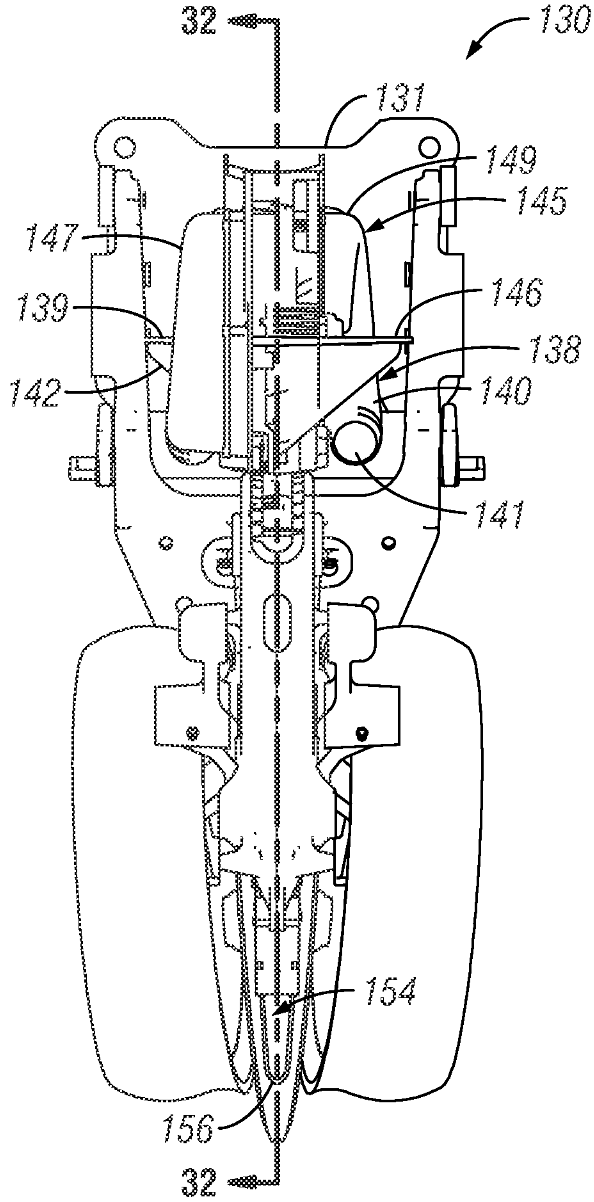
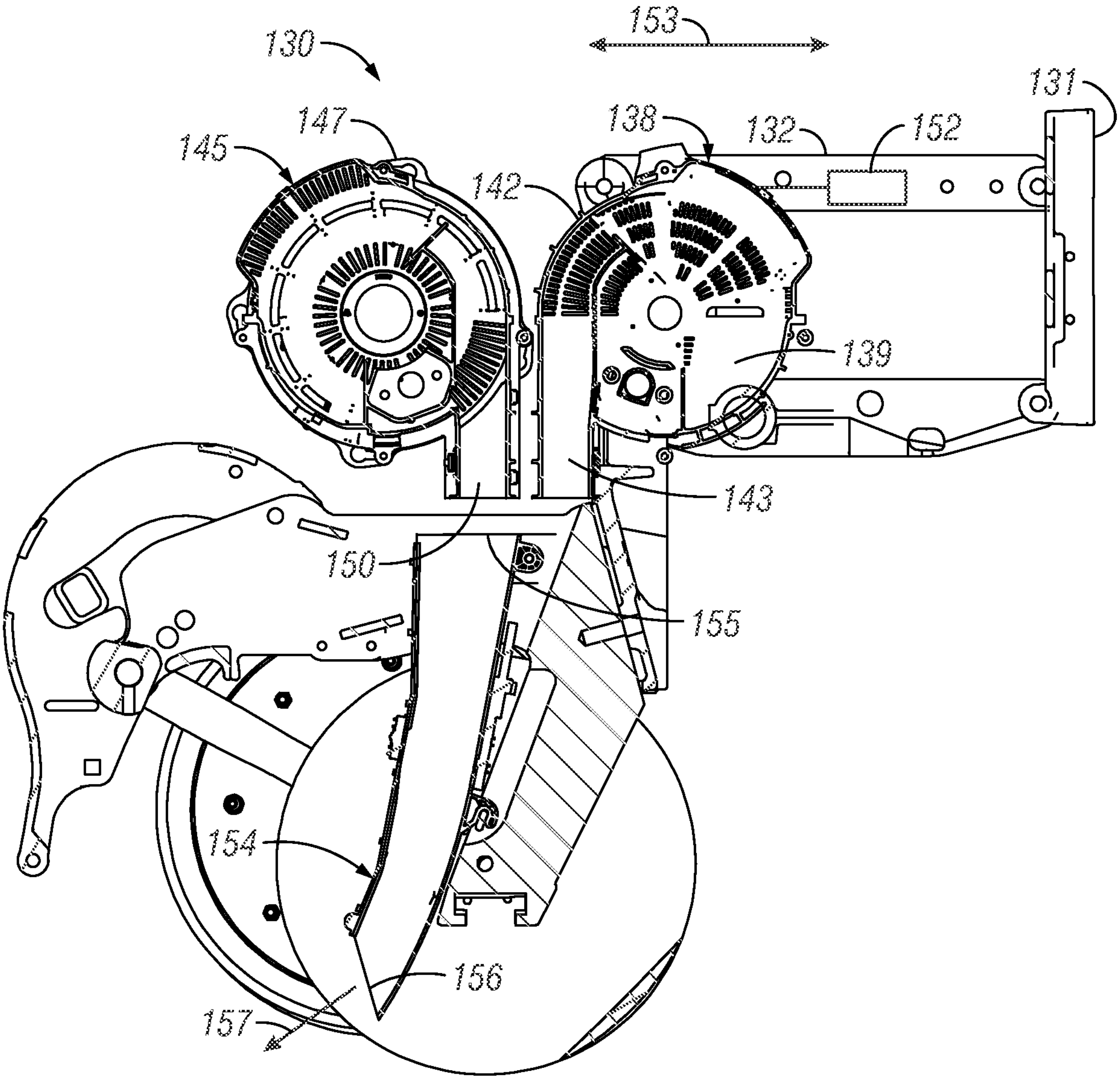


FIG. 31



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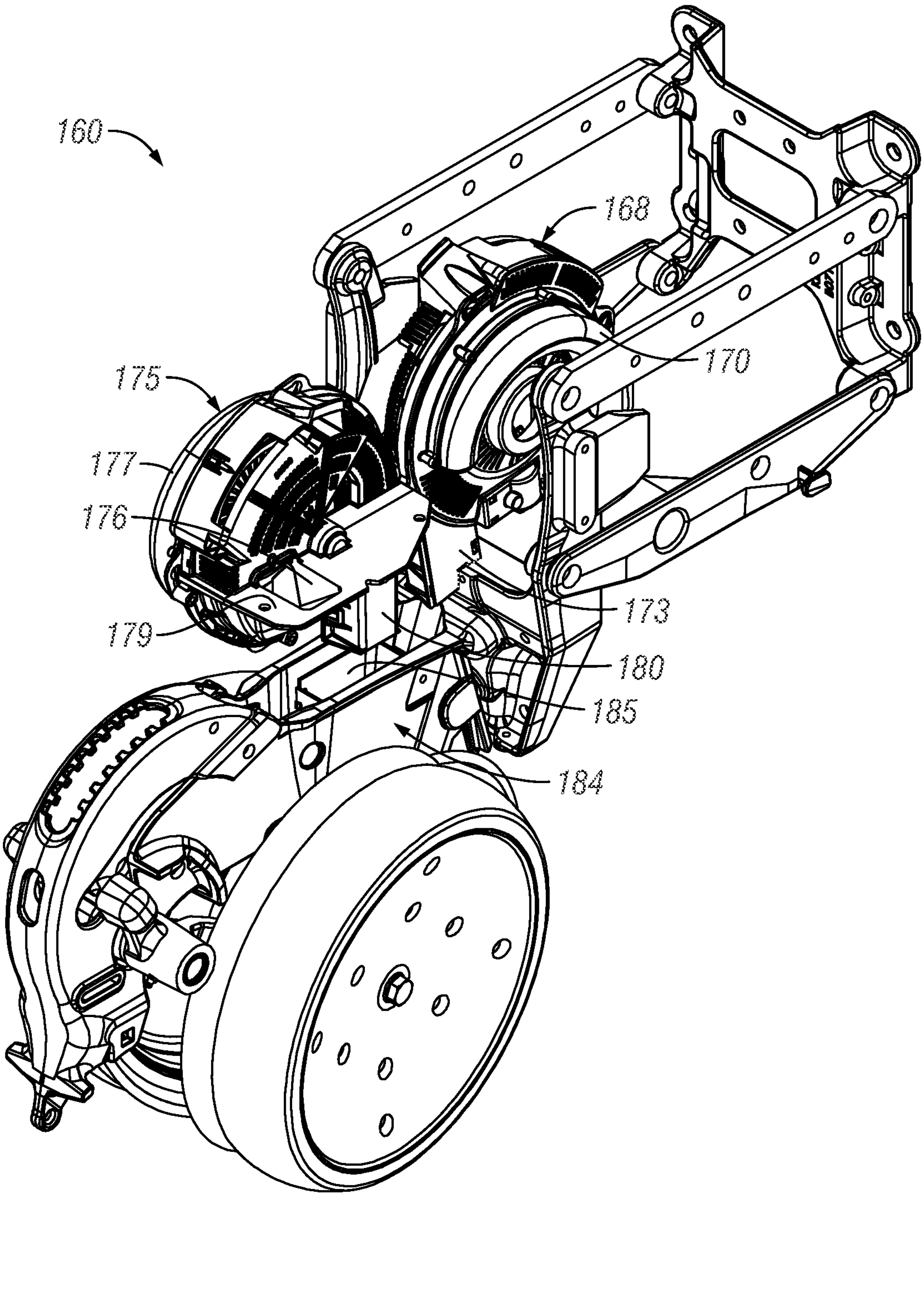

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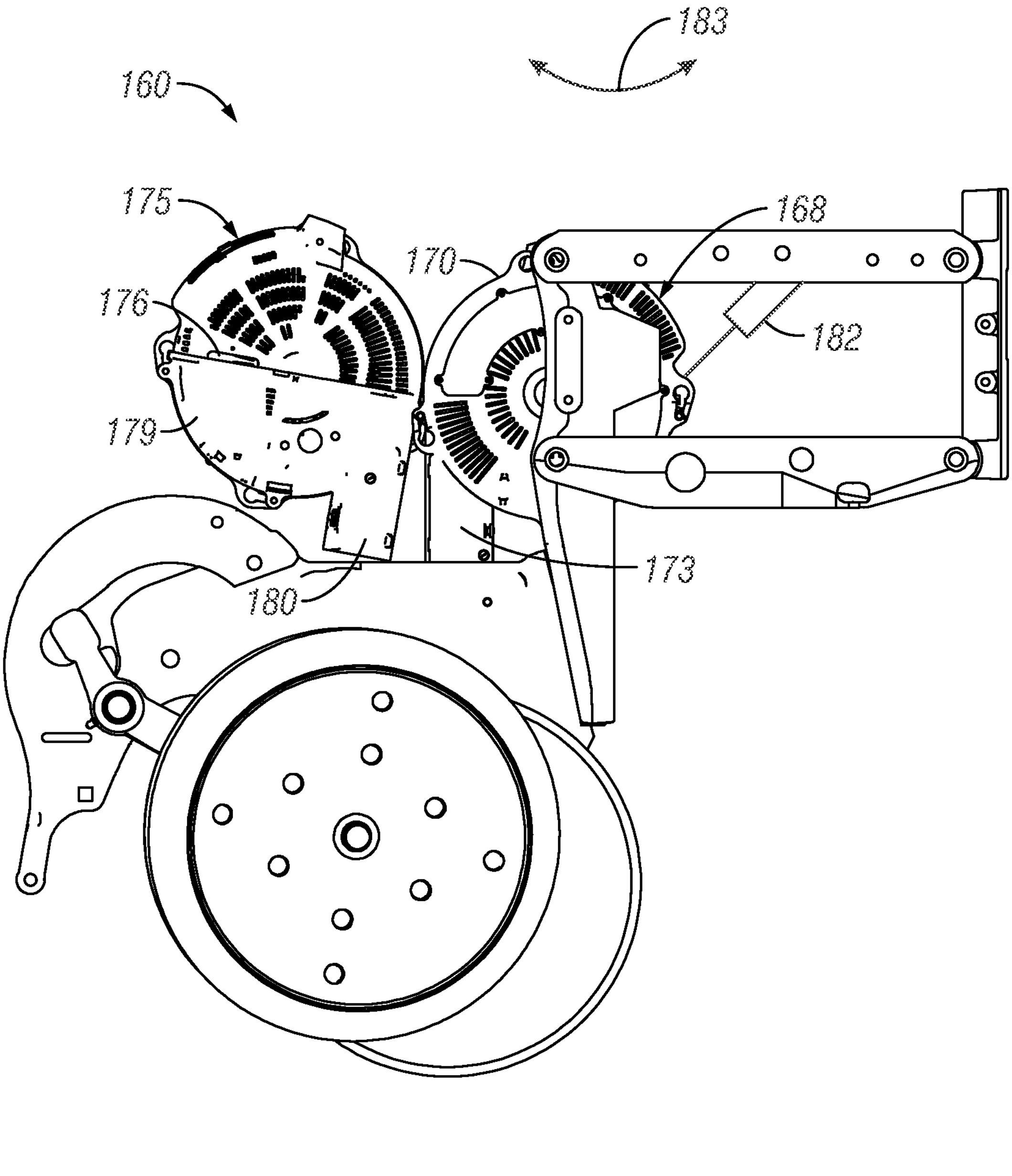
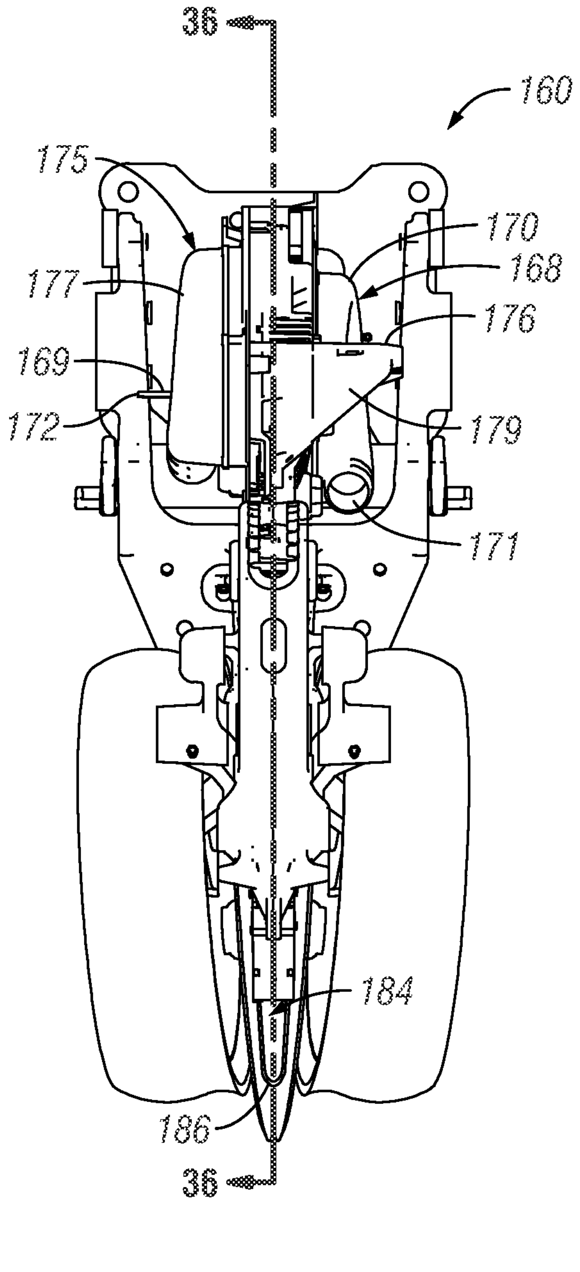


FIG. 34



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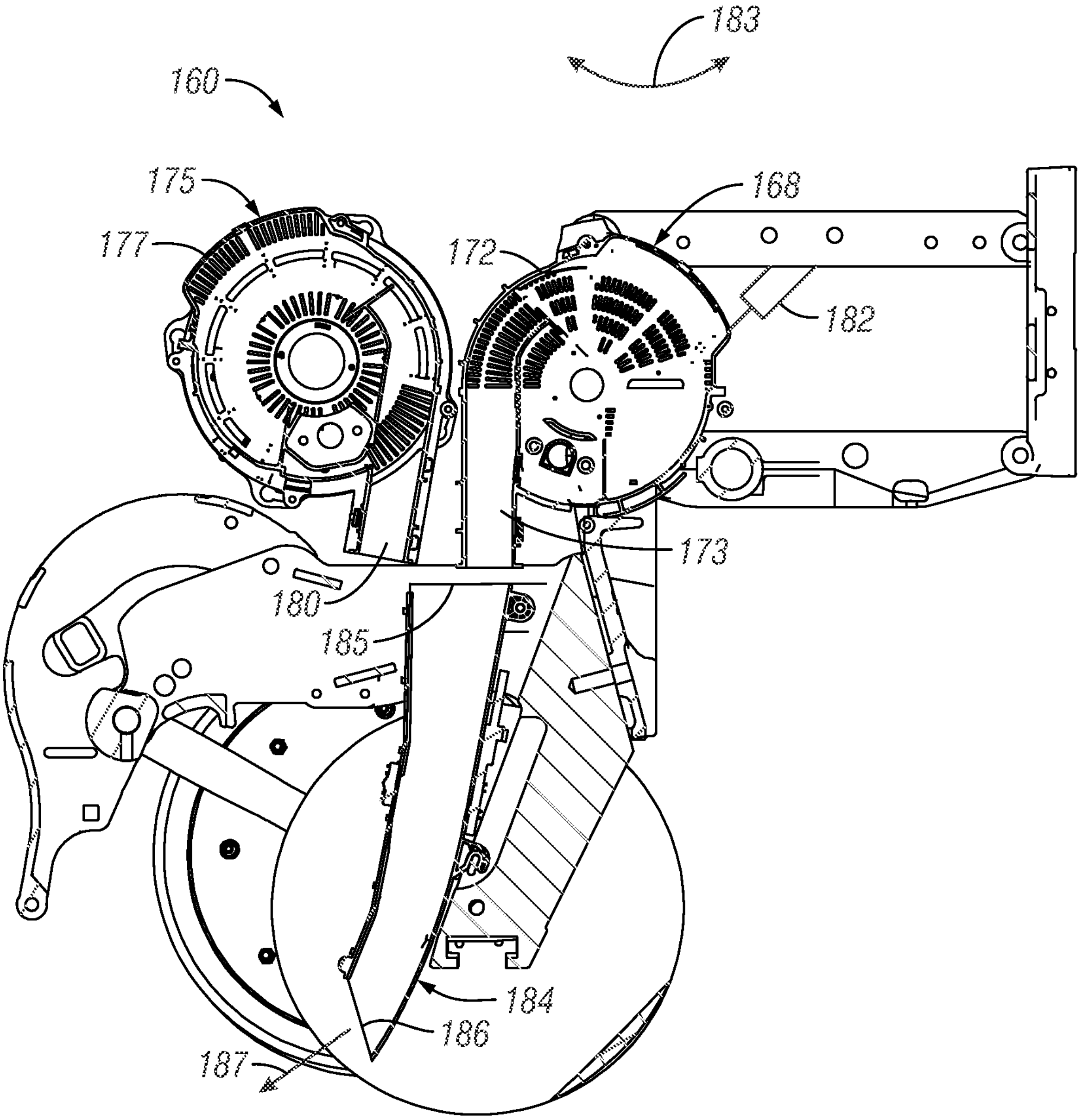
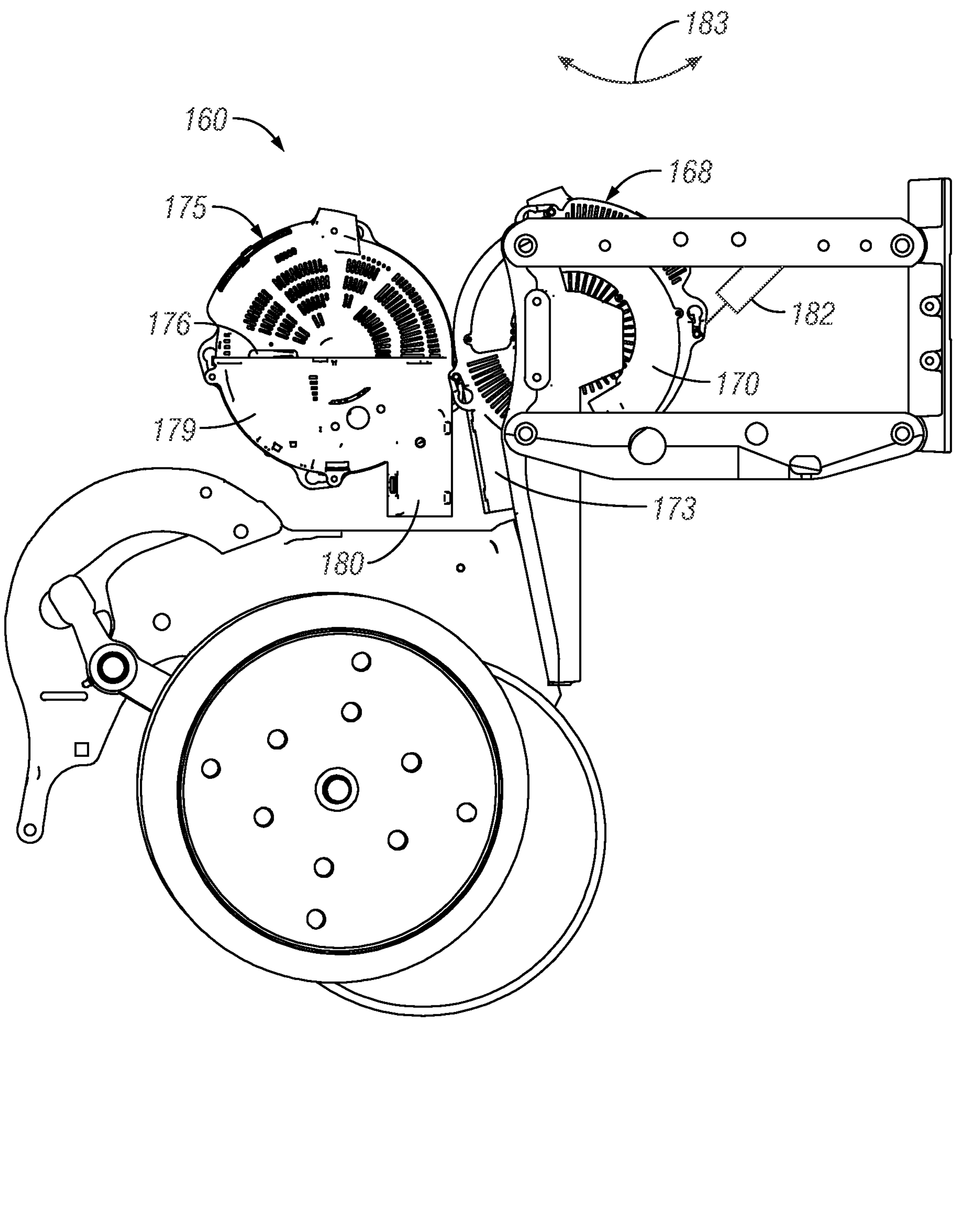


