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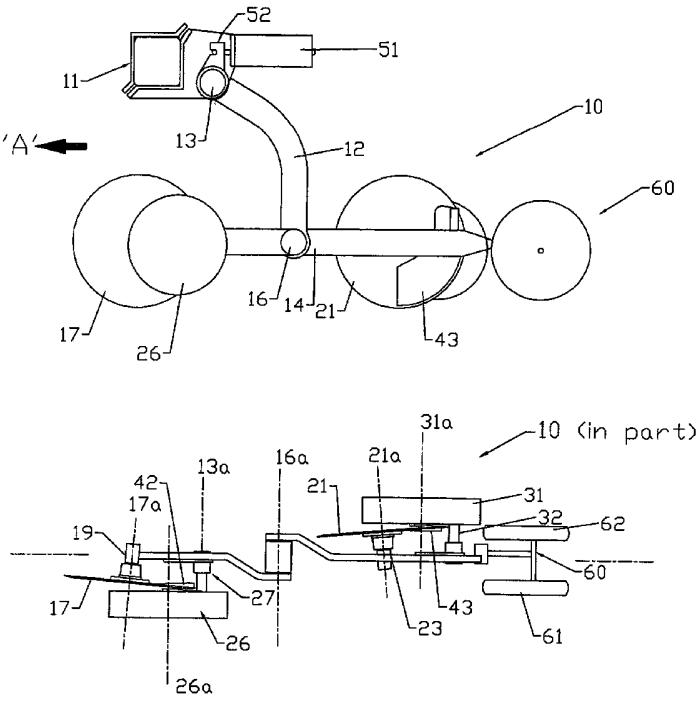

(57) Abstract: An agricultural implement (10), including: (a) a frame assembly (11) adapted to be towed or drawn by a tractor; (b) an arm (12) operatively connected to one end of the frame assembly (11) for up and down pivoting movement relative thereto; (c) a walking beam (14) mounted intermediate its ends to the other end of said arm (12) for up and down pivoting movement relative thereto about a pivot axis extending generally laterally of the direction of travel of the implement (10); (d) a first forward disc (17) mounted to the forward portion of said walking beam (14) for rotation relative thereto about a first forward rotation axis extending generally laterally of the direction of travel of the implement (10) and adapted to open the soil outwardly one way to receive seed or fertiliser; (e) a first rearward disc (21) mounted to the rearward portion of said walking beam (14) for rotation relative thereto about a first rearward rotation axis extending generally laterally of the direction of travel of the implement (10) and adapted to open the soil outwardly the other way to receive seed or fertiliser, and (f) biassing means (51) operatively engaged with the arm (12) to bias said other end of the arm (12) towards the soil.

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AGRICULTURAL IMPLEMENTS

FIELD OF THE INVENTION

This invention relates to agricultural implements. The invention has particular application to agricultural implements and for zero tillage or minimum tillage agriculture and reference will be made to such application. However, the invention could be used to advantage in traditional full tillage agriculture.

BACKGROUND ART

Zero tillage and minimum tillage are now well established forms of agriculture and many implements have been developed for overcoming or ameliorating the particular problems associated with these types of agriculture. Typically, disc type implements are used to open the soil for planting because they can more suitably accommodate the trash covering on the soil from a previous crop which is common with this type of agriculture than many tyned implements, and they disturb the soil less thereby minimising moisture loss. However, double disc implements, that is where they are arranged sided by side with one left hand disc and one right hand disc, are more prone to trash blockage than single disc arrangements and also tend to clog with wet soils. Additionally, the overall width of double disc implements precludes their use for planting in closely spaced rows, for example, 100mm to 175mm spacing. Further, their greater width inhibits the use of double disc implements for planting and fertilising in the same pass in a process known as banding. Banding aims to deposit the seeds and the fertiliser in different spaced apart rows with the fertiliser being deposited deeper than the seeds as well. It is believed that the banding process encourages the plants to send their roots deeper towards the fertiliser but because the fertiliser is in a different row it does not poison the seeds and leaves adequate free moisture adjacent the seeds for their germination and for plant growth.

One object of the present invention is to provide an agricultural implement which overcomes or ameliorates one or more of the aforementioned problems. Another object is to provide an agricultural implement which is reliable and efficient in use.

DISCLOSURE OF THE INVENTION

With the foregoing in view the present invention resides broadly in an agricultural implement, including:

a frame assembly adapted to be towed or drawn by a tractor;

an arm operatively connected at one end to said frame assembly for up and down pivoting movement relative thereto;

a walking beam mounted intermediate its ends to the other end of said arm for up and down pivoting movement relative thereto about a pivot axis extending generally laterally of the direction of travel of the implement;

a first forward disc mounted to the forward portion of said walking beam for rotation relative thereto about a first forward rotation axis extending generally laterally of the direction of travel of the implement and adapted to open the soil outwardly one way to receive seed or fertiliser;

a first rearward disc mounted to the rearward portion of said walking beam for rotation relative thereto about a first rearward rotation axis extending generally laterally of the direction of travel of the implement and adapted to open the soil outwardly the other way to receive seed or fertiliser, and

biassing means operatively engaged with said arm to bias said other end of said arm towards the soil.

In another aspect the invention resides broadly in disc assembly adapted to be mounted to a tool bar or the like adapted to be towed or drawn by a tractor, including:

an arm adapted to be operatively connected at one end to the tool bar to which the disc assembly is to be mounted for up and down pivoting movement relative thereto;

a walking beam mounted intermediate its ends to the other end of said arm for up and down pivoting movement relative thereto about a pivot axis extending generally laterally of the direction of travel of the tool bar;

a first forward disc mounted to the forward portion of said walking beam for rotation relative thereto about a first forward rotation axis extending generally laterally of the direction of travel of the tool bar and adapted to open the soil outwardly one way to receive seed or fertiliser; and

a first rearward disc mounted to the rearward portion of said walking beam for rotation relative thereto about a first rearward rotation axis extending generally laterally of the direction of travel of the tool bar and adapted to open the soil outwardly the other way to receive seed or fertiliser.

In yet another aspect the invention resides broadly in a disc assembly adapted to be mounted to a tool bar or the like adapted to be towed or drawn by a tractor, including:

a headstock adapted to be rigidly secured to the tool bar to which the disc assembly is to be mounted;

an arm operatively connected at one end to said headstock for pivoting movement relative thereto;

a walking beam mounted intermediate its ends to the other end of said arm for up and down pivoting movement relative thereto about a pivot axis extending generally laterally of the direction of travel of the tool bar;

a first forward disc mounted to the forward portion of said walking beam for rotation relative thereto about a first forward rotation axis extending generally laterally of the direction of travel of the tool bar and adapted to open the soil outwardly one way to receive seed or fertiliser; and

a first rearward disc mounted to the rearward portion of said walking beam for rotation relative thereto about a first rearward rotation axis extending generally laterally of the

direction of travel of the tool bar and adapted to open the soil outwardly the other way to receive seed or fertiliser, and

biassing means operatively engaged with said headstock and said arm and arranged to bias said other end of said arm towards the soil.

In the case of a two disc arrangement, it is preferred that the first forward disc and the first rearward disc be laterally spaced such that in use they are adapted to open the soil in spaced apart rows with the discs opening the soil away from each other. Advantageously, such arrangement allows close spacing of the rows which is required for some crops and also allows seed to be planted in one row created by the forward disc and fertiliser to be deposited in another row created by the rearward disc spaced from the seed row by a desired predetermined distance.

Preferably, a forward packer wheel is operatively connected to said walking beam adjacent said forward disc and a rearward packer wheel is operatively connected to said walking beam adjacent said rearward disc, each said packer wheel being arranged to travel in a line beside its respective adjacent disc and pack the soil to minimise disturbance of the adjacent soil. In a preferred form at least one packer wheel is mounted for vertical adjustment so that it can act as a depth wheel setting the depth of cut of its respective disc.

Preferably, a press wheel or set of press wheels are mounted to the walking beam rearward of the rearward disc and arranged to press the soil into the openings after the seed and fertiliser are placed in the respective openings. Advantageously, the depths of the forward disc and the rearward disc can be different thereby allowing fertiliser to be placed at a greater depth than the seed in the same pass and achieve the benefits of banding.

