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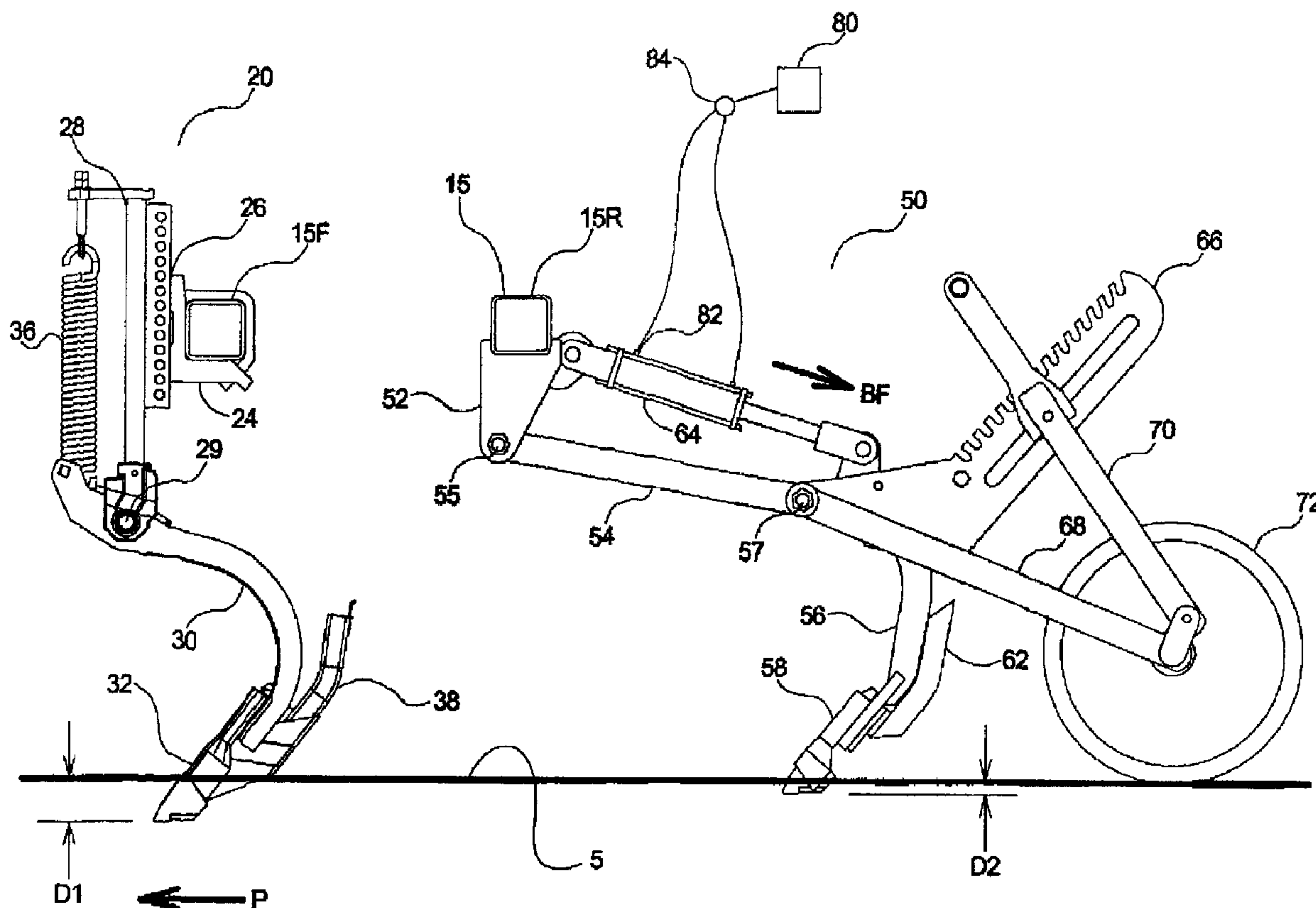
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(54) Titre : SEMOIR AVEC BRAS TIRE ET MACHINE MID ROW BANDER DU TYPE A HOUE

(54) Title: SEEDER WITH TRAILING ARM AND HOE-TYPE MID ROW BANDER



(57) Abrégé/Abstract:

A seeding and fertilizing apparatus comprises a plurality of seed assemblies each comprising a trailing arm pivotally connected at a front end thereof to the frame and a packer wheel rotatably attached to rear end thereof. A seed furrow opener is attached to the trailing arm ahead of the packer wheel which rolls along the seed furrow created by the opener. A vertical position of the seed furrow opener with respect to the packer wheel is adjustable, and a bias device is operative to exert a downward bias force on the

(57) **Abrégé(suite)/Abstract(continued):**

trailing arm. A plurality of fertilizer assemblies each comprises a fertilizer knife mounted to the frame such that a vertical position of the fertilizer knife with respect to the implement frame is adjustable. The seed assemblies and fertilizer assemblies are oriented laterally such that each fertilizer furrow is located between adjacent seed furrows.

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ABSTRACT

A seeding and fertilizing apparatus comprises a plurality of seed assemblies each comprising a trailing arm pivotally connected at a front end thereof to the frame and a
5 packer wheel rotatably attached to rear end thereof. A seed furrow opener is attached to the trailing arm ahead of the packer wheel which rolls along the seed furrow created by the opener. A vertical position of the seed furrow opener with respect to the packer wheel is adjustable, and a bias device is operative to exert a downward bias force on the trailing arm. A plurality of fertilizer assemblies each comprises a fertilizer knife mounted
10 to the frame such that a vertical position of the fertilizer knife with respect to the implement frame is adjustable. The seed assemblies and fertilizer assemblies are oriented laterally such that each fertilizer furrow is located between adjacent seed furrows.

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SEEDER WITH TRAILING ARM AND HOE-TYPE MID ROW BANDER

This invention relates to agricultural implements and more specifically to a seeding apparatus for one pass seeding and fertilizing.

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BACKGROUND

Air seeders typically comprise two or more product tanks, for carrying granular agricultural products such as seed and fertilizer, mounted on a wheeled frame assembly.

10 A fan creates an air stream to distribute the agricultural products to furrow openers and into the soil. Modern air seeders are known that simultaneously place seed and fertilizer in the soil of a field without tillage such that a field can be seeded and fertilized in a single pass.

15 It is generally accepted certain types of fertilizer can be mixed with seed and placed in the same furrow, but for the higher rates and fertilizer types commonly used, it is required to provide some separation between the seed and fertilizer. Fertilizer that is placed too near the seed can damage the seed and reduce crop yield and quality, particularly with more sensitive seeds, in particular soil types and in dry soil conditions.

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Common air seeder equipment is designed to place the seed and the fertilizer in different locations within essentially the same furrow, or in separate furrows that are not much more than one inch apart. A furrow opener apparatus can be mounted on the bottom end of a single shank to deliver seed and fertilizer into separate furrows, as is disclosed for
5 example in United States Patent Numbers 6,640,731 to Rowlett et al., and 6,457,426 to Cruson. Alternatively, a fertilizer furrow opener can be mounted on the bottom of one shank, with a seed furrow opener mounted at the bottom of a separate shank that is operated in close lateral proximity as disclosed for example in United States Patent Numbers 5,396,851 and 5,331,907 to Beaujot, and 6,142,085 to Drever et al. The
10 seeders of Beaujot and Drever include a trailing arm with separate shanks for the seed and fertilizer furrow openers extending down from the arm. A wheel on the rear end of the trailing arm packs the furrow and controls the depth of the fertilizer and seed furrow openers.

15 A problem with these types of systems is that in certain soil & moisture conditions, for example drier clay soils that tend to lump, it is very difficult to achieve separation of seed and fertilizer when the seed and fertilizer rows are in such close proximity. Often, some of the seed falls into the fertilizer furrow where same can be damaged. To avoid this problem, air seeders have been developed that place the fertilizer furrow about midway
20 between the seed furrows, instead of closely adjacent to each seed furrow. An entirely separate furrow opener assembly including a shank, trip mechanism etc. is used for each

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seed furrow opener and for each fertilizer furrow opener. The furrow opener assemblies are spaced laterally along the frame at a desired spacing, and seed and fertilizer are directed into appropriate ones of the furrow opener assemblies to achieve the desired spacing and orientation of the seed and fertilizer in the soil.