FIG. 36



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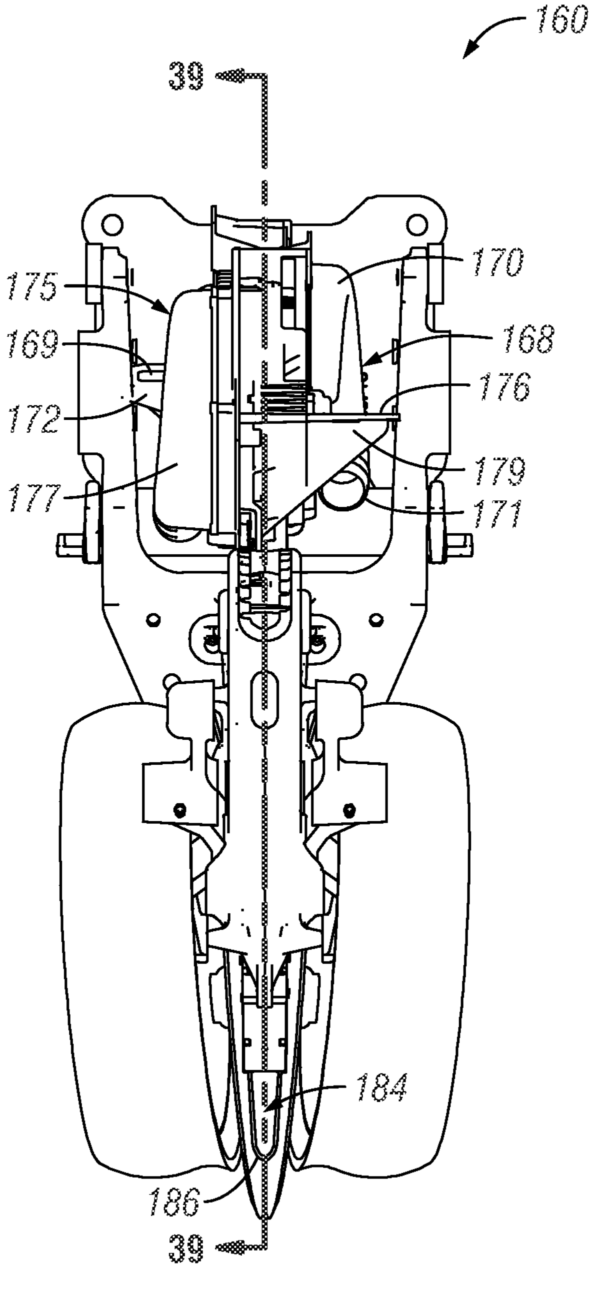
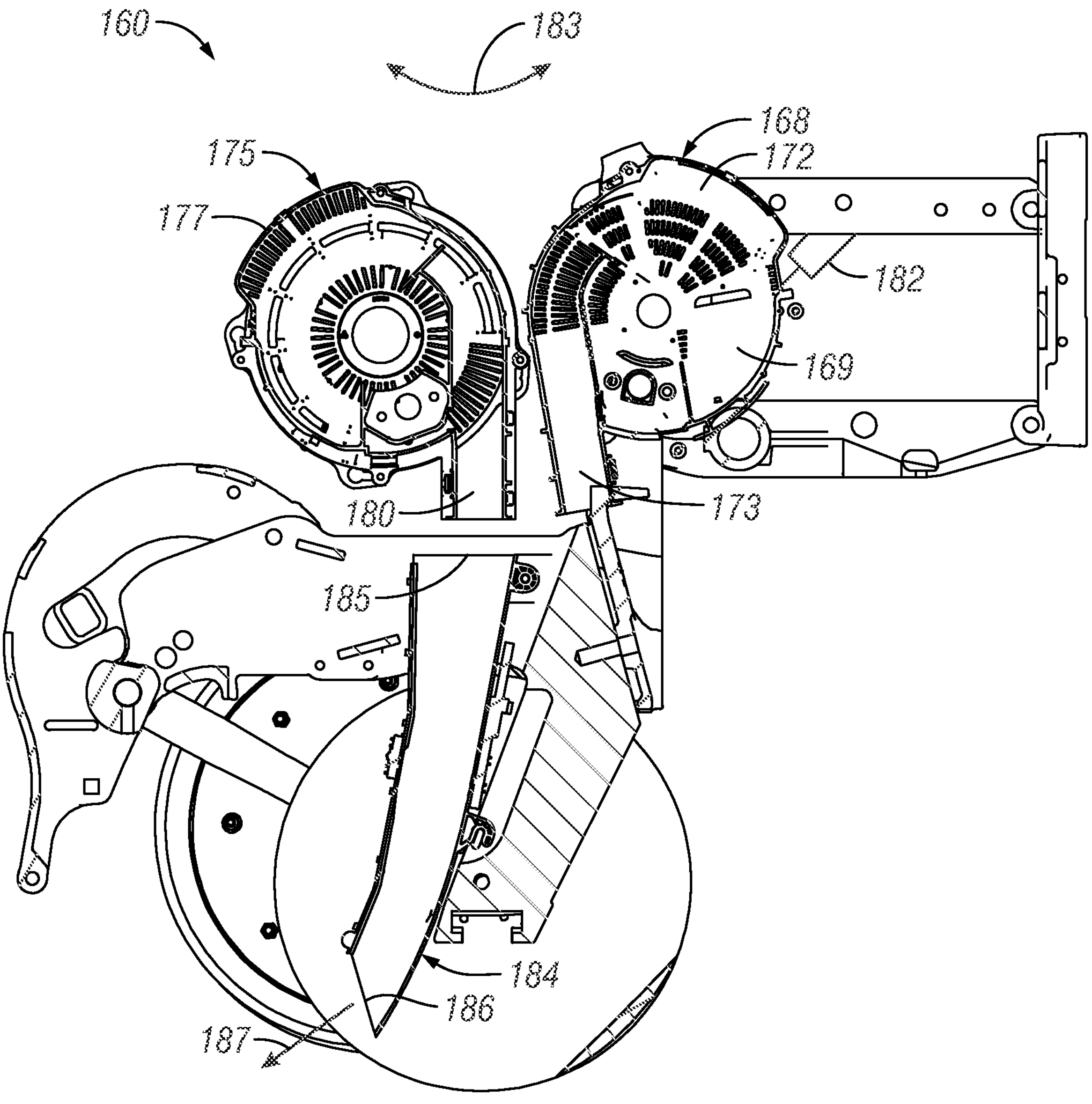


FIG. 38



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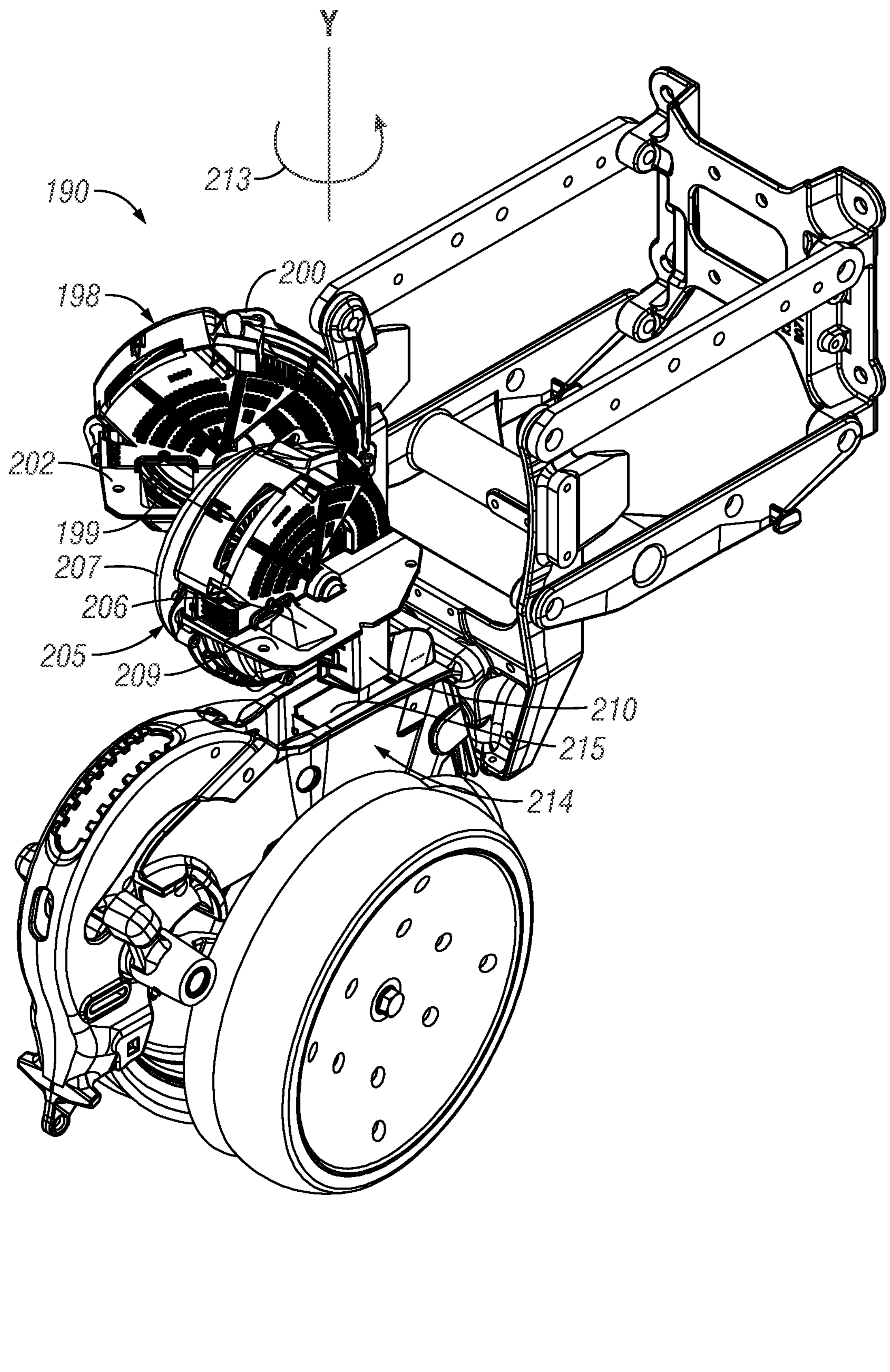

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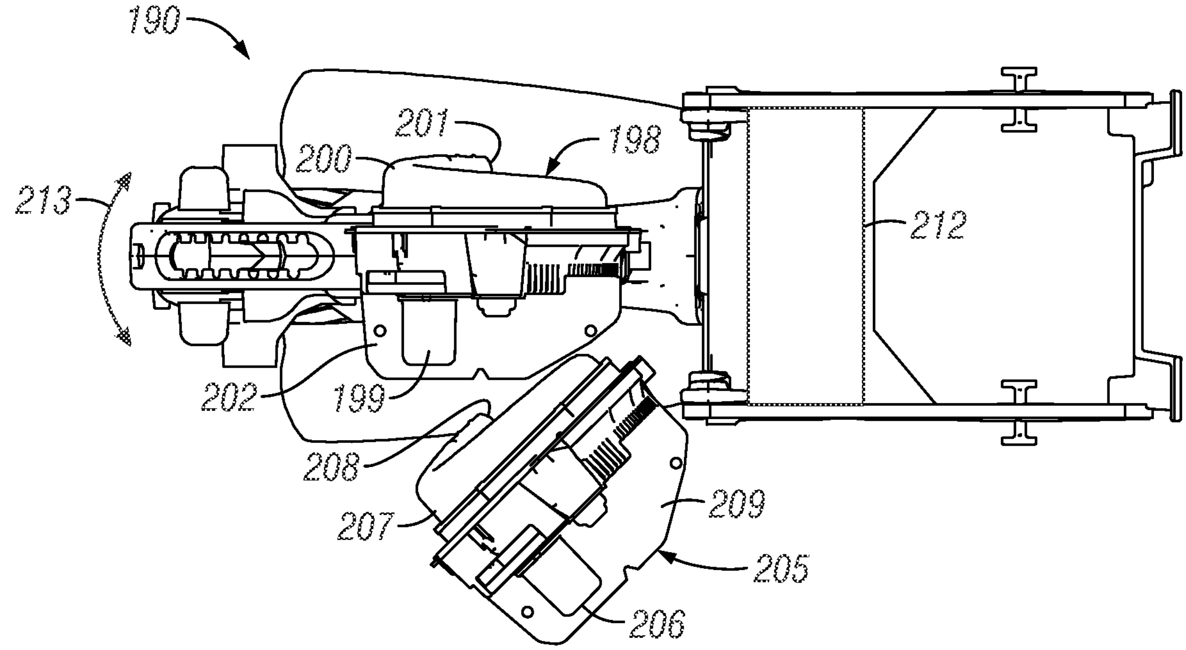
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FIG. 41

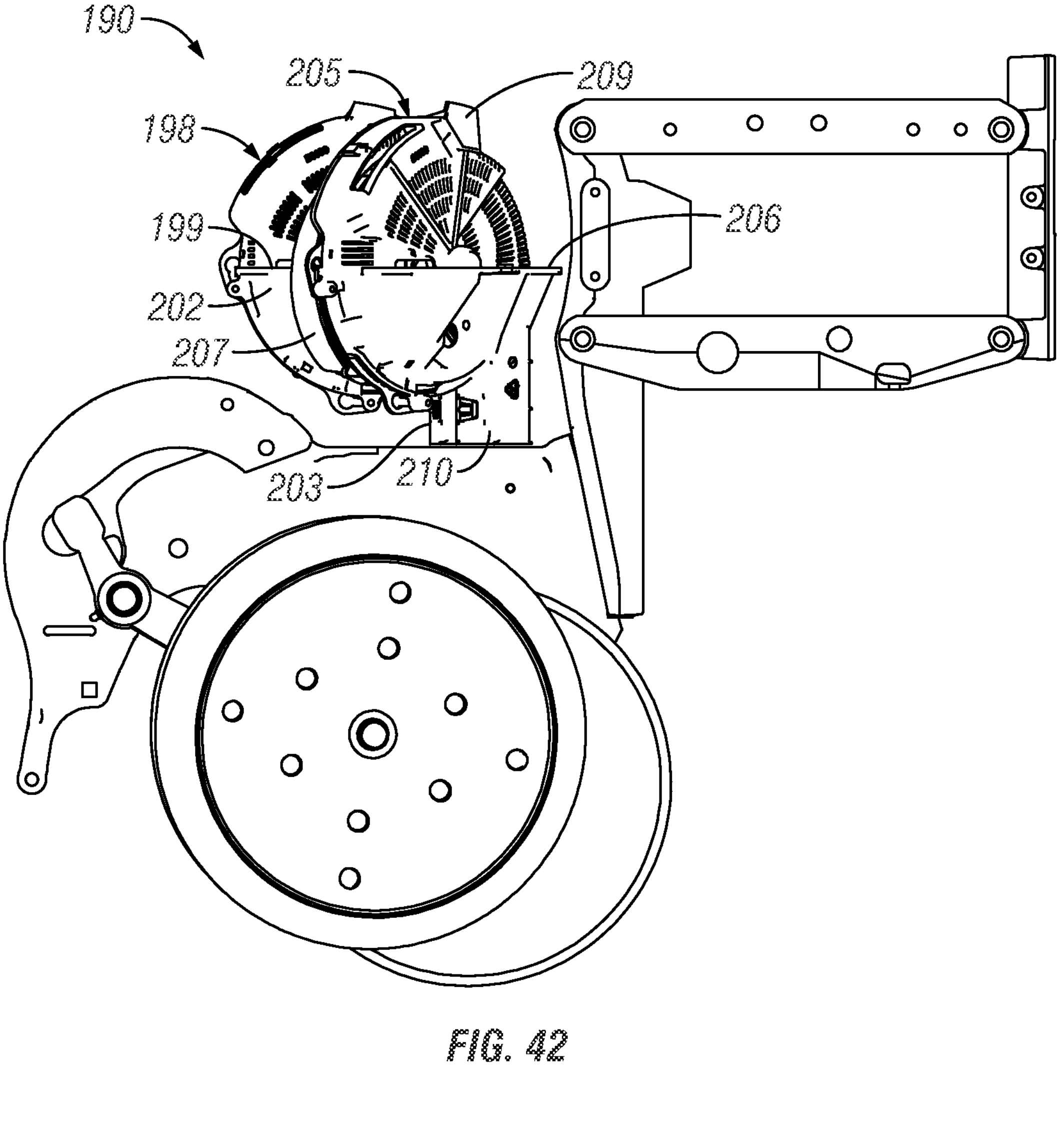
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FIG. 42