In another aspect the invention resides broadly in an agricultural implement, including:

a frame assembly adapted to be towed or drawn by a tractor;

an arm operatively connected to and depending from said frame assembly for up and down pivoting movement relative thereto;

a walking beam mounted intermediate its ends to the lower end of said arm for up and down pivoting movement relative thereto about a pivot axis extending generally laterally of the direction of travel of the implement;

first and second forward discs mounted to the forward portion of said walking beam for rotation relative thereto about first and second forward rotation axes respectively extending generally laterally of the direction of travel of the implement, one disc being adapted to open the soil outwardly one way to receive seed or fertiliser there behind and the other disc being adapted to open the soil outwardly the other way to receive seed or fertiliser therebehind;

first and second rearward discs mounted to the rearward portion of said walking beam for rotation relative thereto about first and second rearward rotation axes respectively extending generally laterally of the direction of travel of the implement, one disc being adapted to open the soil outwardly one way to receive seed or fertiliser there behind and the other disc being adapted to open the soil outwardly the other way to receive seed or fertiliser there behind;

biassing means operatively engaged with said arm to bias said forward and rearward discs towards the ground.

In yet another aspect the invention resides broadly in a disc assembly adapted to be mounted to a tool bar or the like adapted to be towed or drawn by a tractor, including:

a headstock adapted to be rigidly secured to the tool bar to which the disc assembly is to be mounted;

an arm operatively connected at one end to said headstock for pivoting movement relative thereto;

a walking beam mounted intermediate its ends to the other end of said arm for up and down pivoting movement relative thereto about a pivot axis extending generally laterally of the direction of travel of the tool bar;

first and second forward discs mounted to the forward portion of said walking beam for rotation relative thereto about first and second forward rotation axes respectively extending generally laterally of the direction of travel of the implement, one disc being adapted to open the soil outwardly one way to receive seed or fertiliser and the other disc being adapted to open the soil outwardly the other way to receive seed or fertiliser;

first and second rearward discs mounted to the rearward portion of said walking beam for rotation relative thereto about first and second rearward rotation axes respectively extending generally laterally of the direction of travel of the implement, one disc being adapted to open the soil outwardly one way to receive seed or fertiliser and the other disc being adapted to open the soil outwardly the other way to receive seed or fertiliser; and

biassing means operatively engaged with said headstock and said arm and arranged to bias said other end of said arm towards the soil.

In the case of a four disc arrangement, the two forward discs and the two rearward discs are preferably arranged side by side. Advantageously, the four disc arrangement allows two rows of seed to be planted side by side and two rows of fertiliser to be deposited side by side, or by rearranging the seed and fertiliser boots alternate rows of seed and fertiliser may be placed. In the four disc arrangement it is preferred that packer wheels be arranged in pairs and that each pair operate in combination as one depth wheel. As with a two disc implement the depths of the two forward discs can be different from that of the

two rearward discs. Additionally, press wheels could be operatively connected to the walking beam in a similar manner to the two disc arrangement so as to press the soil into the openings behind the respective discs.

In either a two disc or four disc arrangement it is preferred that said arm depend from said headstock or said frame assembly and be a trailing arm relative to said frame assembly.

In still yet another aspect the invention resides broadly in a method of agriculture, including:

providing an agricultural implement as previously described;

planting seeds adjacent one of the forward disc and rearward disc to form a row of seeds and depositing fertiliser adjacent the other of the forward disc and the rearward disc to form a row of fertiliser, and

pressing soil on top of the seeds and the fertiliser.

BRIEF DESCRIPTION OF THE DRAWINGS

In order that the invention may be more readily understood and put into practical effect, reference will now be made to the accompanying drawings wherein:-

Fig. 1 is a diagrammatic end elevation of part of an agricultural implement according to the invention;

Fig. 2 is a diagrammatic plan view of part of the disc assembly of the agricultural implement shown diagrammatically in Fig. 1;

Fig. 3 is a diagrammatic plan view of another disc assembly according to the invention adapted to be substituted for the disc assembly shown diagrammatically in Fig. 2.

Fig. 4 is a pictorial illustration of a disc assembly according to the invention;

Fig. 5 is an end elevation of the disc assembly of Fig. 1 from one end;

Fig. 6 is an end elevation of the disc assembly of Fig. 4

from the other end;

Fig. 7 is a plan view of the disc assembly of Fig. 4;

Fig. 8 is a front elevation of the disc assembly of Fig. 4, and

Fig. 9 is a rear elevation of the disc assembly of Fig. 4.

DETAILED DESCRIPTION OF THE DRAWINGS

The agricultural implement 10 illustrated diagrammatically in part in Fig. 1 includes a frame assembly 11, an arm 12 connected to the frame assembly by a pivot pin 13 and depending therefrom for up and down pivoting movement about a substantially horizontal axis 13a extending perpendicular to the intended direction of travel of the implement, shown as direction "A". It can be seen that in use the arm trails the frame assembly and may be referred to herein as a trailing arm. A walking beam 14 extends longitudinally in the direction of travel and is connected intermediate its ends to the lower end of the trailing arm by a pivot pin 16 for up and down pivoting movement relative to the trailing arm about a substantially horizontal lateral axis 16a through the pivot pin.

A first forward disc 17 is mounted to the forward portion of the walking beam on one side for rotation relative thereto about a first forward rotation axis 17a on a stub shaft 19 secured to the walking beam. The first forward rotation axis is generally horizontal and inclined slightly less than 90 degrees to the walking beam on one side in the usual manner of disc mounting such that the disc has a leading face which is forced against the soil and a trailing face.

A rearward disc 21 is mounted to the rearward portion of the walking beam on one side for rotation relative thereto about a first rearward rotation axis 21a on a stub shaft 23 which is fixed to the walking beam. The first rearward rotation axis is generally horizontal and makes an angle of slightly less than 90

degrees to the walking beam on the other side so that the forces applied to it by the soil through which it travels are opposite to the direction of the forces applied to the forward disc. Both discs are substantially flat with a bevelled leading edge. It will be appreciated that the forward disc opens the soil one way and the rearward disc opens the soil the other way.

A packer wheel 26 is mounted on a crank assembly 27 which in turn is mounted to the walking beam behind the forward disc and is arranged to rotate about a horizontal axis 26a which extends perpendicular to the walking beam. Advantageously, the crank operates so that the packer wheel may be moved in an orbit relative to the walking beam whereby the horizontal axis of rotation 26a of the wheel can be raised and lowered and the packer wheel may function as a depth wheel for the forward disc as well as a packer for soil adjacent the forward disc. In a similar manner, a rear packer wheel 31 is mounted immediately behind the rearward disc on crank arm 32 for rotation about a horizontal axis of rotation 31a which also is perpendicular to the walking beam and can act as a depth wheel for the rearward disc.

As can be seen in Fig. 1, a sowing boot 42 is mounted to the walking beam in close proximity to the rearward part of the forward disc 17 and is arranged to allow seed or fertiliser to be deposited in the opening formed by the disc as it rotates and before soil closes in again. Similarly, a sowing boot 43 is mounted to the walking beam and is arranged to deposit seed or fertilizer immediately behind the rearward disc 21 as it rotates.

The trailing arm 12 is biassed to the most downward position as shown in Fig. 1 by a coil spring 51 attached to a lug 52 extending upwardly from the trailing arm above the pivot pin 13 in known manner. Of course, hydraulic rams or other types of biassing means may be utilised if desired.

A press wheel assembly 60 is mounted to the rear end of the

walking beam 14 and includes a pair of spaced apart press wheels 61 and 62 which are arranged to follow the forward disc and the rearward disc respectively and to press soil into the opening on top of the seed or fertiliser deposited therein as the case may be.

As can be seen in Fig. 2, the two discs are mounted on opposite sides of the longitudinal centre line of the walking beam and are arranged to open the soil in opposite directions. Advantageously, such arrangement of the discs allows very close rows of seed and/or fertiliser to be created, that is as close as 150mm, and for seed to be planted adjacent one of the two discs and fertiliser to be deposited adjacent the other one. Additionally, the height of the packer wheels can be adjusted to a suitable planting depth and so that fertiliser can be deposited at a greater depth than the seed.

