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A planter unit (10) for seeding a body of soil having a soil surface including:

a parallelogram frame (12, 14, 16, 18) having two pairs of opposed frame members (12, 14) for mounting to a toolbar (9);

a resilient member (22) attached to the parallelogram frame (12, 14, 16, 18) for holding the frame members of the parallelogram frame in a parallelogram shape while permitting the shape of the parallelogram frame (12, 14, 16, 18) to alter in response to an external force;

a gauge wheel (24) operatively associated with the parallelogram frame (12, 14, 16, 18) for engaging the soil surface and travelling over the soil surface in use;

a seeding arrangement (30) pivotably mounted to the parallelogram frame (12, 14, 16, 18) at a pivot location which includes a seed dispenser (36) that in an operative position is spaced below the pivot location; and

a biasing arrangement (40) for biasing the seeding arrangement to an operative position whereby movement of the seeding arrangement is independent of movement of the parallelogram frame (12, 14, 16, 18) and thus the seeding arrangement (30) is movable relative to the parallelogram frame (12, 14, 16, 18) in response to an external force on the seeding arrangement (30) that overcomes the bias of the biasing arrangement (40).
A PARALLELOGRAM PLANTER

CROSS REFERENCE TO RELATED APPLICATIONS

The disclosure of the complete specification of Australian Patent Application No. 2010201330, as originally filed and as proposed to be amended, is incorporated herein by reference.

FIELD OF THE INVENTION

This invention relates to a parallelogram planter unit. This invention extends to an apparatus for planting seed including a frame and a plurality of said parallelogram planter units.

This invention relates particularly but not exclusively to a parallelogram planter unit for use in broad acre crop farming where the surface of the land is undulating and the consistency of the soil is not necessarily even. It will therefore be convenient to hereinafter describe the invention in detail with reference to this example application. However it is to be clearly understood that the invention is not to be limited to planters that are used in broad acre farming. The invention could equally be applied to all other planters.

BACKGROUND TO THE INVENTION

Crop cultivation typically involves the placement of seed in a number of rows in the soil in a field. The rows run parallel to each other the length of the field. To sow the seed, the soil needs to be broken up, the seed needs to be placed in the soil, and then the soil needs to be closed and patted down. Further the seed needs to be inserted into the soil at a desired depth to foster germination of the seed and optimize crop growth.
A contrivance known as a parallelogram planter has been used for carrying out this planting process in broadacre crop cultivation for at least twenty years. A parallelogram planter comprises a parallelogram that is mounted to a toolbar of a frame. The parallelogram comprises two spaced uprights and two vertically spaced arms that are pivotally mounted to the uprights. Thus the members can pivot relative to each other and do not firm a fixed and rigid structure.
The parallelogram is held in a certain parallelogram shape by a resilient biasing member, such as a spring. The resilient biasing member permits the parallelogram to change its shape in response to external forces. Specifically the shape of the parallelogram can adjust in response to these external forces by moving to a more upright shape or moving to a more flattened shape.

A gauge wheel is mounted on the parallelogram and extends down from it to engage the soil. The parallelogram forces the gauge wheel downward to engage the surface of the soil with a certain force.

The strength of the resilient biasing member determines the force with which the gauge wheel pressed downwardly against the surface of the soil. The biasing member thus determines the position or height that the gauge wheel adopts relative to the surface of the soil when it is displaced across this surface. Put another way it influences the engagement of the gauge wheel with the surface of the soil. While the parallelogram forces the gauge wheel downward into engagement with the surface of the soil, it is capable of changing shape and therefore does permit some movement of the gauge wheel in response to an external force.

The planter unit also includes a seeding arrangement mounted on the parallelogram and depending downwardly therefrom. The seeding arrangement is held in a downwardly directed orientation by the parallelogram in the same way that the gauge wheel is held down. The seeding arrangement is mounted rearward of the gauge wheel relative to the direction of travel of the planter unit. The seeding arrangement includes a seed dispenser at its lower end for discharging seed into the soil at the appropriate soil depth. The seed dispenser at the lower end of the seeding arrangement can be a tyne or a double disc opener or a chisel plow type.

In the parallelogram planter the seed dispenser, e.g. the tyne, and the gauge wheel are mounted effectively to the same upright of the parallelogram and this
upright is referred to as the primary mounting. Thus their movement is linked together and they do not move independently of each other.

The seed dispenser has an adjustable height whereby to deliver the seed to a desired soil depth, it being recognized that different crops are seeded at different depths for obtaining an optimal yield.

The depth of the seed dispenser is measured from or is set relative to the surface of the gauge wheel. This flows from the idea that the gauge wheel is designed to follow the surface of the soil and accommodate for undulations in the soil. Thus if the surface rises, the gauge wheel will be caused to rise, and the seed dispenser which is set at a specific depth relative to the gauge wheel and follows changes in vertical height of the gauge wheel will also undergo a corresponding rise. This way the seed is dispensed into the soil at the same depth irrespective of undulations in the soil surface. The insertion of seed into the soil at a constant depth along the length of an undulating field is important to achieve effective germination rates for crops and high crop yields.

The planter unit further includes a press wheel that trails behind the tyne for closing the soil opening and patting down the soil after the seed had been delivered into the soil. The press wheel bears down on the soil with a small force and is capable of movement independently of the tyne and the gauge wheel.

A development on this basic planter unit is the Janke planter which was designed and sold by Janke Australia based in Mount Tyson Queensland. The Janke planter has a resilient parallelogram member that is in the form of a jump cylinder that is a hydraulic cylinder extending between the two uprights of the parallelogram. The pressure in the hydraulic jump cylinder presses the gauge wheel and the tyne operatively downward to perform their functions as described above. However with the Janke planter the hydraulic pressure is effectively preset or predetermined and is not operator adjustable.
Instead the Janke planter has a linear actuator for adjusting the position or orientation of the hydraulic jump cylinder within the parallelogram during operation thereof. The adjustment of the position of the hydraulic cylinder in the parallelogram has the effect of altering the shape of the parallelogram and thereby raising or lowering the height of the gauge wheel. It can therefore be used to adjust the height of the gauge wheel.

Thus if an operator notices that the gauge wheel is bulldozing or skipping they can adjust the position of the jump cylinder using the manual adjustment of the linear actuator on planter unit. This achieves an effective lengthening or an effective shortening of the jump cylinder as the case may be and this effects a raising or lowering of the gauge wheel, e.g. to address the bulldozing or skipping thereof.

However this adjustment does require manual adjustment of the linear actuator by an operator, e.g. by rotating a nut on a screw threaded shank. Further each planter unit on the frame needs to be manually adjusted. As there are usually many planter units on a frame, each adjustment will be a time consuming and arduous process. Thus it would simply not be practical to manually adjust the unit on a single traverse along the length of a field for example. The position of the jump cylinder and thereby the pressure on the gauge wheel could be changed a few times a day, but realistically not more than this. The setting that is adopted therefore reflects a compromise of what appears to work best in a given set of conditions.