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Such an air seeder is disclosed for example in United States Patent Number 6,216,616 to Bourgault. The Bourgault apparatus uses coulter disc type fertilizer furrow opener assemblies that create furrows mid way between adjacent pairs of furrows opened by coulter disc type seed furrow opener assemblies. The disclosed apparatus uses the same
10 type of furrow opener assemblies for depositing both seed and fertilizer and does not allow independent adjustment of the seed placement openers nor does it allow independent depth control of each seed assembly during operation.

15 **SUMMARY OF THE INVENTION**

It is an object of the present invention to provide a seeding and fertilizing apparatus that overcomes problems in the prior art.

20 In a first embodiment the invention provides a seeding and fertilizing apparatus comprising an implement frame mounted on wheels for travel over the ground in an

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operating travel direction. A plurality of seed assemblies are attached to the implement frame, each seed assembly comprising a trailing arm pivotally connected at a front end thereof to the frame about a substantially horizontal front arm axis oriented substantially perpendicular to the operating travel direction, a seed furrow opener attached to the
5 trailing arm and operative to create a seed furrow when a bottom end thereof is engaged in the ground, a packer wheel rotatably attached to the trailing arm rearward of the seed furrow opener and oriented to roll substantially along the seed furrow wherein a vertical operating position of the seed furrow opener with respect to the packer wheel is adjustable to vary a depth of the seed furrow, and a bias device operative to exert a
10 downward bias force on the trailing arm, seed furrow opener, and packer wheel. A plurality of fertilizer assemblies each comprises a fertilizer knife mounted to the fertilizer assembly and operative to create a fertilizer furrow when engaged in the ground. The fertilizer knives and seed furrow openers are movable from a transport position above the ground to a lowered operating position wherein the fertilizer knives and seed furrow
15 openers are engaged in the ground, and the seed assemblies and fertilizer assemblies are oriented laterally on the implement frame such that in operation each fertilizer furrow is located between adjacent seed furrows.

In a second embodiment the invention provides a method of seeding and fertilizing a field
20 comprising providing an implement frame mounted on wheels for travel over the ground in an operating travel direction; attaching a plurality of seed assemblies to the implement

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frame, each seed assembly comprising a trailing arm pivotally connected at a front end thereof to the frame about a substantially horizontal front arm axis oriented substantially perpendicular to the operating travel direction, a packer wheel rotatably attached to rear end of the trailing arm, a seed furrow opener attached to the trailing arm ahead of the

5 packer wheel and operative to create a seed furrow when a bottom end thereof is engaged in the ground, the seed furrow opener oriented such that the packer wheel rolls substantially along the seed furrow, and a bias device operative to exert a downward bias force on the trailing arm when the trailing arm is in the operating position; adjusting a vertical position of the seed furrow opener to a desired position with respect to the packer

10 wheel; mounting a plurality of fertilizer assemblies to the frame, each fertilizer assembly comprising a fertilizer knife operative to create a fertilizer furrow when engaged in the ground; orienting the seed assemblies and fertilizer assemblies laterally on the implement frame such that in operation each fertilizer furrow is located between adjacent seed furrows; moving the seed furrow openers and fertilizer knives down from a transport

15 position above the ground to a lowered operating position wherein the fertilizer knives and seed furrow openers are engaged in the ground; moving the implement frame across the field in the operating travel direction and depositing fertilizer into the fertilizer furrows and depositing seed into the seed furrows ahead of the packer wheel.

20 According to the present invention there are provided a number of fertilizer placement openers and a plurality of trailing arm seed placement openers that attach to a frame of a

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planting apparatus. The planting apparatus can be used in one pass seeding to place both seed and fertilizer in a field in a single pass. The seed placement openers are positioned so that furrows created by the seed placement openers are parallel at substantially regular intervals. The fertilizer placement openers are positioned on the frame such that furrows
5 created by the fertilizer placement openers are positioned about mid-way between adjacent pairs of seed furrows created by the seed placement openers.

Fertilizer placement openers are adjustably connected to the frame of the planting apparatus and comprise a knife to create a furrow in a ground surface the planting
10 apparatus is traveling across. Fertilizer is provided by the planting apparatus to a fertilizer feed located just behind the knife to dispense fertilizer into the furrow opened by the knife. The fertilizer is typically, supplied from holding tanks on the planting apparatus to the fertilizer feed through the use of tubes or conduits and can be a liquid type of fertilizer or a granular type of fertilizer.