The four disc disc assembly 110 illustrated in Fig. 3 utilises a walking beam 114 which is mounted to trailing arm 112 (not shown) which is turn is connected to a frame assembly 111 (not shown) in the same manner as in the arrangement of Fig. 1. However, in case of the four disc assembly, instead of having single forward and rearward discs, a pair of forward discs 170 and a pair of spaced apart rearward discs 180 are provided. The two forward discs 171 and 172 are mounted for rotation about respective axis 171a and 172a, the axis 171a making an angle slightly greater than 90 degrees to the walking beam 114 on one side and the axis 172a making an angle slightly less on the other side. The rearward discs are arranged in the same manner about respective axis 181a and 182a. It will be appreciated from Fig. 3, that the two forward discs open the soil in opposite directions and the two rearward discs also open the soil in opposite directions, discs 171 and 181 opening the soil on the same side, with the four discs creating four corresponding spaced apart openings. Pairs of packer wheels 176 and 186 are mounted

adjacent the forward discs in the same manner as in Fig. 2, except that each pair of packer wheels is mounted on the one crank and are adapted to move up and down together to provide depth control for the respective pairs of discs. Press wheels are connected to the rear end of the walking beam in a manner similar to that shown in Fig. 1 to press soil into the openings behind the forward discs. It will be appreciated that the disc assembly of Fig. 3 allows four rows of seed or fertiliser or combination of seed and fertiliser to be deposited.

The disc assembly illustrated in Fig. 4 corresponds generally with the disc assembly shown diagrammatically in Fig.1 and accordingly corresponding components will be referenced by corresponding numbers but prefaced by a "2". The disc assembly 210 illustrated in Fig. 4 is adapted to be rigidly secured to a frame assembly (not shown) made generally of square hollow section steel(SHS). For this purpose the headstock 215 is shaped to abut two adjacent sides of an SHS lateral beam of the frame assembly and to be secured thereto by a V-bolt 215a which abuts the other two sides and engages in bolt holes provided in the headstock. A trailing arm 212 which is comprised of two spaced apart generally triangular plates 212a and 212b which are held together in spaced apart relation by a pivot pin 213a and spacer 212c, with the pivot pin also connecting the trailing arm to the headstock for up and down pivoting movement relative to the headstock about a substantially horizontal axis 213a extending perpendicular to the intended direction of travel of the disc assembly shown as direction "A". The trailing arm is biassed downwardly by a coil spring 251 which extends between the trailing arm and the headstock about a centre T-bolt 253 which is slidably mounted at one end to a lug 252 which in turn is pivotally connected to the headstock and at the other end is engaged in one of a plurality of slots in the trailing arm. As can be seen, the slots are spaced from the pivot pin 213 by

different distances whereby the resisting moment applied by the spring to the trailing arm against the generally upward moment applied by the soil can be adjusted by selecting different slots.

A walking beam 214 extends longitudinally in the direction of travel and is connected intermediate its ends to the lower end of the trailing arm by a pivot pin 216 for up and down pivoting movement relative to the trailing arm about a substantially horizontal lateral axis 216a through the pivot pin. As can be seen the walking beam has a forward portion 214a and a rearward portion 214b which are rigidly connected at opposite ends by a sleeve through which the pivot pin passes to form one long walking beam with the sleeve providing a pivot axis intermediate the ends of the beam and the two portions being offset on either side of a longitudinal axis in the direction of travel. Suitably, a grease nipple 216b is fitted to the sleeve for application of grease to the pivot pin and sleeve.

A first forward disc 217 is mounted to the forward portion of the walking beam on one side for rotation relative thereto about a first forward rotation axis 217a on a stub shaft 219 which is rotatably mounted in a bearing assembly 219a which in turn is bolted to the walking beam. As can be seen in Fig. 7, the forward end portion of the walking beam is bent towards toe longitudinal axis and the rearward end away from the longitudinal axis. Advantageously, the forward bend allows the stub shaft to be mounted perpendicular to the forward end portion of the walking beam to achieve the desired forward rotation axis being generally horizontally and slightly less than 90 degrees to the direction of travel such that the disc has a leading face which is forced against the soil and a trailing face.

A rearward disc 221 is mounted to the rearward portion of the walking beam on one side for rotation relative thereto about a first rearward rotation axis 221a on a stub shaft 223 which is rotatably mounted in a bearing assembly 223a which in turn is

bolted to the walking beam in the same manner as the forward bearing assembly. Suitably, the rearward bend allows the rearward stub shaft 223 to be mounted perpendicular to the rearward end portion of the walking beam to achieve the desired rearward rotation axis being generally horizontal and slightly less than 90 degrees to the walking beam on the other side so that the forces applied to it by the soil through which it travels are opposite to the direction of the forces applied to the forward disc and operate in the same manner as described in relation to Fig. 1.

A packer wheel 226 is mounted on a crank assembly 227 which comprises an adjustment plate 228a, an inner mounting shaft 228b rigidly connected to the adjustment plate and an outer wheel shaft 228c also rigidly connected to the adjustment plate but spaced from the inner shaft. Suitably, the inner shaft is mounted to the walking beam in a bushed sleeve behind the forward disc 217 such that the outer shaft may orbit about the axis of the inner shaft in the manner of a crank. The packer wheel is rotatably mounted on the outer shaft 228c about wheel axis 226 a which extends perpendicular to the walking beam and the direction of travel. Advantageously, the crank assembly provides for height adjustment of the packer wheel whereby it may function as a depth wheel for the forward disc as well as a packer for soil adjacent the forward disc. Suitably, the centre plate has a plurality of notches 229 at its upper end which cooperate with a selectively releasable locking pin 229a to secure the packer wheel in a desired position. In a similar manner, a rear packer wheel 231 is mounted immediately behind the rearward disc on crank assembly 232 which corresponds closely with crank assembly 227 and comprises a centre plate 233a, an inner shaft 233b and an outer wheel shaft 233c which operate in the same manner. Sowing boots (not shown) are mounted to the walking beam in close proximity to the trailing face of the forward disc 217 and the

trailing face of the rearward disc respectively and are arranged to allow seed or fertiliser to be deposited in the openings formed by the discs as they rotate and before soil closes in again as described in relation to Fig. 1.

A press wheel 261 is rotatably mounted to the trailing end of a mounting arm 263 which in turn is pivotally mounted to the walking beam 214 at the end of the pivot pin 216 and arranged to follow the forward disc 217 and to press soil into the opening on top of the seed or fertiliser deposited therein as the case may be. The press wheel is biassed towards the soil by a coil spring 264 which engages at one end with the walking beam and at the other end with the mounting arm. Suitably, the mounting arm is provided with a plurality of notches 265 for this purpose which allows the tension in the spring to be adjusted whereby the pressing force applied by the press wheel to the soil can be varied. As can be seen in Fig. 4, a press wheel 262 is rotatably mounted to a mounting arm 266 in a similar manner and the mounting arm in turn is mounted to the rear end of the walking beam in a similar manner and arranged to follow the rearward disc 221.

A disc scraper assembly 267 is mounted to the walking beam 214 adjacent the forward disc 217 and arranged to scrape wet soil from the disc as it rotates. Similarly, a disc scraper assembly 268 is mounted to the walking beam adjacent the rearward disc 221 and arranged to scrape wet soil from it in the same manner.

It will be understood that any suitable number of disc assemblies may be mounted to a tool bar or other suitable frame assembly either for three point linkage, draw bar connection or other suitable means to a tractor and it will be appreciated that the embodiments described above provide for closer row spacing than is generally possible with minimum tillage equipment and also assist with the process known as banding.

The foregoing description has been given by way of

illustrative example of the invention, and many modifications and variations which will be apparent to persons skilled in the art may be made without departing from the spirit and scope of the invention as defined in the appended claims.