Another potential shortcoming of the Janke planter is that if the tyne encounters resistance as it is displaced in a forward direction through the soil it has limited ability to yield to this resistance. For example if the tyne which is submerged in the soil, gets caught behind a root or log within the soil, it has limited ability to respond to this obstacle. It can move upwardly to some extent, by moving the parallelogram to a more upright position through the hydraulic cylinder. However it cannot pivot rearwardly because its movement is tied to a change in shape of the
parallelogram and the structure does not permit such a movement. Consequently there is a risk that the tyne could either be damaged or broken.

Clearly it would be advantageous if a planter unit could be devised that ameliorated at least some of the shortcomings of the prior art planter units described above. More specifically it would be advantageous if a contrivance could be devised to enable the height of the gauge wheels to be adjusted on a frame in response to skipping or bull dozing more easily. It would also be advantageous if a contrivance could be devised that permitted the tyne to move independently of the parallelogram to enable it to yield in response to an external force and thereby reduce the risk of damaging or breaking the tyne.

**SUMMARY OF THE INVENTION**

According to one aspect of the invention there is provided a planter unit for seeding a body of soil having a soil surface including:

- a parallelogram frame having two pairs of opposed frame members for mounting to a toolbar;
- a resilient member attached to the parallelogram frame for holding the frame members of the parallelogram frame in a parallelogram shape while permitting the shape of the parallelogram to alter in response to an external force;
- a gauge wheel operatively associated with the parallelogram frame for engaging the soil surface and travelling over the soil surface in use;
- a seeding arrangement pivotably mounted to the parallelogram frame at a pivot location which includes a seed dispenser that in an operative position is spaced below the pivot location; and
- a biasing arrangement for biasing the seeding arrangement to an operative position whereby movement of the seeding arrangement is
independent of movement of the parallelogram frame and thus the seeding arrangement is movable relative to the parallelogram frame in response to an external force on the seeding arrangement that overcomes the bias of the biasing arrangement.

The one pair of opposed parallelogram frame members may be broadly upwardly extending. One of the upwardly extending frame members may be a primary mounting and the other upwardly extending frame member may be a toolbar mounting, e.g. for mounting the parallelogram frame to a toolbar.

The other pair of opposed parallelogram frame members may be broadly horizontally extending. One of the horizontally extending parallelogram frame members may be an upper arm. The other horizontally extending parallelogram frame member may be a lower arm.

The resilient parallelogram member may extend between the primary mounting and the toolbar mounting.

The biasing arrangement may permit the seeding arrangement to pivot rearward in response to it encountering resistance when being displaced in a forward direction, e.g. independently of any movement of the gauge wheel on the parallelogram frame.

Thus the seeding arrangement may be pivotally mounted on one of the parallelogram frame members. This enables it to pivot independently relative to the parallelogram, free of any corresponding change in the shape of the parallelogram, e.g. in a rearward direction, to relieve resistance encountered by trash in the soil as it moves through the soil.

The biasing arrangement is independent of the parallelogram and the pivoting movement of the seeding arrangement occurs independently of extension or
retraction of the resilient parallelogram member. Thus the seeding arrangement is able to move quite independently of the gauge wheel.

The gauge wheel may be operatively connected, e.g. rigidly, to the parallelogram frame member that is the primary mounting.

The seeding arrangement may be pivotally mounted to the parallelogram frame member that is the primary mounting.

The biasing arrangement may comprise a resilient biasing member having one end that is coupled to the seeding arrangement and another end that is mounted to one of the frame members of the parallelogram frame which may be the toolbar mounting or the primary mounting.

The resilient biasing member may be a hydraulic cylinder, e.g. a hydraulic cylinder. Instead the resilient biasing member may be a spring, e.g. a coil spring or a pneumatic cylinder.

The resilient parallelogram member may be a jump cylinder that is a hydraulic cylinder. The hydraulic cylinder may be pressurized at a hydraulic pressure of up to 1200psi (8272.8 kPa), e.g. the jump cylinder may be pressurised at a hydraulic pressure of up to 1800psi (12409.2 kPa).

In one form the resilient parallelogram member may be positioned outside of the parallelogram frame and adjacent to the parallelogram frame. For example the resilient member may extend operatively between said primary and toolbar mountings above said upper arm of the parallelogram frame.

Instead in another form the resilient member is received within the parallelogram frame and extends between the primary and toolbar mountings between the upper and the lower arms of the parallelogram frame.
The planter unit may include a pressure adjuster for adjusting the pressure within the hydraulic cylinder forming the resilient parallelogram member to adjust the effective length thereof.

The hydraulic cylinder may comprise a piston that is displaceable within a housing of the cylinder. That is the pressure can be increased to displace the piston out of the cylinder housing to lengthen the hydraulic cylinder. Similarly the pressure can be reduced to retract the piston within the cylinder housing to shorten the overall length of the hydraulic cylinder. The hydraulic jump cylinder may have an adjuster to enable the pressure within the hydraulic cylinder to be adjusted, e.g. to adjust the effective length thereof.

The planter may include a jump cylinder controller for remotely adjusting the effective length of the jump cylinder by adjusting the pressure in the jump cylinder.

The jump cylinder controller may include a hydraulic circuit that is operatively coupled to the jump cylinder that permits the hydraulic pressure applied to the jump cylinder to be increased or decreased from a point along the circuit that is remote from the jump cylinder.

The controller may include an operator control at a remote operator position for increasing or decreasing the pressure. The operator control may include one or more levers that can be manually operated by an operator at the operator position. In use the remote operator position may be on a vehicle that is used to tow a frame, to which the planter unit is mounted, around a paddock.

The hydraulic circuit may include hydraulic hoses extending from the hydraulic cylinder to the operator location. The hydraulic circuit may include an accumulator, e.g. in the form of an accumulator bottle, operatively coupled thereto.
The planter unit may include a fork extending in a downward direction away from said primary mounting and the gauge wheel may be mounted on the fork towards a lower end thereof. Conveniently the fork may be integrally formed with the primary mounting such that it is essentially an extension thereof.

The gauge wheel may have a broadly cylindrical ground engaging wheel body for running along the surface of the ground. The wheel body may have a rubber or rubber like surface for engaging the surface of the soil.

The gauge wheel may also include a disc of greater diameter than the wheel body mounted thereon, that projects radially out beyond the surface of the wheel body. The function of the disc is to penetrate the soil that is to be seeded thereby to clear the way for the seed dispenser to travel through the soil at the seed insertion depth. Thus the disc opens up the soil and cut the stubble and trash that helps to maintain the correct seed depth and reduce hair pinning.