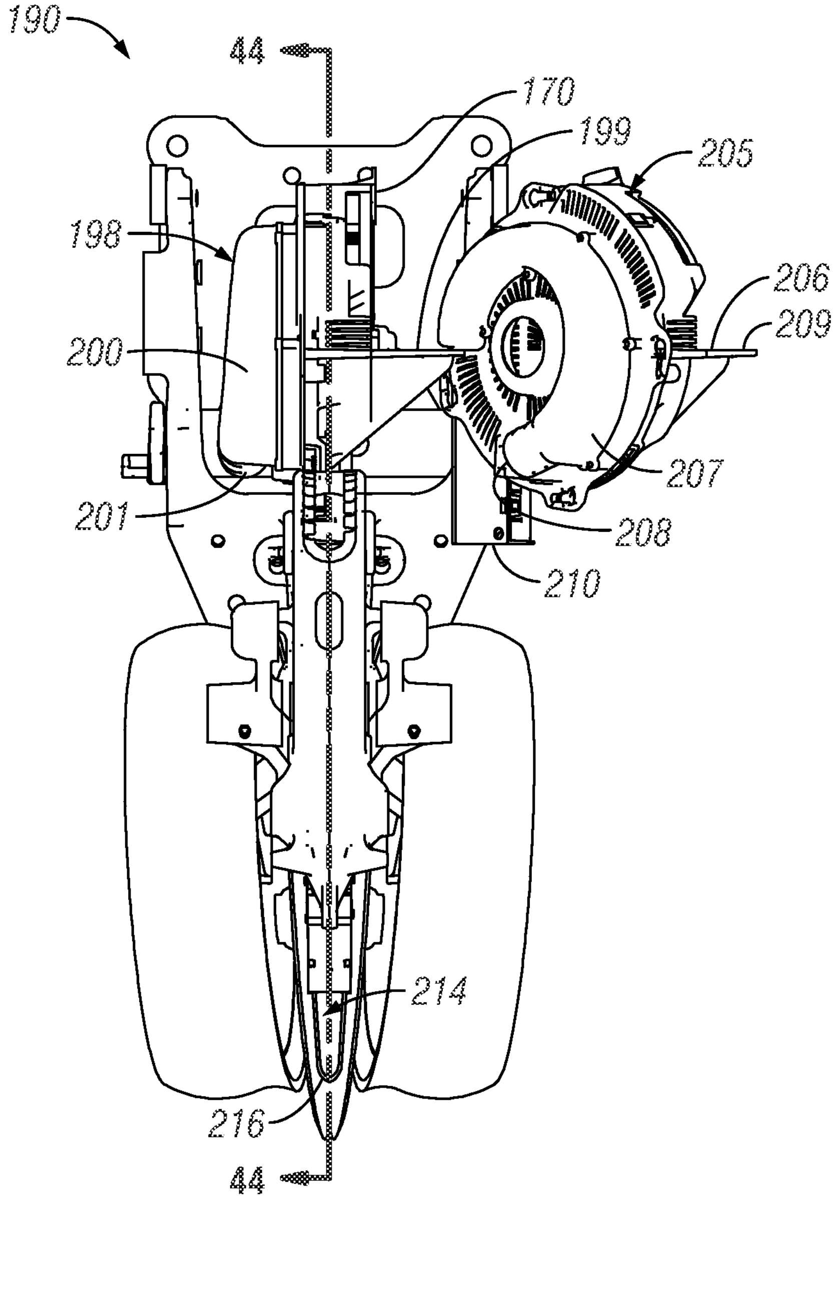

FIG. 43

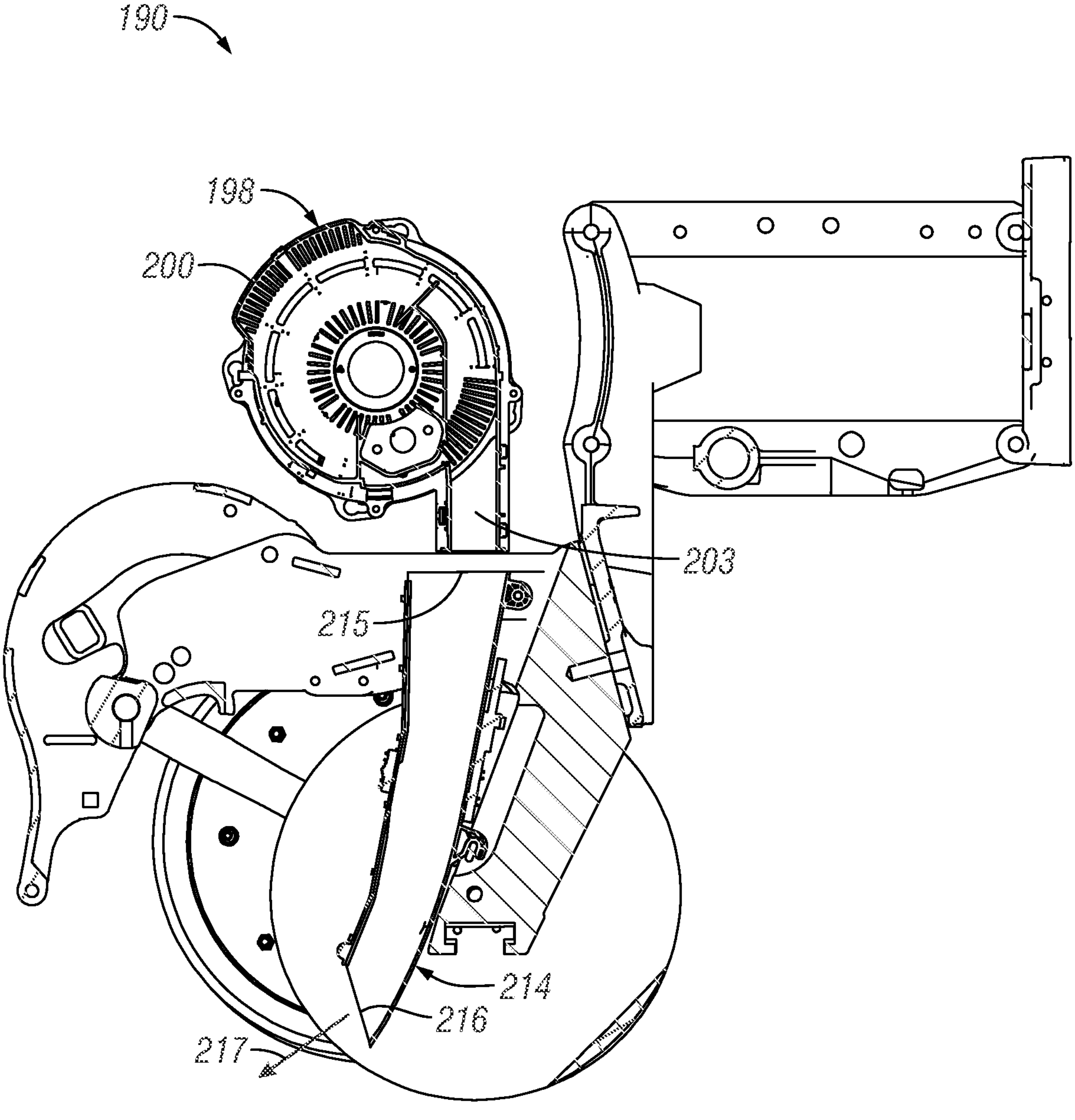

FIG. 44

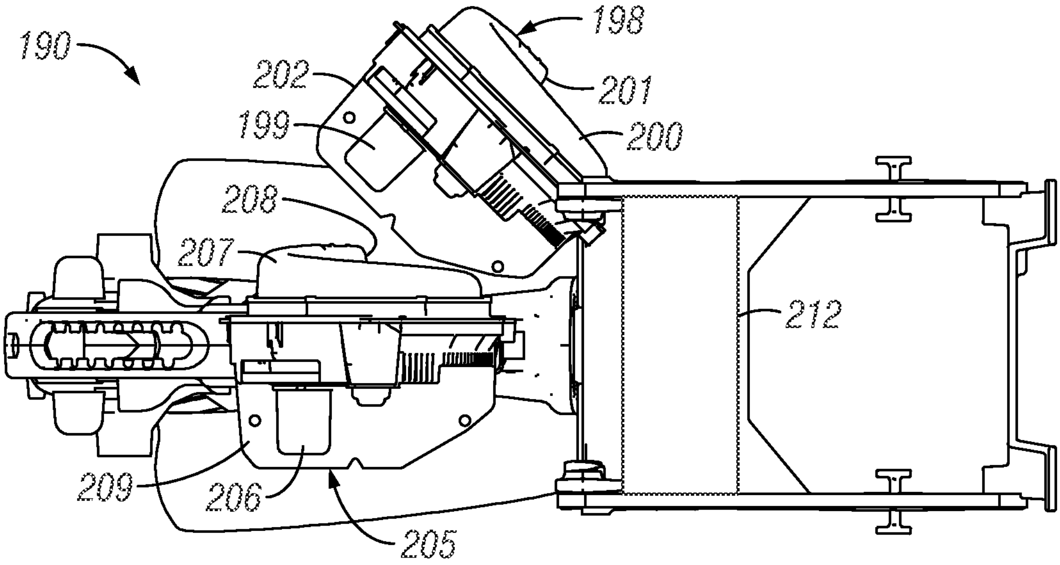
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FIG. 45

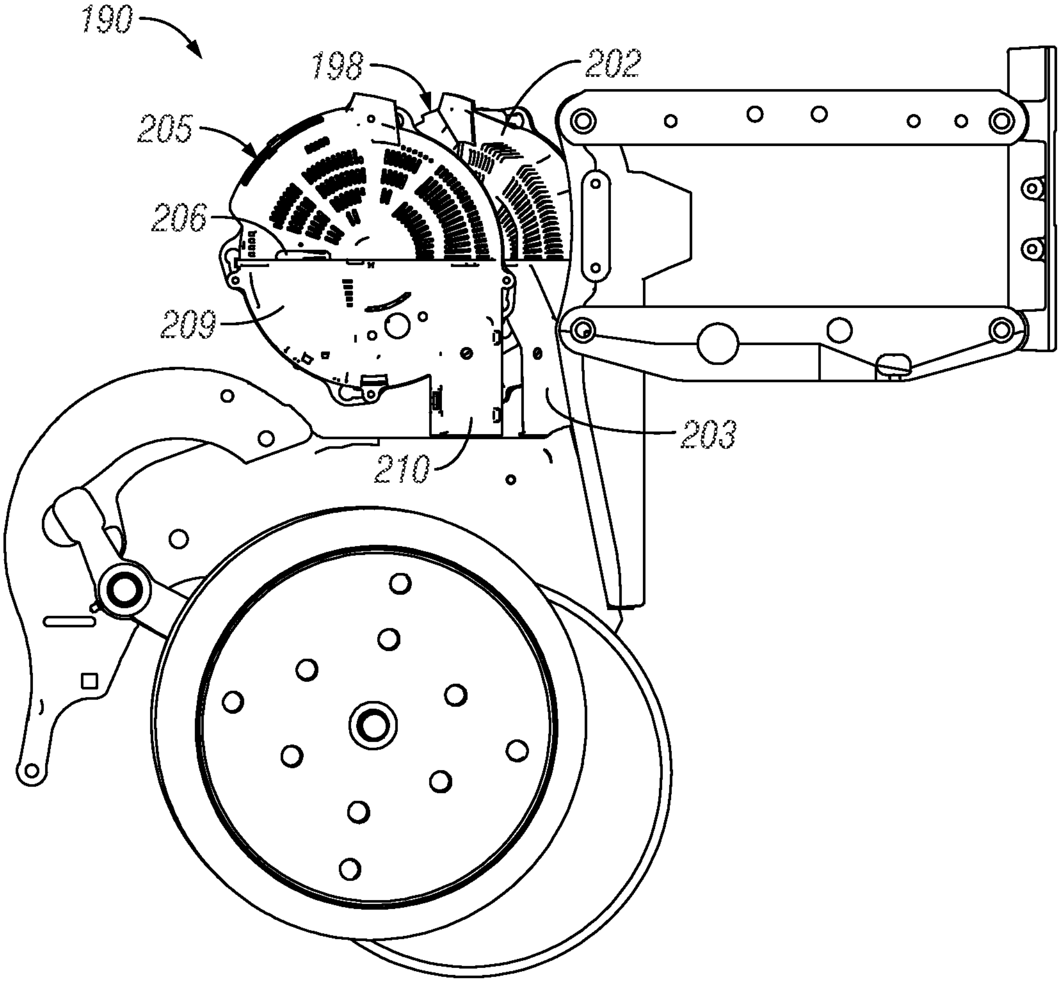
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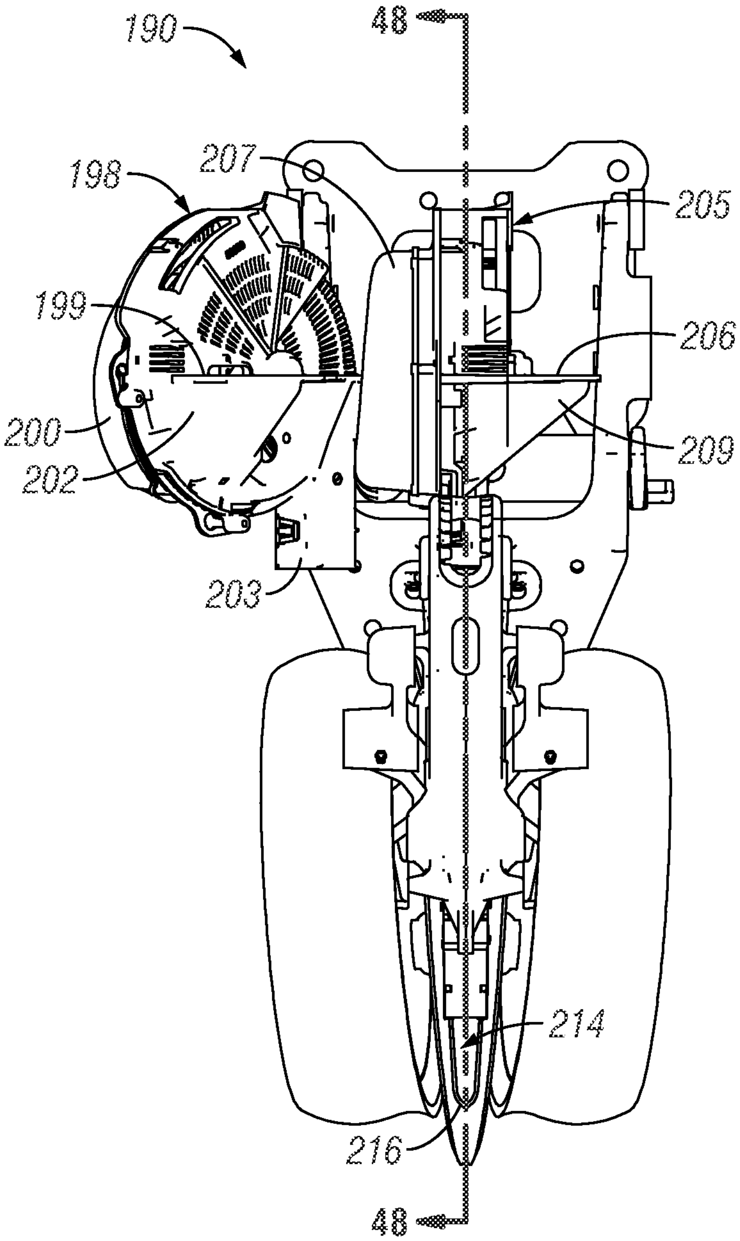
FIG. 46



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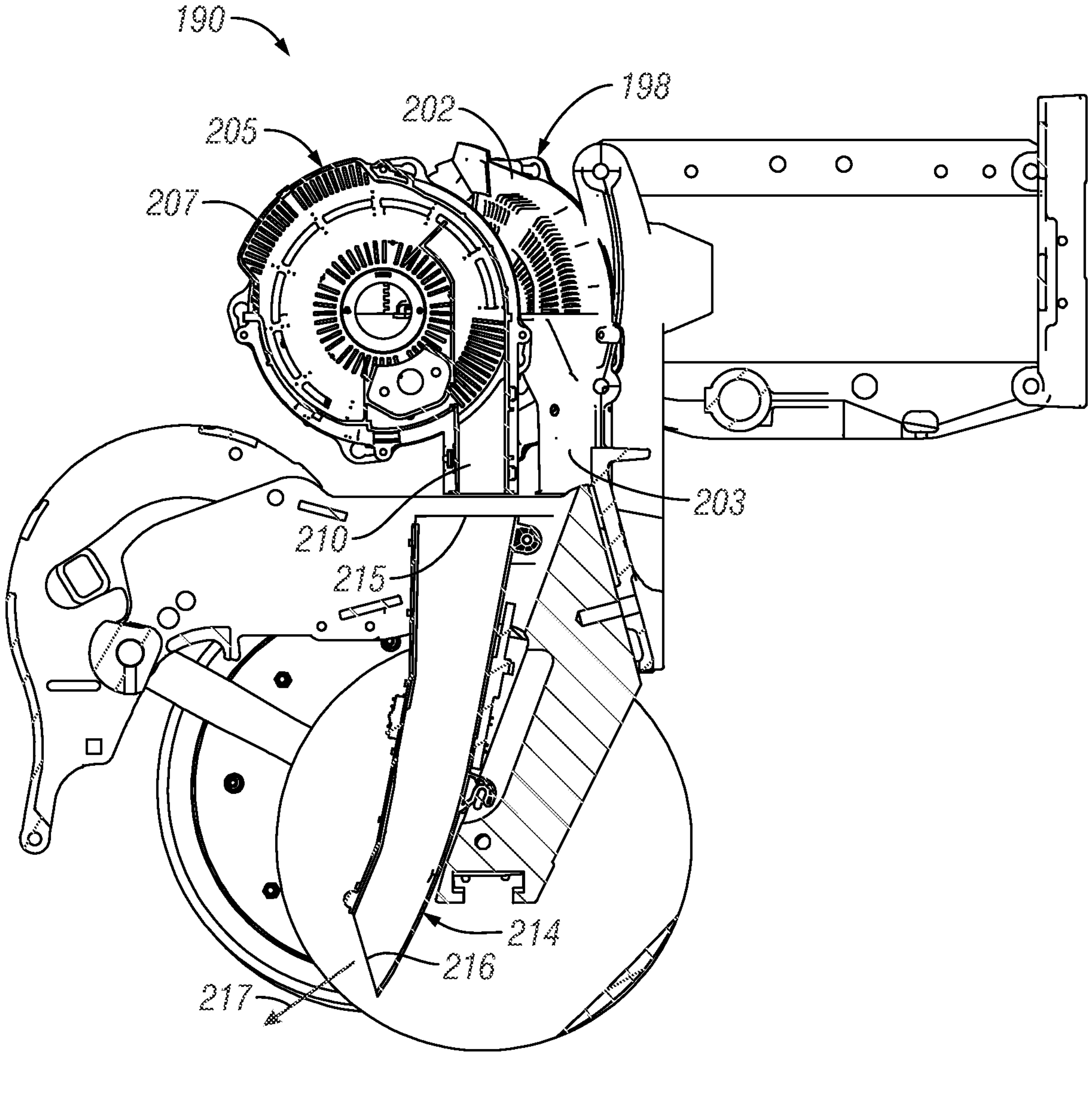