CLAIMS

1. An agricultural implement, including:

a frame assembly adapted to be towed or drawn by a tractor;

an arm operatively connected at one end to said frame assembly for up and down pivoting movement relative thereto;

a walking beam mounted intermediate its ends to the other end of said arm for up and down pivoting movement relative thereto about a pivot axis extending generally laterally of the direction of travel of the implement;

a first forward disc mounted to the forward portion of said walking beam for rotation relative thereto about a first forward rotation axis extending generally laterally of the direction of travel of the implement and adapted to open the soil outwardly one way to receive seed or fertiliser;

a first rearward disc mounted to the rearward portion of said walking beam for rotation relative thereto about a first rearward rotation axis extending generally laterally of the direction of travel of the implement and adapted to open the soil outwardly the other way to receive seed or fertiliser, and

biassing means operatively engaged with said arm to bias said other end of said arm towards the soil.

2. A disc assembly adapted to be mounted to a tool bar or the like adapted to be towed or drawn by a tractor, including:

an arm adapted to be operatively connected at one end to the tool bar to which the disc assembly is to be mounted for up and down pivoting movement relative thereto;

a walking beam mounted intermediate its ends to the other end of said arm for up and down pivoting movement relative thereto about a pivot axis extending generally laterally of the direction of travel of the tool bar;

a first forward disc mounted to the forward portion of said

walking beam for rotation relative thereto about a first forward rotation axis extending generally laterally of the direction of travel of the tool bar and adapted to open the soil outwardly one way to receive seed or fertiliser; and

a first rearward disc mounted to the rearward portion of said walking beam for rotation relative thereto about a first rearward rotation axis extending generally laterally of the direction of travel of the tool bar and adapted to open the soil outwardly the other way to receive seed or fertiliser.

3. A disc assembly adapted to be mounted to a tool bar or the like adapted to be towed or drawn by a tractor, including:

a headstock adapted to be rigidly secured to the tool bar to which the disc assembly is to be mounted;

an arm operatively connected at one end to said headstock for pivoting movement relative thereto;

a walking beam mounted intermediate its ends to the other end of said arm for up and down pivoting movement relative thereto about a pivot axis extending generally laterally of the direction of travel of the tool bar;

a first forward disc mounted to the forward portion of said walking beam for rotation relative thereto about a first forward rotation axis extending generally laterally of the direction of travel of the tool bar and adapted to open the soil outwardly one way to receive seed or fertiliser; and

a first rearward disc mounted to the rearward portion of said walking beam for rotation relative thereto about a first rearward rotation axis extending generally laterally of the direction of travel of the tool bar and adapted to open the soil outwardly the other way to receive seed or fertiliser, and

biassing means operatively engaged with said headstock and said arm and arranged to bias said other end of said arm towards the soil.

4. An agricultural implement or a disc assembly according to any one of the preceding claims, wherein said first forward disc and said first rearward disc are laterally spaced so that in use they are adapted to open the soil in spaced apart rows.

5. An agricultural implement or a disc assembly according to any one of the preceding claims, including a forward packer wheel operatively connected to said walking beam adjacent said forward disc and a rearward packer wheel operatively connected to said walking beam adjacent said rearward disc, each said packer wheel being arranged to travel in a line beside its respective adjacent disc and pack the soil to minimise disturbance of the adjacent soil.

6. An agricultural implement or a disc assembly according to Claim 5, wherein at least one of said forward packer wheel and said rearward packer wheel is adjustably connected to said walking beam for height adjustment so that said at least one packer wheel can act as a depth wheel setting the depth of cut of its respective disc.

7. An agricultural implement or a disc assembly according to Claim 6, wherein both said forward packer wheel and said rearward packer wheel are adjustably connected to said walking beam for height adjustment.

8. An agricultural implement or a disc assembly according to any one of the preceding claims, including seed and/or guiding means mounted adjacent said first forward disc and/or said first rearward disc and adapted to guide seeds and/or fertiliser into the openings created by said first forward disc and/or said second forward disc.

9. An agricultural implement or a disc assembly according to Claim 8 , wherein said seed and/or fertiliser guiding means is mounted adjacent the or each respective disc on the side opposite the or each associated packer wheel.

10. An agricultural implement or a disc assembly according to Claim 8 or Claim 9, wherein said seed and/or fertiliser guiding means includes a sowing boot mounted to said walking beam.

11. An agricultural implement or a disc assembly according to Claim 10, wherein a sowing boot is mounted to said walking beam adjacent said first forward disc and/or said first rearward disc.

12. An agricultural implement or a disc assembly according to any one of the preceding claims, wherein a press wheel or set of press wheels is operatively connected to said walking beam rearward of said rearward disc and arranged to press the soil into the openings created by the respective discs after seed and fertiliser are placed therein respectively.

13. An agricultural implement, including:

a frame assembly adapted to be towed or drawn by a tractor;

an arm operatively connected to and depending from said frame assembly for up and down pivoting movement relative thereto;

a walking beam mounted intermediate its ends to the lower end of said arm for up and down pivoting movement relative thereto about a pivot axis extending generally laterally of the direction of travel of the implement;

first and second forward discs mounted to the forward portion of said walking beam for rotation relative thereto about first and second forward rotation axes respectively extending generally laterally of the direction of travel of the implement,

one disc being adapted to open the soil outwardly one way to receive seed or fertiliser and the other disc being adapted to open the soil outwardly the other way to receive seed or fertiliser;

first and second rearward discs mounted to the rearward portion of said walking beam for rotation relative thereto about first and second rearward rotation axes respectively extending generally laterally of the direction of travel of the implement, one disc being adapted to open the soil outwardly one way to receive seed or fertiliser and the other disc being adapted to open the soil outwardly the other way to receive seed or fertiliser;

biassing means operatively engaged with said arm to bias said forward and rearward discs towards the ground.

14. A disc assembly adapted to be mounted to a tool bar or the like adapted to be towed or drawn by a tractor, including:

an arm adapted to be operatively connected to and depend from the tool bar to which the disc assembly is to be mounted for up and down pivoting movement relative thereto;

a walking beam mounted intermediate its ends to the lower end of said arm for up and down pivoting movement relative thereto about a pivot axis extending generally laterally of the direction of travel of tool bar;

first and second forward discs mounted to the forward portion of said walking beam for rotation relative thereto about first and second forward rotation axes respectively extending generally laterally of the direction of travel of the tool bar, one disc being adapted to open the soil outwardly one way to receive seed or fertiliser and the other disc being adapted to open the soil outwardly the other way to receive seed or fertiliser;

first and second rearward discs mounted to the rearward

portion of said walking beam for rotation relative thereto about first and second rearward rotation axes respectively extending generally laterally of the direction of travel of the tool bar, one disc being adapted to open the soil outwardly one way to receive seed or fertiliser and the other disc being adapted to open the soil outwardly the other way to receive seed or fertiliser.

15. A disc assembly adapted to be mounted to a tool bar or the like adapted to be towed or drawn by a tractor, including:

a headstock adapted to be rigidly secured to the tool bar to which the disc assembly is to be mounted;

an arm operatively connected at one end to said headstock for pivoting movement relative thereto;

a walking beam mounted intermediate its ends to the other end of said arm for up and down pivoting movement relative thereto about a pivot axis extending generally laterally of the direction of travel of the tool bar;

first and second forward discs mounted to the forward portion of said walking beam for rotation relative thereto about first and second forward rotation axes respectively extending generally laterally of the direction of travel of the implement, one disc being adapted to open the soil outwardly one way to receive seed or fertiliser and the other disc being adapted to open the soil outwardly the other way to receive seed or fertiliser;

first and second rearward discs mounted to the rearward portion of said walking beam for rotation relative thereto about first and second rearward rotation axes respectively extending generally laterally of the direction of travel of the implement, one disc being adapted to open the soil outwardly one way to receive seed or fertiliser and the other disc being adapted to open the soil outwardly the other way to receive seed or

fertiliser; and

biassing means operatively engaged with said headstock and said arm and arranged to bias said other end of said arm towards the soil.