The disc may be mounted intermediate the sides of the wheel body, e.g. midway between the sides of the wheel body. The disc may be a Coulter disc, e.g. of steel, and the disc may have a diameter of up to 500mm.

The seeding arrangement may include a shank support that is pivotally mounted to the primary mounting and a shank which is adjustably mounted on the shank support.

The shank support has an upper end that forms the upper end of the seeding arrangement and the shank has a lower end that forms the lower end of the seeding arrangement.

The seeding arrangement may include a seed dispenser mounted on said shank towards said operatively lower end thereof. The seed dispenser may include a tyne. Instead the seed dispenser may include a double disc opener. Yet further the seed dispenser may be in the form of a chisel plough which is also often
referred to as a chisel plow. Yet even further the seed dispenser may be in the form of a sweep.

The seeding arrangement may include a seed depth adjuster for adjusting the depth at which seed is dispensed into the soil during operation.

The seed depth adjuster enables the shank to be checked in any one of a plurality of positions within the shank support whereby to adjust the depth of the seed dispenser within the soil.

The seed depth adjuster enables the vertical position of the seed dispenser relative to the surface of the gauge wheel to be effectively set, and provided that the gauge wheel is positioned on the surface of the soil, as it is designed to do, the seed dispenser dispenses seed into the soil at the depth setting at which the seed depth adjuster has been set.

The planter unit may further include a press wheel arm and a press wheel rotatably mounted on the press wheel arm. The press wheel arm may be may be pivotally mounted to the primary mounting, e.g. at an end thereof that is remote from the press wheel.

The planter unit may further include press wheel biasing means for biasing the press wheel towards a position in which it runs along the surface of the ground but also permits the press wheel to be pivoted upwardly in response to an external force. The press wheel biasing means may be in the form of a spring, e.g. a coil spring, for urging the press wheel down against the surface of the soil.

The toolbar mounting may include a mounting formation for mounting the planter unit to a toolbar. The mounting formation may include a toolbar engaging formation that is shaped to complement the toolbar for receiving the toolbar therein, and a bracket for extending around the toolbar and mounting it to the toolbar mounting.
The primary mounting may include an upright section and also a trailing section extending transversely away from the upright section. The fork may project away from the upright section and the upper and lower arms may be pivotally mounted to the upright section. The seeding arrangement may be pivotally mounted to the trailing section, and the press wheel arm may be mounted to the trailing section.

Further the planter unit may optionally also include a mud scraper mounted on the fork for scraping mud and debris off the gauge wheel as it rotates past the scraper.

According to another aspect of this invention there is provided a planter unit for seeding a body of soil having a soil surface, including:

- a parallelogram frame having two pairs of opposed frame members for mounting to a toolbar;
- a resilient member attached to the parallelogram frame for holding the frame members of the parallelogram frame in a parallelogram shape while permitting the shape of the parallelogram to alter in response to an external force;
- a gauge wheel operatively associated with the parallelogram frame for engaging the soil surface and travelling over the soil surface in use;
- a seeding arrangement attached to the parallelogram frame which includes a seed dispenser that in an operative portion is received in the soil in use to deliver seed into the soil and
- control means for controlling movement of the resilient member and hence movement of the gauge wheel from a remote location.

The resilient member may be a hydraulic cylinder extending between opposed frame members of the parallelogram frame and said control means is a controller spaced from the hydraulic cylinder for enabling an operator to control the hydraulic
pressure in the hydraulic cylinder and thereby the extension or retraction of the hydraulic cylinder from a remote location.

In this aspect of the invention the planter unit may include a biasing arrangement for biasing the seeding arrangement towards the operative position, but which permits the seeding arrangement to be pivoted relative to the parallelogram in response to an external force on the seeding arrangement that overcomes the bias of the biasing arrangement. Specifically the biasing arrangement may permit the seeding arrangement to pivot rearward in response to it encountering resistance when being displaced in a forward direction.

In this aspect of the invention the seeding arrangement may be rigidly mounted to the parallelogram frame whereby to permit the seeding arrangement to move together with the parallelogram in response to an external force, e.g. but not independently thereof.

The resilient member may include a jump cylinder as described above. The control means may be in the form of a controller for remotely adjusting the effective length of the jump cylinder by adjusting the pressure in the jump cylinder. The controller is positioned remote from the jump cylinder whereby to enable the operator to adjust the hydraulic pressure remotely.

The jump or hydraulic cylinder may comprise a piston that is displaceable within a cylinder housing. That is the pressure can be increased to displace the piston out of the cylinder housing to lengthen the hydraulic cylinder. Similarly the pressure can be reduced to retract the piston within the cylinder housing to shorten the overall length of the hydraulic cylinder.

The controller may include a hydraulic circuit that is operatively coupled to the jump cylinder that permits the hydraulic pressure applied to the jump cylinder to be increased or decreased from a point along the circuit that is remote from the jump cylinder.
The controller may include an operator control at a remote operator position for increasing or decreasing the pressure. In use the remote operator position may be on a vehicle that is used to a frame to which the planter unit is mounted around a paddock. The operator control may include one or more levers that can be manually operated by an operator at the remote operator position.

The hydraulic circuit may include hydraulic pipes extending from the hydraulic cylinder to the remote operator position. The hydraulic circuit may include an accumulator, e.g. in the form of an accumulator bottle, operatively coupled thereto.

The planter unit may include any one or more of the other optional features of the planter unit described in the first aspect of the invention above.

The one pair of opposed parallelogram sides may be broadly upwardly extending. One of the upwardly extending sides may be a primary mounting and the other upwardly extending side may be a toolbar mounting, e.g. for mounting the parallelogram to a toolbar.

The other pair of opposed parallelogram sides may be broadly horizontally extending and may comprise an upper arm and a lower arm.

The resilient parallelogram member may extend between the primary mounting and the toolbar mounting, and the gauge wheel and the seeding arrangement may be operatively coupled to the primary mounting.

In one form the resilient parallelogram member may be positioned outside of the parallelogram and adjacent to the parallelogram. Instead in another form the tensioning member may be received within the parallelogram and extends between the primary and toolbar mountings between the upper and the lower arms of the parallelogram.
According to another aspect of this invention there is provided a planter unit for seeding a body of soil having a soil surface including for:

- a parallelogram frame having two pairs of opposed frame members for mounting to a toolbar;
- a resilient member attached to the parallelogram frame for holding the frame members of the parallelogram frame in a parallelogram shape while permitting the shape of the parallelogram to alter in response to an external force;
- a gauge wheel operatively associated with the parallelogram frame for engaging the soil surface and travelling over the soil surface in use;
- a seeding arrangement attached to the parallelogram frame which includes a seed dispenser that in an operative portion is received in the soil in use to deliver seed into the soil and control means for
  (i) controlling operation of the resilient member and hence movement of the gauge wheel; and
  (ii) controlling operation of the biasing arrangement and thus vary the degree of bias applied to the seeding arrangement.