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Seed placement openers are adjustably connected to the frame of the packer apparatus and comprise a trailing arm with a seed dispensing furrow opener mounted thereon that creates a furrow in a ground surface the planting apparatus is traveling across, and a packer wheel mounted on the rear end of the trailing arm. Through the adjustment of the
20 height of packer wheel in relation to the seed furrow opener, the depth the seed furrow opener penetrates the ground surface can be adjusted. Because the packer wheel sets the

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depth the seed furrow opener penetrates the ground surface, this depth of penetration is largely independent from the vertical height of the frame of the planting apparatus and variations in the vertical height of the frame when the planting apparatus is moving over an uneven ground surface. The depth of seed placement in each row remains consistent
5 where the packer wheel which controls the operating depth of the seed furrow opener is located in close proximity to the seed furrow opener.

Seed is typically provided from a holding tank on the planting apparatus through a tube or conduit to the seed furrow opener to be placed in the furrow created by the seed furrow
10 opener.

The invention allows for the individual adjustment of the depth of each furrow created by either a fertilizer placement opener or a seed placement opener, allowing an operator of the planting apparatus to tailor a one pass seeding and initial fertilizing of a field to the
15 conditions of the field, and type of crop that will be seeded.

A parallel linkage trailing arm can conveniently provide improved consistency of seed furrow depth.

20 **DESCRIPTION OF THE DRAWINGS:**

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While the invention is claimed in the concluding portions hereof, preferred embodiments are provided in the accompanying detailed description which may be best understood in conjunction with the accompanying diagrams where like parts in each of the several diagrams are labeled with like numbers, and where:

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Fig. 1 is a schematic side view of an embodiment of the present invention showing a fertilizer assembly and a seed assembly attached to a frame;

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Fig. 2 is a front view of a number of the fertilizer assemblies and seed assemblies as shown in Fig. 1, attached to a section of a frame of a planting apparatus; and

Fig. 3 is a perspective view of the fertilizer and seed assemblies as shown in Fig. 2;

15

Fig. 4 schematically illustrates the movement of the seed furrow opener with respect to the ground as the frame moves up and down with respect to the ground;

Fig. 5 is a schematic side view of an alternate embodiment of the invention showing fertilizer and seed assemblies mounted to a frame, and shown in the operating position;

20

Fig. 6 is a schematic side view of the embodiment of Fig. 5 showing fertilizer and seed assemblies in the transport position;

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fertilizer hoe or knife 32 is mounted to the knife shank 30. The fertilizer knife 32 creates a fertilizer furrow in a ground surface 5 when the fertilizer placement opener 20 is moving in a direction of travel P. A fertilizer feed 38 is mounted behind fertilizer knife 32. The fertilizer feed 38 receives fertilizer from a supply via a conduit or hose (not shown) and dispenses it into the fertilizer furrow opened by the fertilizer knife 32.

The illustrated height adjustable connection 26 comprises a series of apertures in the elongate member 28 such that same can be moved vertically in relation to the mounting bracket 24 and fixed in place by inserting an adjustment bolt or pin into one of the apertures to fix the elongate member 28 in place in relation to the mounting bracket 24. By using the height adjustable connection 26, a depth D1 the fertilizer knife 32 penetrates the ground surface 5 can be either increased or decreased. The depth D1 can also be varied by raising or lowering wheels supporting the frame 15, such that the frame and fertilizer knife 32 move up or down with respect to the ground surface 5. The fertilizer knife 32 is biased to the illustrated operating position by a knife biasing device 36 which is typically, but not necessarily an extension spring. An alternate embodiment described below for example uses a hydraulic cylinder biasing device.

The seed assembly 50 comprises a mounting bracket 52 attached to the frame 15. A front end of an elongate bracing member, trailing arm 54, is pivotally attached to the frame 15 by the mounting bracket 52 using an arm pin 55 such that the trailing arm 54

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The foregoing is considered as illustrative only of the principles of the invention. Further, since numerous changes and modifications will readily occur to those skilled in the art, it is not desired to limit the invention to the exact construction and operation shown and described, and accordingly, all such suitable changes or modifications in
5 structure or operation which may be resorted to are intended to fall within the scope of the claimed invention.