16. An agricultural implement, including:

a frame assembly adapted to be towed or drawn by a tractor;

an arm operatively connected at one end to said frame assembly for up and down pivoting movement relative thereto;

a walking beam mounted intermediate its ends to the other end of said arm for up and down pivoting movement relative thereto about a pivot axis extending generally laterally of the direction of travel of the implement;

a first forward disc mounted to the forward portion of said walking beam for rotation relative thereto about a first forward rotation axis extending generally laterally of the direction of travel of the implement and adapted to open the soil one way to receive seed or fertiliser;

a first rearward disc mounted to the rearward portion of said walking beam for rotation relative thereto about a first rearward rotation axis extending generally laterally of the direction of travel of the implement and adapted to open the soil the other way to receive seed or fertiliser, and

biassing means operatively engaged with said arm to bias said other end of said arm towards the soil.

17. An agricultural implement or a disc assembly according to Claim 16, wherein said first forward disc and said second forward disc open the soil away from each other.

18. An agricultural implement or a disc assembly according to any one of the preceding claims, wherein said arm depends from said headstock or said frame assembly.

19. An agricultural implement or a disc assembly according to any one of the preceding claims, wherein said arm is a trailing arm relative to said headstock or said frame assembly.

20. An agricultural implement as hereinbefore described with reference to the accompanying drawings.

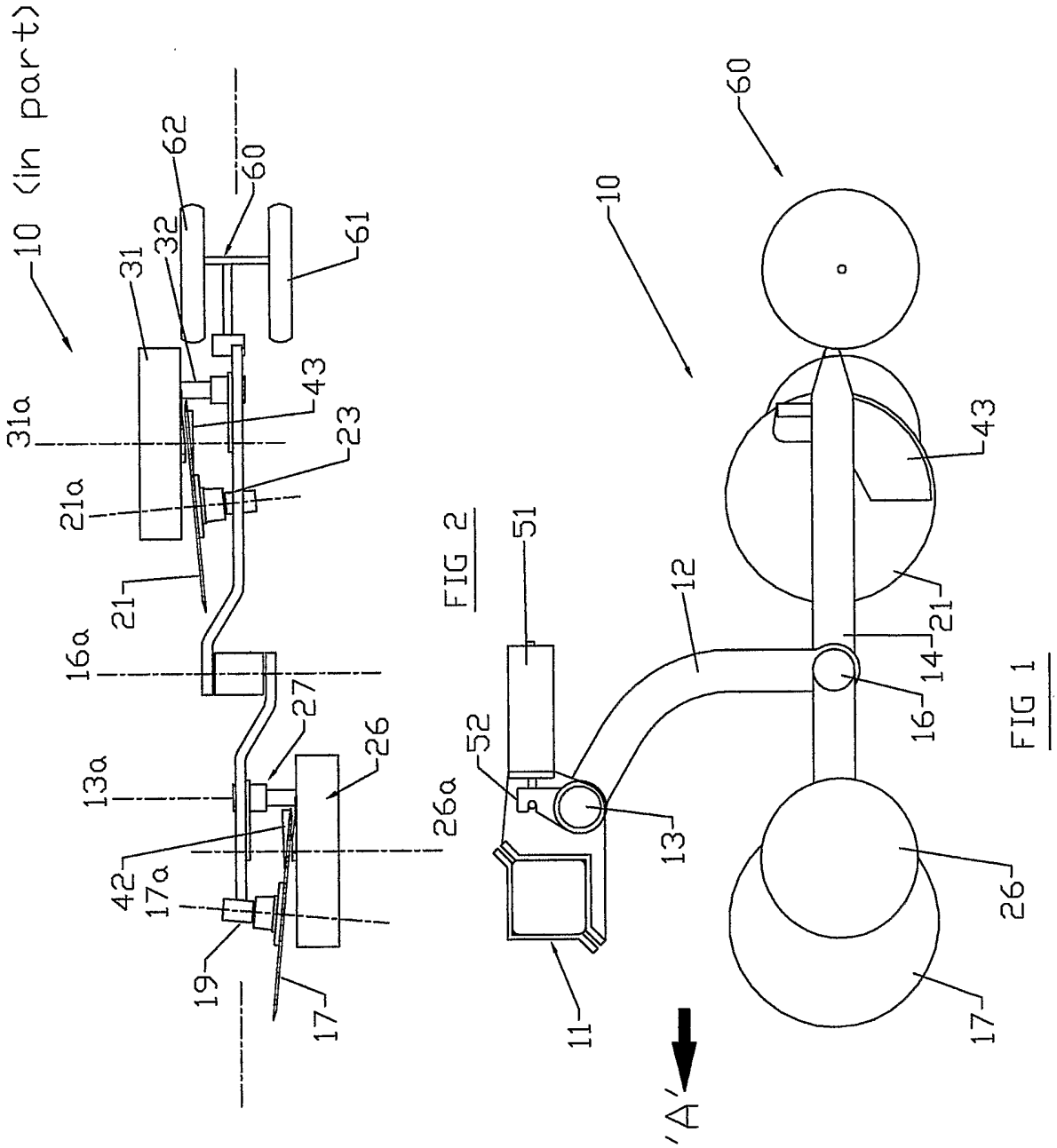
21. A disc assembly as hereinbefore described with reference to the accompanying drawings.

22. A method of agriculture, including:

providing an agricultural implement according to any one of the preceding claims;

planting seeds adjacent one of the forward disc and rearward disc to form a row of seeds and depositing fertiliser adjacent the other of the forward disc and the rearward disc to form a row of fertiliser, and

pressing soil on top of the seeds and the fertiliser.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13a
26a
42
17a
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17
FIG 2
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'A'
FIG 1