The planter units may include any one or more of the optional or preferred features of the planter unit defined or described in any one of the preceding aspects of the invention.

According to yet another aspect of this invention there is provided a method of operation of a planter unit which includes the step of controlling from a remote location operation of a resilient member attached to a parallelogram frame of the planter unit so as to control movement of a gauge wheel attached to the
parallelogram frame for varying the depth of the gauge wheel in soil being traversed by the planter unit.

The method may include a further step of controlling from a remote location operation of a biasing means associated with a seeding arrangement of the planter unit whereby bias applied to the seeding arrangement is varied.

The planter units may include any one or more of the optional or preferred features of the planter unit defined or described in any one of the preceding aspects of the invention.

According to yet another aspect of this invention there is provided an apparatus for planting seed in a number of rows simultaneously which includes:

- a frame; and
- a plurality of planter units as defined in any one of the preceding aspects of the invention attached to the frame.

The frame may have at least one transverse toolbar, preferably a plurality of transverse extending toolbars, e.g. three transverse toolbars.

The frame may be supported on one or more front wheels in the form of castors forward of the toolbars. The frame may also be supported by one or more rear wheels rearward of the toolbars.

The planters may be spaced apart along the length of each transverse toolbar, e.g. at even spacing apart from each other along the length of each toolbar.

The position of the planters on each toolbar is such that they are offset relative to the planter units on the other toolbars.
The frame may be in the form of an open frame, and the frame may have a central section, and wing sections laterally disposed on each side of the central section. Each lateral section may be able to pivot relative to the central section.

5 The apparatus may include a controller for enabling an operator to operatively adjust the pressure in the jump cylinders associated with the parallelograms from a remote controller point.

The controller may include a hydraulic circuit that is operatively coupled to a plurality of jump cylinders associated with the parallelograms. Optionally the hydraulic circuit may be operatively coupled to all of the jump cylinders whereby to enable an operator to adjust all of said jump cylinders together.

The controller may include a central operator control for all planter units, for enabling an operator to adjust all jump cylinders simultaneously from the central operator position. The apparatus may include a towing vehicle, e.g. a tractor, and the central operator control may be located on the towing vehicle.

The central operator control may include a single lever for adjusting the hydraulic pressure in the hydraulic circuit and thereby all the jump cylinders simultaneously. A movement of the single lever in one direction increases the hydraulic pressure and movement of the lever in the other direction increases the pressure.

The hydraulic circuit may include manifold hydraulic pipes extending along the transverse toolbars and branch pipes, e.g. in the form of flexible hoses, extending from a junction with the manifold pipes to each of the planter units.

The controller may also include an accumulator bottle operatively coupled to the hydraulic circuit.

The hydraulic circuit may further include main hydraulic pipes that extend from the main pipes to the central operator control.
The frame may include a draw pole for operatively coupling the frame to a tow hitch of a towing vehicle having motive power, e.g. a tractor.

5 The controller may include a further hydraulic circuit for enabling an operator to remotely control the pressure in the hydraulic cylinders associated with the seeding arrangement for permitting the seeding arrangements to pivot independently of the parallelogram.

10 The further hydraulic circuit may enable an operator to control the hydraulic cylinders associated with the seeding arrangements of all of the planter units simultaneously.

The planter units may include any one or more of the optional or preferred features of the planter unit defined or described in any one of the preceding aspects of the invention.

The invention extends to a planter unit for seeding a body of soil having a soil surface, including:

20 a parallelogram comprising two pairs of opposed parallelogram sides for mounting to a toolbar;

a jump cylinder that is a hydraulic cylinder extending between two opposed members of the parallelogram for holding the parallelogram sides in a parallelogram shape while permitting the shape of the parallelogram shape to alter in response to an external force, wherein the jump cylinder can be extended or retracted by adjustment of the hydraulic pressure;

a controller spaced from the jump cylinder for enabling an operator to control the hydraulic pressure in the jump cylinder and thereby the extension or retraction of the jump cylinder, from a position spaced away from the controller;
a gauge wheel operatively and rigidly mounted on a parallelogram side for engaging the soil surface and thereby following the soil surface as it travels over the soil surface, wherein the height of the gauge wheel is adjusted by extension or retraction of the jump cylinder; and

a seeding arrangement that is mounted to a parallelogram side, the seeding arrangement including a seed dispenser that in an operative position is received in the soil in use to deliver the seed into the soil.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

A planter unit or row unit and an apparatus for planting seed in accordance with the invention may manifest itself in a variety of forms. It will be convenient to hereinafter describe in detail several preferred example embodiments of the invention with reference to accompanying drawings. The purpose of providing this detailed description is to instruct persons having an interest in the subject matter of the invention how to carry the invention into practical effect. However it is to be clearly understood that the specific nature of this detailed description does not supersede the generality of the preceding broad description. In the accompanying diagrammatic drawings:

Fig 1 is a three dimensional view of a planter unit in accordance with one embodiment of the invention;

Fig 2 is a front view of the planter unit of Fig 1;

Fig 3 is an end view of the planter unit of Fig 1;

Fig 4 is a top plan view of the planter of Fig 1;

Fig 5 is a front view of a planter unit in accordance with another embodiment of the invention;
Fig 6 is a schematic front view of a planter unit similar to that in Fig 5 in which the gauge wheel is bulldozing or ploughing in the soil below its desired depth;

Figs 7 and 8 are schematic front views of the planter unit of Fig 6 in which the gauge wheel is skipping across the soil above its desired depth and is controlled;

Fig 9 is a schematic front view of the planter unit of Fig 5 showing a situation where the seed dispenser which is a tyne has encountered resistance in the soil and showing how the biasing arrangement associated with the seed dispenser accommodates this resistance;

Fig 10 is a top plan view of an apparatus for planting seed in accordance with one embodiment of the invention including a plurality of planters as shown in Figure 1;

Fig 11 is a schematic side view of the apparatus of Fig 10 in use in a field being towed by a tractor; and

Fig 12 is a top plan view of the apparatus of Fig 10 (with some details omitted for clarity) showing the controller for controlling the pressure applied to the parallelogram cylinder for setting the height of the gauge wheel.

In Figures 1 to 4 reference numeral 10 refers generally to a planter unit or a row unit in accordance with the invention.

The planter unit or row unit 10 comprises broadly a primary mounting 12 and a toolbar mounting 14 arranged in an opposed relationship to each other. The unit 10 also includes an upper arm 16 and a lower arm 18 extending between upper and lower ends of the primary and toolbar mountings 12, 14. The arms 16, 18
and mountings 12, 14 are pivotally attached to each other so that they can pivot relative to each other.