FIG. 48

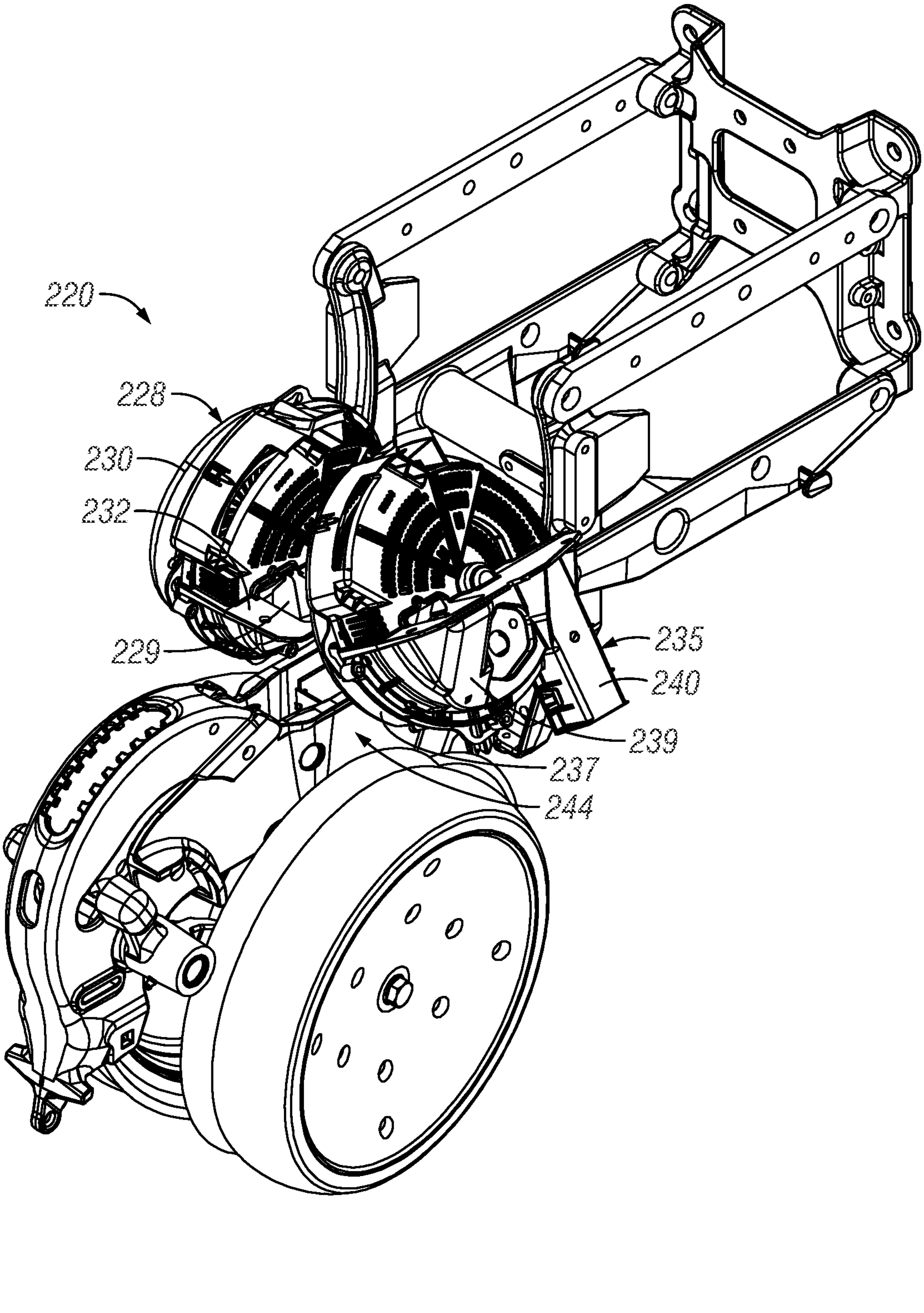

FIG. 49

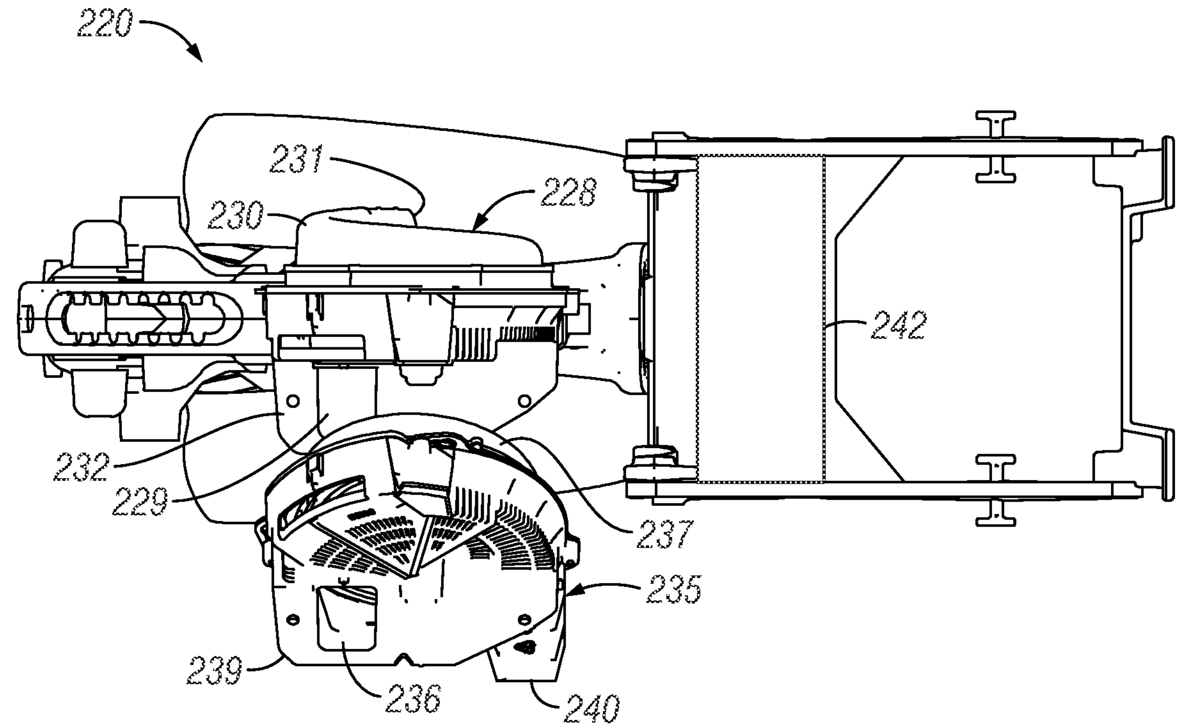

FIG. 50

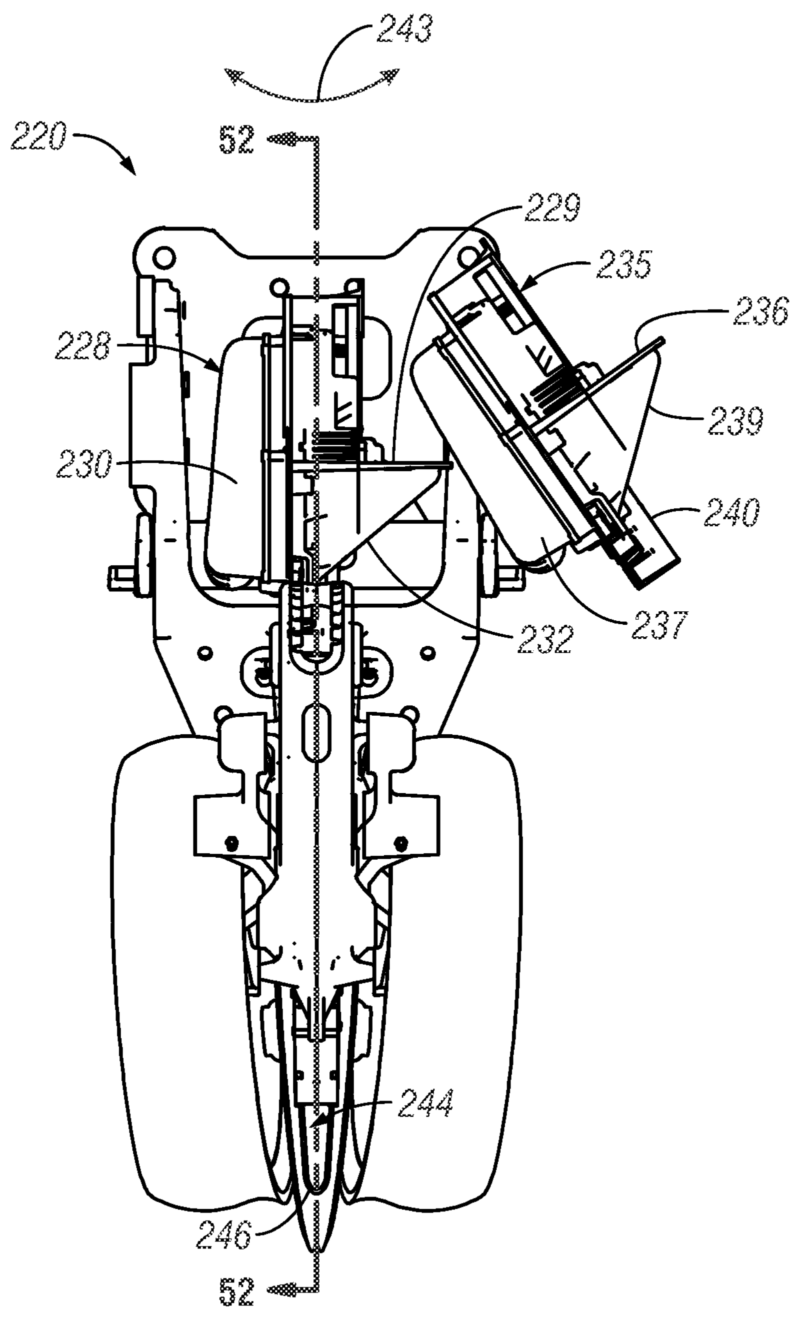

FIG. 51

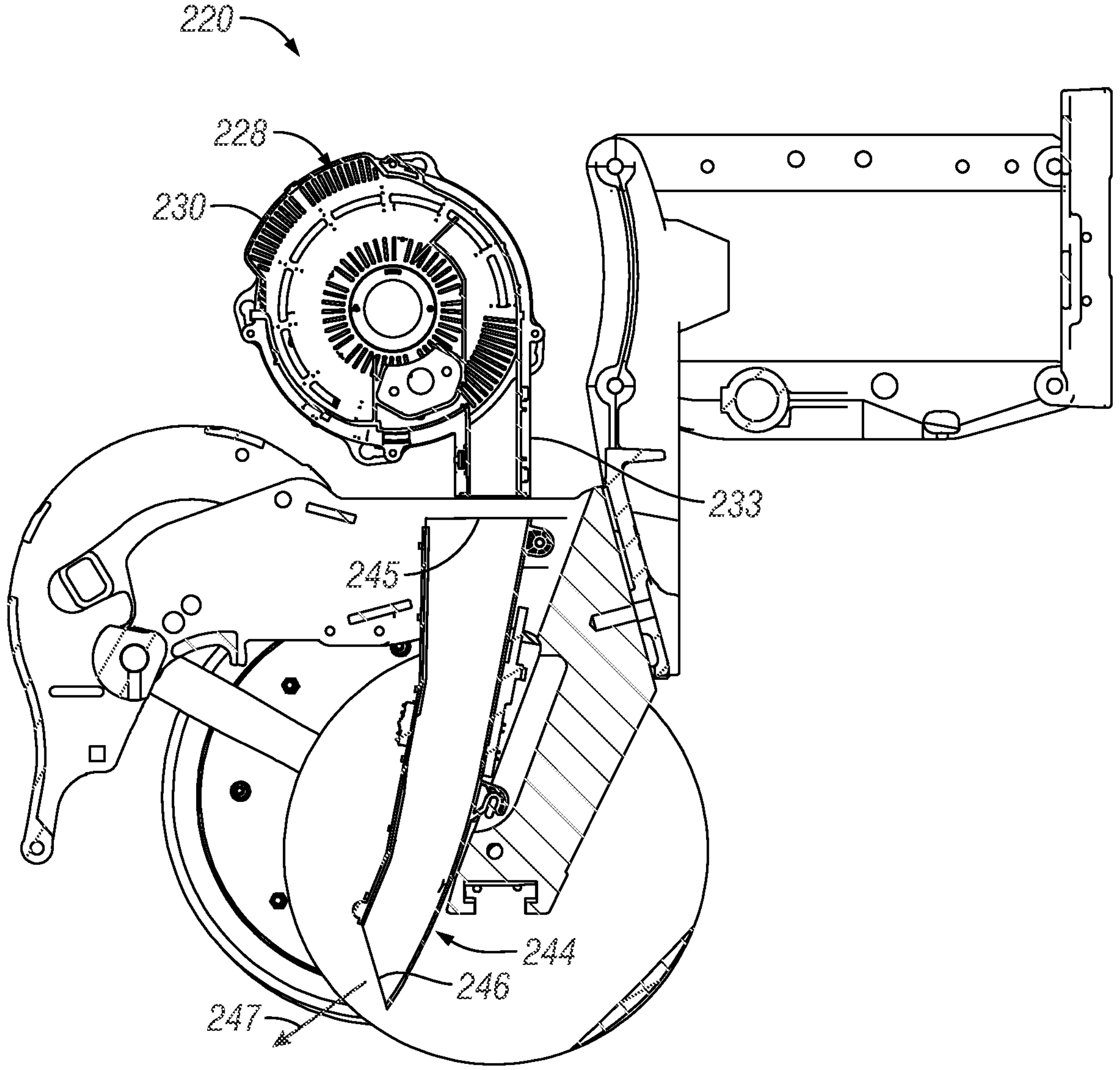

FIG. 52

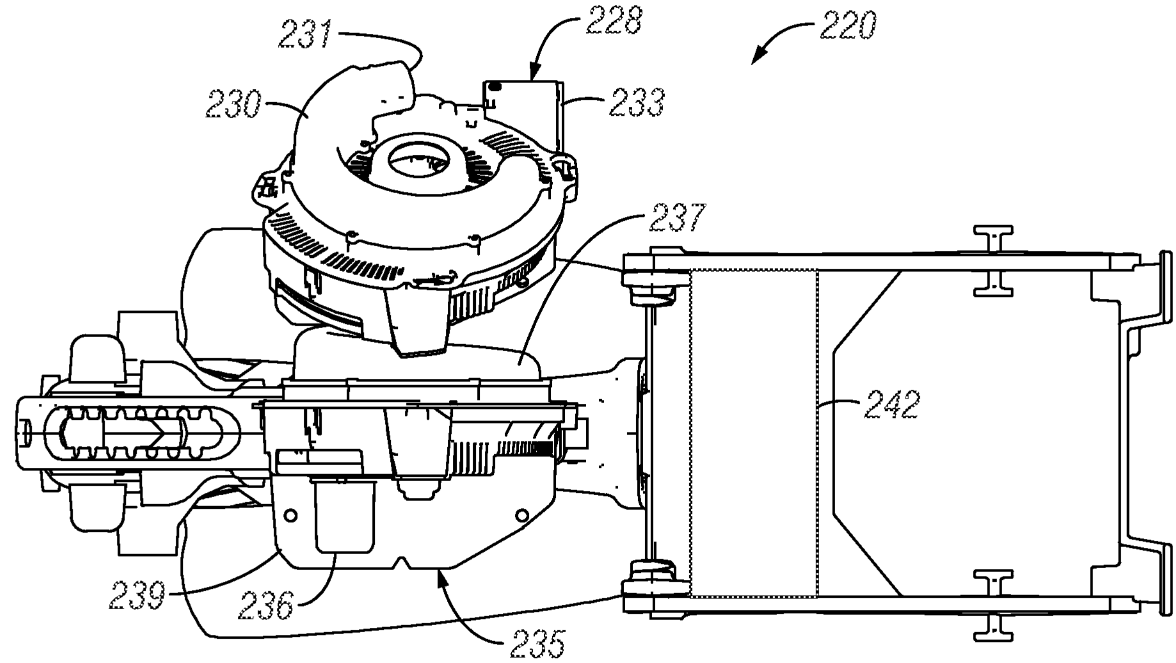

FIG. 53

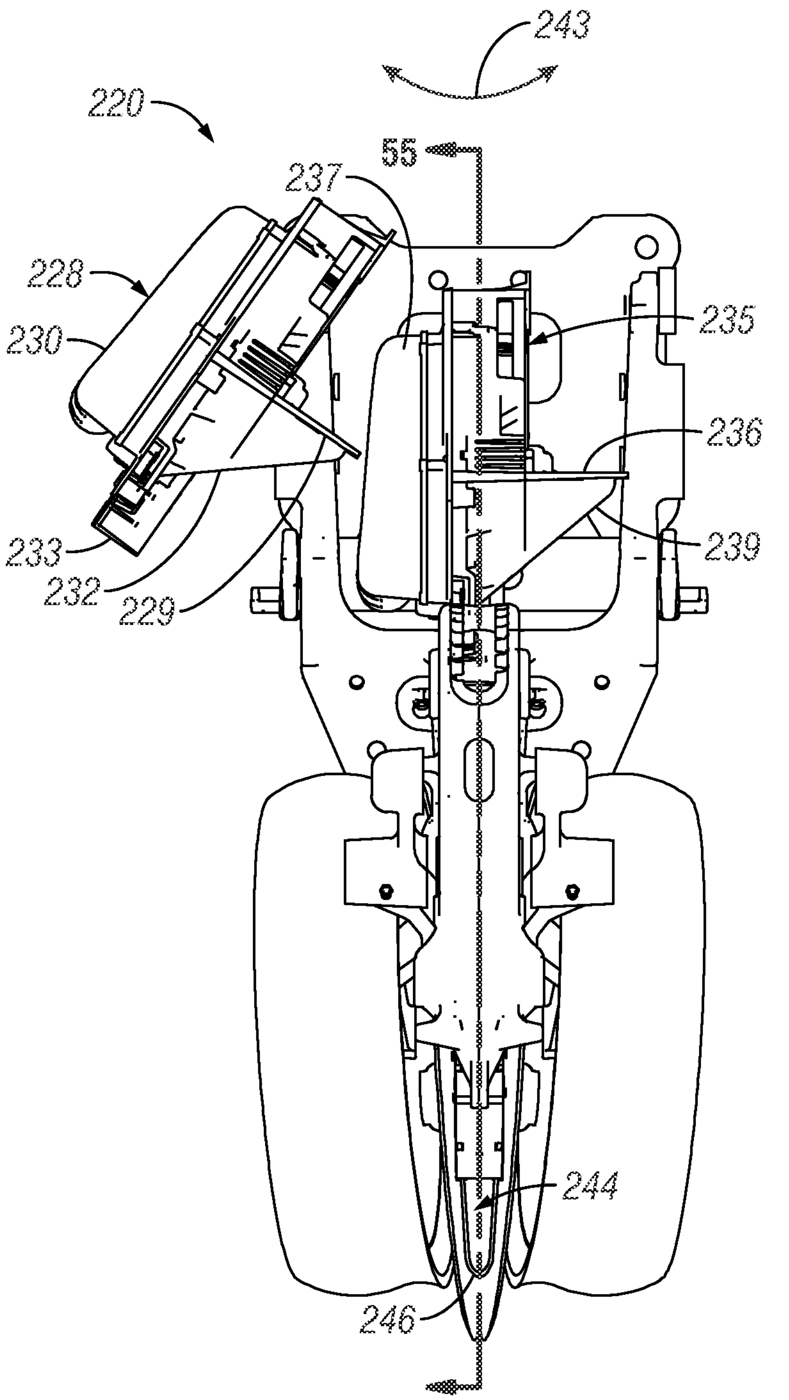

FIG. 54

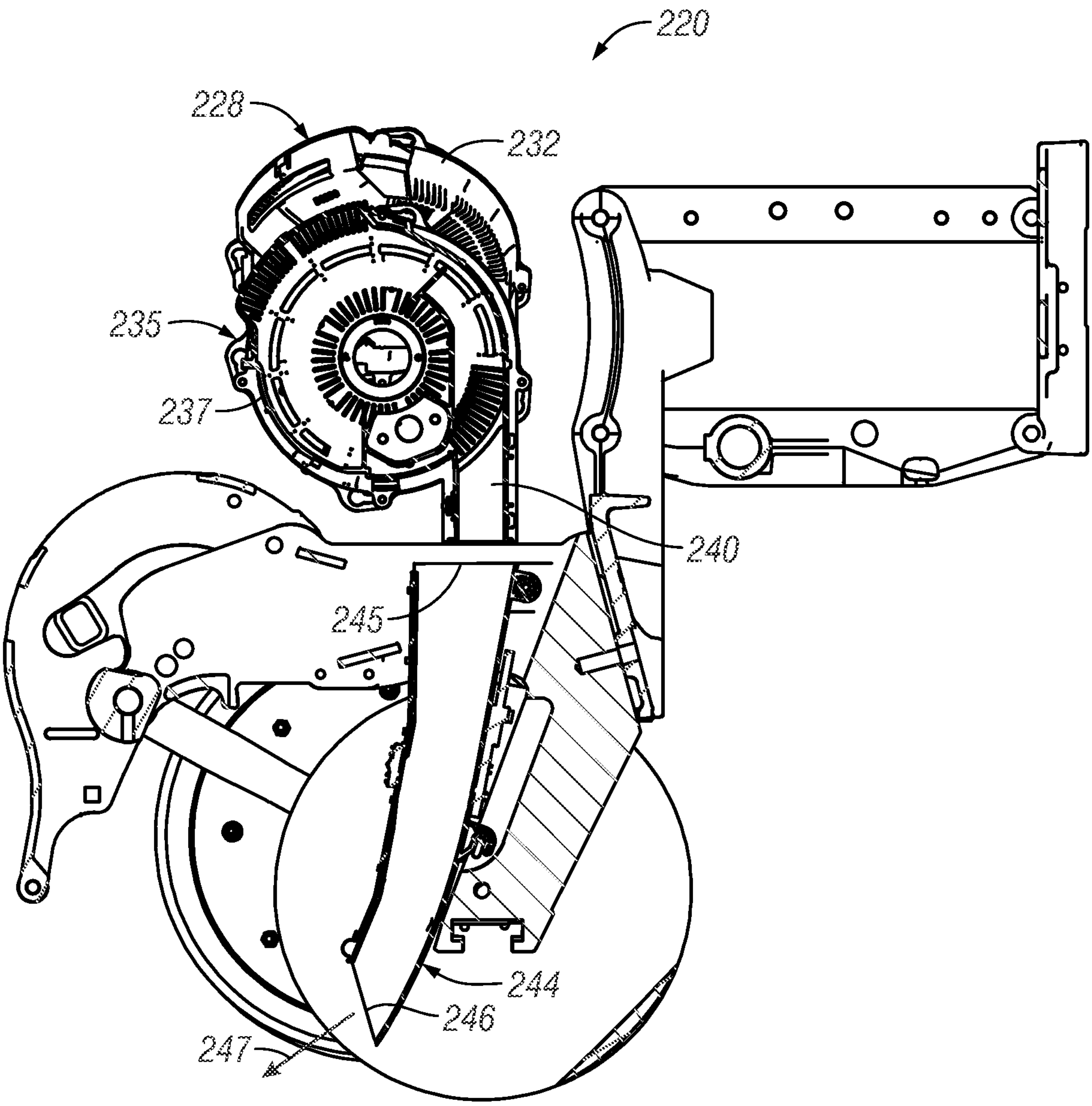