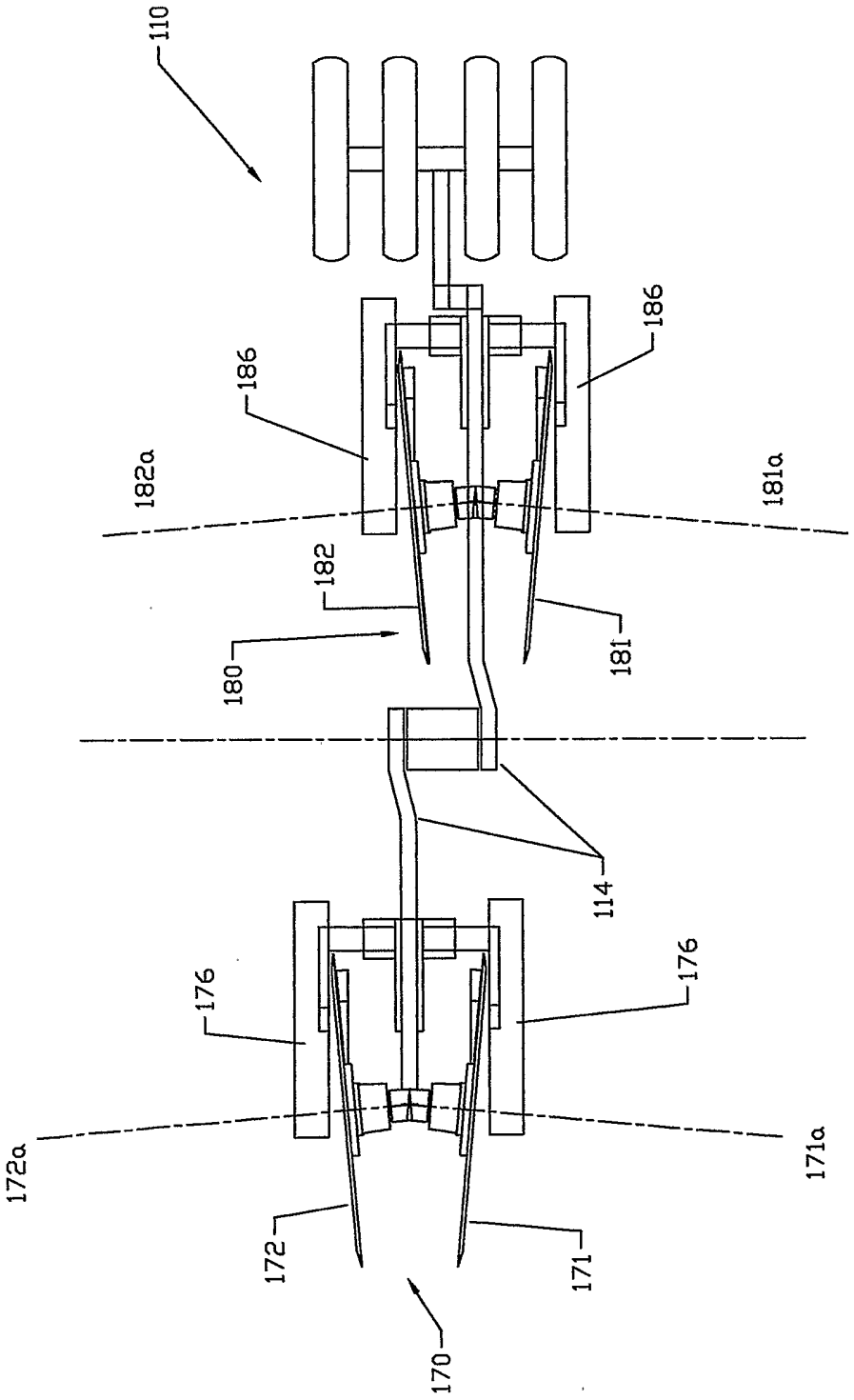
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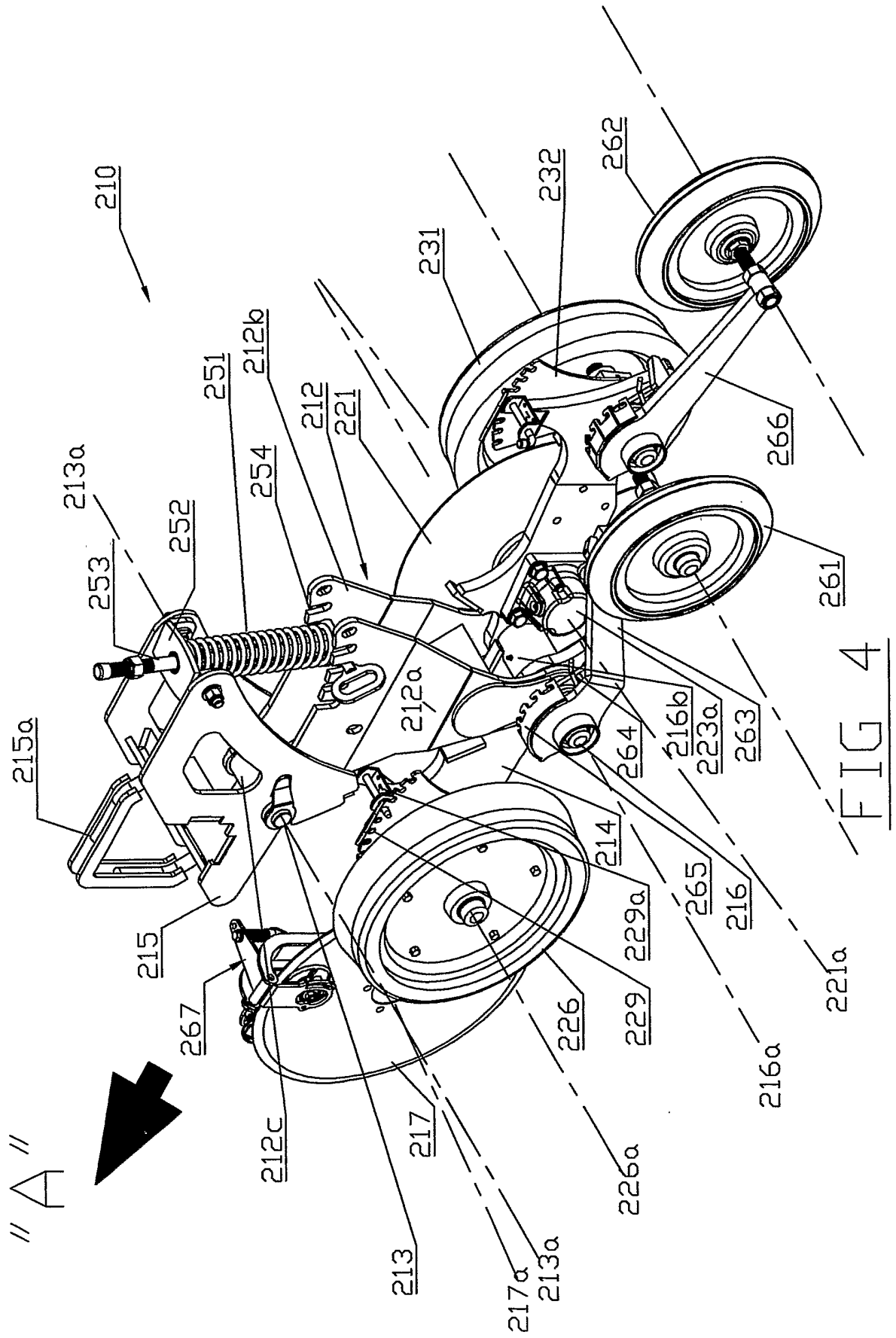
FIG 3.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216a
226a
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212c
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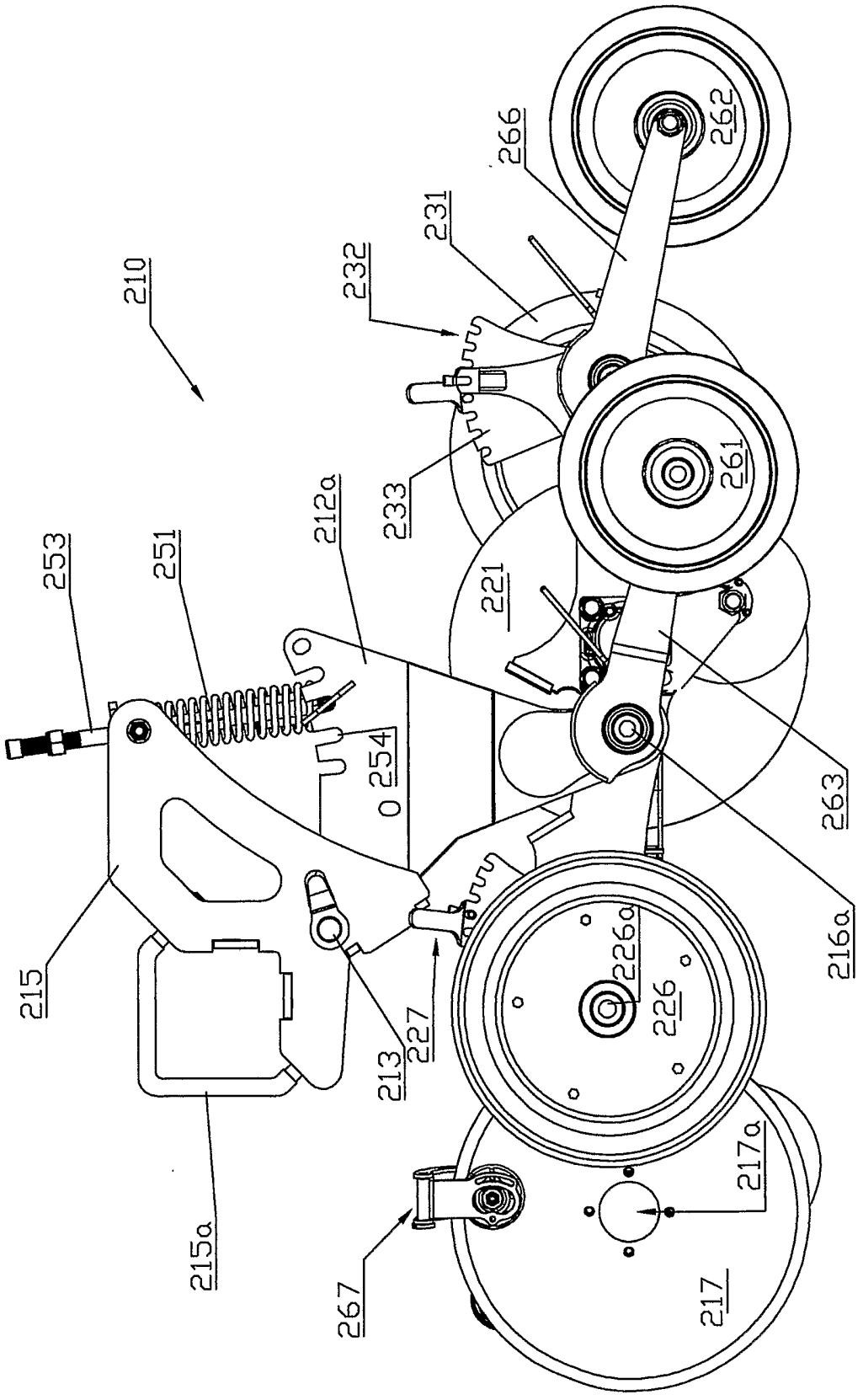
217a
213a