The primary and toolbar mountings 12, 14 and the upper and lower arms 16, 18 together form a parallelogram frame or parallelogram, indicated generally by numeral 20, the shape of which can be changed by pivoting of the mountings and the sides relative to each other while maintaining the overall parallelogram shape. A pivotal movement in one direction causes the parallelogram 20 to move to a more flattened configuration with a lower profile. By contrast a pivotal movement in the other direction causes the parallelogram 20 to adopt a more upright configuration with a higher profile.

The planter unit 10 also includes a resilient parallelogram member or a parallelogram support and shape adjuster in the form of a jump cylinder for adjusting the shape of the parallelogram. The jump cylinder is in the form of a hydraulic cylinder 22 that extends between said primary and toolbar mountings 12, 14. The jump cylinder 22 acts to support the parallelogram 20 in a certain shape.

The hydraulic cylinder 22 can respond to the application of an external force by extending or retracting to some extent but its movement is limited by the constraints of the parallelogram 20. The parallelogram 20 can move to a more upright position or it can move the other way to a more flattened position. The hydraulic cylinder 22 and indeed the parallelogram 20 will return to its original position once the outside force is removed.

In the illustrated embodiment the hydraulic cylinder 22 is positioned outside of the area defined by the mountings 12, 14 and the arms 16, 18 of the parallelogram 20. It is positioned above the upper arm 16, being mounted to upward extensions 12A and 14A of the mountings 12 and 14, each projecting up above and beyond the upper arm 16.
The planter unit 10 also includes a gauge wheel 24 that is operatively mounted on said primary mounting 12 for engaging the surface of the soil to be seeded by the planter unit 10. The function of the gauge wheel 24 is to define a datum or reference level on the surface of the soil relative to which the seeding depth is set as will be described in more detail below.

It is important that the gauge wheel 24 travels correctly along the surface of the soil without bulldozing on the one hand, or skipping over the surface of the soil, on the other hand for the efficacious seeding of the soil. The gauge wheel 24 is urged downwardly against the surface of the soil by the parallelogram 20. The downward force with which the gauge wheel 24 is urged against the soil surface is effectively determined by the pressure that is applied to the hydraulic cylinder 22. The higher the pressure in the cylinder 22 the more firmly is the gauge wheel 24 pressed down onto the soil surface. In an example embodiment a pressure of 1800 psi (12410kPa) can be applied to the hydraulic cylinder 22.

The planter unit 10 also includes a seeding arrangement shown generally by numeral 30, for dispensing seed into the soil. The seeding arrangement 30 has an operatively upper end 32 that is pivotally mounted to the primary mounting 12 and depends down there from to an operatively lower end 34, and also a seed dispenser 36 that is located at the lower end 34. The see dispenser has a formation on its leading end that is designed to engage the soil. The leading end formation can be interchanged with other leading end formations of differing shape. The leading end formation is chosen to suit the prevailing soil and moisture conditions in any application.

The planter unit 10 also includes a biasing arrangement for permitting the seeding arrangement 30 to pivot rearward relative to the primary mounting 12 to which it is pivotally mounted, and also the parallelogram 20, under the influence of an external force. The biasing arrangement is in the form of a further hydraulic cylinder 40 having one end 42 urging against the seeding arrangement 30 and the other end 44 urging against a mounting or arm of the parallelogram 20. In the
illustrated embodiment the other end 44 of the further hydraulic cylinder 40 urges against and is coupled to the toolbar mounting 14 of the parallelogram 20.

Each of the main components outlined above will now be described in more detail.

The primary mounting 12 comprises two parallel extending spaced primary mounting plates 55. The plates 55 are held in their fixed spaced relation by two or more transverse members 56, e.g. pins or bars. Each plate 55 has an upright section 57 that is pivotally mounted to the upper arm 16 at 55A and that is mounted to the lower arm 18 at a point 55B spaced beneath the mounting to the upper arm 16. Each plate 55 also includes a trailing section 58 extending transversely away from the upright section 57 in a rearward direction. The trailing section 58 is pivotally mounted to the seeding arrangement 30 at 58A, e.g. towards the rear end of the trailing section 58.

The planter unit 10 includes two spaced forks 46 extending downward and forward from said primary mounting 12. The forks 46 are rigidly attached to the primary mounting 12 and do not move relative thereto. The forks 46 have an operatively upper end 48 that is rigid with or fast with the primary mounting 12 and an operatively lower end 50 to which the gauge wheel 24 is mounted.

The toolbar mounting 14, like the primary mounting 12, comprises two parallel extending spaced toolbar mounting plates 59 pivotally mounted to arms 16 and 18 at 16A and 18A respectively. The toolbar mounting plates 59 are held in their fixed spaced relation by two or more transverse sections 61 extending between the plates 59.

Overall each tool bar mounting plate 59 comprises an upright section and a forward extending section extending from the upright section. It also has a bracket 63 extending from a leading edge of each forward extending section down to the lower end of the upright section with a right angle or L shaped configuration. As shown in the drawings the toolbar mounting 14 has a rectangular shape when
viewed in end view with the upright and forward extending sections of the mounting plates 59 together with the brackets 63 defining an opening within the rectangular shape. A transverse toolbar 9 shown in phantom of the frame to which the planter unit 10 is mounted is passed through the aperture and fixed to the toolbar mounting 14 by tightening the brackets 63.

The gauge wheel 24 includes a cylindrical wheel body 52 that travels over the soil surface. The outer surface of the cylindrical wheel body can be made of a rubber like material. This provides some cushioning and helps to provide a smooth travel over the surface of the soil.

The gauge wheel 24 also includes a steel disc 54, e.g. a Coulter disc, which projects radially outward away from the soil, for opening up the soil. The disc 54 typically has a radius that is 400-500m, e.g. about 450 mm and is considerably greater than that of the cylindrical wheel body 52 to penetrate the soil to a depth of 63-75mm. This helps to cut open stubble within the soil ahead of the following seeding arrangement 30 that inserts the seed into the soil.

The seeding arrangement 30 includes a shank support 70, and a shank 72 displaceably mounted on the shank support 70 towards its upper end 32. The shank support 70 is pivotally mounted to the primary mounting 12 as described above and as shown in the drawings. The shank 72 has an operatively upper end 74 that projects above the shank support 70 and an operatively lower end 76 on which the seed dispenser 36 is operatively mounted.

The seeding arrangement includes a seed depth adjuster that is shown generally by numeral 78, for adjusting the depth at which seed is dispensed into the soil during operation. The seed depth adjuster 78 comprises a checking arrangement for checking the shank 72 in any one of a plurality of positions along the shank support 70 whereby to adjust the distance from the primary mounting 12 to the seed dispenser 36 and thereby the depth at which seed is dispensed into the soil. In the illustrated embodiment the seed dispenser 36 can be set at any desired
depth below the soil surface up to a maximum depth of 30 cm, e.g. 4 to 30 cm. A seed depth of 30 cm can be used for deep moisture sinking plantings.