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extend and retract in response to forces exerted on the trailing arm, and operative, when connected to a second port of the hydraulic cylinder, to raise the trailing arm to a transport position.

29. The method of any one of Claims 16 – 28 wherein at least one trailing arm comprises a parallel linkage operative to maintain the knife and packer wheel at substantially constant vertical positions with respect to each other as the trailing arm moves up and down.

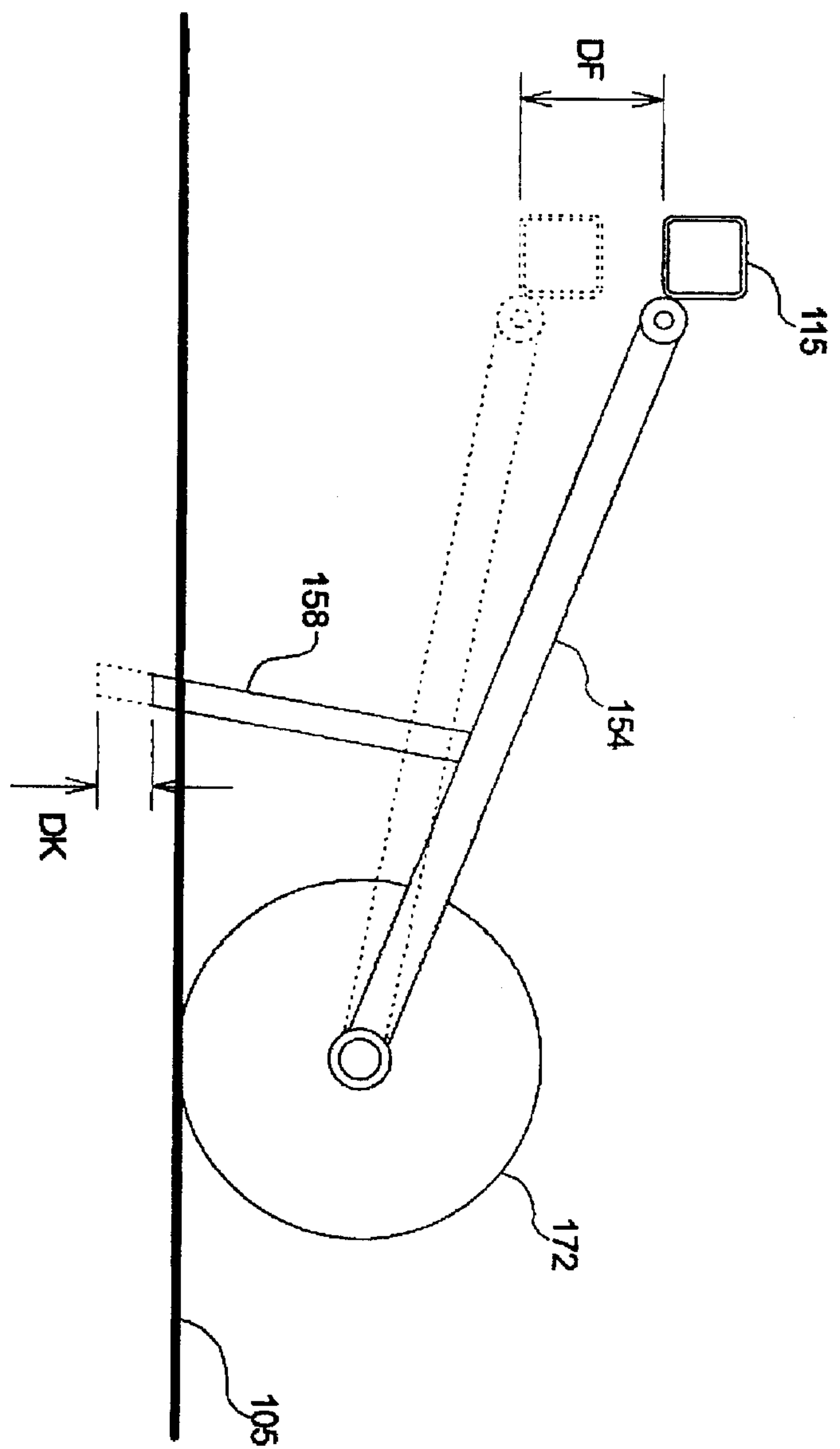


Fig. 4