FIG 4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215a

FIG 5

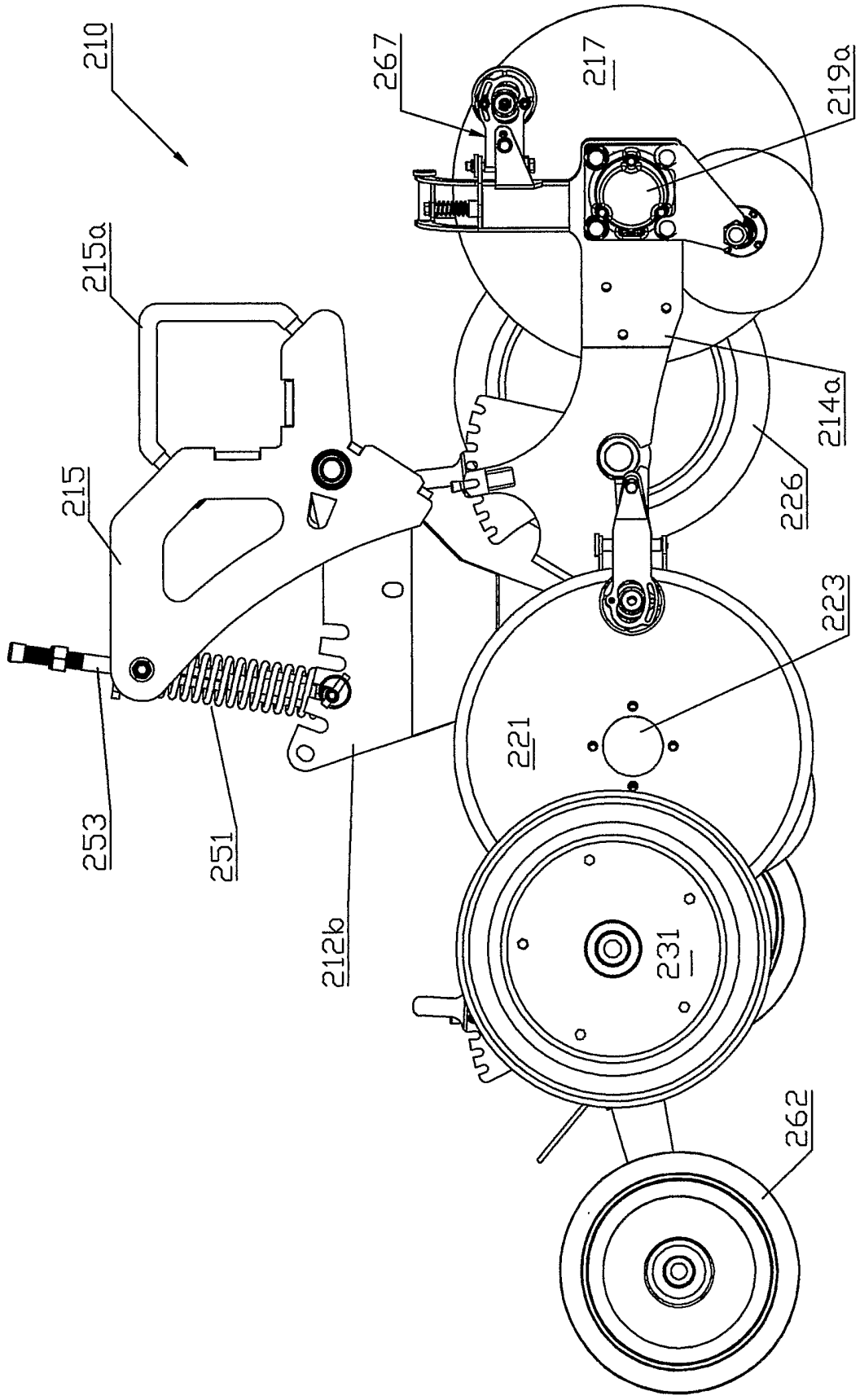
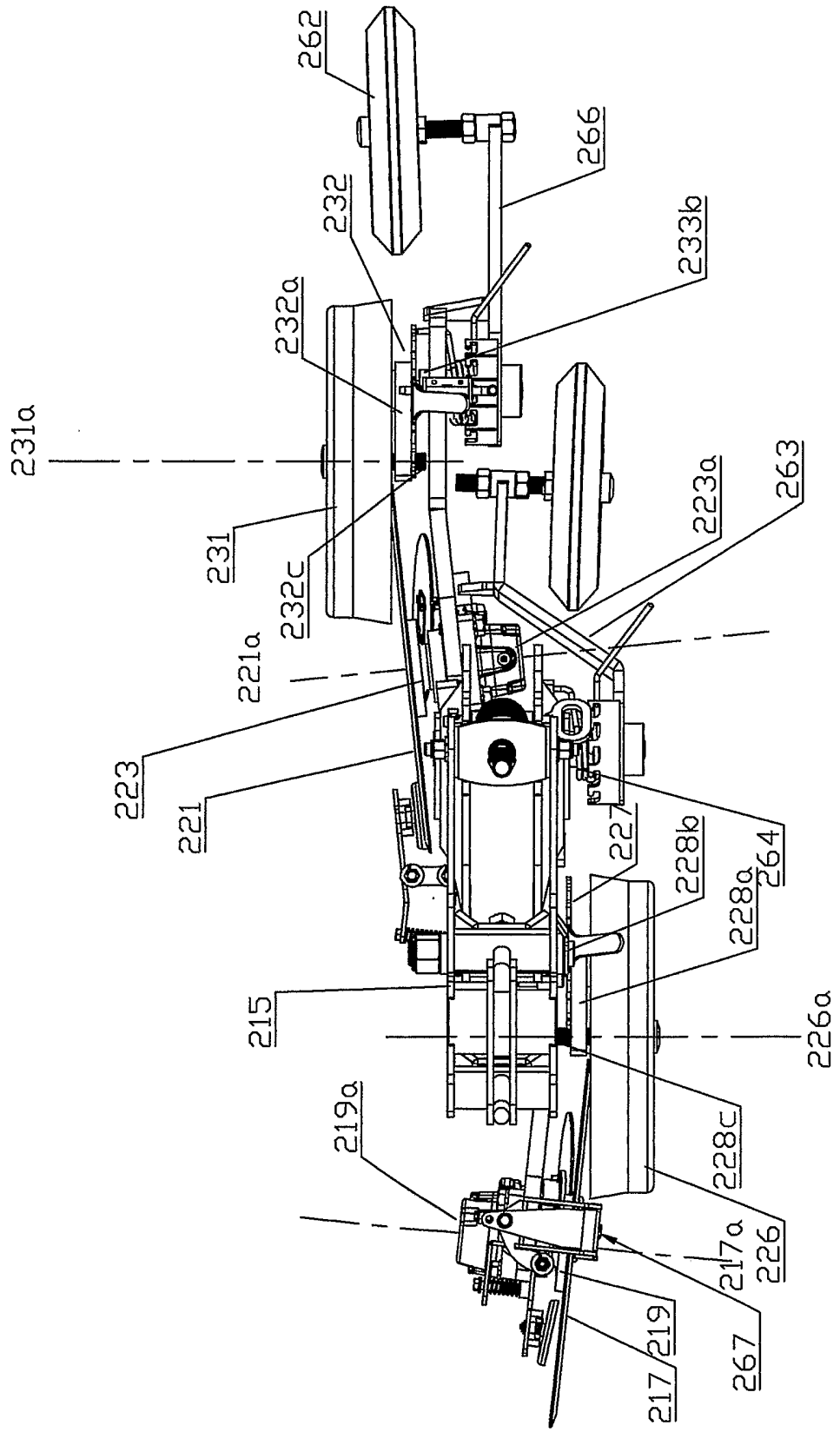