In the illustrated embodiment the shank support 70 has a plurality of pin receiving apertures arranged at different heights and the shank 72 has a corresponding pin that can be aligned with a desired pin aperture and then inserted through the aligned aperture to set the seeding depth of the seed dispenser 36. As these types of mechanical arrangements for depth adjustment of a seed dispenser 36 would be known to persons skilled in the art and do not form part of the invention defined in this application it will not be described in further detail in this application.

The seed dispenser 36 is operatively coupled to a seed feeder in a manner that is known in the art. The seed dispenser 36 can be detachably mounted to the operatively lower end 76 of the shank 72. This enables an operator to interchange one seed dispenser 36 for another and to use a said seed dispenser 36 that is best suited to that particular seed sowing operation.

For example one seed dispenser that can be used is a tyne which is clearly shown in Figs 1 and 2. Another type of seed dispenser that can be used is a double disc opener and this type of seed dispenser is shown in Fig 5. Yet another seed dispenser that can be used is a chisel plough seed dispenser that is known in the art but has not been illustrated in this specification.

The planter unit 10 includes a press wheel 80 that is positioned rearward of the seed dispenser 36 relative to the direction of travel and a press wheel arm 82 for pivotally mounting the press wheel 80 to the primary mounting 12, e.g. the trailing section thereof. It also includes press wheel biasing arrangement 84 bearing against the arm 82 for biasing the press wheel 80 to a resting position in which it runs along the surface of the ground but also permits the press wheel 80 to be pivoted upwardly, e.g. in response to it encountering an obstruction to its forward movement.
In the illustrated embodiment the biasing arrangement 84 comprises a coil spring under compression having one end bearing against the press wheel arm 82 and an opposite end bearing against the primary mounting 12.

Fig 5 illustrates a planter unit in accordance with another embodiment of the invention.

The planter unit has a number of similarities with the planter unit described above with reference to Figs 1 to 4. Accordingly unless otherwise indicated the same reference numerals will be used to describe the same components unless otherwise indicated.

The following description will focus on the differences between this embodiment and the embodiment described above.

The biasing arrangement for permitting the seeding arrangement 30 to pivot rearward relative to the primary mounting 12 is in the form of a further hydraulic cylinder 40 having its other end 44 urging against the primary mounting 12 of the parallelogram 20. In the earlier embodiment the other end 44 of the further hydraulic cylinder 40 is attached to the toolbar mounting 14 of the parallelogram 20. However apart from this structural difference the further hydraulic cylinder 40 performs the same function in this embodiment as it does in the earlier embodiment. This is because the seeding arrangement 30 and the further hydraulic cylinder 40 forming a part thereof is independent of the parallelogram 20 and is separate and independent of the jump cylinder 22 of the parallelogram 20. Therefore it does not matter to which of the mountings 12 or 14 of the parallelogram 20, the further hydraulic cylinder 40 is attached.

A further difference is that the Fig 5 embodiment has a seed dispenser 36 that is in the form of a double disc opener instead of the tyne that is shown in Fig 1. Both the tyne and the double disc opener are recognized seed dispensers that would be known to persons skilled in the art. Both the tyne and the double disc opener
perform the same basic function of dispensing the seed into the soil spaced below
the surface of the soil. They can be interchangeably fitted on the lower end of the
shank. A tyne may be preferred over a double disc opener in some applications
and a double disc opener may be preferred in other applications. The choice
generally depends on which crop seed is used and what condition the soil is in.

In use the planter unit 10 (described in each of the Fig 1 and Fig 5 embodiments)
is used to plant seed in a furrow along the length of a field as described below with
particular reference to Figs 6 to 9.

During normal operation the disc 54 on the gauge wheel 24 cuts open the soil and
the wheel body 52 runs along the surface of the soil 150 in the manner shown in
Fig 8. The wheel body 52 rolling along the soil surface 150 acts as a reference for
setting the depth of the tyne 36 on the seeding arrangement 30. The depth of the
tyne is selected to suit the particular crop that is being sown and is selected by the
operator based on their knowledge and experience. Some crops such as wheat
have a desired seed depth of about 30-50 mm. Other crops such as chick peas or
faber beans have a preferred seed depth of 40-70mm. To obtain results in terms
of germination of the seeds the seeds need to be consistently placed in the soil at
their preferred depth. The depth at which the seed is inserted is determined by a
combination of the moisture profile and the crop being sown.

To do this the seed depth adjuster 78 on the shank 72 of the seeding arrangement
30 is set at the desired depth. This is done be checking the pin on the shank on
the appropriate pin aperture on the shank support. This setting then delivers the
seed into the soil 150 at the desired depth provided that the gauge wheel 24 is
running correctly along the surface of the soil as shown in Fig 8.

If the gauge wheel 24 starts bull dozing as shown in Fig 6, e.g. due to local
softness of the soil or moisture or bogginess in the soil 150, then the gauge wheel
24, and particularly the wheel body 52 thereof will pitch into the soil and drag
along the surface of the soil 150 in the manner shown in Fig 6. This will cause a
concomitant lowering of the depth at which the seed is delivered into the soil 150. Due to the lowering of the height of the gauge wheel 24 this will be below the depth at which it is desired to seed that particular crop.

This is disadvantageous because it typically lengthens the time to germination. It also typically reduces the prospects for successful germination of a given seed and thereby the crop yield. It also increases the resistance to displacement of the planter unit 10 through the soil 150 and therefore increases the fuel consumption of the prime mover such as a tractor or the like.

With the planter unit 10 of this invention shown in the drawings an operator can respond to this situation by reducing the pressure in the hydraulic cylinder 22 which raises the height of the gauge wheel 24 to the point where the wheel body 52 of the gauge wheel 24 runs along the surface of the soil 150 adopting the attitude shown in Fig 8. An operator achieves this by means of a hydraulic controller that will be described in more detail below.

If the gauge wheel 24 starts skipping across the soil 150 as shown in Fig 7 the seed dispenser that is a tyne 36 is raised by a concomitant amount. This causes the seed to be discharged into the soil at a shallower depth than the depth that is preferred for that seed, e.g. near to or on the surface. This situation can lead to lower levels of germination and thereby reduced crop yield.

To deal with this situation an operator increases the pressure in the hydraulic cylinder 22, e.g. by means of a hydraulic controller, which lowers the height of the gauge wheel 24 to the point where the wheel body 52 of the gauge wheel 24 runs over the surface of the soil 150 as shown in Fig 8. An operator achieves this by means of a hydraulic controller that will be described in more detail below.