FIG. 55

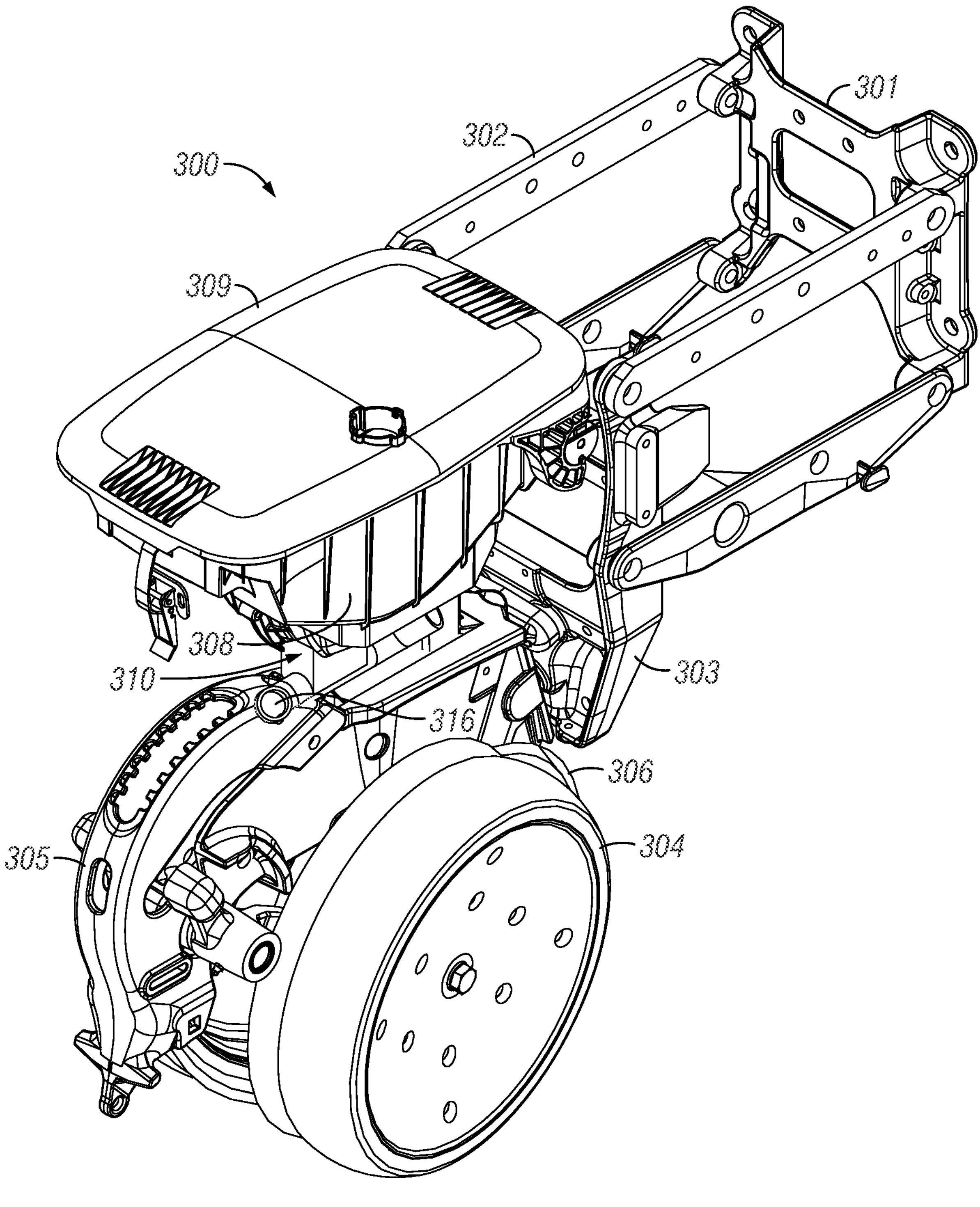

FIG. 56

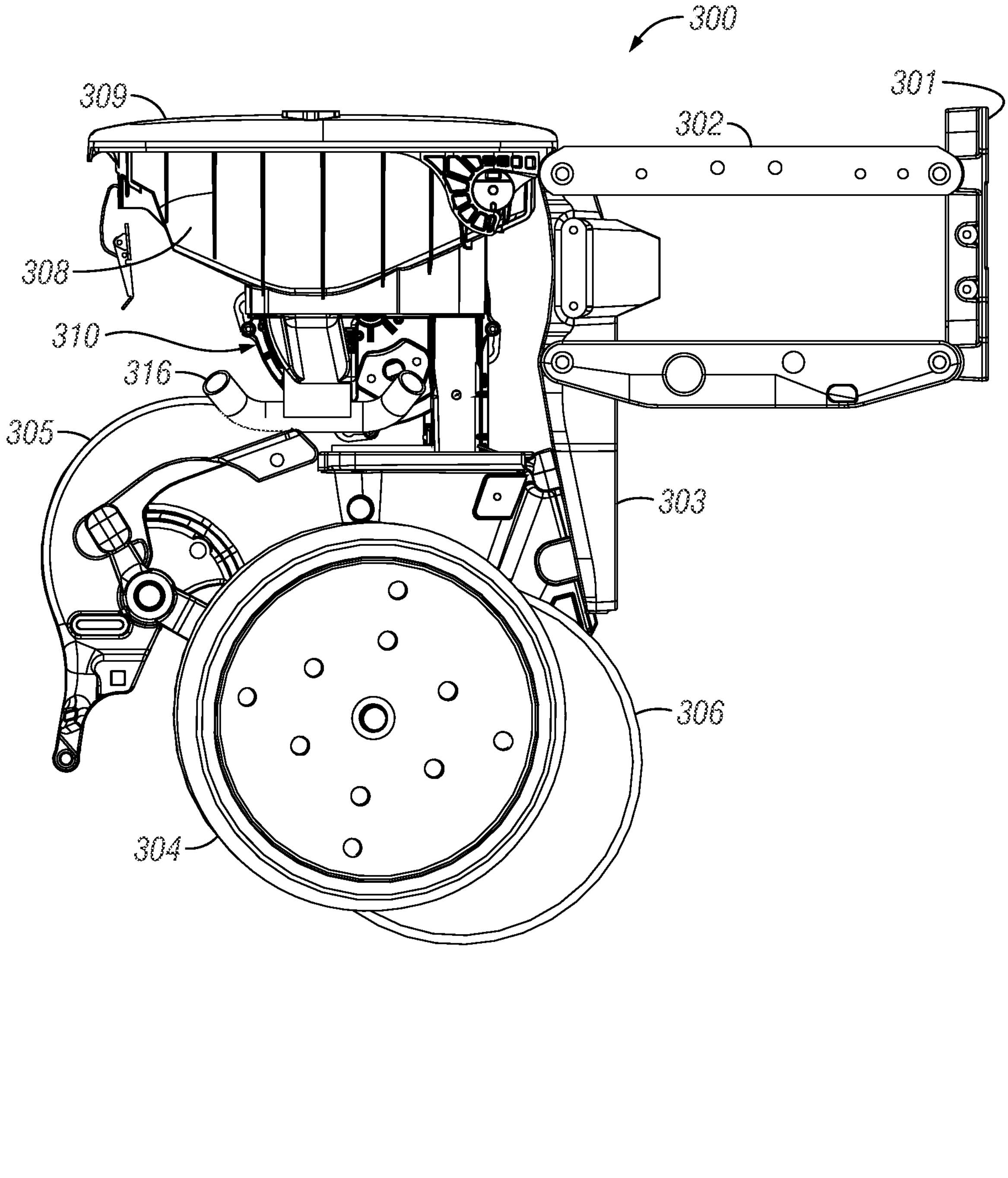

FIG. 57

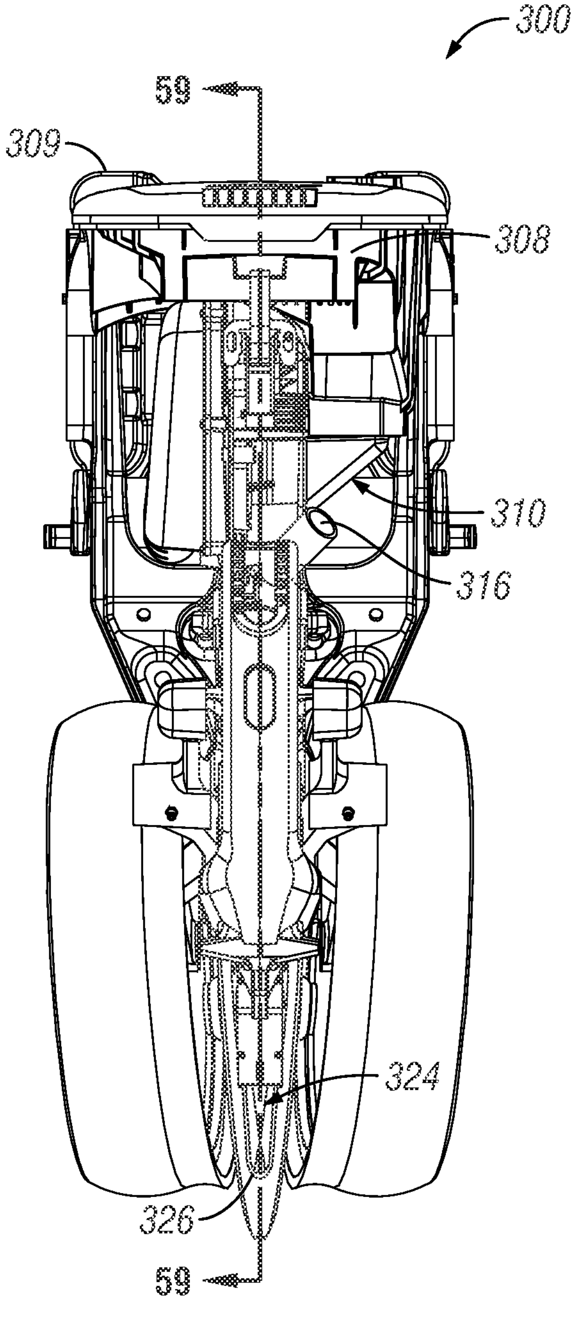

FIG. 58

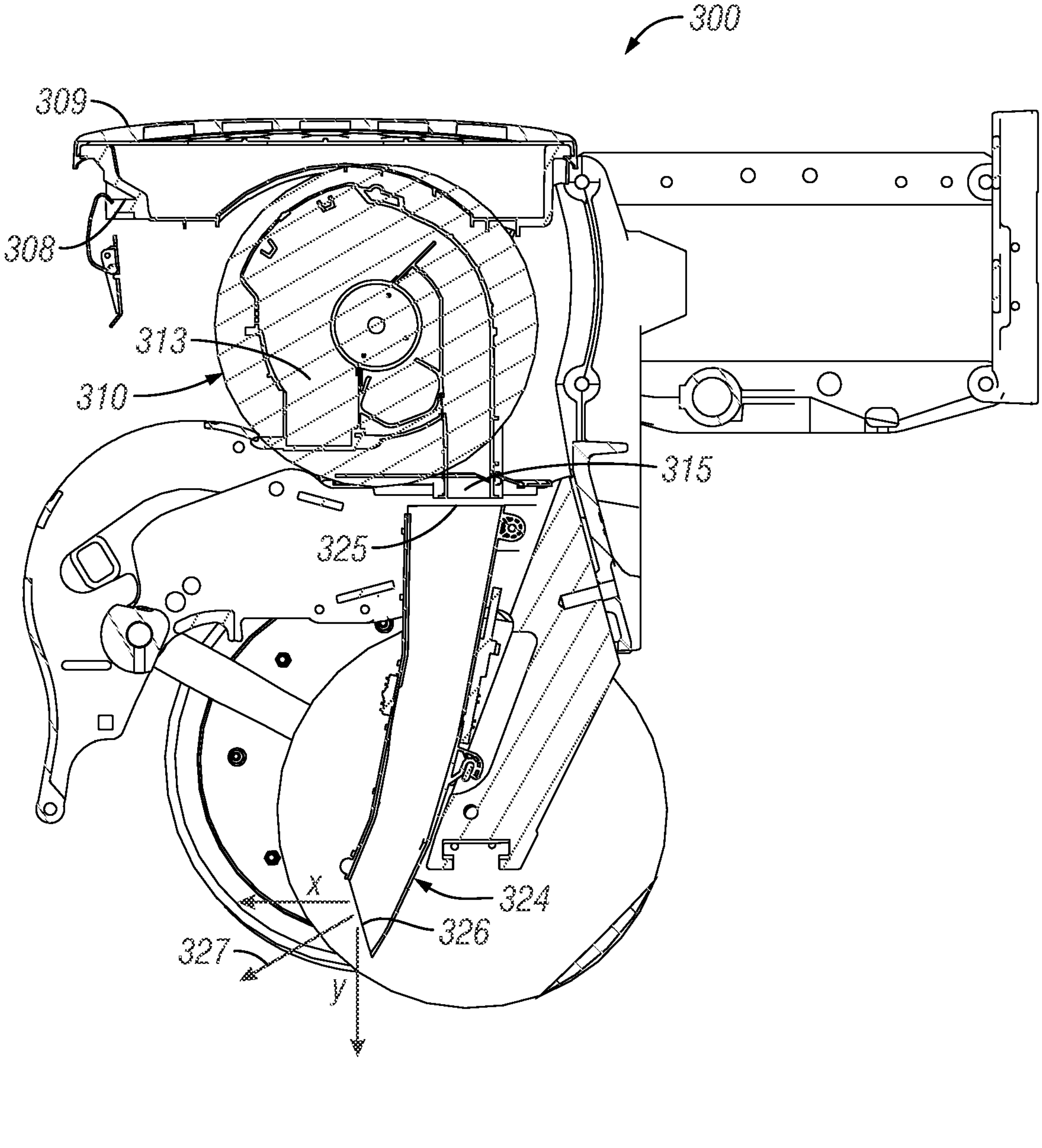

FIG. 59

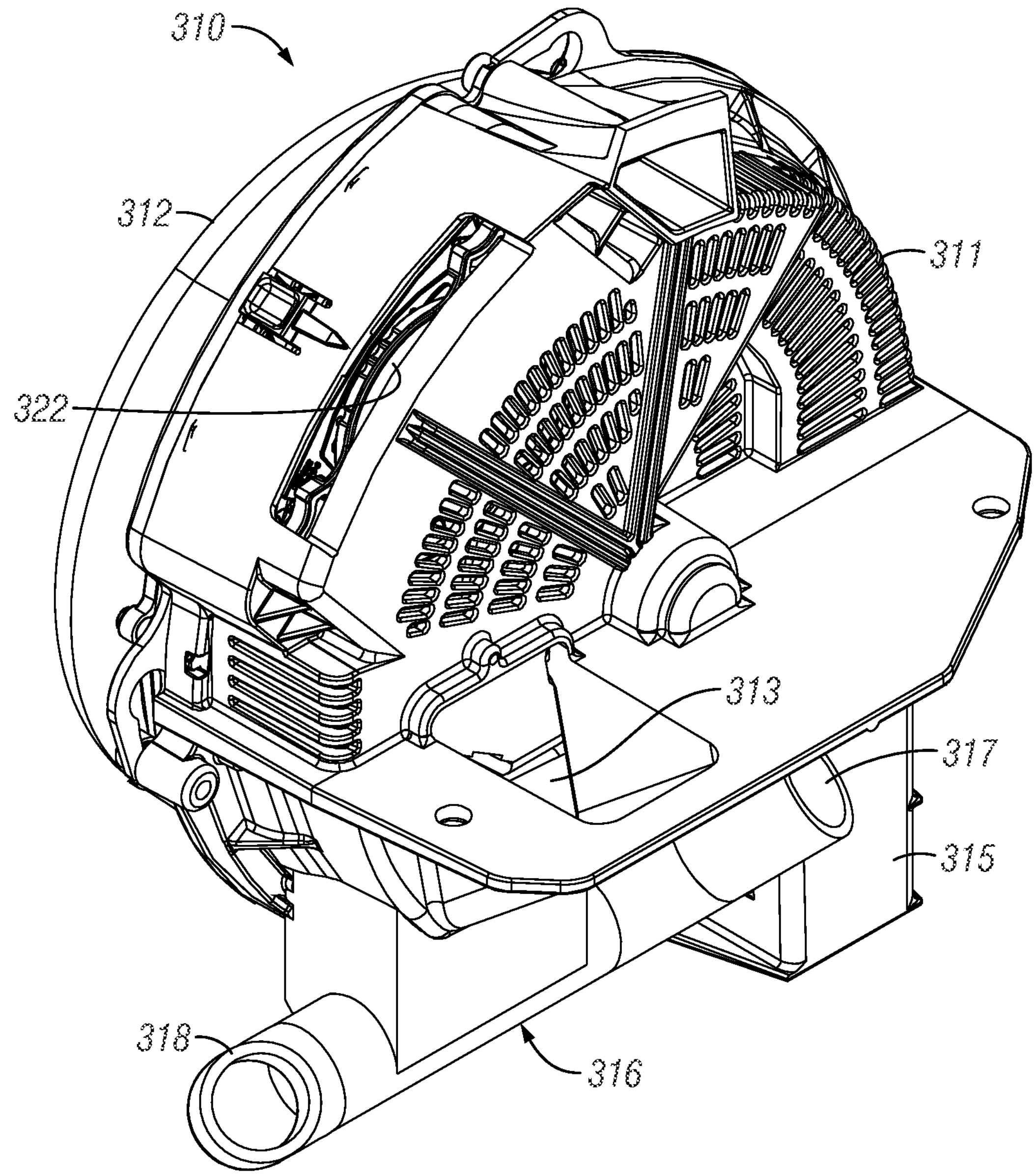

FIG. 60

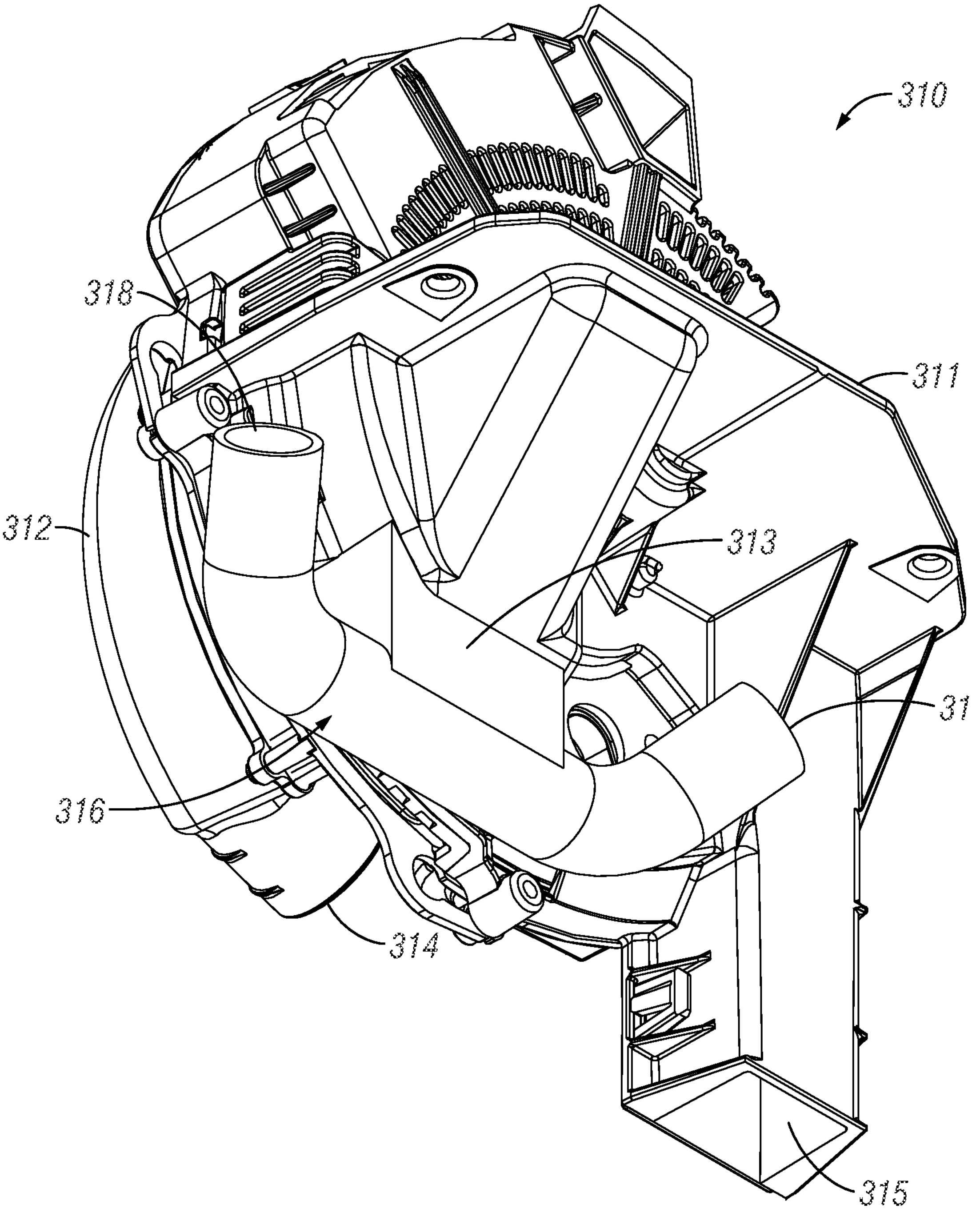

FIG. 61