FIG 6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226a
219a
228c
217a
226
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267
217
A

FIG 7

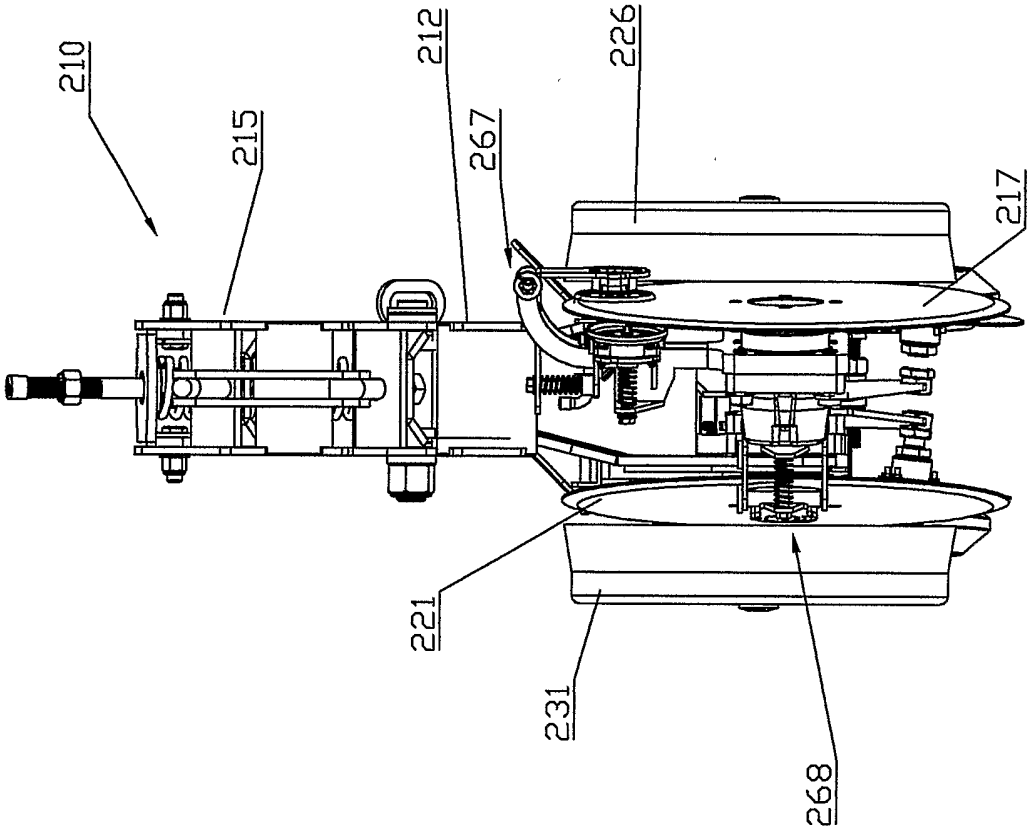

FIG 8

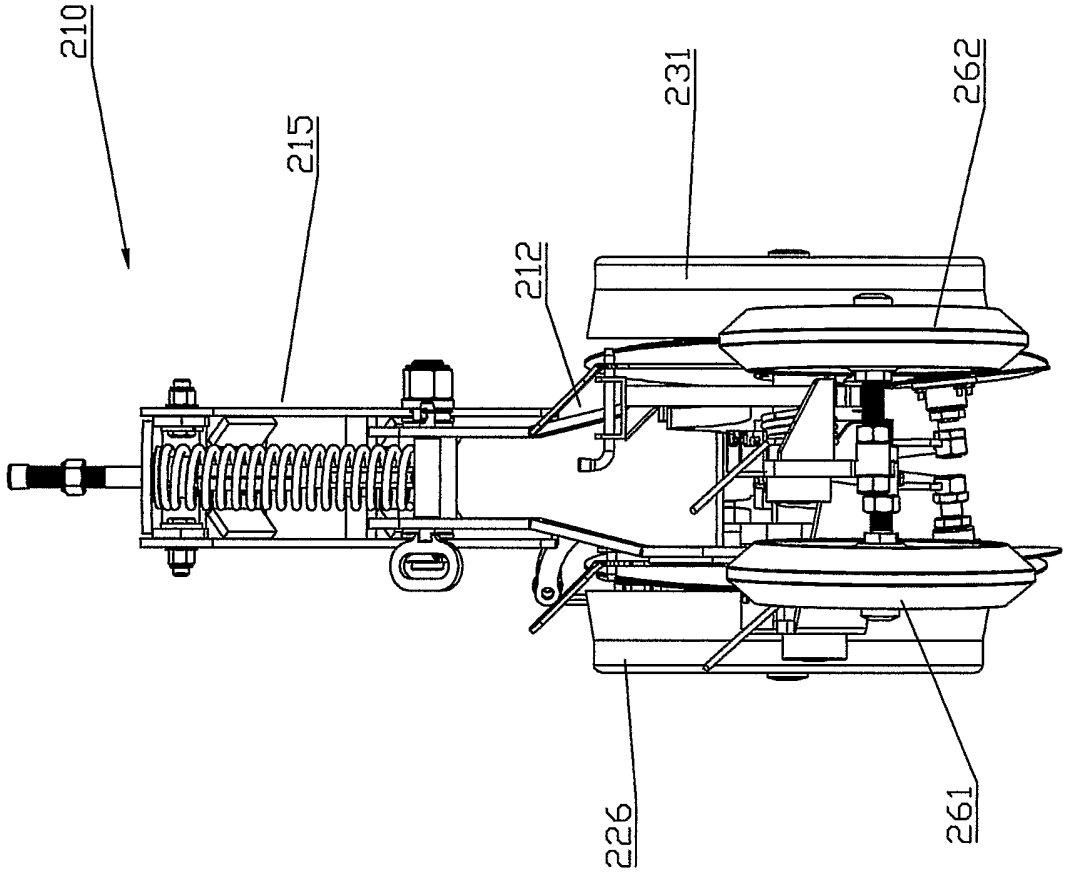

FIG 9

INTERNATIONAL SEARCH REPORT

International application No.
PCT/AU02/01407

A. CLASSIFICATION OF SUBJECT MATTER

Int. Cl. [7]: A01C 5/06, A01B 49/06

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)

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)
DWPI, US and EP databases with keywords (eg A01C 5, A01B 49, disc, beam)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	US 5957217 A (GUNNINK) 28 September 1999 Entire document	1-4, 12, 16-22 5-11, 13-15
Y	US 5074227 A (SCHWITTERS) 24 December 1991 Entire document	5-7, 13-15
Y	US 5235922 A (DECKLER) 17 August 1993 Entire document	5-7, 13-15

[X] Further documents are listed in the continuation of Box C [X] See patent family annex

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
6 November 2002	13 NOV 2002
Name and mailing address of the ISA/AU AUSTRALIAN PATENT OFFICE PO BOX 200, WODEN ACT 2606, AUSTRALIA E-mail address: pct@ipaustralia.gov.au Facsimile No. (02) 6285 3929	Authorized officer **A. SEN** Telephone No : (02) 6283 2158

INTERNATIONAL SEARCH REPORT

International application No.
PCT/AU02/01407

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 4519325 A (MILLER) 28 May 1985 Entire document	8-11, 13-15
Y	US 4407207 A (DREYER) 4 October 1983 Entire document	8-11, 13-15
Y	AU 64039/65 A (MASSEY-FERGUSON INC.) 16 March 1967 Entire document	22
	Note: for Claims 5-7, either the second or third document can be combined with the first; for Claims 8-11, either the fourth or fifth document can be combined with the first; for Claims 13-15, any one of the second, third or fourth documents can be combined with the first; for Claim 22, the last document can be combined with the first	

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.
PCT/AU02/01407

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report	Patent Family Member
US 5957217	NONE
US 5074227	NONE
US 5235922	NONE
US 4519325	NONE
US 4407207	CA 1099992 DE 2814883 FR 2421541 GB 2022983

END OF ANNEX