In the planters of Figs 6 to 8, the cylinder 40 is attached at its end 44 to the primary mounting 12 in the same way as the Fig 5 planter unit and different to the Fig 1 planter unit. However it will be appreciated by those skilled in the art that the
principles shown in Figs 6 to 8 and described above apply equally to a planter unit in accordance with that in Fig 1.

Figs 10 and 11 illustrate an apparatus, indicated generally by the reference numeral 100, for sowing seed using the planter units 10 described above.

In broad terms the apparatus 100 comprises a frame 102 defining a plurality of rows 104 spaced apart from other in a lateral direction. Each row 104 extends from front to rear in the direction of travel of the frame 102.

The frame 102 includes three transverse toolbars 106, 108, 110 extending the width of the frame 102 that are spaced apart from each other in the direction of travel of the frame 102. The planters 10 are evenly spaced apart along the length of each toolbar 106, or 108, or 110. Individual planter units 10 may be spaced 5.4m apart from each other along each individual toolbar. With the three transverse toolbars this translates to a space between adjacent planter units 10, on the frame as a whole, and a space between adjacent lines of seed in the ground, of about 1.4m to 1.6m.

Each row 104 includes one planter unit 10 contributed by each of the three transversely extending toolbars 106, 108, 110, and thus there are three planter units 10 in each row. Each of the planter units 10 in each row 104 are laterally offset relative to each other so that they cut and seed their own individual line in the soil that ultimately forms a line of crop.

Each transverse toolbar has a central section, and wing sections laterally disposed on each side of the central section. The frame 102 as a whole can be assembled such that lateral sections corresponding to the lateral sections of the toolbars are pivotal relative to the central section. This confers an additional ability on a frame covering a large surface area to accommodate for undulations in the land to be planted.
The frame 102 is mounted on the surface of the ground by its own frame wheels 114. These frame wheels 114 include one or more front wheels in the form of castors forward of the toolbars 106, 108, 110. They also include one or more rear wheels rearward of the toolbars 106, 108, 110.

The frame 102 also includes a draw pole 120 for operatively coupling the frame 102 to a tow hitch 122 of a tractor 124 as is shown in Fig 11.

The apparatus also includes a controller 130 for remotely adjusting the pressure in the jump cylinder that is a hydraulic cylinder 22 associated with parallelogram 20 on each planter unit 10. This controller 130 is shown schematically in Fig 12.

The controller 130 comprises a hydraulic circuit comprising hydraulic hoses 132 that are operatively coupled to the hydraulic cylinder 22 of each planter unit 10. The hydraulic hoses 132 are operatively coupled to manifold hydraulic pipes running along each of the transverse tool bars. These main lines are in turn connected to main hydraulic pipes that lead to a remote controller point 134 that is on a towing vehicle that is a tractor 124 for towing the frame 102. The apparatus also includes an accumulator 136 that is operatively coupled to the hydraulic circuit coupled in line with the main pipes.

The hydraulic circuit has a lever at the remote controller point 134 by means of which the pressure to each hydraulic cylinder 22 can be adjusted to increase or decrease the pressure in each cylinder 22 as required. The operator, e.g. on the tractor adjusts this pressure by means of the lever, movement in one direction increasing the hydraulic pressure to the hydraulic cylinder 22 and movement of the lever in the other direction decreasing the pressure. The hydraulic cylinder is a single acting hydraulic cylinder although a double acting cylinder can also be used.

In the illustrated embodiment the apparatus has a second hydraulic circuit that is similarly constructed and arranged for enabling an operator to adjust the pressure
in the other cylinder 40. This further circuit enables the operator to similarly adjust the pressure in the hydraulic cylinder 40 associated with the seeding arrangement 30 to increase or decrease the force with which the tyne is biased towards its downwardly extending orientation.

One advantage of a planter unit described above with reference to the drawings is that the seeding arrangement, e.g. a tyne, is capable of pivoting in a rearward direction when it encounters resistance as it travels through the soil. Thus, if it strikes an obstacle such as strong root under the soil, the shank and tyne will pivot in a rearward direction up to the point where the tyne is above the obstacle and can pass over the top of it.

By contrast with prior art arrangements of which the applicant is aware the tyne and shank could not pivot rearwardly because it was rigidly coupled to the parallelogram and could only adjust, e.g. in an upward direction, to an obstacle in the soil. Its movement would be limited to that permitted by the parallelogram. In many situations this would not enable the tine to be removed from behind the obstruction and this could lead to damage of the tyne or shank or even failure of the tyne or shank.

This advantage is achieved by making the movement of the tyne independent of the movement of the parallelogram. This is achieved practically by pivotally mounting the tyne and the shank to the parallelogram and having a further hydraulic cylinder that permits movement of the tyne out its downward extending position in response to an obstacle in the soil.

Another advantage of the planter unit described above with reference to the drawings is that the seed dispenser is detachably mounted to the operatively lower end of the shank. This enables one type of seed dispenser to be replaced with another type of seed dispenser depending on what type is best suited to the sowing application at that particular time. For example the seed dispensers that
may be detachably mounted to the shank and thereby be interchanged with each other include a tyne, a double disc opener, and a chisel plough.

Yet another advantage of the planter unit described above is that the height of the gauge wheel can be adjusted by adjusting the length of the hydraulic jump cylinder associated with the parallelogram. Extension of the hydraulic cylinder pivots the tool bar mounting forward and this in turn lowers the gauge wheel. Correspondingly the hydraulic cylinder can be retracted to raise the position of the gauge wheel. The extension or retraction of the cylinder is adjusted by adjusting the hydraulic pressure within the cylinder.

Yet another advantage of the apparatus described above with reference to the drawings is that the hydraulic cylinder associated with the parallelogram can have its length adjusted remotely from the planter unit. In particular the adjustment can be made from a central operator position that is a tractor seat. That is the adjustment can be made by a controller that is actuated by an operator seated in a tractor seat.

This enables an operator to make an adjustment to the pressure applied to the hydraulic cylinder of the parallelogram immediately they notice that the travel of the gauge wheel is less than optimum. If the gauge wheel is skipping along the ground they can increase the pressure in the cylinder and this will cause the gauge wheel to press down more firmly and cause the disc to enter the soil and the wheel body to travel along the surface pressing down against the surface.

On the other hand if the gauge wheel is bulldozing into the soil, e.g. due to soft soil, or increased moisture within the soil, or boggy soil, the operator can reduce the hydraulic pressure applied to the hydraulic cylinder and this causes the gauge wheel to lift relative to the surface of the soil to the extent that the wheel body runs evenly along the surface of the soil.
Further this adjustment can be made by the operator while they are positioned on the tractor and without getting off the tractor. Consequently it is quick and relatively easy for an operator to make this adjustment. Consequently they can as, a practical measure, make this change as soon as they notice the gauge wheel is not travelling along the surface in an optimum fashion. As the terrain that is typically traversed in broad acre crop planting is often changes from one region of a paddock to the next, the height can be varied for each run along the length of a paddock.