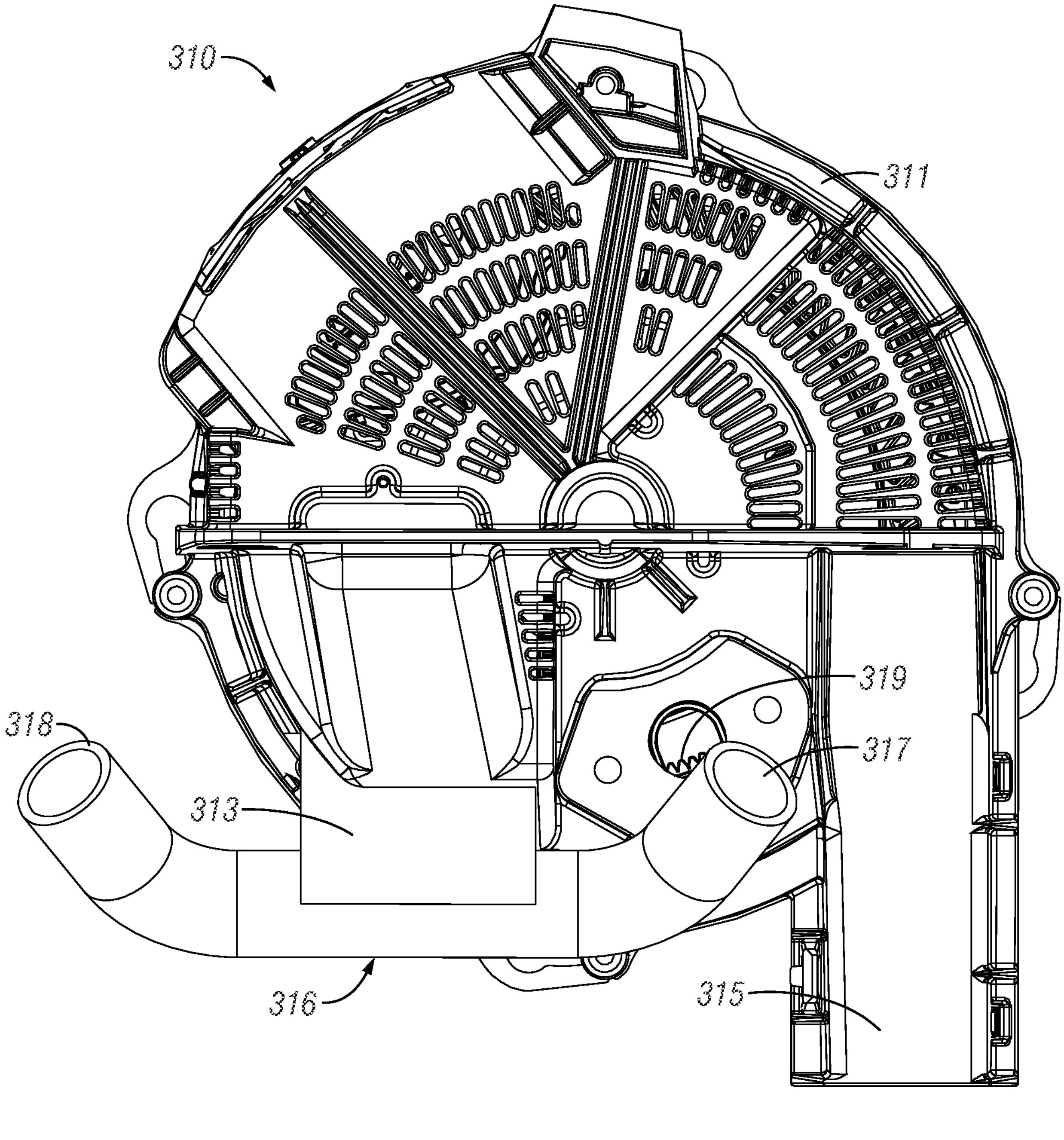

FIG. 62

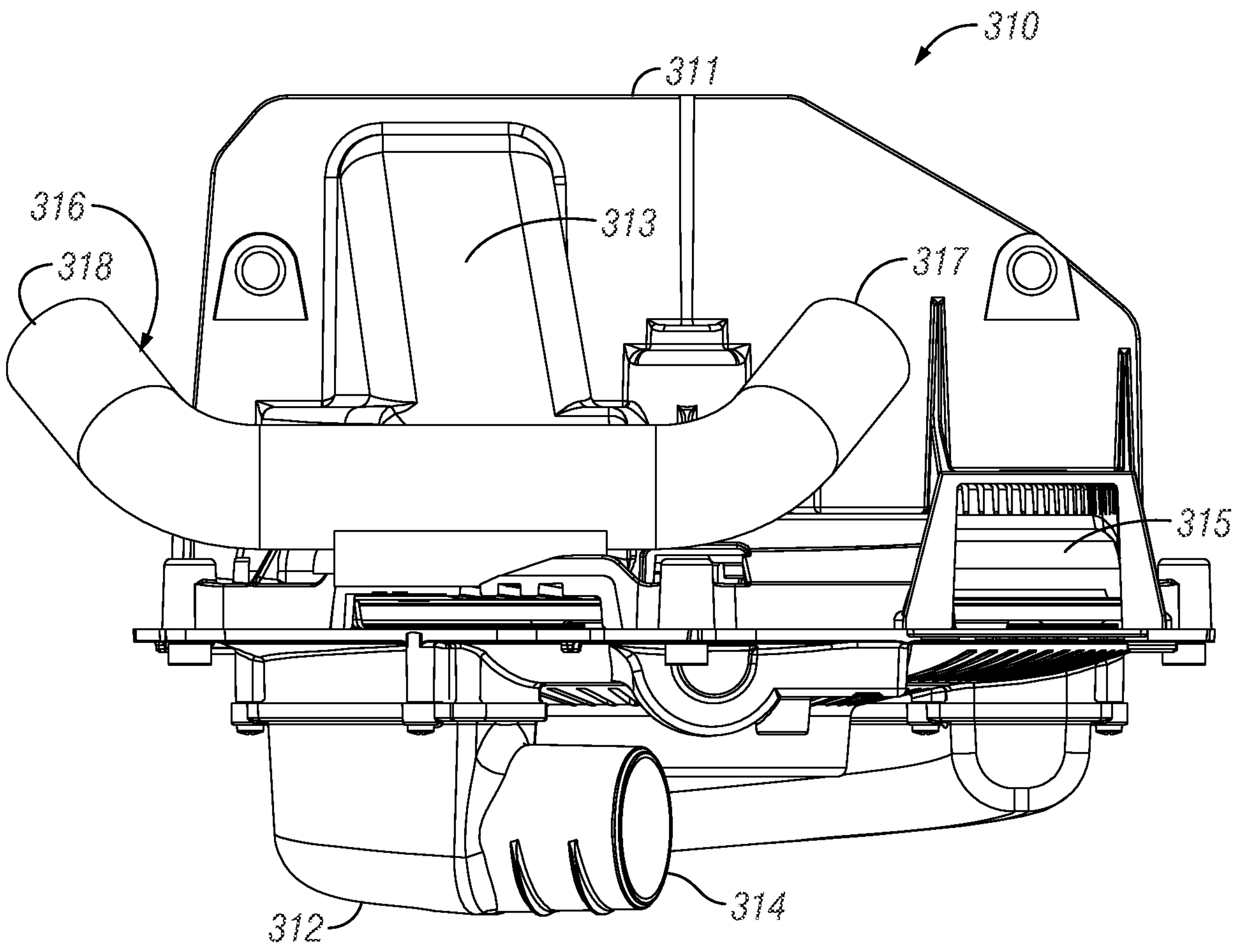

FIG. 63

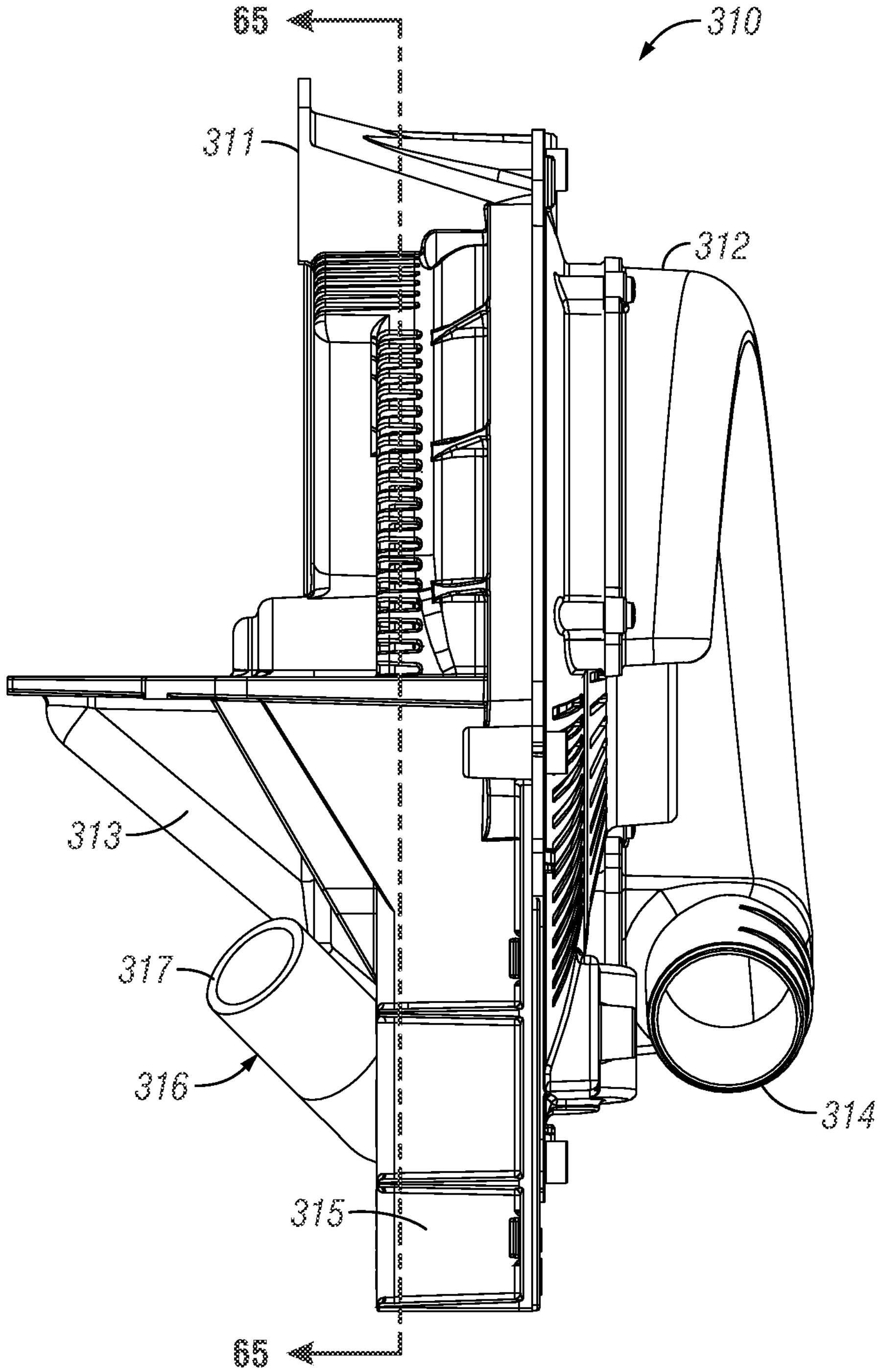

FIG. 64

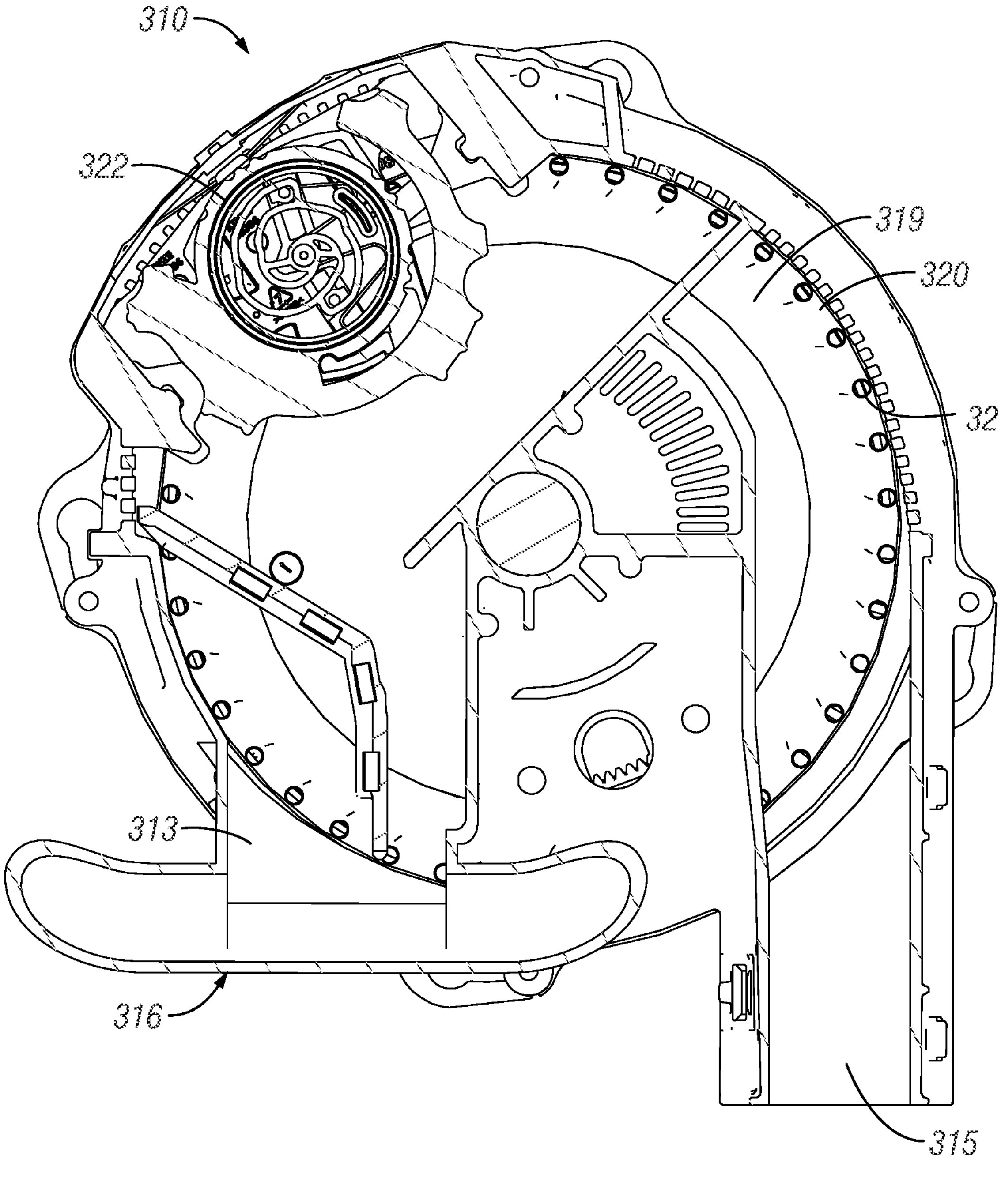

FIG. 65

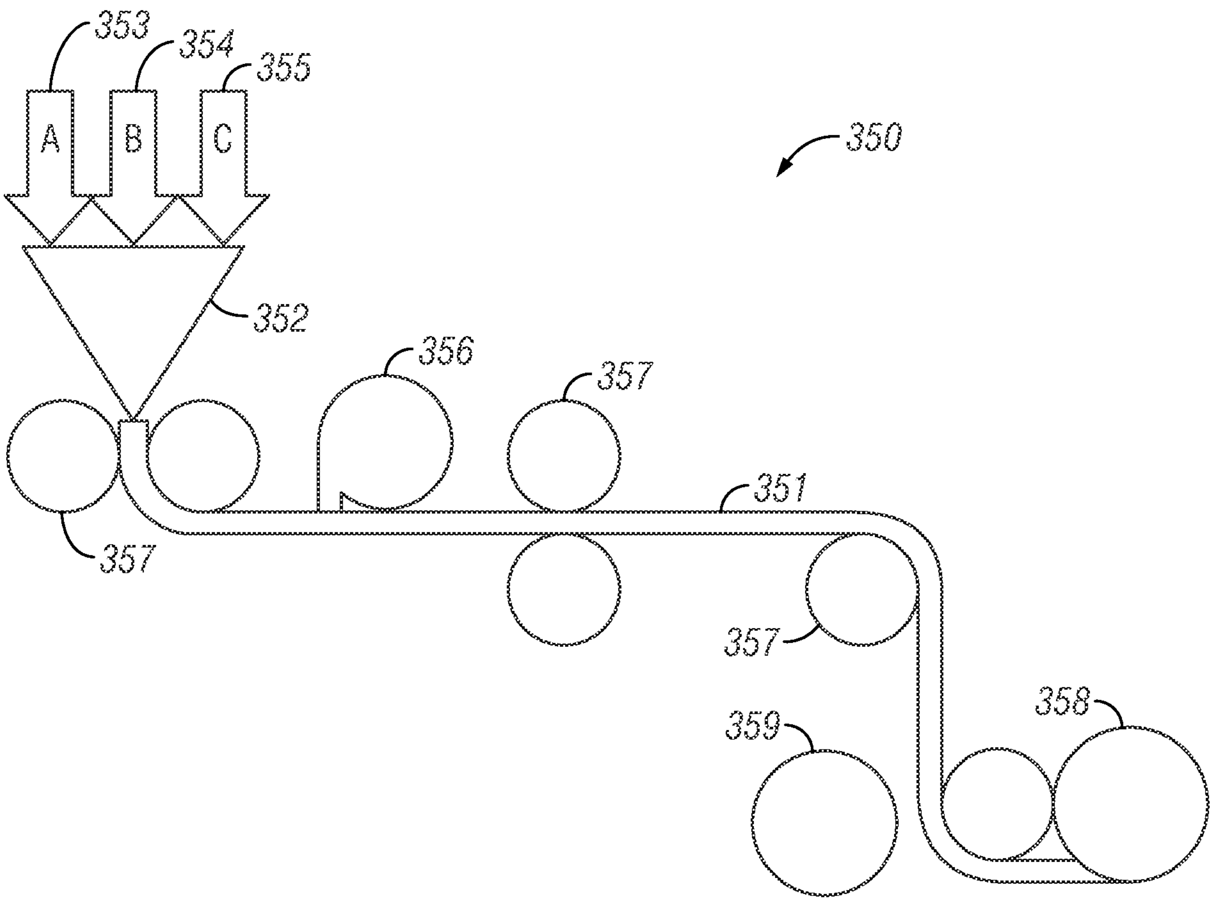

FIG. 66

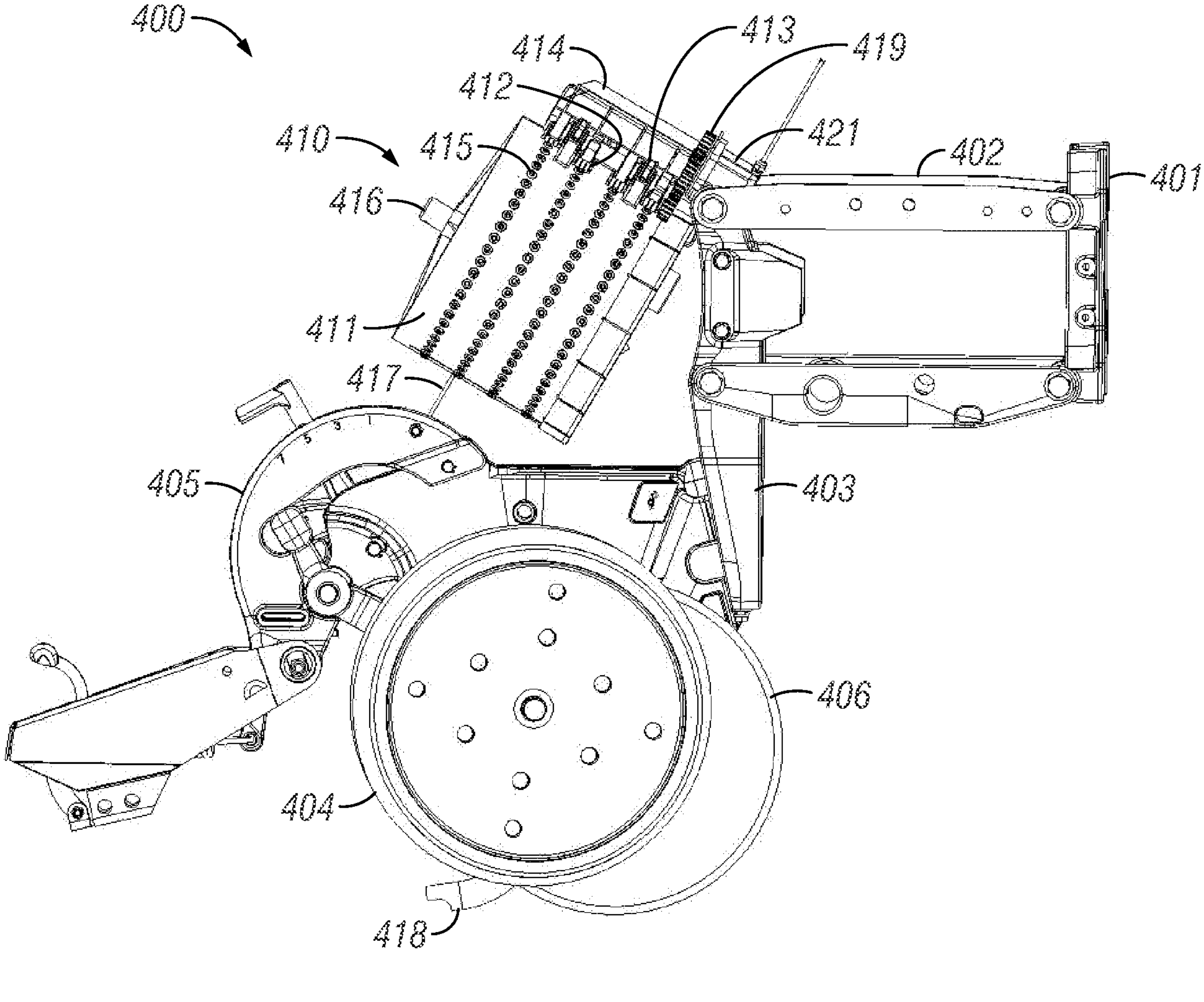
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FIG. 67

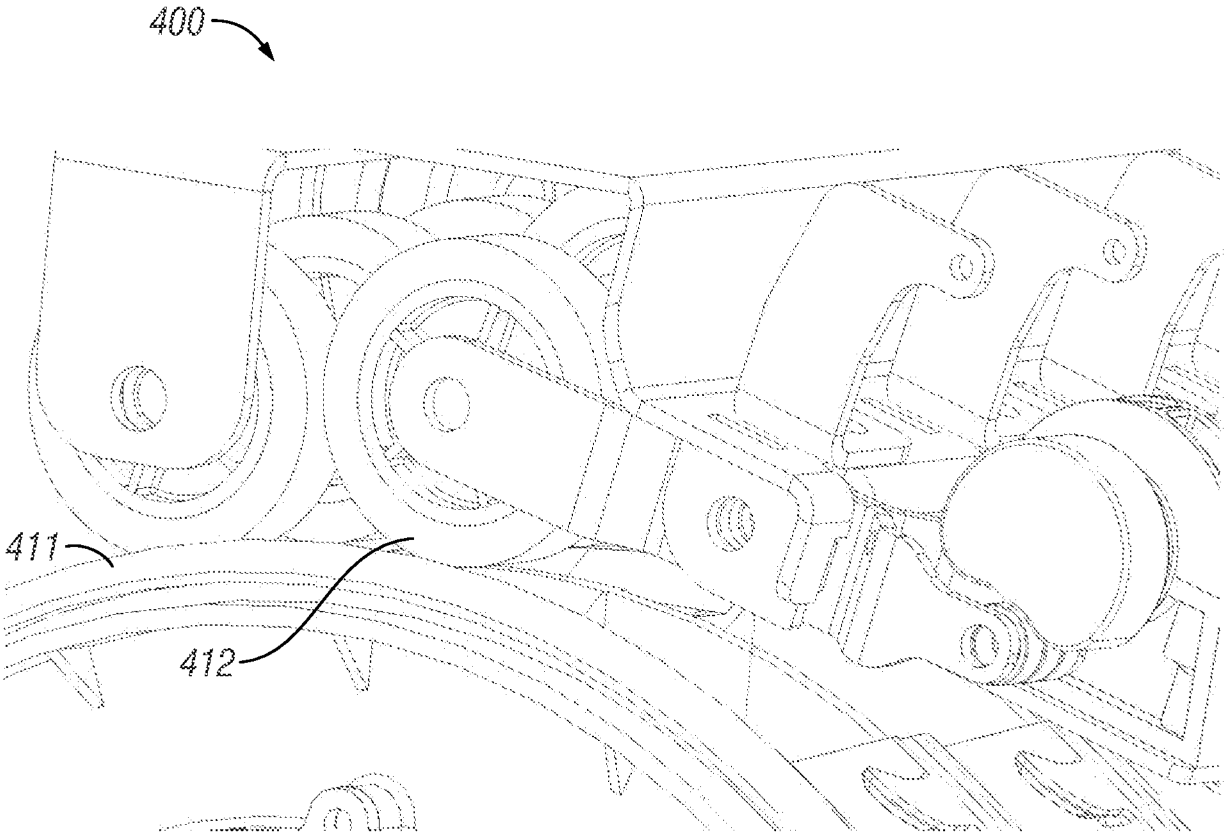

FIG. 68

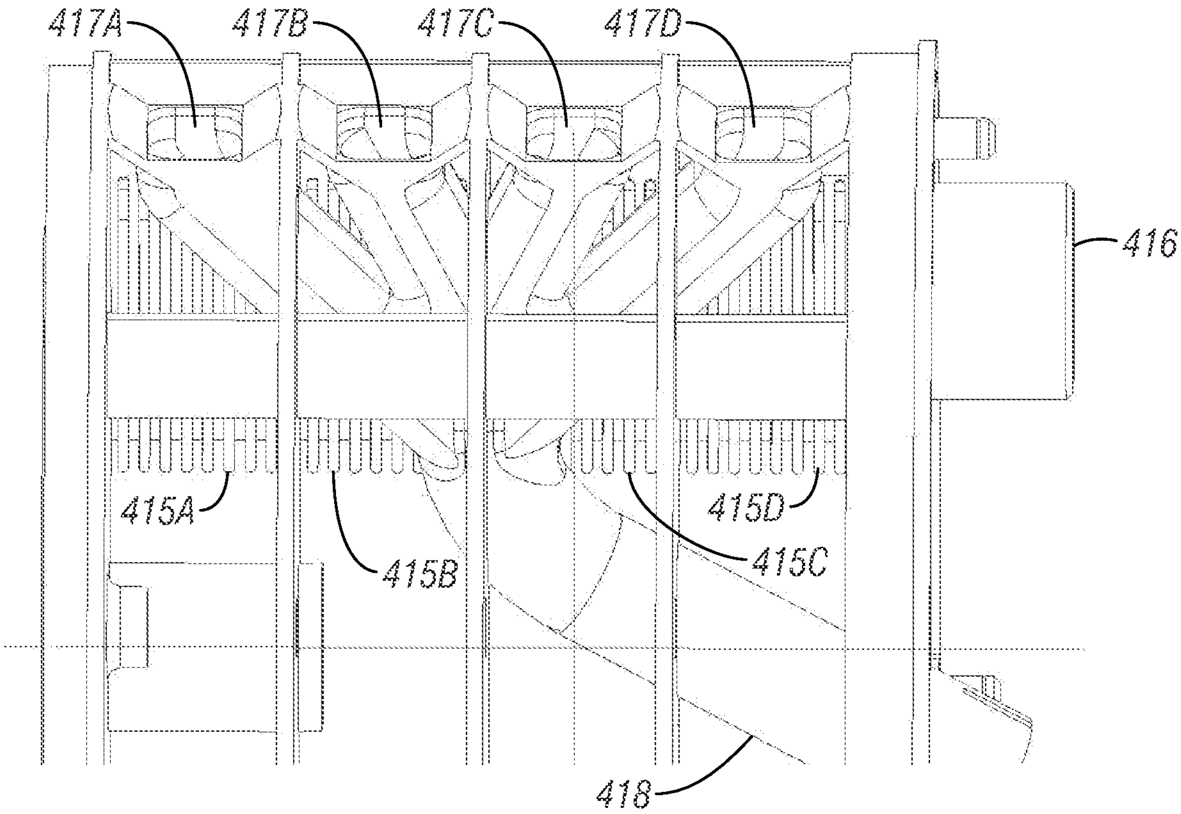

FIG. 69

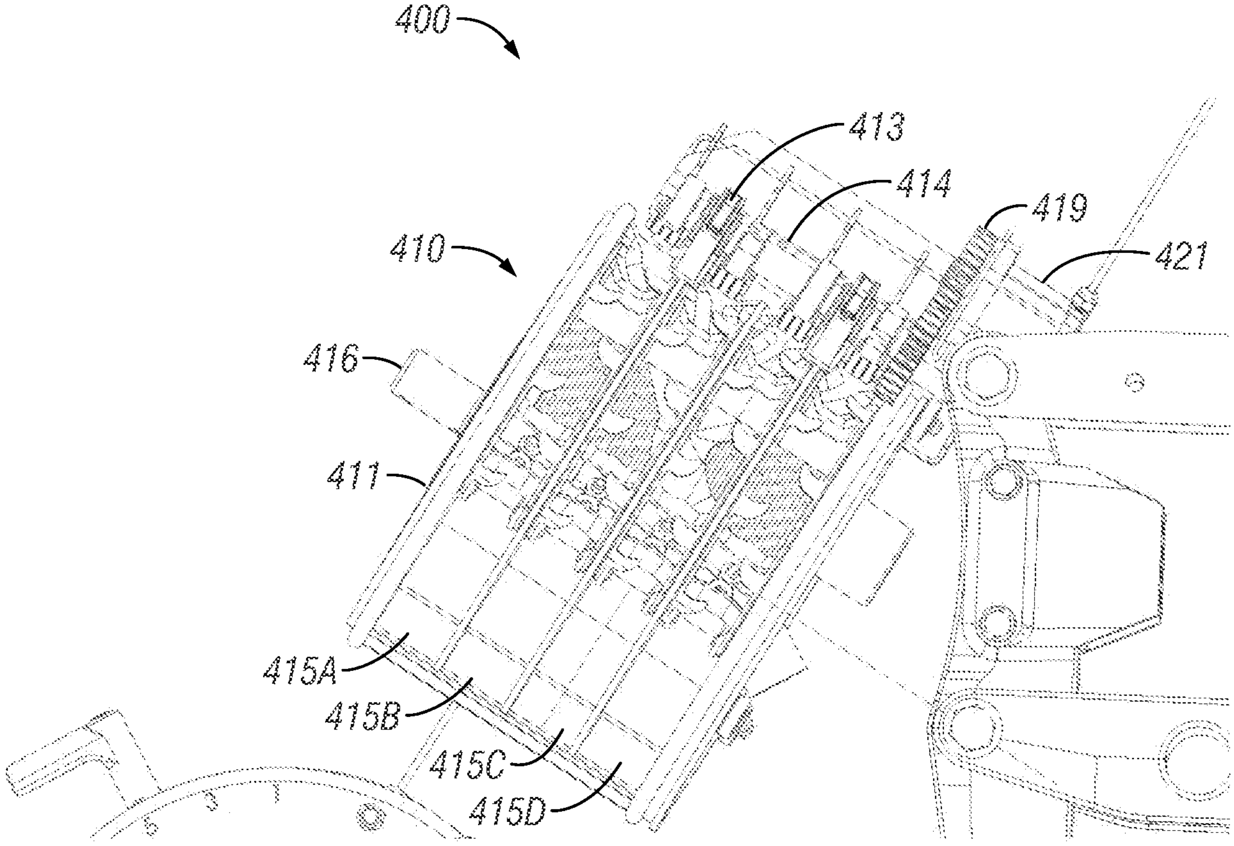

FIG. 70

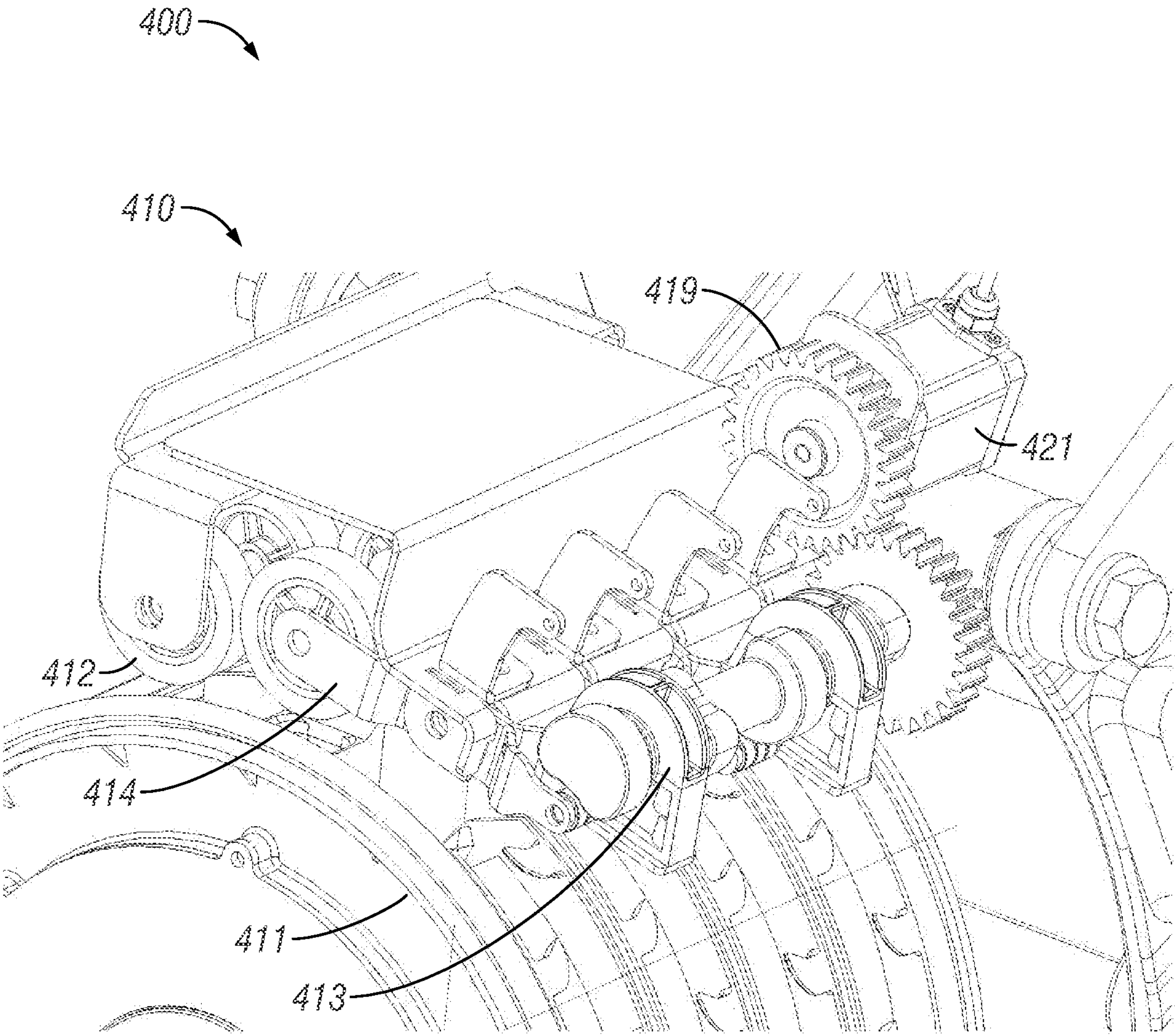

FIG. 71

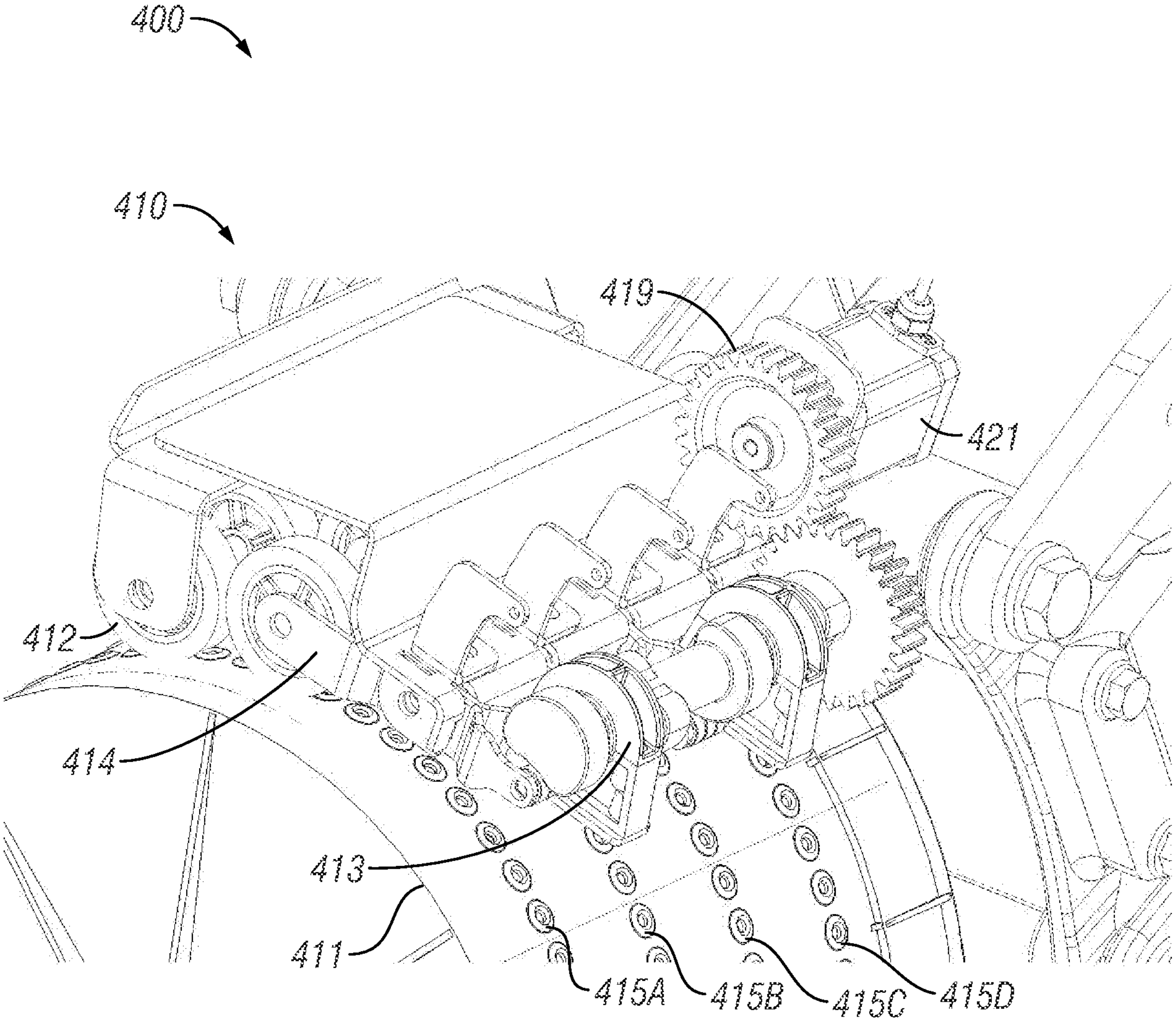

FIG. 72

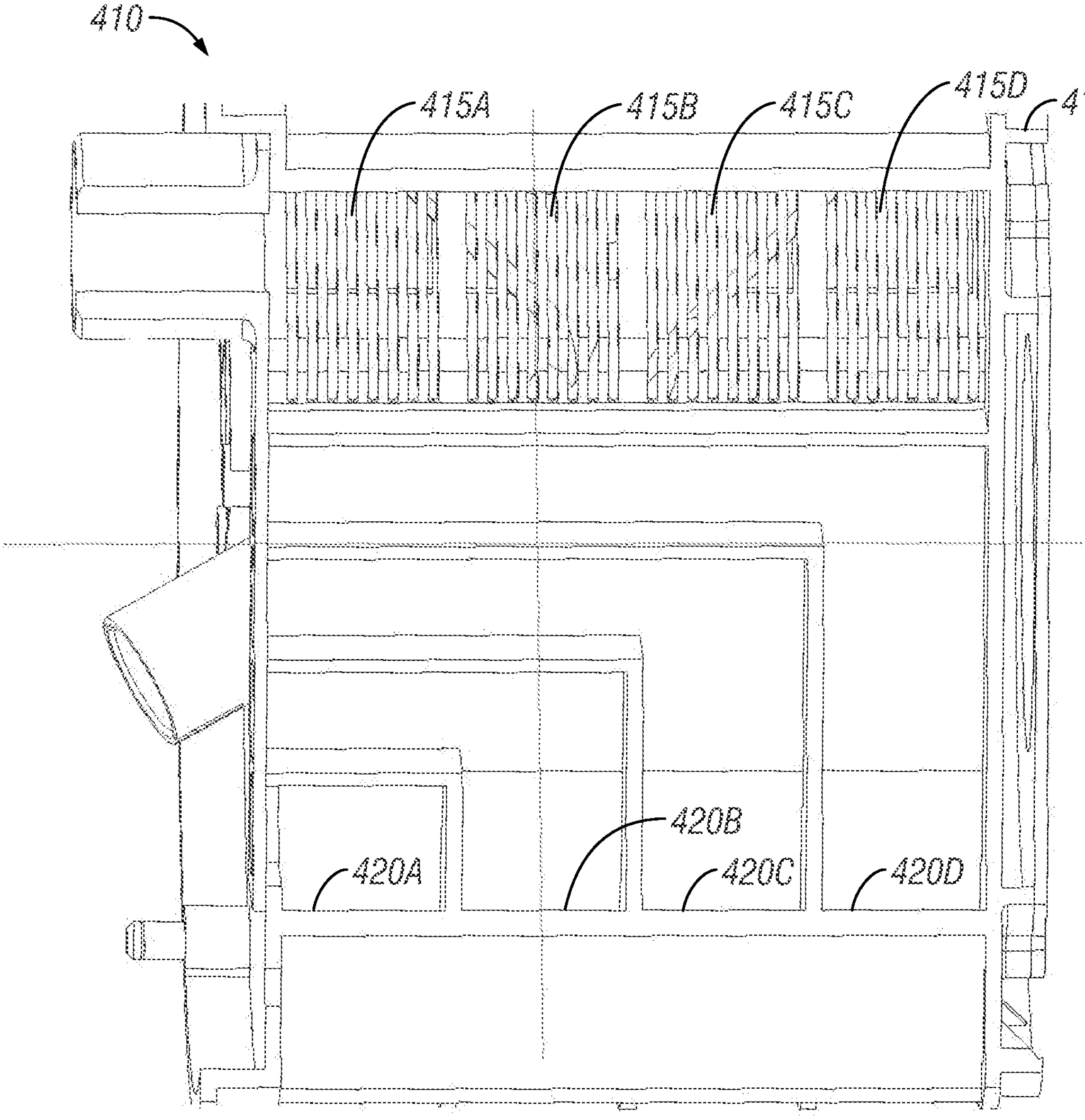

FIG. 73

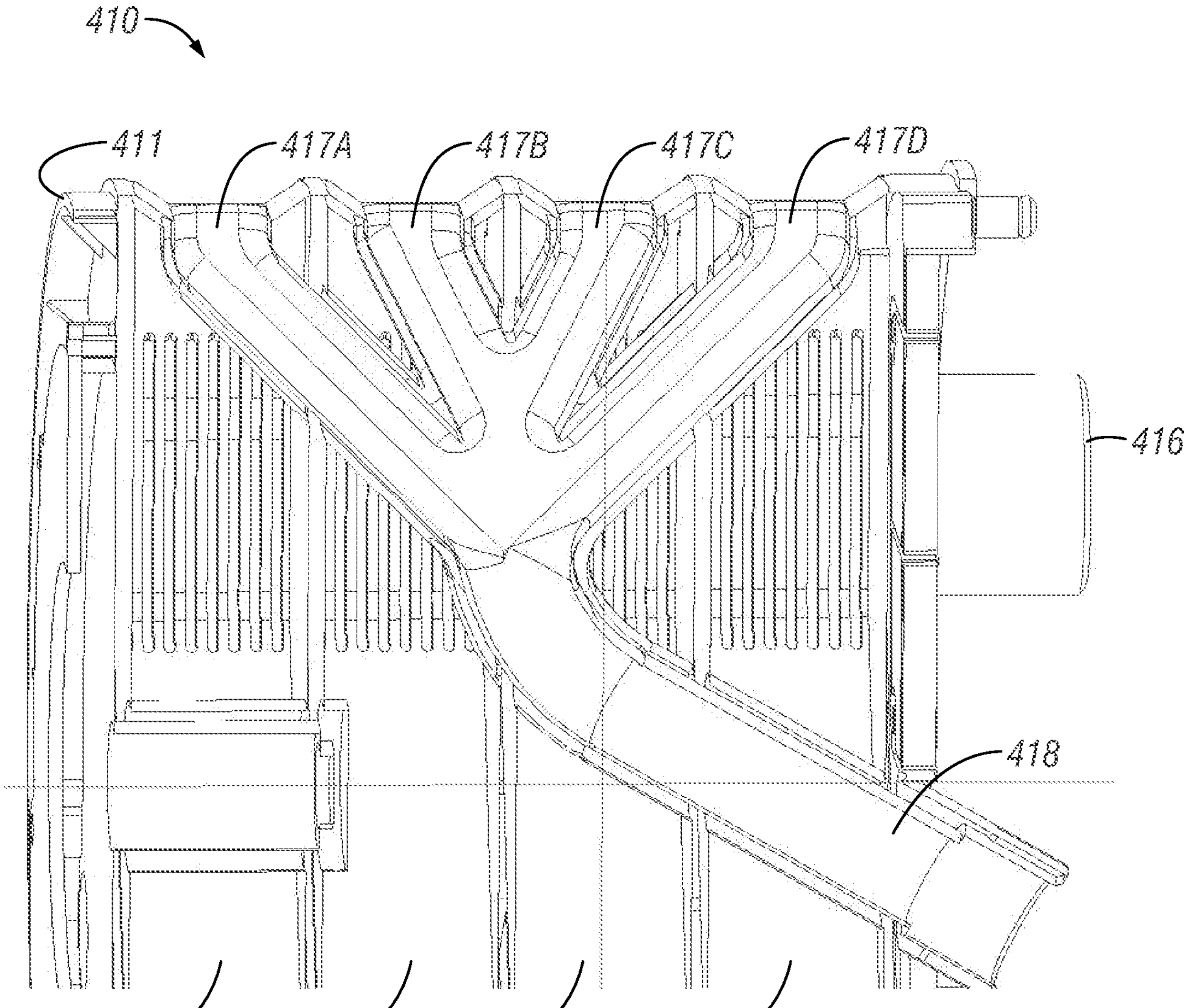

FIG. 74

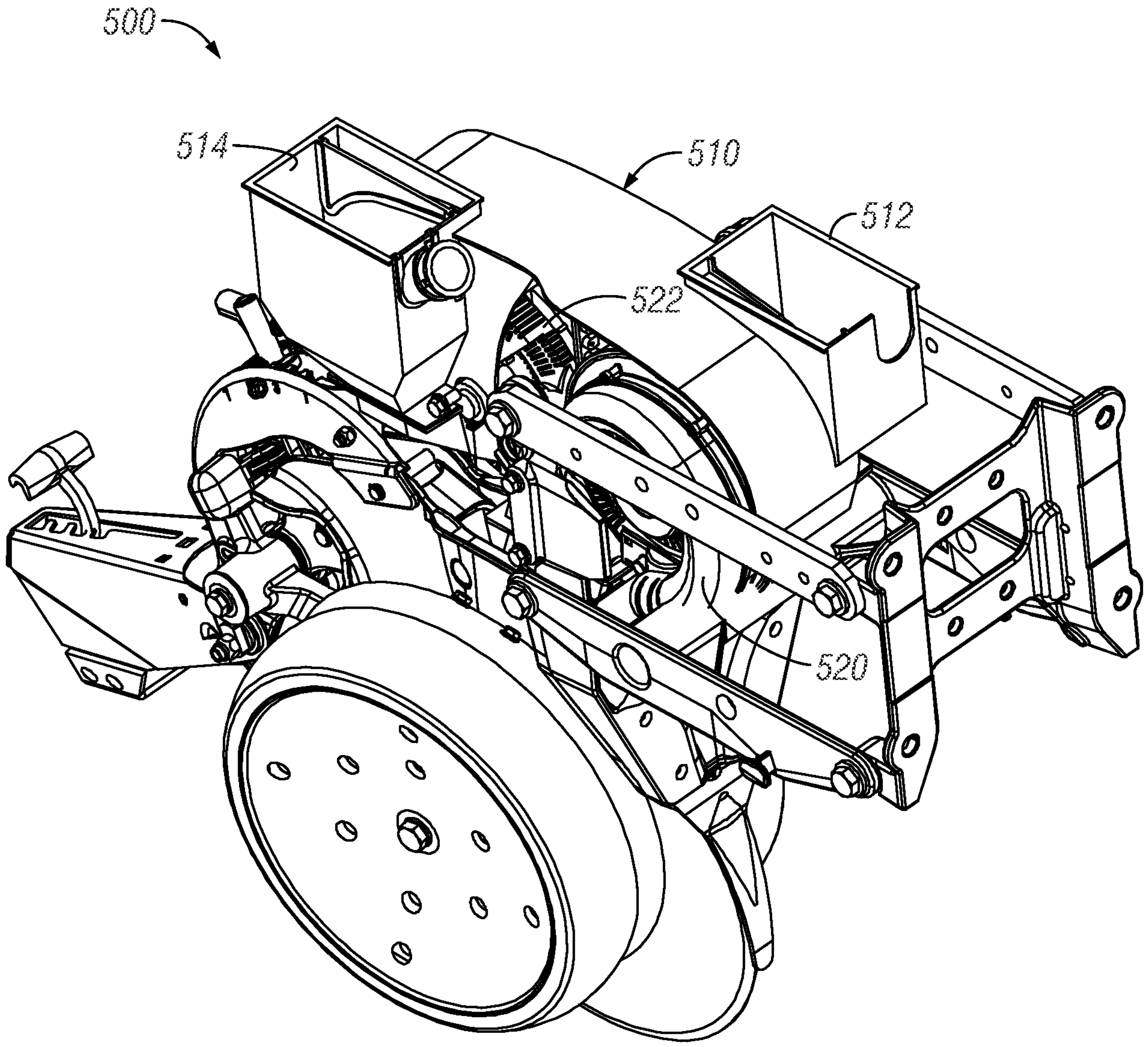

FIG. 75

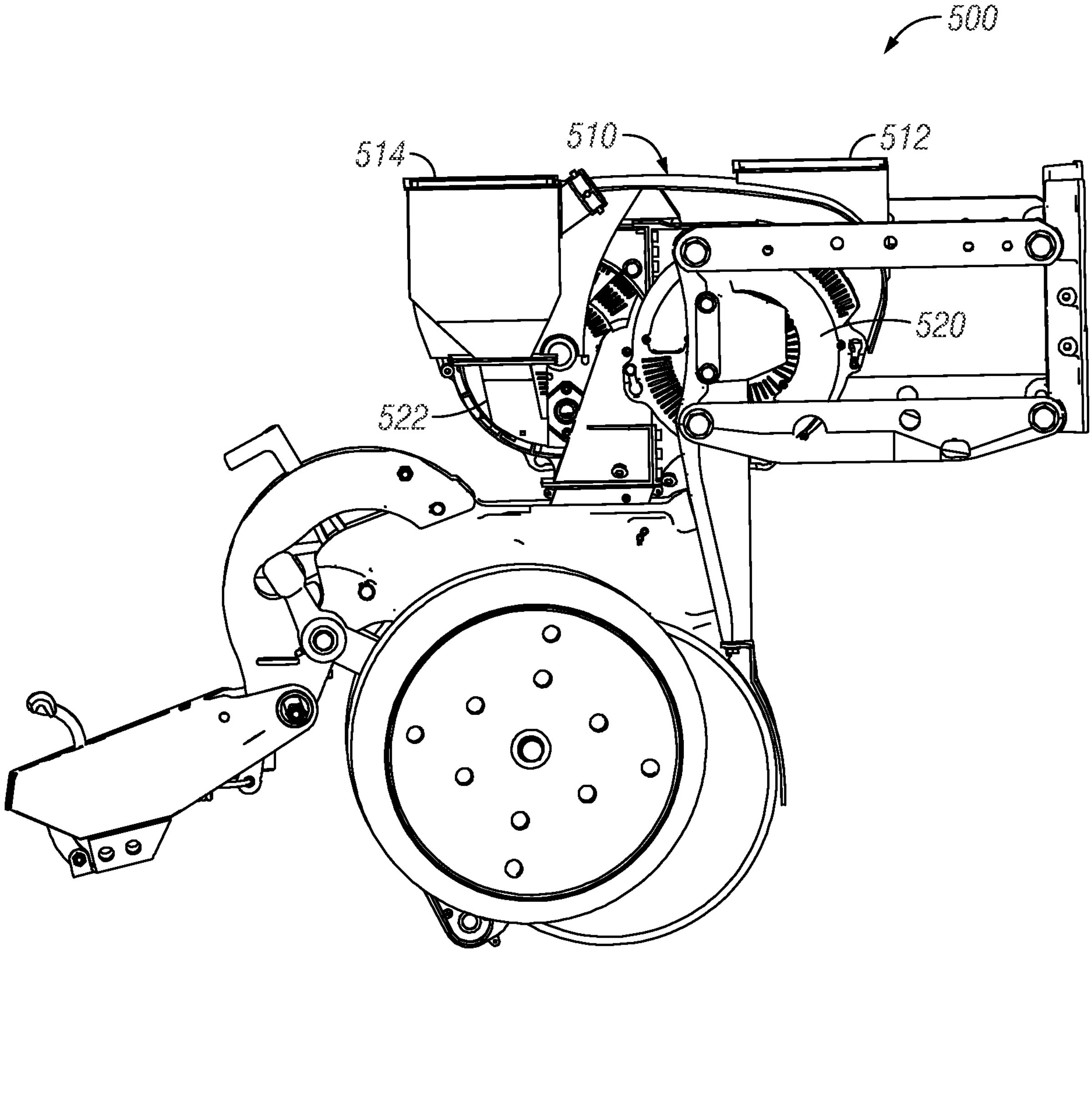

FIG. 76

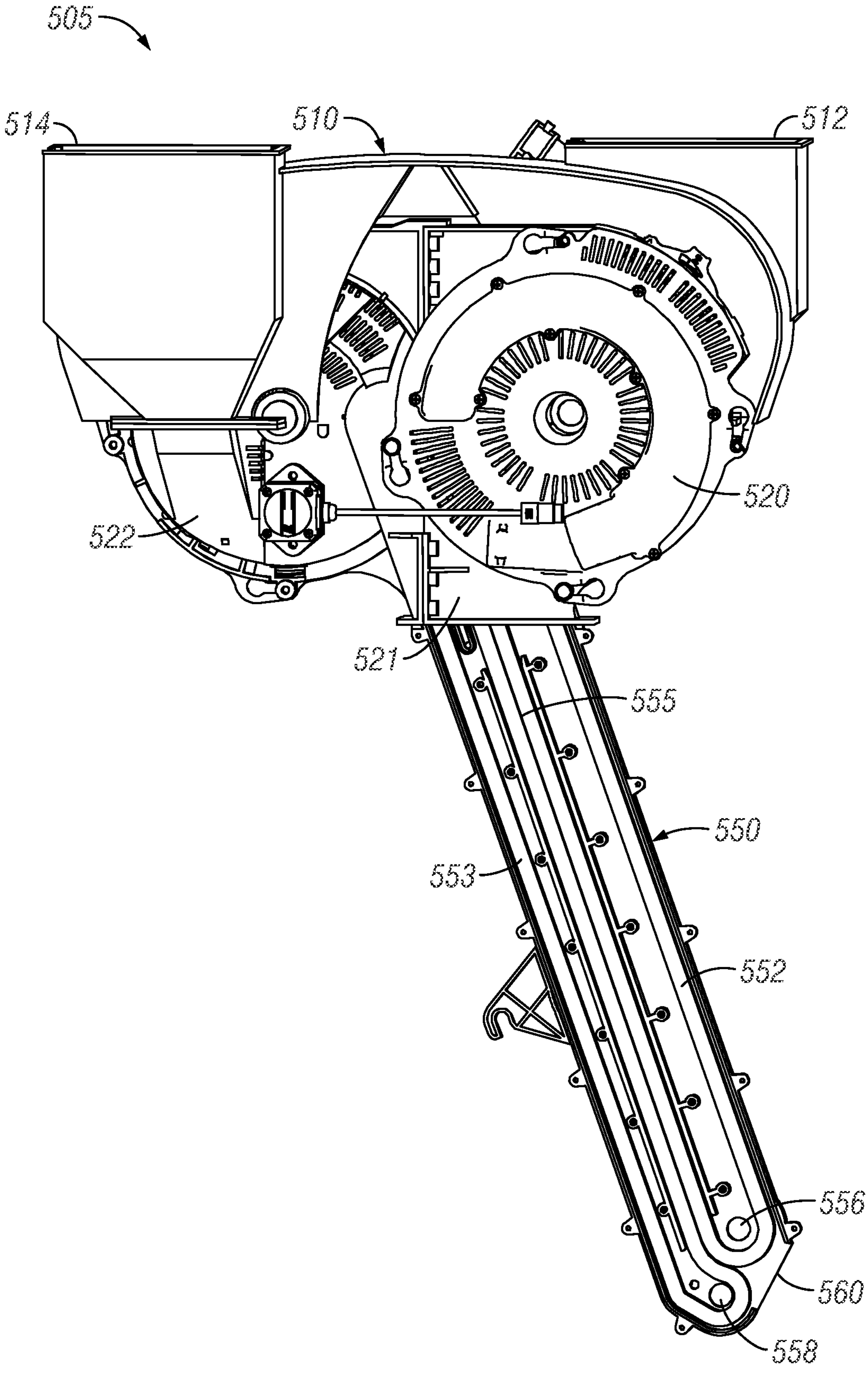

FIG. 77

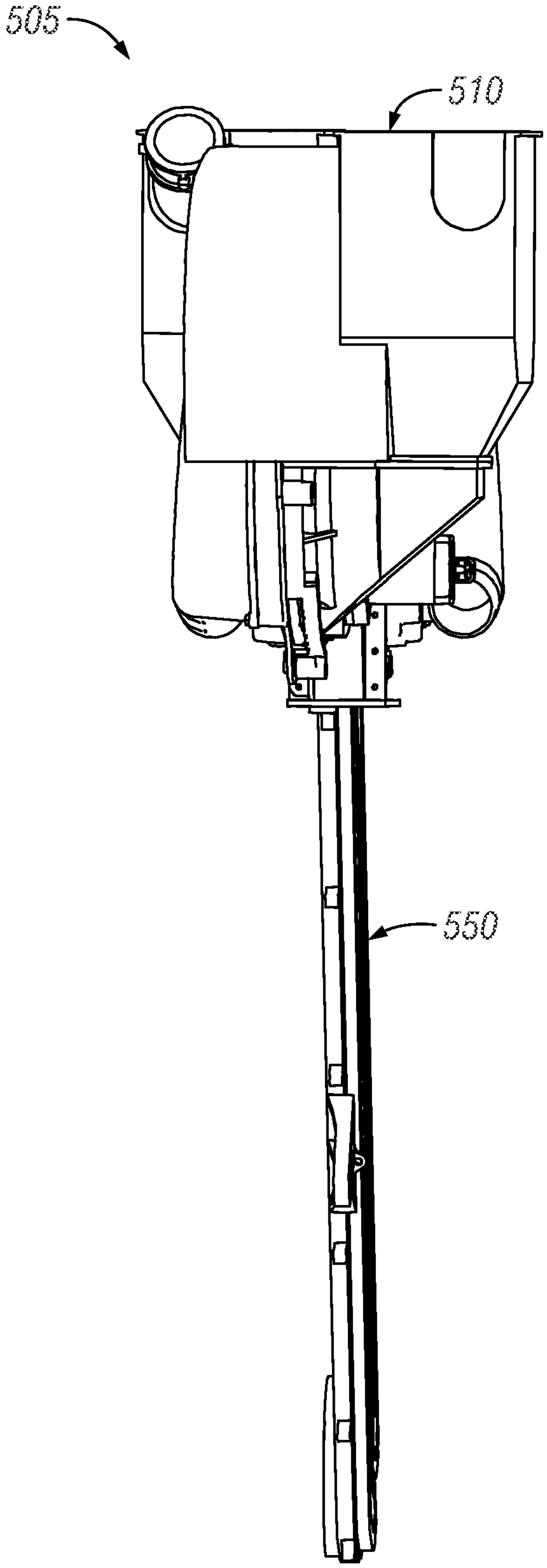

FIG. 78

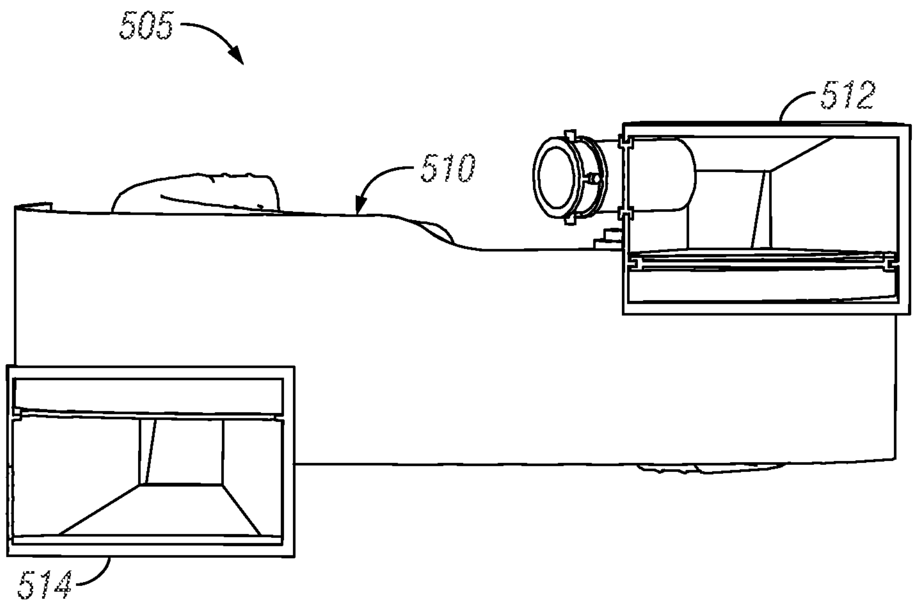

FIG. 79

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2014/054284

A. CLASSIFICATION OF SUBJECT MATTER
INV. A01C21/00 A01C7/04
ADD. A01C7/10

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
A01C A01B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2008/047475 A1 (STEHLING SAM [US] ET AL) 28 February 2008 (2008-02-28) figures 1-22,34-48 paragraphs [0003], [0005] - [0008], [0064] - [0070], [0073], [0075] - [0080], [0085], [0105] - [0109], [0111], [0115] - [0117] paragraph [0149]; claims 20,22	1-20
X	US 4 592 484 A (PREGERMAIN JACQUES [FR]) 3 June 1986 (1986-06-03)	9-12,14
A	figures 1,2 column 1, lines 43-49 column 2, lines 30-66 column 3, lines 23-31,40-43 column 3, line 48 - column 4, line 27	1-8, 15-18

-/--

[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
2 December 2014	18/12/2014

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Reininghaus, F

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2014/054284

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X A	EP 0 100 723 A1 (LACAILLE SA [FR]) 15 February 1984 (1984-02-15) figures 1-5 page 1, lines 5-10 page 3, lines 13-19 page 6, lines 3-12,19-30 page 7, line 31 - page 8, line 3 page 8, line 12 - page 9, line 24 -----	9-11,14 1-8, 15-18

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/US2014/054284

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