Another advantage of the apparatus described above is that the hydraulic cylinders of all the planter units can be adjusted simultaneously by a single hydraulic circuit. That is they are raised or lowered together by a single operator adjustment of the control levers at the ends of the hydraulic hoses that are mounted on the tractor. Significantly it is not necessary to adjust the hydraulic cylinder 22 of each planter unit separately and this results in significant time savings.

It will of course be realized that the above has been given only by way of illustrative example of the invention and that all such modifications and variations thereto, as would be apparent to persons skilled in the art, are deemed to fall within the broad scope and ambit of the invention as is herein set forth.
THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. A planter unit for seeding a body of soil having a soil surface including:

   a parallelogram frame having two pairs of opposed frame members for mounting to a toolbar;

   a resilient member attached to the parallelogram frame for holding the frame members of the parallelogram frame in a parallelogram shape while permitting the shape of the parallelogram frame to alter in response to an external force;

   a gauge wheel operatively associated with the parallelogram frame for engaging the soil surface and travelling over the soil surface in use;

   a seeding arrangement pivotably mounted to the parallelogram frame at a pivot location which includes a seed dispenser that in an operative position is spaced below the pivot location; and

   a biasing arrangement for biasing the seeding arrangement to an operative position whereby movement of the seeding arrangement is independent of movement of the parallelogram frame and thus the seeding arrangement is movable relative to the parallelogram frame in response to an external force on the seeding arrangement that overcomes the bias of the biasing arrangement.

2. A planter unit as claimed in claim 1, further including control means for controlling operation of the resilient member and hence movement of the gauge wheel.
3. A planter unit as claimed in claim 2, further including control means for controlling operation of the biasing arrangement and thus vary the bias applied to the seeding arrangement.

4. A planter unit as claimed in claim 2 or claim 3, wherein the control means is remote controlled.

5. A planter unit as claimed in any one of claims 1 to 4, wherein the parallelogram frame includes a toolbar mounting member and a primary mounting member in opposed relationship.

6. A planter unit as claimed in claim 5, wherein the parallelogram frame includes a pair of opposed arms which interconnect the toolbar mounting member and the primary mounting member and wherein each arm is pivotably mounted to the toolbar mounting member and the primary mounting member.

7. A planter unit as claimed in claim 5 or claim 6, wherein the biasing arrangement is a resilient biasing member pivotably connected to the primary mounting member and interconnecting the seeding arrangement and the primary mounting member.

8. A planter unit as claimed in any one of claims 3 to 5, wherein the gauge wheel is rigidly connected to the primary mounting member.

9. A planter unit as claimed in any one of claims 5 to 8, wherein the resilient member interconnects and is pivotably attached to the toolbar mounting member and the primary mounting member.
10. A planter unit as claimed in any one of claims 1 to 9, wherein the resilient member is a hydraulic cylinder having a pressure adjuster for adjusting the pressure within the hydraulic cylinder.

11. A planter unit as claimed in any one of claims 1 to 10, wherein the seeding arrangement is a shank having the seed dispenser mounted on a lower end of the shank.

12. A planter unit as claimed in claim 11, wherein the shank is coupled to a seed depth adjuster for varying a vertical height of the shank.

13. A planter unit as claimed in any one of claims 4 to 12, wherein the toolbar mounting member includes a mounting formation for mounting the planter unit to a toolbar and a bracket for extending around the toolbar in use.

14. A planter unit as claimed in any one of claims 2 to 9 or claims 11 to 13, wherein the resilient member is a hydraulic cylinder having a pressure adjuster for adjusting the pressure of the hydraulic cylinder and said control means is a controller operatively connected to the hydraulic cylinder which can be operated from a remote location.

15. A planter unit as claimed in any one of claims 3 to 14, wherein the control means includes a hydraulic circuit that interconnects to the hydraulic cylinder and a prime mover attached to the planter unit.

16. A planter unit for seeding a body of soil having a soil surface including:
a parallelogram frame having two pairs of opposed frame members for mounting to a toolbar;

a resilient member attached to the parallelogram frame for holding the frame members of the parallelogram frame in a parallelogram shape while permitting the shape of the parallelogram to alter in response to an external force;

a gauge wheel operatively associated with the parallelogram frame for engaging the soil surface and travelling over the soil surface in use;

a seeding arrangement attached to the parallelogram frame which includes a seed dispenser that in an operative portion is received in the soil in use to deliver seed into the soil; and

control means for controlling movement of the resilient member and hence movement of the gauge wheel from a remote location.

17. A planter unit as claimed in claim 16, wherein the resilient member is a hydraulic cylinder extending between opposed frame members of the parallelogram frame and said control means is a controller spaced from the hydraulic cylinder for enabling an operator to control the hydraulic pressure in the hydraulic cylinder and thereby the extension or retraction of the hydraulic cylinder from a remote location.

18. A planter unit for seeding a body of soil having a soil surface including for:

a parallelogram frame having two pairs of opposed frame members for mounting to a toolbar;

a resilient member attached to the parallelogram frame for holding the frame members of the parallelogram frame in a parallelogram shape while
permitting the shape of the parallelogram to alter in response to an external force;

a gauge wheel operatively associated with the parallelogram frame for engaging the soil surface and travelling over the soil surface in use;

a seeding arrangement attached to the parallelogram frame which includes a seed dispenser that in an operative portion is received in the soil in use to deliver seed into the soil and

control means for

(i) controlling operation of the resilient member and hence movement of the gauge wheel; and

(ii) controlling operation of the biasing arrangement and thus vary the degree of bias applied to the seeding arrangement.

19. A method of operation of a planter unit which includes the step of controlling from a remote location operation of a resilient member attached to a parallelogram frame of the planter unit so as to control movement of a gauge wheel attached to the parallelogram frame for varying the depth of the gauge wheel in soil being traversed by the planter unit.

20. A method as claimed in claim 19 which includes a further step of controlling from a remote location operation of a biasing means associated with a seeding arrangement of the planter unit whereby bias applied to the seeding arrangement is varied.

21. Apparatus for planting seed in a number of rows simultaneously which includes:

a frame; and

a plurality of planter units as claimed in any one of claims 1-18 attached to the frame.
22. A planter unit for seeding a body of soil having a soil surface substantially in accordance with any one of the embodiments described in the detailed description of the invention with reference to the drawings.

23. A method of operation of a planter unit which includes the step of controlling from a remote location operation of a resilient member attached to a parallelogram frame of the planter unit substantially as herein described in the detailed description of the invention with reference to the drawings.

24. Apparatus for planting seed in a number of rows simultaneously which includes a frame, and a plurality of planter units substantially as herein described in the detailed description of the invention with reference to the drawings.
Fig. 6.